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# NORTHEAST CORRIDOR IMPROVEMENT PROJECT

# FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

## Volume I

## June, 1978

U.S. DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration
Northeast Corridor Project
Washington D.C. 20590

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ADMINISTRATIVE ACTION

# FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

# NORTHEAST CORRIDOR IMPROVEMENT PROJECT

Federal Railroad Administration
U.S. Department of Transportation

Submitted pursuant to 42 U.S.C. 4332(2) (c), 16 U.S.C. 470(f) and 49 U.S.C. 1653(f)

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Date

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U.S. DEPARTMENT OF TRANSPORTATION

# PREFACE

The National Environmental Policy Act of 1969 (42 U.S.C. 4322 et seq.) requires that all proposals for major Federal actions which significantly affect the human environment be accompanied by a detailed environmental impact statement. In situations where the proposed action covers a wide region and involves impacts throughout that region, the courts have held that a generic (programmatic) environmental impact statement is required. Since the N·:.heast Corridor Improvement Project (NECIP) is regional in scope and since the impacts of the program are anticipated to be felt throughout the entire Corridor, the Federal Railroad Administration (FRA) made the decision to prepare a programmatic environmental impact statement (PEIS) for this action.

Many of the comments received from individuals, agencies, or governmental entities on the Draft PEIS (see Volume III) stated that the Draft was not sufficiently detailed to allow meaningful comments on various projects within the overall program. In order to respond to these comments and to assure that this document will be reviewed in the proper light, this preface seeks to clarify what the PEIS is and is not intended to do.

The PEIS has three basic functions. The first is to identify the program-level decisions which will be implemented Corridor-wide and alternatives to these decisions. The second purpose is to assess the environmental impacts associated with these program-wide plans. The third purpose is to identify those NECIP activities for which adequate assessment can be provided in this document as opposed to those which will require further detailed environmental assessment. The final PEIS is not a definitive assessment and analysis of all impacts associated with all projects included in the NECIP. Nor is the PEIS the end of the environmental assessment process, which will continue for the length of the program.

The first of the functions of this statement, identification of program-level decisions, is intended to describe for the reviewer those decisions fundamental to the overall program design, as well as a discussion of program-level alternatives. These decisions include: the types of track and bridge maintenance, rehabilitation and replacement programs; the level of work proposed regarding tunnel improvements or replacements; the routing of the Corridor between Washington and Boston; a unified electric power supply throughout the Corridor, and general areas where electrification facilities will be located; the location of stations scheduled for improvement; the types of and general areas where maintenance facilities will be located; the type of signaling system proposed; the type of communication system proposed, and potential locations of communication facilities. The program description contained in the text and in the charts in Volume II represents the locations (and in some cases the generalized areas) where improvements are proposed to be made under this program. As the program's planning becomes more refined, alterations in the location of certain elements could occur.

The second function of the PEIS is assessment of the Corridor-wide impacts associated with the implementation of the overall project and the impacts associated with the operation of a high-speed rail program in the Corridor. The impacts include long term effects of the overall project on such factors as air pollution, noise, energy consumption, the natural environment, the regional transportation system, land use patterns, the social and economic framework of the Corridor and irreversible commitments of resources. Measures to mitigate environmental impacts are also identified.

The first and second functions form a basis for describing and assessing the overall programmatic impact of the NECIP.

In addition, this statement has a third purpose, distinguishable from the program-wide description and assessment functions discussed above. The third function is to identify those individual activities, or categories of activities, included in the NECIP for which adequate assessment can be provided in this document and which, therefore, will not be formally documented again.

The need for further documentation for some activities has already been identified as noted throughout the PEIS, especially in the responses to the comments received on the Draft PEIS. Where such a need is identified, further site-specific documentation will be prepared. Discussion of activities in this PEIS may be considered a preliminary assessment of the environmental impacts of those activities. Examples of projects for which the need for further documentation has been identified include:

- Route realignments involving major track shifts or bridge reconstruction as identified in Appendix A of this document;
- All bridges to be totally reconstructed as identified in Appendix B of this document;
- Any electrical substations, feeder lines and other transmission lines installed at new locations which could cause significant impacts and are listed in Section 1.7.4 of this document;
- Any new communication system activities planned for construction which could cause significant impacts and are listed in Section 1.7.6 of this document;
- All stations scheduled for improvement as listed in Section 1.7.9 of this document;
- Service facilities at the locations listed in Section 1.7.10 of this document;

The elimination of grade crossings (all public and most private) is being separately assessed for environmental impacts. At this time the responsibility for this assessment resides in the Federal Highway Administration acting with the relevant State Department's of Transportation.

The level of environmental documentation presently anticipated for these activities consists of either a full EIS or a negative declaration. However, it is possible, upon further review and analysis, that some of the activities included in the list above may not require as complete an assessment as is currently anticipated. In that case, an analysis will be prepared, but not in the detail necessary for an EIS or a negative declaration. In addition, it is possible that for certain types of activities (e.g., communication facilities and electrification facilities) the documentation prepared may address groups of actions, since this approach may provide a more complete basis for review of the actions.

There are, however, other NECIP activities for which the assessment contained in the PEIS provides a proper basis for determining that no future analysis is necessary before proceeding with these activities. Generally, these include program-level activities which lend themselves to system-wide analysis, and those activities which are traditionally considered normal railroad maintenance.

However, even such an activity will be examined in accordance with Department of Transportation (DOT) Order 5610.1B which contains requirements for the preparation of environmental assessment documents, to determine if further environmental analysis is required for these types of activities. The DOT Order makes clear that certain types of activities receive a higher level of assessment than is contained in the PEIS. Examples of these types of activities are:

- Those which will be undertaken in environmentally sensitive wetland areas;
- Those which use publicly owned parklands, wildlife refuges or recreational areas;
- Those which use or affect historic or archeologically significant sites.

The examination of activities in the list below will include data collected by on-site inspection or review of aerial photography, review of the final scope of work for the activity, and a review of local plans and programs for the specific location. Based upon this examination, a determination will be made as to whether or not further environmental documentation is necessary for the activity.

The types of activities which will be reviewed in this manner include:

Track Structures

- Track renewal and welding
- Tie replacement
- Use of Track Laying System on the Corridor
- Undercutting and ballast cleaning
- Subgrade stabilization
- Drainage improvements
- Access roads
- Interlocking reconfiguration
- Right-of-way cleaning

Bridge Repair and Upgrading

- Sandblasting
- Replacement of structural members
- Grouting
- Painting
- Waterproofing
- Deck repair and/or replacement

Tunnels

- Provision for adequate clearance for electrification
- Waterproofing
- Upgrading of safety devices

Route Realignments

- Realignments on the existing roadbed

Communications

- Installations which lease or otherwise use existing facilities

Signaling

- All signaling activities

Electrification

- Repair and replacement in kind of existing catenary structures and equipment
- Painting existing poles
- Replacement of existing substations at the same site
- Installation of catenary wire and poles from New Haven, Connecticut to Boston, Massachusetts

Fencing

- Installation of fencing

Similar types of activities may be added to this list as program planning progresses.

This PEIS documents the FRA's final, program-level decision regarding the scope and implementation of the NECIP. This document differs from the Draft PEIS in several areas due to the availability of more recent information and in response to comments received from circulation of the Draft in September, 1977 and the public hearings conducted in November, 1977. A reanalysis of project impacts is also included. As a result, the proposed action presented in this final statement reflects various program modifications that were precipitated by public input, changes in policy, financial constraints, and environmental considerations.

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1. FEDERAL RAILROAD ADMINISTRATION

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2. ADDITIONAL INFORMATION. For additional information concerning the Final Programmatic Environmental Impact Statement, please contact:

   Project Director, NEC
   Federal Railroad Administration
   Room 2100
   2100 Second Street, S.W.
   Washington, D.C. 20590

3. DESCRIPTION OF THE PROPOSED ACTION. The Northeast Corridor Improvement Project (NECIP) was mandated by the Railroad Revitalization and Regulatory Reform Act of 1976 (the 4R Act) as a program to upgrade railroad intercity passenger service between Boston, Massachusetts and Washington, D.C. Specific goals of the program are to provide, by February 1981, railroad facilities which can accommodate regularly scheduled dependable service on a three hour, forty minute schedule between Boston and New York and a two hour, forty minute schedule between New York and Washington with appropriate stops. Title VII of the Act authorizes $1.60 billion to undertake physical improvements necessary to achieve program goals. This appropriation, together with an additional $150 million in Federal funds which must be matched equally by state funds for nonoperational improvements to stations and for fencing, results in maximum NECIP funding of $1.90 billion.

The NECIP is comprised of 11 interrelated elements of improvements necessary to facilitate high speed operation and assure safe, comfortable service. These include route realignments; interlocking improvements and track structure upgrading; bridge repair and replacement; tunnel rehabilitation and modification; installation of fences and barriers; elimination of rail/highway grade crossings; electrification improvement and extension to serve the entire Corridor; signaling and traffic control improvements; new communications systems; station rehabilitation and upgrading; and expanded and new maintenance facilities.

## 4. ALTERNATIVES CONSIDERED

The NECIP is the culmination of a planning process spanning more than a decade. In the course of this process, numerous studies of alternative courses of action were undertaken, ranging in scope from consideration of new transportation technologies and acquisition of an all new right-of-way, to detailed consideration of specific route and service alternatives. As a result of these studies, the proposed action was defined in some detail. The upgrading of the NEC rail spine was found to provide the most significant short and long term benefits at a reasonable level of investment.

## 5. SUMMARY OF ENVIRONMENTAL IMPACTS

Impacts of the proposed action were evaluated in relation to seven broad categories: effects on regional and local transportation, energy conservation, air quality, noise and vibration, the natural environment, socio-economics and land use, and historical/cultural/archeological features of the Corridor.

The NECIP is expected to result in a substantial reduction in Amtrak's deficit per passenger mile (thereby improving the productivity of future public operating subsidies), largely as a result of an increase in rail trips to 21.8 million per year in 1990 versus the 13.2 million projected for the unimproved case. The increase will result in part from diversion of trips from auto (2.5 million) and air (1.35 million). The project will also, however, divert passengers from intercity bus, causing a reduction in bus ridership between cities served by NEC during a period when growth would otherwise be expected. The reduction from 1990 projected levels of passenger-miles by intercity bus is approximately 28 percent between NEC Market Cities or less than one percent of the New England and Middle Atlantic Region Markets. Expected levels of commuter rail and rail freight traffic on the NEC will be accommodated in the early 1980's without service degradation. Projected growth in all three rail services, however, may result in congestion on some segments in the long term. There will be some increase in station-related motor vehicle traffic. These impacts will be minimized by traffic and parking improvements undertaken in connection with the project. Improvements to movable bridge structures should benefit marine traffic but in some instances, especially Portal Bridge in New Jersey, this may be offset by increasing train frequencies.

There will be a small (2.6 percent) reduction in total energy consumption for intercity trips in the Corridor in 1990. With electrification of the entire Corridor, and diversion from auto, air and bus, a net reduction in consumption of petroleum-based products equivalent to approximately 171,600 barrels annually is anticipated.

Air quality will improve marginally. There will be a 3.7 percent reduction in 1990 air pollutant emissions for intercity transportation. The expected reduction in hydrocarbon emission, one of the main causes of ozone formation, is less than one-tenth of one percent of total hydrocarbon emissions in the Corridor. Overall, improvement in the noise environment near the right-of-way will result from the proposed improvements. Despite higher train speeds, more frequent trains, and a growth in population of the Corridor, there will be a

28 percent reduction in the index used to assess impact of noise. Eight to ten sites have been identified where noise is expected to increase. The increase in all cases is less than 5 dB ($L_{dn}$).

Along most of the Corridor, the existing natural environment has stabilized in accommodation to man's activities. The NEC will not alter that stabilization in any significant way. In environmentally sensitive areas, notably wetlands and watercourses, the track itself will serve as a buffer to potential impacts. Problems with drainage, erosion and sedimentation will be eliminated or mitigated by the proposed action.

With minor exceptions, all improvements will be within the existing NEC right-of-way. No residential dislocation is anticipated, however, several businesses may be displaced. Operation of the improved intercity service will create an estimated 3,700 new jobs in the Corridor by 1990; the improved mobility afforded by the program, however, should not cause a significant redistribution of population and employment. Construction employment in connection with project implementation is estimated at 36,094 person-years of labor.

6. AGENCIES AND ORGANIZATIONS TO RECEIVE THE FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT REPORT

This Final Programmatic Environmental Impact Statement has been distributed to the officials and federal, state, regional, municipal, local agencies and national organizations who commented on the Draft PEIS. These are listed with their comment letters and responses in Volume III of this Statement.

# CHAPTER 1

# DESCRIPTION OF THE PROPOSED ACTION

## 1.1 OVERVIEW

The Northeast Corridor (NEC) is the spine railroad system carrying high density intercity passenger traffic between Boston, Massachusetts, and Washington, D.C., via Providence, Rhode Island; New York, New York; and Philadelphia, Pennsylvania. The NEC traverses Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, and the District of Columbia (Figure 1.1).

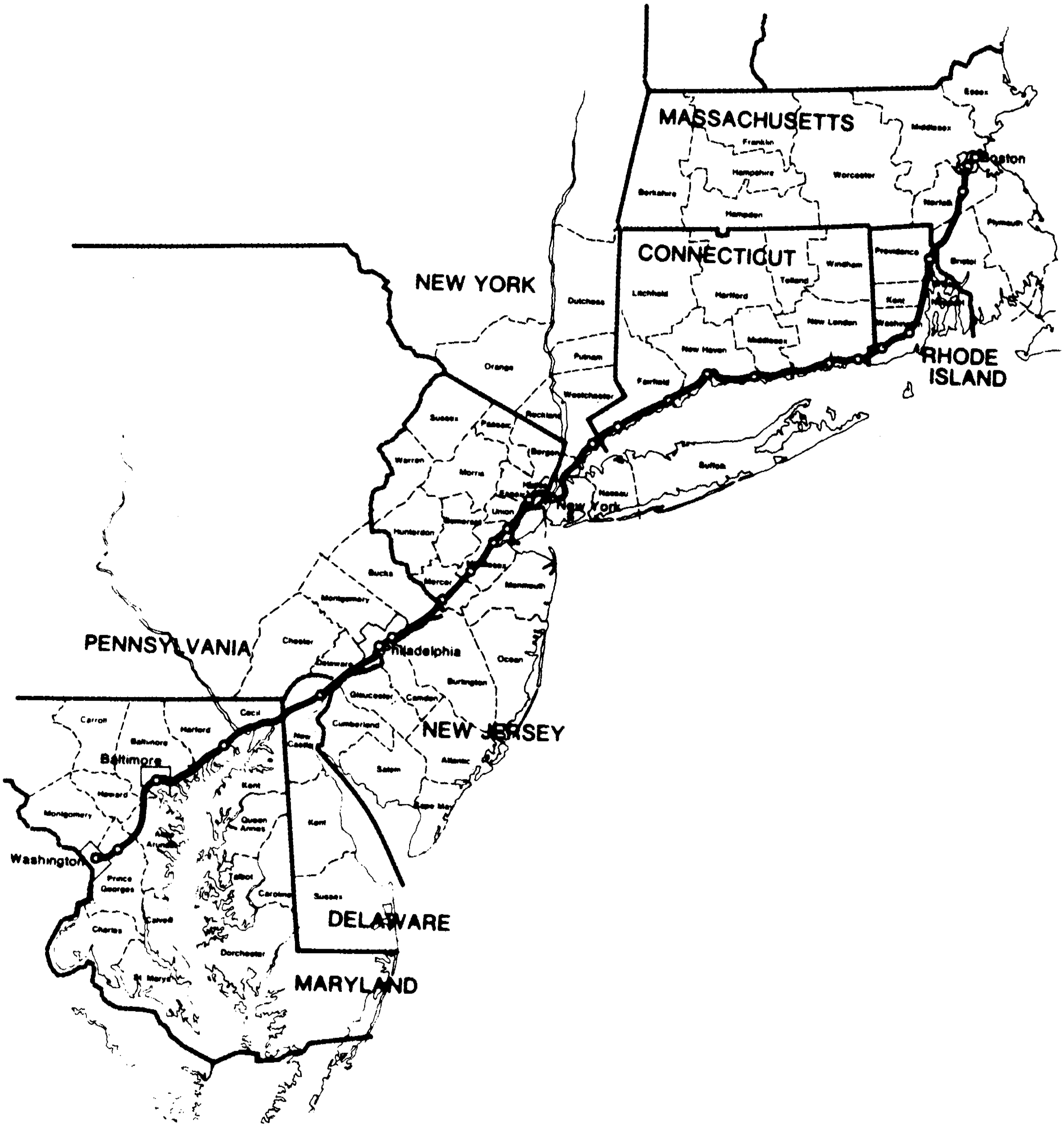
The Northeast Corridor Improvement Project (NECIP) is a comprehensive program of improvements to railroad facilities, installations and other physical plant components on the NEC. The project will improve the overall performance of the NEC railroad system, restore dependable all-weather service and perform the maintenance of equipment and physical plant that has been deferred for many years by previous railroads.

### 1.1.1 LEGISLATION

The Railroad Revitalization and Regulatory Reform Act of 1976 (4R Act, 45 USC Sec. 851 et seq.) authorized the NECIP. Sections 704 (a)(1) and (2) authorized $1.6 billion for improvements to the NEC rail spine, and $150 million (to be matched equally by state/local sources), for fencing and certain nonoperational station improvements.

The major program objective of the 4R Act specifies that:

> Within five years after enactment of this act, the establishment of regularly scheduled and dependable intercity rail passenger service between Boston, Massachusetts, and New York, New York, operating on a three-hour, forty-minute schedule, including




# Figure 1.1
# NORTHEAST CORRIDOR REGION

appropriate intermediate stops; and regularly scheduled and dependable intercity rail passenger service between New York, New York, and Washington, D. C., operating on a two-hour, forty-minute schedule, including appropriate intermediate stops.[1]

The 4R Act identifies the following additional objectives to be achieved through the implementation of the NECIP:

- If funding remains after achieving the primary goal, improvements to facilities on feeder routes to Harrisburg, Pennsylvania, and Albany, New York, from the NEC mainline, and from Springfield, Massachusetts, to Boston, Massachusetts, and New Haven, Connecticut, in order to facilitate compatibility with improved high-speed rail service operating on the NEC mainline;
- The improvement of nonoperational aspects of stations used in intercity rail passenger service;
- The accomplishment of the required improvements in a manner which is compatible with accomplishments in the future, of additional improvements in service levels; and
- The accomplishment of the required improvements in a manner which will produce the maximum labor benefit in terms of hiring presently unemployed persons.

### 1.1.2 ORGANIZATIONAL FRAMEWORK

Responsibility for implementation of the NECIP was assigned to the Secretary of Transportation. This responsibility has been delegated to the Northeast Corridor Project Office, Federal Railroad Administration (FRA).

A contract between FRA and a joint venture headed by the engineering and construction management firm of De Leuw, Cather/Parsons & Associates, provides for the engineering design, procurement and construction management aspects of the program. A contractual agreement exists between FRA and the National Railroad Passenger Corporation (Amtrak) which, with certain exceptions,

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[1] The Railroad Revitalization and Regulatory Reform Act of 1976, Section 703 (1)(A)(i).

owns and operates the intercity passenger rail system in the Corridor (Figure 1.2). This agreement casts Amtrak in a dual role in relation to the project. As system operator and maintainer, Amtrak will participate in program and project development and in construction supervision, testing and acceptance. Additionally, Amtrak will perform selected construction projects as provided in the contract between FRA and Amtrak.

In addition to Amtrak, future agreements concerning project construction and operation will be reached with the Corridor segment owners other than Amtrak, the public agencies and private developers that possess various station properties, the Departments of Transportation (DOTs) and transit authorities that operate commuter service on the Corridor, and the Consolidated Rail Corporation (Conrail) concerning future freight train operations on the Corridor.

Construction work will be accomplished by competitively bid, fixed price contracts awarded by FRA, or by Amtrak subcontracts in accordance with procurement specifications approved by FRA.

### 1.1.3 PROGRAM GOALS

Within the context of the overall goals of the 4R Act, the Federal Railroad Administration has further specified project performance goals based on the planning and preliminary engineering efforts of the last decade. These performance goals specify:

(1) The service performance goals shall reduce travel times between Washington and New York, and New York and Boston in accordance with the 4R Act, as well as decrease the lateness allowance and improve the on-time dependability. The performance goals are summarized in Table 1-1.

(2) The NEC railroad system shall have the capability for providing reliable, dependable service throughout the 6 a.m. to 10 p.m. travel day.

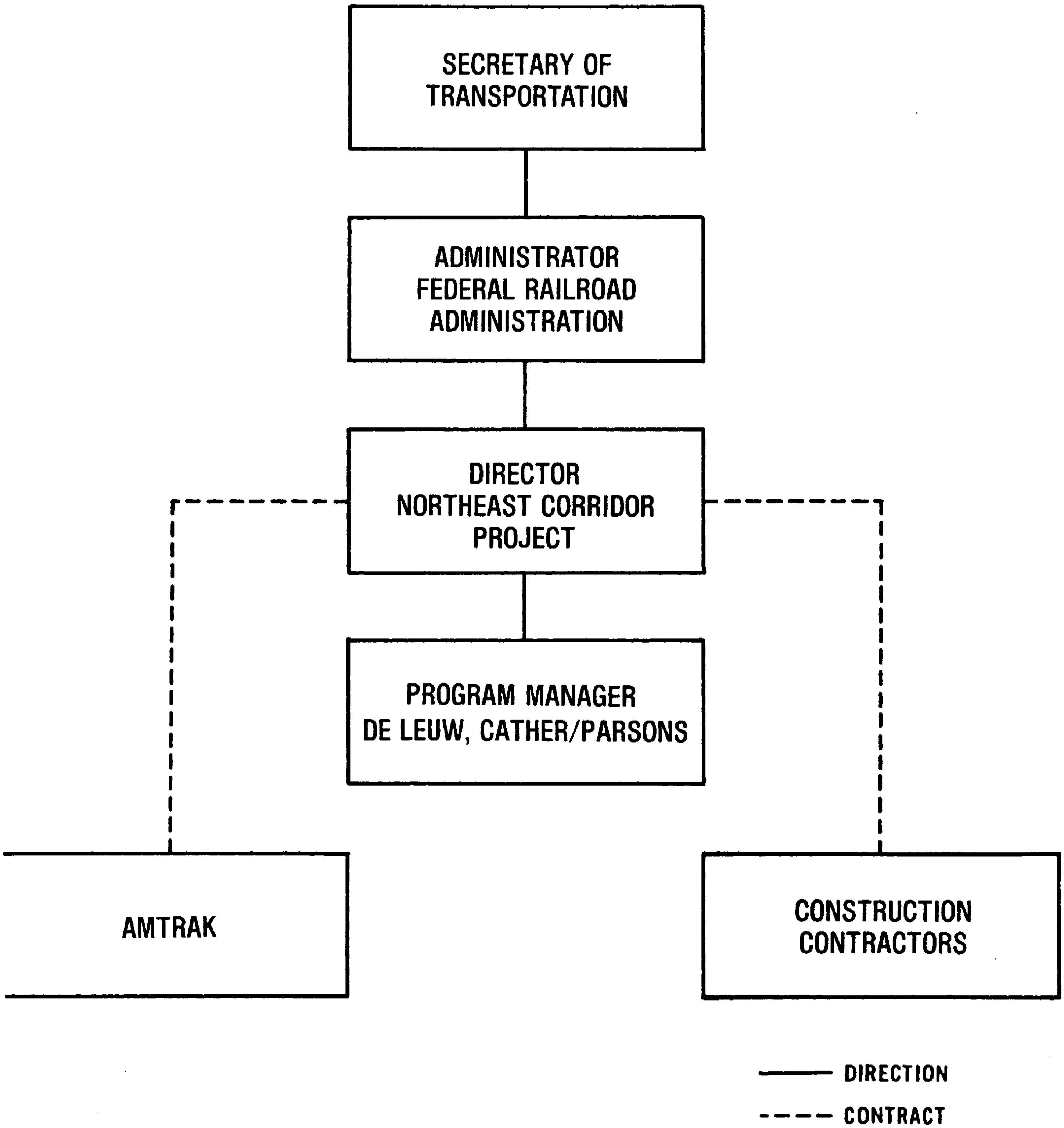


**Figure 1.2**

**NECIP ORGANIZATION**

Table 1-1

COMPARISON OF EXISTING CONDITIONS AND NECIP GOALS

| | Trip Time | Lateness Allowance | On-Time Dependability[1] |
|---|---|---|---|
| Washington to New York | | | |
| Present Service--Conventional | 3 hr.-50 min. | 15 min. | 80 percent |
| Present Service--Metroliner | 3 hr.- 0 min. | 15 min. | 40 percent |
| Proposed Service | 2 hr.-40 min. | 5 min. | 80 percent |
| New York to Boston | | | |
| Present Service | 4 hr.-30 min. | 15 min. | 80 percent |
| Proposed Service | 3 hr.-40 min. | 5 min. | 80 percent |

[1]Existing on-time performance is that of the last half of 1976.

(3) The NECIP shall provide capacity for a system-wide demand of 21.8 million intercity passengers annually. The NEC Amtrak service carried approximately 9.6 million passengers in 1975.

(4) The NECIP, insofar as feasible, shall be designed and constructed in a manner compatible with future service level improvements. Minimum future service level improvements to be considered are:

- Boston to New York - 3 hours with five intermediate stops
- New York to Washington - 2 hours, 30 minutes with five intermediate stops

(5) The design considerations for all elements of the system shall emphasize safety.

(6) The passenger ride comfort levels shall be consistent with acceptable state-of-the-art levels for vibration and noise.

(7) The stations and other public contact spaces shall meet contemporary standards for passenger comfort and conveniences.

(8) The security characteristics of the NEC system shall be designed to minimize vulnerability of the NEC to intrusions, vandalism, and other illegal activities.

(9) The NECIP shall be implemented in a manner compatible with the existing environment.

### 1.1.4 IMPROVEMENT ELEMENTS

The NECIP is comprised of 11 interrelated types of improvements. The program elements described below identify the nature of the work to be accomplished to achieve program goals. A more complete description of the scope and magnitude of each type of improvement is presented in Section 1.7.

- Route Realignments will be made at various locations along the Corridor where necessary to meet trip time goals and increase rider comfort. Certain curves will be realigned and distance between track centers will be increased in areas of major new construction.
- Track Centers will be upgraded to accept increased loads produced by high-speed operations, and to provide free drainage of water from the track. Improvements will be made to the rails, ties, ballast, and subgrade; and numerous interlockings will be eliminated, relocated, replaced or mechanically and electrically refurbished.
- Bridges will be improved to meet new high-speed rail performance requirements. Undergrade railroad bridges crossing streets, rivers, etc., will be rehabilitated, upgraded or replaced to support new loads. Some overhead bridges will be modified where required to provide adequate vertical or lateral clearance. Movable bridge electrical and mechanical systems will be rehabilitated and modernized to provide efficient and reliable operations.
- Tunnels along the NEC will be rehabilitated and modified. Eight tunnels at five individual locations will be affected.
- Fencing and Barriers will be installed as necessary to increase safety and security of individuals and train operations. Special considerations such as impacts upon animal migration and community access will be addressed and resolved.
- Grade Crossings will, with certain exceptions, be eliminated by grade separation, alternate access, or outright purchase. Private grade crossing elimination will be funded through the NECIP while public grade crossing eliminations are funded under a Federal Highway Administration Program.

- Electrification improvements will be implemented with a view toward a unified 25 KV, 60 Hz source of energy all along the Corridor. Conversion of existing electrification and rolling stock, and improvement of existing electrical supply systems will be made from Washington to New Haven. New electrification facilities will be constructed in the remaining section of the rail line from New Haven to Boston.

- Signaling and Traffic Control system improvements will be implemented to provide safe, all-weather signal and traffic control for speeds necessary to meet future trip time goals.

- Communication systems will be provided to insure complete administrative and operational control of the high-speed passenger service.

- Stations will be rehabilitated to facilitate the accomplishment of trip time goals. Improvements at certain stations will be made to allow efficient rail operations and unencumbered use by the elderly and handicapped. Stations with historic significance will be improved without adversely altering their historic or unique architectural character. Improvement to nonoperationally essential elements of the stations will be initiated where the required matching funds are provided.

- Maintenance Facilities will be constructed at various locations. Nine maintenance-of-way bases and seven equipment maintenance shops will be in operation under the NECIP.

### 1.1.5 IMPLEMENTATION COSTS, FUNDING AND COMPLETION SCHEDULE

Funding Sources. The U.S. Department of Transportation (DOT) will fund 100 percent of the costs of all improvements to facilities which are essential to meet the operational goal.

In addition, the 4R Act authorizes $150 million for the improvement of nonoperational portions of stations, and for related facilities and fencing. DOT is authorized to fund 50 percent of the cost of these improvements, the remaining 50 percent to be borne by state, local or regional transportation authorities. The Secretary may, at his discretion, fund entirely any safety-related improvements relating to stations and fencing.

A proposed regulation defining which station and station-area improvements are operationally essential (100 percent fundable) and which are not operationally essential (50 percent Federally fundable) was promulgated in the Federal Register for Comment on April 28, 1978. Generally, the NECIP will fund entirely those improvements necessary for the safety, comfort, and convenience of intercity rail patrons within the eligible stations and their boarding areas.

Full participation by the states and/or transportation authorities in nonoperational improvements, when added to the federal contribution of $1.75 billion in both the operational and nonoperational categories, would result in total NECIP funding of $1.825 billion.

Implementation Cost Estimates. Table 1-2 is a state-by-state summary of estimated NEC railroad system implementation costs by project element. Costs shown are based upon preliminary estimates. Project costs are under continual refinement as planning/programming and engineering activities proceed. Therefore, the figures given should be viewed as general indicators only.

Deferred Maintenance Costs. A sizable percentage of the $1.825 billion represents the cost of eliminating deferred maintenance. This share must be spent to upgrade the deteriorated physical system rather than to improve performance. These costs would presumably be incurred by Amtrak over the next 10 to 15 years, were it not for the NECIP, simply to maintain the integrity and service level of the existing railroad. Included in this estimate are two categories of NECIP work which will reduce Amtrak's future expenditures for maintenance-of-way -- Deferred Maintenance and Capital Improvement in lieu of Deferred Maintenance (Table 1-3).

The portion of the NECIP which is directly associated with elimination of Deferred Maintenance is estimated at $647 million. Included in this estimate is trackwork done by traditional methods, most bridge repairs or upgrading, all tunnel work, and those portions of electrification, signaling, communications and stations which have to do with repair of existing components.

Table 1-2

SUBSYSTEM COST SUMMARY BY STATE
(Cost in millions)

| State | Route Realignments | Track Structure | Bridges | Electrical | Signals | Comm. | Fences | Grade Crossings | Stations | Service Facilities | Tunnels | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Massachusetts | 6.81 | 116.10 | 0.80 | 44.89 | 22.07 | 1.67 | 8.07 | 0.11 | 41.23 | 23.41 | --- | 265.16 |
| Rhode Island | 5.10 | 55.34 | 20.72 | 49.30 | 19.13 | 2.46 | 2.94 | 0.23 | 15.53 | 1.66 | --- | 172.41 |
| Connecticut | 12.35 | 80.43 | 65.83 | 77.17 | 39.20 | 5.58 | 2.85 | 4.24 | 37.98 | 4.35 | 0.47 | 329.45 |
| New York | 0.22 | 43.92 | 8.36 | 14.54 | 9.10 | 1.74 | 4.84 | --- | 6.89 | 13.09 | 12.27 | 114.97 |
| New Jersey | 2.12 | 83.40 | 53.70 | 30.80 | 22.90 | 4.34 | 4.06 | --- | 46.91 | 3.28 | --- | 251.51 |
| Pennsylvania | 4.78 | 55.70 | 26.91 | 27.42 | 31.77 | 4.63 | 10.41 | --- | 13.37 | 16.57 | --- | 191.56 |
| Delaware | 0.48 | 37.89 | 13.39 | 11.94 | 9.40 | 1.05 | 2.42 | --- | 13.23 | 13.09 | --- | 102.89 |
| Maryland | 11.64 | 126.65 | 25.53 | 47.11 | 48.40 | 5.85 | 12.50 | --- | 29.99 | 4.81 | 9.55 | 322.03 |
| Washington, D.C. | | 10.44 | --- | 2.52 | 1.68 | .15 | 5.00 | --- | 38.59 | 21.64 | --- | 75.02 |
| Totals | 43.50 | 609.87 | 215.24 | 305.69 | 202.65 | 27.47 | 48.09 | 4.58 | 243.72 | 101.90 | 22.29 | 1,825.00 |

NOTE: Total does not add to $1.9 billion due to current allocations which reflect reduced matching funds in the fencing and station subsystems.

Table 1-3

CAPITAL COSTS OF NECIP BY CATEGORY[1]
(In Millions $)

| Subsystem | Deferred Maintenance | Capital Improvements In Lieu of Deferred Maintenance | Subtotal (Col. 1 & 2) | Capital Improvement For HSR | Total[2] |
|---|---|---|---|---|---|
| Route Realignments | 0 | 20.10 | 20.10 | 23.40 | 43.50 |
| Track Structures | 353.37 | 141.50 | 494.87 | 115.00 | 609.87 |
| Bridges | 156.94 | 58.30 | 215.24 | 0 | 215.24 |
| Electrification | 29.29 | 111.50 | 140.79 | 164.90 | 305.69 |
| Signals and Traffic Control | 53.95 | 106.30 | 160.25 | 42.40 | 202.65 |
| ~munications | 1.37 | 4.20 | 5.57 | 21.90 | 27.47 |
| Fencing | 0 | 0 | 0 | 48.09 | 48.09 |
| Grade Crossings | 0 | 0 | 0 | 4.58 | 4.58 |
| Stations | 29.82 | 46.60 | 76.42 | 167.30 | 243.72 |
| Service Facilities | 0 | 20.10 | 20.10 | 81.80 | 101.90 |
| Tunnels | 22.29 | 0 | 22.29 | 0 | 22.29 |
| TOTAL | 647.03 | 508.60 | 1,155.63 | 669.37 | 1,825.00 |

[1]Figures include allocations of Program Management and System Engineering Costs.

[2]This amount does not equal the total $1.9 billion authorization because the Secretary of Transportation, as provided by Section 703(1)(B) of the 4R Act, has opted to fund 100 percent of certain safety-related, non-operational improvements.

The second category, Capital Improvements in lieu of Deferred Maintenance is estimated to account for another $509 million and includes total replacement of certain systems or components which will eliminate the need for performing work to overcome deferred maintenance on the corresponding old systems or components. This includes such items as route realignments or track work done by track laying system (TLS) which totally reconstruct sections of existing track, interlocking reconfigurations, bridge replacements, upgrading of the electrification south of New Rochelle to 25 KV, 60 Hz, all relay signals, reconstruction of existing service facilities, replacement of the MOW communication system and operational station improvements (except new platforms).

The total value of deferred maintenance overcome by the NECIP then, would include all of the $647 million in direct Deferred Maintenance and most, but not all of the $509 million cost of Capital Improvements in lieu of Deferred Maintenance. The latter would not be fully included because some of the replacement systems are designed to higher and presumeably more expensive standards than would be achieved through maintenance of the old system.

The remaining $669 million represents the Capital Improvement and covers those items designed specifically to reduce trip times, to improve performance and to improve passenger comfort and convenience. Included are such work items as new interlockings, new electrification north of New Haven, new service facilities, fencing, grade crossing elimination, centralized traffic control, the new trunk communication system, high level platforms, parking and other non-operational improvements.

Completion Schedule. In accordance with the 4R Act, those improvements required to allow operation of intercity service at the required trip time will be completed by February, 1981. As a result of revised design and construction scheduling, and redirection of certain portions of the program to allow better coordination with the plans of various commuter authorities, however, it now appears likely that completion of some construction activity may extend to 1982 and 1983.

## 1.2 BACKGROUND AND HISTORY OF THE PROJECT

The NEC is in many ways uniquely suited to the implementation of a high-speed, high-frequency intercity rail service. The Corridor is the core of the largest, most densely settled urban concentration in the United States, stretching along the Atlantic seaboard in a nearly unbroken band of urban and suburban development from Virginia to Massachusetts. Within the metropolitan areas traversed by the 456 mile Corridor rail system reside approximately 32.3 million people, the greatest majority of them in six metropolitan areas of greater than two million population. At the Corridor's geographic center is the nation's largest city, New York.

The social and economic ties which link the NEC together demand a highly developed system for the movement of people and goods. In 1975, 87 million intercity trips were made in the Corridor; 117 million intercity trips are forecast by 1990. To meet these intercity transportation needs in addition to local trips, an extensive network of interstate highways, air routes, and rail services has been established. Major highways along the spine of the Corridor, such as I-95, are supplemented by cross-spine highways and circumferential roads skirting the larger cities. These are versatile facilities, heavily used for both intercity and local auto travel, bus service, and freight movement, but subject to increasing levels of congestion. Air transportation, though primarily limited to intercity passenger movement, is also congested, particularly around the New York City hub area.

Though the private automobile and air travel are the modes of choice for the majority of intercity travelers in the Corridor, nearly 10 percent of intercity trips in 1975 were made by rail, many times the national average. Still, the NEC rail system existing today is underutilized. Though in need of rehabilitation and upgrading, the system has the capacity to accommodate a larger proportion of 1990's increased intercity and commuter travel demand.

Congressional authorization to implement the NECIP followed over a decade of research into the transportation needs and problems of the Northeast, analysis of existing and potential alternative transportation systems, and preliminary engineering studies on high speed rail systems. The earliest investigation into the problem of NEC transport began in 1963 with a $625,000 Congressional appropriation establishing the Northeast Corridor Project (NECP) within the Department of Commerce. The program was devoted primarily to data gathering and fact finding about travel needs, the condition of the existing facilities and the state-of-the-art. The High-Speed Ground Transportation Act of 1965 established the Office of High Speed Ground Transportation (OHSGT) within the Department of Commerce and authorized the Northeast Corridor Transportation Project. The major aim of the Act was to provide for research development and demonstration of possible high-speed ground transportation alternatives. The two major high-speed ground transportation demonstrations initiated under this act were the Turbotrain and the Metroliner programs. Although the Turbotrain project was of limited success, the Metroliner program has had substantial use and continues to demonstrate the future possibilities of high-speed ground transportation. Following creation of the Department of Transportation (DOT) in 1966, the Office of High Speed Ground Transportation was shifted from the Department of Commerce to the Department of Transportation.

In 1970, the Railway Passenger Service Act of 1970 was passed. Designed to prevent further deterioration of passenger rail service, this act sought to make possible an upgrading of passenger service to acceptable standards while providing a viable rail passenger service between major population centers. The Act created the National Railroad Passenger Corporation (Amtrak) to contract with the railroads to provide crews and operating facilities and to provide rail passenger service. Equipment would be largely owned by the Corporation.

In 1971, the Secretary of the Department of Transportation prepared and released a comprehensive set of recommendations entitled, Recommendations for Northeast Corridor Transportation. This report emphasized the need for action by pointing out critical problems with other modes of transportation. The report concluded that high-speed rail was one of the best alternatives for short- and long-term future transportation needs. In January of 1973, DOT produced an update and extension of its 1971 report, entitled, Improved High-Speed Rail for the Northeast Corridor. This report recognized that current highway and air transportation systems were insufficient to accommodate increased future patronage, and that expansion was difficult due to community opposition. It constituted a proposal to implement rail passenger service improvements in the NEC as a means of moving large numbers of passengers safely and comfortably through the densely populated Northeast. This report included ideas for specific improvements, an organization to accomplish them, and a financial plan and schedule for implementation.

The Regional Rail Reorganization Act of 1973 (3R) was enacted primarily to provide for federally directed reorganization of the Penn Central Railroad and a number of smaller bankrupt freight carriers in the Northeast and Midwest. The U. S. Railway Association (USRA) was created to plan the reorganization of the bankrupt railroads into a new carrier, the Consolidated Rail Corporation (Conrail). While the 3R Act was concerned primarily with rail freight transportation, it also recognized the need for improved passenger service in the NEC. The Act directed the Secretary to begin the engineering studies necessary to implement improved rail passenger service on the NEC. The U. S. Railway Association was empowered to designate for acquisition or lease by Amtrak, those rail properties necessary to implement the improved service. In its Final System Plan, USRA designated the NEC mainline for Amtrak acquisition, excepting those segments which Penn Central had previously sold or leased to states or transportation authorities. The Corridor was acquired by Amtrak in 1976. The 4R Act authorized the NECIP and appropriated $25 million in 1976, and an additional $25 million for the transition quarter enabling initiation of the improvement action.

## 1.3 THE EXISTING RAIL SYSTEM

### 1.3.1 OVERVIEW

The development of the interstate highway system and the resulting travel time improvements of auto, truck and bus contributed greatly to the decline of rail passenger and freight demand in the NEC region through the 1950s and 1960s. This decline in demand was a factor in the bankruptcy of the independent railroads of New England and the Midwest in the late 1960s and early 1970s. Of necessity, the rail companies lowered standards of efficiency and service to the public during that period. As the rail system deteriorated financially, the physical facilities constructed in the late 19th and early 20th century were allowed to deteriorate, maintenance was deferred and worn-out equipment was not replaced.

Deficiencies in the NEC's rail passenger system are primarily traceable, then, to the age of the rail facilities and equipment. Most rail line locations date back to the 1800s even though some signaling, electrification and alignment improvements were made through the 1930s.

One of the last major line improvements made by the Pennsylvania Railroad was the construction of tunnels into Manhattan to serve the new Pennsylvania Station. The Hell Gate Bridge and connecting viaducts over the Bronx and Queens finally provided a direct connection between the Pennsylvania and New Haven lines in 1917. The Pennsylvania mainline electrification project in the 1930s provided a final opportunity for major construction projects, including monumental new stations at Philadelphia and Newark, alignment changes, bridge construction and grade separations. With few exceptions, these changes were the last alignment improvements made by the rail companies.

Speeds are limited along many sections of the mainline by the curvature of the route and at some locations by the horizontal and vertical clearances at overpasses and underpasses. Catenary support structures on many curves south of New Haven are inadequate to permit higher speed operation. The original electric locomotives used on the line were not designed to operate at a speed higher than 80 mph and thus, the design of the railroad was not altered from the time of steam or diesel locomotive use.

Congestion and lower speeds also result from the mix of traffic sharing the NEC right-of-way, including freight, commuter and intercity passenger trains. The NEC mainline from Washington to Boston is the most complex blend of high density intercity travel, commuter travel and freight traffic in the nation. The combination of these factors creates numerous difficulties in scheduling a mix of service on one rail line while minimizing service interference. The problem becomes particularly acute at points (such as at some tunnels and bridges) where the number of tracks is reduced.

The years of deferred maintenance also have caused slow orders[1] to be imposed frequently along the Corridor. In April, 1977, there were 23 slow orders on 30 miles of track for conventional trains operating between New Haven and Boston and 52 slow orders on 88 miles of track for conventional trains operating between New York and Washington.[2] In the same month, Metroliner operations between New York and Washington had 70 restrictions on 102 miles of track. Overall, the outdated system design which does not permit maximum use of the available resource, the congestion caused by the mix of freight, commuter and Amtrak traffic and the slow orders caused by deferred maintenance have cumulatively contributed to rail service's poor competitive position.

The effects of congestion, slow orders and equipment failure are reflected in the poor reliability of the intercity service. During the latter half of 1975 the on-time performance for Corridor intercity trains averaged about 70 percent. Metroliner performance dropped as low as 26

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[1]A slow order is normally a temporary speed restriction imposed because of deteriorated track or structure conditions.

[2]1977 speed restriction data from Amtrak temporary speed restriction summary dated April 14, 1977.

percent for on-time arrivals in June, 1976 and again in September, 1977, and averaged about 44 percent on-time for FY 1977. The conventional trains operating in the Corridor dropped as low as 62 percent on-time in July of 1977 and averaged 78 percent on-time for FY 1977. A train is considered on time if it arrives at a station no later than five minutes after the scheduled arrival time for every 100 miles it has traveled, up to a maximum of 30 minutes. On the average conventional trains experience 12 minutes of delay while Metroliners experience delays of 16 minutes. Delays of 45 minutes or more are not uncommon for individual trains.

### 1.3.2 OWNERSHIP

The right-of-way of the NEC is owned by Amtrak with the following exceptions:

- Union Station to Ivy City Yard in Washington is owned by the Washington Terminal Company, a joint Amtrak/Chessie System arrangement.
- New Rochelle, New York to the Connecticut/New York border is owned by the New York Metropolitan Transportation Authority (MTA).
- Connecticut/New York border to New Haven is owned by the Penn Central Trustees, and is currently in the fifth year of a 60-year lease to the State of Connecticut.
- Certain segments of trackage in the City of Providence are owned by the Providence and Worcester Company.
- Trackage between the Rhode Island/Massachusetts border and Boston South Station is owned by the Massachusetts Bay Transportation Authority (MBTA).
- Yard tracks at Boston South Station are owned by the Boston Redevelopment Authority (BRA).

Amtrak also owns 14 of the 26 stations served by Amtrak on the NEC rail system--Baltimore, Aberdeen, Wilmington, Philadelphia 30th Street, North Philadelphia, Princeton Junction, New Brunswick, Newark, New York Penn Station, Old Saybrook, Mystic, Westerly, Kingston and Providence.

The latter may soon be conveyed to the State of Rhode Island. Washington Union Station is owned by the Washington Terminal Company; Capital Beltway by Prince George's County, Maryland; Trenton and Metropark by the State of New Jersey; Stamford by Transport Plaza Associates; Rye by the MTA; and Bridgeport by the City of Bridgeport. New Haven Station is under lease by the State from the Penn Central Trustees; New London Station is owned by Union Station Associates; Route 128 and Back Bay are owned by the MBTA; and Boston South Station is owned by the Boston Redevelopment Authority.

Amtrak has agreements for the operation of intercity rail service on those segments and within those stations that it does not own.

### 1.3.3 RAIL SYSTEM DESCRIPTION BY SEGMENT

Washington to Baltimore. From Union Station to New York Avenue in Washington, the Corridor trackage converges to two tracks and is used only for intercity and commuter passenger traffic. From New York Avenue to Landover Interlocking,[1] the Corridor continues as a two-track system owned by Amtrak serving only intercity and commuter passenger traffic and local freight. Conrail freight service enters and leaves the Corridor at Landover where a third track is added. The Corridor is a three-track system serving Amtrak, Conrail and commuter traffic to Winans Interlocking, and similar operations continue to Fulton Interlocking just south of Baltimore.

Baltimore. At Fulton Interlocking the trackage immediately converges to two tracks passing through the B & P Tunnel and the Baltimore Station, becoming three tracks through the Union Tunnel, and four tracks through Bay View Yard to River Interlocking near the Back River. Commuter service presently operates from Baltimore to Washington, but not north of Baltimore.

Baltimore to Wilmington. The Corridor carries both freight and intercity passenger traffic on this segment, which alternates between two, three, and four tracks. At Ragan Interlocking just south of Wilmington, most freight is routed off the Corridor onto the Shellpot branch.

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[1] An interlocking is a point on the track where signals and crossovers permit the controlled interchanging of trains between various tracks.

Wilmington to Philadelphia. Two and three tracks exist through Wilmington. Freight reenters the Corridor via the Shellpot branch just south of Bell Interlocking, about five miles north of Wilmington. From Bell to Arsenal Interlocking just south of Philadelphia, the Corridor is a four-track system serving intercity, commuter, and freight traffic. All freight traffic is diverted from the Corridor tracks at Arsenal. Conrail operates commuter service on the Corridor for the Southeastern Pennsylvania Transportation Authority (SEPTA) between the West Yard Interlocking, Wilmington, and downtown Philadelphia. SEPTA has future plans for an airport rapid transit line in the area between Brill Interlocking and downtown. From Arsenal to the Penn Interlocking at Philadelphia 30th Street Station, the Corridor is double tracked and serves only commuter and intercity passenger traffic.

Philadelphia to Trenton. Traffic from 30th Street Station (Penn) to the Zoo Interlocking just north of Philadelphia, is limited to intercity and commuter passengers. At Zoo, freight reenters the Corridor onto a four-track system. SEPTA commuter service terminates at Trenton Station; and New Jersey Department of Transportation service starts at Trenton, proceeding east to Penn Station, New York.

Trenton to Newark. New Jersey Department of Transportation commuter service begins at Trenton or enters the Corridor from other lines at County (New Brunswick), Union (Rahway), and Hunter (Newark) Interlockings. With the exception of former Central of New Jersey Railroad and some New York and Long Branch commuter trains that terminate at Newark, all intercity and commuter trains proceed to New York City. Through freight service to and from the south enters and leaves the Corridor at Lane Interlocking just south of Newark. This segment is essentially a four-track system ending at the Hudson Interlocking just east of Newark. Some trailer van trains leave the mainline at Hudson.

Newark to New Rochelle. At the Hudson Interlocking, the Corridor becomes a high density, two-track system which enters Penn Station via the North (Hudson) River Tunnels. The Corridor leaves Penn Station via two of the four East River Tunnels to the Harold Interlocking in Queens. At Harold the Long Island Railroad (LIRR) and Corridor tracks diverge. The Corridor then utilizes the double track passenger line of the New York Connecting Railroad, the four-track Hell Gate Bridge over the East River, and two tracks of the four-track Harlem River Branch to Pelham Bay Interlocking near Baychester. Freight and Corridor passenger traffic then jointly use the two-track system to Shell Interlocking at New Rochelle.

New Rochelle to New Haven. At Shell the Corridor joins the New Haven mainline, converging with West End commuter trains which operate between Grand Central Station and New Haven, New Canaan and Danbury, Connecticut. The Corridor is a four-track system between New Rochelle and New Haven with heavy commuter traffic operated jointly for the Metropolitan Transportation Authority (MTA) and the Connecticut Department of Transportation, by Conrail. The freight traffic operating on this segment of the Corridor is local with the exception of four through freights a day between Albany (Selkirk) and New Haven (Cedar Hill) which enter the Corridor at Devon Interlocking in Stratford.

New Haven to New London. At Fair Street Interlocking in New Haven, the Corridor becomes a two-track system carrying only intercity and local freight service. The Hartford/Springfield branch is a separate two-track line from New Haven Station to Mill River Interlocking.

New London to Providence. The two-track system continues to Providence, serving intercity passenger and local freight trains. The Rhode Island Department of Transportation has long-range plans for rail commuter service on the Westerly/Providence segment.

Providence to Boston. The Corridor remains a two-track system to Readville Interlocking in Boston where it becomes a three- and four-track system to South Station. This segment accommodates Amtrak, local freight service, and commuter service which becomes increasingly dense as the Corridor approaches Boston. That section of the Corridor between

Forest Hills Interlocking (two miles inside Route 128) and South Station will be reconstructed as part of the Orange Line Rapid Transit Relocation project by the MBTA.

### 1.3.4 PHYSICAL PLANT

Track Structure. In preparation for Metroliner service, which began in January, 1969, over half of the rail in the Corridor between Washington and New Haven was replaced with 140 pounds-per-yard, continuously welded rail (CWR). This track was tied and ballasted to meet high-speed service standards. The interlockings were rehabilitated by replacement, realignment, or ballasting. The CWR has been relatively well maintained, but the interlockings have deteriorated. The majority of the track between New Haven and Boston is constructed of jointed rail.

The continuous welded rail sections between Washington and New York at present permit maximum speeds of 105 mph for Metroliner equipment. Maximum authorized speed between New York and Boston is 79 miles per hour for conventional trains.

Alignment. There are eight curves greater than 3° between Washington and New York City, and 60 curves greater than 3° between New York and Boston. Of these, 12 curves are greater than 5°; the maximum degree of curvature is 10° at Back Bay.

Grades. There are approximately 3.2 miles of gradient greater than one percent between Washington and New York, and 5.6 miles between New York and Boston, with ruling gradients of 1.89 and 1.30, respectively.

Bridges. There are 772 undergrade bridges which carry the Corridor tracks over streams, roads, etc. Of these, 15 are movable spans which accommodate marine traffic on navigable rivers. Almost one-quarter of the bridges were built before 1895, and half were built between 1895 and 1920. Many of these bridges require load and/or speed restrictions due to deterioration. There are 528 overhead bridges along the Corridor which carry roads or other rail lines over the main line tracks.

Tunnels. Eight tunnels in five locations are currently in use along the NEC: the Union and B & P tunnels in Baltimore, the

North River and East River tunnels in New York City and a relatively short tunnel section in East Haven, Connecticut. Because maintenance of these tunnels has been deferred, the roadbeds, drainage systems and tunnel linings are deteriorated.

Fencing. Approximately 35 percent of the ROW is fenced to some degree. Most of the existing fencing was installed by adjacent land owners, with railroad-owned fencing primarily in yard and station areas.

Grade Crossings. There are 19 privately owned grade crossings along the NEC railroad system: 12 in Connecticut, six in Rhode Island, and one in Massachusetts. In addition, there are 48 public grade crossings which are currently funded for elimination under a Federal Highway Administration program.

Traction Power. Metroliners and electric locomotives are powered by a 12 KV (nominal), 25 Hz overhead catenary electrification system between Washington and New Haven. The power is presently supplied by Baltimore Gas and Electric Company, Pennsylvania Power and Light, Philadelphia Electric Company, Consolidated Edison, and the Cos Cob Power Plant. Drastically increased maintenance costs and frequent failures indicate that equipment is reaching the end of its useful life. The electrification system between New York and New Haven is presently being replaced by a 12.5 KV, 60 Hz system by the MTA and the Connecticut Department of Transportation (ConnDOT). Traction power is provided by diesel locomotive from New Haven to Boston. At present eight to 15 minutes are required to change locomotives at New Haven from electric to diesel or vice versa.

Signals and Communications. Current signaling along the Corridor consists of a mixture of operational but antiquated automatic block systems, including both cab and wayside signals, some of which would be incompatible with improved electrification. Communications equipment is generally deteriorated.

Maintenance Facilities. Corridor equipment is presently maintained in facilities which are inadequate in design to perform necessary running repair and major overhaul. Service and running repairs are made at facilities in Boston, New York, Philadelphia, and Washington. Major maintenance facilities are located at Wilmington, New Haven, and Stamford (commuter equipment). Presently, there are neither heavy maintenance facilities nor maintenance-of-way facilities on the Corridor owned or operated by Amtrak, capable of supporting the projected 1990 operations. All exterior car washing and interior extraordinary cleaning facilities are exposed to the elements, reducing their effectiveness during inclement weather.

Stations. There are currently 26 stations on the NEC spine served by Amtrak, many of which have deteriorated and no longer provide reasonable convenience and comfort. Some station buildings are in fact closed to the public and only loading platforms are used. Several of the stations were built in the early 1890s in a monumental style, in recognition of the significance of the early railroads. The exceptions are the newer outlying stations such as Metropark (Iselin, New Jersey), Route 128 (Boston), New Carrollton (Capital Beltway) and the new station at Bridgeport, Connecticut.

### 1.3.5 OPERATIONS

Amtrak operates all intercity passenger service on the NEC rail system. Two service levels include coach service (Amfleet service), which operates over the entire Corridor, and Metroliner service, which operates between New York and Washington (and one round trip daily from New Haven to Washington). Amfleet service is provided by relatively new, locomotive-hauled cars. Metroliner service is faster, using self-propelled electric cars which were introduced in 1969. Metroliners are becoming unreliable due to equipment failure. Amtrak has plans to refurbish and upgrade the Metroliner cars in the next two years.

In the MTA-ConnDOT territory maintenance-of-way and dispatching is performed by Conrail. In the MBTA area of operation, Amtrak provides these functions.

A summary of frequency of service and 1975 patronage at 25 stations served by Amtrak is shown in Table 1-4. Ridership and service on the Corridor is heavily concentrated in the New York to Washington segment. Over the last eight years, the southern part of the Corridor has accounted for 82 to 88 percent of total rail traffic in the NEC.

Rail fares are generally proportional to mileage on the Corridor. The following are representative:

- Boston to Washington costs $38.50 for coach.
- Boston to New York costs $19.50 for coach.
- New York to Washington costs $21 for coach and $26 for Metroliner.

Commuter rail service is operated on the Corridor by the following agencies:

- The Maryland Department of Transportation which operates commuter rail service in the Baltimore to Washington segment.
- SEPTA which operates service on the Wilmington to Philadelphia segment and, in conjunction with New Jersey Department of Transportation, on the Trenton to Philadelphia segment.
- New Jersey Department of Transportation which operates commuter rail between Trenton and New York Penn Station.
- MTA which operates Long Island Railroad service sharing the Penn Station to Harold ROW.
- MTA and Connecticut Department of Transportation which operate the West End commuter service utilizing the New Haven to New Rochelle segment of the Corridor on its route to Grand Central Station.
- MBTA which operates commuter rail service on the Providence to Boston segment of the Corridor.

The density of rail traffic on the NEC is clearly dominated by commuter trains on the segments flanking New York City from Trenton to New Haven (Figure 1.3).

Rail freight service in the NEC currently consists of delivery and pick-up at industrial sidings and through freight trains operating nonstop between major yards. The only through freight service using the

Table 1-4

SERVICE LEVEL AND PATRONAGE
AT NEC STATIONS, 1975

| STATIONS | NEC Intercity Annual Patronage (000) | Service Level (Intercity Trains Per Day) |
|---|---|---|
| Boston South | 537 | 22 |
| Back Bay | 104 | 22 |
| Route 128 | 105 | 22 |
| Providence | 262 | 22 |
| Kingston | 29 | 10 |
| Westerly | 21 | 10 |
| Mystic | 9 | 8 |
| New London | 156 | 22 |
| Old Saybrook | 44 | 10 |
| New Haven | 359 | 30 |
| Bridgeport | 50 | 12 |
| Stamford | 152 | 18 |
| Rye | 76 | 20 |
| New York Penn | 5,982 | 82 |
| Newark | 1,321 | 62 |
| Metropark | 438 | 18 |
| New Brunswick | 395 | 20 |
| Princeton Jct. | 652 | 26 |
| Trenton | 1,763 | 52 |
| N. Philadelphia | 198 | 38 |
| 30th Street | 3,109 | 80 |
| Wilmington | 529 | 48 |
| Baltimore | 897 | 50 |
| New Carrollton | 184 | 24 |
| Washington, D.C. | 1,856 | 50 |

NOTE: A 26th station, Aberdeen, Maryland, is served by one Amtrak train in each direction daily.

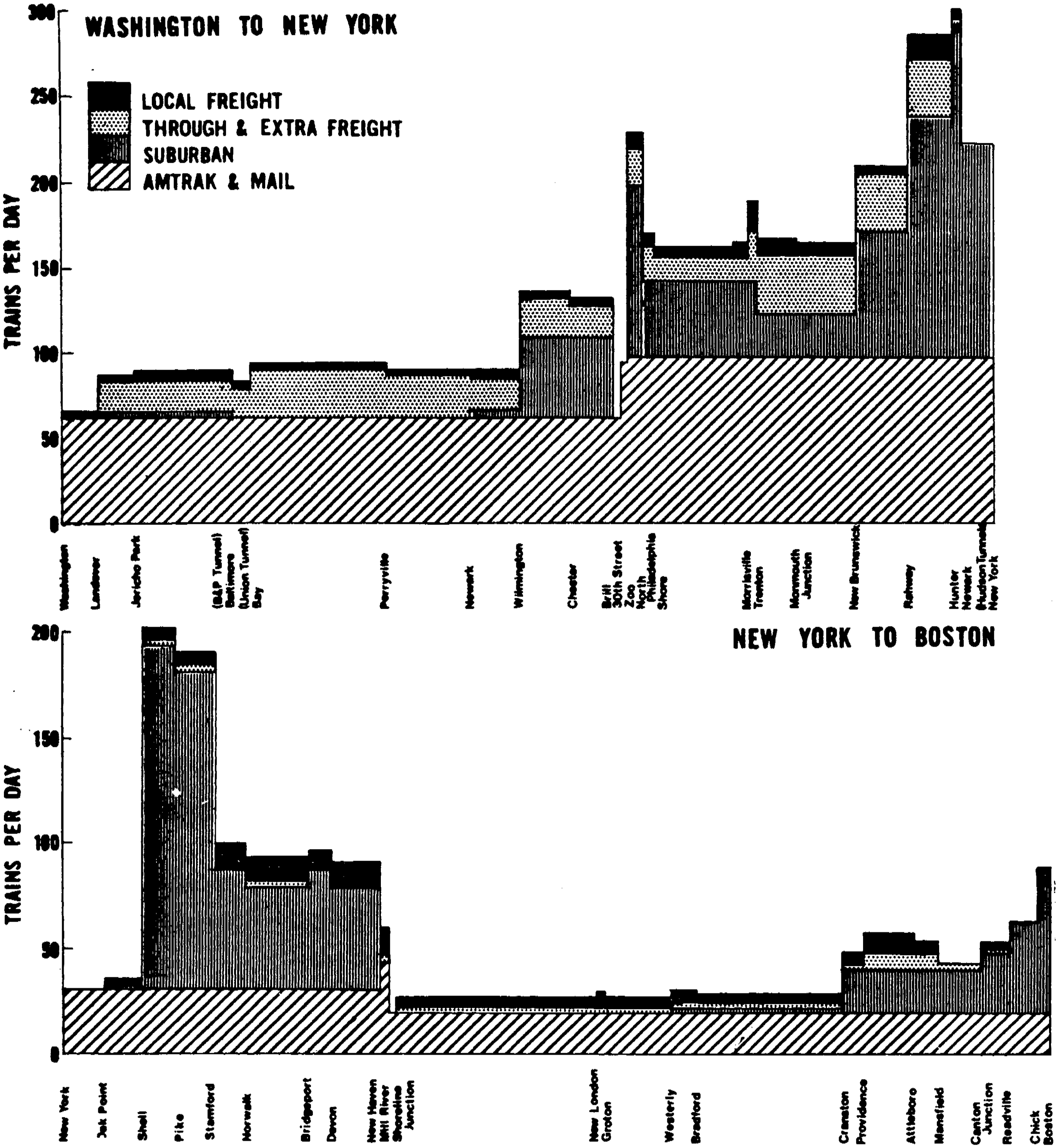


**Figure 1.3**

**RAIL TRAFFIC DENSITY ON THE NEC - 1974**

Corridor between Newark and Boston involves four trains daily between Milford and New Haven and some freights on various short segments between Providence and Readville. Through freights make extensive use of the Newark-Washington segment, primarily for movements between major Corridor freight yards and Enola Yard in Harrisburg and Potomac Yard in Alexandria. Local freight service is provided both north and south of New York, but the heavier concentration of industrial installations in New Jersey and Pennsylvania has required more extensive local service south of New York (Figure 1.3).

### 1.3.6 RIDERSHIP, REVENUE AND COST OF INTERCITY SERVICE

Even though the NEC accounts for only about 2 percent of the total rail mileage served by Amtrak in the United States, the NEC service accounts for nearly 60 percent of the trips and 30 percent of the passenger-miles traveled on Amtrak trains (Table 1-5). Thus, almost 10 percent of the intercity trips in the NEC are by rail as opposed to only about one percent in the nation.

Between 1972 and 1976, Amtrak trains provided service for an increasing number of intercity travelers in the NEC. Patronage grew from 8.1 million to 9.7 million during that five year period (a 20 percent increase or 3.7 percent per annum), peaking at 10 million passengers in 1974 during the Arab oil embargo, and is currently back to that level (Table 1-5). This growth in ridership combined with fare increases has led to consistently growing revenue--overall a 49 percent increase between 1972 and 1976 according to the best available Amtrak data. The rapid growth in revenue available to Amtrak has unfortunately been outstripped by even greater increases in operating costs. Over the same five year period that saw revenue grow by 49 percent, operating costs grew by 134 percent.

Because of inconsistencies in accounting procedures it is not relevant to compare Amtrak's historical revenue/cost data to data for FY 1976 and FY 1977, which is based on a revised reporting system. As a result, financial data for the NEC system, based on Amtrak's Route Profitability reports, is shown in Table 1-6. Over that two-year period, it can be seen that

Table 1-5

INTERCITY RAIL PASSENGERS AND PASSENGER-MILES
TOTAL AMTRAK SYSTEM AND NEC AMTRAK SYSTEM
(millions)

| | Passenger Trips | | | Passenger-Miles | | |
|---|---|---|---|---|---|---|
| Year | Total System | NEC | NEC as Percent of Total | Total System | NEC | NEC as Percent of Total |
| 1972 | 13.7 | 8.1 | 59.1 | 2920.3 | 817.0 | 28.0 |
| 1973 | 14.7 | 8.7 | 59.2 | 3344.5 | 962.3 | 28.8 |
| 1974 | 16.7 | 10.0 | 59.9 | 4415.0 | 1171.2 | 26.5 |
| 1975 | 15.8 | 9.6 | 57.5 | 3744.9 | 1097.4 | 29.3 |
| 1976 | 16.8 | 9.7 | 57.7 | 3717.6 | 1098.1 | 29.5 |
| Percent Increase (1972-1976) | 22.6 | 19.8 | | 27.3 | 34.4 | |

SOURCE: National Railroad Passenger Corporation, Market Section, Unpublished Operating Statistics for the NEC. Some inconsistencies do exist because of the reporting transition in early Amtrak years.

Table 1-6

OPERATING AND FINANCIAL SUMMARY OF AMTRAK NEC SERVICE
FY 1976 and 1977

| CATEGORY | FY 1976 (FY 1976$) | FY 1976 (FY 1977$) | FY 1977 (FY 1977$) |
|---|---|---|---|
| STATISTICS (millions) | | | |
| Passengers: | | | |
| Metroliner | 2.2 | 2.2 | 2.1 |
| Conventional | 7.1 | 7.1 | 7.6 |
| Total | 9.3 | 9.3 | 9.7 |
| Passenger-miles: | | | |
| Metroliner | 321.7 | 321.7 | 295.1 |
| Conventional | 730.9 | 730.9 | 852.7 |
| Total | 1,052.6 | 1,052.6 | 1,147.8 |
| Train-miles: | | | |
| Metroliner | 2.26 | 2.26 | 2.01 |
| Conventional | 4.20 | 4.20 | 4.27 |
| Total | 6.46 | 6.46 | 6.28 |
| Revenue: | | | |
| Metroliner | 40.1 | 42.1 | 36.9 |
| Conventional | 47.4 | 49.8 | 51.5 |
| Total | 87.5 | 91.9 | 88.4 |
| Total Operating Costs: | | | |
| Metroliner | 53.8 | 58.4 | 49.8 |
| Conventional | 111.1 | 120.5 | 122.7 |
| Total | 164.9 | 178.9 | 172.5 |
| Surplus/deficit on operating costs: | | | |
| Metroliner | -13.7 | -16.3 | -12.9 |
| Conventional | -63.7 | -70.7 | -71.2 |
| Total | -77.4 | -87.0 | -84.1 |
| DERIVATIVES | | | |
| Revenue/passenger-mile: | | | |
| Metroliner | .125 | .131 | 0.125 |
| Conventional | .065 | .068 | 0.060 |
| Total | .083 | .087 | 0.077 |
| Operating cost/passenger-mile: | | | |
| Metroliner | 0.167 | .181 | 0.169 |
| Conventional | 0.152 | .165 | 0.144 |
| Total | 0.157 | .170 | 0.150 |
| Surplus/Deficit/passenger-mile: | | | |
| Metroliner | -.043 | .050 | -.044 |
| Conventional | -.087 | .097 | -.084 |
| Total | -.074 | .083 | -.073 |

SOURCES: Amtrak, Five-Year Plans, Interstate Commerce Commission Report, Effectiveness of the Act.

slight declines in revenue and operating cost lead to a reduction in deficit per passenger-mile from 8.3 cents to 7.3 cents (in FY 1977$).

Figure 1.4 illustrates the varying densities of the 1975 intercity rail passenger traffic by segments between the major urban areas. The rail volumes shown on this figure are the cumulative total of all rail passengers traveling on the section of the NEC rail system between each of the ten NEC urban areas. Trips to and from the New York urban area form the dominant rail travel pattern in the NEC. About 78 percent of all 1975 NEC rail trips either began or terminated (or both) in the New York urban area (Figure 1.4). Approximately 17 percent of the rail trips were made only between those five NEC urban areas south of New York, approximately three percent were made only between those four NEC urban areas north of New York, and only two percent traveled between urban areas north of New York and urban areas south of New York (i.e., through New York).

The percentage of intercity travelers by segment that traveled on rail also varied substantially through the Corridor. Although the rail passengers in 1975 average 10 percent of all NEC intercity travelers, they accounted for less than four percent of the segment total between Boston and Providence and nearly 17 percent of the total NEC segment passengers between Trenton and New York (Figures 1.5 and 1.6).

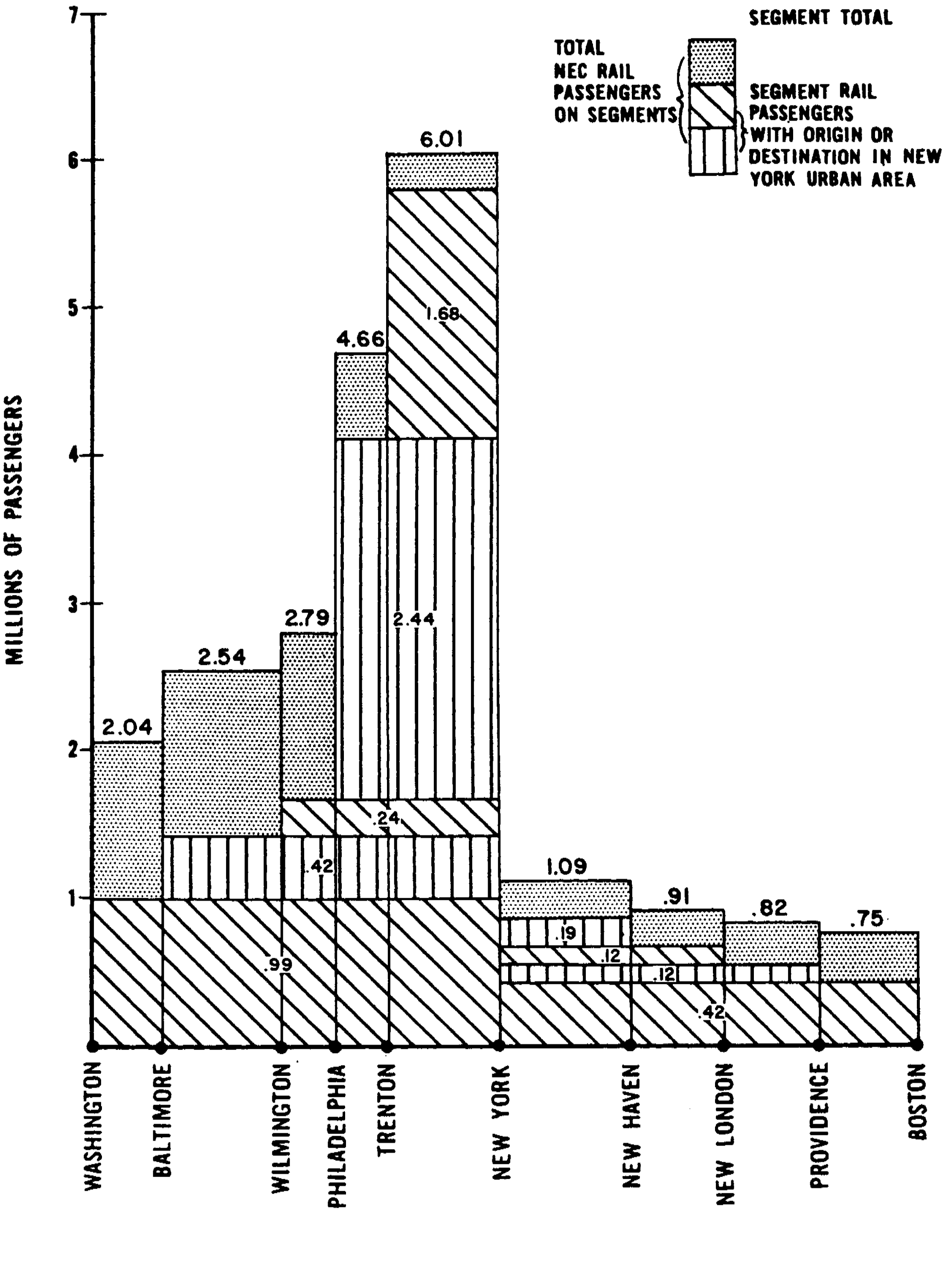


**Figure 1.4**

**1975 NEC RAIL PASSENGERS**

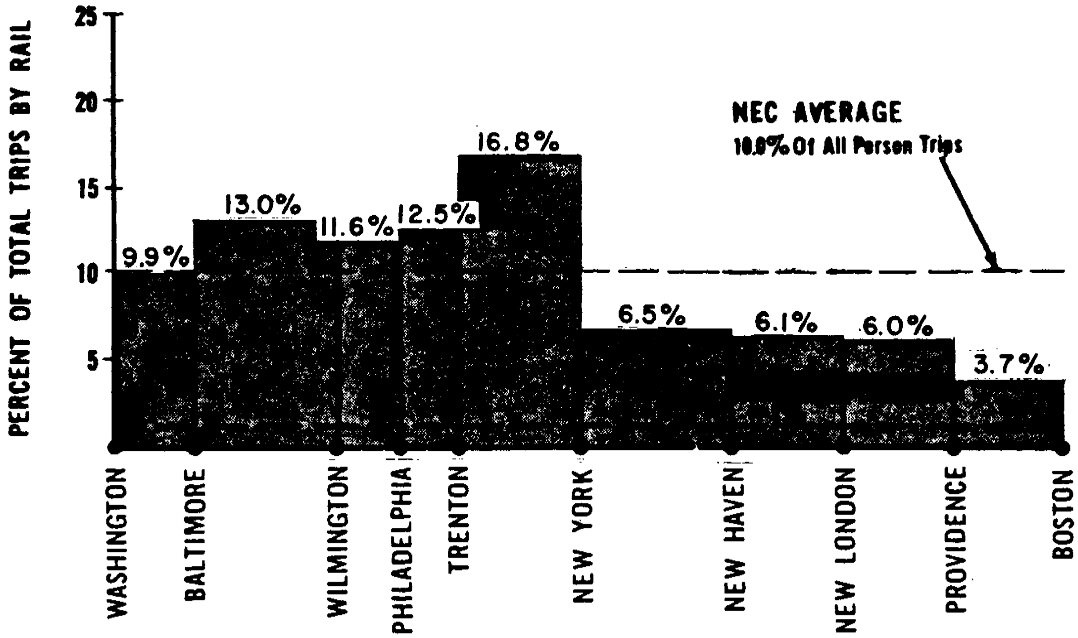


**Figure 1.5**
**1975 PERCENT OF TOTAL INTERCITY PERSON TRIPS BY RAIL**

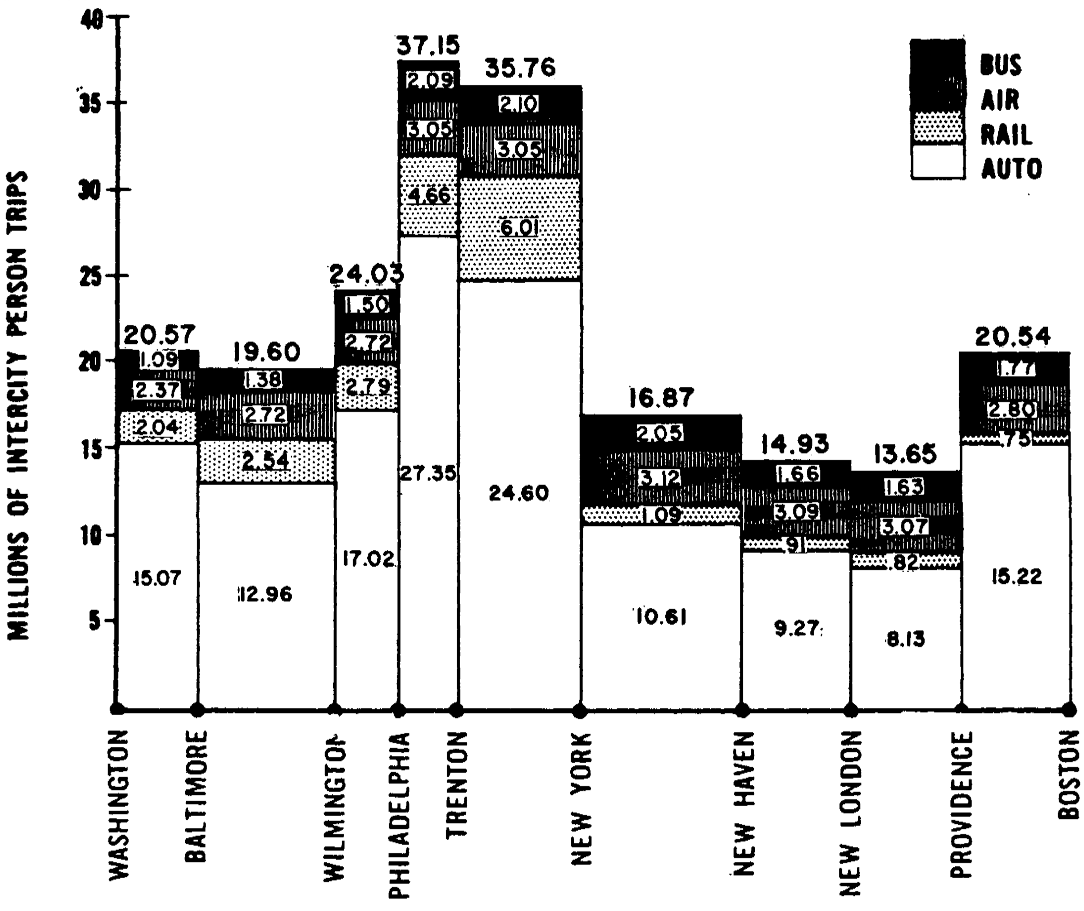


**Figure 1.6**
**1975 TOTAL INTERCITY PERSON TRIPS BY ALL MODES**

## 1.4 DEMAND PROJECTIONS

### 1.4.1 OVERVIEW

In a continuing effort to develop accurate, reliable and policy sensitive demand projections for NEC planning, a variety of assumptions concerning 1990 socio-economic and transportation system conditions have been forecasted since the development of projections used in the Draft PEIS. Additionally, updated and more reliable travel data for rail, air and bus have been obtained for the 1975 base year, causing a recalibration of the demand forecast model.

In the total demand model, for example, forecasts of baseline populations and income projections have been revised downward to reflect more recent trends. This resulted in an expected 1990 total demand for all intercity trips of 117 million rather than 131 million previously forecast, both being increases over the 87 million intercity trips of 1975. In the mode split model, various scenarios concerning the key variables such as 1990 fuel cost, rail trip time, frequency of service and fare have been modeled and a range of 1990 demand for the improved rail system and other modes has resulted. A basic conclusion is that the 26.4 million rail passenger trips previously (i.e., in the Draft PEIS) forecast for 1990 rail demand as a result of the NECIP is too high. The most likely estimates of population, income, fuel price and rail system service level now yield a total 1990 rail demand of 21.8 million trips (as compared to 9.6 million in 1975). In addition to a reduction in total demand, the distribution of projected trips has changed because of the updated base data.

The general effect of the 17 percent reduction in demand expectation (from 26.4 million to 21.8 million) on the various environmental effects identified in the Draft PEIS has been assessed and is reflected in revisions to the appropriate impact analyses of Chapter 3. Where appropriate the implications of rail demand 25 percent higher or lower than that projected is also assessed. A summary of the effects of over- or under-estimation of demand on environmental impacts of the NECIP is presented in Section 1.4.5.

Without the NECIP rail demand in the Corridor is expected to grow from 9.6 million in 1975 to 13.2 million trips in 1990, partly as a result of normal growth and partly as a result of expected increases in fuel prices which would disproportionately increase the costs of auto and air trips. Using the new "baseline" or "most likely" projection for the improved rail system, the number of intercity rail passenger trips in the NEC is instead forecast to grow to 21.8 million in 1990 as a direct result of the improvements in travel time, comfort and reliability afforded by the proposed NECIP. The increase reflects a growth in the rail share of the travel market from 10 percent of the 87 million intercity trips in 1975 to over 18 percent of the 117 million intercity trips projected for the NEC in 1990. Without the NECIP, patronage of the rail system would grow to 13.2 million in 1990 with only a marginal improvement in market share.

The sources of the 12.2 million passenger increase in rail trips over that 15-year period will be: (1) normal rail user growth, (2) persons who would have made the trip by another mode, and (3) persons who would not have made the trip at all were it not for the increased accessibility afforded by improved rail service (i.e., induced trips)(Figure 1.7 ). Normal growth is estimated to account for 3.6 million or 30 percent of the 12.2 million passenger increase. Trips which will be diverted from autos will account for 2.5 million; trips diverted from bus will account for 1.9 million; and trips diverted from air will account for 1.35 million. The remaining 2.85 million are induced[1] rail trips which represent an increase in total trips due to rail service level improvements.

The diversion of trips from the other modes will reduce expected levels of intercity person-miles traveled in automobiles by 3.9 percent (300 million), in buses by 28.1 percent (192 million), and in aircraft by 11.6 percent (269 million). The reduction in intercity travel time by rail will not be sufficient to attract significant numbers of the longer NEC intercity trips (300 to 400 miles), but will have its most profound effect in the 100 to 250 mile trip range. Diversion of trips in this

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[1] Induced trips are trips which would not have been made because of a potential traveller's perception of congestion or cost. An improvement such as the NECIP which reduces real or perceived congestion and cost will "induce" these trips to be made.

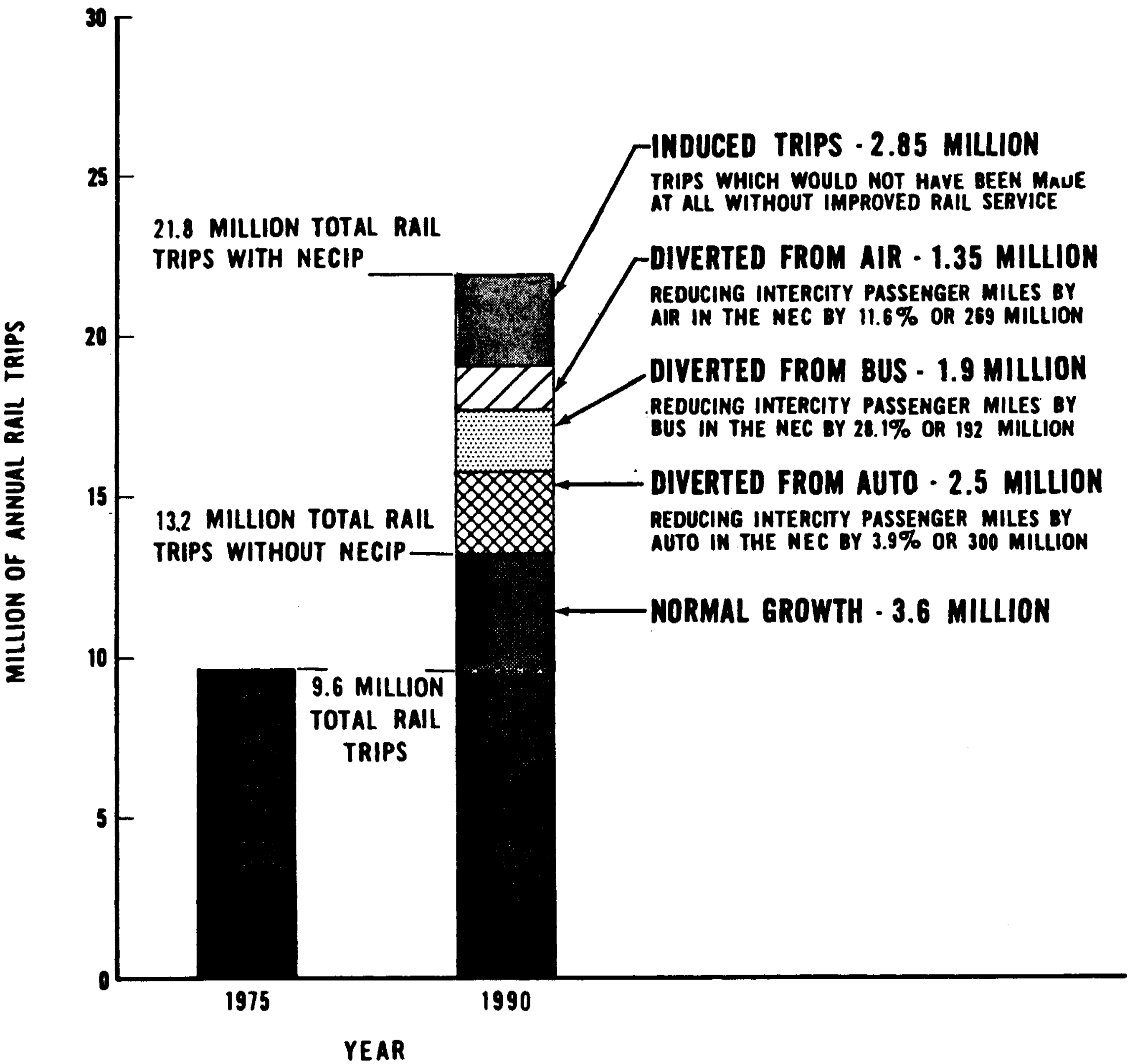


**Figure 1.7**

**COMPOSITION OF 1990 PATRONAGE ON THE IMPROVED RAIL SYSTEM**

range will be reflected in an increase in average trip length for all rail passengers from 111 miles in 1975 to 116 miles in 1990.

### 1.4.2 METHODOLOGY

Intercity travel demand in the NEC has been the subject of a number of in-depth studies and computer modeling efforts in recent years.[1,2] The latest projections of intercity travel demand developed for use in NECIP planning draw upon the analysis and results of these previous efforts but depend primarily upon the results of a new recently developed model.

There are two basic parts to this model. One part is a modified "gravity" model which forecasts total demand by all modes and the other estimates mode splits (or share of total demand by mode) by simulating traveler choice. For the purpose of this analysis, the NEC consists essentially of the region bounded by the 18 semi-contiguous Standard Metropolitan Statistical Areas (SMSA) along the east coast from Boston to Washington. The NEC was aggregated for the purpose of this analysis into 10 urban areas (see Figure 1.8). Each urban area was subdivided into a large number of zones for which trip making factors were developed and projected. Each specific origin-destination pair is modeled (i.e., forecasted) separately.

The total demand model was calibrated on historical patronage data for a number of years between 1960 and 1972. The total demand for travel between origin-destination pairs is directly related to the attractive forces of economic activity and inversely proportional to the time/cost of travel between them and the availability of alternate destinations which would satisfy that demand. The independent variables used in the regression model are: city-pair income (median family) product; city-pair economic perceived cost function (a composite of total time and cost of trips by all available modes); and alternate destination population (populations near a city weighted by distance).

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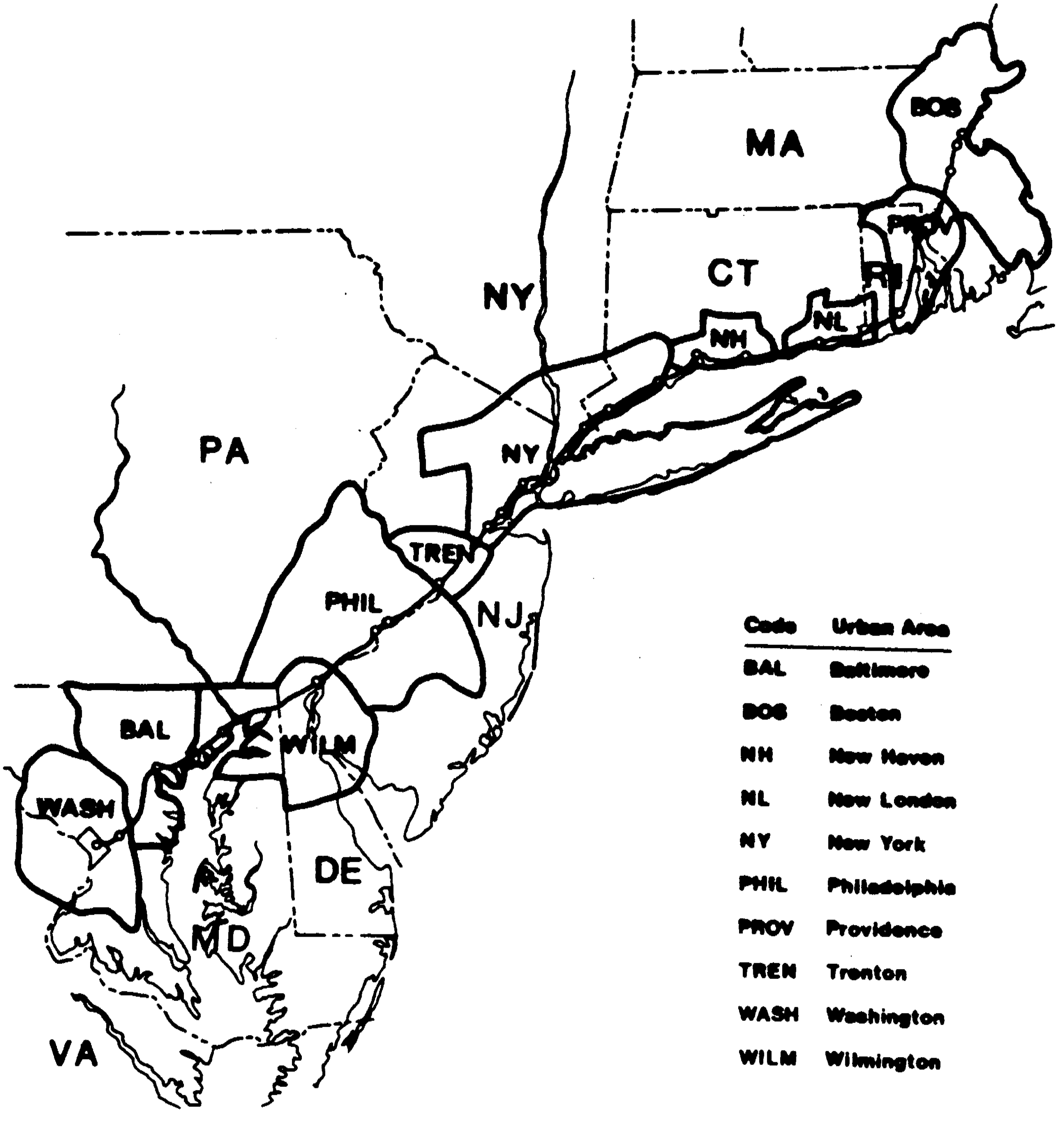
[1] Demand Analysis, Task 1, Federal Railroad Administration, 1975.

[2] Demand Projections for the Northeast Corridor, Peat, Marwick, Mitchell and Company for the Federal Railroad Administration, January, 1976.

[3] Demand Methodology, Volume 1 Summary, The Aerospace Corporation for the Federal Railroad Administration, March 1, 1978.




Source: <u>Issues Affecting Northeast Corridor Transportation</u>, Interim Report, prepared for the Federal Railroad Administration by The Aerospace Corporation, June, 1977.

**Figure 1.8**

**URBAN AREAS IN THE NORTHEAST CORRIDOR**

The mode split submodel, the second part of the overall model, estimates the mode split among each available mode of travel between a particular city pair by essentially simulating the travel choices of a random sample of individual travelers. Each city (origin or destination) is defined in terms of population, median family income, relative resident/visitor and business/non-business demand, intrazonal time and cost factors (peak/off-peak), and time value for business/non-business travelers and income levels. All modal ports (i.e., rail terminal, airport, etc.) are specified as to location within a city and are defined by processing cost and time (peak/off-peak), and parking cost and time. Mode service characteristics between any two city pairs are specified as to time, cost, frequency, and a calibration factor which historically accounts for trips by a particular mode over and above the independent variables specifically identified.

A key aspect of the modal split estimation is the generation of sample travelers with particular attributes. The attributes utilized in this study are the resident city, desired departure time, purpose of trip (business/non-business), party size, trip duration, exact origin and destination, value of time, car availability and modal preference. (The 1972 Census of Transportation Survey data was utilized to calibrate a number of these factors.) A traveler with certain attributes is generated based on historical probability distributions. This traveler examines all possible paths to/from the ports for his destination/origin cities, including available terminal access/egress modes (e.g., taxi, bus, rapid transit, etc.). The traveler converts all time factors into an overall impedence (i.e., perceived cost) factor based on his value of time attribute, and then selects that mode which minimizes the total trip impedence. This simulation is done for a large random sample of travelers; mode splits are determined by calculating what proportion of travelers utilize each intercity mode.

It should be noted that this modeling approach is based on a calibration of each city pair. There are many city pair combinations for which historical data were lacking in detail for calibration.

For the NEC, it was possible to calibrate completely 17 city pairs which accounted for approximately 90 percent of historical rail patronage passenger-miles. Due to assumed relationships between these 17 origin-destination pairs and another 12 identified rail-origin destination pairs, it was possible to increase total rail trip estimates to represent 99 percent of all rail trips. Results could then be expanded to all city pairs with a satisfactory degree of confidence.

The modeling efforts were undertaken for five separate conditions: 1975 base year; 1982 without improved rail; 1982 with improved rail; 1990 without improved rail; and 1990 with improved rail. The basic difference in model input for each of the five was the travel time and frequency of rail trips. In 1982 and 1990 projections without the improved rail service are the "baseline" projections for the NEC and represent a continuation of the current frequency and quality of rail service along with the expected socio-demographic changes.

The general expectation is that there will be a surge of demand over a period of time (possibly up to a year or longer) after improved rail service is implemented in 1981. Patronage levels are then likely to level off to a steady growth due to population/income growth forecasts and other relevant variables.

### 1.4.3 PROJECTION SCENARIOS

As noted earlier, variables that can impact on rail transportation are quite numerous and the combinations are practically infinite. It is therefore prudent to develop a range of scenarios and then a range of rail (and total) travel demand in the NEC to indicate the uncertainty involved in forecasting. The "most likely" projection of 1990 demand for the improved rail system (21.8 million) was selected from among the many scenarios examined with the demand model to represent the scenario which incorporated the best available estimates of the factors which will affect travel demand in 1990. The FRA will continue the examination of issues and trends that might have an impact on NEC passenger transportation and will update forecasts accordingly. Some of these factors are policy-related variables that can be controlled by the operator while other factors are uncontrollable. The key factors selected for variation in NEC demand forecasting were as follows:[1]

- Urban Area Population - This factor directly affects the total number of passenger trips by any mode. Examination of various recent forecasts (e.g., National Planning Association, Bureau of the Census, etc.), resulted in overall forecasted range of population growth from now until 1990 from zero percent per year (pessimistic) growth to approximately 1.0 percent per year (optimistic, based on 1972 Bureau of Economic Research). The baseline, or most likely, projection of total NEC population is 0.35 percent per year (see Table 1-7).

- Urban Area Median Family Income - This factor also directly affects the propensity of the population to travel and the preference for mode of travel. Based on forecasts from such sources as Data Resources, Inc. (for the FEA) and the National Planning Association, the range of real income growth selected was from 1.0 percent per year to 2.4 percent per year. Table 1-8 shows the baseline income growth projection of 1.7 percent per year.

- Energy (Oil) Costs - This factor has a significant impact on the cost of travel particularly for auto and air modes. The procedure was to forecast cost of crude oil prices which in turn was translated into mode operating fuel costs. The forecast ranges were based on studies conducted by the Federal Energy Administration, Central Intelligence Agency, and others and were as follows:[2]

  1982: $14.34 per barrel to $16.40 per barrel
  1990: $14.56 per barrel to $22.10 per barrel

[1] For in-depth discussion of the socio-economic and transportation system factors evaluated for use in the demand modeling, see Issues Affecting Northeast Corridor Transportation, Interim Report, prepared for the Federal Railroad Administration by The Aerospace Corporation, June, 1977 and subsequent updates of February, 1978. A final report is expected during the summer of 1978.

[2] All cost estimates have been factored to 1977 dollars.

Table 1-7

NATIONAL PLANNING ASSOCIATION PROJECTIONS
OF NEC URBAN AREA POPULATIONS
(BASELINE PROJECTION)

| | Mid-Year Population (Thousands) | | | |
|---|---|---|---|---|
| Urban Area | 1975 | 1980 | 1982* | 1990 |
| Baltimore | 2,153 | 2,256 | 2,305 | 2,496 |
| Boston[1] | 3,766 | 3,799 | 3,831 | 3,965 |
| New Haven | 421 | 444 | 453 | 485 |
| New London[2] | 251 | 260 | 262 | 274 |
| New York | 16,343 | 16,457 | 16,542 | 16,787 |
| Philadelphia | 4,815 | 4,847 | 4,879 | 5,007 |
| Providence | 910 | 923 | 928 | 950 |
| Trenton | 319 | 339 | 347 | 376 |
| Washington[3] | 2,938 | 2,995 | 3,034 | 3,201 |
| Wilmington | 513 | 551 | 564 | 612 |
| Total of NEC Urban Areas | 32,429 | 32,871 | 33,145 | 34,153 |

*Derived by linear interpolation.

[1]Based on NPA projections of Boston area SMSA's which in 1970 amounted to 95.0 percent of the Boston urban area population.

[2]Based on NPA projections of New York area SMSA's which in 1970 amounted to 101.8 percent of the New York urban area population.

[3]Based on NPA projection of Washington SMSA which in 1970 amounted to 103.3 percent of the Washington urban area population.

SOURCE: Regional Economic Projections: 1976, National Planning Association.

Table 1-8

NOMINAL PROJECTIONS OF NEC URBAN AREA MEDIAN INCOMES
(BASELINE PROJECTIONS)

| Urban Area | Median Family Income (1977 dollars) 1975* | 1982 | 1990 |
|---|---|---|---|
| Baltimore | 15,708 | 16,902 | 18,754 |
| Boston | 15,703 | 17,996 | 20,922 |
| New Haven | 14,440 | 15,941 | 17,979 |
| New London | 13,541 | 15,142 | 17,854 |
| New York | 15,295 | 17,041 | 19,685 |
| Philadelphia | 15,415 | 17,267 | 19,955 |
| Providence | 14,401 | 15,550 | 17,317 |
| Trenton | 14,796 | 16,173 | 18,314 |
| Washington | 18,381 | 20,604 | 23,889 |
| Wilmington | 16,797 | 19,019 | 22,356 |
| Total NEC Urban Areas | 15,637 | 17,454 | 20,123 |

*Estimated Actual 1975 Values

SOURCE: 1975 values derived from State Personal Income Estimates (Survey of Current Business) and 1970 SMSA Census Tracts.

1982 and 1990 values derived from NPA projections (Regional Economic Projection Series: 1976) and DRI forecast of U.S. Personal Income (1976 National Energy Outlook).

In translating these costs into auto fuel costs, it was estimated that $1.00 per barrel of crude oil translates into $.025 per gallon at the pump. For comparison purposes, oil prices today are approximately $11.76 (1977 dollars) (weighted by foreign and domestic consumption) and total average cost of a gallon of gasoline (including taxes) is $.655 in the NEC.

In translating oil costs into air fares, projected fuel efficiency of aircraft engines was incorporated in the analysis. For comparison purposes, the percentage real increase in air fares over 1976 for the selected oil cost baseline was as follows:

| Year | Baseline Oil Costs | Air Fare Increase Over 1976 |
|---|---|---|
| 1982 | $14.56/bbl | 4 percent |
| 1990 | $17.92/bbl | 6 percent |

Since bus fuel costs are such a small part of bus operating costs, it was concluded that the oil cost scenarios would have little impact on bus fares.

- Fuel Efficiency - This factor affects the cost of a trip and is considered significant, particularly for the auto and air modes. The estimates are as follows:

| Year | Air Fuel Efficiency Over 1978 | Auto Average MPG Over 1975 |
|---|---|---|
| 1982 | 104 percent | 121 percent |
| 1990 | 116 percent | 164 percent |

Little fuel efficiency changes are forecast for the bus mode. Rail energy costs were deliberately removed from this analysis for several reasons. First, there is not a direct correlation between oil costs (which is a recognized critical issue for scenario analysis) and electric rail energy costs. Second, the energy costs prorated to passengers is so small to have negligible impact on fares. Thirdly, a study is underway to examine rail operating and maintenance costs in detail. And finally, Amtrak has stated that fare increase will continue to be planned at approximately the same rate as the Consumer Price Index. Nevertheless, the impact of rail fare variations was examined.

- Rail Fares - Rail fare variation around current fares was examined within the range of ±45 percent to determine the impacts on ridership and revenue. In addition, several selected differential fare strategies were investigated. Rail fares used in the baseline projection for 1990 are 1976 fares, but since a single overall regression equation was used, minor variations may be noted. The assumption of reduced rail fares used in the projections of the Draft PEIS has been eliminated as a baseline.

- Rail Frequencies - Rail service frequencies were examined by various selected values with ranges of minus 67 percent to plus 100 percent over baseline frequencies. Baseline frequencies for 1982 were based on Amtrak proposed schedules. Baseline service for 1990 was based on increased frequencies to provide improved service. Some selected schedule options were also investigated. The baseline frequencies of trains per day (each direction) were as follows:

| Segment | 1982 | 1990 |
|---|---|---|
| Washington-Philadelphia | 30 | 37 |
| Philadelphia- New York City | 40 | 52 |
| New York City-Boston | 15 | 30 |

  The frequency of trains for 1990 used in the baseline demand model run is somewhat different than that now projected (38/53/19 respectively).[1] This is particularly true on the New York City-Boston segment where the assumption is reduced from 30 trains per day to 19 trains per day. Analysis of sensitivity runs indicates that those demand projections having a trip end north of New York would be reduced by only about 5 percent by this change.

- Rail Times - Section 703(1)(A)(i) of the 4R Act calls for 2:40/3:40 trip time by "regularly scheduled trains" and dependable service with "appropriate" stops. The operating scenario chosen for the baseline demand forecasts was that all stations will receive at least

[1] See Section 1.5 for discussion of service frequency used in impact analyses.

the same frequency of service as presently offered. The South Corridor would receive premium service with the same frequency between New York and Washington as Metroliner service today (essentially hourly). In the North, a premium service of every two hours between New York and Boston was defined as the operational goal. Additional trains can make various combinations of skip-stop service at many intermediate stations.

The 4R Act has directed an examination of trip time goals of 2:30/3:00 beyond the current improvement program. Thus this scenario was examined along with parametric variations of trip times in the range of ±30 percent to evaluate the sensitivity of demand to time.

The above discussions presented the range of values reflecting uncertainty in certain variables that are likely to have an impact on rail and total transportation in the NEC in the period 1981 to 1990. The combinations of such variables are still practically infinite. Specific values were selected within the ranges of the various variables. The end points of each range were obvious values to consider since they will bound the forecast estimates. A value somewhere within the range was also selected to represent the "baseline" or best judgmental value for that parameter. Most of the scenarios were developed around the baseline for 1982 and 1990 by varying one or several parameters and evaluating the resulting demand estimates.

For informational purposes the following demand sensitivities have been identified as a result of the more than 50 scenarios which have been run to date:[1]

- Population and Income - Total trip demand (all modes) was shown in the Draft PEIS to be 131 million for 1990 under what is now considered the high (and unlikely) estimate of population and income. The baseline scenario now yields a total demand of 117 million intercity trips in 1990.

- Fuel Prices - A "fuel conservation" scenario in which oil costs are at the high end and auto speed limits are reduced and enforced resulted in a 6 percent increase in demand.

[1] For more details on scenario assumptions and results, refer to Appendix D of the Two Year Report on the Northeast Corridor, U.S. Department of Transportation, February 1978.

- Rail Fares - Modifications reflecting a conversion to a constant revenue per passenger-mile showed a 23 percent increase in demand with only a slight (2 percent) reduction in revenue from the baseline case. A 10 to 15 percent increase in fares (over 1976) increases revenue by only 2 to 3 percent while demand drops by 6 to 11 percent.

- Rail Frequencies - On a systemwide basis demand and revenue are not terribly sensitive to frequency because of the high service levels already provided. A 30 percent increase in frequency only results in a 5 percent increase in demand and revenue. Specific city-pairs which now receive "little" service would be much more sensitive.

- Rail Trip Times - Demand and revenue are very sensitive to trip time (elasticity close to one). Improvement from the 2:40/3:40 mandated by the 4R Act to the 2:30/3:00 trip times, holding all other factors constant, resulted in an 11 percent increase in demand and a 14 percent increase in revenue.

The range of uncertainties involved in the demand variables has yielded a range of 1990 rail demand of 15.5 million to 27.0 million with a baseline (most likely) projection of 21.8 million. The 26.4 million projection used in the impact analyses for the Draft PEIS is clearly at the high end of the range. It should be noted that the extremities of this range resulted from scenarios which are considered extremely unlikely. For example, scenarios resulting in the low end of the range included fare levels 30 to 45 percent higher than 1976. Scenarios resulting in the high projection were obtained with extremely optimistic projections of population and income or with rail fares 45 percent lower than those of 1976.

### 1.4.4 PROJECTION RESULTS

In 1975, the estimated 32.4 million people living in the NEC made almost 87 million trips by all modes traveling between the NEC urban areas. The average distance traveled by all modes was 108 miles per trip resulting in 9.35 billion person-miles of travel. Rail travel accounted for 1.02 billion miles or almost 11 percent of this travel. The rail trips average 111 miles, slightly longer than the average of all trips (Table 1-9).

By 1990, the 34.2 million people living in the NEC will make more than 117 million trips between the ten NEC urban areas, traveling more than 12 billion miles. With the improved rail system, 17.6 percent of these trips and 20.0 percent of the total miles of travel will occur on the NEC rail system in the baseline case (Table 1-9).

Table 1-9

PROJECTED NEC RAIL TRAVEL

| | TOTAL INTERCITY PERSON TRIPS | | | TOTAL INTERCITY PERSON-MILES TRAVELED | | | PERCENT INCREASE OVER 1975 BASE | | | AVERAGE TRIP LENGTH | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All Modes (millions) | NEC Rail* (millions) | Percent NEC Rail | All Modes (billions) | NEC Rail* (billions) | Percent NEC Rail | Trips By All Modes | Trips By Rail | Person-Miles By Rail | All Mode (miles) | NEC Rail (miles) |
| 1975 Base | 86.7 | 8.7 (9.6) | 10.0 | 9.35 | 1.02 (1.06) | 10.9 | - | - | - | 108 | 117 |
| 1982 Unimproved Rail System | 99.7 | 10.4 (11.3) | 10.4 | 10.68 | 1.21 (1.24) | 11.3 | 15.0 | 19.5 | 18.6 | 107 | 116 |
| 1982 Improved Rail System | 102.4 | 13.9 (14.7) | 13.6 | 10.85 | 1.72 (1.75) | 15.9 | 18.1 | 59.8 | 68.6 | 106 | 124 |
| 1990 Unimproved Rail System | 114.6 | 12.3 (13.2) | 10.7 | 12.20 | 1.40 (1.43) | 11.5 | 32.2 | 41.4 | 37.3 | 106 | 114 |
| 1990 Improved Rail System | 117.1 | 20.6 (21.8) | 17.6 | 12.52 | 2.50 (2.53) | 20.0 | 35.1 | 136.8 | 145.1 | 107 | 121 |

* Numbers in parentheses represent total NEC intercity rail demand including some intercity rail trips which have both origin and destination in the New York Urban Area. These "Intra-New York" rail trips were deleted from the table in all calculations in order to be consistent with total demand data (All Modes). The New York Urban Area extends generally from Bridgeport, Connecticut to New Brunswick, New Jersey.

| | Projected Population | Percent Increase from 1975 Base | Median Family Income (1977$) | Percent Increase from 1975 Base |
|---|---|---|---|---|
| 1975 | 32,429,000 | - | 15,637 | - |
| 1982 | 33,145,000 | 2.2 | 17,454 | 11.6 |
| 1990 | 34,153,000 | 5.3 | 20,123 | 28.7 |

Projected NEC trips are accumulated by segment of the Corridor, by mode in Figure 1.9 for 1990 without the improved NEC rail system and in Figure 1.10 for 1990 with the improved NEC rail system.

With the improved rail system in 1990, substantial diversions of NEC intercity trips from other modes are projected. A comparison of the projected 1990 travel in the NEC with and without the improved rail system indicates there will be 8.6 million more rail passengers with the improved rail system. Approximately 5.75 million passengers will be diverted from other modes of travel and 2.85 million trips induced by the improved rail system.

Of the 5.75 million passenger trips diverted from other modes, approximately 44 percent will be diverted from auto, 33 percent from bus and 13 percent from air in 1990 if the improved rail system is in operation. Intercity auto-miles of travel are projected to be lower than otherwise by 3.9 percent, bus passenger-miles of travel by 28.1 percent, and air passenger-miles of travel by 11.6 percent (see Table 1-10). The most significant effects would occur in the southern section of the Corridor between Baltimore and New York where over 25 percent of the total NEC intercity trips would be captured by rail. When comparing the improved rail system with the unimproved rail system in 1990, the rail share increases from 14.5 percent to 24.6 percent in the southern half of the Corridor and from 6.7 percent to 11.5 percent in the northern half.

Table 1-10
PASSENGER-MILES TRAVELED BY MODE
IN THE NEC, 1975 AND 1990
(Billions)

| | 1975 | 1990(Unimproved) | 1990(Improved) | Percent Change (1990 I/1990 U) |
|---|---|---|---|---|
| Rail | 1.020 | 1.431 | 2.528 | +76.7 |
| Auto | 6.488 | 7.748 | 7.448 | - 3.9 |
| Bus | 0.576 | 0.725 | 0.521 | -28.1 |
| Air | 1.267 | 2.322 | 2.053 | -11.6 |

The 1990 rail travel to and from the New York urban area with the improved rail system is by far the most dominant rail travel in the Corridor. Fully 72 percent of all 1990 rail trips will either begin or terminate (or

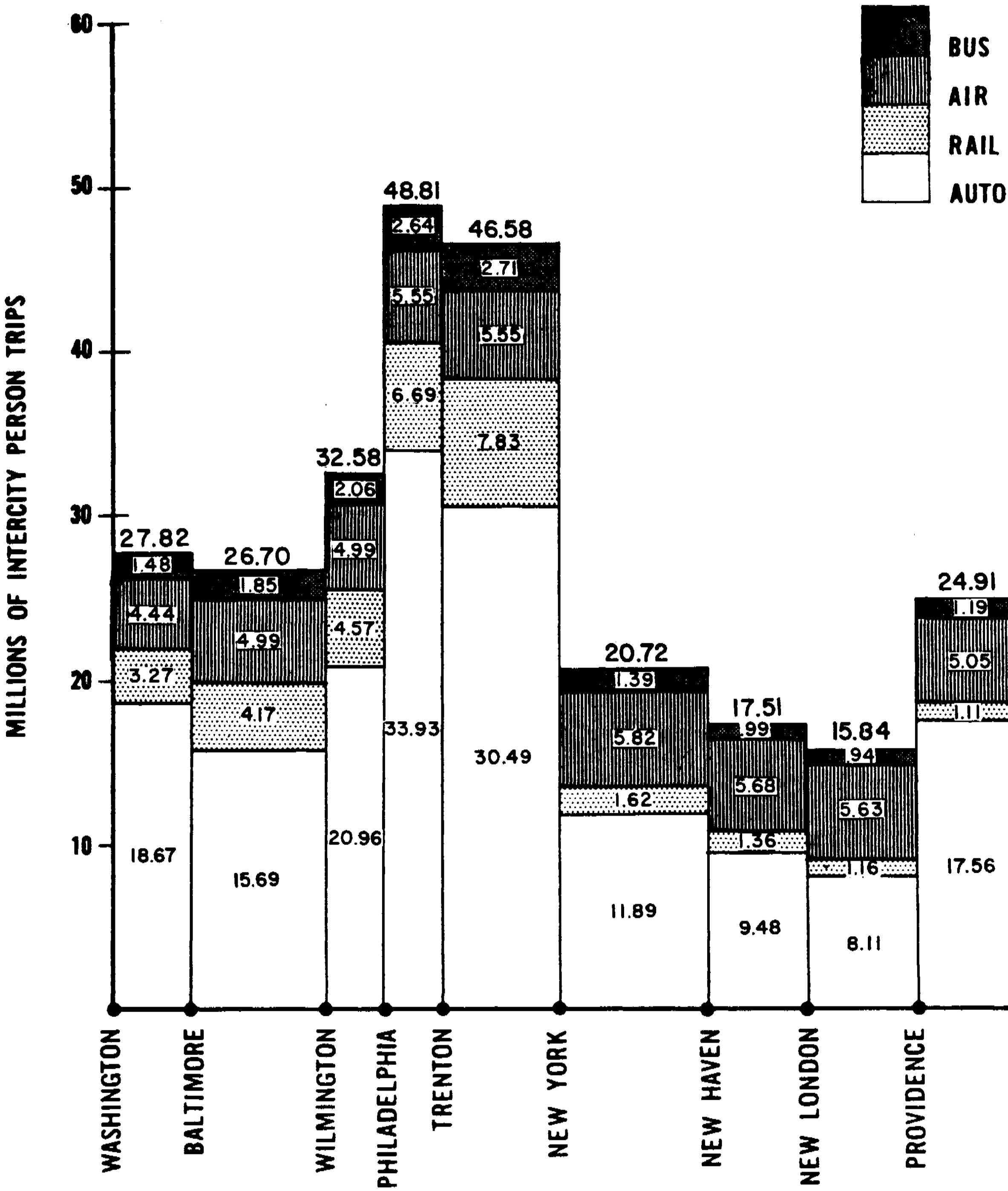



**Figure 1.9**

**1990 TOTAL INTERCITY PERSON TRIPS BY ALL MODES WITHOUT IMPROVED RAIL SYSTEM**

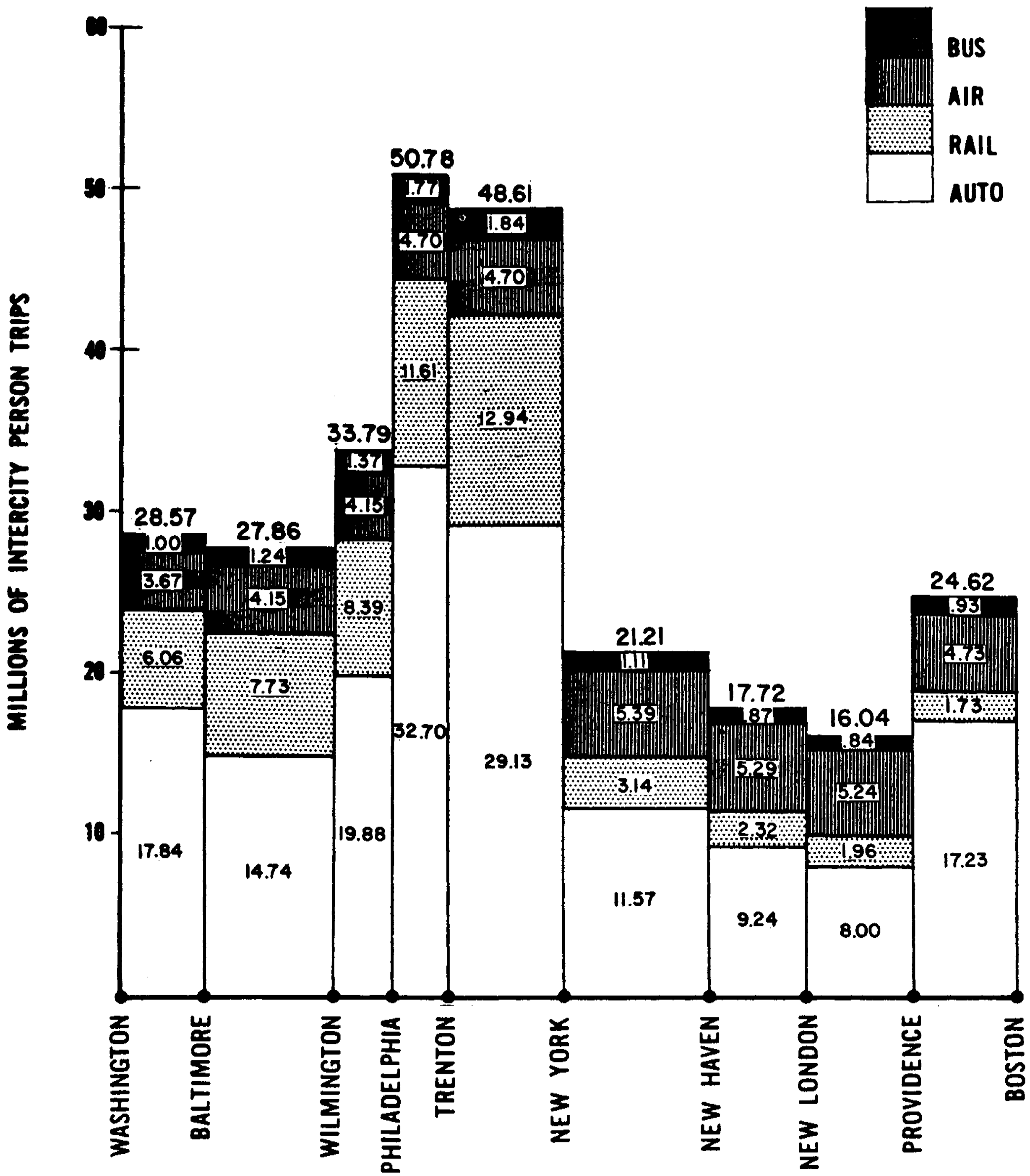



**Figure 1.10**

**1990 TOTAL INTERCITY PERSON TRIPS BY ALL MODES WITH IMPROVED RAIL SYSTEM**

both) in the NEC New York urban area.

The dominance of New York is made even more clear when rail trips are accumulated as station flows (Table 1-11). New York Penn Station accommodated 31 percent of all rail trip ends on the NEC in 1975. Total trip ends at Penn Station will nearly double by 1990, but its share of total NEC trip ends will decline to 24 percent. Stations south of New York will continue to dominate the generation of rail trips, accommodating 63 percent of all NEC trips, while stations north of New York will accommodate 13 percent of all intercity trips.

Aside from NEC intercity patrons, Corridor stations are used by millions of commuters and long-haul rail passengers each year. Projections of these activities have been obtained from appropriate commuter authorities and Amtrak for use in NECIP planning and design. These projections are listed in Table 1-12.

### 1.4.5 SENSITIVITY OF IMPACTS TO VARIATIONS IN DEMAND

As previously discussed, the factors acting on total travel demand and mode choice are numerous and the uncertainties involved in their prediction are no less numerous. Certainly the fact that the models were calibrated on data from years when the rail system in the NEC was (with the possible exception of the Metroliner demonstration program) deteriorated, unreliable, uncomfortable and perhaps perceived to be unsafe, would lead one to believe that, all other things being equal, the model might underestimate rail demand. Others argue that the image of the railroads will never change. Whatever the case, it is prudent to analyze the implications of over-or under-estimation of demand with regard to the environmental effects of the NECIP. Specific sensitivities are discussed in appropriate sections of Chapter 3. However, an overview assessment is provided here.

Impacts on the natural environment and cultural resources are likely not to vary with changes in demand. Since impacts on other rail operations and on noise are generally a function of the number of trains operating, demand levels in 1990 that are 10 to 15 percent higher or lower than the 21.8 million baseline projection are likely to cause little change in this impact category. Fairly small changes in scheduling and in most

Table 1-11

PROJECTED ANNUAL STATION FLOWS
(NEC INTERCITY RAIL TRIPS ONLY - IN THOUSANDS)

| STATION | 1975 Baseline | 1982 Unimproved | 1982 Improved | 1990 Unimproved | 1990 Improved |
|---|---|---|---|---|---|
| Boston South | 537 | 592 | 677 | 654 | 923 |
| Back Bay | 104 | 132 | 154 | 164 | 188 |
| Route 128 | 105 | 183 | 356 | 272 | 598 |
| Providence | 262 | 349 | 476 | 448 | 740 |
| Kingston | 29 | 44 | 71 | 61 | 120 |
| Westerly | 21 | 28 | 38 | 37 | 63 |
| Mystic | 9 | 16 | 27 | 25 | 49 |
| New London | 156 | 214 | 295 | 281 | 485 |
| Old Saybrook | 44 | 56 | 68 | 70 | 106 |
| New Haven | 359 | 470 | 856 | 596 | 1,258 |
| Bridgeport | 50 | 66 | 114 | 84 | 187 |
| Stamford | 152 | 199 | 297 | 253 | 511 |
| Rye | 76 | 168 | 308 | 274 | 511 |
| New York (Penn) | 5,982 | 6,254 | 7,032 | 6,565 | 10,383 |
| Newark | 1,321 | 1,662 | 2,009 | 2,052 | 2,723 |
| Metropark | 438 | 538 | 890 | 652 | 1,464 |
| New Brunswick | 395 | 510 | 765 | 641 | 1,242 |
| Princeton Jct. | 652 | 726 | 804 | 810 | 1,351 |
| Trenton | 1,763 | 2,452 | 2,852 | 3,239 | 4,052 |
| N. Philadelphia | 198 | 207 | 265 | 217 | 454 |
| Philadelphia (30th Street) | 3,109 | 3,247 | 4,159 | 3,404 | 6,036 |
| Wilmington | 529 | 683 | 943 | 858 | 1,352 |
| Baltimore | 897 | 1,186 | 1,802 | 1,516 | 2,689 |
| New Carrollton | 184 | 266 | 568 | 360 | 1,031 |
| Washington, D.C. | 1,856 | 2,347 | 3,487 | 2,909 | 5,031 |
| TOTAL TRIP ENDS | 19,228 | 22,595 | 29,313 | 26,442 | 43,547 |
| TOTAL TRIPS | 9,614 | 11,298 | 14,657 | 13,221 | 21,774 |

Table 1-12

PROJECTED ANNUAL NEC, COMMUTER AND INTERCITY LONG-HAUL STATION FLOWS, 1990

| STATION | Trip Ends in Thousands | | | |
|---|---|---|---|---|
| | Commuter | Long Haul[1] | NEC Intercity[2] | Total |
| Boston South | 3,834.0 | 118.1 | 923.0 | 4,872.1 |
| Back Bay | 2,032.0 | 31.8 | 188.0 | 2,251.8 |
| Route 128 | 388.0 | 7.1 | 598.0 | 993.1 |
| Providence | 1,344.3 | 29.7 | 740.0 | 2,114.0 |
| Kingston | - | - | 120.0 | 120.0 |
| Westerly | - | - | 63.0 | 63.0 |
| Mystic | - | - | 49.0 | 49.0 |
| New London | - | 17.0 | 485.0 | 485.0 |
| Old Saybrook | - | - | 106.0 | 106.0 |
| New Haven | 594.0 | 36.5 | 1,258.0 | 1,888.5 |
| Bridgeport | 565.0(e) | na | 187.0 | 752.0+ |
| Stamford | 1,728.0 | 15.5 | 511.0 | 2,254.5 |
| Rye | 810.0 | 12.2 | 511.0 | 604.2 |
| New York (Penn) | 67,770.0 | 1,415.0 | 10,383.0 | 79,568.0 |
| Newark | 11,988.0 | 200.0 | 2,723.0 | 14,911.0 |
| Metropark | 1,350.0 | 5.8 | 1,464.0 | 2,819.8 |
| New Brunswick | 1,026.0(e) | na | 1,242.0 | 2,268.0+ |
| Princeton Jct. | 708.0(e) | na | 1,351.0 | 2,059.0+ |
| Trenton | 1,566.0 | 108.4 | 4,052.0 | 5,726.4 |
| N. Philadelphia | 255.0(e) | na | 454.0 | 709.0+ |
| Philadelphia (30th Street) | 11,070.0 | 235.6 | 6,036.0 | 17,341.6 |
| Wilmington | 918.0 | 47.2 | 1,352.0 | 2,317.2 |
| Baltimore | 918.0 | 110.0 | 2,689.0 | 3,717.0 |
| New Carrollton | na | 8.8 | 1,031.0 | 1,039.8+ |
| Washington, D.C. | 7,182.0 | 495.0 | 5,031.0 | 12,708.0 |

[1]Long-haul trips are those having an origin or destination on the NEC but not both (i.e., New York-Montreal). These trips are not included in NEC intercity projections (Table 1-11), which have both trip ends on the NEC.

[2]See Table 1-11.

(e) = Estimated based on daily counts times 270. na = Not available.

SOURCE: Except as noted or in cases where subsequent agreements have been reached with appropriate Commuter Authorities, projections are as reported in Corridor Station Requirements, Task 12.1, Federal Railroad Administration, July, 1976.

cases decreased or increased train consist can accommodate such variations. Fare adjustments in these ranges would be applied if necessary to insure no change in total Amtrak revenue since demand is relatively inelastic over small ranges with respect to fare. If the demand change were to result from a 10 to 15 percent higher or lower diversion from the other intercity modes, then the projected benefits of the project on energy consumption and air quality would be correspondingly reduced or increased.

If the project has significantly underestimated demand, that response would inevitably cause rethinking about the level of investment which is warranted in the NEC rail system and result in additonal investment to improve service levels and to eliminate rail congestion with other modes. Benefits of the project with regard to diversion of air and auto trips, reduction of Amtrak deficit levels, reduced energy consumption, improved air quality and revitalization of station areas would be magnified accordingly. Expanded schedules would result in increased noise levels at some locations and further reduce the ability to open movable bridges to main traffic on call. Additional investment to accommodate increased traffic at stations may also be required. Further reductions in revenue for bus companies due to higher than expected diversion from bus would further aggravate the financial position of those companies operating in the Corridor.

Gross over-estimation of demand, on the other hand, would require cut-backs in the planned schedule for intercity service. The "cost" of such an error would be the capital investment in the improvements plus the minor adverse natural environment, cultural, and land-use/socio-economic impacts that will be associated with the physical aspects of improvement. These "costs" must of course be weighed against the benefits that the project would have even if no additional demand were generated, such as a better, safer and faster ride for existing users, improved efficiency and reduced maintenance requirements for Amtrak, improved operations for commuter and freight users of the Corridor, improved reliability of movable bridges, and rehabilitation of stations and station areas.

## 1.5 THE FUTURE RAIL SYSTEM

Although the proposed action is a program of physical improvements which will only allow improved rail service in the NEC, it is the intention of Congress, the FRA and Amtrak to implement subsequent increases in rail service in order to encourage major increases in rail patronage. The amount and nature of that service will be prime determinants of the long-term impacts directly resulting from the NECIP (especially those upon transportation, socio-economic factors, air, noise, and energy). This section is designed to identify responsibility for the future operation of the system and to postulate future service characteristics which can reasonably be used as the basis for long-term (operational) impact analyses.

### 1.5.1 SCHEDULING AND OPERATING RESPONSIBILITY

The National Railroad Passenger Corporation (Amtrak) will have responsibility for all fares, schedules, stops, operating procedures, marketing, maintenance and other actions which comprise the intercity passenger service during and after the NECIP. The year-to-year implementation of service expansion by Amtrak will be the result of continuing market analysis, cash flow considerations, and, if necessary, public financial support.

Amtrak has a five-year improvement plan[1] and is currently engaged in long-range service planning, but cannot be definitive about 1990 service levels. The FRA, in an effort to assist Amtrak in basic research regarding equipment options, equipment mix, routing and scheduling, is engaged in a detailed study of these factors but will not complete this effort until sometime during the summer of 1978.[2]

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[1] Five Year Corporate Plan, Fiscal Years 1977-1981, National Railroad Passenger Corporation.

[2] See Two-Year Report on the Northeast Corridor, U.S. Department of Transportation, February, 1978, for preliminary findings of this analysis.

With preliminary results of this analysis, as well as input from Amtrak, a rail service schedule for the NEC in 1990 was developed for use in the analysis of long-range impacts of the NECIP.

### 1.5.2 ANTICIPATED FUTURE SCHEDULE

Future NEC service will encompass all 26 stations currently served by Amtrak and no station will suffer a reduction in intercity service as a direct result of the NECIP. All stations will receive service which will directly benefit from the track improvements made by the NECIP. A selected set of regularly scheduled trains which make five intermediate stops will be required to meet the trip time goals of the 4R Act. Trains which stop at more than five stops and other trains such as New York to Philadelphia "clockers" will not be required to meet those goals but will realize comparable speed increases.

Scheduling projections are based on the peaking characteristics of demand, improved trip time, reduced dwell time at stations, maximum train consist of 14 cars and improved turnaround times. Clearly the service must, and indeed does, reflect the fact that over 80 percent of total NEC patronage will be between the urban areas (i.e., have both trip ends) in the New York to Washington segment. The 1990 NEC schedule postulated for impact analysis is accumulated by segments as follows:

| Corridor Segment | Trains Per day (Each Direction) | | | |
|---|---|---|---|---|
| | 1975[1] | 1976[2] | 1977[3] | 1990 (improved)[4] |
| Bos-NH | 11 | 10 | 11 | 19 |
| NH-NY | 14 | 13 | 12 | 23 |
| NY-Phil | 41 | 40 | 39 | 53 |
| Phil-Wash | 25 | 25 | 25 | 38 |

[1] Amtrak All-America Schedules, effective May 15, 1975

[2] Amtrak National Train Timetables, effective October 31, 1976

[3] Amtrak National Train Timetables, effective June 22, 1977.

[4] The Draft PEIS showed higher levels of expected service on the New York-Washington segment. The reduction reflects the revised demand projection for 1990 which now predicts 21.8 million annual rail trips rather than the 26.4 million previously projected (see Section 1.4). Service on the Boston-New York segment remains unchanged because hourly service on the improved NEC is felt to be a minimum basic service consistent with overall goals.

Service on the Boston to New York segment of the NEC would thereby be expected to increase from recent service levels of about one train every two hours during the normal travel day to one train each hour, with the possibility of two trains per hour during peak periods. The 23 trains per day on the New Haven-New York segments reflect an expected increase in Springfield-Washington through trains (which join the NEC at New Haven) from three to four by 1990. Feeder line studies are currently being undertaken to evaluate service on this route as well as routes to Harrisburg, PA and Albany, NY.

The basic service on the New York-Washington segment is 38 trains per day, or about two trains per hour over the normal travel day with supplementary service during peak periods. Continuation of 15 New York-Philadelphia "clockers" brings the expected density of intercity service on that segment to 53 trains per day in 1990.

The above discussion accumulates trains by segment; in reality, train routes are likely to include some New York-Boston trains, New York-Washington trains, New York-Philadelphia trains and some Boston-Washington through trains.

### 1.5.3 FUTURE SYSTEM CHARACTERISTICS

The improved service will be manifested primarily in the reduction in travel time (Table 1-13) and increased service frequency. The best available service now requires seven hours, fifty minutes from Boston to Washington (assuming one made a transfer to a Metroliner for the New York to Washington section) with an average speed (including station stops) of 50 mph. The NECIP goals will increase average speeds to 70 mph and allow six hour, 30 minute service for the 456-mile trip.

The following increases in the quantity of rail service are projected. Tables 1-14 and 1-15 give detailed breakdowns of the 1975 and 1990 service levels. Projections for the 1990 improved service are based on schedule assumptions previously described. Projections of service levels for 1990 without the NECIP presume continuation of current train schedules but with larger consists to accommodate the higher demand and with some improvement in load factors over 1975 as is consistent with recent experience.[1]

| | 1975 | 1990 (Unimproved) | 1990 (Improved) |
|---|---|---|---|
| Train-Miles[2] | 7.2 million | 7.2 million | 10.6 million |
| Average Train Consist | 5 cars | 6 cars | 5 to 7 cars |
| Car-Miles | 38 million | 43 million | 55 to 71 million |
| Seat-Miles | 2.6 billion | 2.9 billion | 3.9 to 5.0 billion |
| Load Factor | 41 percent | 50 percent | 51 to 65 percent |

Rolling stock for use on the NEC in 1990 will either be an advanced version of the self-propelled Metroliner cars currently used by Amtrak south of New York, or locomotive hauled coaches similar to present Amfleet service but hauled by higher performance locomotives, or some combination of the two. Amtrak has placed an order for eight AEM-7 high-speed locomotives for revenue service and plans to replace all 40 GG-1s currently in use on the NEC with locomotives of this type by 1981.

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[1] Overall load factors for NEC service in FY 1977 were 52.4 percent for Metroliners and 45.6 percent for conventional trains. See Northeast Corridor Improvement Project, FY 1977 Annual Report, Federal Railroad Administration, February, 1978.

[2] A train-mile is a scheduled train traveling one mile. A car-mile is a scheduled car traveling one mile, or the number of train-miles times the average train consist. A seat-mile is a scheduled seat traveling one mile, on the number of car-miles times the average number of seats per car. Load factor is annual passenger miles divided by annual seat-miles

Table 1-13

AVERAGE SPEED AND RUNNING TIME
NEC RAIL SERVICE

| Present Service | Average Speed | Running Time[1] |
|---|---|---|
| Conventional Trains | | |
| Washington - New York | 56.5 mph | 3'58" |
| New York - Boston | 48.5 | 4'47" |
| Washington - Boston | 50.4 | 9'04" |
| Metroliner | | |
| Washington - New York | 74.0 | 3'02" |
| Proposed High-Speed Service | | |
| Washington - New York | 84.0 | 2'40" |
| New York - Boston | 63.3 | 3'40" |
| Washington - Boston | 70.2 | 6'30" |

[1] Running time in hours (') and minutes (").

SOURCE: Table IX of the AMTRAK First Annual Report on the Northeast Corridor dated March 4, 1977.

Table 1-14

INTERCITY RAIL SERVICE LEVELS ON THE NEC, 1975

| SEGMENT/SERVICE | Trains Per Day[1] | Mileage | Daily Train-Miles | Annual Train-Miles[2] (million) | Average Consist[3] | Annual Car-Miles (million) | Average Seats Per Car | Annual Seat-Miles (million) |
|---|---|---|---|---|---|---|---|---|
| **BOSTON-NEW HAVEN** | | | | | | | | |
| Conventional (Diesel) | 22 | 156 | 3,432 | 1.25 | 6 | 7.52 | 70 | 525 |
| **NEW HAVEN-NEW YORK** | | | | | | | | |
| Conventional (Electric) | 26 | 76 | 1,976 | 0.72 | 6 | 4.33 | 70 | 301 |
| Metroliner | 2 | 76 | 152 | 0.06 | 4 | 0.24 | 65 | 16 |
| **NEW YORK-PHILADELPHIA** | | | | | | | | |
| Conventional (Electric) | 28 | 90 | 2.520 | 0.92 | 6 | 5.52 | 70 | 386 |
| Metroliner | 30 | 90 | 2,700 | 0.99 | 4 | 3.94 | 65 | 256 |
| Clockers | 24 | 90 | 2,160 | 0.79 | 6 | 4.73 | 70 | 331 |
| **PHILADELPHIA-WASHINGTON** | | | | | | | | |
| Conventional (Electric) | 20 | 134 | 2,680 | 0.98 | 6 | 5.87 | 70 | 411 |
| Metroliner | 30 | 134 | 4,020 | 1.47 | 4 | 5.88 | 65 | 382 |
| | | | 19,640 | 7.18 | | 38.03 | | 2,608 |

Total Annual Passenger-Miles = 1.020 Billion; Load Factor[4] = 39.1%

[1] Amtrak All-American Schedules, Effective May 15, 1975

[2] Equals Daily Train Miles times 365

[3] Consists derived from Amtrak data and represent overall averages for conventional service (6) and Metroliner service (4). Strictly speaking these averages cannot be directly applied on a segment by segment basis for the conventional service. The magnitude of any inaccuracy created by this assumption is not critical for these purposes.

[4] Load Factor equals Annual Passenger-Miles divided by Annual Seat-Miles.

Table 1-15

PROJECTED INTERCITY RAIL SERVICE LEVELS ON THE NEC, 1990 (IMPROVED)

| SEGMENT | Trains Per Day[1] | Mileage | Daily Train-Miles | Annual Train-Miles (million) | Average Consist[2] | | Annual Car-Miles (million) | | Average Seats Per Car | Annual Seat-Miles (million) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Low | High | Low | High | | Low | High |
| BOSTON-NEW HAVEN | 38 | 156 | 5,928 | 2.16 | 4 | 5.5 | 8.64 | 11.88 | 70 | 605 | 832 |
| NEW HAVEN-NEW YORK | 46 | 76 | 3,496 | 1.28 | 4 | 5.5 | 5.12 | 7.04 | 70 | 358 | 493 |
| NEW YORK-PHILADELPHIA | 106 | 90 | 9,540 | 3.48 | 6 | 7.5 | 20.88 | 26.1 | 70 | 1,462 | 1,827 |
| PHILADELPHIA-WASHINGTON | 76 | 134 | 10,184 | 3.72 | 5.5 | 7 | 20.46 | 26.0 | 70 | 1,432 | 1,822 |
| | | | 29,148 | 10.64 | 5.2 | 6.7 | 55.10 | 71.02 | | 3,857 | 4,974 |

Annual Passenger-Miles = 2.528 Billion; Load Factor = 65.5% (Low Average Consist) or 51.0% (High Average Consist)

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[1] See Text for source.

[2] Low average consist is based on an assumption of highly improved efficiency in adding or dropping cars as needed at major terminals over the course of the day. High average consist is based on an assumption of fixed consist trains sized to accommodate peak demand for that day. Advantages and disadvantages of the operating and capital cost implication of each service option is currently under study.

## 1.6 TRADE-OFF ANALYSIS

### 1.6.1 THE NEED FOR TRADE-OFFS

The level of funding available to the NECIP will allow development of a faster and more reliable intercity rail passenger service in the Northeast Corridor, but clearly cannot meet all of the demands of all interests. For example, it will not correct all of the "errors" made in the original construction of the rail system (such as the use of valuable shoreline property for its route or construction of bridges with clearance which eventually proved to be inadequate). Nor will it provide the expanded capacity necessary to permit independent operation of intercity, commuter and freight services, even where congestion is cometimes severe (such as the Baltimore tunnels). Finally, it will not allow construction of all of the facilities which may be required by ever increasing levels of intercity, commuter and freight usage, even though design will most assuredly consider and not preclude such expansion.

The competing demands on program development can perhaps be best illustrated by an examination of some of the comments received on the program as proposed in the Draft PEIS.

The Secretary of Transportation in Massachusetts, the Massachusetts Bay Transportation Authority (MBTA), the City of Boston, the City of Providence, the Connecticut Department of Transportation, and the Sierra Club chapter in Massachusetts requested that the Program be implemented in a manner which will enable an eventual three-hour trip time between Boston and New York City. Such a system will require electrification. On the other hand, the Tri-State Regional Planning Commission and the Port Authority of New York-New Jersey questioned whether electrification should be installed between New Haven and Boston. Instead, they favored projects such as a high level Portal Bridge, greater improvement to Penn Station, greater tunnel improvements in the New York City area and construction of flyovers in the vicinity of the Shell and Harold interlockings. MBTA and the Rhode Island Department of Transportation suggested that a third track must be installed between Providence and an area south of Boston due to the capacity problems created by the increased speed of Amtrak trains in this area. Several groups favored the construction of a new station near the Co-op City area of New York City. Many freight users on the Corridor suggested that a new tunnel be constructed in Baltimore to eliminate congestion in that area. Many of these groups also favored the reconstruction of a bridge at Poughkeepsie, New York to allow freight movement into southern New England. Other groups favored the higher cost improvement of the Inland Route over the Shoreline Route in the New Haven to Boston segment. Finally, a large number of municipalities and states urged the rehabilitation or reconstruction of various overhead and undergrade bridges in order to improve motor vehicle traffic flow, safety and clearances.

What would this "ideal" system cost? That, of course, is a difficult question to answer because of the myriad of interrelated options which could be incorporated. Nonetheless, evaluation and cost of all of the components of this "ideal" system was absolutely essential for sound program development in the sense that it provided the "shopping list" of improvements from which a logical program (which met the goals of the 4R Act within the available funding) could be selected. This "shopping list" was prepared by the Project in a report called the Baseline Plan.[1]

The Baseline Plan. The Regional Rail Reorganization (3R) Act of 1973 authorized the engineering studies necessary to define performance specifications, program requirements and costs of the total renewal of the existing system. Although these studies[2] were directed towards a design to accommodate faster trip times and higher demand levels than are currently defined, they also clearly assessed the condition and potential of the existing rail system and the costs to eliminate the effects of years of deferred maintenance on the Corridor rail system.

[1] Baseline Implementation Master Plan, De Leuw, Cather/Parsons and Associates for the Federal Railroad Administration, April 1977.

[2] Published as Tasks 1 thru 21, Northeast Corridor High Speed Rail Passenger Improvement Project by the Federal Railroad Administration, 1975 thru 1977.

The estimated cost of this complete renewal of the NEC rail system, derived largely from these previous task reports but scaled down in areas such as curve realignments to reflect lower trip time goals and demand levels, is contained in a Baseline Plan developed early in 1977.[1] This Baseline Plan included: a substantial curve realignment element; construction of flyovers at Harold, Shell, Lane and Bay interlockings; total renewal of two "dedicated" passenger tracks and major interlocking work; replacement, upgrading or repair of 755 of the 772 undergrade bridges on the Corridor; a uniform electrification system for the entire Corridor and numerous other improvements. The cost identified for Baseline Plan improvements was $3.5 billion (Table 1-16). Other improvements identified as options in the Baseline Plan or in subsequent analyses included a new Presstman Street tunnel in Baltimore ($223 million), a third track in all two track territory between the Gunpowder River and North East Maryland ($288 million), a high-level Portal Bridge in New Jersey ($86 million), a third track in MBTA territory in Massachusetts ($15 million), and an array of other track additions or interlocking reconfigurations ($50 million). These options brought the total cost of the "ideal" system improvement to over $4 billion. The cost of correction of substandard clearances at undergrade bridges, of structural rehabilitation or replacement of all overhead bridges, or of diversion of through freight to parallel routes would add millions more to this total.

It is important to note that most of the projects identified as desirable for inclusion in the Baseline Plan were supported by one or more parties in the comments to the program described in the Draft PEIS. All of the concerns expressed in the comments and in the program planning process have considerable merit. The decision of the Administration and

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[1] Baseline Implementation Master Plan, De Leuw, Cather/Parsons and Associates for the Federal Railroad Administration, April 1977.

Congress, however, which limited NECIP funding to $1.75 billion in 1975/76 because of competing national priorities, clearly do not permit inclusion of all desirable improvements in the program. Necessarily, therefore, compromises and trade-offs were required in the program development. Subsequent sections describe the framework and factors which comprise the trade-off process, a process which is very much an ongoing program development process.

### 1.6.2 THE PROGRAM DEVELOPMENT PROCESS

Authorization of funding for the NECIP by the 4R Act initiated development of a framework or planning process by which individual improvements would be selected for incorporation into the program. The first step was the development of the System Performance Specification, a first level planning document which delineated the specific performance capability to be achieved by balancing interpretation of the goals of the Act against state-of-the-art technology, available funding and other similar constraints. Along with the more apparent, explicit goals such as travel time and on-time performance, the System Performance Specification sets goals in other areas related to the project, such as the provision for future expansion of the system, accommodation of other users of the Corridor, ride comfort, maintainability, accessibility by the elderly and handicapped, and environmental compatibility. In short, the System Performance Specification is the project foundation in terms of the desirable, functional performance goals in both quantitative and qualitative regards.

Under the umbrella of this first level planning document, a complex, iterative process of evaluation and trade-off of site-specific improvements and systems was undertaken. The overall task is one of selecting a balanced set of Program Requirements and an Implementation Master Plan which provides the greatest overall benefit with available funds. It is this iterative process, still very much an on-going process which continues to narrow the program to that which is ultimately implemented.

The Program Requirements identify the site-specific improvements needed to accomplish the goals defined by the System Performance Specifications which introduced constraints not applied to the Baseline Plan. The task reports generated by the 3R Act, as previously discussed, provided much of the basic criteria and inventory input for the Program Requirements. Sophisticated numerical tools which simulate train performance and operations continue to be used in the program evaluation process (see Section 3.1.3).

The development of the Implementation Master Plan (IMP) also significantly affects the selection of improvements which can be included in the program. The IMP is the overall schedule into which the design and construction of the individual Program Requirements are fit. The key constraints in the IMP's schedule are construction related (track availability selected to minimize train delays and procurement of long lead time items). Design and overall construction periods are fit in around these and other constraints. The scheduling of a specific improvement permits accurate projection of the cost of that improvement. Items scheduled for construction in 1980 will, for example, cost more than if they could be scheduled in 1978 because of inflation. Summing these projected costs against a fixed budget constrains the total amount of work which can be undertaken.

The finalization of the Program Requirements and the Implementation Master Plan is clearly an iterative process which is by no means complete. Additional environmental impact assessment, agency coordination, achievement or non-achievement of specific agreements for matching funds or operating rights and refinement of design and cost estimates have caused and will continue to cause revisions to the program.

### 1.6.3 THE FACTORS INFLUENCING PROGRAM DEVELOPMENT

In developing the Program Requirements and Implementation Master Plan, a multitude of legislative, political, systemwide and site-specific constraints were taken into consideration. These constraints took the form of a series of factors which were developed and applied to arrive at the optimum program which would meet the intent of the 4R Act within the funding level authorized by Congress. These factors include:

- Accomplishment of the goals of travel time and reliability contained in the 4R Act;
- Uniformity of the entire system;
- Compatibility with possible future expansion;
- Geographic distribution of facilities;
- Minimizing environmental impacts of the improvements;
- Minimizing impacts on other rail system users;
- Economic stimulus;
- Time necessary to complete the improvement.

Through the continuing application of these factors, an attempt was and continues to be made to balance the competing and sometimes contradictory interests along the Corridor in a reasonable manner beneficial to the jurisdictions and the public at large.

The following paragraphs illustrate the manner in which these factors were and are being applied.

The accomplishment of <u>trip time and reliability</u> goals contained in the 4R Act are essential to the entire program. To meet these goals, a series of inter-related improvements became necessary. For example, as improvements were selected which would allow increased speeds, the necessity for improved signaling and electrification became greater to ensure that increased speeds could be reliably attained from these improvements.

Improvements to track structures and bridges, together with the elimination of grade crossings, will enable trains to operate at higher speeds. The construction of maintenance facilities for both rolling stock and the physical plant will ensure continued high levels of reliability.

System uniformity involves the concept that the Corridor be viewed as a single system with design and performance standards applied uniformly. This translates into a series of improvements which are directed at minimizing future maintenance costs while maximizing operational efficiency and flexibility. For example, the uniform electrification system throughout the Corridor reduces maintenance since two different types of rolling stock will not be necessary, and since the system will utilize standard 60 cycle components throughout the Corridor.

Elimination of deferred maintenance takes into consideration that little maintenance has been routinely performed on the Corridor over the past 20 years. To meet the trip time and reliability goals, a significant portion of the available funds (as much as $1.16 billion, or nearly 67 percent of the available funds) are directed toward performing the previously deferred maintenance necessary to restore and insure the structural and operational integrity of the existing system. The level of expenditure necessary for elimination of deferred maintenance virtually eliminates projects which are solely related to expansion of the capacity of the existing system. In addition to the elimination of deferred maintenance of track structures, bridges, and related system components, the emphasis is placed on the rehabilitation of existing stations rather than the construction of totally new facilities.

To the maximum extent practicable, improvements are to be designed and constructed in a manner which is compatible with possible future improvements which may take place. The 4R Act specified that the possible future trip time to be considered is three hours from Boston to New York and two hours, 30 minutes from New York to Washington. The electrification system, for example, is being designed to accommodate 150 mph speeds in areas where that speed is potentially attainable. Signaling, route realignments and new bridges are being designed and constructed with track centers and other standards which will be compatible with increased speeds in the future. The incorporation of compatibility with future expansion into the design and construction of improvements has marginally increased initial costs of these projects, but may reduce necessary expenditures in future years. The increased cost, which reduces the funds available for other improvements in this program, was felt to be justified by the extremely high cost of expansion in future years versus the marginal cost of its incorporation at this time.

The geographic distribution of several types of improvements is important for several reasons. With respect to maintenance facilities, it is important to locate facilities so as to reduce the amount of time that equipment or track segments are out of service for necessary maintenance. The spacing of substations for the electrification system is being done in a manner which minimizes energy losses due to transmission of current. Geographic distribution is also important to the process by which stations have been selected for eligibility for operational improvements. For example in Boston, South Station and Back Bay Station are located within one mile of each other, as a result Back Bay is not included in this program. In Philadelphia, North Philadelphia Station was not selected partly because it is only four miles from 30th Street Station and has excellent connections to that station via rail commuter services. Furthermore, vehicular access is constrained and the station is remote from the major commercial center of the city. On the other hand, one of the considerations in the selection of Providence and New London Stations was that they serve the major population areas between New Haven and Boston.

The selection of the improvements to be included in the program includes consideration of numerous environmental factors. For example, route realignments were eliminated from inclusion in the program in areas where sensitive wetlands, parks or historic resources would have been significantly impacted. In many other projects, environmental or historical factors triggered revised design concepts, modified criteria for site selection, and inclusion of pollution control specifications in proposed construction contracts. While these refinements increase the cost of the specific improvement in some instances, they eliminate or significantly reduce the negative environmental impacts associated with the improvement.

An important factor for consideration was the impact a proposed improvement would have on other users of the rail system. The program is designed to accommodate all current rail users, as well as to the maximum possible extent the future growth projected by other users of the system. The impact of the improvements to electrification and signaling systems on commuter operations led to the inclusion of funding in the program for the modification of eligible commuter rolling stock to be compatible with the improved systems.

One of the goals of the Program established by Congress in the 4R Act was to stimulate the economy. In order to accomplish this goal in the near term, various improvements have been included in the program which have the advantage of putting people to work quickly and training these individuals for the future. These projects include bridge painting, minor bridge repairs and clearing the right-of-way of debris. Were it not for the goal of near term economic stimulation, it is likely that some of these projects may not have been included in the NECIP.

The final factor considered in the development of this Program involves the time necessary to complete the project. The 4R Act has mandated project completion by February, 1981. Although it now appears that some construction activity may extend beyond 1981, the goal is still to complete improvements which will allow accomplishment of the trip time goals by 1981. The effects of track availability and procurement of long lead time items on program scheduling were previously mentioned. Another example of the influence of this factor is the fact that replacement of ties with new concrete ties is limited to the number of miles of ties which can be replaced by the new Track Laying System in the three remaining construction seasons.

Both the development and application of these factors involve difficult balancing of goals and needs. In many cases there are no easy trade-offs. For example, reasonable arguments can be made that greater levels of improvements at stations should be made at the expense of other subsystems such as bridges, or that certain improvements which emphasize expansion of the present capacity of the system should be included in the Program in place of certain of the improvement projects. These arguments and others have been recognized and evaluated in both the development and application of these factors.

### 1.6.4 THE EVOLUTION OF THE PROGRAM

The efforts undertaken to reduce the unconstrained Baseline Plan to an optimum program which met all of the criteria previously discussed resulted initially in the "August (1977) IMP" which was the basis for the proposed action described in the Draft PEIS (Table 1-16).

Transition from the "August (1977) IMP" to the version which describes the program as currently contemplated (referred to as the Proposed Action in Table 1-16 and described in Section 1.7), reflects continued refinement of the program development process. The trade-offs made as a part of this process include reduction of speed related improvements found not to be necessary to meet trip time goals, continued refinement of engineering and cost estimates, and continued analysis of environmental effects including comments received on the Draft PEIS. The following paragraphs describe the evolution of each element of the program from the Baseline Plan to the "August (1977) IMP" to the currently Proposed Action.

Continuing performance simulations permitted a substantial reduction in the curve relignment effort and elimination of the four flyovers of the Baseline Plan while still ensuring achievement of trip time goals. The cost of the route realignment element was reduced from $439 million to $165 million at the time of the "August IMP" and now to $43.5 million for the current proposal.

Recognition of the fact that the dedicated track concept was not implementable under this program and refined data on trackwork productivity reduced the trackwork element from $932 million to $498 million at the time of the "August IMP". The trackwork program still reflected a desire to maximize the renewal of the NEC trackbed as a priority, constrained primarily by limitations on track availability and productivity of the Track Laying System in the three years which remain in the mandated five-year program. Reconfiguration of additional interlockings to achieve

Table 1-16

THE EVOLUTION OF THE IMPLEMENTATION MASTER PLAN

| | BASELINE (UNCONSTRAINED) IMPLEMENTATION MASTER PLAN April, 1977 | | IMPLEMENTATION MASTER PLAN OF AUGUST 1977 (Basis for Draft PEIS) | | THE PROPOSED ACTION (Basis for Final PEIS) | |
|---|---|---|---|---|---|---|
| PROGRAM ELEMENT | DESCRIPTION | COST (millions) | DESCRIPTION | COST (millions) | DESCRIPTION | COST (millions) |
| Route Realignments | 32 major curves; 291 minor curves; 4 flyovers (Shell, Harold, Lane, Bay) | $432.2 | 22 major curves, 190 minor curves (total 212 curves) | $ 165.0 | 76 Minor Curves | $ 43.5 |
| Track Structures | 900 miles of dedicated track with all new CWR and concrete ties; 450 miles of non-dedicated track upgraded; 10 new interlockings; 19 interlockings relocated or reconfigured. | $932.3 | 515 miles of CWR, 400 miles of concrete ties, 675 miles of wood tie replacement; 55 reconfigured interlockings | $ 498.0 | 513 Miles of CWR, 400 miles of concrete ties, 615 miles of wood tie replacement, 58 reconfigured interlockings | $609.9 |
| Bridges | 34 replacements, 228 major rehabilitations, 317 minor rehabilitations, 176 minor repair (includes work on 755 of the 772 undergrade bridges) | $432.9 | 35 replacements, 365 upgrade and repair (work on 400 undergrade bridges) | $ 264.0 | 31 Replacements, 107 upgrade, 114 repair | $215.2 |
| Electrification | Uniform 25 KV, 60 Hz system for the entire Corridor | $462.1 | Upgrade Washington to Shell to 25 KV, 60 Hz; new system from New Haven to Boston at 25 KV. 60 Hz | $ 256.0 | Upgrade Washington to Shell to 25 KV 60 Hz; new system from New Haven to Boston at 25 KV, 60 Hz | $305.7 |
| Signaling and Traffic Control | CTC on all systems; reverse signaling on all dedicated track | $282.8 | CTC on all two-track segments; reverse signaling on 456 miles | $ 178.0 | CTC on all two-track systems; reverse signaling on 456 miles | $202.7 |
| Communications | New microwave system | $ 35.8 | New microwave or fiber optics system | $ 27.0 | New Microwave or fiber optics system | $ 27.5 |
| Fencing | Total Corridor fencing: 185 miles of urban fence, 710 miles of rural fence, all overhead bridges | $108.3 | Fencing of selected high-security areas and stations; all overhead bridges | $ 53.0 | Fencing of selected high-security areas and stations all overhead bridges | $ 48.1 |
| Grade Crossings | Eliminate 26 private grade crossings | $ 3.9 | Eliminate 19 private grade crossings | $ 4.0 | Eliminate 19 private grade crossings | $ 4.6 |
| Stations | Rehabilitation, replacement, expand, or upgrade 15 stations | $490.1 | Rehabilitate, replace, expand, or upgrade 15 stations | $ 242.0 | Rehabilitate, replace, expand, or upgrade stations | $243.7 |
| Maintenance and Service Facilities | 14 Maintenance-of-Way bases, five major service facilities, and one refueling facility | $267.3 | Thirteen Maintenance-of-Way bases and five major service facilities, and one refueling facility | $ 113.0 | Nine MOW bases; five major service facilities, one refueling facility | $101.9 |
| Tunnels | Major upgrading of seven tunnels at four locations | $ 37.5 | Eight tunnels (at five locations) to be upgraded | $ 20.0 | Eight tunnels (at five locations) to be upgraded | $ 22.2 |
| TOTAL | | $3,502.0 | | $1,820.0 | | $1,825.0 |

operational flexibility and capacity mandated an increase in the track structure program since the "August IMP". The priority given to renewal of the NEC trackbed is still clearly in evidence in the Proposed Action, accounting for one-third of the entire budget.

The bridge program outlined in the Baseline Plan drew from a previous study of bridge inspection which rated bridges as "adequate", "questionable", or "critical" in terms of their ability to provide the long-term load capacity demanded by NEC operations. The Baseline Plan included the work necessary to bring all bridges to a "30-year life expectancy". The bridge program for the "August IMP" was cut to include only the necessary work on those bridges which fell into the "critical" category (with the exception of certain minor repair projects already contracted to Amtrak for early training and employment). In developing the currently Proposed Action, additional bridge repair work was deferred in order to reduce the bridge program budget to cover higher estimated costs in other system-wide elements. Bridges with borderline structural adequacy have been and are continuing to be reassessed to reduce repairs to those absolutely essential or to defer the improvement.

The electrification program was initially reduced for the "August IMP" due to refinement of cost data on system requirements and a new lower estimate of affected bridges. In addition, deferring conversion of the MTA/ConnDOT segment and resulting need to convert that line's new commuter cars at very substantial cost also allowed significant reduction in the electrification cost estimate. The signaling budget of the "August IMP" reflected the elimination of CTC and reverse signaling on all but the two-track segments. The electrification, signaling and communication programs remain largely the same as in the August version of the Implementation Master Plan, but budgets reflect continuing refinement of cost estimates and design.

The fencing program initially was reduced reflecting the abandonment of the total Corridor fencing concept due to local cost sharing and environmental objections. The program did not substantively change between the "August IMP" and the Proposed Action except for the addition of fencing at certain parks.

The grade crossing program did not change between the Baseline Plan and the "August IMP". The number of crossings included in the program since that time, however, has been reduced to 19 because coordination with the Federal Highway Administration (FHWA) revealed that seven of the original 26 crossings were already included or were being eliminated in conjunction with the FHWA public grade crossing elimination program.

Reduction in the station program since the Baseline Plan reflected a scaling down of improvement level at all stations. That budget has not changed since the "August IMP" despite the addition of New Brunswick, Princeton Junction, and Rye to the list of stations eligible for operational improvements and the opening of the non-operational category to all stations on a first-come, first-served basis. At this time, the budget allocation between the stations is undecided. (See Section 2.8.2 for discussion.)

The maintenance and service facility budget has been reduced in development of the "August IMP" and again in development of the Proposed Action. This, combined with refined cost estimates for the bases, results in the deferral of four and construction of only nine of the 13 original MOW bases in the current program.

The tunnel program was initially scaled downward from the Baseline Plan in spite of the addition of improvements to the East Haven tunnel. The budget has since expanded slightly to reflect refinement of cost estimates and design.

In general, the program is one of compromise from ideal improvement levels in all elements. The emphasis has been retained in those areas related to deferred maintenance and maximizing the usability of the existing physical plant. Bridge, track, tunnel, signal and communication improvements account for 60 percent of the total program budget. Speed related improvements have been limited to the extent necessary to meet trip time goals. No major expansion of system capacity is planned at any point on the Corridor, but improvements to solve those site-specific capacity problems which would degrade existing commuter or freight service are being incorporated.

The program development process is ongoing and subject to further refinement and definition as the project proceeds. For example, there are many program details which cannot be settled until actual site-specific engineering design is complete. Certain other critical factors such as cost inflation, agreements, refinement in cost estimates within the fixed total budget limitations, and continuing environmental impact evaluation may also cause modifications to the program. Thus, this statement has attempted to identify all the major program actions and impacts which may occur even though the actual program may not be able to complete all the actions planned or discussed. In the event that major subsystems or elements of subsystems are deleted from the Program, additional detailed analysis will be performed.

## 1.7 DESCRIPTION OF PROPOSED PHYSICAL IMPROVEMENTS

The proposed physical improvements under this program are grouped into eleven distinct elements. These sub-program elements are described in detail in the following sections:

| | | | |
|---|---|---|---|
| 1.7.1 | Route Realignments | 1.7.6 | Communications |
| 1.7.2 | Track Structures | 1.7.7 | Fencing and Barriers |
| 1.7.3 | Bridges | 1.7.8 | Grade Crossing Eliminations |
| 1.7.4 | Electrification | 1.7.9 | Stations |
| 1.7.5 | Signaling and Traffic Control | 1.7.10 | Service Facilities |
| | | 1.7.11 | Tunnels |

Each element has been system engineered in order to identify the location, level and time frame of the proposed improvements. Coordination both within and between the elements played a vital role in the development of the NECIP. The cost effectiveness of the individual or groups of site-specific improvements has been determined by a series of trade-off analyses which subsequently was translated into systemwide program requirements/proposals.

The extent to which the sub-program elements will be implemented under the NECIP is shown on the Project Activities by Location (PAL) charts contained in Volume II of this statement. Corresponding segments of the PAL charts are printed facing the Environmental Planning Factors exhibits.

### 1.7.1 ROUTE REALIGNMENTS

Route realignment is a broad term used to summarize four interrelated types of improvement. These are: (1) curve realignments, (2) rail/rail grade separations, (3) additional tracks, and (4) increasing the center-to-center distance between tracks. These various improvements contribute to safer high speed operation, increase system capacity, reduce operational conflicts, improve maintainability, and increase rider comfort. The extent to which these improvements will be implemented under the NECIP is discussed below.

Curve Realignments. Of the 415 identified curves along the Corridor, 76 are being design investigated for realignment. Of these, 62 have been selected for complete design and construction based on engineering analysis and environmental sensitivity. Candidate curve realignments were initially evaluated and ranked on the basis of cost per minute saved. Environmental factors were integrated into the process by identifying potential socio-economic and natural environmental impact levels for each candidate curve. Finally, the magnitude of the entire curve realignment program was balanced against the costs and benefits of other NECIP projects, which when coupled with information obtained from additional Train Performance Calculator (TPC) test runs, relinquished the need for major curve realignments to obtain the desired trip time goals. This process and the list of proposed realignments is continually being refined as more data are obtained and the level of engineering progresses.

Of the 62 proposed curve realignments, eight will be implemented due to station platform reconfiguration, six due to bridge replacements and ten due to interlocking reconfigurations. The remaining 38 curves will be modified by making relatively minor changes in spiral length (transition area between curve and tangent) and/or superelevation (banking) increases to a maximum of six inches.

The magnitude of track shifts associated with these realignments varies from less than 0.1 feet to a maximum of 37 feet. Approximately 85 percent of these proposed realignments will cause track shifts of less than five feet. Further, it is expected that if all curves are shifted in the manner presently planned, four will significantly affect bridges. Realignment of these four curves would require the widening, shifting or replacement of six bridges. A complete list of the proposed curve realignments by state is given in Table 1-17. Also shown are the bridges affected. A detailed list of individual curves is given in Appendix A of this statement.

Table 1-17

PROPOSED CURVE REALIGNMENTS

| State | Total Number of Realignments | Number of Realignments That Affect Bridges | Number of Bridges Affected (Undergrade and Overhead) |
|---|---|---|---|
| Massachusetts | 5 | 0 | 0 |
| Rhode Island | 11 | 0 | 0 |
| Connecticut | 18 | 1 | 1 |
| New York | 2 | 0 | 0 |
| New Jersey | 8 | 0 | 0 |
| Pennsylvania | 4 | 2 | 2 |
| Delaware | 5 | 0 | 0 |
| Maryland | 23 | 1 | 3 |
| Washington, DC | 0 | 0 | 0 |
| TOTAL | 76 | 4 | 6 |

Grade Separations. The vertical separation of crossing railroad tracks (i.e., grade separations) reduces conflicting train movements. Existing train operations and the results of operation simulations were reviewed to identify those sites where current or future operations resulted in train conflicts. These conflicts cause congestion and delays which could affect trip-time goal reliability. The grade separation studies were conducted at Bay (Baltimore, MD), County (New Brunswick, NJ), Lane (Elizabeth, NJ), Harold (New York City), and Shell (New Rochelle, NY) interlockings.

At the five sites, the delays due to track reconfiguration and congestion were determined and the distribution of delays examined. The alternative of a grade separation was compared to a reconfiguration of the interlocking and/or track. At all five locations, it was determined that reconfiguration or upgrading of the existing configuration of the track would be more cost effective than a grade separation.

Track Additions. The addition of more tracks in selected areas would increase system capacity. During the system simulation analysis, additional track segments were considered at ten locations along the Corridor. Time savings realized by the additional tracks were computed and the approximate cost per minute saved was then determined. Consideration of the cost per minute parameter, and trade-offs with other program elements precipitated the reduction of this sub-element in the program.

Track Centers. The growth in size of locomotives, freight and passenger cars without corresponding increase in track center distance has reduced clearances between cars on adjacent tracks at many locations on the NEC to the acceptable minimum at current speeds. Studies have been made to determine the aerodynamic effect of increasing speeds to the 120- and 150-mph levels. Those studies have demonstrated the adverse impacts on equipment and passengers relative to the design of cars and to the distances between tracks. The adverse aerodynamic effects can be mitigated by retaining existing track centers as a minimum for 120 mph or increasing to 13 feet at 150 mph.

In addition to the aerodynamic effect, inadequate track center distances also cause operating restrictions and limit the design width of new vehicles. The most restrictive condition now in existence on the NEC occurs on a 6°44' curve at Bridgeport, Connecticut, where track centers of 12 feet are encountered. Because of car overhang and curve superelevation, the net effective distance is reduced to less than 11 feet. Consequently, it is necessary to prohibit the simultaneous occupancy of any two adjacent tracks with certain equipment.

Increasing track center distance at Bridgeport would alleviate the operating restriction and would permit increased design width of new vehicles. To do so, however, would not result in elimination but rather the relocation of the operating restriction. Therefore, a study of the track center limitations was undertaken to determine the track realignments and new equipment design parameters which would maximize car design flexibility and minimize operating restrictions in the most cost-effective manner. The results of that study with respect to track relocation were that track center widening by itself could not be justified due to the significant monetary investment required.

Under the proposed program, no tracks in the NEC will be realigned solely for the purpose of increasing track centers. However, in consideration of possible future passenger train speeds of 150 mph, 13-foot track centers (plus allowance for overhang) were adopted for interlocking reconfiguration and curve relocation and 14-foot track centers for reconstructed or relocated bridges.

### 1.7.2 TRACK STRUCTURES

Improvements under this element include rehabilitation, modification or replacement of the various components which make up the railroad vehicle carrying system. The components basically consist of the rails, ties, ballast, and subgrade. The eleven different improvements comprising track structures are discussed below.

Rail Installation. Five hundred thirteen miles of track are proposed for replacement with new (465 miles) or acceptable used (fit)(48 miles) continuous welded rail (CWR). This replacement of rail is necessary to provide rider comfort and maintainability of track structure geometry. Replacement with CWR will provide a track which, with joint elimination will be more economical to maintain and will reduce load impact to the track structure.

Rail surface and profile is permanently deformed at many joint locations resulting in a ride which is uncomfortable to the passengers and damaging to the vehicle and track structure. At other locations, the rail section is reduced and the gauge is misaligned to the extent that replacement is required.

The replacement of aged rail is also required to prevent the occurence of rail failures which affect the safe and reliable operation of trains. These rail failures are the results of time and tonnage-related growth of small defects which occur during the rolling or mishandling of the rail.

The following policies will govern the replacement of rail sections as proposed for the NECIP:

- South of New Haven, all rail in the mainline tracks will be 140 pound CWR.
- All alternate passenger tracks between New York and Philadelphia which are presently jointed or excessively worn will be relaid with new 140 pound CWR.
- North of New Haven, mainline passenger tracks will be of 132 pound section except rail placed in the CY 77 program.
- Freight tracks between Washington and Boston will be laid using acceptable (fit) relay CWR.
- Rail will not be laid in the areas controlled by MTA/ConnDOT, which is maintained by Conrail.

These replacement rail sections were selected on the basis of analysis considering axle loads, tonnage, speeds, and resulting life-cycle maintenance costs projected to be incurred in the NEC. New or acceptable used (fit) rail will be installed as follows:

- Washington to New York

| | |
|---|---|
| New (140 RE)[1] | 234 miles |
| Fit (140 RE) | 38 miles |

- New York to Boston

| | |
|---|---|
| New (132 RE) | 231 miles |
| Fit (140 RE) | 10 miles |

Concrete Tie Installation. It is proposed that concrete ties be installed in approximately 400 miles of mainline passenger tracks; 200 miles between Washington to New York and 200 miles between New York to Boston. Concrete ties are proposed for all high-speed areas of mainline passenger track. The concrete ties will be installed by a highly mechanized process termed the Track Laying System (TLS). Performance calculations and review of inservice tests have proven that concrete ties increase the horizontal and vertical stability of the track structure and result in improved ride comfort as well as increased length between maintenance cycles. Life-cycle cost analyses

[1]Designation of type of rail; i.e., 140 pounds per linear yard in weight, a measure of strength, durability, and physical shape.

performed have also shown that for total replacement the TLS installations of concrete ties is the most effective track renewal method. Approximately 1.1 million concrete ties will be required on the NEC; this is considered to be a sufficient quantity to reduce unit price cost to the level assumed in the life-cycle analyses.

Wood Tie Installations. Six hundred forty-three thousand ties are proposed to be installed in approximately 615 track miles of the Corridor. Defective wood ties will be replaced in track sections not designated as high-speed areas for passenger trains, and where extensive tie replacement is not required. This installation is to effect the replacement of wood ties which are defective due to age or defect propagation. Ties are the primary element in maintaining the rail at proper gauge and transmitting load from the rail to the ballast. If the ties cannot maintain the relationship or properly transmit the loading from the rail to the ballast, they will be replaced so that a reliable track structure capable of being cost effectively maintained can be provided.

The number of replacement ties and locations involved have been determined by field inspection and review of maintenance records.

Joint Elimination and Insulated Joint Improvements. Approximately 12,000 bolted rail joints in existing CWR stretches and unbonded insulated joints are proposed for replacement with field welds and bonded insulated joints. This will eliminate joint gap and provide continuous support. This is a fundamental improvement which will reduce maintenance cost, provide reliability to the signal system by installing an improved insulated joint, increase ride comfort, and decrease the load impact to the track structure. All bolted joints in CWR stretches on the Corridor will be replaced. The number of joints was determined by field inspection of various typical sections of existing track.

Interlocking Reconfigurations. Generally, the operating capacity and flexibility of individual interlockings (as described previously) will be improved through the addition, deletion, modification and/or relocation of interlockings to satisfy system capacity and flexibility requirements (Table 1-18). Interlockings will be modified to increase train operating speed and to be made more compatible with high-speed operation. Interlockings will be removed from curves wherever feasible, and relocated (if necessary) to tangents where high-speed crossovers can be more easily made. Additional interlockings will be rehabilitated.

Turnout Improvements. It is proposed that approximately 410 turnout units, including timbers, ballast, rail and special trackwork be repaired, replaced, or modified to assume safe train operation, provide adequate ride comfort, and alleviate deferred maintenance. The program includes upgrading turnouts within interlockings and turnouts outside of interlocking limits which are located in rail-renewal sections. This, however, does not include turnouts located in interlockings to be reconfigured. These improvements are required because the turnout is a critical track structure component which affects the safe passage of trains, on-time performance and future maintenance costs. Horizontal and vertical alignment of turnouts must be maintained to high standards. If the subgrade, ballast, timber, joints, or rail are in a condition which cannot properly support the axle loading, they will cause a rapid deterioration of the alignment. These deviations in alignment will result in potential slow orders, ride discomfort and increased maintenance costs.

The reliable operation of turnouts within interlockings can only be accompiished by proper inspection and maintenance of the various components and the timely replacement of those components which have become worn, resulting in the inability to properly adjust the switch mechanism. The turnouts requiring replacement or modification were determined through field inspection. Turnouts outside of interlockings, not in rail-renewal stretches, and not in mainline passenger tracks have not been included in the turnout improvements.

Track Undercutting and Ballast Cleaning. Track undercutting is the removal of ballast from below the tracks while the rails and ties remain in place. Ballast is then screened to remove soil, pulverized stone and

Table 1-18

PROPOSED INTERLOCKING RECONFIGURATIONS

WASHINGTON-NEW YORK

| Interlocking | Town/State |
|---|---|
| New York Avenue | Washington, DC |
| Capital Beltway | Lanham, MD |
| New Carrollton Station | New Carrollton, MD |
| Bowie | Bowie, MD |
| Odenton | Patuxent, MD |
| New Vern* | Patuxent, MD |
| Vern | Patuxent, MD |
| Fulton | Baltimore, MD |
| B & P | Baltimore, MD |
| Union | Baltimore, MD |
| Biddle Street | Baltimore, MD |
| Canton Junction | Baltimore, MD |
| Bay | Baltimore, MD |
| North Point | Baltimore, MD |
| Gunpowder | Baltimore County,MD |
| Principio | Charlestown, MD |
| North East | Charlestown, MD |
| Ragan | Wilmington, DE |
| Westyard-Wilmington | Wilmington, DE |
| Bell | Wilmington, DE |
| Holly Oak* | Wilmington, DE |
| Brill | Philadelphia, PA |
| Arsenal | Philadelphia, PA |
| Holmes | Holmesburg, PA |
| Fair | Trenton, NJ |
| Fairham | Trenton, NJ |
| Millham | Trenton, NJ |
| Metro park* | Woodbridge, NJ |
| Bergen* | Secaucus, NJ |

NEW YORK-BOSTON

| Interlocking | Town/State |
|---|---|
| Harold (westbound) | New York, NY |
| Sunnyside Jct. | New York, NY |
| Market | New York, NY |
| Pelham Bay | New York, NY |
| Shell | New Rochelle, NY |
| New Haven | New Haven, CT |
| Mill River Junction | New Haven, CT |
| Guilford | Guilford, CT |
| Clinton | Clinton, CT |
| Old Saybrook-Midway | Old Saybrook, CT |
| Black Point* | Old Lyme, CT |
| Waterford | Waterford, CT |
| Groton - Palmer's Cove | Groton, CT |
| Mystic - Quambaug Cove* | Mystic, CT |
| High Street | Westerly, RI |
| Bradford | Bradford, RI |
| Wood River Junction - Kingston* | Charlestown, RI |
| Warwick | Warwick, RI |
| Providence | Providence, RI |
| Tower One | Boston, MA |
| Lawn | Providence, RI |
| Attleboro | Attleboro, MA |
| Mansfield | Mansfield, MA |
| Canton Junction | Canton, MA |

* Indicates new interlocking

fine debris which are fouling the ballast, reducing strength and preventing proper drainage. The clean ballast will be returned to the track and waste material will be properly disposed.

The ballast section of the mainline passenger tracks which have been designated to receive concrete ties is proposed for undercutting. In areas where there are four tracks, with the two inside tracks designated as NECIP passenger mainline, the outside tracks will also be undercut. Three hundred ninety-five miles of track will be undercut.

Undercutting of the track is necessary to create a ballast section capable of providing proper support for the concrete ties and improving drainage. Additionally, undercutting extends the time interval between periodic surfacing and lining of the track. Tracks will be undercut to a depth of approximately 16 inches. In areas where the required increase in vertical clearance to accommodate electrification at overhead bridges is marginal, undercutting can lower the track profile as required for the needed clearance.

Shoulder ballast cleaning also screens ballast to remove fine particulates but only ballast from under the shoulders is cleaned. While not as effective as undercutting, it still improves ballast drainage, particularly in two-track sections. Cleaning of the shoulder ballast sections will be performed on approximately 650 miles of Corridor tracks that will receive new rail and/or wood ties.

Rail Grinding. Eight hundred eighty-seven track miles of rail are proposed to be ground in order to provide a smoother and quieter ride, to decrease the impact loading of the trains, and to increase the useful life of rail. All new rail on the Corridor will be ground.

This operation is required to enhance ride comfort and provide a rail surface that supports track geometry standards. Imperfections and increasing corrugations in the rail cause excessive noise within and vibration of the vehicle, annoying the passengers and damaging the vehicle. Also, the increased impact loading of the track structure causes accelerated deterioration of the track geometry components and subgrade.

Drainage Improvements. Selected roadway ditches are proposed to be cleaned and/or modified to provide adequate lateral and longitudinal drainage, and to improve the flow of surface drainage away from the track structure. In addition, a number of culverts will be cleaned, repaired or replaced. Areas requiring drainage improvements are being identified by field inspection and ongoing detailed engineering design.

These improvements are required to provide a well drained track structure and subgrade. Drainage is essential to the track stability required for high-speed operation. Particular emphasis has been placed on cuts and areas established as potential problem sites. At a minimum, the ditch line will comply with a standard roadway ditch cross section.

Subgrade Stabilization. Approximately 11 track miles of subgrade will be stabilized.

The subgrade is the foundation which supports the ballast and track structure. If this foundation is unstable, it usually requires excessive maintenance and may lead to sudden subsidence creating poor ride comfort and ultimately unsafe operating conditions. Through analysis of the stability of the fill material, it was decided to use a combination of lime injection, grouting and fill reconfiguration to correct these problem areas.

The locations of these unstable roadbed conditions were determined through discussions with maintenance personnel, record examinations and field inspection.

Debris Removal. The ROW will be cleaned of accumulated overgrowth brush, track, debris, maintenance-of-way scrap and trash. This program will be implemented because the debris on the ROW constitutes an impediment to maintenance, a hazard to safe rail operations, and possibly a problem to personnel working in the vicinity.

Areas requiring debris removal were identified by field inspection and constitute the 1977-1978 ROW Cleanup Program.

### 1.7.3 BRIDGES

There are a total of 1,300 bridges along the NEC. Among these bridges are two general types: undergrade and overhead. Undergrade bridges are those which carry the railroad. Overhead bridges are those in which the crossing mode (e.g., road, another railroad) passes over the railroad. There are 772 undergrade and 528 overhead bridges along the NEC rail system. Generally, overhead bridges will not be replaced or modified for structural reasons. The primary factor dictating whether overhead bridges require modification is inadequate vertical or horizontal clearance. Undergrade bridges, on the other hand, will be subjected to maintenance, repair, or reconstruction for various reasons including inadequate structural capacity. Adequate structural capacity and improvement of undergrade bridges is necessary to meet NECIP goals. The disposition of each of the undergrade bridges is presented in Appendix B.

Overhead Bridges. Given the needs defined by the electrification and route realignment programs, there are three basic alterations that will affect overhead bridges. To accommodate the electrification north of New Haven, some overhead bridge superstructures will be replaced and the piers/abutments modified. In areas where the required increase in vertical clearance is marginal, minor underdeck modifications will be performed or the tracks will be lowered; in these cases, the bridge piers/abutments may have to be underpinned and extended. To accommodate track shifts for proposed curve realignments, certain bridges will be completely reconstructed. Extensive preliminary analyses have been performed to minimize the number of bridges being replaced which would have impact on adjacent lands and may be further minimized by ongoing detailed engineering designs (Table 1-19).

Table 1-19

PROPOSED OVERHEAD BRIDGE IMPROVEMENTS

| | Improvements | | | |
|---|---|---|---|---|
| State | Lower Track | Modify Underdeck | Replace | Improvement Pending Engineering Design |
| Massachusetts | 9 | - | 13 | 2 |
| Rhode Island | 6 | - | 5 | 1 |
| Connecticut | 1 | - | 13 | - |
| New York | - | - | - | - |
| New Jersey | 2 | - | - | - |
| Pennsylvania | 1 | 2 | 1* | - |
| Delaware | - | - | - | - |
| Maryland | 3 | - | - | - |
| Washington, DC | - | - | - | - |
| TOTAL | 22 | 2 | 32 | 3 |

*Replacement due to curve realignment

Undergrade Bridges. The improvements proposed for undergrade bridges are based on the level of improvement necessary to provide adequate capacity in all bridges for 120 mph operation. These proposed improvements were developed under the assumption that to provide safe operations, eliminate deferred maintenance, and reduce future maintenance, it will be necessary to repair bridges of adequate strength, upgrade bridges of inadequate strength, and replace bridges that are beyond repair or upgrading.

Generally, the proposed improvements to undergrade bridges can be grouped into these three categories: repair, upgrade and replace. These categories are described below:

- Repair--Bridges that are structurally sound but will undergo minor rehabilitation activities to rectify deteriorating conditions. Proposed improvements include such activities as deck waterproofing, gunite strengthening, pointing and grouting, painting, replacement of bearings and anchors, and replacement of rivets with high strength bolts.

- Upgrade--Bridges that are structurally inadequate and will undergo many of the activities under the repair category plus structural member replacement or strengthening of structural members.

- Replace--Bridges which will be totally demolished and replaced by a new structure.

Table 1-20 lists the undergrade bridges by anticipated level of improvement and by state.

Table 1-20

PROPOSED UNDERGRADE BRIDGE IMPROVEMENTS

| State | Improvements | | | Number Affected by Curve Realignments |
|---|---|---|---|---|
| | Repair | Upgrade | Replace | |
| Massachusetts | 7 | 1 | 0 | 0 |
| Rhode Island | 9 | 2 | 6 | 0 |
| Connecticut | 22 | 20 | 12 | 1 |
| New York | 12 | 7 | 0 | 0 |
| New Jersey | 16 | 30 | 9 | 0 |
| Pennsylvania | 23 | 18 | 2 | 1 |
| Delaware | 7 | 18 | 0 | 0 |
| Maryland | 17 | 11 | 2 | 3 |
| Washington, DC | 1 | 0 | 0 | 0 |
| TOTAL | 114 | 107 | 31 | 5 |

As shown in Table 1-20, five undergrade bridges are likely to be affected by proposed curve realignments.

Movable Bridges. There are fifteen operable, movable bridges along the NEC: nine bascule bridges, five swing bridges and one vertical lift bridge. They range from 40 to 85 years old; 11 of these bridges are more than 65 years old.

These bridges were inspected to determine the condition of mechanical-electrical equipment and to observe operational characteristics. The bridges were rated for as-built and as-inspected condition and the as-inspected rating including reductions to capacity due to deteriorated components. This information served as the basis for a proposed improvement program necessary to meet the speed and service characteristics of the improved rail system. Of the 15 movable bridges, three are recommended for replacement. In these cases it is probable that the alignment will be shifted to meet new bridge structures. For ten of the remaining bridges, structural, mechanical, electrical and ancillary facility repair or reinforcement are recommended. The Perryville Bridge over the Susquehanna River and the Bush Bridge over the Bush River are not slated to undergo improvements under the NECIP.

Table 1-21 lists the 13 movable bridges included in the NECIP and the improvements proposed for each bridge.

Table 1-21

PROPOSED MOVABLE BRIDGE IMPROVEMENTS

| Bridge Name | Town/State | Proposed Improvement | |
|---|---|---|---|
| | | Replace | Rehabilitate |
| Mystic River | Mystic, CT | X | |
| Thames River | Groton, CT | | X |
| Shaw's Cove | New London, CT | X | |
| Niantic River | Waterford, CT | X | |
| Connecticut River | Old Saybrook, CT | | X |
| Devon | Milford, CT | | X |
| Pequonnock River | Bridgeport, CT | | X |
| Saugatuck River | Westport, CT | | X |
| Norwalk River | Norwalk, CT | | X |
| Cos Cob | Greenwich, CT | | X |
| Pelham Bay | Pelham Manor, NY | | X |
| Portal | Secaucus, NJ | | X |
| Dock | Newark, NJ | | X |

Federal Permits. The improvements to movable bridges and certain of the other undergrade bridges which traverse navigable and/or tidal waters will be subject to federal permit procedures. Permits on the federal level may be required from the Corps of Engineers, and/or the Coast Guard for improvements to bridges over navigable waters.

Coast Guard bridge permits are required under the General Bridge Act of 1946 (33 USC 535) and Section 9 of the Rivers and Harbors Act, prior to the erection of structures (or repairs which change clearances, type of structure, substructure, superstructure or navigation conditions, e.g., position of piers) across navigable waters of the U.S. including bridges, causeways, approaches, fenders, and appurtenances.

Corps of Engineers permits are required under both Section 10 of the Rivers and Harbors Act and Section 404 of the Federal Water Pollution Control Act. Section 10 establishes regulation of structures (piers, jetties, wharfs) and work in those waters that have been used in the past, are now used, or are susceptible to use, as a means to transport interstate commerce landward up to their ordinary high-water mark, and waters subject to the tides up to their mean high-water mark. Section 404 regulates (as of July 1977) discharges of fill or dredge material into any streams with a flow of more than five cubic feet/second and any lakes of more than five acres. Activities in tidal or freshwater wetlands contiguous or adjacent to such waters are also regulated.

### 1.7.4 ELECTRIFICATION

Improvements and additions to the NEC electrical traction power system will involve conversion to 25 KV, 60 Hz power and refurbished catenary, construction of a new power supply system, and selected conversion of rolling stock in commuter service on the NEC.

Traction Power and Catenary. The 226 route mile segment between Washington and New York City and 15 miles of the Hell Gate Line to New Rochelle, New York, are electrified utilizing 11 KV, 25 Hz electric traction power through fixed anchorage compound catenary. High voltage transmission lines are also an essential part of this system. Between New Rochelle and New Haven, 58 route miles of four-track territory of the Metropolitan Transportation Authority/Connecticut Department of Transportation zone are being converted to 12.5 KV, 60 Hz by MTA/ConnDOT. The catenary throughout this territory is of an old design dating back to the early 1900's. The balance of the Corridor, the 156 route miles of track between New Haven and Boston, is not electrified.

A unified 25 KV, 60 Hz commercial power system is proposed for the ultimate NEC system. Since the existing system has characteristics unique to specific areas, differing improvements are proposed for three segments: Washington to Shell Interlocking in New York, Shell to New Haven and New Haven to Boston.

Between Washington and "Harold" Interlocking, the existing catenary is primarily the compound catenary style. These will not have to be restrung although some repairs and modifications are necessary for 120 mph operation. The catenary from "Harold" to "Shell" (30 track miles) is so badly deteriorated that replacement may be more economical than repair. The catenary under some bridges and in the New York tunnels will have to be modified or clearances increased.

The New Rochelle to New Haven section of the NEC is not owned by Amtrak. The section from Shell to the New York/Connecticut border is the property of the Metropolitan Transportation Authority (MTA) of New York and the section from the New York/Connecticut border to New Haven is leased by the Connecticut Department of Transportation (ConnDOT). Since the system is not owned or under the direct control of Amtrak, alterations of the electric traction system for this section have been deferred based on the outcome of negotiations with the MTA and ConnDOT. Because of the high cost of converting existing MTA/ConnDOT cars, construction of facilities for 25 KV power is not proposed for Shell to New Haven under the NECIP. However, to assure that this section would be compatible with the remainder of the NEC when it is ultimately converted to 25 KV, NECIP funds are budgeted for the design of catenary and power supply in this section consistent with the total system. The New Haven Railroad triangular style of catenary is not compatible with high-speed service or 25 KV power. Projected train speeds between New Rochelle and Stamford are about 80 mph; if higher speeds were instituted, the steel messenger wires are sufficiently deteriorated that major repair work or a new catenary system would be required.

The New Haven to Boston section presently uses diesel-electric traction power; the proposed system will extend electrification through the area. The additional cost of a new catenary for speeds to 150 mph is negligible compared to the basic cost of a new 120 mph design. It is therefore proposed to build a new catenary system from New Haven to Boston which will be capable of sustaining operations at 150 mph with three raised pantographs. The new catenary will be of a compound style, constant tensioned, with telescopic hangers and a typical span length of about 210 feet on a straight length of track. A simple catenary version of this design will be used in heavily curved segments where speeds cannot exceed 100 mph without substantial track realignment in addition to that proposed under the NECIP. Yards and complex terminal trackage will be equipped with a simple catenary, or possibly only trolley wire with fixed anchorage since speed is of no concern. Figure 1.11 illustrates the proposed catenary poles superimposed onto a typical picture of a section of the ROW along the coastline.

In addition to the mainline trackage between Potomac Yard, Alexandria, VA and Boston South Station, certain short branch lines

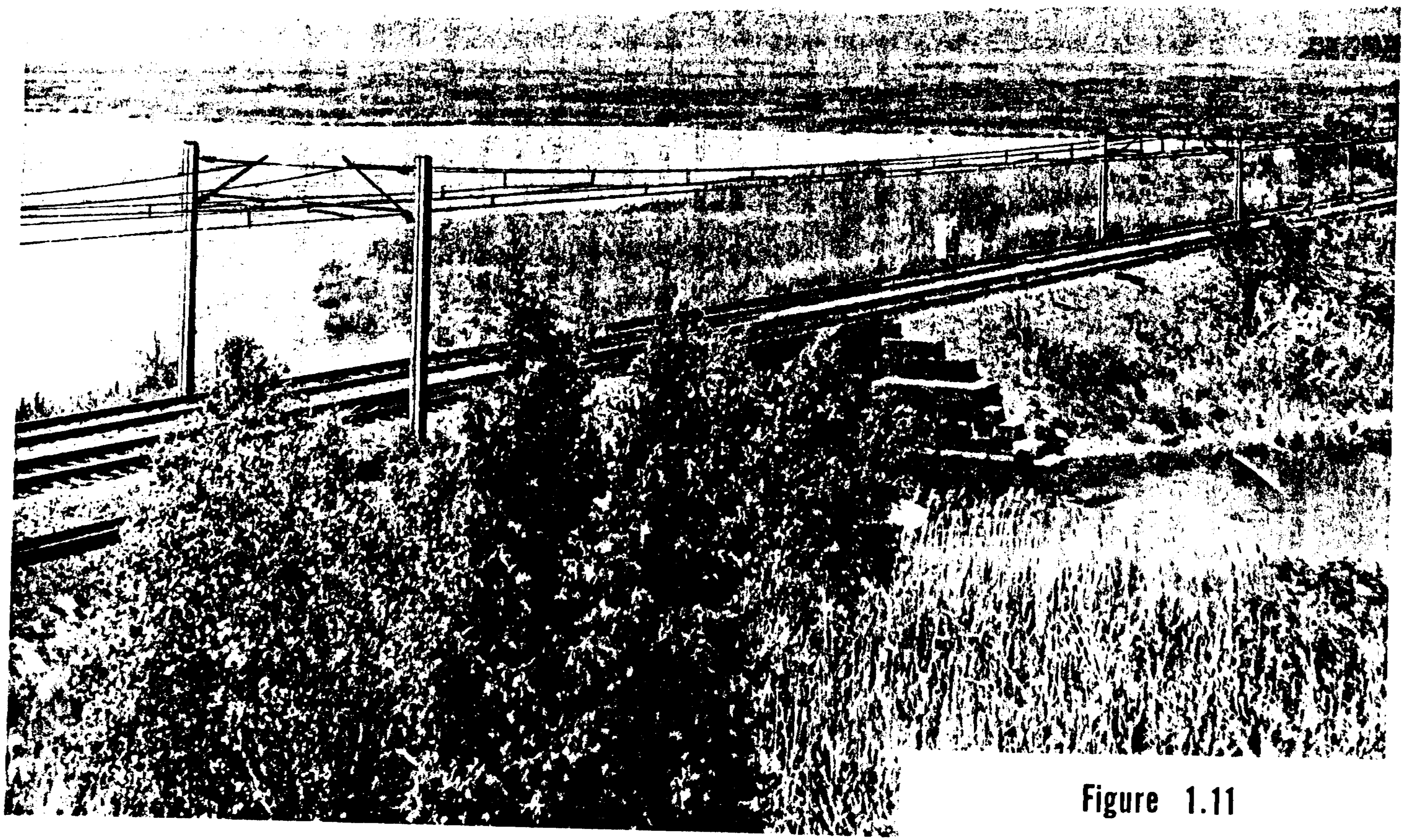

Figure 1.11
TYPICAL CATENARY INSTALLATION

and yards which are presently supplied from the Corridor will be converted to 25 KV, 60 Hz. These are:

- Shellpot Branch, freight bypass around Wilmington, DE
- Suburban Station connection to mainline, Philadelphia, PA
- Powelton Avenue Coach Yards, Philadelphia, PA
- Princeton Branch, NJ
- Waverly Yards, Newark, NJ
- Sunnyside Yards, New York, NY

Power Supply. The power supply system will consist of incoming high voltage from the utility grid, a railroad substation where a transformer will step voltage down to 25 KV, and switchgear which will supply power to the catenary. The existing power supply system between Washington and New York cannot accommodate the conversion to 25 KV, 60 Hz, and therefore will have to be replaced with new facilities and equipment. Power supply between Shell and New Haven is part of the electrification improvement being implemented by MTA/ConnDOT. Between New Haven and Boston, an entirely new system of power feed must be constructed.

The requirements for all intercity, commuter and freight trains will be supplied by single-phase traction substations, each feeding a section of the Corridor from the center of the section. Each station will require approximately 8,000 square feet of land. The highest structure will be the terminal structure for the transmission line. The tallest component of the substation equipment will be about 15 feet high.

The 25 KV switchgear will be enclosed in a metal housing, which will also accommodate auxiliary equipment such as communications, supervisory control, battery charger, and protective relays. The metal housing could easily be expanded to enclose additional circuit breakers. Fencing will be erected to enclose each substation and intrusion security alarms will be installed.

Switching stations will be located at the midway point between adjacent substations. The switchgear arrangement will be very similar to that of the single-bank substation. In addition, each switching station will contain a tie breaker that will close only under emergency conditions. The area of land required for a switching station is approximately 400 square feet.

The system will accommodate the emergency condition of substation outage. It is assumed that on the average there will not be more than one substation out of service along the Corridor at any one time; the electrification system is designed so that train performance will not be significantly altered with one substation out. In the latter case, the two adjacent substations will each feed one-half of the affected section, through the tie breaker at the mid-point switching station. The decrease in performance from the increased feeding distance will result in a 12.6-second maximum increase in travel time between the two substations. If two or more adjacent substations are out at the same time, the system will continue to operate, but train performance will be perceptibly affected.

Criteria used in the substation and switching station site selection process included:

- Required substation spacing
- Availability of utility high voltage
- Ease of construction
- Access
- Location of phase breaks
- Environmental sensitivity

The most important requirement in selecting locations for substations and switching stations is limiting the maximum distance between substations to a spacing that will not result in a degradation in performance under the maximum traffic density, train acceleration and speed projected for the system. This distance is determined on the basis of permissable voltage drop along the catenary for maximum power demand considering the power factor, number of tracks, high and low voltage fault levels and open circuit voltage. The NEC system will be designed to a 0.8 voltage factor; i.e., the substations will be spaced so that the voltage at the pantograph never falls below 20 KV on a 25 KV base. For a low voltage fault level of 500 MVA, the system must be designed to withstand a short-circuit current of 20,000 A.

The worst case power demand for a two-track system was taken as being one high-speed train on each track, with one train accelerating and one cruising at high speeds. If this train load is placed at one end of the feeding section, the optimum length of catenary between substations was calculated to be 13.3 miles. For a four-track system, the worst case was assumed to be two high-speed trains at the end of the feeding section, with the commuter load spread evenly on both sides of the section, lumped and located at the substation. The optimum distance was found to be 15.8 miles. In areas where speed restrictions will not allow high speed operation or where double transformer banks will be used, this distance can be increased.

Availability of power supply is another major consideration in selecting station sites. Power is to be supplied by the local utility companies at 115 KV, 138 KV, or 230 KV. Tapping from a higher voltage than 230 KV would be uneconomical because of the cost of necessary insulation, and tapping from less than 115 KV would probably result in an unacceptable strain on the utility company and higher voltage distortion. Utility impact studies will be carried out in such cases and correction equipment installed as necessary.

To avoid the cost and potential adverse impacts of constructing new transmission lines, as many substations as possible will be located where existing utility lines cross or run parallel to the right-of-way. In other cases north of New Haven, power will be supplied via: (1) 115 KV overhead lines if potential impacts are small; (2) 115 KV underground cable in environmentally sensitive areas; or (3) 25 KV lines or underground cable supplied by a railroad substation located at the utility substation. The latter method requires the switchgear housing at the right-of-way to transfer the power to the catenary and is not feasible for long distance transmission due to the voltage drop along the transmission line. South of New Haven, the ultimate 25 KV system design calls for running any required high voltage transmission lines from the nearest utility in or adjacent to the right-of-way, along the existing overbuild to the substation.

Access to all substation and switching station sites is necessary for construction, and must remain available for an estimated two trips per year for normal maintenance after the system is in operation.

There will be a phase break at every substation and switching station. This is a section of insulated catenary approximately 15 feet long which isolates one power section from another. Care must be taken to locate these phase breaks where there is the least likelihood of stranding a train.

Locating as many substations as possible at powerline crossings, combined with spacing requirements, limits the possible locations for remaining substations. Environmentally sensitive areas--wetlands, parklands, areas of historic significance, and high-density residential areas--will be avoided where possible. In cases where this is not feasible, care will be taken to select sites where the impact would be least.

The section from Washington to New Rochelle will have 18 substations, compared with the existing 25. There will be 12 substations between New Haven and Boston, and design provision for three substations between New Rochelle and New Haven.

Tentative general locations of the substations are:

| | |
|---|---|
| Potomac Yard, VA | Bacon Hill, MD |
| Landover, MD | Stanton, DE |
| Bowie, MD | Naaman, DE |
| Elkridge, MD | Brill, PA |
| Chesaco Park, MD | Torresdale, PA |
| Magnolia, MD | Morris, PA |
| Oak, MD | Schalks, NJ |

| | |
|---|---|
| Edison, NJ | Old Saybrook, CT |
| Newark, NJ | Waterford, CT |
| Sunnyside, NY | Mystic, CT |
| New Rochelle, NY | Alton, RI |
| Cos Cob, CT* | Slocium, RI |
| Westport, CT* | Greenwich, RI |
| Devon, CT* | Providence, RI |
| New Haven, CT | Norton, MA |
| Guilford, CT | Canton, MA |
| | Roxbury Crossing, MA |

* No construction under NECIP

Equipment Conversion. The NECIP will convert existing commuter equipment in use on the NEC to operate at 25 KV, 60 Hz in those cases where the conversion is necessary to allow continued operation and where the equipment has sufficient remaining useful life to make conversion cost effective (Table 1-22). Multiple unit commuter cars to be converted with NECIP funds total 291 units operated by SEPTA and NJDOT. A total of 51 multiple unit cars owned by SEPTA and NJDOT and 13 NJDOT locomotives are near the end of their useful life and do not warrant conversion. The fleets of MTA and ConnDOT cars do not require conversion as their operating territory will not be converted to 25 KV power.

### 1.7.5 SIGNALING AND TRAFFIC CONTROL

Signaling. Many different types and styles of signaling equipment exist along the Corridor, some dating prior to 1890. The great bulk of the signaling system was installed in the early 1930's as part of the Pennsylvania Railroad's electrification program. The existing system is a wayside signal light system supplemented by direct communication of the speed orders to the train through cab signals.

The present track side signals and train detectors are linked to 116 interlockings operated from 77 towers positioned as strategic points along the Corridor. The route of a train along the Corridor is controlled by men located in the towers. These tower men in turn report by telephone to dispatchers located at central points who direct the routing of each

Table 1-22

EFFECT OF NECIP ON COMMUTER EQUIPMENT

Equipment to be Converted to 25 KV, 60 Hz by NECIP

| Type | Service | Number |
|---|---|---|
| Silverliner II | SEPTA | 37 |
| Silverliner III | SEPTA | 20 |
| Silverliner IV | SEPTA | 130 |
| Jersey Arrow I | NJDOT | 34 |
| Jersey Arrow II | NJDOT | 70 |

Equipment to be Retired

| Type | Service | Number |
|---|---|---|
| Silverliner I | SEPTA | 5 |
| E-6 | SEPTA | 28 |
| E-6 | NJDOT | 18 |
| GG-1 Locomotives | NJDOT | 13 |

Equipment to Continue in Operation at 12.5 KV, 60 Hz

| Type | Service | Number |
|---|---|---|
| M-2 | MTA | 122 |
| M-2 | ConnDOT | 122 |

train. The telephone communications link frequently means that train locations are not known until a tower is passed, often too late to make a change and avoid a delay.

A total of 741 track miles of existing signal facilities from Washington to Shell Interlocking will be modified and 40 interlockings will be rehabilitated and modified. Hardware components being rehabilitated or replaced include cable, switch machines, relays, instrument housings, signals, and impedance bonds. Between New Haven and Boston, bi-directional automatic block signals will be installed on 310 miles of track. These installations are required for long term serviceable, flexible operation with a reliable all-weather system.

Approximately 2,700 mainline and 700 off-Corridor track circuits and 15 to 20 100 Hz signal power frequency conversion facilities from Washington to Shell will be modified or installed. The track circuits and frequency conversion equipment must be modified to be compatible with 60 Hz traction power.

Signal upgrading will be required on approximately 650 signal sites between Washington and New Rochelle. Onboard cab signal equipment which provides direct commands to the train will be installed or modified on approximately 300 vehicles.

Sixty-one all-relay interlockings will be installed, 28 south of Shell and 33 between New Haven and Boston. Existing interlocking control machines are 40 to 90 years old. Their condition is commensurate with age and they must be replaced to provide reliable, cost-effective operation.

Centralized Traffic Control (CTC) will be installed on all main tracks between Washington and Wilmington, and New Haven to Boston, including computerized control centers at Philadelphia and New Haven. Centralized traffic control will assist in meeting trip-time goals by increasing capacity through enhanced operations planning, and will eliminate the need for many manned control towers. The design of a CTC system removes elements from manned control, such as issuance of train orders for movements against the flow of traffic, and places their specific performance under automated sequential operation of components monitored by equipment designed on the fail-safe principle. The routine performance of hardware designed for particular application is far more reliable than the routine performance of the same task manually. Failure of the automated system will result in the automatic implementation of appropriate safety measures, while communicating a failure message to a manned facility.

Over-speed automatic train control will be installed or modified on approximately 291 vehicles. At the present time, a number of vehicles operating on the NEC do not have over-speed automatic train control. To ensure safe operation, all trains must be so equipped and operators trained in its use.

A train operations recording system will be installed at the central traffic control centers which will provide printouts of information tailored to meet specific needs, such as train arrival and departure times. The central operators will, therefore, not be required to record the data manually allowing more time for operational decisions.

A programmed multiple operations system will be installed which automatically establishes routes and clear signals for train movements on a prescribed schedule. The system reduces the control operator's involvement in establishing routes and clearing signals to emergency situations or where exceptions from the prescribed schedule occur.

Twenty-two additional hot journal detectors (a device to detect wheel bearing failure) will be installed. Detectors will increase the safety of operations by detecting defective journals before accidents occur.

An additional 82 self-restoring dragging equipment detectors will be installed at selected locations to provide protection as required. Detectors will increase the safety of operation by detecting equipment dragging from vehicles that may cause accidents.

High, wide load detectors will be installed at approximately 20 locations. These detectors are required to ensure that road freight movements entering the system meet clearance requirements.

As part of the turnout improvements, switch heaters will be installed on 547 turnouts which are not protected from the weather by overhead cover and are needed for continuous operation. Adequate switch heaters are essential to railroad operation during snow and ice storms.

1.7.6 COMMUNICATIONS

A new high capacity communications system is proposed for the NEC to replace the deteriorated patchwork system now existing and to provide the additional circuits necessitated by high-speed, high-volume operation. The existing communication system basically consists of paper-insulated lead covered cables supplemented with some leased circuits which were added as portions of the original system were abandoned. The railroad-owned facilities still in use are badly deteriorated and frequently become inoperative in rainy weather as the duct lines fill with water.

It is impractical to mix existing communication plant facilities installed in the 1930's with present state-of-the-art telecommunications equipment and design. The physical size of hardware alone has been reduced 10 to 20 times, making patchwork replacement unfeasible. To meet current and future signal control, power supervisory, radio, closed circuit television, and telecommunications circuitry standards, and obtain the reliability required, it is proposed to replace the existing NEC trunk cable and leased lines and totally redesign the transmission modes.

To coordinate operations on the entire Corridor, including intercity, commuter and freight movements, the communications system will incorporate data, telephone and radio circuits. The telephone and radio circuits will provide for voice communication among all personnel responsible for the operation, maintenance, and security of the railroad while the data circuits will perform the following functions:

- Data and command transmission between signaling locations on the right-of-way and the Centralized Traffic Control (CTC) centers at Philadelphia and New Haven. (Operational control of traffic in areas where CTC is not installed will utilize dedicated telephone lines.)
- Data and command transmission between electric traction power system locations (e.g., substations and switching stations) and the electrification control centers, also at Philadelphia and New Haven.
- Data transmission from the hazard-detection system, designed to warn of trains with dragging equipment, hot wheel bearings, etc.
- Connection of security alarms at various unmanned facilities to security control centers.
- Connection of Amtrak stations and administrative offices for customer services (e.g., reservations) and various other data exchanges.

The linear nature of the Corridor prompts design of a communications system consisting of a trunkline backbone system running the length of the Corridor and interconnecting a number of terminal nodes, each of which is served by a local distribution system. Selection of terminal nodes is related to location of fixed facilities such as maintenance bases and passenger stations. Terminals are proposed for Ivy City (Washington, D.C.); Odenton, Baltimore, and Perryville, MD; Wilmington, DEL; Philadelphia, PA; Morrisville, New Brunswick and Newark, NJ; New York, NY; New Haven, Old Saybrook, and Groton, CT; Providence, RI; and Readville and Boston, MA. In addition, redundancy must be provided in order to maintain certain operationally critical circuits in service in the event of failure in either the backbone or local distribution system.

Each of the three necessary service elements (backbone, local distribution, and critical circuit redundancy) may be provided by several technologies, all of which have been evaluated for cost and reliability in light of the needed capacity.[1]

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[1]FRA, NECIP, Communication System Development, Task 206, Draft Report, April 1978.

- Conventional Cable. Conventional multipair and coaxial cable, the traditional means of communications transmission, can be used for any of the three service elements. The cables would be buried in ducts along the right-of-way as in the existing system. The primary disadvantage of conventional cable on electrified railroads such as the NEC is that costly shielding is needed to prevent electromagnetic interference induced by the proximity of high-voltage electric traction power lines.
- Microwave. Alternatively, transmission over the backbone may be accomplished by radio-frequency energy beamed along a series of microwave towers. Since an unobstructed line-of-site between towers is necessary, the towers would be located on high ground off the right-of-way and communications would be beamed from the backbone to the terminal nodes. For the same reason, microwave is not practical for local distribution along the right-of-way.
- Fiber Optics. A third method is the use of light energy for transmission of communications in digital form through very fine strands of fiberglass. Fiber optics is a new technology allowing a cable the size of ordinary house wiring to carry as many circuits as a microwave system. Since light energy is unaffected by electromagnetic interference, such cables can be run along the right-of-way, either buried or strung from the catenary poles, and can be used for any of the three service elements.

In addition to the technological alternatives, all of which have been evaluated as railroad-owned systems, the option exists to lease the needed trunkline circuits or redundant critical circuits from public communication utilities. Because the number of critical circuits requiring redundant facilities is limited, provision of this service element by leased lines is particularly attractive.

Analysis of all the feasible combinations of technological alternatives and lease-buy options has concluded that the most cost-effective communications system for the NEC over an expected 30-year life cycle would utilize fiber optics for both backbone and local distribution and dedicated leased lines for critical circuit backup.

The fiber-optics system would also minimize environmental impacts since the basic transmission system would be contained within the right-of-way, utilizing a single six-fiber cable, either buried or hung from the catenary poles.

Since fiber optics is a relatively new technology and has not yet been used in railroad communications, the risk involved in its application is under continuing evaluation. If it is eventually decided that the technological risk involved with fiber optics is unacceptable, the next least-costly system is proposed for implementation, consisting of a low-power, highly directional microwave backbone, conventional multipair cable along the right-of-way for local distribution, and leased lines for critical circuit redundancy.

The number and general location of backbone microwave tower sites is determined by the need for an unobstructed line-of-sight between towers and the amount of signal strength fade over distance which can be tolerated. Also, interference with existing microwave systems must be avoided. A total of 19 backbone towers with an average spacing of 20 to 23 miles will be required, at the following general locations:

Washington, DC
Odenton, MD
Baltimore, MD
Aberdeen, MD
Cecil County, MD
Wilmington, DE
Philadelphia, PA
Middletown Township, Bucks County, PA
Franklin Township, Somerset County, NJ
Mountainside, Union County, NJ
New York City, NY
Harrison, NY
Southwest Connecticut Region
New Haven Area, CT
Connecticut River Estuary Region, Hamburg, CT
New London/Norwich Region, CT
Exeter, RI
Central Falls, RI
Boston, MA

Alternative sites within each of these general areas have been evaluated for power availability, access roads, and environmental constraints (e.g., residential areas, marshland and parks). Where possible, existing microwave towers or buildings presently developed for antenna systems would be used for the backbone system. Preliminary investigation indicates that seven of the 19 backbone locations could utilize existing towers or buildings. New towers would be self-supporting and range from 100 feet to 250 feet in height (Figure 1.12). The towers would be painted international orange and white as required by the Federal Aviation Administration. Each would require a site 75 feet square.

Since communications would be beamed from the backbone system to the terminal locations along the right-of-way for local distribution by conventional cable, terminals would require installation of microwave dishes either on towers or atop buildings, as necessary. If a microwave system is proposed, site-specific environmental documents will be required for new microwave towers located near historic sites, in parks or near residential areas. The following locations may require site-specific documents: Washington, DC, Cecil County, MD; Philadelphia; Mountainside, NJ; Southwest Connecticut Region; New Haven area, CT; River Estuary Region, Hamburg, CT; New London/Norwich Region, CT; Central Falls, RI; and Boston, MA. In addition, a Federal Communications Commission license must be obtained.

### 1.7.7 FENCING AND BARRIERS

Fencing the railroad right-of-way is a desirable means of preventing unwanted and high hazardous intrusion of people, animals and vehicles onto the right-of-way in the path of moving trains. By limiting access to selected sections of the right-of-way, fencing contributes to train security, decreases vandalism of railroad property, and promotes public safety.

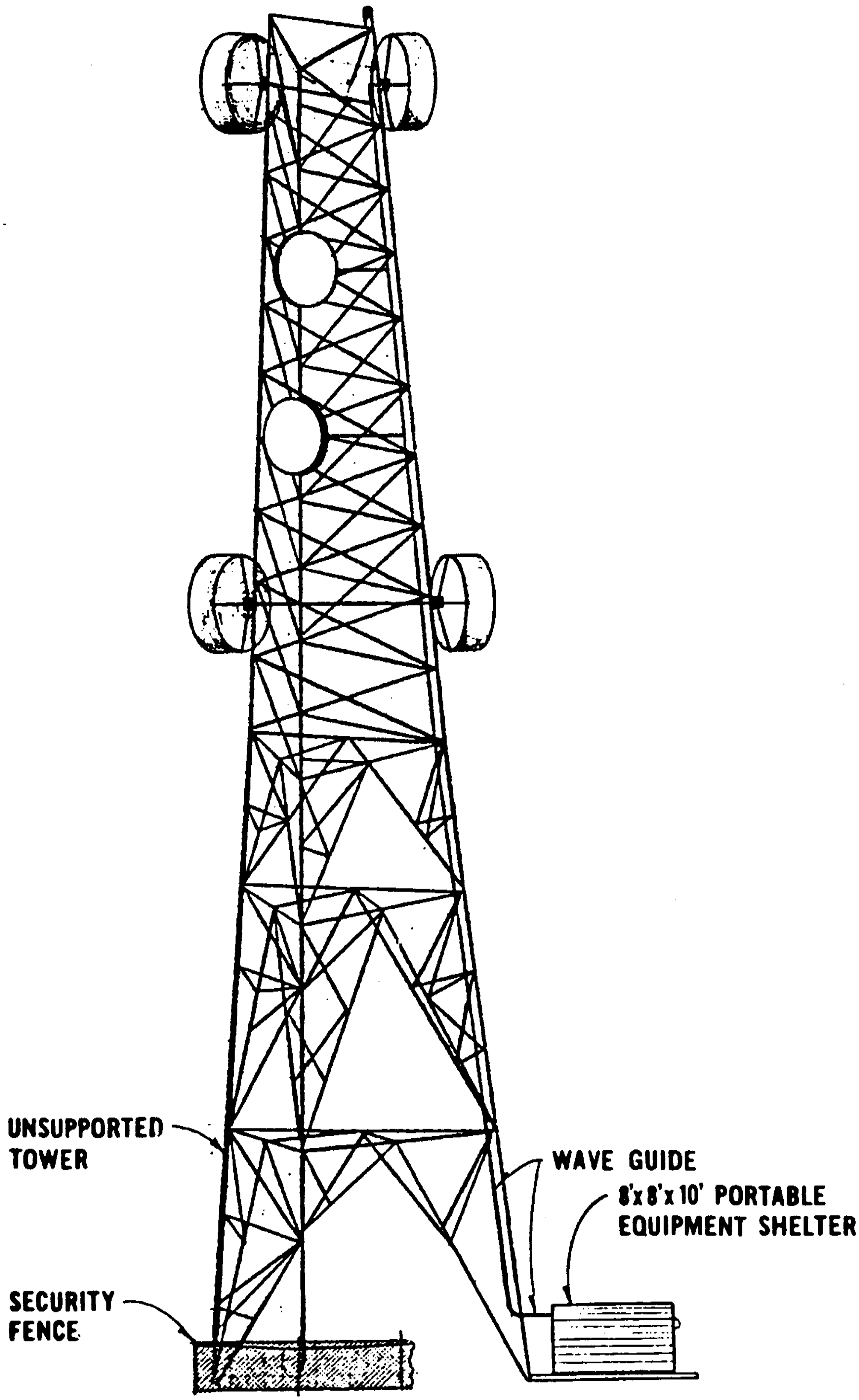



**Figure 1.12**

**TYPICAL BACKBONE TOWER**

The conditions of existing fencing along the NEC varies widely. Approximately 35 percent of the right-of-way is presently fenced to some degree. Much of the fencing was constructed by abutting landowners and does not meet the standards or security requirements of the NECIP. The majority of the fencing is not located on railroad property. No dominant condition exists over any extended area except the lack of satisfactory fencing. The degree to which fencing has been maintained also varies widely.

Under the original program definition, the entire Corridor was to be fenced, with costs shared equally between the states and the Federal Government. Due to a number of factors including environmental concerns and lack of sufficient local funding, the overall fencing program has been scaled down considerably.

At this time, the recommended program consist of fencing those areas considered highest priority at an estimated cost of $48.9 million. Fencing will be constructed by the NECIP at maintenance-of-way bases, repair shops, most stations and overhead bridges and other high priority security areas to minimize trespassing and vandalism. Specific program elements include:

Right-of-Way Fencing. Security fencing is to be installed in the areas near stations, selected on a site-specific basis to provide the greatest degree of protection within the allocated budget; priority will be given to areas with a high incidence of railroad-related crime. In response to local priorities, the entire right-of-way in Massachusetts will be fenced; those areas not fenced with 100 percent Federal funds will be fenced on a 50/50 cost sharing basis with Massachusetts. In total, approximately 113 route miles of right-of-way fencing are included in the NECIP, or roughly 24 percent of total Corridor mileage. Table 1-23 shows miles of fencing in each state. In addition to the above, active parks abutting the right-of-way will be fenced, with 100 percent Federal funding. Table 1-24 identifies the active parks to be fenced.

Table 1-23

PROPOSED RIGHT-OF-WAY FENCING

| Location | Length of Fencing (Route Miles) |
|---|---|
| Massachusetts | 37 |
| Rhode Island | 7 |
| Connecticut | 7 |
| New York | 12 |
| New Jersey | 9 |
| Pennsylvania | 15 |
| Delaware | 4 |
| Maryland | 22 |
| Washington, D.C. | 0 |
| TOTAL | 113 |

Overhead Bridge Fencing. Fencing of overhead bridges is required to protect high-speed trains, the catenary system, and the roadbed from unintentional dropping and intentional throwing of damaging objects from bridges. It also provides protection to pedestrians from the catenary system. Fencing will be installed on most overhead bridges that do not currently provide such protection to rail traffic or replaced where present fencing does not meet NEC standards.

Pedestrian Access. Overhead or undergrade pedestrian crossings of the Corridor will be installed only in the vicinity of suburban commuter stations and selected high-security areas. Site-specific program requirements for pedestrian access are being identified and developed.

Fence types will generally be limited to four (Figures 1.13 and 1.14). These include:

- Six foot chain link with three strand barbed wire
- Seven foot chain link
- Six foot metal picket
- Eight foot metal picket.

Selection of the specific fence type will be dependent on visual compatibility with surroundings and safety/security needs. Overhead bridge fencing will be similar to that shown in Figure 1.14.

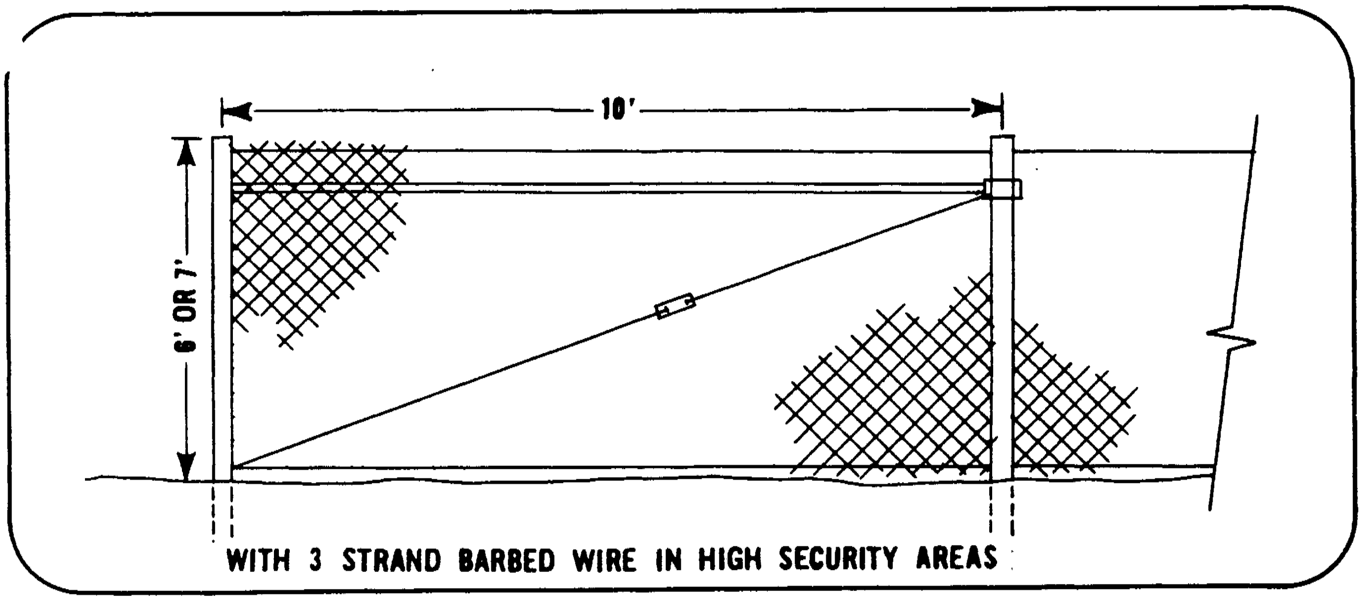
Commuter Station Fencing. Fencing at commuter stations is required to insure public safety through protection of pedestrians from rail operations. Table 1-25 lists commuter stations to be fenced.

Table 1-24

PROPOSED ACTIVE PARKS ALONG NEC RIGHT-OF-WAY TO BE FENCED

| | Park | Municipality | Milepost |
|---|---|---|---|
| Massachusetts | | | |
| | Playground | Attleboro | 197.8 - 197.9 |
| | Playground | Attleboro | 197.1 - 197.3 |
| | Attleboro Recreation Ground | Attleboro | 196.0 |
| Rhode Island | | | |
| | Kingston Fairgrounds | Kingston | 157.8 - 157.9 |
| Connecticut | | | |
| | Caulking Park | New London | 122.0 |
| | Niantic Town Beach | Niantic | 115.4 - 116.8 |
| | Rocky Neck State Park | East Lyme | 112.2 - 112.9 |
| New York | West Farms Park | New York | 11.4 - 11.7 |
| | Astoria Park | New York | 6.9 - 7.1 |
| New Jersey | Kellog Park | Elizabeth | 12.7 - 12.9 |
| | Merrell Park | Iselin | 20.9 - 22.1 |
| | Roosevelt Park | Metuchen | 25.4 - 25.5 |
| | Playground | Metuchen | 26.3 - 26.4 |
| | City Park | Highland Park | 28.8 - 28.9 |
| | Johnson Park | Highland Park | 30.8 - 30.9 |
| | City Park | New Brunswick | 31.9 - 32.0 |
| | City Park | New Brunswick | 33.6 - 33.9 |
| Pennsylvania | | | |
| | Curtiss Park | Sharon Hill | 6.9 - 7.0 |
| | Public Park | Chester | 12.7 - 12.9 |
| | Fairmont Park | Philadelphia | 87.0 - 87.4 |
| | Pennypack Park | Torresdale | 76.7 - 77.0 |
| Delaware | | | |
| | Banning Park | Newport | 24.4 - 29.9 |
| | Public Park | Newark | 34.7 - 34.9 |
| | University of Delaware | Newark | 38.5 - 38.8 |
| | Public Park | Newark | 39.2 - 39.4 |
| | Public Park | Newark | 39.6 - 39.9 |
| Maryland | | | |
| | Gwenn Falls Park | Baltimore | 99.2 - 99.4 |
| | Violetville Playground | Baltimore | 100.8 - 100.9 |
| | Patapsco State Park | Baltimore (County) | 104.4 - 106.0 |

CHAIN LINK FENCE




METAL PICKET FENCE

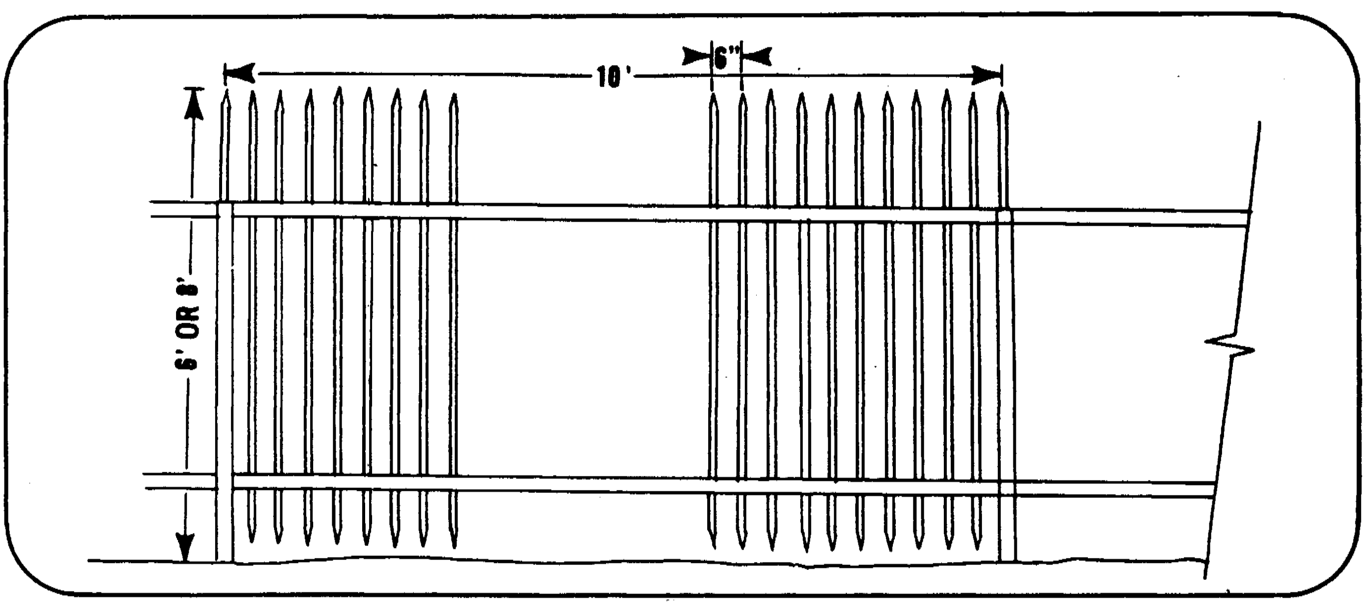
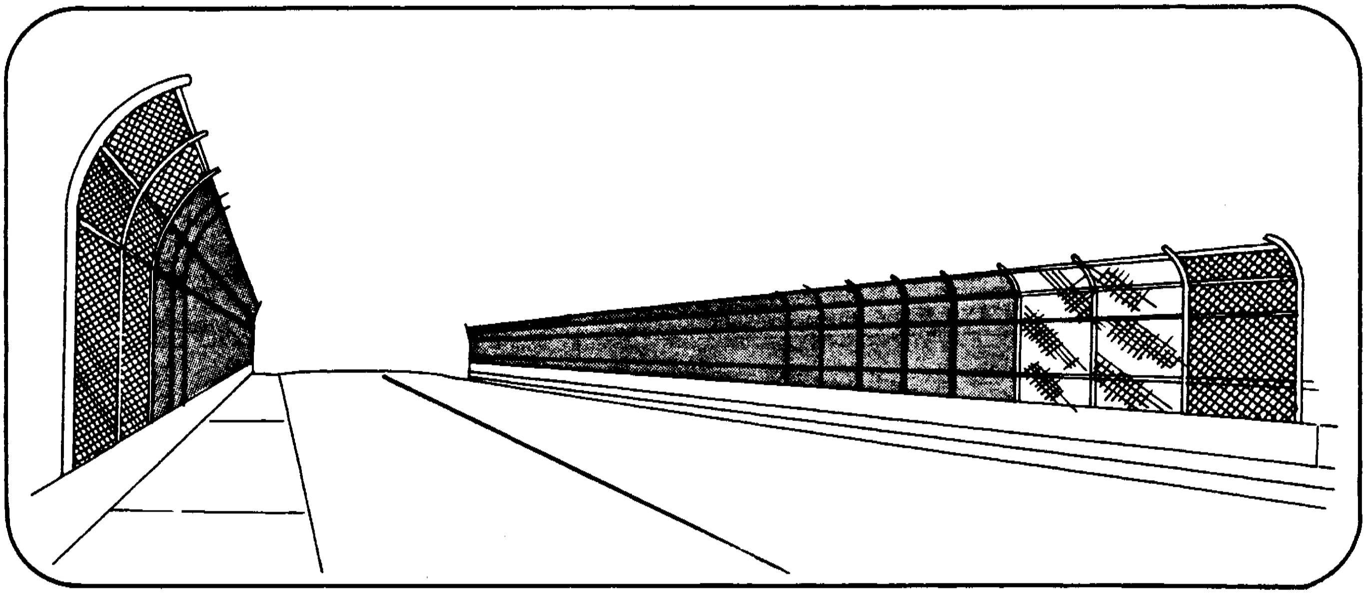



**Figure 1.13**

**RIGHT-OF-WAY FENCE TYPES**

VEHICULAR AND PEDESTRIAN OVERPASS



PEDESTRIAN OVERPASS

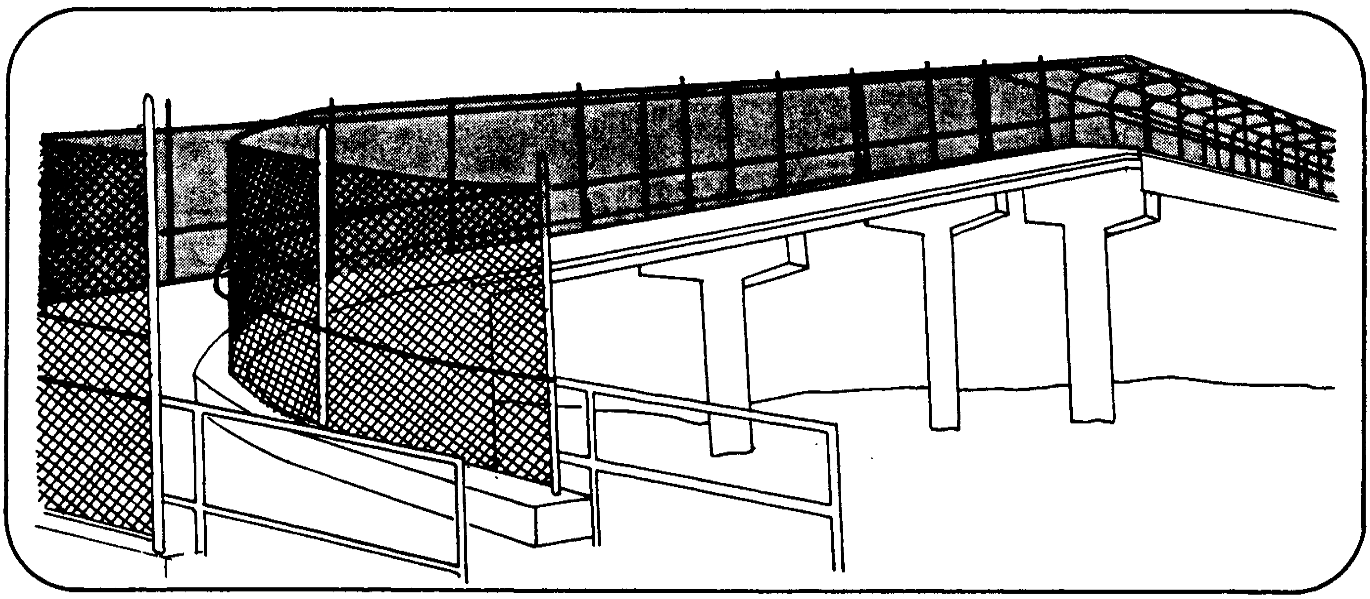


**Figure 1.14**

**OVERHEAD BRIDGE FENCING TYPES**

Table 1-25

PROPOSED COMMUTER STATIONS ALONG THE NEC TO BE FENCED

| | Commuter Station | Municipality |
|---|---|---|
| Massachusetts | | |
| | Readville Station | Readville |
| | Canton Junction Station | Canton |
| | Sharon Station | Sharon |
| | East Foxboro Station | East Foxboro |
| | Mansfield Station | Mansfield |
| | Attleboro Station | Attleboro |
| Rhode Island | | |
| | Pawtucket Station | Pawtucket |
| | East Greenwich Station | East Greenwich |
| | Wickford Station | Wickford |
| | Kenyons Station | Kenyons |
| | Shannock Station | Shannock |
| | Westerly Station* | Westerly |
| Connecticut | | |
| | Mystic Station* | Mystic |
| | Old Saybrook Station* | Old Saybrook |
| New York | | |
| | New Rochelle Station | New Rochelle |
| | Morris Park Station | Bronx |
| | Van Nest Station | Bronx |
| | Larchmont Station | Larchmont |
| New Jersey | | |
| | Linden Station | Linden |
| | Rahway Station | Rahway |
| | Metuchen Station | Metuchen |
| | Edison Station | Edison |
| | New Brunswick Station* | New Brunswick |
| | Princeton Junction Station* | Princeton Junction |
| Pennsylvania | | |
| | Levittown/Tullytown Station | Levittown/Tullytown |
| | Bristol Station | Bristol |
| | Croydon Station | Croydon |
| | Cornwell Station | Cornwell Heights |
| | Andalusia Station | Andalusia |
| | Torresdale Station | Torresdale |

* NEC Stations.

Table 1-25

(cont.)

| | Commuter Station | Municipality |
|---|---|---|
| Pennsylvania (cont.) | | |
| | Holmesburg Junction Station (Disston Street) | Holmesburg |
| | Holmesburg Junction Station (Rhawn Street) | Holmesburg |
| | Bridgeburg Station | Bridgeburg |
| | Frankford Station (Church Street) | Frankford |
| | Frankford Station (Disston Street) | Frankford |
| | No. Philadelphia Station* | No. Philadelphia |
| | Darby Station | Darby |
| | Curtis Park Station | Curtis Park |
| | Sharon Hill Station | Sharon |
| | Folcroft Station | Folcroft |
| | Glenholden Station | Glenholden |
| | Norwood Station | Norwood |
| | Lincoln Avenue Station | Moore |
| | Ridley Station | Ridley |
| | Lynne Station | Lynne |
| | Baldwin Station | Baldwin |
| | Crum Station | Crum |
| | Chester Station | Chester |
| | Lamokin Avenue Station | Lamokin |
| | Highland Avenue Station | Trainer |
| | Trainer Creek Station | Trainer |
| | Market Street Station | Philadelphia |
| Delaware | | |
| | Stanton Road Station | Stanton |
| | Davis Station | Newark |
| | Bellvue Station | Edgemoore |
| | Claymont Station | Claymont |
| | Naaman Station | Naaman |
| Maryland | | |
| | Elkton Station | Elkton |
| | Havre de Grace Station | Havre de Grace |
| | Aberdeen Station | Aberdeen |
| | Edgewood Station | Edgewood |

* NEC Stations.

Table 1-25

(cont.)

| | Commuter Station | Municipality |
|---|---|---|
| Maryland (cont.) | Edmondson Station | Edmondson |
| | Fort Meade Station/Odenton | Odenton |
| | Jericho Park Road Station | Jericho Park |
| | Bowie Station | Bowie |
| | Glendale Station | Glendale |
| | Seabrook Station | Seabrook |
| | Landover Station | Landover |

## 1.7.8 GRADE CROSSING ELIMINATION

All at-grade highway crossings of the rail line will be eliminated along the Corridor with the exception of certain grade crossings in the vicinity of Union Station, New London, Connecticut, which will have gates. The primary benefits derived from segregating the intercity rail operations from intersecting vehicular and pedestrian movements are: (1) safety and protection of the general public as well as rail passengers; and (2) improved efficiency of rail operations.

A total of 67 public and private at-grade crossings on the NEC will be modified to permit the safe and reliable operation of trains. The modifications include constructing grade separations, closing the crossing and either providing alternate access on using existing alternate access, condemnation of crossing rights or purchase of property.

There are 48 public crossings in Maryland, Delaware, Connecticut, Rhode Island and Massachusetts which are being modified or eliminated by the appropriate state transportation agencies under a current Federal Highway Administration (FHWA) program (Title 23).

The remaining 19 private grade crossings are to be eliminated using NECIP funds. The Federal Highway Administration will also administer this program, however, specific design will be the responsibility of the appropriate State Highway Department and FHWA. Based on previous studies and on-site investigation, these private crossings are expected to be modified or eliminated as follows:

- Installation of gates — three crossings
- Close, provision of alternate access — eight crossings
- Close, use existing alternate access — seven crossings
- Condemnation of crossing rights/purchase — one crossing

Proposed actions at each crossing are shown in Table 1-26.

Table 1-26

NECIP PRIVATE GRADE CROSSING ELIMINATION PROGRAM

| CROSSING NAME | TOWN, STATE | PROPOSED ACTION (Currently Anticipated) |
|---|---|---|
| Farm Road | Madison, CT | To be closed |
| Lawyer's Crossing | Clinton, CT | Close, provide alternate access |
| Mulcahy's Crossing | Old Saybrook, CT | Close, provide alternate access |
| Chapman's Crossing | Old Lyme, CT | Close, alternate access exists |
| Chappel Coal Co. Rd. | New London, CT | Close or provide gates |
| Denoia's Crossing | New London, CT | Close or provide gates |
| Central Coal Co. Rd. | New London, CT | Close or provide gates |
| Mumford Cove Road | Groton, CT | Close, alternate access exists |
| Storey's Crossing | Groton, CT | Close, alternate access exists |
| Wilcox Crossing | Stonington, CT | Close, alternate access exists |
| Cheseboro Crossing | Stonington, CT | Close, provide alternate access |
| Gulf Crossing | Stonington, CT | Close, provide alternate access |
| Town Farm Road | Westerly, RI | Close, alternate access exists |
| Caros Crossing | Westerly, RI | Close, alternate access exists |
| Weavers Crossing | Westerly, RI | Close, alternate access exists |
| Yawgoo Valley Road | Exeter, RI | Close, provide alternate access |
| Dorsett Mill Road | Exeter, RI | Close, provide alternate access |
| Alger Avenue | Warwick, RI | Close, provide alternate access |
| Lazy Lady Farm Crossing | Attleboro, MA | Close, provide alternate access |

* The State of Delaware has brought to the attention of the Federal Railroad Administration the possible existence of four private grade crossings in that state. If this is found to be legitimate, then appropriate funding for their elimination will be allocated.

## 1.7.9 STATIONS

Station improvements under the NECIP will be directed toward accommodating and promoting intercity rail patronage by the construction, rehabilitation, and upgrading of stations and certain related facilities along the Corridor. The following section describes the scope and funding of the station improvement program and the specific actions proposed at the eligible stations.

Under the NECIP, 18 of the 26 Amtrak-served stations along the Corridor are eligible for 100 percent Federally funded (operational) improvements. Only 15 stations were included in the program discussed in the Draft PEIS. Those 15 stations included Washington Union, New Carrollton, Baltimore, Wilmington, Philadelphia 30th Street, Trenton, Metropark, Newark, New York Penn, Stamford, New Haven, New London, Providence, Route 128, and Boston South.

After that document was issued, three stations - Princeton Junction and New Brunswick in New Jersey and Rye in New York - were made eligible as a result of additional planning analysis, refined patronage projections and comments received on the Draft PEIS. The process of station selection is discussed in greater detail in Section 2.8.2, Location and Number of Improved Stations.

The types of improvements contemplated under the station program fall into three general categories. The first category is operational improvements. These are improvements that are considered essential to intercity passenger operations and safety, and, in general, they include structural and utility system improvements to the station building, ticketing, waiting, staging and support facilities; public services; improvement to concourses and circulation; and improvements to intercity platforms, including escalators, stairs or elevators. The FRA will consider funding 100 percent of the costs of improvements that fall into this category.[1] Only the 18 previously mentioned are eligible for this funding.

[1] On April 28, 1978 in Volume 43 of the Federal Register, page 18394, the FRA proposed a determination of station program cost sharing. The elements listed above are consistent with that proposed rule making.

The second category of improvements are those called non-operational. A non-operational improvement is one which indirectly facilitates intercity rail passenger service such as certain commuter ticketing and support activities and station access or site improvements which facilitate intermodal connections to local bus and commuter rail facilities.

The third category, related facilities, are those which are not part of a station but the operation of which with respect to the station would enhance the purpose of the station project. Site landscaping, and short and long-term parking would be included under this third definition.

The FRA will share 50 percent of the costs of second and third category improvements with states or localities participating in the program. Twenty-five Amtrak served stations are eligible for this type of funding.[1] In addition, the FRA would consider sharing the cost of certain improvements to commuter platforms and station access depending on the extent of their benefit to the intercity rail program.

Funding limitations will influence the extent of the improvement program at a particular station. The overall budget for operational improvements at stations is limited and is not expected to be sufficient to make all of the improvements outlined below. Factors to be considered in the development of work scopes at the 18 eligible stations are discussed in Section 2.8.2. Funds for non-operational improvements, however, are available on a first-come, first-served basis at all 25 stations on the Corridor.

The proposed improvements are continuously undergoing refinement during the station planning and design process. Design studies, financial feasibility analyses, environmental impact assessments and discussions with local officials and citizens groups will all influence the specific package of improvements proposed at any given station. Current program recommendations for the 18 eligible stations are described below.

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[1]Aberdeen, Maryland, which currently is served by two trains per day, is not included in service improvement scenarios. Therefore, Aberdeen is not considered for such improvements.

Union Station, Washington, D. C. Located in downtown Washington, this station is currently served by NEC intercity, long-haul, and commuter rail services in addition to local buses, the Metrorail subway, and Tourmobiles. The station, which is leased by the U. S. Department of the Interior, was renovated to house the National Visitor Center, and rail uses were relocated in a replacement station located behind the station concourse. The original station building is on the National Register of Historic Places.

The proposed improvements in the 100 percent Federally funded category include relocation of primary rail functions back into the original station; improvements to the platforms and canopies; and rehabilitation of structural, mechanical, and electrical systems.

Optional improvements, if required funding is forthcoming, could include the completion of a 1,400-car parking garage, improved access, and commuter facilities.

Legislation has been introduced jointly by the Secretaries of Interior and Transportation which would modify the National Visitor Center Act to allow these types of improvements.

New Carrollton Station, Prince George's County, Maryland. This facility will be part of a joint Amtrak-Metrorail station which is currently under construction near New Carrollton in suburban Washington, D. C. At present, Amtrak service is available at the Beltway Station which was constructed in 1969 as part of the U. S. Department of Transportation's Beltway Demonstration Project. The Beltway Station is located one-half mile north of the new station site.

The program for 100 percent Federally funded improvements calls for completion of the intercity rail portion of the station shell, construction of a new high-level platform and passenger staging area, and realignment of tracks to accommodate the new platform.

Optional improvements, if local matching funds become available, could include a parking garage with 800 to 1,000 spaces for intercity rail patrons and parking-related access improvements.

Pennsylvania Station, Baltimore, Maryland. Baltimore's Pennsylvania Station is a classic four-story structure which is located about one mile from the central business district. The station, built in 1911, is on the

National Register of Historic Places. Owned by Amtrak, it is served by NEC intercity, long-haul and commuter rail. Plans proposed by the Baltimore Department of Planning call for the eventual creation of a multi-modal transportation center with light-rail transit and intercity bus in addition to the rail service at this station.

Proposed improvements under the 100 percent Federally funded category of the NECIP include renovation of the station interior; replacement of the station roof; extension of the high-level platform; and renovation of electrical and mechanical systems.

Should local matching funds become available, optional improvements could include parking for approximately 1,200 cars, vehicular access, and commuter-related improvements.

Wilmington Station, Wilmington, Delaware. The Amtrak station at Wilmington was built in 1905 and has recently been added to the National Register of Historic Places. It is located on the north bank of the Christina River, in an older industrial and warehousing section of the center city, and is just south of the central business district. The three-story brick station building is structurally sound but has fallen into disrepair and substantial refurbishment is required.

The 100 percent Federally funded improvements proposed for Wilmington Station include renovation and reorganization of the main station space; extension of the center platform and replacement of its canopy; replacement of the station roof; improvements to track drainage for track located above the station; and improved handicapped access.

If local or state agencies commit the local share, optional improvements could include construction of a 600-car parking garage; vehicular access improvements; and renovated commuter rail facilities.

30th Street Station, Philadelphia, Pennsylvania. The Amtrak-owned 30th Street Station is located west of Philadelphia's central business district in a predominantly business and institutional area. It functions as a center for NEC intercity, long-haul and commuter rail service as well as for local public transit. The structure was completed in 1934 and has been determined eligible for the National Register of Historic Places.

The proposed 100 percent Federally funded improvements include refurbishment or replacement of ticketing and other passenger service facilities; improvements to the intercity platforms; repair of mechanical and electrical systems; and improved handicapped access.

Should local funds become available, optional improvements could include a parking garage and improvements to vehicular access and commuter facilities. Intercity parking requirements at this station have been estimated at approximately 940 spaces.

Trenton Station, Trenton, New Jersey. The Trenton Station, a modern facility renovated and expanded in 1971, is a one-story, steel-frame structure located half a mile from Trenton's central business district. The station is owned by the State of New Jersey and is used by NEC intercity, long-haul and commuter rail operators.

The station building is in good structural condition, and the improvements proposed by the FRA and eligible for 100 percent Federal funding will be limited to basic cleaning and replacement of unserviceable elements, platform repairs, upgrading of some passenger services, and improvements related to handicapped use.

Optional improvements could involve those relating to parking and vehicular access if local matching funds are forthcoming.

Princeton Junction Station, New Jersey. The existing Princeton Junction Station is owned by Amtrak and consists of a small track-level structure on each side of the tracks. A narrow passageway under the tracks connects the two structures and provides access to an adjacent parking lot. Low-level platforms serve NEC intercity and commuter rail.

Operational improvements at this station could range from a repair and upgrading of station facilities and platforms, painting and cleaning, and improvements to accommodate the handicapped, up to construction of a new station of adequate size for future needs, along with new platforms and station access facilities. Estimates of parking demand for intercity passengers at this station are from 500 to 600 spaces.

Optional improvements would include parking and access improvements and only undertaken if local matching funds are secured.

New Brunswick Station, New Brunswick, New Jersey. The New Brunswick Station, built in 1905, is a two-story masonry structure adjacent to and below the elevated tracks. It is owned by Amtrak and served by intercity, long-haul and commuter rail. Two low-level side platforms are covered by wooden canopies and wind screens, and a brick arched tunnel provides access under the tracks.

Improvements could range from upgrading the existing station and platforms, general cleaning and painting, repair of unserviceable elements, and improvements related to handicapped use, up to the construction of an entirely new station of adequate size and related facilities such as platforms and station access.

Should the local share of costs be obtained, optional improvements could include parking for an estimated 300 to 400 cars and vehicular access modification.

Metropark, Iselin, New Jersey. Metropark is a modern beltway station built in 1971 and is located at the interchange of the Garden State Parkway and State Route 27. The station is owned by the State of New Jersey and is currently served by intercity, long-haul and commuter rail.

The proposed 100 percent Federally funded improvements will be limited to include painting, paving, and repairs to platforms; signage and information systems; improved access for the handicapped to the platforms; and improved station lighting.

Optional improvements, if the local share is forthcoming, could include vehicular access and a parking garage over the existing surface lot to accommodate up to 1,850 intercity parkers.

Pennsylvania Station, Newark, New Jersey. Newark's Pennsylvania Station was constructed between 1932 and 1935. Owned by Amtrak, it functions as a multimodal facility containing four levels and serving NEC intercity, long-haul and commuter rail, as well as rapid transit and local and interstate bus. The station was added to the State Historic Register in 1977 and is eligible for the National Register of Historic Places.

The 100 percent Federally funded improvements proposed for the station involve rehabilitation of portions of the station building including electrical and mechanical systems; improvements to escalators; platform improvements; roof replacement; and general cleaning and painting.

A short-term parking area, a parking garage for 600 to 900 cars, and commuter-related platform improvements could be included under the optional improvements program if local matching funds are made available.

Pennsylvania Station, New York, New York. Penn Station's new facilities were completed in 1968 and are located in the lower level of the Madison Square Garden Penn Plaza Office Building complex in Manhattan. The station is a multimodal facility providing intercity, long-haul, commuter rail, rapid transit, and taxi service. This station is the busiest in the country, and in addition to serving Corridor traffic, it is a major departure and arrival point for commuters and passengers traveling outside the Corridor.

The improvements proposed for 100 percent Federal funding are designed to upgrade passenger circulation and staging areas; included are platform rehabilitation; signage; new stairs, escalators and elevators; and a new emergency power system.

Optional improvements, if local matching funds become available, would include commuter and local transit-related access improvements such as elevators and escalators. Except for the elevator access for the handicapped, no exterior changes are proposed.

Rye Station, Rye, New York. Rye Station is owned by the New York State Metropolitan Transit Authority, and is a 27-year old, one-story brick and glass structure located on the north side of the track. Partial high-level side platforms provide service to intercity, long-haul and commuter operations.

Improvements could range from cleaning and painting of the existing station, signage and information systems, and platform repairs, up to construction of a new station facility to replace the existing structure and new platforms. Intercity parking demand at the station would be in the range of 300 to 400 spaces.

Vehicular access and parking improvements would only be undertaken if the local share of costs can be obtained.

Stamford Station, Stamford, Connecticut. The existing station, built in 1895, is located on the fringe of Stamford's downtown area and is served by NEC intercity, long-haul and commuter rail. The facility and the site are owned by a private developer, Transportation Plaza Associates, which plans to build an office complex on the site.

The proposed action for the station, which could be 100 percent Federally funded, would involve construction of a new facility within the development proposed for the site. Reconstruction of the right-of-way to expand platform capacity and relieve congestion is also proposed.

If a commitment of local funds is secured, optional items could include a parking facility for approximately 400 intercity rail patrons and related access improvements.

Union Station, New Haven, Connecticut. The original station was built in 1920 and is on the National Register of Historic Places. Located just south of the central business district in an area undergoing redevelopment, it is owned by the Penn Central Trustees and leased to the State of Connecticut. The four-story station building was closed to the public in 1974; since that time, rail functions have been housed in a small temporary station constructed beside the original station. The station building is structurally sound but requires extensive rehabilitation.

Proposed improvements for Union Station to be 100 percent Federally funded include moving back into the original station building, replacing the roof and mechanical and electrical systems and expansion and upgrading of platforms, track realignment and interlocking changes.

Optional improvements, if local matching funds are forthcoming, could include a parking garage with a capacity for 600 to 800 cars and vehicular access improvements.

Union Station, New London, Connecticut. New London's Union Station was built in 1886-87 and is listed on the National Register of Historic Places. It was recently renovated by the owner, Union Station Trust, Inc., and includes offices and commercial rental space. Amtrak presently leases about a quarter of the three-story station building. Located on the waterfront, the station is adjacent to the central business district and several harbor-related facilities.

Major changes to the station structure and interior are not proposed under the NECIP. The FRA's 100 percent Federally funded improvements will involve new lighting and signage, and canopy improvements.

Should local matching funds become available, optional improvements could include pedestrian and vehicular access improvements and additional parking facilities for approximately 400 to 500 cars.

Union Station, Providence, Rhode Island. This station was completed in 1897 and has been placed on the National Register of Historic Places. The station complex consists of four separate buildings located in the center of Providence's downtown area. Union Station is part of an extensive downtown redevelopment program which includes the station's renovation as well as possible related commercial development by a private party in cooperation with City and State officials.

The proposed improvements that will be 100 percent Federally funded are renovation of the two levels of the central station building for rail use. Included are mechanical, electrical and plumbing systems; upgrading and reorganization of rail functions; reconstruction of the passageway providing platform access; construction of a high-level platform and vertical access; and bridge improvements.

Optional improvements, which would require a local commitment to 50 percent of the costs, would include a new parking garage for 200 to 400 cars and access improvements.

Route 128, Dedham, Massachusetts. The existing station at Route 128 was built in 1965 and is a single-story, 2,500-square-foot brick structure. This suburban station presently serves intercity and commuter rail passengers and is located adjacent to Route 128, one mile from Interstate 95. The station and its 690-space parking lot are owned by the Massachusetts Bay Transportation Authority (MBTA).

The size of the existing facility is not adequate to accommodate projected 1990 patronage. Construction of a new above-track station with central platforms is proposed by the FRA and will be 100 percent Federally funded.

Optional improvements could include a parking structure for approximately 900 to 1,000 spaces together with access improvements, if the local share of the cost for these actions is secured.

South Station, Boston, Massachusetts. South Station is located on the eastern edge of Boston's downtown area and is owned by the Boston Redevelopment Authority (BRA). The headhouse section of the station was constructed in 1896 and the facade is on the National Register of Historic Places. The station is now served by commuter rail, intercity rail, commuter bus, local bus and subway. Plans for NECIP improvements are being coordinated with local plans for air-rights development and commuter rail improvements at the site.

The FRA's proposed rail improvements for Boston's South Station that will be 100 percent Federally funded include station rehabilitation and reconstruction of the concourse.

Assuming commitment by a state or local agency of the 50 percent local share of costs, optional improvements could include commuter rail facilities, new access to the existing subway station, and a parking facilitiy for 600 cars. Negotiated funding agreements will be made concerning a revised track configuration and interlocking.

1.7.10 SERVICE FACILITIES

The various maintenance facilities along the NEC date from the 1880's to about 1920, with two minor modern exceptions. The facilities and their equipment were built to repair steam engines and the cars of that era, not high-speed electric trains now operating or projected for operation in the near future.

There are two basic types of maintenance activities required on the Corridor to protect the large investment being made to improve passenger service: maintenance of the fixed plant (track, signals, bridges, stations, etc.) and maintenance of the equipment or rolling stock (locomotives, cars, etc.). Maintenance of the fixed plant entails movement of labor and machines to the location which requires work, while maintenance of equipment can be performed in a shop with the item needing work being brought to the facility.

These requirements will be met by six equipment maintenance shops, 13 maintenance-of-way bases, and one maintenance-of-way equipment repair shop.

Equipment Maintenance. There are three basic levels of work performed on rolling stock: inspection and adjustment, running repairs, and heavy overhaul or rebuilding. Many of the inspections and adjustments are required by Federal regulations and must be performed before the train is permitted to operate with passengers aboard. Other repairs which involve the whole vehicles, such as reupholstering or structural work after a derailment, can be made only with the whole vehicle in a shop specially equipped to handle these very heavy and specialized repairs. Only when a railroad operates more than a thousand of each kind of vehicle can the specialized heavy repair shop be set up to run on a production line basis.

Six existing facilities were assessed to see if they were or could be made adequate to handle the repairs anticipated on Corridor vehicles. Under the proposed equipment maintenance program, each facility would have a unique function. Immediate or long-range improvements are proposed at each site, as follows:

Ivy City Yard - Washington, D.C. The shop at Ivy City, a mile north of Washington Union Station, consists of an inadequate coach storage yard, the remains of a unique 1915 dual turntable roundhouse, an outdoor car repair area, and several small brick frame buildings in poor condition. In order to handle the routine servicing, the Ivy City complex needs additional storage capacity, a new train washing facility, dump complex, a new periodic inspection and maintenance facility, as well as appropriate welfare facilities for employees.

Wilmington Yard - Wilmington, Delaware. The heavy repair shops at Wilmington, Delaware, were built initially about 1880 and expanded about 1900 and have not been improved since. Wilmington does have a large force of trained labor which is protected under the terms of the 4R Act and related agreements. Partial rehabilitation of the entire shop or partial replacement by new modular shops is proposed under the NECIP, together with provision of new unit repair and limited component repair facilities. The facility will be equipped to overhaul the entire fleet, including locomotives, multiple unit cars (Metroliners) and Amfleet equipment on a scheduled basis. A new MOW equipment repair shop will also be located here.

30th Street Station - Philadelphia, Pennsylvania. The yard adjacent to the 30th Street Station in Philadelphia was constructed in 1930 and has no locomotive repair facilities and only a roof over the car repair area. Although the storage yard is one of the largest on the Corridor with more than sufficient storage space for anticipated Corridor traffic, these facilities are totally inadequate to handle the normal inspections and running repairs associated with a terminal operation. The proposed action includes the installation of a small all-weather enclosed facility sufficient to meet the projected workloads of a running repair facility organized for efficient work.

Sunnyside Yard - New York, New York. The building of Pennsylvania Station in New York from 1908 to 1910 included the immense Sunnyside Yard about four miles east of the station on Long Island. For many years, this was the largest passenger-car yard in the world, having a capacity of over 1,400 cars. Today, most maintenance facilities are original. The NECIP envisions construction of new shop facilities to repair passenger cars, metroliners and locomotives, material storage for spare parts and components, adequate welfare and office facilities, and sufficient machines to efficiently maintain the Corridor equipment to acceptable standards. Sufficient room is available for the reinstallation of storage tracks as the need is demonstrated.

New Haven Station Yard - New Haven, Connecticut. The facilities at New Haven used by Amtrak were built between 1880 and 1920. This location has served as the locomotive change point (electric to steam or diesel) since 1914. All types of repairs have been performed at this shop in the past, but extension of electrification to Boston will dramatically reduce its function to caring for the Springfield shuttle trains and the Montreal train. The existing diesel fueling and sanding facility is adjacent to the station. Broken pipes, frequent oil spills and other incidents have totally saturated the ground with oil which has seeped into the station basement and released unpleasant fumes. Since this area is desired for passenger-oriented activities and only a few trains will still need fuel after the NECIP is complete, it has been shown that it is more economical to build a small fueling apron in the yard complex than to rebuild or rehabilitate the existing equipment. This action will respond to the numerous citations issued for pollution by local agencies. No other facilities are planned for New Haven.

Southampton Yard - Boston, Massachusetts. South Station in Boston, completed in 1898, was once the busiest station in the United States (almost 1000 trains a day) and was supported by the Dover Street Yard complex a half mile from the station. This large complex was sold by the Penn Central to the Massachusetts Bay Transportation Authority for use as a subway yard in the late 1960's. No replacement facilities were provided and Amtrak is now functioning in a yard too small for present operations and lacking any facilities to repair rolling stock. The NECIP proposes to build a new storage yard and maintenance complex in the old Southampton Street freight yard obtained by Amtrak at conveyance. This facility will be built to perform all required inspections to locomotives, Metroliners, and cars, make running repairs, provide material storage space and provide the necessary welfare facilities for employees. The all weather capability of this shop will significantly improve the level of service. The major equipment repair facility of the New Haven Railroad was located at Readville, Massachusetts. Operations were curtailed in 1959 with the bankruptcy of the line. Action proposed under the NECIP includes setting aside funds for land acquisition, to permit future development of this site.

Overhaul Facility. At this time there is no shop complex on the Corridor capable of making all types of heavy repair to the existing rolling stock and the equipment on order for the NEC fleet. Construction of such shops has been proposed, either at the existing Wilmington repair facility or at Readville, Massachusetts. However, delivery of advanced equipment is not anticipated before 1985. Accordingly, construction of a new major shop complex has been deferred, and the required repair functions for existing stock will be provided at existing shops in Wilmington.

Maintenance of Way Bases. The maintenance-of-way (MOW) base program is designed to provide headquarter operational facilities for Amtrak maintenance-of-way divisions along the NEC. These bases are to serve as reporting sites for work crews responsible for maintenance of track, structures, bridges, signaling and communication, and electric traction. An objective of site selection was base spacing so that work points would be readily accessible and convenient reporting sites would be available for the crews of each division.

Bases will range in size from 10-20 acres and will contain tracks, structures and space for maintenance-of-way equipment, storage and running repair operations.

Estimated building floor space for each base is 20,000 square feet. The building will serve as headquarters and welfare facilities for the work crews, provide shop space for emergency running repairs and preventive maintenance of track equipment and highway vehicles. Provision will also be made for indoor storage of items that must be protected from the weather, and for office space and support space. A fueling area will be necessary for track equipment and highway vehicles. Parking space will vary depending on the base size and staffing, with 40 spaces out of the total reserved for truck parking.

Bases will include ground storage areas for materials necessary to bridge, track and catenary maintenance and ballast, ties, spikes, rail, wire, etc. Yard tracks will provide for movement and storage of ballast waste cars, ties, cars, camp train, maintenance-of-way equipment track, wire train, shop track, engine track, and, in the case of Track Laying Systems (TLS), a rail train and tie transport cars.

Thirteen areas have been selected as sites for maintenance-of-way bases:

- Odenton, MD
- North Point, MD (base to be deferred)
- Perryville, MD
- Wilmington, MD
- Philadelphia, PA
- Morrisville, PA (base to be deferred)
- Adams, New Brunswick, NJ
- Hunter, Newark, NJ (base to be deferred)
- Sunnyside, Queens, NY
- Cedar Hill, New Haven, CT
- Groton, CT (base to be deferred)
- Providence, RI
- Readville, MA

Within each of these areas, numerous potential sites were and continue to be investigated according to a site suitability evaluation process. The evaluation criteria included suitable topography, accessibility, land use and zoning compatibility, utilities and services, historical and archeological resources, ownership and development and operating cost. Over 50 potential sites along the Corridor were investigated.

Track Laying System (TLS) Staging Bases. Three temporary staging bases are proposed for the workforce and equipment required by the Track Laying System (TLS) during 1978, 1979 and 1980 construction seasons.

A staging and supply base is proposed for construction in Readville, MA, on a 17-acre tract owned by Amtrak. This base will serve as a delivery and distribution point for new concrete ties and a removal center for used wooden ties, plates and spikes. Support functions include storage of TLS materials (rails, ballast, etc.) and weekend storage of machinery.

Support bases are proposed at Havre de Grace, MD and Davisville, RI. Functions will include car and material storage; work gangs will be housed at the Davisville base.

## 1.7.11 TUNNELS

Northeast Corridor tunnels will be rehabilitated and modified to enhance clearances and improve service integrity. These improvements will include the installation of 25 KV electrification system hardware and repairing or upgrading the tunnel structure, track structure, drainage and ventilation systems. These actions will minimize future maintenance requirements and support safe operating and maintenance conditions.

There are eight tunnels on the Corridor at five locations. The tunnels are the Baltimore and Potomac (B&P) and Union Tunnels in Baltimore, the East River and North River Tunnels in New York, and the East Haven Tunnel near New Haven. Following is a brief description of each of the tunnels:

B&P Tunnel. A 7,400-foot-long double track tunnel, the B&P Tunnel is located just south of Baltimore's Pennsylvania Station and extends between Gilmore Street on the south and North Avenue in the north. The tunnel was completed in 1873, and actually consists of three segments separated by two short openings (200 to 350 feet) to the surface, at Pennsylvania Avenue and John Street. It has two eight-degree curves that are sharp by railroad operating standards and a 1.3 percent grade as it descends to Pennsylvania Station. Tight horizontal and vertical clearances require that freight trains with oversize cars use a 928-foot long gauntlet track around one of the eight-degree curves, thereby effectively restricting this tunnel to a single track.

Union Tunnels. The Union Tunnels consist of two adjacent parallel tubes, each 3,400 feet long. The oldest (completed 1873) was originally double-tracked, but at the completion of the second double-track tube in 1913, it was converted to a single track. The Union Tunnels begin about 2,000 feet north of Baltimore's Pennsylvania Station and extend from Greenmount Avenue in the south to Bond Street in the north. The tunnels are on a tangent, and the tracks have an uphill (south to north) 1.2 percent grade.

North River Tunnels. The twin North River Tunnels carry Amtrak and local commuter trains beneath Manhattan, the Hudson River, and the Palisades of New Jersey. They are 13,240 feet long and consist of two circular, adjacent single-track tubes. The southern portals are in North Bergen, New Jersey, just east of the Hackensack Meadowland. The northern portals are at 10th Avenue in New York, just west of Pennsylvania Station. The tubes are constructed on a tangent or very slight curves and have grades of 1.3 and 1.4 percent as they descend under the Palisades and the Hudson River and a 1.9 percent grade as they climb to Pennsylvania Station.

East River Tunnels. The East River Tunnels are of varying lengths of about 2.5 miles and consist of four adjacent single-track tubes, only two of which are used by Amtrak trains. The tunnel's southern portal is at Pennsylvania Station, and the northern portal is in Long Island City, Queens, at the southern end of the Sunnyside Railroad Yard. In Manhattan, the tubes lie beneath East 32nd and 33rd Streets. There are two $1^{\circ}$, 30' curves as the tracks descend under the East River.

East Haven Tunnel. This double-track, horseshoe-shaped tunnel, approximately 1,200 feet in length, is currently being investigated to determine improvements needed to meet NEC standards. Areas being investigated include improvements to track structures, drainage system, and existence of proper clearances for electrification. Program requirements will be identified after this investigation is completed.

Proposed Improvements. Proposed improvements at the B&P Tunnel call for reconstructing the track structure at the same elevation and incorporating a new drainage system for the entire length. The existing sump and pump unit will be overhauled to minimize future maintenance. Infiltration through the tunnel lining will be mitigated by guniting or grouting and applying a waterproofing agent and renovating weep-holes or constructing new drains. The lighting system will be renovated with lights staggered on opposite walls at 100-foot centers. The oilostatic electric lines will be placed in a new location.

At the Union Tunnels no improvements to the double track tunnel structure are proposed as it is in good shape. In the older, single track tunnel, cracks in the concrete lining will be repaired and where infiltration occurs, the areas of the wall will be treated to reduce leakage. Walkway railings and ladders which have been damaged or destroyed by overhanging loads will be repaired or replaced. The existing lighting system will be refurbished. The undertrack drainage system will be refurbished and cleaned.

At the North and East River Tunnels, the cracks in the surface and face of the benches which occur throughout all tubes will be cleaned and patched. The lining will be patched and treated at the few locations in each tube where infiltration occurs. For an aggregate length of about 2,500 feet in each tube some of the concrete liner will be chased to provide the required air gap for electrical insulation of the catenary and pantograph. The drainage system in lines 1 and 2 of the East River Tunnel and the entire North River Tunnel will be cleaned and refurbished and sump pumps will be replaced at some locations. New ventilation fans and dampers will be installed in each tube. Fire lines will be installed in each tube.

Existing wood tie and ballast tracks in lines 1 and 2 of the East River Tunnel and the entire North River Tunnel will be replaced. This requirement includes complete tunnel replacement down to the invert of ballast and ties, installation of third-rail ties, and replacement of broken or missing drain covers. Total length of designated track (Lines 1 and 2 and north-south tubes) to be replaced is approximately 52,000 track feet.

# CHAPTER 2

## ALTERNATIVES TO THE PROPOSED ACTION

In recognition of the need for a systematic, interdisciplinary decision-making process for major federal projects, the National Environmental Policy Act of 1969 (42 USC 4332) requires that:

> ...All agencies of the Federal Government shall... study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.

The number of possible alternatives to the proposed action is virtually limitless, ranging from "no-build" (i.e., either nothing is done or investments are made in modes other than high-speed rail), to alternative high-speed ground transportation/technologies, service levels, and routes.

Review of the more than ten years of studies which culminated in the NEC funding provided by the 4R Act indicates that alternatives which cover the full range of policy options available have been explicitly or implicitly evaluated. Those studies found long-term merit in certain alternatives, but generally concluded that (1) a commitment to the upgrading of the existing rail system does not preclude the orderly and rational development of other modes and new technologies; and (2) that the upgrading of the NEC rail spine provided the most significant near-term benefits at a reasonable investment.

It is not the intention of this chapter on alternatives to redo previous studies, but rather to document their assumptions, methods, and conclusions, and to evaluate the reasonableness of those conclusions in the light of present conditions and trends. These studies formed the factual basis for the decision-making process leading to the passage of the 4R Act, and beyond that, for the subsequent major policies which are now being formulated for implementation of the Act. A large body of research conducted over an extended period is thus available as input to the present evaluation of program alternatives. The documentation presented in the subsequent sections progresses from a broad range of alternatives to the proposed action, to the rather specific alternatives within the proposed action. Beyond the environmental process as reflected by this document, implementation alternatives are under continuing evaluation by FRA. This evaluation process is most recently documented in the Secretary's Two Year Report to Congress.

## 2.1 DO NOTHING

At whatever rate one chooses to project economic activity in the NEC, historic trends indicate that intercity travel demand will continue to grow and that with this growth intercity travel speeds as well as overall service levels will decline unless there is adequate public investment in the various modes (whether it be in the form of the highways that buses and autos traverse, the airports used by the private airlines, or the operating subsidy paid to Amtrak). No form of intercity transport service now operates without some form of public funds.

The implications of no public investment in any transportation mode are two-fold. First, failure to invest in transportation improvements would have severe environmental consequences. Public funding of various modes is a tool which may be used to achieve the air quality, energy efficiency, and other social, economic, and environmental goals of the nation.

Second, the intercity transportation system is a basic economic resource for the region. In a regional economy which is increasingly service based, the intercity passenger transportation system is an important economic resource and its condition has a direct effect on business communication and productivity. Deterioration of the passenger transportation system in the NEC is likely to have negative economic consequences such as higher transportation costs and a decreasing ability to maintain and expand an adequate economic base. The region has already experienced the erosion of its manufacturing base to other parts of the nation due to the high costs of labor, transportation and energy.

Without such investment, the demand for air and automobile travel in critical areas would exceed the capacity of existing facilities in the 1980s. Growing congestion and delays in the air and highway systems could force additional use of rail as an alternative. Without public investment in rail, the system would not be capable of accommodating this demand.

The previous discussion pertaining to the "do nothing" alternative, is based on the assumption that no public investment whatsoever would be made in transportation facilities. As far as the alternative uses for the allocated NECIP funds are concerned, this, of course, is not a feasible alternative since NEC legislation has no effect on other transportation funding mechanisms; e.g., the Highway Trust Fund. Nonetheless, it is important to emphasize that the "do nothing" alternative, or no public investment in any mode of transportation would not be a prudent or feasible choice.

Public support of Amtrak operations, in the NEC and nation-wide, is provided today as a result of decisions which were made previous to the NECIP and are independent of it except to the extent that the NECIP is expected to improve the cost-effectiveness of that operational support. However, it is possible to expand the do-nothing alternative to include no federal investment in transportation facilities <u>or operations</u>. The consequences of this alternative would be even more serious, since intercity rail service in the NEC would cease while no new or improved facilities would be made available in other modes to absorb either the travel demand presently served by rail or the overall future growth in intercity demand. Cost-conscious travelers would likely transfer to buses, to autos if traveling in groups, or simply not make their trip. Passengers more sensitive to travel time would generally be forced to travel by air, contributing further to congestion in this mode. The modal choice which intercity rail offers the public, particularly those who by reason of age or income do not have an auto available, would be lost. The general mobility of the public in the NEC region would therefore suffer, particularly accessibility between the central cities of the Corridor.

Lacking any public investment in NEC facilities or operations, the NEC could not survive as a unified transportation system. The Corridor rail system has the potential for accommodating a significant portion of intercity travel demand in the future at a capital investment which is modest in comparison to improving facilities for other modes. Further, intercity rail alone among the intercity modes need not be dependent on petroleum-based fuels. Finally, if Amtrak NEC funding were stopped, continued commuter and freight services on the Corridor would be endangered. Retaining these services would require, at a minimum, that entirely new institutional relationships be established and that public funding from other sources be committed for maintenance of most of the Corridor.

## 2.2 INVESTMENT IN ALTERNATIVE MODES ONLY

### 2.2.1 AIR TRANSPORTATION

A number of characteristics have traditionally made airline service an attractive option for improved intercity transportation in the NEC. Higher terminal-to-terminal operating speeds, scheduling flexibility which permits direct non-stop service when demand is sufficient, personalized service and other amenities, more efficient use of capital investment because equipment is not dedicated to NEC service, and sufficient operating profits to attract private capital and avoid direct public subsidy.

Because of these advantages, investment in improved NEC air service has been the subject of numerous comparitive studies over the last decade.[1,2,3,4,5] The studies have evaluated both the continued improvement of conventional take-off and landing (CTOL) aircraft service and the rapid introduction of the more flexible short take-off and landing (STOL) and vertical take-off and landing (VTOL) aircraft.

The ability of CTOL improvements to effectively accommodate growing intercity travel demand in the NEC is decreasing as reflected in the following statement from a DOT report submitted to Congress by the Secretary of Transportation in 1971:

> ...Despite favorable assumptions regarding major improvements in air traffic control, the wide-spread use of high capacity jets, better rationalization of airline operations, constraints on general aviation operations, and the diversion of Corridor short-haul air travelers to high speed

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[1] Recommendations for Northeast Corridor Transportation, U.S. Department of Transportation, September, 1971.

[2] Air Mode Service Analysis in the Northeast Corridor, U.S. Department of Transportation, Office of High Speed Ground Transportation, December, 1969.

[3] Northeast Corridor Transportation Project, U.S. Department of Transportation, Office of High Speed Ground Transportation, April, 1970.

[4] Mode Shift Strategies to Affect Energy Savings in Intercity Transportation, U.S. Department of Transportation, 1976.

[5] Improved High Speed Rail for the Northeast Corridor, U.S. Department of Transportation, Federal Railroad Administration, January, 1973.

ground modes, the NEC Transportation Project concludes that, unless additional actions to divert CTOL passengers are undertaken, the New York hub area will, in all likelihood, face severe and unmanageable air congestion problems in the 1980s.[1]

The New York hub area system of airports referred to in that quote includes Kennedy, LaGuardia, and Newark airports which accounted for 10.35 percent of the total enplaned passengers at all 521 U.S. air carrier airports in 1974 (Table 2-1).[2] These three New York hub airports enplaned 35 percent of all airline passengers traveling between the ten metropolitan areas of the NEC in 1975 (i.e., 1.835 million of 5.077 million).

Washington (National Airport) and Boston (Logan International Airport) are also experiencing congestion problems; 20 to 30 percent of total traffic at these two airports is NEC intercity traffic (see Section 3.1.3). Because of the relatively higher average load factors (number of passengers carried in relation to plane capacity), the percent of operations (takeoffs and landings) associated with NEC trips is less than the percent of NEC bound passengers enplaned in the region's airports. For example, in 1974 at Logan Airport, 21 percent of total air carrier operations were to or from other NEC airports while about 29 percent of total passengers were to and from other NEC airports. In either case, NEC intercity traffic is contributing heavily to the total airline demand and congestion at regional airports.

Demand projections of the Federal Aviation Administration (FAA) indicate that increases of 65 to 90 percent in passenger enplanements might be expected between 1974 and 1986 at the six largest NEC airports (Table 2-1).[3] The introduction of more wide-bodied aircraft will reduce the growth in operations rate to approximately 40 or 50 percent, except at Washington

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[1] Recommendations for Northeast Corridor Transportation, U.S. Department of Transportation, Office of Systems Analysis and Information, September, 1971.

[2] Terminal Area Forecast, 1976-1986, U.S. Department of Transportation, Federal Aviation Administration, September, 1974.

[3] FAA is developing forecasts which are expected to revise these projections downward. See FAA Aviation Forecasts, Fiscal Years 1978-1989, U.S. Department of Transportation, September, 1977. The conclusions of this section are not expected to be substantially affected.

Table 2-1

PROJECTED AIR TRAFFIC AT MAJOR AIR CARRIER AIRPORTS IN THE NEC

| AIRPORT/ FISCAL YEAR | ENPLANED PASSENGERS (000) | | | | AIRCRAFT OPERATIONS (000) | | |
|---|---|---|---|---|---|---|---|
| | AIR CARRIER | AIR TAXI | PERCENT OF U.S. TOTAL | U.S. RANK | AIR CARRIER | AIR TAXI | TOTAL |
| NEW YORK (KENNEDY) | | | | | | | |
| 1974 | 10,034 | 101 | 5.00 | 4 | 306 | 30 | 360 |
| 1981 | 15,151 | 223 | | | 395 | 42 | 491 |
| 1986 | 16,763 | 393 | | | 444 | 56 | 727 |
| NEW YORK (LAGUARDIA) | | | | | | | |
| 1974 | 7,315 | 35 | 3.64 | 6 | 265 | 15 | 339 |
| 1981 | 11,045 | 77 | | | 342 | 21 | 383 |
| 1986 | 12,679 | 136 | | | 384 | 28 | 413 |
| WASHINGTON (NATIONAL) | | | | | | | |
| 1974 | 5,380 | 133 | 2.68 | 8 | 214 | 33 | 326 |
| 1981 | 8,208 | 214 | | | 210 | 46 | 311 |
| 1986 | 9,824 | 299 | | | 206 | 61 | 298 |
| BOSTON (LOGAN) | | | | | | | |
| 1974 | 5,175 | 133 | 2.58 | 10 | 199 | 51 | 295 |
| 1981 | 7,814 | 214 | | | 257 | 72 | 424 |
| 1986 | 9,677 | 299 | | | 288 | 95 | 575 |
| PHILADELPHIA | | | | | | | |
| 1974 | 3,598 | 197 | 1.79 | 14 | 160 | 66 | 316 |
| 1981 | 5,432 | 435 | | | 207 | 93 | 455 |
| 1986 | 6,728 | 768 | | | 232 | 123 | 616 |
| NEWARK | | | | | | | |
| 1974 | 3,446 | 45 | 1.71 | 16 | 150 | 24 | 220 |
| 1981 | 5,203 | 99 | | | 194 | 33 | 333 |
| 1986 | 6,444 | 175 | | | 217 | 45 | 477 |

Note: 1. Enplaned passenger data is actually for Fiscal Year 1973.
2. The seventh busiest NEC airport is Baltimore, ranked 29 with 1,528,000 passengers; followed by Washington-Dulles (39/1 134,000), Hartford (42/1,074,000) and Providence (73/450,000).
3. Aircraft Operations total includes general aviation.

SOURCE: *Terminal Area Forecast, 1976-1986*, U.S. Department of Transportation, Federal Aviation Administration, September, 1974.

National Airport where current operation levels will be maintained.

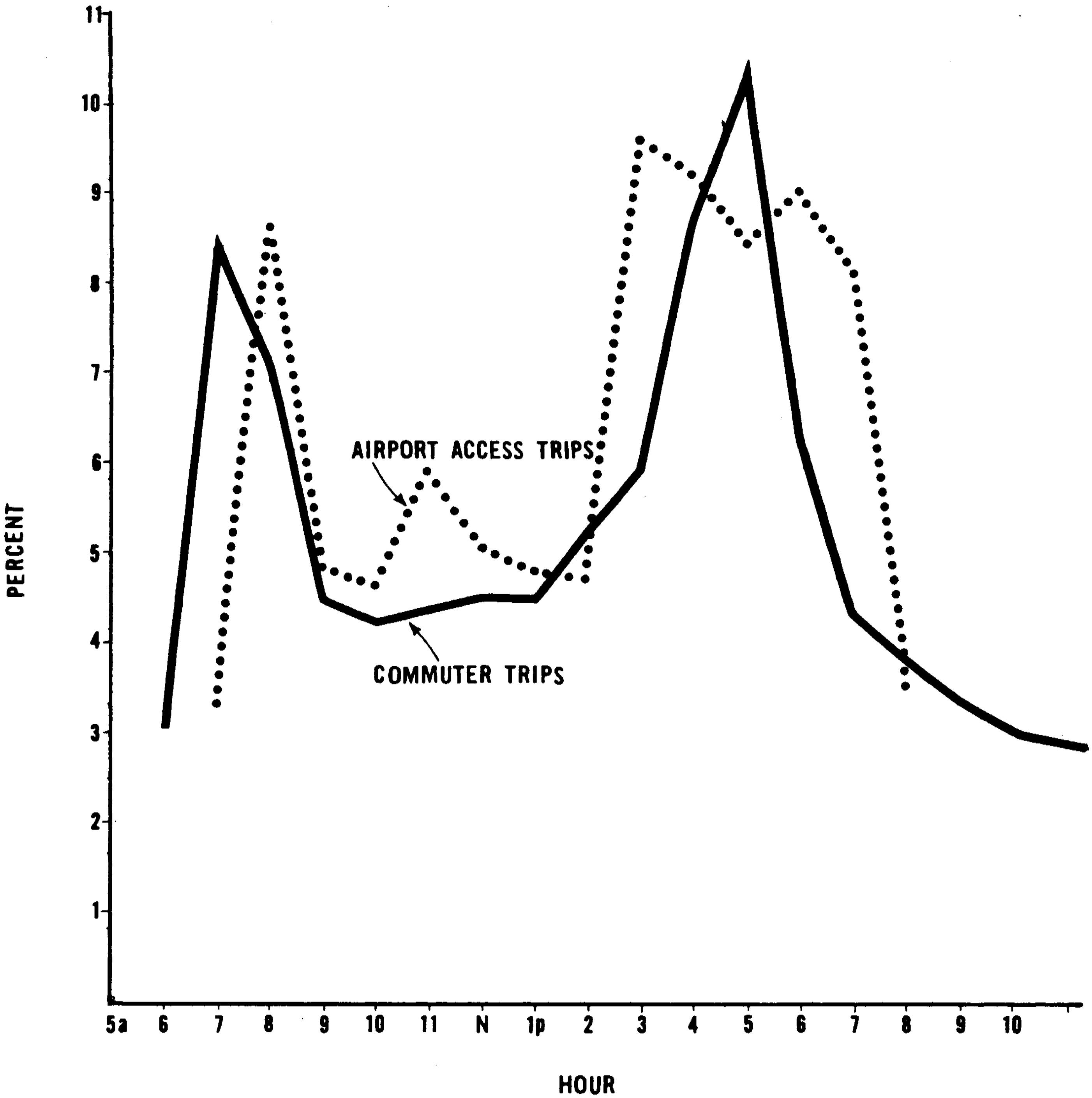
Terminal area congestion (i.e., baggage handling, ticketing, gates, apron areas) will require substantial investments at certain airports if the FAA passenger traffic forecasts are accurate. These expansions can normally be accomplished on existing airport property without adverse environmental effects if sufficient funding is made available. The Airport and Airways Development Act of 1976 made terminal improvements eligible for federal-aid funding for the first time.

Surface access to the region's airports is a continuing source of traffic congestion which increases total trip time and reduces the reliability of on-time arrival. Airport access is almost entirely dependent on highway facilities, via private automobiles, rented cars, scheduled coaches, or limousines. The dual peak of afternoon airport bound traffic suggests that air travelers are deliberately scheduling their airport trips to avoid the commuters, but, as a result, are lengthening the afternoon rush hour (Figure 2.1).

Major cities are turning to transit options in an attempt to divert significant numbers of air travelers from the highway-related terminal access modes. The Washington, D.C. Metro Rail Transit Extension to National Airport opened on July 1, 1977. Other rail transit access improvements are planned at Philadelphia, Baltimore, New York and Newark Airports.

The high proportions of air travel which originate in, or are destined for, the expanding low-densitv areas will, however, encourage the continued dominance of the highway vehicle as the major mode of access to airports. Additional investment to expand highway access to airports has met strong opposition based on social/environmental effects. This is reflected in the long range transportation plans of the various metropolitan areas, where major investments are not being scheduled for highway access to airports.

Future congestion in the form of delay to aircraft in the airfield/ airspace system is a function of future capacity per aircraft, the peaking characteristics of air travel demand, the state-of-the-art in air traffic




Source: Recommendations for the Northeast Corridor Transportation, Main Report, U.S. Department of Transportation, 1971

Figure 2.1

**MAJOR CITY COMMUTER/ AIRPORT ACCESS FLOW**

control equipment and procedures, and the number and configuration of independent runways at a particular airport.

Congestion problems can be resolved by various means. The use of larger aircraft to accommodate a greater number of passengers would reduce the number of aircraft operations. A 74 percent increase in average vehicle size between 1970 and the 1980s has been projected.[1] Air travel demand could be redistributed by (1) instituting variable landing fees and fares to induce a change in the daily demand profile, (2) limiting general aviation at commercial airports, (3) establishing threshold load factors for landing rights, and (4) encouraging direct flights, thereby diverting through and transfer traffic from major airports. System capacity can be increased with a concomitant reduction in congestion by improving air traffic control (ATC) capabilities, expanding and improving existing airport facilities, and/or implementing STOL service at airports with short runways. However, implementation of these measures will require the development of policies and regulations in a time frame that exceeds the objective of near term improvement in intercity passenger service.

Attempts to alleviate airport congestion commonly involve airport expansion through the construction of new airports or new runways. However, such plans have been strongly opposed on environmental grounds of land use conflicts, and noise and air quality impacts. It appears that with the possible exception of Newark, no major airfield expansion is feasible at any of the major NEC air terminals in the foreseeable future.[2] Even the efforts to develop a fourth New York hub area jetport at Stewart Air Force Base (50 miles from Manhattan) met with strong opposition, and forced a scale-down of that proposal.

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[1] Recommendations for Northeast Corridor Transportation, Final Report, U.S. Department of Transportation, May, 1971.

[2] Ibid.

A final area of concern in the future of CTOL aircraft service is the relatively inefficient operation of aircraft on short haul routes (i.e., less than 250 miles). A major reason for the high cost of aircraft operations on NEC service is the energy inefficiency of aircraft on short haul trips which comprise 75 percent of NEC air trips. Air and auto are by far the most energy consumptive modes in terms of seat miles provided for a 300 mile trip (Table 2-2). In terms of energy consumption per revenue-passenger-mile based on typical NEC load factors, the air system improves somewhat relative to the other modes because of relatively higher load factors. On the other hand, the auto becomes more inefficient because its average load factor tends to be lower.

The example is significant in that it is based on a 300 mile trip. The energy efficiency of the air mode tends to worsen for trips shorter than 300 miles (97 percent of the intercity trips in the NEC are shorter than 300 miles). Thus, investment in the air conventional mode to the exclusion of the more energy-efficient modes involve high risks due to the declining availability and increasing price of energy.

V/STOL services (vertical or short take-off and landing aircraft), because they exhibit most of the high performance characteristics of CTOL along with substantially more flexibility, have also been the subject of much comparative study in the NEC.[1,2] However, a significant amount of public investment is required in vehicle research and development to overcome certain ride quality problems that may affect marketability and, therefore, expected patronage in V/STOL. Also, community acceptance of new V/STOL terminals is questionable, particularly if V/STOL aircraft development cannot overcome noise and air quality problems.

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[1] Northeast Corridor Transportation Project Report, U.S. Department of Transportation, Office of High Speed Ground Transportation, April, 1970.

[2] Recommendations for Northeast Corridor Transportation, U.S. Department of Transportation, May, 1971.

Table 2-2

COMPARISON OF MODAL ENERGY INDICES
300-MILE EXAMPLE

| MODE | Energy Index, BTU/ASM[6] 1982 | 1990 | Remarks |
|---|---|---|---|
| Air | | | Port-to-Port, No Penalty for Air Traffic Control Delays |
| o 727-200[1] | 3,749 | - | |
| o DC9-50[2] | 2,910 | 2,910 | |
| Auto[3] | 1,260 | 1,140 | Door-to-Door, 15 percent Urban, 85 percent Intercity |
| Bus[4] | 450 | 450 | Port-to-Port, 10 percent Urban 90 percent Intercity |
| Rail[5] | 690 | 690 | Port-to-Port |

1. PSA Commuter, 150 seats
2. NEC Shuttle, 130 seats
3. Five seats
4. 46 seats
5. Metroliner, 390 seats, New York - Washington
6. ASM - available seat miles

SOURCE: Mode Shift Strategies to Effect Energy Savings in Intercity Transportation, U.S. Department of Transportation, 1976.

Present STOL and VTOL aircraft exhibit higher internal noise and vibration levels, and have at least twice the sensitivity to wind gusts as compared to conventional jet aircraft. They must also operate at altitudes which are highly subject to atmospheric turbulence. It is these altitudes which are now utilized for general aviation aircraft operations creating air traffic control problems as well.

Land acquisition for STOL and VTOL terminal ports poses a serious future constraint to these systems. Almost every attempt at new construction or expansion of conventional airports in the Corridor over the past decade has met with strong community opposition. All attempts to establish a STOL port in Manhattan have failed. Major objections again center on noise, air quality, congestion and the safety of terminals in high density areas.

Finally, a previous study simulated hypothesized STOL, VTOL and improved rail systems and showed that the total annualized cost per passenger mile for V/STOL is substantially higher (two to three times) than that of a high speed rail system at all levels of demand.[1] Thus, significant expansion of the air transport system as a means of improving the service level of intercity travel does not appear to be a promising option. Moreover, there are serious policy questions regarding the desirability of investing in a mode which has poor energy efficiency in the short haul markets of the NEC.

### 2.2.2 HIGHWAY

Intercity travel by auto has certain advantages which make it an attractive alternative. Highway travel is not confined to fixed terminals and offers the advantages of door to door travel with no modal transfers. Highway travel also offers distinct out-of-pocket cost advantages when

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[1] Recommendation for Northeast Corridor Transportation, U.S. Department of Transportation, May, 1971.

two or more persons travel together. For NEC intercity trips of less than 250 miles, the auto has been the overwhelmingly preferred mode (80 percent of the market). For trips of 250 to 500 miles, the auto is chosen by 50 percent of all travelers in the NEC.[1] Given this demonstrated preference, and the fact that 96 percent of all intercity trips in the NEC are less than 250 miles, it would appear that investment in improved intercity highway facilities would be the overwhelming choice of intercity travelers.

Between 1950 and the mid 1960s, substantial improvements to the Corridor highway network led to a more than 30 percent reduction in travel time between Boston and New York and a 40 percent reduction between New York and Washington. In recent years, however, travel times have begun to increase gradually due to traffic congestion in and around urban areas. The NEC analysis of intercity highway travel indicates that there will be a general deterioration between 1970 and 1985 in the travel speed and schedule reliability (i.e., percent of on-time arrivals) provided to the intercity traveler along the NEC spine.[2]

The problem of providing intercity highway services is not one of inadequacy in the links between urban areas, but of traffic congestion during peak hours within the urban areas (Figure 2.2). One-third of intercity auto travelers must bypass one or more metropolitan areas. This congestion continues to reduce the drivers' ability to maintain maximum highway speed (55 mph) through these urban areas. Decisions regarding trip making, starting times, and travel route selection will be affected by this congestion.

The range of potential improvements available to reduce this conflict between intercity and intracity highway travelers includes: diversion of commuters and trucks from highways, construction of new north-south expressways and/or additional lanes on existing expressways, and efficiency/

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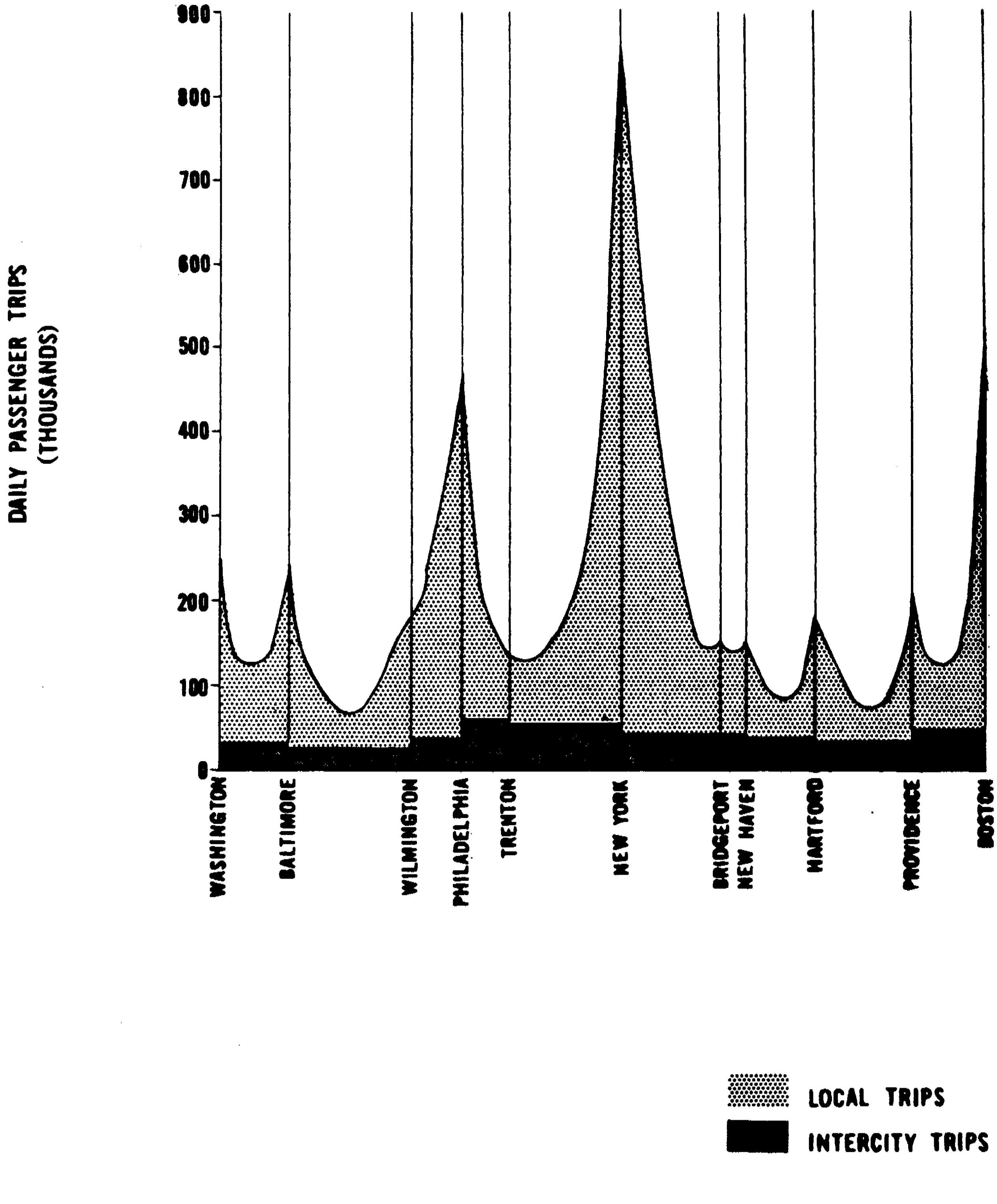
[1] Draft Northeast Corridor Initial Assessment, U.S. Department of Transportation, Federal Railroad Administration, 1976.

[2] Recommendations for Northeast Corridor Transportation, U.S. Department of Transportation, May, 1971.




## Figure 2.2

## 1968 AUTOMOBILE TRAVEL ON MAJOR NEC INTERCITY HIGHWAY LINKS— INTERCITY TRIPS VS. LOCAL TRIPS

Source: Northeast Corridor Intercity Travel Survey, U.S. Department of Transportation, March 1971.

operational improvements. Although the inability to divert intracity commuters and trucks from freeways has been a problem for years, investment in suburban public transit to attract commuters from their autos has increased. This diversion to transit will make it easier for intercity drivers to travel the highways near metropolitan areas. However, two phenomena tend to negate the effectiveness of public transit in actually diverting riders. First, as more people are diverted from autos to public transit, it becomes easier for the remainder to drive. Thus, public transit will divert drivers, but not in sufficient numbers to actually eliminate the congestion on parallel highways. Secondly, increased investment in public transit provides an overall incentive in any particular travel corridor and thus induces more trips to be made (i.e., more people will make trips when it becomes easier to travel).

This is not to say that investment in public transit is not justifiable. In fact, the federal government is making such investments through the Urban Mass Transportation Administration (UMTA) and the Federal Highway Administration (FHWA). To the extent that it will guide future development and travel patterns, public transit will reduce the long-range need for additional highway capacity. It is very unlikely, however, that the diversion will significantly improve intercity travel times by reducing congestion. If factors such as higher fuel prices are introduced as an attempt to increase this diversion, use of autos would become a less attractive alternative. However, investment in suburban public transit is not seen as an effective tool to alleviate intercity highway congestion and improve service levels.

Diversion of truck freight to rail or intracoastal ship is likely to be similarly unsuccessful. Goods shipped through the northeast tend to be either low-volume/high-value manufactured products not conducive to rail or ship, or perishable produce from the south unsuited to lengthy rail/ship movements. Because of differing terminal and line haul handling expense characteristics, truck rates are usually lower than rail rates on small shipments and short hauls.

Uncompleted sections of major freeways generally parallel to the NEC spine are presently being designed and/or constructed under programs administered by the FHWA. Although completion of such sections of highway will provide local improvements to highway travel, this will not result in significant improvements of intercity travel speed and ease. Construction of additional new facilities or major expansion of existing facilities is difficult to envision along the NEC spine. Public opposition to some urban NEC area highway projects has stopped the projects and lead to funding of transit projects under interstate transfer provisions of the Federal Aid to Highways Act. This has been demonstrated in a number of areas including Boston, Philadelphia, New York and Washington.

Thus, due to the enormous monetary and environmental costs of building major new facilities, primarily through heavily developed areas where such facilities would be most needed, substantial expansion of the existing/planned highway system does not appear to be a feasible option to improve intercity travel in the NEC.

The early studies of NEC transportation alternatives were not as sensitive to issues of energy conservation and air quality as we must now be in the light of more recent events. Major highway investments which pose the distinct possibility of induced increases in total intercity auto travel must be carefully considered. Auto travel has some energy efficiency advantages over aircraft but significantly less than rail or bus in the NEC[1] (see Chapter 3 of this Statement).

In conclusion, it would appear that, as an alternative to this high-speed rail project, new major highway investments to improve intercity travel are unlikely and pose serious risks with respect to the future energy situation in the nation.

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[1]<u>Mode Shift Strategies to Effect Energy Savings in Intercity Transportation</u>, U.S. Department of Transportation, 1976.

### .3 INTERCITY BUS

Intercity bus service is a third modal investment alternative to high-speed rail service in the NEC. The advantages which make bus service potentially desirable for intercity travel improvements are: (1) bus service is more flexible with regard to routing and terminal location than is air or rail service, (2) as a general rule, cost to the user (fare) is as low or lower than all other modes with the exception of shared auto trips, (3) intercity bus service has traditionally avoided public operating subsidies while offering a comfortable modern service, and (4) like rail, intercity bus offers distinct advantages over the air and auto modes with respect to air quality and is the most energy efficient of all the intercity modes.

In general, however, present ridership is attracted primarily by lower fares, and appears to be stabilized. Between 1950 and 1968, bus travel has remained nearly constant, growing only from 22.7 billion to 24.5 billion passenger miles nationwide. At present, intercity bus accounts for 5.1 percent of all intercity trips of less than 250 miles in the NEC, and 3.6 percent of trips between 250 miles and 500 miles. Growing congestion on the urban segments of intercity expressways, and the 55 mph speed limit restriction are contributing to an erosion of the intercity bus lines ability to attract more passengers from other modes.

Since buses operate on public highways, improvement potential for intercity bus is generally limited to (1) additional highway capacity to reduce congestion, (2) exclusive busways, and other operational improvements to existing highways, and/or (3) operating subsidies which would allow increased frequency of service and/or lower fares. The bus improvement options which deal with the construction of new highways or even exclusive busways (e.g., the Shirley Highway in Washington, D.C.) present many of the same economic, social, and environmental concerns as those outlined for the highway mode improvement alternative. The construction of capacity improvements for buses are needed in the most densely populated and traveled portions of our urban areas where they are most difficult and costly to provide.

Operational improvements which do not involve new highway construction, such as real-time information systems or contra-flow bus lanes are often productive and are currently being actively pursued (e.g., the Southeast Expressway in Boston and the Lincoln Tunnel in New York).

The real maximum potential for bus travel is constrained, however, by the longer travel time required for most trips. Based on 1975 bus company schedules, travel time from Boston to New York is four hours and 35 minutes, and from New York to Washington is four hours and 20 minutes. While this compares favorably with existing rail time north of New York, it does not compare favorably with the existing rail service from New York to Washington or with the potential travel time by rail (3 hours, 40 minutes and 2 hours, 40 minutes respectively) under the proposed action.

The option of public subsidy to intercity bus services is clearly beyond the purview of the NECIP as defined by Congress, but, in the broadest view of alternatives for improved intercity transportation available to the Federal government, it is a viable alternative. Such a subsidy might take many forms: operating subsidy to reduce fares of increase service frequency at current fares; subsidized development of bus terminals or multi-modal terminals at train stations; or subsidized development of more fuel efficient and technologically advanced vehicles.

When viewed in the national context, operating subsidy to intercity bus is a valid topic for public debate. The thrust of such an operating subsidy may be to maintain the bus option for travellers in low density areas and to maintain or improve service available to the "transportation poor" (i.e., those with low incomes, no auto available and/or the elderly, handicapped and young). In low density areas, rail is not a cost-effective competitor to intercity bus. In the high density NEC, however, the share of intercity trips captured by bus and rail in the NEC is as much as ten times that of the rest of the nation.

Any "no-build" option which lead to the demise of intercity rail service in the NEC would clearly improve the competetive position of intercity bus even without subsidy. In the baseline case, with continued rail service at current levels, operating subsidy which reduced bus fares would divert some passengers from rail. In the case of the full implementation of the NECIP, bus subsidy might maintain service which might otherwise be reduced.

Even substantial reduction in bus fares through subsidization in lieu of the NECIP would not, however, satisfy the transportation demands of all of the persons currently using bus and rail. In the New York-Boston segment of the Corridor, trip times by bus and rail are presently similar and lower bus fares are likely to attract substantial numbers of current Amtrak riders. On the New York-Washington section of the Corridor, however, a clear distinction must be made between the cost-conscious traveler (those who may be attracted by lower bus fares) and the trip-time conscious traveler (those who are likely to choose air, rail or auto over bus even in the face of lower bus fares). Metroliner patrons (67 percent of which are traveling on business according to a recent Amtrak survey[1]) accounted for 65 percent of Amtrak ridership on the New York-Washington segment in 1972 and now account for just under 50 percent. The reduction has come about because of the deteriorating condition and reliability of the Metroliner and the introduction of new Amfleet cars. These riders--50 to 65 percent of total--are clearly trip time conscious since they were willing to pay higher fares to save up to 60 minutes over the Amfleet service, and would therefore not generally be attracted to bus if fares were lowered. Even the remaining 35 to 50 percent of total Amtrak ridership on this segment may not be attracted by lower bus fares since the conventional Amfleet service even now enjoys a trip time advantage over bus.

In summary, it would appear that well under one-half and perhaps as little as one-quarter of the 10 million Amtrak riders of the NEC would be satisfied to choose the bus for their intercity trip even if bus fares were substantially lowered through public operating subsidy. The remaining Amtrak riders would, if Amtrak subsidy were ended in favor of intercity bus subsidy, either not make the trip or return to the air or auto mode for their trip. Trips diverted from air and auto to rail and induced trips generated by the trip-time improvements of the NECIP (see Section 1.4) would, of course, also generally not choose the bus mode in spite of lower fares.

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[1]On-board surveys conducted by Amtrak in autumn 1975 and spring 1976.

Public investment in bus terminals and vehicle research may also be considered in the future. Such investments may marginally reduce bus operating costs but would not, as above, serve to substantially improve the competitiveness of the bus mode vis-a-vis the NECIP improvement with regard to rail, particularly in terms of diversion of trips from the energy intensive air and auto modes. The NECIP is not precluding and is in fact encouraging multi-modal use of rail station facilities.

## 2.3 MAINTAIN ALL MODES WITH PRESENT DEVELOPMENT TREND

This alternative consists of development of the various travel modes at a rate consistent with currently projected funding policies and market demands, but without the Northeast Corridor Rail Improvement Project. This is the most realistic "no-build" option in that it represents what would probably be the natural evolution of transportation development if the NECIP were not superimposed. This alternative can therefore be seen as the baseline case for the future of intercity transportation in the NEC.

For over three decades, air and highway modes have been heavily funded for development and maintenance. If history is any indication, the distribution of future funding to all intercity modes would maintain a first class national highway system and a first class national airport and airway system. In contrast, it is difficult to predict a future level of investment for the NEC in the absence of the NECIP. The post-war trend has, of course, been a major shortfall in maintenance expenditure resulting in continuing deterioration of the NEC physical plant. Since the transfer of most of the NEC to Amtrak ownership under provisions of the 4R Act has been accomplished, it can be assumed that Amtrak would seek to reverse, or at least halt, this deterioration. Without the NECIP, the future maintenance program for the Corridor would necessarily be carried out with funding made available directly to Amtrak.

Two no-build scenarios are thus suggested, depending on the level of revenues and subsidization available to Amtrak. The first case assumes a continuation of federal operating subsidies and limited capital funding on a nationwide basis, without additional funds for rehabilitation of the Corridor. Amtrak would initially provide a level of service roughly equivalent to today's but the quality of that service would deteriorate as necessary rehabilitation is further deferred. The available maintenance funding would increasingly be committed to only the most critical problem areas, making a normalized maintenance program impossible.

The number of slow orders on substandard sections of track would increase, forcing longer scheduled travel times. Systems such as electrification, signaling and communications would break down with increasing regularity, resulting in more frequent unanticipated delays and poorer schedule adherence. As more and more components of the system become critical, only the most cursory stop-gap repairs would be possible within the maintenance budget. At best, the resultant degradation in service quality would be balanced by the increasing cost of intercity travel by other modes, so that intercity rail patronage would continue for some period at approximately today's levels. At worst, an inability to keep pace with advancing deterioration would cause a loss of ridership large enough to bring continuation of service into question.

During this period, the cost of providing intercity service on a per-passenger basis would rise as longer running times and more frequent delays affect operations. Nor would these increased costs be felt only by Amtrak; the commuter rail services which utilize the Corridor would also be required to operate on the deteriorated system. Thus, public support for both Amtrak intercity and commuter rail services would become less cost-effective.

Eventually, deterioration would advance to the stage where intercity rail service on the NEC would become unsafe at any reasonable speed and service would have to be terminated. Commuter services could only survive if public funding from sources other than the NECIP were expended to maintain those portions of the Corridor. Presently, 287 miles, or some 63 percent of the total route mileage of the NEC, is used for the provision of commuter service. In some areas, present commuter services are limited and their abandonment might not cause major transportation impacts. However, between Boston and Providence and along the entire Corridor from New Haven, CT to Wilmington, DE, commuter rail on the NEC is an essential component of metropolitan transportation systems. Without public investment the introduction of new commuter services, currently projected to be in operation by 1990 on an additional 22 percent of the NEC, would be precluded.

Finally, regional rail freight services would be impacted by the advancing deterioration of the NEC. Conrail would be required to adopt more circuitous routings or bear the cost of upgrading alternative routes.

The second no-build scenario assumes that sufficient additional funding is made available to Amtrak for rehabilitation of the Corridor to maintain the integrity and service level of the existing railroad through 1990. The cost of those portions of the NECIP which would need to be undertaken by Amtrak over the next 10 to 15 years if the NECIP were not implemented in order to maintain the existing railroad gives us an approximation of the cost of this scenario. Included in this estimate are two categories of NECIP work which will reduce Amtrak's future expenditures for maintenance-of-way - Deferred Maintenance and Capital Improvement in lieu of Deferred Maintenance.

The portion of the $1.75 billion NECIP which is directly associated with elimination of Deferred Maintenance is estimated at $647 million. Included in this estimate is trackwork done by traditional methods, most bridge repairs or upgrading, all tunnel work, and those portions of electrification, signaling, communications and stations which have to do with repair of existing components.

The second category, Capital Improvements in lieu of Deferred Maintenance, is estimated to account for another $509 million and includes total replacement of systems or components which will eliminate the need for performing work to overcome deferred maintenance on the old systems or components. This includes such items as route realignments or trackwork done by TLS which totally reconstruct sections of existing track, interlocking reconfigurations, bridge replacements, upgrading of the electrification south of New Rochelle to 25 KV, 60 Hz, conversion to all relay signals, reconstruction of existing service facilities, replacement of the basic communication system and operational station improvements (except new platforms.

The "cost" of this scenario, then, would include all of the $647 million in Deferred Maintenance and most, but not all of the $509 million cost of Capital Improvements in lieu of Deferred Maintenance. The latter would not be fully included because some of the replacement systems are designed to higher and presumably more expensive standards than would be achieved through maintenance of the old system.

Under this maintenance scenario, none of the actual capital improvements to the NEC would be made. Less station work would be done; thus, the comfort and convenience associated with new or renovated structures, new intercity and commuter platforms, and expanded parking would be foregone. The safety improvements of fencing and grade crossing elimination and the operating efficiencies of modern maintenance facilities would be foregone. Finally, no improvement in travel time or schedule adherence would be realized.

The maintenance scenario has been adopted as the baseline no-build alternative against which the impacts of the NECIP are evaluated. Its estimated ridership effects indicate a 38 percent growth in NEC rail trips between 1975 and 1990, to 13.2 million. NEC intercity trips by auto would grow 27 percent to 86.7 million, air trips by 93 percent to 9.8 million, and bus trips 28 percent to 5.7 million.

With the improvement in rail service levels resulting from the NECIP, the projected 1990 level of auto trips would drop to 84 million, air trips to 8.5 million and bus trips to 3.8 million, while rail travel would increase to 21.8 million.[1]

The 1990 improved rail service will therefore result in just under six million fewer trips annually by auto, air and bus than would the baseline case offered by expenditure in excess of up to $1.16 billion for deferred maintenance. In addition, the improved mobility offered by the NECIP will result in 2.7 million intercity trips per year by 1990 which otherwise would not be taken.

Although the no-build scenarios would cause certain environmental benefits associated with the NECIP to be foregone, the construction related environmental impacts will be avoided. Chapter 3 of this document compares in detail the environmental effects of the baseline (no-build) alternative and those of the NECIP.

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[1]See Section 1.4 for source of demand projections.

## 2.4 SYNOPSIS OF NON-RAIL ALTERNATIVES

In the previous three sections of this chapter, the various non-rail modal alternatives available to improve and assure adequate future capacity for intercity travel in the NEC were examined. The alternatives evaluated included do nothing, total investment in alternative modes only, and maintenance of the present development trend.

The do nothing option, or no public investment in transportation, is not a prudent alternative. Since the transportation system in the NEC is a resource to the region, its deterioration, which will inevitably occur if the system were not improved to keep pace with future demand levels, would lead to adverse economic effects resulting in declining regional productivity and general well being. Adverse environmental effects would result from the elimination of public investment in transportation and the loss of this tool to meet air quality and energy conservation goals.

The alternative of total investment in other (non-rail) modes only, also falls short of attaining desired transportation goals in several areas. Further development of the air mode to meet future travel demand is hampered by airfield capacity constraints, limitations on state-of-the-art advancements in airspace capacity, air traffic control equipment/procedures, and most importantly, serious environmental problems with respect to noise control and abatement, energy and surface access to airfield.

The highway mode of travel is faced with similar development constraints. Urban highway segments along the NEC spine are accommodating freight, intercity and local commuter traffic, and many are very near or at design capacity. The level of service provided on the regional highway network is deteriorating around these urban centers during the peak hours of travel. Capacity increases along the network basically must be accomplished through the addition of more travel lanes or new highway segments; however, the associated environmental costs of obtaining the necessary right-of-way (ROW) to accomplish this would be substantial. Moreover, since the existing network traverses highly developed urban areas, it is not likely that the necessary land would be available without substantial monetary cost as well. As a further consideration, the induced auto traffic which could result from highway improvements would adversely affect energy conservation efforts and air pollution abatement efforts.

Intercity bus, as a modal alternative, is constrained on travel time. Both the auto mode and current rail service have a travel time advantage over intercity bus. Also, since buses utilize the existing highway system, bus patrons are experiencing delays and congestion similar to the auto mode. Here again, the improvements necessary to increase capacity; e.g., exclusive bus lanes on existing highways, must be equated to marked monetary and environmental costs. Subsidized intercity bus service, in lieu of the NECIP, is not likely to capture the majority of present rail passengers.

The alternative of maintaining present development trends of all modes of transportation or current funding levels, is not consistent with emerging air quality and energy goals. Evaluation of the effects of this alternative on intercity rail service depends on varying assumptions of the financial capacity of Amtrak to maintain the Corridor in the absence of the NECIP. A continuation of present operational funding would result in advancing deterioration of the Corridor facilities, with severe impacts on intercity commuter, and freight services. Halting this advancing deterioration would require expenditures in excess of $684 million in public funds over the next 10 to 15 years. On the other hand, rail improvement would precipitate some reduced congestion on other modes (due to modal diversion), improved air quality, and more efficient use of energy in transportation. Approximately six million trips could be diverted from auto, air, and bus modes if the underutilized rail system were developed as proposed in the NECIP.

In summary, the preceding sections of this chapter have described a macro-analysis of the various modes of transportation that have the potential to accommodate future intercity travel demand in the NEC. Due to the current status of alternative modes (air, auto, bus) and the under-utilized development potential of rail transportation, the NECIP appears to offer the most environmentally acceptable means by which transportation can be improved and enhanced in the Corridor.

Given this determination that the rail mode of travel should be improved in the NEC, four groups of alternative actions within the rail option must be examined: (1) technological alternatives, (2) route alternatives, (3) operational alternatives, and (4) service level alternatives. These four areas are discussed in Sections 2.5, 2.6, 2.7 and 2.8 respectively.

## 2.5 TECHNOLOGICAL ALTERNATIVES

### 2.5.1 NEW TECHNOLOGY

The potential applicability of several forms of new fixed-guideway vehicles has been considered in the development of the NECIP.[1] These technological alternatives include advanced high-speed rail (200 mph), tracked air cushion vehicles (TACV), underground tube vehicles, and magnetic levitation vehicles.

The underground tube vehicle system has been eliminated as a feasible 1980s alternative because of the prohibitive costs of tunneling and the limitations on state-of-the-art tunneling technique.[2] The limited technological development of magnetically levitated vehicles has not been sufficient to warrant further consideration.

The advanced high-speed rail (AHSR) vehicle is conceptually similar to the Japanese New Tokaido Line. HSR extends the steel wheel/steel rail concept to its technological speed limits. The most serious consequence of this alternative is that a new ROW, with reduced curvature to allow for high speed operation, would be required. The AHSR system could use cars similar to those proposed in the NECIP but with increased traction power and the system would have to be completely electrified with an improved roadbed or possibly on a concrete slab or beam structure.

In the TACV systems, the vehicle is supported by forcing air between the vehicle and the guideway thereby eliminating mechanical contact. Air cushions are also employed which act against vertical surfaces to constrain the vehicle to within one degree of freedom. TACV which can be designed for a 300 mph cruising speed are powered by linear induction motors and

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[1] Recommendations for Northeast Corridor Transportation, U.S. Department of Transportation, May, 1971.

[2] Ibid.

operate on a box beam guideway. In addition to extensive research and development prior to producing a suitable configuration for guideway and vehicle procurement, implementation of this system would require a substantial acquisition and construction effort on a new alignment to provide an elevated two-track system with a 100-foot ROW.

Assembly of a continuous 450-mile transportation corridor for either HSR or TACV linking the major cities of the nation's most heavily developed and densely populated region would be a costly, time-consuming undertaking. The acquisition of a 100-foot ROW between Boston and Washington was estimated by DOT to cost $557 million based on 1972 land values.[1] In addition, $370 million was estimated for tunneling and new underground stations in central cities where land acquisition would be prohibitively expensive. Implementation of HSR or TACV systems over a new ROW could also be expected to cause significant socio-economic and environmental impacts. In urban areas, the most serious impacts are likely to be the displacement of people from their residences and the dislocation of businesses.

Although the above two alternatives, HSR and TACV, seem feasible for the 1980s, technological risks are involved with the implementation of each. HSR involves a technological risk in pushing the steel rail/flanged wheel technology to higher speeds. Problems of truck "hunting" (vehicle dynamics), gyroscopic and centrifugal forces, cross-wind loads, track alignment, etc., all increase with speed. Ride quality and safety are also involved in the speed increase. TACV involves technological risks in obtaining the desired performance for the suspension and propulsion systems. Wayside power pick-up at 300 mph will pose special difficulties as will the technique for switching the TACV guideways.

In summary, AHSR and TACV are intercity passenger transport systems which offer the potential of operating speeds substantially superior to those of the proposed system. While both higher speed systems seem feasible

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[1] High Speed Ground Transportation Alternatives Study, U.S. Department of Transportation, 1973.

for the 1980s, the technological risks involved suggest that further research and development be undertaken prior to their implementation. Further, the new ROW required for either AHSR or TACV represents a major implementation cost item not within the scope of the proposed action and can be expected to have socio-economic and environmental impacts which require substantial further study.

### 2.5.2 TRACTION POWER

Five alternatives are available for use in the NEC railroad system. One alternative would involve retaining of the existing dual traction system. The NEC is presently electrified along the 300.7 mile route between Washington, D.C. and New Haven, Connecticut. The remaining 156.7 miles between New Haven and Boston are not electrified, thereby necessitating the use of diesel-electric locomotives in this section. Retention of this dual traction system would involve (1) a savings in new electrification costs if the existing 25 Hz power (1 Hz is one cycle per second) is retained south of New Haven, (2) efficient utilization of existing equipment, (3) a slight increase in maintenance costs, (4) no change in the types of environmental effects but a substantial increase in diesel exhause emissions and noise due to higher train frequencies and speeds, (5) continuation of an 8 to 15 minute time delay at New Haven due to the required equipment change, (6) no alternative sources of fuel if shortages in diesel oil supplies occur, (7) long-term risks associated with escalating fuel costs and (8) poorer performance capabilities.

A second alternative entails abandonment of all electrification and implementation of a turbine locomotive system along the entire Corridor. Although such turbine locomotives have been tested on the NEC and are being used successfully in other areas, conversion to turbine traction presents serious cost, environmental and operational problems. This conversion requires (1) a large initial investment in rolling stock; (2) construction of new major fuel depots in New York, Philadelphia and other cities; (3) initiation of a major retraining program for maintenance personnel; (4) poor utilization of existing electrified rolling stock and hardware; and (5) increased oil requirements. Also, due to safety regulations, this type of locomotive cannot operate in New York City tunnels or Penn Station without a third rail electric traction capability. Use of such equipment further degrades the ambient air quality along the NEC.

A third alternative involves full conversion to a diesel-electric locomotive system along the entire NEC and abandonment of existing electrification. Diesel-electric locomotives are presently in service between New Haven and Boston as well as other areas within the Amtrak/Conrail system and provide a reliable source of power which is readily maintained. If this alternative is selected, no capital expenditures for electrification north of New Haven or maintenance of the electrification system south of New Haven would be required by Amtrak and the construction of a catenary system north of New Haven would be avoided. However, the dismantling of the redundant catenary system would require capital expenditures. Diesel-electric traction requires 93 percent of the prime fuel required for the electric traction option, but relies completely on petroleum based diesel fuel and therefore would consume more petroleum based products than the electric option.[1] In addition to having many of the disadvantages of the turbine equipment, the acceleration rates of diesel-electric equipment are significantly lower than electric locomotives and their use would reduce overall performance of the vehicle system below existing levels.

A fourth alternative is to completely abandon the diesel-electrics and 11.5 KV (1 KV is 1000 volts), 25 Hz system and replace it with a direct current power feed. The estimated peak power requirements (a demand of 30,000,000 volt amps for each train) would require the use of high voltage or specially designed equipment using advanced technology which has not yet been proven reliable. Existing traction motors are designed for relatively low DC Voltages (under 700 volts each). Transmission at 700 volts, for the power needed, would require that power be introduced into the system at frequent intervals, either through increased substations and/or overbuild. This would be cost prohibitive. The Electricity at 25,000 volts

[1]See Section 3.2 for a discussion of energy consumption for each option.

from a feed system (either a third rail or catenary) could not be directly fed to these motors. It would be necessary to convert the electricity from DC to AC, step down the voltage to 700 volts and convert the system back to DC before use. This would require two conversions on the train (extra space and weight and the use of equipment which has not yet been proven reliable, as well as one conversion at the substation.

A third rail power feed at high voltage is not feasible because it would be dangerous to workers and possibly the surroundings at these high feed voltages. A DC catenary feed is possible, but was rejected because it would require, using present technology, the two additional conversions between direct and alternating currents discussed above and vehicle equipment not yet proven reliable at 60 Hz.

The fifth alternative is the full electrification of the entire NEC. As previously mentioned, the Corridor is presently electrified between Washington and New Haven. Electricity is supplied through wires suspended from steel supports called catenaries. The electricity is transferred from the catenary system to the locomotive via a pantograph ( a collapsible frame extending from the locomotive roof) and thereby is supplied to the motors used for tractive power. Advantages associated with full electrification are (1) a power source is provided independent of the availability of one type of fuel; (2) existing electric rolling stock and electrification hardware can be used; (3) excellent acceleration/deceleration characteristics of electric equipment is utilized;[1] (4) air quality degradation is reduced due to reduced emissions from diesel-electric equipment; and (5) characteristic noise levels are lower at all speeds. To fully implement this alternative, the railroad ROW north of New Haven must be electrified and a catenary system will have to be constructed. In addition, electrification requires upgrading or replacement of elements of the existing catenary system south of New Haven and modification of existing vehicles and the purchase of electric traction vehicles.

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[1] Techincal and Economic Analysis of Vehicle/ROW Systems, Task 9, Volume I & II, U.S. Department of Transportation, Federal Railroad Administration, August, 1975.

Electric traction consumes slightly more energy than the diesel-electric option, but the dependence on petroleum based products is eliminated. This system requires increased output from electrical generating stations but this increase is minimal and within the capabilities of the systems servicing the Corridor.[1]

In summary, electrification of the entire NEC provides higher performance capability, less noise generation, improved air quality, avoidance of route realignments to meet travel time goals (due to performance and no engine change at New Haven) and a reduced dependence on petroleum based fuel as a power source.

Electrification Options. Within the decision to electrify the NEC railroad system, there are several alternatives. The existing system south of New York provides electricity at 11 KV, 25 Hz. The system from New York to New Haven is presently being upgraded to 12.5 KV, 60 Hz by the MTA and the Conn DOT. In evaluating which voltage and frequency would be the most cost effective for the NEC railroad system, initial capital investment including cost of converting rolling stock, maintenance costs, and operating costs must be considered. In each case, it is assumed that the existing equipment can be used where possible.

The two main voltage options under consideration for use in the NEC railroad system are 11 KV (12.5 KV is essentially equivalent) and 25 KV. There are several physical characteristics of power transmission which affect the choice of feeder voltage for the system.

Railroad electrification worldwide is moving toward 25 KV and 50 KV commercial frequency systems where possible since total costs are lower to accommodate the very high power requirements of freight trains. For the NEC the 50 KV option was discarded when it was found

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[1] Electrification Systems and Standards, Task 16, Final Report, U.S. Department of Transportation and Federal Railroad Administration.

that in order to get adequate clearances between catenary wire and physical structures, six new tunnels in New York were required at a cost in excess of $400 million and the raising of hundreds of bridges costing several hundred million dollars more was necessary. Further, under NEC conditions, a new 50 KV catenary is no more economical than 25 KV catenary because the mechanical loading of wind and ice coupled with the high tension required to satisfy speed criteria exceeds the electric current capacity requirements.

Power is the product of voltage and current, as the voltage decreases, the current to produce the same power increases. The increase in power requirements needed to achieve anticipated higher speeds and increased number of trains will produce a proportional increase in current if the voltage remains unchanged. As current increases, the conductors (wires) which transmit the power must be made larger. Initial studies of power requirements for an eight car or larger consist indicates that most catenary in the southern end will have to be replaced with larger size wire. Power, however, can be increased by increasing voltage instead of current. A 25 KV feed system permits the use of the smaller, existing conductors.

The 25 KV system has the disadvantage of requiring more clearance between the top of the car and the catenary wire, and between the catenary wire and any structure above it (e.g. tunnel roof, bridges, support beams). Switching to a 25 KV system in the existing electrified section will require minimum additional two inches of clearance from fixed objects such as overhead bridges. In the section which is not electrified, an 11 KV system requires a total of 16 inches of space and the 25 KV system requires a minimum of 18 inches with 27 inches desirable.

An estimate of the cost of initial capital investment, operating costs, and maintenance costs are shown in Table 2-3. As indicated, the 25 KV option is less expensive to build, operate and maintain, and is the recommended system.

Table 2-3
RELATIVE SYSTEM-WIDE COSTS FOR VOLTAGE OPTIONS
(1979 Dollars in Millions)

| | 25 KV-60 Hz Washington-Boston | 12.5 KV-60 Hz Washington-Boston |
|---|---|---|
| Capital Costs | 588 | 730 |
| Annual Operation and Maintenance Costs | 5 | 8 |
| Total | 593 | 738 |

Source: U.S. Department of Transportation, Federal Railroad Administration, Unpublished Technical Data

The two main frequency options considered for the NEC railroad system are 25 Hz and 60 Hz. The primary advantage of the existing 25 Hz system is that its retention would avoid many of the coordination problems associated with making the switch in power. The main disadvantages are:

(1) Higher equipment cost. Conversion and transmission equipment must be purchased and non-standardized 25 Hz equipment requires substantially higher initial costs as well as higher operating and maintenance costs. Inspection of the existing equipment used to convert 60 Hz power to 25 Hz indicates that the equipment is near the end of its useful life.[1] As a result, any analysis of alternative frequencies must assume that the conversion equipment must be replaced. Outside the railroad system there are no other uses that have equipment

[1] Electrification, Task 5, U.S. Department of Transportation, Federal Railroad Administration, August, 1975.

designed for 25 Hz and the cost of the equipment and its maintenance is much higher than the commercial standard 60 Hz equipment. Similarly, since utility company power pools supply power at 60 Hz, the railroad must own, operate and maintain conversion equipment and private transmission lines if 25 Hz power is to be utilized.

(2) Transmission lines cause the catenary system to be more visible. Once power is converted to 25 Hz, it must be transmitted along the Corridor at high voltage unless a much more expensive system involving many small converters at substations is used. These transmission lines presently exist south of New York and are frequently carried high above the normal catenary support structure. This may make the electrification system more obtrusive and less acceptable north of New Haven.

(3) Higher maintenance costs are associated with the 25 Hz system because of replacement costs.

(4) A 60 Hz system is being installed by MTA/Conn DOT. Therefore, certain 25 Hz rolling stock cannot be used between New York City and New Haven without additional conversion to accommodate 60 Hz operations.

(5) Rolling stock operating on the New Jersey Long Branch would require dual frequency capacity since this line is being electrified at 60 Hz.

The most significant advantage of a 60 Hz system is that standardization of electrical equipment will result in substantially less expensive initial capital and operating costs. (Commercial power is 60 Hz and can be purchased directly.) This frequency is being established as a standard for electrification throughout the United States.

The main implications of a 60 Hz system are:[1,2]

(1) Equipment used by electrified commuter trains which now operates at 25 Hz would require modification for use on the Corridor.

(2) The conversion to 25 KV requires greater vertical clearances or modifications to existing electrical systems to accommodate increased losses due to the higher freqencies. Both of these result in disadvantages which were discussed in the voltage section

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[1] Electrification, Task 5, U.S. Department of Transportation, Federal Railroad Administration, August, 1973.

[2] Electrification Systems and Standards, Task 16, U.S. Department of Transportation, Federal Railroad Administration, November, 1976.

(3) More electrical interference requiring more sophisticated noise (static) suppression equipment. Such interference occurs when communication lines closely parallel the catenary (or transmission) lines for long distances.

(4) The existing track signal circuit on the NEC which presently operates at a 100 Hz would need modification because of possible interference from the 60 Hz main power system.

Estimates of the costs of initial capital investment, operating costs, and maintenance costs for each option indicate that retaining the 25 Hz system requires a far greater initial investment and greater operation and maintenance budgets. Once it had been determined that the existing voltage, 11 KV, was not sufficient to supply the needed power without major modifications, the decision to convert the entire system to the more common 60 Hz system in light of the above factors becomes the preferred option. Table 2-4 shows a comparison of five of the options available, namely:

Option A: A mixed system, 11 KV, 25 Hz between Washington and New York, and 12.5 KV, 60 Hz between New York and Boston.

Option B: A uniform 12.5 KV, 60 Hz system.

Option C: A uniform 25 KV, 60 Hz system.

Option D: A mixed system: 25 KV, 60 Hz from Washington to New York; 12.5 KV, 60 Hz from New York to New Haven; and 25 KV, 60 Hz from New Haven to Boston.

Option E: A mixed system: 25 KV, 60 Hz from Washington to New York, and 12.5 KV, 60 Hz from New York to Boston.

As shown, Option D is the least expensive. This is followed closely by the uniform 25 KV, 60 Hz system. The proposed action is to plan for conversion of the entire Corridor to 25 KV, 60 Hz. Initial work will be to convert the sections between Washington and New York and build the section between New Haven and Boston. As the recently purchased equipment on the New York to New Haven section of MTA/CTA is replaced, that section of the NEC will be converted to 25 KV.

## Table 2-4

### COST COMPARISON OF TRACTION POWER ALTERNATIVES
(Millions)

| Option | A | B | C | D | E |
|---|---|---|---|---|---|
| | Mixed 11 KV 25Hz | 12.5KV 60Hz | 25KV 60Hz | Mixed 25KV 60Hz | Mixed 25KV 60Hz |
| **D.C. - N.Y.** | | | | | |
| Catenary | $ 80 (80) | $ 80 (80) | $ 17 (17) | $ 17 (17) | $ 17 (17) |
| Substations | 47 (50) | 62 (66) | 39 (41) | 39 (41) | 39 (41) |
| Conversion Equip. | 69 (73) | 0 ( 0 ) | 0 ( 0 ) | 0 ( 0 ) | 0 ( 0 ) |
| Transmission | 48 (48) | 45 (45) | 15 (15) | 15 (15) | 15 (15) |
| Bridges | 0 ( 0) | 0 ( 0) | 2 ( 2) | 2 ( 2) | 2 ( 2) |
| Tunnels | 0 ( 0) | 0 ( 0) | 5 ( 5) | 5 ( 5) | 5 ( 5) |
| Signals | 33 (33) | 58 (58) | 42 (42) | 42 (42) | 42 (42) |
| **Rolling Stock Conversion | 0 ( 0) | 44 (44) | 44 (44) | 44 (44) | 44 (44) |
| | $277 (284) | $289 (293) | $164 (166) | $164 (166) | $164 (166) |
| | 12.5KV 60Hz | | | 12.5KV 60Hz | 12.5KV 60Hz |
| **N.Y. - N.H.** | | | | | |
| Catenary | 17 (17) | 17 (17) | 15 (15) | 17 (17) | 17 (17) |
| Substations | 13 (13) | 13 (13) | 8 ( 9) | 13 (13) | 13 (13) |
| Conversions Equip. | 0 ( 0) | 0 ( 0) | 9 ( 0) | 0 ( 0) | 0 ( 0) |
| Transmission | 12 (12) | 12 (12) | 4 ( 4) | 12 (12) | 12 (12) |
| Bridges | 0 ( 0) | 0 ( 0) | 0 ( 0) | 0 ( 0) | 0 ( 0) |
| Signals | 10 (10) | 10 (10) | 6 ( 6) | 10 (10) | 10 (10) |
| **Rolling Stock Conversion | 3 ( 3) | 0 ( 0) | 35 (35) | 0 ( 0) | 0 ( 0) |
| | 55 (55) | 52 (52) | 68 (69) | 52 (52) | 52 (52) |
| | 12.5KV 60Hz | | | 25KV 60 Hz | 12.5KV 60 Hz |
| **N.H. - BOS** | | | | | |
| Catenary | 87 (87) | 87 (87) | 81 (81) | 81 (81) | 87 (87) |
| Substations | 28 (30) | 28 (30) | 18 (19) | 18 (19) | 28 (30) |
| Conversion | 0 ( 0) | 0 ( 0) | 0 ( 0) | 0 ( 0) | 0 ( 0) |
| Transmission | 31 (31) | 31 (31) | 12 (12) | 12 (12) | 31 (31) |
| Bridges | 23 (23) | 23 (23) | 30 (30) | 30 (30) | 23 (23) |
| Signals | 25 (25) | 25 (25) | 22 (22) | 22 (22) | 25 (25) |
| Rolling Stock Conversion | 0 ( 0) | 0 ( 0) | 0 ( 0) | 0 ( 0) | 0 ( 0) |
| | 194 (196) | 194 (196) | 163 (164) | 163 (164) | 194 (196) |
| SUB-TOTAL | 526 (535) | 535 (541) | 395 (399) | 379 (382) | 410 (414) |
| REPLACEMENT VEHICLES | 189 (189( | 189 (189) | 189 (189) | 189 (189) | 189 (189) |
| GRAND TOTAL | 715 (724) | 724 (730) | 584 (588) | 568 (571) | 599 (603) |
| Annual Maintenance and Operating Cost (Vehicle and Fixed Plant) | 11 ( 11) | 8 ( 8) | 5 ( 5) | 7 ( 7) | 7+( 7+) |
| TOTAL | (735) | (738) | (593) | (578) | (700+) |

* Does not include costs to relocate catenary in order to realign curves for 150 mph operations.

** Includes cost of replacing some outlawed PCB filled transformers.

## 2.6 ROUTE ALTERNATIVES

### 2.6.1 NEW RAIL CORRIDOR

High speed rail service in the Northeast Corridor could conceivably be implemented on a number of alternate transportation corridors including the existing Boston-Washington Amtrak mainline. The existing mainline is not an ideal corridor from an operational standpoint: the number and severity of curves make attainment of the congressionally required time goals difficult because of low operating speeds. Thus, the alternative of a totally new ROW has appeal particularly when considering the long-term technological potential of very high speed (200 mph and higher) ground transportation systems.

The cost and environmental problems associated with a new rail corridor were discussed in the previous section in the assessment of 200 mph HSR and TACV systems. Land acquisition and tunneling costs[1] for a new transportation corridor are estimated to total $927 million for land, labor and material prices (1972 dollars). To establish an operable system, the cost of entirely new track structures, overhead and undergrade bridges, electrification, signaling, and service facilities would have to be added. In short, implementating HSR service on an entirely new corridor would be extremely expensive and greatly exceed authorized funding. Given this constraint in addition to the status of high-speed ground transportation technology documented earlier, and the expected socio-economic and environmental impacts of a new Corridor alternative, it is apparent that this would not be a feasible alternative.

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[1] High Speed Ground Transportation Alternatives Study, U.S. Department of Transportation, Federal Railroad Administration, 1973.

## 2.6.2 SOUTHERN NEW ENGLAND INLAND ROUTE

The proposed action involves physical improvements to the NEC mainline as presently defined by law[1] and operated by Amtrak: Washington to Boston via Baltimore, Philadelphia, New York, New Haven, and Providence. A major sub-corridor alternative route, however, is the Southern New England Inland Route: New Haven to Boston via Hartford, Springfield, and Worcester (Figure 2.3).[2] Briefly, the Inland Route is an important alternative to the proposed shoreline routing since overall route mileage is comparable, both are two track unelectrified systems, and the population potentially served by the Inland Route is substantially larger than that served via the shoreline. The New Haven-Springfield segment of the Inland Route is owned by Amtrak and currently supports a substantial amount of Amtrak service.

The alternative under consideration involves physical improvements to the Inland Route resulting in system performance equivalent to that contemplated under the proposed action (i.e., travel times of 3 hours, 40 minutes from New York to Boston and 2 hours, 17 minutes from New Haven to Boston) and no investment in improvements to the existing mainline between New Haven and Boston (the Shoreline Route).

<u>Ownership</u>. The Shoreline Route between New Haven and the Rhode Island-Massachusetts border is owned by Amtrak. The remainder of the route (Rhode

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[1] Railroad Revitalization and Regulatory Reform Act of 1976, Section 703 (1) (A)

[2] The Inland Route was identified as a potential route alternative by the Secretary of Transportation in <u>Recommendations for Northeast Corridor Transportation</u>, 1971.

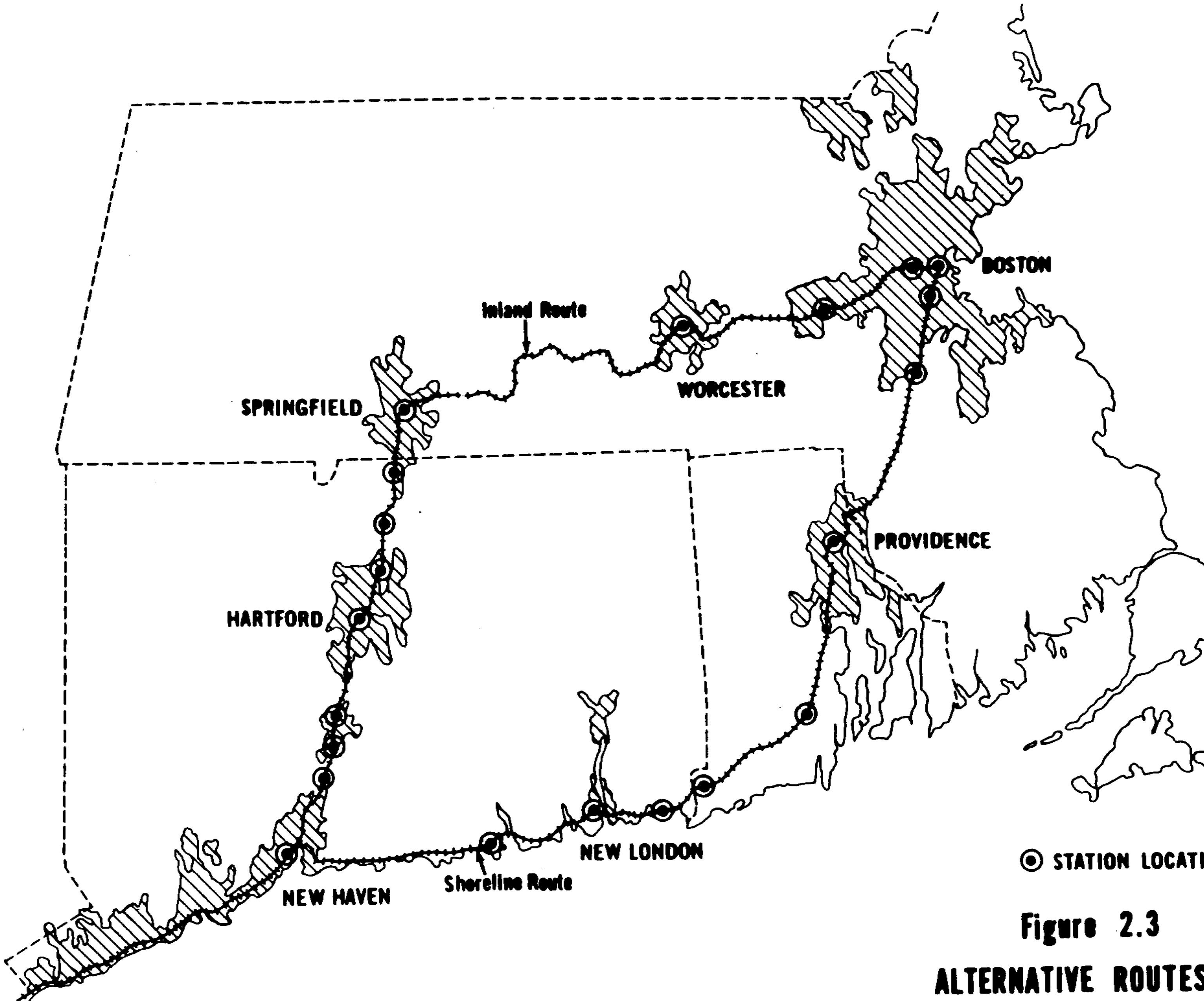


**Figure 2.3**

**ALTERNATIVE ROUTES: NEW HAVEN TO BOSTON**

Island border to Boston) is controlled by the Massachusetts Bay Transportation Authority (MBTA), which has an agreement with Amtrak to operate and maintain this segment. Inland Route ownership is divided three ways: Amtrak (New Haven to Springfield), Conrail (Springfield to Framingham), and MBTA (Framingham to Boston).

Congress provided for Amtrak ownership of all NEC properties except those controlled by commuter authorities. This provision reflected the conclusion by USRA and Congress that the dominant user of the NEC properties should control them, particularly in view of the special potential for operation conflict between high speed passenger and freight service. Operational problems are to be resolved by an NEC operations review panel created by authority of the legislation.

Physical Characteristics. Station to station, the Inland Route is 4.6 miles longer than the Shoreline Route (Table 2-5). This additional mileage would require Inland Route trains to attain an average speed (including stops) which is two miles per hour greater than that required on the Shoreline Route (70.8 mph vs. 68.8 mph) if the proposed New Haven-Boston travel time of 2 hours, 17 minutes is to be met. Both alternative routes are two-track systems without electrification. The condition of the existing track structures is reflected in the maximum speeds which passenger trains can travel. On the Shoreline, passenger train speeds of 70-80 mph are allowed over approximately 80 percent of the route. The remainder of the route is restricted to speeds under 70 mph due to curves, station areas, etc. By contrast, existing conditions on the Inland Route restrict passenger train speeds to 60 mph over most of the New Haven - Springfield segment and 50 mph over most of the Springfield-Boston segment.

As indicated, track curvature is a limiting factor in the attainment of high operating speeds, the amelioration of which involves both high cost and potential environmental impact. With adequate superelevation (differential rail heights) curves up to one degree in curvature will safely permit operating speeds of 120 mph. Therefore, the number and cumulative mileage of curves exceeding one degree were tabulated for the alternative routes. While the Inland Route has more miles of curves, the

Table 2-5

PHYSICAL CHARACTERISTICS OF ALTERNATE ROUTES:

NEW HAVEN TO BOSTON

| | Shoreline | | Inland Route | |
|---|---|---|---|---|
| Route Mileage | 156.9 mi | | 161.5 mi | |
| Maximum Train Speeds (Passenger trains) | Speed | Miles | Speed | Miles |
| | 79 | 95.1 | - | - |
| | 70-75 | 33.0 | - | - |
| | Below 70 | 28.8 | 60 | 53.6 |
| | | | 50 | 87.4 |
| | | | Below 50 | 20.5 |
| Crossing at Grade | | | | |
| Public | 23 | | 38 | |
| Private | 26 | | 39 | |
| Total | 49 | | 77 | |
| Curves (degrees) | Number | Miles | Number | Miles |
| 0 - 1 | N/A | 114.4 | N/A | 113.8 |
| 1 - 2 | 65 | 21.8 | 62 | 23.6 |
| 2 - 3 | 41 | 9.9 | 49 | 13.6 |
| 3 - 4 | 23 | 5.9 | 24 | 7.6 |
| 4 - 5 | 10 | 2.6 | 8 | 1.7 |
| over 5 | 9 | 2.3 | 6 | 1.2 |
| Total curves over 1° | 148 | 42.5 | 149 | 47.7 |
| Grades | Miles | | Miles | |
| .75% - 1.0% | 2.0 | | 12.6 | |
| over 1.0% | - | | 3.7 | |
| Number of Bridges | | | | |
| Undergrade | 204 | | 199 | |
| Overhead | 191 | | 201 | |
| Total | 395 | | 400 | |

Shoreline Route has a greater mileage of severe (over four degree) curves.

Railroad grade also influences operational speeds. A maximum grade standard of 0.7 percent is recommended for the NEC railroad system to avoid speed reductions (especially for freight trains).[1] The Shoreline is the superior alternative in terms of grades, having only two miles of track with grades above 0.75 percent, while the Inland Route has 12.6 miles above 0.75 percent, and 3.7 miles greater than one percent.

In addition, crossings at grade level present a serious safety concern. The Inland Route has 28 more grade crossings than exist on the Shoreline Route.

The number of bridges, both undergrade and overhead, is virtually identical for the two routes. Both types of bridges are major cost items in upgrading for high-speed service. Undergrade spans where structural deficiencies exist must be rehabilitated or replaced. Overhead bridges where vertical clearance is insufficient for introduction of electrification must be raised or the rail profile lowered.

There are eight stations presently receiving Amtrak service on the Shoreline Route (excluding New Haven and Boston South Station). Improvements at three stations, New London, Providence, and Route 128, will cost approximately $35 million. Eleven stations along the Inland Route are presently served (seven of which are in Connecticut). If this route were selected, Hartford, Springfield, and Worcester would be the most likely candidates for station improvement. New stations were recently constructed in Springfield and Worcester and preliminary designs for rehabilitation of Hartford's Union Station have been drawn as part of regional transportation planning activities.

Operational Characteristics. Between New Haven and Boston, the present travel time for daily trains is 2 hours and 57 minutes. A running

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[1] NECIP Track and Structures Standards Development, Task 3, U.S. Department of Transportation, Federal Railroad Administration, 1975.

time of 3 hours, 40 minutes was estimated for the Inland Route under existing conditions. Before being discontinued in 1975, Amtrak's Inland Route train operated on a 3 hour, 55 minute schedule and was 15 minutes longer than current travel estimates due to a greater number of intermediate stops. Thus, a travel time improvement of 1 hour, 23 minutes and 26.8 mph would be required on the Inland Route to reach the same standards achievable with a 40 minute and 15.6 mph improvement on the Shoreline Route (Table 2- 6).

Table 2-6

TIME/SPEED IMPROVEMENTS REQUIRED FOR ALTERNATE ROUTES: NEW HAVEN TO BOSTON

| Route | Miles | Time | Average Speed |
|---|---|---|---|
| Shoreline (existing) | 156.9 | 2:57 | 53.2 |
| Shoreline (improved) | 156.9 | 2:17 | 68.8 |
| Required Improvements | | 0:40 | 15.6 |
| Inland (estimated) | 161.5 | 3:40 | 44.0 |
| Inland (improved) | 161.5 | 2:17 | 70.8 |
| Required Improvements | | 1:23 | 26.8 |

Evaluation of the physical and operational characteristics of these alternate route leads to the following conclusions:

(1) The data sources reviewed did not indicate a substantial cost differential between the alternative routes for improvements to curvature, bridges and stations and for introduction of electrification.

(2) The Shoreline Route is superior in terms of vertical alignment and grade crossings. The impact of adverse grades on the Inland Route train performance would have to be balanced by further improvements in other system elements. Elimination of the 28 additional grade crossings on the Inland Route would increase program costs and affect local accessibility and community cohesion.

(3) Current track conditions on the Shoreline Route are far superior for high speed passenger train use. Travel time improvement over existing conditions on the Inland Route is more than twice that required for the Shoreline Route (83 minutes vs. 40 minutes).

Freight Operation. The two line segments which make up the Inland Route are major routes for the movement of freight to and from New England. Conrail funnels its New England traffic through Selkirk yard near Albany, New York. From Selkirk, the great majority of Conrail trains are routed via the Boston-Albany mainline, making it the most densely traveled freight corridor in New England (Figure 2.4).[1]

Between Springfield and Boston, freight density is over 20 million gross ton miles per year (MGTM). Nine to thirteen scheduled through freight trains per day are required to haul this tonnage. In addition, local freights utilize the line in sections, adding two to four train movements per day along most of the segment. The Springfield-New Haven line is also a major freight route which accommodates the greatest portion of traffic terminated by Conrail in the State of Connecticut. Freight density on this segment is in the range of 5 to 10 million gross ton miles per year, hauled by 2 to 6 through freights per day plus locals.

By contrast, the Shoreline east of New Haven is lightly used for freight. With the exception of the 20 mile section between Providence and Mansfield, Massachusetts, density on the Shoreline is under 5 million gross ton miles per year. Given this level of freight use, the existing two track system has been judged adequate for improved passenger service with limited improvements to increase flexibility and capacity. The Penn Central/Conrail preference for routing New England traffic via Selkirk is, therefore, beneficial to the NEC system if the Shoreline routing is adopted. Traffic control is facilitated, maintenance costs are reduced, and safe

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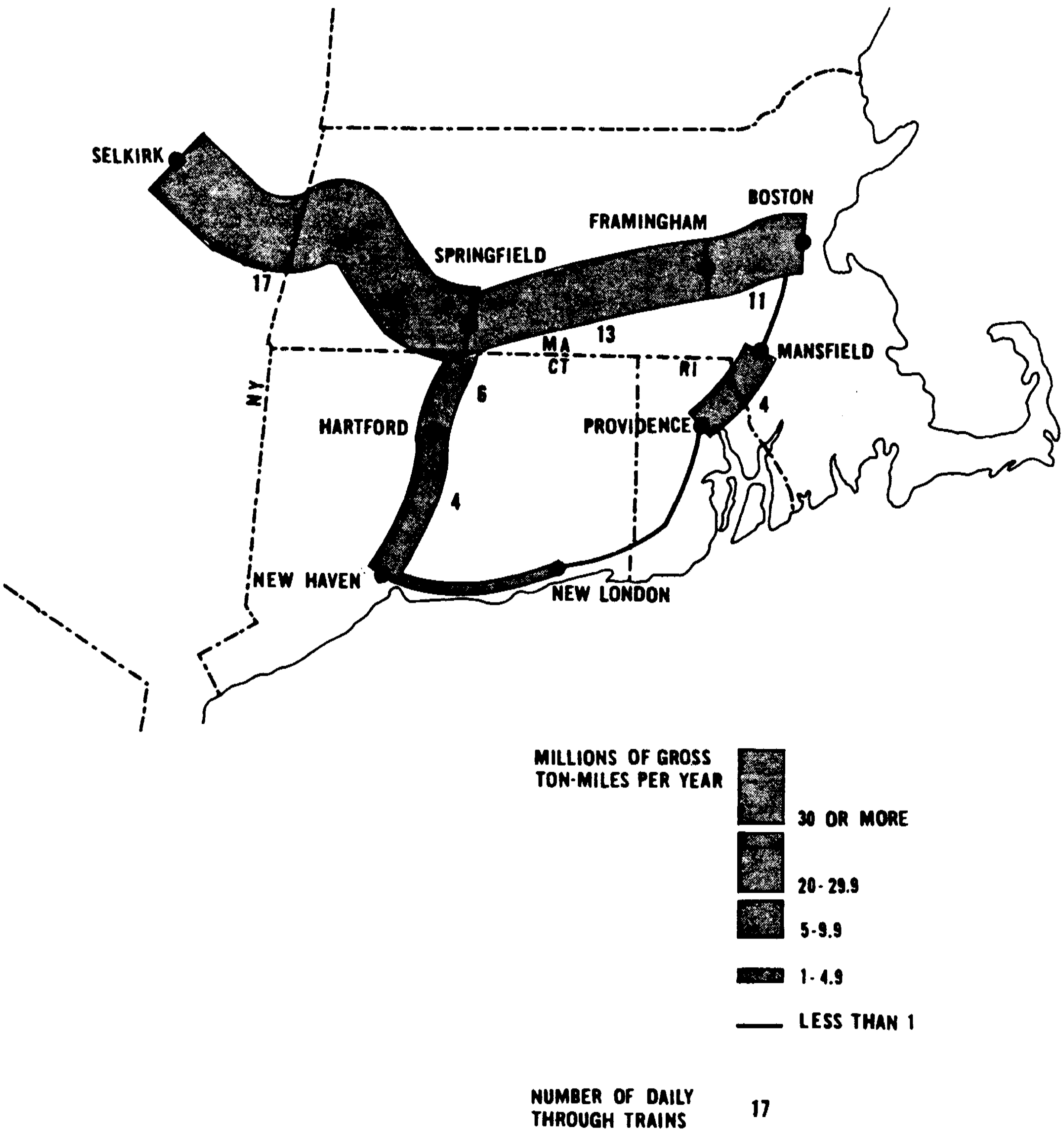
[1] Final Standards, Classification, and Designation of Lines of Class I Railroads in the United States, U.S. Department of Transportation, January, 1977.




Source: U.S. Department of Transportation, Final Standards, Classification and Designation of Lines of Class 1 Railroads in the United States, 1977.

**Figure 2.4**

**FREIGHT DENSITY - SHORELINE & INLAND ROUTES**

operation is enhanced.

If, on the other hand, the planned Corridor intercity passenger trains were added to existing freight volume on the Inland Route, operational conflicts could be expected which would impact both the attainment of NEC system performance objectives (particularly the goal of 80 percent on-time operation) and the efficient movement of freight to and from New England. Unless freight operations are completely reorganized to run primarily at night (creating maintenance of way and other problems) joint passenger/freight operation on the two-track system on the Inland Route would require construction of additional facilities. Even with its low level of freight operations, the Shoreline Route will require interlocking improvements for flexibility. Passing sidings may also be necessary in some sections. Such improvements would not be sufficient to accommodate freight density of the Inland Route, however. At a minimum, a number of parallel sidings would be required along the route to allow passenger trains to overtake freights. Provision of sidings is far from a complete solution because delays to freight movement would still occur. Finally, the greater weight of freight trains would cause more rapid deterioration of high speed track structures resulting in higher maintenance costs and reduced passenger comfort.[1]

Considering the ownership and/or physical conditions of alternative freight routes, removal of through freights from the Inland Route to reduce these capacity and maintenance cost constraints could be accomplished only at high cost to Conrail. Justification of such an alternative would be difficult.

Existing Passenger Service. There is presently no through passenger service between Boston and New Haven via the Inland Route; Amtrak discontinued a daily round trip in February, 1975. Three types of Amtrak

[1] NECIP Track and Structures Standards Development, Task 3, U.S. Department of Transportation, Federal Railroad Administration, 1975.

services are provided on segments of the route. They are the recently implemented Boston to Chicago Lake Shore Limited; through trains between Springfield and Washington; and Budd car (i.e., self-propelled diesel) service between New Haven and Springfield.

The Boston-Chicago service is provided once daily in each direction with intermediate stops at Back Bay, Framingham, Worcester, and Springfield. The MBTA presently operates the only existing Inland Route commuter service on this segment, comprised of 12 trains per day between Framingham and Boston. Six daily Amtrak through trains are presently routed via the New Haven-Springfield line with intermediate stops at Meriden, Berlin (New Britain), and Hartford on all trains and Wallingford, Windsor, Windsor Locks, Thompsonville (Enfield) on some trains.

Budd cars offer the most frequent service on the New Haven-Springfield line. Five cars per day in each direction serve New Haven to Springfield, and one additional train makes a New Haven-Hartford run in both directions. Departure times are spread through the daylight and early evening hours. Stops are made between New Haven and Springfield at the same stations served by the through trains.

The States of Massachusetts and Connecticut are presently comtemplating institution of Inland Route service in concert with Amtrak under the provisions of Section 403 (b) of the Rail Passenger Service Act. (Section 403 (b) provides for introduction of service routes where states agree to subsidize one-half of any operating loss.) The Connecticut DOT conducted a latent demand survey to determine interest in the service. The results were inconclusive. Initial discussions have been held with Amtrak, but Amtrak is deferring and decisions on new services pending a system-wide route productivity study by FRA are expected this summer. A Section 403(b) approach should provide sufficient service to determine the Inland Route demand in actual operation without a heavy investment in physical improvements.

In 1974, the metropolitan population along the Inland Route was twice that along the Shoreline (Table 2-7). Thus, NEC rail service via the Inland Route would serve a larger population base although the increase is small (4 percent) in terms of total NEC population. The assumption might then be made that the Inland Route alternative would generate a higher level of system-wide patronage and revenue.

Table 2-7

METROPOLITAN AREA POPULATION
SHORELINE VS. INLAND ROUTE
(1975)

| SHORELINE ROUTE | | INLAND ROUTE | |
|---|---|---|---|
| New London-Norwich | 240,000 | Hartford-New Britain-Bristol | 1,058,700 |
| Providence-Warwick-Pawtucket | 854,000 | Springfield-Chicopee-Holyoke | 589,700 |
| | | Worcester-Fitchburg-Leominster | 648,400 |
| Total Metropolitan Population Between New Haven and Boston | 1,094,000 | Total Metropolitan Population Between New Haven and Boston | 2,296,800 |
| Total Corridor Population | 30,051,200 | Total Corridor Population | 32,263,900 |

Demand and revenue projections were made for 1985, assuming a frequency of 17 trains per day and a New Haven-Boston trip time of 135 minutes.[1] For 1985, an improved Inland Route was projected to generate 393 more daily one-way passengers (and approximately $3.3 million more annual revenue) over an improved Shoreline Route. Assuming that a ten percent return on investment was required and that facilities would have a 35 year service life, this additional revenue would justify a $32.1 million greater investment on the Inland Route than on the Shoreline Route. Yet the Inland Route patronage advantage over the Shoreline Route was projected to increase only 13 percent between 1975 and 1985 while total system patronage was projected to increase 33 percent in the same period. This is due to a higher projected rate of population growth along the Shoreline which, if continued, over the long term, would reduce the patronage advantage of the Inland Route.

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[1] Evaluation of Alternative Improved Rail Routes Between New Haven and Boston, U.S. Department of Transportation, 1972.

Given the lower growth rates now forecasted by the states, any major change in relative advantage will likely take substantially longer to develop.

While detailed cost comparisons were not made, available information on the physical condition of both routes indicated that the Inland Route would cost substantially more to improve for high speed service than the Shoreline Route and the differential would exceed $32 million justified on the basis of potential patronage.

Implementation Time. NEC railroad system planning and engineering work is proceeding toward implementation of high speed rail service by 1981, as mandated by Congress in the 4R Act. Preliminary engineering work including the Shoreline has been underway since 1974. Adoption of the Inland Route alternative at this stage would involve substantial additional engineering in order to inventory and identify the necessary improvements in detail. More important, the time required for these studies and for planning and negotiation of satisfactory operating arrangements with Conrail would undoubtedly preclude the introduction of high-speed rail service in 1981, as mandated by Congress.

Natural Environment. Within the natural environment, many different habitat types are present along both the Shoreline and Inland Routes. However, to simplify the comparison, only wetlands upon which the ROW generates a direct impact are considered because wetlands are considerably more productive and environmentally sensitive than other land forms. There is generally a greater diversity of life and often a greater resistance to minor environmental disturbances in wetlands than in other less diverse land forms such as forests[1] and deserts[2].

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[1] "Effects of Recreational Use on Forested Sites", Brown, J.H., S.P. Kalisz and W.R. Wright, Environmental Management, Volume 1(5) (in press), 1977.

[2] "The Impact of Off-Road Vehicles on a Desert Ecosystem", Vollmer, A.T., G.G. Maza, F.B. Turner, and S.A. Bambery, Environmental Management, Volume 1(2), 1977.

The Shoreline Route between New Haven and Boston is adjacent to approximately 57 miles of primarily marine wetlands while the Inland Route is adjacent to 42 miles of wetlands.

Thus, the Shoreline Route may impact 26 percent more wetland area than the Inland Route. However, the Inland Route alternative would generate slightly more impact on the natural environment than would the Shoreline Route because: (1) inland wetlands are generally smaller and more sensitive to a unit of impact than would be coastal wetlands to the same unit of impact, and (2) inland wetlands are less environmentally stable and homogenous relative to physical and chemical characteristics as compared to coastal wetlands where the vast marine environment is relatively homogeneous and can better dilute and buffer that unit of impact.

In general, however, it is clear that activities along the NEC will not result in any substantial change in the natural environment except where possible site-specific alternatives involve construction outside the existing ROW.

Air Quality. Since either route would be electrified by the NECIP, the local ROW impact should be minimal because there will be no increase in diesel exhaust emissions along either route as a result of this improvement. In fact, there will be a net reduction in diesel emissions along the Shoreline Route.

On a regional scale, a 1969 study[1] of automotive intercity trips shows a higher number of trips along the New York-Hartford/Springfield-Boston route than along the New York-New London/Providence- Boston Corridor. The potential diversion from the automobile is, therefore, higher; and the Inland Route might be expected to result in a greater decrease in automotive-related emissions. A detailed analysis of this potential improvement is not possible without studying the traffic diversion in detail.

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[1] Status of Transportation System and Plans for Improving Intercity Transportation in the NEC, U.S. Department of Transportation, NECTP-211, December, 1969.

On a local level, each route has the potential to positively impact the commuter traffic along their respective routes. At the present time, the Shoreline Route accommodates substantial commuter service in the region from Providence to Boston. The upgrading of this route is not projected to substantially increase the service level. However, the upgrading of the Inland Route could possibly result in a commitment to initiate commuter service in the Hartford, Springfield, and Worcester areas, which would have further positive impacts on air quality.

Energy. Either route alternative can be expected to divert passenger trips from other modes of travel. As discussed previously, the Inland Route can potentially divert a greater number of intercity trips from the automobile to rail which is a more efficient mode of transportation because the energy consumed per passenger mile is less for the train that the automobile (see Chapter 3.2). Therefore, the Inland Route is potentially more consistent with long term energy conservation goals designed to reduce energy consumption.

Noise. A comparison of the alternative routes in terms of contributions of train noise to the existing noise climate may be made by determining the daily number of train movements by type (intercity, commuter, freight) and computing the noise level for each type. This process reveals both the number and severity of train noise events per day for each route.

Table 2-8 summarizes rail activity on the Shoreline and the Inland Route by segment and type of motive power. The diesel locomotive trains in Amtrak or freight service are estimated to produce peak locomotive noise levels of 96 to 97 dBA primarily resulting from engine noise. The dominant noise source of the self-propelled rail cars now operating on the Inland Route was assumed to be wheel/rail noise,[1] calculated at 83 to 86 dBA at 60 mph between New Haven and Springfield.

[1] NECIP Initial Assessment, U.S. Department of Transportation, Federal Railroad Administration, 1971.

Table 2-8

WEEKDAY TRAIN MOVEMENTS AND PEAK NOISE LEVELS OF ALTERNATIVE ROUTES: NEW HAVEN TO BOSTON, 1977

| | Diesel Locomotive[1] $L_A$ (50')=96-97 dBA | | | Self-Propelled Passenger Cars $L_A$(50')=83-86dBA |
|---|---|---|---|---|
| | Passenger | Freight | Total | |
| SHORELINE | | | | |
| New Haven-New London (51 miles) | 19 | 2 | 21 | 0 |
| New London-Providence (62 miles) | 21 | 2 | 23 | 0 |
| Providence-Boston (44 miles) | 35 | 2 | 37 | 0 |
| INLAND ROUTE | | | | |
| New Haven-Springfield (63 miles) | 6 | 8 | 14 | 12 |
| Springfield-Framingham (77 miles) | 2 | 15 | 17 | 0 |
| Framingham-Boston (21 miles) | 2 | 11 | 13 | 12 |

[1] Includes Amtrak intercity, commuter and freight

SOURCE: Conrail, Amtrak and commuter schedules. (NOTE: Two local freight train movements are included for each segment; some short sections experience a greater number.)

To comparatively assess the potential noise impacts on the Shoreline versus the Inland Routes, a noise exposure index was computed. This index, referred to as the equivalent noise impact (ENI), includes consideration of both the number of people impacted and the sound level to which they are exposed (a complete discussion of the ENI methodology for noise assessment is contained in Section 3.4 of this Statement). The noise levels generated by future train traffic were computed, and superimposed on the average population density in areas traversed by the Shoreline and Inland Routes. These computations allowed the development of ENI values.

The conclusion of the analysis was that the ENI for the Shoreline Route, which is 12,333 at present, would be reduced to 8,991 with NECIP improvements while the Inland Route, which is 12,719 at present, would be reduced only to 10,725, primarily due to the continued dominance of freight trains. Thus, the potential noise impact for the Inland Route would be greater than for the Shoreline Route.

Conclusions. Based on the available information, the following conclusions can be drawn:

- Overall system patronage and revenues would probably be increased by adoption of the Inland Route alternative, assuming that system performance equivalent to that proposed for the Shoreline could be achieved.

- Given the disadvantages of the Inland Route in terms of present operating and physical characteristics, conflicting freight use, and ownership, the cost of implementing the Inland Route alternative is expected to exceed the cost of necessary improvements to the Shoreline Route.

- Commitment of only the available capital resources to the Inland Route alternative would result in system performance substantially below the level mandated by law (and that judged necessary to attain the projected levels of system patronage and revenues).

- Environmental impacts seem to be somewhat greater on the Inland Route but the difference would not be a controlling factor so long as the proposed improvements remain within the existing ROW. (Since there is a need for a large gain in time on the Inland Route, a likelihood exists that major curve realignments would be necessary, thereby increasing the potential for adverse environmental impacts.)

- To meet the required system goals of improved trip times with the available resources by the required date, the proposed routing via the Shoreline between New Haven and Boston is the preferred alternative.

Congress has recognized in the 4R Act that the Inland Route is one of three feeder routes which should be improved, subject to funding availability (4R Act, Section 701(a)(4) and Section 703(1)(A)(iii)). The DOT has subsequently contracted for conceptual studies which will generate cost estimates for feeder line physical improvements. The Inland Route study[1] concluded that an investment of $149 million would be required to upgrade the Inland Route for 90 mph maximum speeds from New Haven to Springfield and 80 mph maximum speeds from Springfield to Boston. These improvements could result in 1,176,000 trips per year on the Inland Route by 1990. Feeder line improvements are identified in the Secretary's Two Year Report among the potential investments which could be made in the Corridor rail network post-NECIP.

### 2.6.3 WASHINGTON, D.C. TO NEW YORK PARALLEL ROUTE

An existing parallel rail line traverses the Corridor between Washington and New York. This parallel line consists of segments of several different railroads and includes portions of the Baltimore and Ohio (B&O), Reading (RDG), Lehigh Valley (LV) and Central of New Jersey (CNJ) railroads. With the establishment of additional trackage and several connections, this line could conceiveably provide a continuous intercity passenger railway from Washington to New York as an alternative to the present Amtrak mainline. This option does, however, have the following undesirable consequences: complex institutional restraints and agreements; the limited physical plant facilities and their poor condition; and the possible displacement of existing traffic on the parallel route.

The section of the route between Washington and Philadelphia is presently owned by B&O, which is part of the Chessie system. This is a solvent railroad and a competitor to Conrail. In order to operate intercity passenger trains on this route, Amtrak would need to either purchase the line or obtain trackage rights.

[1] FRA, NECIP, Feeder Line Conceptual Design: Inland Route, Draft Report, December, 1977.

The 92-mile section between Baltimore and Philadelphia is only a single track system with isolated sidings in several locations. The section of the line between Washington and Baltimore is likely to cause a severe constraint on capacity.[1] Except for the Howard Street tunnel, the line is double tracked, but predominantly signaled for single direction operation on each track. This section presently accommodates eight commuter trains per day and extensive local freight operations which currently serve the industries lining both sides of the route. If high-speed passenger trains were added, the capacity would undoubtedly be exceeded and additional tracks would have to be added. Between Philadelphia and Newark, Conrail owns the parallel line and is presently engaged in an evaluation of the possible diversion of Harrisburg-Newark through freights from the NEC mainline to this route.

Constant use by heavy freight trains on this route has caused a track condition (alignment and gauge) which is not suitable for high-speed passenger train use. Moreover, the required electrification of the route would add considerably to the improvement cost. Since the line is not presently electrified, an entire electrification system, including catenaries, substations, power feeds, etc., would have to be installed.

In summary, the institutional problems, the cost of providing the required condition and capacity and the potential environmental effects associated with upgrading the parallel route for intercity passenger services preclude its consideration as a reasonable alternative. Further investigation in terms of detailed physical plant evaluations and environmental consideration were therefore not warranted. Section 2.7 discusses the option of diverting through freight from the Amtrak-owned NEC mainline to this parallel route.

### 2.6.4 BALTIMORE AREA

Previous analyses of train operations identified the tunnel sections in the Baltimore area as major constraints on the capacity of the Corridor.[2]

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[1] Evaluation of the U.S. Railway Association's Preliminary System Plan, Rail Services Planning Office, Interstate Commerce Commission, April, 1975.

[2] Scenario Development and System Simulation, Task 4, U.S. Department of Transportation, Federal Railroad Administration, June, 1975.

As a result, the Baltimore area has been the subject of intensive study of options available for improving rail operations.

Presently, two mainline rail routes traverse the Baltimore area. These are the B & O and the Amtrak/Conrail lines (Figure 2.5).[1] The B & O route accommodates local and through-freight operations via the Howard Street tunnel while the Amtrak route services its passenger and Conrail freight traffic utilizing the B & P and Union tunnels. Both routes with their respective tunnels possess operating and clearance problems that could be further aggravated by the increased frequency of NEC passenger trains.[2] Also, the Howard Street tunnel has drainage problems during periods of high tide.

The 7,400-foot B & P tunnel between B & P Junction and Fulton is a significant bottleneck to traffic on the Amtrak line. It is a horseshoe shaped tunnel with two tracks available for passenger operations. Tight tunnel clearances require that freight trains with cars of width or height exceeding ten feet, eight inches and fifteen feet, one inch, respectively, use a gauntlet track in the center of the tunnel which prohibits simultaneous use of the tunnel by opposing traffic. Also, Conrail safety regulations require that no trains follow a freight train which has used the gauntlet track into the tunnel until the track has been cleared. Similarly, all northbound freights must stop at the north end of the tunnel in accordance with railroad safety regulations. Based upon these factors, the B & P tunnel figured heavily into the development of alternative plans to the existing route in the Baltimore area.

Three basic alternatives have been considered to alleviate the congestion and increase the capacity for future freight and passenger operations.[3]

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[1]The actual owner of the line is Amtrak. Conrail holds trackage rights for freight operations.

[2]Scenario Development and System Simulation, Task 4, U.S. Department of Transportation, Federal Railroad Administration, June, 1975.

[3]Northeast Corridor Rail System Operations Analysis (Baltimore Route Alternatives), U.S. Department of Transportation, Federal Railroad Administration, June, 1976.

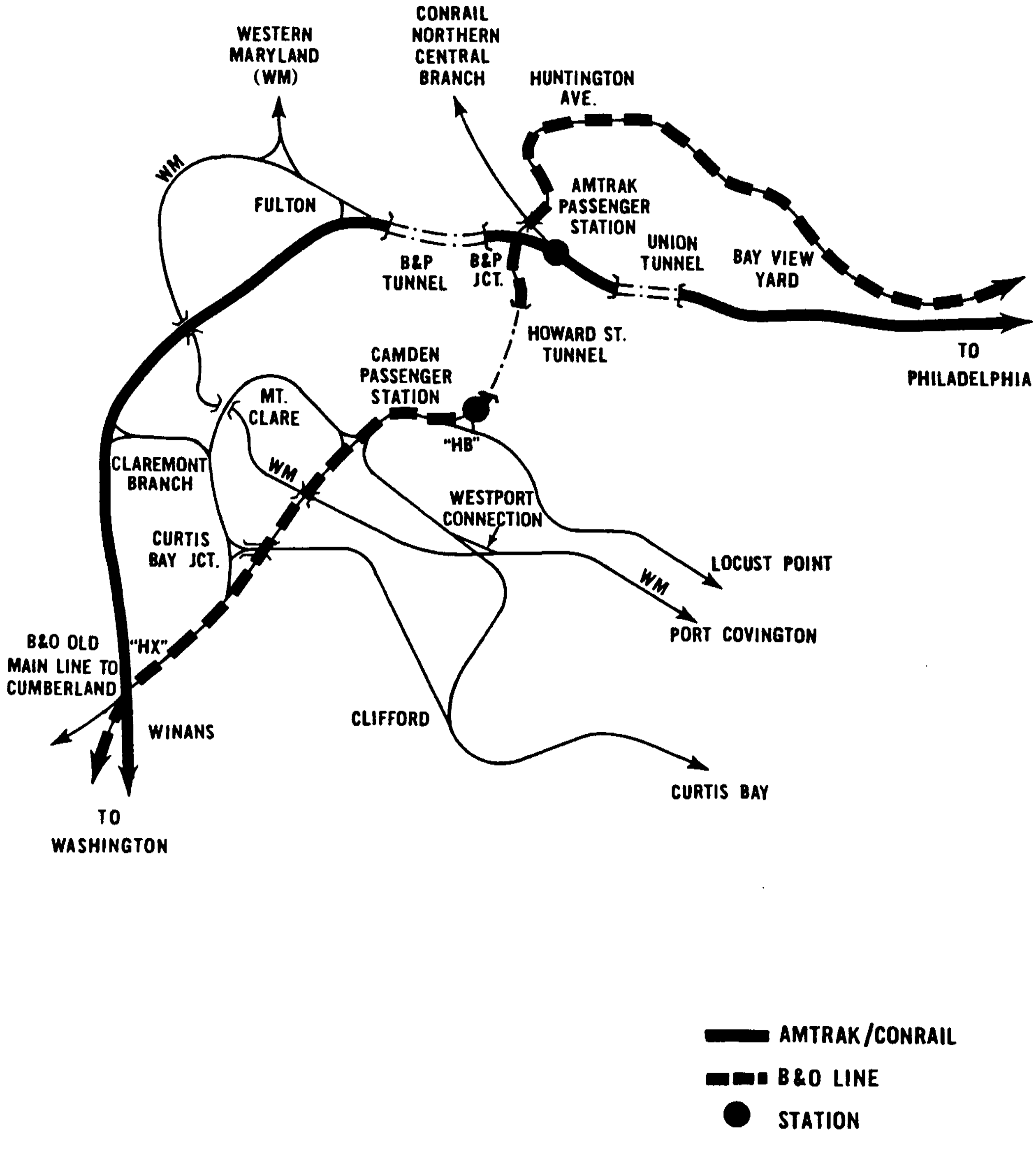


Figure 2.5

BALTIMORE EXISTING MAINLINE ROUTES

Alternative A provides for Conrail through-freight to be routed on the Corridor as far north as Fulton. From Fulton, a new tunnel (the Presstman Street Tunnel) would be constructed and provide a connection to the B & O line at Huntington Avenue (Figure 2.6). The tunnel would be approximately the same length as the Howard Street tunnel with approaches leading from a point just south of the entrance to the existng B & P tunnel. On the north side of the new tunnel, through-freight would operate on the B & O line to a new connection with the Amtrak line at Bay View. Passenger trains would continue to utilize the existing B & P and Union tunnels into Baltimore Penn Station.

The proposed Presstman Street tunnel would be constructed under a residential area and emerge at the south end of the Mt. Vernon Produce Yard. Most of the property rights for the tunnel are owned by Amtrak.

Implementation of this alternative would eliminate delays to passenger trains caused by the congestion of freight traffic and thereby, enhance reliability. Also, freight train speeds and overall travel times would be enhanced. However, construction of a new tunnel and the purchase of additional ROW (existing tunnel easements do not provide sufficient property) would be necessary. In addition, potential negative environmental impacts exist with the construction of a new tunnel.

The second operating plan, Alternative B, comtemplates continued independent operation of B & O and Conrail freight trains (Figure 2.6). This alternative is similar to A in that it routes Conrail through-freight on the Corridor to Fulton, and it also utilizes a proposed new tunnel along the Presstman Street alignment. The difference is that a connection would be made to the Amtrak line via the Northern Central line rather than to the B & O at Huntington Avenue. North of the new tunnel, two exclusive freight tracks would bypass B & P Junction and Penn Station enroute to the Union Tunnels. There would be no interference between freight and passenger services, and the freight train speed limit would be increased from 15 mph to 30 mph. The potential for conflict between this alternative and the Northern Central Rail Transit proposal does exist. The evaluation of potential effects and the full coordination of design would need to be undertaken were this alternative implemented.

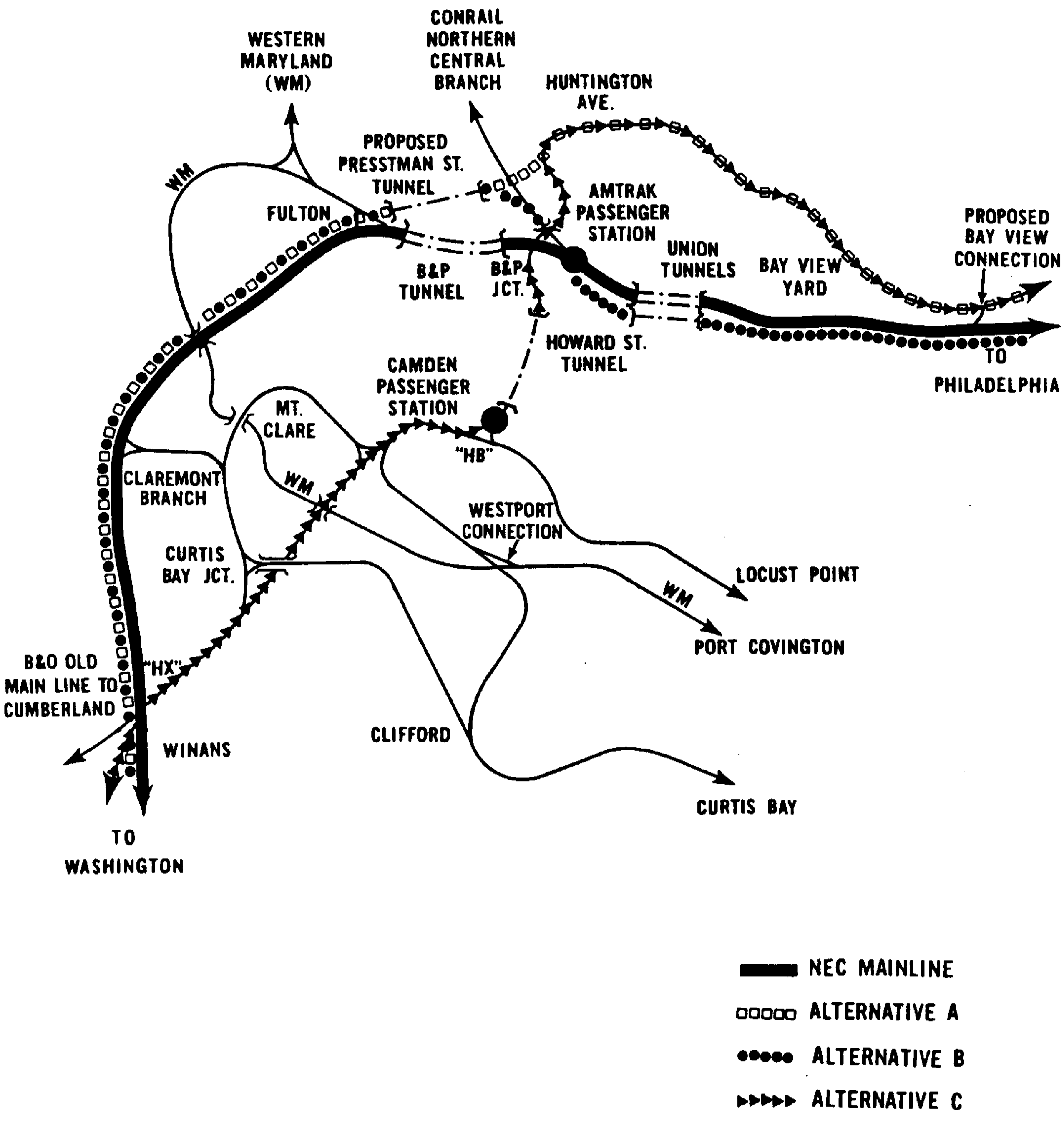


**Figure 2.6**

**SCHEMATIC OF BALTIMORE ALTERNATIVE FREIGHT ROUTES**

Alternative B has benefits similar to A, with the added advantage that it eliminates all dependence on B & O lines; thus, the institutional problem of dual management of operations over a common link would be avoided. By not using any portion of the B & O lines (as described under Alternative A) certain cost items would be avoided, but the major disadvantages to this alternative are still the high cost and potential negative environmental impacts associated with the construction of a new tunnel.

Alternative C which does not involve a new tunnel, would route Corridor freight traffic over the B & O trackage via the Howard Street tunnel. This B & O line would be improved as necessary with NECIP funds, including the required upgrading of the Howard Street tunnel, building two additional tracks between Curtis Bay Junction and the HB connection and revision of several interlockings to facilitate removal of local and switching movements.

Operational simulation of the three alternatives allowed calculation of average run times between Winans and Bay View.[1] Alternative C produced the poorest performance of the three alternatives. In fact, for Conrail trains, the run times are 100 to 150 percent longer than for Alternatives A and B. Alternatives A and B provide similar performance for southbound trains on both B & O and Conrail lines, but there is a three minute advantage in the northbound direction under Alternative A.

Alternative B has the lowest overall implementation costs by approximately $2 million (Table 2-9). The high on-Corridor costs are primarily due to the construction of the new Presstman Street tunnel proposed with this alternative. Costs on-Corridor are least under C by approximately $15 million, while off-Corridor costs are the lowest under Alternative B (Table 2-9).

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[1] Northeast Corridor Rail System Operations Analysis (Baltimore Route Alternatives), U.S. Department of Transportation, Federal Railroad Administration, June, 1976.

Table 2-9

IMPLEMENTATION COST COMPARISON OF BALTIMORE AREA ALTERNATIVES[1]
millions of dollars (1975)

| Item | Alt. A | Alt. B | Alt. C |
|---|---|---|---|
| Costs On-Corridor | $ 90,181 | $ 87,813 | $ 72,746 |
| Costs Off-Corridor | 41,778 | 39,453 | 56,313 |
| TOTAL | $131,959 | $127,266 | $129,059 |

Non-monetary costs such as adverse environmental impacts must also be considered in weighing the alternatives. Since all of the alternative lines, with the exception of the new tunnel, are existing, heavily utilized facilities, changes contemplated under the various alternatives would not result in any significant adverse environmental impacts. There are, however, potential environmental impacts associated with the construction of the new tunnel contemplated under Alternatives A and B. The most significant of these possible impacts include:

- The proposed design requires additional property acquisition beyond the current holdings.
- The alignment passes underneath many two to three story residential buildings, and potential noise and vibration impacts during both construction and operation exist.
- The nature and magnitude of the construction effort could cause adverse short-term impacts (e.g., dust, noise, blasting).
- Utility relocation and traffic disruption would occur in certain areas.

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[1] Northeast Corridor Rail System Operations Analysis (Baltimore Route Alternatives), U.S. Department of Transportation, Federal Railroad Administration, June, 1976.

- The ground water level is up to 25 feet above the proposed tunnel profile; thus the water table would have to be drawn down by deep wells. The potential effects of this must be considered with regard to settlement of existing structures and facilities.
- Considerable amounts of soil and muck generated during construction would have to be disposed.
- Alternate B may require as yet undertermined changes to the Baltimore North Central rail transit proposal.

In summary, of the three basic alternatives identified, Alternative B was evaluated as the best long-range approach to solving the operational/capacity problems in the Baltimore region provided conflicts with local transit/highway proposals can be worked out.[1] As described previously, this alternative assumes complete independence of B&O and Conrail operations, and also the construction of a new Presstman Street tunnel. However current funding and the 1981 operational requirements preclude its implementation. NECIP travel time goals can be accommodated in spite of congestion and delay in the Baltimore tunnel sections by making operational improvements at lower dollar and environment costs elsewhere in the system.[2] The Federal Railroad Administration has recently initiated a comprehensive, in-depth analysis of the Baltimore area rail system for the purpose of ascertaining currently and into the future the nature and extent of operational problems and for developing alternative ways to overcome them. This new study is currently scheduled to be completed in the spring of 1979.

Improvements to the existing B & P tunnel include: rehabilitation of the track structure at the same elevation; incorporation of a new drainage system for the entire length; and various other safety-related improvements (see Section 1.7 of this Statement for further discussion).

### 2.6.5 PROVIDENCE ALTERNATE ROUTE

An alternative rail route exists between the Providence passenger station and East Junction interlocking in Massachusetts (Figure 2.7). The Shoreline Route is utilized by all NEC Amtrak passenger trains north from the Providence passenger station to Pawtucket, where it curves east and

[1] Northeast Corridor Rail System Operations Analysis (Baltimore Route Alternatives), U.S. Department of Transportation, Federal Railroad Administration, June, 1976.

[2] More recent data indicates the cost of the new Presstman Tunnel may exceed $200 million.

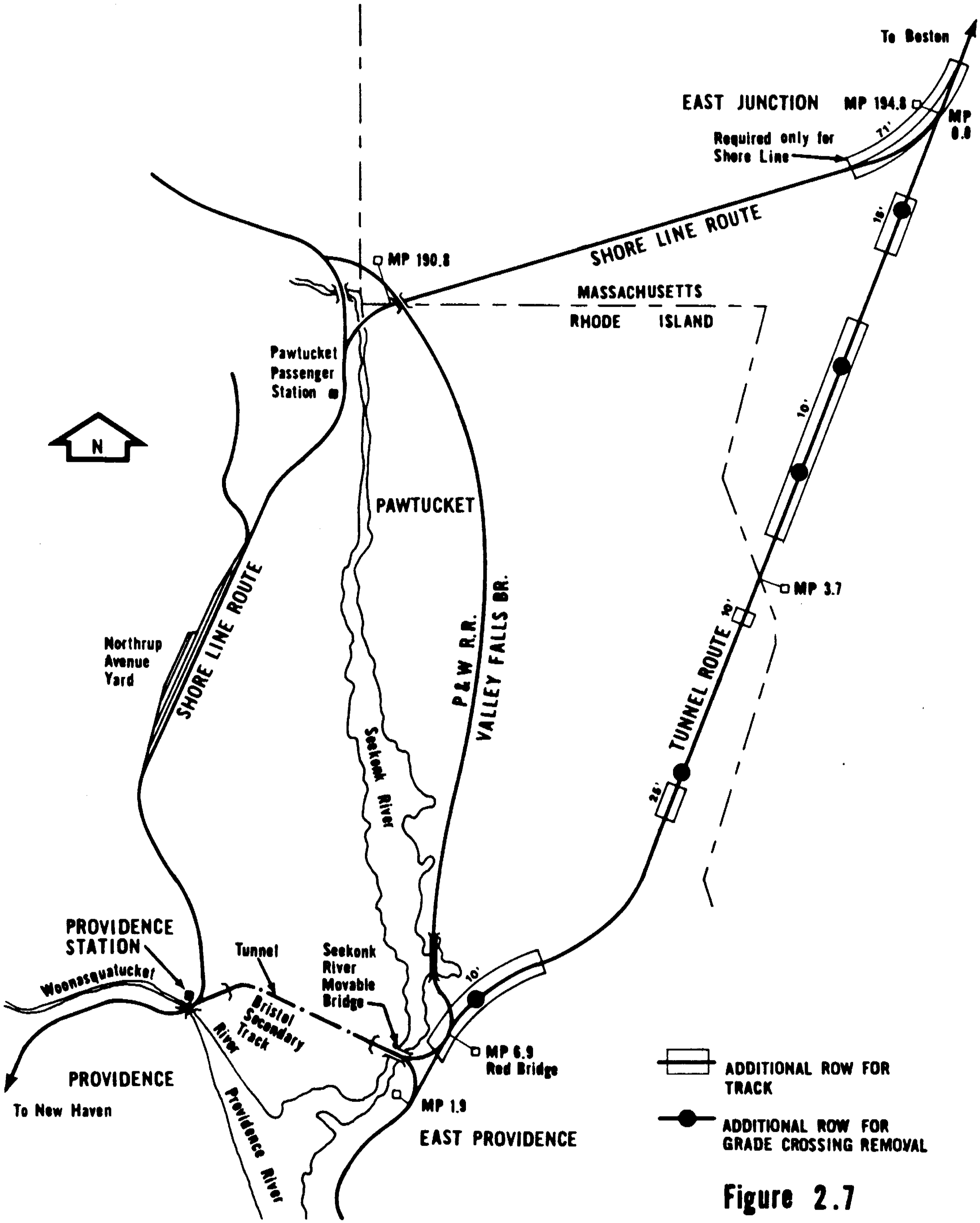


**Figure 2.7**

**ALTERNATIVE ROUTES THROUGH PROVIDENCE**

continues to East Junction. This alternative route, herein referred to as the Providence Tunnel Route, extends eastward from the Providence passenger station over the Bristol Secondary track, through a 5,079 foot tunnel and over the Seekonk River movable bridge. East of the Seekonk bridge the route curves north and continues on to East Junction. The distance between Providence passenger station and East Junction along the Shoreline Route is 9.3 miles. The distance between these two points utilizing the Tunnel Route is 8.9 miles (Table 2-10).

Table 2-10

PROVIDENCE ROUTE CHARACTERISTICS COMPARISON[1]

| Item | Shoreline Route | Providence Tunnel Route |
|---|---|---|
| Distance | 9.3 miles | 8.9 miles |
| Speed Restricting Curves | 19 | 2 |
| Bridges - Overhead | 20 | 3 |
| - Undergrade | 11 | 11 |
| - Movable | 0 | 1 |
| Grade Crossings | 0 | 7 |
| Tunnels | 0 | 1 |
| Cost of Rehabilitation | $29,681,000 | $36,834,000 |
| Estimated Average Maintenance Cost | $ 410,800 | $ 435,000 |
| Operating Time | 9.32 minutes | 7.92 minutes |

The general condition of the Shoreline is good. Continuous use by Amtrak intercity and MBTA suburban trains has necessitated ongoing maintenance efforts along the route. However, the condition of the tunnel route is only fair. Constructed in the late 1880s as a double track railroad, only one track remains today. The route is primarily used for freight movements within the area and little continuous maintenance has occured.

Ownership. Ownership of the Shoreline Route is divided into two sections. The segment from the Providence passenger station to the Rhode Island/Massachusetts border is owned jointly by Amtrak and the Providence and

[1] Route Selection, Providence to East Junction, Task 15.4, U.S. Department of Transportation, Federal Railroad Administration, January, 1977.

Worcester (P & W) Company, with some parcels wholly owned by P & W. The northern section, from the state line to East Junction, is held by MBTA. Conrail owns the Rhode Island portion of the Tunnel route and MBTA owns the Massachusetts portion.

Operation. Amtrak currently operates nine intercity passenger trains in each direction on the Shoreline Route seven days a week. MBTA operates eight suburban passenger service trains in each direction on this route Monday through Friday, four trains on Saturday, and one train on Sunday.

Conrail operates limited freight service on the Shoreline route in the Providence area. The majority of freight movements are between industries and connecting railroads within the area. Twenty-eight freight trains presently operate over the line between Providence and East Junction in a 24-hour period. None of these trains traverse the entire route and only two operate five or more days a week.

Based upon the current and projected level of Conrail's freight train operations, there is no indication that freight movements along the Shoreline will increase greatly in the future. Therefore, potential interference with passenger trains along this route would not be significant.

No intercity or suburban passenger trains presently use the Tunnel Route. Freight operations consist of limited service Monday, Wednesday, and Friday, to industries located along the route. Increased industrial activity necessitating daily service would not interfere with high-speed intercity passenger trains if scheduled properly. A further consideration is that there are existing railroad properties on the Shoreline Route which could easily accommodate a future maintenance-of-way base.

Alignment. Nineteen curves varying from 1.5 degrees 30' to 9 degrees presently restrict train speed on the Shoreline. Minor reconstruction of these curves would increase the attainable speed throughout the line, but only to a limited extent. Only two curves along the Tunnel Route would restrict train speeds. Relocation or realignment of these areas may be considered to increase time savings along the line.

Bridges. Bridge improvements on the Shoreline are required throughout the route. Clearance at 9 overhead bridges must be increased to accommodate the catenary system for electrification.

Fourteen bridges on the tunnel route require replacement of the superstructure due to widespread deterioration. Four bridges, which currently carry one track, require the addition of one new span to accommodate a two-track system.

The Seekonk River movable bridge, located at the west end of a 6 degree curve and just east of the Providence tunnel, has had little repair since 1935 and would require substantial rehabilitation.

Track Structures. The Shoreline Route's four-, three-, and two-track sections between Providence Station and East Junction require substantial track rehabilitation to accommodate high-speed passenger trains. The existing bolted rail must be entirely replaced with continuously welded rail and 25 percent of the ties require renewal.[1] No additional ROW is required for track rehabilitation on this route.

Track rehabilitation on the Tunnel Route would require construction of 7.64 miles of ballasted mainline track. The single existing track must be removed and replaced with double track CWR and new ties. The acquisition of additional ROW necessary to accommodate a double track system along the Tunnel Route could have adverse socio-economic and environmental effects on adjacent areas.

Providence Tunnel. The general condition of the tunnel is good but minor repairs and modifications are needed to eliminate or reduce concrete spalling and leaking. Adequate horizontal and vertical clearance exist to accommodate high-speed electrified passenger train service.

The impact of tunnel rehabilitation and operation on the Providence Tunnel Route would be insignificant. Construction effects of rehabilitation

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[1] Route Selection Providence to East Junction, Task 15.4, U.S. Department of Transportation, Federal Railroad Administration, January, 1977.

would be confined to the interior of the tunnel. Temporary interference with train operations will be minimal as a result of the low level of present traffic.

Grade Crossings. There are seven grade crossings (six public and one private) on the Providence Tunnel Route and none on the Shoreline Route. At least five of the six public crossings would require grade separation projects while the two remaining crossings would be closed. Additional ROW is required for all grade separation projects. Three crossings slated for separation are in residential areas, one in an industrial area, and one in a mixed residential/industrial neighborhood. The King Phillip Road crossing and one recommended for separation (Dexter Road) provide access to a large industrial complex.

The Ferris Avenue crossing is situated in a residential area located between the Ten Mile River and the Turner Reservoir. The area is dominated by single family homes, some within 50 feet of the ROW. Construction of this grade separation will necessitate the acquisition and demolition of several homes and the modification of access to the neighborhood school. Adoption of this alternative would result in decreased land values, and the instrusion of an active railroad into the area.

Fencing. Fencing of the Shoreline Route is expected to have little impact since the route traverses industrial areas at grade and residential areas primarily in below grade, walled sections. Fencing of the Tunnel Route will affect access patterns in some residential/recreational areas of East Providence.

Electrification. As a result of the difference in adjacent land use and the higher track grade, electrification would have a more significant visual impact along the Tunnel Route than along the Shoreline.

Providence Station. Proper layout of station tracks is affected on both routes by bridge piers and the ramps of the proposed I-95 Civic Center Interchange to the west of the station, and by the sharp 9 degree curve at the east end of the station if operation is via the Shoreline. Train operation would be affected by this curve as a result of its adverse impact on tangent platform layout which provides for optimum boarding safety to passengers. The standard clearance of seven inches between the edge of the platform and the end door of a passenger car would be exceeded substantially for a train on the convex side of the platform. The clearance at the end door of a passenger car would not create a greater safety hazard for a train standing on the concave side; however, the additional space between the edge of the platform and the center of the side of a passenger car would present an equal or greater safety hazard to passenger movements on the platform as riders prepare to board or leave the train.

Operation via the Tunnel Route would remove the problem of the 9 degree curve, provide easier access to the entire length of station platforms and alleviate the need for one additional freight track which would be required if operation continues on the existing Shoreline Route.

There is an operating freight yard on the Shoreline north of Providence Station. Existing yard operations should not be affected by operations via either the Shoreline or the Tunnel Route. However, possible route and yard deterioration as a result of Amtrak abandonment of the line due to selection of the Tunnel Route for high-speed service is likely to occur.

Air Quality. Impacts of Providence Route alternative on air quality will depend on whether or not MBTA commuter trains are electrified. If all passenger trains are electrified, there will be a significant decrease in diesel emissions along the Shoreline Route, and no increase along the Tunnel Route, regardless of the route option selected for either service.

If MBTA trains are not electrified, impacts will reflect the route selected for commuter trains. If both Amtrak and MBTA trains continue to use the Shoreline Route, there will be a slight decrease in diesel exhaust due to the Amtrak electrification. If MBTA trains are shifted to the Tunnel Route, there will be a significant decrease in diesel exhaust along the Shoreline Route, but an increase along the Tunnel Route. It seems likely, however, that all equipment operating on the Corridor will be electrified at some time in the future because of operating advantages.

Noise and Vibration. The existing noise environment within 1,000 feet of the Shoreline is influenced by such noise sources as: road traffic (including I-95), local streets, and industrial truck movements, train traffic including intercity passenger, commuter, and local freight; and industrial activity on a large scale. Road traffic tends to dominate the average noise environment in this area and will continue to do so. Improvements in the intercity passenger service associated with the NEC railroad system will consequently result in an insignificant increase in noise levels because these trains are only one component in an environment already dominated by another source along the Shoreline Route.

The existing noise environment along the Tunnel Route is influenced by local street traffic, some industrial truck movement, train traffic consisting of infrequent slow freight trains, and industrial activity on small scale. These sources contribute to an average noise level considerably lower than that associated with the Shoreline.

Noise from increased train traffic due to introduction of high-speed passenger trains on the Tunnel Route will dominate the noise environment within 1,000 feet of the tracks. This would be a significant increase in noise levels and would consequently constitute some degradation of the environment for the nearly 1,300 residences within that distance.

A second potential effect of the Tunnel Route concerns vibrations in buildings in the immediate vicinity of the tunnel. Depending on the trackbed details in the tunnel invert, ground vibrations from train operations could propagate to buildings founded on the same soil and rock strata. In order to quantify the potential problem, a detailed vibration analysis would be required.

<u>Travel Time/Cost</u>. Projected operating time for high-speed intercity passenger trains utilizing the Shoreline Route between Providence Station and East Junction is 9.32 minutes and via the Tunnel Route is 7.92 minutes.[1] The time saved by high speed rail operation via the Tunnel Route is 1.4 minutes.

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[1] <u>Rail System Operation Analysis, Task 17</u>, U.S. Department of Transportation Federal Railroad Administration, December, 1976.

Rehabilitation of the Tunnel Route would cost $37 million as compared to $29.6 million for the Shoreline Route. The Tunnel Route is $7.4 million more expensive but saves 1.4 minutes for a cost per minute saved of $5.2 million. This level of capital investment is low when compared with the cost of other alternative time-saving methods.

Conclusion. The Providence Tunnel Route has not been chosen as an element of the proposed action. While significant times savings and better station platform design are possible, the constraints imposed by lack of Amtrak ownership, high improvement cost, longer implementation time, and potential adverse environmental effects outweight these advantages at the present time. Moreover, NECIP trip time goals can be achieved without this alternative routing.

### 2.6.6 DORCHESTER BRANCH

An alternative access route into Boston is provided by the Dorchester Branch, a two-track line which begins at Readville on the NEC mainline (approximately two miles north of the Route 128 passenger station) and terminates with the mainline at Boston South Station. The Dorchester Branch requires evaluation as an alternate route primarily because of rail transit improvement programs now being developed by MBTA. MBTA, which owns the NEC mainline in Massachusetts, has applied to the UMTA for federal grant assistance to relocate approximately 4.7 miles of the existing Orange Rapid Transit Line. Orange Line service is planned to be accommodated, along with commuter trains and Amtrak intercity trains, on an upgrade section of the NEC mainline between South Cove (just south of Boston South Station) and Forest Hills.[1]

The proposed Orange Line relocation will take approximately 8-10 years and involve replacement of the existing NEC mainline four-track system between South Cove and Forest Hills with a five-track system. It is evident that this project, which is imposed on top of the NECIP for

[1] Final Environmental Impact Statement, Orange Line Relocation and Arterial Street Construction, Urban Mass Transportation Administration and Federal Highway Administration, 1978.

approximately four miles, will not be completed at the same time as other NECIP improvements. One feature of the MBTA project is the diversion of Amtrak trains to the Dorchester Branch which will be improved by MBTA for use during construction of their project.

However, given the complexity of the interface between the two projects, a possible alternative would be to designate the Dorchester Branch as the permanent NEC mainline in this area and improve it for Amtrak intercity service. Three major disadvantages exist for the Dorchester Branch. Service via the Dorchester Branch would deny all intercity service to Back Bay Station. This station is projected to handle 188,000 intercity passengers in 1990 with the improved NEC system. Preliminary engineering done for the Dorchester Branch upgrading project has concluded that electrification would be extremely costly due to the high number of existing overhead bridges with insufficient clearance. If the branch were chosen for the NEC mainline, the NECIP would have to bear the cost of raising these bridges. Finally, it is doubtful that the Dorchester Branch two-track system would have sufficient capacity if commuter rail service were expanded on it at some future date.

These drawbacks seem sufficient to outweigh the coordination and timing problems facing joint implementation of NECIP and the Orange Line Relocation Project.

## 2.7 OPERATIONAL ALTERNATIVES

The designated NEC rail line accommodates four basic types of train operations: through passenger, commuter service, through freight, and local freight.[1] These four types do not necessarily operate on all sections of the route. Nonetheless, they must all be accommodated on a system-wide basis.

The volume of trains and the traffic mix was shown in graphic form in Figure 1.3 of Chapter 1. The section of the route between Philadelphia and New York accommodates the most complex and highest volume of traffic. The section of the route between New Rochelle, New York, and New Haven, Connecticut, also carries a high volume of traffic, but most of these are suburban/commuter trains which are concentrated primarily in the peak hours of the day. There is a significant drop in traffic volume north of New Haven. Passenger through-service comprises 80 to 90 percent of the total volume in this area with the exception of the Providence-Boston commuter traffic.

Two basic alternatives are available to accommodate the various kinds of train operations on the NEC. Both alternatives are concerned with the disposition of freight operations on the Corridor since freight traffic occurs along the entire Corridor, and generally possess operational characteristics which are not compatible with high-speed passenger operations or maintenance. The two alternatives are: (1) freight off-Corridor, meaning most of the freight traffic will be diverted to an alternate route; (2) freight on-Corridor, implying that through and local freight will continue to use the Corridor but on designated tracks. The following discussion summarizes the positive and negative consequences of each option.[2] It is primarily centered on the segment of the

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[1] Scenario Development and System Simulation, Task 4, United States Department of Transportation, Federal Railroad Administration, June, 1975.

[2] Evaluation of USRA Preliminary System Plan, Rail Services Planning Office, Interstate Commerce Commission, April, 1975.

line between Washington and New York since this area experiences the most critical volume-to-capacity ratios and is paralleled by an alternate freight route. Freight volume north of New York is minimal and not an operational nor capacity problem.

### 2.7.1 FREIGHT OFF-CORRIDOR

Numerous operational scenarios have been developed and tested with the system simulation models to determine operational efficiency and potentially critical capacities.[1] Although developed for an operating speed of 150 mph, these analyses indicate that diverting through-freight away from the main-line NEC tracks would be desirable. Moreover, in its Final System Plan, USRA recommended that: "Passenger and freight traffic on the route between New York and Washington on the NEC, optimally, should be separated by providing a parallel through freight route comprised of segments of the Baltimore and Ohio (B & O), the former Reading (RDG), Lehigh Valley (LV) and Central of New Jersey (CNJ)."[2]

This alternate corridor referenced by USRA is shown in Figure 2.8. The route utilizes the B & O line from Potomac Yard north to Philadelphia, then sections of the RDG, LV, and CNJ lines to various yards in northern New Jersey.

This alternate provides operational and physical separation of passenger and freight operations and would free the NEC mainline from a great deal of long haul and slower freight movements for use by intercity and commuter passenger trains. The principal exception would be local switching of freight cars to and from industries along the NEC. Physical separation of freight and passenger traffic is advantageous because it:[3]

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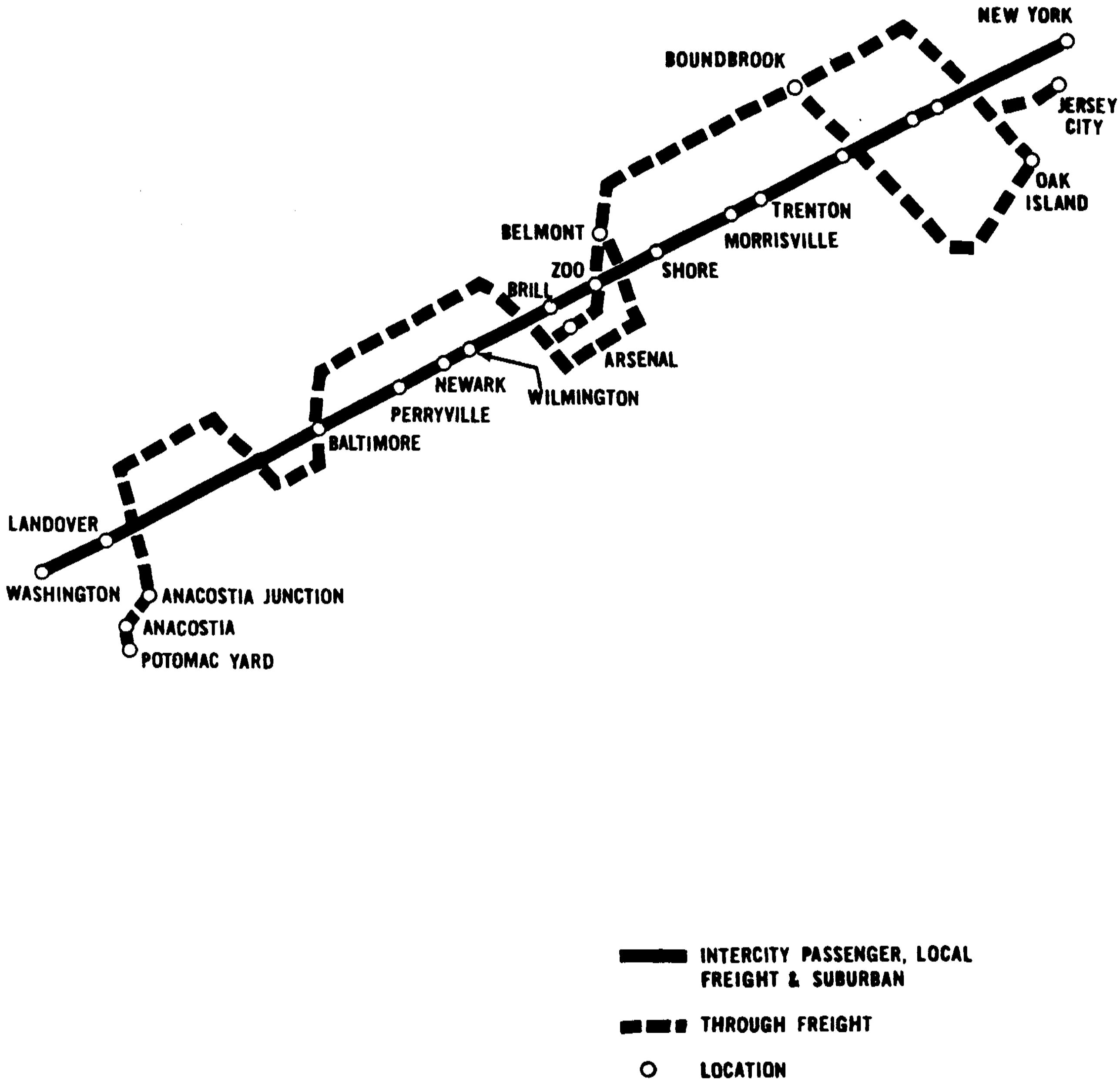
1 Scenario Development and System Simulation, Task 4, U.S. Department of Transportation, Federal Railroad Administration, June, 1975.

2 Preliminary System Plan, United States Railway Association, 1, February, 1975.

3 Final System Plan, United States Railway Association, Volume 1, February, 1975.




## Figure 2.8

## ALTERNATIVE ROUTING FOR NEC THROUGH FREIGHT OPERATIONS

- Insures reduced maintenance costs on the physical plant due to removal of heavy freight trains
- Provides emergency detour capabilities in the event a line is blocked by a serious derailment
- Insures less delay and simplified scheduling on the NEC for passenger and freight trains
- Improves the potential capacity of the NEC for passenger trains
- Provides easier access for track and roadway maintenance
- Extends the service life, the gauge and the alignment characteristics of rail, thus improving passenger comfort
- Reduces the probability of accidents for passenger trains due to derailments and the shifting of freight load (i.e., sideswiping).
- Removes most of the institutional problems implicit in Amtrak regulations on size, weight, scheduling, and speed of freight using the Corridor.

There are several major considerations that reduce the attractiveness of this separation. The most significant of these is the institutional problem of operating Conrail freight on the Chessie line. Since the solvent B&O currently operates freight on their line, Conrail would have to purchase trackage rights and develop an operational schedule that would be acceptable from a capacity and delay standpoint.

The ramifications of this consideration highlight the second major consideration, i.e., the improvement required on the parallel route to handle the additional volume of freight traffic and connections to NEC railroad system facilities. It is estimated that $300 million (1975 dollars) would be required for capacity improvements and necessary modifications to accomplish the basic objectives of the plan.[1,2] Conrail suggests that the cost is substantially higher.

A third consideration is the physical routing of the line. Although generally parallel to the NEC, this route is somewhat circuitous and does not provide the same level of access to Conrail's major freight yards and key freight trunk lines. In addition, because the off-Corridor scenario is approximately six miles longer than the on-Corridor for freight movements and has greater adverse grades, it would result in a nine percent increase in energy consumption.[3] In addition, the introduction of a significantly larger number of freight trains on this line would have as yet undetermined, but undoubtedly negative, environmental effects in communities along its route. The significance of these impacts would need to be assessed before any large scale diversion and upgrading were undertaken.

Conrail is presently studying the possibility of upgrading of the Philadelphia-Newark portion of this route to divert certain Harrisburg-Newark through trains from the Amtrak-owned NEC mainline. This action is heavily influenced by the user fees Conrail must now pay for use of the NEC mainline. Any large scale diversion of freight from the NEC mainline would result in higher maintenance cost shares to Amtrak and commuter agencies.

### 2.7.2 FREIGHT ON-CORRIDOR

As mentioned earlier, the freight on-Corridor alternative is based on the assumption that all Conrail freight will remain on the NEC rail system, thus facilitating complete independence of B & O operations. Within this

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[1] Preliminary estimates developed for the FRA, contained in the Preliminary System Plan, United States Railway Association, Volume I, February, 1975.

[2] A detailed technical discussion of the specific capacity constraints on this parallel route can be found in the Interstate Commerce Commission's Evaluation of the USRA Final System Plan, August, 1975.

[3] Draft FRA Staff Report on NEC Development Program (Grey Book), May, 1975.

alternative, however, there are two further options: (1) retention of the present conditions where all types of operations are assigned tracks and dispatched on an "as needed" basis; and (2) the dedication of certain tracks for exclusive passenger operations.

The first option has several disadvantages that are not easily reconciled.[1] Foremost are the capacity restraints associated with the operation of slow-freight and high-speed passenger trains on common tracks. Freight trains are generally much longer and slower in acceleration and running speed than passenger trains. Consequently, large segments of open trackage are necessary for these operations. The conflict between the different speed movements will reduce the delays to both freight and passenger movements and would reduce the reliability of scheduled running times. In addition, the operation of heavy freight trains on common tracks with passenger trains will adversely affect track characteristics (alignment and gauge) necessary for high speed passenger operations. Consequently, maintenance costs would increase significantly.

A dedicated track option would assign two tracks exclusively for passenger operations. It has several positive consequences and compares favorably against the previously discussed alternatives and options. While certain of the advantages are common to the first option, this scenario emphasizes those benefits while adding several additional features. Implementation of the freight on-Corridor with the dedicated track option would lead to the following positive effects:

- Freight service would remain on the NEC with its electrification and superior ROW
- Freight operation on the B & O would be completely independent of Conrail operations and thus would experience no delays due to Conrail traffic

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[1] Preliminary System Plan, United States Railway Association, Volume I February, 1975.

- All necessity for trackage rights and other institutional or operational agreements would be eliminated.

- Optimum access to most Conrail yards, trunk lines, and major industries would be maintained

- Scheduling of traffic would be simplified

- The adverse consequences of freight trains operating on passenger tracks (e.g., higher maintenance costs and decreased rider comfort) would generally be avoided (south of New York)

- The need for high horsepower-to-weight ratios on freight trains, necessary to optimize operational characteristics, would be reduced.

However, implementation of this alternative would require the construction of additional trackage along certain segments of the NEC, and the reconstruction of several bridges, as well as some ROW acquisition.

### 2.7.3 CONCLUSIONS

While freight off-Corridor appears to be the most effective long-term solution to operational, capacity and safety problems on the NEC, the cost and institutional barriers preclude its implementation. NEC tracks will be designated for passenger and freight traffic with joint usage permitted. The dedicated track concept is not proposed primarily because of the cost associated with its implementation.

The NECIP then is being implemented to accommodate present freight service on the Corridor. It is expected that this can be accomplished without degradation of freight service if certain operational controls and improved discipline of freight movements are achieved. (See Section 3.1.3 for discussion.) The NECIP is therefore not making substantial investments in capacity expansion which would be made unnecessary by a freight off-Corridor scenario and is not precluding the possible long term implementation of freight off-Corridor or dedicated tracks.

## 2.8 SERVICE LEVEL ALTERNATIVES

### 2.8.1 TRAVEL TIME/SPEED

Earlier analysis of various service levels identified three basic options for improving the NEC rail system.[1] The first option assumed no modifications, redesign, or major improvements to the existing system (physical plant and rolling stock) other than normal and routine maintenance operations at a pace somewhat greater than existing levels. This option termed as the "Conventional System" was designed to arrest the rate of decline in the rail system and provide the capability of reliably operating at published Amtrak schedules.

The second option, High-Speed Rail - 120 mph was basically very similar to the NECIP in terms of service levels. A major program of track renewal and upgrading would be implemented, under this option, to restore the entire Corridor to the best standards employed in the 1966-68 Metroliner upgrading, thereby improving ride quality to an acceptable level and increasing maximum operating speeds to approximately 120 mph. Additionally curve superelevation would be increased to the maximum extent practicable, and electrification would extend beyond New Haven to Boston.

The third option, High-Speed Rail - 150 mph was conceived to provide an improved physical plant for the NEC rail system beyond the capabilities of the conventional system or those associated with the 120 mph level of service. This level of improvement would provide superior riding quality and the capability of up to 150 mph top speed on a scheduled basis. Curves would be superelevated to the maximum extent possible with spiral transitions lengthened and curvature reduced in selected locations. Bridges unable to withstand the increased loading resulting from 150 mph operation would be replaced or strengthened; and electrification would again extend along the entire Corridor.

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[1] Draft Federal Railroad Administration Staff Report on NEC Corridor Development Program (Grey Book), May, 1975.

The service alternatives presented provide for a spectrum of travel times and, in the 120 mph and 150 mph levels, for an improved level of service with respect to maintainability, reliability, safety, comfort, and operating cost. The travel times and maximum allowable speeds are summarized in Table 2-11.

Table 2-11

TRAVEL TIME BY SERVICE OPTION

| | New York-Washington 5 stops | New York-Boston 5 stops | Maximum Allowable Speed |
|---|---|---|---|
| Conventional System | 3:00 | 4:00 | 80 |
| 120 mph System | 2:50 | 3:30 | 120 |
| 150 mph System | 2:30 | 3:00 | 150 |

In addition to the three basic options described above, two further "partial build" options were also identified and analyzed. The first of these assumes the Conventional System Improvement level in the area from New York to Boston, and a 120 mph level of improvement between Washington to New York. The second option identifies a system which is comprised of 120 mph improvement levels from New York to Boston and 150 mph levels from Washington to New York.

The five options described above can be measured and compared quantitatively by examining investment required, operating income, and expected ridership parameters (Table 2-12). It should be noted that the 120 mph option considered in this analysis is not exactly like the proposed action (i.e., the NECIP proposal) in all aspects, thus the expected patronage in 1990, and the expected cost is slightly different. The 120 mph option compares favorably with either the Conventional System or the 150 mph system. The most significant difference in required investment would occur in upgrading the Conventional System to 120 mph levels; i.e., $538 million to $1,966 million. This level of investment, however, yields substantial increases in projected operating income and expected ridership. Operating income would rise from $345 million to $992 million (an increase of 187 percent), and expected ridership would almost double from 14.9 million with the Conventional System to 26.2 million with 120 mph service. It is evident, too, that a 150 mph level of improvement is unattainable with present funding. This level of service remains a future goal as identified in the Legislation.

Table 2-12

COMPARISON OF TRAVEL TIME/SPEED SERVICE OPTIONS[1]

(millions)

| Service Option | Required Investment 1976-1990 | Operating Income 1982-1990 | Expected 1990 Ridership |
|---|---|---|---|
| Conventional System | 538 | 345 | 14.9 |
| 120 mph System | 1,966 | 992 | 26.2 |
| 150 mph System | 2,542 | 1,222 | 30.0 |
| Conventional System New York-Boston 120 mph System Washington-New York (Alternative 1) | 1,450 | 858 | 24.0 |
| 120 mph System New York-Boston 150 mph System Washington-New York (Alternative 2) | 2,309 | 1,097 | 28.9 |

To upgrade the service to the 150 mph level would be less cost effective. A 30 percent increase over the 120 mph system in required investment would be necessary to implement the 150 mph system. The additional initial cost would yield smaller incremental increases in operating income and expected ridership. Income would increase from $992 million to $1,222 million ( a 13 percent increase), and ridership would increase by 15 percent, from 26.2 million to 30.0 million.

[1]Draft Federal Railroad Administration Staff Report on NEC Corridor Development Program, (Grey Book), May, 1975.

All three analysis parameters for the two partial build alternatives "bracket" the 120 mph system. The required investment of the 120 mph system ($1,966 million) is 35 percent higher than partial build Alternative 1 but approximately $350 million less than partial build Alternative 2. Similarly, expected ridership for the 120 mph system is 2.2 million higher than Alternative 1 but 2.7 million less than Alternative 2.

The proposed action, which is basically the 120 mph system, meets legislative requirements and provides travel times of 2 hours and 40 minutes, and 3 hours and 40 minutes between Washington and New York, and New York and Boston, respectively. This system can be implemented for an overall cost of $1.9 billion, and thus provide a reasonable alternative in terms of the cost versus income and ridership parameters.

### 2.8.2 LOCATION AND NUMBER OF IMPROVED STATIONS

There are 26 stations on the Corridor currently served by Amtrak and, as described in Chapter I, 25 of these will, at the discretion of Amtrak, receive improved service as a result of the NECIP.[1] Many of these statioı are deteriorated and undersized facilities which will not be adequate to accommodate anticipated passenger demand for improved rail service. In addition, parking facilities at various station sites will not meet the needs of passengers driving to the stations, particularly at terminal and suburban stations.

The 4R Act does not explicitly mandate station improvements in the NECIP but rather implies that such improvements are a part of the overall program to meet mandated trip times and service levels. The only terminals mentioned in the Act are Boston, New York, and Washington, D.C. as end

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[1] Aberdeen, Maryland, which currently is served by two trains per day, is not included in service improvement scenarios. In addition, on May 1, 1978, Amtrak instituted service from New Haven to Boston with 13 intermediate stops. The new stations served are not considered in this analysis.

points for the travel time segments. The 4R Act does authorize ". . . improvement of nonoperational portions of stations"; the cost of such improvements is to be shared equally by the Federal Government and the appropriate state or local government.

The Draft PEIS identified 15 stations which were to be improved with NECIP funds. The stations so identified were: Boston South Station, Route 128, Providence Station, New London Station, New Haven Station, Stamford Station, New York Penn Station, Newark Station, Metropark Station, Trenton Station, Philadelphia 30th Street Station, Wilmington Station, Baltimore Station, New Carrollton Station, and Washington Union Station. Stations were selected on the basis of a series of factors which included:

- Existing and potential patronage
- Distance between stations
- Modal accessibility to the station (surface and rail transit)
- Proximity to major population centers
- Existing station's physical condition
- Station's ability to accommodate increased patronage growth
- Potential adverse environmental impacts
- NECIP program budget.

The Draft PEIS identified existing and projected patronage levels as the primary criterion for the selection of stations. As a result of the continuing planning process, the issuance of the Two-Year Report to Congress as required by Section 703(1)(E) of the 4R Act, and comments received on the Draft PEIS, the systemwide patronage projections have been revised (see Section 1.4). As a part of the revision of these projections, more refined baseline (1975) and future patronage projections for each of the stations on the Corridor were developed. Table 2-13 contains a listing of baseline patronage together with prior projections and the current 1990 projections.

Table 2-13

COMPARISON OF OLD AND NEW ANNUAL STATION FLOWS

| Station | Trip Ends (000) | | | |
|---|---|---|---|---|
| | 1975 | | 1990 | |
| | Old | New | Old | New |
| Boston South | 519 | 537 | 1,441 | 923 |
| Back Bay | 227 | 104 | 711 | 188 |
| Route 128 | 164 | 105 | 694 | 598 |
| Providence | 282 | 262 | 858 | 740 |
| Kingston | 42 | 29 | 127 | 120 |
| Westerly | 26 | 21 | 76 | 63 |
| Mystic | 9 | 9 | 27 | 49 |
| New London | 155 | 156 | 447 | 485 |
| Old Saybrook | 48 | 44 | 137 | 106 |
| New Haven | 426 | 359 | 1,720 | 1,258 |
| Bridgeport | 75 | 50 | 442 | 187 |
| Stamford | 150 | 152 | 884 | 511 |
| Rye | 73 | 76 | 161 | 511 |
| New York Penn | 5,766 | 5,982 | 12,586 | 10,383 |
| Newark | 949 | 1,321 | 4,309 | 2,723 |
| Metropark | 146 | 438 | 981 | 1,464 |
| New Brunswick | 146 | 395 | 981 | 1,242 |
| Princeton Jct. | 302 | 652 | 464 | 1,351 |
| Trenton | 1,580 | 1,763 | 2,435 | 4,052 |
| N. Philadelphia | 195 | 198 | 538 | 454 |
| 30th Street | 3,704 | 3,109 | 10,229 | 6,036 |
| Wilmington | 547 | 529 | 1,580 | 1,352 |
| Baltimore | 932 | 897 | 2,963 | 2,689 |
| New Carrollton | 186 | 184 | 1,803 | 1,031 |
| Washington | 1,974 | 1,856 | 6,150 | 5,031 |

NOTE: "Old" refers to baseline data and projections referenced in the Draft PEIS; "New" refers to revised projections developed since the Draft; see Section 1.4 for discussion.

As a result of the revised patronage projections and the comments received on the Draft PEIS, a review of the station selection process was undertaken. The same selection factors as had been applied previously were used in this re-examination since the factors took into account the major issues relevant to the selection process. In addition, the policy regarding distribution of available funding for station improvements was modified.

Based upon the foregoing review, certain modifications have been made in the proposals for stations. First, the number of stations eligible for receipt of operational improvements has increased from the 15 identified in the Draft PEIS to 18. The stations added are New Brunswick, Princeton Junction, and Rye. Second, since overall budget levels for operational improvements have not been increased, eligibility for receipt of improvements may not necessarily result in improvements being made at a given station. Third, non-operational funds are to be made available to all Corridor stations on a first-come, first-served basis, so long as benefits to intercity rail passengers have a reasonable relationship to expenditures.

With regard to the review of the selection of stations eligible for operational improvements, the selection factors listed above were reapplied to the stations currently receiving intercity rail service, taking into account the revised patronage estimates. As was done previously, the initial criterion for selection of stations was existing and projected patronage levels. Based upon projected 1990 patronage levels there are six stations with greater than 2.0 million intercity passengers--New York Penn Station, Philadelphia 30th Street Station, Washington Union Station, and the Trenton, Newark and Baltimore Stations. In addition, there are seven other stations with 1990 projected patronage levels between 900,000 and 1.5 million--Metropark, Wilmington, Princeton Junction, New Haven, New Brunswick, New Carrollton and Boston South Station.

Conversely, seven stations have projected 1990 patronage of under 200,000 per year and must be given low priority for improvement--Kingston, Rhode Island; Westerly, Rhode Island; Boston Back Bay; Bridgeport, Connecticut; Old Saybrook, Connecticut; Mystic, Connecticut; and Aberdeen, Maryland.

The remaining six stations fall between 400,000 and 750,000 in projected 1990 patronage. These stations are: Providence, Route 128, Stamford, Rye, New London and North Philadelphia. In these cases, factors such as a station's proximity to another station and potential environmental impacts of increased patronage played important roles in the selection process.

Selection Criteria. The stations above two million in projected patronage clearly merit selection for consideration of operational improvements solely on the basis of projected patronage.

Of the seven stations between 900,000 and 1.5 million in projected patronage, patronage plays an important role in the selection process, although it is not the sole determinant for selection in all cases. Boston South Station is important since it serves as the northern terminus of the NEC. The increases in projected patronage at New Brunswick and Princeton Junction due to the more refined estimates, increase intercity patronage at both stations over the one million level. The increased level of patronage is likely to have a more significant impact on NEC operations, station capacity, and local streets and parking than had been anticipated at the time the Draft PEIS was prepared. This increase in patronage coupled with the increased impacts is enough to offset the fact that four stations--Metropark, New Brunswick, Princeton Junction and Trenton--are located within close geographic proximity to one another.

Of the stations in the 400,000 to 750,000 level, geographic distribution and projected environmental impact provide the main basis for selection. Route 128 Station was selected because it has good vehicular accessibility from the existing metropolitan area highway system, and it is in a growing suburban area with regard to population shifts for residential as well as employment purposes. Providence and New London clearly provide good geographic distribution between Boston and New Haven, have more than adequate modal accessibility and are located in the two largest population centers between these two cities. Rye has been included for eligibility for operational improvements on the basis of a sharp increase in projected patronage and the impact this increase would have on NEC operations, station capacity as well as traffic congestion and parking in the vicinity of the station. These factors offset Rye's proximity to Stamford, but do not diminish the need for an improved station at Stamford due to Stamford's growth potential for through trips to Philadelphia and Washington.and it's connectivity with commuter rail service. Conversely, North Philadelphia was not selected because it has excellent commuter rail connections to 30th Street Station which is only four miles away. Furthermore, vehicular access is constrained and the station is remote from the major commercial center of the city.

For those stations with projected patronage under 200,000, no operational improvements are proposed. In the case of Bridgeport, the decreased patronage projections, together with the fact that the station has recently been constructed with partial UMTA funding, eliminates the necessity for operational improvements. Similarly, the projected patronage at Boston Back Bay Station coupled with its proximity to South Station and the reconstruction proposed in the relocation of the Orange Line rail transit facility, support the proposal to not include this station among those eligible for operational improvements.

Potential environmental impacts associated with station improvements played an ancillary role in the selection of New Brunswick, Princeton Junction and Rye. At these three stations, as well as the other 23 on the Corridor, increases in patronage will affect local traffic circulation and potentially the parking demand in the area surrounding the stations. The increases in patronage, therefore, affect air quality, noise, energy consumption and the socio-economic character of the areas surrounding all 26 stations. The direction of these impacts is similar at all 26 stations. However, in the case of New Brunswick, Princeton Junction and Rye, the increased patronage levels, together with the existing station surroundings, indicate that the magnitude of impact warrants consideration for selection. Other environmental factors did not affect station selection. As can be seen from Table 2-14, the stations on the Corridor generally fall into three categories: those set in downtown urbanized areas; those set in suburbs of major population centers; and those set in rural or semi-rural areas. With the exception of Route 128, all stations have quite low sensitivity to construction activities, and at Route 128, proper siting of improvements can avoid the sensitive areas.

Table 2-14 indicates that many stations are included in or are eligible for inclusion in the National Register of Historic Places. The improvements which may occur at these stations will be closely coordinated with State Historic Preservation Officers. However, in no case does the historic significance of the station play a role in the selection (or non-selection) for eligibility for operational funding.

Funding Alternatives. As noted above, one of the modifications made to the station subprogram is that the selection of a station for eligibility for operational improvements does not necessarily assure that all or any of the proposed improvements will be made. The reasons for this modification include the addition of three facilities counterposed against a budget for station improvements which has not increased. Given this fixed level of funding, two approaches for distribution among the selected stations are available: a scaling down of the projected improvements at some or all stations to allow some improvement to each station; or the total elimination of improvements at certain stations. Some of the factors which may influence the course of action taken with respect to allocation of funding include: the modification of present plans for a given station due to the environmental and historic resource review process; the resolution of institutional issues such as ownership of the station complex and allocation of station operation costs; and the availability of the local share for non-operational improvements. This final factor is especially important for the

Table 2-1

STATION AREA ENVIRONMENT

| 1990 Patronage/Station | Historic Significance | Sensitivity of Surrounding Natural Environment to Construction Activity | Surrounding Land Use |
|---|---|---|---|
| OVER 2,000,000 | | | |
| *New York Penn | -- | None | High Density Commercial |
| *Philadelphia 30th St. | Eligible | Low | High Density Commercial |
| *Washington | Registered | None | High Density Commercial & Residential |
| *Trenton | -- | None | Medium Density Residential & Commercial |
| *Newark | Eligible | Low | High Density Commercial |
| *Baltimore | Registered | None | High Density Residential & Commercial |
| 900,000 - 1,500,000 | | | |
| *Metropark | --- | Low | Low Density Residential & Commercial |
| *Wilmington | Registered | Low | Medium Density Mixed Commercial/ Industrial/Residential |
| *Princeton Junction | May be Eligible | Low | Low Density Residential & Commercial |
| *New Haven | Registered | Low | Medium Density Industrial & Residential |
| *New Brunswick | May be Eligible | Low | Medium Density Commercial |
| *New Carrollton | --- | Moderate | Low Density Industrial, Open Space |
| *Boston South | Registered | None | High Density Commercial |
| 400,000 - 750,000 | | | |
| *Providence | Registered | Low | High Density Commercial |
| *Route 128 | --- | High** | Low Density Industrial, Open Space, Freeway |
| *Stamford | --- | None | Medium Density Mixed Commercial/ Industrial/Residential |
| *Rye | --- | Low | Low Density Residential & Commercial |
| *New London | Registered | Low | Medium Density Commercial |
| North Philadelphia | May be Eligible | None | High Density Residential & Commercial |
| UNDER 200,000 | | | |
| Boston Back Bay | May be Eligible | None | High Density Residential & Commercial |
| Bridgeport | --- | Low | Medium Density Commercial |
| Kingston | Registered | Low | Very Low Density Agricultural |
| Old Saybrook | May be Eligible | None | Low Density Commercial |
| Westerly | Registered | None | Low Density Commercial |
| Mystic | May be Eligible | Low | Low Density Mixed |

* Selected for operational Improvement.
** It appears that siting of improvements can avoid sensitive wetlands. Minor encroachment during construction may be necessary.

so-called "Beltway" stations (i.e., Route 128, New Carrollton, Metropark) due to the fact that the availability of parking is an integral part of passenger handling facilities at these stations.

The final modification in the station subprogram involved the distribution of non-operational funds. Comments expressed by communities both at the public hearings and in writing indicated a desire on the part of many communities to make improvements to their stations which would be classified as non-operational. In response to these desires, the previous policy was modified under which non-operational improvement funds were to be made available first to those stations selected for operational improvements, with other stations applying for funding only after selected stations were accommodated. The new policy makes these funds available to all Corridor stations which currently receive intercity service, as long as benefit to intercity passengers has a reasonable relationship to expenditures. These funds will be available on a first-come, first-served basis.

This modification in policy will enable communities whose stations are selected for improvement to have greater flexibility in the design of the project. However, it will require these communities to make commitments of the necessary local share in a timely manner, to assure that funds will be available. In addition, this policy will enable communities with stations which have not been selected for operational improvements to obtain improvements under the NECIP.

# CHAPTER 3

# PROBABLE IMPACTS

## 3.1 REGIONAL AND LOCAL TRANSPORTATION

### 3.1.1 SUMMARY

The NECIP will provide a rail service level that is expected to attract over two times the current annual patronage and nearly two and one-half times the current annual revenue passenger-miles traveled by rail in the NEC by 1990. Seat-miles of service provided are expected to increase by a factor of 1.5 to 2.0 over that period, but at the same time the baseline Amtrak deficit per revenue passenger-mile will, under "low" and "high" projections of future operating cost and revenue, be reduced from 8.2 cents in 1977 to something between 1.5 and 5.4 cents in 1990 (all in 1978 dollars).

Diversion of passenger traffic to the rail system will have varying effects on other transportation modes within the Corridor. This effect is somewhat different than that predicted in the Draft PEIS due to revised demand projections (see Section 1.4). The expected reduction in baseline intercity miles of travel by auto of four percent represents only two-tenths of one percent of projected total person-miles of travel (including local trips) by auto in the NEC in 1990. The effect on congested urban segments of the Interstate highway system will be even less apparent.

The expected reduction in 1990 baseline person-miles traveled by air (12 percent) will not represent an absolute reduction in current patronage but rather will only slow the rate at which those carriers will be required to expand available seats. The reduced revenue growth can in all likelihood be offset by equivalent reductions in operating costs and fleet investment. Reduced delay at NEC airports has not been definitively measured but would appear to benefit LaGuardia Airport in New York by the largest amount. Reduction in landing fee revenues at NEC airports will not affect future expansion plans.

Impacts on the intercity bus industry are potentially more serious in certain market areas. Since bus and rail compete for much the same cost-conscious market, reduction in rail trip times is expected to reduce person-miles traveled by bus in 1990 by 28 percent. This in fact represents an absolute reduction in bus person-miles traveled along the NEC spine of 9.5 percent from 1975 levels. Although supporting data are proprietary, the bus industry contends that these diversions are on some of their most profitable routes and reduced revenue on these routes will force reductions in service on marginal or unprofitable runs in the region, even in some markets not served by rail. The revenue reduction, however, represents less than one percent of the total revenue of all Class I Motor Carriers operating in the New England and Middle Atlantic states in 1975 and less than three-tenths of one percent of total revenue for those carriers nationwide.

In accordance with the goals of the 4R Act, the NECIP will facilitate improvements in and the usage of commuter rail service sharing the Corridor and the maintenance and improvement of through and local freight service on the Corridor to the extent compatible with high-speed intercity passenger service. Signaling, interlocking and track improvements are expected to negate many of the potential delays to commuter rail and rail freight services that may result from higher speed and more frequent intercity service in 1981. Rail freight will, however, continue to be the third priority user of the system and incur the major share of any congestion delay which does occur, particularly if Conrail cannot improve the reliability and discipline of freight operations. Beyond 1981 additional congestion and delay to all users could occur on some sections if projections of increased traffic by Amtrak, Conrail and the commuter authorities are achieved. The NECIP unfortunately cannot make major capacity improvements to accommodate the total 1990 commuter, freight, and intercity passenger projections within the program's goals and funding.

The NECIP will fund the conversion cost of commuter equipment not compatible with the proposed electrification system, provided that equipment has significant remaining useful life. UMTA will fund 80 percent of the cost of replacing equipment which is obsolete or uneconomical to convert. In this regard the project may advance by a few years the scheduled replacement of this equipment by the various commuter authorities. The MTA/ConnDOT equipment does not require conversion at this time since the New Haven-New Rochelle segment will continue to operate at 12.5 kilovolts. The cost of conversion or replacement of electric freight locomotives, however, will be borne by Conrail. This cost has been estimated at $28.5 million. Conrail is eligible for loan funds under other portions of the 4R Act for this purpose.

The effect of increased train frequency on the ability to accommodate mariners at movable bridges is expected to be insignificant at all except the Portal Bridge over the Hackensack River. Total daily trains crossing the Portal Bridge is expected to increase by 47 percent by 1990 and the delay to marine traffic may be significant at certain times. About 25 percent of that increase will be attributable to increased Amtrak service, the rest to commuter growth (not including the Direct Rail Access Project).

Parking and traffic demand increase at the NEC stations due to intercity rail travel can be accommodated without major adverse effects. New Brunswick, Princeton Junction and Rye stations have, as a result of comments on the Draft PEIS and revised demand projections, been made eligible for operational improvements along with the original 15 stations, and all stations have been made eligible for non-operational improvements on a "first come, first served" basis, the latter being available to mitigate potentially adverse traffic or parking demand impacts.

Ten of the nineteen private grade crossings being eliminated by the NECIP will have no effect on vehicular traffic circulation. At the other nine crossings, some form of compensation or alternate access will be provided for those with access agreements. Private grade crossings in New London, CT will not be eliminated.

### 3.1.2 IMPACTS ON INTERCITY RAIL PASSENGER SERVICE

The NECIP will generate substantial improvements in the quantity and quality of intercity passenger service in the NEC. These improvements will affect the operating costs and operating revenues of the supplier of the service--Amtrak--and will impart certain time and cost-related benefits to the users of the system.

The existing conditions and trends for intercity rail service in the NEC were described in detail in Chapter I. This section defines the financial impact of the improvement on the supplier and the user.

Operating Costs. The cost of the operation and maintenance of NEC intercity rail service in FY 1976 was $174 million for 6.46 million train-miles and in 1977 was $172 million for 6.28 million train-miles, both in 1977 dollars.[1] In 1978 dollars, these costs inflate to $194 million and $187 million, respectively. This suggests that unit operating and maintenance (O & M) costs were $28.95 per train-mile in 1976 and $29.80 per train-mile in 1977, both in 1978 dollars.

Operating and maintenance costs have increased rapidly in recent years. For example, O & M costs rose by 134 percent between 1972 and 1976 for essentially the same amount of service and a 20 percent increase in patronage based on historical Amtrak data. Amtrak believes that this trend may continue although some of the increase may be due to better cost accounting.

Basic to an impact evaluation of the NECIP is its effect on the future cost of operating the intercity rail service it is designed to accommodate. A number of features of the improved system are likely to exert opposing influences on what would otherwise be the current trend in O & M costs:

- The complete renewal of track structures, bridges, etc., will reduce the need for future maintenance-of-way expenditures, but the increased standards demanded by the proposed high-speed, high-comfort service will dictate increased maintenance as has been the experience in Japan and Europe.

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[1] Two-Year Report on the Northeast Corridor, U.S. Department of Transportation, Federal Railroad Administration, February, 1978. (See Table 1-6)

- The same will be true for the new rolling stock where high performance reliability and comfortable, attractive cars will be maintained.

- New, automated train control systems will reduce field labor needs but the more sophisticated equipment is likely to require surveillance and monitoring at higher maintenance and labor costs.

- Upgraded stations, yards and maintenance facilities should allow substantial improvement in labor productivity but labor agreements may not be flexible enough to permit the full realization of savings.

- Greater amounts of train service will increase total transportation costs, but administrative expenses and some other expenses such as facility rents, are not likely to increase at as fast a rate as additional train- or car-miles of service.

- Renegotiation of contracts and agreements with Conrail, commuter authorities, and station owners as well as expense share for the Washington Terminal may cause wide variations in operating costs for specific segments.

The issues involved in projecting post-NECIP operating and maintenance costs are clearly complex. Amtrak projects increases in operating costs to $30.90 per train-mile by 1982, largely due to an expected 59 percent increase in track maintenance costs.[1] Beyond 1982, confidence in the ability to predict costs and the factors influencing them diminishes. As a prudent recourse, a number of sources for unit operating costs were examined to develop a range of operating costs for 1990. In each case all costs projections were reduced to "per train-mile" estimates. Since average consist for 1990 is not projected to be significantly different under the 1990 schedule assumption (Section 1.5), train-miles were felt to be the most reasonable basis for expansion of cost even though certain administrative, overhead and fixed plant costs would not rise as rapidly

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[1] Two Year Report on the Northeast Corridor, U.S. Department of Transportation, Federal Railroad Administration, 1978.

as train-miles. In addition, all costs have been translated into constant FY 1978 dollars.

- Two-Year Report "High". These projections were identified as the high end of the range of costs for service option analysis in the Two-Year Report on the Northeast Corridor.[1] The costs were derived largely from information supplied by Amtrak[2] but supplemented in certain cost categories with conservatively high estimates of previous studies conducted under contract to FRA.[3] Unit costs derived from this source amount to $33.41 per train-mile.

- Two-Year Report "Low-1". These projections were identified in the same study as the low end of the cost range. Costs were derived largely from consultant studies of operating costs under post-NECIP conditions.[4] Unit cost would be $24.91 per train-mile in this case.

- Two-Year Report "Low-2". Unlike "Low-1" this projection assumes improved turnaround time for trains at major terminals, allowing the same amount of service with less equipment. Unit cost in this case reduces to $24.53 per train-mile.

- PMM. The most comprehensive attempt to project post-NECIP operating costs from a zero base was a 1975 study by Peat, Marwick, Mitchell and Company for the U.S. DOT.[5] This study projected costs with what might be

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[1] See Two-Year Report on the Northeast Corridor, U.S. Department of Transportation, Federal Railroad Administration, February, 1978.

[2] Letter from Charles E. Bertrand, Vice President and General Manager, NEC Amtrak; to Thomas F. Ferrara, Chief, Planning and Analysis Division, Northeast Corridor Project, Federal Railroad Administration, October 28, 1977.

[3] Financial Analysis of the Northeast Corridor Development Project, Peat, Marwick, Mitchell and Company, U.S. Department of Transportation, Transportation Systems Center, February, 1978.

[4] Primarily Support Services: Engineering, Economics, and Cost Estimating Task 18, U.S. Department of Transportation, Federal Railroad Administration, July, 1976; and Technical and Economic Analyses of Vehicle Right-of-Way Systems, Task 9, U.S. Department of Transportation, Federal Railroad Administration, August, 1975.

[5] Op. cit. Peat, Marwick, Mitchell and Company.

considered optimistic assumptions about reduced crew size as well as favorable renegotiation of cost-sharing agreements with other system users. Adjusting unit costs derived from the total cost projections of this study to FY 1978 dollars yields an estimate of $24.00 per train-mile.

Applying the estimates of operating cost from each of these four sources, as well as utilization of Amtrak's actual 1976 and 1977 unit operating costs and Amtrak's projection of 1982 operating unit cost to the 10.6 million train-miles projected for the NEC in 1990,[1] gives the following estimates of 1990 operating costs:

| Source of Unit Cost | Operating Cost Per Train-Mile (FY 1978 $) | Total Cost for 10.6 Million Train-Miles (Millions of FY 1978 $) |
|---|---|---|
| Amtrak FY 1976 Actual | 28.95 | 307 |
| Amtrak FY 1977 Actual | 29.80 | 316 |
| Amtrak FY 1982 Projection | 30.90 | 328 |
| Two-Year Report "High" | 33.41 | 354 |
| Two-Year Report "Low-1" | 24.91 | 264 |
| Two-Year Report "Low-2" | 24.53 | 260 |
| PMM | 24.00 | 254 |

The range of possible costs is clearly wider than one would like for service option planning. The Two-Year Report on the Northeast Corridor has recommended an in-depth technical study of cost factors and the FRA is now engaged in the reanalysis of service options. Nonetheless, examination of the range can, for the purposes of this document, give insight into possible effects that the project might have on Amtrak's operating finances and public investment.

It must be remembered that the high end of the range ($350 million) assumes that Amtrak will realize no operating efficiencies as a result of the NECIP and in fact will be forced to expend even larger amounts to maintain the improved system. The low end of the range ($250 million),

[1] See Section 1.5 for projections of train-miles.

on the other hand, assumes reduced crew sizes and increased labor productivity which is not immediately foreseeable but may be within the realm of possibility by 1990. Full realization of these reductions would require changes in the present content and trend in labor agreements in the industry.

The following projections of O & M cost for the NEC seem appropriate:

| Year | O&M Cost (1978 $) | Train-Miles of Service |
|---|---|---|
| 1976 | $194 million | 6.5 million |
| 1977 | $187 million | 6.3 million |
| 1990 Unimproved | $215 million | 7.2 million |
| 1990 Improved | $254-$354 million | 10.6 million |

The 1990 unimproved service is designed to accommodate 1990 demand for the unimproved system at 1977 unit O & M costs.

Operating Revenue. The following operating revenues were calculated for the various future scenarios:

| Year | Revenue Passenger-Miles (Billions) | Total Revenue (Millions of 1978$) |
|---|---|---|
| 1976 Actual | 1.05 | 97 |
| 1977 Actual | 1.15 | 93 |
| 1982 Baseline | 1.21 | 118 |
| 1982 Improved | 1.75 | 178 |
| 1990 Baseline | 1.43 | 140 |
| 1990 Improved | 2.53 | 217 |

All scenarios are based on 1976 average fare levels.[1] Revenue for the 1990 improved system used a single regression formula for all Corridor

[1]Using "constant dollar" fare levels for this analysis (i.e., comparison with "constant dollar" costs) implicitly assumes that revenues (and costs) will increase at the general inflation rate. Amtrak, in its Five-Year Plan, has stated that they expect fare increases to keep pace with the Consumer Price Index.

fares, which in effect "smooths" the fare levels into a single, mileage-related fare formula. This is felt to be most consistent with the Corridor-wide service improvements and eliminates the lower fare assumption of the DPEIS.

Operating Profit/Deficit. The operating deficit for Amtrak NEC service in 1976 was approximately $97 million in FY 1976 and $94 million in FY 1977, both in 1978 dollars. This deficit is projected to decline to $75 million in constant (1978) dollars by 1990 under the baseline (unimproved) system scenario, which would reduce the deficit per revenue passenger-mile from 8.2 cents in 1977 to 5.2 cents in 1990.

For the improved service the results of the NECIP are expected to be quite dramatic in improving the productivity of public investments in operation of NEC rail service:

| | Millions of 1978 Dollars | | | |
|---|---|---|---|---|
| Year | Cost | Revenue | Deficit | Deficit Per Revenue Passenger-Mile |
| 1976 | $194 | $ 97 | $ 97 | 9.2¢ |
| 1977 | $187 | $ 93 | $ 94 | 8.2¢ |
| 1990 Baseline | $215 | $140 | $ 75 | 5.2¢ |
| 1990 Improved | $254-354 | $217 | $37-137 | 1.5-5.4¢ |

Unquantified Economic Benefits. Apart from the substantial improvement in the expense/revenue outlook for the supplier of rail service, the NECIP will produce other economic benefits, particularly to the future users of the system. Users will receive a travel time savings equivalent to the difference in unimproved and improved rail schedule time for regular users and to the difference between travel time by improved rail versus that of another mode for those diverted as a result of lower travel time.

Users of the system will also realize some out-of-pocket cost savings if they are diverted from another, more expensive travel mode such as air. Finally, users and some non-users will benefit from accidents avoided due to the decrease in total travel by modes less safe than rail.

Quantification of the monetary benefits associated with user savings for the NECIP could be generated with certain assumptions regarding cost, value of time, and value of a life or personal injury. In the final analysis, however, such assumptions are rarely without fault and the user benefit imparted by the NECIP would remain a value judgement in the same manner as some non-quantifiable environmental factors.

### 3.1.3 IMPACTS ON OTHER TRANSPORTATION MODES

Intercity Auto. Implementation of the NECIP is expected to result in a diversion of future automobile trips to the improved intercity rail service. Positive impacts on remaining auto users will presumably result from lessened congestion. Some impacts will be felt by Federal and State governments as a result of reduced growth in user tax revenues. Toll authorities will also experience reduced growth in revenue.

- Existing Conditions and Trends. In 1975, approximately 79 percent of the 86.7 million intercity trips in the Corridor were made by auto. These 68.4 million trips resulted in 6.5 billion person-miles of travel or 69 percent of all the NEC intercity person-miles of travel.

While significant with respect to intercity travel, the 6.5 billion person-miles represents 3.2 billion vehicle-miles of travel which is only 2.5 percent of the estimated 129 billion total person-miles traveled by auto in the NEC in 1975.[1] The majority of these total Corridor person-trips and the resulting congestion occurred in and near the major urban centers. In these areas of very high traffic volume and substantial existing vehicle congestion, intercity trips would account for less than two percent of the total highway volume. Even in less congested rural areas between urban centers, intercity trips accounted for less than 40 percent of the traffic on major expressways and highways in the Washington to Boston Corridor at the time of the 1968 NEC intercity travel survey.[2] In recent years, increasing traffic demand on those segments of the highway system within large metropolitan areas has resulted in substantial congestion and a corresponding increase in intercity travel time.

[1] The 1975 estimate was developed by multiplying the 1975 population of the NEC (32.4 million) by a value for annual miles of travel per capita (4,000 miles). The 4,000 miles of travel per capita is approximately two-thirds of the 1975 national average of 6,228 auto vehicle-miles per capita and just slightly higher than the 3,594 auto vehicle-miles per capita traveled in the State of New York.

[2] NEC Intercity Travel Survey, U.S. Department of Transportation, March, 1971

Without the rail improvement, there should be 27 percent more intercity auto trips (86.7 million person-trips) by 1990 (Table 3-1). The expected effect of diversion to the improved rail service should reduce that total to 84.2 million, representing a 23 percent increase over 1975.

Projected person-miles of travel by auto for 1990 are expected to be reduced by a larger amount than auto trips (3.9 percent) due to the improved rail service. This diversion will be reflected in a slight reduction in average intercity auto trip length. The segments with the largest volume of NEC intercity travel are between Wilmington and New York (see Figure 3.1). In these segments, the reduction in projected 1990 NEC vehicle trips due to diversion to the improved intercity rail service is estimated to be between 4 and 5 percent.

- Operational Impacts. Even though the diversion of auto travelers is relatively large in absolute numbers (2.5 million trips per year in 1990), this diversion will have little impact on NEC highway congestion. When the reduction in vehicle-miles per year (210 million in 1982 and 300 million in 1990) is compared to the total estimated Corridor vehicle-miles (133 billion in 1982 and 137 billion in 1990), the diverted NEC intercity trips are less than two-tenths of one percent of the total auto miles in 1982 and only slightly more than two-tenths of one percent in 1990.

On a section of expressway where NEC intercity auto trips account for 40 percent of the total highway volume, and the diversion to rail is five percent, the diversion would reduce the total traffic by only two percent. The most congested highway sections occur in and near major cities. In these locations, the intercity auto trips would generally account for less than 10 percent of the total vehicle demand. The reduction in total vehicle demand due to the auto trips diverted to rail would be only one-half of one percent.

The uncertainty that exists in the forecast of the potential improvements to the existing NEC highway system combined with the relatively small impact on future highway congestion resulting from the rail diversion make the calculation of money and time benefits to remaining auto users almost meaningless. The overall reduction of 300 million miles of vehicle travel is equivalent to two-tenths of one percent of the 1990 total Corridor auto vehicle-miles of travel. If the 4.5 percent increase in annual vehicle-

Table 3-1

PROJECTED NEC INTERCITY AUTO TRIPS

| | Total Intercity Person Trips (millions) | Auto Intercity Person Trips (millions) | Auto Trips as a % of Total | Total Intercity Person-Miles (billions) | Auto Intercity Person-Miles (billions) | Auto Person-Miles as a % of Total | Average Trip Length (miles) | | % Increase in NEC Auto over 1975 Base | | % Increase in Trips by all Modes over 1975 Base |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | All Modes | Auto Only | Trips | Miles of Travel | |
| 1975 Base | 86.7 | 68.4 | 78.9 | 9.35 | 6.49 | 69.4 | 108 | 95 | --- | --- | --- |
| 1982 Unimproved Rail System | 99.7 | 77.8 | 77.1 | 10.68 | 7.08 | 66.3 | 107 | 91 | 12 | 9 | 15 |
| 1982 Improved Rail System | 102.4 | 77.2 | 75.4 | 10.85 | 6.87 | 63.3 | 106 | 89 | 13 | 6 | 18 |
| 1990 Unimproved Rail System | 114.6 | 86.7 | 75.7 | 12.20 | 7.75 | 63.5 | 106 | 88 | 27 | 19 | 32 |
| 1990 Improved Rail System | 117.1 | 84.2 | 71.9 | 12.52 | 7.45 | 59.5 | 107 | 89 | 23 | 15 | 35 |

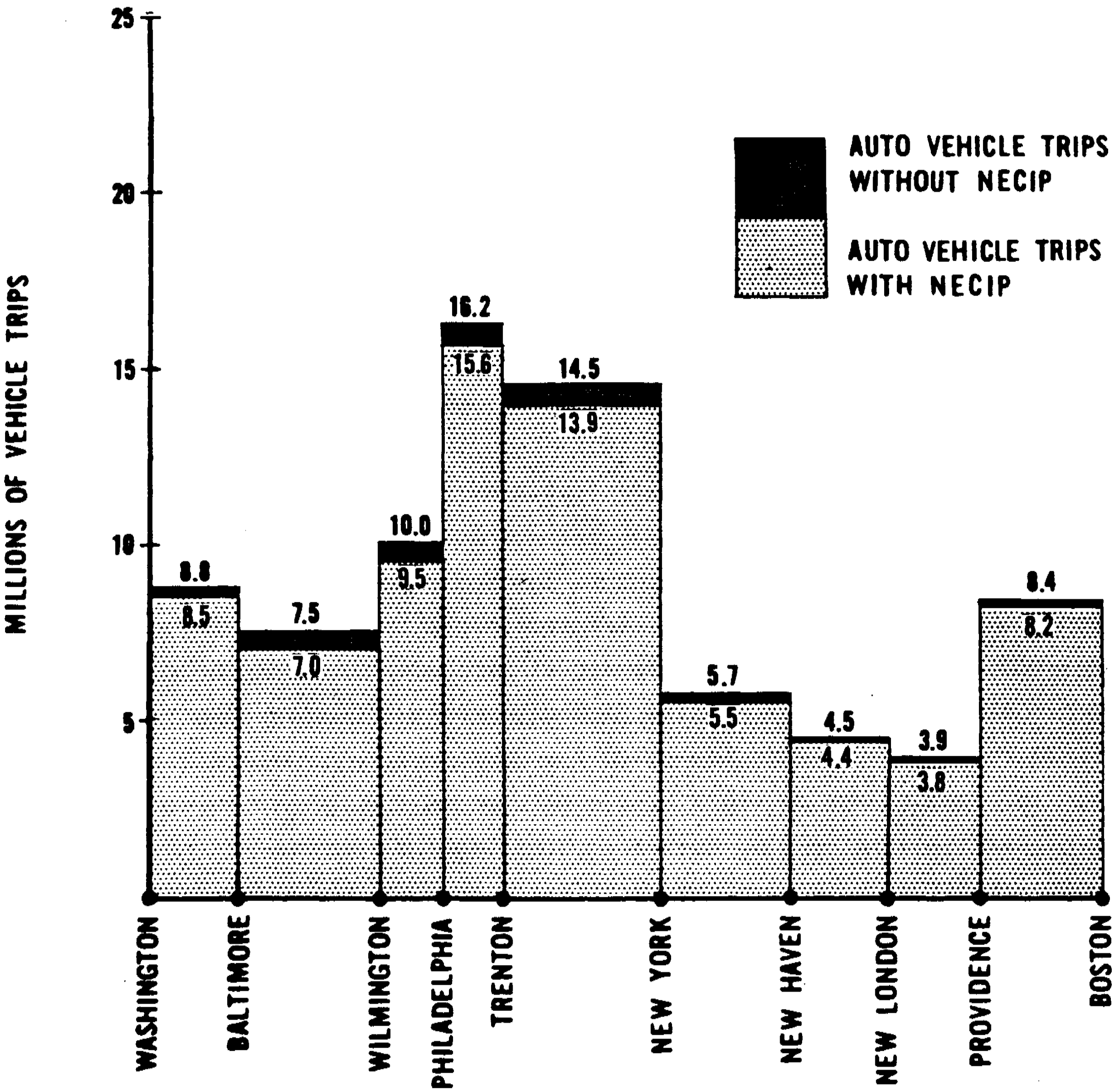


**Figure 3.1**

**PROJECTED INTERCITY AUTO VEHICLE TRIPS - 1990**

miles that occured between 1975 and 1976 were assumed for 1990, diversion to rail would represent less than one month of traffic volume increase in the Corridor. The total time savings resulting from this diversion to high-speed rail would be insignificant relative to the overall total intercity travel time.

The total fuel consumed in 1975 for NEC intercity auto trips was approximately 224 million gallons of gasoline and generated slightly more than $29 million in state and federal gas taxes (Table 3-2). Clearly the expected increase in fuel efficiency resulting from miles per gallon improvements in future automobiles will have a much more substantial effect on federal and state gasoline tax revenue than will the diversion of auto trips to rail. Even at current taxation rates, the reduction in total fuel tax revenue due to diversion to rail in 1990 is $0.6 million for the eight states and the District of Columbia. Reduction in toll revenues will be similarly insignificant.

Air Transportation. The potential impact of the NECIP on airlines, the air transport industry, and air travelers is solely a function of the expected diversion of air travelers to the high-speed rail system. Positive impacts on the air transport mode are expected in the form of reduced air congestion and delay, reduced need for airport expansion and reduced need for aircraft fleet expansion at a time when airlines are finding it difficult to raise capital even for renewal of the present fleet. Negative financial impacts are possible as a result of reduced growth in revenue to air carriers and in landing fee revenue to individual airports.

- Existing Conditions and Trends. Over a dozen air carriers and commuter airlines currently provide air transport service in the NEC. Six airlines, however, carry 97 percent of the air traffic between the nine city pairs which account for 96 percent of NEC air traffic. Eastern Airlines clearly dominates with an estimated 54.7 percent of the air trips between these nine city pairs, followed by American (18.1 percent), Allegheny (10.3 percent), Delta (9.6 percent) and National and TWA (4.4 percent combined).[1]

[1] Table 10, O & D Survey of Airline Passenger Traffic, Civil Aeronautics Board, 4th Quarter, 1975.

Table 3-2

ANNUAL NEC INTERCITY AUTO FUEL CONSUMPTION AND TAX

| | NEC Intercity Auto Vehicle-Miles of Travel (millions) | Average[1] MPG for composite | Total Fuel Consumed (million gal.) | State Gas Tax Revenue (millions) | Federal Gas Revenue @ 4¢/gal. (millions) | Total State & Federal Gas Tax Revenue (millions) |
|---|---|---|---|---|---|---|
| 1975 Base | 3,197 | 14.3 | 224 | $ 20.2 | $ 9.0 | $ 29.2 |
| 1982 Unimproved rail service | 3,501 | 18.9 | 185 | $ 16.7 | $ 7.4 | $ 24.1 |
| 1982 Improved rail service | 3,414 | 18.9 | 181 | $ 16.3 | $ 7.2 | $ 23.5 |
| Difference with improved rail service | 87 | -- | 4 | $ 0.4 | $ 0.2 | $ 0.6 |
| 1990 Unimproved rail service | 3,849 | 25.8 | 149 | $ 13.4 | $ 6.0 | $ 19.4 |
| 1990 Improved rail service | 3,706 | 25.8 | 144 | $ 13.0 | $ 5.8 | $ 18.8 |
| Difference with improved rail service | 143 | -- | 5 | $ 0.4 | $ 0.2 | $ 0.6 |

[1]Average Mile per Gallon for composite fleet from the "Connecticut Energy Outlook, 1977-1996".

The remaining airlines and commuters carry only 2.9 percent of total traffic. The dominance of Eastern Airlines in the NEC results primarily from its dominance of the service for the New York-Washington and New York-Boston city pairs. Eastern carries nearly 75 percent of the air trips in these two markets.

Over 36 percent of intra-NEC air trips are enplaned at the three New York hub airports--Kennedy, LaGuardia, and Newark. The Boston and Washington metropolitan areas follow with 23 and 28 percent of the total NEC enplanements respectively (Table 3-3). Trips between these three metropolitan areas alone account for 87 percent of all intra-NEC air travel.

The population of the New York, Boston and Washington areas and their regional importance as governmental, industrial, and financial centers are the major reasons for their dominance of NEC air travel. The distance between these cities largely determines the mode choice of travelers. Overall, 5.9 percent of NEC intercity trips are presently made by air, but this average reflects specific percentages ranging from nearly 70 percent of the long trips from Boston to Washington (400 miles), to 20 to 30 percent of the medium length trips between New York and Boston and New York and Washington (200 miles), to less than one percent of the short trips between New York and Philadelphia (84 miles) (Table 3-4).

Air clearly dominates the long haul market of over 250 miles. The air terminal to air terminal segment accounts for a large percentage of the total trip length, and trip time on that segment is the shortest of any mode because of the high speed characteristics of air travel. Flight time for the 400 mile trip from Boston to Washington is about one hour as compared to 6.5 hours for the improved intercity rail service. Conversely, auto clearly dominates the short haul intercity market (under 100 miles) because terminal access time, which is a large percentage of the short haul trip, is nonexistent for the auto mode.

It is the middle range of trip lengths in the NEC, i.e., 100 to 250 miles, where the improved rail system will be competitive with both auto and air. Approximately 74 percent of intercity air trips in the NEC are presently in this 100- to 250-mile range. The projected diversion of trips from air to rail is predominantly within this range (Table 3-5).

Table 3-3

PROJECTED NEC TRIP ENDS BY AIR AT MAJOR METROPOLITAN AREAS

| | 1975 | 1990 With Improved Rail | | 1990 Without Improved Rail | | Improved/ Unimproved |
|---|---|---|---|---|---|---|
| | No. (000) | No. (000) | 1990/1975 | No. (000) | 1990/1975 | |
| Washington | 2,377 | 3,672 | 1.55 | 4,446 | 1.87 | 0.83 |
| Baltimore | 355 | 640 | 1.80 | 819 | 2.31 | 0.78 |
| Wilmington | 27 | 2 | n/a | 4 | n/a | 0.50 |
| Philadelphia | 625 | 1,219 | 1.95 | 1,476 | 2.36 | 0.83 |
| Trenton | 6 | 1 | 0.17 | 3 | 0.50 | 0.33 |
| New York | 3,670 | 6,025 | 1.64 | 7,033 | 1.92 | 0.85 |
| New Haven | 33 | 105 | 3.18 | 152 | 4.61 | 0.69 |
| New London | 25 | 62 | 2.48 | 82 | 3.28 | 0.76 |
| Providence | 267 | 513 | 1.92 | 582 | 2.18 | 0.88 |
| Boston | 2,795 | 4.722 | 1.69 | 5.032 | 1.80 | 0.94 |
| TOTAL | 10,153 | 16,961 | 1.67 | 19,628 | 1.93 | 0.86 |
| PERCENT OF TOTAL INTERCITY TRIPS | 5.9% | 7.2% | | 8.6% | | |

Table 3-4

EXISTING AIR TRAVEL IN THE NEC

| CITY PAIR | 1975 Air Trips[1] | | Air Distance (miles) | Air Fare (One Way Coach)[1] | Air Fare/ Rail Coach Fare[2] | Percent of Total Intercity Trips by Air |
|---|---|---|---|---|---|---|
| | No. (000) | % of Total | | | | |
| New York-Washington | 1,564 | 30.8 | 215 | 37.00 | 2.18 | 21.4 |
| New York-Boston | 1,722 | 33.9 | 191 | 35.00 | 2.12 | 23.6 |
| Boston-Washington | 552 | 10.9 | 406 | 55.00 | 1.64 | 68.3 |
| Boston-Philadelphia | 366 | 7.2 | 370 | 43.00 | 1.79 | 41.2 |
| New York-Baltimore | 168 | 3.3 | 179 | 34.00 | 2.26 | 7.1 |
| Washington-Philadelphia | 134 | 2.6 | 126 | 29.00 | 2.76 | 3.2 |
| New York-Providence | 127 | 2.5 | 145 | | | 10.1 |
| Boston-Baltimore | 150 | 3.0 | 370 | 51.00 | 1.64 | 73.9 |
| New York-Philadelphia | 70 | 1.3 | 84 | 25.00 | 3.22 | 0.4 |
| All Other | 223 | 4.5 | - | - | - | 0.5 |
| TOTAL | 5,076 | 100.0 | | | | 5.9 |

[1] Official Airline Guide, January 15, 1977.

[2] Amtrak 1976 Schedule.

Table 3-5

PROJECTED NEC AIR TRAVEL FOR MAJOR CITY PAIRS IN THE NEC

| | | 1975 | 1990 With Improved Rail | | 1990 Without Improved Rail | | |
|---|---|---|---|---|---|---|---|
| CITY PAIR | Air Distance | Air Trips (000) | Air Trips (000) | 1990/1975 | Air Trips (000) | 1990/1975 | Improved/ Unimproved |
| New York-Washington | 215 | 1,564 | 2,214 | 1.42 | 2,747 | 1.76 | 0.81 |
| New York-Baltimore | 179 | 168 | 280 | 1.67 | 378 | 2.25 | 0.74 |
| New York-Philadelphia | 84 | 70 | 174 | 2.49 | 259 | 3.70 | 0.67 |
| New York-Providence | 145 | 127 | 270 | 1.34 | 323 | 2.54 | 0.84 |
| New York-Boston | 191 | 1,722 | 3,051 | 1.77 | 3,267 | 1.90 | 0.93 |
| Boston-Washington | 406 | 552 | 879 | 1.59 | 930 | 1.68 | 0.95 |
| Boston-Baltimore | 370 | 150 | 209 | 1.39 | 221 | 1.84 | 0.95 |
| Boston-Philadelphia | 271 | 366 | 570 | 1.56 | 599 | 1.64 | 0.95 |
| Washington-Philadelphia | 126 | 134 | 316 | 2.36 | 424 | 3.16 | 0.75 |
| Subtotal of 9 city pairs | | 4,853 | 7,963 | 1.64 | 9,148 | 1.89 | 0.87 |
| All other city pairs | | 223 | 517 | 2.32 | 666 | 2.99 | 0.78 |
| TOTAL | | 5,076 | 8,480 | 1.67 | 9,814 | 1.93 | 0.86 |
| PERCENT OF TOTAL INTERCITY TRIPS | | 5.9% | 7.2% | | 8.6% | | |

As expected, almost no diversion is projected for trips between city pairs over 250 miles apart. Diversion of trips in the 100- to 200-mile range is projected at 15 to 25 percent. For trips in the 200- to 250-mile range, notably those between New York and Washington and between New York and Boston, diversion is estimated at 19 percent and 7 percent, respectively--the difference reflecting the less competitive (3 hour and 40 minute) time goal for improved rail service between the latter pair.

The experience of the Metroliner demonstration program between New York and Washington supports the expectations for diversion from the higher-priced and generally less accessible air mode in the 200-mile trip range.[1] The Metroliner demonstration program began in 1969 when rail attracted 24.8 percent of the rail/air travel market between New York and Washington. The Metroliner offered higher speed and more luxurious service than did conventional trains. By 1975, with 15 Metroliners per day operating in each direction (plus 38 conventional trains) the rail share of that market had grown to 39.3 percent even though the total rail/air market size over those seven years had not grown. The expectation, then, that rail can indeed attract passengers from the air mode, even in the 200-mile trip range, seems appropriate.

Individual airports or groups of airports will also experience reductions in passengers enplaned and deplaned due to the diversion to improved intercity rail service. Overall, a 14 percent reduction in total 1990 trip ends by air is projected with the improved rail service (Table 3-3). The greatest reductions are in the medium-sized cities (i.e., Providence, New London, New Haven, Wilmington, Baltimore, and Trenton). In Trenton dependence upon air for trips to other NEC cities nearly vanishes. The 15 percent reduction in trip ends at New York is significant because of its size. About 40 percent of the 3.3 million trips diverted to rail in 1990 would begin or end in the New York hub area.

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[1] Seven Years of Train-Air Competition in the New York to Washington Passenger Market, Robert C. Winestone, Federal Railroad Administration, 1976.

• Operational Impacts. Air traffic levels for 1990 in the NEC will be higher than in 1975 with or without the introduction of improved rail service. Implementation of the NECIP will, however, reduce the projected 1975-1990 growth rate of air traffic from a 93 percent increase to a 67 percent increase. Even with improved rail service, the air mode will increase its share of the intercity market--7.2 percent in 1990, versus 5.9 percent in 1975. Without the NECIP, the air mode market share of all 1990 NEC intercity trips was projected to increase to 8.6 percent. The overall effect of the NECIP on airlines, then, is that slower rather than negative growth rates will force airlines to revise their growth expectations.

Airline revenues for NEC operations without the improved rail system were projected at $365 million in 1990 at 1977 fare levels.[1] With the anticipated diversion to the improved rail service, 1990 airline revenues would be reduced to $320 million--a loss of $45 million in revenue (12.3 percent reduction) for that year in 1977 dollars. By comparison, combined total revenue for the five major NEC carriers (American, Allegheny, Delta, Eastern, and National) was $3.5 billion in 1972.[2] Eastern Airlines with its New York to Boston, and New York to Washington services, and Allegheny Airlines, with its New York to Baltimore and Washington to Philadelphia services, will experience the greatest diversion.

The slower growth rate of air traffic revenues for 1990 is clearly not the net effect of the diversion of air travelers to improved rail. Recognition of this slower growth rate by the airlines will probably result in certain actions to reduce operating costs, particularly the purchase of fewer aircraft. If it could be assumed that all costs are directly proportional to revenue, the net revenue loss for 1990 would amount to less than

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[1]Using currently published airline coach fares for each city pair projected.

[2]Handbook of Airline Statistics, Civil Aeronautics Board, Washington, D.C., 1973.

$2 million. This assumes that the historic 1963 to 1972 operating ratio[1] equal to 0.963 can be applied to NEC airlines.[2] It would seem that the 10 to 12 year period over which airlines can adjust operating investments is sufficiently long to assume no significant change in operating ratio.

As a result of the 269 million reduction in person-miles travelled by air with the NECIP in 1990, about three to four fewer planes of the average size of the 727-200 than would otherwise be required to carry NEC air traffic will be needed. This assumes that productivity per 727-200 is 78.5 million passenger-miles annually as was experienced by Eastern's fleet in 1972.[3] At $10 million to $15 million per aircraft, this is a $30 million to $60 million reduction in necessary capital investment for 1990 service.

While the NECIP will have a fairly insignificant effect on the financial well-being of the major airlines, certain minor carriers and commuter airlines may be less able to withstand revenue reductions. It is the least travelled city pairs which will have the highest percent diversion to rail. These carriers generally do not have the revenue base to absorb reductions, but normally have more flexibility in terms of scheduling and use of smaller, less congested airports.

An informal survey of domestic trunk, local service, and commuter air carriers was conducted in 1975 to solicit opinions on the expected diversion to high speed rail.[4] Diversion projections were considerably higher for HSR than those forecast for the NECIP. The consensus of comments received in that survey were:

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[1] Operating ratio equals total revenues divided by total costs.

[2] The Northeast Corridor High Speed Rail System: Selected Impacts on Alternative Modes, U.S. Department of Transportation, 1975.

[3] Ibid, p. III-6.

[4] Ibid, p. III-26.

- Little concern was expressed over the problems associated with adjustment of costs and capital utilization due to diversion

- Countermeasures to diversion were not considered likely

- NEC traffic is a small and not very profitable portion of total traffic for the domestic trunk airlines

- Air congestion was seen as the most pressing problem in the NEC.

The diversion of air passengers to the rail system will have a small but positive effect on air congestion. A previous study examined data with or without a proposed high-speed rail system at the six major airports in the NEC--Logan, LaGuardia, Newark, Philadelphia, Baltimore-Washington International (BWI), and National Airports.[1] Two scenarios which were studied are of interest:

- Case 1: Air traffic grows to 1986 Federal Aviation Administration (FAA) projected traffic levels in 1990. (There is some evidence that those forecasts are higher than what is now expected.) Airport capacity, however, remains at 1974 levels.
- Case 2: Again assumes that 1986 FAA projected traffic levels are representative of 1990, but that airport capacity will be increased to the 1985 expansion projected by U.S. DOT (Logan +71 percent, LaGuardia +72 percent, Newark +120 percent, Philadelphia +128 percent, BWI +67 percent, National +70 percent).[2]

A model developed by FAA which relates aircraft operations to number of delays was utilized to analyze the effect of reduced aircraft operations due to diversion to rail under the two cases. Table 3-6 shows the projected reduction in number of aircraft delayed with and without the high speed rail system[3] in 1990 for the two cases.

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[1] The Northeast Corridor High Speed Rail System: Selected Impacts on Alternative Modes, U.S. Department of Transportation, 1975.

[2] Recommendations for Northeast Corridor Transportation, U.S. Department of Transportation, 1971.

[3] It should be noted that the High Speed Rail System postulated in that study was a 150 mph system which diverted twice the passengers from air as that expected for the NECIP.

Table 3-6

AIR TRAFFIC CONGESTION REDUCTION IN 1990 THROUGH HIGH SPEED RAIL (HSR) SERVICE*

| | Diverted No. Operations (000) | Number of Aircraft Delayed | | Change |
|---|---|---|---|---|
| | | Without HSRS | With HSRS | |
| Case 1 - With No Capacity Increase | | | | |
| Logan | 28 | 14,780 | 10,994 | 3,786 |
| LaGuardia | 30 | 20,204 | 15,495 | 4,709 |
| Newark | 4 | 33,543 | 32,564 | 979 |
| Philadelphia | 6 | 16,699 | 16,134 | 565 |
| Baltimore-Washington | 6 | 6,942 | 6,641 | 301 |
| National | 18 | 1,297 | 1,042 | 255 |
| Case 2 - With Capacity Increase | | | | |
| Logan | 28 | 1,979 | 1,457 | 522 |
| LaGuardia | 20 | 2,992 | 1,870 | 1,122 |
| Newark | 4 | 2,099 | 1,966 | 133 |
| Philadelphia | 6 | 917 | 847 | 70 |
| Baltimore-Washington | 6 | 1,136 | 1,055 | 81 |
| National | 18 | 199 | 136 | 63 |

*This projection is not for the currently proposed NECIP but rather was for the previous High Speed Rail System proposal which projected a larger diversion from air to rail.

SOURCE: The Northeast Corridor High-Speed Rail System: Selected Impacts on Alternate Modes, U.S. Department of Transportation, 1975.

LaGuardia Airport is the primary beneficiary of the diversion to rail, first, because it is the most congested NEC airport,[1] and second, because a large percent of all air trips diverted to rail begin or end in the New York area.

The study translated number of delayed aircraft into minutes of delay and dollar value of delay, assuming: average delay was 90 minutes for Case 1 and 15 minutes for Case 2; travelers value their time at $12 per hour and airline cost of delay is $10 per minute. The dollar value of the annual delay savings due to HSR ranged from $10.0 million for Case 1 to $0.3 million for Case 2.

The actual impact of the NECIP on air congestion will probably be somewhere between Case 1 and Case 2. Case 1 is an overestimate of delay, because it assumes no increases in airport capacity by 1990. The capacity increases projected for Case 2 are generally felt to be very optimistic and therefore underestimate delays.

Whatever the volume/capacity problems at NEC airports in 1990, the study estimated that the reduced air traffic due to diversion to HSR would be overcome in 15 months at 1974 growth rates. The estimate of the expected diversion to the currently proposed NECIP may provide a "grace period" only half that long.

The reduction in landing fees at eight major corridor airports in 1990, using 1974 rates, was estimated at $7.2 million or 5.6 percent of estimated total 1990 landing fees at those airports.[2] While this again utilized a higher level of diversion than NECIP and some simplistic assumptions, it seems clear that the revenue differential will affect neither the expansion plans nor the financial viability of any major NEC airport.

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[1]Number of aircraft delayed increases exponentially with increasing number of operations.

[2]The Northeast Corridor High-Speed Rail System: Selected Impacts on Alternate Modes, U.S. Department of Transportation, 1975.

Intercity Bus. The NECIP will have an impact on the intercity bus service in the Corridor due to the diversion of riders from intercity bus to rail. The bus industry, commenting on the Draft of this Statement, predicts that these diversions will have serious implications for the future of bus service in the region and they express clear opposition to the NECIP. Three of their concerns are relevant to this portion of the impact analysis: (1) that post-NECIP diversion of passengers from bus to rail could be substantially greater than projected by FRA since the two modes are direct competitors; (2) that despite an overall loss of ridership over the last decade, many of the bus runs directly affected by the NECIP are profitable and contribute more than their share toward the fixed costs of system operation (e.g., terminal expenses); and (3) that the reduction in revenue on these profitable runs will force the bus companies to curtail or eliminate service on marginal runs, perhaps thereby extending the impacts of the NECIP beyond the urban areas directly benefiting from the rail improvement.

The Draft PEIS suggested that these concerns were not serious since the demand projections then available predicted continued and significant growth for bus patronage in the Corridor, albeit at a slower rate than otherwise, even with the improved rail system. However, after restudying the situation, we now believe that the NECIP will force an actual decline in bus ridership along the spine of the Corridor. There are two reasons for the different results. First, the estimate of total intercity travel for 1990 is lower. Second, the estimate for bus trips in the base year, 1975, was found to be seriously understated. This impact is of concern but the publicly available evidence suggests that the magnitude of diverted trips is small in comparison to regional bus trips and that service reductions, if necessary, will be confined to the Corridor spine where improved rail service will offer a viable alternative. The following sections examine the magnitude and significance of this impact in detail.

- Existing Conditions and Trends. Intercity bus service in the NEC is dominated by two Class I Motor Carriers--Greyhound Lines, Inc., and Continental Trailways, Inc. Nineteen city-pairs accounted for 90 percent f the 1975 NEC bus patronage with Greyhound providing 56 percent and Continental Trailways 40 percent of the total weekly bus trips between those city pairs.[1]

The intercity bus mode has had a declining share of the total NEC market in the past 20 years (Table 3-7). Like rail, the bus industry enjoyed a substantial recovery in 1974/1975, largely as a result of the energy crisis. The bus industry further has indicated that factors which led to the declining ridership of recent years have generally played out. These factors included the decline in the U.S. military establishment, growing auto ownership--particuarly among students who are traditional bus riders--and the decline of center city areas where bus terminals are located. Unlike rail, intercity bus carriers have been able to maintain relatively modern fleets out of operating revenues partly by keeping better pace with the travel time reductions of the auto mode as the interstate highway system was constructed.

The trend in revenue and operating expenses for carriers in the New England and Middle Atlantic Regions (excluding Greyhound) indicates that gross revenues show fairly consistent growth, primarily due to fare increases, ıt that on a per bus-mile basis, revenues have not quite kept pace with costs (Table 3-7). The comparison, because it is based on gross data and does not include Greyhound, is admittedly crude, but it does point to the fact that the region's carriers as a whole appear not to be in the financial position to absorb sudden and prolonged losses of revenue without some curtailment of service.

The intercity bus mode has its highest share of the NEC travel market between cities which are 75 to 200 miles apart (Table 3-8). The five city pairs where intercity bus has its greatest share of the total market fall within this 75 to 200 mile distance range. Intercity bus currently captures 5.1 percent of all intercity trips in the NEC. In the baseline case, without the NECIP, this is projected to decline slightly to 5.0 percent of NEC intercity trips by 1990 and with the NECIP to 4.5 percent. The overall diversion to

[1] Based on base year city-pair demand data (see Section 1.4) and bus schedule data collected for the Federal Railroad Administration by Aerospace Systems, Inc., 1977.

Table 3-7

TREND IN INTERCITY BUS RIDERSHIP, EXPENSES, AND REVENUES FOR CARRIERS OPERATING IN THE NEW ENGLAND AND MIDDLE ATLANTIC REGIONS EXCLUDING GREYHOUND

| Year | Gross Revenues (000) | Bus Miles (000) | Gross Revenue Per Bus Mile | Expenses Per Bus Mile[1] | Total Revenue Passenger (000) | | |
|---|---|---|---|---|---|---|---|
| | | | | | New England Region | Mid Atlantic Region | Total |
| 1975 | 95,752 | 94,871 | $1.04 | $1.08 | 7,361 | 27,719 | 35,079 |
| 1974 | 92,751 | 97,099 | .96 | 1.01 | 7,868 | 28,851 | 36,719 |
| 1973 | 69,694 | 79,949 | .87 | .88 | 6,802 | 20,746 | 27,547 |
| 1972 | 66,054 | 80,068 | .83 | .89 | 7,151 | 20,806 | 27,956 |
| 1971 | 78,414 | 92,719 | .85 | .86 | 7,419 | 22,877 | 30,296 |
| 1970 | 73,275 | 94,479 | .78 | .81 | 7,446 | 23,822 | 31,268 |
| 1969 | 58,973 | 80,950 | .73 | .75 | 6,948 | 21,149 | 28,097 |
| 1968 | 64,235 | 89,253 | .72 | .70 | 6,854 | 23,861 | 30,714 |
| 1967 | 67,402 | 105,700 | .64 | .64 | 8,519 | 31,242 | 39,702 |
| 1966 | 64,772 | 104,849 | .62 | .60 | 8,248 | 31,659 | 39,907 |
| 1965 | 62,161 | 101,104 | .62 | .59 | 7,438 | 31,734 | 39,172 |

[1]Equals gross carrier expenses for all services (intercity, local and suburban, and charter) divided by gross bus miles for all services.

Note: Some errors may be associated with individual years due to non-reporting or late reporting

SOURCE: Financial and Operating Statistics, Class I Motor Carriers of Passengers, U.S. Interstate Commerce Commission, Bureau of Accounts, 1965-1975.

Table 3-8
NEC BUS PATRONAGE, 1975

| | Bus Trips (000) | Total Trips All Modes (000) | Bus Percentage of Total | Bus Mileage Between City Pair |
|---|---|---|---|---|
| Baltimore-New York | 422.6 | 2,361 | 17.9 | 194 |
| Baltimore-Philadelphia | 200.1 | 1,888 | 10.6 | 99 |
| Boston-Providence | 340.0 | 9,181 | 3.7 | 50 |
| Boston-New London | 16.0 | 615 | 2.6 | 106 |
| Boston-New Haven | 35.7 | 673 | 5.3 | 148 |
| Boston-New York | 500.1 | 6,946 | 7.2 | 226 |
| Boston-Philadelphia | 45.3 | 888 | 5.1 | 327 |
| Boston-Washington | 21.8 | 808 | 2.7 | 458 |
| New Haven-New York | 403.6 | 3,915 | 11.0 | 78 |
| New London-New York | 48.2 | 909 | 5.3 | 126 |
| New York-Philadelphia | 754.6 | 17,549 | 4.3 | 101 |
| New York-Providence | 167.6 | 1,260 | 13.3 | 186 |
| New York-Trenton | 85.8 | 3,901 | 2.2 | 59 |
| New York-Washington | 584.6 | 7,308 | 8.0 | 232 |
| New York-Wilmington | 145.3 | 1,597 | 9.1 | 124 |
| Philadelphia-Trenton | 80.2 | 5,011 | 1.6 | 33 |
| Philadelphia-Washington | 100.6 | 4,190 | 2.4 | 137 |
| Washington-Baltimore | 351.2 | 7,168 | 4.9 | 40 |
| Washington-Wilmington | 17.9 | 558 | 3.2 | 107 |
| Subtotal | 4,348.2 | 76,726 | 5.7 | |
| Percentage of Total | 98.3 | 88.5 | | |
| All Other City-Pairs | 76.3 | 9,942 | 0.8 | |
| TOATL | 4,424.5 | 86,668 | 5.1 | |

rail projected in 1990 is 34 percent of the 5.7 million bus trips which would be expected without the NECIP and represents a 15 percent reduction from 1975 bus ridership (Table 3-9). The diversion is generally expected in the shorter than average bus trips as reflected in the increase in average trip length by bus from 127 miles without the NECIP to 138 miles with the NECIP. In 1975, bus travel in the NEC accounted for 576 million person-miles of travel. This is projected to grow to 725 million person-miles without the NECIP or 521 million person-miles with the NECIP, a reduction of 28 percent in person-miles which would otherwise be traveled by bus in 1990 due to the diversion to rail and a reduction of 9.5 percent from 1975 levels of person-miles by bus.

- Operational Impacts. Bus services operating between the urban areas along the NEC spine in 1975 generated total revenue estimated at $28.8 million, assuming $.05 per passenger mile. At the same fare level (i.e., constant dollars), revenue would decline to $26.1 million in 1990 as a result of diversion of bus riders to rail. Without the NECIP, bus revenue is projected to grow to $36.3 million by 1990. The $2.7 million revenue reduction from 1975 levels represents 9.5 percent of total bus revenue on the NEC spine ($28.8 million). It represents 0.4 percent of total U.S. passenger operating revenues for Class 1 Motor Carriers in intercity schedules in 1975, and 0.24 percent of total U.S. revenue for all bus service (including charters and local services by those same carriers).[1] Furthermore, the revenue reduction represents about 1.4 percent of estimated total revenue from intercity services for Class 1 Motor Carriers in the New England and Middle Atlantic Region (about $200 million) and less than one percent of total revenue from all services in the New England and Middle Atlantic Region.[2]

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[1] Total revenues as reported in Financial and Operating Statistics, Class I Motor Carriers of Passengers, U.S. Interstate Commerce Commission, Bureau of Accounts, 1975.

[2] Source is same as (1); however, since regional totals do not include Greyhound, totals were doubled to adjust for this exclusion. The factor (two) was based on an analysis of Greyhound's percentage of bus runs operated in intercity service schedules in the NEC region.

Ta 3-9

PROJECTED PATRONAGE FOR INTERCITY ; WITH AND WITHOUT THE NECIP, 1990
Number of Trips (000)

| Trip | 1975 | 1990 With Improved Rail | 1990/1975 | 1990 Without Improved Rail | 1990/1975 | Improved/ Unimproved |
|---|---|---|---|---|---|---|
| Balt-NY | 422.6 | 323.2 | .76 | 479.8 | 1.14 | .67 |
| Balt-Phil | 200.1 | 186.9 | .93 | 267.0 | 1.33 | .70 |
| Bost-Prov | 340.0 | 261.0 | .77 | 478.7 | 1.41 | .54 |
| Bost-NL | 16.0 | 11.6 | .73 | 23.4 | 1.46 | .50 |
| Bost-NH | 35.7 | 39.0 | 1.09 | 42.0 | 1.18 | .93 |
| Bost-NY | 500.1 | 519.8 | 1.04 | 541.4 | 1.08 | .96 |
| Bost-Phil | 45.3 | 48.1 | 1.06 | 55.1 | 1.22 | .87 |
| Bost-Wash | 21.8 | 26.8 | 1.23 | 33.4 | 1.53 | .80 |
| NH-NY | 430.6 | 280.6 | .65 | 446.6 | 1.04 | .63 |
| NL-NY | 48.2 | 29.8 | .62 | 49.4 | 1.02 | .60 |
| NY-Phil | 754.6 | 574.9 | .76 | 840.0 | 1.11 | .68 |
| NY-Prov | 167.6 | 139.6 | .83 | 180.0 | 1.07 | .78 |
| NY-Tren | 85.8 | 105.0 | 1.22 | 249.1 | 2.90 | .42 |
| NY-Wash | 584.6 | 574.4 | .98 | 798.6 | 1.37 | .72 |
| NY-Wilm | 145.3 | 119.3 | .82 | 173.6 | 1.19 | .69 |
| Phil-Tren | 80.2 | 41.6 | .52 | 158.3 | 1.97 | .26 |
| Phil-Wash | 100.6 | 85.8 | .85 | 153.4 | 1.52 | .56 |
| Wash-Balt | 351.2 | 282.6 | .81 | 427.0 | 1.22 | .66 |
| Wash-Wilm | 17.9 | 15.6 | .87 | 24.6 | 1.37 | .63 |
| Subtotal | 4,348.2 | 3,665.6 | .84 | 5,431.3 | 1.25 | .68 |
| All Other City Pairs | 76.3 | 103.2 | 1.36 | 259.4 | 3.40 | .40 |
| TOTAL | 4,424.5 | 3,768.8 | .85 | 5,690.7 | 1.29 | .66 |
| Percent of All Trips | 5.1 | 4.5 | | 5.0 | | |

The effect that such a revenue reduction will have on contribution to fixed costs and profits is not clear. Some portion of the reduced revenue can be offset by reduced operating cost. Curtailment of some service frequencies on the NEC spine will save at least the variable costs of driver salary, fuel, maintenance and depreciation of vehicles. Clearly then, the net effect is substantially lower than the $2.7 million reduction in revenue.

Unfortunately, a precise evaluation of the impact is impossible because ridership, revenue or cost data by bus route have never been made publicly available by the bus companies. Attempts by the Department and its consultants to obtain specific NEC O-D demand and revenue data over time have resulted in minimal fragmented data. In fairness to the companies involved, some of the data are simply not collected in a form useful to NEC planning and, as with any competitive enterprise, the companies do not see that their interests would be served by divulging this data. Greyhound has made some information available to DOT from its annual July Destination Survey but under stringent confidentiality requirements. All that can be concluded from the data are some verification that the 1975 baseline origin-destination estimates for some city pairs used in the demand modeling seem reasonable.

As a consequence of this lack of data, the FRA must take the assurances of the bus companies that the routes primarily impacted by the NECIP are profitable. Since many of the region's high density routes are involved, this conclusion does not appear unreasonable. Certain carriers are also likely to be affected more than others, but this conclusion is likewise based on limited data.

A number of options would seem to be available to the bus companies to offset the effects of continued declines in revenue other than reduction in service frequency. Some restructuring of routes to serve markets not readily accessible to rail and expansion of joint-marketing with Amtrak may be appropriate. The present through-ticketing and baggage checking agreements between Bonanza Bus Company and Amtrak for trips to Cape Cod via Providence and between Greyhound and Amtrak for trips to northern New England are examples of this. Application of these kinds of adjustments combined with growth on other regional routes would seem to indicate that service curtailment or abandonment on marginal bus runs outside the NEC spine due to the projected revenue reduction is unlikely.

Mitigation of the impact of reduced bus revenues is generally impossible within the context of the NECIP. The fact that bus and rail appeal to the same cost-conscious travelers leads to the inalterable conclusion that these travelers will be attracted to the faster rail mode for trips between center cities. Policy changes by DOT or Congress which would alter this basic economic choice (e.g., subsidization of bus fares or station costs) are clearly beyond the purview of the FRA, but are being examined by the Department and the Congress in response to recently introduced legislation. The FRA does actively encourage joint use of rail stations by intercity bus where appropriate.

Finally, the sensitivity of the impacts on the bus industry to errors in the demand projections was of concern to those commenting on the Draft PEIS. One of the bus mode's greatest advantages is its ability to serve numerous terminals in a large urban area as well as many of the small urban areas which will not have direct access to the improved rail system. The bus mode will continue to maintain superior travel times for many of these trips. The FRA is confident that the demand projections reflect the best available data and state-of-the-art projection techniques. As with all projections, however, numerous factors both internal and external to the model itself can affect the accurancy of the estimates. If it is assumed that the projection of diversion from bus to rail was in error by as much as 100 percent, then the reduction in revenue could be twice that predicted but still would represent only three to four percent of total regional revenues of the bus industry.

It would seem that substantially larger errors would be necessary to change the basic conclusions of this analysis. The probability of such errors is felt to be sufficiently small that concern for this possibility is not warranted.

Commuter Rail Service. A number of commuter rail operations share the NEC right-of-way with Amtrak intercity trains. Areas analyzed for impact magnitude include: (1) the effect of the increased frequency and speed of intercity trains on commuter rail travel, schedule reliability, and growth potential; (2) the conversion of commuter equipment to traction power and cab signals compatible with the electrification and signal improvements proposed; and (3) the potential for the competitive diversion of commuter service users to the improved intercity rail system. The following sections discuss these analyses.

- Existing Conditions and Trends. NEC commuter services are provided via agreements with Conrail for operation of commuter trains over the Amtrak-owned ROW. Amtrak and Conrail also have operating agreements with other rail authorities for ROW owned by others; i.e., the Massachusetts portion of the NEC owned by MBTA, the New Haven-Greenwich section controlled by ConnDOT under lease from the Penn Central, and the Greenwich-New Rochelle section owned by the MTA (New York).

Projections of 1981 and 1990 commuter train operations on the NEC were supplied by the various commuter operating authorities (Table 3-10).[1] Certain operators are projecting significant increases in the frequency of trains to accommodate growing travel needs while others are not anticipating increases in frequency and will accommodate growth by increasing train consists.

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[1]The only exception to the use of commuter authority projections is the MBTA 1981 data which showed service levels higher than the MBTA projection for 1990 (which was already 300 percent higher than present). The data was modified to reflect a smoother growth trend to the 1990 levels.

Table 3-10

EXISTING AND PROJECTED COMMUTER ACTIVITY ON THE NEC
AS PROVIDED BY THE APPROPRIATE COMMUTER AUTHORITY
FOR USE IN NEC SIMULATIONS

| Operating Authority | Service | Enters Corridor | Exits Corridor | Trains Per Day[1] (Both Directions) 1977 | 1981 | 1990 |
|---|---|---|---|---|---|---|
| MBTA[2] | Boston-Needham | Boston | Forest Hills | 28 | 53 | 99 |
| | Boston-Franklin | Boston | Readville | 18 | 40 | 63 |
| | Boston-Stoughton | Boston | Canton Jct. | 12 | 28 | 48 |
| | Boston-Attleboro | Boston | Attleboro | 12 | 12 | 29 |
| | Boston-Providence | Boston | Providence | 16 | 16 | 41 |
| RIDOT | Providence-Westerly | Providence | Westerly | 0 | 0 | 4 |
| | Providence-Quonset Point | Providence | Davisville | 0 | 0 | 41 |
| MTA/CTDOT | New Haven-New York | New Haven | New Rochelle | 46 | 46 | 46 |
| | Stamford-New York | Stamford | New Rochelle | 80 | 80 | 80 |
| | New Rochelle-New York | New Rochelle | Shell | 14 | 14 | 14 |
| | Berk-New York | Berk (Norwalk) | New Rochelle | 4 | 4 | 4 |
| | Pike-New York | Pike (Rye) | New Rochelle | 24 | 24 | 24 |
| | Waterbury-Bridgeport | Stratford | Bridgeport | 8 | 8 | 8 |
| | Danbury-New York | Norwalk | New Rochelle | 4 | 4 | 4 |
| | New Canaan-New York | Stamford | New Rochelle | 6 | 6 | 8 |
| LIRR[3] | Long Island-Penn Station | Harold | Penn Station | 408 | 408 | 408 |
| NJDOT | New York-Trenton | Trenton | Penn Station | 34 | 34 | 34 |
| | New York-New Brunswick | County | Penn Station | 37 | 46 | 46 |
| | New York-Bayhead | Rahway | Penn Station | 20 | 6 | 6 |
| | New York-Rahway | Rahway | Penn Station | 26 | 41 | 41 |
| | Newark-Harrison | Newark | Hunter | 56 | 56 | 60 |
| | Newark-Bayhead | Harrison | Rahway | 14 | 8 | 8 |

(continued)

[1] Includes deadhead commuter trains.

[2] The only exception to the use of commuter authority projections is the MBTA 1981 data which showed service levels higher than the MBTA projection for 1990 (which was already 300 percent higher than present). The data was modified to reflect a smoother growth trend to the 1990 levels.

[3] Aside from crossover at Harold, only 72 LIRR trains actually use NEC tracks (Line 1 and 2); does not include proposed JFK Airport Rail Service (see text).

Table 3-10

(cont.)

| Operating Authority | Service | Enters Corridor | Exits Corridor | Trains Per Day (Both Directions) | | |
|---|---|---|---|---|---|---|
| | | | | 1977 | 1981 | 1990 |
| SEPTA | Trenton-Philadelphia | Trenton | Zoo | 41 | 41 | 61 |
| | Chestnut Hill-Philadelphia | N. Philadelphia | Zoo | 76 | 76 | 76 |
| | Philadelphia-Wilmington | Arsenal | West Yard | 40 | 40 | 66 |
| | Philadelphia-Newark | Arsenal | Newark, DE | 6 | 6 | 6 |
| | Philadelphia-Lamokin | Arsenal | Lamokin | 6 | 6 | 6 |
| | Philadelphia-Baldwin | Arsenal | Baldwin | 2 | 2 | 2 |
| | Philadelphia-Media/West Chester | Penn | Arsenal | 80 | 80 | 80 |
| | Philadelphia-Airport[4] | Arsenal | Brill | 0 | 106 | 137 |
| DEDOT | Wilmington-Baltimore | Wilmington | Baltimore | 0 | 0 | 6 |
| MD-DOT[5] | Baltimore-Washington, D.C. | Baltimore | Washington, D.C. | 4 | 4 | 29 |

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[4]Proposed Airport High Speed Line Service (see text).

[5]A new commuter service operating between Philadelphia and Washington, D.C., the "Chesapeake", consisting of one train per day in each direction, was instituted in May, 1978.

SOURCE: Current NEC timetables and projections supplied to the FRA by the appropriate commuter authority.

• Operational Impacts. The 4R Act requires that the NECIP facilitate improvements in and usage of rail commuter services to the extent compatible with overall program goals.[1]

Achievement of this goal depends primarily on identification of system capacity requirements based upon estimated future levels of intercity, commuter and freight traffic and the subsequent design and construction of a system which meets the capacity requirements.

Simulation of the projected system operation identifies specific physical improvements which must be undertaken to meet the intercity trip-time goals while maintaining or improving the quality of commuter and freight services. The NECIP has employed two computer-based simulations for this purpose: the Train Performance Calculator (TPC) and the Logistics Simulator (LOGSIM). TPC is a computerized train simulation which calculates the performance of an NEC train against existing speed restraints such as curve geometry and station stops. By varying the restraints and the improvement costs necessary to reduce them, site-specific improvements may be evaluated for cost-effectiveness.

Trip times calculated by the TPC simulation, combined with additional facilities improvements, schedules and operating rules are the input for LOGSIM, the operations simulation. The LOGSIM includes all projected future traffic on the system (as reflected for commuter service in Table 3-10) and identifies and locates conflicts between trains that result in congestion and delay. Specific delays must then be reviewed by an experienced operations analyst to determine whether they have been caused by inadequate facilities or by the conceptual nature of some schedules which can be eliminated by proper scheduling.

To permit excessive delays to commuter operations upon completion of the NECIP is clearly contrary to the intent of Section 703(2) of the 4R Act.

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[1] 4R Act, Section 703(2).

As a result, unacceptable delays identified through the simulation/analysis process are corrected by the introduction of appropriate facility improvements. It should be emphasized that these improvements (to track layout, interlockings, etc.) generally provide capacity and service benefits to all users of the Corridor. The analysis, combined with continuing engineering, economic, market and environmental evaluations, forms the basis for the final selection of railroad infrastructure changes to be implemented under this Project.

The simulation and operation analysis for the NECIP is not complete. The nature of this process requires that it be a continuing effort reflecting in its development the concurrent trade-off analysis of program elements versus available funds, as well as the various operating agreements being negotiated. In this light, the publishing of the results of any single simulation run is clearly not meaningful without voluminous documentation of assumptions and implications. On the other hand, the expected effects of the project on current commuter operations and the long term implications with regard to commuter growth potential can be discussed utilizing the interim results.

Three things are clear from the analysis completed to date. First, upon completion of the project in 1981, no adverse effects will be felt by existing commuter operations which cannot be eliminated by minor operational modifications or schedule changes. Specific schedule modifications would be implemented by agreement between Amtrak and the individual commuter authorities. The facility changes proposed by this project are designed to provide insurance of no conflict in this time period and will result in greater reliability, speed and schedule flexibility for commuter operations. Second, new commuter services which are presently well advanced and moving to implementation will be accommodated on the NEC (e.g., MBTA Orange Line, Philadelphia Airport High Speed Line). In each case, FRA, working with Amtrak and Conrail, is now negotiating agreements with the commuter authorities on the facilities to be provided and the allocation of costs.

Third, it is likely that certain facilities beyond those proposed by the NECIP will be required by 1990 if the projections of service level for all classes (including certain potential new commuter services) are to be met without degradation of some schedules. The selection of improvements to be installed under the NECIP has been guided by two considerations pertinent to future capacity for all users of the Corridor:

- The NECIP should attempt to provide facilities sufficient to accommodate projected future levels of all classes of service to the extent that the cost of providing such capacity does not preclude attainment of the primary program goal of reliable high-speed intercity passenger service with the funding available.

- In attempting to provide such capacity, priority should be given to existing commuter services (at projected future levels) and to new services which are certain to be implemented. Lesser priority should be given to services which are proposed but which may or may not be implemented.

The following paragraphs discuss the elements of the program which are expected to impart benefits to some degree on all users of the NEC rail system, as well as a segment by segment description of the short and long term effects of the NECIP, to the degree that analyses to date allow.

The proposed signaling and interlocking improvements will enhance operating efficiency and improve the utilization of existing capacity for all classes of service. Centralized Traffic Control (CTC) will be installed in those sections of the Corridor which are generally limited to two tracks. Where installed, CTC allows monitoring of all trains on the system or seeking entrance to it and remote switching. The progress of individual trains through the entire section may thus be planned and adjustments made as necessary. Cab signaling and automatic train control will be provided in CTC territory to ensure that all trains operate as directed. Where CTC is not planned, all signaling improvements will be compatible with its eventual installation.

In selected sections where CTC is not planned, reverse signaling will be added, allowing individual tracks to be used either by northbound or southbound trains. Reverse signaling capability is particularly valuable in accommodating traffic during peak commuter hours with predominantly unidirectional flow, and during maintenance repair work which causes a track to be taken out of service.

Signaling improvements planned by section are:

- Washington to Ragan Interlocking (Wilmington, DE): CTC with cab signaling and automatic train control, controlled from Philadelphia.
- Ragan to Portal Interlocking (Newark, NJ): Rehabilitated system with reverse signaling added on selected main tracks.
- Portal to Harold Interlocking (New York, NY): No change.
- Harold to New Rochelle, NY: Cab signaling and automatic train control.
- New Rochelle to New Haven, CT: Improvement by MTA/ConnDOT, compatible with NECIP improvements.
- New Haven to Boston, MA: CTC with cab signaling and automatic train control, controlled from New Haven.

Selected interlockings will be improved to allow diversionary moves from one track to another at higher speeds and to provide greater operational flexibility in concert with the improved signaling system.

On the Boston to Providence segment of the Corridor, improved intercity service must coexist with current MBTA commuter rail service and with future increases in commuter rail service. First, the MBTA is proceeding with plans to relocate the Orange Line rail rapid transit line onto the MBTA-owned, NEC right-of-way between Forest Hills and Boston (approximately four miles). This segment will be totally reconstructed, largely on a depressed ROW, to accommodate the rapid transit service on two dedicated tracks and Amtrak and MBTA rail commuter service on three separate tracks. Environmental impact documentation for these construction activities is comprehensively discussed in the Final Environmental Impact Statement for the Orange Line Relocation and Arterial Street Construction, South Cove to Forest Hills, filed as a Final EIS in March, 1978.[1] The NECIP is committing approximately $62 million to the MBTA for the Orange Line Project to ensure that the operational needs of the improved intercity rail service are incorporated as proposed and also as a contribution toward the construction of that system. All services will temporarily be rerouted from Readville to Boston on the Dorchester Branch Line during construction of the Orange Line relocation which is currently scheduled to be completed by 1983.

Second, the MBTA has provided forecasts of commuter train operations for 1990 which exceed current service levels by 300 to 400 percent. If these projections are achieved, track capacity problems between Readville and Providence are likely to occur as a result of the significant speed differential between Amtrak and MBTA trains. The potential conflict involves the scheduling of trains departing South Station to avoid the overtaking of a slower commuter train by a high-speed Amtrak train on the two-track Readville to Providence segment.

Preliminary analysis indicates that it is possible to increase both commuter and Amtrak service above current levels to a substantial degree if some schedule flexibility is permitted by both parties. Service levels which approach the 1990 levels now predicted by MBTA are likely, however, to require additional trackage. The extent of the additional trackage would of course depend on the level of service. Realistic projected levels of growth in commuter service between now and 1990 are required as inputs for further simulations. Information has been requested from Massachusetts EOTC for these simulations. Required information includes projected schedule data (trains per day, peak period trains, stops, trip times) and data on the additional equipment the MBTA plans to purchase for this service (performance characteristics, diesel versus electric, have any been ordered yet, what is timing of phase in). The data and subsequent simulation will be used to finalize designs for the NECIP which will avoid short term problems and insure that long term capacity needs are not precluded.

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[1] UMTA Project No. MA-23-9007, FHWA Project No. U-393 (1).

Evaluation of the use of better performing commuter equipment for the long term is also a valid option for increasing capacity and must be examined in relation to the cost and impact of expanded physical plant as well.

No commuter rail service currently is provided on the Providence to New Haven segment of the Corridor. The State of Rhode Island has, however, projected service from Providence to Bristol, Quonset Point and Westerly for 1990. Projections for the last two services are incorporated into the simulations of 1990 service. The probability of overtaking of commuter trains by intercity trains on the Providence-Westerly segment is substantially less than that for the MBTA service described above for two reasons. First, Rhode Island projects relatively low service levels (only two trains per day in each direction to Westerly and 20 trains per day in each direction to Davisville (Quonset Point). Second, the State has projected use of state-of-the-art electric traction equipment with performance characteristics which will result in a lesser trip time differential between the two services.

The State of Connecticut and New York Metropolitan Transportation Authority provide high density commuter service on the New Haven to New Rochelle segment of the Corridor, originating at New Haven, Stamford, Waterbury, New Canaan and Danbury and destined for Grand Central Terminal in New York. The only change in service level (frequency) projected for 1990 by the agencies involved is a slight increase in New Canaan service. The Connecticut DOT and the MTA are currently engaged in electrification and signal improvements, including reverse signaling, which will improve the utilization of the existing four-track system and insure the capacity and reliability needed for 1990 service levels. The NECIP will not affect the implementation of these improvements; design of catenary and power supply systems for eventual high speed service at 25 KV, 60 Hz is proposed under the NECIP. The divergence (crossover) of Amtrak and MTA/ConnDOT services at Shell Interlocking in New Rochelle will continue to be studied as a potential source of future reliability problems. The construction of a flyover at Shell was evaluated but rejected as a part of this Project because of cost. Further degradation of service reliability at Shell is not expected to result from the levels of traffic projected for the three classes of service.

The improved intercity rail service will also coexist with high density commuter services in the area of Penn Station in New York. Between the Harold Interlocking in Long Island and the Hudson Interlocking in New Jersey, the NEC rail line accommodates a highly complex interaction of through and originating Amtrak trains, Long Island Rail Road trains approaching from the east, and New Jersey DOT commuter trains approaching from the west, all utilizing platform space at Penn Station. In addition, proposals exist for new rail service to JFK Airport and Direct Rail Access to Penn Station (DRAP) via a connection to the former Erie-Lackawanna line near Secaucus and Kearney, New Jersey.

The complexity of the various future service scenarios and the physical configuration of this segment has led FRA to contract for a detailed simulation of the Penn Station area. Three cases will be simulated:

Case 1: Existing track layout and signal system. Current traffic as per timetables.

Case 2: Same as Case 1 but with projected 1981 Amtrack and commuter service levels.

Case 3: Same as Case 1 but with projected 1990 Amtrak and commuter service levels.

Analysis to date indicates that 1990 levels of LIRR commuter service (not including JFK service) and Amtrak service can be accommodated without degradation as a result of the interlocking and other improvements proposed by this project at Harold and through the East River Tunnel to Penn Station. Construction of a flyover at Harold to accommodate the crossover of converging LIRR trains was studied and deferred because of cost; however, a new westbound track will be constructed at the Harold Interlocking. The LIRR controls operations at Harold. The proposal to connect the LIRR with Grand Central Terminal via a new 63rd Street tunnel will not be affected by the NECIP. It does not appear that a new tunnel will be necessary to accommodate 1990 levels of intercity and LIRR traffic; this conclusion will be further tested by the above simulation studies.

Although an agreement with Amtrak does exist for provision of the JFK service, no firm proposals for implementation of this service have surfaced to date and none are expected in the immediate future. As with the JFK service proposal, no firm plan exists for the Direct Rail Access Project on the New Jersey side of Penn Station even though the concept has been studied since the early 1960s. No agreement currently exists or is being negotiated to allow such a service into the Amtrak-owned Penn Station. The simulations of Penn Station will form the basis for prediction of conflict and delay caused by introduction of the JFK and DRAP services and the improvements necessary to avoid such conflicts. The design of improvements under the current NECIP will respect these potential services to the degree possible within current funding limitations.

No conflicts which would require facility expansion are anticipated with the present levels of New Jersey DOT commuter service operating on the Trenton to New York segment of the Corridor. The proposal to extend PATH service from Newark to Plainfield, New Jersey, utilizing a portion of the NEC right-of-way (on separate tracks from Newark to Elizabeth) would in fact replace some of the former CNJ service which now operates on NEC tracks and would actually reduce current levels of total traffic on the NEC. The Plainfield Extension will not be affected by the NECIP.

The Trenton to Philadelphia segment of the Corridor accommodates SEPTA commuter rail service originating at Trenton and Chestnut Hill. Increases are projected for the Trenton service by 1990 but simulation studies to date indicate that sufficient track capacity exists to accommodate that increase plus the improved intercity service.

SEPTA also operates service on the Philadelphia to Wilmington segment of the Corridor where some increase in service level is projected by 1990 and a new service to the Philadelphia International Airport (the Airport High-Speed Line) is also proposed. The AHSL proposal had been advanced to the design stage prior to the initiation of the NECIP. Negotiations are ongoing with the City of Philadelphia and SEPTA regarding design concepts and the allocation of costs to accommodate the AHSL on the Corridor between Arsenal and Brill Interlockings. The basis for NECIP participation is that some work would likely have been performed on these interlockings by the NECIP even without the AHSL proposal.

Simulations completed thus far indicated possible capacity problems in accommodating existing SEPTA service in the Wilmington area. The major problem is the movement of commuter trains from West Yard to the Wilmington Station and (primarily as a result of freight movements from the Shellpot Branch through Bell) possible congestion on the Wilmington to Holly Oak segment. A third track from the West Yard to the station is incorporated into the program to eliminate the former. Interlocking improvements are expected to ensure no degradation of current service levels on the Wilmington-Holly Oak segment.

No commuter service has existed on the Wilmington to Baltimore segment of the Corridor but the Delaware DOT has expressed interest in providing some service by 1990 (three trains per day in each direction).[1] This level of service can easily be accommodated on the proposed system. A new number "3" track is proposed for the North Point to Bay segment to alleviate interference with freight traffic.

Considerable concern has been expressed in Baltimore over the impacts of the NECIP on the Northern Central Rail Transit Project. The Northern Central Project is the highest priority for Phase II of the proposed rail transit system for the Baltimore area, linking central Baltimore with Cockeysville, Maryland. The proposed alignment would include a stop at

[1] A new commuter service operating between Philadelphia and Washington, D.C., the "Chesapeake", consisting of one train per day in each direction, was instituted in May, 1978.

Pennsylvania Station, Baltimore, thereby requiring a portion of the NEC right-of-way for a distance of approximately 3,000 feet in order to construct two exclusive transit tracks into the Station. Proposals of the NECIP to reconfigure track in the B & P Junction area will not preclude development of the Northern Central Project. Coordination is ongoing to insure compatible development of both services.

Congestion and delay to intercity, commuter and freight services in the Baltimore area have been chronic problems and the subjects of numerous recent studies. While the NECIP is not expected to degrade service in the short term, the elimination of existing problems would clearly involve substantial capital investment. The FRA has promised continuing analysis of rail operations in the Baltimore area to achieve an equitable long term solution.

Plans in the Washington to Baltimore segment call for improved rail commuter service on the NEC right-of-way, completion of METRO improvements at New Carrollton Station, and a new station at Baltimore-Washington International Airport. The airport station will be constructed with federal funds under a special grant and is not an NECIP improvement. Coordination with Maryland DOT, the District of Columbia and WMATA is ongoing and is expected to lead to implementation of fully compatible improvements.

In summary, current levels of commuter activity on the Corridor, as well as those proposed new services which are proceeding to implementation in the near term, will be accommodated without degradation, and in some cases, with improvement to schedules and reliability. Continuing simulation and analysis will further identify problem areas and possible solutions. Negotiations for minor schedule/operational changes or incorporation of modifications to the physical facilities by the NECIP will be implemented as appropriate.

On the other hand, it is likely that a number of capacity/reliability problems will surface in the 1990 time period if the full projections of Amtrak service, freight service and the various expansions of commuter service or implementation of new commuter services are achieved. Many of these problems would develop even in the absence of the NECIP. In some cases the NECIP will defer the problem, allowing more time for solution. One thing is clear, however, the NECIP with its fixed budget and competing needs cannot afford to construct to full 1990 design volumes and still meet the goals of the 4R Act.

Continuing simulation and analysis will also further identify 1990 facilities needs and the NECIP will be designed for future compatibility with those needs. This data will also provide a quantitative basis for the negotiation of an appropriate allocation of costs for further improvement.

- Impacts on Commuter Equipment. The second area of concern with regard to the impact of the NECIP on commuter rail services is the necessity for the conversion of commuter equipment to 25 KV, 60 Hz traction power and installation of cab signals in order to continue operations on the Corridor after the planned upgrading of electrification and signals. As discussed in Section 1.7.4, the NECIP will fund the conversion of all NEC commuter equipment having a reasonable remaining useful life which is made incompatible by the electrification improvements. In addition, the NECIP will fund the installation or modification of cab signals in all commuter equipment which will remain on the NEC after 1981.

Section 1.7.4 lists the equipment to be converted and equipment which is judged uneconomical to convert due to age and condition. The NECIP will fund the conversion of 187 SEPTA Silverliner MU cars and 104 NJDOT Jersey Arrow MU cars. A schedule of conversion which would complete all conversions by February, 1981 has been developed and judged feasible.[1] Curtailment of present service levels during the conversion period can be avoided by substituting part of the large pool of equipment ultimately destined for service in Conrail's Erie Lackawanna territory for the cars out of service. Delivery of this equipment has begun, and it is expected

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[1]NECIP, Electric Multiple-Unit Car and Locomotive Conversion for Dual-Voltage, Duel Frequency Operation, September, 1977.

to be available until electrification of the EL territory is complete around the end of 1990.

Analysis of conversion and necessary rehabilitation costs have concluded that five SEPTA Silverliner I MU cars, 28 SEPTA E-6 MU cars, 18 NJDOT E-6 MU cars and 13 NJDOT GG-1 locomotives are not economical to convert and should be retired upon implementation of the 25 KV, 60 Hz Corridor electrification system.[1] Twelve E-5 MU cars owned by SEPTA and the Maryland DOT and used in Baltimore-Washington service were not included in the conversion cost analysis because: (1) they are obviously not economical to convert due to their antiquated traction motor design and dilapidated condition; and (2) SEPTA has indicated that all E-5s are planned for retirement before 1981.

The NECIP will impact commuter authorities in those cases where the proposed change in NEC power supply forces retirement of equipment with some useful life remaining. To maintain service, commuter authorities will be required to provide the local share funding to replace outmoded equipment at an earlier date than would be necessary if the NECIP were not implemented. In general, the life of this equipment has been extended to the point where long term total costs exceed those total costs which would result if new equipment were purchased.

Projected replacement needs for SEPTA (on a seat-by-seat basis) are 21 MU cars at a total cost of approximately $16.8 million. Assuming 80 percent funding by UMTA, cost to SEPTA would total approximately $3.4 million. For the Maryland DOT, six new MU cars would be needed to replace the cars presently in service, at a total cost of $4.8 million ($1.0 million local share). NJDOT presently has on order 230 new MU cars for various services; it is anticipated that sufficient cars are included in this order to replace the 18 MU cars which will be retired because of the NECIP. Finally, NJDOT GG-1 locomotives would cost approximately $26 million to replace, $5.2 million of which would be born by the State. The exact number and type of cars to be purchased will depend on further

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[1] NECIP, Electric Multiple-Unit Car and Locomotive Conversion for Dual-Voltage, Dual Frequency Operation, September, 1977.

coordination with the respective commuter authorities, and more precise costs must await firm proposals from manufacturers.

The Urban Mass Transportation Administration has been directed by the Secretary of Transportation to give priority to funding the necessary replacements under the normal UMTA capital grant application process in order to ensure no interruption of service. The total estimated federal share for replacements is $41.2 million. UMTA Section 3 capital grants over the last five years have averaged approximately $1 billion per year nationwide. Assuming continued appropriations in this range, replacement of retired NEC equipment should not significantly impact UMTA's ability to fund other needed capital improvements on a regional or national basis.

Finally, agreements may be reached with regard to pricing and ticketing policies which would prevent wholesale diversion of commuter rail users to Amtrak intercity trains. Such a policy exists now, for example, between Amtrak and Connecticut DOT which prevents Amtrak ticket sales for trips between New York and points west of New Haven.

Rail Freight Service. In addition to Amtrak's intercity and suburban commuter rail passenger services, the NEC accommodates varying levels of rail freight service provided by Conrail. Freight trains will continue to be third priority users of the Corridor,[1] after intercity and commuter trains, and will experience the greatest potential for any delay resulting from the increased speed and frequency of passenger service. NECIP improvements, in concert with a more disciplined Corridor operation by all users, will accommodate 1981 levels of freight on-Corridor without degradation of service. If a 30 percent increase in carloads by 1990 is achieved along with the projected levels of passenger service, congestion

[1]Section 403 of the Rail Passenger Service Act (45 U.S.C. 562 (e)(1) provides that "except in an emergency, intercity passenger trains operated by or on behalf of the Corporation [Amtrak] shall be accorded preference over freight trains in the use of any given line of track, junction, or crossing ...". This section is not restricted to the NEC but applies nationwide.

delays will increase and further capacity improvements may become necessary. In addition, Conrail will bear the capital cost of converting to 25 KV, 60 Hz motive power.

• Existing Conditions and Trends. Rail freight operations are made up of two general types of trains: through freights and local freights. Through freights are regularly scheduled trains which run between major terminals and perform the road haul portion of the car movement. Local freight operations involve the pickup and delivery of cars between a terminal and local industries.

The overall level of rail freight activity on the NEC differs considerably in the segments south and north of New York. The southern half of the NEC from Newark, NJ to Washington, DC is heavily used as a through freight corridor while only locals use the NEC in the north with the exceptions of four trains per day which use the Devon to New Haven segment and trains which use short segments between Providence and Readville (Table 3-11). This distinct difference reflects the greatest concentration of the rail-shipping industry on the Corridor south of New York, the greater capacity of the system in this portion, and the line ownership and routing patterns of Conrail and its predecessor railroads.

Fashioned from the Penn Central Railroad and six smaller bankrupt carriers, Conrail is the largest railroad in the nation, operating 1,500 freight trains daily over a 17,000-mile route structure in 16 states and two Canadian provinces. Included in this route system are the trackage rights for freight services on the NEC. Conrail pays Amtrak a user fee based on freight car-miles operated on the NEC; these fees, based on a Conrail/Amtrak operating agreement dated April 1, 1976, amounted to some $28 million in the first year of Conrail operation. A final agreement on car-mile fees has yet to be reached; at issue is the extent of Conrail's contribution to maintenance expense post-NECIP. Conrail carries 44 percent

Table 3-11

DAILY TRAFFIC DENSITY ON NORTHEAST CORRIDOR SEGMENTS

| Line Segment | Number of Miles | Number of Main Tracks | Number of Trains | | | |
|---|---|---|---|---|---|---|
| | | | Intercity | Commuter | Freight[1] | |
| | | | | | Local | Through |
| North of New York: | | | | | | |
| Boston to Providence | 44 | 2-3 | 22 | 16-86 | 6 | - |
| Providence to New London | 62 | 2 | 22 | 0 | 4 | - |
| New London to New Haven | 51 | 2 | 22 | 0 | 4 | - |
| New Haven to Stamford | 39 | 4 | 28 | 46-62 | 6 | 4 |
| Stamford to New Rochelle | 16 | 4 | 28 | 140-178 | 4 | - |
| New Rochelle to New York | 20 | 2-4 | 28 | 0-408 | 0 | - |
| South of New York: | | | | | | |
| New York to Newark | 10 | 2 | 82 | 117 | 0 | - |
| Newark to Rahway | 11 | 4-6 | 82 | 131-187 | 3 | 27 |
| Rahway to Trenton | 37 | 4 | 82 | 34-71 | 7 | 27 |
| Trenton to Philadelphia | 33 | 4 | 82 | 46-134 | 6 | 11 |
| Philadelphia to Wilmington | 27 | 4 | 50 | 40-94 | 3 | 16 |
| Wilmington to Perryville | 32 | 2-3 | 50 | 6 | 7 | 17 |
| Perryville to Baltimore | 36 | 4-2 | 50 | 0 | 3 | 25 |
| Baltimore to Washington | 40 | 3 | 50 | 4 | 3 | 19 |

[1]Draft Initial Assessment, U.S. Department of Transportation, Federal Railroad Administration, 1976.

[2]Operates over some portions of the line segment.

[3]Does not include unscheduled freight trains.

of revenue ton-miles in the Eastern District,[1] nearly double that of its two major competitors in that area--the Chessie System (25 percent) and the Norfolk & Western (21 percent).[2] Conrail is challenged in the NEC region, however, only by Chessie's parallel route from Washington to Philadelphia and the alternative access to New England provided by the Boston and Maine (Figure 3.2).

Freight operations on the NEC system are largely defined by this mainline route system and the two primary northeastern classification yards established by Penn Central and maintained by Conrail. These are the Selkirk yard near Albany, New York and the Enola Yard near Harrisburg, Pennsylvania. Selkirk is the gateway for traffic destined for New York City, Long Island and New England; primary flows are along the Hudson River, across Massachusetts on the Boston & Albany line and south to New Haven. This routing pattern virtually eliminates through freights from the NEC north of Newark, New Jersey while allowing pick-up and delivery by local freights at industries located on the Corridor.

Conrail traffic for the NEC region south of New York consists primarily of trains made up at Enola Yard near Harrisburg (or made up at Conway Yard, Pittsburgh and routed via Harrisburg), and traffic fed onto the Corridor by connecting carriers to the south via Potomac Yards. Freight traffic on the NEC south of Newark is made up of through trains from the west and south traveling over portions of the Corridor enroute to major Corridor yards, through freights operating between Corridor yards, and locals operating between yards and Corridor industries.

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[1]The Interstate Commerce Commission Eastern District includes: Maine, New Hampshire, Massachusetts, Vermont, Connecticut, Rhode Island, Pennsylvania, New York, New Jersey, Maryland, Delaware, Virginia, West Virginia, Ohio, Indiana, Eastern Illinois, and the southwest peninsula of Michigan.

[2]Preliminary System Plan, United States Railway Association, Volume I 1973.

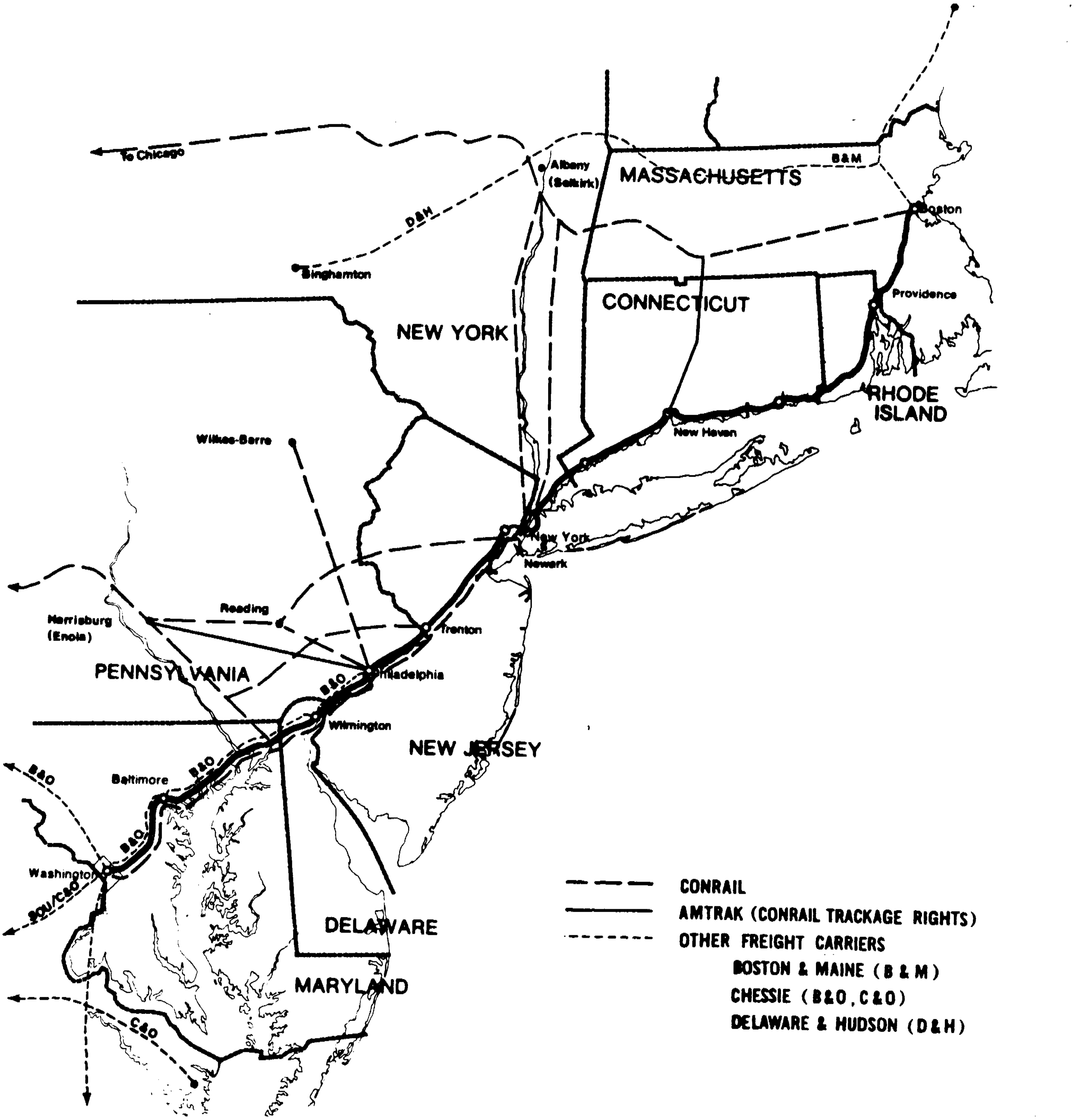


Figure 3.2

MAINLINE FREIGHT ROUTES
NEC REGION

Between Newark, New Jersey and Boston, Massachusetts, system capacity is generally adequate at the present time due to the virtual absence of through freight operations (Table 3-11). However, the high density of all three types of trains and the operational differences between them create congestion between Newark and Washington. The highest overall traffic levels are found between Newark and Philadelphia. Between Wilmington and Baltimore, no commuter service is provided but high levels of freight, especially trains traveling between Enola and Potomac Yards, and Amtrak trains must be accommodated on a partially double-track system.

The slow long-term rate of traffic growth experienced by railroads nationally and the actual post-war decline in Eastern District rail freight volume has resulted from a number of factors, particularly the technological development of competing modes, the construction of an interstate highway system, and the shift of rail-oriented heavy manufacturing to the south and west. However, a number of recent developments suggest that at least a modest Eastern District recovery lies ahead. Conrail represents a serious attempt to deal with the cycle of decline of many eastern railroads. In addition to public investment in rail rehabilitation, any large-scale conversion of electrical generation to coal will benefit railroads, which dominate shipment of coal (78 percent by rail nationally in 1970). Also, railroads are an energy-efficient mode, penalized less than highway and air carriers by increases in energy cost. This, combined with efficiency improvements in both Trailer-on-Flat Car (TOFC) and Container-on-Flat Car (COFC) services, should improve the rail freight market share.

FRA has adopted an NEC system freight projection of 1.3 times 1973 carloadings for simulation of 1990 operations. This projection reflects a series of freight traffic estimates developed initially in Task I.[1,2] USRA subsequently developed forecasts for the entire Conrail system for use in planning the restructuring of freight service in the Northeast and

[1] Demand Analysis, Task I, U.S. Department of Transportation, Federal Railroad Administration, 1975.

[2] The projection does not reflect Conrail's own Five-Year Business Plan projections which predict an actual decline in system traffic. By using the conservatively high estimate of growth, we attempt to introduce flexibility in future freight operations on the Corridor.

Midwest. In its final form, the compound annual tonnage growth rate for the Conrail system from 1973 to 1985 was projected at 1.21 percent.[1] This growth rate computes to 1985 system tonnage 1.16 times the 1973 base year. Extending the forecast to 1990 at the same growth rate would yield 1.23 times the base year. Earlier USRA projections, which were based upon more optimistic forecasts for the national economy, compute to 1.18 times the base year for 1985 and 1.27 for 1990 (again assuming the same growth rate through that year).[2]

In short, USRA's freight forecasts seem consistent with the NECIP 1990 projection of 1.3 times 1973 carloadings. It should be emphasized however, that attainment of a 30 percent growth in traffic by Conrail is by no means certain. Major improvement in the quality of service will be necessary to reverse the post-war decline in rail freight tonnage. Also, both NECIP and USRA forecasts are heavily dependent on markedly increased coal production. While large scale conversion of electric utilities and industry to coal is proposed, no concrete action toward this end has yet been taken.

- Operational Impacts. The 4R Act requires that implementation of the NECIP result in the maintenance and improvement of rail freight service to all users located on or adjacent to the NEC and the maintenance and improvement of all through freight services which remain in the NEC, to the extent compatible with overall NECIP goals.[3]

Joint passenger-freight use of the NEC presents special operational problems deriving from the operational characteristics of freight trains. Freights operate at lower speeds than existing passenger trains and this operational difference will increase when high-speed passenger service is introduced. Therefore, a freight train must either: (1) operate on tracks not used by intercity trains; (2) be given sufficient track space to

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[1] Final System Plan, United States Railway Association, 1975.

[2] Preliminary System Plan, United States Railway Association, 1975.

[3] Section 703(3) of the 4R Act.

complete its on-Corridor movement before being overtaken by a passenger train; or (3) be switched off mainline tracks to allow the passage of passenger trains. Local freight operations are characterized by many movements onto and off the Corridor throughout a workday. The schedule reliability of freights is poor in comparison to passenger operations; as an input to the NEC operations simulation, it was found that 25 percent of conventional trains departed Waverly Yard, Newark, more than two hours behind schedule.[1] Trains which are made up at yards off the Corridor, but travel over the Corridor to their destinations (such as Enola to Potomac Yard via Perryville) have an even wider variation. These characteristics represent potential delay-producing conflicts with passenger operations which must be resolved in order to achieve the trip time goals and desired increased levels of reliability.

Substantial system design and simulation work was performed by the FRA prior to the establishment of project goals.[2] Two systems to accommodate freight operations between Washington and New York were selected for this earlier modeling. The "off-Corridor" scenario involved maximum separation of through freight and high-speed passenger services by diverting this freight traffic to a parallel route utilizing Baltimore and Ohio and Conrail lines. The other scenario kept freight on-Corridor but separated it from passenger service by construction of major ROW improvements such as additional tracks. The "on-Corridor" scenario was by far the more expensive solution, but avoided the institutional problems of B&O ownership of the Washington-Philadelphia parallel route. Both scenarios involve much more extensive and costly system facilities than are now judged necessary to meet the NECIP goals.

Two major simulation inputs based on the requirements of the 3R Act, which are no longer applicable, are responsible for this difference. First,

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[1] Scenario Development and System Simulation, Task 4, U.S. Department of Transportation, Federal Railroad Administration, 1975.

[2] System Simulation of Scenario 14, Task 4B, U.S. Department of Transportation, Federal Railroad Administration, 1975.

the early simulations used trip time goals of two and a half hours between Washington and New York and three hours between New York and Boston. The NECIP goals have been set by the 4R Act at two hours and forty minutes, and three hours and forty minutes, allowing closer train spacing and accommodating a greater delay allowance for intercity passenger trains while still achieving the specified running time. Second, the earlier simulations portrayed systems which were required to accommodate much higher levels of traffic than are now projected; i.e., 36.7 million annual intercity passengers instead of the currently projected 21.8 million passengers, and a doubling of freight traffic instead of the projected 30 percent increase.

Simulations based on revised traffic level projections indicate that the 4R Act trip-time goals for intercity passenter trains can be met, and 1981 levels of freight traffic maintained on-Corridor, without major construction of new facilities such as long stretches of additional track, grade separations or tunnels. A sufficient increase in system capacity will be gained by previously discussed improvements to track alignment, interlockings and signaling, and by improved operational procedures. However, should NEC freight traffic attain a 30 percent growth level by 1990 along with the projected levels of intercity passenger and commuter traffic, increased congestion at some locations on the Corridor will occur and further physical improvement will probably be necessary.

The NECIP, as proposed, reflects the concept that operational benefits can be gained at little cost from a more disciplined operation by all users of the Corridor and that certain standard procedures should be applied to freight operations in lieu of major capital investments to accommodate levels of freight traffic which may not develop. The key to the future compatibility of freight and passenger operations on the NEC is, then, improvement in the discipline associated with all operations on the Corridor. Freight trains are by far the least disciplined operators on the NEC, particularly in terms of schedule reliability and equipment failure. The NECIP must be designed under the assumption that improved discipline in freight operations, and in fact certain controls on freight operations (some of which exist today but are not regularly enforced), will be implemented in the future. Among the more probable controls are: limitations on train length; restriction of freight entry onto the NEC during peak passenger traffic hours; elimination of make-up or switching movements utilizing high-speed tracks; and requirement of continuous movement for all access and egress to and from high-speed tracks.

Recent research and railway experience indicate that train length is a significant factor in the reliability of freight trains, longer trains being more prone to failures and delays. The increased per-car costs of operating shorter trains under normal conditions may thus be outweighed by the unpredicted costs involved with random failures. Increased reliability of freight train operations also decreases the chance that such a train, properly scheduled, will be "side-tracked" which presently occurs when a freight running off-schedule is causing delay to passenger operations. While Conrail may initially perceive such a restriction negatively, limiting freight trains to no more than 85 cars would probably be beneficial in the long run.

Proper inspection of rolling stock is also necessary for reliable operations. The equipment of all classes of trains must be properly inspected and only dispatched if it is found that it can be operated safely and reliably at scheduled speeds. Present regulations covering such inspections and maintenance are adequate, if rigidly adhered to, to meet the requirements for operation on the NEC.

The NEC, as does any railroad, has a specific capacity to efficiently handle a given number of trains of a given class or a given number of trains for a particular mix of the various classes of trains. Railroads have historically scheduled their train operations on a prioritized basis to accommodate this situation. It has been particularly true of operations in the NEC during periods when there was a greater emphasis on reliability of scheduled performance and the economics which are realized from a disciplined operation. If the total number of trains to be operated during short peak periods is in excess of that which can be reliably operated, it may be necessary to restrict the operation of freight trains during these periods.

Finally, a designated track concept of operations will be implemented on the NEC. Two tracks will be designated for mainline passenger trains: the two westerly tracks between Washington and Wilmington; the two center tracks between Wilmington and New Haven; and, of course, both of the existing tracks between New Haven and Boston. Wherever possible use of the mainline tracks by other than intercity passenger trains will be minimized. The chosen designations place freight traffic on the easterly side of the system where most freight facilities are presently located. Crossing movements by freights will be eliminated to the extent possible.

This operational concept differs from dedicated tracks, in which certain tracks could be reserved for the exclusive use of passenger trains. Rather, the concept to be implemented on the NEC can best be described as a "game plan" to be applied in the scheduling of various classes of trains. When it is found that a particular train cannot be scheduled on a track as designated by the "game plan" but that there is a "window" in which it can be scheduled on another track without degrading any class of service, this will be done. This logic will likewise be applied in the day to day dispatching of trains. Application of the designated track concept will minimize the damage to high-speed tracks caused by heavy freights while not limiting the track capacity available to freight operations.

Improved, more realistic scheduling and the more disciplined operation of all classes of trains is essential to the NECIP goal of improved performance of all classes of trains on the NEC. This will clearly produce increased performance reliability and if the train schedules are properly developed, greater schedule adherence which is desired by all the operators of trains on the NEC. It is not economically feasible to construct the additional capacity which would be required to permit any particular carrier to operate its trains "at will" without respect for the effect on other trains being operated.

It is anticipated that Conrail's per-car cost of operating freight trains on the NEC can be reduced. The present erratic performance of freight results in the use of relief crews and delay to traffic which can be reduced or even eliminated by prudent scheduling and a more disciplined operation. Conrail may incur an incremental increase in the cost of inspecting and maintaining locomotive and car equipment but only to the degree that the present methods may be substandard and counterproductive.

As with the commuter operations previously discussed, the continuing simulation of 1981 and 1990 NEC operations will identify problems associated with increasing levels of freight operations which will occur even with the assumptions regarding more disciplined operations. Interlocking reconfigurations and, where necessary, limited segments of additional track, are being incorporated into the NECIP to insure the maintenance and enhancement of freight operations as required by the 4R Act.

- Capital Cost Impact. Conrail will incur substantial capital costs to make its motive power compatible with the electrical system to be installed on the NEC. Conrail has three types of equipment to consider: modern electric; ancient electric; and diesel. The ancient electrics--GG-1's and E-40's--will have to be replaced soon, regardless of project actions. The conversions are further discussed in Section 1.7.4. Replacement cost for equivalent capability with new locomotives is approximately $59 million. The 66 modern E-44 locomotives and 10 E-33 locomotives can be modified at a cost compatible with any electrification options. It is expected that Conrail will bear the $28.5 million cost using funds already provided under the Act. As yet unidentified, costs for the modification or installation of cab signals must also be borne by Conrail. Title V provides funding to Conrail for rehabilitation of equipment and the cost allocation principles in the Final System Plan stated clearly that where a user is not the principal user, he is expected to assume all incremental costs.

Faced with these capital costs and the continuing assessment of car-mile fees for use of the NEC, Conrail may find it cost-effective to make investments in alternate routes and remove freight traffic from the Corridor wherever possible. This strategy is already being followed in a limited manner north of New York where Conrail has diverted trains from the Amtrak-owned Springfield-New Haven line to its own route down the Hudson River. On a larger scale, Conrail controls an alternative route between Newark, NJ and Philadelphia. The cost to upgrade this by-pass route was estimated in 1975 at $36.8 million[1] and Conrail is presently conducting its own study of diverting traffic off-Corridor between Newark, NJ and Philadelphia. South of Philadelphia, the Chessie System owns the practical by-pass routes. Conrail use of these lines would require more substantial investment to construct new track capacity and the subsequent negotiation of a mutually beneficial trackage rights agreement. The implementation of any major freight diversion routes will, then, be based on the judgement of Conrail management and the availability of funding.

Finally, it is the general intent of the Project to maintain the capability to accommodate all shipments which are presently moved on the NEC. The staff is working with Conrail and is presently undertaking an inventory of the types of oversize shipments which are moved with some regularity on the NEC and the impact, if any, which proposed changes will have on Conrail's future ability to move via existing or alternate routes. Established clearance standards will be used in the construction of new bridges where environmental and economic constraints permit.

Waterway Navigation. The NEC mainline tracks between Boston and Washington cross approximately 206 individual waterways.[2] Fifty-one of

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[1] Scenario Development and System Simulation, Task 4, U.S. Department of Transportation, Federal Railroad Administration, June, 1975.

[2] NECIP Bridge Inspection, Analysis, Rating and Improvement Program, U.S. Department of Transportation, Federal Railroad Administration, January, 1977.

these waterways presently accommodate commercial and recreational boat traffic. Due to the projected increase in passenger operations along the NEC, long-term operational effects may occur at the 15 movable bridges.

- Existing Conditions and Trends. Ten of the movable bridges on the Corridor are in Connecticut, one is in New York, two are in New Jersey, and two are in Maryland (Table 3-12). All of the bridges cross major rivers except Shaw's Cove which is a small tidal inlet off the Thames River in New London, Connecticut.

The nature and volume of traffic on these waterways varies and includes both commercial vessels and recreational craft. Significant levels of commercial traffic exist at Groton, Connecticut River, Pequonnock River, Norwalk River, Pelham Bay, Hackensack River and Passaic River. It is important to note that not all movements require a bridge opening. Much of the traffic can pass under the bridges while the span is in the closed position. Exact data on the number of watercraft which pass under the bridges is not available; however, the total number of bridge openings was obtained from a review of the individual bridge logs (Table 3-12). The variation is large--from less than 25 times per year at Bush and Perryville to over 2,500 times at Mystic, Niantic, Pelham Bay, and Dock.

Research into the laws and statutes pertaining to the railroad's obligations to open a given drawbridge for mariners reveals a potential conflict with increasing train frequency. Section 5 of the 1894 Bridge Act (33 U.S.C. 499) states:

> It shall be the duty of all persons owning, operating and tending the drawbridges now built (prior to August 18, 1894) or which may hereafter be built across the navigable rivers and other waters of the United States, to open, or cause to be opened, the draws of such bridges under such rules and regulations as in the opinion of the Secretary (of Transportation) the public interests require to govern the opening of drawbridges for the passage of vessels and other watercrafts, and such rules and regulations, when so made and published, shall have the force of the law.

Table 3-12

BRIDGE LOCATIONS, TOTAL OPENINGS, AND COMMERCIAL NAVIGATION

| Bridge Name | Waterbody | Town/State | Total Number Openings | Vertical Clearance With Closed Span (Feet Above MHW) |
|---|---|---|---|---|
| Mystic River | Mystic River | Mystic/Connecticut | 3,027[1] | 4.5 |
| Groton | Thames River | Groton/Connecticut | 2,286[1] | 30.9 |
| Shaw's Cove | Inlet to Cove | New London/Connecticut | 1,213[1] | 3.0 |
| Niantic River (Nan) | Niantic River | Waterford/Connecticut | 2,635[1] | 11.0 |
| Connecticut River (Conn) | Connecticut River | Old Saybrook/Connecticut | N/A | 18.5 |
| Devon | Housatonic River | Milford/Connecticut | 207[2] | 19.6 |
| Pequonnock River (Peck) | Pequonnock River | Bridgeport/Connecticut | 148[2] | 18.0 |
| Saugatuck River (Saga) | Saugatuck River | Westport/Connecticut | 168[1] | 13.0 |
| Norwalk River (Walk) | Norwalk River | Norwalk/Connecticut | 506[1] | 16.2 |
| Cos Cob | Mianus River | Greenwich/Connecticut | 1,961[1] | 20.0 |
| Pelham Bay | Hutchinson River | Pelham Manor/New York | 4,000[3] | 8.0 |
| Portal | Hackensack River | Secaucus/New Jersey | 1,300[1] | 23.0 |
| Dock | Passaic River | Newark/New Jersey | 600[1] | 24.0 |
| Perryville | Susquehanna River | Perryville/Maryland | 1-2[3] | 52.0 |
| Bush | Bush River | Edgewood/Maryland | 25[3] | 12.0 |

[1] 1976-1977 data collected by inspection of individual bridge logs.

[2] 1973-1974 Data, U.S. Coast Guard, Third District.

[3] Unpublished Engineering Data, Tasks 15.1 and 15.2, U.S. Department of Transportation, Federal Railroad Administration.

The Secretary of the Army and the Commandant of the Coast Guard have promulgated specific regulations for each drawbridge in the U.S. (Title 33, Code of Federal Regulations, Section 117).

● Operational Impacts. The possibility that a movable bridge will not immediately accommodate mariner traffic becomes significant considering the increase in number of train movements and the reduced headways anticipated with the NECIP (Table 3-13). The projected increase in daily trains crossings of each bridge between 1975 and 1990 ranges from 13 percent at Cos Cob to 64 percent at the Pelham Bay, Perryville, and Bush River Bridges. For the bridges south of Devon, except for Pelham Bay, total train movements will exceed 100 per day. Except for the Cos Cob Bridge, intercity trains will account for more than one-third of the total train movements in 1990.

Although the frequency and duration of delays is now known, some mariners will experience delays as a result of the increased train movements scheduled in conjunction with the NECIP. Possible delays to mariners on those rivers east of New Haven, i.e., Mystic, Groton, Shaw's Cove, Niantic, and Connecticut, should not be significant since intercity trains will operate at one-hour headways, freight traffic is light, and no commuter service is provided. Between New Haven and New York, intercity trains will also operate at about one-hour headways, but increased intercity volume in combination with increasing commuter rail may cause delays to mariners at the Devon, Peck, Saga, Walk, and Cos Cob Bridges. Delays to marine traffic south of New York are most likely to occur at the Portal and Dock bridges, which are presently opened 1,300 and 600 times per year, respectively. In this area, volumes of both intercity and commuter trains are at a maximum. Because the Perryville Bridge is only opened once or twice a year, no significant delays are anticipated in accommodating the passage of large boats from a shipbuilder located four miles upstream. Similarly, delays at the Bush Bridge due to additional train traffic should not be significant since this bridge is only opened 25 times a year, mainly on weekends.

In order to minimize these potential delays to marine traffic, structural and mechanical improvements or full replacement will be made to 13 of the movable bridges. Many of the bridges have mechanical and electrical components which are in a poor state of repair. Consequently, the movable spans

Table 3-13

DAILY NUMBER OF TRAINS CROSSING MOVABLE BRIDGES

| BRIDGE | Total Train Crossings[1] 1975 | Total Train Crossings[1] 1990 | Increase Number | Increase Percent | No. of Intercity Trains 1975 No./% of Total | No. of Intercity Trains 1990 No./% of Total |
|---|---|---|---|---|---|---|
| Mystic | 26 | 42 | 16 | 62 | 22/85 | 38/90 |
| Groton | 26 | 42 | 16 | 62 | 22/85 | 38/90 |
| Shaw's Cove | 26 | 40 | 14 | 54 | 22/85 | 38/95 |
| Niantic | 26 | 40 | 14 | 54 | 22/85 | 38/95 |
| Conn | 26 | 40 | 14 | 54 | 22/85 | 38/95 |
| Devon | 88 | 106 | 18 | 20 | 28/32 | 46/43 |
| Peck | 88 | 106 | 18 | 20 | 28/32 | 46/43 |
| Saga | 86 | 106 | 20 | 23 | 28/33 | 46/43 |
| Walk | 86 | 106 | 20 | 23 | 28/33 | 46/43 |
| Cos Cob | 160 | 180 | 20 | 13 | 28/18 | 46/26 |
| Pelham Bay | 28 | 46 | 18 | 64 | 28/100 | 46/100 |
| Portal | 199 | 293 | 94 | 47 | 82/41 | 106/36 |
| Dock[2] | 199 | 293 | 94 | 47 | 82/41 | 106/36 |
| Perryville | 78 | 128 | 50 | 64 | 50/64 | 76/59 |
| Bush | 78 | 128 | 50 | 64 | 50/64 | 76/59 |

[1] Includes through and local freight, commuter and intercity trains.

[2] Dock bridge also accommodates Port Authority commuter trains on a separate span. These trains are not included in totals.

frequently jam and render the bridge impassable to marine and/or rail traffic. With the improvements planned, the mechanical, electrical, and structural components of the bridges will be completely restored and refurbished to ensure efficient, consistent operation of the movable spans, virtually eliminating the frequent breakdowns now experienced and reducing the opening/closing cycle time. In addition, several movable bridges (Mystic, Shaw's Cove, and Niantic) will be totally reconstructed to correct structural deficiencies and increase vertical clearance to the maximum extent feasible. With these improvements a greater number of vessels will be able to pass under the bridges with the spans in the closed position.

The potential for delay to waterborne commerce is greatest at Portal Bridge. Rail traffic across this bridge is presently 199 trains per weekday, projected to grow to 293 trains per weekday by 1990. Approximately 25 percent of the total projected increase will result from increases in intercity trains (82 in 1975 to 106 in 1990). The projected 1990 traffic would exceed 293 trains per day if the Direct Rail Access Project (DRAP) is implemented. The DRAP proposal envisions direct commuter service from the New Jersey suburbs to Penn Station, New York.

Marine traffic requiring a Portal Bridge opening during 1977 has been estimated at 1,287 vessels. (Estimate was derived by recording from the bridge operator's log, two week's activity for each month and factoring to 52 weeks.) Traffic is almost exclusively commercial, showing a relatively even distribution throughout the year (from a low of 40 vessels for the two-week sample in June, 1977, to a high of 67 for two weeks in February). Marine traffic is also evenly distributed throughout the week, averaging just under four vessels per day, except for lower volumes on Sundays. Hourly distribution reveals a higher frequency in the 10 pm - 6 am period perhaps indicating an effort on the part of some operators to avoid delays by arriving at Portal when rail traffic is light. Nevertheless, 60 percent of the total traffic passes the bridge between 6 am and 10 pm, when trains are crossing at peaks up to 20 trains per hour.

The Coast Guard regulations governing operation of Portal Bridge (Title 33, Code of Federal Regulations, 117.200) require as a general rule that the draw be opened promptly upon signal for the passage of vessels at any hour. However, the regulations give priority to the passage of passenger trains: if a vessel reaches the bridge less than five minutes before a train is due, the draw need not be opened until the train has passed. Operation of this bridge under the current regulations thus results in delay to waterborne traffic, and the incidence of delay will increase in the future with higher train volumes. Also, a limited amount of delay is experienced by intercity and commuter trains since the minimum time required to open the bridge, pass a vessel, and close the bridge is approximately 10 minutes. The number of trains delayed would also increase in the future.

More severe disruptions to navigation are caused by the poor operational reliability of the Portal Bridge. The Coast Guard has reported 24 malfunctions affecting navigation during 1977. These malfunctions would typically cause delays of much longer duration than are experienced awaiting an opening between trains.

Rehabilitation of the existing Portal Bridge and replacement of six deteriorated undergrade bridges on both sides of the river are proposed under the NECIP, at an estimated cost of $18.2 million. Rehabilitation of Portal Bridge will remove the train speed restrictions currently imposed and will virtually eliminate the repeated malfunctions and breakdowns which cause major disruptions to navigation.

Both the Port Authority of New York and New Jersey and the U.S. Coast Guard have proposed that the NECIP construct a new high-level (40-foot to 50-foot clearance) fixed bridge to improve rail access to and from New York City, and allow passage of shipping without delay. The cost of a high-level fixed bridge is estimated at approximately $86 million dollars. The concept of a high-level fixed bridge has been developed as one component of the DRAP proposal which, if implemented, would add four trains per hour during peak periods to the rail traffic between Newark and Penn

Station, New York. The benefit of a fixed bridge would be that trains could not be delayed by bridge openings.

While considerable study has been accomplished in development of the DRAP proposal and funding may soon be committed for connection of the New Jersey commuter lines to the NEC, a number of institutional and physical constraints to full implementation exist. All of these constraints revolve around the capacity of the Corridor between Newark and Penn Station. The entire system in this area is limited to two tracks, including the Hudson River Tunnels. FRA is currently conducting studies to evaluate the operational capacity of the system and the improvements needed to increase that capacity. If it is found that sufficient capacity can be provided at reasonable cost through signaling improvements to accommodate future levels of present intercity and commuter services plus DRAP trains, then a new Portal Bridge will be a desirable improvement, though not necessarily essential to implementation of DRAP. If sufficient capacity in the system cannot be provided at reasonable cost, construction of a high-level bridge will remove only one of many constraints to implementation. In either case, substantial expenditure will be required to implement DRAP beyond that necessary for the bridge alone.

The most serious impacts to navigation at Portal are likely to be caused by breakdowns of the movable span. These breakdowns would be eliminated as a result of the proposed rehabilitation. As train frequencies increase, the incidence of delays to waterborne traffic will increase. It may become advisable at some future date to modify the regulations controlling operation of this bridge. Restriction or prohibition of openings during peak train traffic hours (7-9 am and 4-6 pm) would largely eliminate conflicts between the two modes.

In conclusion, there is little doubt that under present regulations, marine commercial interests will incur added delays at Portal Bridge with growing levels of train service, one-quarter of which will come about from intercity service expansion directly resulting from the NECIP. Mitigation of this impact by construction of a high level bridge within the current project, at a cost of some $70 million over the cost of the proposed rehabilitation, is not cost-effective when benefits to four vessels per day are weighed against the many competing demands for project funds.

### 3.1.4 LOCALIZED TRAFFIC IMPACTS

Traffic and Parking Demand at Stations. Fifteen of the twenty-six stations to be served by Amtrak in the NEC were originally proposed for significant improvements at the time of the Draft PEIS. As a result of the revised patronage projections and comments on that document, three additional stations--New Brunswick, Princeton Junction, and Rye--have been made eligible for operational improvements and all 26 stations have been made eligible for non-operational matching funds for such things as parking and traffic access improvements (see Section 2.8.2). This section discusses the potential impacts of increased patronage on traffic flow and parking demand in the vicinity of 25 stations (excluding Aberdeen, Maryland which is served by only two trains per day). Site-specific environmental documentation will be prepared at stations. Where significant modification or expansion of the parking/access system is proposed, this documentation will be coupled with local public participation. These kinds of modifications require a 50 percent local funding match and as a result of the proposals must be locally initiated. The level of improvement at each station is therefore subject to budget allocations and local agreements which are not yet finalized.

- Existing Conditions and Trends. Eighteen of the 25 stations are in or near the central business districts of their respective cities. All of these stations enjoy good regional accessibility by highway and transit modes. Those stations not located in the center city--Route 128 in Boston; Metropark in Iselin, New Jersey; and New Carrollton Station in Lanham, Maryland--are adjacent to limited access highways to take advantage of the good automobile access to suburban residential areas afforded by these facilities. Stations at Princeton Junction, Old Saybrook, Mystic and Kingston are located in rural small community settings.

While all stations are served by intercity rail, only certain stations have commuter service. This produces a considerable variation in the percent of total station users representing Amtrak intercity patronage. In 1974/75 this percentage ranged from a low of eight percent at New York to a high of 100 percent at a number of the smaller stations (Table 3-14). Table 3-15 indicates the same distribution of station users projected to 1990 and shows the net effect of the NECIP patronage increase in relation to total station usage expected in that year. That percentage again varies widely from four percent at Back Bay, six percent at New York, and nine percent at Boston South up to 200 to 450 percent at the stations between New Haven and Providence where no commuter service exists.

- Operational Impacts. Those daily rail patrons using the automobile (private, taxi, or limousine) as their mode of travel to and from the station will create the principal traffic demands associated with the station activities. Increases in traffic levels in varying amounts are expected at all stations on the NEC. Funding is available on 50 percent matching basis, as discussed in Section 1.7.9, for the purpose of mitigating expected traffic congestion or increasing parking supply.

Order-of-magnitude estimates of the traffic and parking needs generated by rail patrons, including commuter passengers where applicable, were made to assess the potential effects of increased traffic and parking demand. Design day rail demand is assumed to be 1/270 of the annual demand projected for NEC intercity trips (Section 1.4). Commuter demand is generally that projected by commuter authorities for Task 12.1 - Corridor Station Requirements,[1] updated in certain instances where subsequent contact with local agencies has resulted in revised projections. Long-haul rail demand is also from Task 12.1. Mode of arrival percentages, peaking characteristics, vehicle occupancy factors and parking demand factors are also largely derived

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[1] Task 12.1 - Corridor Station Requirements, Federal Railroad Administration, July, 1976.

Table 3-14

COMPARISON OF INTERCITY RAIL PATRONS TO ALL PATRONS AT NEC STATIONS, 1974/75

| STATION | NEC Intercity Rail[1] | All Other Rail[2] | Total | Percent NEC Rail |
|---|---|---|---|---|
| | 1974/75 ESTIMATED PATRONAGE (000) | | | |
| Boston | 537 | 2,820 | 3,357 | 16 |
| Back Bay | 104 | 1,020(e) | 1,124 | 9 |
| Route 128 | 105 | 295 | 400 | 26 |
| Providence | 262 | 157 | 419 | 63 |
| Kingston | 29 | -- | 29 | 100 |
| Westerly | 21 | -- | 21 | 100 |
| Mystic | 9 | -- | 9 | 100 |
| New London | 156 | 7 | 163 | 96 |
| Old Saybrook | 44 | -- | 44 | 100 |
| New Haven | 359 | 525 | 884 | 41 |
| Bridgeport | 50 | 513(e) | 563 | 9 |
| Stamford | 152 | 1,612 | 1,764 | 9 |
| Rye | 76 | 730(e) | 806 | |
| New York | 5,982 | 69,907 | 75,889 | 8 |
| Newark | 1,321 | 8,839 | 10,160 | 13 |
| Metropark | 438 | 1,243 | 1,681 | 26 |
| New Brunswick | 395 | 940(e) | 1,335 | 30 |
| Princeton Jct. | 652 | 570(e) | 1,222 | 53 |
| Trenton | 1,763 | 1,138 | 2,901 | 61 |
| N. Philadelphia | 198 | 254(e) | 452 | |
| Philadelphia | 3,109 | 7,027 | 10,136 | 31 |
| Wilmington | 529 | 457 | 986 | 54 |
| Baltimore | 897 | 153 | 1,050 | 85 |
| New Carrollton | 184 | 3 | 187 | 98 |
| Washington | 1,856 | 1,727 | 3,583 | 52 |

(e) = Estimated based on daily counts times 270.

[1]SOURCE: See Section 1.4.

[2]SOURCE: Task 12.1 - Corridor Station Requirements, Federal Railroad Administration, July, 1978, except as noted. Includes commuter and long-haul patrons.

Table 3-15

COMPARISON OF INTERCITY RAIL PATRONS TO ALL PATRONS AT NEC STATIONS, 1990 (IMPROVED)

| STATION | NEC Intercity Rail[1] | All Other Rail[2] | Total | Percent NEC Rail | Net Effect of NECIP[5] |
|---|---|---|---|---|---|
| Boston South | 923 | 3,952 | 4,875 | 19 | 9 |
| Back Bay | 188 | 2,065 | 2,253 | 8 | 4 |
| Route 128 | 598 | 395[3] | 993 | 60 | 99 |
| Providence | 740 | 1,374[3] | 2,114 | 35 | 29 |
| Kingston | 120 | na | na | na | na |
| Westerly | 63 | na | na | na | na |
| Mystic | 49 | -- | 49 | 100 | 444 |
| New London | 485 | 17 | 502 | 97 | 190 |
| Old Saybrook | 106 | -- | | 100 | 141 |
| New Haven | 1,258 | 630[6] | 1,888 | 66 | 91 |
| Bridgeport | 187 | 564[6] | 751 | 25 | 22 |
| Stamford | 511 | 1,743[6] | 2,254 | 23 | 19 |
| Rye | 511 | 810[6] | 1,321 | 39 | 49 |
| New York | 10,383 | 69,185 | 79,568 | 13 | 6 |
| Newark | 2,723 | 12,188 | 14,861 | 18 | 10 |
| Metropark | 1,464 | 1,356[6] | 2,820 | 52 | 57 |
| New Brunswick | 1,242 | 1,026[6] | 2,268 | 55 | 60 |
| Princeton Jct. | 1,351 | 708[6] | 2,059 | 66 | 55 |
| Trenton | 4,052 | 1,674[6] | 5,726 | 71 | 67 |
| N. Philadelphia | 454 | 254[6] | 708 | 64 | 57 |
| Philadelphia | 6,036 | 11,306 | 17,342 | 35 | 20 |
| Wilmington | 1,352 | 965 | 2,317 | 58 | 55 |
| Baltimore | 2,689 | 1,028[4] | 3,771 | 71 | 93 |
| New Carrollton | 1,031 | 4,517[4] | 5,548 | 19 | 18 |
| Washington | 5,031 | 7.677 | 12,708 | 40 | 33 |

[1]SOURCE: See Section 1.4

[2]Except as noted, from Task 12.1 - Corridor Station Requirements, Federal Railroad Administration, July, 1978.

[3]Commuter projections from RI Statewide Planning Program, March, 1978, plus Long-Haul from Task 12.1 (1,344 + 30 = 1,374).

[4]WMATA 1990 patronage estimate for New Carrollton.

[5]Equals increase in NEC intercity rail trips (1975 to 1990) divided by 1990 commuter and long-haul plus 1975 NEC intercity, expressed as a percent increase.

[6]Estimate based on discussions with local commuter authorities.

from surveys done for Task 12.1 and previous studies, updated for certain tations based on subsequent surveys. These estimates are order-of-magnitude only and will be refined as appropriate for any site-specific impact assessment or design. Appendix C contains a table of the factors used to develop traffic and parking demands for this analysis. Based on the rail patronage and auto access mode factors, peak hour traffic volumes generated by rail passengers were approximated for each station--during the base year 1975, the year 1990 without improved rail service, and the year 1990 with improved rail service (Table 3-16). In most instances, station-related traffic is a small proportion of total traffic on adjacent streets and the relative impact of Amtrak-induced traffic on local street operations will be imperceptible. Twenty of the 25 stations in Table 3-16 exhibit traffic increases which are expected to be minor or insignificant in comparison to background traffic.

Even small increases in traffic can aggrevate already congested roadways in the vicinity of some stations. Five stations-Metropark, New Brunswick, Trenton, Philadelphia and Washington Union - may fall into this category. A number of factors may, however serve to lessen the effect at these and the other stations.

At Metropark and Washington Union stations, traffic improvements already initiated by others would solve existing congestion problems. The New Jersey Department of Transportation has programmed improvements in the access to Metropark. Completion of the parking garage and ramps at Washington Union Station, now held up awaiting congressional and administrative decisions, would relieve congestion in the pick-up, drop-off area in front of the station.

At New Burnswick, Trenton and Philadelphia, inbound intercity train riders tend to arrive well after the local commuter peak because of the characteristics of trips in that area. Patrons who park at these stations tend to travel into New York City and to return after the normal business day. Their arrivals therefore peak during the 6 PM to 7 PM time period which will perhaps extend the peak but will not particularly add to it.

Table 3-16

ESTIMATED TRAFFIC DEMANDS GENERATED BY RAIL PASSENGERS AT STATIONS*

| STATION/TYPE PATRON | Estimated Peak Hour Traffic Volumes (vph) Generated by Rail Passengers | | | | | Effect of NECIP Traffic Growth on Traffic Operations on Adjacent Streets |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP Over 1975 | Increase Due To NECIP Over 1990U | |
| <u>BOSTON SOUTH</u> | | | | | | |
| Intercity NEC | 65 | 80 | 140 | 75 | 60 | Insignificant addition to already congested area. |
| Long Haul | 5 | 10 | 15 | -- | -- | |
| Commuter Rail | 60 | 90 | 90 | -- | -- | |
| <u>BACK BAY</u> | | | | | | |
| Intercity NEC | 20 | 30 | 40 | 20 | 10 | Minor; improved loading circulation along Buckingham Street should off-set increased traffic demand. |
| Commuter Rail | 50 | 100 | 100 | -- | -- | |
| <u>ROUTE 128</u> | | | | | | |
| Intercity NEC | 45 | 115 | 267 | 222 | 152 | Minor; will somewhat aggravate already congested conditions on Route 128 itself. |
| Long Haul | -- | -- | -- | -- | -- | |
| Commuter Rail | 256 | 341 | 341 | -- | -- | |
| <u>PROVIDENCE</u> | | | | | | |
| Intercity NEC | 110 | 190 | 310 | 200 | 120 | Peak traffic on Exchange Terrace would increase by five percent. |
| Long Haul | 5 | 10 | 10 | -- | -- | |
| Commuter (B&M) | 15 | 25 | 25 | -- | -- | |
| Commuter (E&W Bay) | -- | 5 | 5 | -- | -- | |
| <u>KINGSTON</u> | | | | | | |
| Intercity NEC | 30 | 50 | 100 | 70 | 50 | Insignificant |
| <u>WESTERLY</u> | | | | | | |
| Intercity NEC | 90 | 160 | 270 | 180 | 110 | Insignificant |

* [illegible]liminary estimates; see text for assumptions a[illegible] [illegible]urces.

Tɛ 3-16

ESTIMATED TRAFFIC DEMANDS GENERATED BY RAIL PASSENGERS AT STATIONS*

(cont.)

| STATION/TYPE PATRON | Estimated Peak Hour Traffic Volumes (vph) Generated by Rail Passengers | | | | | Effect of NECIP Traffic Growth on Traffic Operations on Adjacent Streets |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP Over 1975 | Increase Due To NECIP Over 1990U | |
| **MYSTIC** | | | | | | |
| Intercity NEC | 45 | 120 | 225 | 180 | 105 | Insignificant |
| **NEW LONDON** | | | | | | |
| Intercity NEC | 35 | 65 | 110 | 75 | 45 | Insignificant |
| Long Haul | 2 | 5 | 5 | -- | -- | |
| **OLD SAYBROOK** | | | | | | |
| Intercity NEC | 40 | 65 | 100 | 60 | 35 | Insignificant |
| **NEW HAVEN** | | | | | | |
| Intercity NEC | 200 | 270 | 565 | 365 | 295 | Peak traffic on Union Avenue would increase by ten percent, but would remain at level-of-service A(free flow condition) |
| Long Haul | 5 | 15 | 15 | -- | -- | |
| Commuter Rail | 355 | 370 | 370 | -- | -- | |
| **BRIDGEPORT** | | | | | | |
| Intercity NEC | 30 | 45 | 100 | 70 | 55 | Minor; capacity of Water Street near the Station is more than adequate for added volume. |
| Commuter Rail | 270 | 290 | 290 | -- | -- | |
| **STAMFORD** | | | | | | |
| Intercity NEC | 85 | 140 | 285 | 200 | 145 | Minor; particularly in light of the expected increase in nonrail traffic due to redevelopment plans by City. |
| Long Haul | 5 | 10 | 10 | -- | -- | |
| Commuter Rail | 580 | 625 | 625 | -- | -- | |

*Preliminary estimates; see text for assumptions and sources.

Table 3-16

ESTIMATED TRAFFIC DEMANDS GENERATED BY RAIL PASSENGERS AT STATIONS*
(cont.)

| STATION/TYPE PATRON | Estimated Peak Hour Traffic Volumes (vph) Generated by Rail Passengers | | | | | Effect of NECIP Traffic Growth on Traffic Operations on Adjacent Streets |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP Over 1975 | Increase Due To NECIP Over 1990U | |
| **RYE** | | | | | | |
| Intercity NEC | 45 | 160 | 300 | 255 | 140 | Minor; spread over several access streets. |
| Commuter Rail | 510 | 570 | 570 | -- | -- | |
| **NEW YORK PENN** | | | | | | |
| Intercity NEC | 375 | 410 | 650 | 275 | 240 | Insignificant |
| Long Haul | 40 | 100 | 100 | -- | -- | |
| Commuter Rail | 445 | 430 | 430 | -- | -- | |
| **NEWARK** | | | | | | |
| Intercity NEC | 100 | 160 | 210 | 110 | 50 | Negligible - existing local highways are major arterials. |
| Long Haul | 6 | 15 | 15 | -- | -- | |
| Commuter Rail | 746 | 1,021 | 1,021 | -- | -- | |
| **METROPARK** | | | | | | |
| Intercity NEC | 170 | 250 | 570 | 400 | 320 | Significant impact in area already congested. Improvements planned in access system by State are expected to accommodate increase. |
| Long Haul | 35 | 90 | 90 | -- | -- | |
| Commuter Rail | 85 | 406 | 406 | -- | -- | |
| **NEW BRUNSWICK** | | | | | | |
| Intercity NEC | 195 | 310 | 600 | 405 | 290 | Would contribute to congestion in vicinity of Easton Avenue intersection with French-Albany Street. |
| Commuter Rail | 540 | 590 | 590 | -- | -- | |

* Preliminary estimates; see text for assumptions and sources.

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ESTIMATED TRAFFIC DEMANDS GENERATED BY RAIL PASSENGERS AT STATIONS*

(cont.)

| STATION/TYPE PATRON | Estimated Peak Hour Traffic Volumes (vph) Generated by Rail Passengers | | | | | Effect of NECIP Traffic Growth on Traffic Operations on Adjacent Streets |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP Over 1975 | Increase Due To NECIP Over 1990U | |
| **PRINCETON JUNCTION** | | | | | | |
| Intercity NEC | 320 | 400 | 662 | 342 | 262 | Minor; spread over several access roads. |
| Commuter Rail | 250 | 320 | 320 | -- | -- | |
| **TRENTON** | | | | | | |
| Intercity NEC | 807 | 1,484 | 1,851 | 1,044 | 367 | Increase will probably extend peak period traffic hours but at levels not exceeding present commuter peaks since intercity peak occurs at 6 pm to 7 pm (after commuters). |
| Long Haul | 24 | 60 | 60 | -- | -- | |
| Commuter Rail | 802 | 1,145 | 1,145 | -- | -- | |
| **NORTH PHILADELPHIA** | | | | | | |
| Intercity NEC | 90 | 100 | 205 | 115 | 105 | Minor; would add less than two percent to Broad Street rush hour traffic. |
| Commuter Rail | 130 | 130 | 130 | -- | -- | |
| **PHILADELPHIA (30th St.)** | | | | | | |
| Intercity NEC | 670 | 748 | 1,298 | 628 | 550 | Would contribute to existing congestion on Schuylkill Avenue West and John F. Kennedy Boulevard and Schuylkill Expressway ramps, but will lag beyond present commuter peak hours. |
| Long Haul | 51 | 130 | 130 | -- | -- | |
| Commuter Rail | 4,260 | 6,800 | 6,800 | -- | -- | |

* Preliminary estimates; see text for assumptions and sources.

Table 3-16

ESTIMATED TRAFFIC DEMANDS GENERATED BY RAIL PASSENGERS AT STATIONS*

(cont.)

| STATION/TYPE PATRON | Estimated Peak Hour Traffic Volumes (vph) Generated by Rail Passengers | | | | | Effect of NECIP Traffic Growth on Traffic Operations on Adjacent Streets |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP | | |
| | | | | Over 1975 | Over 1990U | |
| **WILMINGTON** | | | | | | |
| Intercity NEC | 180 | 290 | 460 | 280 | 170 | Minor; in the vicinity of the station where rail traffic is most highly concentrated, the nonrail traffic volumes are not large. |
| Long Haul | 5 | 15 | 15 | -- | -- | |
| Commuter Rail | 145 | 305 | 305 | -- | -- | |
| **BALTIMORE** | | | | | | |
| Intercity NEC | 597 | 1,010 | 1,792 | 1,195 | 782 | Charles Street and St. Paul Street will show an increase of less than ten percent. Beyond North Avenue and Mount Royal Avenue the impact will be minimal. |
| Long Haul | 24 | 60 | 60 | -- | -- | |
| Commuter Rail | 200 | 480 | 480 | -- | -- | |
| **NEW CARROLLTON** | | | | | | |
| Intercity NEC | 100 | 200 | 573 | 473 | 373 | Increase of less than ten percent of base condition at these sites due to traffic increase expected from WMATA service and office complex. |
| Commuter Rail | -- | 2,983 | 2,983 | -- | -- | |
| **WASHINGTON UNION** | | | | | | |
| Intercity NEC | 325 | 510 | 880 | 555 | 370 | Improved circulation plan will alleviate most problems (i.e., completion of garage and ramps). Problem is mainly in pick-up, drop-off area in front of the station. |
| Long Haul | 35 | 90 | 90 | -- | -- | |
| Commuter Rail | 85 | 406 | 406 | -- | -- | |

* Preliminary estimates; see text for assumptions and sources.

At New Brunswick Station, for example, intersection design hour traffic estimates for the year 1976 in the Middlesex County TOPICS report indicate that about 7,000 vehicles enter and leave the station area street system--bounded by Easton Avenue, Somerset Street, George Street and Albany Street--during the evening downtown rush hour. Base year station generated traffic (735 vehicles per hour) comprised about 10 percent of these rush hour traffic volumes. Current rush hour traffic operations on the street systems, particularly in the vicinity of the Easton Avenue intersection with French-Albany Street, is congested principally due to at-curb business parking activities. While the increase in rail passenger generated traffic of 290 vehicles per hour due to improved rail service is less than 5 percent of the current levels of traffic on the station's street system, it could be expected to further degrade traffic movements. More restrictive on-street parking control measures, implemented in the vicinity of the station, could improve street capacity enough to accommodate the additional generated traffic without degrading current traffic operations.

Order-of-magnitude parking space needs were approximated principally on the basis of those required to satisfy rail patrons that park at the station, with some adjustment to reflect the loading and short-term parking needs. Long-term parking for these patrons was estimated to create peak accumulation needs equivalent to one-half of the total daily rail patrons that drive and park at the station this ratio was applied to both the intercity and commuter rail passengers. Parking for long-haul rail patrons is relatively minor at all stations and is not specifically listed. The number of spaces currently available for rail patrons was also identified (Table 3-17).

Excess parking demand <u>caused</u> by the NECIP is indicated in the last column of numbers in Table 3-17 as the difference in intercity parking demand for 1990 with and without the improved service. In three cases(Route 128, Metropark and Trenton) the increase is 900 to 1000 spaces for intercity patrons alone. At Philadelphia and Baltimore the increases is 580 to 700 spaces and at all other stations the increase is less than 350 spaces.

Table 3-17

ESTIMATED PARKING SPACE NEEDS TO SERVE RAIL DEMAND AT STATIONS*

| STATION/TYPE PATRON | Approximate Number of Long-Term and Short-Term Parking Spaces Needed to Serve Rail Patrons | | | | | Comments Pertaining to 1990 Parking Needs with NECIP |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP: Over 1975 | Increase Due To NECIP: Over 1990U | |
| **BOSTON SOUTH** | | | | | | |
| Intercity NEC | 10 | 15 | 155 | 145 | 140 | Existing parking in limited supply; parking freeze now in effect by the City. |
| Commuter Rail | -- | -- | -- | | | |
| **BACK BAY** | | | | | | |
| Intercity NEC | 15 | 25 | 30 | 10 | 5 | These long-term parking needs would be expected to be accommodated in public facilities. |
| Commuter Rail | 5 | 10 | 10 | | | |
| | 20 | 35 | 40 | | | |
| **ROUTE 128** | | | | | | |
| Intercity NEC | 130 | 700 | 1,620 | 1,490 | 920 | About 700 spaces currently exist. Approximately 1,800 additional spaces would be needed by 1990 for all users. |
| Commuter Rail | 365 | 875 | 875 | | | |
| | 495 | 1,575 | 2,495 | | | |
| **PROVIDENCE** | | | | | | |
| Intercity NEC | 95 | 165 | 275 | 180 | 110 | Vacant parking spaces presently exist but are over one-quarter mile from station. |
| Commuter (B&M) | 110 | 170 | 170 | | | |
| Commuter (E&W Bay) | -- | -- | -- | | | |
| | 205 | 335 | 445 | | | |
| **KINGSTON** | | | | | | |
| Intercity NEC | 20 | 40 | 90 | 70 | 50 | About 60 spaces now available. Land to develop additional parking space needed is available at the site. |

* [illegible]liminary estimates; see text for assumptions and [illegible]rces.

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ESTIMATED PARKING SPACE NEEDS TO SERVE RAIL DEMAND AT STATIONS*

(cont.)

| STATION/TYPE PATRON | Approximate Number of Long-Term and Short-Term Parking Spaces Needed to Serve Rail Patrons | | | | | Comments Pertaining to 1990 Parking Needs with NECIP |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP: Over 1975 | Increase Due To NECIP: Over 1990U | |
| **WESTERLY** | | | | | | |
| Intercity NEC | 20 | 30 | 60 | 40 | 30 | Approximately 150 spaces are now available. Existing parking adequate for future demands. |
| **MYSTIC** | | | | | | |
| Intercity NEC | 8 | 20 | 40 | 32 | 20 | Nominal additional parking will be needed. |
| **NEW LONDON** | | | | | | |
| Intercity NEC | 260 | 464 | 803 | 543 | 339 | About 1,000 spaces are available but subject to future competing users. |
| **OLD SAYBROOK** | | | | | | |
| Intercity NEC | 35 | 58 | 87 | 52 | 29 | About 70 spaces are now available. Space is available to add 40 to 50 parking spaces at the site. |
| **NEW HAVEN** | | | | | | |
| Intercity NEC | 210 | 340 | 660 | 450 | 320 | Existing parking lot almost fully utilized; 500 additional spaces required, plus 30 additional drop-off/pick-up spaces. |
| Commuter Rail | 385 | 440 | 440 | | | |
| | 595 | 780 | 1,100 | | | |

* Preliminary estimates; see text for assumptions and sources.

Table 3-17

ESTIMATED PARKING SPACE NEEDS TO SERVE RAIL DEMAND AT STATIONS*

(cont.)

| STATION/TYPE PATRON | Approximate Number of Long-Term and Short-Term Parking Spaces Needed to Serve Rail Patrons | | | | | Comments Pertaining to 1990 Parking Needs with NECIP |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP: Over 1975 | Increase Due To NECIP: Over 1990U | |
| **BRIDGEPORT** | | | | | | |
| Intercity NEC | 30 | 50 | 110 | 80 | 60 | Unused spaces currently available under I-95 and on east side of old station. Competing demand for these spaces is being studied locally. |
| Commuter Rail | 300 | 330 | 330 | | | |
| | 330 | 380 | 440 | | | |
| **STAMFORD** | | | | | | |
| Intercity NEC | 95 | 160 | 320 | 225 | 160 | Parking supply is now sufficient to cover demand. Rail user growth combined with competing demand from redevelopment will result in total demand for at least 800 new spaces by 1990. |
| Commuter Rail | 1,340 | 1,440 | 1,440 | | | |
| | 1,435 | 1,600 | 1,760 | | | |
| **RYE** | | | | | | |
| Intercity NEC | 55 | 205 | 380 | 325 | 175 | Some 650 to 700 spaces now available. About 300 additional parking spaces needed by 1990. |
| Commuter Rail | 540 | 600 | 600 | | | |
| | 595 | 805 | 980 | | | |
| **NEW YORK PENN** | | | | | | |
| Intercity NEC | -- | -- | -- | -- | -- | Parking, where utilized, is found off-site. Negligible parking demand. |
| Commuter | -- | -- | -- | -- | -- | |
| **NEWARK** | | | | | | |
| Intercity NEC | 280 | 480 | 640 | 360 | 160 | Totaly supply is now about 200 to 300 spaces short of demand. About 600 to 800 total spaces will be needed by 1990. |
| Commuter Rail | 1,730 | 1,800 | 1,800 | | | |
| | 2,010 | 2,280 | 2,440 | | | |

* liminary estimates; see text for assumptions and s :es.

T: 3-17

ESTIMATED PARKING SPACE NEEDS TO SERVE RAIL DEMAND AT STATIONS*

(cont.)

| STATION/TYPE PATRON | Approximate Number of Long-Term and Short-Term Parking Spaces Needed to Serve Rail Patrons | | | | | Comments Pertaining to 1990 Parking Needs with NECIP |
|---|---|---|---|---|---|---|
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Increase Due To NECIP: Over 1975 | Increase Due To NECIP: Over 1990U | |
| METROPARK | | | | | | |
| Intercity NEC | 200 | 735 | 1,650 | 1,450 | 915 | About 1,330 spaces now available. Estimated 1,850 spaces short of demand for all users by 1990. |
| Commuter Rail | 1,200 | 1,520 | 1,520 | | | |
| | 1,400 | 2,255 | 3,170 | | | |
| NEW BRUNSWICK | | | | | | |
| Intercity NEC | 130 | 210 | 410 | 280 | 200 | About 350 spaces currently available. Facilities to park 300 to 400 more vehicles will be needed by 1990. |
| Commuter Rail | 250 | 270 | 270 | | | |
| | 380 | 480 | 680 | | | |
| PRINCETON JUNCTION | | | | | | |
| Intercity NEC | 460 | 570 | 952 | 492 | 382 | About 1,100 spaces currently available. 500 to 600 additional parking spaces may be needed by 1990. |
| Commuter Rail | 550 | 680 | 680 | | | |
| | 1,010 | 1,250 | 1,632 | | | |
| TRENTON | | | | | | |
| Intercity NEC | 2,060 | 3,800 | 4,750 | 1,860 | 950 | There will be a need for approximately 4,000 more parking spaces by 1990 for all users. |
| Commuter Rail | 1,180 | 1,690 | 1,690 | | | |
| | 3,240 | 5,490 | 6,440 | | | |
| NORTH PHILADELPHIA | | | | | | |
| Intercity NEC | 65 | 70 | 150 | 85 | 80 | Existing parking adequate for future demands. |
| Commuter Rail | 130 | 130 | 130 | | | |
| | 195 | 200 | 280 | | | |

* Preliminary estimates; see text for assumptions and sources.

Table 3-17

ESTIMATED PARKING SPACE NEEDS TO SERVE RAIL DEMAND AT STATIONS *

| STATION/TYPE PATRON | Approximate Number of Long-Term and Short-Term Parking Spaces Needed to Serve Rail Patrons | | | | | Comments Pertaining to 1990 Parking Needs with NECIP |
|---|---|---|---|---|---|---|
| | | | | Increase Due To NECIP | | |
| | 1975 | 1990 Unimproved Service | 1990 Improved Service | Over 1975 | Over 1990U | |
| **PHILADELPHIA (30th St.)** | | | | | | |
| Intercity NEC | 800 | 880 | 1,550 | 750 | 670 | There are about 450 excess spaces now available but these are subject to competing uses. Facilities for 600 to 700 more vehicles will be needed by 1990. |
| Commuter Rail | -- | -- | -- | | | |
| | 800 | 880 | 1,550 | | | |
| **WILMINGTON** | | | | | | |
| Intercity NEC | 345 | 555 | 875 | 530 | 320 | 900 new long-term parking spaces will be needed in 1990. In addition 60 to 70 pick-up/drop-off spaces will be needed. |
| Commuter Rail | 370 | 780 | 780 | | | |
| | 715 | 1,335 | 1,655 | | | |
| **BALTIMORE** | | | | | | |
| Intercity NEC | 560 | 650 | 1,200 | 640 | 550 | Extreme shortage even for present; 600 to 700 spaces needed for Intercity NEC alone by 1990. |
| Commuter Rail | 160 | 900 | 900 | | | |
| | 720 | 1,550 | 2,100 | | | |
| **NEW CARROLLTON** | | | | | | |
| Intercity NEC | 250 | 500 | 800 | 550 | 300 | 500 to 600 spaces needed by 1990 for NEC Intercity plus about 250 replacement spaces. |
| Commuter Rail | -- | 825 | 825 | | | |
| | 250 | 1,325 | 1,625 | | | |
| **WASHINGTON UNION** | | | | | | |
| Intercity NEC | 75 | 465 | 800 | 725 | 335 | No significant parking available within 1,500 feet of the station. Unfinished garage not under active construction. |
| Commuter Rail | -- | -- | -- | | | |
| | 75 | 465 | 800 | | | |

* Preliminary estimates; see text for assumptions and sources.

The increases in parking demand due to the NECIP is in many cases lwarfed by the current level of parking demand, the expected growth in commuter parking demand and/or the normal growth expected in intercity patronage even without the NECIP. If this "unconstrained" demand for parking is to be met, it is fair to say that most of the larger stations on the corridor will require substantial expansion of parking facilities long before 1990.

A number of options are available to the affected communities in the face of this increased parking demand. First, a conscious decision not to increase parking supply would force patrons to use other public access modes or drop-off, pick-up. On the other hand this strategy may encourage long-term on-street parking in residential or commercial areas if prohibitions are not strictly enforced, and constrained parking supply may in fact discourage use of the rail system to some degree.

A second option is to allow some local entrepreneur to construct parking in accordance with the financial dictates of the private sector. This option runs the risk of also constraining parking to the amount justifiable to amortize the full capital investment and operating cost, as well as lack of control over competition for spaces with non-station related parkers.

The third option is the use of non-operational NECIP station funding for construction of necessary parking. This funding as previously discussed requires a 50 percent local match. The design and size of any facility would be fixed thorugh negotiation of an agreement between the community and FRA, analysis of financial feasibility and detailed assessment of site-specific environmental effects. These activities would be scheduled once some commitment to interest in local funding is secured.

Grade Crossing Elimination. There are a total of 67 at-grade crossings on the NEC which will be subject to elimination to permit safe and reliable operation of high speed intercity trains. Of these 67 crossings, 48 are public crossings in Maryland, Delaware, Connecticut, Rhode Island and Massachusetts, which are being eliminated under an on-going Federal Highway Administration (FHWA) program. The elimination of the remaining 19 crossings are part of the NECIP (Table 3-18). The actual elimination of these private crossings will also be administered by the FHWA.

Three of the crossings are in New London, CT and because of federal legislation exempting New London crossings from elimination, will be closed only if they are no longer needed. Otherwise, gates with flashers will be provided.

Eight of the 19 crossings (Farm Road; Lawyer's, Mumford; Storey's; Cheseboro; Gulf; Town Farm Road; and Caro's) are currently inactive and do not accommodate the movement of vehicles or pedestrians on a regular basis. Many of the approaches to these crossings have been abandoned, regraded, and are overgrown with vegetation. Thus, the elimination of these eight crossings will have no impact on local traffic and transportation. Two of the crossings, Chapman's and Wilcox, accommodate only pedestrian movements, and field investigation indicates that neither of the two are used by a significant number of pedestrians on a regular basis. Again, elimination of these crossings will have a minor effect on local transportation.

The remaining nine crossings are open to vehicular traffic and are presently in use. Usage of these crossings varies from less than six to approximately 250 vehicles per day. It is likely that there will be some effects on local traffic/circulation associated with the elimination of

Table 3-18

PRIVATE GRADE CROSSINGS

| Crossing Name | Town/State | Classification[1] | Usage[2] | Condition of Approaches | Approach Width and No. Lanes | Current Proposal For Elimination |
|---|---|---|---|---|---|---|
| Farm Road | Madison/CT | P | Inactive | Abandoned and overgrown | -- | Obtain crossing rights |
| Lawyer's | Clinton/CT | P | Inactive | Dirt | 10'-1 | Acquire property |
| Mulcahy's | Old Saybrook/CT | P | 25 VPD | Dirt | 15'-1 | Construct Alternate access road |
| Chapman's | Old Lyme/CT | P | Pedestrians Only | Dirt | 6'-0 | Obtain crossing rights |
| Mumford | Groton/CT | P | Inactive | Paved | 10'-1 | Obtain crossing rights |
| Storey's | Groton/CT | P | Inactive | Abandoned and overgrown | -- | Obtain crossing rights |
| Chappel Coal | New London/CT | P | -- | -- | -- | Close or construct gate |
| Denoia's | New London/CT | P | -- | -- | -- | Close or construct gate |
| Central Coal | New London/CT | P | -- | -- | -- | Close or construct gate |
| Wilcox | Stonington/CT | P | Pedestrians Only | Dirt | 10'-0 | Obtain crossing rights |
| Cheseboro | Stonington/CT | P | Inactive | Abandoned and overgrown | -- | Provide alternate access |

1 P = Private Ownership, PU = Private ownership with public use

2 VPD = Vehicles per day, average

SOURCE: NEC Passenger Service Improvement Program, Task 20 - Engineering Development Program for Private Grade Crossing Elimination, U.S. Department of Transportation, Federal Railroad Administration, June, 1976.

Table 3-18 (cont.)

PRIVATE GRADE CROSSINGS

| Crossing Name | Town/State | Classification[1] | Usage[2] | Condition of Approaches | Approach Width and No. Lanes | Current Proposal For Elimination |
|---|---|---|---|---|---|---|
| Gulf | Stonington/CT | P | Inactive | Abandoned and overgrown | -- | Construct alternate access road |
| Town Farm Road | Westerly/RI | P | Inactive | Abandoned and overgrown | -- | Obtain crossing rights. |
| Caro's | Westerly/RI | P | Inactive | Abandoned and overgrown | -- | Obtain crossing rights |
| Weaver's | Westerly/RI | P | 1-5 VPD | Paved | 12'-1 | Obtain crossing rights |
| Yawgoo Valley | Exeter/RI | PU | Moderate | Paved | 20'-2 | Provide alternate access |
| Dorsett Mill Rd | Exeter/RI | PU | Light | Dirt | 10'-1 | Provide alternate access |
| Alger Avenue | Warwick/RI | PU | 140 VPD | Paved | 20'-2 | Provide alternate access |
| Lazy Lady Farm | Attleboro/MA | P | 1-5 VPD | Dirt | 12'-1 | Provide alternate access |

1 P = Private Ownership, PU = Private ownership with public use

2 VPD = Vehicles per day, average

SOURCE: NEC Passenger Service Improvement Program, Task 20-Engineering Development Program for Private Grade Crossing Elimination, U.S. Department of Transportation, Federal Railroad Administration, June, 1976, updated is appropriate.

certain crossings. Current proposals for elimination of these crossings generally include construction of a new alternate access roadway or grade separation structure. The possibility of adverse environmental impacts should be investigated by the appropriate state highway departments during design studies for the elimination on a site specific basis.

### 3.1.5 TRANSPORTATION IMPACTS DURING CONSTRUCTION

Rail Operations. All rail carriers (intercity passenger trains, suburban commuter trains, and freight trains) using the Corridor system will experience delays caused by an effective reduction in system capacity during the construction period, due to route realignments and improvements to track structures, bridges, tunnels and electrification. Improvements to each of these system elements will require temporary closure of individual tracks, and accommodation of existing Amtrak, commuter and freight trains on the remaining tracks. The system will therefore be more congested, although the location and severity of the congestion will vary according to construction scheduling and the extent of work required. All trains will be subject to operation at reduced speed because of slow orders or other restrictions made necessary by the construction work. Amtrak trains may experience average delays of up to 15 minutes between Washington and New York and up to 15 minutes between New York and Boston during the height of the construction effort (Table 3-19). Amtrak will publish schedules reflecting anticipated construction delays and will further inform its patrons through station announcements, signs and reservations personnel. Commuter services would likely experience shorter average delays because of the shorter distances involved, but delays would be more variable in length. Since passenger services will logically receive operating priority, the time loss impact can be expected to be most severe for freight trains.

Table 3-19

ESTIMATED CHANGE IN RUNNING TIME
DURING NECIP CONSTRUCTION

| Route Segment | | Percentage Change in Running Time (Negative Indicates Longer Trip Time) | | | | |
|---|---|---|---|---|---|---|
| | | FY78 | FY79 | FY80 | FY81 | FY82 |
| Washington-Philadelphia | Base | (Metro 1:45) (Conv. 2:10) | -10.3% | -7.0% | +6.7% | -13.2% |
| Philadelphia-New York | Base | (Metro 1:15) (Conv. 1:40) | -- | +0.5% | +6.4% | +12.4% |
| New York-New Haven | Base | (1:45) | -11.7% | -15.6% | -4.2% | +8.9% |
| New Haven-Boston | Base | (3:00) | -- | -- | +5.7% | +26.9% |

SOURCE: Amtrak, Five Year Corporate Plan, FY1978-1982, 1977.

In addition to reduced speed operation, freights may be required to queue up in yards while awaiting clearance for access to the Corridor tracks and, once on the Corridor, to wait at interlockings for adequate time to make the required move. In addition to access and running time delays, time of day restrictions may be necessary to control freight train access to the Corridor. Freight schedules may have to be modified to include a greater number of night operations and access may be denied altogether during hours of peak commuter traffic.

When faced with construction-induced operational delays, Conrail may find diversion of through freights off-Corridor a lesser cost option, to the extent it can be implemented. Since freight operations north of Newark, NJ, are exclusively local, no diversion is possible in this sector. Between Philadelphia and Newark, NJ, however, Conrail has an alternative route over old Reading (RDG) and Lehigh Valley Railroad (LV) lines. Any decision to utilize the RDG/LV by-pass and the extent of the upgrading program required for that line would depend on both short- and long-term operational savings and the availability of funding to Conrail.

The impact of delays will be reflected in increased operating costs and potential losses in patronage or freight traffic. Patronage loss to Amtrak should not be large if the above estimated average delay is not exceeded. Patrons can be expected to react more negatively to the occasional very late train than to a schedule which reflects anticipated delays and is dependable in terms of time of arrival. A similar response can be expected from users of commuter service, but the risk of patronage loss should be less since practical alternatives to commuter rail do not exist for many users. Significant loss of freight traffic from rail to other modes is unlikely since rail freight customers are generally more sensitive to transport cost than time. In addition, rail freight is primarily a long-haul mode, thus construction period delays should represent a very small addition to the total travel time of cars originating or terminating on-Corridor.

While construction period delays will undoubtedly occur, they will be minimized to the extent feasible through construction planning and work scheduling. A primary goal of the NECIP is to carry out all physical improvements with minimum disruption of service to all NEC users. Except for occasional unavoidable shutdowns of certain segments, the system will remain continuously operational, albeit at reduced capacity, over its entire length throughout the construction period. The longest complete shutdowns anticipated are one and a half to two days and these will occur on weekends. Amtrak may be required to use alternative routes where available, or bus passengers around short segments when track segments are shut down.

Work scheduling measures are available and will be employed to minimize service disruptions. The first and most widely applicable of these measures is to maintain in service the maximum number of tracks in any single route segment while work is proceeding. Most track, structural, electrification, and route realignment work can be undertaken one track at a time. Some undergrade bridges and tunnels which require upgrading present greater difficulties, but at least one track can generally be kept open. Scheduling and phasing of construction work will be guided by track availability guidelines developed jointly with Amtrak. Preliminary guidelines have been provided based upon segmentation of the NEC into 11 Railroad Development Projects (RDPs) ranging from 8 to 60 miles in length. The RDPs have been subdivided into 105 segments between major interlockings called "blocks". For most of the Corridor length, these guidelines require that within an RDP, no more than one track in one block may be taken out of service for construction work at any particular time. The only exceptions will occur where work affects two blocks, as in relocating an interlocking; in these cases, Amtrak will allow one track to be out of service in both blocks. More severe restrictions will be imposed in the New York City area (between Hudson and Harold Interlockings) where no tracks may be taken out of service for extended periods during the week and work will be scheduled at night and on weekends. The NECIP operations simulation capability will be employed both to schedule work for minimum operational impact and to correct unanticipated construction delay conditions should they occur.

One of the measures to minimize service disruption can be employed where construction would otherwise shut down route segments for an extended period, as in the case of a total bridge span replacement. First, a parallel alignment may be chosen, enabling the new structure to be constructed immediately adjacent to the old. Once the new structure is in place, the existing tracks need only be tied into the new approaches. A second alternative is construction of temporary structures to carry the track while improvements are made to the existing structure. Where neither of these options is feasible, a temporary shut-down is inevitable and the design and work scheduling must seek to reduce out-of-service time to a minimum.

To some degree the implementation of reverse signaling and track structure improvements as soon as possible will reduce delays by allowing better, and occasionally faster, operation over the remainder of the segment.

Auto Traffic. Short term, construction-related impacts on vehicular traffic may be experienced as a result of several of the sub-program improvement elements. Bridges, route realignments, stations and grade crossings have the greatest potential for construction-related traffic impacts.

Measures which will be employed to mitigate or reduce any potential adverse effects during construction include:

- Scheduling of construction activities to avoid the peak hours of roadway use.

- Use of various construction techniques to minimize interruption to traffic. For example, bridges could be modified or rebuilt in sections, thus allowing for one lane to remain open to traffic.

- In certain areas where it is not possible to implement construction in sections or phases, temporary roadway and/or bridge structures could be built to divert traffic in the immediate vicinity of the construction activity.

- Local officials will be asked to participate in the description and selection of alternate detour routes in order to clearly identify locally sensitive areas.

- Public information programs through the news media would minimize possible delay or adverse effects. Letting the public know where construction is taking place and on what days would allow time for necessary rescheduling, rerouting or consolidation of trips by individuals as well as business.

Waterway Navigation. The NECIP will impact waterborne commerce and recreational boating during the construction period. Almost all railroad bridges over navigable waters are scheduled for repair or upgrading. These improvements include replacement of bearings and anchors, replacement of rivets with high strength bolts, and bridge painting. During the course of construction, navigation may be temporarily interrupted to facilitate construction. It is possible that the channel may be closed or blocked by construction apparatus such as scaffolding; in certain instances, the channel may be closed for safety reasons. For example, if heavy equipment or structural components of the bridge are being positioned over the channel, no waterborne traffic will be allowed under the work area. Instances such as this are not expected to exceed several hours to one day in length.

The total construction time for the bridge improvements varies significantly and is a function of the type of bridge (through-truss, deck truss, etc.) the level of improvement, and the length or size of the bridge. For the fixed span bridges over navigable waterways, however, the average construction time is expected to be 20 days. It is not anticipated that interruptions to navigation or closings of the channel will extend for this entire construction period.

Short term or construction related impacts are also a factor for the movable bridges. Three of the 15 bridges--Mystic, Shaw's Cove, Niantic--will be completely replaced with new structures. There will be short-term closings of the channel and interruptions to navigation to facilitate construction equipment and operations. While total construction periods are expected to range from 17 to 24 months for these three bridges, it is unlikely that the channel will be closed for consecutive periods exceeding several hours to one day. Ten of the remaining 12 movable bridges are scheduled for a variety of improvements to the superstructures and/or mechanical and electrical equipment. These minor operations are not expected to render the bridge inoperative for periods exceeding those previously mentioned.

Certain precautions will be taken to reduce interruptions to commercial and recreational boat traffic: construction scheduling in off-peak or off-season periods; construction techniques to facilitate maintenance and protection of traffic; increasing vertical clearances where feasible; public information programs.

For those waterways which are subject to seasonal variations in boat traffic, construction activities which are expected to interrupt or block navigation will be scheduled where possible for off-peak periods such as the winter months for recreational waterways or weekends for waterways serving predominantly commercial traffic.

Avoiding interruptions to both rail and marine traffic will be given high priority in the planning and design processes. This will influence the type and location of bridges and result in construction specifications which will insure that the contractor's procedures are geared to minimizing delays.

In all cases, improvements will be coordinated with the U.S. Coast Guard and will result in adequate public notice of bridge closure.

## 3.2 ENERGY

### 3.2.1 SUMMARY

The expected reduction in energy consumption for intercity travel as a result of the NECIP is negligible. There is a projected 2.6 percent reduction in 1990 and a 0.6 percent reduction in 1982. It is estimated that by 1990, the NECIP will be saving 171,600 barrels of oil annually through decreased energy usage and use of alternate fuels for electricity generation.

### 3.2.2 EXISTING CONDITIONS AND TRENDS

Six major economic sectors - electric utilities, transportation, industry, housing, commerce and agriculture - are prime users of key energy sources including petroleum-based products (i.e., gasoline, residual, distillate and diesel oil); natural gas; liquid gas; coal; nuclear power and hydroelectric power.

Energy consumption has been analyzed in terms of equivalent BTUs (British Thermai Units) of energy.[1] In this chapter, options are discussed in terms of BTUs (see Table 3-20 for conversion factors).

In 1975,[2] the NEC states used one-fifth of the energy consumed natior ally. Natural gas, coal and gasoline are the primary fuels used in the U.S.; in the NEC, residuals, distillates, gasoline, natural gas and coal are consumed in nearly equal quantities (Figure 3.3). The NEC states use almost half the residual oil and over one-third of the distillate oil consumed in the U.S., but only one-tenth of the natural gas, because of both the limited quantity of low sulfur fuel produced in the region and the unavailability of larger quantities of natural gas. Approximately half the gross energy is used by the electrical utility and transportation sectors (Figure 3.4).

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[1]On the average, one kilowatt hour (kwh) of electricity equals 3,413 BTUs, while one barrel (42 gallons) of residual oil equals 6.29 x $10^6$ BTUs. Therefore, it takes 1,842 kwhs to produce the energy equivalent of 42 gallons of oil.

[2]Federal Energy Administration data, 1977.

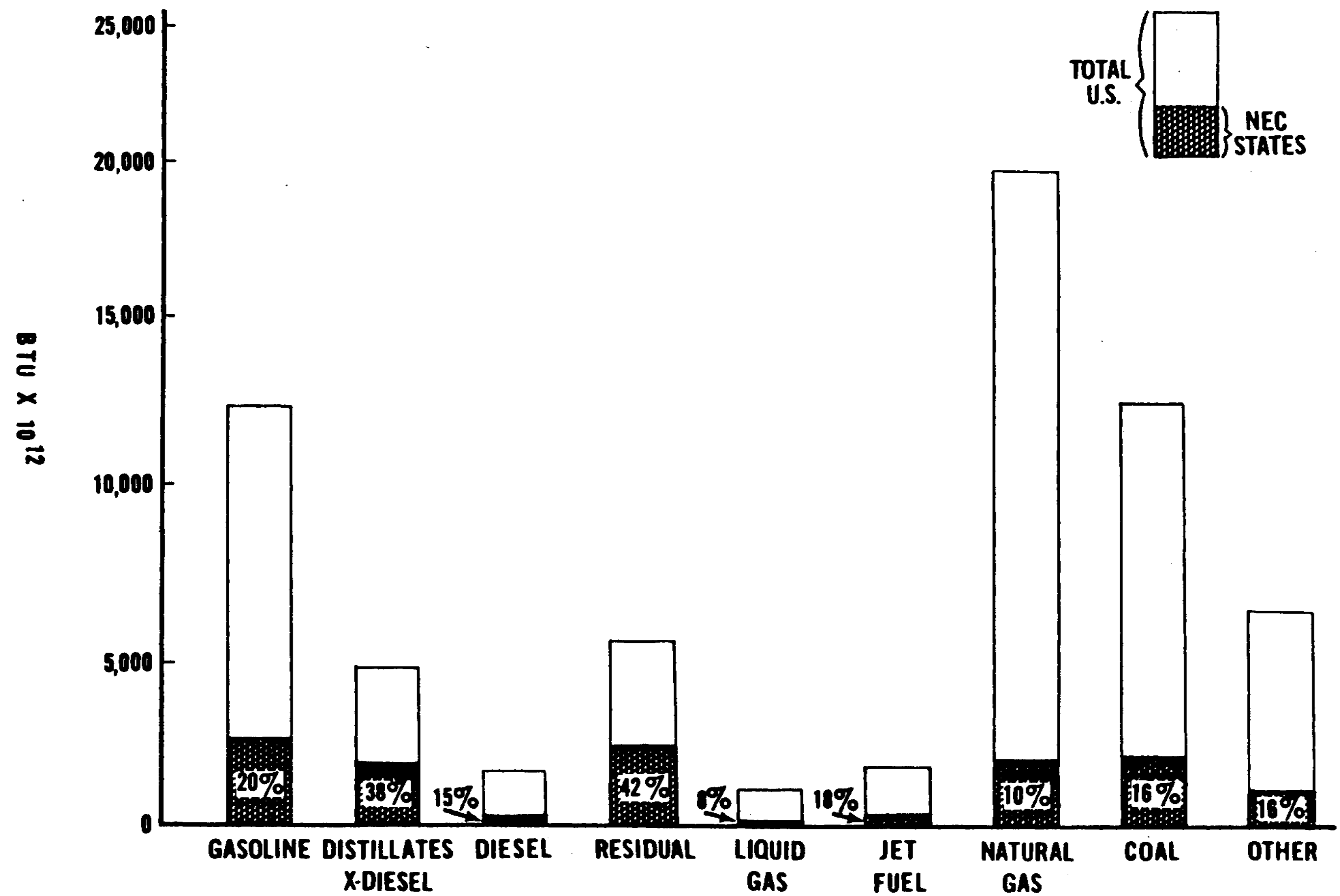
Table 3-20

BTU VALUES OF ENERGY SOURCES[1]

| | BTU |
|---|---|
| Coal (per 2,000 lb. ton) | |
| Anthracite | $25.4 \times 10^6$ |
| Bituminous | $26.2 \times 10^6$ |
| Sub-bituminous | $19.0 \times 10^6$ |
| Lignite | $13.4 \times 10^6$ |
| Natural Gas (per cubic foot) | |
| Dry | 1,031 |
| Wet | 1,103 |
| Liquid (average) | 4,100 |
| Electricity - 1 kwh | 3,413 |
| Petroleum (per barrel) | |
| Crude oil | $5.60 \times 10^6$ |
| Residual Fuel oil | $6.29 \times 10^6$ |
| Distillate Fuel oil | $5.83 \times 10^6$ |
| Gasoline (including aviation gas) | $5.25 \times 10^6$ |
| Jet Fuel (kerosene) | $5.67 \times 10^6$ |
| Jet Fuel (naphtha) | $5.36 \times 10^6$ |
| Nuclear | |
| 1 gram of fissioned U-235 | 74,000 |
| **Other Conversion Factors** | |
| Electricity - kwh | = 0.88 lbs. of coal<br>= 0.076 gal. of oil<br>= 10.4 cu. ft. of natural gas |

[1]These are conventional or average values, not precise equivalents.

Source: Transportation Energy Conservation Data Book, ORNL 51-98 October, 1976.




Source: Data Bank, Federal Energy Administration, 1977

**Figure 3.3**

**TOTAL GROSS ENERGY CONSUMED BY FUEL FOR THE U.S. AND NEC STATES - 1975**

Three-quarters of all energy consumed in the NEC for transportation purposes is in the form of gasoline (Figure 3.5). Distillates, residual oil, and jet fuel comprise the majority of the remaining energy consumed. Electricity is used for less than 0.5 percent of the energy consumed for transportation in the NEC, which is nevertheless high relative to the national rate of less than 0.1 percent.

Consumption data in 1975 show that the NEC states depend on residual oil and coal as primary fuels for electric utilities (Figure 3.6). However, national historical patterns suggest that there has been a decreasing use of coal and an increase in the use of petroleum, natural gas, and nuclear fuel (Figure 3.7).

There is not a one-to-one conversion of fuel to electricity, as much of the heat generated by burning the primary fuel is lost up the smokestack or consumed to overcome frictional forces and other process-related activities. Only 31 BTUs of energy are produced for every 100 BTUs of prime fuel consumed. An additional eight percent of this produced electrical energy is lost in transmission and distribution. The result is a total of 29 BTUs of electricity for consumer consumption. The electricity generated and the electricity consumed in the U.S. in 1975 demonstrates this cycle (Table 3-21).

Table 3-21

CONVERSION EFFICIENCY FOR ELECTRIC UTILITY SECTOR-1975

| Total Energy Consumed | Net Electricity Generated | Conversion Efficiency Factor For Generation | Net Electricity Purchased | Final Conversion Efficiency Factor |
|---|---|---|---|---|
| ($10^{12}$ BTU)[1] | ($10^{12}$ BTU)[2] | (percent) | ($10^{12}$ BTU)[1] | (percent) |
| 20,601 | 6,404 | 31.1 | 5,889 | 28.6 |

[1] Fossil and Nuclear Fuel for Electric Utility Generation, National Electric Reliability Council, June 1976.

[2] Federal Energy Administration, 1977.

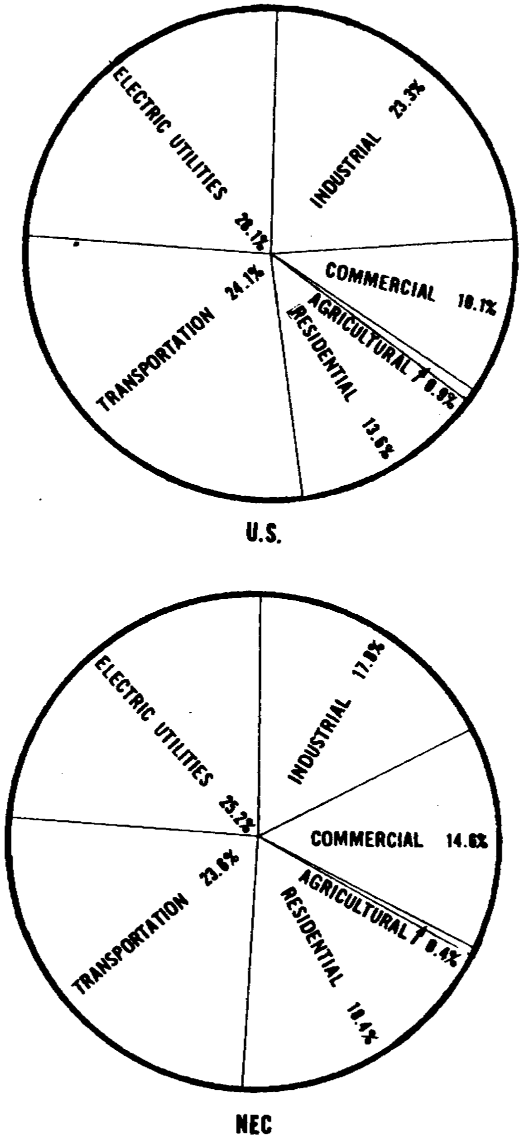



**Figure 3.4**
**ENERGY CONSUMPTION BY SECTOR**

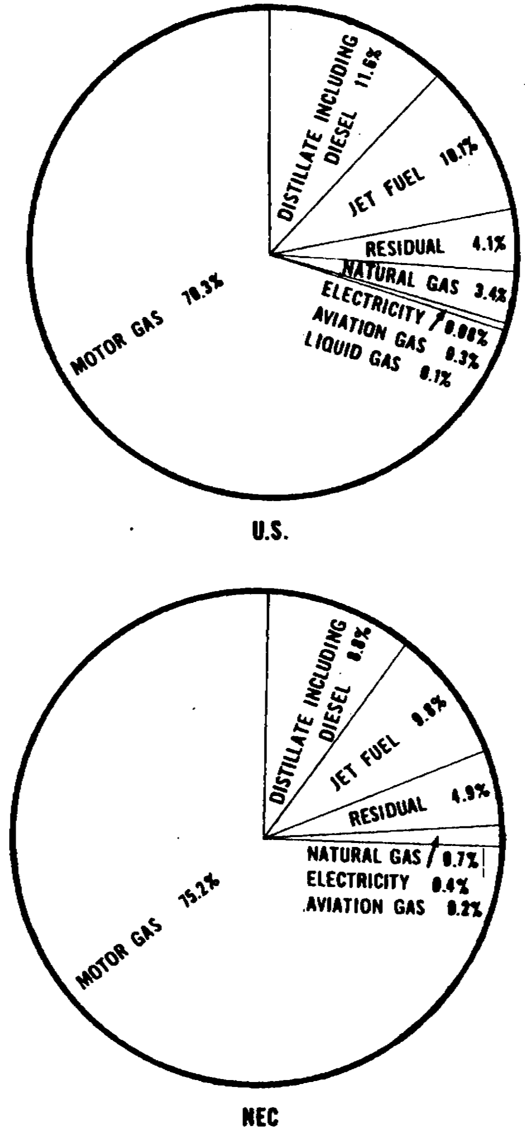



**Figure 3.5**
**TRANSPORTATION FUEL CONSUMPTION**

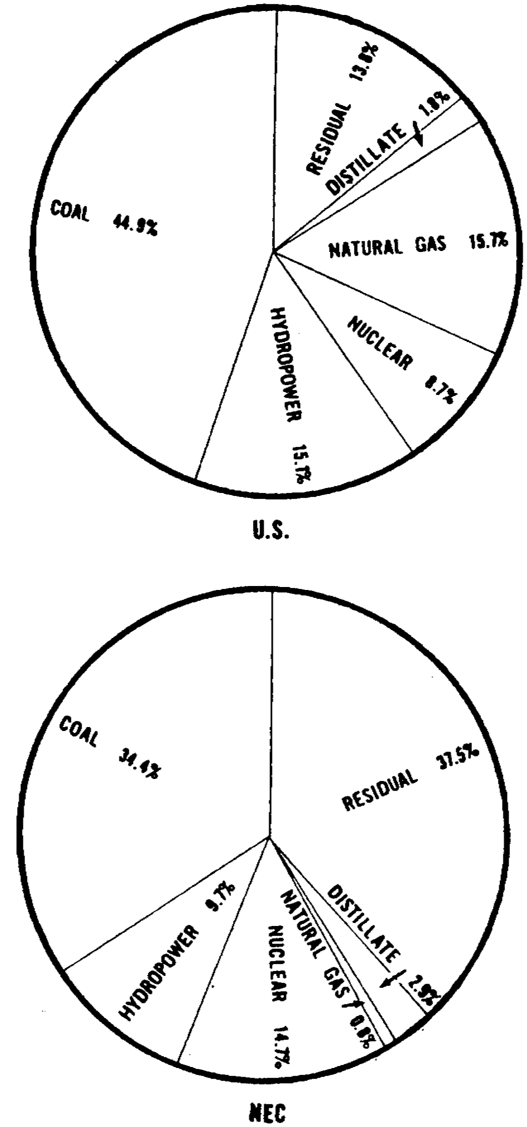
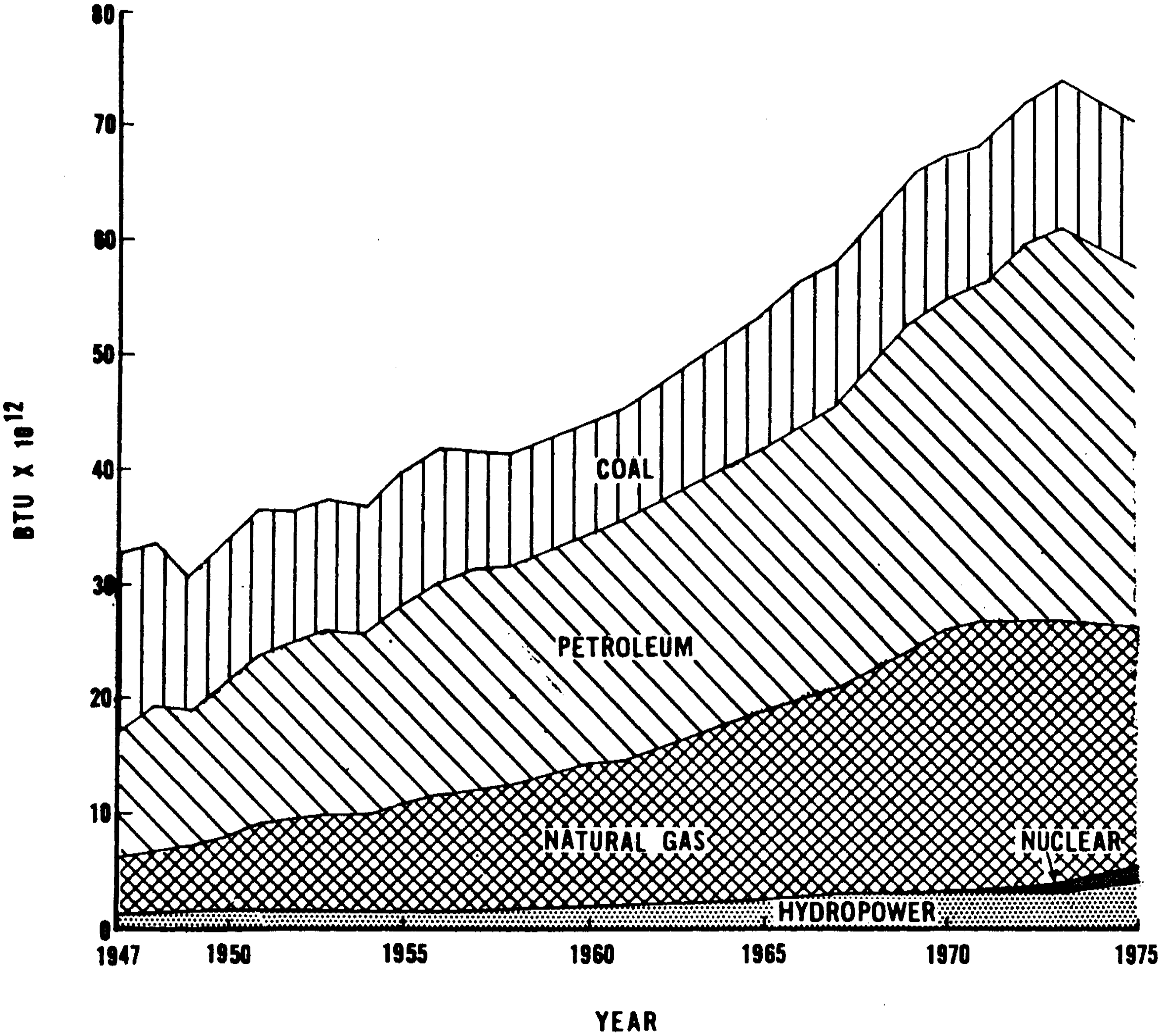



**Figure 3.6**
**ELECTRIC UTILITY FUEL CONSUMPTION**




SOURCE: Historic Energy Consumption data, U.S. Department of Interior Bureau of Mines, 1976

**Figure 3.7**

**U.S. GROSS ENERGY CONSUMPTION BY SOURCE**

Federal and State Energy Programs. The Federal Energy Administration has responded to a growing U.S. energy consciousness by having each state develop plans to reduce the energy consumption of its residents. The basic elements of these state programs are:

- Thermal efficiency standards for new construction and renovation of buildings
- Retrofitting of existing residential housing
- Mandatory heating and lighting efficiency standards
- State and/or local car-pool programs
- Public information programs on energy efficiency
- Programs to improve traffic flow
- Efficiency programs for state government operations.

The success of such state programs depends on the cooperation of the public in implementing conservation measures. Yet state-level programs have not attempted to change the type of energy consumed.

Federal policies are being developed for both the general public and private industry. Of particular significance are the measures proposed for the electric utility industry, including:

- Taxing of utilities and other industries that use oil and gas as boiler fuel. At the present time, the tax is not proposed to go into effect until 1983.
- Phasing out promotional rates-pricing that gives discounts to volume users of electricity
- Modifying higher rates during the day (peak use hours) and lower rates at night.

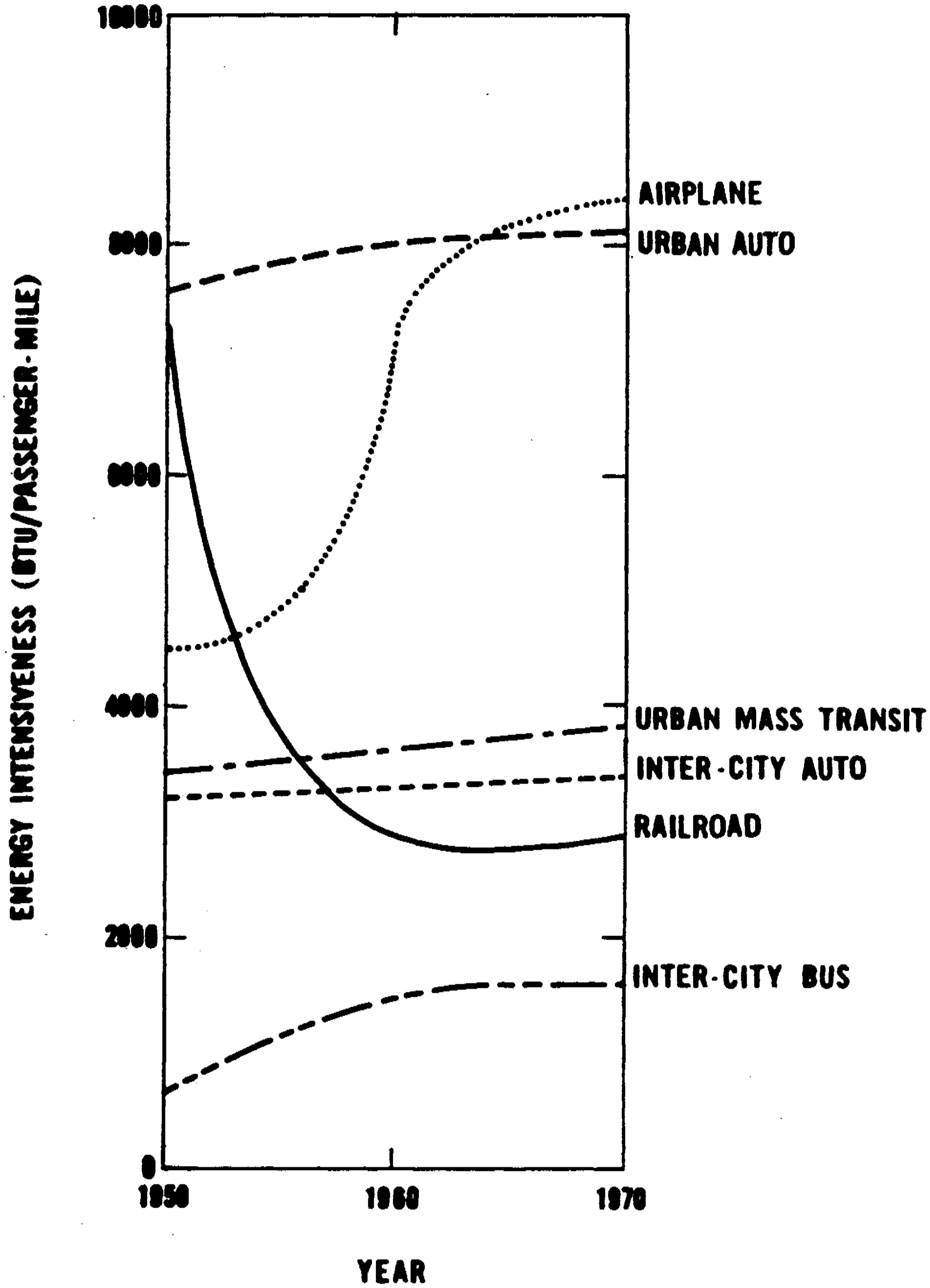
Because these policies are still in formative stages, their ultimate impact upon the NECIP is unkown.

### ?.2.3 ENERGY ASSESSMENT METHODOLOGY

Objectives of the energy impacts analysis were to determine the total change in energy expected in 1982, one year after program implementation, and in 1990, the design year, for the NECIP. The type of fuel (i.e., petroleum versus non-petroleum) was also quantified, and the relative change evaluated to determine consistency with the goal of oil independence. Studies have shown that total energy consumption varies with the mode of travel, the speed of travel, and the number of passengers moved per trip. Historically (Figure 3.8), the bus has been the most energy efficient form of intercity travel since it consumes roughly one-half the energy per person per trip of its closest competitor, the intercity train.

Train Energy Consumption. The Draft PEIS used existing published data on energy consumption for the train. Based on comments by several groups, these data were reanalyzed. All data presented in the following discussion assume a 29 percent conversion efficiency for electricity production and give energy consumption in terms of prime fuel consumed rather than at-the-wheel energy (i.e., a train consuming 29 BTUs of electricity is responsible for the power plant consuming 100 BTUs of prime fuel. In all cases, the train data are presented as consuming the 100 BTUs of prime fuel.) Consumption for the rail system was reevaluated from a schedule of train trips along the Corridor, and estimates of energy consumption per trip. These estimates of the energy consumption per trip included energy required for hotel power (heat, electricity, cooling for the cars) and power losses in the catenary, as well as the energy required to move the train. This analysis differentiated between the type of fuel used. The resulting energy consumption per seat-mile[1] of travel (Figure 3.9) indicated that the Draft PEIS energy consumption estimate of 1,939 BTUs per seat-mile (BTU/SM) in 1975 was an overestimation of both existing and future consumption. As shown, the Metroliner consumes 1,615 BTU/SM while E-60 and GG-1 hauled trains

[1] Energy consumption per seat-mile (BTU/SM) is the energy required to move one seat, full or empty, one mile.




SOURCE: Transportation Energy Use and Conservation Potential, November 1973

**Figure 3.8**

**HISTORICAL VARIATION IN ENERGY INTENSIVENESS OF PASSENGER MODES**

consume less than half of this amount (743 BTU/SM and 625 BTU/SM, respectively). Part of the higher consumption rate for the Metroliner is due to higher speeds. These consumption estimates agree well with Amtrak's figures for average energy consumption for all types of trains, 1,430 BTU/SM. The energy per seat-mile, and ultimately per passenger-mile for a train, depend to some extent on the number of cars in each train. The estimates for 1982 and 1990 assumed the average number of cars discussed in Section 3.1. Since the energy consumption characteristics vary significantly by type of traction power and speed as well as train size, best estimates of the type of locomotive and size were made for each section of track assuming a fixed consist. These estimates, along with the corresponding total energy per seat-mile (BTU/SM) are given in Table 3-22.

These projections of energy consumption were then used with the total seat-mile projections for each track segment to calculate total 1990 energy, and divided by total passenger-miles to determine total energy per passenger-mile (BTU/PM).

The improved Metroliner is a redesigned existing Metroliner. It is a little lighter and more energy-efficient with better acceleration characteristics, but it is not the Metroliner II, the design train for 1990. It can be expected that the Metroliner II will be similar in efficiency to the AEM-7, a recently introduced EMD (Electromotive Division of General Motors) locomotive. Therefore, data for the 1990 improved system assume that all trains have the operating characteristics of the AEM-7. The 1990 energy consumption data (Figure 3.9) project that the energy required per seat-mile will vary significantly by segment of Corridor, consumption, and type of train, and indicate that the Draft PEIS estimate of energy consumption was high. Bus, air, and auto energy consumption per seat-mile are also shown for comparison purposes.

The diesel-electric traction energy is calculated in a similar manner. Energy consumption per seat-mile is estimated[1] and applied to the average

[1] Energy Requirements for Passenger Ground Transportation, Goss and McGowan ASME Paper, September, 1973.

Table 3-22

ENERGY CONSUMPTION FOR NEC TRAINS

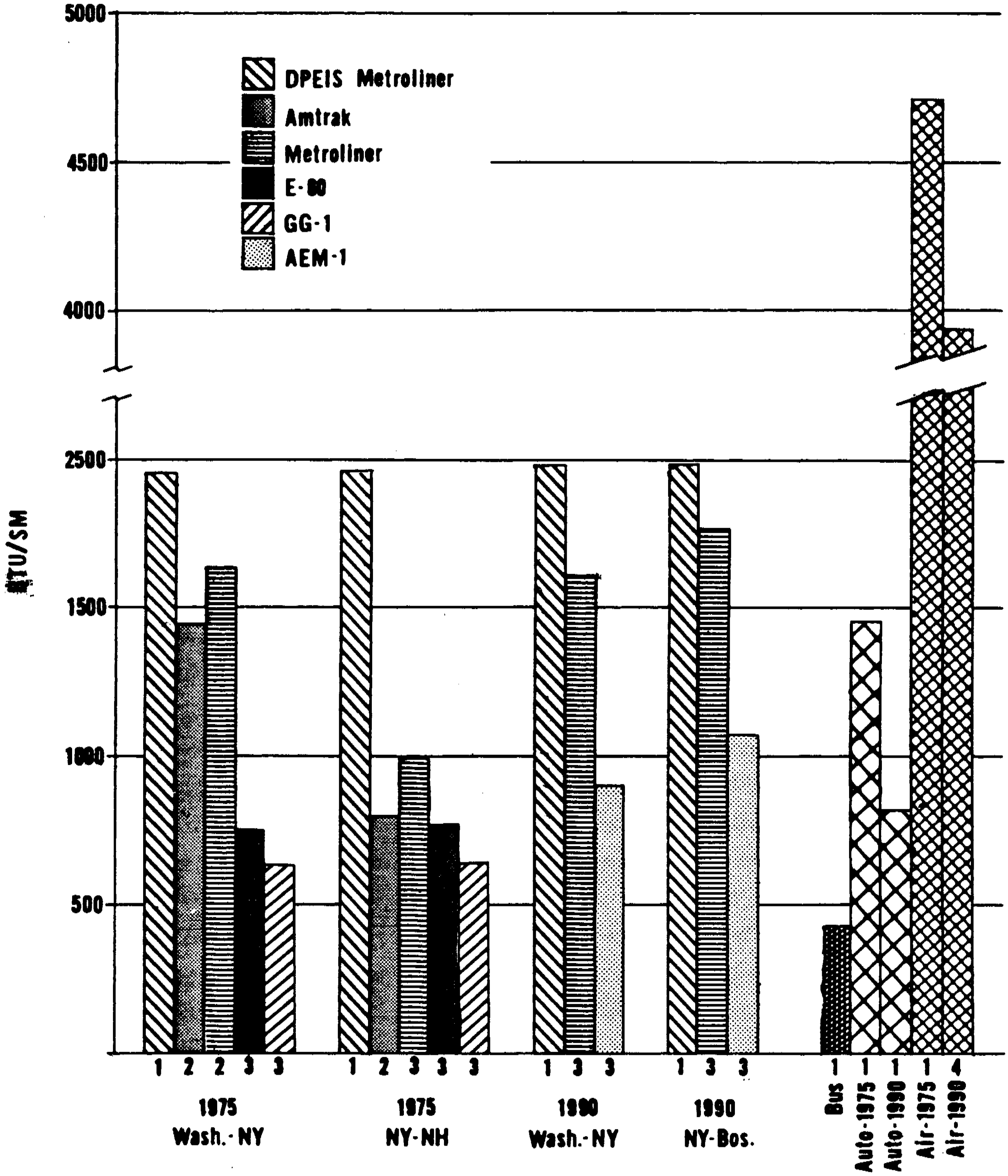
| Year/System Condition | Train Type | Track Segment | Energy Consumption (BTU/SM)[1] |
|---|---|---|---|
| 1975 | E-60 | Washington-New York | 743 |
| | | New York-New Haven | 762 |
| | Metroliner | Washington-New York | 1,615 |
| | | New York-New Haven | 982 |
| | Diesel-Electric[2] | New Haven-Boston | 914 |
| 1982,1990/Unimproved | E-60 | Washington-New York | 743 |
| | | New York-New Haven | 762 |
| | Improved Metroliner | Washington-New York | 1,594 |
| | | New York-New Haven | 1,751 |
| | Diesel-Electric | New Haven-Boston | 914 |
| 1982/Improved | Improved Metroliner | Washington-New York | 1,594 |
| | AEM-7[3] | Washington-New York | 1,077 |
| | | New York-Boston | 1,237 |
| 1990/Improved | AEM-7[3] | Washington-New York | 897 |
| | | New York-Boston | 1,060 |

[1] Assumes 29 percent conversion efficiency at power plant, hotel power and catenary line losses.

[2] Energy Requirements for Ground Transportation, Goss and McGowan, ASME Paper, September, 1973.

[3] AEM-7 is an existing EMD (Electromotive Division of General Motors) locomotive being put in service in the NEC.

SOURCE: Train Performance Calculator Model, Federal Railroad Administration, 1977.




[1]Draft Programmatic Impact Statement, FRA, 1977.
[2]Private communication with Amtrak personnel.
[3]Computer simulation of energy consumption.
[4]Assumes 14 percent improvement in energy efficiency over 1975.

Includes 29% efficiency for electricity generation and transmission

**Figure 3-9**
**PRIME ENERGY CONSUMPTION PER SEAT-MILE IN THE NEC**

consist size in Chapter I to determine total energy consumption in 1982 and 1990. Average BTU per passenger-mile is determined by dividing the total calculated energy by the total passenger-miles.

A second issue, type of fuel consumed, was also addressed. The NECIP is within two power coordinating councils, namely the Mid-Atlantic Area Council (MAAC) and the Northeast Power Coordinating Council (NPCC). Within any coordinating council, electricity is generated by various power companies and distributed throughout the region. At any given moment in time, electricity at a given point in the system could have been generated by any one of the council companies. It is therefore not possible to attribute traction power to specific types of fuel, other than in proportion to total consumption of fuel in each council area. The councils have estimated growth by type of fuel through 1985. In many cases, these estimates are based on power plants already under construction. 1990 estimates assume a proportional increase in growth for each type of generating fuel. The data used are shown in Table 3-23. All electricity consumed between New York and Washington was assumed to come from MAAC and all electricity between New York and Boston from NPCC. (The percent consumption by type of fuel differs from the summary for the NEC states alone, because the coordinating councils encompass states outside the NEC.) This probably results in an overestimation of the consumption of oil and coal, since some of these plants are used to provide peak-load requirements. Since there is a strong possibility that many of the oil-fired power plants will be converted to coal, estimates of fuel consumption which assume 100 percent conversion of oil-fired power plants to coal have also been provided for the worst case air quality analysis presented in Section 3.3. The conversion rates, BTUs to gallons, tons and cubic feet, are based on existing 1975 efficiency rates for each of the Councils (Table 3-24).

The diesel-electric traction energy is calculated in a similar manner. Energy consumption per seat-mile is estimated[1] and applied to the

[1] Energy Requirements for Passenger Ground Transportation, Goss and McGowan, Systems, ASME Paper, September, 1973.

Table 3-23

PERCENT CONSUMPTION BY TYPE OF FUEL FOR MAAC AND NPCC

| Fuel | 1975 | | 1982[1] | | 1990[1] | |
|---|---|---|---|---|---|---|
| | MAAC | NPPC | MAAC | NPCC | MAAC | NPCC |
| Nuclear | 16.4 | 18.1 | 36.3 | 27.1 | 47.4 | 34.5 |
| Hydro | 2.7 | 18.3 | 1.0 | 13.0 | 0.7 | 11.1 |
| Coal | 54.4 | 11.4 | 43.7 | 13.2 | 37.4 | 14.1 |
| Oil | 25.9 | 51.3 | 18.6 | 46.7 | 14.2 | 40.2 |
| Gas | 0.6 | 0.6 | 0.2 | ---- | 0.2 | ---- |

[1]Projections based on National Electric Reliability Council 1986 distribution.

Source: Fossil and Nuclear Fuel for Electric Utility Generation, National Electric Reliability Council, June, 1976.

Table 3-24

1975 BTU CONVERSION EFFICIENCY RATINGS BY FUEL
MACC AND NPCC

| | Coal BTU/Ton | Oil BTU/Gal. |
|---|---|---|
| MAAC | $25.8 \times 10^6$ | 141,428 |
| NPCC | $25.4 \times 10^6$ | 152,857 |

Source: Fossil and Nuclear Fuel for Electric Utility Generation, National Electric Reliability Council, June, 1976.

average consist size in Chapter I to determine total energy consumption in 1982 and 1990. Average BTU per passenger-mile is determined by dividing the total calculated energy by the total passenger-miles.

Energy Consumption for Air, Auto and Bus. Estimated energy consumption per passenger-mile for the air and bus alternative modes of intercity transportation is given in Table 3-25. The data presented in this table do not vary significantly from the data in the Draft PEIS. However, in this analysis, the air transportation system was assumed to become progressively more energy-efficient between 1975 and 1990. It was assumed that the 1982 consumption rate would be 94 percent of 1975, and that the 1990 rate would be 86 percent of 1975.[1]

Congress has mandated that new cars achieve higher energy efficiency. By 1986, the average car sold will be required to consume no more than one gallon per 27.5 miles. This implies that the average car on the street, based on typical turnover rates and age distribution, will consume one gallon per 24.2 miles. The projected energy consumption for each year of interest is given in Table 3-26.

The final energy consumption figures per passenger-mile for each of the alternative modes of travel were used along with estimates of passenger-miles to determine total energy consumption for air, auto and bus. The rail figures for electric traction were calculated from a train schedule and patronage projections, and the energy totals per passenger-mile given in Table 3-25 were calculated from estimated patronage.

### 3.2.4 PROBABLE IMPACTS

Projections indicate that NEC intercity trips will require less total energy with the NECIP than with the unimproved system, in both 1982 and 1990. Figure 3.10 shows the estimated impact of the NECIP on all modes of intercity travel. As shown, there is a projected $0.25 \times 10^{12}$ BTU energy savings in 1982, which is equivalent to a 0.6 percent reduction in total

[1] Issues Affecting Northeast Corridor Transportation, The Aerospace Corporation, June, 1977.

Table 3-25

BTU/PASSENGER MILE BY MODE

| Mode | Year | Load Factor | BTU/PASSENGER MILE[5] |
|---|---|---|---|
| Rail: Electric[1] | 1975 | 0.408 | 2329 |
| Unimproved | 1982 | 0.451 | 2006 |
| Improved | | 0.577 | 2152 |
| Unimproved | 1990 | 0.492 | 1857 |
| Improved | | 0.508 | 1855 |
| Rail: Diesel-Electric | 1975 | 0.217 | 4211[2] |
| | 1982 | 0.244 | 3778 |
| | 1990 | 0.273 | 3375 |
| Rail: Turbine-Electric[2] | 1990 | 0.450 | 2344 |
| Bus[2] | All Years | 0.510 | 819 |
| Air[2,3] | 1975 | 0.550 | 8500 |
| | 1982 | 0.550 | 8143 |
| | 1990 | 0.550 | 7115 |
| Auto[4] | 1975 | 0.350 | 4166 |
| | 1982 | 0.350 | 3125 |
| | 1990 | 0.350 | 2315 |

[1]See Chapter 1 and Table 3-22.

[2]Energy Requirements for Passenger Ground Transportation, Goss and McGowan, ASME Paper, September, 1973.

[3]Issues Affecting Northeast Corridor Transportation, The Aerospace Corporation, February, 1978.

[4]Connecticut's Energy Outlook 1976-1995, Connecticut Energy Advisory Board, January, 1976; and 1976 Statistical Abstract, U.S. Department of Commerce. Assumes 125,000 BTU/gallon.

[5]Data adjusted from references above to reflect the load factors in the NEC and assumes 125,000 BTU/gal. for automobile energy consumption and 136,000 BTU/gal. for all other fuels.

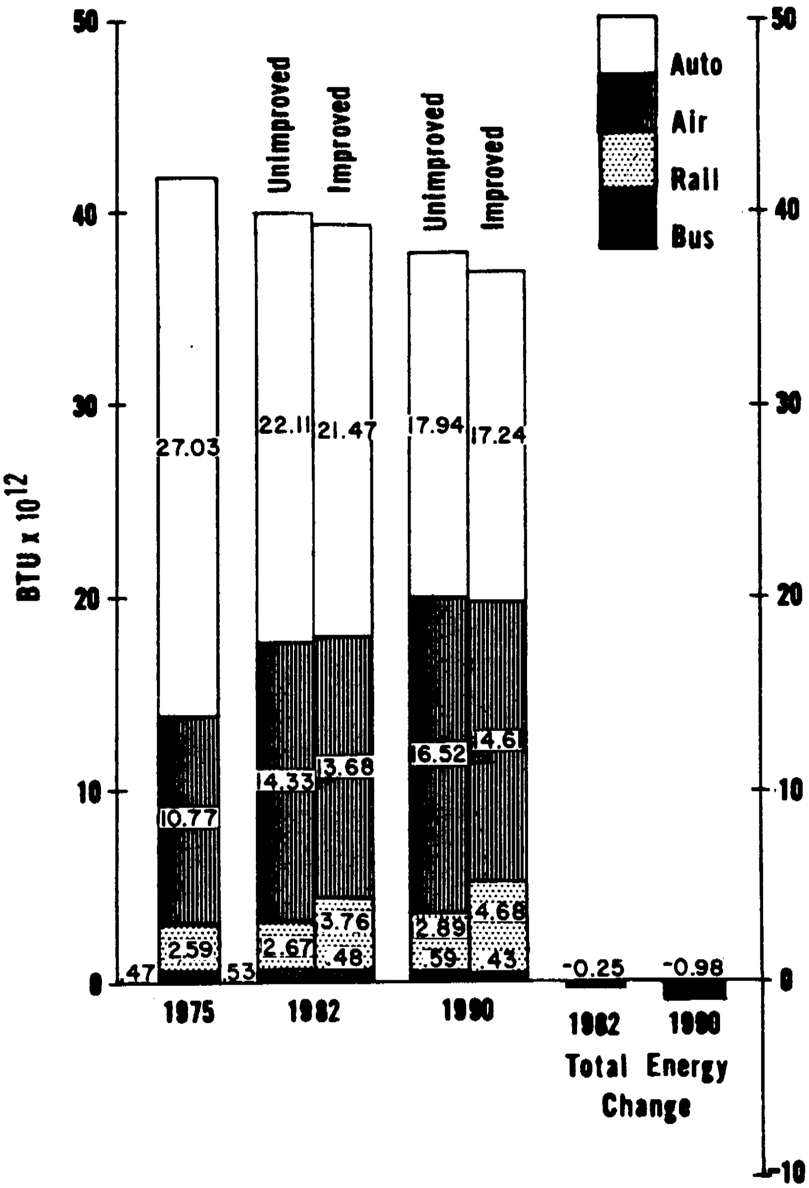



**Figure 3.10**
**TOTAL INTERCITY ENERGY CONSUMPTION (NEC)**

Table 3-26

AUTOMOBILE FUEL CONSUMPTION RATES, 1975-1996

| | Average Miles per Gallon[1] | |
|---|---|---|
| | New Cars (Mandated) | All Cars (Est.) |
| 1974[2] | | 13.7 |
| 1975[3] | | 14.3 |
| 1976 | 17.6 | 14.9 |
| 1977 | 18.6 | 14.9 |
| 1978 | 18.0 | 15.6 |
| 1979 | 19.0 | 15.8 |
| 1980 | 20.0 | 16.6 |
| 1981 | 21.5 | 17.6 |
| 1982[3] | | 18.9 |
| 1986 | 27.5 | 24.2 |
| 1990[3] | | 25.8 |
| 1996 | 27.5 | 27.5 |

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[1] Except as noted: Connecticut's Energy Outlook 1977-1996, Connecticut Energy Advisory Board, January 1977.

[2] 1976 Statistical Abstract, U.S. Department of Commerce, 1976

[3] Interpolated from data

fuel used for intercity travel. By 1990, there is a projected 2.6 percent savings in total energy ($0.98 \times 10^{12}$ BTU). This energy savings is a direct savings in petroleum. Figure 3.11 shows the 1990 change for each mode and the amount of the total that is petroleum based.

The results indicate an increase in energy consumption by rail ($1.70 \times 10^{12}$ BTU non-petroleum and $0.09 \times 10^{12}$ BTU petroleum) and a decrease in consumption by bus, air and auto ($2.77 \times 10^{12}$ BTU). The net savings in petroleum-based products is $2.68 \times 10^{12}$ BTU (469,200 barrels of oil). The net savings in energy is $0.98 \times 10^{12}$ BTU, which is equivalent to 171,600 barrels of oil. This net energy savings is all attributable to petroleum-based products and although small, represents more energy than the total projected consumption by bus for intercity travel in the NEC in 1990.

In Chapter 1, analysis using fixed and variable consist was discussed. The above energy calculations assume a fixed consist. If energy costs become a sufficiently serious issue, Amtrak could reduce total consumption by adjusting consist size to reflect variation in demand. If a variable consist is assumed, the energy savings projected would increase to $1.35 \times 10^{12}$ BTU or 3.6 percent of the total energy projected for intercity trips in the NEC. The load factor would increase to 0.655. (The figures for energy consumption per seat-mile used to calculate the variable size consist were 1,237 BTU/SM for the Boston to New York segment and 1,077 BTU/SM for New York to Washington. The energy per seat-mile is higher, but the total energy per trip is lower.)

Finally, in Chapter 2, three traction-power systems were discussed as alternatives for use on the improved Corridor. An analysis of propulsion system efficiencies indicates that for the same power output, the total efficiency of the diesel-electric is 29 percent, the electric is 27 percent and the turbine-electric is 19 percent (Table 3-27). Based on these data, the diesel-electric traction option would consume approximately 93 percent of the energy required for the electric option and the turbine-electric would consume 1.44 times the energy of the electric traction alternative. However, diesel-electric and turbine-electric consume 100

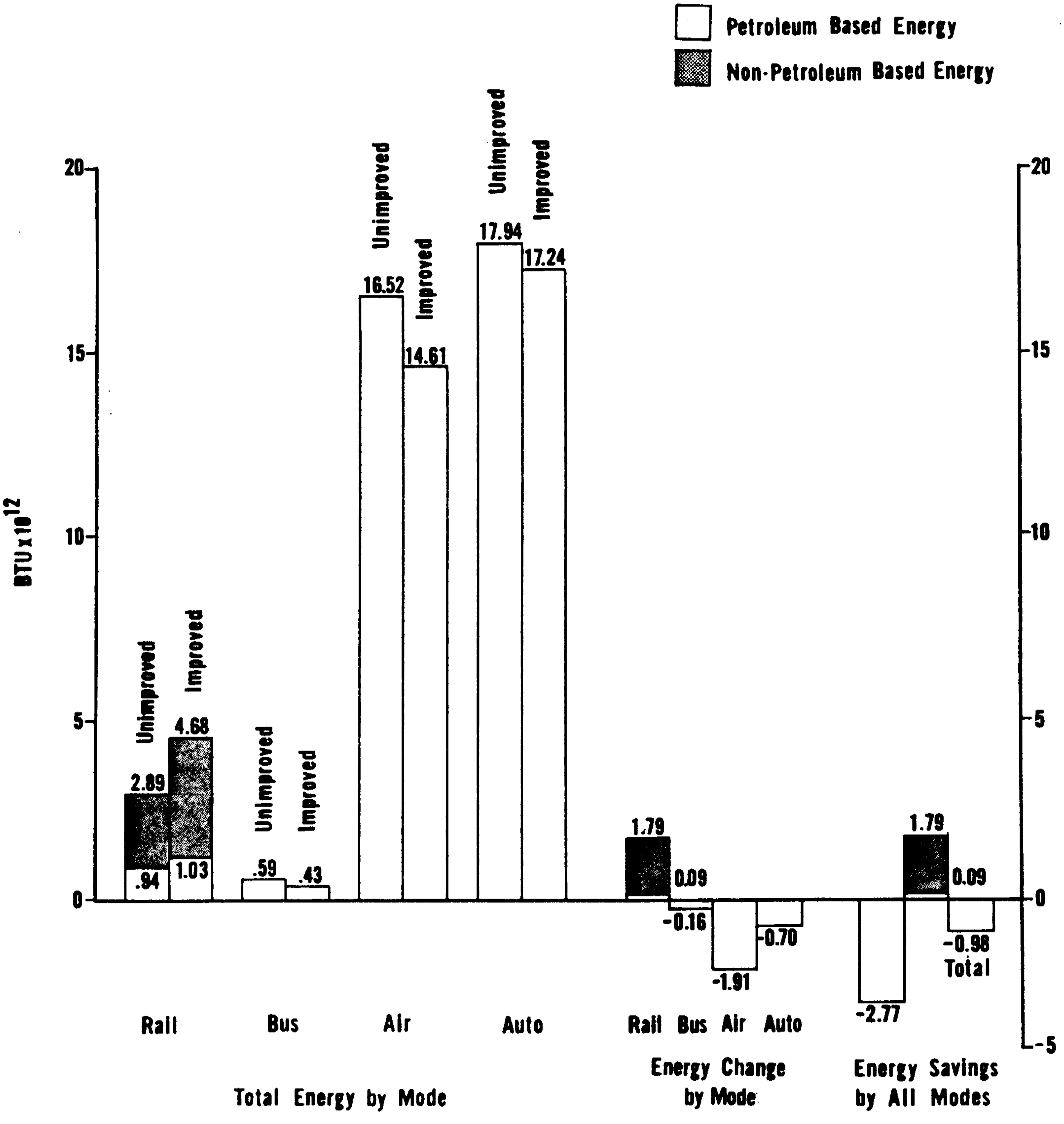


**Figure 3.11**
**1990 INTERCITY ENERGY CONSUMPTION (NEC)**

Table 3-27

ALTERNATIVE PROPULSION SYSTEM EFFICIENCIES

| | |
|---|---|
| **Electric** | |
| Electric locomotive efficiency (a) | 85% |
| Transmission efficiency - Train to Power Plant (b) | 90% |
| Power Plant Thermal Efficiency (c) | 35% |
| Overall Electric Traction System Efficiency | 27% |
| **Diesel** | |
| Diesel Engine Thermal Efficiency (d,e) | 35% |
| Motor-Generator Efficiency (f) | 82% |
| Overall Diesel Traction System Efficiency | 29% |
| **Turbine - Electric** | |
| Gas Turbine Engine Thermal Efficiency (g) | 25% |
| Turbine Final Drive Efficiency (a) | 75% |
| Overall Turbine Traction System Efficiency | 19% |

(a) Technical and Economic Analysis of Vehicle/Right-of-Way Systems, Volume II. U.S. Department of Transportation, Federal Railroad Administration, August, 1975.

(b) The 1970 National Power Survey, Federal Power Commission.

(c) Ibid.

(d) "National Cooperative Highway Research Program Report III" Claffey, P.I., Highway Research Board; "The Conversion of Energy", Claude Summers, Scientific American, September, 1971.

(e) "Transportation and Energy - A Future Confrontation", Goss, W. P. and McGowan, J.G., Transportation Research.

(f) Personal Communication with Mr. E.T. Harley - Chief Mechanical Superintendant, Penn Central Transportation Company.

(g) Calculated for the Allison T56-A15 3000 HP Industrial Turbine by dividing the output shaft horsepower by the fuel rate.

SOURCE: Technical and Economic Analysis of Vehicle/Right-of-Way Systems, Volume II, Task 9, U.S. Department of Transportation, August 1975.

percent petroleum-based products, while for the electric traction option, only 27.7 percent of the electricity is projected to come from petroleum-based products. In addition, the electric-traction option has the added benefit of permitting complete independence from petroleum-based products through the use of alternative fuels.

Energy Sensitivity Analysis. Several comments on the Draft PEIS noted that an error in the patronage projections and/or the modal split of the diversions would result in a change in the energy impacts. The comments suggested, correctly, that a modal split which diverted more trips from bus and less trips from auto and/or air would result in the project actually costing energy. This was certainly true with the assumption for energy consumption per passenger-mile used in the Draft PEIS. As discussed in the methodology section (3.2.2), energy consumption projected for the NECIP was significantly overestimated. There was a wide divergence of consumption rates reported in the literature and the highest estimate of energy consumption was assumed. No credit was given for newer, more energy-efficient trains. Even the analysis presented in this Final PEIS does not speculate on train efficiency, and is based only on existing technology for train consumption. Airplane efficiencies and auto efficiencies are, on the other hand, assumed to improve by 1990. This results in an overall reduction in energy consumption for these modes beyond present day performance. Therefore the estimate of energy savings from the NECIP presented in this analysis is the minimum expected savings for the anticipated diversion. Based on the most recent data, the patronage projections used are the best estimate of demand in 1990, and the modal split is an accurate estimate based on likely conditions in 1990 (see Section 1.4). However, the primary question raised by the comments to the Draft PEIS is how much of an error in modal split would be required to result in the system costing energy. There is no definitive answer to this question since there are an infinite variety of possible scenarios to review. However, it is possible to look at the order of magnitude of the potential error for several cases.

For example, Figure 3.11 shows that the additional energy required to run the projected 1990 train schedule is $1.79 \times 10^{12}$ BTU, while the total savings is $2.77 \times 10^{12}$ BTU. This implies that the estimates of diversion would have to be off 35 percent to cause a break-even condition. Even if the estimate of the diversion from auto is off 100 percent and nobody is diverted from the auto to rail, the system will result in an energy savings based on the estimated diversion from air.

If, on the other hand, no one at all was diverted to the train from alternative modes, and the 1990 schedule was maintained, there would be increased energy costs. This energy cost, 4.7 percent, is unlikely, since it is more probable that the train schedule and consist size would be reduced to that of the no-build. In this more likely case, the result would be that the total system would use approximately the same energy, but that the trains would run faster. Finally, if the total estimate of total trips is low for all modes, the energy savings would increase in proportion to the degree of underestimation.

In conclusion, it is not likely that the NECIP will cost energy, even under the scenarios suggested in comments to the Draft PEIS. It is highly likely, in fact, that the NECIP will result in an energy savings.

## 3.3 AIR QUALITY

### 3.3.1 SUMMARY

The diversion of air, auto and bus patrons to improved intercity rail will result in a slight improvement in air quality. It will reduce total air pollution emissions from intercity travel by 3.7 percent (3.3 kilotons) in 1990. There will be a marginal decrease (0.1 percent) in hydrocarbons emitted by automobiles in the Northeast. The effects of added auto trips to railroad stations are expected to be minimal. Electrification of the mainline will eliminate the diesel exhaust emission from Amtrak trains north of New Haven but will increase pollution from electricity generating plants; however, the NECIP-related power plant emissions of 2.7 kilotons in 1990 represents less than 0.1 percent of the total electric utility emissions projected for the region.

Construction-related activities may cause some short-term impacts, but these are not expected to be significant. Fugitive dust from ballast cleaning, undercutting and sandblasting may cause localized impacts, which can be controlled through various mitigation techniques.

### 3.3.2 EXISTING CONDITIONS

Air Pollutants Characteristics and Health Effects. The six major air pollutants for which the Federal Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards are: total suspended particulates, oxides of sulfur, carbon monoxide, photochemical oxidants or smog, oxides of nitrogen, and hydrocarbons. The health effects and major sources of each are described as follows:

- Total suspended particulates (TSP): These microscopic particles are suspended in the air either as a solid or as liquid droplets and range in size from fly ash, which is easily visible to the eye, to particles small enough to be inhaled and absorbed by the lungs. Particulates remain in the air until they settle out on their own or in precipitation. In addition to soiling clothes, some particulates cause damage to buildings and paints while others can be toxic (lead) or carcinogenic (asbestos), or can act as vehicles to carry molecules of other harmful substances, such as sulfur oxides, into the lungs. The major sources of particulates are fuel combustion, incineration, industrial processes, and fugitive dust.

- Oxides of sulfur ($SO_x$). These are formed as a by-product from the combustion of fuels containing sulfur and during some chemical plant operations. Sulfur dioxide, a colorless and odorless gas, is formed during combustion. It can irritate mucous membranes and cause damage to vegetation, and is corrosive. Chemical reactions may bring about the formation of sulfuric acids which are more corrosive and irritating than sulfur dioxide. Hydrogen sulfide gas and mercaptans are emitted from petroleum refineries, kraft pulping mills and some chemical processes. They are foul-smelling gases that can corrode silver and attack lead-base paints. The primary source of oxides of sulfur in most areas, however, is fuel burning; consequently, ambient levels are highest during the winter.

- Carbon monoxide (CO): Carbon monoxide, a colorless and odorless gas, is a by-product of incomplete combustion. A large concentration of carbon monoxide is lethal, while lesser doses cause fatigue, headaches, dizziness, and loss of muscle control. The primary sources of ambient carbon monoxide are automobiles, power plants and incineration. Because carbon monoxide disperses rapidly in the atmosphere, the major source of ground-level carbon monoxide is automobile exhaust.

- Photochemical smog (ozone, PAN, aldehydes): This is a category of gases produced when oxides of nitrogen and hydrocarbons in the air are catalyzed by sunlight. These compounds cause the characteristic haze found during summer air stagnation periods. They also cause eye irritation, coughing, headaches and fatigue in humans and damage plants, rubber and fabrics. The presence of photochemical smog is directly related to auto emissions.

- Oxides of nitrogen ($NO_x$): These are products of fuel combustion. Nitric oxide, a colorless gas, is formed during combustion of fuels at high temperatures and pressures. Although it is relatively harmless, it can readily convert to nitrogen dioxide which can reduce the oxygen-carrying capacity of the blood and is harmful to vegetation. Nitrogen dioxide is also a major constituent of photochemical smog (discussed above). In most areas, motor vehicle exhaust is the largest single source of oxides of nitrogen.

- Hydrocarbons: These are a general class of compounds containing hydrogen and carbon. Hydrocarbons are emitted from fuels through evaporation and combustion. Two main types of hydrocarbons are aromatics and olefins. Some aromatics are carcinogens, while olefins are harmful to plants. Most nonmethane hydrocarbons play a major role in the formation of photochemical oxidants.

Climatological Conditions Affecting Air Pollution. How severely pollutants will affect an area depends on a number of factors including concentration, duration of exposure, amount and time of the interaction of various pollutants and general weather conditions. Under favorable conditions, the wind disperses pollutants. However, in the NEC, the hilly topography and high pressure systems both contribute to frequent increase in ambient air pollutant concentrations.

Because of hilliness of the region, upper air layers are heated before the cooler valley air; this temperature inversion causes pollution to remain in the valley, rather than disperse (see Figure 3.12).

High ozone levels occur when a high pressure system with clockwise moving winds travels through the Northeast Quadrant of the United States. Into the system's fixed volume of air, more and more hydrocarbons and oxides of nitrogen are introduced, and a recent study[1] has documented that there is a definite increase in ozone levels as the high pressure system moves through the area. In addition, if the center settles off the coast, the volume of air continues to pass over the urbanized heavily traveled east coast, causing increased levels of ozone with each passing day.

Air Quality Standards. Since exposure to high concentrations of the above pollutants causes serious health problems, EPA and individual states have established primary standards to minimize human exposure to unhealthy levels of air pollution (Table 3-28). For some pollutants, these standards have been set for two or three time periods and concentrations because long-term exposure to relatively low levels is as dangerous as short-term exposure to high levels. Secondary standards have also been established to insure against less harmful exposure and thereby guard the public welfare. In some instances, the state standard is more stringent than the federal limit.

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[1] Wight, G. W., G. T. Wolff, P. J. Lioy and R. T. Cederwall, "Formation and Transport of Ozone in the Northeast Quadrant of the United States", Proceedings of the ASTM Symposium on Air Quality Meteorology and Atmospheric Ozone, Boulder, Colorado, August, 1977. In publication 1978.

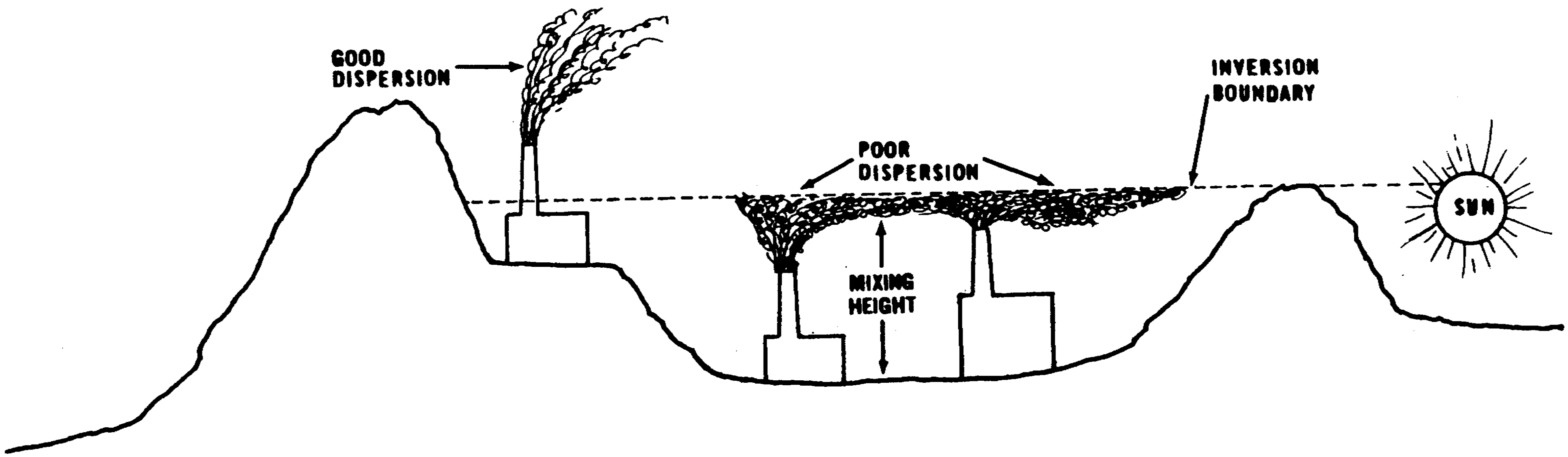


**Figure 3.12**
**EFFECT OF AN EARLY MORNING INVERSION ON AIR QUALITY**

Table 3-28

PRIMARY AMBIENT AIR QUALITY STANDARDS BY STATE

| STATE | $SO_2$ (ug/m³) | | Particulates (ug/m³) | | HC (ug/m³) | $NO_x$ (ug/m³) | $O_3$ (ug/m³) | CO (mg/m³) | |
|---|---|---|---|---|---|---|---|---|---|
| | Annual | 24 hr. | Annual | 24 hr. | 3 hr. | Annual | 1 hr. | 1 hr. | 8 hr. |
| Massachusetts | 80 | 365[1] | 75 | 260[1] | 160[1] | 100[1] | 160[1] | 40[1] | 10[1] |
| Rhode Island | 80 | 365[1] | 75 | 260[1] | No Standard | 100[1] | 160[1] | 40[1] | 10[1] |
| Connecticut | 80 | 365[1] | 75 | 260[1] | 160[1,2] | 100 | 160[1] | 40[1] | 10[1] |
| New York[7] | 80 | 365 | 75 | 250 | 160 | 100 | 160 | 35 ppm[3] | 9 ppm[3] |
| New Jersey | 80 | 365[1] | 75 | 260[1] | 160[1,2] | 100[1] | 160[1] | 35 ppm[1,3] | 9 ppm[1,3] |
| Pennsylvania | 80 | 365[1] | 75 | 260[1] | 160[1,2] | 100 | 160[1] | 40[1] | 10[1] |
| Delaware | 80 | 340 | 70 | 200[1] | 0.2ppm | 0.5 ppm[3] | 0.08ppm[1,3]<br>0.1 ppm[5] | 35 ppm[3] | 12 ppm[5]<br>8 ppm[6] |
| Maryland | 79 | 262[1] | 75[8] | 160[1] | 160[1] | 100[1] | 160[1] | 40[1] | 10[1] |
| Washington, D.C. | 75 | 285[1] | 75 | 160[1] | 160[1,2] | 100 | 160[1] | 40[1] | 10[1] |
| Federal | 80 | 365[1] | 75 | 260[1] | 160[1,2] | 100 | 160[1] | 40[1] | 10[1] |

1. Not to be exceeded more than once a year
2. 6 a.m. to 9 a.m.
3. Equivalent to Federal Standard
4. Have a 6-9 a.m. guideline
5. Not to be exceeded
6. Cannot be exceeded 0.1 percent of year
7. Beginning March, 1977, Short Term standards can be exceeded no more than once per year.
8. Annual Arithmetic Standard

Existing Air Quality Levels. Each state in the NEC has a network of monitoring stations which sample ambient air concentrations and furnish data to assess the impact of control strategies. In 1975, the annual standard for oxides of sulfur, measured as sulfur dioxide was violated in one state, while the annual standard for oxides of nitrogen, measured as nitrogen dioxide, was violated in two states (see Table 3-29). Four states showed violations of the state primary particulate 24-hour standard and in six of the NEC states, the annual standard was exceeded as well. The one-hour carbon monoxide standard was violated in two states while the eight-hour standard was violated in every state except Delaware. Delaware's standard is three parts per million higher than the federal standard, which was violated. The photochemical oxidant standard was exceeded frequently in every state during the spring and summer.

The monitoring results for individual sites in each state are tabulated in more detail in Appendix D.

As a result of high ozone levels reported in the Corridor, the EPA has required all states and the District of Columbia to develop strategies to reduce the total emissions from motor vehicles in use. Strategies being proposed include periodic vehicle inspection and maintenance; installation of retrofitting devices to reduce vehicle exhaust emissions from uncontrolled vehicles; and programs to reduce vehicle-miles of travel. Because emissions of hydrocarbons and carbon monoxide increase at slower vehicle speeds, program measures such as parking bans, exclusive bus lanes, mass transit improvements, car pooling and improved traffic flow are being developed to reduce congestion and increase average vehicle speed. Transferring intercity trips within the NEC from car to electric train results in a decrease in vehicle emissions, which is consistent with the goal of these transportation control plans.

Table 3-29

COMPLIANCE WITH STATE AIR QUALITY STANDARDS (1975)

| | $SO_2$ | | Particulates | | HC | $NO_X$ | 03 | CO | |
|---|---|---|---|---|---|---|---|---|---|
| STATE | Annual | 24 hr. | Annual | 24 hr. Primary | 3 hr. | Annual | 1 hr. | 1 hr. | 8 hr. |
| Massachusetts | 0 | 0 | X[1] | 0 | N/A | X | X | 0 | X |
| Rhode Island | 0 | 0 | X | 0 | N/A | 0 | X | 0 | X |
| Connecticut | 0 | X | 0 | 0 | N/A | 0 | X | 0 | X |
| New York | 0 | 0 | 0 | 0 | N/A | 0 | X | X | X |
| New Jersey | 0 | 0 | X | 0 | X | X | X | 0 | X |
| Pennsylvania | X | 0 | X | X | X | 0 | X | 0 | X |
| Delaware | 0 | X | X[2] | X[3] | N/A | N/A | X | 0 | 0[2] |
| Maryland | 0 | 0 | X | X | X | 0 | X | 0 | X |
| Washington, D.C. | 0 | 0 | 0 | X | X | 0 | X | X | X |

[1] Under investigation for validity of data (one site only).

[2] Exceeded Environmental Protection Agency standard.

[3] Did not exceed Environmental Protection Agency standard.

X= Violation of standard recorded within Corridor.

0= No violation of standard recorded within Corridor.

### 3.3.3 AIR QUALITY ASSESSMENT METHODOLOGY

The decrease in the total vehicle-miles of travel (VMT) by automobile and the increase in fuel consumption for electricity will affect the air quality emissions for the NEC. Quantification of the long-term air quality impact of the NECIP is complicated by the presently developing federal strategies designed to reduce the consumption of petroleum-based fuels for electrical energy production. The proposed strategies include the conversion of some oil-fired electric generating plants to coal. Most coal contains a high percentage of sulfur and ash, and consequently results in increase emissions of sulfur oxides and particulates. Although particulate emission controls can result in the removal of 90 percent of the particulate emissions, removal of sulfur oxides is more costly, and emissions are usually controlled by burning a low sulfur-content coal. To analyze the NECIP impact, two scenarios were investigated. In the first, it was assumed that the types of fuel used for power generation would continue as presently projected by the electric utility companies (see Section 3.2); in the second, it was assumed that all oil-fired boilers would be converted to coal.

In some states the existing regulations require that the sulfur content of any fuel be 0.5 percent or lower, unless emissions are controlled. In this analysis, it was assumed that the average sulfur content is 1.0 percent for oil and 2.0 percent for coal. Since the controls, if any, which will be used to reduce sulfur oxide emissions have not been determined, only the uncontrolled sulfur oxide emissions were calculated; this was thus a worst case condition. However, in the analysis it was assumed that 90 percent of the particulate emissions from coal-fired plants would be removed.

Diversion of passengers from bus, air, and auto to electrified rail will result in a change in total air pollution. The extent of the impact on total air pollution was evaluated by assuming the patronage, load factors and energy consumption shifts discussed in Sections 3.1 and 3.2. Overall, no improvement in emissions for any mode was assumed unless there was a basis in Congressional mandates. For example, inspection/ maintenance for automobiles was not included because the Federal laws do not explicitly require this program. A discussion of assumptions for each mode follows.

Railroad. The improved rail system was assumed to be electrified, with the source of electricity varying from hydro and nuclear (relatively clean) to coal. As discussed in the energy section, it is not possible to determine which source of electricity will be used at a given time. Therefore, it was assumed that the fuel sources of electricity consumed at the rail would be proportional to the fuel sources of all electricity generated in the region (i.e., if it was projected that one-third of the electricity would be generated by coal, then one-third of the electricity used by the NECIP trains was allocated to coal). EPA emission factors,[1] and where applicable, pollution controls were then assumed. Two cases were studied: one where it was assumed that oil would be available in 1990; and one where it was assumed that no oil would be available, and the reduction in oil would be made up in the form of increased coal production. This implies a worst case analysis since it is highly likely that some increase in nuclear production will occur.

Similarly, the emissions from diesel-electric trains for the 1975, 1982 and 1990 unimproved system were calculated from EPA emission factors,[2] using the estimate for total gallons of fuel consumed as discussed in Section 3.2.

Aircraft. The number of airplane trips was estimated from patronage and load factor data (see Section 3.1) and used in conjunction with EPA emission factors[3] to determine total airplane emissions.

Bus and Auto. For bus and automobiles, load factors and passenger-mile data were used to determine vehicle-miles of travel (VMT) in conjunction

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[1] Compilation of Air Pollution Emission Factors, U.S. Environmental Protection Agency, February, 1976.

[2] Ibid.

[3] Ibid.

with EPA emission factors.[1] These data were used to generate estimates of total air pollution for the two highway modes.

### 3.3.4 PROBABLE IMPACTS

Estimates of the relative air pollution generated by each mode in 1982 and 1990 and the change in emissions resulting from the NECIP are shown graphically in Figure 3.13. These data indicate that the NECIP will result in a 2.6 percent reduction in total pollution (4.2 kilotons) in 1982 and a 3.7 percent reduction (3.3 kilotons) in 1990. The pollution from auto emissions is now and is projected to continue to be the major source of pollution from intercity travel. Carbon monoxide accounts for 80 percent of these pollutants, followed by hydrocarbons (11 percent) and $NO_x$ (9 percent); all are automobile-related pollutants.

The increase in emissions resulting from increased electricity use is anticipated to be more than offset by the decrease in emissions from diesel rail, bus, and airplanes, under either the projected or the worst case estimate of fuel used to generate power.

It is estimated that emissions resulting from electrical energy generation for the NECIP would increase by 2.1 kilotons in 1982 and 2.7 kilotons in 1990 if there were no oil-fired boilers and the difference was generated with coal. In 1990, most of this increase would be in the form of oxides of sulfur (1.9 kilotons in 1990), oxides of nitrogen (0.4 kilotons) and particulates (0.4 kilotons). Based on total fuel consumption projections for electrical energy production (see Section 3.2), it is estimated that a total of 2,620 kilotons of pollutants will be emitted in 1990 to generate all electricity for all uses in the MAAC and NPCC; thus the projected increase in emissions from electric generation due to the NECIP, even under worst case assumptions, would be less than 0.1 percent of the total.

[1] Compilation of Air Pollution Emission Factors, U.S. Environmental Protection Agency, February, 1976.

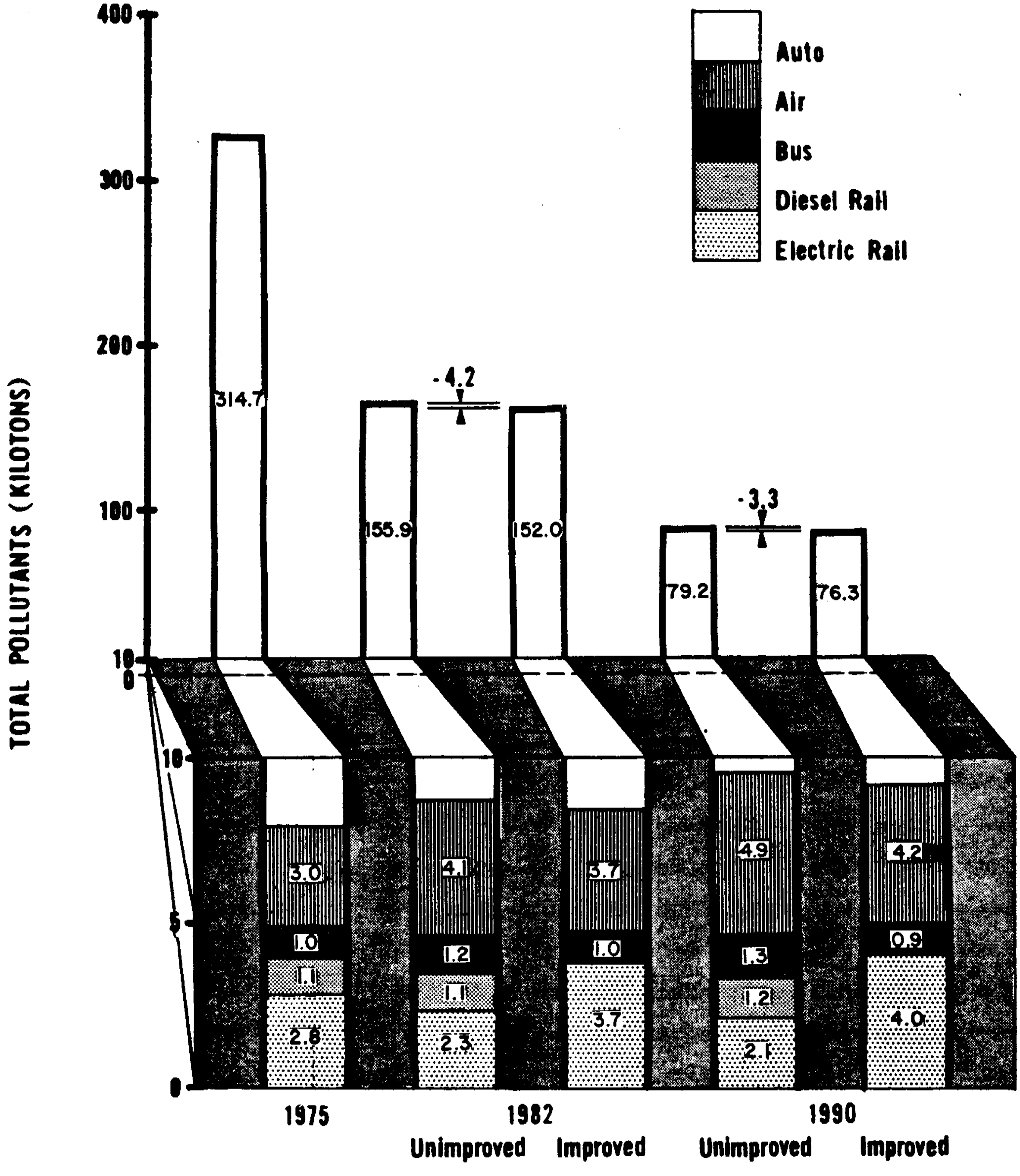


**Figure 3.13**
**AIR POLLUTION FROM INTERCITY TRANSPORTATION**

With oil-fired electricity, there would be less increase in total power plant emissions: 1.4 kilotons in 1982 and 1.9 kilotons in 1990. If more efficient control equipment were added to smokestacks, or if low-sulfur coal were burned (rather than two percent sulfur coal, as assumed here), the NECIP-related power plant emissions would be even lower.

The diversion of people to rail will result in a reduction in the emissions from the other modes of transportation in the NECIP. The automobile VMT reduction anticipated as a result of the diversion to rail would cause a decrease of 3.9 kilotons of air pollutants in 1982 and 2.9 kilotons in 1990. This is equivalent to a three percent average Corridor-long reduction in intercity automobile emissions in 1982 and a four percent Corridor-long reduction in 1990. Relative to the total auto emissions from all auto activity in the major SMSAs within the Corridor, the NECIP would reduce hydrocarbon emissions from autos by only 0.1 percent in 1990. Since it is estimated that autos will cause a total of 40 percent of the hydrocarbon emissions in 1990, the NECIP is expected to result in an overall hydrocarbon reduction of less than 0.05 percent.

An estimate of the reduction by region[1] (Table 3-30) indicates that the greatest reduction can be expected in the New York, Trenton, Baltimore and Wilmington areas and that the Philadelphia and New Haven areas will also experience significant reductions. The least reductions are expected in the Washington, New London, Providence and Boston areas. Since the areas involved in the reduction estimates do not correspond to the exact boundaries of the Air Quality Control Regions, the data should only be used as upper bound estimates of the anticipated reduction from the NECIP for a given region.

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[1]Estimates of the vehicle trips between each major city pair were calculated from unpublished 1977 FRA person-trip data, and were in turn used to calculate the hydrocarbon emissions. One-half of the emissions for each city pair was attributed to each of the two cities involved. For example, the emissions for New York were the sum of one-half of the emissions for trips between Trenton and New York (including trips originating south of Trenton) plus one-half of the emissions for trips between New York and New Haven (including trips originating or terminating north of New Haven).

Table 3-30

PROJECTED 1990 HYDROCARBON EMISSIONS FROM INTERCITY AUTOMOBILE TRAVEL FOR TEN MAJOR CITY AREAS (in kilotons)

| City | Improved | Unimproved | Reduction |
|---|---|---|---|
| Washington | 0.36 | 0.37 | 0.01 |
| Baltimore | 0.86 | 0.91 | 0.05 |
| Wilmington | 0.77 | 0.82 | 0.05 |
| Philadelphia | 0.81 | 0.84 | 0.03 |
| Trenton | 1.39 | 1.45 | 0.06 |
| New York | 1.28 | 1.33 | 0.05 |
| New Haven | 0.67 | 0.69 | 0.02 |
| New London | 0.48 | 0.49 | 0.01 |
| Providence | 0.63 | 0.64 | 0.01 |
| Boston | 0.38 | 0.39 | 0.01 |
| TOTAL | 7.63 | 7.93 | 0.30 |

SOURCE: Compilation of Air Pollutant Emission Factors, AP-42, U.S. Environmental Protection Agency, February, 1976.

In addition to the reductions in automobile emissions discussed above, there is an expected 0.8 kiloton reduction in total 1990 emissions from intercity air transportation.

It has been projected that the total intercity bus emissions will be 0.1 kilotons lower in 1982 and 0.4 kilotons lower in 1990 with the NECIP than with the unimproved rail system. Finally, the conversion of the entire Corridor to electric traction will result in a reduction in the diesel-electric exhaust emissions along the ROW. Diesel-electric locomotives will continue to be used to some degree for switching, freight and work crew operations. In the unimproved system, Amtrak diesel locomotives traveling between New Haven and Boston would generate 1.1 kilotons of pollutants in 1982 and 1.2 kilotons in 1990 (Table 3-31). Assuming that only the intercity Amtrak locomotives are converted to electric-traction and that all other operations remain the same under both the improved and unimproved systems, emissions would be 1.1 kilotons lower in 1982 and 1.2 kilotons lower in 1990 with the improved system than without.

Table 3-31

DIESEL-ELECTRIC LOCOMOTIVE EMISSIONS (Kilotons)[1] BETWEEN NEW HAVEN AND BOSTON ASSUMING THE SYSTEM IS NOT ELECTRIFIED

| Emissions | 1975 Existing | 1982 Unimproved | 1990 Unimproved |
|---|---|---|---|
| Fuel Consumption (x $10^6$ gallons) | 3.53 | 3.72 | 3.94 |
| CO | 0.28 | 0.29 | 0.32 |
| HC | 0.05 | 0.05 | 0.06 |
| $NO_x$ | 0.58 | 0.61 | 0.65 |
| TSP | 0.04 | 0.05 | 0.05 |
| $SO_2$ | 0.10 | 0.11 | 0.11 |
| TOTAL | 1.05 | 1.11 | 1.19 |

[1]Assumes a two-stroke turbocharged diesel engine, emission factors from Compilation of Air Pollutant Emission Factors, AP-42, U.S. Environmental Protection Agency, February, 1976.

The above discussion assumes that electric-traction power will be used in the NECIP. In Chapter 2, electrification options were discussed and reference was made to the relative air pollutant emissions from the electric, diesel-electric, and gas turbine-electric alternatives. A comparison of the anticipated air pollutant emissions from each of these alternatives (Table 3-32) shows that the electric-traction alternative causes the least total air pollution with the lowest CO, HC and $NO_x$, and the highest oxides of sulfur and particulate emissions. The $SO_x$ and particulate emissions would be released into the atmosphere at relatively few locations (electric utility plants) which have high stacks and particulate emission control equipment. The diesel-electric alternative would emit pollutants along the entire Corridor from stacks which are relatively close to ground level. In addition, the types of pollutants emitted would be those aggravating the photochemical oxidant problem in the Northeast.

Table 3-32

COMPARISON OF EMISSIONS IN 1990 USING ALTERNATIVE TRACTION POWER SOURCES
(Kilotons)

| Power Source | CO | HC | $NO_x$ | Particulate | $SO_x$ | Total |
|---|---|---|---|---|---|---|
| Electric Traction | 0.0 | 0.0 | 0.8 | 0.4 | 2.5 | 3.7 |
| Diesel-Electric Traction[1] | 2.3 | 0.4 | 4.8 | 0.4 | 0.8 | 8.7 |
| Turbine-Electric Traction[2] | 0.3 | 0.1 | 1.5 | 0.1 | 3.1 | 51 |

[1]Assumes a two-stroke turbocharged engine.

[2]Assumes equivalent to an electric utility oil-fired turbine engine (one percent sulfur).

SOURCE: Compilation of Air Pollution Emission Factors, AP-42, U.S. Environmental Protection Agency, February, 1976.

The overall impact of the increased traffic and parking demand at the railroad stations is not expected to be significant. Initial studies at Boston South Station, New Haven, Wilmington and New Carrollton indicate that the traffic due to intercity rail is only a small portion of the total traffic. However, each state along the Corridor experienced carbon monoxide levels above applicable ambient air quality standards in 1975. Some of these cities may be experiencing CO levels above the standard in the station vicinity and the increased traffic, although small, may result in aggravating these violations. At any station where a parking garage is built, or where access to or from the station is altered, analysis of the air quality impacts will be undertaken. At stations where the only station improvements will be to interior and facade, an air quality analysis is not planned. Since a preliminary evaluation of each station (Section 3.1.4) indicates that the increase in traffic resulting from the NECIP is only a small percentage of the total station traffic, detailed analyses and mitigation will only be completed where local interests provide the matching funds for access and street improvements or parking.

Guidelines For Air Quality Maintenance Planning and Analysis, Volume 9: Evaluating Indirect Sources, U.S. Environmental Protection Agency, January 1975 will be used to determine the potential impacts at those stations where air quality analysis is completed.

Air Quality Sensitivity Analysis. Some of the comments in the Draft PEIS suggested that the NECIP would result in increased air pollution if the estimates of diversion were incorrect. An analysis was conducted to determine under what conditions the NECIP would cause an increase in air pollution. The total, maximum additional air pollution from the NECIP was calculated to be 1.5 kilotons. This assumed no oil-fired power plants and the use of coal to generate all the electricity previously projected to be generated from oil. The coal was assumed to be two percent sulfur with no sulfur emission controls. It was therefore a worst case. On the other hand, the reductions in bus, air and auto emission were assumed to be 0.4 kilotons, 0.8 kilotons and 2.9 kilotons, respectively.

No reductions in emission as a result of technology improvements were assumed for bus in 1990. The automobile emissions assumed compliance with congressionally mandated emission standards, but no inspection/maintenance benefits. The airplane was assumed to improve in fuel economy, but emissions per engine were assumed to be the same. It can therefore be assumed that these are worst case air pollution estimates for bus, air and auto, as well.

The data indicate that actual emissions and diversion from auto would have to deviate dramatically from estimates to result in an increase in air pollution. In fact, even if there were no diversion from auto, there would be a reduction in total pollution just from the savings in emissions from the bus and air modes.

If, on the other hand, total rail demand were 25 percent higher, the savings in air pollution would be substantially greater than shown, since there would be additional proportional decreases in emissions from bus, air and auto.

In conclusion, it is highly unlikely that the NECIP will cause an increase in air pollution. It would require that there be essentially no trip diversion to rail; even in that case the additional air pollution would only be 1.6 percent of the total generated by intercity travel in the No-Build alternative.

Construction Impacts. All construction activities will create some short-term air pollution. The sources of pollution from these activities include exhaust from construction equipment, fugitive dust from grading and digging, from the transfer and storage of material, and from sandblasting; and increased automobile exhaust from the congestion and rerouting of local traffic. All of these are one-time only activities, and in most cases the emissions will not cause a significant increase in areawide levels because the number of pieces of equipment running at any given time will be small and the area is large. A monitoring device placed downwind from a construction site would not measure a violation of either the one-hour or the eight-hour carbon monoxide standard because an insufficient amount of CO would be emitted from the construction equipment. The long-term standard for oxides of nitrogen, another major pollutant in diesel exhaust, is not significantly affected because the duration of equipment operation is short relative to the one-year standard. Finally, the additional hydrocarbon emissions from construction equipment is insignificant relative to mobile sources (automobiles) in the area. Signaling and train control, communications, electrification, fencing and grade crossing programs are not expected to cause any major emissions. Also, most of the minor route realignments, bridge improvements, and a few of the stations and maintenance-of-way facilities are not expected to have a significant impact. However, some of the station improvements, the major route realignments, and the bridge replacements and repairs could cause measurable increases in emissions. The air pollution impact of all of these major activities will be evaluated in site-specific assessments. The tunnel improvements and track structure activities will also result in construction-related pollutant emission. Three of the activities which will have the most significant impact are ballast cleaning, undercutting and tie replacement; these are evaluated below as a measure of the expected impact of construction-related activities.

For a two track system, tie replacement along one mile of track using conventional methods is expected to generate not more than 0.05 tons (100 pounds) of CO, 0.022 tons of HC, 0.2 tons of $SO_x$, 0.02 tons of particulate, and 0.3 tons of $NO_x$ (Table 3-33). Similar emissions are expected with the Track Laying System (TLS). Fugitive dust (particulate) emissions for ballast cleaning have also been estimated. The estimate of the fugitive dust assumes that the ballast cleaning of one track would create no more than 390 cubic yards of spoil per mile. The spoil is composed of crushed ballast, dirt and other debris ranging in size from very fine up to coarse 3/8-inch-diameter rock. It was assumed that one percent of the spoil by weight would be small enough to become airborne when agitated and that one percent of these particles (or 0.01 percent of the total spoil) would become airborne. This would cause an additional 0.1 tons of particulate per square mile for a two-track system (Table 3-33).

To determine the upper limit on particle loading, a "worst possible" analysis was made assuming prolonged dry weather, with spoil dumped on the side near enough to the tracks to be easily disturbed by turbulence from passing trains. Under this worst case, with no mitigation measures, particulate emissions per square mile would be 1.1 tons.

The track structure activity described above is part of the maintenance work which is required to provide continued service. The impact is not continuous or yearly. In order to determine its impact relative to ble 3-33

ESTIMATED CONSTRUCTION EMISSIONS PER SQUARE MILE FOR TRACKLAYING OPERATIONS AND TYPICAL EMISSIONS FOR SOME GRIDS IN CONNECTICUT[1]

| | CO | HC | $NO_x$ | $SO_x$ | Particulates |
|---|---|---|---|---|---|
| Emissions per Square Mile: | | | | | |
| Track laying tractor (lbs/hr.) | 0.3860 | 0.1100 | 1.4700 | 0.1370 | 0.1120 |
| Track laying loader (lbs/hr.) | 0.1600 | 0.0320 | 0.5840 | 0.0760 | 0.0580 |
| Scraper (lbs/hr.) | 1.4600 | 0.6260 | 6.2200 | 0.4630 | 0.4060 |
| 4 miscellaneous (lbs/hr.) | 1.6560 | 0.6280 | 9.0800 | 0.5720 | 0.5560 |
| TOTAL (lbs/hr.) | 3.6620 | 1.3960 | 17.3540 | 1.2480 | 1.1320 |
| TOTAL (lbs/foot)[2] | 0.0105 | 0.0040 | 0.0496 | 0.0036 | 0.0032 |
| For a two track system (tons/mile) | 0.0540 | 0.0220 | 0.2620 | 0.0180 | 0.0180 |
| Emissions from ballast cleaning for a two-track system[3] | | | | | 0.1000 |
| Madison Grid #2252: | | | | | |
| Average emissions (tons/year) | 197 | 29 | 22 | 13 | 2.0 |
| Increase from construction activity | 0.03% | | 0.08% | 1.2% | 0.14% |
| New Haven Grid #2435: | | | | | |
| Average emissions (tons/year) | 5,727 | 773 | 1,073 | 84 | 215 |
| Increase from construction activity | --- | --- | 0.2% | 0.02% | 0.05% |

1 -Each grid is 5,000 feet square
2 -Assumes that the tracklaying operation progresses at 350 ft./hr.
3 -Ballast cleaning operation assumes 390 cubic yards of waste per mile, at 100 lbs per cubic foot and 10 percent by weight small enough to become airborne.

SOURCE: Compilation of Air Pollutant Emission Factors, U.S. Environmental Protection Agency, February, 1976; and State of Connecticut Department of Environmental Protection Data File, 1977.

ambient conditions, the emissions were calculated for 5,000 foot grids in Madison and New Haven, CT; results are shown in Table 3-33. The Connecticut emission inventory data bank was chosen for comparison purposes because the 5,000 foot grid system facilitates comparison per mile of track. In addition, Connecticut has 23 percent of total Corridor miles and has the highest recorded ozone levels in the Corridor.

New Haven grid #2435 (Figure 3.14) contains all of the major arterials into New Haven as well as sections of the Connecticut Turnpike and I-91, and represents the emissions which can be expected in any typical urban environment. Madison grid #2242 (Figure 3.15) contains U.S. Route 1 in a low-use area, and a large part of the grid is a golf course. This section of Madison is a relatively pristine area.

A comparison of ambient levels with the emissions estimated for tie replacement activities and ballast cleaning indicates that there will be an insignificant increase in carbon monoxide, hydrocarbons, and oxides of sulfur in both of the sample grids. In the New Haven grid, the increase in emissions would be negligible for all pollutants. Oxides of nitrogen could be expected to increase by one percent, and particulates by 5.9 percent if the ballast were removed from the ROW in the pristine region of Madison. If the ballast were placed along the ROW, under the worst case conditions described earlier, it is possible that instead of a 0.1 ton increase, there would be a 1.1 ton increase which would be a 59 percent increase in the particulate emissions in the Madison Grid. Although this would not cause a violation of the particulate standards, it would represent a significant increase in the emissions there. Also, as discussed under existing conditions, several states have recorded violations of the particulate standard, and any activity which would contribute additional loadings should be mitigated to the greatest possible extent.

Because of this, spoil will not be dumped along the tracks under conditions which would result in excessive suspension of dust particles without watering or some other mitigation measures.

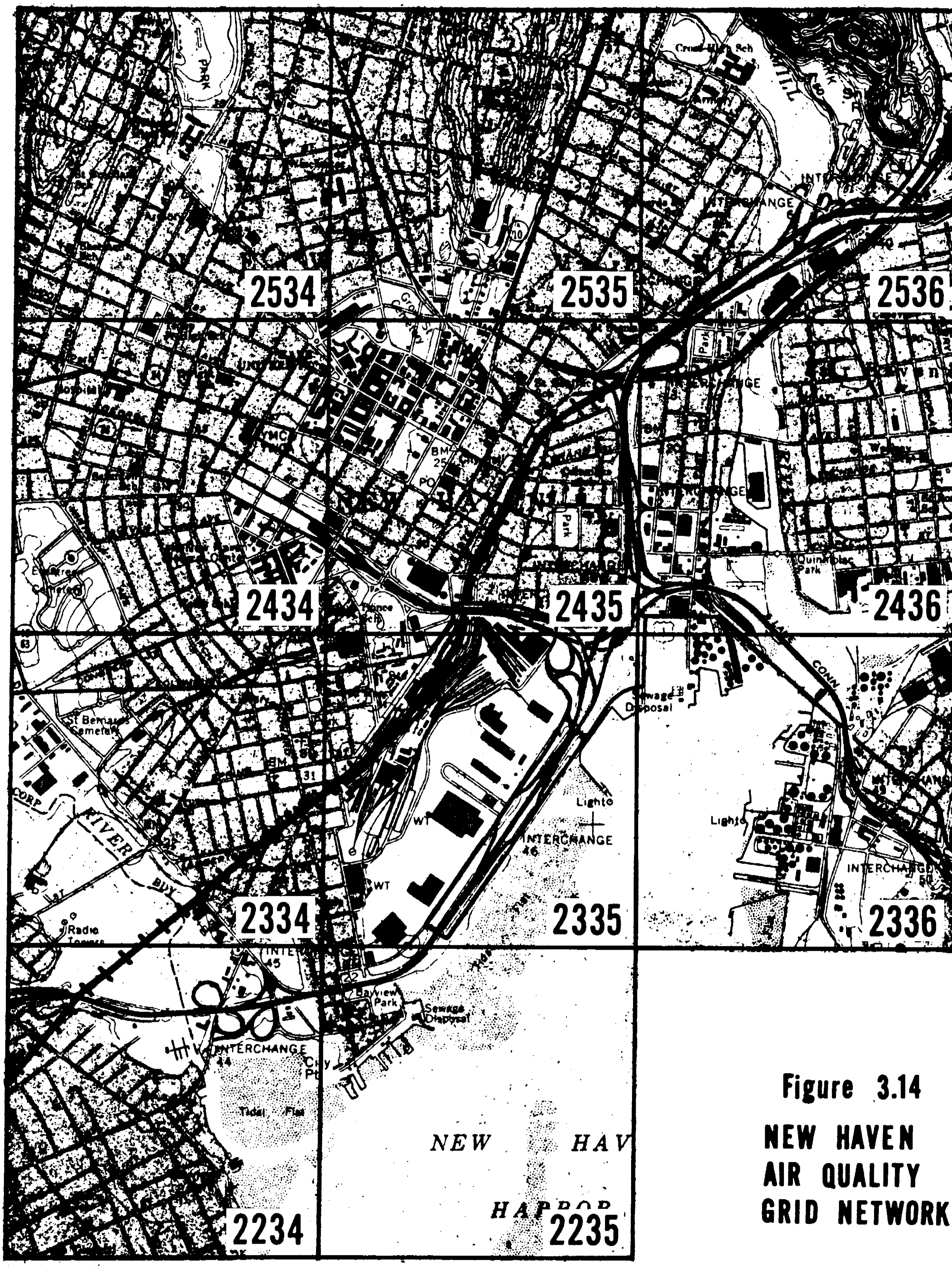


Figure 3.14
NEW HAVEN
AIR QUALITY
GRID NETWORK

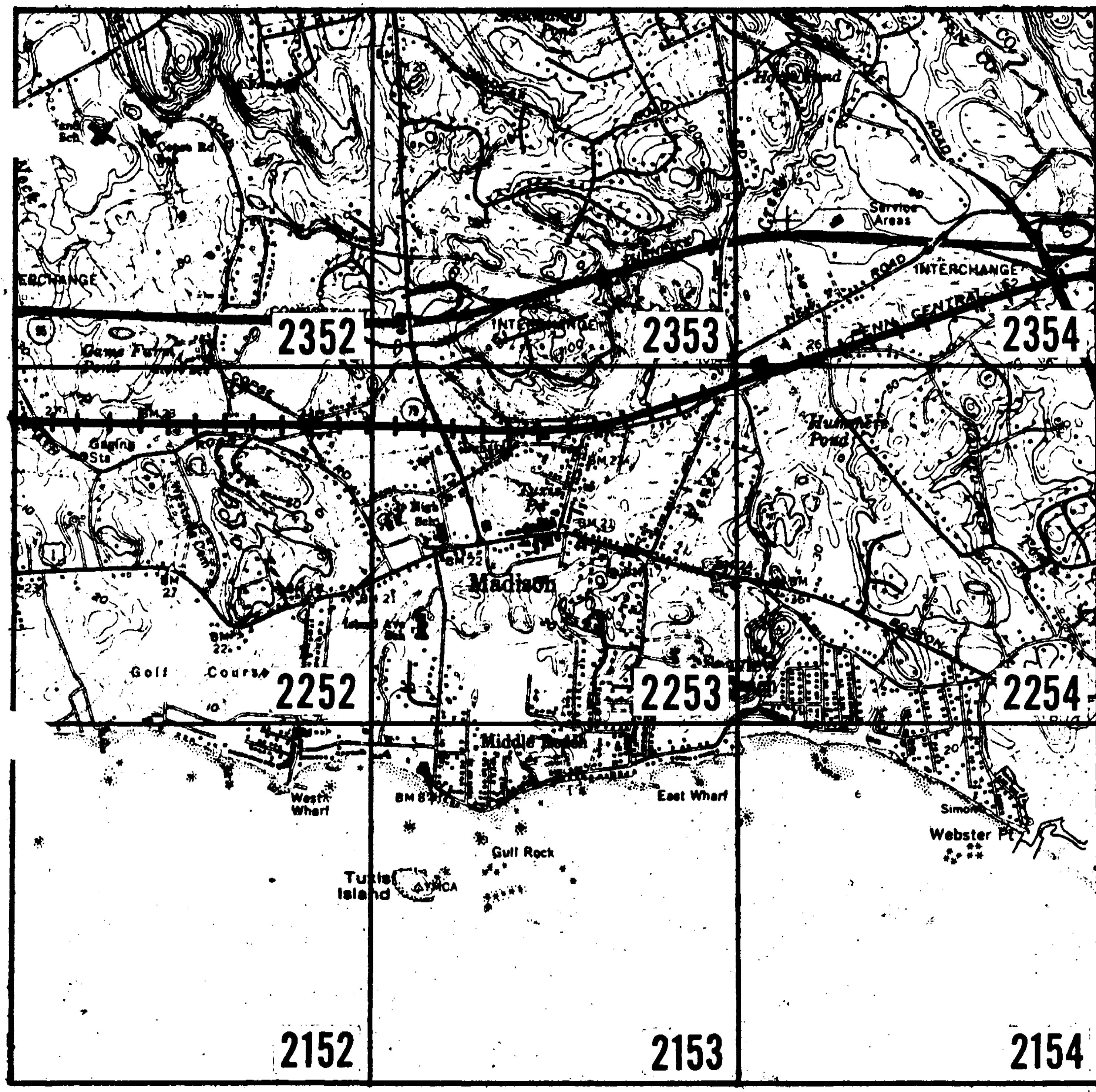


**Figure 3.15**

**MADISON AIR QUALITY GRID NETWORK**

## 3.4 NOISE AND VIBRATION

### 3.4.1 SUMMARY

Despite the increased number of trains, higher train speeds and larger groups of people expected in and around station areas, there is a projected long-term reduction of noise levels as a result of the improvement project. The index ENI (Equivalent Noise Impact), used in this report for noise impact assessment, is expected to decrease 28 percent from current levels along the entire Corridor by 1990.

Short-term noise impacts from construction activity are not expected to affect nearby residential areas; however, temporary impacts may be experienced in areas where night work takes place, where bridges are replaced or where tracks are shifted more than a few feet. Ground vibrations caused by trains are expected to diminish as a result of the project.

### 3.4.2 NOISE ASSESSMENT METHODOLOGY

Both short-term noise effects resulting directly from NECIP construction and long-term noise effects resulting from rail service and maintenance of way in the NEC have been assessed. The concept of noise impact is based on the relationships between people's reactions to noise and appropriate physical measures of noise. The acceptability of a project in terms of noise is related to the number of people disturbed by the noise it causes for any reason. Social surveys[1] have been taken of people highly annoyed by noise from various sources and the day-night average sound level ($L_{dn}$) outside their residence. Although not yet substantiated, the acceptability of a project may also be related to whether it is a new facility or merely an existing one being improved. In the first case, noise

[1] "Synthesis of Social Surveys on Annoyance due to Noise" T. J. Shultz, Proceeding of 9th International Congress of Acoustics, Madrid, Spain, June, 1977.

levels may increase substantially; in the second, the improvement may reduce noise levels. A definite relationship has not yet been established between noise increase and annoyance. However, in general, an increase in noise levels greater than 5 dB is noticeable, and an increase greater than 10 dB is considered undesirable. Analysis of these results has led to the development of recommended noise standards and criteria for various government agencies based on a common approach, elements of which are used in the NECIP noise assessment.

Noise Parameters. Because of its high correlation with annoyance, the day-night average sound level ($L_{dn}$) is the primary measure for describing community noise in the NECIP environmental assessment. Several noise concepts are incorporated in the formulation of $L_{dn}$:

- $L_{dn}$ is expressed in decibels (dB), which is a measure of sound pressure amplitude; noise levels of 0 dB correspond roughly to the threshold of hearing.
- $L_{dn}$ is A-weighted, which is the name of a frequency weighting scale that de-emphasizes the high frequencies and the low frequencies of sounds to correspond to the response of the human ear.
- $L_{dn}$ is an average sound level, sometimes called equivalent sound level (Leq) which is numerically equal to the value of a steady sound level that would carry the same sound energy (mean-square sound pressure) as does the actual time-varying sound in the same time period.
- $L_{dn}$ is a 24-hour average sound level in which night noise levels occurring between the hours of 10 p.m. and 7 a.m. are penalized by an increase of 10 dB before calculation of the 24-hour average.

$L_{dn}$ is used for this report in describing the noise in neighborhoods adjacent to the railroad ROW, because it represents noise accumulated from all sources in an area over a typical weekday. Implicit is the assumption that the noise environment is characterized by permanent features of the neighborhood and that temporary noise sources, such as the construction of a permanent facility, are excluded.

For the special case of such temporary sources, a specific measure called the annual outdoor average $L_{dn}$ is used which describes the constant sound level for one year (24 hours a day, seven days a week) that has the same energy as the collection of discontinuous sounds from a construction site during all of the eight-hour working days in a year.

Nationwide surveys sponsored by the U.S. Environmental Protection Agency[1] and the U.S. Department of Housing and Urban Development[2] have identified specific $L_{dn}$ values with public health and welfare effects:

- $L_{dn}$ = 55 dB--satisfactory residential environment, two percent of people highly annoyed.
- $L_{dn}$ = 65 dB--threshold for normally unacceptable housing environment; 15 percent of people highly annoyed.
- $L_{dn}$ = 75 dB--unacceptable permanent residential environment; 100 percent of people highly annoyed.
- $L_{dn}$ = 90 dB--unacceptable temporary residential environment.

Fractional Impact Method. According to EPA the most appropriate method developed to date for performing an environmental noise impact assessment is the Fractional Impact Method which emphasizes a term called Equivalent Noise Impact (ENI). The strength of this approach for a region-wide project is that it accounts explicitly for both intensity (i.e., the noise may affect a few people very greatly) and extensity (i.e., the noise may affect a large number of people to a lesser degree). The use of this method enables one to estimate the general scale or magnitude of the expected noise impact from a project.

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[1] Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, U.S. Environmental Protection Agency, March, 1974.

[2] "Synthesis of Social Surveys on Annoyances due to Noise", T. J. Shulz, Proceedings of 9th International Congress on Acoustics, Madrid, Spain, July, 1977.

The key concept in this method is that an index is computed which represents an equivalent 100-percent-impacted population. It is important to note the distinction between ENI and the actual number of people exposed to various sound levels. ENI is the index which includes consideration of both the number of people and the sound level to which they are exposed. For an estimate of the actual number of people exposed to various sound levels, it is necessary to tabulate the number of people exposed to $L_{dn}$ greater than 55 dB, 65 dB, and 75 dB.

For the NECIP environmental assessment, ENI is computed for residential areas using $L_{dn}$ = 55 dB as the lower limit of impact and $L_{dn}$ = 75 dB as full impact. Partial impact is distributed linearly between zero impact at 55 dB and 100 percent impact at 75 dB, so that two people exposed to 65 dB $L_{dn}$ are equivalent to one person exposed to 75 dB $L_{dn}$.

The Fractional Impact Method is used to compute ENI within a zone along the railroad ROW where train noise is the major contributor to the ambient noise level of a community. The width of this corridor is determined as the distance between the ROW and a boundary defined by one of the following mutually exclusive criteria:

- If the community ambient noise level expressed in $L_{dn}$ is greater than 55 dB, the boundary is at the point where $L_{dn}$ from train traffic alone (train noise) is 5 dB below the ambient.
- If the community ambient $L_{dn}$ is between 53 dB and 55 dB, the boundary is at the point where the train noise is 50 dB.
- If the ambient $L_{dn}$ is less than 53 dB, the boundary is at the point where the $L_{dn}$ of the community ambient plus the train is equal to 55 dB.

The above defined railroad noise corridor, or zone of influence, is the region likely to be affected by any change of train operations.

Noise Prediction Method. Determination of present and future noise conditions in the NEC requires knowledge of both the noise levels produced by the railroad and the noise levels due to all non-railroad activities. Noise levels have been measured at four prototypical sites as part of earlier FRA analysis, but the results cannot be realistically extended to the entire Corridor. Consequently, these measurements are supplemented by using mathematical noise prediction methods which predict train and ambient noise, based on measurements of community and railroad related noise. By using "source noise levels" of specific railroad equipment and the ambient noise level for each community the noise generated by specific railroad operations have been estimated.

Railroad source noise levels are predicted based upon the type of locomotive and number of cars, the frequency of each type of train during the day and night, speed, track conditions and frequency of horn operations in order to compute the $L_{dn}$ at 100 feet for each community along the Corridor. The propagation of train noise into the community for distances greater than 100 feet depends on whether the community is urban, suburban or rural (Figure 3.16).

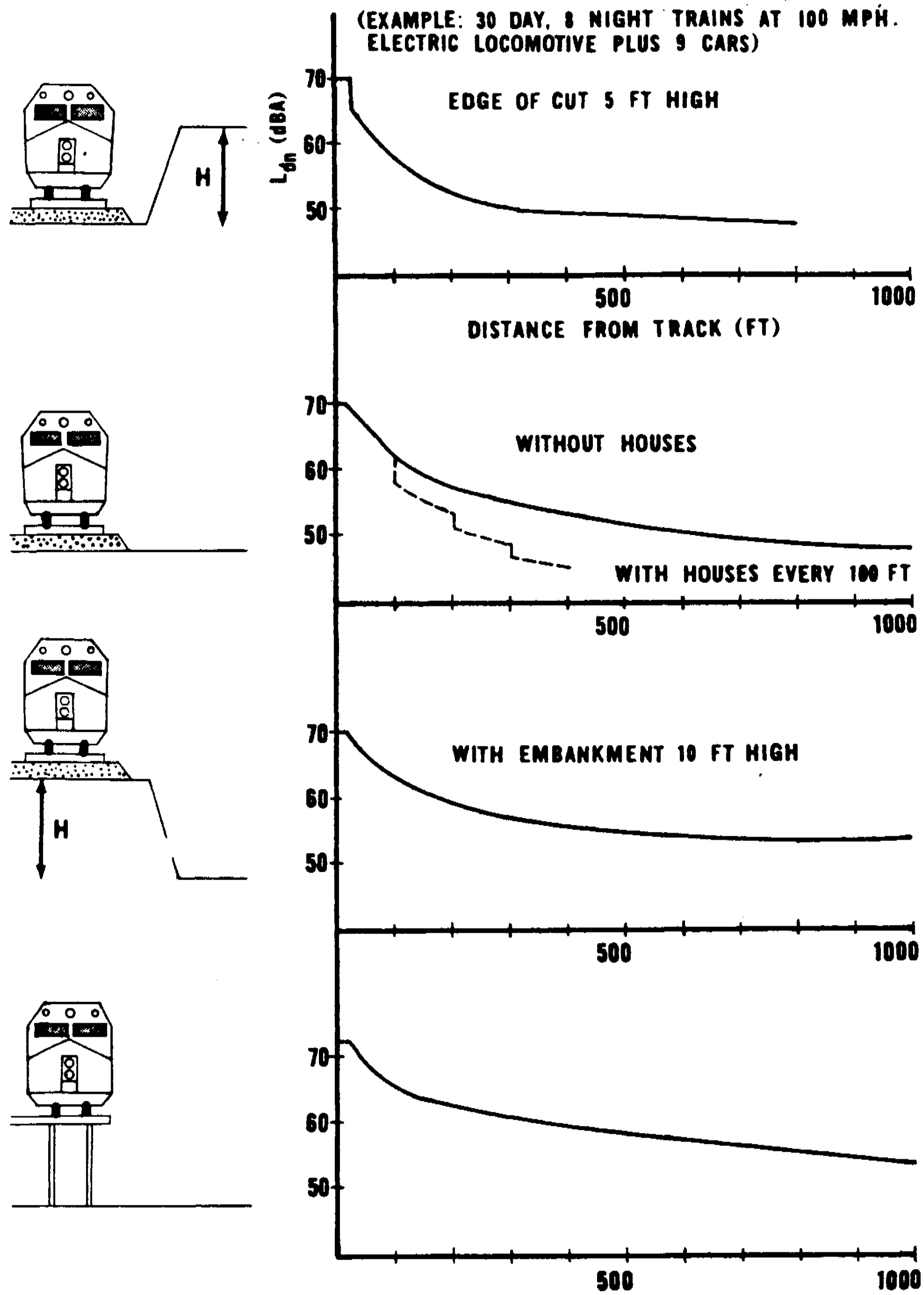
In rural areas, $L_{dn}$ decreases 4.5 dB for every distance doubling from 100 feet. In urban and suburban communities, $L_{dn}$ decreases 4.5 dB for every distance doubling but with decreases of 4.5 dB for the first row and 1.5 dB for each succeeding row of buildings in the propagation path. Due to the complexity involved in applying this procedure to every track segment along the entire NEC, a generalization was introduced for urban and suburban areas which is based on the assumption that the first row of buildings is encountered at 100 feet from the ROW and succeeding buildings are encountered every 100 feet thereafter. This assumption allows the analysis to approximate actual conditions along the Corridor. In lieu of measurements in every community, ambient noise levels are estimated using

Trackbed in cut. Flat terrain, or rolling terrain with berms less than 4 feet high.

Trackbed at grade. Flat terrain, or rolling terrain with berms less than 4 feet high.

Trackbed on embankment. Flat terrain or rolling terrain with berms less than 4 feet high.

Track on structure. Flat terrain or rolling terrain with berms less than 4 feet high.




Note: For all sections, $L_{dn}$ decreases by 4.5 dB for the first row of houses along the track, and by 1.5 dB for each succeeding row (to a maximum decrease of 10 dB).

**Figure 3.16**

**NOISE RADIATED FROM ELECTRIC TRAINS IN TYPICAL RAILROAD TERRAINS**

the relation between population density in a community and $L_{dn}$ found by EPA:[1]

$$L_{dn} = 22 + 10 \text{ Log } \rho$$

where $\rho$ = population density in people per square mile.

This relation was applied to every community along the NEC to estimate the background $L_{dn}$.

As a check on the accuracy of the noise prediction method, predicted values were compared with measured values at three sites along the NEC. Agreement was within one decibel in two cases and within two decibels in the third case, which validated the method.

Discussion of Railroad Noise Sources. Passenger trains, freight trains, train horns, and station, yard and ROW maintenance activities all produce noise. Except for self-propelled passenger cars, both passenger and freight trains are composed of two basic noise sources: the locomotive and the cars. Locomotives are either diesel-electric or electric powered. For diesel-electric locomotives, the diesel engine is the primary source of noise and since when underway the engine operates most of the time at a single rotation speed, the noise of these locomotives does not vary appreciably with speed. On the other hand, noise from electric locomotives is mainly generated by wheel/rail contact. Because noise from wheel/rail contact is related to speed, electric locomotive wayside noise increases with increasing speed.

Passenger cars, freight cars and self-powered electric cars, though generally not as loud as locomotives, produce enough noise to be included in any prediction of noise levels due to railroad operations. Wheel/rail interaction is the primary source of noise on these cars, and the noise thus generated increases proportionally with train speed (Figure 3.17).

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[1] Population Distribution of the United States as a Function of Outdoor Noise Levels, U.S. Environmental Protection Agency, June, 1974.

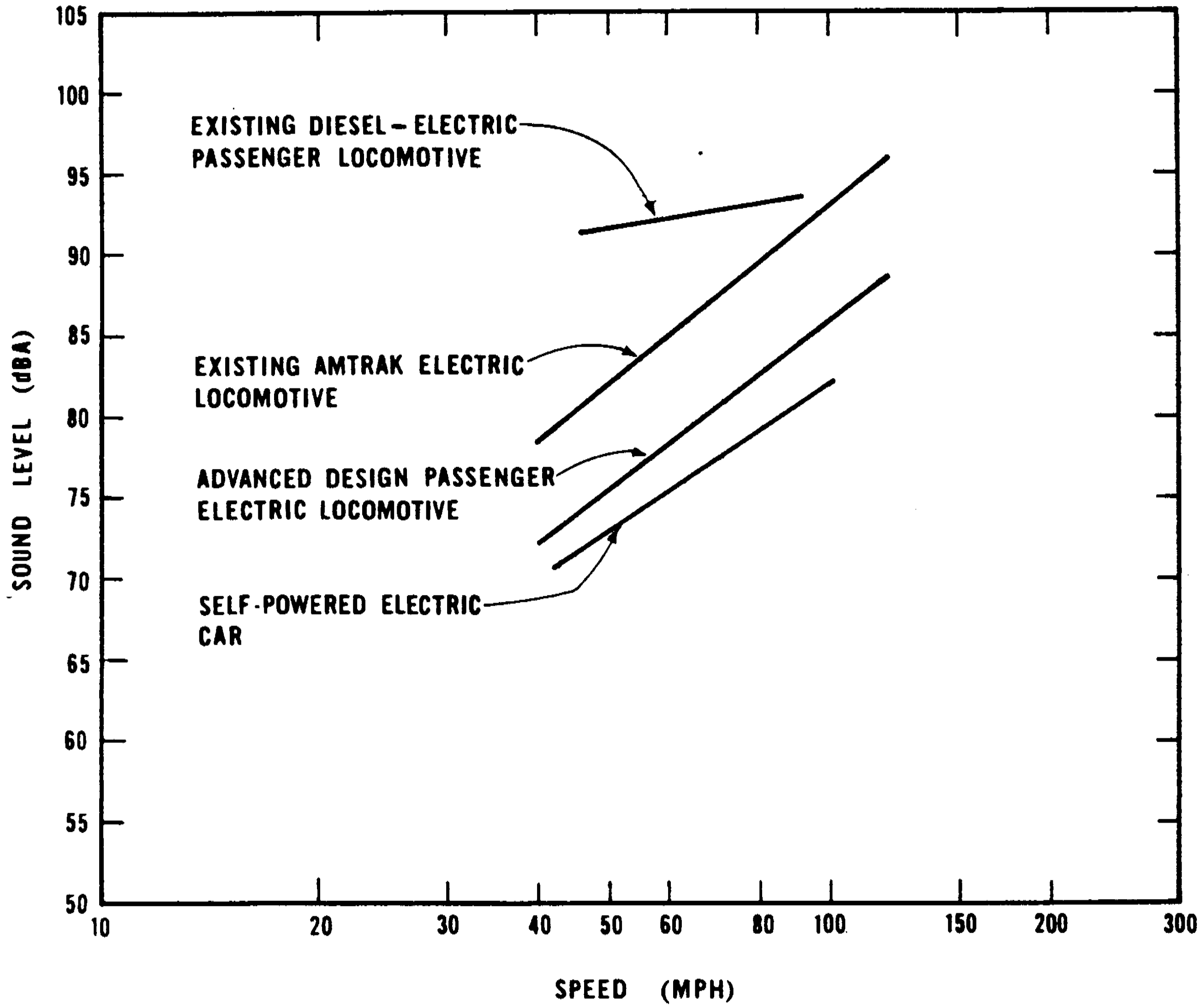


**Figure 3.17**

**NOISE LEVELS AT 100 FEET FROM EXISTING AND FUTURE LOCOMOTIVES ON THE NEC**

Warning devices on trains, including bells and horns, can be the loudest noise sources on a train with noise levels of 90 dBA to 110 dBA at 100 feet. Required horn use increases grade crossing noise levels.

Railroad maintenance yards along the NEC are sources of noise, mainly as a result of running engines of stationary locomotives and diesel-powered equipment.

Railroad stations may be considered contributors to community noise for a variety of reasons. At stations, trains entering and leaving platform areas create noises resulting from bells, brake squeal, acceleration and deceleration. Announcements over the public address system can often be heard beyond the station boundaries. Moreover, stations attract automobiles, trucks and buses which bring passengers and goods for rail transportation. All of these foregoing activities cause noise which impacts the nearby community to a varying extent depending on the station setting. In cases where railroad stations are located in busy urban areas with high ambient noise levels, the station activity may have minimal impact. All of the NEC stations are either in urban areas or in beltway areas with low population density.

Another source of railroad noise in communities along the NEC is ongoing railroad maintenance, including tie renewal, surfacing, shoulder ballast cleaning and installation of continuously welded rail. Noise from such activities is transient, lasting only until the repair or maintenance work is complete. Consequently, it usually blends in with other noise sources which make up the community ambient noise level.

Other Community Noise Sources. The primary and most pervasive community noise sources are surface transportation vehicles. Even in locations far from highways, automobiles and trucks using local streets often control the ambient noise levels in urban and suburban communities. EPA found that the relationship given in the Noise Prediction Method section of this chapter can relate such community noise levels to population density.

Aircraft are the other major transportation noise source which dominate the noise environment of communities adjacent to airports. Other noise sources contribute to the community noise environment. Barking dogs, lawnmowers, chain saws, construction equipment, stereos and radios are familiar sounds in residential communities.

Discussion of Operational Noise. The operational noise impacts of the NECIP can be brought into perspective by determining the change in noise resulting from different actions, which are translated into either an increase or decrease in the noise exposure of residents along the Corridor. Some of these actions and their benefits or disadvantages with respect to noise impact are:

- Continuously Welded Rail. The use of continuously welded rail instead of jointed rail will reduce wheel/rail noise by about 5 dB. Since wheel/rail noise is the major component of the total electric train noise level at the wayside, the use of continuously welded rail will have a positive impact (i.e., a benefit) with respect to the future noise environment.
- Curve Realignments. Another aspect of wheel/rail noise is additional noise generated along curves. For curves with a radius of less than 2,000 feet, turnouts, and in some yards, wheel flanges rub along the track thereby increasing the noise level. On even tighter curves (radius less than 900 feet), wheel squeal can occur as well. Along those segments of the track where curve realignment activities of the improvement program eliminate tight curves, there may be up to a 4 dB decrease in wayside average noise levels from each train passage. On the other hand, route realignments may change the noise environment for buildings on either side of the tracks.

- Bridges. The rehabilitation or reconstruction of bridges should have a positive effect on noise. Some bridges will have decks converted from open to ballasted type which will reduce noise. Some bridges of the deck-truss type will be replaced with girder spans, which generally radiate less noise.
- Electrification. The use of all-electric locomotives will also provide noise benefit. The electric locomotives used by Amtrak on some segments of the Corridor are 4 dB to 10 dB quieter than the diesel-electric locomotives used on the non-electrified portion of the Corridor. The use of new advanced electric locomotives manufactured after December 31, 1979, will generate about 6 dB lower noise levels than the currently operating electric locomotives on the Corridor for the same speeds.[1]
- Higher Speed. Train speed is expected to increase, and since the wayside noise level from electric trains increases approximately 5 dB for a 50 percent increase in speed, the noise benefit from using electric locomotives may be partially offset by the faster running speeds. On the other hand, higher speeds will mean nearby residences will be exposed to train pass-bys of shorter durations, thereby decreasing the noise exposure.
- Increased Rail Activity. A higher frequency of trains will result in an increase in wayside average sound levels. However, the noise exposure is not strongly dependent on the number of operations. Due to the logarithmic nature of the dB scale, a doubling in sound energy will produce a maximum of a 3 dB increase.
- Station and Yard Activity. Activities at various stations and yards may change significantly with planned improvements. The resulting increase in noise level at individual stations and yards will be evaluated on a site-by-site basis.
- Grade Crossing Elimination. This feature of the improved Corridor will result in significant benefit in the vicinity of the present grade crossings by eliminating the use of the train horns in these areas. Average noise levels in these areas should decrease 8 dB to 10 dB as a result.

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[1] U.S. Environmental Protection Agency, "Railroad Noise Emission Standards" (40 CFR 201) Federal Register 41, January 14, 1976.

Noise Impact Assessment Method. The railroad noise information together with the community ambient $L_{dn}$ was used to determine both the railroad noise corridor and the ENI using the Fraction Impact Method. Estimates were performed for the following conditions (Appendix E):

1. Existing conditions, using present population density, train traffic, train speeds and trackbed conditions.
2. Future conditions (1990) with all improvements provided by the NECIP, including improved trackbed, improved trains, increased train traffic, increased train speeds and future population projections.
3. Future conditions (1990) with all improvements provided by the NECIP, including improved trackbed, improved trains, increased train traffic, increased train speeds but with existing population projections (this is used in the impact screening process only).
4. Future conditions (1990) with future population projections and no improvements in rail service afforded by the NECIP, but with track improvements expected as part of a general maintenance program.

This method readily quantifies the overall noise impact resulting from the NECIP. An improvement in the noise environment would be signified by a decrease in ENI from present to future. Conversely, a degradation of the noise environment would be signified by an increase in ENI for those conditions.

Noise Impact Locations. In order to identify those areas where a potential adverse impact might occur from either railroad operations or installation of a new permanent railroad-related facility, an evaluation procedure has been established. This process determines a location as impacted and a candidate for site specific noise mitigation if it has all of the following characteristics:

- Noise sensitive land use occurs within the railroad Noise Corridor (defined previously in this section),
- ENI based on existing population increases in 1990 compared to present conditions, and
- People in 1990 are exposed to $L_{dn}$ greater than 65 dB from railroad noise.

The foregoing noise impact definition requires the NECIP to take responsibility only for increases in noise impact, as measured by ENI, on the existing population within the train noise corridor. This is done by superimposing future noise contours on the existing population base. Mitigation of the increase in ENI due to forecasts of unconstrained population growth can be accomplished by preventing population increase near the ROW by land use planning and zoning controls, neither of which is the responsibility of the NECIP.

The foregoing process includes consideration for noise mitigation where future population is expected to be exposed to $L_{dn}$ greater than 65 dB, which is consistent with noise policy of other Federal agencies such as current Federal Aviation Administration Compliance Procedures[1] as well as the EPA National Strategy for reducing noise through rigorous planning action.[2]

This screening process is employed in this document for operational noise and will be used in the site-specific environmental impact analyse during the course of the NECIP.

### 3.4.3 OPERATIONAL NOISE IMPACT

The long-term effects for the NECIP are presented as follows:

- The ENI as an index of noise impact.
- The number of people exposed to $L_{dn}$ greater than 75 dB, 65 dB, and 55 dB as a measure of the distribution of noise impact.

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[1] Federal Aviation Administration Compliance Procedures 1050.1B, June 1977 (F.R. 42 No. 123, June 27, 1977).

[2] National Strategy for Noise Control, U.S. Environmental Protection Agency, 1977.

These numbers are tabulated for present and future conditions. Future conditions (1990) are compared with present conditions to assess potential increases to noise impact. Future operations in the NEC are considered with and without the NECIP.[1] The improvements brought about by the NECIP are assumed to be permanent through continued maintenance of track and rolling stock.

The improvements associated with the NECIP result in a decrease in ENI by 1990 in each state in the NEC. Total ENI along the Corridor will be 28 percent lower than at present, indicating overall improvement in the noise environment. Only in Connecticut will there be a slight increase in the number of people exposed to noise levels above the threshold for normally unacceptable housing environment ($L_{dn}$ = 65 dB). (See Table 3-34).[2] A measure of the improvement in noise conditions brought about by the project is the considerable reduction in the number of people exposed to $L_{dn}$ greater than 75 dB in the future compared to the present. Although the project decreases noise in general, approximately 1000 people continue to be exposed to noise levels of $L_{dn}$ greater than 75 dB, which are considered to be unsatisfactory by the U.S. Environmental Protection Agency. Reference to Appendix E shows that these people are primarily in urban areas where dense housing is close to the ROW.

The Unimproved Alternative was assessed in order to provide a comparison with the effects of the project. Essentially, this alternative is a system with no improvement over present conditions in Amtrak service but with increases in freight and commuter service in 1990 as well as track improvements and grade crossing elimination. This case assumes funding alternatives will be found to improve tracks and eliminate

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[1] The unimproved case includes many of the same activities of the NECIP that would be performed under other funding arrangements during the next few years to ensure continued operation of railroad traffic in the NEC. Some of these activities are assumed to include installation of continuous welded rail and elimination of public grade crossings (hence horn blowing).

[2] The numbers in this table have been revised since publication of the Draft PEIS to incorporate revised train traffic projections and slight changes in speed profile along the Corridor.

Table 3-34

SUMMARY OF NOISE IMPACT ALONG THE NORTHEAST CORRIDOR

| State | Existing | | | | 1990 Unimproved | | | | 1990 Improved | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | People Within Impact Corridor Exposed to $L_{dn}$ Values Above: | | | | People Within Impact Corridor Exposed to $L_{dn}$ Values Above: | | | | People Within Impact Corridor Exposed to $L_{dn}$ Values Above | | | |
| | ENI | 75 | 65 | 55 | ENI | 75 | 65 | 55 | ENI | 75 | 65 | 55 |
| Massachusetts | 6,621 | 30 | 9,480 | 13,339 | 5,165 | 6 | 8,691 | 12,713 | 4,787 | 0 | 8,310 | 12,336 |
| Rhode Island | 2,330 | 0 | 4,887 | 7,881 | 1,704 | 7 | 4,383 | 6,502 | 2,037 | 0 | 2,867 | 7,965 |
| Connecticut | 5,807 | 160 | 7,704 | 22,012 | 5,778 | 144 | 8,201 | 22,258 | 4,961 | 0 | 7,742 | 20,880 |
| New York | 8,763 | 0 | 19,258 | 21,925 | 3,995 | 0 | 14,553 | 15,828 | 7,724 | 0 | 19,048 | 20,782 |
| New Jersey | 16,763 | 2,299 | 14,973 | 35,305 | 10,733 | 92 | 10,710 | 24,197 | 11,786 | 581 | 10,402 | 25,684 |
| Delaware | 4,289 | 256 | 2,375 | 13,371 | 2,599 | 0 | 2,042 | 9,495 | 3,277 | 19 | 2,345 | 11,307 |
| Pennsylvania | 28,835 | 3,240 | 34,719 | 46,116 | 16,850 | 0 | 30,023 | 37,555 | 19,998 | 236 | 29,313 | 39,048 |
| Maryland | 15,620 | 1,896 | 11,627 | 36,895 | 9,321 | 0 | 8,982 | 28,025 | 11,295 | 174 | 8,197 | 30,444 |
| Washington, | 4,112 | 420 | 4,024 | 6,612 | 777 | 0 | 2,690 | 2,690 | 743 | 0 | 2,650 | 2,690 |
| Total | 93,150 | 8,301 | 109,047 | 203,456 | 56,848 | 249 | 90,138 | 158,960 | 66,608 | 1,010 | 90,874 | 171,136 |

private grade crossings. These improvements, however, would not lead to higher speeds or increase ridership which would increase frequency. This alternative shows a somewhat lesser noise impact than either existing conditions or the project, mainly because the track is improved, the horns are eliminated, and the Amtrak trains continue to run at frequency and speed similar to those at present.

In addition to the foregoing estimation of overall noise impact from future (1990) railroad operations, the noise impact screening procedure from Section 3.4.2 has been applied to all communities in the Northeast Corridor to identify those which may be candidates for noise mitigation measures. Ten communities, two in Rhode Island and eight in Connecticut, have potential noise impact according to the criteria in the screening method (Table 3-35). The noise increases at Cranston and Warwick, Rhode Island, are projected because of an anticipated institution of a new commuter service by the Rhode Island Department of Transportation. The remaining eight communities, all in Connecticut, are identified by the screening method even though the actual $L_{dn}$ increase is slight. More detailed analysis for all ten communities is given in Chapter 4.

Table 3-35

COMMUNITIES WITH POTENTIAL NOISE IMPACT FROM RAILROAD OPERATIONS IN THE NEC

| State | Community | ENI Increase* | Ldn Increase |
|---|---|---|---|
| Rhode Island | Cranston | 58 | 5.9 dB |
| | Warwick | 221 | 5.6 dB |
| Connecticut | Westbrook | 3 | 0.5 dB |
| | Guilford | 181 | 2.5 dB |
| | West Haven | 199 | 4.7 dB |
| | Orange | 7 | 3.8 dB |
| | Milford | 54 | 1.2 dB |
| | Stratford | 3 | 1.5 dB |
| | Bridgeport | 170 | 1.8 dB |
| | Fairfield | 29 | 1.2 dB |

*Using present population for both future and existing cases, as specified in the screening method.

Case Studies. To help interpret the noise assessment, two communities were chosen for description of the effects of the NECIP. The case studies were chosen on the basis of geographical location; i.e., one in the northerly section of the Corridor and one in the southerly section. Also the communities were chosen as typical in terms of development characteristics and land use/population distribution. These two studies are intended to serve as illustrative examples for interpretation of the data tables contained in Appendix E of this statement.

- Canton, Massachusetts. At present, the train traffic through Canton averages three local freight trains, 18 Amtrak trains, and 55 commuter trains which are powered by diesel locomotives. Train speeds vary within the town boundaries, but range up to 50 mph for freight trains and 79 mph for Amtrak and commuter trains. The rails are jointed and the track is at grade. The day-night average noise level from this traffic is computed at $L_{dn}$ = 66 dB at 100 feet from the centerline of the tracks. Canton is a suburban community, with some houses as close as 100 feet from the tracks. Noise reduction due to shielding from the first row of houses is expected to decrease 4.5 dB per distance doubling from natural spreading of sound waves with an additional 4.5 dB reduction by the first row of houses and 1.5 dB reduction for each succeeding row of houses. This suburban noise propagation effect leads to the result that $L_{dn}$ from train noise alone reaches the level of 55 dB at 300 feet from the track. Since the population density of Canton is relatively low (924 people per square mile) the ambient noise is also low (estimated at $L_{dn}$ = 52 dB) and therefore, the train noise presently dominates the noise environment within 300 feet of the track, thus defining the existing railroad noise corridor.

In 1990, daily train traffic is expected to include two local freights, 38 Amtrak trains and 70 commuter trains. All Amtrak trains and half the commuter trains are expected to be electric-powered. Speeds for Amtrak trains are expected to increase to 90 mph, with all other train speeds remaining the same as today (see Section 3.1). The tracks will have continuous welded rails and the trackbed will be improved in this area. Canton's train noise level should decrease as a result of the electric locomotives and the new rail. At 100 feet from the tracks $L_{dn}$ will equal 64 dB, and $L_{dn}$ = 55 dB will be reached at 280 feet from the tracks. However, because of a projected increase in population density for Canton (1,243 people per square mile), the future noise impact index will increase slightly, i.e., from ENI = 85 presently to ENI = 94 in 1990. The number of people exposed to noise levels greater than $L_{dn}$ = 65 dB also slightly increases from 131 people at present to 165 people in 1990 due to the expected population increase.

- **Newark, Delaware.** Daily train traffic on the mainline is presently: 22 through freight trains at 50 mph, 13 local freight trains at 50 mph, 77 Amtrak trains (Metroliners at 105 mph and Amfleet at 80 mph), and three commuter trains at 79 mph. Diesel-electric locomotives are used on the local freight trains and approximately half of the through freights. All Amtrak trains are electric. Two of the tracks have welded rails at present and the trackbed is at grade.

Train horns are blown where several roads cross the mainline tracks at grade in the Newark area such as Iron Hill Road, Otis Chapel Road, and South Chapel Street. Near these crossings, train noise is $L_{dn}$ = 75 dB at 100 feet, 65 dB at 300 feet and 55 dB at 1,260 feet. Other parts of Newark along the mainline are exposed to an $L_{dn}$ = 72 dB at 100 feet, an $L_{dn}$ = 65 dB at 141 feet, and a threshold of impact at 590 feet. The present noise impact can be expressed as ENI = 391 for all of Newark, with a total of 36 people exposed to $L_{dn}$ greater than 75 dB, 205 people exposed to $L_{dn}$ greater than 65 dB and 1,045 people exposed to levels greater than 55 dB.

In 1990, the train traffic is expected to include 26 through freights, 18 local freights, 76 Amtrak, 12 commuter, and 20 long-haul passenger trains (see Section 3.1, Regional and Local Transportation). The local freights and the long-haul passenger trains are assumed to be diesel-electric powered, and the rest electric. It is also assumed that grade crossings will be eliminated, thereby eliminating the need for horn blowing. The result is that despite the increased number of trains, the noise level decreases such that $L_{dn}$ = 70 dB is expected at 100 feet from the track, $L_{dn}$ = 65 dB is expected at 121 feet and $L_{dn}$ = 55 dB will be reached at 460 feet. The total ENI for Newark will be reduced to 214 and the improvement is such that no one will be exposed to levels exceeding $L_{dn}$ = 75 dB, 164 people will be exposed to $L_{dn}$ greater than 65 dB and 627 people will be exposed to levels greater than 55 dB. This will be due both to elimination of horn blowing and use of quieter electric locomotives.

### 3.4.4 CONSTRUCTION NOISE IMPACT

With the exception of maintenance-of-way operations and station enhancement program work, no long-term major construction work has been performed recently along the Corridor. Thus, planned construction under the improvement program may increase the noise exposure of nearby residents considerably. However, this impact will be site-specific and temporary. Only those in the immediate vicinity of a bridge, curve, station or section of track under repair or modification will experience the noise impact. Such impacts will be localized and will vary during the course of the improvement program as different facilities are improved at different locations. The actual duration of activity at a specific location will be relatively short (one to two days along sections of track being improved) except where major reconstruction, e.g., of bridges and stations, will be required. In such cases, construction-related noise may be experienced for a period of several months to more than a year.

Despite the transient nature of construction, the noise impact from these activities may be significant due to the high noise levels generated by individual pieces of construction equipment. In addition, the possibility of night construction work to minimize disruption of current train operations will add further to the noise impact. Since background ambient noise levels are lower during the evening hours, a noise level of a given intensity would be perceived as louder during the evening than during the daytime hours. Certain trackwork operations, e.g., undercutting, and various phases of major construction efforts may occur during the evening hours.

Short-term construction noise effects are considered if residences will be exposed to an annual outdoor average $L_{dn}$ greater than 65 dB. Short-term construction or particularly noisy phases on longer projects are assessed on the basis of a daily $L_{dn}$ of 90 dB as the threshold of noise impact. Residents exposed to either of these noise levels are enumerated as "impacted people".

Bridges. Construction on both overhead and undergrade bridges will range from surface repair to complete replacement. The construction activities may take place for only a few days or for several months, depending on the extent of modification and the length and location of the bridge.

Noise level data exists on nearly all of the equipment to be used in bridge construction work. The major noise sources will be pile drivers, cranes, sandblasters, jack hammers, concrete mixers, trucks, impact wrenches, air compressors, and loaders.

Day-night average noise levels ($L_{dn}$) are predicted for each of the eight construction activity categories and for a range of project sizes based primarily on bridge length (Table 3-36). The noise for each activity category is derived from information on types, usage factors and pieces of equipment estimated by construction engineers.

Table 3-36

BRIDGE REPAIR CONSTRUCTION NOISE LEVELS

| Estimated $L_{dn}$ at 50 Feet from Site | Undergrade Bridges | | | | Overhead Bridges | | | |
|---|---|---|---|---|---|---|---|---|
| | Replace | Upgrade | Repair | Surface Repair | Relocate | Shift Location | Lift Super-Structure | Lower Track |
| Noisiest Phase $L_{dn}$ (dBA) | 88-92 | 85-90 | 85-90 | 85-90 | 88-92 | 88-92 | 81-86 | 80-85 |
| Average Daily $L_{dn}$ (dBA) | 88-92 | 83-87 | 83-87 | 86-89 | 88-92 | 88-92 | 81-86 | 70-75 |
| Annual Average Range $L_{dn}$ (dBA) | 84-90 | 70-85 | 62-80 | 60-79 | 84-90 | 75-89 | 68-84 | 55-60 |
| Average $L_{dn}$ (dBA) | 88 | 80 | 72 | 71 | 88 | 85 | 79 | 57 |
| Project Durations Range | 7-30 mos. | 20-200 days | 30-70 days | 1-35 days | 7-30 days | 20-200 days | 20-200 days | 3-15 days |
| Average | 20 mos. | 130 days | 20 days | 8 days | 20 mos. | 130 days | 130 days | 10 days |
| Distance from Bridge to 65 dBA $L_{dn}$ | | | | | | | | |
| Urban/suburban | 293 ft. | 158 ft. | 100 ft. | 100 ft. | 293 ft. | 233 ft. | 147 ft. | --- |
| Rural | 550 ft. | 262 ft. | 126 ft. | 115 ft. | 550 ft. | 417 ft. | 240 ft. | --- |

During the noisiest phases of bridge replacement, the $L_{dn}$ level can reach 92 dB with an annual average of 88 dB. In urban areas, these noise levels can cause impact 292 feet from the site. The number of residents potentially exposed to bridge construction noise impact is 2,429. These impacts are shown separately for each state along the Corridor (Table 3-37). Details required for the construction noise impact analysis are given in Appendix E.

Table 3-37

BRIDGE CONSTRUCTION NOISE IMPACT

| State | Number of People Impacted By Bridge Construction |
|---|---|
| Massachusetts | 20 |
| Rhode Island | 294 |
| Connecticut | 341 |
| New York | 237 |
| New Jersey | 632 |
| Pennsylvania | 612 |
| Delaware | 151 |
| Maryland | 139 |
| Washington, D.C. | 3 |
| TOTAL | 2,429 |

Route Realignments. Curve realignment activity is most likely to affect noise levels. This activity falls into two distinct categories based on the amount of lateral distance the track is to be moved. First, a shift of less than 2-1/2 feet requires no significant change to the roadbed, and the average period of construction is about five days. Second, a shift of more than 2-1/2 feet requires complete roadbed preparation and takes about 250 days.

The dominant sources of construction noise used for a shift of more than 2-1/2 feet include trucks, scrapers, graders, bulldozers, loaders and ballast tampers. During the noisiest phase, the $L_{dn}$ will range from 76 to 80 dB at 50 feet for shifts less than 2-1/2 feet and from 85 to 90 dB at 50 feet for the shifts greater than 2-1/2 feet (Table 3-38). The difference occurs because of the increased size of equipment and number of pieces used. The sound levels for route realignments are based on daytime construction activity only. If construction activity is to take place at night, the $L_{dn}$ levels will increase significantly.

The total number of residents potentially exposed to curve realignment construction noise impact is expected to be 3,485, twice the number impacted by bridge construction. When evaluated for each state along the Corridor, the greatest impact is found to occur in Pennsylvania and Maryland where many long curves with shifts greater than 2-1/2 feet are planned in densely populated areas (Table 3-39). No noise impact is expected for curve realignments where the track is to be shifted less than 2-1/2 feet.

Trackwork. Trackwork activity involves the maintenance of rail, ties, and roadbed. Primary activities to be considered as part of the NECIP are tie renewal, ballast cleaning and undercutting, installation of continuously welded rail (conventional or TLS), and rail surfacing and grinding. Each of these operations involves one or more pieces of specialized rail maintenance equipment which moves relatively continuously along the track.

## Table 3-38

## NOISE LEVELS FROM CURVE REALIGNMENT CONSTRUCTION

| | Curve Realignment with less than 2½ ft shift | Curve Realignment with more than 2½ ft shift |
|---|---|---|
| Estimated $L_{dn}$[1] at 50 feet from site | | |
| Noisiest Phase $L_{dn}$ (dBA) | 76-80 | 85-90 |
| Average Daily $L_{dn}$ (dBA) | 72-76 | 76-80 |
| Annual Average $L_{dn}$ (dBA) | | |
| Range | 53-57 | 74-78 |
| Average | 55 | 76 |
| Project Duration | 5 days[2] | 250 days[3] |
| Distance from site to 65 dBA $L_{dn}$ | Urb/Sub. (within ROW) 132 feet<br>Rural (within ROW) 288 feet | |

[1]Based on daytime (7 a.m. to 10 p.m.) construction only

[2]Based on curve length of 2,500 feet

[3]Based on curve length of 5,000 feet

## Table 3-39

## NOISE IMPACT FROM CURVE REALIGNMENT CONSTRUCTION

| State | Number of People Impacted: Shift less than 2½ feet | Number of People Impacted: Shift greater than 2½ feet |
|---|---|---|
| Massachusetts | 0 | 140 |
| Rhode Island | 0 | 383 |
| Connecticut | 0 | 188 |
| New York | 0 | 1,184 |
| New Jersey | 0 | 204 |
| Pennsylvania | 0 | 370 |
| Delaware | 0 | 269 |
| Maryland | 0 | 1,632 |
| Washington, D.C. | 0 | 0 |
| TOTAL | 0 | 4,370 |

Noise measurements were made on several trackwork operations as part of this project. The noise prediction method uses the measured data and predicts $L_{dn}$ at wayside for a single passage of each operation. $L_{dn}$ levels are also indicated for trackwork operations which might occur at night (Table 3-40). The noisiest operation for which data is available is tie renewal, which attains a 75 dB $L_{dn}$ level for daytime activities. Because daily noise levels are well below $L_{dn}$ = 90 dB, no noise impacts due to trackwork operations are indicated. However, operations conducted at night near residential neighborhoods have the greatest annoyance potential.

Table 3-40

TRACKWORK NOISE SUMMARY

| Operation | Rate of Travel (ft/hr) | Daily $L_{dn}$ at 50 feet Noisiest Day (dBA) | | Annual Average $L_{dn}$ 50 Feet from Track | |
|---|---|---|---|---|---|
| | | Daytime Operation | Nighttime Operation | Daytime Operation | Nighttime Operation |
| Tie Renewal | 200 | 75 | 85 | 50 | 60 |
| Surfacing | 500 | 68 | 78 | 42 | 52 |
| Shoulder Ballast Cleaning | 2,000 | 58 | 68 | 33 | 43 |
| Continuous Welded Rail Installation | 700 | 65-75 | 75-85 | 40-50 | 50-60 |

Electrification. Two elements of the electrification program have been identified as potential sources of noise impact: installation of new catenary structures, and cleaning and painting of the existing catenary supports.

Two types of machines are required to install new catenaries: a machine (either a grub digger or an auger-type excavator) to dig holes for the foundation, and a crane to handle materials. The rate of catenary installation is about 0.16 to 0.40 hours per support. Sandblasting is proposed to clean existing catenary supports; this activity is expected to take approximately one and a half to two hours per support. Painting is expected to be done by hand.

Noise levels from the hole-digging machinery and cranes have been estimated from other similar diesel powered equipment. Noise level data from sandblasting operations have been used to predict noise from catenary cleaning.

The noise prediction method developed for trackwork operations, which also involves one passage of construction equipment, has been applied to the electrification program to predict daily annual averages $L_{dn}$ at wayside (Table 3-41). During noisiest phases of catenary installation, $L_{dn}$ at 50 feet from the site is expected to range from 56 to 69 dB with an annual average $L_{dn}$ of 30 to 43 dB. Catenary support cleaning is expected to be noisier ranging from 71 to 84 dB. No daytime impact is expected since all daily levels are well below 90 dB and no nighttime catenary cleaning is expected.

### 3.4.5 VIBRATION ASSESSMENT

The term vibration refers to rapidly varying motions of the ground or a structure which result, in decreasing order of severity, in structural damage, in perceptible sensations in the human body, in interference with certain vibration-sensitive work tasks or in the radiation or rumbling sounds of walls of rooms. Any of the above manifestations of ground vibration are likely to cause complaints

Table 3-41

ELECTRIFICATION PROGRAM CONSTRUCTION NOISE SUMMARY

| | Catenary Installation | Catenary Support Cleaning (Sandblasting) |
|---|---|---|
| Estimated Noisiest Day $L_{dn}$ at 50 feet from site | | |
| Daytime Operation[1] | | |
| Range $L_{dn}$ (dBA) | 56 to 69 | 71 to 84 |
| Average $L_{dn}$ (dBA) | 63 | 78 |
| Nighttime Operation[2] | | |
| Range $L_{dn}$ (dBA) | 66 to 79 | None |
| Average $L_{dn}$ (dBA) | 73 | Expected |
| Annual Average $L_{dn}$ at 50 Feet from Site | | |
| Daytime Operation[1] | | |
| Range $L_{dn}$ (dBA) | 30 to 43 | 48 to 61 |
| Average $L_{dn}$ (dBA) | 37 | 55 |
| Nighttime Operation[2] | | |
| Range $L_{dn}$ (dBA) | 40 to 53 | None |
| Average $L_{dn}$ (dBA) | 47 | Expected |

[1] Daytime hours are 7 a.m. - 10 p.m.

[2] Nighttime hours are 10 p.m. - 7 a.m.

from people who experience them during normal activities. However, ground vibration levels which are clearly perceptible by people are considered to be highly undesirable and therefore a measure of vibration impact.[1] International standards, as well as the results of complaint investigations and the comment of bio-acoustic researchers, point out that vibration just above perceptibility can be the source of annoyance and disturbance especially when felt in the home. Based on this widely shared attitude, the threshold of perception to whole body vibration has been selected as the vibration impact criterion for the NECIP.

As trains pass over railroad tracks, forces are generated between the train wheels and the rails that cause ground motion. Although the amplitudes of these vibrations are too small to be seen, they can be felt, especially if the observer is very close to the tracks. These resulting vibrations propagate away from the tracks as waves, in much the same manner as ripples propagate across the surface of a pond. One important aspect of these ground waves is that they diminish with distance from the tracks. Vibrations are often measured in units of velocity; velocity and ground motions greater than 0.0035 inches per second are perceptible by humans and those greater than about 0.2 inches per second can cause minor damage to buildings.

Measurements for various soils show that propagation of ground vibration depends on the soil type. For example, vibration diminishes more rapidly in clay than in sandy soil.[2] This information is combined with measurement results for trains in the NEC[3] and vibration criteria for perception in homes to determine the distance to the limits of vibration impact zone.

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[1] Vibrations and Shock Limits for Occupants in Buildings, Amendment to International Organization for Standardization (ISO) Standard 2631-1974, 1977.

[2] "Propagation of Ground Vibration: A Review", T.G. Gutowski and C.L. Dym. Journal of Sound and Vibration 492, 1976.

[3] Wayside Noise and Vibration Signatures of High-Speed Trains in the Northeast Corridor, U.S. Department of Transportation, 1973.

In conventional trains, locomotives cause the highest vibration levels. Measurements in the NEC show clearly perceptible vibrations at 25 feet (greater than 0.0035 inches/second) for existing locomotives on jointed rail and for a speed range of 70 to 80 mph. However, even as close as 25 feet the measured vibration level from trains is well below vibration damage limits for residential structures (0.2 inches/second).[1,2] By using vibration propagation information for sandy soils, ground vibration can be estimated to be perceptible out to a distance of 630 feet; in clay soils the distance is much shorter, only about 210 feet.

Future Vibration Conditions. Ground vibrations will be influenced by two important factors: in general, train speeds will increase, and the present jointed rail will be replaced by continuously welded rail. The increased speeds will tend to increase vibration slightly, while eliminating the rail joints will definitely reduce vibration. For example, where jointed rail will be replaced by continuously welded rail and train speed will increase from 79 mph to 110 mph, a greatly reduced vibration impact along the Corridor will result: 280 feet from the track in sandy soil, and 125 feet from the track in clay soil.

The consequence of trackbed improvements associated with NECIP will be a definite improvement in ground vibration levels.

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[1] "Propagation of Ground Vibration: A Review". T.G. Gutowski and C.L. Dym. Journal of Sound and Vibration 492, 1976.

[2] Wayside Noise and Vibration Signatures of High-Speed Trains in the Northeast Corridor, U.S. Department of Transportation, 1973.

## 3.5 NATURAL ENVIRONMENT

### 3.5.1 SUMMARY

The NEC passes along one of the world's most densely populated and industrially developed coastlines. The present natural environment of the 456-mile long Corridor shows the effects of several generations of human activity and along much of the present Corridor, the existing natural environment has essentially stabilized in response to this. The proposed NECIP will not alter that significantly. Nearly 500 discrete environmentally sensitive wetlands and watercourses contiguous to the existing roadway can be identified. These areas, as well as other less sensitive natural settings, will not be significantly impacted because the vast majority of the proposed project will not involve areas outside the roadway. Although NECIP activities will not directly affect the natural environment, consideration will be given here to those sensitive areas which might be adjacent to potentially harmful activities. The specific activities, their location and extent along the NEC, and all crossings of watercourses are shown on the Project Activities by Location Charts (PAL Charts) and should be consulted in conjunction with the overview provided by this section and Table 3-49 in particular. Table 3-49 is presented at the end of this section.

Wetlands and watercourses which touch the railway account for roughly 39,000 acres within a ribbon of land 6,000 feet wide along the entire Corridor. These potentially sensitive areas represent about 12 percent of all the land within that ribbon which includes noncontiguous wetlands and watercourses. Concern for mitigation of impacts presented in this section of the PEIS is focused upon that area. The potential for impact on the remaining land area is essentially non-existent.

Relatively specific concerns which exist for project activities adjacent to sensitive areas essentially involve short-term impacts calling for the prevention of erosion and sedimentation, the removal of solid waste, and the careful use of such materials as paint and chemicals. Nearly all such concerns are related to NECIP construction activities.

The basic design objectives of the NECIP have several significant features which minimize the potential for adverse impacts. The roadway itself serves as a buffer to potential impacts upon the natural environment. It is level, porous, contains little organic material, and is well-drained and stable. Therefore, both short-term and long-term activities on the roadway are likely to be confined to that roadway with limited impact on nearby areas (Figure 3.18).

The potential long-term impacts on the natural environment resulting from the proposed operation of the railroad are expected to be insignificant and not different in consequence from present activities. Some problems with drainage, erosion and sedimentation will be eliminated by the proposed program and proper maintenance will insure that significant impacts will not be encountered in the future.

### 3.5.2 EXISTING CONDITIONS

Physiography. The natural environment along the NEC, in the broadest possible ecological terms, is dominated by an uninterrupted temperate, deciduous forest transected by an occasional river or estuary. The existing railroad and its adjacent developed lands lie wholly within a biological community originally dominated botanically by oak and maple trees and zoologically by deer. Based on geological and climatic factors, the area through which the Corridor passes can be subdivided into four physiographic regions (Figure 3.19).

The Coastal Plain is a relatively low and smooth region composed of beach and other marine-derived sediments. In Maryland, Delaware, New Jersey and New York, the Corridor is either immediately adjacent to or within such a coastal plain.

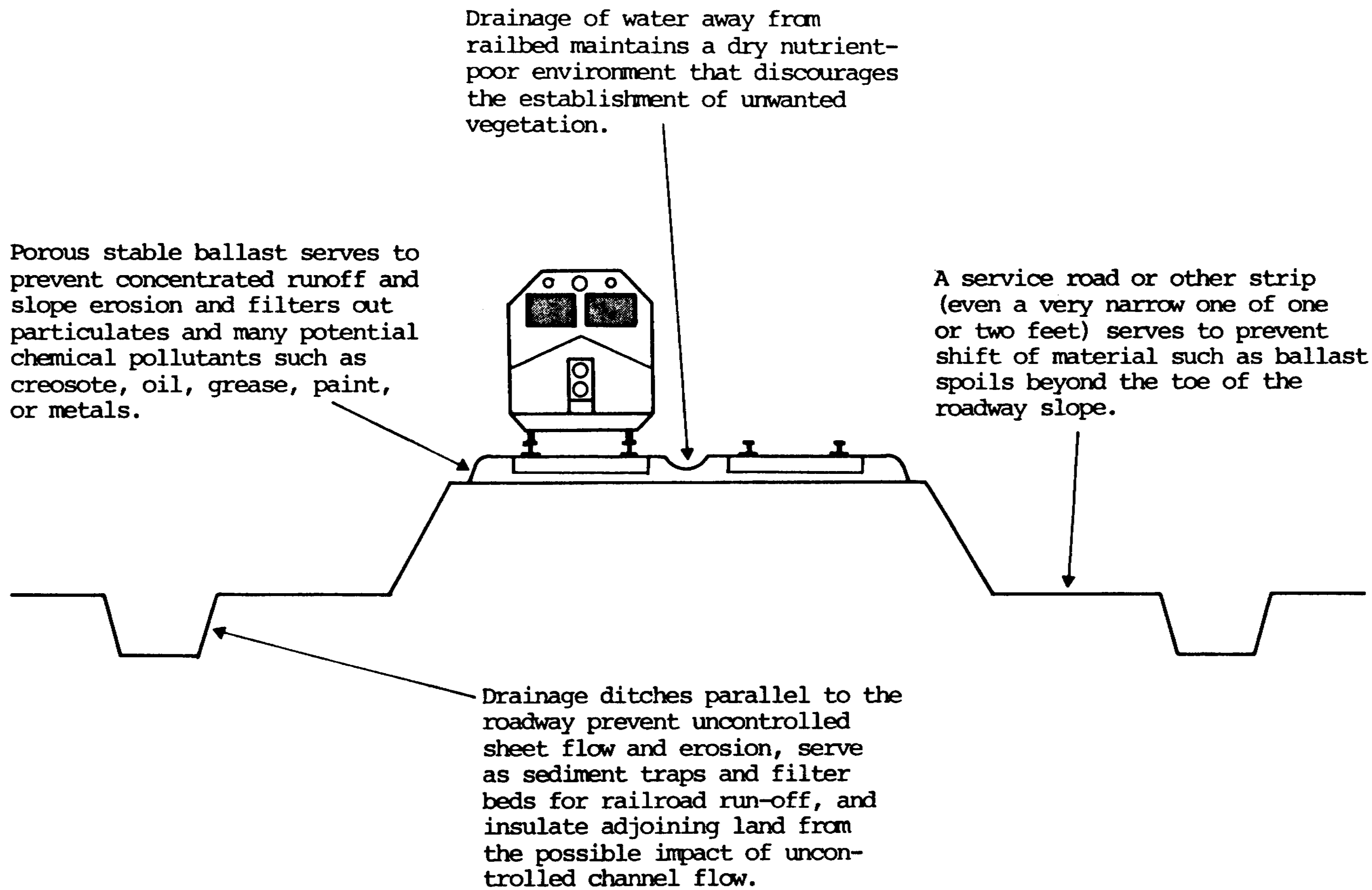
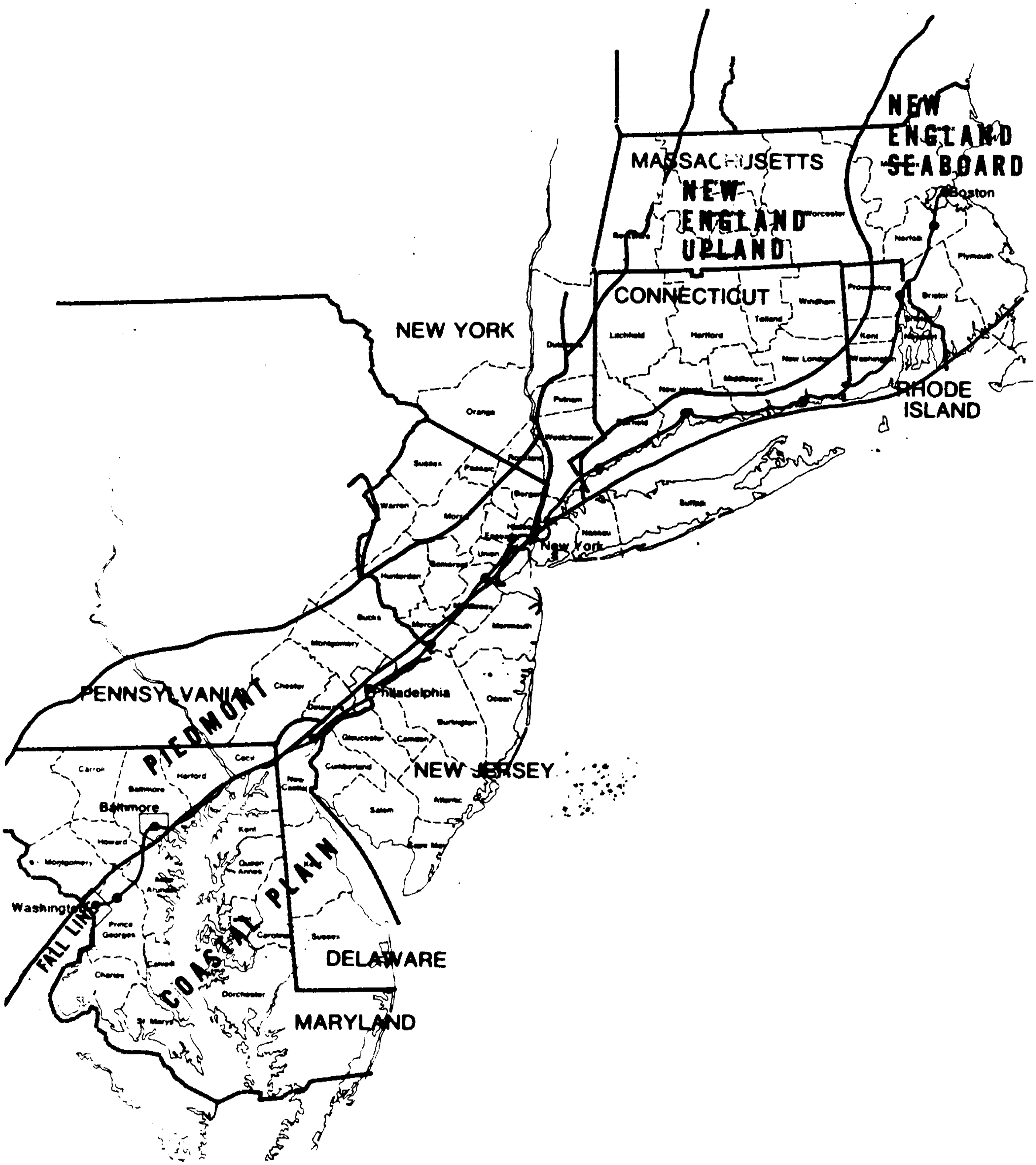



Figure 3.18

CHARACTERISTIC CROSS-SECTION OF THE ROADWAY




SOURCE: <u>A Forest Atlas of the Northeast</u>
U.S. Dept. of Agriculture, Forest Service,
1968

**Figure 3.19**

**PHYSIOGRAPHIC REGIONS**

The Piedmont forms the transition between the Coastal Plain and the Appalachian Mountains. Portions of the Corridor in Maryland, Delaware, Pennsylvania and the southern portion of New Jersey touch this zone of gently rolling terrain and deep-cut valleys.

The New England Seaboard extends northward from the Piedmont of northern New Jersey. Unlike the Coastal Plain to the south, this region is characterized by shallow surface deposits and outcrops of bedrock formed by glaciation.

As the Corridor moves inland from the coast of Rhode Island into the New England Upland, the elevation rises and narrow, stream-cut valleys with steep slopes formed during several glacial periods become regular features of the landscape.

Average annual precipitation along the Corridor is 42 inches. South of New York, the heaviest precipitation occurs in July and August. North of New York, precipitation is equally distributed throughout the year.

Within the tropical storm season (June through November), the Corridor region is occasionally exposed to winds and inland and coastal flooding. Flooding associated with other causes, such as spring thaws and storms, affects the Corridor to a lesser degree, but with more regularity than that caused by tropical storms. In both instances, the major impact of flooding is erosion and sedimentation, depending upon the soil type involved.

Soils can be classified into those which naturally occur along and within the Corridor and man-deposited soils forming the railroad bed. The natural soils generally surrounding the Corridor south of New York City are derived from sands and contain secondary components of silt and clay. The Corridor north of New York City is surrounded by soils derived from glaciated uplands and alluvial plains.

The fill in the Corridor is usually derived from local material composed of a mixture of gravel, sand and silt. When the railbed was not placed on rocky material, the existing material was often removed and replaced with more stable and drainable fill which was compacted during construction and by subsequent rail traffic. Absence of erosion and the associated stability of the railbed are fundamental characteristics all along the Corridor. After a century of use, the Corridor roadbed is perhaps its greatest distinguishable asset. Therefore, concern for potential environmental impacts relating to soil is focused on activities which may temporarily alter the pre-existing stability of the railbed or the native soils immediately adjacent to the railbed.

Natural or man-induced erosion may occur along the Corridor as a result of channel erosion (concentrated, stream-like flow of water), shoreline erosion (waves and currents) and overland erosion (evenly distributed erosion resulting from the sheet flow of water). Depending upon the particle size and the density of the eroded materials, sedimentation may occur either near or far from the source. However, with respect to the present railbed, sedimentation generally occurs within drainage ditches adjacent to that railbed.

Aquatic Environment. The Corridor is generally located near the seacoast within a physiographic setting dominated by Coastal Plain and New England Seaboard. It intersects or parallels five major estuarine complexes which vary in quality from heavily impacted and polluted (Raritan/Hudson Estuary complex) to relatively clean (Chesapeake Bay and Narragansett Bay). The impact of existing Corridor activities upon the highly productive natural marine environment is insignificant.

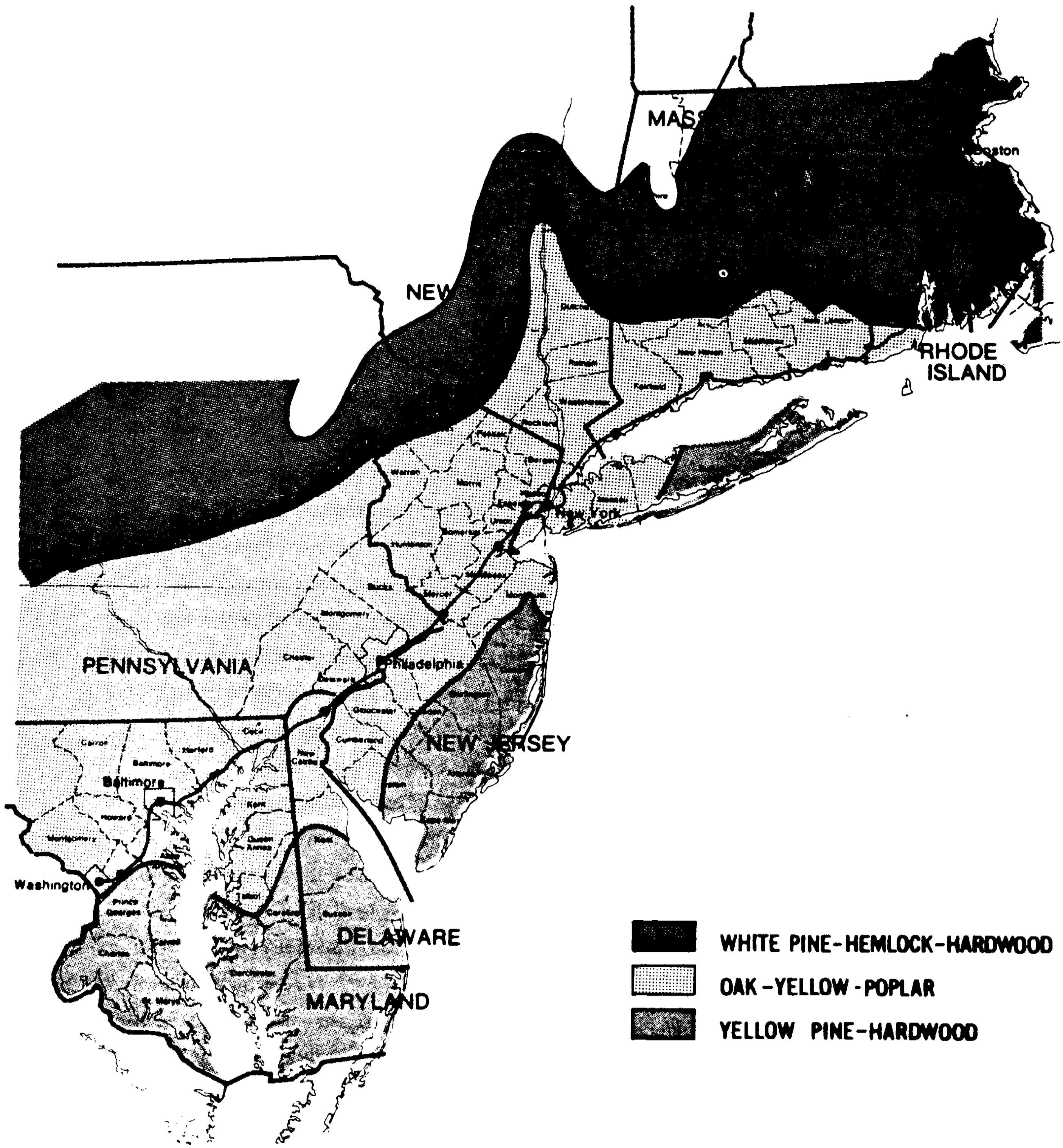
The Corridor also crosses both estuarine and freshwater streams. The present impact of maintenance activities and traffic along the Corridor upon these streams has apparently been unnoticeable as compared with that of the adjacent urban and industrial complexes. There is no evidence of significant disruption of the present natural environment as a result of the present NEC operation.

Water quality within the freshwater, estuarine, and marine systems along the Corridor is designated by the appropriate state and regional standards. When water quality in different regions is compared, the water along the Corridor clearly reflects the impact of urbanization and industrialization and not the presence of the railbed itself. Because the currents along the shore move parallel to the coast and bottom currents off the continental shelf move more or less perpendicular to the coast, there is a regular pattern of mixing and natural dilution of these coastal waters with ocean waters. This results in the relatively isolated pockets of diminished water quality associated with the major urban developments, such as New York City, along the coast. The collective impact of the railroad upon the water quality of the Corridor coastline is infinitesimally small.

Biological Geography. The present environment along the Corridor supports a variety of ecosystems. Each ecosystem contains certain community associations dominated by particular species and a number of distinct habitats associated with the species present.

Within the so-called Oak-Deer-Maple Biome of the eastern half of the United States, the Corridor can be roughly divided into three community associations: the yellow pine/hardwoods of the Delmarva Peninsula and southern New Jersey, the oak/yellow-poplar community extending through Connecticut and into Rhode Island and the white pine/hemlock/hardwoods of Rhode Island and Massachusetts (Figure 3.20). Although interesting from a biogeographical point of view, these community distinctions are not particularly significant with respect to potential impacts from existing Corridor activities.

Within the ecological communities through which the Corridor passes, certain species require relatively specific physical and biological interrelationships. The most significant habitats which occur adjacent to portions of the Corridor include: salt marshes, freshwater marshes, swamps and bogs, meadows, bottomland hardwood forests, upland pine forests, upland hardwood forests, old field communities, and beaches. The predominant animal species associated with these habitats are deer, rabbit, squirrel, waterfowl, and a wide variety of marine and freshwater fish and invertebrates. In all instances, the




SOURCE: A Forest Atlas of the Northeast
U.S. Department of Agriculture, Forest
Service, 1968.

**Figure 3.20**

**FOREST ASSOCIATIONS**

present environmental setting has become relatively stable over the past century during which a rail system has existed within the Corridor. Habitats have been altered naturally and artificially and wildlife populations have adjusted to the presence of the railroad.

### 3.5.3 POTENTIAL AND ACTUAL IMPACTS UPON THE NATURAL ENVIRONMENT

Assuming that all appropriate mitigation measures are taken as specified according to work activities and site-specific considerations, the NECIP will not generate any significant impact upon the natural environment. This conclusion has been drawn from an analysis of all the presently available data of the rehabilitation program and the pertinent information referred to in the Appendices.

Since adjustments to the roadbed and its associated structures are taking place essentially within the ROW, concern for protection of the natural environment is primarily focused on those ROW segments adjacent to sensitive areas. There need be little concern for the direct encroachment upon sensitive areas since such expansion is not required within the scope of the NECIP. The preliminary studies undertaken to define the general project scope have evolved to avoid the taking of any important environmental area, e.g., wetlands. The absence of all curve realignments which would require new land acquisition has eliminated that potential impact. Other forms of potential impact are manageable.

Although there are almost 500 environmentally sensitive areas along the 456-mile Corridor (Table 3-42) including fresh water streams and rivers, tidal and estuarine waters, tidal wetlands and non-tidal wetlands, the environmental impact upon these areas will be minimal because (1) all potential erodible materials will be kept under strict control, (2) environmentally significant solid wastes will be utilized on site or will be transported to suitable disposal sites, (3) materials and processes which may be harmful to organisms will be specified and carefully handled according to specifications, (4) removed vegetation will be replaced wherever possible, and (5) other mitigation measures will be

Table 3-42

NUMBERS AND AREAS BY STATE OF WETLANDS AND WATERCOURSES
ADJACENT TO THE NEC

| STATE | Waterways[1] | | Wetlands | | Total Area[2] (acres x $10^4$) | Area Wetlands and Waterways[3] (acres x $10^4$) | Percent |
|---|---|---|---|---|---|---|---|
| | Fresh | Tidal | Non-Tidal | Tidal | | | |
| Massachusetts | 11 | 1 | 35 | - | 2.8 | 0.400 | 14.3 |
| Rhode Island | 22 | 1 | 37 | 1 | 3.8 | 0.400 | 10.5 |
| Connecticut | 60 | 33 | 67 | 61 | 8.6 | 1.600 | 18.6 |
| New York | 8 | 5 | - | - | 2.1 | 0.200 | 9.5 |
| New Jersey | 27 | 5 | 9 | 10 | 4.1 | 0.500 | 12.2 |
| Pennsylvania | 18 | 6 | 1 | - | 3.4 | 0.100 | 2.9 |
| Delaware | 9 | 3 | 4 | - | 1.7 | 0.300 | 17.6 |
| Maryland | 31 | 6 | 10 | 2 | 6.5 | 0.400 | 6.2 |
| Washington, D.C. | 1 | - | 1 | - | 0.3 | 0.003 | 1.0 |
| TOTAL | 187 | 60 | 164 | 74 | 33.3 | 3.900 | 11.7 |

[1] Includes waterways crossed by or immediately adjacent to ROW.

[2] Total areas include land within 3,000 feet on either side of the railroad.

[3] Areas include only those contiguous wetlands and waterways directly contacting the ROW and within 3,000 feet on either side.

applied where appropriate to avoid any unnecessary impacts upon the contiguous natural environments. Generally speaking, the long-term impacts of this rehabilitation project upon the natural environment are expected to be insignificant.

### 3.5.4 ENVIRONMENTAL IMPACTS OF CONSTRUCTION AND OPERATIONAL ACTIVITIES

Three sources of potential impact related to construction activities along the Corridor are: (1) increased erosion and sedimentation, (2) generation of solid waste, and (3) introduction of chemical pollutants. These sources will usually be present in each program element but their relative significance is extremely variable. Therefore, the associated environmental impacts will depend upon the specific nature of the work, the location of the activity and the effectiveness of the mitigating measures applied.

Erosion and Sedimentation. Stockpiled soil or exposed slopes from which vegetation or other stabilizing layers might be removed can be eroded rapidly by the channel and sheet flow of runoff. Such impacts on the land usually lead to decreased water retention, increased channelized flow, increased erosion and decreased overall habitat value. In addition, the process generates sediments which are moved downslope and introduced into receiving waters as suspended particulates.

The removal of vegetation outside the right-of-way due to bridge reconstruction and substation and maintenance-of-way base construction will result in increased erosion potential and the destruction or alteration of terrestrial habitat in a minor way. Thirteen maintenance-of-way bases are planned on as many sites, varying in size from ten to twenty acres. Thirty-three substations are planned on as many sites, none exceeding one-quarter of an acre. In all, no more than 200 acres will be required for these activities. Virtually all of this area will be disturbed ROW land and will not involve any natural habitat.

Activities within the ROW (including the right-of-way clean-up program involving selective cutting of vegetation) will not disturb the feeding, breeding or nesting grounds of sensitive wildlife. Thus, the probable environmental impact will not be significant relative to habitat disturbances. Any increase in erosion potential will be mitigated by use of mulch, drainage ditches or revegetation with suitable ground cover of exposed areas.

Activities that include vegetation removal and erosion and sedimentation as potential impact sources are:

- Cleaning and construction of drainage facilities
- Cut and fill associated with curve realignments
- Stripping and clear/grub/grade operations associated with access roads
- Clearing and excavation of substations, maintenance-of-way bases, communication towers, service roads, power line access, fence installation and building construction.

The fine particles of sediments will cause water quality changes by decreasing the oxygen content and increasing the turbidity in receiving water bodies. Fish, such as trout or herring, require a high level of oxygen in the water and could die or try to avoid the stressed watercourse. Gill structures of fish can clog and animals, such as oysters, which feed by screening fine particles from the water, could be damaged or die if conditions were not improved. Those plants requiring a certain level of illumination could eventually die as a result of the decrease in light caused by an increase in suspended sediments. These potential impacts, however, will be minimized and/or eliminated by careful erosion control in the NECIP.

Sediments are suspended in water so long as the movement of the water is sufficiently swift to prevent the solids from settling out. Most suspended sediments, except colloidal-sized particles, in a watercourse will settle out in still waters. If substantial amounts of sediments are involved, they may cause the resident populations of animals and plants to substantially change. However, with respect to the NECIP, there will be minimal environmental impact resulting from erosion and sedimentation. In those relatively limited areas which may require special attention to sedimentation/erosion control, appropriate mitigation measures to prevent any significant impacts will be taken. The drainage channels parallel to the roadbed are generally small and have relatively gentle slopes which will accommodate the deposition of any suspended sediments issuing from the ROW and prior to entry into natural watercourses. Furthermore, the stable and porous nature of the roadbed serves to filter and slow runoff thereby counteracting problems of erosion and sedimentation. Proper maintenance of these drainage channels will insure that their sediment deposition function will continue.

Solid Waste Generation. The solid waste generated by this project will include ties, spoil material from ballast cleaning and undercutting, soils from excavation, and scrap metal components. The potential impacts of solid waste accumulation and disposal include: (1) habitat alteration or destruction, (2) alterations in drainage which might encourage erosion and sedimentation, and (3) generation of significant concentrations of leachable material which might cause ecological alterations at or adjacent to the railroad ROW.

Materials such as spikes, plates, and other scrap metal will be recycled in all instances. Waste ballast material will be used as subgrade on existing ROW access roads wherever possible or will be removed for deposition in designated disposal areas. Other waste material will be removed to appropriate landfills in order to avoid any environmental degradation, especially to environmentally sensitive areas such as wetlands and waterways. Most of the activities that include generation of solid waste as a source of potential impact include:

- Tie renewal
- Undercutting and ballast cleaning
- Cleaning of drainage facilities
- Rail grinding

- Joint elimination and turnout improvements
- Sandblasting
- Cut and fill
- Stripping and clear/grub/grade operations
- Improving interlockings
- Rehabilitating existing catenary
- Excavation
- Fencing installation
- Grade crossing elimination
- Building construction
- Bridge work

Chemical Pollutants. Chemical agents that will be used in various elements of the NECIP are (1) paint and cleaning agents, (2) creosote (tie removal), (3) lime slurry chemical or cement (subgrade stabilization), (4) cement (general construction), (5) petroleum products from train, truck, and rail equipment operations, and (6) selective application of herbicides. The introduction of some of these substances in excessive quantities into the sensitive areas near the railroad ROW could contaminate ground/surface waters, or result in the introduction of toxic materials into various biological food chains. Although these substances are associated with temporary construction activities, they could have long-term effects. Therefore, appropriate measures will be implemented to prevent the entrance of such substances into wetlands or water bodies.

The potential impact of these chemical agents is entirely dependent upon the quantity and quality of toxic material spilled in the environment and on the material's mobility in the environment. If spilled paint is not allowed to become mobilized in the environment, no impact will be seen. Even if we assume that there is no mitigation, the potential environmental impact resulting from painting catenary poles, stations, and overhead bridges will be imperceptible because the spattered or sprayed paints will be effectively immobilized on the surface of the dry roadbed. The potential migration of such metallic toxic elements (such as lead) in the paint is negligible. If metallic ions are carried into the ballast or adjacent soil, these elements, especially lead, will tend to become bound to the soil and will not be carried far from their original point of deposition.[1]

Virtually all of the preceding potential impacts associated with the work during rehabilitation are short-term. With proper maintenance of the completed project, there will be virtually no impacts associated with the operation of the railroad. As an activity, the proposed NECIP operation will not appreciably add any new materials to the natural environment once the roadbed is completed, and will not deposit any new significant foreign materials. With the exception of maintenance clearing and repair, the only activity associated with the completed project is the passage of traffic within a highly restricted ROW. Long-term potential impacts upon the natural environment are primarily centered upon a few special areas of concern including microwave communications towers and consideration of threatened and endangered wildlife species.

### 3.5.5 MAGNITUDE AND SIGNIFICANCE OF IMPACTS[2]

The environmental impact analysis of any project requires the consideration of two aspects of each action which may have an impact upon the environment. The first is the definition of the magnitude of the impact. The term magnitude is used in the sense of degree, extensiveness, or scale. For example, tie renewal and undercutting generates a large amount (i.e., magnitude) of solid waste along the NEC. The second is a subjective weighting of the degree of importance or significance of the potential impact. For instance, the environmental significance of solid waste generation within the NEC is not very high

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[1] "Contamination of roadside soil and vegetation with cadmium, nickel, lead and zinc." Largerwertf, J. V. and A. W. Specht. Environmental Science Technology, 1970.

[2] The conceptual framework of this section has been derived from A Procedure for Evaluating Environmental Impact, U.S. Department of the Interior, 1971.

because there is an existing ROW, and most of the solid waste will remain within that ROW or be disposed of by sale or removal to acceptable disposal areas and not affect the surrounding natural environment.

There are 20 major project activities considered here which may involve some potential sources of impacts. In nearly all NECIP activities, the magnitude and significance of potential environmental impact is low, as shown in Table 3-43. The subjective judgements which were made in order to construct this table of Magnitude and Significance of Potential Impacts are based upon field observation of the existing environment and representative work activities, and experience. For example, the magnitude of potential impacts upon the natural environment from undercutting activities is high. It is rated as 5 because 356 tons of spoil can be generated for each mile of single track cleaned in that way. The significance of that potential impact is rated as 1 (very low) because experience has shown that in virtually every case, disposal of this spoil is upon the roadway and does not impact the natural environment in any significant way. Similar subjective classifications have been made to account for the other project activities listed in Table 3-43. If all aspects of the project are averaged, a value of 2.5/2 is derived from the table which suggests that the average magnitude of impacts is low and the average significance is also low. In those isolated cases where significance is high, special attention must be given to mitigation. On the whole, the NECIP will not have any significant Corridor-wide impact on the natural environment.

Herbicide Usage. Herbicide chemicals, such as ammonium sulfamate, 2, 4-dichlorophenoxyacetic acid, 2, 4, 5-trichlorophenoxyacetic acid, and picloram or their equivalents, have been used in the past and may be used along the NEC in the future as an aid in controlling the regrowth of unwanted vegetation. Contract specifications will insure the environmentally safe usage of any such application. Generally, herbicides are not directly harmful to animals and these chemicals are usually broken down into harmless end products fairly rapidly.

Table 3- 43

MAGNITUDE AND SIGNIFICANCE[1] OF POTENTIAL IMPACTS ACCORDING TO THEIR SOURCES AND PROJECT ACTIVITIES

| Project Activity | Sources of Potential Impacts Related to the Natural Environment | | | |
|---|---|---|---|---|
| | Removal of Vegetation | Erosion and Sedimentation | Generation of Solid Waste | Chemical Pollution |
| Tie Renewal | | | 4/3 | 2/1 |
| Undercutting | | | 5/1 | |
| Ballast Cleaning | | | 3/1 | |
| Cleaning & Construction of Drainage Facilities | 2/1 | | 3/1 | |
| Subgrade Stabilization | | 2/2 | | 2/2 |
| Rail Grinding | | | 1/1 | |
| Sandblasting | | | 2/4 | |
| Joint Elimination | | | 2/2 | |
| Turnout Improvements | | | 1/1 | |
| Cut and Fill | 3/2 | 2/2 | 4/1 | |

[1] The upper left-hand corner of each box indicates the magnitude of the possible impact and the lower right-hand corner indicates its significance. (5 represents the greatest and 1 is the least value of either magnitude or significance.)

Table 3- 43 (cont)

MAGNITUDE AND SIGNIFICANCE[1] OF POTENTIAL IMPACTS ACCORDING TO THEIR SOURCES AND PROJECT ACTIVITIES

| Project Activity | Sources of Potential Impacts Related to the Natural Environment | | | |
|---|---|---|---|---|
| | Removal of Vegetation | Erosion and Sedimentation | Generation of Solid Waste | Chemical Pollution |
| Improve Interlockings | | | 1/1 | |
| Rehabilitate Existing Catenary | | | 1/1 | |
| Install New Catenary | | 1/1 | | |
| Use of Paint Cleaning Agents | | | | 2/4 |
| Excavation | 3/2 | 2/3 | 4/1 | |
| Fencing Installation | 1/1 | 1/1 | 1/1 | |
| Grade Crossing Elimination | | | 2/2 | |
| Building Construction | 4/4 | 3/3 | 2/2 | 1/1 |
| Strip, Clear and Grub Grade | 4/3 | 3/2 | 4/2 | |
| Construction of Service Roads | 4/3 | 3/4 | | |
| | | | | |

[1]The upper left-hand corner of each box indicates the magnitude of the possible impact and the lower right-hand corner indicates its significance. (5 represents the greatest and 1 is the least value of either magnitude or significance).

If any are used in this project, all aspects of that use will be prepared and supervised by appropriately qualified and licensed personnel. The objectives of that supervision, and all accompanying specifications, will be to protect all sensitive areas, especially wetlands, watercourses, aquifers, and non-target vegetation. Only selective applications will be permitted. Broadcast spraying will be prohibited as will any indiscriminate, unnecessary, or uncontrolled usage.

As appropriate, applications would be made during the local, active growing season by selective spraying of stumps. An environmentally safe dye tracer (such as Red 0) may be used in order to visually mark sprayed stumps. Application methods and mixtures will conform to all state and federal regulations as applicable to the jurisdiction in which the proposed project site may be located.

Microwave Communication. The NECIP may employ a 600 channel microwave communications system with radio terminals every 20 miles for 300 miles of the 456-mile Corridor. The transmission frequency will be at either 6 GHz or 12 GHz (1 GHz is equivalent to $1 \times 10^9$ cycles per second). As microwaves are highly directional and the area of the transmitting antenna's aperture is very small (100 $cm^2$), power requirements are very low (less than 5 watts). Transmitters and receivers will be mounted on towers on or near the ROW. Tower height will vary, but will typically be between 100 and 200 feet.

Biological impact of microwaves depends on two factors, power and frequency. It has been shown that microwaves at frequencies above 10 GHz, regardless of power output, can only cause superficial skin heating because these frequencies do not penetrate the skin.[1] Thus, if the

[1] "Environmental Aspects of Microwave Radiation," Environmental Health Perspectives, McRee, Donald I., October, 1972.

same 12 GHz system is selected, this negligible impact will be all that can be expected, while the 6 GHz alternative system is in the middle frequency band within which significant biological impacts have been identified including skin, eye, and testicle damage (Table 3-44).

The American National Standards Institute has determined (1966) that ten milliwatts per square centimeter (10 $mW/cm^2$) is the maximum safe continuous microwave exposure level for any frequency.[1] The 10 mW standard is a source of some controversey. Biological effects have been observed at levels from one to ten milliwatts per square centimeter; these observations include changes in learning behavior or task performance, electromagnetic radiation perception, and possible alterations in metabolism.[2] However, these studies have limited data or are inconclusive in indicating microwave radiation as the direct cause of the observed effects. It is nevertheless important to be aware of possible influences from this source of radiation.

To determine the impact of the microwave system, the predicted power density at various distances from the antenna has been calculated (Table 3-45).[3] The power density is greatest on the axis of the antenna in the near-field region, which extends to a distance given by A/2 $\lambda$ where

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[1] "Environmental Aspects of Microwave Radiation", Environmental Health Perspectives, McRee, Donald I., October, 1972.

[2] Program for Control of Electromagnetic Pollution of the Environment: The Assessment of Biological Hazards of Nonionizing Electromagnetic Radiation, Fourth Report, Office of Telecommunications, June, 1976.

[3] Reference Data for Radio Engineers, Howard W. Sams and Company, Inc.

Table 3-44

THERMAL-BIOLOGICAL EFFECTS OF MICROWAVES

| Frequency, megahertz | Wavelength, cm | Site of major tissue effect | Major biological effects |
|---|---|---|---|
| 10,000 | 3 | Skin | Skin surface acts as reflector or absorber with heating effects |
| 10,000 | 3 | Skin | Skin heating with sensation of warmth |
| 10,000 to 3,300 | 3 to 10 | Top layers of skin, lens of eye | Lens of eye and testicles particularly susceptible |
| 10,000 to 1,000 | 3 to 30 | Lens of eye | Critical wavelength band for eye cataracts and testicular damage |
| 1,200 to 150 | 25 to 200 | Internal body organs | Damage to internal organs from overheating |
| 150 | Above 200 | | Body is transparent to waves above 200 cm |

SOURCE: "Environmental Aspects of Microwave Radiation" McRee, Donald I., Environmental Health Perspectives, October, 1974.

A=area of the antenna and $\lambda$ is the wavelength of the microwave. The maximum power density, W, in the near-field region is: W-4P/A where P is the average transmitted power. In the far-field region, the power density at a distance, d, is given by $W=AP/\lambda^2 d^2$. [1]

For a system with an average power output of five watts, a wavelength of 6 cm and an antenna aperture area of 100 $cm^2$, the maximum power density is 200 $mW/cm^2$ and the near-field extends to 0.27 feet or 8.3 centimeters. The far-field begins at a distance of $2D^2/\lambda$ where D is the diameter of the antenna, 21.2 cm, or 0.7 feet. At this distance, the power density is 30 $mW/cm^2$. The power density does not decrease below the standard until a distance of 37.3 cm or 1.2 feet from the antenna. At 100 feet from the antenna, the power density is 0.001 $mW/cm^2$. Since the antenna will be at least 100 feet above the ground, and since the power density is below 10 $mW/cm^2$ at a distance of 1.2 feet from the antenna, there are no environmental impacts expected from the microwave system. The only potentially injurious short-term exposure will be for birds that alight on or fly into the near-field region of the beam. In either case, the length of time during which the animal would be exposed would be so short as not to bring about any serious effects.

Table 3-45

POWER DENSITY AT VARIOUS DISTANCES FROM THE ANTENNA

| Distance from Antenna (feet) | Power Density ($mW/cm^2$) |
|---|---|
| 0 - 25 | 200 |
| 0.7 | 30 |
| 1.2 | 10 |
| 1.5 | 6 |
| 100 | 0.001 |

[1] Reference Data for Radio Engineers, Howard W. Sams and Company, Inc.

Threatened and Endangered Wildlife Species. The Endangered Species Act of 1973 (23 U.S.C. 1321 et seq.) states that the Secretary of the Interior shall declare a species eligible for endangered status if any of the following threats exist:

- Present or threatened destruction, modification or curtailment of its habitat or range;
- Overutilization for commercial, sporting, scientific or educational purposes;
- Disease or predation;
- Inadequacy of existing regulatory mechanisms; or
- Other natural or man-made factors affecting its continued existence.

The Act further defines a species as "endangered" if it is "in danger of extinction throughout all or a significant portion of its range", and as "threatened" if it is "likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range."

Relative to their natural habitats and/or their migratory ranges, eight endangered wildlife species could exist along the Corridor had it not been developed over the past 200 years for industrial, residential and transportation purposes (Table 3-46).

Table 3-46[1]

ENDANGERED WILDLIFE

| Common Name | Scientific Name | Known Distribution | Status |
|---|---|---|---|
| MAMMALS | | | |
| Indiana Bat | *Myotis sodalis* | Eastern and Midwestern USA | endangered |
| Eastern Cougar | *Felis concolor cougar* | USA (Eastern) | endangered |
| Delmarva Peninsula Fox Squirrel | *Sciurus niger cinereus* | USA (Maryland) | endangered |
| BIRDS | | | |
| Eskimo Curlew | *Numenius borealis* | Canada to Argentina | endangered |

[1]Based on information in the Federal Register, Volume 41, Number 208, October 27, 1976.

Table 3-46 (cont)

| Common Name | Scientific Name | Known Distribution | Status |
|---|---|---|---|
| Southern Bald Eagle | Haliaeetus leucocephalus | USA (South of 40th parallel) | endangered |
| American Peregrine Falcon | Falco peregrinus amatum | Canada, USA, Mexico | endangered |
| FISH | | | |
| Maryland Darter | Etheostoma sellare | USA (Maryland) | endangered |
| Shortnose Sturgeon | Acipenser brevirostrum | USA (Atlantic coast of U.S. and Canada) | endangered |

Although the shortnose sturgeon, the southern bald eagle, and the American peregrine falcon may exist in the vicinity of the NEC, the probability that any of these three species will be affected by the NECIP is very slight. Additionally, the NECIP will have no known impact on threatened or endangered plant species. Nevertheless, all subsequent site-specific environmental analyses will include a biogeographical survey in order to investigate the presence or absence of these species or their associated habitats.

### 3.5.6 CUMULATIVE IMPACTS

All cumulative impacts with respect to the natural environment pertain to construction activities and are relatively minor and of short duration. They can be eliminated or considerably lessened by the proper selection and timing of mitigation measures (Chapter 4). If local impacts are well mitigated, cumulative impacts will not occur. No serious cumulative impacts resulting from the NECIP have been identified.

The total numbers of bridges and curves adjacent to or within natural areas are presented by state in Tables 3-47 and 3-48. It should be noted that numbers and percents are not additive, because in many instances a bridge or curve is near more than one type of area. Thirty-six

Table 3-47

NUMBER AND PERCENT OF BRIDGES REQUIRING WORK ADJACENT TO OR WITHIN NATURAL AREAS[1]

| STATE | Number of Bridges | | | Bridges Adjacent to or Within Natural Areas[3] | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Wetlands or Water | | Vacant | | Parks | |
| | UG[1] | OH[2] | Total | Number | Percent | Number | Percent | Number | Percent |
| Massachusetts | 8 | 24 | 32 | 8 | 25% | 7 | 22% | 0 | 0% |
| Rhode Island | 17 | 12 | 29 | 10 | 34% | 9 | 30% | 0 | 0% |
| Connecticut | 54 | 14 | 68 | 48 | 71% | 16 | 23% | 0 | 0% |
| New York | 19 | 0 | 19 | 5 | 26% | 0 | 0% | 0 | 0% |
| New Jersey | 55 | 2 | 57 | 10 | 18% | 1 | 2% | 1 | 2% |
| Pennsylvania | 43 | 4 | 47 | 8 | 17% | 0 | 21% | 2 | 4% |
| Delaware | 25 | 0 | 25 | 4 | 16% | 0 | 0% | 0 | 0% |
| Maryland | 30 | 3 | 33 | 20 | 61% | 2 | 6% | 0 | 0% |
| District of Columbia | 1 | 0 | 1 | 0 | 0% | 0 | 0% | 0 | 0% |
| TOTAL (average in %) | 252 | 59 | 311 | 113 | 36% | 35 | 11% | 3 | 1% |

[1]Undergrade bridges - see Appendix B for specific locations.

[2]Overhead bridges.

[3]Numbers and percents are not additive because a bridge may be adjacent to more than one natural area.

Table 3-48

NUMBER AND PERCENT OF CURVES REQUIRING WORK ADJACENT TO OR WITHIN NATURAL AREAS[1]

| State | Total Number Of Curves | Curves Adjacent to or Within Natural Areas[2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | Wetlands or Water | | Vacant | | Parks | |
| | | Number | Percent | Number | Percent | Number | Percent |
| District of Columbia | 0 | 0 | 0% | 0 | 0% | 0 | 0% |
| Maryland | 23 | 2 | 9% | 7 | 29% | 1 | 4% |
| Delaware | 5 | 0 | 0% | 1 | 20% | 0 | 0% |
| Pennsylvania | 4 | 1 | 25% | 0 | 0% | 1 | 25% |
| New Jersey | 8 | 2 | 22% | 0 | 0% | 4 | 44% |
| New York | 2 | 0 | 0% | 0 | 0% | 0 | 0% |
| Connecticut | 18 | 12 | 67% | 1 | 6% | 0 | 0% |
| Rhode Island | 11 | 0 | 0% | 3 | 15% | 0 | 0% |
| Massachusetts | 5 | 3 | 60% | 0 | 0% | 0 | 0% |
| Total | 76 | 22 | 29% | 11 | 14% | 8 | 10% |

[1] See Appendix A for specific locations.

[2] Numbers and percents are not additive because a curve may be adjacent to more than one type of natural area.

percent (113) of the bridges and 29 percent (22) of the curves are located in or adjacent to wetlands or watercourses. In those instances, care will be exercised to avoid impacting the natural environment during project activities at those sites.

It has been estimated that overall, not more than 12 percent of the NECIP passes through sensitive environments defined as wetlands and watercourses. The activities associated with the proposed rehabilitation of the railroad will be essentially controllable and will not affect the natural environment adjacent to the ROW. The cumulative magnitude and significance of all probable project impacts are summarized in Table 3-43, and from a programmatic point of view, no significant impacts on the natural environment are expected.

The following quantitative summary (Table 3-49) of activities and associated major sources of potential impacts provides a condensation of those factors considered in evaluating the potential impacts of the NECIP upon the natural environment.

Consistency With Executive Order 11990: Protection of Wetlands. Executive Order 11990, issued May 24, 1977, requires that all Federal agencies avoid undertaking new construction in wetlands unless that agency finds: (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm which might otherwise result from such use.

Approximately 12 percent of the area within 3,000 feet on either side of the ROW consists of wetlands (see Table 3-42). In virtually every instance where work on the ROW adjoins those wetlands, the required activities will not significantly affect the survival or quality of the wetlands. That is, minor erosion and sedimentation and the minor migration of other materials, such as paint or chemicals off the ROW, will not cause any significant impact on these wetlands. Where impacts are anticipated, appropriate mitigation will be incorporated to the maximum extent practicable. Minor intrusions off the ROW have occurred as a result of past activities and there appears to be no historical evidence which shows any significant cumulative impacts upon present day wetlands. Those activities which are proposed to go beyond the roadbed and which may involve a wetland, such as a bridge replacement, will include a finding in compliance with this Executive Order as part of their site-specific documentation.

Table 3-49

SUMMARY OF PROJECT ACTIVITIES AND MAJOR SOURCES OF POTENTIAL IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | EXTENT OF ACTIVITY | MAJOR SOURCE(S) OF POTENTIAL IMPACT | QUANTITY AND KIND OF MATERIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tie Renewal | x | x | | | | | | | | | | 400 miles—concrete<br>616 miles—wood | Generation of solid waste<br>Chemical Pollution | 1.1 million concrete ties<br>900,000 wood ties<br>Creosote-contains polycyclic aromatic hydrocarbons |
| Undercutting | x | | | | | | | | | | | 509 miles | Generation of solid waste | Use of 3/8 inch screen will generate approximately 356 tons of dirt and fines per mile of single track |
| Ballast Cleaning | x | | | | | | | | | | | 495 miles | | |
| Cleaning and Construction of Drainage Facilities | x | x | x | x | | | x | | | | | 85 miles | Generation of solid waste<br>Vegetation removal (potential erosion and sedimentation) | Cleaning activities generate significant amounts of organic litter and debris<br>Where new drainage facilities are installed there will be increased soil disturbance and exposed soils[1] |

[1] See Chapter 1 for more details on extent and location of specific activities.

Table 3-49 (cont)

SUMMARY OF PROJECT ACTIVITIES AND MAJOR SOURCES OF POTENTIAL IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | EXTENT OF ACTIVITY | MAJOR SOURCE(S) OF POTENTIAL IMPACT | QUANTITY AND KIND OF MATERIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subgrade Stabilization | x | x | | | | | | | | | | 58,080 feet | Chemical pollution | Lime slurry injections may affect pH of water under tracks |
| | | | | | | | | | | | | | Potential Erosion and Sedimentation | Added fill used to stabilize an area[1] |
| Rail Grinding | x | x | | | | | | | | | | 1,008 miles | Generation of solid waste | Deposition of fines into roadbed that may clog ballast causing poor drainage |
| Sandblasting | | | x | | | | x | | | x | x | 400 bridges most of which will be sandblasted, 11 stations, approx 30,000 old catenary poles | | |
| Joint Elimination | x | x | | | | | | | | | | 18,000 | Generation of solid waste | Solid waste in the form of excess rail, joints and metal fines[1] |
| Turnout Improvements | x | x | | | | | | | | | | 530 | | |

[1] See Chapter 1 for more details on extent and location of specific activities.

Table 3-49 (cont)

SUMMARY OF PROJECT ACTIVITIES AND MAJOR SOURCES OF POTENTIAL IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | EXTENT OF ACTIVITY | MAJOR SOURCE(S) OF POTENTIAL IMPACT | QUANTITY AND KIND OF MATERIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cut and Fill | | x | x | | | x | | | | | | To change ground surface level[1] for roadbed construction. May be necessary to widen roadbed and subgrade for curve realignments and bridges | Vegetation removal (potential erosion and sedimentation) | Alteration of habitats and exposure of soils[1] |
| | | | | | | | | | | | | | Solid waste generation | Waste in the form of earth and rock from blasting activities |

[1] See Chapter 1 for more details on extent and location of specific activities.

Table 3-49 (cont)

SUMMARY OF PROJECT ACTIVITIES AND MAJOR SOURCES OF POTENTIAL IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | EXTENT OF ACTIVITY | MAJOR SOURCE(S) OF POTENTIAL IMPACT | QUANTITY AND KIND OF MATERIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cut and Fill (cont.) | | | | | | | | | | | | | Potential sedimentation and erosion from new fill | May increase sedimentation/erosion during work because of increased disturbed earth and soils[1]. This may cause changed water quality or fill existing drainage channels[1] |
| Improve Interlocking | | x | | | | | x | x | | | | 27 between Washington, DC and New York 22 between New York and Boston | Generation of solid waste | Solid waste in form of metal scrap and old signaling and catenary equipment from relocation activities[1] |
| Rehabilitate Existing Catenary | | | | | | | x | | | | | 1,220 miles | Generation of solid waste | Waste in the form of old catenary |
| Install New Catenary | | | | | | | x | | | | | 344 miles | Sedimentation and erosion | Pour concrete footings |

[1] See Chapter 1 for more details on extent and location of specific activities.

Table 3-49 (cont)

SUMMARY OF PROJECT ACTIVITIES AND MAJOR SOURCES OF POTENTIAL IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | EXTENT OF ACTIVITY | MAJOR SOURCE(S) OF POTENTIAL IMPACT | QUANTITY AND KIND OF MATERIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Use of Paint and Cleaning Agents | x | | x | x | x | | x | | | x | x | 172 bridges repaired, 157 bridges upgraded—these will include painting; approximately 30,000 catenary poles; 11 stations. | Chemical pollution | Deposition of paint and cleaning agents into soil or ballast, it may be carried away in runoff or directly enter water system affecting water quality [1] |
| Excavation | | x | x | x | x | | x | x | x | x | x | Systemwide | Solid waste generation | Large amounts of solid waste in form of earth, rock[1] |
| | | | | | | | | | | | | | Vegetation removal | Alteration of habitat and exposure of soils to erosion |

[1] See Chapter 1 for more details on extent and location of specific activities.

Table 3-49 (cont)

SUMMARY OF PROJECT ACTIVITIES AND MAJOR SOURCES OF POTENTIAL IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | EXTENT OF ACTIVITY | MAJOR SOURCE(S) OF POTENTIAL IMPACT | QUANTITY AND KIND OF MATERIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavation (cont.) | | | | | | | | | | | | | Potential erosion and sedimentation | Excavated materials may be stored at site, increased rates and energy of storm-water runoff |
| Fencing Installation | | | x | | x | | x | | | x | x | 114 miles ROW fencing<br><br>147,000 feet overhead bridge fence | Vegetation removal<br><br>Potential sedimentation and erosion<br><br>Solid waste generation | Cutting and clearing of vegetation for specified distance on either side of fence causing habitat destruction.<br><br>Displacement of soils from foundation hole, may generate fill material[1] |
| Grade Crossing Elimination | | | | | | x | | | | | | 19 crossings (16 private & 3 private with public use) to be eliminated as part of the NEC | Solid waste generation | Rubble and metal wastes will be generated from tearing up approaches[1] |

[1] See Chapter 1 for more details on extent and location of specific activities.

Table 3-49 (cont)

SUMMARY OF PROJECT ACTIVITIES AND MAJOR SOURCES OF POTENTIAL IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | EXTENT OF ACTIVITY | MAJOR SOURCE(S) OF POTENTIAL IMPACT | QUANTITY AND KIND OF MATERIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Construction of Service Roads | x | x | x | x | x | x | x | x | x | x | x | Systemwide | Vegetation removal erosion/sedimentation | A number of roads will be required for access and maintenance within ROW. May cause the destruction of habitats and increased sedimentation erosion, on-track equipment will cause less possible impact than equipment using service roads[1] |

[1] See Chapter 1 for more details on extent and location of specific activities.

Table 3-49 (cont)

SUMMARY OF PROJECT ACTIVITIES AND MAJOR SOURCES OF POTENTIAL IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | EXTENT OF ACTIVITY | MAJOR SOURCE(S) OF POTENTIAL IMPACT | QUANTITY AND KIND OF MATERIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Building Construction | | | | | | | x | | x | x | x | 19 mainten-ance and ser-vice facili-ties, 15 sta-tions, 36 sub-stations | Vegetation removal | Habitat alteration and pot-ential exposure of soils to erosion |
| | | | | | | | | | | | | | Erosion and Sedimen-tation | Excavated and fill material |
| | | | | | | | | | | | | (11 stations and the main-tenance fac-ilities will require site specific anaylsis) | Solid waste genera-tion | In the form of excavated material, and construction materials |
| | | | | | | | | | | | | | Chemical pollution | Paint and cleaning agents |
| Strip and Clear, Grub, Grade | x | x | x | x | x | x | x | x | x | x | x | Systemwide | Vegetation removal | Altered habitat and poten-tial exposure of soil to erosion[1] |
| | | | | | | | | | | | | | Potential erosion and sedimentation | Increase rates and energy of stormwater runoff[1] |
| | | | | | | | | | | | | | Solid Waste Genera-tion | Solid waste in form of slash materials from cut-ting, clearing & grubbing[1] |

[1] See Chapter 1 for more details on extent and location of specific activities.

# 3.6 LAND USE AND SOCIO-ECONOMICS

## 3.6.1 SUMMARY

An estimated 3,700 permanent jobs are expected to be created by 1990 as a result of operations of the improved intercity service. Allowing for the future job impact of trip diversions from other transportation modes, net new jobs created as a result of the NECIP are estimated at 2,805.

The degree of improved mobility represented by the NECIP should not cause a significant redistribution of population and employment. Only minor impacts are expected on local planning, accessibility, community cohesion, development potential and local government services and revenues. System safety improvements will benefit both patrons and the general population. ROW fencing and new electrification may be considered objectionable in some areas.

Construction employment is estimated at 36,094 person-years of labor. Other construction-period impacts will be limited; the land acquisition requirements of the program are minimal. Neither unusual disruption nor residential dislocation is expected.

## 3.6.2 EXISTING CONDITIONS

Population. The NEC mainline traverses 18 Standard Metropolitan Statistical Areas (SMSAs) in eight states, within which nearly 30 million people or 14 percent of the total U.S. population live (Table 3-50). The SMSAs comprise 94 percent of the Corridor land area and 98 percent of the NEC population, and are continuous from Washington, D.C., to Boston, Massachusetts, with only two breaks: one between New Haven and New London and the other between New London and Providence.

Since 1960, the NEC population has grown at a slower rate than that of the nation as a whole. For the decade from 1960 to 1970, there was a 12 percent net increase in population in the 18 SMSAs. From 1970 to 1973, there was a slight decrease in the NEC SMSAs overall population.

Table 3-50

NEC POPULATION BY SMSA
1960, 1970, 1973 (In Thousands)
(1973 Boundary Divisions)

| | 1960 | 1970 | 1973 | Percent Change 1960-1970 | Percent Change 1970-1973 |
|---|---|---|---|---|---|
| All SMSAs National | 173,685 | 203,212 | 209,212 | 17 | 3 |
| Washington, D.C. | 2,097 | 2,910 | 3,020 | 38 | 3 |
| Baltimore | 1,804 | 2,071 | 2,128 | 14 | 2 |
| Wilmington | 415 | 499 | 516 | 20 | 3 |
| Philadelphia | 4,343 | 4,824 | 4,806 | 11 | 0 |
| Trenton | 266 | 304 | 315 | 14 | 3 |
| New Brunswick | 434 | 583 | 594 | 34 | 2 |
| Newark | 1,833 | 2,057 | 2,053 | 12 | 0 |
| Paterson | 407 | 461 | 461 | 13 | 0 |
| Jersey City | 611 | 608 | 598 | 0 | -1 |
| New York | 9,540 | 9,974 | 9,739 | 5 | -2 |
| Stamford | 178 | 206 | 202 | 15 | -1 |
| Norwalk | 97 | 120 | 120 | 23 | 0 |
| Bridgeport | 338 | 389 | 384 | 15 | -1 |
| New Haven | 321 | 356 | 354 | 10 | 0 |
| New London | 171 | 209 | 214 | 22 | 2 |
| Providence | 821 | 914 | 926 | 11 | 1 |
| Brockton | 149 | 190 | 203 | 27 | 7 |
| Boston | 2,688 | 2,899 | 2,898 | 7 | 0 |
| NEC TOTAL | 26,513 | 29,574 | 29,531 | 12 | 0 |

SOURCES: Statistical Abstract of the U.S., U.S. Department of Commerce, Bureau of Census, 1975.
Census of Population, U.S. Department of Commerce, Bureau of Census, 1970.
Bureau of Census Series P-25 No. 537, U.S. Department of Commerce, Bureau of Census.

The majority of NEC central cities have been losing population due to the out-migration of middle income families from the inner cities to metropolitan area suburbs. This has been offset somewhat by the migration of low income families into central cities. NEC urban area population projections by the National Planning Association (Table 1-8) forecast a continuation of the present trend of slow growth. Population is projected to increase only 5.3 percent between 1975 and 1990.

Population characteristics for NEC SMSAs are similar to those for all national SMSAs in terms of male-female distribution, minority population, age characteristics and educational levels. The median age of the total NEC population is 30, which is two years over the national average for all SMSAs.

Mobility characteristics of the NEC SMSA population are represented by the means of transportation used to reach places of employment (Table 3-51). In general, automobiles are the most frequently used means of transportation. In 1970, 62 percent of the NEC working population drove a car to work. The other most frequent modes of transportation to work are auto (passenger), bus, rapid transit and commuter rail, in that order.

The NEC from Philadelphia through Norwalk has the highest rate of railroad usage and an average automobile driver rate which is ten percent lower than the overall average for the nation. In the four SMSAs surrounding and including New York City, there are considerably more rail passengers. For example, in 1970, Stamford had the largest percentage of persons using the railroad to commute to and from work. New York City, Boston, Jersey City, and Philadelphia have a high percentage of subway riders.

Table 3-51

NEC TRANSPORTATION TO WORK BY SMSA, 1970

| SMSA | Percent by Mode: Auto Driver | Auto Passenger | Bus | Commuter Rail | Other[1] |
|---|---|---|---|---|---|
| Washington, D.C. | 60.4 | 13.2 | 15.3 | 0.1 | 0.1 |
| Baltimore | 61.3 | 14.8 | 12.9 | 1.0 | 0.1 |
| Wilmington | 69.5 | 14.4 | 3.9 | 0.5 | 0.03 |
| Philadelphia | 57.3 | 10.1 | 13.2 | 3.1 | 4.1 |
| Trenton | 66.5 | 12.6 | 5.8 | 2.0 | 0.05 |
| New Brunswick | 63.0 | 11.0 | 4.0 | 1.0 | 1.0 |
| Newark | 61.2 | 10.3 | 13.5 | 4.2 | 0.5 |
| Paterson | 66.0 | 10.0 | 12.0 | 2.0 | 1.0 |
| Jersey City | 39.0 | 9.3 | 28.0 | 1.3 | 6.1 |
| New York | 34.5 | 6.0 | 11.4 | 4.0 | 31.5 |
| Stamford | 62.0 | 9.8 | 3.1 | 12.2 | 0.4 |
| Norwalk | 70.7 | 9.3 | 0.9 | 8.7 | 0.0 |
| Bridgeport | 72.4 | 11.7 | 6.5 | 0.7 | 0.0 |
| New Haven | 68.3 | 11.4 | 9.0 | 0.2 | 0.0 |
| New London | 68.1 | 13.5 | 0.6 | 0.1 | 2.0 |
| Providence | 67.1 | 14.6 | 4.5 | 0.1 | 0.3 |
| Brockton | 71.0 | 15.0 | 2.0 | 0.6 | 0.2 |
| Boston | 56.0 | 11.0 | 12.0 | 1.2 | 7.0 |
| AVERAGE | 58.1 | 10.8 | 13.4 | 3.0 | 14.7 |

[1]Subway, Walking, Bicycling, etc.

SOURCE: General Social and Economic Characteristics, U.S. Department of Commerce, Bureau of the Census, 1970.

New York City seems to be the exception to the normal transportation pattern because subway and rail usage is competitive with the automobile. Only in New York does there seem to be a somewhat more varied utilization of different transportation modes; it may be deduced from these figures that New York is the only SMSA with extensive service on transit alternatives. In addition, traffic is usually congested enough to make driving unattractive even to commuters who own cars.

Trends on which the patronage forecast were based indicate that since 1970, more people are seeking means of transportation other than automobiles to reach their work places. The energy crisis has resulted in a shifting or changing of lifestyles. Traffic congestion in the NEC has also contributed to the trend of seeking other transportation modes. This trend can be expected to increase in all NEC SMSAs, considering the present energy crisis in conjunction with high fuel costs.

Housing. In general, the housing growth rate has increased steadily along the Corridor SMSAs, although this increase has been lower than the national average for SMSAs. Compared to housing conditions in SMSAs nationwide, the NEC has a lesser rate of increase in the number of dwelling units; more multi-unit buildings and fewer single-unit ones; more rental units and fewer owner-occupied buildings; older housing stock; and higher rents/housing costs. Data from 1975 indicate that trends seen in 1970 data are continuing, in particular regarding costs, unit type and housing shortage/demand.[1]

Land Use. In earlier planning studies conducted by U.S. DOT, a land use study region was defined, extending from Manchester, New Hampshire, to Norfolk, Virginia.[2] The region reaches inland some 80 to 120 miles from the

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[1] Annual Housing Survey 1975, U.S. Department of Commerce, Bureau of the Census.

[2] Recommendations for Northeast Corridor Transportation, Volume 3, U.S. Department of Transportation, 1971.

Atlantic Ocean westward to interior cities such as Albany, Harrisburg and Richmond.

Land use in the study region is apportioned into seven categories (Table 3-52). In 1971, the majority of this land (72 percent) was undeveloped or agricultural. Residential, recreational and transportation systems utilized 24 percent of the total area while the remaining four percent was utilized for commercial and industrial uses and public facilities.

Commercial/industrial land use in the study region represents two percent of the total land area. Even though this is a relatively small area, any significant increase in commercial, office or factory stock will have important repercussions on transportation service requirements. Other land uses include public facilities (2 percent), transportation and parks/recreation (6 percent each), residential (12 percent), agricultural (31 percent) and undeveloped (41 percent). By 1985, assuming no major shifts in land use patterns, and based on the most recent population growth forecast for the region, land development is expected to increase by only 3.4 percent.[1]

Population settlement within the land use study region exhibits characteristics of two density patterns: that of an unbroken belt of development, with 100 persons per square mile (exurban gross density) or that of a chain of discrete metropolitan areas, with 1,000 persons per square mile as a baseline scale. The average population density is nearly 700 persons per square mile. For the 18 SMSAs which lie at the core of the study region, the average density for residential land rises to 2,450 persons per square mile.

Population densities for the cities and towns traversed by the NEC mainline are higher still, ranging from under 2,000 persons per square mile in Connecticut and Rhode Island to 37,000 persons per square mile in New York, and averaging 5,900 persons per square mile (Table 3-53).

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[1] Recommendations for Northeast Corridor Transportation, Volume 3, U.S. Department of Transportation, 1971.

Table 3-52

NEC LAND USE DISTRIBUTION

| Land Classification | Percent of Total Land |
|---|---|
| Residential | 12.0 |
| Commercial/Industrial | 2.0 |
| Undeveloped | 41.0 |
| Parks-Recreation | 6.0 |
| Public Facilities | 2.0 |
| Transportation | 6.0 |
| Agriculture | 31.0 |
| TOTAL | 100.0 |

SOURCES: Recommendations for NEC Transportation, Volume 3, U.S. Department of Transportation, Department of Commerce, 1971.

County and City Data Book, U.S. Department of Commerce, Bureau of the Census, 1970.

Table 3-53

POPULATION DENSITY[1]

| State | Persons Per Square Mile |
|---|---|
| Massachusetts | 4,349 |
| Rhode Island | 1,313 |
| Connecticut | 1,697 |
| New York | 37,109 |
| New Jersey | 10,080 |
| Pennsylvania | 14,465 |
| Delaware | 5,135 |
| Maryland/District of Columbia | 9,530 |
| AVERAGE | 5,904 |

[1]Computed for the cities and towns through which the Corridor passes.

SOURCE: City and County Data Book. U.S. Department of Commerce, Bureau of the Census, 1972.

The following discussion summarizes the present land uses within a 4,000 foot strip adjacent to the NEC mainline. These land uses are graphically delineated in the Environmental Planning Factors Exhibits, Volume II.

- District of Columbia. The Washington, D.C., Corridor area is primarily industrial with residential areas located on the fringe of the Corridor strip. Park and recreation areas adjacent to the tracks include the National Arboretum and the Kenilworth Aquatic Gardens. The Anacostia River is next to the Aquatic Gardens and adjacent to Maryland.

- Maryland. In Prince Georges County, the Corridor passes through an industrial area around the New Carrollton Station, and small scattered residential developments. There are wetlands at the Prince Georges County-Anne Arundel County line. The Corridor area in Anne Arundel County is predominantly open space/undeveloped land with low density residential development. Two rivers, the Patuxent and Little Patuxent, traverse this section; there are wetland areas along the river valleys. Between the two rivers is Fort Meade Military Reservation. Baltimore/Washington International Airport is adjacent to the tracks and the Baltimore Washington Parkway intersects the tracks. Baltimore County is highly urbanized. Beyond the city, however, there are scattered wetlands around Bird River near the Baltimore and Harford County line. In Harford County, the Corridor traverses open space, with small residential pockets. Aberdeen Proving Ground Military Installation lies north of the Gunpowder River. The Susquehanna River divides the counties of Harford and Cecil. Cecil County includes the towns of Havre de Grace and Elkton; remaining land is open space, with spot residential uses and wetlands around Mill Creek and Furnace Bay.

- Delaware. New Castle County is primarily an urbanized area with scattered industrial uses adjacent to the tracks near the cities of Newark and Wilmington. There are extensive wetlands around the Christina and Delaware Rivers.

- Pennsylvania. In Pennsylvania, the Corridor passes through Delaware, Philadelphia, and Bucks Counties. The Corridor area, which includes the Philadelphia SMSA, is highly developed with little open space or vacant land.

- New Jersey. The Corridor enters New Jersey at Trenton, then traverses a relatively thinly populated area, predominantly agricultural. Wetlands and recreational areas characterize the coastal plain to the east. At New Brunswick, the Corridor enters a highly industrialized sector extending through the Newark SMSA. Beyond Newark, near the New York State line, are additional wetlands (Hackensack Meadowlands); Newark Airport is also located along the Corridor area.

- New York. Crossing the Hudson River, the Corridor enters New York City. Population densities range from 160,000 persons per square mile within the city to about 37,000 persons per square mile along the Corridor north of the city. The major industrial areas are located in New York City. Residential land uses predominate in New Rochelle, Larchmont and Rye.

- Connecticut. Residential land uses are continuous from the New York state line to New Haven. There are major industrial areas in Stamford and New Haven along the Corridor. Wetlands and swamp lands characterize the land from New Haven to New London, with scattered residential development. Between these two cities, within 4,000 feet of the Corridor is Cockaponset State Forest in New Haven County and Rocky Neck State Park in New London County.

From New London to the Rhode Island State line, the Corridor passes by Bluff Point State Park and through the towns of Groton, Mystic, and Stonington. Wetlands and agricultural uses predominate in the non-urbanized areas.

- Rhode Island. Primarily undeveloped, wetland and agricultural areas characterize Rhode Island from the state line to the Washington County line, especially around the Pawcatuck River. The Providence SMSA, from Kent County to the Massachusetts state line, is heavily industrialized.

- Massachusetts. Predominantly undeveloped areas and wetlands are found in Bristol and Norfolk Counties, particularly in the Massapaug Lake and Neponset River Reservation vicinity. Norwood Memorial Airport is just south of Route 128 Station in Norfolk County. Industrial land uses are concentrated in Boston, and residential areas can be found in Attleboro, Bristol County, and in Dedham and Boston in Suffolk County.

Regional Economy. The 18 SMSAs traversed by the NEC rail system account for nearly 15 percent of the national labor force (1975), 15 percent of all manufacturing employment (1972), and 18 percent of value added by manufacturing (1972). For most of the post-World War II period, the NEC region has been growing at a slower rate than the nation. The relative economic decline of the 18 NEC SMSAs, measured by the size of the labor force, was small, though measurable, for the decade ending 1970 (Table 3-54). Between 1970 and 1975, the long-term trend has accelerated, resulting in a labor force growth of only 2.2 percent while the national labor force grew 15.7 percent. The New York metropolitan area is without question the most significant component of this trend. New York's very slow rate of labor force growth between 1960 and 1970 (4.4 percent) was primarily responsible for the failure of the NEC to keep pace with national trends, evidenced by the fact that the remaining 17 SMSAs in the region as a group exceeded the national growth rate in this period.

Since 1970, the New York metropolitan area has experienced a loss of approximately 100,000 workers per year. The remainder of the region grew sufficiently between 1970 and 1975 to offset New York's loss and register a slight gain for the NEC as a whole, but the region outside of New York

Table 3-54

CIVILIAN LABOR FORCE, U.S. AND NEC, BY SMSAs

1960,1970,1975

| SMSA | 1960 | 1970 | 1975* | Percent Change 1960-1970 | Percent Change 1970-1975 |
|---|---|---|---|---|---|
| United States | 68,144,079 | 80,051,046 | 92,600,000 | 17.5 | 15.7 |
| Washington, D.C. | 815,056 | 1,211,169 | 1,413,259 | 48.6 | 16.7 |
| Baltimore | 679,460 | 840,003 | 935,000 | 23.6 | 11.3 |
| Wilmington | 144,039 | 199,716 | 223,610 | 38.7 | 11.9 |
| Philadelphia | 1,729,944 | 1,950,005 | 2,019,000 | 12.7 | 3.5 |
| Trenton | 113,074 | 132,107 | 146,630 | 16.8 | 11.0 |
| New Brunswick | 170,826 | 247,422 | 280,347 | 44.8 | 13.3 |
| Newark | 712,678 | 791,342 | 820,954 | 11.0 | 3.7 |
| Paterson | 492,925 | 599,023 | 626,758 | 21.5 | 4.6 |
| Jersey City | 267,535 | 267,319 | 253,674 | 0 | -5.1 |
| New York | 4,586,236 | 4,789,182 | 4,300,893 | 4.4 | -10.2 |
| Stamford | 75,655 | 89,450 | 103,317 | 18.2 | 15.5 |
| Norwalk | 40,687 | 52,602 | 60,733 | 29.3 | 15.4 |
| Bridgeport | 139,884 | 169,536 | 184,878 | 21.2 | 9.0 |
| New Haven | 132,411 | 154,558 | 194,294 | 16.7 | 25.7 |
| New London | 54,276 | 74,510 | 97,301 | 37.3 | 30.6 |
| Providence | 331,014 | 386,696 | 429,735 | 16.8 | 11.1 |
| Brockton | 58,620 | 77,083 | 75,064 | 31.5 | -2.6 |
| Boston | 1,063,625 | 1,177,942 | 1,341,000 | 10.7 | 13.8 |
| Total NEC | 11,607,945 | 13,209,665 | 13,506,447 | 13.8 | 2.2 |

*1975 statistics adjusted to reflect SMSA boundary definitions of 1970.

SOURCES: County and City Data Book, U.S. Department of Commerce, Bureau of the Census, 1972; Local Area Labor Statistics, U.S. Department of Commerce, Bureau of Labor Statistics, 1977.

grew at a rate well below that of the United States (9.3 percent vs. 15.7 percent). Thus, the decline of the NEC relative to the nation appears to be a long-term trend, which is accelerating and becoming increasingly widespread among the region's metropolitan areas. Generally, the smaller, more suburban areas have fared better over the 1960-1975 period than the larger, older areas whose central cities have long been losing population and jobs (Table 3-55).

The NEC area unemployment rate, both for 1970 and for November 1976, is below the national average, supported particularly by the Washington and Boston areas (Table 3-56). Unemployment in the central cities is generally higher than the rate for the entire SMSA. The maintenance of NEC unemployment at lower than national rates has been achieved by adjustments in the size of the labor force, in response to limited new job opportunities: the net increase of new additions to the labor force over retirements has been balanced by out-migrations.

The greatest regional economic change is evident in the manufacturing sector (Table 3-57). While the share of total employment represented by manufacturing has been declining nationally, the number of manufacturing jobs has increased. In the NEC, however, the decline has been absolute, decreasing from 3.4 million manufacturing jobs in 1967 to 3 million in 1972.[1,2]

Many factors are responsible for the shift of manufacturing jobs from the Northeast to the South and Southwest, among them the corporate search for less extensive unionization, lower wage rates, cheaper energy, favorable tax treatment and other incentives, and the advantages to employees of a lower cost of living and warmer climate. When combined with a decreasing economy of scale in manufacturing and major improvements in the national transportation network, these advantages made large plants concentrated near large markets less attractive and spurred decentralization.

Service sector employment in the NEC has failed over the past 15 years to grow at a rate sufficient to compensate for the loss of manufacturing jobs

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[1] County and City Data Book, U.S. Bureau of the Census, 1972

[2] Census of Manufacturers, U.S. Bureau of the Census, 1972.

Table 3-55

CIVILIAN LABOR FORCE, CENTRAL CITIES OF NEC SMSAs[1]
1960, 1970

| | 1960 | 1970 | Percent Change 1960-1970 |
|---|---|---|---|
| Washington, D.C. | 356,297 | 348,113 | -2.3 |
| Baltimore | 387,293 | 369,823 | -4.5 |
| Philadelphia | 842,988 | 800,326 | -5.1 |
| Trenton | 48,605 | 43,421 | -10.7 |
| Newark | 176,814 | 146,681 | -17.0 |
| Jersey City | 119,034 | 109,812 | -7.7 |
| New York | 3,487,572 | 3,330,803 | -4.5 |
| Stamford | 41,336 | 49,509 | 19.8 |
| Norwalk | 29,753 | 33,897 | 13.9 |
| Bridgeport | 67,781 | 68,549 | 1.1 |
| New Haven | 66,640 | 59,166 | -11.2 |
| Providence | 85,402 | 77,838 | -8.9 |
| Brockton | 29,794 | 36,754 | 23.4 |
| Boston | 303,494 | 278,607 | -8.2 |

[1]Cities comprising less than 20 percent of total SMSA Labor Force (1970) not listed.

SOURCES: County and City Data Book, U.S. Department of Commerce, Bureau of the Census, 1972; County and City Data Book, U.S. Department of Commerce, Bureau of the Census, 1962.

Table 3-56

UNEMPLOYMENT RATES, U.S. AND NEC BY SMSAs AND CENTER CITIES 1970 - NOVEMBER 1976 (percent)

| | SMSA | | Center City[1] |
|---|---|---|---|
| | 1970 | Nov. 1976 | Nov. 1976 |
| United States | 4.4 | 8.0 | |
| Washington, D.C. | 2.7 | 5.0 | 6.9 |
| Baltimore | 3.5 | 6.7 | 8.3 |
| Wilmington | 3.8 | 8.0 | |
| Philadelphia | 3.7 | 8.3 | 9.5 |
| Trenton | 3.5 | 5.4 | 7.7 |
| New Brunswick | 3.0 | 7.2 | |
| Newark | 3.7 | 7.7 | 13.6 |
| Paterson | 3.7 | 8.9 | |
| Jersey City | 4.7 | 9.4 | 8.6 |
| New York | 3.8 | 9.2 | 9.6 |
| Stamford | 2.3 | 6.6 | 8.7 |
| Norwalk | 2.7 | 6.3 | 7.5 |
| Bridgeport | 3.8 | 9.2 | 11.0 |
| New Haven | 3.4 | 8.9 | 9.9 |
| New London | 3.9 | 6.8 | |
| Providence | 3.9 | 8.0 | 9.0 |
| Brockton | 3.7 | 6.0 | 6.0 |
| Boston | 3.5 | 5.7 | 7.0 |
| NEC Total | 3.6 | 7.3 | 9.3 |

[1]Cities comprising less than 20 percent of total SMSA labor force not listed.

SOURCES: County and City Data Book, U.S. Department of Commerce, Bureau of the Census, 1972; Local Area Unemployment Statistics, Monthly Labor Review, U.S. Department of Commerce, Bureau of Labor Statistics, 1977.

Table 3-57

PERCENT EMPLOYMENT BY INDUSTRY, U.S. AND NEC BY SMSA

| | Manufacturing | | Wholesale & Retail Trade | | Construction | | Government | | Services[1] | Educational Services | | Other | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1960 | 1970 | 1960 | 1970 | 1960 | 1970 | 1960 | 1970 | 1970 | 1960 | 1970 | 1960 | 1970 |
| United States | 27.1 | 25.9 | 18.2 | 20.1 | 5.9 | 6.0 | 4.6 | 16.1 | 7.7 | 5.3 | 8.0 | 38.9 | 16.2 |
| Washington, D.C. | 7.5 | 6.5 | 15.1 | 16.8 | 6.2 | 5.7 | 26.9 | 39.1 | 9.6 | 5.7 | 8.5 | 38.6 | 13.8 |
| Baltimore | 30.2 | 25.2 | 17.8 | 19.4 | 6.0 | 6.2 | 7.0 | 21.0 | 7.1 | 4.6 | 7.4 | 34.4 | 13.7 |
| Wilmington | 37.5 | 32.4 | 15.6 | 18.6 | 6.3 | 7.0 | 3.3 | 14.2 | 7.9 | 4.8 | 8.2 | 32.5 | 11.7 |
| Philadelphia | 35.8 | 30.8 | 17.7 | 20.0 | 5.0 | 5.2 | 4.5 | 14.4 | 7.2 | 4.4 | 7.0 | 32.6 | 15.4 |
| Trenton | 32.0 | 27.7 | 14.8 | 15.5 | 6.1 | 5.3 | 8.4 | 21.6 | 8.6 | 7.7 | 10.7 | 31.0 | 10.6 |
| New Brunswick | 44.1 | 38.9 | 15.7 | 18.2 | 5.6 | 5.0 | 4.3 | 13.1 | 5.4 | 4.9 | 7.8 | 25.4 | 11.6 |
| Newark | 35.6 | 32.7 | 16.6 | 18.1 | 4.6 | 4.7 | 3.8 | 13.4 | 8.0 | 4.2 | 6.8 | 35.2 | 16.3 |
| Paterson | 38.2 | 33.1 | 18.1 | 21.2 | 5.5 | 5.0 | 3.1 | 10.7 | 7.3 | 4.1 | 6.3 | 30.9 | 16.4 |
| Jersey City | 37.9 | 34.7 | 15.4 | 16.8 | 3.7 | 3.7 | 4.6 | 12.4 | 7.0 | 3.1 | 4.5 | 35.3 | 20.9 |
| New York | 25.8 | 20.7 | 19,0 | 19.9 | 4.5 | 4.3 | 4.8 | 16.6 | 9.3 | 4.1 | 7.2 | 41.8 | 22.0 |
| Stamford | 30.8 | 27.3 | 15.4 | 19.5 | 5.8 | 5.4 | 2.7 | 9.8 | 11.7 | 4.6 | 6.7 | 40.7 | 19.6 |
| Norwalk | 34.9 | 31.7 | 15.2 | 18.8 | 6.9 | 6.0 | 2.4 | 10.9 | 9.2 | 5.2 | 8.4 | 35.6 | 15.0 |
| Bridgeport | 45.8 | 41.1 | 15.3 | 19.7 | 5.4 | 4.7 | 3.2 | 11.5 | 5.4 | 4.2 | 6.8 | 26.1 | 10.8 |
| New Haven | 32.2 | 25.8 | 17.3 | 19.7 | 5.4 | 5.7 | 3.6 | 13.9 | 6.6 | 8.0 | 12.1 | 33.5 | 16.2 |
| New London | 38.9 | 34.3 | 16.3 | 18.7 | 5.8 | 6.1 | 5.4 | 19.1 | 5.2 | 5.4 | 8.6 | 28.2 | 8.0 |
| Providence | 42.1 | 37.8 | 16.0 | 18.9 | 5.1 | 5.3 | 5.3 | 13.9 | 5.4 | 4.6 | 7.2 | 16.9 | 11.5 |
| Brockton | 38.1 | 30.7 | 18.6 | 23.1 | 6.2 | 6.1 | 4.1 | 14.5 | 5.4 | 4.3 | 7.0 | 28.7 | 13.2 |
| Boston | 28.8 | 22.4 | 18.7 | 21.0 | 5.0 | 5.0 | 5.5 | 15.6 | 7.1 | 6.3 | 9.5 | 25.7 | 19.4 |
| NEC | 28.4 | 24.5 | 17.8 | 19.4 | 5.0 | 4.9 | 6.4 | 17.7 | 8.1 | 4.6 | 7.5 | 36.9 | 17.9 |

[1]Data for services in 1960 not available.

SOURCE: County and City Data Book, U.S. Department of Commerce, Bureau of the Census, 1972; County and City Data Book, U.S. Department of Commerce, Bureau of Census, 1962.

and produce overall growth approaching the national rate. The common service functions such as consumer retail, local banking, and real estate have grown up to serve increasing populations in the rapidly developing regions outside the Northeast. At the same time, many of the more specialized service industries and corporate headquarters are leaving the high rents and congestion of large Northeastern cities and establishing new locations, either at suburban sites or in new regional centers outside the Northeast.

Personal income in the region has historically been higher than the national average. In 1969, every SMSA in the Corridor had a higher median family income than the United States median. The NEC contains the four highest income metropolitan areas in the country as measured in 1969 (Stamford, Norwalk, Washington, and Paterson). NEC per capita income in 1972 averaged 24.8 percent above the nation. However, the generally high income of the Corridor population is impacted by the prevailing cost of living.

Generally, the cost of living in the urbanized sections of the Corridor is higher than the national average[1], with Boston leading the way in 1975 with a high of $18,090 for a family of four. Projections for 1982 and 1990 indicate an expected increase in median income of 15.9 percent in the 1975-1982 period and 16.2 percent between 1982 and 1990.[2]

Services and Revenues. The larger and older urban areas of the NEC generally have substantially higher direct local government expenditure on a per capita basis than the nation as a whole (Table 3-58), largely because of the strong influence of the declining center cities. Rising public service costs in the large cities are being shared by not only a stagnant or shrinking number of persons, but also by a population less able to support those services. These cities have been unable to reduce government

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[1] Statistical Abstract of the U.S., U.S. Bureau of the Census, 1976.

[2] NEC Population Projections, U.S. Department of Transportation, Federal Railroad Administration, March, 1977.

Table 3-58

DIRECT LOCAL GOVERNMENT GENERAL EXPENDITURE (1972)
U.S. AND NEC BY SMSA

| SMSA | Total Expenditure (Millions) | Expenditure Per Capita |
|---|---|---|
| United States | $ 106,596.6 | $ 524 |
| Washington, D.C. | 2,220.3 | 776 |
| Baltimore | 1,312.6 | 633 |
| Wilmington | 243.4 | 487 |
| Philadelphia | 2,574.4 | 534 |
| Trenton | 180.9 | 595 |
| New Brunswick | 311.3 | 533 |
| Newark | 1,187.3 | 639 |
| Paterson | 723.4 | 533 |
| Jersey City | 343.2 | 563 |
| New York City | 12,935.3 | 1,117 |
| Stamford | 145.3 | 704 |
| Norwalk | 64.0 | 533 |
| Bridgeport | 203.7 | 523 |
| New Haven | 171.2 | 481 |
| New London | 80.9 | 387 |
| Providence | 323.8 | 354 |
| Brockton | 88.1 | 464 |
| Boston | 1,440.9 | 523 |
| | Total NEC $ 24,550.0 | Average $ 764 |

SOURCE: Census of Governments, U.S. Department of Commerce, Bureau of Census, 1972.

expenditures and employment as population declined (Table 3-59). Much of the local government expenditure commitment is not a function of population, but rather of the size and age of the city's infrastructure--including its buildings, streets, and utilities. This, combined with institutional resistance to trimming employment and costs in the provision of services, has resulted in levels of expenditure among the NEC urban areas for police and fire protection and sanitation which are proportionally higher than those for the rest of the nation.

Taxes (as opposed to various user charges and fees) generate the great majority of the locally raised revenue for NEC governments, and these governments rely heavily on property taxes. In the New England areas and in the smaller SMSAs south of New York, property taxes account for some 90 percent of all locally-raised revenue. The largest areas raise substantially less from property taxation, suggesting that the increasing use of other types of taxation, such as local sales taxes, has been necessary to support their higher level of per capita expenditure. The assessed valuation upon which property taxation in the NEC is based totaled over $125 billion in 1971.

When per capita state taxes and charges are added to those levied by local governments the total tax impact of residence in the NEC is seen. Total non-federal taxes for the Corridor averaged $891 per capita in 1972, or 28 percent above the national average. However, non-federal taxes as a percentage of per capita income were only slightly above the national average in that year, indicating that the burden of local and state taxation on residents of the Corridor is not unusually severe.

### 3.6.3 OPERATIONAL IMPACTS

Operational Employment. A major beneficial impact of the NECIP will be the increased levels of Amtrak employment necessary to operate, maintain, and manage the system at greatly increased levels of patronage.

Table 3-59

LOCAL GOVERNMENT EMPLOYMENT
U.S. AND NEC BY SMSA (1967, 1972)

| | Total Employment (Full Time Equivalent) | | Payroll ($ Million) | | Employees per 1000 Population[1] |
|---|---|---|---|---|---|
| | 1967 | 1972 | 1967 | 1972 | 1972 |
| United States | 5,508,512 | 6,750,164 | 3,107.7 | 5,303.4 | 32.1 |
| Washington, D.C. | 88,298 | 121,186 | 53.3 | 107.6 | 40.1 |
| Baltimore | 58,727 | 69,817 | 33.7 | 58.2 | 32.8 |
| Wilmington | 10,948 | 13,626 | 6.3 | 11.4 | 26.5 |
| Philadelphia | 110,549 | 147,684 | 69.9 | 131.8 | 30.7 |
| Trenton | 7,680 | 10,190 | 5.0 | 9.3 | 32.3 |
| New Brunswick | 13,776 | 18,437 | 8.3 | 16.9 | 30.9 |
| Newark | 54,644 | 64,312 | 35.2 | 60.1 | 31.3 |
| Paterson | 30,816 | 38,696 | 20.0 | 36.5 | 28.6 |
| Jersey City | 18,230 | 19,315 | 9.7 | 15.3 | 32.3 |
| New York | 439,396 | 519,433 | 305.8 | 524.4 | 45.5 |
| Stamford | 5,277 | 6,717 | 3.6 | 6.6 | 33.3 |
| Norwalk | 3,138 | 3,761 | 2.3 | 3.6 | 29.4 |
| Bridgeport | 8,431 | 10,928 | 5.5 | 9.5 | 27.5 |
| New Haven | 8,789 | 10,305 | 5.3 | 8.8 | 29.1 |
| New London | 4,147 | 5,377 | 2.5 | 4.6 | 22.1 |
| Providence | 18,842 | 23,014 | 10.5 | 18.5 | 23.8 |
| Brockton | 4,142 | 5,754 | 2.3 | 4.6 | 38.1 |
| Boston | 82,982 | 97,363 | 50.1 | 87.0 | 33.6 |
| Total NEC | 967,812 | 1,185,915 | 629.3 | 1,114.7 | 36.9 |

[1] 1973 Population

SOURCE: County and City Data Book, U.S. Department of Commerce, Bureau of Census, 1972 Census of Governments, U.S. Department of Commerce, Bureau of Census.

Personnel engaged in the provision of Amtrak's NEC service totaled approximately 8,750 in September 1976. The majority of these people are former Penn Central employees who were transferred to Amtrak as labor contracts were negotiated subsequent to Amtrak's assumption of ownership and operation of the Corridor on April 1, 1976. The existing work force is projected to grow by 3,700 people in order to accommodate the growth to 21.8 million riders by 1990 (Table 3-60).

Nearly two-thirds of the estimated 1990 NEC employees will be operating crews and maintenance personnel. Operating crew sizes should increase by 63 percent in proportion to annual train miles. Maintenance-of-way personnel will increase by 1,050 as employees involved in the NECIP are applied to on-going maintenance activity. The number of maintenance-of-equipment personnel is expected to increase by approximately 30 percent, based on continuation of certain fixed costs and the projected increases in locomotive and car miles. Other groups of employees are projected to increase by approximately one-third. These estimates fall below the 5,200 job increase forecasted in the Draft PEIS. The reduction is primarily due to (1) the revised 1990 patronage projections and (2) more accurate 1976 base employment figures, particularly the exclusion from the base figures of 1,050 new MOW employees (see note 2, Table 3-60).

The estimated Amtrak employment increase of 3,700 jobs represents a 3.7 percent increase over total 1975 railroad employment--both passenger and freight--in the eight NEC states and District of Columbia. Amtrak 1990 employment will be dispersed along the Corridor. Jobs in the two largest employment categories--maintenance-of-way and maintenance-of-equipment--will be divided among the planned maintenance facilities and repair shops. The Wilmington, Philadelphia, New York and Boston areas can expect considerably higher numbers of maintenance employees.

In order to assess the net long-term job impact of the NECIP, it is necessary to estimate the number of new jobs which would be created by growth in other intercity travel modes if the NECIP were not implemented. Nearly one-half of the total projected 1990 diversion to rail will be former auto drivers. Because intercity travel represents a very small percentage of total vehicle-miles traveled by auto in the NEC, the diversion to rail will reduce the total

Table 3-60

AMTRAK NEC EMPLOYMENT
1976 and Estimated 1990

| | End of FY 76 | Estimated 1990 |
|---|---|---|
| Operating crews | 1300[1] | 2100 |
| Maintenance of way | 1650[2] | 2700 |
| Maintenance of equipment | 2600 | 3350 |
| All other (station personnel, dispatching, signaling and communications, security, clerical) | 3200 | 4300 |
| Total | 8,750 | 12,450 |

[1]On this date, operating crews were not directly employed by Amtrak as a labor contract transfering these crews to Amtrak had not been negotiated.

[2]By the end of calendar 1976, Amtrak had hired an additional 1,050 MOW employees. These employees will initially be engaged in NECIP track work contracted to Amtrak but are expected to be retained after the NECIP to provide for an increased future level of maintenance.

percentage of NEC 1990 vehicle-miles by auto by less than one percent, creating only a minimal impact on future auto-related jobs, such as those for service station personnel. The employment impact of diversion from intercity bus and air was calculated based on current ratios of yearly revenue passenger-miles (RPM) per employee. The reduction in RPM caused by diversions from bus to rail resulted in the loss of approximately 100 present bus company jobs because of the predicted reduction in bus-miles between 1975 and 1990. It should be noted that this loss will be experienced on those city-pair routes which are directly competitive with NEC rail service and that growth in other Northeast Region routes could result in a net regional increase in bus company employment between 1975 and 1990. Also projected is the loss of 270 additional jobs which do not now exist but which would be created by bus company growth on competitive routes if the NECIP were not implemented.

Since air travel will increase by 1990 with or without the NECIP, no existing airline jobs would be affected. However, the reduction in the rate of airline passenger-mile growth caused by improved rail service will result in the creation of approximately 525 fewer airline jobs than would exist by 1990 without the NECIP. The estimated job impact on air and bus modes differs from that contained in the Draft PEIS because of the revised 1990 projections for diversion to intercity rail. Nevertheless, the operational employment impact of the NECIP is substantial and positive. Only 100 existing jobs in competing modes will be lost and an estimated 2,805 net new permanent jobs will be created by 1990.

Distribution of Population and Employment. At the completion of the NECIP, the Corridor rail system will offer a significant, though not radical, improvement in intercity transportation. The degree of impact of the improved NEC system upon the distribution of population and economic activity will depend on: the scale of improvement relative to other transportation modes; whether the improvement tends to reinforce or counter existing and projected trends of distribution; and the relative strength or the reinforcing or countering tendency of the improvement in comparison to other forces.

On the inter-regional scale, the NEC rail system represents a transportation improvement benefit to the Corridor region exclusively, and thus would tend to counter the regional trend of NEC economic decline relative to the rest of the U.S.. The benefits of the NEC rail system will be felt increasingly in future years as the level of congestion in other modes increases. However, the NECIP is a minor improvement in comparison to the major transportation system improvements, particularly the interstate highway system, which have contributed to the current trend of redistribution to other regions.

As noted, the rapid loss of manufacturing jobs is responsible for most of the Corridor's economic decline. The NEC rail system cannot be expected to help slow the departure significantly because it will not directly result in improved goods movement. In addition, an improved transportation system is only one of the many factors enumerated above which have made other regions desirable for business and which will not be altered by the improved Corridor system. In short, any inter-regional redistribution effects of the system would favor the Corridor region but those effects are not expected to be significant.

This conclusion is supported by economic modeling conducted for the project.[1,2] A computer model (INTRA) for estimating the effects of transportation improvements on the spatial distribution of population and economic activity was developed and employed. The initial model tests predicted increased employment in the modeled area in response to a cost/time reduction in inter-area freight movements. However, minimal changes in employment resulted from improvements in passenger transportation.

The INTRA model was also utilized to forecast inter-metropolitan shifts. The improved passenger transport system included tracked air-cushion vehicles (TACV) and STOL aircraft services, a level of improvement far in excess of the proposed high speed rail. The results showed a slight, but clear tendency toward regional decentralization of population and jobs along the Corridor's north-south axis in response to the improved passenger transport system. The predicted impact thus reinforces the existing trend;

[1] The INTRA Model as a Tool for Forecasting and Policy Evaluation, U.S. Department of Transportation, Federal Railroad Administration, 1977.

[2] Impact Studies: NEC Transportation Project, U.S. Department of Transportation, Federal Railroad Administration, 1970.

the New York and Newark areas lose population and jobs (-0.5 percent and -1.1 percent employment differences between the two transportation networks over the 1975-1990 period), while areas such as Providence, New Haven, Baltimore, and Washington benefit. Employment is judged to change in response to transportation-induced changes in population. Improved intercity access would increase accessibility from outlying metropolitan areas to the specialized services of the largest areas, particularly New York, and make physical proximity to these services less critical. It should be noted, however, that the shifts forecasted by the model are small and assume a much greater transportation improvement than will be obtained through the NECIP so that shifts in population due to the NECIP are expected to be very slight.

Finally, the upgraded system will improve access to the central cities of the NEC and should therefore help to maintain central business district employment. A number of the system stations, however, are at suburban locations or in smaller cities with easy access from suburban locations, making a conclusion as to urban-suburban distributive effects difficult.

Development Potential. Although the impact of the NECIP on the regional distribution of population and economic activity is expected to be small, localized impacts on development potential could take place at specific sites along the Corridor as a result of station improvements and grade crossing eliminations. The improvement of certain stations on the Corridor system and the increased number of patrons traveling through them could stimulate commercial development in their immediate vicinity.

The possible types of development include travel-related service facilities such as hotels and restaurants, retail facilities seeking exposure to high levels of pedestrian traffic either in or adjacent to stations and office facilities for companies seeking easy access between NEC cities. The degree to which improved rail service induces economic development in the station areas will depend on the surrounding land use, the amount of development, activity currently taking place, the adequacy of existing or developing complimentary service facilities, such as hotels, to accommodate future rail traffic levels, and the availability of vacant or redevelopable property in the station area. The highest potential for induced development would be expected in urban station areas where renewal or rehabilitation programs are underway and sites are or will be available (e.g., Boston South Station and New London Union Station). Additional environmental documentation for such sites will precede the decision concerning design of station improvements.

A second category consists of station areas where substantial development has recently taken place or is committed, and additional facilities are unlikely to be required (e.g., the New Carrollton and Metropark suburban stations). Increased rail patronage may add to the level of activity around these stations, but the major development stimulus has already been felt.

A third type of area has low potential for rail-induced development because little new commercial activity has grown up or is expected. The causes for this lack of activity vary. Trenton's station is in a declining area where no renewal effort is underway. The Route 128 station area has large areas of undeveloped land but is subject to a number of development controls.

Elimination of five of the Corridor total 67 grade crossings could result in a loss of development potential if the closings are accomplished according to initial recommendations.[1,2] Lawyer's Crossing, a private crossing in Clinton, Connecticut, is probably the most critical of the five problem areas. This crossing provides the only access across the ROW to seven parcels of undeveloped real estate totaling approximately 66 acres. The initial proposal is to close the crossing without providing an alternate access. The cost to acquire this land has been determined to be substantially less than the cost to provide an access road to all the

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[1] Grade Crossings and Fencing, Tasks 10N and 10S, U.S. Department of Transportation, Federal Railroad Administration, 1975.

[2] Engineering Development Program for Private Grade Elimination, Task 20, U.S. Department of Transportation, Federal Railroad Administration, 1976.

properties. To purchase this land would limit the possibility of future development of this land, all of which is zoned industrial. Extension of an access road into this area is a possible future option if conditions warrant.

The remaining four crossings, Chappell Coal, Denoia, Central Coal, and Sparyard Street are all in New London, Connecticut. Of these, Chappell Coal, Central Coal and Denoia are private crossings providing access to waterfront property which is not presently in use, and no immediate plans exist for its future development. The fourth crossing, Sparyard Street, is public and presently provides access to a marine salvage company. However, the Interstate Commerce Commission has approved the institution of a ferry service from the area and closing of Sparyard Crossing would negate this possibility. However, it should be noted that public grade crossings in New London are exempted from closure by federal regulations.

In some cases, a grade crossing elimination may be beneficial since improved access would result. Mulcahey's Crossing in Old Saybrook, Connecticut, is one area where eliminating the present crossing and providing an alternate access could stimulate the development of the land served. The present crossing is an unpaved private roadway ranging from 12 to 15 feet wide serving an area of approximately 32 acres of undeveloped, residential zoned land. The alternate access, although still a private road, would provide a paved roadway of adequate standards to service full development in that area.

Service/Revenues. Potential impacts on local governments of the NEC rail system after the construction period consist first, of changes in government revenues resulting from alterations in the local property tax base and second, of changes in the level and type of local services required by the rail system.

Property tax revenue impacts may be classified as: direct, involving the removal of presently taxable property from the tax rolls and additions to the rolls of improvements installed under the NECIP; and indirect, involving effects of the system operation on land values, which will eventually be reflected in assessments. Railroad ROW and the facilities and improvements upon them are taxable property in the States of Rhode Island, New York, Maryland and the District of Columbia. In Pennsylvania and Delaware, no property taxes are levied on railroad ROWs, while Massachusetts and New Jersey tax only buildings and Connecticut collects a state tax based on gross railroad revenue in lieu of local taxes.

Land acquisition by the NECIP for Amtrak use will thus remove property from the tax rolls in Delaware, Pennsylvania, New Jersey, Connecticut, and Massachusetts. Acquisitions will be necessary in these states for maintenance bases and for electrification substations and feeder lines. Maintenance bases are, in the great majority of cases, planned for construction within existing railroad yards. Therefore, acquisition of property within these yards will not alter its tax status.

In those cases where private property is acquired by public bodies rather than Amtrak, this property will be removed from local tax rolls in all Corridor states. Limited public acquisitions will be necessary for bridge approaches under the grade crossing elimination program. Where private grade crossings are closed without provision of alternative access the inaccessible property will be publicly acquired. Also, acquisition of private property for public parking structures and for improvement of vehicular access at stations may take place, dependent on the availability of local share funding.

The value of improvements to be installed under the NECIP, and the local tax revenue generated from them, will more than compensate for any revenue lost from properties acquired by public bodies in those states where railroad property is taxed. In Delaware, Pennsylvania, New Jersey, Connecticut, and Massachusetts, both public and Amtrak acquisitions will remove property from taxation while Amtrak ROW improvements will not be taxed. Philadelphia and Wilmington will benefit from the value of improvements to their stations, which are Amtrak-owned. The net direct property tax impact of the NECIP should therefore be positive, though individual jurisdictions may lose some revenues.

Indirect tax impacts would result from changes in land value caused by NEC physical improvements or the operation of the system. Land value changes, eventually manifesting themselves in property assessments, could be caused by changes in accessibility, by proximity effects and by increased economic activity in station areas. Accessibility will be impacted by the grade crossing elimination program. The impact on development potential of grade crossing eliminations was discussed above and the net impact judged to be minimal. Any upgrading of existing overhead bridges should have a positive impact on land values.

Proximity or spillover effects are those impacts on property along the Corridor and its inhabitants caused by the physical presence of the rail system and operations over it. The proximity effects of concern are noise and air quality changes caused by an increased number of higher speed train operations and aesthetic and safety changes caused by the electrification and fencing programs. The major impacts of the NEC system on adjacent properties are reflected in current land values, since the system has been in place for many decades. Therefore, major changes in the severity of proximity effects would be required to change property values. An improvement in the noise environment and a minimal improvement in air quality along the ROW are expected to result from the NECIP. The fencing program will increase resident safety greatly while fencing, and electrification east of New Haven, will have some visual impact. The net effect of these changes is small in comparison to proximity effects presently experienced, and therefore, no measurable change in land values, and consequently in property tax revenue is expected.

The NEC rail system may stimulate economic activity in the area of the Corridor stations. Should the NEC rail system provide impetus for travel-related commercial development, land values will rise and new or renovated structures will be added to the tax rolls. Induced development would be particularly beneficial to local government if it takes place on publicly-owned redevelopment parcels.

Operation of the NEC system should demand little additional direct local public services beyond those now provided. Needs for water and sewer are not significant in comparison to existing levels for other purposes or system capacities. Additional police protection should not be needed since Amtrak maintains, and will increase, its own security forces. Fire protection needs should not increase significantly, though the limitation of access points for crossing the ROW may increase the cost of fire protection slightly. Increased local transit services may be stimulated though not required by the NEC system. Electric utilities have been consulted concerning the future power demands of the system and have indicated sufficient generating capacity will be available.

Compatibility with Land Use Plans. A passenger rail system has been in existence in the NEC for nearly 60 years. The improvement program for the Amtrak passenger system will not alter the size, location or function of the existing rail system, and therefore will not conflict with regional state or local plans. Improvements to the existing system will not require major land acquisition or zoning changes. Indeed, the upgrading of the NEC will complement the communities the system traverses by helping to achieve their desired goals of public transportation.

Accessibility/Community Cohesion. A major objective of the NECIP is to provide safe rail operations for system passengers and operating personnel as well as the general population. To achieve this objective, access to and across the railroad will necessarily be limited by the NECIP. The fencing and grade crossing programs will beneficially affect the Corridor by increasing both pedestrian and vehicular safety.

Fencing should prevent persons crossing the tracks for short-cuts to adjacent areas and should deter crime and vandalism on railroad property. Substations, maintenance areas and all stations (including commuter stops) will be fenced for safety and security. Accessibility at stations will be maintained via pedestrian overpasses and underpasses where necessary. This will eliminate passengers crossing the tracks to adjacent parking areas or to board trains. Ongoing studies are being conducted of the aerodynamic impacts of trains going through stations at increased speeds to further determine and identify these impacts. Improvements to many of the NEC Amtrak stations will provide increased parking spaces and therefore improve accessibility downtown near industrial and commercial activity.

The elimination of at-grade crossings will, in some cases, alter vehicular access across the railroad. The elimination of at-grade crossings will be implemented by the FHWA in conjunction with state highway departments. Alternative access or appropriate compensation will be provided. Access by authorized personnel to railroad property will be achieved where sufficient ROW exists by unpaved parallel access roads. Where such roads cannot be created, some crossing easements may have to be acquired by negotiation with the respective property owners. Access to maintenance bases and other facilities by Amtrak employees should not impact local street systems significantly since sufficient street capacity is a criterion in selecting sites for these facilities.

Community cohesion refers to the degree of attraction among individuals, groups and institutions within a neighborhood. Cohesion may be impacted by the introduction of a new physical element which is not in character with the existing community or which changes substantially the pattern of movement used to pursue social contacts. The existing Corridor rail system has long been a physical presence in communities along the ROW. Upgrading the system will not substantially alter that presence. Elimination of grade crossings may affect patterns of movement in some localities, but alternative access will be provided close by. The overall effect of the NECIP on community cohesion should not, therefore, be significant.

Aesthetics. The most significant effects of the NECIP on the visual quality of the Corridor environment will be caused by the fencing and electrification subprograms, and possibly the communications subprogram. Fencing will be installed on railroad-owned property at those locations along the Corridor where it is required for the safety of the public or for the security of the rail system. Locations to be fenced include station areas, identified high vandalism areas, overhead bridges, existing grade crossing locations where vehicular access will be closed, and yards, shops and electrical substations. The four fence types proposed for the ROW and a typical overhead bridge installation are illustrated in Chapter I. The selection of fence types was based upon initial cost, useful life, degree of security offered, supply considerations, and visual characteristics. Application of the types at specific locations along the ROW will depend primarily on the degree of security required.

Since aesthetic impacts are subjective in nature it is difficult to quantitatively assess the impacts of the fencing program. However, one must consider several important characteristics of the fencing concept as it applies to the NECIP. First, fencing can shield certain views of trains as well as the railroad physical plant. In some cases, depending on the fence type and application this might be perceived as a positive aethetic effect. Secondly, the existing fencing along the Corridor lacks continuity or consistency in type and location and in many instances is in a poor state of repair. The proposed fencing program will remove some of this old fencing and replace it with new sections. Thirdly, a fence can also act as a visual barrier and block a view of some attractive or symbolic feature. This may occur, for example, along sections of the coast where the railroad is routed close to the shoreline.

The 8-foot steel picket fence will be used at stations and in identified high vandalism areas where maximum resistance to penetration by persons is needed. The standard urban area fence will be chain link. The type of fence will vary for rural areas, which are judged more sensitive to introductions of new, man-made elements and also less demanding in terms of system security and numbers of potential track crossings by pedestrians. These fence types are much less obtrusive visually than the urban types.

The electrification program will have limited aesthetic impact where electrification now exists and a greater effect where new electrification is to be installed. No structural changes other than some reinforcement will be made to the existing catenary support systems between Washington, D.C. and New York City. Repainting the structural members will improve their appearance. The new electrification system from New Haven to Boston will be composed of many structural elements similar to the existing system but with different levels of visual impact. Visual prominence in the landscape will be lessened by the use of structures of modern, clean design. The vertical supports will be smaller, with an approximate constant height of 20 feet, and will have an appropriate painted finish. The catenary type to be used is illustrated in Section 1.7.

Preliminary system design indicates that no new electrical transmission lines along the ROW are necessary, thus avoiding the use of vertical extensions carrying transmission lines, which is common on the existing system south of New Haven. Also, the catenary support system can be less extensive since it will span a predominately two-track railroad rather than the wider sections of up to six tracks in the existing electrified territory.

Wherever possible, substations will be placed at or near locations where existing transmission lines cross the ROW. Where this is not possible, cross-country feeder lines (either overhead or underground) must be constructed to bring power to the substation. Of the 12 preliminary substation sites between New Haven and Boston, eight are located where transmission lines cross the ROW. The remaining four substations, and the maximum distances of the feeder lines needed are:

- Guilford, Connecticut 5.5 miles
- Old Saybrook, Connecticut 1.25 miles
- Mystic, Connecticut 1.25 miles
- Greenwich, Rhode Island 1.0 mile

Further engineering is necessary before designs of cross-country feeder lines can be developed. The location and design of feeder lines will be the subject of site specific environmental documents. These feeder lines do have the potential for some visual effects and ROW takings.

On the whole, the new electrification system north of New Haven will thus be dramatically less obtrusive than that now existing on the remainder of the NEC. Nevertheless, the new electrification will have an evident visual effect, introducing a new physical element where unencumbered views previously existed. The impact will be most significant in visually sensitive environments such as coastal and rural areas.

The station improvement and grade crossing elimination programs will have lesser, site-specific visual impacts. Exterior and interior refurbishment of existing stations, coordinated with new facilities where necessary, will greatly improve the appearance of the NEC stations, many of which are historic structures with obvious architectural merit.

No determination has yet been made whether the proposed communication system will utilize fiber-optics or microwave for transmission. Fiber-optics would have no discernable visual impact, since transmission cable is no larger than normal household wiring and would be run along the ROW. Fiber-optics is the least-cost alternative and will be used if it is determined that the technological risk is acceptable. If a microwave system is used, visual impacts are possible at each microwave backbone and terminal site requiring construction of a new tower. The degree of impact would vary with each site and would require evaluation within site-specific environmental documents.

Construction of grade separation structures where grade crossings are eliminated will require sensitive design if significant visual intrusion is to be avoided. The remaining NECIP project components should have no significant aesthetic impact so long as sites for electrical substations, maintenance buildings, etc., are carefully chosen according to the established criteria.

### 3.6.4 CONSTRUCTION IMPACTS

Construction Employment. Reducing unemployment is one of the goals of Title VII of the 4R Act. The expenditure of the $1.825 billion for the NECIP is anticipated to create a total of 36,094 person-years of labor (Table 3-61) throughout the Corridor during the period of implementation. This figure represents only the jobs that are generated as a direct result

Table 3-61

EMPLOYMENT BY STATE BY YEAR

TOTAL NEC IMPROVEMENT PROGRAM EMPLOYMENT[1]

| | Prior to 1978 | 1978 | 1979 | 1980 | 1981 | Total |
|---|---|---|---|---|---|---|
| Washington, D.C. | 121 | 158 | 332 | 563 | 310 | 1,484 |
| Maryland | 799 | 1,077 | 1,827 | 1,782 | 884 | 6,369 |
| Delaware | 234 | 326 | 564 | 622 | 289 | 2,035 |
| Pennsylvania | 453 | 571 | 1,077 | 1,143 | 544 | 3,788 |
| New Jersey | 550 | 776 | 1,688 | 1,300 | 660 | 4,974 |
| New York | 259 | 375 | 682 | 679 | 278 | 2,273 |
| Connecticut | 676 | 962 | 2,111 | 1,813 | 953 | 6,515 |
| Rhode Island | 392 | 547 | 932 | 1,004 | 537 | 3,412 |
| Massachusetts | 660 | 904 | 1,193 | 1,660 | 827 | 5,244 |
| TOTAL | 4,144 | 5,696 | 10,406 | 10,566 | 5,282 | 36,094 |
| CUMULATIVE TOTAL | 4,144 | 9,840 | 20,246 | 30,812 | 36,094 | |

[1]Figures represent manpower employed working on NEC improvement program and exclude those involved in peripheral areas related to final material preparation (e.g., manufacturing, processing, transportation, etc.).

SOURCE: Implementation Master Plan, March, 1978.

of the construction phase of the program, and does not represent jobs generated through manufacture and transportation of the necessary materials, so that the total number of persons employed because of the $1.825 billion allocation would actually be higher. The number of construction industry workers in the NEC states has decreased 15 percent between the years 1970 and 1975. This compares to an increase of 3.3 percent in the number of construction employees throughout the nation. The influx of 36,094 jobs into the construction industry will increase the number of employees on an average of 1.2 percent per year over the 1975 figures. This addition, while significant, does not promise to alter substantially the trend of declining regional employment in construction.

Connecticut and Maryland are expected to benefit most from the influx of construction jobs. It is estimated that the NECIP will create about 6,515 construction jobs in Connecticut during implementation. This results in an average of approximately 1,460 jobs annually from 1978 through 1981, which is a 3.2 percent rise per year in construction employment over the 1975 figures. Connecticut has experienced a 1.3 percent decrease in construction employment from 1975 to 1976.

Maryland will have the next largest increase in the number of construction jobs within the Corridor. This state is expected to receive about 5,570 construction jobs over the next four years, or an average of 1,393 jobs annually. This will result in a job increase of 5.6 percent per year over the 1976 level.

Including the amount of employment induced in other sectors of the economy by the NECIP, the total number of persons that can be expected to be employed during the project would be considerably higher than the estimated 36,094. By using an estimated multiplier for secondary job creation of 1.6, based on the present day state of the regional economy, the total number of jobs generated by the NECIP, both direct and induced, would equal 2.6 times the number of jobs directly stemming from the $1,825 billion. However, this impact will last only for the duration of the construction phase.

Another goal of the 4R Act of 1976 is to encourage minority employment and to contract with minority business for construction projects. A Minority Business Research Center has been established within FRA with one of its primary functions to "design and conduct programs to encourage, promote and assist minority enterprises and business to secure contracts, subcontracts, and projects related to the maintenance, rehabilitation, restructuring, improvement, and revitalization of the Nation's Railroads."[1]

The NECIP's Minority Business Office identifies minority businesses in the construction industry and provides information and assistance regarding business opportunities. The program goal is to ensure that at least 15 percent of the project's total funding goes to minority business firms. The program also establishes minority hiring goals for employment by construction contractors. The National Urban League has been contracted to study the Corridor area for the project construction skills available from the minority population. Based on this skills inventory, training needs to assure attainment of goals for minority participation in the NECIP are being identified and an appropriate program initiated. Minority training programs will be developed through local, public and private agencies concerned with assuring equal opportunity employment.

Materials and Supply. The question of timely availability of materials and equipment to complete the NECIP has been studied.[2] The materials and equipment necessary for the NECIP include cross ties, rail, track hardware, bridge steel, signals and traffic control hardware, electrification components, fencing, maintenance-of-way equipment, and shop equipment. Station improvements will require passenger elevators and escalators, air conditioning, automatic ticket equipment, and automated passenger information display.

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[1] Railroad Revitalization and Regulatory Reform Act of 1976, Section 906.

[2] Materials and Equipment Demand/Supply Study, U.S. Department of Transportation, Federal Railroad Administration, 1976.

Due to the slowdown of the economy around 1974, many of the plants that produce needed materials are working at less than full capacity. The result of this slowdown is that there should be adequate supplies available to meet the demands put on the industries by the NECIP.

The most likely of the products to run into supply bottlenecks are the treated wood cross ties, standard steel rail, and steel fence posts. The needs for the NECIP are low when compared to other railroads in the country. Should the construction industry pick up in the next few years, delays in supply could develop. Steel rail and fence posts are both dependent on the supply of hot metal. Should there be a shortage, rail production could slow down, since it accounts for only a small percentage of total steel production, and the larger users would tend to receive preferred treatment. Possible supply problems will be avoided by ordering well in advance of need on the construction sites.

Land Acquisition. Land acquisition requirements as a result of the NECIP will be minimal, primarily involving electrification, maintenance facilities and the station improvement programs. The bridge program generally will not require acquisition of land outside the existing ROW. However, replacement of movable bridges will probably require limited acquisition is replacement occurs on a parallel alignment.

Land acquisition is also required for the majority of 33 substations, one-half to one acre of each substation. In addition, easements may be required for power line ROW when substations cannot be located where transmission lines cross the Corridor. The new electrification system from New Haven to Boston will require installation of new catenary poles. Also, curve shifts of one foot or more will require the shifting of the catenary poles in currently electrified territory. Valuation maps indicate that the railroad ROW is of sufficient width for catenary poles for the electrification program. No acquisition should be required.

The communications program will require land acquisition if a microwave transmission system is eventually chosen. Backbone microwave tower sites would require less than one acre each.

New facilities will be constructed under the NECIP for the maintenance of the ROW and of equipment. Wherever possible, these facilities will be constructed on property already owned by Amtrak. Where property must be acquired, the sites are generally vacant industrially-zoned land. Acquisition for maintenance bases and shops should not exceed 150 acres in total and no relocation or demolition of residences or businesses is planned.

The optional station improvement program may require acquisition of adjacent private property primarily for parking structures. At some stations, the parking structure sites have been tentatively identified. Certain of these sites are presently privately operated parking lots, which by their nature employ few people; therefore, acquisition impacts will be minimal and offset by the benefit of an improved station. Commitment to construct parking facilities at any of these locations is dependent on the availability of local matching funds and agreements between FRA and local authorities. Site-specific environmental documentation will be prepared when programs for individual stations have been developed.

In summary, the total land acquisition requirements of the NECIP are modest and no difficulty is expected in fulfilling those requirements while avoiding dislocation of people and businesses. It appears that no environmentally sensitive areas such as unique agricultural land, park land or community facilities will be taken for the program.

Disruption of Local Services. A limited degree of visual impacts and minor disruption during construction along the NEC is unavoidable and will result from the presence of construction equipment/materials, and waste materials, before they are removed. The impacts will be short-term and are not considered major.

During the construction phase, overhead bridge improvements may cause minor disruptions of local utilities. In particular, where approaches to the bridges undergo construction, underlying sewer, gas and water lines may be disrupted temporarily. Where overhead bridge construction activities are located near utility lines, minor short-term disruptions may result. During the actual construction activities, traffic patterns may be disrupted, especially where multiple car lanes are reduced to single lanes.

There will also be short-term accessibility impacts resulting from the station improvement program. Several stations will undergo extensive renovations which will cause traffic and congestion problems during construction. These impacts will be addressed more specifically by additional environmental documentation for each station.

During construction, the NECIP will require additional municipal services, primarily in the need for additional police to control traffic at construction sites. Deposition of solid waste generated from ballast cleaning and tie replacement could tax the capacity of some municipal landfills, or substantially shorten their useful life. Disposal sites will, therefore, be chosen to avoid major impacts on these municipal facilities.

In summary, the NECIP can be expected to cause minor and temporary disruptions normally associated with construction activities. The project is not expected to place major demands on local services.

Local Cost Sharing. Financial participation by the states or localities will be required if the non-operational station improvement and fencing programs are to be implemented fully. The fencing program and construction of facilities not essential to the operation of intercity rail service at or adjacent to stations, will be 50 percent funded by the NECIP. The remaining 50 percent of the total estimated cost of $300 million for these improvements would be borne by the respective states, local governments, or regional transportation authorities.[1] These improvements represent substantial expenditure. Since state/local participation in the station improvement and fencing program is not mandatory, these governments will weigh the benefits of these programs against other possible uses of their financial resources and reach local decisions on whether to commit the 50 percent local match. The role of the NECIP prior to such decisions is to provide preliminary planning and design work in consultation with local officials, particularly in regard to the non-operational station improvement program.

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[1] 4R Act, Section 703 (1) (B).

It is anticipated that cost sharing in revenue producing facilities such as parking garages will be forthcoming. To date, Massachusetts has passed legislation committing funds for all cost sharing proposals within that state.

## 3.7 HISTORIC AND CULTURAL RESOURCES

### 3.7.1 SUMMARY

The potential effects of the NECIP on historic and cultural resources concern: (1) historic structures or components of the NEC railroad system, (2) standing structures of historical significance adjacent to the NEC right-of-way, and (3) sites of possible archeological significance.

About 200 railroad bridges along the NEC were built prior to 1900. Moreover, the four tunnels, five maintenance facilities, and segments of the signaling and electrification systems south of New York were constructed in the late 1800s or early 1900's. The systems north of New York were constructed during the same period; however, some facilities, such as electrification, communications and signaling are even older in this section. While some of these features have historical value, many can no longer safely and reliably perform their functions, and thus must be replaced or modified. Other elements such as historic stations are eligible for rehabilitation to be compatible with NECIP goals, while retaining their historic character and integrity.

Potential effects on non-railroad cultural resources will be limited; virtually none of the proposed improvements will encroach upon areas outside the existing railroad ROW. A site-specific assessment will document potential effects of improvements off the roadbed.

### 3.7.2 EXISTING CONDITIONS

Archeology. Archeological resources within the NEC are the product of over 10,000 years of occupation by prehistoric American Indians and more recent Euro-African colonists. The earliest inhabitants were migrating communities of hunters and gatherers who gradually learned to efficiently exploit local environments. These early occupants of the Atlantic Coast lived in small campsites found in a variety of topographical areas reflecting their temporary use of specialized resources. Sites of this period are likely to be quite small and shallow unless buried under later flood or slope wash deposits.

Later human activity centered around larger sedentary campsites where abundant marine shellfish and coastal river littoral resources were available for extensive exploitation. Archeological sites of this period (referred to as the Archaic) are much larger due to frequent moving of dwelling sites within a specific location. Most such Archaic sites are on river banks and buried by flood deposits. Small Archaic hunting camps are also found in upland areas.

A period of intense experimentation with different subsistence and settlement patterns began around 1,500 B.C. By 1,000 B.C. settlements were large and predominately sedentary, utilizing coastal resources and some agricultural products. Artifact types, such as the widely used ceramic vessel, the bow and arrow, and permanent house styles, can be closely tied to localized social and cultural traits. Sites were quite large and continuously occupied over periods of hundreds of years.

The earliest European explorers and settlers found large Indian villages occupied by politically sophisticated peoples, with a complex lifestyle, including extensive trade and communication. These social units, or tribes, were extensively influenced and disrupted by contact with Europeans, and gradually moved inland or dwindled in numbers.

Europeans settled in the river valleys of Delaware, New Jersey, Pennsylvania, and New York. They were followed by English-based settlements in the Maryland and Rhode Island/Connecticut/Massachusetts coastal regions. All of these settlements utilized coastal resources as did the earlier Indian populations, and often occupied sites previously occupied by the Indians. Many of these sites lie at the core of the well-developed metropolitan areas along the NEC today.

Archeological resources consist of the remains of the living debris and the often partially buried architectural features which reflect the earlier lifestyles. Industrial and economic debris (middens) are also considered archeological resources. Prehistoric garbage heaps or historic fills can provide valuable information about cultural history and human socio-cultural affairs. Also considered in the category of archeological resources are human burials or remains which provide data on population size and composition as well as information on social life. These resources, if properly investigated, can lead to a much fuller understanding of American history. The presence of "modern" development within the earlier occupied areas often serves to "preserve" these scarce remains or archeological resources and is considered quite sensitive to adverse impact of NECIP activities. Table F-1 in Appendix F lists known and predicted sensitive archeological zones on the NEC.

Historic Sites or Structures Off the NEC Right-of-Way. Over 600 individual structures of historic interest lie within 2,000 feet of the NEC rail line. These structures have been identified through data presented in local plans and publications, state inventories and the National Register of Historic Places, as well as FRA field surveys. After initial reconnaissance, it was determined that 500 feet on either side of the rail line was a realistic study area for determination of effect on historic sites. This distance defines the area in which noise, vibration or visual effects from the NECIP could potentially affect adjacent sites. In most urban and rural environments, noise and visual intrusion decrease considerably after 500 feet, and in most soil types, ground vibration is not perceptible beyond this point. All sites were surveyed and vegetation and intervening structures were noted to the extent that they might affect the degree of impact. The 323 sites identified within the impact area are listed in Table F-2 in Appendix F.

In addition, 52 historic districts have been identified in the area adjacent to the NEC rail line (see Table 3-62). Thirty-eight of these are on or have been determined eligible for the National Register of Historic Places.

The NEC rail line passes within 500 feet of four sites of historic significance in Washington, D.C. The City Post Office is located adjacent to Union Station while the National Arboretum, Kenilworth Aquatic Gardens, and the United Clay Products Brickyard lie south of the rail ROW, close to the District/Maryland border.

The rail line passes through outer suburban and rural areas in Maryland before reaching Baltimore. The few historic structures in this

Table 3-62

HISTORIC DISTRICTS OF THE NEC AREA

| District | Town/State |
|---|---|
| Bolton Hill Historic District* | Baltimore, Maryland |
| Charlestown Historic District* | Charlestown, Maryland |
| Marcus Hook Historic District* | Marcus Hook, Pennsylvania |
| Fairmount Park Historic District* | Philadelphia, Pennsylvania |
| Queens Campus Historic District* | New Brunswick, New Jersey |
| Sniffen Court Historic District* | New York City, New York |
| Hunters Point Historic District* | New York City, New York |
| Cos Cob Historic District | Greenwich, Connecticut |
| Southport Historic District* | Fairfield, Connecticut |
| Fairfield Historic District* | Fairfield, Connecticut |
| Washington Park Historic District | Bridgeport, Connecticut |
| Wooster Square Historic District* | New Haven, Connecticut |
| New Haven Green Historic District* | New Haven, Connecticut |
| Guilford Town Center* | Guilford, Connecticut |
| Old Lyme Historic District* | Old Lyme, Connecticut |
| Whale Oil Row Historic District* | New London, Connecticut |
| Groton Bank Historic District* | Groton, Connecticut |
| Mystic Bridge Historic District* | Stonington, Connecticut |
| Mystic Historic District* | Mystic, Connecticut |
| Wilcox Park Historic District* | Westerly, Rhode Island |
| Central Business District* | Westerly, Rhode Island |
| Main Street Extension* | Westerly, Rhode Island |
| Branford Historic District* | Westerly, Rhode Island |
| Wood River Junction Historic District | Richmond, Rhode Island |
| Shannock Historic District | Richmond, Rhode Island |
| Kenyon Historic District | Richmond, Rhode Island |
| Slocum Agricultural Historical District | North Kingston, Rhode Island |
| Hatchery-Kettle Hole Natural Historical Dst. | North Kingston, Rhode Island |
| Wickford Junction Historic District | Wickford Junction, Rhode Island |
| Fast Greenwich Historic District* | East Greenwich, Rhode Island |
| Roger Williams Park* | Providence, Rhode Island |
| Broadway-Armory Historic District* | Providence, Rhode Island |
| College Hill Historic District* | Providence, Rhode Island |
| Moshassuck Square Historic District | Providence, Rhode Island |
| Kennedy Exchange Plaza* | Providence, Rhode Island |
| Custom House Historic District* | Providence, Rhode Island |

* On or eligible for the National Register of Historic Places

Table 3-62 (Concluded)

HISTORIC DISTRICTS OF THE NEC AREA

| District | Town/State |
|---|---|
| North Burial Ground* | Providence, Rhode Island |
| Mineral Spring Park and Collyer Monument* | Pawtucket, Rhode Island |
| Central Falls Mill District* | Central Falls, Rhode Island |
| Dodgeville Mill Area | Attleboro, Massachusetts |
| Sharon Historic District* | Sharon, Massachusetts |
| Neponset Cotton Mill District | Canton, Massachusetts |
| Forest Hills Cemetery | Boston, Massachusetts |
| Arnold Arboretum* | Boston, Massachusetts |
| Franklin Park, Olmsted Park System* | Boston, Massachusetts |
| Roxbury Highlands Area* | Boston, Massachusetts |
| John Elliot Square Historic District* | Boston, Massachusetts |
| South End District* | Boston, Massachusetts |
| St. Botolph Street Area* | Boston, Massachusetts |
| Ellis Street Historic District | Boston, Massachusetts |
| Bay Village Area | Boston, Massachusetts |
| Back Bay Historic District* | Boston, Massachusetts |
| Boston Commons Public Garden* | Boston, Massachusetts |

* On or eligible for the <u>National Register of Historic Places</u>

area are residential buildings dating from the 19th century. The railroad is located underground in tunnels in the City of Baltimore, and is beneath the Bolton Hill Historic District. The route through the rest of Maryland traverses unpopulated areas interspersed with small towns on the river banks. Historic buildings in these towns range from 18th century taverns to large residential structures dating from the mid-18th to 19th centuries.

The area traversed in Delaware is similar to the rural area in Maryland. At the southwestern end of the state, the rail line passes through Stanton and Newport, where historic structures are predominantly residential, dating from the mid-1800s. Many earlier structures have been demolished, but their foundations remain as archeological evidence. The NEC passes through the southern portion of Wilmington where structures reflecting the long and intense occupation of the city remain. The Thomas Mendenhall House, across the street from Wilmington Station, is one of the oldest residential structures remaining in the city. The Friends Meeting House and the Old Swedes Church still stand as reminders of the early Quaker influence and Swedish settlement in Wilmington during the 17th century.

In Pennsylvania the rail line traverses a number of older commercial and industrial areas dating from the mid-1800s. In Philadelphia the rail line follows the Schuylkill River and passes through a section of Fairmount Park which is a historic district. Although a large number of historic structures are located within the park, only two, Solitude and the Letitia Street House are within the impact area. Two historic transportation facilities also parallel the NEC in Pennsylvania; the Delaware Division of the Pennsylvania Canal and the Bristol Pike lie along the Corridor between Bristol and Morrisville.

In New Jersey, the rail line passes through the urbanized areas of Trenton, New Brunswick, Elizabeth and Newark in addition to a number of smaller towns. In these areas most historic structures are shielded from the NEC by intervening modern buildings. In Newark, however, a number of 19th century industrial buildings line the ROW, and in New Brunswick the elevated rail is nearly adjacent to historic Queens Campus of Rutgers

University. In Metuchen the tracks run through the center of town and numerous locally recognized historic structures are close to the tracks. Many of the residential and commercial structures in these towns date from the early to mid-1800s and were built before or during the construction of the railroad.

In New York City the rail line travels underneath Manhattan in tunnels. The only historic structure potentially affected by the NECIP is the U.S. General Post Office. This building was originally built as a companion to the old Pennsylvania Station which was demolished in the 1960s. Today it faces the modern structure housing the new Pennsylvania Station and Madison Square Garden. In Bronx and Westchester Counties, outside New York City, there are several historic manor houses in suburban areas. These are, however, more than 500 feet from the NEC right-of-way.

The NEC follows the shoreline of Connecticut where it passes through towns dating from the 17th, 18th and 19th centuries. Many of the standing structures from these periods are in excellent condition and are typically clustered around a town green in the traditional New England fashion. Several clusters of early residences have been designated as historic districts and coexist with the railroad.

In Rhode Island the NEC passes through industrial towns dating from the 17th to 19th centuries. Typical structures close to the right-of-way are mills, warehouses and other industrial buildings, in addition to residential and commercial structures dating from the 19th century. A number of the industrial structures display fine architectural detail, especially in Central Falls and Providence. Twenty groups of structures have been designated as historic districts, of which College Hill in Providence is probably the best known.

In Massachusetts the NEC passes through or near several small mill towns before terminating in Boston, where six individual historic structures and eleven districts dating from the 19th century have been identified within 500 feet of the ROW. The South End and Back Bay historic districts are noted by the variety of excellent architecture they exhibit; both are on the National Register.

Industrial Archeology--Historic Railroad Structures. Railroad-related structures and equipment of the NEC are important components illustrating the history of railroad development in America. Following the Revolutionary War, there was growing interest in alternative methods to transport agricultural and industrial products within the expanding nation. The development of the railroad in the 1830's added a much needed dimension to American communication and transportation. One of the major areas of railroad development was the Northeastern region. In this area along the Atlantic coastal plain, the principal effect of the railroad was to stimulate the growth of existing communities and to change the development of cities to accommodate the necessary rail facilities, such as stations, trackbeds, yards and shops.

As the 1830s proceeded, railroads were built to serve all major centers on the Atlantic Coast and a 20-year period of continual rapid growth began. By the mid-1840s the principal cities of New York, Philadelphia, Baltimore and Washington were connected by one or more lines, and each city radiated shorter lines connecting to smaller centers of population in the interior.

The New York-Washington line of the NEC was completed by the 1840s through the cooperation and consolidation of a number of small railroad companies. In 1848, the New York to New Haven railroad was opened, five years after a Boston-Providence-Stonington route went into operation. The New York to Boston shoreline route was in operation by 1858. Throughout the 19th century experimentation in railroad equipment and facilities was typical with gradual technological improvement.

To facilitate this expansion a tremendous labor force was necessary. Blacks and recent European immigrants supplied much of the hard labor that built the railroad in the Northeast and kept it in operation.

By 1900 the railroad system of the U.S. had increased in size and operation, and passenger traffic became the most profitable branch of rail operations, brought about by economic growth, multiplication of large cities and increasing social and personal mobility. The railroads built their metropolitan terminals on a grand scale, huge in size to handle the volume of traffic, extravagant in facilities and decoration to compete with other railroads and attract the passenger A variety of structural techniques were used in station design and construction, with major stations on the NEC designed by America's best known architects and built with the finest materials. They now remain as monuments to railroad prosperity and as entrances to the city which they serve. Table 3-63 indicates that nine of the 18 stations on the NEC which are eligible for operational improvements under the NECIP are on or eligible for the National Register.

The rapid growth of railroads was a strong stimulus for development of bridge structures which would have the required rigidity and resistance to shock, and at the same time respond to the need for rapid and inexpensive construction. Stone and brick arch bridges and viaducts still remain from as early as the 1830s and continue in use on the NEC. The most famous of these is probably the Canton Viaduct in Canton, Massachusetts, built in 1836. A less expensive alternative to the arch bridge was the truss bridge, first built of wood and later of wrought iron or steel. Great numbers of truss bridges were built by the railroads in the last decades of the 19th century, many examples of which remain in use on the NEC. Prefabricated by numerous bridge companies, they were shipped to the site for erection by local construction gangs, under the supervision of railroad bridge engineers. Many of these represent some of the finest achievements of American engineering and construction technology. The metal truss bridge is uniquely indigenous to America; no other country experimented with the truss concept as the U.S. did in the 19th century. One of the most outstanding examples on the NEC is the Washington and Main Streets bridge in Norwalk, Connecticut, described as a Pratt half-hip with vertical end posts.

The movable span bridges along the NEC represent another type of bridge construction, developed in response to the special needs of a coastline railroad passing over navigable waterways. Until the late 19th century rail passengers were transported across these rivers by

Table 3-63

NECIP STATIONS ON OR ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES

| Station | Currently on National Register | Eligible for National Register | Potentially Eligible |
|---|---|---|---|
| Union (Washington) | X | | |
| Penn (Baltimore) | X | | |
| Wilmington | X | | |
| 30th Street (Philadelphia) | | X | |
| Princeton Junction | | | X |
| New Brunswick | | | X |
| Penn (Newark) | | X | |
| Union (New Haven) | X | | |
| Union (New London) | X | | |
| Union (Providence) | X | | |
| South Station (Boston) | X | | |

ferry. The swing bridge was the earliest type on the Corridor, but the bascule span was developed in the late 19th century. There are 15 movable bridges in operation on the NEC and all have been identified as having sufficient historical interest to be eligible for the National Register. The most unusual among these is the Niantic River Bridge, a chain-driven Scherzer rolling lift bascule span.

The famous steel arch Hell Gate Bridge in New York City has also been determined to be eligible for the National Register by the FRA due to its historical and architectural merit. Designed by Gustav Lindenthal, the foremost bridge engineer, it was the longest arch in the world at the time of its completion in 1917.

The two tunnels in Baltimore which are on the NEC are the B&P, completed in 1873, and the Union Tunnel, built in 1871; they were constructed in open cuts which were later filled in. The two tunnels in New York City, the East and North River tunnels, date from the early 20th century. The North River tunnel project, begun in 1904, has been described as "one of the boldest and most courageous undertakings ever conceived by the creative imagination of man."[1] They were both constructed by the shield method as much as 70 feet below the high water level. Made up of 23-foot-diameter cast-iron shells lined with two feet of concrete, these tunneling projects are the subject of displays in the Smithsonian Institution's National Museum of History and Technology.

Electrification of the railroad was a unique experiment, followed with considerable interest by the railroad industry, as well as the scientific community and the competing electric companies. One of the earliest and most extensive electrification projects was undertaken by the New York, New Haven and Hartford Railroad. After a decade of trial on branch lines, the Company, in compliance with the 1903 Act of the New York legislature prohibiting the use of steam motive power into Manhattan after July 1, 1908, electrified this line. There was considerable experimentation with various voltages and catenary systems, as well as controversy over direct versus alternating current. South of New York, the Pennsylvania Railroad

[1] When the Steam Railroad Electrified, William O. Middleton, Kalmbach Books, Milwaukee, 1974.

electrified the NEC in the 1930s. Most of the early and very experimental equipment is still in use on the NEC, with little, if any, modification in the past seventy years.

The power supply system which supported the electrification is of the highest significance, especially plants such as Cos Cob Generating Plant in Cos Cob, Connecticut, which supplied the power for the entire New York-New Haven line, and the plants at Sunnyside Yard, as well as smaller generating plants at the stations.

Overhead wire distribution systems were used with few exceptions on the NEC. Some of the original catenary designs remain from the early electrification period, including novel variations, such as exist near Glenbrook, Connecticut.

The signaling and communication system has undergone numerous changes and developments as methods were refined for visibility, reliability and uniformity. The signaling equipment now in use on many parts of the Corridor is quite old, with some units even identified as unique and the last of their kind, such as the semaphore automatic signals between Stamford and Devon, Connecticut. Many of the signal and interlocking towers remain from the early 20th century; some are architecturally significant, with equipment, while outdated, of historic interest.

The yards and shops on the NEC reflect the changes in railroad technology and the role of the railroad in American life. Most yards on the Corridor were built in the early 20th century, but some have buildings which remain from earlier facilities, such as the Providence Freight Station, built in 1848.

Historic railroad structures identified by the FRA, and possibly eligible for the National Register, are shown in Table F-3 in Appendix F.

### 3.7.3 IDENTIFICATION PROCESS

The process for identification of cultural resources potentially affected by the NECIP consists of four basis steps, as discussed below.

Identification of National Register Properties. All properties included in the National Register of Historic Places including archeological sites, historic sites, structures and districts were identified and mapped. Information was obtained from the National Register and published monthly supplements of the Federal Register.

Identification of Properties Eligible for the National Register. Activities to identify eligible properties included three separate surveys, covering historic, archeological, and industrial archeological resources, and an evaluation of the survey data in conjunction with State Historic Preservation Officers and the Heritage Conservation and Recreation Service of the U.S. Department of the Interior.

State Historic Preservation Officers (SHPOs) for all states along the NEC and the District of Columbia were contacted for an assessment of properties listed in state and local files as possessing historical, architectural or cultural value which were located within the area potentially affected by the NECIP. In addition, representatives of local and regional historical organizations were contacted regarding additional sites and structures of historical value.

Standing structures off the right-of-way, but within 500 feet of the tracks, which are on or eligible for the National Register were then identified. The identification process included the field survey of all structures noted by federal, state and local historical groups, and an assessment of their potential eligibility for the National Register. A list of these sites and structures is presented in Table F-2 in Appendix F.

The second survey was conducted to identify sensitive archeological zones along the NEC. The initial phase of the archeological investigations included a compilation of existing information of a general nature concerning archeological resources in the area of the NECIP. Requests for information were sent to archeologists in NEC states as well as to members of amateur archeological and historical societies. The SHPO was contacted and asked to provide an inventory of known sites within the study area.

This information was compiled and supplied to a consultant who then conducted a sensitivity survey of the entire Corridor which resulted in a description of zones of known or predicted historic or prehistoric archeological sensitivity.[1] The survey data were assembled through a literature search, file search, examination of aerial photographs and maps and limited field investigations. The results of the archeological sensitivity survey are shown in Table F-1 in Appendix F.

The final survey was a preliminary inventory of industrial archeological resources, principally those related to railroading. Robert Vogel of the National Museum of History and Technology of the Smithsonian Institution, Eric DeLony and Larry Lankton of the Historic American Engineering Record (HAER) and Jack Boucher of the Office of Archeology and Historic Preservation, the Heritage Conservation and Recreation Service conducted an aerial photographic survey. This survey resulted in a priority listing of historic resources related to the development of railroading along the NEC which is being circulated to the State Historic Preservation Offices for review and a subsequent determination of eligibility for the National Register. Table F-3 in Appendix F reflects the results of that survey plus resources identified during on-the-ground survey of the NEC. Resources include bridges, maintenance facilities, substations, electrification facilities, and equipment.

Request for National Register Status. Properties which potentially meet the criteria for inclusion in the National Register of Historic Places have been identified. As these sites have been identified and documented, the FRA is requesting a determination of eligibility from the Keeper of the National Register. If no action is proposed in the NECIP that will affect the resource, eligibility will not be sought. The FRA has already determined that several properties meet the eligibility criteria with the

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[1] A Report on Archeological Sensitivity Along the Amtrak Northeast Corridor, Boston, Massachusetts to Washington, D.C., Cultural Resource Management Services, Newton, New Jersey, February 1978.

concurrence of the SHPO and the National Register. These include the 15 movable bridges on the NEC, the bridges and viaducts of the Hell Gate span on the New York Connecting Railroad, and two NECIP stations, 30th Street Station in Philadelphia and the Newark, New Jersey Station.

Determination of Effect. A determination of effect will be made for each property on or eligible for the National Register and potentially affected by the NECIP. To make this determination, FRA, in consultation with the SHPO will apply the criteria of effect set forth in Title 36, Code of Federal Regulations, Section 800.8 of the Procedures of the Advisory Council on Historic Preservation. When the application of criteria results in a finding of no effect, the proposed NECIP action may proceed. If it is found that a proposed action may affect a protected property, the criteria of adverse effect, set forth in Section 800.9 of the Advisory Council Procedures will be applied. If an effect is found, but determined not adverse, adequate documentation of the determination will be transmitted to the Executive Director of the Advisory Council for review; and unless the Executive Director notes an objection to the action within 45 days of receiving the material, the procedure will have been satisfied.

Various procedures are being followed to allow decisions as to the need for and nature of mitigation of potential adverse effect. If an effect is determined to be adverse, the nature of the resource and the impacting nature of the NECIP specific activity are evaluated before mitigation procedures are recommended. Site-specific evaluations and assessments will describe these actions and the procedures to be followed, in compliance with Advisory Council Procedures.

### 3.7.4 POTENTIAL IMPACTS

NEC program planning has, as an objective, the minimization or avoidance of impact on cultural resources. An archeological survey has assisted in the selection of suitable locations for new facilities such as maintenance-of-way bases and substations, as well as other program actions. The major area of unavoidable impact will be program effects on those historic railroad facilities which are in deteriorated condition, obsolete or incapable of performance consistent with the goals of the NECIP.

Project actions which could affect historic non-railroad structures and sites of the NEC include both physical and operational changes. The physical changes which might affect surrounding areas are curve realignments, improvements to the tracks and track bed, electrification of the NEC north of New Haven, and bridge improvements and repair, as well as fencing. Operational changes which might affect historic standing structures and districts include an increase in the number of trains operating on the NEC, and trains operating at higher speeds.

In general, however, there would be positive effects on most cultural resources of the NEC. Corridor-wide project actions, however, might affect those qualities which made a site, structure or district eligible for the National Register, and these have been analyzed in separate assessments and circulated to the SHPOs for comment.

Analysis of the effect on cultural resources followed the procedures for the protection of historic and cultural properties as defined in 36 CFR 800.8 and 800.9. Any condition which "may cause any change, beneficial or adverse, in the quality of the historical, architectural, archeological or cultural characteristic that qualifies the property" for the National Register was considered in this analysis. If an effect was found, the criteria of adverse effect was used, specifically, Part (b), "isolation from or alteration of its surrounding environment;" and (c) "introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting," as described in Section 800.9. For purposes of analysis, effects on cultural resources have been categorized into construction-related and operation-related impacts.

Construction Impacts. Any construction activities which involve subsurface excavation are potentially destructive of cultural (archeological) resources. Areas considered as filled may actually consist of transformed cultural debris, and excavation through "clean" fill to covered occupation or industrial areas may affect those buried culture-bearing strata. This is considered in determination of effect on archeological resources. Adverse effect could also be caused by NECIP activities that involve neither excavation nor filling. Rebuilding of structures within or adjacent to waterways might cause currents to cut into and erode banks containing archeological resources. Pilings driven into river bottoms (actually subsurface excavation) might impact submerged cultural resources. All construction activities were considered within the category of potentially destructive activities. Preliminary assessment from the viewpoint of archeological resources is standard practice.

Construction-related changes in air quality, noise, vibration and traffic flow have been considered to be of special interest in view of their potential impact on the setting of historic standing structures. Construction activities might increase noise levels in the immediate vicinity of historic structures for short periods of time. For track improvements, the duration of activity will be only one to two days, and depending on the existing ambient noise level, the additional noise may be imperceptible. Major construction projects will be the subject of site-specific assessments and documentation will be submitted separately.

Construction activities might also increase the amount of ground vibration, possibly affecting those structures within 300 feet of the action. These activities would be short-term and temporary, and have been determined to result in no permanent effect on any structures close to the ROW.

Increased traffic in historic areas due to construction might cause short-term impacts. Assessing the degree of effect required analysis of the specific nature of the site, the street system, and mitigation measures specified in the construction activities. These effects of construction on historic sites and districts have been analyzed and determinations sent to SHPOs for their comments. Table F-4 in Appendix F lists FRA and SHPO determinations. Suggested mitigation measures for potential adverse effects include the scheduling of construction activities and regulation of traffic flow in affected areas.

Operational Impacts. Despite the increased number of trains, higher train speeds, and larger groups of people expected in and around station areas within the NECIP there is a projected long-term reduction in noise levels along the NEC right-of-way and an improvement in ground vibration levels as a result of the project. Effects on noise and vibration are discussed in detail in Section 3.4 of this PEIS.

The NECIP is expected to result in a small, beneficial reduction in total air pollution. These slight changes will not produce any perceptible positive or negative impacts on historic sites within 500 feet of the NEC, with the potential exception of historic stations. Impacts on NECIP stations will be considered on a site-specific basis.

There are a number of program elements which could result in visual impacts on historic sites and structures. Prominent among them is the electrification program. In locations where electrification now exists, there will be beneficial effects if deteriorated equipment is repaired or replaced. In most cases, no structural changes other than some reinforcement will be made to the existing catenary support systems between Washington, D.C. and New York City.

The following is a discussion by element (as described in Section 1.7 of this PEIS) of the potential impacts on cultural resources of the NEC.

- Route Realignments. Since approximately 85 percent of the proposed route realignments would cause track shifts of less than five feet, most construction work would take place on the existing roadbed where the potential significance of cultural resources is not great. Construction in these areas would not exceed the depth of the roadbed where the ground surface has been previously excavated and worked on a regular basis. The few realignments of a more significant magnitude which would extend beyond the existing roadbed might affect areas of potential archeological activity, and these cases will be evaluated on a site-specific basis. Realignment on the roadbed could also mean the taking of historic railroad structures, or alteration of the resource. Any standing structure which might be affected by route realignment will be documented in a site-specific analysis. This includes any realignment in a sensitive archeological zone even if the realignment is on the existing roadbed, where a full archeological reconnaissance survey will be conducted, and if necessary, an intensive survey according to recommended procedures of Inter-Agency Archeological Services of the Heritage Conservation and Recreation Service of the Department of the Interior.

- Track Structures. The improvements proposed under this program element would be confined to the existing physical plant and, for the most part, would be within the existing roadbed. The rails are not of a historic nature, and thus there would be no impact on that element. The NEC tracks have been improved many times in the years since they were first laid and therefore the equipment is not original, experimental or unique. Exceptions in this category are the interlockings and associated structures including some towers. Some of these are the last surviving examples of their type. A mechanical interlocking in Groton, Connecticut (MP 124.5) is of historic interest; its removal would constitute an impact. It is possible that other interlockings will be determined to be of historic interest and eligible for the National Register. If to be affected, they will be documented and mitigation developed in conjunction with the SHPO and Advisory Council on Historic Preservation.

- Bridges. Many of the bridges on the NEC are historically significant and most of the early ones, especially those of truss construction or multi-span brick or stone arches are probably eligible for the National Register. The type of effect on these bridges will vary with the proposed level of improvement.

Repair operations would have variable effects which might or might not affect the historic nature of the bridge. In most cases painting or deck waterproofing is not likely to create an adverse effect. Other repair activities would not affect the silhouette of the structure and would preclude the need for more drastic repair activities at a later date; this work is seen as deferred maintenance, having no effect on the historic aspects of the structure.

All other categories of bridge improvements, including structural alteration or replacement, will require specific analysis to determine the effect, if any, on the significance of the structure. Site-specific analyses will be conducted when preliminary analysis indicates that improvements might affect the historic nature of the bridge.

● Tunnels. There are five major tunnels on the NEC, all of which are of historic significance. It is not anticipated that work on any of these structures would affect their historic character. The portals are often noteworthy, but these would not be altered by the NECIP as presently defined. The air shafts of the B&P Tunnel in Baltimore may be closed by the City of Baltimore. If so, the documentation of effect will be the responsibility of the City.

● Fencing. The installation of fencing could affect any one of the three categories of cultural resources on the NEC, depending on the type and location. Excavation necessary for the installation of fence posts may affect subsurface cultural deposits, dependent on the depth and location. It is not likely that significant archeological material would be affected by driven posts on the existing roadbed. When specific field locations for fencing are known, a preliminary determination will be made as to whether further site-specific assessment is necessary.

Fencing on overhead bridges could affect cultural resources in two ways. If the bridge is of historic significance, the visual effect must be considered; in addition, it will be necessary to assess the effect of construction and installation on the structure. This will be documented in site-specific reports.

Fencing could potentially affect historic standing structures, including non-railroad structures close to the ROW, historic districts which are traversed by the rail line, and railroad facilities including stations. These fencing projects will all be assessed on a site-specific basis, and the need for, and type of fencing possible will be analyzed.

● Grade Crossing Elimination. Proposed grade crossing elimination procedures include construction of alternate access roads and/or new bridges at certain locations. Elimination of public and private crossings is being implemented by FHWA and its state agents, with NECIP funding for certain private crossings. Any required documentation would be prepared by FHWA and its state agents.

- Electrification. The electrification program included in the NECIP requires the removal of some of the structures relating to the early electrification on the NEC, including the catenary structures, poles, and wires. Eligible structures would be recorded prior to their removal according to methods suggested by the Historic American Engineering Record through a Memorandum of Agreement being processed between the Advisory Council on Historic Preservation and FRA. It is possible that some of the early equipment would be retained where it does not constitute a visual or operational obstruction.

The new catenary to be installed north of New Haven might have a visual effect on structures and historic districts. This effect has been documented and is being reviewed by the State Historic Preservation Officers. There is a potential adverse effect when the historic structure is extremely close to the tracks and no intervening features intercede. Mitigation measures will be developed to minimize the effects of catenary on standing structures.

There is a potential effect in the removal and installation of new electrical substations, and in the phasing out of existing power plants. Planning is in progress to avoid impact on archeological resources and standing historic structures. Those existing facilities affected will be analyzed on a site-specific basis when the final construction program is known.

- Communications. The development of a microwave system could have an effect on areas away from the NEC. The construction of new microwave towers could visually affect historic structures and districts. In addition, archeological resources in the immediate tower area would be affected by excavation, placement of fill, driving of holes for supports, and the laying of concrete slabs. A site-specific assessment for each of the potential tower locations are being prepared and will be reviewed by appropriate agencies.

When underground cables are used to relay communications there would be a potential impact on archeological material. When excavation activities are necessary effects would be analyzed on a site-specific basis.

- Stations. Of the stations eligible for operational improvements as part of the NECIP, nine are on or are eligible for the National Register of Historic Places (see Table 3-63). In addition, there are smaller stations on the Corridor which are of historic interest, some of which are on the National Register. Efforts are being made to insure that the improvements are consistent with the historical nature of the structures and close coordination is being maintained with the SHPO in the respective state. Site-specific assessments are being prepared in each case, not only relative to the station, but also to document potential effects on other cultural resources. This includes documentation of effects on standing structures near the station, and potential effects on subsurface archeological remains.

An interim work program has already been initiated on the major stations (The Station Work Program). This action is intended to correct structural deficiencies or major problems relating to the operation of the station for rail service. In all cases, there has been close coordination with the SHPO and determinations of effect, if necessary, have been processed through the Advisory Council on Historic Preservation. Any effects on smaller stations of historical significance are to be avoided, unless the effect would be beneficial.

- Service Facilities. The equipment maintenance shops would be constructed at existing sites and would have little, if any, effect on standing structures except those obsolete yard structures which might have to be removed. Site-specific analysis will document any effect which may take place, including potential impacts on subsurface archeological material. New maintenance-of-way bases have been sited to avoid any possible archeological impact; site-specific analyses will document the procedure and potential effect.

Determinations of Effect and Eligibility. Procedures defined in 36 CFR 800.8 and 800.9 have been completed for a number of early project actions. Determinations are shown in Table F-4 in Appendix F. There have been 112 determinations of "no effect", 14 of "no adverse effect", and one "adverse effect" in the case of the replacement of the Woonasquatucket River Bridge at Providence Station. With regard to the latter, a Memorandum of Agreement has been signed by the Advisory Council on Historic Preservation, the Rhode Island SHPO and the FRA documenting agreements on the need to replace the bridge and measures to minimize harm. Determinations of "no effect" were made for repairs to a number of small masonry arch bridges and enhancement activities at some stations.

More than 300 additional requests for determination of effect have been processed for programmatic actions which may affect cultural resources on the NEC--especially historic districts and standing structures within 500 feet of the ROW. These proposed determinations are listed in Table F-5 in Appendix F and include 94 determinations of "no effect", 219 of "no adverse effect", and 27 instances where mitigations would be required to minimize or avoid an adverse effect. With regard to the latter, mitigation measures are being developed to minimize the potential effect anticipated from the installation of the catenary in the section north of New Haven. SHPO comments have been received and the Advisory Council is being consulted for these procedures.

Twenty-three determinations of eligibility for the National Register have been processed to date, and more are in preparation for all categories of resources. Those structures already determined eligible for the National Register are listed in Table F-6 in Appendix F. The NECIP process of identification and determination of effect is a comprehensive, cooperative and continuing one. Coordination with Federal, State and local preservation groups has been in effect since late 1976.

State Historic Preservation Officers for each NEC state were contacted and have been kept informed of program planning as it develops, and have offered methods of avoiding adverse impact to cultural resources. These officers have been helpful in the identification of cultural resources including both National Register properties and those eligible for the National Register as determined by surveys. A letter from each SHPO is included in Appendix F of this PEIS indicating that regulations are being observed by the NECIP in the identification of cultural resources and in the determination of effect.

Section 4(f) Determinations. Section 4(f) of the DOT Act states that: "The Secretary shall not approve any program or project which requires the use of any publicly-owned land from a public park, recreation area, or wildlife and waterfowl refuge of National, State or Local significance as determined by the Federal, State or Local officials having jurisdiction thereof, or any land from an historic site of National, State or Local significance as so determined by such officials unless: (1) there is no feasible and prudent alternative to the use of such land, and (2) such program includes all possible planning to minimize harm to such park, recreational area, wildlife and waterfowl refuge, or historic site resulting from such use."

The application of 4(f) to historic properties on the NEC is unusual because the protected properties are elements of the railroad itself. For these railroad facilities, a 4(f) determination will be prepared for activities which would remove an historic structure or site or which would modify such facilities substantially.

The NEC runs through and adjacent to parkland and other properties protected by Section 4(f). It is anticipated that work on the NECIP might involve use of such other properties protected by 4(f). For example, 4(f) considerations would arise when the acquisition of a construction easement was necessary to permit access through 4(f) property to substructure of undergrade bridges or similar railroad facilities. As such cases are identified, they will be analyzed in accordance with the Section 4(f) requirements.

Site-specific environmental documents which will include a Section 4(f) report, evidence of compliance with the Advisory Council on Historic

Preservation Procedures, as well as detailed information about impacts will be prepared as the planning and design of these activities develops. The most obvious examples of actions which will require Section 4(f) determinations are the proposed replacements of three badly deteriorated movable bridges: Mystic, Shaw's Cove, and Niantic. One 4(f) determination, for the Woonasquatucket River Bridge replacement, has already been processed.

# CHAPTER 4

# ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED AND MITIGATION MEASURES

## 4.1 OVERVIEW

The NECIP, with its planned mitigation measures, will result in little adverse environmental impacts. In those instances where special care must be taken to protect environmental areas such as wetlands, watercourses, residential neighborhoods and other sensitive areas, mitigation is directed at the short-term consequences of construction. Guidelines have been established to be incorporated as appropriate and to be applied to all contract specifications and design manuals.

Proper selection of mitigation measures and proper timing of their application will result in either the elimination or the major reduction of potential impacts. An important goal of mitigation measures is the preparation of architectural and engineering designs and specifications that incorporate environmental management practices permitting prospective contractors to bid and construct intelligently. Another is to give sufficient discussion of control practices before construction in order to allow for timely installation of appropriate structural and vegetative controls by the contractor.

Assurance that environmental specifications will be a part of project implementation is provided by the NEC standard specifications, NECSPEC, which will govern all design and construction activity as a part of all pertinent contract documents. Division I of the specifications outlines general requirements for the use of methods and materials for design and construction which will minimize any environmental impacts.

Site work and painting provisions for protection of the natural environment and compliance with air quality standards are covered in Division 2 and Division 9, respectively. Noise and vibration control techniques are cited in Division 15. Archeological and historic preservation and salvage sections are examples of the provisions being added to NECSPEC. Similar provisions are also contained in the standard Amtrak construction specifications.

Construction packages for site-specific projects will include these base specifications. The specifications preparation will be monitored during project development, and any unique or unusual factors requiring special controls to mitigate particular impacts of a specific project will be added. These will form the basis for construction management, inspection and project implementation. Section 4.2 details the impact areas where mitigation measures might be required.

## 4.2 MITIGATION MEASURES

### 4.2.1 REGIONAL AND LOCAL TRANSPORTATION

Mitigation of potential impacts on commuter rail and rail freight operations which use portions of the Corridor takes two forms. First, the inclusion in the NECIP of certain trackwork, track additions, interlocking reconfigurations and station platform work is based on a need to mitigate possible capacity problems which might affect commuter rail operations existing upon project completion. Other improvements of this type mitigate possible similar impacts on Conrail freight operations.

No improvements are planned which increase system capacity to accommodate levels of commuter service projected for 1990. Second, the NECIP is funding the conversion of commuter equipment (with remaining useful life) which would otherwise be rendered incompatible with Corridor electrification. Such a measure is unnecessary for Conrail, as Conrail has other Federal funding sources available to convert its equipment.

Marine traffic affected by reduced opportunities to open movable bridges because of rail traffic growth will also benefit from certain mitigation incorporated into the NECIP. Design requirements for mechanical, electrical and structural upgrading of these bridges will increase operational reliability, and, where feasible, reduce the cycle time required for opening and closing these bridges. In addition, for those movable bridges to be replaced, increased vertical clearance in the closed position will be incorporated in design where costs and environmental factors permit.

Possible impacts on traffic and parking in the vicinity of stations can also be mitigated through NECIP funding, but only if local funding is available. The project will match equally funding committed by a local agency to make improvements to roadways or to expand parking to accommodate all station users.[1]

One potentially significant impact of the NECIP--the diversion of patrons from intercity bus to rail--cannot be mitigated within the authority or funding provided by the NECIP. The project is, however, promoting the multimodal use of rail stations to facilitate modal transfers.

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[1] Federal Register, Volume 43, No. 83, April 28, 1978.

## 4.2.2 AIR QUALITY

As shown, long-term air quality will be marginally improved with the implementation of the NECIP. However, there will be some increased vehicular activity in the station areas. Mitigation of potential adverse impacts could include the construction of a parking garage, improvement of access/egress, and the redesign of the intersections in the area together with other programs to improve the smooth flow of traffic. Such mitigation measures in station areas will be evaluated and implemented only where 50 percent of the cost is borne by state or local interests, since these improvements are considered "nonoperational" or "related facilities" as defined in 43 FR 18394 which are being prepared to implement Section 703 (1)(B) of the 4R Act.

Construction activities will create some short-term adverse effects. The three major sources of construction-related pollution are: (1) construction equipment exhaust, (2) construction activities, and (3) automobile exhaust created as a result of congestion and rerouting of traffic during construction.

The standard mechanisms which will be used to minimize these impacts include positioning equipment as far as possible from receptor locations, prohibiting the idling of construction vehicles when they are not in use, avoiding increased fugitive dust through chemical treatment, covering the stockpiles, enclosing sandblasting operations where appropriate, washing of vehicles, and minimizing vehicular congestion by prudent programming of construction staging and street closings.

Handling and storage of spoil from undercutting and ballast cleaning has been shown to be potentially significant, although tolerable. Those areas where spoil could have an impact, such as visible emissions outside the ROW, will be identified and appropriate mitigation measures will be established. These may include, but will not be limited to, such traditional measures as chemical treatment, watering, seeding or removal to a landfill area.

### 4.2.3 NOISE AND VIBRATION CONTROL

It must be recognized that the NECIP involves improvement of an existing railroad ROW, which is inherently noisy. Many noise reduction and control measures applicable to rail noise problems are incorporated in the NECIP. Noise reduction is an important by-product of such improvements as grade crossing elimination, which eliminates the necessity of horn blowing by trains; installation of continuous welded rail, which eliminates rail joint impact noise; and the use of advanced design electric trains, which eliminates diesel engine noise. Moreover, all railroad operations including mainline operations, yards, shops and facilities, must be in compliance with forthcoming EPA railroad noise emission regulations. Though the overall noise environment should improve, there are some locations where noise will remain a problem.

Mitigation of Long Term Noise Impact. Long term noise impact may occur as a result of three types of NECIP activity: railroad operations on the NEC spine, placement of new permanent facilities in locations where no railroad facilities previously existed, and improvement of existing railroad facilities. Short term noise impact may result from the construction activity. Operational noise impact and some aspects of construction noise impact have been identified in Section 3.4. Noise impact from other NECIP activity will be quantified during site specific environmental analyses to be conducted during the course of the NECIP.

In these site specific environmental analyses after a noise impact is identified by the procedure described in Section 3.4.2, a determination of the most appropriate mitigation measure will be made. Specific mitigation measures will be selected to fit the situation when significant noise impact on residential land uses occurs. The relative significance of noise impact is related to likelihood of complaints from the adjacent community. The U.S. Environmental Protection Agency has found that widespread community complaints may be expected when the normalized $L_{dn}$ of an intruding noise exceeds the ambient noise level by approximately 5 dB.[1] The normalization procedure

[1] U.S. Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, Report No. 550/9-74-004, March, 1974.

takes into account a correction for previous exposure and community attitudes. Hence, an increase in $L_{dn}$ of 5 dB brought about by railroad activities is a measure of significant impact.

Specific noise mitigation measures to be incorporated in the NECIP depend on the specific situation. For example, specific noise processes can be shielded from noise sensitive receivers by specially designed noise barriers. Buffer zones of additional land can be used to reduce noise. Public address system components in yards, shops and stations can be placed so that nearby residents will not be disturbed by announcements. Traffic access routes can be directed away from quiet residential areas. Many other design details can be included with inherent noise control benefits. The final selection of the most appropriate noise mitigation measure will depend on the number of impacted homes, the increase in noise level, the cost associated with the mitigation, as well as other related environmental engineering factors. Mitigation measures will be incorporated into the NECIP only in areas where the cost for benefits derived or other related factors are considered to be a prudent action. It is anticipated that environmental documents will be produced for specific facilities which produce significant noise impacts; thus, EPA and affected members of the public will have the opportunity to have input into the process. The operational noise impacts are considered to be assessed and the decision that noise barriers or other mitigation measures are not needed at sites not receiving major facilities is being made in this document.

Mitigation of Construction Noise Impact. The identification of temporary noise impacts due to construction is done according to the criteria discussed in Section 3.4. For those locations which are considered to be impacted, a variety of mitigation measures will be incorporated into the construction process. Work in residential areas between 10 p.m. and 7 a.m. will occur only in locations where daytime train traffic must be maintained. The quietest method of operation near residential areas will be selected whenever feasible. Where this is not practical, noise equipment and processes will be located away from noise sensitive receivers. Although mufflers will be used on all motor driven equipment, some equipment can be obtained with additional noise control features (such as quiet air compressors). In locations where construction noise without quieted equipment is expected to severely impact residences (daily $L_{dn}$ greater than 90 dB), contract documents will include specifications requiring quieted equipment and limiting work to daytime hours. Trucks associated with NECIP construction will be routed away from residential areas.

Operational Noise Impact Mitigation. In Section 3.4.3, ten communities along the NEC were identified in which ENI from railroad operations increased, signifying an increase in noise impact in the future on the present population. The noise environments for these ten communities are discussed below.

o Cranston, RI. Noise impact in the train noise corridor of Cranston is expected to increase by the equivalent of 58 fully impacted persons by 1990 assuming a uniform population distribution and increase in $L_{dn}$ of nearly 6 dB. This information is enough to identify Cranston as a potential noise impacted community. However, detailed surveys of aerial photographs show no residences in Cranston exposed to $L_{dn}$ greater than 65 dB from railroad operations on the NEC tracks. This, combined with the fact that the noise increase predicted in 1990 would result from the State of Rhode Island's planned introduction of a new diesel-hauled commuter service between Kingston and Providence, eliminates Cranston as a location where special noise control measures for NEC intercity operations would be warranted.

o Warwick, RI. A large increase in ENI is registered for Warwick, chiefly due to a large residential area near the tracks and a 5.6 dB increase in $L_{dn}$ by 1990. Here as in Cranston, the estimated noise increase in the future is largely the result of a drastic projected increase in the number of diesel-hauled commuter trains operating between Kingston and Providence. The estimated future contribution of NEC intercity passenger trains to the $L_{dn}$ is 62 dB compared with a total $L_{dn}$ from all train traffic of 68 dB. The remainder would be dominated by an estimated 41 new daily commuter trains approximately half of which would be diesel-hauled. Since these trains are to be added by RIDOT, the NECIP will not be responsible for the noise increase in this case. In fact, by providing electrification along the

Corridor, the NECIP will make possible commuter operations, incorporating the most effective noise mitigation measures available--using electric instead of diesel powered commuter trains. Therefore, no additional noise control measures are to be incorporated in Warwick.

- Westbrook, CT. A slight increase in noise is estimated to occur in Westbrook from trains running faster, but the increase is so slight (approximately 0.5 dB) as to be insignificant. No noise mitigation is planned in this area.

- Guilford, CT. Application of the screening method in Guilford showed an increase in ENI of 181, with approximately 500 people estimated to be exposed to $L_{dn}$ greater than 65 dB. Upon closer scrutiny, however, only two houses in Guilford are within the 65 dB $L_{dn}$ contour; none are within the 75 dB contour. Since the noise level from trains is expected to increase only 2.5 dB by 1990 at these homes, no mitigation on operational noise is planned for this area.

The remaining six areas in which noise increases are projected are in Western Connecticut. There, the right-of-way is controlled by the Connecticut Department of Transportation and commuter trains are the controlling noise source. ConnDOT does not anticipate significant increase in commuter service on this segment but commuter trains will nonetheless continue to be the dominant noise source. The NECIP will not add noise mitigation measures at these sites. The noise impacts, as described below, are not serious.

- West Haven, CT. West Haven shows an increase in ENI of 199 and a noise increase in $L_{dn}$ of 4.7 dB from train operations. Detailed examination of the area within the 65 dB contour shows only one residence impacted.

- Orange, CT. A slight increase in ENI triggered the selection process for Orange. Closer scrutiny of aerial photos shows no homes within the $L_{dn}$ contour of 65 dB.

- Milford, CT. Milford shows a slight increase in ENI. Further assessment shows that 12 homes are exposed to future $L_{dn}$ over 65 dB from railroad noise. However, the increase in noise from present conditions is only 1.2 dB.

- Stratford, CT. A very slight increase in ENI of three occurs in Stratford; ten homes are exposed to predicted $L_{dn}$ over 65 dB. The noise increase is expected to be only 1.5 dB. No special noise mitigation measures are therefore planned in Stratford.

o Bridgeport, CT. Although a significant increase in ENI is shown through the screening procedure, detailed analysis shows only two homes actually lie within the future $L_{dn}$ contour of 65 dB. Here again, the noise increase is considered insignificant (1.8 dB).

o Fairfield, CT. In Fairfield, the increase in ENI and the actual house counts within the $L_{dn}$ contour of 65 dB showed good agreement. The increase in $L_{dn}$ is insignificant (about one dB) for those residences.

In addition to the ten communities identified above, reference to Table 3-34 shows four states where, despite overall noise reductions brought about by the NECIP, some residents will be exposed to $L_{dn}$ greater than 75 dB. Appendix E shows the specific communities involved, all of which have housing abutting the ROW. Additional noise reductions at these locations are not planned. Due to their location, these houses are already heavily impacted; implementation of mitigation measures adequate to modify this impact are beyond the scope of the project, in view of the limited funds available and the substantial program improvements required.

### 4.2.4 NATURAL ENVIRONMENT

In general, nonpoint source pollution resulting from erosion and sedimentation, and the potential spillage of paint and cleaning agents, will be carefully controlled to insure that potential impact from the NECIP implementation will be insignificant. The design engineers will identify sensitive environmental areas adjacent to construction activities which are likely to create impacts. Mitigation measures of the type displayed in Table 4-1 and also contained in the NECSPEC and the design manual which provides specific guidelines for the protection of the environment will be included in contract documents as warranted. The construction inspectors and regional engineers are charged with enforcing the specifications. They will also have authority to invoke special mitigation measures as unanticipated problems arise. Where construction activities are likely to have a potential for harm, details of mitigation measures will be outlined in site specific environmental documents and any special, unique, or unusual measures described to be included in the design and construction specifications.

Table 4-1

SUMMARY OF PROJECT MITIGATION OF UNAVOIDABLE IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tie Renewal | x | x | | | | | | | | | | Prompt and complete removal of waste from ROW. |
| Under-cutting | x | | | | | | | | | | | Use for subsurface of service roads and dressing of roadbed slopes provided material does not extend beyond toe of slope; remainder to be removed from site for similar use elsewhere. |
| Ballast Cleaning | x | | | | | | | | | | | |
| Cleaning and Construction of Drainage Facilities | x | x | x | x | | | x | | | | | Organic litter such as vegetation and silt will be used as a soil conditioner in areas to be seeded or disposed of at acceptible site. Erosion and sedimentation controls will be provided in specifications as standard practice, see text. |
| Subgrade Stabilization | x | x | | | | | | | | | | No aquifer involvement will be assured. Erosion and sedimentation controls will be provided as standard specifications, (see text). |
| Sand Blasting | | | x | | | | x | | | x | x | In areas where sandblasting waste may enter water courses or may impact other sensitive receptors, precautions will be taken to collect and/ |

Table 4-1 (cont.)

SUMMARY OF PROJECT MITIGATION OF UNAVOIDABLE IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sand-blasting (con't) | | | x | | | | x | | | x | x | or clean up the waste. Temporary fencing, suspended tarpauline, other means will be used. |
| Joint Eliminating | x | x | | | | | | | | | | Prompt and complete removal of solid waste from ROW for recycling or appropriate disposal. Covered truck will be used to transport any dust generating load. |
| Turnout Improvements | x | x | | | | | | | | | | |
| Improve interlockings | | x | | | | | x | x | | | | Prompt and complete removal of solid waste from ROW. Use of covered vehicles to mitigate fugitive dust impact. |
| Rehabilitate Existing Catenary | | | | | | | x | | | | | Prompt and complete removal of solid waste from ROW including recycling of materials as appropriate. |
| Install New Catenary | | | | | | | x | | | | | Prompt cleanup of spillage of paints and confinement of painting activities to ROW. |

Table 4-1 (cont.)

SUMMARY OF PROJECT MITIGATION OF UNAVOIDABLE IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Use of Paint and Cleaning Agents | x | | x | x | x | | x | | | x | x | Spread or suspend tarpaulin or other covers to catch material before it enters the ballast, soil or water. Prompt cleanup of spillage and contingency plan where there is potential impact on any environmentally sensitive area. |
| Excavation | | x | x | x | x | x | x | x | x | x | x | Stabilize exposed soils by seeding, mulching, or sodding. Excess material may be stored at the site for use as backfill or base material, if stabilized. Prompt and complete removal of excess waste from ROW.<br><br>Expose as small an area as possible and provide mitigation measures for erosion/sedimentation control including controls such as retaining structures around stored earth. |
| Fencing Installation | | | x | | x | | x | | | x | x | Vegetation will be allowed to spread on the outside of the fence.<br><br>Provide erosion and sedimentation control methods (see text). |

Table 4-1 (cont.)

SUMMARY OF PROJECT MITIGATION OF UNAVOIDABLE IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Prompt and complete removal of solid waste from ROW. |
| Grade Crossing Elimination | | | | | | x | | | | | | Prompt and complete removal of soil waste from ROW for use as fill or top dressing elsewhere. (9 crossings require further site-specific investigation because of new grade separation or road construction). |
| Building Construction | | | | | | | x | | x | x | x | Soil stabilization methods will be used to mitigate erosion (see text).<br>Retaining structures or covers to prevent erosion will be provided (see text).<br>Prompt and complete removal of excess solid waste.<br>Spread tarpaulins or other covers to catch material. Prompt cleanup of spillage of paint or other materials. |
| Strip, Grub Clear, and Grade | x | x | x | x | x | x | x | x | x | x | x | Stabilize disturbed soil through seeding techniques or use mulch. |

Table 4-1 (cont.)

SUMMARY OF PROJECT MITIGATION OF UNAVOIDABLE IMPACTS

| ACTIVITY | Track Structures | Route Realignments | Bridges | Tunnels | Fencing | Grade Crossing Elimination | Electrification | Signaling | Communications | Stations | Maintenance Facilities | MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Strip, Grub, clear, and Grade (cont'd) | | | | | | | | | | | | Chip and use mulch at site or elsewhere as needed.<br><br>Provide erosion and sedimentation controls (see text). |
| Construction of Service Roads | x | x | x | x | x | x | x | x | x | x | x | Erosion and sedimentation control methods will be provided (see text). On-track equipment will be favored for implementation where practical. Operation will be directed to avoid activities other than along the roadway. |
| Rail Grinding | x | x | | | | | | | | | | All collectable wastes will be recycled or acceptably disposed of off site. Grinding will be unavoidable wasted into the ballast. |

Measures will be taken through the planning of structures and/or plantings to protect environmentally sensitive areas. The specific control measures are provided in the Standard Specifications NECSPEC. All of the mitigation measures may not be applicable to every work element because of the varying types of activities involved at each site. The design engineer is responsible for both the selection and the modification of standard clauses to meet the specific needs of that project.

These specific mitigation measures to be used where necessary for impacts to the natural environment include:

- Erosion and sedimentation control measures such as haybales, sandbags, check/filter dams, interceptor dams and dikes, and drainage or settlement basins.
- Soil stabilization measures such as seeding, mulching, sodding and use of fiber mats.
- Retaining structures or covers to prevent erosion of topsoil or any other materials to be stockpiked.
- Stream buffers or drop cloths installed during bridge cleaning and painting operations to prevent stream pollution with paint, paint chips, dust or other harmful materials.
- Removal of ground or surface water from excavations and conveyance to collecting or runoff areas.
- Removal of solid waste for disposal at appropriate sites or recycling wherever possible.
- Consideration of potential impacts on animal migration movements in the staging of activities.
- Selection and use of herbicides to minimize harm to non-target vegetation.

### 4.2.5 SOCIO-ECONOMIC AND LAND USE

Mitigation measures will be provided for possible effects on the socio-economic and land use aspects of the NEC region. The aesthetic effect of fencing and electrification subprograms, which will create the most significant systemwide visual impacts, has been taken into consideration. Fencing selected will be appropriate for its setting in terms of material, size, color, and other qualities. Special condition fencing will be considered at sites that require unique treatment not included in standard fence types.

Visual qualities of the existing catenary system will be improved as part of the NECIP; elements of the new system will be designed to create the minimal aesthetic impact possible; where new systems are planned, they will be less obtrusive than the existing system elements.

Potential visual impacts are one consideration in the evaluation of fiber optics versus microwave for the communications system. Should a microwave system be proposed, final microwave tower locations will consider visual effects, and will be discussed in site specific documentation.

Pedestrian overpasses and underpasses will be provided to mitigate the effects of fencing programs in stations where other crossing structures do not exist. Standard practices for minimization of pedestrian and vehicular traffic disruption during construction, such as approved detour routes, will be applied.

Certain construction activities in high traffic sections of the Corridor must be restricted to night hours (10 p.m. to 7 a.m.). Conversely, such activities which could cause adverse noise effects in sensitive receptor areas (e.g., residential, hospitals, and schools) will be limited to daytime hours where train congestion permits.

Every effort will be taken to minimize the impact of solid waste distribution on landfill areas, in consideration of those with a relatively short useful lifespan. Waste will be distributed evenly, so no one facility will be overloaded.

Wherever possible, improvement projects will be conducted in cooperation with existing local programs, and efforts will be coordinated accordingly (e.g., for bridge rehabilitation, etc.) so local communities can benefit to the fullest extent from the NECIP.

### 4.2.6 HISTORIC AND CULTURAL RESOURCES

Application of the Historic Preservation Act of 1966 and Executive Order 11593 (see preceding Section 3.7) to NECIP projects results in mitigation of adverse effect to properties on or eligible for the National Register whenever possible. Project planning has been undertaken to avoid adverse impact to cultural resources and in some cases, such as stations, to have a beneficial effect to the resource.

Coordination with State Historic Preservation Officers and the Advisory Council on Historic Preservation is being maintained to ensure that applicable groups and individuals have an opportunity to comment on mitigation measures. Mitigation measures for historic structures or sites generally will be contained in a memorandum agreement with the Advisory Council on Historic Preservation. Short-term effects during the construction phase, such as air and noise pollution, will be mitigated as noted to avoid adverse effect to old buildings. The effects of vibration to historic structures has also been analyzed and minimized if necessary.

In areas where the installation of new catenary equipment could have an adverse effect on historic structures off the ROW, methods are being undertaken in coordination with the SHPO and ACHP to minimize the adverse visual effect by placement of catenary poles in unobtrusive locations, and in some cases, by planting new tree cover to minimize the visual effect.

When historic elements of the rail system are outmoded and to be replaced, such as some signals, or communication and control equipment, it is anticipated that appropriate museums and historic societies will be potential repositories. Final procedures are being adopted for the collection, storage and disposition of historic salvage materials. All resources which will be affected and have been identified as potentially eligible to the National Register will be documented and recorded prior to NECIP action in accordance with the Historic American Engineering Record's guidance and procedures.

Attempts have been made to minimize the adverse effect of fencing in historic areas or near structures of historic interest. Fencing at stations will be of a type compatible with the nature of the station, and fencing on historic overhead bridges will be avoided whenever possible. In some cases, NECIP overhead bridge fencing will replace an earlier type which detracted from the silhouette of the structure as originally designed.

If it is determined through an intensive archeological survey that there are significant archeological resources that may be affected by a NECIP project action, an attempt will be made to mitigate that effect by redesigning the action or by changing the project location to allow for preservation of the resource in place. If this is determined impossible, a data recovery project will be undertaken, in coordination with the Interagency Archeological Services personnel of the Heritage Conservation and Recreation Service to assure compliance with Section 106 of the Historic Preservation Act of 1966 and Executive Order 11593.

# CHAPTER 5

# THE RELATIONSHIP BETWEEN LOCAL SHORT TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

The existing environment is not expected to be adversely affected in any significant way as a result of NECIP implementation. The project will reduce the anticipated transportation burden on air and vehicular travel along the Corridor. This displacement of impact from air and land travel to the rail system will lead to a diminished stress on the environment. As has been pointed out, the NECIP offers relatively few impacts upon the natural environment while substantially assisting the management and economic prospects of the NEC region of influence. That is, with relatively few impacts upon the natural environment, the NECIP increases the options, reliability and efficiency, of transportation within the region.

The proposed project markedly improves intercity rail usage and results in the economic benefits associated with the construction and rehabilitation work required over the short term. The long-term productivity includes all those benefits associated with the existence of an efficient, fully utilized system and it also provides a viable alternative to overland transportation. Such an alternative will clearly become increasingly important in the maintenance and enhancement of the region's socio-economic health as petroleum-based fuels become restricted in use.

The apparent trade-offs which exist between environmental and sociological losses and gains created by the NECIP are clearly far more positive than negative and the project is of overall benefit. The NEC represents an existing, potentially efficient transportation system, operable by the widest assortment of energy alternatives. Proposed for rehabilitation, the trade-offs, therefore, do not involve any significant new land aquisition and no significant modification in the present scope of activities or the present character of the NEC. By its nature, the proposed project does not physically foreclose future options. Therefore, the project achieves maximum long-term productivity based upon minimum short-term uses of the environmental and sociological aspects of the existing project region. This is an unusual set of circumstances which are not usually available to other projects. They are present here primarily because this project entails the rehabilitation and renovation of a pre-existing system, with relatively few new additions proposed.

Since the improved rail system will be electrified, the energy supply to provide power to move the trains can come from any source of fuel such as nuclear, coal, oil, hydro-electric, and is not completely dependent on one fuel. No other option, within rail, or within the transportation sector, ensures this energy independence for the movement of people and goods within the NEC.

Although the air pollution emitted from power plants increases slightly as a result of the NECIP and there may be some additional exhaust emissions in the vicinity of the railroad stations, the overall air pollution will decrease in the design year and diesel exhaust will be virtually eliminated between New Haven and Boston. Additionally, there will be a reduction in noise, and the total energy required for transportation within the NEC will decrease.

# CHAPTER 6

## IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

With respect to commitment of land resources along the Corridor, it is expected that virtually all NECIP activities including final construction will be strictly confined to the existing railroad ROW. Land which might be required for new approaches to the movable bridges scheduled for replacement would not exceed ten acres and probably would be limited to a total of five acres. Most of this land is presently aquatic marine. All other utilization of land will be essentially limited to disturbed areas on the ROW which would be redeveloped. A maximum of about 200 acres may be required for this redevelopment, of which fewer than 20 acres is assumed to involve second growth upland forest species. Therefore, it has been concluded that in no instance will there be any significant loss of natural habitat as a result of the NECIP. However, should final plans call for more use of undeveloped land tnan is contemplated here, additional environmental documentation would be provided.

Similarly, since virtually all the proposed work will take place entirely upon existing railroad ROW, possible indirect impacts on adjacent land uses are very slight. Therefore, no significant alteration to contiguous areas is expected to result from any aspect of the NECIP.

The irretrievable commitment of construction materials required by this project is essentially limited to those elements, such as paint, wood, and cement, which are non-recyclable. As is presently practiced, steel, ballast, and all other salvageable materials will be recycled wherever possible. To the extent quantifiable, amounts of materials to be committed to the NECIP are presented in Chapter 4, Mitigation Measures.

With respect to the use of new ballast to be added to the existing railbed, it is estimated that between ten and fifteen 70 ton loads of ballast would be required for each track mile undercut. Of the approximately 395 track miles to be undercut, 339 are specified in the NECIP and about 56 miles in the ongoing 1977-1978 track program. Therefore, between 700 and 1,050 tons of new ballast is anticipated to be used in conjunction with use of the undercutter for each track mile. This use accounts for about 40 percent of the new ballast used in the project.

New ballast is also proposed for uses in the NECIP for laying or shifting of rail line, interlockings and tie and surface work. Other uses collectively account for about 60 percent of the new ballast to be used in the proposed project.

In addition, the new electrification of the right-of-way from New Haven to Boston will result in a commitment to the use of electricity rather than diesel fuel for powering trains.

# CHAPTER 7

# COORDINATION WITH OTHER AGENCIES

During the preparation of this Programmatic Environmental Impact Statement, many federal, state, regional, municipal, and special interest groups were contacted. Information and opinions were solicited in order to insure that full public disclosure was made of the proposed program and in order to maximize public involvement. In conformance with federal guidelines and as part of the liaison effort, meetings were held with the Fish and Wildlife Service of the Department of Interior, the U.S. Environmental Protection Agency, the Advisory Council on Historic Preservation, and the State Historic Preservation Officers. Several other groups were also consulted, as listed below.

The conduct of these liaison and information meetings was continued throughout preparation of this Final Programmatic Environmental Impact Statement. It included responses to letters, meetings with federal, state and local officials, and the public, and preparation of the responses presented in Volume III of this Statement. That volume represents the nature and scope of the coordination undertaken during and after the Public Hearings. It forms the basis from which this Final Statement evolved. All significant issues which were uncovered have been considered and their evaluation has been greatly assisted through the coordination undertaken.

<u>FEDERAL</u>

U.S. Army Corps of Engineers
- Washington, D.C., Headquarters
- New England Division
- North Atlantic Division
- Baltimore District
- Philadelphia District

U.S. Department of the Interior
- Fish and Wildlife Service
- Geological Survey - Maryland Office
- Heritage Conservation and Recreation Service
  - Office of Archeology and Historic Preservation
    - Historic American Building Survey
    - Historic American Engineering Record
    - National Register
- Bureau of Outdoor Recreation
- Bureau of Reclamation - Philadelphia

U.S. Coast Guard, Headquarters
- First District
- Third District
- Fifth District
- Office of Marine Environment Systems - Bridge Permit Branch

U.S. Environmental Protection Agency, Regions I, II, III

U.S. Department of Housing and Urban Development
- Philadelphia Office, Pennsylvania
- Richmond Office, Virginia
- Washington Office, District of Columbia
- Wilmington Office, Delaware

Advisory Council on Historic Preservation

## STATE AGENCIES AND THE DISTRICT OF COLUMBIA

### Rhode Island

Department of Transportation, Rhode Island
Rhode Island Department of Environmental Management
- Division of Coastal Resources
- Planning and Development Office

Rhode Island State Planning Council
Rhode Island Historical Commission
Rhode Island Statewide Planning Program

### Massachusetts

Massachusetts Bureau of Transportation Planning and Development
Massachusetts Historical Commission
Executive Office of Transportation and Construction
Massachusetts Department of Public Works

### Connecticut

Governor's Rail Advisory Task Force
State Historic Preservation Office
Connecticut Agricultural Experiment Station
Connecticut Department of Planning and Energy Policy
Connecticut Department of Environmental Protection
Connecticut Department of Transportation
Connecticut Association of Rail and Bus Users
Connecticut Public Utility Control Authority

## New York

New York Department of Environmental Conservation
- Region 2
- Region 3
- Division of Air Resources
- Land Resources Planning Group
- Office of Community Assistance

Division for Historic Preservation - Department of Parks & Recreation
Office of Environmental Analysis - State Project Review Section
New York State Regional Planning Commission
New York Department of Transportation
Metropolitan Transportation Authority

## New Jersey

New Jersey Department of Environmental Protection
- Office of Environmental Review
- Environmental Quality
- Bureau of Flood Plain Management
- Historic Sites
- Division of Water Resources

New Jersey Department of Transportation
- Bureau of Common Carrier Planning
- Division of Transportation Systems Planning

Transport of New Jersey

## Delaware

Delaware Department of Transportation
- Highway Division

Office of Historic and Cultural Affairs
Delaware Department of Natural Resources and Environmental Control
- Coastal Zone Management Office
- Wetlands Management Office

Delaware Transportation Authority

## Pennsylvania

Pennsylvania Department of Environmental Resources
- Bureau of Water Quality Management
- Division of Abatement and Compliance
- Bureau of Air Quality and Noise Control

Pennsylvania Office of Environmental Review
Pennsylvania State Historical Preservation Office
Pennsylvania Office of State Planning and Development
Mid-Atlantic Rail Passenger Coordinating Commission

## Maryland

Maryland Department of Transportation
Maryland Department of Natural Resources
    Land Planning Resources
    Water Resources Administration
Maryland Geological Survey
State of Maryland Coordinator of Permits for Development and Construction
Maryland Park and Planning Commission
Maryland Department of Public Works

## District of Columbia

District of Columbia Department of Housing and Community Development
Metropolitan Washington Council of Governments
District of Columbia Municipal Planning Office
Washington Metropolitan Area Transit Authority

## REGIONAL AND OTHER AGENCIES

### Rhode Island

Coastal Resources Management Council
Ecology for Rhode Island

### Massachusetts

Central Transportation Planning Section, MAPC
Massachusetts Bay Transportation Authority
Boston Transportation Group (Southern New England)
Southeastern Regional Planning and Economic Development
  (Mansfield and Attleboro)

### Connecticut

Regional Planning Agency of South Central Connecticut
Southwest Regional Planning Agency
Connecticut River Estuary Regional Planning Agency
Southeast Connecticut Regional Planning Acency
Greater Bridgeport Regional Planning Agency
Greater Bridgeport Transportation Endorsement Board
Capitol Region Council of Governments
Connecticut Public Transit Authority

New York

Regional Plan Association
Tri-State Planning Commission (New York, New Jersey, Connecticut)
Port Authority of New York and New Jersey

New Jersey

Essex County Improvement Authority Transportation Office
Delaware River Basin Commission
Hackensack Meadowlands Development Commission
Middlesex-Somerset-Mercer Regional Planning Council

Delaware

New Castle County Planning Commission
Wilmington Metropolitan Area Planning Coordination Council

Pennsylvania

Mid-Atlantic Rail Passenger Coordinating Commission
Delaware Valley Regional Planning Commission
Bucks County Department of Planning
Delaware County Department of Planning
Southeastern Pennsylvania Transportation Authority

Maryland

Maryland Department of Public Works - Prince Georges County
Baltimore County Planning Commission
Maryland National Capitol Park and Planning Commission - Prince Georges County
Regional Planning Council - Harford County and Baltimore County
Anne Arundel County Office of Planning and Zoning
Cecil County Planning Department
Harford County Planning Commission

COUNTY AND/OR MUNICIPALITY

Massachusetts

City of Boston
City of Worcester
City of Springfield
Town of Mansfield
Town of Attleboro
Town of Dedham
Town of Westwood
Town of Canton
Town of Sharon
Town of Foxborough

Connecticut

Town of Stonington
Town of Groton
City of Groton
City of New London
Town of Waterford
Town of East Lyme
Town of Old Lyme
Town of Old Saybrook
Town of Westport
City of Norwalk
Town of Darien
City of Stamford
Town of Greenwich
Town of Westbrook
Town of Clinton
Town of Madison
Town of Guilford
Town of Branford
Town of East New Haven
City of New Haven
City of West Haven
Town of Orange
City of Milford
Town of Stratford
City of Bridgeport
Town of Fairfield

Rhode Island

Town of Central Falls
City of Pawtucket
City of Providence
Town of Cranston
Town of Warwick
City of East Providence
Town of East Greenwich
Town of North Kingstown
Town of Exeter
Town of South Kingstown
Town of Richmond
Town of Charlestown
Town of Hopkinton
Town of Westerly

New York

Westchester County
Village of Port Chester
City of Rye
Town of Harrison
Town of Mamaroneck
Village of Larchmont
City of New Rochelle
Village of Pelham Manor
City of New York
Borough of the Bronx
Borough of Queens
Borough of Manhattan

## New Jersey

Hudson County
- Weekhawken Township
- Union City
- North Bergen Township
- Town of Secaucus
- Town of Kearney
- Town of Harrison

Essex County
- City of Newark

Union County
- City of Elizabeth
- City of Linden
- City of Rahway

Middlesex County
- Woodbridge Township
- Edison Township
- Borough of Metuchen
- Borough of Highland Park
- City of New Brunswick
- North Brunswick Township
- South Brunswick Township
- Plainsboro Township

Mercer County
- West Windsor Township
- Lawrence Township
- Hamilton Township
- City of Trenton

## Delaware

New Castle County
- City of Wilmington
- City of Newport
- City of Newark

## District of Columbia

Washington

## Pennsylvania

Bucks County
- Borough of Morrisville
- Falls Township
- Borough of Tullytown
- Bristol Township
- Bensalem Township

Philadelphia County
- City of Philadelphia

Delaware County
- Borough of Colwyn
- Borough of Darby
- Borough of Sharon Hill
- Borough of Folcroft
- Borough of Glenolden
- Borough of Norwood
- Borough of Prospect Park
- Borough of Ridley Park
- Ridley Township
- Borough of Eddystone
- City of Chester
- Borough of Trainer
- Borough of Marcus Hook
- Lower Chichester Township

## Maryland

Cecil County
- Town of Elkton
- Town of North East
- Town of Charlestown
- Town of Perryville

Hartford County
- Town of Havre de Grace
- Town of Aberdeen

Baltimore County

City of Baltimore

Anne Arundel County

Prince Georges County
- City of Bowie
- City of New Carrollton
- Town of Landover Hills
- Town of Cheverly

# APPENDICES

# APPENDIX A

# DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF MASSACHUSETTS

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South Station | Boston | --- --- | - | | Yes | | None | None | | | * |
| 1 | Boston | 228.60 228.80 | | | | | | | | | |
| 2 | Boston | 228.25 228.30 | | | | | | | | | |
| 3 | Boston | 228.15 228.25 | | | | | | | | | |
| 4 | Boston | 227.94 228.02 | | | | | | | | | |
| 5 | Boston | 227.80 227.88 | | | | | | | | | |
| 6 | Boston | 227.49 227.62 | | | | | | | | | |
| 7 | Boston | 226.00 226.04 | | | | | | | | | |
| 8 | Boston | 226.20 226.30 | | | | | | | | | |
| 9 | Boston | 225.60 226.00 | | | | | | | | | |
| 10 | Boston | 225.43 225.55 | | | | | | | | | |
| 11 | Boston | 224.39 224.63 | | | | | | | | | |
| 12 | Boston | 224.79 225.12 | | | | | | | | | |
| 13 | Boston | 224.24 223.14 | | | | | | | | | |
| 14 | Boston | 222.16 222.08 | | | | | | | | | |
| 15 | Boston | 220.94 220.60 | 1.5 | 66 | Yes | | None | None | | | * |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF MASSACHUSETTS

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | Boston | 216.06<br>215.58 | | | | | | | | | |
| 17 | Canton | 213.38<br>213.00 | | | | | | | | | |
| 18 | Sharon | 212.69<br>212.41 | 0.1 | 65 | Yes | | None | None | | | * |
| 19 | Sharon | 211.54<br>211.31 | 2.3 | 75 | Yes | | None | None | | | * |
| 20 | Sharon | 210.67<br>210.46 | | | | | | | | | |
| 21 | Sharon | 210.63<br>210.12 | 1.0 | 200 | Yes | | None | None | | | * |
| 22 | Foxboro | 207.00<br>206.57 | | | | | | | | | |
| 23 | Foxboro | 205.24<br>205.04 | | | | | | | | | |
| 24 | Attleboro | 193.63<br>194.55 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF RHODE ISLAND

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | Central Falls | 190.48<br>190.02 | | | | | | | | | |
| 26 | Central Falls | 190.45<br>189.90 | | | | | | | | | |
| 27 | Pawtucket | 189.32<br>189.74 | | | | | | | | | |
| 28 | Pawtucket | 188.85<br>188.68 | | | | | | | | | |
| 29 | Pawtucket | 188.64<br>188.54 | 0.2 | 150 | Yes | | None | None | | | * |
| 30 | Pawtucket | 188.51<br>187.94 | 0.2 | 160 | Yes | | None | None | | | * |
| 31 | Providence | 188.00<br>187.94 | | | | | | | | | |
| 32 | Providence | 187.90<br>187.72 | | | | | | | | | |
| 33 | Providence | 187.90<br>187.25 | | | | | | | | | |
| 34 | Providence | 187.00<br>186.81 | | | | | | | | | |
| 35 | Providence | 186.52<br>186.75 | 37 | 140 | Yes | | None | None | | | * |
| 36 | Providence | 186.52<br>186.40 | 37 | 140 | Yes | | None | None | | | * |
| 37 | Providence | 185.94<br>186.37 | | | | | | | | | * |
| 38 | Providence | 185.20<br>185.70 | | | | | | | | | |
| 39 | Providence | 185.10<br>184.92 | - | 1200 | Yes | | None | None | | | * |
| 40 | Providence | 184.75<br>184.88 | - | 1200 | Yes | | None | None | | | * |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF RHODE ISLAND

| CURVE NO | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | Providence | 184.19<br>184.31 | | | | | | | | | |
| 41A | Providence | 184.31<br>184.47 | | | | | | | | | |
| 42 | Providence | 183.62<br>184.06 | | | | | | | | | |
| 43 | Providence | 183.11<br>183.35 | | | | | | | | | |
| 44 | Providence | 183.37<br>183.57 | | | | | | | | | |
| 45 | Providence | 182.24<br>182.83 | | | | | | | | | |
| 46 | Providence | 181.59<br>182.00 | | | | | | | | | |
| 47 | Cranston | 180.52<br>181.06 | 1.0 | 340 | Yes | | None | None | | | * |
| 48 | Cranston | 180.44<br>180.24 | 0.25 | 130 | Yes | | None | None | | | * |
| 49 | Cranston | 180.24<br>180.06 | | | | | | | | | |
| 50 | Warwick | 174.35<br>173.78 | | | | | | | | | |
| 51 | Warwick | 173.35<br>173.00 | | | | | | | | | |
| 52 | East Greenwich | 172.23<br>171.58 | | | | | | | | | |
| 53 | East Greenwich | 170.73<br>170.40 | | | | | | | | | |
| 54 | East Greenwich | 168.05<br>168.10 | | | | | | | | | |
| 55 | East Greenwich | 167.83<br>168.00 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF RHODE ISLAND

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | North Kingstown | 162.10<br>162.20 | 0.1 | 70 | Yes | | None | None | | | * |
| 57 | North Kingstown | 162.00<br>162.10 | 0.1 | 150 | Yes | | None | None | | | * |
| 58 | Exeter | 160.34<br>159.24 | | | | | | | | | |
| 59 | South Kingstown | 158.45<br>158.50 | 0.2 | 80 | Yes | | None | None | | | * |
| 60 | South Kingstown | 158.35<br>158.40 | | | | | | | | | |
| 61 | Richmond | 154.34<br>155.40 | | | | | | | | | |
| 62 | Richmond | 153.51<br>152.97 | | | | | | | | | |
| 63 | Charlestown | 152.57<br>151.88 | | | | | | | | | |
| 64 | Charlestown | 151.22<br>150.65 | | | | | | | | | |
| 65 | Charlestown | 149.38<br>147.46 | | | | | | | | | |
| 66 | Charlestown | 148.08<br>147.27 | | | | | | | | | |
| 67 | Westerly | 145.38<br>145.13 | | | | | | | | | |
| 68 | Westerly | 144.68<br>144.04 | | | | | | | | | |
| 69 | Westerly | 142.45<br>142.63 | | | | | | | | | |
| 70 | Westerly | 141.77<br>142.14 | | | | | | | | | |
| 71 | Westerly | 140.95<br>141.46 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 72 | Stonington | 139.40<br>140.28 | | | | | | | | | |
| 73 | Stonington | 139.01<br>138.61 | | | | | | | | | |
| 74 | Stonington | 138.41<br>138.24 | 0.5 | 180 | Yes | | None | None | | | * |
| 75 | Stonington | 136.61<br>135.96 | | | | | | | | | |
| 76 | Stonington | 134.84<br>135.07 | | | | | | | | | |
| 77 | Stonington | 134.89<br>135.24 | | | | | | | | | |
| 78 | Stonington | 134.70<br>133.30 | | | | | | | | | |
| 79 | Stonington | 133.53<br>133.89 | | | | | | | | | |
| 80 | Stonington | 133.53<br>133.29 | | | | | | | | | |
| 81 | Stonington | 132.58<br>132.21 | - | 100 | Yes | | None | None | | | * |
| 82 | Groton | 131.82<br>131.19 | - | 120 | Yes | | None | None | | | * |
| 83 | Groton | 130.83<br>130.54 | | | | | | | | | |
| 84 | Groton | 129.87<br>130.11 | | | | | | | | | |
| 85 | Groton | 130.13<br>128.91 | | | | | | | | | |
| 86 | Groton | 130.13<br>128.91 | | | | | | | | | |
| 87 | Groton | 127.62<br>127.01 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED | | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ug | oh | | | |
| 88 | Groton | 126.10<br>126.46 | | | | | | | | | |
| 89 | Groton | 126.14<br>125.90 | | | | | | | | | |
| 90 | Groton | 125.34<br>125.63 | | | | | | | | | |
| 91 | Groton | 124.65<br>125.28 | | | | | | | | | |
| 92 | Groton | 124.26<br>123.94 | | | | | | | | | |
| 93 | New London | 123.68<br>123.06 | | | | | | | | | |
| 94 | New London | 122.62<br>123.01 | | | | | | | | | |
| 95 | New London | 122.40<br>122.57 | - | 30 | Yes | | None | None | | | * |
| 96 | New London | 122.00<br>121.50 | - | 50 | Yes | | None | None | | | * |
| 97 | New London | 121.93<br>121.87 | | | | | | | | | |
| 98 | New London | 120.75<br>121.57 | | | | | | | | | |
| 99 | Waterford | 119.64<br>120.66 | | | | | | | | | |
| 100 | Waterford | 119.28<br>118.88 | | | | | | | | | |
| 101 | Waterford | 118.79<br>118.93 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | Waterford | 118.38<br>118.08 | | | | | | | | | |
| 103 | Waterford | 117.58<br>118.11 | | | | | | | | | |
| 104 | East Lyme | 116.75<br>117.03 | - | 365 | Yes | | None | None | | | * |
| 105 | East Lyme | 115.80<br>116.69 | - | 35 | Yes | | None | None | | | * |
| 106 | East Lyme | 114.28<br>114.62 | | | | | | | | | |
| 107 | East Lyme | 113.36<br>113.85 | | | | | | | | | |
| 108 | East Lyme | 112.58<br>112.76 | | | | | | | | | |
| 109 | East Lyme | 112.36<br>112.58 | | | | | | | | | |
| 110 | East Lyme | 112.08<br>112.34 | | | | | | | | | |
| 111 | Old Lyme | 110.51<br>111.46 | | | | | | | | | |
| 112 | Old Lyme | 109.51<br>110.99 | | | | | | | | | |
| 113 | Old Lyme | 109.16<br>110.45 | | | | | | | | | |
| 114 | Old Lyme | 109.02<br>108.26 | 7.0 | 100 | Yes | | None | None | | | * |
| 115 | Old Lyme | 107.40<br>107.00 | | | | | | | | | |
| 116 | Old Lyme | 106.00<br>106.28 | | | | | | | | | |
| 117 | Old Saybrook | 104.24<br>104.49 | 2.5 | 100 | Yes | | None | None | | | * |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 118 | Old Saybrook | 104.07<br>103.45 | | | | | | | | | |
| 119 | Old Saybrook | 103.09<br>103.23 | | | | | | | | | |
| 120 | Westbrook | 102.01<br>102.20 | | | | | | | | | |
| 121 | Westbrook | 100.95<br>100.26 | | | | | | | | | |
| 122 | Westbrook | 100.06<br>99.69 | | | | | | | | | |
| 123 | Westbrook | 98.86<br>98.03 | | | | | | | | | |
| 124 | Clinton | 97.60<br>97.24 | 2.0 | 76 | Yes | | None | None | | | * |
| 125 | Clinton | 96.54<br>96.17 | | | | | | | | | |
| 126 | Clinton | 94.81<br>94.35 | | | | | | | | | |
| 127 | Madison | 93.30<br>92.98 | | | | | | | | | |
| 128 | Madison | 91.58<br>91.24 | | | | | | | | | |
| 129 | Madison | 91.07<br>90.74 | 4.0 | 156 | Yes | | None | None | | | * |
| 130 | Madison | 90.86<br>90.75 | 4.0 | 120 | Yes | | None | None | | | * |
| 131 | Madison | 90.60<br>90.33 | 2.0 | 110 | Yes | | None | None | | | * |
| 132 | Madison | 89.04<br>89.10 | 0.2 | 190 | Yes | | None | None | | | * |
| 133 | Guilford | 88.31<br>87.88 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 134 | Guilford | 86.77<br>87.47 | | | | | | | | | |
| 135 | Guilford | 86.72<br>86.57 | | | | | | | | | |
| 136 | Guilford | 86.45<br>86.26 | | | | | | | | | |
| 137 | Guilford | 85.92<br>85.58 | | | | | | | | | |
| 138 | Branford | 83.67<br>83.09 | | | | | | | | | |
| 139 | Branford | 82.76<br>82.41 | | | | | | | | | |
| 140 | Branford | 82.09<br>81.74 | | | | | | | | | |
| 141 | Branford | 81.73<br>81.41 | | | | | | | | | |
| 142 | Branford | 81.32<br>81.05 | | | | | | | | | |
| 143 | Branford | 80.71<br>80.39 | | | | | | | | | |
| 144 | East Haven | 79.07<br>80.20 | | | | | | | | | |
| 145 | East Haven | 78.56<br>78.21 | | | | | | | | | |
| 146 | East Haven | 78.23<br>78.58 | | | | | | | | | |
| 147 | East Haven | 77.64<br>76.89 | 1.8 | 430 | Yes | | None | None | | | * |
| 148 | New Haven | 75.87<br>77.40 | | | | | | | | | |
| 148A | New Haven | 74.23<br>74.05 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 148B | New Haven | 74.05<br>73.95 | | | | | | | | | |
| 149 | New Haven | 73.32<br>73.56 | | | | | | | | | |
| 150 | New Haven | 73.11<br>73.30 | | | | | | | | | |
| 151 | New Haven | 72.80<br>73.02 | | | | | | | | | |
| 151A | New Haven | 72.75<br>72.69 | | | | | | | | | |
| 151B | New Haven | 72.61<br>77.66 | | | | | | | | | |
| 152 | New Haven | 72.43<br>72.47 | - | 260 | Yes | | None | None | | | * |
| 152A | New Haven | 72.30<br>72.43 | | | | | | | | | |
| 153 | New Haven | 72.13<br>72.27 | - | 260 | Yes | | None | None | | | * |
| 154 | New Haven | 71.84<br>71.94 | | | | | | | | | |
| 155 | New Haven | 70.59<br>71.08 | | | | | | | | | |
| 156 | New Haven | 69.48<br>70.05 | | | | | | | | | |
| 157 | New Haven | 68.84<br>69.33 | | | | | | | | | |
| 158 | Milford | 66.49<br>66.97 | | | | | | | | | |
| 159 | Milford | 65.11<br>65.47 | | | | | | | | | |
| 160 | Milford | 64.15<br>64.82 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 161 | Milford | 63.06<br>63.68 | | | | | | | | | |
| 162 | Milford | 62.64<br>63.00 | | | | | | | | | |
| 163 | Milford | 62.10<br>62.45 | | | | | | | | | |
| 164 | Milford | 61.77<br>62.10 | | | | | | | | | |
| 165 | Stratford | 60.61<br>60.73 | | | | | | | | | |
| 166 | Stratford | 60.46<br>60.71 | | | | | | | | | |
| 167 | Stratford | ---<br>--- | | | | | | | | | |
| 168 | Stratford | 59.76<br>60.08 | | | | | | | | | |
| 169 | Stratford | 59.26<br>59.39 | | | | | | | | | |
| 170 | Stratford | 58.31<br>57.74 | | | | | | | | | |
| 171 | Bridgeport | 55.86<br>56.45 | | | | | | | | | |
| 172 | Bridgeport | 55.57<br>55.82 | | | | | | | | | |
| 173 | Bridgeport | 54.66<br>55.23 | | | | | | | | | |
| 174 | Bridgeport | 50.03<br>53.32 | | | | | | | | | |
| 175 | Fairfield | 52.61<br>52.91 | | | | | | | | | |
| 176 | Fairfield | 51.37<br>51.70 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 177 | Fairfield | 50.06<br>51.20 | | | | | | | | | |
| 178 | Fairfield | 49.28<br>49.64 | | | | | | | | | |
| 179 | Westport | 47.76<br>48.09 | | | | | | | | | |
| 180 | Westport | 46.39<br>46.95 | | | | | | | | | |
| 181 | Westport | 45.64<br>46.00 | | | | | | | | | |
| 182 | Westport | 44.81<br>44.99 | | | | | | | | | |
| 183 | Westport | 43.65<br>44.05 | | | | | | | | | |
| 184 | Norwalk | 42.45<br>42.67 | | | | | | | | | |
| 185 | Norwalk | 41.62<br>41.77 | | | | | | | | | |
| 186 | Norwalk | 41.22<br>41.46 | | | | | | | | | |
| 187 | Norwalk | 41.44<br>40.64 | | | | | | | | | |
| 188 | Darien | 39.48<br>40.12 | | | | | | | | | |
| 189 | Darien | 38.77<br>39.02 | | | | | | | | | |
| 190 | Darien | 37.95<br>38.15 | | | | | | | | | |
| 191 | Darien | 37.14<br>37.59 | | | | | | | | | |
| 192 | Darien | 36.28<br>37.66 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF CONNECTICUT

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 193 | Stamford | 34.77<br>35.61 | | | | | | | | | |
| 194 | Stamford | 34.05<br>34.43 | | | | | | | | | |
| 195 | Stamford | 33.51<br>33.81 | | | | | | | | | |
| Stamford Station | Stamford | 32.81<br>33.81 | 20 | 80 | | | None | None | | | * |
| 196 | Stamford | 32.47<br>32.81 | | | | | | | | | |
| 197 | Greenwich | 31.74<br>32.31 | | | | | | | | | |
| 198 | Greenwich | 30.86<br>31.17 | | | | | | | | | |
| 199 | Greenwich | 30.01<br>30.17 | | | | | | | | | |
| 200 | Greenwich | 29.38<br>29.56 | | | | | | | | | |
| 201 | Greenwich | 28.55<br>28.70 | | | | | | | | | |
| 202 | Greenwich | 28.21<br>28.41 | | | | | | | | | |
| 203 | Greenwich | 27.53<br>27.99 | | | | | | | | | |
| 204 | Greenwich | 26.49<br>26.76 | | | | | | | | | |
| 205 | Greenwich | 26.12<br>26.31 | | | | | | | | | |
| 206 | Greenwich | 25.70<br>26.07 | | | | | | | | | |
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DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF NEW YORK

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 207 | Rye | 24.21<br>24.69 | | | | | | | | | |
| 208 | Rye | 23.85<br>24.17 | | | | | | | | | |
| 209 | Harrison | 22.27<br>22.39 | | | | | | | | | |
| 210 | Harrison | 21.64<br>21.98 | | | | | | | | | |
| 211 | Mamaroneck | 21.35<br>21.61 | | | | | | | | | |
| 212 | Larchmont | 18.23<br>18.50 | | | | | | | | | |
| 213 | New Rochelle | 17.26<br>17.48 | | | | | | | | | |
| 214 | New Rochelle | 15.98<br>16.20 | | | | | | | | | |
| 215 | Pelham Manor | 18.72<br>18.90 | | | | | | | | | |
| 216 | Pelham Manor | 17.95<br>18.05 | | | | | | | | | |
| 217 | Pelham Manor | 17.51<br>17.75 | | | | | | | | | |
| 217A | Pelham Manor | 17.47<br>17.62 | | | | | | | | | |
| 217B | New York City | 17.37<br>17.42 | | | | | | | | | |
| 218 | New York City | 15.60<br>15.74 | | | | | | | | | |
| 219 | New York City | 15.21<br>15.43 | | | | | | | | | |
| 219A | New York City | 15.04<br>15.16 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF NEW YORK

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 219B | New York City | 14.56<br>14.64 | | | | | | | | | |
| 219C | New York City | 14.50<br>14.56 | | | | | | | | | |
| 220 | New York City | 14.01<br>14.36 | | | | | | | | | |
| 221A | New York City | 13.22<br>13.63 | | | | | | | | | |
| 221B | New York City | 13.02<br>13.08 | | | | | | | | | |
| 222 | New York City | 12.80<br>12.92 | | | | | | | | | |
| 223 | New York City | 12.35<br>12.62 | 5.0 | 130 | Yes | | None | None | | | * |
| 224 | New York City | 11.81<br>12.06 | | | | | | | | | |
| 225 | New York City | 10.89<br>11.11 | | | | | | | | | |
| 226 | New York City | 10.47<br>10.79 | | | | | | | | | |
| 227 | New York City | 10.19<br>10.68 | | | | | | | | | |
| 228 | New York City | 9.94<br>10.11 | | | | | | | | | |
| 229 | New York City | 9.17<br>9.42 | | | | | | | | | |
| 230 | New York City | 8.44<br>8.56 | | | | | | | | | |
| 231 | New York City | 8.85<br>8.22 | | | | | | | | | |
| 232 | New York City | 7.09<br>7.64 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF NEW YORK

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 233 | New York City | 5.91<br>6.57 | 1.0 | 80 | Yes | | None | None | | | * |
| 234 | New York City | 5.12<br>5.38 | | | | | | | | | |
| 235 | New York City | 4.77<br>4.90 | | | | | | | | | |
| 235A | New York City | 4.50<br>4.76 | | | | | | | | | |
| 236 | New York City | 2.95<br>3.40 | | | | | | | | | |
| 237 | New York City | 2.20<br>2.60 | | | | | | | | | |
| 238A | New York City | 0.11<br>0.04 | | | | | | | | | |
| 238B | New York City | 0.18<br>0.13 | | | | | | | | | |
| 238C | New York City | 0.31<br>0.27 | | | | | | | | | |
| 239 | New York City | 0.56<br>0.51 | | | | | | | | | |
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DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF NEW JERSEY

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED | | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ug | oh | | | |
| 240 | Weehawkin | 2.62<br>4.09 | | | | | | | | | |
| 241 | Secaucus | 5.45<br>5.83 | 2.0 | 320 | Yes | | None | None | | | * |
| 242 | Newark | 6.98<br>8.16 | | | | | | | | | |
| 243 | Newark | 7.78<br>8.02 | | | | | | | | | |
| 244 | Newark | 7.96<br>8.39 | | | | | | | | | |
| 245 | Newark | 8.39<br>8.46 | | | | | | | | | |
| 246 | Newark | 8.39<br>8.74 | | | | | | | | | |
| 246A | Newark | 8.68<br>8.80 | | | | | | | | | |
| 247 | Newark | 8.90<br>8.97 | | | | | | | | | |
| 248 | Newark | 8.99<br>9.43 | | | | | | | | | |
| 249 | Newark | 10.19<br>10.69 | | | | | | | | | |
| 250 | Newark | 12.68<br>12.29 | 0.0 | 188 | Yes | | None | None | | | * |
| 251 | Elizabeth | 13.03<br>13.12 | | | | | | | | | |
| 252 | Elizabeth | 14.06<br>14.26 | | | | | | | | | |
| 253 | Elizabeth | 14.29<br>14.68 | | | | | | | | | |
| 254 | Rahway | ---<br>--- | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF NEW JERSEY

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 255 | Rahway | 18.85<br>18.98 | | | | | | | | | |
| 256 | Rahway | 19.27<br>19.42 | | | | | | | | | |
| 257 | Rahway | 19.66<br>19.72 | | | | | | | | | |
| 258 | Rahway | 19.73<br>19.80 | | | | | | | | | |
| 259 | Rahway | 20.45<br>20.71 | 0.5 | 230 | Yes | | None | None | | | * |
| 260 | Rahway | 20.73<br>20.81 | 2.3 | 200 | Yes | | None | None | | | * |
| 261 | Woodbridge | 21.68<br>21.87 | 2.0 | 246 | Yes | | None | None | | | * |
| 262 | Woodbridge | 21.90<br>22.15 | 2.9 | 100 | Yes | | None | None | | | * |
| 263 | Woodbridge | 22.47<br>22.89 | | | | | | | | | |
| 264 | Woodbridge | 22.59<br>23.68 | | | | | | | | | |
| 265 | Woodbridge | 23.68<br>23.95 | | | | | | | | | |
| 266 | Woodbridge | 24.15<br>24.56 | | | | | | | | | |
| 267 | Woodbridge | 25.72<br>25.59 | | | | | | | | | |
| 268 | Metuchen | 24.40<br>24.65 | | | | | | | | | |
| 269 | Edison | 26.77<br>27.77 | | | | | | | | | |
| 270 | Edison | 27.45<br>27.72 | 0.6 | 370 | Yes | | 27.66 | None | | | * |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF NEW JERSEY

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 271 | Edison | 28.85<br>28.94 | | | | | | | | | |
| 272 | New Brunswick | 30.25<br>20.69 | | | | | | | | | |
| 273 | New Brunswick | 31.17<br>31.35 | 1.0 | 200 | Yes | | None | None | | | * |
| 274 | New Brunswick | 33.78<br>34.21 | | | | | | | | | |
| 275 | South Brunswick | 39.07<br>39.34 | | | | | | | | | |
| 276 | South Brunswick | 39.50<br>40.21 | | | | | | | | | |
| 277 | Princeton | 50.36<br>50.50 | | | | | | | | | |
| 278 | Trenton | 56.14<br>56.27 | | | | | | | | | |
| 279 | Trenton | 57.00<br>57.18 | | | | | | | | | |
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DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF PENNSYLVANIA

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 280 | Morrisville | 58.36<br>59.25 | | | | | | | | | |
| 281 | Morrisville | ---<br>--- | | | | | | | | | |
| 282 | Morrisville | 60.25<br>60.55 | | | | | | | | | |
| 283 | Morrisville | 61.41<br>61.94 | | | | | | | | | |
| 284 | Bristol | 64.61<br>64.95 | | | | | | | | | |
| 285 | Bristol | 65.64<br>66.36 | | | | | | | | | |
| 286 | Bristol | 66.67<br>68.07 | | | | | | | | | |
| 287 | Bristol | 68.10<br>68.46 | 0.1 | 120 | Yes | | None | None | | | * |
| 288 | Bensalem | 69.96<br>70.77 | | | | | | | | | |
| 289 | Bensalem | 72.09<br>72.49 | | | | | | | | | |
| 290 | Philadelphia | 74.08<br>74.49 | | | | | | | | | |
| 291 | Philadelphia | 75.65<br>75.09 | | | | | | | | | |
| 292 | Philadelphia | 75.16<br>75.46 | | | | | | | | | |
| 293 | Philadelphia | 75.73<br>76.22 | | | | | | | | | |
| 294 | Philadelphia | 76.70<br>76.04 | | | | | | | | | |
| 295 | Philadelphia | 75.11<br>76.40 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF PENNSYLVANIA

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED | | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ug | oh | | | |
| 296 | Philadelphia | 79.21<br>79.64 | | | | | | | | | |
| 297 | Philadelphia | 80.91<br>81.32 | | | | | | | | | |
| 298 | Philadelphia | 81.39<br>81.77 | | | | | | | | | |
| 299 | Philadelphia | 83.57<br>83.91 | | | | | | | | | |
| 299A | Philadelphia | 84.74<br>84.89 | | | | | | | | | |
| 300 | Philadelphia | 84.87<br>85.15 | | | | | | | | | |
| 301 | Philadelphia | 85.07<br>85.20 | | | | | | | | | |
| 302 | Philadelphia | 85.36<br>85.50 | | | | | | | | | |
| 303 | Philadelphia | 86.25<br>86.36 | | | | | | | | | |
| 304 | Philadelphia | 1.80<br>2.02 | | | | | | | | | |
| 305 | Philadelphia | 2.00<br>2.09 | | | | | | | | | |
| 306 | Philadelphia | 2.40<br>2.47 | 15.0 | 80 | Yes | | None | None | | | * |
| 307 | Philadelphia | 2.81<br>2.90 | | | | | | | | | |
| 308 | Colwyn | 5.40<br>6.17 | | | | | | | | | |
| 309 | Colwyn | 6.07<br>6.85 | | | | | | | | | |
| 310 | Colwyn | 6.85<br>7.33 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF PENNSYLVANIA

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 311 | Sharon Hill | 6.80<br>7.29 | | | | | | | | | |
| 312 | Norwood | 9.42<br>9.77 | 2.4 | 91 | Yes | | 9.56 | None | ● | | * |
| 313 | Ridley Park | 10.47<br>11.08 | | | | | | | | | |
| 314 | Eddystone | 11.82<br>12.93 | | | | | | | | | |
| 315 | Chester | 13.69<br>14.07 | | | | | | | | | |
| 316 | Chester | 14.80<br>15.13 | 0.5 | 150 | Yes | | None | None | ● | | * |
| 317 | Chester | 15.80<br>15.91 | | | | | | | | | |
| 318 | Chester | 15.85<br>15.94 | | | | | | | | | |
| 319 | Marcus Hook | 17.97<br>18.64 | | | | | | | | | |
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DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF DELAWARE

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 320 | Marcus Hook | 19.85<br>19.45 | | | | | | | | | |
| 321 | Holly Oak | 20.67<br>21.04 | | | | | | | | | |
| 322 | Holly Oak | 20.97<br>21.20 | | | | | | | | | |
| 322A | Holly Oak | 21.48<br>21.63 | | | | | | | | | |
| 322B | Holly Oak | 21.74<br>21.94 | | | | | | | | | |
| 323 | Holly Oak | 22.21<br>22.96 | 10.0 | 270 | Yes | | None | None | | | * |
| 324 | Wilmington | 22.86<br>23.28 | | | | | | | | | |
| 325 | Wilmington | 23.28<br>23.69 | | | | | | | | | |
| 326 | Wilmington | 24.11<br>25.32 | | | | | | | | | |
| 327 | Wilmington | 26.19<br>26.77 | | | | | | | | | |
| 327A,B | Wilmington | 26.77<br>26.82 | | | | | | | | | |
| 328 | Wilmington | 27.00<br>27.49 | | | | | | | | | |
| 329 | Wilmington | 28.61<br>29.44 | | | | | | | | | |
| 330 | Newport | 30.08<br>30.45 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF DELAWARE

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 331 | Newport | 30.82<br>31.08 | 1.2 | 254 | Yes | | None | None | | | * |
| 332 | Newport | 32.61<br>32.48 | | | | | | | | | |
| 333 | Newport | 33.32<br>33.90 | | | | | | | | | |
| 334 | Newark | 34.53<br>34.82 | 3.0 | 188 | Yes | | None | None | | | * |
| 335 | Newark | 35.69<br>35.81 | | | | | | | | | |
| 336 | Newark | 39.46<br>40.75 | | | | | | | | | |
| 337 | Newark | 41.79<br>42.03 | | | | | | | | | |
| 338 | Newark | 43.70<br>44.94 | 1.0 | 200 | Yes | | None | None | | | * |
| 339 | Newark/Elkton | 45.27<br>46.02 | 0.4 | 290 | Yes | | None | None | | | * |
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DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF MARYLAND

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 340 | Elkton | 46.80<br>47.60 | | | | | | | | | |
| 341 | North East | 48.76<br>49.18 | | | | | | | | | |
| 342 | North East | 49.86<br>50.59 | | | | | | | | | |
| 343 | North East | 51.20<br>52.00 | 6.5 | 190 | Yes | | None | None | | | * |
| 344 | Charlestown | 53.30<br>53.79 | | | | | | | | | |
| 345 | Charlestown | 53.81<br>54.25 | | | | | | | | | |
| 346 | N/A | | | | | | | | | | |
| 347 | Perryville | 56.74<br>57.19 | | | | | | | | | |
| 348 | Perryville | 57.59<br>58.04 | 1.0 | 212 | Yes | | None | None | | | * |
| 349 | Perryville | 61.49<br>61.59 | | | | | | | | | |
| 350 | Havre de Grace | 62.10<br>62.79 | | | | | | | | | |
| 351 | Aberdeen | 63.63<br>65.42 | | | | | | | | | |
| 352 | Aberdeen | 66.21<br>66.72 | | | | | | | | | |
| 353 | Aberdeen | 69.80<br>71.00 | — | 156 | Yes | | None | None | | | * |
| 354 | Harford Co. | 70.98<br>71.42 | 1.0 | 162 | Yes | | None | None | | | * |
| 354A | Harford Co. | 71.49<br>71.79 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF MARYLAND

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 354B | Harford County | 71.68<br>71.72 | | | | | | | | | |
| 354C | Harford County | 71.74<br>71.79 | | | | | | | | | |
| 355 | Harford County | 73.80<br>73.87 | | | | | | | | | |
| 356 | Harford County | 77.60<br>77.78 | 0.9 | 188 | Yes | | None | None | | | * |
| 357 | Baltimore County | 77.89<br>78.40 | | | | | | | | | |
| 358 | Baltimore County | 82.58<br>82.89 | | | | | | | | | |
| 359 | Baltimore County | 85.65<br>85.76 | | | | | | | | | |
| 360 | Baltimore County | 85.76<br>86.40 | | | | | | | | | |
| 361 | Baltimore County | 86.61<br>88.20 | | | | | | | | | |
| 362 | Baltimore County | 86.27<br>87.10 | | | | | | | | | |
| 363 | Baltimore County | 88.20<br>89.80 | | | | | | | | | |
| 364 | Baltimore | Part of<br>Curve 363 | | | | | | | | | |
| 365 | Baltimore | 89.55<br>89.77 | | | | | | | | | |
| 366 | Baltimore | 90.20<br>91.28 | 1.0 | 328 | Yes | | None | None | | | * |
| 367 | Baltimore | 90.20<br>91.28 | - | 530 | Yes | | None | None | | | * |
| 368 | Baltimore | 90.20<br>91.28 | 0.5 | 492 | Yes | | None | None | | | * |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF MARYLAND

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 369 | Baltimore | 91.17<br>91.50 | 15.0 | 310 | Yes | | None | None | | | * |
| 370 | Baltimore | N/A | | | | | | | | | |
| 371 | Baltimore | 91.85<br>92.05 | - | 310 | Yes | | None | None | | | * |
| 372 | Baltimore | 92.02<br>92.44 | | | | | | | | | |
| 373 | Baltimore | 92.80<br>93.30 | | | | | | | | | |
| 374 | Baltimore | 93.80<br>94.20 | | | | | | | | | |
| 375 | Baltimore | 94.21<br>94.65 | 17.0 | 160 | Yes | | 94.50<br>94.34<br>94.30 | None | ● | | * |
| 375A | Baltimore | 94.51<br>94.60 | | | | | | | | | |
| 375B | Baltimore | 95.67<br>95.76 | | | | | | | | | |
| 376 | Baltimore | 95.93<br>96.71 | - | 160 | Yes | | None | None | | | * |
| 377 | Baltimore | Part of<br>Curve 376 | - | 160 | Yes | | None | None | | | * |
| 378 | Baltimore | 96.98<br>97.13 | | | | | | | | | |
| 379 | Baltimore | N/A | | | | | | | | | |
| 380 | Baltimore | 97.62<br>98.08 | 13.0 | 160 | Yes | | None | None | | | * |
| 381 | Baltimore | 98.19<br>98.67 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF MARYLAND

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 382 | Baltimore | 99.37<br>99.38 | | | | | | | | | |
| 383 | Baltimore | 99.70<br>100.10 | | | | | | | | | |
| 384 | Baltimore | 100.20<br>100.31 | | | | | | | | | |
| 385 | Baltimore Co. | 101.40<br>102.15 | | | | | | | | | |
| 386 | Baltimore Co. | ---<br>--- | | | | | | | | | |
| 387 | Baltimore Co. | 103.43<br>103.75 | | | | | | | | | |
| 388 | Baltimore Co. | 103.90<br>104.15 | | | | | | | | | |
| 389 | Baltimore Co. | 104.30<br>104.80 | 2.2 | 150 | Yes | | None | None | | | * |
| 390 | Anne Arundel County | 105.35<br>106.00 | | | | | | | | | |
| 391 | Anne Arundel County | 106.01<br>107.38 | | | | | | | | | |
| 392 | Anne Arundel County | 108.15<br>108.55 | 2.0 | 130 | Yes | | None | None | | | * |
| 393 | Anne Arundel County | 109.60<br>109.70 | | | | | | | | | |
| 394 | Anne Arundel County | 109.32<br>109.43 | | | | | | | | | |
| 395 | Anne Arundel County | 109.89<br>110.69 | | | | | | | | | |
| 396 A/B | Anne Arundel County | 110.60<br>111.30 | 1.4 | 383 | Yes | | None | None | | | * |
| 397 | Anne Arundel County | 113.20<br>113.54 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC

STATE OF MARYLAND

| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 398 | Anne Arundel County | 113.80<br>114.34 | | | | | | | | | |
| 399 | Anne Arundel County | 115.15<br>115.62 | | | | | | | | | |
| 400 | Anne Arundel County | 116.19<br>116.67 | | | | | | | | | |
| 401 | Anne Arundel County | 116.83<br>117.33 | | | | | | | | | |
| 402 | Anne Arundel County | 117.56<br>117.77 | | | | | | | | | |
| 403 | Bowie | 118.00<br>118.60 | | | | | | | | | |
| 404 | Bowie | 119.00<br>119.80 | 0.2 | 180 | Yes | | None | None | | | * |
| 405 | Bowie | 119.90<br>120.20 | 3.5 | 150 | Yes | | None | None | | | * |
| 406 | Prince Georges County | 121.80<br>122.10 | 1.0 | 130 | Yes | | None | None | | | * |
| 407 | Prince Georges County | 125.10<br>125.50 | | | | | | | | | |
| 408 | Prince Georges County | 125.80<br>126.20 | | | | | | | | | |
| 409 | Landover Hills | 126.70<br>127.00 | 33.0 | 290 | Yes | | None | None | | | * |
| 410 | Landover Hills | 127.40<br>127.90 | 25.0 | 160 | Yes | | None | None | | | * |
| 411 | Cheverly | 128.30<br>128.70 | | | | | | | | | |
| 412 | Cheverly | Part of Curve 411 | | | | | | | | | |
| 413 | Cheverly | 129.10<br>130.90 | | | | | | | | | |

DISPOSITION OF CURVE REALIGNMENTS OF THE NEC



| CURVE NO. | TOWN | MILEPOST | AMOUNT OF SHIFT (FT) | R.O.W. WIDTH | WITHIN R.O.W. (Yes-No) | POTENTIAL TIME SAVINGS (Minutes) | BRIDGES AFFECTED ug | BRIDGES AFFECTED oh | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | REASONS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 414 | Washington, D.C. | 133.40<br>133.90 | | | | | | | | | |
| 415 | Washington, D.C. | 134.81<br>135.12 | | | | | | | | | |
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# APPENDIX B

# DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW YORK

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 20.39 | Mamaroneck Ave. | Mamaroneck | Repair | Maintenance | | Road | 76 | 4 | |
| 20.12 | Fenimore Rd. | Mamaroneck | Upgrade | Structurally Inadequate | | Road | 55 | 4 | |
| 19.08 | Webster Ave. | New Rochelle | Repair | Maintenance | | Road | 65 | 2 | |
| 19.00 | Beechwood Ave. | New Rochelle | Repair | Maintenance | | Road | 55 | 3 | |
| 18.75 | King's Highway | New Rochelle | Repair | Maintenance | | Road | 62 | 3 | * |
| 18.67 | Station Subway | New Rochelle | Repair | Maintenance | | Tunnel | 10 | 4 | |
| 18.64 | Boston Post Rd. | New Rochelle | Repair | Maintenance | | Road | 82 | 3 | |
| 18.28 | Reynolds Crossing | New Rochelle | Repair | Maintenance | | Viaduct | 54 | 2 | |
| 18.07 | Black Crossing | Pelham | Repair | Maintenance | | Viaduct | 54 | 2 | * |
| 17.87 | Pelhamdale Ave. | Pelham | Repair | Maintenance | | Road | 79 | 2 | |
| 16.99 | Cedar St. | Pelham | Repair | Maintenance | | Road | 104 | 4 | |
| 16.61 | Station Subway | Pelham | Repair | Maintenance | | Tunnel | 15 | 4 | |
| 16.60 | Pelham Lane | Pelham | Repair | Maintenance | | Road | 102 | 2 | |
| 16.32 | Center St. | Pelham | Repair | Maintenance | | Road | 62 | 2 | |
| 16.12 | Webster St. | Pelham | Repair | Maintenance | | Road | 65 | 2 | |
| 15.85 | Hutchinson River | Bronx | Repair | | ● | Navigable River | 395 | 2 | * |
| 15.73 | Hutchinson River | Bronx | Repair | Maintenance | ● | Navigable River | 150 | 2 | * |
| 15.69 | Hutchinson River | Bronx | Repair | Maintenance | ● | Navigable River | 405 | 2 | * |
| 13.92 | Eastchester Rd. | Bronx | Upgrade | Structurally Inadequate | | Road | 174 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW YORK

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 26.06 | Byram River | Port Chester | Repair | Maintenance | | Non-Navigable River/Stream | 60 | 4 | |
| 25.94 | North Main St. | Port Chester | Upgrade | Structurally Inadequate | | Road | 74 | 4 | * |
| 25.85 | Highland St. | Port Chester | Upgrade | Structurally Inadequate | | Road | 49 | 4 | |
| 25.75 | Willet Ave. | Port Chester | Upgrade | Structurally Inadequate | | Road | 64 | 4 | |
| 25.69 | King St. | Port Chester | Upgrade | Structurally Inadequate | | Road | 82 | 4 | * |
| 25.55 | Westchester Ave. | Port Chester | Repair | Maintenance | | Road | 71 | 4 | |
| 25.29 | South Main St. | Port Chester | Upgrade | Structurally Inadequate | | Road | 123 | 4 | |
| 24.07 | Station Subway | Rye | Repair | Maintenance | | Tunnel | 11 | 4 | |
| 24.02 | Purchase St. | Rye | Repair | Maintenance | | Road | 77 | 4 | |
| 23.90 | Blind Brook | Rye | Repair | Maintenance | | Non-Navigable River/Stream | 25 | 4 | |
| 23.73 | Locust Ave. | Rye | Repair | Maintenance | | Road | 49 | 4 | |
| 22.72 | Beaver Swamp | Harrison | Repair | Maintenance | | Tunnel | 24 | 4 | |
| 22.38 | Macy St. | Harrison | Repair | Maintenance | | Road | 25 | 4 | |
| 21.80 | Culvert | Harrison | Repair | Maintenance | | Non-Navigable River/Stream | 10 | 4 | |
| 20.59 | Union St. | Mamaroneck | Repair | Maintenance | | Road | 40 | 4 | |
| 20.57 | Mamaroneck River | Mamaroneck | Repair | Maintenance | | Non-Navigable River/Stream | 50 | 4 | |
| 20.48 | Station Subway | Mamaroneck | Repair | Maintenance | | Tunnel | 10 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC — STATE OF NEW YORK

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 8.79 | 132nd St. | Bronx | Repair | Maintenance | | Viaduct | 95 | 2 | |
| 8.69 | 132nd St. | Bronx | Repair | Maintenance | | Viaduct | 1141 | 2 | |
| 8.58 | North Approach | Bronx | Repair | Maintenance | | Non-Navigable River/Stream | 74 | 2 | |
| 8.54 | Bronx Kill | Bronx | Repair | Maintenance | | Non-Navigable River/Stream | 346 | 2 | |
| 8.50 | South Approach | Bronx | Repair | Maintenance | | Non-Navigable River/Stream | 75 | 2 | |
| 8.31 | Randall's Island | Manhattan | Repair | Maintenance | | Viaduct | 1965 | 2 | |
| 8.02 | Little Hell Gate | Manhattan | Repair | Maintenance | | Non-Navigable River/Stream | 1137 | 2 | |
| 7.65 | Ward Island | Manhattan | Repair | Maintenance | | Road | 2655 | 2 | |
| 7.29 | Hell Gate | Manhattan | Repair | Maintenance | ● | Navigable River | 977 | 2 | * |
| 7.13 | Shore Blvd. | Queens | Repair | Maintenance | | Viaduct | 518 | 2 | |
| 7.01 | 19th St. | Queens | Repair | Maintenance | | Viaduct | 90 | 2 | |
| 6.94 | Viaduct | Queens | Repair | Maintenance | | Viaduct | 335 | 2 | |
| 6.89 | 21st St. | Queens | Repair | Maintenance | | Viaduct | 100 | 2 | |
| 6.85 | Viaduct | Queens | Repair | Maintenance | | Viaduct | 285 | 2 | |
| 6.81 | 23rd St. | Queens | Repair | Maintenance | | Viaduct | 90 | 2 | |
| 6.79 | Viaduct | Queens | Repair | Maintenance | | Viaduct | 170 | 2 | |
| 6.77 | 24th St. | Queens | Repair | Maintenance | | Viaduct | 90 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW YORK

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 13.26 | Bronxdale Ave. | Bronx | Repair | Maintenance | | Road | 159 | 2 | |
| 11.40 | Bronx River | Bronx | Repair | Maintenance | | Navigable River | 182 | 2 | |
| 9.34 | NYC & H R. R. | Bronx | Repair | Maintenance | | Viaduct | 193 | 2 | |
| 9.25 | 141 Street Sta. | Bronx | Repair | Maintenance | | Viaduct | 65 | 2 | |
| 9.20 | 140th Street Station | Bronx | Repair | Maintenance | | Viaduct | 75 | 2 | |
| 9.16 | 139th St. | Bronx | Repair | Maintenance | | Viaduct | 75 | 2 | |
| 9.13 | 138th St. | Bronx | Repair | Maintenance | | Viaduct | 113 | 2 | |
| 9.10 | 138-137th St. | Bronx | Repair | Maintenance | | Viaduct | 192 | 2 | |
| 9.07 | 137th St. | Bronx | Repair | Maintenance | | Viaduct | 71 | 2 | |
| 9.05 | 137th-136th St. | Bronx | Repair | Maintenance | | Viaduct | 189 | 2 | * |
| 9.02 | 136th St. | Bronx | Repair | Maintenance | | Viaduct | 71 | 2 | * |
| 9.00 | 136-135th St. | Bronx | Repair | Maintenance | | Viaduct | 192 | 2 | |
| 8.98 | 135th St. | Bronx | Repair | Maintenance | | Viaduct | 71 | 2 | |
| 8.95 | 135-134th St. | Bronx | Repair | Miantenance | | Viaduct | 195 | 2 | |
| 8.92 | 134th St. | Bronx | Repair | Maintenance | | Viaduct | 91 | 2 | |
| 8.89 | 134-133rd St. | Bronx | Repair | Maintenance | | Viaduct | 192 | 2 | |
| 8.85 | 133rd St. | Bronx | Repair | Maintenance | | Viaduct | 71 | 2 | |
| 8.82 | 133-132nd St. | Bronx | Upgrade | Structurally Inadequate | | Viaduct | 182 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW YORK

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 5.99 | 41st St. | Queens | Repair | Maintenance | | Road | 586 | 2 | |
| 5.89 | 44th St. | Queens | Repair | Maintenance | | Road | 71 | 2 | |
| 5.83 | 45th St. | Queens | Repair | Maintenance | | Road | 72 | 2 | * |
| 5.78 | 46th St. | Queens | Repair | Maintenance | | Road | 72 | 2 | * |
| 5.72 | 47th St. | Queens | Repair | Maintenance | | Road | 171 | 2 | |
| 5.66 | 48th St. | Queens | Upgrade | Structurally Inadequate | | Road | 85 | 2 | * |
| 5.60 | 49th St. | Queens | Upgrade | Structurally Inadequate | | Road | 85 | 2 | * |
| 5.54 | 50th St. | Queens | Repair | Maintenance | | Road | 72 | 2 | |
| 5.14 | 31st Ave. | Queens | Repair | Maintenance | | Road | 89 | 2 | |
| 5.03 | 32nd Ave. | Queens | Repair | Maintenance | | Road | 89 | 2 | |
| 4.96 | 56th St. | Queens | Repair | Maintenance | | Road | 146 | 2 | |
| 4.85 | 55th St. | Queens | Repair | Maintenance | | Road | 390 | 2 | |
| 4.77 | 54th St. | Queens | Repair | Maintenance | | Road | 118 | 2 | |
| 4.63 | Woodside Ave. | Queens | Repair | Maintenance | | Road | 264 | 2 | |
| 4.50 | N.Y. Conn. R.R. | Queens | Repair | Maintenance | | Railroad | 22 | 1 | |
| 4.40 | N.Y. Conn. R.R. | Queens | Repair | Maintenance | | Railroad | 43 | 1 | |
| 4.33 | Gosman Ave. | Queens | Upgrade | Structurally Inadequate | | Road | 105 | 1 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW YORK

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 6.73 | Viaduct | Queens | Repair | Maintenance | | Viaduct | 170 | 2 | |
| 6.71 | 25th St. | Queens | Repair | Maintenance | | Viaduct | 90 | 2 | |
| 6.69 | Viaduct | Queens | Repair | Maintenance | | Viaduct | 172 | 2 | |
| 6.67 | 26th St. | Queens | Repair | Maintenance | | Viaduct | 90 | 2 | |
| 6.65 | Viaduct | Queens | Repair | Maintenance | | Viaduct | 170 | 2 | |
| 6.62 | 27th St. | Queens | Repair | Maintenance | | Viaduct | 90 | 2 | |
| 6.60 | Viaduct | Queens | Repair | Maintenance | | Viaduct | 174 | 2 | |
| 6.57 | 28th St. | Queens | Repair | Maintenance | | Viaduct | 90 | 2 | |
| 6.55 | Viaduct | Queens | Repair | Maintenance | | Viaduct | 144 | 2 | |
| 6.52 | 29th St. | Queens | Repair | Maintenance | | Road | 61 | 2 | |
| 6.45 | 31st St. | Queens | Repair | Maintenance | | Road | 103 | 2 | * |
| 6.37 | 33rd St. | Queens | Repair | Maintenance | | Road | 73 | 2 | |
| 6.31 | 35th St. | Queens | Repair | Maintenance | | Road | 405 | 2 | |
| 6.26 | 36th St. | Queens | Repair | Maintenance | | Road | 75 | 2 | * |
| 6.21 | 37th St. | Queens | Repair | Maintenance | | Road | 65 | 2 | * |
| 5.15 | 38th St. | Queens | Repair | Maintenance | | Road | 75 | 2 | |
| 6.08 | Steinway St. | Queens | Repair | Maintenance | | Road | 240 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC — STATE OF NEW JERSEY

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 3.10 | Northern Railroad of New Jersey | Union City | Replace | Structurally Inadequate | ● | Railroad | 134 | 2 | * |
| 3.82 | Secaucus Road | Secaucus | Replace | Structurally Inadequate | ● | Road | 69 | 2 | * |
| 4.61 | Erie Lackawanna Railroad | Secaucus | Upgrade | Structurally Inadequate | ● | Road and Railroad | 799 | 2 | * |
| 4.76 | Erie Lackawanna Railroad | Secaucus | Replace | Structurally Inadequate | ● | Railroad | 70 | 2 | * |
| 4.95 | Erie Lackawanna Railroad | Secaucus | Replace | Structurally Inadequate | ● | Railroad | 110 | 2 | * |
| 5.65 | Erie Lackawanna Railroad | Secaucus | Replace | Structurally Inadequate | ● | Railroad | 140 | 2 | * |
| 6.10 | Hackensack River | Secaucus | Upgrade | Structurally Inadequate | ● | Navigable River | 961 | 2 | * |
| 6.28 | Erie Lackawanna Railroad | Kearny | Replace | Structurally Inadequate | ● | Railroad | 65 | 2 | * |
| 6.59 | Belleville Road | Kearny | Replace | Structurally Inadequate | ● | Road | 104 | 2 | * |
| 6.86 | Erie Lackawanna Railroad | Kearny | Replace | Structurally Inadequate | ● | Railroad | 69 | 2 | * |
| 7.03 | Newark Turnpike | Kearny | Replace | Structurally Inadequate | ● | Road | 256 | 2 | * |
| 7.80 | Erie Lackawanna Railroad | Harrison | Repair | Maintenance | | Railroad | 496 | 2 | * |
| 7.96 | Path | Harrison | Repair | Maintenance | | Railroad | 497 | 2 | * |
| 7.98 | Fifth Street | Harrison | Repair | Maintenance | | Road | 16 | 4 | |
| 8.10 | Fourth Street | Harrison | Upgrade | Structurally Inadequate | | Road | 106 | 3 | * |
| A8.50 | Passaic River | Newark | Repair | Maintenance | | Navigable River | 538 | 3 | * |
| 8.50 | Passaic River | Newark | Repair | Maintenance | | Navigable River | 538 | 3 | * |
| C8.50 | Passaic River | Newark | Repair | Maintenance | | Navigable River | 538 | 1 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

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|---|---|---|---|---|---|---|---|---|---|
| 4.07 | Laurel Hill Ave | Queens | Upgrade | Structurally Inadequate | | Road | 105 | 2 | * |
| 4.05 | Loop Tracks | Queens | Repair | Maintenance | | Railroad | 68 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW JERSEY

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 9.89 | Astor Street | Newark | Upgrade | Structurally Inadequate | | Road | 69 | 4 | * |
| 9.94 | Emmett Street | Newark | Upgrade | Structurally Inadequate | | Road | 69 | 4 | * |
| 10.00 | Wright Street | Newark | Upgrade | Structurally Inadequate | | Road | 69 | 4 | * |
| 10.05 | Miller Street | Newark | Upgrade | Structurally Inadequate | | Road | 69 | 4 | * |
| 10.10 | Vanderpool St. | Newark | Upgrade | Structurally Inadequate | | Road | 69 | 4 | * |
| 10.70 | Peddie Stream | Newark | Repair | Maintenance | | Concrete Pipe | 34 | 4 | |
| 10.71 | Peddie Stream | Newark | Repair | Maintenance | | Concrete Pipe | 52 | 4 | |
| 12.12 | Waverly Jumpover | Newark | Repair | Maintenance | | Railroad | 131 | 2 | * |
| 12.37 | McClellan Street | Newark | Upgrade | Structurally Inadequate | | Road | 38 | 4 | * |
| 12.98 | North Avenue | Elizabeth | Repair | Maintenance | | Road | 85 | 4 | |
| 13.36 | Fairmount Avenue | Elizabeth | Upgrade | Structurally Inadequate | | Road | 86 | 4 | * |
| 13.64 | Mary Street | Elizabeth | Repair | Maintenance | | Road | 74 | 4 | * |
| 13.83 | Magnolia Street | Elizabeth | Repair | Maintenance | | Road | 52 | 4 | |
| 13.90 | Chestnut Street | Elizabeth | Repair | Maintenance | | Road | 52 | 4 | |
| 14.03 | Broad Street | Elizabeth | Repair | Maintenance | | Road | 50 | 4 | |
| 14.04 | Morris Avenue | Elizabeth | Repair | Maintenance | | Road | 50 | 4 | |
| 14.05 | Central Railroad of New Jersey | Elizabeth | Upgrade | Structurally Inadequate | | Railroad | 84 | 4 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW JERSEY

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|---|---|---|---|---|---|---|---|---|---|
| 8.57 | Newark Station | Newark | Repair | Maintenance | | Building | 263 | 4 | |
| 8.59 | Reymond Blvd. | Newark | Repair | Maintenance | | Road | 188 | 5 | |
| 8.66 | Newark Pass | Newark | Repair | Maintenance | | Building | 514 | 5 | |
| 8.71 | Market Street | Newark | Repair | Maintenance | | Road | 550 | 5 | |
| 8.77 | Edison Place | Newark | Repair | Maintenance | | Road | 87 | 5 | |
| 8.95 | Lafayette Street | Newark | Repair | Maintenance | | Road | 100 | 5 | |
| 9.02 | Green Street | Newark | Repair | Maintenance | | Road | 61 | 5 | |
| 9.10 | Elm Street | Newark | Repair | Maintenance | | Road | 60 | 5 | |
| 9.15 | Walnut Street | Newark | Repair | Maintenance | | Road | 75 | 2 | |
| 9.20 | Cottage Street | Newark | Repair | Maintenance | | Road | 62 | 4 | |
| 9.29 | E. Kinney Street | Newark | Upgrade | Structurally Inadequate | | Road | 62 | 4 | * |
| 9.34 | Oliver Street | Newark | Repair | Maintenance | | Road | 58 | 4 | |
| 9.39 | Chestnut Street | Newark | Upgrade | Structurally Inadequate | | Road | 54 | 4 | * |
| 9.54 | Pennington Street | Newark | Upgrade | Structurally Inadequate | | Road | 59 | 4 | * |
| 9.59 | Tichnor Street | Newark | Upgrade | Structurally Inadequate | | Road | 63 | 4 | * |
| 9.64 | South Street | Newark | Upgrade | Structurally Inadequate | | Road | 89 | 4 | * |
| 9.84 | Murray Street | Newark | Upgrade | Structurally Inadequate | | Road | 69 | 4 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC — STATE OF NEW JERSEY

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 19.41 | Milton Avenue | Rahway | Upgrade | Structurally Inadequate | | Road | 86 | 6 | |
| 19.55 | W. Emerson Avenue | Rahway | Upgrade | Structurally Inadequate | | Road | 75 | 7 | * |
| 19.72 | Haxelwood Avenue | Rahway | Upgrade | Structurally Inadequate | | Road | 78 | 1 | |
| 20.05 | Tunnel | Rahway | Repair | Maintenance | | Railroad | 20 | 1 | |
| 20.16 | Inman Avenue | Rahway | Upgrade | Structurally Inadequate | | Road | 135 | 1 | * |
| 20.50 | St. George Avenue | Rahway | Repair | Maintenance | | Road | 109 | 6 | |
| 21.90 | Sucker Brook | Woodbridge Township | Repair | Maintenance | | Non-Navigable River/Stream | 25 | 4 | |
| 22.65 | Oak Tree Road | Woodbridge Township | Repair | Maintenance | | Road | 70 | 4 | |
| 23.07 | Garden State Parkway | Woodbridge Township | Repair | Maintenance | | Road | 168 | 4 | |
| 23.42 | Wood Avenue South | Woodbridge Township | Repair | Maintenance | | Road | 38 | 4 | |
| 24.08 | Evergreen Avenue | Edison Township | Repair | Maintenance | | Road | 27 | 4 | * |
| 24.38 | Parsonage Road | Edison Township | Repair | Maintenance | | Road | 27 | 4 | |
| 24.56 | Port Reading Railroad | Metuchen | Repair | Maintenance | | Railroad | 45 | 4 | * |
| 25.32 | Grove Avenue | Metuchen | Repair | Maintenance | | Road | 59 | 4 | * |
| 25.84 | Main Street | Metuchen | Upgrade | Structurally Inadequate | | Road | 52 | 4 | |
| 26.05 | Lake Street | Metuchen | Upgrade | Structurally Inadequate | | Road | 46 | 4 | |
| 26.18 | Lehigh Valley Railroad | Metuchen | Upgrade | Structurally Inadequate | | Railroad | 39 | 4 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW JERSEY

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 14.06 | Roadway (Station) | Elizabeth | Repair | Maintenance | | Road | 54 | 4 | |
| 14.12 | W. Grand Street | Elizabeth | Repair | Maintenance | | Road | 62 | 4 | |
| 14.22 | W. Jersey Street | Elizabeth | Repair | Maintenance | | Road | 66 | 4 | |
| 14.45 | Elizabeth River | Elizabeth | Repair | Maintenance | | Navigable River | 87 | 4 | |
| 14.49 | Rahway Avenue | Elizabeth | Repair | Maintenance | | Road | 68 | 4 | |
| 14.59 | Pearl Street | Elizabeth | Upgrade | Structurally Inadequate | | Road | 77 | 4 | * |
| 14.71 | South Street | Elizabeth | Upgrade | Structurally Inadequate | | Road | 76 | 4 | * |
| 15.10 | Bayway Street | Linden | Upgrade | Structurally Inadequate | | Road | 88 | 6 | * |
| 16.14 | Tannery Creek | Linden | Repair | Maintenance | | Non-Navigable River/Stream | 19 | 6 | * |
| 17.26 | Wood Avenue | Linden | Upgrade | Structurally Inadequate | | Road | 86 | 6 | * |
| 17.65 | Stiles Street | Linden | Repair | Maintenance | | Road | 59 | 6 | |
| 18.76 | Scott Avenue | Rahway | Repair | Maintenance | | Road | 72 | 6 | |
| 18.98 | Grand Street | Rahway | Upgrade | Structurally Inadequate | | Road | 73 | 4 | |
| 19.13 | Rahway River | Rahway | Repair | Maintenance | | Non-Navigable River | 210 | 4 | |
| 19.17 | Main Street | Rahway | Upgrade | Structually Inadequate | | Road | 74 | 6 | |
| 19.21 | Poplar Street | Rahway | Upgrade | Structurally Inadequate | | Road | 84 | 3 | * |
| 19.31 | Irving & Cherry Streets | Rahway | Upgrade | Structurally Inadequate | | Road | 351 | 6 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW JERSEY

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 31.75 | Townsend Street | New Brunswick | Repair | Maintenance | | Road | 67 | 4 | |
| 31.80 | Suydam Street | New Brunswick | Repair | Maintenance | | Road | 86 | 4 | |
| 31.90 | Handy Street | New Brunswick | Repair | Maintenance | | Road | 67 | 4 | |
| 32.61 | One Mile Run | New Brunswick | Repair | Maintenance | | Non-Navigable River/Stream | 12 | 4 | |
| 38.16 | Oakey's Brook | South Brunswick | Repair | Maintenance | | Non-Navigable River/Stream | 33 | 4 | |
| 38.60 | Dean's Lane | South Brunswick | Repair | Maintenance | | Road | 56 | 4 | * |
| 39.27 | Dean Pond Road | South Brunswick | Repair | Maintenance | | Road | 16 | 4 | |
| 39.35 | Lawrence Brook | South Brunswick Township | Repair | Maintenance | | Non-Navigable River/Stream | 12 | 4 | |
| 44.48 | Devil's Run | Princeton | Repair | Maintenance | | Non-Navigable River/Stream | 24 | 4 | |
| 46.30 | Millstone River | Princeton | Repair | Maintenance | | Non-Navigable River/Stream | 154 | 5 | |
| 46.47 | Swinger Race | Princeton | Repair | Maintenance | | Non-Navigable River/Stream | 43 | 4 | |
| 51.49 | Assunpink Creek | Trenton | Repair | Maintenance | | Non-Navigable River/Stream | 91 | 4 | * |
| 63.64 | Coleman's Creek | Trenton | Repair | Maintenance | | Non-Navigable River/Stream | 30 | 4 | |
| 55.23 | Nottingham Highway | Trenton | Upgrade | Structurally Inadequate | | Road | 80 | 4 | * |
| 55.51 | Assunpink Creek | Trenton | Repair | Maintenance | | Non-Navigable River/Stream | 14 | 4 | |
| 57.43 | Union Street | Trenton | Upgrade | Structurally Inadequate | ● | Road | 107 | 4 | * |
| 57.54 | Warren Street | Trenton | Upgrade | Structurally Inadequate | ● | Road | 97 | 4 | * |

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 26.23 | Memorial Parkway | Metuchen | Upgrade | Structurally Inadequate | | Road | 56 | 4 | * |
| 27.66 | Talmadge Road | Edison Township | Repair | Maintenance | | Road | 47 | 4 | |
| 28.84 | Plainfield Avenue | Edison Township | Repair | Maintenance | | Road | 60 | 4 | |
| 29.42 | Sutton Lane | Edison Township | Repair | Maintenance | | Road | 35 | 4 | |
| 30.80 | Boundbrook Road | Highland Park | Repair | Maintenance | | Road | 37 | 4 | |
| 30.92 | Raritan River | New Brunswick | Repair | Maintenance | | Navigable River | 660 | 4 | |
| 31.01 | D & R Canal | New Brunswick | Repair | Maintenance | | Navigable River | 112 | 4 | |
| 31.02 | River Road | New Brunswick | Repair | Maintenance | | Road | 51 | 4 | * |
| 31.03 | Water Street | New Brunswick | Repair | Maintenance | | Road | 51 | 4 | |
| 31.08 | Viaduct | New Brunswick | Repair | Maintenance | | Viaduct | 306 | 4 | |
| 31.12 | Nellson Street | New Brunswick | Repair | Maintenance | | Road | 76 | 4 | * |
| 31.22 | George Avenue | New Brunswick | Repair | Maintenance | | Road | 89 | 4 | |
| 31.36 | Easton Avenue | New Brunswick | Repair | Maintenance | | Road | 71 | 4 | * |
| 31.43 | French Street | New Brunswick | Repair | Maintenance | | Road | 183 | 4 | |
| 31.49 | Joyce Kilmer Street | New Brunswick | Upgrade | Structurally Inadequate | | Road | 78 | 4 | * |
| 31.55 | Paterson Street | New Brunswick | Repair | Maintenance | | Road | 85 | 4 | |
| 31.63 | Bayard Street | New Brunswick | Repair | Maintenance | | Road | 85 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF PENNSYLVANIA

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 57.75 | Delaware River | Morrisville | Repair | Maintenance | | Navigable River | 1228 | 4 | * |
| 58.03 | Washington St. | Morrisville | Upgrade | Structurally Inadequate | | Road | 58 | 4 | * |
| 58.11 | Passenger Tunnel | Morrisville | Repair | Maintenance | | Tunnel | 15 | 4 | * |
| 58.16 | Pennsylvania Avenue | Morrisville | Upgrade | Structurally Inadequate | | Road | 75 | 4 | * |
| 62.59 | Belsford Run | Tullytown | Repair | Maintenance | | Non-Navigable River/Stream | 33 | 4 | |
| 65.47 | Green Lane | Bristol | Repair | Maintenance | | Road | 48 | 4 | * |
| 62.02 | Adams Hollow Creek | Bristol | Repair | Maintenance | | Non-Navigable River/Stream | 15 | 5 | |
| 66.06 | Penn. Canal | Bristol | Repair | Maintenance | | Non-Navigable River/Stream | 67 | 4 | |
| 66.22 | Jefferson St. | Bristol | Repair | Maintenance | | Road | 65 | 4 | |
| 66.41 | Beaver St. | Bristol | Upgrade | Structurally Inadequate | | Road | 86 | 4 | * |
| 66.57 | Corson St. | Bristol | Repair | Maintenance | | Road | 53 | 4 | |
| 66.64 | Pine St. | Bristol | Repair | Maintenance | | Road | 53 | 4 | |
| 66.71 | Spruce St. | Bristol | Repair | Maintenance | | Road | 53 | 4 | |
| 66.86 | Bath St. | Bristol | Upgrade | Structurally Inadequate | | Road | 72 | 4 | |
| 67.17 | Otter Creek | Bristol | Repair | Maintenance | | Non-Navigable River/Stream | 61 | 4 | |
| 67.46 | Bristol Tnpk. | Bristol | Repair | Maintenance | | Road | 68 | 4 | |
| 69.29 | Cedar Rd. | Bensalem | Repair | Maintenance | | Road | 40 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF NEW JERSEY

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 57.61 | Bloombury Road | Trenton | Repair | Maintenance | | Road | 66 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC    STATE OF PENNSYLVANIA

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 79.80 | Aramingo Ave. | Philadelphia | Repair | Maintenance | | Road | 58 | 4 | |
| 79.73 | Bridge St. | Philadelphia | Repair | Maintenance | | Road | 57 | 4 | |
| 79.89 | Wakeling St. | Philadelphia | Repair | Maintenance | | Road | 58 | 4 | * |
| 80.12 | Margaret St. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 58 | 4 | * |
| 80.22 | Orthodox St. | Philadelphia | Repair | Maintenance | | Road | 58 | 4 | * |
| 80.48 | Church St. | Philadelphia | Repair | Maintenance | | Road | 58 | 4 | |
| 80.71 | Adams Ave. | Philadelphia | Repair | Maintenance | | Road | 63 | 4 | |
| 80.92 | Frankford Creek | Philadelphia | Repair | Maintenance | | Non-Navigable River/Stream | 102 | 4 | |
| 81.39 | Frankford Ave. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 78 | 4 | |
| 81.53 | Castor Ave. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 86 | 4 | |
| 81.69 | Kensington Ave. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 111 | 4 | |
| 81.85 | K St. | Philadelphia | Repair | Maintenance | | Road | 57 | 4 | |
| 82.06 | I St. | Philadelphia | Repair | Maintenance | | Road | 86 | 4 | |
| 82.82 | B St. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 88 | 4 | |
| 83.45 | Reading RR | Philadelphia | Repair | Maintenance | | Railroad | 46 | 4 | |
| 83.70 | 6th St. | Philadelphia | Repair | Maintenance | | Road | 69 | 4 | |
| 83.85 | Reading RR | Philadelphia | Repair | Maintenance | | Railroad | 54 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF PENNSYLVANIA

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 69.65 | Cedar Rd. | Bensalem | Repair | Maintenance | | Road and Non-Navigable River/Stream | 334 | 4 | |
| 70.69 | Neshaminy Creek | Bensalem | Repair | Maintenance | | Non-Navigable River/Stream | 30 | 4 | * |
| 72.11 | Station Ave. | Bensalem | Repair | Maintenance | | Road | 42 | 6 | * |
| 74.10 | Mill Rd. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 35 | 4 | |
| 74.20 | Poquessing Creek | Philadelphia | Repair | Maintenance | | Road & Non-Navigable River | 41 | 4 | * |
| 76.07 | Stream | Philadelphia | Repair | Maintenance | | Non-Navigable River/Stream | 20 | 4 | |
| 76.70 | Pennypacker Creek | Philadelphia | Repair | Maintenance | | Non-Navigable River/Stream | 186 | 4 | |
| 76.81 | Rhawn St. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 67 | 4 | * |
| 77.45 | Cottman St. | Philadelphia | Repair | Maintenance | | Road | 58 | 4 | * |
| 77.68 | Princeton Ave. | Philadelphia | Replace | Structurally Inadequate | ● | Road | 76 | 4 | * |
| 77.91 | Disston St. | Philadelphia | Repair | Maintenance | | Road | 67 | 4 | * |
| 77.98 | Longshore St. | Philadelphia | Repair | Maintenance | | Road | 57 | 4 | * |
| 78.17 | Unruh St. | Philadelphia | Repair | Maintenance | | Road | 57 | 4 | * |
| 78.29 | Magee St. | Philadelphia | Replace | Structurally Inadequate | | Road | 65 | 4 | * |
| 78.51 | Levick St. | Philadelphia | Repair | Maintenance | | Road | 80 | 4 | |
| 78.99 | Comly St. | Philadelphia | Repair | Maintenance | | Road | 68 | 4 | * |
| 79.15 | Vankirk St. | Philadelphia | Repair | Maintenance | | Road | 68 | 4 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF PENNSYLVANIA

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|---|---|---|---|---|---|---|---|---|---|
| A 87.98 | Baggage Subway | Philadelphia | Repair | Maintenance | | Tunnel | 20 | 19 | * |
| A 88.12 | Tunnel | Philadelphia | Repair | Maintenance | | Tunnel | 20 | 19 | |
| A 88.13 | Baggage Subway | Philadelphia | Repair | Maintenance | | Tunnel | 24 | 10 | * |
| 89.32 | University Ave. | Philadelphia | Repair | Maintenance | | Road | 115 | 2 | * |
| 89.71 | Sewer | Philadelphia | Repair | Maintenance | | Non-Navigable River/Stream | 20 | 4 | |
| 5.58 | Island Ave. | Philadelphia | Repair | Maintenance | | Road | 70 | 4 | |
| 5.73 | Cobb's Creek | Colwyn | Repair | Maintenance | | Non-Navigable River/Stream | 74 | 4 | |
| 6.19 | 5th St. | Colwyn | Repair | Maintenance | | Road | 63 | 4 | |
| 6.44 | Darby Creek | Sharon Hill | Repair | Maintenance | | Non-Navigable River/Stream | 150 | 4 | |
| 8.32 | Glenolden Ave. | Glenolden | Repair | Maintenance | | Road | 53 | 4 | |
| 8.64 | Chester Pike | Glenolden | Upgrade | Structurally Inadequate | | Road | 152 | 4 | * |
| 8.73 | Muckinipatts Creek | Prospect Park | Repair | Maintenance | | Non-Navigable River/Stream | 44 | 4 | * |
| 9.56 | Lincoln Ave. | Prospect Park | Repair | Maintenance/ Curve 312 | | Road | 55 | 2 | * |
| 10.05 | Stone Creek | Ridley Park | Repair | Maintenance | | Non-Navigable River/Stream | 33 | 4 | * |
| 11.08 | Little Crum Creek | Ridley Park | Repair | Maintenance | | Non-Navigable River/Stream | 33 | 4 | * |
| 11.18 | Chester & Darby | Ridley Park | Repair | Maintenance | | Road | 139 | 4 | |
| 11.52 | Liederville Crossing | Ridley Park | Repair | Maintenance | | Road | 12 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC    STATE OF PENNSYLVANIA

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 83.93 | Alleghany Ave. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 107 | 4 | * |
| 84.16 | Germantown Ave. | Philadelphia | Repair | Maintenance | | Road | 67 | 6 | |
| 84.30 | 12th St. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 70 | 6 | |
| 84.51 | Broad St. | Philadelphia | Repair | Maintenance | | Road | 151 | 6 | |
| 84.60 | Passenger Tunnel | Philadelphia | No Action Required | | | Tunnel | 16 | 6 | |
| 84.69 | Reading RR | Philadelphia | Repair | Maintenance | | Railroad | 74 | 8 | |
| 84.83 | 17th St. | Philadelphia | Repair | Maintenance | | Road | 81 | 6 | |
| 84.97 | Lehigh Ave. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 149 | 4 | |
| 85.41 | 22nd St. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 90 | 4 | |
| 85.46 | York St. | Philadelphia | Repair | Maintenance | | Road | 82 | 4 | |
| 85.61 | Dauphin St. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 84 | 4 | * |
| 85.76 | 25th St. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 78 | 6 | * |
| 86.86 | Water Main | Philadelphia | No Action Required | | | Road & Non-navigable River | 36 | 4 | |
| 86.98 | Reading RR | Philadelphia | Repair | Maintenance | | Railroad | 103 | 4 | |
| 87.14 | Shuylkill River | Philadelphia | Repair | Maintenance | | Navigable River | 869 | 4 | |
| 87.24 | Girard Ave. | Philadelphia | Upgrade | Structurally Inadequate | | Road | 208 | 4 | |
| 87.97 | Steam Tunnel | Philadelphia | Repair | Maintenance | | Tunnel | 24 | 10 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC    STATE OF PENNSYLVANIA

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 13.70 | Pennsylvania St. | Chester | Repair | Maintenance | | Road | 66 | 4 | |
| 13.79 | Barclay St. | Chester | Repair | Maintenance | | Road | 66 | 4 | |
| 13.83 | Concord Ave. | Chester | Repair | Maintenance | | Road | 66 | 4 | |
| 13.96 | Parker St. | Chester | Repair | Maintenance | | Road | 69 | 4 | |
| 14.02 | Kerlin St. | Chester | Upgrade | Structurally Inadequate | | Road | 67 | 4 | |
| 14.60 | Tilghman St. | Chester | Upgrade | Structurally Inadequate | | Road | 67 | 4 | * |
| 14.67 | Central Ave. | Chester | Upgrade | Structurally Inadequate | | Road | 67 | 4 | |
| 14.80 | Flower St. | Chester | Repair | Maintenance | | Road | 68 | 4 | |
| 14.85 | Reaney St. | Chester | Repair | Maintenance | | Road | 67 | 4 | |
| 14.94 | Yarnall St. | Chester | Repair | Maintenance | | Road | 68 | 4 | |
| 15.02 | Jeffrey Street | Chester | Upgrade | Structurally Inadequate | | Road | 68 | 4 | * |
| 15.09 | Engle St. | Chester | Upgrade | Structurally Inadequate | | Road | 68 | 4 | * |
| 15.36 | Wilson St. | Chester | Upgrade | Structurally Inadequate | | Road | 68 | 4 | * |
| 15.50 | Highland Ave. | Chester | Upgrade | Structurally Inadequate | | Road | 68 | 4 | * |
| 15.70 | Booth St. | Chester | Upgrade | Structurally Inadequate | | Road | 67 | 4 | |
| 16.35 | Main St. | Trainer | Repair | Maintenance | | Road | 59 | 4 | |
| 16.49 | Marcus Hook Creek | Marcus Hook | Repair | Maintenance | | Non-Navigable River/Stream | 55 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF PENNSYLVANIA

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 11.69 | B&O Railroad Crossing | Ridley Park | Repair | Maintenance | | Railroad | 32 | 4 | * |
| 11.70 | Crum Creek | Ridley Park | Repair | Maintenance | | Non-Navigable River/Stream | 48 | 4 | |
| 11.75 | Patterson Dr. | Eddystone | Repair | Maintenance | | Road | 15 | 4 | |
| 12.28 | Saville Ave. | Eddystone | Upgrade | Structurally Inadequate | ● | Road | 72 | 2 | * |
| 12.41 | Eddystone Ave. | Eddystone | Repair | Maintenance | | Road | 69 | 4 | |
| 12.65 | Ridley Creek | Chester | Repair | Maintenance | | Non-Navigable River/Stream | 142 | 4 | |
| 12.85 | Hinkson St. | Chester | Upgrade | Structurally Inadequate | | Road | 78 | 4 | |
| 12.92 | Caldwell St. | Chester | Upgrade | Structurally Inadequate | | Road | 61 | 4 | |
| 13.07 | Potter St. | Chester | Upgrade | Structurally Inadequate | ● | Road | 129 | 4 | * |
| 13.17 | Upland St. | Chester | Upgrade | Structurally Inadequate | | Road | 52 | 4 | * |
| 13.25 | Madison St. | Chester | Upgrade | Structurally Inadequate | | Road | 57 | 4 | * |
| 13.42 | Welsh St. | Chester | Upgrade | Structurally Inadequate | | Road | 58 | 4 | * |
| 13.49 | Edgemont Ave. | Chester | Upgrade | Structurally Inadequate | | Road | 101 | 4 | |
| 13.51 | Chester Viaduct | Chester | Repair | Maintenance | | Viaduct | 331 | 4 | |
| 13.58 | Chester Creek | Chester | Repair | Maintenance | | Non-Navigable River/Stream | 123 | 4 | |
| 13.60 | Chester Viaduct | Chester | Repair | Maintenance | | Viaduct | 440 | 4 | |
| 13.68 | Chester Viaduct | Chester | Repair | Maintenance | | Viaduct | 110 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC — STATE OF DELAWARE

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 26.60 | Lombard St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 60 | 2 | |
| 26.65 | Front St. | Wilmington | Upgrade | Structurally Inadequate | ● | Road | 160 | 2 | * |
| 26.69 | Poplar St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 57 | 2 | |
| 26.73 | Walnut St. | Wilmington | Repair | Maintenance | | Road | 72 | 2 | * |
| 26.75 | Walnut St. | Wilmington | Repair | Maintenance | | Road | 46 | 2 | |
| 26.79 | Station Viaduct | Wilmington | Repair | Maintenance | | Viaduct | 87 | 2 | * |
| 26.82 | French St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 80 | 2 | * |
| 26.85 | King St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 80 | 2 | * |
| 26.92 | Market St. | Wilmington | Repair | Maintenance | | Road | 72 | 2 | |
| 26.95 | Shipley St. | Wilmington | Repair | Maintenance | | Road | 56 | 2 | |
| 27.00 | Orange St. | Wilmington | Repair | Maintenance | | Road | 57 | 2 | |
| 27.02 | Thorn St. | Wilmington | Upgrade | Structurally Inadequate | ● | Road | 50 | 2 | * |
| 27.06 | Tatnall St. | Wilmington | Upgrade | Structurally Inadequate | ● | Road | 57 | 2 | * |
| 27.10 | West St. | Wilmington | Upgrade | Structurally Inadequate | ● | Road | 57 | 2 | * |
| 27.21 | Justison St. | Wilmington | Repair | Maintenance | ● | Road | 62 | 2 | * |
| 27.32 | Madison St. | Wilmington | Upgrade | Structurally Inadequate | ● | Road | 88 | 2 | * |
| 27.36 | Shipley Run | Wilmington | Repair | Maintenance | | Non-Navigable River/Stream | 31 | 2 | |
| 27.42 | West Liberty St | Wilmington | Repair | Maintenance | | Road | 43 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF DELAWARE

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 18.51 | Philadelphia Pike | Holly Oak | Repair | Maintenance | | Road | 119 | 4 | |
| 18.58 | Brick Yard Rd. | Holly Oak | Upgrade | Structurally Inadequate | | Road | 24 | 4 | * |
| 18.62 | Naaman Creek | Holly Oak | Repair | Maintenance | | Non-Navigable River/Stream | 87 | 4 | |
| 18.70 | Private Lane | Holly Oak | Repair | Maintenance | | Road | 29 | 4 | * |
| 20.98 | Perkins Creek | Holly Oak | Repair | Maintenance | | Non-Navigable River/Stream | 28 | 4 | |
| 21.24 | Perkins Creek | Holly Oak | Repair | Maintenance | | Non-Navigable River/Stream | 19 | 4 | |
| 21.73 | Freight Track | Holly Oak | Upgrade | Structurally Inadequate | | Railroad | 158 | 1 | |
| 21.98 | Quarryville Creek | Holly Oak | Repair | Maintenance | ● | Non-Navigable River/Stream | 71 | 4 | |
| 24.69 | Shellpot Creek | Wilmington | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 61 | 2 | * |
| 25.45 | Vandever St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 68 | 4 | * |
| 25.58 | 14th St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 63 | 2 | * |
| 25.73 | 12th St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 63 | 2 | * |
| 25.97 | Brandywine Creek | Wilmington | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 244 | 2 | |
| 26.07 | 8th St. | Wilmington | Repair | Maintenance | | Road | 32 | 2 | * |
| 26.11 | 7th St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 64 | 2 | * |
| 26.33 | 4th and Church Street | Wilmington | Upgrade | Structurally Inadequate | ● | Road | 202 | 2 | * |
| 26.40 | 3rd St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 76 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES

STATE OF MARYLAND

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 42.51 | Muddy Lane | Elkton | Upgrade | Structurally Inadequate | | Road | 35 | 3 | * |
| 43.33 | Cow Run #1 | Elkton | Repair | Maintenance | | Non-Navigable River/Stream | 32 | 3 | * |
| 44.06 | Cow Run #2 | Elkton | Repair | Maintenance | | Non-Navigable River/Stream | 18 | 3 | * |
| 44.26 | Big Elk Creek | Elkton | Repair | Maintenance | | Non-Navigable River/Stream | 168 | 3 | |
| 46.11 | Little Elk Creek | Elkton | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 185 | 3 | * |
| 46.67 | Tillison Run | Elkton | Repair | Maintenance | | Non-Navigable River/Stream | 12 | 3 | |
| 47.70 | Mill Creek | Northeast | Repair | Maintenance | | Non-Navigable River/Stream | 37 | 3 | * |
| 48.15 | Pole Cat Run | Northeast | Repair | Maintenance | | Non-Navigable River/Stream | 34 | 3 | |
| 51.03 | Northeast Creek | Northeast | Repair | Maintenance | | Non-Navigable River/Stream | 110 | 4 | * |
| 51.12 | McCulloughs Creek | Northeast | Repair | Maintenance | | Non-Navigable River/Stream | 13 | 3 | |
| 51.14 | McCulloughs Dr. | Northeast | Repair | Maintenance | | Road | 16 | 3 | |
| 51.88 | Md. Route 7 | Northeast | Repair | Maintenance | | Road | 35 | 3 | |
| 51.94 | Stony Run | Northeast | Repair | Maintenance | | Non-Navigable River/Stream | 55 | 2 | |
| 52.64 | Pedlers Run | Charlestown | Repair | Maintenance | | Non-Navigable River/Stream | 28 | 2 | |
| 52.96 | Broad Creek | Charlestown | Repair | Maintenance | | Non-Navigable River/Stream | 36 | 2 | * |
| 54.29 | Stream | Charlestown | Repair | Maintenance | | Non-Navigable River/Stream | 14 | 2 | |
| 56.51 | Carpenter Road | Perryville | Repair | Maintenance | | Road | 22 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF DELAWARE

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 27.52 | Viaduct | Wilmington | Upgrade | Structurally Inadequate | | Viaduct | 1075 | 2 | |
| 27.64 | Beech St. | Wilmington | Upgrade | Structurally Inadequate | | Road | 64 | 2 | * |
| 27.73 | Viaduct | Wilmington | Repair | Maintenance | | Viaduct | 952 | 2 | * |
| 27.85 | B & O Reading Railroad | Wilmington | Repair | Maintenance | ● | Railroad | 139 | 2 | * |
| 28.72 | Little Mill Creek | Newport | Repair | Maintenance | | Non-Navigable River/Stream | 38 | 2 | |
| 30.67 | James St. | Newport | Repair | Maintenance | | Road | 52 | 3 | |
| 31.92 | Hershey Run | Newport | Repair | Maintenance | | Non-Navigable River/Stream | 24 | 3 | |
| 32.72 | White Clay Creek | Newport | Repair | Maintenance | | Navigable Stream | 259 | 3 | |
| 33.00 | Stanton Rd. | Newport | Upgrade | Structurally Inadequate | | Road | 38 | 3 | * |
| 33.11 | Mill Race | Newport | Repair | Maintenance | | Non-Navigable River/Stream | 18 | 4 | |
| 36.42 | Ogletown Road | Newark | Repair | Maintenance | | Road | 55 | 3 | |
| 40.12 | Christina Creek | Newark | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 130 | 4 | * |
| 40.71 | Persimmon Run | Newark | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 39 | 4 | * |
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DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF MARYLAND

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 75.12 | Edgewood Rd. | Baltimore County | Repair | Maintenance | | Road | 48 | 2 | |
| 78.86 | Gunpowder River | Baltimore County | Upgrade | Structurally Inadequate | | Navigable River | 4962 | 2 | |
| 85.15 | State H.W. 150 | Baltimore County | Upgrade | Structurally Inadequate | | Road | 55 | 4 | * |
| 87.03 | Stemmers Run Rd | Baltimore County | Repair | Maintenance | | Road | 28 | 4 | |
| 87.07 | Stemmers Run Rd | Baltimore County | Repair | Maintenance | | Non-Navigable River/Stream | 60 | 4 | |
| 89.45 | Back River | Baltimore County | Repair | Maintenance | | Non-Navigable River/Stream | 161 | 4 | |
| 90.98A | North Point Rd. | Baltimore | Repair | Maintenance | | Road | 103 | 1 | |
| 90.98 | North Point Rd. | Baltimore | Repair | Maintenance | | Road | 72 | 3 | |
| 92.42 | Pulaski Highway | Baltimore | Upgrade | Structurally Inadequate | | Road | 74 | 4 | |
| 92.50 | Kresson St. | Baltimore | Repair | Maintenance | | Road | 88 | 4 | * |
| 92.61 | Monument St. | Baltimore | Upgrade | Structurally Inadequate | | Road | 224 | 4 | * |
| 92.68 | North Haven St. | Baltimore | Repair | Maintenance | | Road | 87 | 4 | * |
| 93.45 | Linwood Ave. | Baltimore | Upgrade | Structurally Inadequate | | Road | 76 | 4 | * |
| 93.52 | Kenwood Ave. | Baltimore | Repair | Maintenance | | Road | 76 | 4 | |
| 93.60 | Lakewood Ave. | Baltimore | Repair | Maintenance | | Road | 76 | 4 | * |
| 93.68 | Luzerne Rd. | Baltimore | Repair | Maintenance | | Road | 77 | 4 | |
| 93.75 | Milton Ave. | Baltimore | Repair | Maintenance | | Road | 80 | 4 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC    STATE OF [illegible]

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 56.92 | Principio Creek | Perryville | Repair | Maintenance | | Non-Navigable River/Stream | 39 | 2 | |
| 59.00 | Mill Creek | Perryville | Repair | Maintenance | | Non-Navigable River/Stream | 55 | 4 | |
| 59.39 | Stauton Arch | Perryville | Repair | Maintenance | | Road | 32 | 4 | |
| 59.52 | Penn Central Railroad | Perryville | Upgrade | Structurally Inadequate | | Road and Railroad | 74 | 4 | * |
| 60.07 | Susquehana River | Perryville | Repair | Maintenance | | Navigable River | 4155 | 2 | |
| 60.51 | Freedom Alley | Havre De Grace | Repair | Maintenance | | Road | 32 | 2 | |
| 60.56 | Stokes St. | Havre De Grace | Repair | Maintenance | | Road | 83 | 4 | |
| 60.61 | Centenial Alley | Havre De Grace | Repair | Maintenance | | Road | 32 | 4 | |
| 60.66 | Adams St. | Havre De Grace | Upgrade | Structurally Inadequate | | Road | 86 | 4 | * |
| 60.77 | Juniata St. | Havre De Grace | Repair | Maintenance | | Road | 90 | 4 | |
| 60.85 | Stream | Havre De Grace | Repair | Maintenance | | Non-Navigable River/Stream | 28 | 4 | |
| 61.72 | Lewis Run | Havre De Grace | Repair | Maintenance | | Non-Navigable River/Stream | 18 | 4 | |
| 62.70 | Mill Run | Havre De Grace | Repair | Maintenance | | Non-Navigable River/Stream | 31 | 2 | |
| 63.12 | Blenham's Run | Aberdeen | Repair | Maintenance | | Non-Navigable River/Stream | 24 | 3 | * |
| 63.97 | Swan Creek | Aberdeen | Repair | Maintenance | | Non-Navigable River/Stream | 39 | 3 | * |
| 64.47 | Jays Run | Aberdeen | Repair | Maintenance | | Non-Navigable River/Stream | 38 | 3 | * |
| 72.14 | Bush River | Hartford County | Upgrade | Structurally Inadequate | | Navigable River | 2752 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF MARYLAND

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 103.52 | Herbert's Run | Baltimore County | Repair | Maintenance | | Non-Navigable River/Stream | 152 | 2 | |
| 104.36 | Patapsco River | Baltimore County | Repair | Maintenance | | Navigable River | 560 | 3 | |
| 104.88 | Elkridge Rd. | Howard County | Repair | Maintenance | | Road | 26 | 3 | |
| 106.06 | Red Run | Anne Arundel County | Repair | Maintenance | | Non-Navigable River/Stream | 18 | 3 | |
| 112.17 | Severn Run | Anne Arundel County | Repair | Maintenance | | Non-Navigable River/Stream | 25 | 3 | * |
| 115.61 | Rogue's Harbor | Anne Arundel County | Repair | Maintenance | | Non-Navigable River/Stream | 50 | 3 | |
| 116.04 | Little Patuxent River | Anne Arundel County | Upgrade | Structurally Inadequate | ● | Navigable River | 181 | 3 | * |
| 116.42 | Public Road | Anne Arundel County | Repair | Maintenance | | Road | 21 | 3 | |
| 118.09 | Big Patuxent River | Anne Arundel County | Repair | Maintenance | | Navigable River | 297 | 3 | * |
| 125.32 | Muddy Hole | Prince Georges County | Repair | Maintenance | | Non-Navigable River/Stream | 11 | 2 | |
| 127.65 | Beaver Dam | Landover Hills | Repair | Maintenance | | Non-Navigable River/Stream | 12 | 2 | |
| 127.88 | Beaver Dam | Landover Hills | Repair | Maintenance | | Non-Navigable River/Stream | 14 | 3 | |
| 128.76 | Beaver Dam | Landover Hills | Repair | Maintenance | | Non-Navigable River/Stream | 12 | 2 | |
| 130.53 | Stream | Cheverly | Repair | Maintenance | | Non-Navigable River/Stream | 16 | 2 | |
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DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF MARYLAND

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 93.90 | Patterson Park | Baltimore | Upgrade | Structurally Inadequate | | Road | 77 | 4 | * |
| 93.97 | Collington Ave. | Baltimore | Upgrade | Structurally Inadequate | | Road | 86 | 4 | * |
| 94.07 | Chester St. | Baltimore | Repair | Maintenance | | Road | 104 | 4 | |
| 94.10 | Chase St. | Baltimore | Repair | Maintenance | | Road | 97 | 4 | |
| 94.20 | Wash and Biddle Sts. | Baltimore | Repair | Maintenance | | Road | 171 | 4 | |
| 94.30 | Preston St. | Baltimore | Upgrade | Structurally Inadequate Curve 375 | ● | Road | 166 | 4 | * |
| 94.34 | Gay St. | Baltimore | Replace | Curve 375 | ● | Road | 60 | 4 | * |
| 94.50 | Broadway Rd. | Baltimore | Replace | Curve 375 | ● | Road | 139 | 4 | * |
| 95.95 | Jones Falls | Baltimore | Repair | Maintenance | | Non-Navigable River/Stream | 80 | 2 | |
| 98.45 | Franklin St. | Baltimore | Repair | Maintenance | | Road | 85 | 4 | |
| 98.50 | Mulberry St. | Baltimore | Repair | Maintenance | | Road | 63 | 4 | |
| 98.69 | Warwick Ave. | Baltimore | Repair | Maintenance | | Road | 85 | 4 | |
| 98.95 | Franklin Town Rd | Baltimore | Repair | Maintenance | | Road | 84 | 4 | |
| 99.20 | Gwynns Falls | Baltimore | Repair | Maintenance | | Non-Navigable River/Stream | 420 | 4 | |
| 100.25 | Loudon Park Dr. | Baltimore | Repair | Maintenance | | Road | 16 | 4 | * |
| 100.33 | Maiden Choice Run | Baltimore | Repair | Maintenance | | Non-Navigable River/Stream | 15 | 4 | * |
| 102.35 | Sulfur Spring Rd. | Baltimore County | Repair | Maintenance | | Road | 72 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 48.64 | Sasco Creek | Fairfield | Repair | Maintenance | | Non-Navigable River/Stream | 42 | 4 | |
| 47.44 | Maple Lane | Westport | Repair | Maintenance | | Road | 40 | 4 | |
| 47.16 | New Creek Rd. | Westport | Repair | Maintenance | | Road | 33 | 4 | |
| 44.67 | Compo Rd. | Westport | Repair | Maintenance | | Road | 40 | 4 | |
| 44.30 | Saugatuck River | Westport | Repair | Maintenance | | Navigable River | 458 | 4 | * |
| 44.20 | Station Subway | Westport | Repair | Maintenance | | Tunnel | 10 | 4 | |
| 43.97 | Saugatuck Ave. | Westport | Repair | Maintenance | | Road | 42 | 4 | |
| 42.37 | Strawberry Hill Ave. | Westport | Repair | Maintenance | | Road | 33 | 4 | |
| 42.14 | East Ave. | Westport | Repair | Maintenance | | Road | 41 | 4 | |
| 41.99 | Osborne Ave. | Westport | Upgrade | Structurally Inadequate | | Road | 39 | 4 | |
| 41.82 | Ft. Point St. | Westport | Repair | Maintenance | | Road | 37 | 4 | |
| 41.47 | Norwalk River | Norwalk | Upgrade | Structurally Inadequate | | Navigable River | 562 | 4 | * |
| 41.28 | Washington and Main St. | Norwalk | Upgrade | Structurally Inadequate | | Road | 146 | 4 | |
| 41.10 | Monroe St. | Norwalk | Repair | Maintenance | | Road | 80 | 5 | |
| 41.02 | Station Subway | Norwalk | Repair | Maintenance | | Tunnel | 10 | 4 | |
| 40.93 | Spring St. | Norwalk | Repair | Maintenance | | Road | 48 | 4 | |
| 39.11 | Rowayton Ave. | Norwalk | Upgrade | Structurally Inadequate | | Road | 30 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 54.44 | South Ave. | Bridgeport | Repair | Maintenance | | Road | 85 | 4 | |
| 54.22 | Iranisian Ave. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 75 | 4 | |
| 54.06 | Wordin Ave. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 77 | 4 | |
| 53.83 | Howard Ave. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 64 | 4 | |
| 53.70 | Hancock Ave. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 66 | 4 | |
| 53.59 | Bostwick Ave. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 66 | 4 | |
| 53.43 | Fairfield Ave. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 102 | 4 | |
| 53.03 | Ash Creek | Bridgeport | Repair | Maintenance | | Non-Navigable River/Stream | 37 | 4 | |
| 51.64 | Fairfield Creek | Bridgeport | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 15 | 4 | |
| 51.09 | Benson Rd. | Fairfield | Repair | Maintenance | | Road | 33 | 4 | |
| 50.88 | Round Hill Rd. | Fairfield | Repair | Maintenance | | Road | 33 | 4 | |
| 50.30 | Mill Plain Rd. | Fairfield | Repair | Maintenance | | Road | 39 | 4 | |
| 50.01 | North Pine Creek Rd. | Fairfield | Repair | Maintenance | | Road | 28 | 4 | |
| 49.65 | Mill River Rd. | Fairfield | Repair | Maintenance | | Road | 76 | 4 | |
| 49.08 | Old Post Rd. | Fairfield | Repair | Maintenance | | Road | 33 | 4 | |
| 48.89 | Spruce St. | Fairfield | Repair | Maintenance | | Road | 33 | 4 | |
| 48.87 | Center St. | Fairfield | Repair | Maintenance | | Road | 33 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC — STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 31.29 | Sound Beach Ave. | Greenwich | Repair | Maintenance | | Road | 56 | 4 | |
| 31.13 | Waterway | Greenwich | Repair | Maintenance | | Non-Navigable River/Stream | 10 | 4 | |
| 31.04 | Arch St. | Greenwich | Repair | Maintenance | | Road | 14 | 4 | |
| 29.91 | Mianus River | Greenwich | Upgrade | Structurally Inadequate | ● | Navigable River | 1039 | 4 | * |
| 29.69 | Lukes Crossing | Greenwich | Repair | Maintenance | | Road | 36 | 4 | |
| 29.50 | Sachem Rd. | Greenwich | Repair | Maintenance | | Road | 28 | 4 | |
| 28.68 | Davis Mill Pond | Greenwich | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 64 | 4 | |
| 28.49 | Davis Ave. | Greenwich | Upgrade | Structurally Inadequate | | Road | 34 | 4 | |
| 28.22 | Steamboat Rd. | Greenwich | Upgrade | Structurally Inadequate | | Road | 56 | 4 | |
| 28.07 | Arch St. | Greenwich | Upgrade | Structurally Inadequate | | Road | 55 | 4 | |
| 27.78 | Field Point Rd. | Greenwich | Repair | Maintenance | | Road | 40 | 4 | |
| 26.80 | Hamilton Ave. | Greenwich | Upgrade | Structurally Inadequate | | Road | 27 | 4 | * |
| 26.12 | N. Water St. | Greenwich | Upgrade | Structurally Inadequate | | Road | 44 | 4 | * |

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 39.06 | Five Mile River | Norwalk | Repair | Maintenance | | Non-Navigable River/Stream | 26 | 4 | |
| 38.93 | Raymond St. | Darien | Upgrade | Structurally Inadequate | | Road | 27 | 4 | |
| 37.98 | Waterway | Darien | Repair | Maintenance | | Non-Navigable River/Stream | 19 | 4 | |
| 37.80 | Boston Post Rd. | Darien | Upgrade | Structurally Inadequate | | Road | 80 | 4 | |
| 37.57 | Leroy Ave. | Darien | Upgrade | Structurally Inadequate | | Road | 29 | 4 | |
| 37.16 | Stony Brook | Darien | Repair | Maintenance | | Non-Navigable River/Stream | 10 | 4 | |
| 35.58 | Norton River | Stamford | Repair | Maintenance | | Non-Navigable River/Stream | 27 | 4 | |
| 34.71 | Hamilton Ave. | Stamford | Upgrade | Structurally Inadequate | | Road | 52 | 5 | |
| 34.16 | E. Main St. | Stamford | Upgrade | Structurally Inadequate | | Road | 107 | 5 | |
| 33.76 | Elm St. | Stamford | Upgrade | Structurally Inadequate | | Road | 71 | 8 | |
| 33.40 | Canal St. | Stamford | Repair | Maintenance | | Road | 65 | 7 | |
| 33.18 | Atlantic St. | Stamford | Upgrade | Structurally Inadequate | | Road | 110 | 5 | |
| 33.05 | Station Subway | Stamford | Repair | Maintenance | | Tunnel | 10 | 4 | |
| 32.97 | South St. | Stamford | Repair | Curve 196 | | Road | 100 | 6 | * |
| 32.85 | Mill River | Greenwich | Upgrade | Structurally Inadequate | | Navigable River | 120 | 4 | |
| 32.80 | Greenwich Ave. | Greenwich | Upgrade | Structurally Inadequate | | Road | 65 | 4 | |
| 31.62 | Harding Rd. | Greenwich | Upgrade | Structurally Inadequate | | Road | 34 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 56.09 | Kossuth St. | Bridgeport | Repair | Maintenance | | Road | 58 | 4 | * |
| 55.97 | Noble St. | Bridgeport | Upgrade | Structurally Inadequate | ● | Road | 251 | 4 | * |
| 55.94 | Sterling St. | Bridgeport | Repair | Maintenance | ● | Road | 164 | 4 | * |
| 55.90 | Pulaski St. | Bridgeport | Repair | Maintenance | ● | Road | 67 | 4 | * |
| 55.86 | Viaduct | Bridgeport | Repair | Maintenance | ● | Viaduct | 225 | 4 | * |
| 55.82 | Poquonock River | Bridgeport | Repair | Maintenance | ● | Navigable River | 359 | 4 | * |
| 55.69 | Station Viaduct | Bridgeport | Repair | Maintenance | ● | Viaduct | 1000 | 5 | * |
| 55.68 | Fairfield Ave. | Bridgeport | Repair | Maintenance | ● | Road | 434 | 4 | * |
| 55.51 | Concrete Viaduct | Bridgeport | Repair | Maintenance | | Viaduct | 690 | 6 | |
| 55.36 | Union St. | Bridgeport | Repair | Maintenance | | Road | 36 | 4 | |
| 55.15 | Housatonic Crossing | Bridgeport | Repair | Maintenance | | Railroad | 143 | 4 | |
| 54.98 | Main St. | Bridgeport | Repair | Maintenance | | Road | 68 | 4 | |
| 54.92 | Broad St. | Bridgeport | Repair | Maintenance | | Road | 61 | 4 | |
| 54.84 | Lafayette St. | Bridgeport | Repair | Maintenance | | Road | 58 | 4 | |
| 54.78 | Warren St. | Bridgeport | Repair | Maintenance | | Road | 57 | 4 | |
| 54.70 | Myrtle St. | Bridgeport | Repair | Maintenance | | Road | 61 | 4 | |
| 54.55 | Park Ave. | Bridgeport | Repair | Maintenance | | Road | 98 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

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|---|---|---|---|---|---|---|---|---|---|
| 63.85 | Gull St. | Milford | Upgrade | Structurally Inadequate | | Road | 27 | 4 | |
| 63.55 | Wepawaug River | Milford | Upgrade | Structurally Inadequate | ● | Non-Navigable River/Stream | 127 | 4 | * |
| 63.45 | River St. | Milford | Upgrade | Structurally Inadequate | | Road | 80 | 4 | |
| 63.31 | High St. | Milford | Upgrade | Structurally Inadequate | | Road | 57 | 4 | * |
| 62.98 | Beardsley Ave. | Milford | Upgrade | Structurally Inadequate | | Road | 34 | 4 | |
| 60.44 | Housatonic River | Stratford | Upgrade | Structurally Inadequate | ● | Navigable River | 1,052 | 4 | * |
| 59.99 | E. Main St. | Stratford | Repair | Maintenance | | Road | 44 | 5 | |
| 59.04 | Main St. | Stratford | Upgrade | Structurally Inadequate | | Road | 69 | 4 | |
| 58.92 | King St. | Stratford | Upgrade | Structurally Inadequate | | Road | 35 | 4 | |
| 58.75 | W. Broad St. | Stratford | Upgrade | Structurally Inadequate | | Road | 36 | 4 | |
| 57.60 | Bruce Ave. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 34 | 6 | |
| 57.44 | Bishop Ave. | Bridgeport | Repair | Maintenance | | Road | 58 | 4 | |
| 56.75 | Seaview Ave. | Bridgeport | Repair | Maintenance | | Road | 53 | 5 | |
| 56.68 | Waterway | Bridgeport | Repair | Maintenance | | Non-Navigable River/Stream | 16 | 5 | |
| 56.46 | Hallett St. | Bridgeport | Repair | Maintenance | | Road | 57 | 4 | |
| 56.33 | Pembroke St. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 60 | 4 | |
| 56.19 | E. Main St. | Bridgeport | Upgrade | Structurally Inadequate | | Road | 68 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 75.77 | Quinnipiac Ave. | New Haven | Upgrade | Structurally Inadequate | | Road | 86 | 2 | * |
| 75.24 | Little River | New Haven | Replace | Structurally Inadequate | | Non-Navigable River/Stream | 30 | 2 | * |
| 75.05 | Middletown Ave. | New Haven | Upgrade | Structurally Inadequate | | Road | 57 | 2 | * |
| 74.79 | Quinnipiac River | New Haven | Repair | Maintenance | | Non-Navigable River/Stream | 176 | 2 | * |
| 73.97 | James St. | New Haven | Upgrade | Structurally Inadequate | | Road | 82 | 4 | * |
| 73.85 | Humphrey St. | New Haven | Upgrade | Structurally Inadequate | | Road | 154 | 4 | * |
| 73.72 | Mill River | New Haven | Repair | Maintenance | | Non-Navigable River/Stream | 116 | 2 | |
| 72.28 | Station Subway | New Haven | Repair | Maintenance | | Pedestrian Tunnel | 34 | 10 | |
| 71.26 | West River | New Haven | Repair | Maintenance | | Navigable River | 90 | 4 | |
| 70.37 | Washington Ave. | West Haven | Upgrade | Structurally Inadequate | | Road | 55 | 4 | |
| 70.25 | Campbell Ave. | West Haven | Upgrade | Structurally Inadequate | | Road | 60 | 4 | |
| 69.66 | Sawmill Rd. | West Haven | Repair | Maintenance | | Road | 61 | 4 | |
| 68.10 | Morgan Lane | West Haven | Repair | Maintenance | | Road | 29 | 4 | |
| 66.68 | Depot Rd. | Milford | Repair | Maintenance | | Road | 29 | 4 | |
| 66.56 | Rock Lane | Milford | Replace | Structurally Inadequate | ● | Road | 47 | 4 | * |
| 64.74 | Old Gate Lane | Milford | Upgrade | Structurally Inadequate | | Road | 27 | 4 | |
| 64.59 | Indian River | Milford | Repair | Maintenance | | Non-Navigable River/Stream | 35 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 87.79 | Sachem Head Rd. | Guilford | Repair | Maintenance | | Non-Navigable River/Stream | 16 | 2 | |
| 87.27 | Island Creek | Branford | Repair | Maintenance | | Non-Navigable River/Stream | 16 | 2 | |
| 86.17 | New Quarry Rd. | Branford | Upgrade | Structurally Inadequate | | Road | 34 | 2 | * |
| 85.95 | Leetes Island Rd | Branford | Repair | Maintenance | | Road | 28 | 2 | |
| 85.58 | Rogers Farm Rd. | Branford | Repair | Maintenance | | Road | 15 | 2 | |
| 85.41 | Stony Creek | Branford | Repair | Maintenance | | Non-Navigable River/Stream | 76 | 2 | |
| 84.76 | Thimble Island Rd. | Branford | Repair | Maintenance | | Road | 44 | 2 | |
| 84.41 | Pine River | Branford | Repair | Maintenance | | Non-Navigable River/Stream | 77 | 2 | |
| 83.91 | Branford Stem Railroad | Branford | Repair | Maintenance | | Railroad | 74 | 2 | |
| 83.58 | Totoket Rd. | Branford | Replace | Structurally Inadequate | ● | Road | 34 | 2 | * |
| 82.00 | Branford River | Branford | Repair | Maintenance | | Non-Navigable River/Stream | 90 | 2 | |
| 81.87 | Montowese St. | Branford | Repair | Maintenance | | Road | 23 | 2 | |
| 81.44 | Indian Head Rd. | Branford | Repair | Maintenance | | Road | 23 | 2 | * |
| 80.59 | Boston Post Rd. | Branford | Repair | Maintenance | | Road | 59 | 2 | |
| 78.83 | Lake Saltonstall | East Haven | Repair | Maintenance | | Non-Navigable River/Stream | 10 | 2 | |
| 78.57 | Foxon River | East Haven | Repair | Maintenance | | Non-Navigable River/Stream | 44 | 2 | * |
| 75.92 | Hemingway St. | New Haven | Repair | Maintenance | | Road | 44 | 2 | |
| 3.48+ | Quinnipiac River | North Haven | Upgrade | Structurally Inadequate | ● | Navigable River | 288 | 1 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 104.56 | King's Crossing | Old Saybrook | Upgrade | Structurally Inadequate | | Road | 34 | 4 | * |
| 104.48 | Oyster River | Old Saybrook | Repair | Maintenance | | Navigable River | 30 | 4 | |
| 101.22 | Westbrook River | Westbrook | Repair | Maintenance | | Non-Navigable River/Stream | 45 | 2 | |
| 101.11 | Pond Meadow Rd. | Westbrook | Repair | Maintenance | | Road | 30 | 2 | |
| 99.80 | Wrights River | Westbrook | Repair | Maintenance | | Non-Navigable River/Stream | 34 | 2 | |
| 97.10 | Cemetery Drwy. | Clinton | Repair | Maintenance | | Road | 16 | 2 | |
| 97.04 | Indian River | Clinton | Repair | Maintenance | | Navigable River | 20 | 2 | * |
| 96.93 | Pedestrian Underpass | Clinton | Replace | Structurally Inadequate | ● | Tunnel | 13 | 2 | * |
| 96.89 | Railroad Ave. | Clinton | Upgrade | Structurally Inadequate | | Road | 55 | 2 | * |
| 96.60 | Cow Hill Rd. | Clinton | Replace | Structurally Inadequate | ● | Road | 34 | 3 | * |
| 94.83 | River Rd. | Clinton | Repair | Maintenance | | Road and Navigable River | 108 | 2 | |
| 93.95 | Bishop Crossing | Madison | Replace | Structurally Inadequate | ● | Road | 18 | 2 | * |
| 91.91 | Neck River | Madison | Repair | Maintenance | | Non-Navigable River/Stream | 21 | 2 | |
| 91.45 | Mungertown Rd. | Madison | Repair | Maintenance | | Road | 35 | 2 | |
| 91.18 | Boston Post Rd. | Madison | Repair | Maintenance | | Road | 78 | 2 | * |
| 90.60 | East River | Madison | Repair | Maintenance | | Navigable River | 87 | 2 | |
| 89.64 | East Creek | Guilford | Repair | Maintenance | | Non-Navigable River/Stream | 14 | 2 | |
| 88.43 | West River | Guilford | Repair | Maintenance | | Navigable River | 75 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC — STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 115.86 | Beach Passway | East Lyme | Repair | Maintenance | | Tunnel | 18 | 2 | |
| 115.13 | Black Pt. Rd. | Old Lyme | Repair | Maintenance | | Road | 27 | 2 | |
| 114.30 | Miamicock River | Old Lyme | Repair | Maintenance | | Non-Navigable River/Stream | 76 | 2 | * |
| 113.77 | Lyle Creek | East Lyme | Repair | Maintenance | | Non-Navigable River/Stream | 27 | 2 | * |
| 113.20 | Giant Neck Rd. | East Lyme | Repair | Maintenance | | Road | 28 | 2 | |
| 113.18 | Bridge's Brook | East Lyme | Repair | Maintenance | | Non-Navigable River/Stream | 24 | 2 | |
| 112.82 | Rocky Neck Rd. | East Lyme | Repair | Maintenance | | Road | 16 | 2 | |
| 112.58 | Four Mile River | Old Lyme | Repair | Maintenance | | Navigable River | 105 | 2 | |
| 112.06 | Champion's Rd. | Old Lyme | Repair | Maintenance | | Road | 27 | 3 | |
| 110.95 | Swans Cat Pass | Old Lyme | Repair | Maintenance | | Tunnel | 13 | 2 | |
| 110.74 | Gross Rd. | Old Lyme | Repair | Maintenance | | Road | 34 | 2 | |
| 109.21 | Black Hall River | Old Lyme | Repair | Maintenance | | Navigable River | 40 | 2 | |
| 108.76 | Ferry Creek | Old Lyme | Repair | Maintenance | | Non-Navigable River/Stream | 30 | 2 | |
| 108.11 | Black Hall Rd. | Old Lyme | Upgrade | Structurally Inadequate | | Road | 35 | 2 | * |
| 107.94 | Duck River | Old Lyme | Repair | Maintenance | | Navigable River | 37 | 2 | |
| 107.35 | Lieutenant River | Old Lyme | Repair | Maintenance | | Navigable River | 128 | 2 | |
| 106.89 | Connecticut River | Old Saybrook | Upgrade | Structurally Inadequate | ● | Navigable River | 1,581 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 127.22 | South Rd. | Groton | Repair | Maintenance | | Road | 40 | 4 | |
| 126.45 | Avery's Rd. | Groton | Upgrade | Curve 89 | | Road | 47 | 4 | |
| 124.35 | Fairview Ave. | Groton | Repair | Maintenance | | Road | 52 | 2 | |
| 124.09 | Thames River | Groton | Upgrade | Structurally Inadequate | ● | Navigable River | 1,389 | 2 | * |
| 123.90 | State Crossings | New London | Repair | Maintenance | | Road | 56 | 2 | |
| 123.83 | Central Vermont Railway | New London | Repair | Maintenance | | Road and Railroad | 79 | 2 | |
| 123.80 | Central Vermont Railway | New London | Repair | Maintenance | | Road and Railroad | 214 | 2 | |
| 123.59 | Winthrop St. | New London | Repair | Maintenance | | Road | 58 | 2 | * |
| 123.54 | Winthrop Cove | New London | Repair | Maintenance | | Navigable River | 22 | 2 | |
| 122.65 | Shaws Cove | New London | Replace | Structurally Inadequate | ● | Navigable River | 324 | 2 | * |
| 122.40 | Hamilton Ave. | New London | Repair | Maintenance | | Road | 16 | 2 | |
| 122.20 | Walback St. | New London | Replace | Structurally Inadequate | ● | Road | 44 | 2 | * |
| 122.11 | Pequot Ave. | New London | Replace | Curve 97 | ● | Road | 66 | 2 | * |
| 118.92 | Jordan's Cove | New London | Repair | Maintenance | | Navigable River | 76 | 2 | |
| 118.19 | Gardner's Wood | Waterford | Upgrade | Curve 102 | | Road | 26 | 2 | |
| 116.79 | Roadway | Waterford | Replace | Structurally Inadequate | ● | Road | 15 | 2 | * |
| 116.74 | Niantic River | Waterford | Replace | Structurally Inadequate | ● | Navigable River | 294 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC STATE OF CONNECTICUT

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 141.35 | Pawcatuck River | Stonington | Repair | Maintenance | | Navigable River | 132 | 2 | * |
| 141.16 | W. Broad St. | Stonington | Repair | Maintenance | | Road | 146 | 2 | |
| 137.52 | Wequetequock Cove | Stonington | Repair | Maintenance | | Navigable River | 71 | 2 | * |
| 135.67 | East Harbor | Stonington | Upgrade | Structurally Inadequate | | Navigable River | 80 | 2 | * |
| 135.51 | West Harbor | Stonington | Upgrade | Structurally Inadequate | | Navigable River | 69 | 2 | * |
| 134.25 | Quiambog Cove | Stonington | Repair | Maintenance | | Navigable River | 57 | 2 | * |
| 133.77 | Wilcox Cove | Stonington | Repair | Maintenance | | Non-Navigable River/Stream | 52 | 2 | |
| 132.75 | Williams Cove | Stonington | Repair | Maintenance | | Navigable River | 20 | 2 | |
| 132.16 | Mystic River | Stonington | Replace | Structurally Inadequate | ● | Navigable River | 277 | 2 | * |
| 131.90 | Benner's Cove | Groton | Repair | Maintenance | | Non-Navigable River/Stream | 24 | 2 | |
| 131.42 | Parker Cove | Groton | Repair | Maintenance | | Non-Navigable River/Stream | 24 | 2 | |
| 131.20 | Six Penny Cove | Groton | Repair | Maintenance | | Non-Navigable River/Stream | 24 | 2 | |
| 130.63 | Noank Cove | Groton | Repair | Maintenance | | Non-Navigable River/Stream | 126 | 2 | * |
| 129.54 | Palmer's Cove | Groton | Repair | Maintenance | | Navigable River | 56 | 2 | |
| 128.34 | Mumfords Cove | Groton | Repair | Maintenance | | Non-Navigable River/Stream | 24 | 2 | |
| 127.50 | Gardner's Rd. | Groton | Repair | Maintenance | | Road | 26 | 4 | |
| 127.40 | Poquonock River | Groton | Repair | Maintenance | | Navigable River | 40 | 4 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF RHODE ISLAND

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 146.39 | Pawcatuck River | Westerly | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 146 | 2 | |
| 144.35 | Dixon Swamp | Westerly | Repair | Maintenance | | Non-Navigable River/Stream | 22 | 2 | * |
| 141.49 | Station Subway | Westerly | Repair | Maintenance | | Tunnel | 10 | 2 | |
| 141.44 | Canal Street | Westerly | Upgrade | Structurally Inadequate | | Road | 55 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF RHODE ISLAND

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 171.06 | Pains Pond | East Greenwich | Repair | Maintenance | | Non-Navigable River/Stream | 16 | 2 | |
| 171.00 | Forge Road | East Greenwich | Repair | Maintenance | | Road | 80 | 2 | * |
| 170.10 | Hunts River | East Greenwich | Repair | Maintenance | | Non-Navigable River/Stream | 67 | 2 | |
| 167.66 | Farmway Tk. 2&4 | East Greenwich | Replace | Structurally Inadequate | ● | Road | 15 | 2 | * |
| 165.90 | Ten Rod Road | North Kingstown | Repair | Maintenance | | Road | 81 | 3 | * |
| 159.37 | Hundred Acre Pond | South Kingstown | Repair | Maintenance | | Non-Navigable River/Stream | 18 | 2 | |
| 156.03 | Sherman Swamp | South Kingstown | Replace | Structurally Inadequate | ● | Non-Navigable River/Stream | 17 | 2 | * |
| 155.85 | Usquepaug River | South Kingstown | Repair | Maintenance | | Non-Navigable River/Stream | 77 | 2 | |
| 154.61 | Queens Brook | Richmond | Upgrade | Structurally Inadequate | | Non-Navigable River/Stream | 26 | 2 | * |
| 153.93 | Pawcatuck River | Richmond | Repair | Maintenance | | Non-Navigable River/Stream | 77 | 2 | |
| 153.34 | Pawcatuck River | Richmond | Repair | Maintenance | | Non-Navigable River/Stream | 104 | 2 | |
| 153.01 | Shannock Road | Richmond | Repair | Maintenance | | Road | 58 | 1 | |
| 152.71 | Pawcatuck River | Richmond | Repair | Maintenance | | Non-Navigable River/Stream | 105 | 2 | |
| 150.59 | Pawcatuck River | Richmond | Repair | Maintenance | | Non-Navigable River/Stream | 104 | 2 | |
| 150.25 | Meadow Brook | Richmond | Repair | Maintenance | | Non-Navigable River/Stream | 17 | 2 | * |
| 149.47 | Pawcatuck River | Richmond | Repair | Maintenance | | Non-Navigable River/Stream | 104 | 2 | |
| 147.45 | Pawcatuck River | Richmond | Repair | Maintenance | | Non-Navigable River/Stream | 104 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

STATE OF RHODE ISLAND

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 190.55 | Blackstone River | Pawtucket | Repair | Maintenance | ● | Road and Non-Navigable River/Stream | 376 | 2 | * |
| 190.49 | High Street | Pawtucket | Repair | Maintenance | | Road | 19 | 2 | |
| 188.27 | Moshassuck River | Pawtucket | Repair | Maintenance | | Non-Navigable River/Stream | 20 | 2 | |
| 186.75 | West River | Pawtucket | Repair | Maintenance | | Non-Navigable River/Stream | 31 | 2 | |
| 185.47 | Promenade Street | Providence | Replace | Structurally Inadequate | ● | Road | 73 | 2 | * |
| 185.46 | Woonasquatucket River | Providence | Replace | Structurally Inadequate | ● | Non-Navigable River/Stream | 119 | 2 | * |
| 185.35 | Francis Street | Providence | Replace | Structurally Inadequate | ● | Road | 336 | 2 | * |
| 185.34 | Gaspee Street | Providence | Replace | Structurally Inadequate | ● | Road | 74 | 2 | * |
| 179.16 | Pawtuxet River | Cranston | Repair | Maintenance | | Road and Non-Navigable River/Stream | 130 | 2 | |
| 177.81 | Lincoln Avenue | Warwick | Repair | Maintenance | | Road | 19 | 2 | * |
| 174.76 | Rocky Point Road | Warwick | Repair | Maintenance | | Road | 46 | 2 | * |
| 174.54 | Apponaug Cove | Warwick | Repair | Maintenance | | Navigable River | 177 | 2 | |
| 174.06 | Arnold Neck Road | Warwick | Repair | Maintenance | | Road | 26 | 2 | |
| 173.71 | Masthead Road | Warwick | Repair | Maintenance | | Road | 23 | 2 | |
| 172.74 | Ocean Point Avenue | Warwick | Repair | Maintenance | | Road | 14 | 2 | |
| 172.13 | King Street | East Greenwich | Repair | Maintenance | | Road | 32 | 2 | |
| 171.84 | Ped. Underpass | East Greenwich | Repair | Maintenance | | Tunnel | 23 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC    STATE OF MASSACHUSETTS

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 200.66 | Wading River | Mansfield | Repair | Maintenance | | Non-Navigable River/Stream | 35 | 2 | * |
| 197.64 | Peck St. | Attleboro | Repair | Maintenance | | Road | 35 | 2 | |
| 197.38 | Park St. | Attleboro | Repair | Maintenance | | Road | 80 | 2 | |
| 197.21 | Mill St. | Attleboro | Repair | Maintenance | | Road | 45 | 2 | * |
| 197.19 | Station Subway | Attleboro | Repair | Maintenance | | Tunnel | 10 | 2 | |
| 197.13 | S. Main St. | Attleboro | Repair | Maintenance | | Road | 50 | 2 | |
| 196.59 | Ten Mile River | Attleboro | Repair | Maintenance | | Non-Navigable River/Stream | 30 | 2 | |
| 195.58 | Ten Mile River | Attleboro | Repair | Maintenance | | Non-Navigable River/Stream | 30 | 2 | |
| 195.55 | Canal | Dodgeville | Repair | Maintenance | | Non-Navigable River/Stream | 30 | 2 | |
| 193.75 | Ten Mile River | Hebronville | Repair | Maintenance | | Non-Navigable River/Stream | 74 | 2 | |
| 193.69 | Ten Mile River | Hebronville | Repair | Maintenance | | Non-Navigable River/Stream | 74 | 2 | |
| 192.76 | Seven Mile River | S. Attleboro | Repair | Maintenance | | Non-Navigable River/Stream | 36 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC — STATE OF MASSACHUSETTS

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 223.86 | Asticou Rd. | Boston | Replace | Structurally Inadequate | | Road | 55 | 4 | |
| 223.79 | Washington St. | Boston | Replace | Structurally Inadequate | | Road | 87 | 2 | |
| 223.15 | Ped. Underpass | Boston | Repair | Maintenance | | Tunnel | 12 | 2 | |
| 223.00 | Stony Brook | Boston | No Action Required | | | Non-Navigable River/Stream | 15 | 2 | |
| 220.42 | Mother Brook | Boston | Repair | Maintenance | | Non-Navigable River/Stream | 50 | 2 | |
| 219.46 | Station Subway | Boston | Upgrade | Structurally Inadequate | | Tunnel | 12 | 2 | * |
| 218.57 | Spraques Brook | Dedham | Repair | Maintenance | | Non-Navigable River/Stream | 13 | 2 | |
| 216.32 | Neponset River | Canton | Repair | Maintenance | | Non-Navigable River/Stream | 85 | 2 | |
| 214.75 | Stream | Canton | Repair | Maintenance | | Non-Navigable River/Stream | 17 | 2 | |
| 213.74 | Viaduct | Canton | Repair | Maintenance | | Viaduct | 640 | 2 | |
| 212.02 | Canton St. | Canton | Repair | Maintenance | | Road | 32 | 2 | |
| 212.02 | Garden Street Underpass | Sharon | Repair | Maintenance | | Tunnel | 10 | 2 | |
| 209.66 | Garden St. Underpass | Sharon | Repair | Maintenance | | Tunnel | 10 | 2 | |
| 204.44 | N. Main St. | Mainsfield | Repair | Maintenance | | Road | 96 | 2 | * |
| 204.17 | Route 106 | Mansfield | Repair | Maintenance | | Road | 130 | 2 | * |
| 204,00 | Rumford River | Mansfield | Repair | Maintenance | | Non-Navigable River/Stream | 20 | 2 | * |
| 203.85 | Route 140 | Mansfield | Repair | Maintenance | | Road | 60 | 2 | * |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC — STATE OF MASSACHUSETTS

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 225.65 | Ruggles St. | Boston | Upgrade | Structurally Inadequate | | Road | 87 | 2 | |
| 226.45 | Prentiss St. | Boston | Repair | Maintenance | | Road | 46 | 2 | |
| 226.35 | Station St. | Boston | Repair | Maintenance | | Road | 45 | 2 | |
| 226.29 | Station Drwy. | Boston | Replace | Structurally Inadequate | | Road | 46 | 2 | |
| 226.27 | Tremont St. | Boston | Repair | Maintenance | | Road | 80 | 2 | |
| 225.87 | New Heath St. | Boston | Upgrade | Structurally Inadequate | | Road | 55 | 2 | |
| 225.76 | Old Heath St. | Boston | Upgrade | Structurally Inadequate | | Road | 10 | 2 | |
| 225.63 | Center St. | Boston | Upgrade | Structurally Inadequate | | Road | 88 | 2 | |
| 225.33 | Atherton St. | Boston | Repair | Maintenance | | Road | 46 | 2 | |
| 225.17 | Boyleston St. | Boston | Upgrade | Structurally Inadequate | | Road | 48 | 2 | |
| 224.94 | Lawnsdale | Boston | Repair | Maintenance | | Pedestrian Tunnel | 10 | 2 | |
| 224.69 | Green St. | Boston | Upgrade | Structurally Inadequate | | Road | 65 | 2 | |
| 224.45 | Williams St. | Boston | Repair | Maintenance | | Road | 45 | 2 | |
| 224.34 | McBridge St. | Boston | Repair | Maintenance | | Road | 45 | 2 | |
| 223.99 | Parkway | Boston | Repair | Maintenance | | Road | 128 | 2 | |
| 223.97 | Morton St. | Boston | Repair | Maintenance | | Road | 40 | 2 | |
| 223.89 | Station Subway | Boston | Repair | Maintenance | | Pedestrian Tunnel | 10 | 2 | |

DISPOSITION OF UNDERGRADE BRIDGES OF THE NEC

DISTRICT OF COLUMBIA

| MILE POST | NAME | TOWN | ACTION REQUIRED | REASON FOR IMPROVEMENT | FURTHER ENVIRONMENTAL DOCUMENTATION ANTICIPATED | TYPE OF CROSSING | BRIDGE LENGTH | NUMBER OF TRACKS | PROBABLE INCLUSION IN PROGRAM |
|---|---|---|---|---|---|---|---|---|---|
| 131.75 | Anacostia River | D.C. | Repair | Maintenance | | Navigable River | 340 | 2 | |
| 132.26 | Stream | D.C. | Repair | Maintenance | | Non-Navigable River/Stream | 20 | 2 | * |
| 133.28 | Bladensburg Rd. | D.C. | Repair | Maintenance | | Road | 92 | 2 | |
| 133.39 | Stream | D.C. | Repair | Maintenance | | Non-Navigable River/Stream | 10 | 2 | |
| 133.62 | Montana Avenue | D.C. | Repair | Maintenance | | Road | 63 | 2 | |
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# APPENDIX C

# AUTO ACCESS CHARACTERISTICS AT STATIONS

Table C-1

ESTIMATED RAIL PARTONAGE AND AUTO ACCESS
CHARACTERISTICS AT STATIONS

| STATION/TYPE PATRON | Daily Rail Patrons (Rides to and from Station) | | | Estimated Percent of Rail Patrons by Auto Access Mode 1975(1990 with NECIP) | | | | Estimated Patrons Per Vehicle | Estimated Peak Hour as a Percent of Daily Activities |
|---|---|---|---|---|---|---|---|---|---|
| | 1974/ 1975 | 1990 Unimproved Service | 1990 with NECIP | Parked Auto | Drop-off Pickup | Taxi Limo | Total Auto | | |
| **BOSTON SOUTH** | | | | | | | | | |
| Intercity NEC | 1,990 | 2,860 | 3,420 | 1(10) | 10(10) | 13(13) | 24(33) | 1.3 | 13 |
| Long Haul | 170 | 440 | 440 | 1(10) | 10(10) | 13(13) | 24(33) | 1.3 | 13 |
| Commuter Rail | 10,280 | 14,200 | 14,200 | -(-) | 1(1) | -(-) | 1(1) | 1.2 | 30 |
| **BACK BAY** | | | | | | | | | |
| Intercity NEC | 390 | 610 | 700 | 9(9) | 12(12) | 12(12) | 31(31) | 1.5 | 15 |
| Commuter Rail | 3,780 | 7,500 | 7,500 | | | 5(5) | 5(5) | 1.25 | 20 |
| **ROUTE 128** | | | | | | | | | |
| Intercity NEC | 390 | 1,000 | 2,315 | 33(77) | 64(20) | 1(1) | 98 | 1.1 | 13 |
| Long Haul | 10 | 25 | 25 | 33(77) | 64(20) | 1(1) | 98 | 1.1 | 13 |
| Commuter Rail | 1,080 | 1,440 | 1,440 | 33(79) | 67(21) | 1(1) | 98 | 1.1 | 29 |
| **PROVIDENCE** | | | | | | | | | |
| Intercity NEC | 970 | 1,660 | 2,740 | 23(23) | 35(35) | 8(8) | 66(66) | 1.3 | 12 |
| Long Haul | 45 | 110 | 110 | 23(23) | 35(35) | 8(8) | 66(66) | 1.3 | 12 |
| Commuter (B&M) | 540 | 840 | 840 | 50(50) | 15(15) | 3(3) | 68(68) | 1.25 | 6 |
| Commuter (E&W Bay) | - | 4,140 | 4,140 | -(-) | -(-) | -(1) | -(2) | 1.25 | 5 |
| **KINGSTON** | | | | | | | | | |
| Intercity NEC | 110 | 230 | 450 | 42(42) | 42(42) | 16(16) | 100 | 1.4 | 20 |

Table C-1 (Cont'd)

ESTIMATED RAIL PARTONAGE AND AUTO ACCESS CHARACTERISTICS AT STATIONS

| STATION/TYPE PATRON | Daily Rail Patrons (Rides to and from Station) | | | Estimated Percent of Rail Patrons by Auto Access Mode 1975(1990 with NECIP) | | | | Estimated Patrons Per Vehicle | Estimated Peak Hour as a Percent of Daily Activities |
|---|---|---|---|---|---|---|---|---|---|
| | 1974/ 1975 | 1990 Unimproved Service | 1990 with NECIP | Parked Auto | Drop-off Pickup | Taxi Limo | Total Auto | | |
| **WESTERLY** | | | | | | | | | |
| Intercity NEC | 80 | 140 | 240 | 50(50) | 25(25) | 20(20) | 95(95) | 1.25 | 20 |
| **MYSTIC** | | | | | | | | | |
| Intercity NEC | 35 | 95 | 180 | 45(45) | 55(55) | -(-) | 100(100) | 1.25 | 20 |
| **NEW LONDON** | | | | | | | | | |
| Intercity NEC | 580 | 1,040 | 1,800 | 58(58) | 20(20) | 2(2) | 80(80) | 1.3 | 10 |
| Long Haul | 25 | 65 | 65 | 58(58) | 20(20) | 2(2) | 80(80) | 1.3 | 10 |
| **OLD SAYBROOK** | | | | | | | | | |
| Intercity NEC | 165 | 260 | 395 | 45(45) | 40(40) | 15(15) | 100(100) | 1.25 | 20 |
| **NEW HAVEN** | | | | | | | | | |
| Intercity NEC | 1,330 | 2,210 | 4,660 | 35(33) | 40(30) | 15(12) | 90(75) | 1.3 | 15 |
| Long Haul | 50 | 130 | 130 | 35(33) | 40(30) | 15(12) | 90(75) | 1.3 | 15 |
| Commuter Rail | 1,930 | 2,200 | 2,200 | 50(50) | 30(25) | 5(5) | 85(80) | 1.25 | 20 |
| **BRIDGEPORT** | | | | | | | | | |
| Intercity NEC | 185 | 310 | 695 | 35(35) | 30(30) | 15(15) | 80(80) | 1.25 | 15 |
| Commuter Rail | 1,900 | 2,090 | 2,090 | 35(35) | 20(20) | 10(10) | 65(65) | 1.25 | 20 |

Table C-1 (Cont'd)

ESTIMATED RAIL PARTONAGE AND AUTO ACCESS
CHARACTERISTICS AT STATIONS

| STATION/TYPE PATRON | Daily Rail Patrons (Rides to and from Station) 1974/1975 | 1990 Unimproved Service | 1990 with NECIP | Estimated Percent of Rail Patrons by Auto Access Mode 1975(1990 with NECIP) Parked Auto | Drop-off Pickup | Taxi Limo | Total Auto | Estimated Patrons Per Vehicle | Estimated Peak Hour as a Percent of Daily Activities |
|---|---|---|---|---|---|---|---|---|---|
| **STAMFORD** | | | | | | | | | |
| Intercity NEC | 560 | 940 | 1,890 | 34(34) | 45(45) | 3(3) | 82(82) | 1.15 | 13 |
| Long Haul | 25 | 55 | 55 | 34(34) | 45(45) | 3(3) | 82(82) | 1.15 | 13 |
| Commuter | 5,950 | 6,400 | 6,400 | 55(55) | 24(24) | 3(3) | 82(82) | 1.15 | 11 |
| **RYE** | | | | | | | | | |
| Intercity NEC | 280 | 1,015 | 1,890 | 50(50) | 30(30) | 10(10) | 90(90) | 1.25 | 15 |
| Commuter Rail | 2,700 | 3,000 | 3,000 | 50(50) | 30(30) | 5(5) | 85(85) | 1.25 | 20 |
| **NEW YORK PENN** | | | | | | | | | |
| Intercity NEC | 22,150 | 24,315 | 38,450 | 0.5(0.5) | -(-) | 18(18) | 18.5(18.5) | 1.1 | 10 |
| Long Haul | 2,065 | 5,240 | 5,240 | 0.5(0.5) | -(-) | 18(18) | 18.5(18.5) | 1.1 | 12 |
| Commuter | 256,850 | 251,000 | 251,000 | -(-) | -(-) | 1(1) | 1(1) | 1.1 | 19 |
| **NEWARK** | | | | | | | | | |
| Intercity NEC | 4,890 | 7,600 | 10,085 | 14(14) | 6(6) | 3(3) | 23(23) | 1.1 | 10 |
| Long Haul | 290 | 740 | 740 | 14(14) | 6(16) | 3(3) | 23(23) | 1.1 | 10 |
| Commuter | 32,440 | 44,400 | 44,400 | 9(9) | 1(1) | 1(1) | 11(11) | 1.1 | 23 |
| **METROPARK** | | | | | | | | | |
| Intercity NEC | 1,620 | 2,415 | 5,420 | 25(70) | 65(20) | 2(2) | 92(92) | 1.15 | 13 |
| Long Haul | 10 | 21 | 21 | -(70) | 90(70) | 2(2) | 92(90) | 1.15 | 13 |
| Commuter | 4,600 | 5,000 | 5,000 | 52(70) | 38(20) | 1(1) | 91(91) | 1.15 | 16 |

Table C-1 (Cont'd)

ESTIMATED RAIL PARTONAGE AND AUTO ACCESS CHARACTERISTICS AT STATIONS

| STATION/TYPE PATRON | Daily Rail Patrons (Rides to and from Station) | | | Estimated Percent of Rail Patrons by Auto Access Mode 1975 (1990 with NECIP) | | | | Estimated Patrons Per Vehicle | Estimated Peak Hour as a Percent of Daily Activities |
|---|---|---|---|---|---|---|---|---|---|
| | 1974/1975 | 1990 Unimproved Service | 1990 with NECIP | Parked Auto | Drop-off Pickup | Taxi Limo | Total Auto | | |
| **NEW BRUNSWICK** | | | | | | | | | |
| Intercity NEC | 1,470 | 2,380 | 4,600 | 21(21) | 28(28) | 28(28) | 77(77) | 1.4 | 15 |
| Commuter Rail | 3,480 | 3,800 | 3,800 | 15(15) | 25(25) | 20(20) | 60(60) | 1.25 | 20 |
| **PRINCETON JUNCTION** | | | | | | | | | |
| Intercity NEC | 2,420 | 3,000 | 5,010 | 50(50) | 32(32) | -(-) | 82(82) | 1.3 | 15 |
| Commuter Rail | 2,100 | 2,620 | 2,620 | 70(70) | 18(18) | -(-) | 88(88) | 1.3 | 15 |
| **TRENTON** | | | | | | | | | |
| Intercity NEC | 6,520 | 12,000 | 15,000 | 73(73) | 11(11) | 11(11) | 94(94) | 1.15 | 15 |
| Commuter | 4,060 | 5,800 | 5,800 | 73(73) | 11(11) | 11(11) | 94(94) | 1.25 | 24 |
| **NORTH PHILADELPHIA** | | | | | | | | | |
| Intercity NEC | 740 | 810 | 1,700 | 18(18) | 27(27) | 27(27) | 72(72) | 1.5 | 15 |
| Commuter Rail | 940 | 940 | 940 | 30(30) | 15(15) | 15(15) | 60(60) | 1.25 | 20 |
| **PHILADELPHIA (30th St.)** | | | | | | | | | |
| Intercity NEC | 11,500 | 12,600 | 22,300 | 16(16) | 18(18) | 15(15) | 49(49) | 1.15 | 15 |
| Commuter | 25,600 | 41,000 | 41,000 | -(-) | -(-) | -(-) | -(-) | -.- | 20 |
| **WILMINGTON** | | | | | | | | | |
| Intercity NEC | 1,960 | 3,180 | 5,010 | 40(40) | 38(38) | 10(10) | 88(88) | 1.20 | 13 |
| Long Haul | 70 | 175 | 175 | 40(40) | 38(38) | 10(10) | 88(88) | 1.20 | 13 |
| Commuter | 1,620 | 3,400 | 3,400 | 55(55) | 20(20) | 3(3) | 78(78) | 1.20 | 13 |

Table C-1 (Cont'd)

ESTIMATED RAIL PARTONAGE AND AUTO ACCESS
CHARACTERISTICS AT STATIONS

| STATION/TYPE PATRON | Daily Rail Patrons (Rides to and from Station) | | | Estimated Percent of Rail Patrons by Auto Access Mode 1975 (1990 with NECIP) | | | | Estimated Patrons Per Vehicle | Estimated Peak Hour as a Percent of Daily Activities |
|---|---|---|---|---|---|---|---|---|---|
| | 1974/ 1975 | 1990 Unimproved Service | 1990 with NECIP | Parked Auto | Drop-off Pickup | Taxi Limo | Total Auto | | |
| **BALTIMORE** | | | | | | | | | |
| Intercity NEC | 3,322 | 5,615 | 9,960 | 30(30) | 25(25) | 10(10) | 65(65) | 1.10 | 18 |
| Commuter | 650 | 2,875 | 2,875 | 51(51) | 15(15) | -(-) | 66(66) | 1.10 | 25 |
| **NEW CARROLLTON** | | | | | | | | | |
| Intercity NEC | 680 | 1,335 | 3,818 | 40(40) | 20(20) | 2(12) | 62(62) | 1.16 | 15 |
| Commuter | - | 19,900 | 19,900 | 64(64) | 31(31) | -(-) | 95(95) | 1.16 | 15 |
| **WASHINGTON UNION** | | | | | | | | | |
| Intercity NEC | 6,870 | 10,770 | 18,630 | 2(12) | 22(12) | 20(20) | 44(44) | 1.4 | 15 |
| Long Haul | 720 | 1,830 | 1,830 | 2(12) | 22(12) | 20(20) | 44(44) | 1.4 | 15 |
| Commuter | 5,600 | 26,600 | 26,600 | -(-) | 2(2) | 5(5) | 7(7) | 1.1 | 24 |

# APPENDIX D

# AMBIENT AIR QUALITY DATA

## APPENDIX D

## AMBIENT AIR QUALITY DATA

Tables C-1 through C-5 show the ambient air quality levels in 1975 for five pollutants. Also indicated in the tables are the locations at which established federal standards have been exceeded. The notation for exceedence of standards is as follows:

* Exceeds federal primary standard
** Exceeds federal secondary standard

The sources of the data contained in the table are as given below:

[1] Monthly Summary of Continuous Data (Boston: Bureau of Air Quality Control, May, 1976, Division of Environmental Health, Massachusetts Department of Public Health).

[2] Air Quality Data Summary: Trends and Analysis - Calendar Year 1975 (Providence: Division of Occupational Health, Division of Air Quality Control, Rhode Island Department of Health).

[3] Connecticut Air Quality Summary - 1975 (Hartford: Connecticut Department of Environmental Protection).

[4] New York State Air Quality Report: Continuous and Manual Air Monitoring Systems, Annual, 1975 DAR-76-1 (Division of Air Resources, New York State Department of Environmental Conservation).

[5] Data Report - Aerometric Network, Calendar Year 1975 (New York: Environmental Protection Administration, New York City Department of Air Resources).

6 *Air Quality in New Jersey Compared with Air Quality Standards - 1975* (Trenton: New Jersey Department of Environmental Protection).

7 *Pennsylvania Air Quality Surveillance Report - 1975* - Air Quality Report (Harrisburg: Pennsylvania Department of Environmental Resources).

8 *Monthly Air Quality Data Summaries - 1976* (Dover: Division of Environmental Control, Delaware Department of Natural Resources and Environmental Control).

9 *Maryland Air Quality Data Report* (Baltimore: Environmental Health Administration, Maryland Department of Health and Mental Hygiene, May, 1976).

10 *Annual Report on the Quality of Air in Washington, D.C. - 1975* (Washington: Air Monitoring Division, Bureau of Air and Water Quality, Environmental Health Administration, DC Department of Environmental Services).

Table D-1

AMBIENT AIR QUALITY DATA

POLLUTANT: SULFUR DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARD | |
|---|---|---|---|---|
| | ANNUAL | 24-HOUR | PRIMARY | SECONDARY |
| MASSACHUSETTS | 0.03 (standard) | | 0.14 (standard) | |
| Boston | .011 | .044 | | |
| Boston | .013 | .059 | | |
| Boston | .007 | .034 | | |
| Needham | .007 | .037 | | |
| Norwood | .008 | .033 | | |
| Quincy | .010 | .044 | | |
| Quincy | .007 | .026 | | |
| RHODE ISLAND | 0.03 (standard) | | 0.14 (standard) | |
| Cranston | .005 | .024 | | |
| Cranston | .012 | .042 | | |
| E.Providence | --- | .016 | | |
| E.Providence | .008 | .031 | | |
| E.Providence | N/A | .034 | | |
| E.Providence | N/A | .027 | | |
| N.Kingston | .003 | .018 | | |
| Pawtucket | .005 | .028 | | |
| Providence | .008 | .033 | | |
| Providence | .012 | .066 | | |
| Providence | .013 | .034 | | |
| Providence | .017 | .060 | | |
| Providence | .011 | .055 | | |

Table D-1

AMBIENT AIR QUALITY DATA

POLLUTANT: SULFUR DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARD | |
|---|---|---|---|---|
| | ANNUAL | 24-HOUR | PRIMARY | SECONDARY |
| Providence | N/A | .035 | | |
| Providence | N/A | .051 | | |
| Richmond | .003 | .010 | | |
| Warwick | .005 | .016 | | |
| Westerly | N/A | .011 | | |
| CONNECTICUT | 0.03 (standard) | | 0.145 (standard) | 0.10 (standard) |
| Bridgeport,01 | .024 | .156* | N/A | N/A |
| Bridgeport,03 | .018 | .100 | N/A | N/A |
| Bridgeport,123 | | .046 | N/A | N/A |
| Derby | | .039 | N/A | N/A |
| Greenwich | | .040 | N/A | N/A |
| Groton | .011 | .031 | N/A | N/A |
| Milford | .019 | .133 | N/A | N/A |
| New Haven,04 | .019 | .068 | N/A | N/A |
| New Haven,123 | | .072 | N/A | N/A |
| Stamford | .019 | .060 | N/A | N/A |
| NEW YORK | 0.03 (standard) | | 0.14 (standard) | |
| Greenburgh | .007 | .034 | | |
| Mamaroneck | .013 | .045 | | |
| Mt. Pleasant | .008 | .043 | | |
| Mt. Vernon | .016 | .103 | | |
| New York City | .021 | .052 | | |

Table D-1

AMBIENT AIR QUALITY DATA

POLLUTANT: SULFUR DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARD | |
|---|---|---|---|---|
| | ANNUAL | 24-HOUR | PRIMARY | SECONDARY |
| New York City | .018 | .068 | | |
| New York City | .038* | .015 | | |
| New York City | .020 | .088 | | |
| New York City | .018 | .054 | | |
| New York City | .027 | .090 | | |
| New York City | .028 | .100 | | |
| New York City | .037* | .087 | | |
| New YOrk City | .013 | .046 | | |
| New York City | .028 | .058 | | |
| New York City | .025 | .072 | | |
| New York City | .006 | .014 | | |
| New York City | .030 | .059 | | |
| New York City | .023 | .075 | | |
| New York City | .022 | .043 | | |
| New York City | .007 | .024 | | |
| New York City | .020 | .036 | | |
| New York City | .023 | .053 | | |
| New York City | .005 | .019 | | |
| New York City | .007 | .027 | | |
| New York City | ---- | .032 | | |
| New York City | .006 | .043 | | |
| New York City | .026 | .077 | | |

Table D-1

AMBIENT AIR QUALITY DATA

POLLUTANT: SULFUR DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) | | NUBMER OF DAYS EXCEEDING 24-HOUR STANDARD | |
|---|---|---|---|---|
| | ANNUAL | 24-HOUR | PRIMARY | SECONDARY |
| New York City | .019 | .040 | | |
| New York City | .011 | .031 | | |
| New York City | ---- | .050 | | |
| New York City | .022 | .055 | | |
| New York City | .025 | .075 | | |
| New York City | .023 | .071 | | |
| New York City | .014 | .042 | | |
| New York City | .021 | .065 | | |
| New York City | .018 | .057 | | |
| New York City | .025 | .068 | | |
| New York City | .018 | .045 | | |
| New York City | .017 | .076 | | |
| New York City | .030 | .117 | | |
| New York City | .021 | .052 | | |
| Port Chester | .012 | .056 | | |
| Somers | .008 | .043 | | |
| White Plains | .012 | .044 | | |
| NEW JERSEY | 0.03 (standard) | | 0.14 (standard) | 0.10 (standard) |
| Bayonne | .018 | .059 | | |
| Elizabeth | .013 | .058 | | |
| Jersey City | .016 | .054 | | |
| | | | | |

Table D-1

AMBIENT AIR QUALITY DATA

POLLUTANT: SULFUR DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARD | |
|---|---|---|---|---|
| | ANNUAL | 24-HOUR | PRIMARY | SECONDARY |
| Trenton | .009 | .060 | | |
| **PENNSYLVANIA** | 0.03 (standard) | | 0.14 (standard) | |
| Bristol | .011 | .051 | | |
| Chester | .018 | .204* | | |
| Philadelphia | .026 | .109 | | |
| Philadelphia | .019 | .077 | | |
| Philadelphia | .015 | .050 | | |
| Philadelphia | .029 | .078 | | |
| Philadelphia | .017 | .062 | | |
| Philadelphia | .016 | .067 | | |
| Philadelphia | .015 | .083 | | |
| Philadelphia | .029 | .095 | | |
| Philadelphia | .022 | .109 | | |
| Philadelphia | .032* | .162* | 1 | 1 |
| Philadelphia | .025 | .077 | | |
| Norristown | .005 | .052 | | |
| Middle River | .003 | .006 | | |
| Odenton | .005 | .023 | | |
| Riviera Beach | .009 | .026 | | |
| Solliers Point | .013 | .034 | | |
| DELAWARE | 0.03 (standard) | | 0.14 (standard) | 0.10 (standard) |
| Claymont | .014 | .060 | N/A | N/A |
| Faulkland | .014 | .12[illegible] | N/A | N/A |

Table D-1

AMBIENT AIR QUALITY DATA

POLLUTANT: SULFUR DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARD | |
|---|---|---|---|---|
| | ANNUAL | 24-HOUR | PRIMARY | SECONDARY |
| Faulk Road | .009 | .110** | N/A | N/A |
| Lindamere | .007 | .050 | N/A | N/A |
| Milltown | .010 | .070 | N/A | N/A |
| Newark | .008 | .060 | N/A | N/A |
| New Castle | .010 | .070 | N/A | N/A |
| New Land | .004 | .050 | N/A | N/A |
| Wilmington | .017 | .090 | N/A | N/A |
| Wilmington | .014 | .060 | N/A | N/A |
| MARYLAND | 0.0296 (standard) | | 0.10 (standard) | |
| Baltimore | .008 | .030 | | |
| Baltimore | .009 | .024 | | |
| Baltimore | .016 | .050 | | |
| Baltimore | .014 | .045 | | |
| Baltimore | .010 | .030 | | |
| Baltimore | .005 | .021 | | |
| Baltimore | .007 | .025 | | |
| Baltimore | .010 | .027 | | |
| Baltimore | --- | --- | | |
| Beltsville | --- | --- | | |
| Bowie | .003 | .010 | | |
| Cheverly | .008 | .027 | | |
| Essex | .010 | .032 | | |

Table D-1

AMBIENT AIR QUALITY DATA

POLLUTANT: SULFUR DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARD | |
|---|---|---|---|---|
| | ANNUAL | 24-HOUR | PRIMARY | SECONDARY |
| Essex | .010 | .032 | | |
| Elkton | .008 | .030 | | |
| Glen Burnie | .007 | .015 | | |
| Harmons | .004 | .023 | | |
| Hyattsville | --- | --- | | |
| Landsdowne | .001 | .003 | | |
| Linthicum | --- | --- | | |
| WASHINGTON, DC | 0.029 (standard) | | 0.109 (standard) | 0.086 (standard) |
| Camp | .024 | .045 | | |
| D.C. General | .013 | .048 | | |
| Sharpe Health | .025 | .115* | 2 | |
| T-F Library | .017 | .045 | | |
| West End Library | .016 | .048 | | |
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Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION ($ug/m^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| MASSACHUSETTS | 75 (standard) | | 250 (standard) | 150 (standard) |
| Attleboro | 45 | 136 | | |
| Boston, JFK | 61** | 145 | | |
| Boston, Kenmore Square | 99* | 206** | N/A | N/A |
| Boston, South Bay | 63** | 150 | | |
| Needham | 38 | 80 | | |
| Norwood | 45 | 117 | | |
| Quincy | 45 | 88 | | |
| RHODE ISLAND | 75 (standard) | | 250 (standard) | 150 (standard) |
| Cranston Police Station | 52 | N/A | | |
| Cranston General Hosp. | 45 | N/A | | |
| E. Providence Central Jr High | 42 | N/A | | |
| N. Kingston | 36 | N/A | | |
| Pawtucket | 48 | 101 | | 1 |
| Providence Police Station | 58 | N/A | | |
| Providence State Ofc. Bldg | 55 | N/A | | |
| Providence Dyer Street | 90* | 202 | | 7 |
| Providence--St. Joseph's Hosp. | 44 | N/A | | |
| Richmond | 28 | N/A | | |
| Warwick Police Station | 53 | 121 | | |
| Westerly | 47 | N/A | | |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION ($ug/m^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| CONNECTICUT | 75 (standard) | | 260 (standard) | 150 (standard) |
| Ansonia | 55.7 | 157** | | |
| Bridgeport, 01 | 51.9 | 114 | | |
| Bridgeport, 02 | 44.9 | 79 | | |
| Bridgeport,123 | 65.7** | 135 | | |
| Derby | 55.0 | 89 | | |
| Fairfield | 44.9 | 86 | | |
| Greenwich, 01 | 62.7** | 158** | | |
| Greenwich, 02 | 52.6 | 134 | | |
| Greenwich, 03 | 50.1 | 114 | | |
| Greenwich, 04 | 37.4 | 96 | | |
| Greenwich, 08 | 61.5** | 133 | | |
| Greenwich, 14 | 58.5 | 116 | | |
| Groton | 38.7 | 94 | | |
| Milford, 01 | 45.7 | 113 | | |
| Milford, 02 | 62.5** | 148 | | |
| Milford, 06 | 41.6 | 99 | | |
| New Haven, 01 | 59.0 | 135 | | |
| New Haven, 02 | 68.3** | 208** | | |
| New Haven, 03 | 52.1 | 120 | | |
| New Haven, 05 | 53.4 | 126 | | |
| New Haven, 09 | 54.8 | 113 | | |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION (ug/m$^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| Norwalk, 01 | 53.8 | 148 | | |
| Norwalk, 05 | 56.1 | 141 | | |
| Old Saybrook | 64.9** | 190** | | |
| Stamford, 01 | 55.4 | 140 | | |
| Stamford, 03 | 57.3 | 143 | | |
| Stamford, 04 | 41.9 | 140 | | |
| Stamford, 07 | 61.6 | 145 | | |
| Stratford, 01 | 45.7 | 109 | | |
| Stratford, 05 | 52.7 | 144 | | |
| Waterford | 32.3 | 98 | | |
| NEW YORK | 75 (standard) | | 260 (standard) | |
| Greenburg | 55 | 159** | N/A | N/A |
| Mamaroneck (5909-01) | 48 | 102 | N/A | N/A |
| Mamaroneck (5956-01) | 52 | 124 | N/A | N/A |
| Mt. Vernon | 50 | 107 | N/A | N/A |
| Mt. Pleasant | 42 | 113 | N/A | N/A |
| New Rochelle | 59 | 122 | N/A | N/A |
| No. Tarrytown | 44 | 120 | N/A | N/A |
| Ossining | 46 | 116 | N/A | N/A |
| Peekskill | 60 | 142 | N/A | N/A |
| Port Chester | 42 | 109 | N/A | N/A |
| Rye | 64** | 145 | N/A | N/A |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION ($ug/m^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| Somers | 34 | 80 | N/A | N/A |
| White Plains | 50 | 113 | N/A | N/A |
| Yonkers | 68** | 168** | N/A | N/A |
| Yorktown | 33 | 87 | N/A | N/A |
| New York City | | | | N/A |
| Bronx H.S. of Science | 57 | N/A | | N/A |
| City College | 70** | N/A | | N/A |
| Morrisanna Hospital | 75** | N/A | | N/A |
| Junior H.S. 142 | 55 | N/A | | N/A |
| .rsenal Central Park | 65** | N/A | | N/A |
| S. Gompers H.S. Annex | 76* | N/A | | N/A |
| Bowery Bay | 96* | N/A | | N/A |
| Fort Schuyler | 48 | N/A | | N/A |
| M.D. Bacon H.S. Annex | 71** | N/A | | N/A |
| Greenpoint | 73** | N/A | | N/A |
| Public School 11 | 73** | N/A | | N/A |
| Junction Blvd. | 63** | N/A | | N/A |
| Queens College | 50 | N/A | | N/A |
| Bayside High School | 48 | N/A | | N/A |
| Van Buren H.S. | 59 | N/A | | N/A |
| Public School 371 | 77* | N/A | | N/A |
| ɪrooklyn Public Library | 52 | N/A | | N/A |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION (ug/m$^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| Public School 40 | 66** | N/A | | N/A |
| Grover Cleveland H.S. | 67** | N/A | | N/A |
| East N.Y. Voc. H.S. | 65** | N/A | | N/A |
| Queensboro Hall | 0 | N/A | | N/A |
| Andrew Jackson High School | 62** | N/A | | N/A |
| Public School 104 | 59 | N/A | | N/A |
| Sheepshead Bay H.S. | 62** | N/A | | N/A |
| Tilden H.S. | 61** | N/A | | N/A |
| Public School 207 | 57 | N/A | | N/A |
| Springfield Grounds H.S. | 51 | N/A | | N/A |
| Goethals Bridge Toll. | 72* | N/A | | N/A |
| Richmond Boro Hall | 68** | N/A | | N/A |
| French Kills Land Fill | 82* | N/A | | N/A |
| Seaview Hospital | 60 | N/A | | N/A |
| Egbert Junior High School | 64** | N/A | | N/A |
| Tottenville HS | 53 | N/A | | N/A |
| S.S. John Brown | 62** | N/A | | N/A |
| Criminal Courthouse | 59 | N/A | | N/A |
| Laboratory Station | 89* | N/A | | N/A |
| Public School 226 | 57 | N/A | | N/A |
| **NEW JERSEY** | 75 (standard) | | 250 (standard) | 150 (standard) |
| Bayonne | 64.0** | 129 | | |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION ($ug/m^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| Carteret | 86.1* | 176** | | 8 |
| Cheesequake | 35.2 | 80 | | |
| East Orange | 55.7 | 116 | | |
| Grovers Mill | 39.7 | 83 | | |
| Hamilton | 42.7 | 148 | | 1 |
| Hoboken | 60.5** | 119 | | |
| Irvington | 48.7 | 123 | | |
| Jersey City | 81.4* | 160 | | 4 |
| Jersey City | 71.3** | 141 | | 1 |
| Linden | 62.4** | 130 | | |
| Livingston | 31.8 | 70 | | |
| Metuchen | 50.6 | 122 | | 1 |
| Middlesex | 51.2 | 159** | | 2 |
| Newark | 53.0 | 121 | | 1 |
| Orange | 47.4 | 104 | | |
| Perth Amboy | 61.6** | 115 | | |
| Rahway | 44.2 | 113 | | |
| Roselle | 66.3** | 152** | | 3 |
| Sayreville | 57.1 | 139 | | 1 |
| Seacaucus | 59.2 | 135 | | |
| Sewaren | 56.7 | 126 | | |
| So. Amboy | 59.3 | 127 | | |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION (ug/m$^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| So. Brunswick | 48.7 | 130 | | |
| Trenton | 53.3 | 125 | | |
| Union | 43.4 | 102 | | |
| Washington Crossing | 39.1 | 83 | | |
| West Orange | 46.9 | 106 | | |
| Woodbridge | 51.1 | 106 | | 1 |
| PENNSYLVANIA | 75 (standard) | | 260 (standard) | 150 (standard) |
| Bristol | 52 | 151** | N/A | N/A |
| Chester | 65** | 173** | N/A | N/A |
| Coatesville | 84* | 330* | N/A | N/A |
| Conshohoken | 76* | 162** | N/A | N/A |
| Downington | 50 | 157** | N/A | N/A |
| Doylestown | 53 | 131 | N/A | N/A |
| Lansdale | 51 | 106 | N/A | N/A |
| Media | 60 | 227** | N/A | N/A |
| Morrisville | 42 | 133 | N/A | N/A |
| Perkasie | 37 | 99 | N/A | N/A |
| Philadelphia DEF | 87* | 206** | N/A | N/A |
| Philadelphia ALL | 102* | 252** | N/A | N/A |
| Philadelphia INT | 93* | 226** | N/A | N/A |
| Philadelphia | 58 | 122 | N/A | N/A |
| Philadelphia ROX | 56 | 154** | N/A | N/A |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION ($ug/m^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| Philadelphia N/E | 56 | 151** | N/A | N/A |
| Philadelphia NBR | 102* | 251** | N/A | N/A |
| Philadelphia FRL | 82* | 174** | N/A | N/A |
| Philadelphia LAB | 74** | 186** | N/A | N/A |
| Philadelphia SBR | 117* | 225** | N/A | N/A |
| Philadelphia S/E | 87* | 206** | N/A | N/A |
| Philadelphia 500 | 73** | 258** | N/A | N/A |
| Philadelphia AFS | 96* | 238** | N/A | N/A |
| Phoenixville | 55 | 182** | N/A | N/A |
| ɔttstown | 65** | 294* | N/A | N/A |
| Quakertown | 36 | 91 | N/A | N/A |
| Westchester | 47 | 128 | N/A | N/A |
| Willow Grove | 53 | 169** | N/A | N/A |
| DELAWARE | 70 (standard) | | 200 (standard) | 150 (standard) |
| Claymont | 50.9 | 158** | N/A | N/A |
| Faulkland | 46.3 | 145 | N/A | N/A |
| Faulk Road | 40.6 | 146 | N/A | N/A |
| Lindamere | 49.1 | 182** | N/A | N/A |
| Milltown | 44.3 | 166** | N/A | N/A |
| Newark | 67.1** | 193** | N/A | N/A |
| New Castle | 53.5 | 217** | N/A | N/A |
| :w Castle | 42.1 | 172** | N/A | N/A |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION ($ug/m^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| Wilmington | 94.4* | 274* | N/A | N/A |
| Odenton | 42 | 72 | | |
| Riviera Beach | 59 | 357* | 3 | 3 |
| Sollers Point | 75** | 145 | | 1 |
| Essex | 60 | 133 | | |
| Wilmington | 72.2** | 165** | N/A | N/A |
| MARYLAND | | | | |
| Baltimore City Fire Dept.,Hdg. | 92* | 184** | 1 | 5 |
| Baltimore Fire Dept.#10 | 136* | 358* | 5 | 35 |
| Baltimore Fort McHenry | 93* | 190** | | 4 |
| Baltimore Fire Dept.#22 | 96* | 208** | | 6 |
| Baltimore Ratapsco Sta. | 169* | 398* | 8 | 24 |
| Baltimore NE Police Sta. | 54 | 203** | | 2 |
| Baltimore NW Police Sta. | 60 | 129 | | 1 |
| Baltimore SE Police Sta. | 89* | 167** | | 3 |
| Baltimore SW Police Sta. | 70* | 161** | | 2 |
| Beltsville | 48 | 86 | | |
| Bowie | 36 | 65 | | |
| Cheverly | 48 | 102 | | |
| Elkton | 54 | 69 | | |
| Glen Burnie | 69** | 114 | | |
| Harmons | 51 | 99 | | |

Table D-2

AMBIENT AIR QUALITY DATA

POLLUTANT: TOTAL SUSPENDED PARTICULATE

| MONITORING STATION | CONCENTRATION (ug/m$^3$) | | NUMBER OF DAYS EXCEEDING 24-HOUR STANDARDS | |
|---|---|---|---|---|
| | ANNUAL | 2nd HIGHEST 24-HOUR | PRIMARY | SECONDARY |
| Hyattsville | 54 | 92 | | |
| Landsdowne | 65** | 113 | | |
| Linthicum | 61** | 97 | | |
| Middle River | 57 | 140 | | |
| WASHINGTON, D.C. | | | | |
| Amer. Chemical | 57 | 255** | 6 | 1 |
| National Aboretum | 47 | 204** | 2 | 1 |
| Camp | 72** | 292* | 8 | 2 |
| Catholic Univ. | 57 | 168** | 4 | 1 |
| Clevelnad Park | 48 | 184** | 5 | 2 |
| D.C. General | 46 | 222** | 3 | 1 |
| N. Thomas School | 59 | 185** | 2 | 3 |
| Tenley-Friend | 43 | 161** | 2 | 1 |
| West End Library | 48 | 161** | 2 | 0 |
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Table D-3

AMBIENT AIR QUALITY DATA

POLLUTANT: NITROGEN DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) ANNUAL |
|---|---|
| **MASSACHUSETTS** | 0.05 (standard) |
| Boston | .035 |
| Boston | .053* |
| Boston | .028 |
| Needham | .026 |
| Norwood | .028 |
| Quincy | .034 |
| Quincy | .027 |
| **RHODE ISLAND** | 0.05 (standard) |
| Cranston | .010 |
| Cranston | .016 |
| E. Providence | N/A |
| E. Providence | .016 |
| E. Providence | N/A |
| E. Providence | N/A |
| N. Kingston | N/A |
| Pawtucket | .017 |
| Providence | .020 |
| Providence | .021 |
| Providence | .023 |
| Providence | .029 |
| Providence | .016 |

| MONITORING STATION | CONCENTRATION (in parts per million) ANNUAL |
|---|---|
| Providence | N/A |
| Providence | N/A |
| Richmond | .005 |
| Warwick | .011 |
| Westerly | N/A |
| **CONNECTICUT** | 0.05 (standard) |
| Bridgeport | .022 |
| Bridgeport | .027 |
| Bridgeport | .028 |
| Greenwich | .014 |
| Greenwich | .021 |
| Groton | .016 |
| Milford | .023 |
| New Haven | .029 |
| Norwalk | .032 |
| Norwich | .017 |
| Old Saybrook | .027 |
| Stamford | .020 |
| Stamford | .028 |
| Stratford | .028 |
| **NEW YORK** | |
| Greenburg | .042 |

Table D-3

AMBIENT AIR QUALITY DATA

POLLUTANT: NITROGEN DIOXIDE

| MONITORING STATION | CONCENTRATION (in parts per million) ANNUAL |
|---|---|
| Mamaroneck | .043 |
| Mt. Pleasant | .016 |
| Port Chester | .034 |
| Somers | .013 |
| White Plains | .034 |
| NEW JERSEY | 0.05 (standard) |
| Bayonne | .031 |
| Elizabeth | .052* |
| Newark | .044 |
| PENNSYLVANIA | |
| Bristol | .016 |
| Chester | .022 |
| Philadelphia | .037 |
| Philadelphia | .037 |
| Philadelphia | .029 |
| Philadelphia | .038 |
| Norristown | .028 |
| DELAWARE | 0.05 (standard) |
| No data | |
| MARYLAND | 0.05 (standard) |
| Baltimore | .025 |
| Baltimore | .024 |
| Baltimore | .021 |
| Baltimore | .021 |
| Baltimore | .018 |
| Baltimore | .021 |
| Bowie | .012 |
| Cheverly | .019 |
| Elkton | .015 |
| Essex | .024 |
| Glen Burnie | .019 |
| Harmons | .015 |
| Landsdowne | .023 |
| Middle River | .016 |
| Odenton | .015 |
| Riviera Beach | .016 |
| Solliers Point | .018 |
| WASHINGTON, DC | 0.05 (standard) |
| Camp | .037 |
| Cleveland Park | .030 |
| D.C. General | .046 |
| West End Library | .039 |
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Table D-4

AMBIENT AIR QUALITY DATA

POLLUTANT: OZONE

| MONITORING STATION | CONCENTRATION (in parts per million) 1-HOUR | NUMBER OF HOURS EX-CEEDING STANDARD |
|---|---|---|
| MASSACHUSETTS | 0.08 (standard) | |
| Boston | 0.109* | 9 |
| Quincy | .152* | 178 |
| RHODE ISLAND | 0.08 (standard) | |
| Providence | .180* | 110 |
| CONNECTICUT | 0.08 (standard) | |
| Bridgeport | .260* | 31% |
| Greenwich | .175* | 34% |
| Groton | .210* | 36% |
| New Haven | .295* | 25% |
| Stamford | .195* | 31% |
| NEW YORK | | |
| Mamaroneck | o.140* | 47 |
| 51 Astor PL NYC | .165* | 67 |
| NEW JERSEY | 0.08 (standard) | |
| Bayonne | .182* | 180 |
| PENNSYLVANIA | 0.08 (standard) | |
| Bristol | .327* | |
| Chester | .182* | |
| Philadelphia | .180* | 120 |
| Philadelphia | .190* | 391 |
| Philadelphia | .150* | 56 |
| Philadelphia | .080* | |
| Philadelphia | .180* | 335 |
| Philadelphia | .200* | 396 |
| Philadelphia | .150* | 107 |
| Philadelphia | .200* | 196 |
| Philadelphia | .170* | 218 |
| Philadelphia | .160* | 142 |
| Philadelphia | .240* | 274 |
| Norristown | .178* | -- |
| DELAWARE | 0.08 (standard) | |
| Clayout | --- | |
| Wilmington | --- | |
| Cleveland Park | .180* | 4 |
| D.C. General | .100* | 17 |
| Sharpe School | .075* | 2 |
| West End Library | .045 | |
| MARYLAND | 0.08 (standard) | |
| Baltimore | .121* | 45 |
| Baltimore | .158* | 96 |
| Baltimore | .053 | |
| Baltimore | .098* | 20 |
| Cheverly | .158* | 49 |

Table D-4

AMBIENT AIR QUALITY DATA

POLLUTANT: OZONE

| MONITORING STATION | CONCENTRATION (in parts per million) 1-HOUR | NUMBER OF HOURS EXCEEDING STANDARD | MONITORING STATION | CONCENTRATION (in parts per million) 1-HOUR | NUMBER OF HOURS EXCEEDING STANDARD |
|---|---|---|---|---|---|
| Essex | .196* | 275 | | | |
| WASHINGTON,DC | 0.08 (standard) | | | | |
| Camp | .180* | 31 | | | |
| Cleveland Park | .180* | 17 | | | |
| D. C. General | .100* | 4 | | | |
| Sharpe School | .075 | | | | |
| West End Lib. | .045 | | | | |
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Table D-5

AMBIENT AIR QUALITY DATA

POLLUTANT: CARBON MONOXIDE

| MONITORING STATION | 2nd HIGHEST CONCENTRATION (in parts per million) | | NUMBER OF TIMES STANDARD EXCEEDED | |
|---|---|---|---|---|
| | 8-HOUR | 1-HOUR | 8-HOUR STANDARD | 1-HOUR STANDARD |
| MASSACHUSETTS | 9 (standard) | 35 (standard) | | |
| Boston | 14.0 | 22.0 | 226 | |
| Boston | 13.7 | 22.0 | 72 | |
| Quincy | 8.3 | 12.0 | | |
| RHODE ISLAND | 9 (standard) | 35 (standard) | | |
| Providence | 9.4 | standard not exceeded | 3 | |
| Providence | 15.5 | standard not exceeded | 83 | |
| CONNECTICUT | 9 (standard) | 35 (standard) | | |
| Bridgeport | 11.9* | 16.0 | N/A | N/A |
| Bridgeport | 7.4 | 10.5 | N/A | N/A |
| Greenwich | 11.8* | 22.0 | N/A | N/A |
| Groton | 7.8 | 11.0 | N/A | N/A |
| New Haven | 9.5* | 17.5 | N/A | N/A |
| Norwalk | 12.5 | 22.5 | N/A | N/A |
| Stamford | 8.2 | 13.9 | N/A | N/A |
| NEW YORK | 9 (standard) | 35 (standard) | | |
| Bronx H.S. | 8.0 | 12.0 | | |
| Brooklyn Library | 8.0 | 15.0 | | |
| Canal Street | 20.3* | 40.0 * | 148 | 1 |
| Central Park | 6.0 | 13.0 | | |
| Greenpoint | 7.0 | 13.0 | | |
| M.D. Bacon | 9.0 | 13.0 | | |

Table D-5

AMBIENT AIR QUALITY DATA

POLLUTANT: CARBON MONOXIDE

| MONITORING STATION | 2nd HIGHEST CONCENTRATION (in parts per million) | | NUMBER OF TIMES STANDARD EXCEEDED | |
|---|---|---|---|---|
| | 8-HOUR | 1-HOUR | 8-HOUR STANDARD | 1-HOUR STANDARD |
| Morrisiana | 9.0 | 13.0 | | |
| Seaview Hospital | 5.0 | 8.0 | | |
| Sheapshead Bay HS | 6.0 | 14.0 | | |
| Springfield Gardens | N/A | N/A | | |
| Queens College | 8.0 | 17.0 | | |
| 45th and Lexington | 23.3* | 36.0* | 44 | 1 |
| 59th Street Bridge | 34.0* | 50.0* | 302 | 69 |
| 121st Street | 9.1* | 16.0 | 1 | |
| Mamaroneck*** | 13.1* | 19.6 | 14 | 0 |
| NEW JERSEY | 9 (standard) | 35 (standard) | | |
| Bayonne | 8.6 | 10.6 | | |
| Elizabeth | 10.4* | 17.2 | 7 | |
| Elizabeth | 15.2* | 29.2 | 665 | |
| Jersey City | 20.2* | 32.7 | 954 | |
| Newark | 22.5 | 28.8 | 84 | |
| Trenton | 9.7* | 13.7 | 4 | |
| PENNSYLVANIA | 9 (standard) | 35 (standard) | | |
| Bristol | N/A | 12.8 | N/A | |
| Chester | N/A | 12.4 | N/A | |
| Philadelphia | 7.3 | 24.0 | | |
| Philadelphia | 8.0 | 9.0 | | |
| Philadelphia | 6.9 | 19.0 | | |

Table D-5

AMBIENT AIR QUALITY DATA

POLLUTANT: CARBON MONOXIDE

| MONITORING STATION | 2nd HIGHEST CONCENTRATION (in parts per million) | | NUMBER OF TIMES STANDARD EXCEEDED | |
|---|---|---|---|---|
| | 8-HOUR | 1-HOUR | 8-HOUR STANDARD | 1-HOUR STANDARD |
| Philadelphia | 5.6 | 12.0 | | |
| Philadelphia | 8.0 | 9.0 | | |
| Philadelphia | 9.5* | 13.0 | 1 | |
| Philadelphia | 14.9* | 29.0 | 10 | |
| Philadelphia | 7.4 | 19.0 | | |
| Philadelphia | 19.7* | 27.0 | 2 | |
| Philadelphia | 13.9* | 19.0 | 18 | |
| Philadelphia | 8.7 | 13.0 | | |
| Norristown | N/A | 53.8* | N/A | 1 |
| DELAWARE | 12 (standard) | 35 (standard) | | |
| Claymont | standard not exceeded | standard not exceeded | | |
| New Castle | standard not exceeded | | | |
| Wilmington | standard not exceeded | | | |
| MARYLAND | 9 (standard) | 35 (standard) | | |
| Cheverly | 15.7 | 12.6 | 5 | |
| Baltimore | 20.1 | 9.0 | 3 | |
| Baltimore | 22.7 | 14.4* | 0 | |
| Baltimore | 21.9 | 16.2 | 9 | |
| Baltimore | 9.6 | 0.0 | 1 | |
| Baltimore | 18.4 | 11.7* | 1 | |
| Essex | 18.4 | 11.7& | 1 | |
| WASHINGTON, DC | 9 (standard) | 35 (standard) | | |

Table D-5

AMBIENT AIR QUALITY DATA

POLLUTANT: CARBON MONOXIDE

| MONITORING STATION | 2nd HIGHEST CONCENTRATION (in parts per million) | | NUMBER OF TIMES STANDARD EXCEEDED | |
|---|---|---|---|---|
| | 8-HOUR | 1-HOUR | 8-HOUR STANDARD | 1-HOUR STANDARD |
| Camp | 24.4* | 53.0* | 15 | 2 |
| D.C. General | 13.9* | 17.0 | 11 | |
| Sharpe School | 20.1* | 30.0 | 31 | |
| St. Elizabeth | 12.9 | 22.0 | 5 | |
| T-F Library | 13.8* | 25.0 | 15 | |
| West End Library | 11.8* | 25.0 | 6 | |
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# APPENDIX E

# NOISE IMPACT DATA

## APPENDIX E

## NOISE IMPACT DATA

Tables E1-E3 tabulate noise impact by community from operations and Tables D4-D5 tabulate construction noise impacts from bridge improvements and curve realignments. Interpretation of Tables E1-E3 is facilitated by the following explanatory notes.

1. The impact Corridor is defined as the area between the ROW (assumed to be 50 feet from the tracks) and a boundary defined by one of the following criteria:

   A. If the ambient $L_{dn}$ is greater than 55 dB, the boundary is at the point where the train noise is 5 dB below the ambient.

   B. If the ambient $L_{dn}$ is between 53.3 and 55 dB, the boundary is at the point where the train noise is 50 dB.

   C. If the ambient $L_{dn}$ is less than 53.3 dB, the boundary is at the point where the total noise of the ambient and the trains is 55 dB (see Appendix A for additional explanation).

2. The column labelled "CORR CRIT" (Corridor Criterion) indicates which of the above criteria was used to determine the Corridor width for a given community.

3. A "+" following the number of people exposed to a particular $L_{dn}$ value means that the $L_{dn}$ value does not exist within the impact Corridor. In this case, the number shown is the total number of people living within the impact Corridor.

4. A "*" following the distance to a particular contour means that the $L_{dn}$ value does not exist within the impact Corridor. In this case, the number shown is the distance from the tracks to the outer boundary of the impact Corridor as determined by one of the criteria.

5. A distance of 0 feet to a particular contour means that the contour is within 50 feet of the track and thus is not in the impact Corridor.

## Table E-1

## NOISE IMPACT FROM EXISTING TRAINS

| STATE | COMMUNITY | ENI | PEOPLE WITHIN IMPACT CORRIDOR EXPOSED TO $L_{db}$ VALUES ABOVE 75 | 65 | 55 | DISTANCE (IN FEET) TO $L_{dn}$ CONTOURS WITHIN IMPACT CORR 75 | 65 | 55 | COOR CRIT |
|---|---|---|---|---|---|---|---|---|---|
| MA | BOSTON 1 | 3250 | 26 | 3965 | 4856+ | 51 | 199 | 233* | A |
| | BOSTON 2 | 2649 | 0 | 4502 | 5261+ | 0 | 169 | 198* | A |
| | DEDHAM 1 | 99 | 0 | 78 | 359+ | 0 | 100 | 460* | A |
| | DEDHAM 2 | 69 | 0 | 78 | 266+ | 0 | 100 | 341* | A |
| | WESTWOOD | 0 | 0 | 0 | 0 | 0 | 100 | 218 | C |
| | CANTON | 85 | 0 | 131 | 391 | 0 | 100 | 298 | C |
| | SHARON 1 | 23 | 0 | 48 | 124 | 0 | 100 | 255 | C |
| | SHARON 2 | 25 | 0 | 48 | 115 | 0 | 100 | 235 | C |
| | FOXBORO | 49 | 0 | 86 | 229 | 0 | 100 | 265 | C |
| | MANSFLD 1 | 37 | 0 | 68 | 169 | 0 | 100 | 248 | C |
| | MANSFLD 2 | 39 | 0 | 68 | 171 | 0 | 100 | 250 | C |
| | ATIBORO H1 | 19 | 2 | 10 | 72 | 79 | 163 | 803 | C |
| | ATIBORO 1 | 129 | 0 | 194 | 635 | 0 | 100 | 327 | C |
| | ATIBORO H2 | 19 | 2 | 10 | 70 | 77 | 159 | 785 | C |
| | ATIBORO 2 | 126 | 0 | 194 | 621 | 0 | 100 | 319 | C |
| | TOTAL: | 6621 | 30 | 9480 | 13339 | | | | |
| RI | CNTRL FLLS | 329 | 0 | 837 | 837+ | 0 | 126 | 126* | A |
| | PAWTCKET 1 | 229 | 0 | 367 | 622+ | 0 | 100 | 169* | A |
| | PAWTCKET 2 | 151 | 0 | 367 | 466+ | 0 | 100 | 127* | A |
| | PRVIDNCE 1 | 479 | 0 | 1228 | 1467+ | 0 | 100 | 119* | A |
| | PRVIDNCE 2 | 427 | 0 | 1228 | 1385+ | 0 | 100 | 112* | A |
| | CRANSTON 1 | 40 | 0 | 66 | 194+ | 0 | 74 | 220* | A |
| | CRANSTON 2 | 42 | 0 | 68 | 199+ | 0 | 77 | 225* | A |
| | WARWICK H | 287 | 0 | 213 | 1028+ | 0 | 112 | 543* | A |
| | WARWICK | 207 | 0 | 331 | 1016+ | 0 | 76 | 234* | A |
| | E GRNWCH H | 45 | 0 | 46 | 170 | 0 | 107 | 397 | C |
| | N KNGSTN H | 0 | 0 | 0 | 0 | 0 | 215 | 1000 | C |
| | N KNGSTN | 0 | 0 | 0 | 0 | 0 | 70 | 326 | C |
| | EXETER H | 0 | 0 | 0 | 0 | 0 | 215 | 1000 | C |
| | EXETER | 0 | 0 | 0 | 0 | 0 | 70 | 326 | C |
| | S KNGSTN H | 13 | 0 | 10 | 52 | 0 | 217 | 1113 | C |
| | S KNGSTN | 31 | 0 | 32 | 167 | 0 | 70 | 363 | C |
| | RICHMOND H | 3 | 0 | 6 | 30 | 0 | 215 | 1021 | C |
| | RICHMOND | 3 | 0 | 4 | 19 | 0 | 70 | 333 | C |
| | CHARLESTWN | 0 | 0 | 0 | 0 | 0 | 70 | 326 | C |
| | HOPKINGTON | 0 | 0 | 0 | 0 | 0 | 70 | 326 | C |
| | WESTERLY H | 19 | 0 | 19 | 72 | 0 | 107 | 397 | C |
| | WESTERLY | 29 | 0 | 65 | 157 | 0 | 71 | 171 | C |
| | TOTAL: | 2330 | 0 | 4887 | 7881 | | | | |
| CT | STNNGTN H1 | 20 | 0 | 21 | 75 | 0 | 107 | 377 | C |
| | STNNGTN 1 | 15 | 0 | 37 | 84 | 0 | 71 | 162 | C |
| | STNNGTN H2 | 23 | 0 | 13 | 73 | 53 | 118 | 418 | C |
| | STNNGTN 2 | 14 | 0 | 34 | 79 | 0 | 65 | 153 | C |
| | GRTN TN H1 | 38 | 0 | 19 | 143 | 53 | 121 | 573 | C |
| | GRTN TN 1 | 45 | 0 | 86 | 269 | 0 | 67 | 210 | C |
| | GRTN TN H2 | 39 | 1 | 20 | 147 | 55 | 123 | 586 | C |
| | GRTN TN 2 | 46 | 0 | 89 | 275 | 0 | 69 | 215 | C |
| | GRTN CTY H | 169 | 4 | 72 | 466+ | 55 | 129 | 562* | A |
| | GRTN CTY | 2 | 0 | 4 | 12+ | 0 | 74 | 206* | A |
| | NW LNDN H1 | 479 | 16 | 243 | 1003+ | 55 | 139 | 419* | A |
| | NW LNDN H2 | 749 | 116 | 419 | 1529+ | 92 | 204 | 613* | A |
| | WATRFRD H1 | 7 | 1 | 5 | 23 | 91 | 178 | 642 | C |
| | WATRFRD 1 | 14 | 0 | 33 | 73 | 0 | 89 | 198 | C |
| | WATRFRD H2 | 4 | 0 | 2 | 14 | 51 | 116 | 419 | C |
| | WATRFRD 2 | 11 | 0 | 25 | 60 | 0 | 70 | 165 | C |
| | EAST LYME | 16 | 0 | 38 | 87 | 0 | 69 | 157 | C |
| | OLD LYME H | 10 | 0 | 6 | 37 | 51 | 241 | 1197 | C |
| | OLD LYME | 26 | 0 | 28 | 140 | 0 | 69 | 345 | C |
| | OLD SYBR H | 31 | 0 | 17 | 117 | 51 | 244 | 1384 | C |
| | OLD SYBR | 59 | 0 | 56 | 317 | 0 | 70 | 399 | C |
| | WESTBRK 1 | 10 | 0 | 11 | 56 | 0 | 69 | 349 | C |
| | WESTBRK 2 | 13 | 0 | 11 | 55 | 0 | 68 | 343 | C |
| | CLINTON H | 31 | 0 | 21 | 126 | 0 | 216 | 1268 | C |
| | CLINTON | 67 | 0 | 62 | 364 | 0 | 69 | 407 | C |
| | MADISON H | 12 | 0 | 9 | 46 | 0 | 214 | 1085 | C |
| | MADISON | 26 | 0 | 27 | 137 | 0 | 68 | 348 | C |
| | GILFORD H | 199 | 0 | 94 | 728+ | 0 | 232 | 1786* | A |
| | GILFORD | 554 | 0 | 316 | 2433+ | 0 | 74 | 573* | A |
| | BRANFORD | 95 | 0 | 174 | 484 | 0 | 70 | 195 | C |
| | EAST HAVEN | 61 | 0 | 96 | 327+ | 0 | 73 | 248* | A |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CT | NEW HAVN 1 | 337 | 0 | 783 | 1089+ | 0 | 93 | 129* | A |
| | NEW HAVN 2 | 182 | 0 | 471 | 840+ | 0 | 56 | 100* | A |
| | WST HAVN 1 | 75 | 0 | 0 | 372+ | 0 | 0 | 111* | A |
| | WST HAVN 2 | 93 | 0 | 188 | 413+ | 0 | 56 | 123* | A |
| | ORANGE 1 | 3 | 0 | 0 | 22 | 0 | 0 | 303 | C |
| | ORANGE 2 | 5 | 0 | 4 | 23 | 0 | 62 | 394 | C |
| | MILFORD | 232 | 0 | 373 | 1220+ | 0 | 66 | 216* | A |
| | STRATFRD 1 | 62 | 0 | 105 | 300+ | 0 | 67 | 192* | A |
| | STRATFRD 2 | 66 | 0 | 110 | 311+ | 0 | 71 | 199* | A |
| | BRIDGEPORT | 535 | 0 | 1646 | 1788+ | 0 | 100 | 108* | A |
| | FAIRFLD 1 | 71 | 0 | 114 | 399+ | 0 | 68 | 239* | B |
| | FAIRFLD 2 | 97 | 0 | 148 | 486+ | 0 | 88 | 291* | B |
| | WESTPORT | 129 | 0 | 217 | 726 | 0 | 87 | 291 | B |
| | NORWALK 1 | 181 | 0 | 285 | 653+ | 0 | 94 | 217* | A |
| | NORWALK 2 | 205 | 0 | 300 | 707+ | 0 | 100 | 235* | A |
| | DARIEN 1 | 66 | 0 | 103 | 335 | 0 | 97 | 316 | B |
| | DARIEN 2 | 43 | 0 | 81 | 279 | 0 | 76 | 263 | B |
| | STAMFRD H1 | 89 | 11 | 47 | 245+ | 100 | 262 | 1140* | A |
| | STAMFRD 1 | 102 | 0 | 164 | 450+ | 0 | 80 | 219* | A |
| | STAMFRD H2 | 85 | 11 | 45 | 234+ | 100 | 250 | 1089* | A |
| | STAMFRD 2 | 113 | 0 | 183 | 488+ | 0 | 89 | 238* | A |
| | GRENWICH 1 | 63 | 0 | 114 | 358 | 0 | 84 | 264 | C |
| | GRENWICH 2 | 100 | 0 | 135 | 489 | 0 | 100 | 361 | C |
| | TOTAL: | 5807 | 160 | 7704 | 22012 | | | | |
| NY | PORT CHSTR | 304 | 0 | 431 | 797+ | 0 | 100 | 184* | A |
| | RYE 1 | 95 | 0 | 107 | 351+ | 0 | 100 | 326* | A |
| | RYE 2 | 23 | 0 | 0 | 133+ | 0 | 0 | 124* | A |
| | HARRISON 1 | 4 | 0 | 0 | 38 | 0 | 0 | 125 | C |
| | HARRISON 2 | 22 | 0 | 30 | 103 | 0 | 100 | 342 | C |
| | MAMARONECK | 324 | 0 | 369 | 879+ | 0 | 100 | 237* | A |
| | LARCHMONT | 152 | 0 | 183 | 407+ | 0 | 100 | 222* | A |
| | PELHAM 1 | 84 | 0 | 116 | 217+ | 0 | 100 | 186* | A |
| | PELHAM 2 | 85 | 0 | 116 | 219+ | 0 | 100 | 188* | A |
| | NEW ROCHEL | 627 | 0 | 769 | 1644+ | 0 | 100 | 213* | A |
| | BRONX 1 | 2560 | 0 | 6252+ | 6252+ | 0 | 100* | 100* | A |
| | BRONX 2 | 2532 | 0 | 6252+ | 6252+ | 0 | 100* | 100* | A |
| | QUEENS | 1951 | 0 | 4633 | 4633+ | 0 | 132 | 132* | A |
| | MANHATTAN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | A |
| | TOTAL: | 8763 | 0 | 19258 | 21925 | | | | |
| NJ | WEEHAWKEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | A |
| | UNION CITY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | A |
| | N BERGEN | 339 | 0 | 399 | 756+ | 0 | 126 | 239* | A |
| | SECAUCUS | 0 | 0 | 0 | 0 | 0 | 179 | 832 | C |
| | KEARNY | 0 | 0 | 0 | 0 | 0 | 179 | 832 | C |
| | HARRISON | 0 | 0 | 0 | 0 | 0 | 100 | 291 | C |
| | NEWARK 1 | 1084 | 0 | 2098 | 2098+ | 0 | 181 | 181* | A |
| | NEWARK 2 | 2246 | 349 | 2905 | 2905+ | 80 | 301 | 301* | A |
| | ELIZABTH 1 | 1011 | 143 | 821 | 1724+ | 78 | 212 | 391* | A |
| | ELIZABTH 2 | 1167 | 208 | 952 | 1965+ | 91 | 238 | 439* | A |
| | LINDEN | 1192 | 176 | 626 | 2911+ | 89 | 190 | 703* | A |
| | RAHWAY 1 | 749 | 123 | 501 | 1380+ | 90 | 215 | 505* | A |
| | RAHWAY 2 | 698 | 102 | 464 | 1294+ | 83 | 203 | 477* | A |
| | WOODBRIDGE | 116 | 20 | 73 | 362 | 82 | 164 | 615 | C |
| | EDISON | 873 | 114 | 425 | 2998+ | 82 | 171 | 903* | A |
| | METUCHEN | 1216 | 166 | 705 | 2427+ | 83 | 192 | 538* | A |
| | HIGHLND PK | 508 | 75 | 347 | 931+ | 84 | 205 | 468* | A |
| | NW BNSWK 1 | 811 | 120 | 549 | 1491+ | 84 | 205 | 471* | A |
| | NW BNSWK 2 | 870 | 144 | 592 | 1589+ | 90 | 217 | 498* | A |
| | N BRUNSWCK | 569 | 89 | 296 | 2115 | 88 | 178 | 966 | B |
| | S BRUNSWCK | 409 | 25 | 242 | 1402 | 88 | 415 | 2159 | C |
| | PLAINSBORO | 110 | 7 | 68 | 365 | 88 | 412 | 1997 | C |
| | W WINDSOR | 238 | 15 | 144 | 802 | 88 | 413 | 2076 | C |
| | LAWRENCE | 62 | 11 | 37 | 208 | 88 | 175 | 743 | C |
| | HAMILTON | 608 | 118 | 398 | 2785+ | 89 | 181 | 966* | B |
| | TRENTON 1 | 1106 | 221 | 1361 | 1626+ | 92 | 313 | 365* | A |
| | TRENTON 2 | 781 | 73 | 970 | 1171+ | 64 | 238 | 276* | A |
| | TOTAL: | 16763 | 2299 | 14973 | 35305. | | | | |
| DE | NW CSTL CO | 2577 | 100 | 1403 | 9647 | 70 | 333 | 2000 | C |
| | WILMNGTN 1 | 624 | 59 | 368 | 1223+ | 69 | 170 | 449* | A |
| | WILMNGTN 2 | 607 | 53 | 356 | 1191+ | 67 | 166 | 439* | A |
| | NEWPORT | 90 | 8 | 43 | 265+ | 70 | 155 | 694* | A |
| | NEWARK H1 | 276 | 29 | 151 | 723+ | 100 | 303 | 1259* | A |
| | NEWARK 2 | 115 | 7 | 54 | 322+ | 61 | 141 | 589* | A |
| | TOTAL: | 4289 | 256 | 2375 | 13371 | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DE | NW CSTL CO | 2577 | 100 | 1403 | 9647 | 70 | 333 | 2000 | C |
| | WILMNGTN 1 | 624 | 59 | 368 | 1223+ | 69 | 170 | 449* | A |
| | WILMNGTN 2 | 607 | 53 | 356 | 1191+ | 67 | 166 | 439* | A |
| | NEWPORT | 90 | 8 | 43 | 265+ | 70 | 155 | 694* | A |
| | NEWARK H1 | 276 | 29 | 151 | 723+ | 100 | 303 | 1259* | A |
| | NEWARK 2 | 115 | 7 | 54 | 322+ | 61 | 141 | 589* | A |
| | TOTAL: | 4289 | 256 | 2375 | 13371 | | | | |
| PA | MORRISVILL | 354 | 9 | 198 | 697+ | 54 | 141 | 372* | A |
| | FALLS TWP | 28 | 0 | 16 | 96 | 53 | 247 | 1171 | C |
| | TULLYTOWN | 256 | 1 | 114 | 1129 | 53 | 257 | 2093 | C |
| | BRISTL T 1 | 640 | 99 | 751+ | 751+ | 62 | 143* | 143* | A |
| | BRISTL T 2 | 591 | 69 | 699+ | 699+ | 58 | 137* | 137* | A |
| | BRISTOL | 2111 | 19 | 1291 | 3962+ | 51 | 141 | 329* | A |
| | BENSALEM | 438 | 1 | 191 | 1656 | 0 | 117 | 630 | B |
| | PHILA 1 | 3337 | 75 | 4788 | 4788+ | 52 | 228 | 228* | A |
| | PHILA 2 | 4487 | 614 | 6463 | 6463+ | 72 | 291 | 291* | A |
| | PHILA 3 | 5690 | 1157 | 8042 | 8042+ | 93 | 350 | 350* | A |
| | PHILA 4 | 4615 | 674 | 6645 | 6645+ | 75 | 298 | 298* | A |
| | COLWYN 1 | 307 | 46 | 439 | 439+ | 75 | 291 | 291* | A |
| | COLWYN 2 | 263 | 24 | 376 | 376+ | 63 | 257 | 257* | A |
| | DARBY | 86 | 8 | 121 | 121+ | 63 | 247 | 247* | A |
| | SHARON HLL | 671 | 49 | 516 | 1163+ | 62 | 176 | 335* | A |
| | FOLCROFT | 87 | 5 | 53 | 167+ | 61 | 159 | 390* | A |
| | GLENOLDEN | 533 | 38 | 386 | 945+ | 62 | 171 | 346* | A |
| | NORWOOD | 214 | 15 | 160 | 376+ | 62 | 174 | 340* | A |
| | PROSPCT PK | 430 | 31 | 323 | 753+ | 62 | 174 | 339* | A |
| | RIDLEY PK | 801 | 56 | 555 | 1446+ | 61 | 167 | 357* | A |
| | RIDLEY TWP | 155 | 10 | 94 | 299+ | 61 | 158 | 394* | A |
| | EDDYSTONE | 189 | 10 | 87 | 566+ | 60 | 138 | 622* | A |
| | CHESTER 1 | 1107 | 91 | 1104 | 1763+ | 62 | 203 | 295* | A |
| | CHESTER 2 | 1173 | 120 | 1173 | 1863+ | 66 | 213 | 309* | A |
| | TRAINER | 192 | 13 | 89 | 621+ | 64 | 143 | 701* | A |
| | MRCUS HOOK | 8 | 0 | 4 | 24+ | 64 | 146 | 614* | A |
| | LINWOOD 1 | 37 | 3 | 20 | 132 | 64 | 138 | 612 | C |
| | LINWOOD 2 | 39 | 3 | 21 | 134 | 65 | 140 | 619 | C |
| MD | CECIL CO | 3 | 0 | 2 | 10 | 98 | 457 | 2122 | C |
| | ELKTON H | 339 | 42 | 180 | 1152 | 100 | 263 | 1412 | B |
| | ELKTON | 62 | 3 | 28 | 227 | 61 | 136 | 732 | B |
| | NORTHEST H | 956 | 56 | 417 | 2589+ | 148 | 778 | 4574* | A |
| | NORTHEST | 137 | 2 | 57 | 386+ | 61 | 324 | 1907* | A |
| | CHARLESTWN | 173 | 4 | 87 | 696 | 61 | 293 | 1995 | C |
| | PERRYVLL 1 | 4 | 0 | 2 | 15 | 61 | 284 | 1341 | C |
| | PERRYVLL 2 | 7 | 0 | 4 | 25 | 98 | 457 | 2159 | C |
| | HARFORD CO | 973 | 63 | 530 | 2887 | 100 | 467 | 2321 | C |
| | HAV DGRC H | 292 | 28 | 164 | 700+ | 100 | 337 | 1274* | A |
| | HAV DGRC | 537 | 88 | 279 | 1301+ | 100 | 208 | 785* | A |
| | ABERDEEN H | 486 | 47 | 268 | 1283+ | 100 | 331 | 1396* | A |
| | ABERDEEN | 93 | 15 | 46 | 245+ | 100 | 204 | 861* | A |
| | BAL CNTY H | 133 | 16 | 84 | 426 | 100 | 313 | 1379 | C |
| | BAL CNTY | 1337 | 277 | 795 | 4445 | 100 | 193 | 850 | C |
| | BALTIMR H1 | 261 | 30 | 256 | 403+ | 100 | 471 | 713* | A |
| | BALTIMR 1 | 2981 | 597 | 2874 | 4659+ | 100 | 290 | 439* | A |
| | BALTIMR H2 | 233 | 30 | 228 | 360+ | 100 | 424 | 643* | A |
| | BALTIMR 2 | 1911 | 175 | 1832 | 3081+ | 64 | 203 | 307* | A |
| | BALTIMR H3 | 271 | 32 | 266 | 418+ | 103 | 487 | 738* | A |
| | BALTIMR 3 | 1965 | 199 | 1889 | 3167+ | 66 | 208 | 315* | A |
| | AN ARN COH | 39 | 5 | 25 | 114 | 100 | 271 | 1053 | C |
| | AN ARN CO | 396 | 42 | 234 | 1298 | 66 | 140 | 546 | C |
| | PR GEO COH | 305 | 40 | 176 | 1077 | 100 | 265 | 1370 | C |
| | PR GEO CO | 839 | 68 | 427 | 3196 | 64 | 139 | 719 | C |
| | BOWIE | 729 | 15 | 295 | 2229+ | 64 | 333 | 2191* | A |
| | NEW CRLTN | 97 | 9 | 79 | 165+ | 66 | 190 | 340* | A |
| | LNDOVR HL | 41 | 3 | 28 | 75+ | 65 | 174 | 378* | A |
| | CHEVERLY | 136 | 10 | 75 | 276+ | 65 | 159 | 449* | A |
| | TOTAL: | 15620 | 1896 | 11627 | 36895 | | | | |
| DC | WASHNTN DC | 4122 | 420 | 4024 | 6612+ | 66 | 210 | 312* | A |
| | TOTAL: | 4122 | 420 | 4024 | 6612 | | | | |

Table E-2

FUTURE NOISE IMPACT FROM NO-BUILD OPTION

| STATE | COMMUNITY | ENI | PEOPLE WITHIN IMPACT CORRIDOR EXPOSED TO $L_{dn}$ VALUES ABOVE 75 | 65 | 55 | DISTANCE (IN FEET) TO $L_{dn}$ CONTOURS WITHIN IMPACT CORR 75 | 65 | 55 | CORR CRIT |
|---|---|---|---|---|---|---|---|---|---|
| MA | BOSTON 1 | 2971 | 0 | 4642 | 5784+ | 0 | 182 | 227* | A |
| | BOSTON 2 | 1621 | 0 | 3139 | 3910+ | 0 | 123 | 153* | A |
| | DEDHAM 1 | 73 | 0 | 80 | 277+ | 0 | 100 | 343* | A |
| | DEDHAM 2 | 60 | 0 | 80 | 236+ | 0 | 100 | 292* | A |
| | WESTWOOD 1 | 0 | 0 | 0 | 0 | 0 | 100 | 190 | C |
| | WESTWOOD 2 | 0 | 0 | 0 | 0 | 0 | 98 | 171 | C |
| | CANTON 1 | 46 | 0 | 81 | 246 | 0 | 92 | 279 | C |
| | CANTON 2 | 31 | 0 | 57 | 189 | 0 | 64 | 214 | C |
| | SHARON | 42 | 0 | 92 | 244 | 0 | 63 | 169 | C |
| | FOXBORO | 38 | 0 | 74 | 228 | 0 | 64 | 198 | C |
| | MANSFLD 1 | 27 | 0 | 58 | 161 | 0 | 64 | 177 | C |
| | MANSFLD 2 | 29 | 0 | 60 | 167 | 0 | 67 | 184 | C |
| | ATLBORO H1 | 24 | 3 | 12 | 93 | 79 | 164 | 891 | B |
| | ATLBORO 1 | 93 | 0 | 153 | 546 | 0 | 68 | 242 | B |
| | ATLBORO H2 | 24 | 3 | 12 | 92 | 78 | 162 | 881 | B |
| | ATLBORO 2 | 89 | 0 | 151 | 540 | 0 | 67 | 239 | B |
| | TOTAL: | 5165 | 6 | 8691 | 12713 | | | | |
| RI | CNTRL FLLS | 179 | 0 | 613 | 613+ | 0 | 100 | 100* | A |
| | PAWTUCKET | 286 | 0 | 729 | 898+ | 0 | 100 | 123* | A |
| | PROVDNCE 1 | 345 | 0 | 1133 | 1243+ | 0 | 93 | 102* | A |
| | PROVDNCE 2 | 327 | 0 | 1099 | 1217+ | 0 | 90 | 100* | A |
| | CRANSTON 1 | 35 | 0 | 63 | 177+ | 0 | 59 | 167* | A |
| | CRANSTON 2 | 45 | 0 | 77 | 206+ | 0 | 72 | 194* | A |
| | WARWICK H | 95 | 7 | 45 | 271+ | 65 | 147 | 629* | A |
| | WARWICK | 313 | 0 | 524 | 1440+ | 0 | 72 | 198* | A |
| | E GRNWCH 1 | 9 | 0 | 18 | 49 | 0 | 66 | 173 | C |
| | E GRNWCH 2 | 6 | 0 | 14 | 40 | 0 | 51 | 142 | C |
| | N KINGSTON | 0 | 0 | 0 | 0 | 0 | 0 | 232 | C |
| | EXETER H | 0 | 0 | 0 | 0 | 54 | 255 | 1184 | C |
| | EXETER | 0 | 0 | 0 | 0 | 0 | 0 | 232 | C |
| | S KINGSTON | 21 | 0 | 25 | 131 | 0 | 0 | 259 | C |
| | RICHMOND H | 3 | 0 | 2 | 11 | 54 | 255 | 1209 | C |
| | RICHMOND | 2 | 0 | 3 | 18 | 0 | 0 | 237 | C |
| | CHARLESTWN | 0 | 0 | 0 | 0 | 0 | 0 | 232 | C |
| | HOPKINGTON | 0 | 0 | 0 | 0 | 0 | 0 | 232 | C |
| | WESTRLY H1 | 11 | 0 | 6 | 36 | 55 | 122 | 451 | C |
| | WESTRLY 1 | 10 | 0 | 23 | 61 | 0 | 51 | 133 | C |
| | WESTRLY H2 | 8 | 0 | 9 | 33 | 0 | 100 | 362 | C |
| | WESTRLY 2 | 10 | 0 | 0 | 58 | 0 | 0 | 127 | C |
| | TOTAL: | 1704 | 7 | 4383 | 6502 | | | | |
| CT | STNINGTN H | 14 | 0 | 14 | 51 | 0 | 110 | 390 | C |
| | STNINGTN | 29 | 0 | 67 | 166 | 0 | 51 | 127 | C |
| | GRTN TWN H | 31 | 0 | 24 | 134 | 0 | 113 | 616 | B |
| | GRTN TWN | 111 | 0 | 186 | 704 | 0 | 53 | 201 | B |
| | GRTN CY H1 | 36 | 0 | 26 | 116+ | 0 | 118 | 513* | A |
| | GRTN CY 1 | 8 | 0 | 14 | 43+ | 0 | 56 | 167* | A |
| | GRTN CY H2 | 45 | 3 | 21 | 130+ | 63 | 144 | 623* | A |
| | GRTN CY 2 | 11 | 0 | 19 | 53+ | 0 | 74 | 206* | A |
| | NW LNDN H1 | 406 | 49 | 228 | 823+ | 78 | 181 | 524* | A |
| | NW LNDN 1 | 61 | 0 | 109 | 189+ | 0 | 95 | 166* | A |
| | NW LNDN H2 | 563 | 86 | 329 | 1113+ | 100 | 239 | 692* | A |
| | NW LNDN 2 | 84 | 0 | 114 | 238+ | 0 | 100 | 208* | A |
| | WATERFORD | 32 | 0 | 73 | 190 | 0 | 70 | 173 | C |
| | E LYME | 24 | 0 | 56 | 133 | 0 | 70 | 165 | C |
| | OLD LYME H | 21 | 0 | 12 | 74 | 63 | 296 | 1527 | C |
| | OLD LYME | 43 | 0 | 44 | 227 | 0 | 69 | 360 | C |
| | OLD SYBR H | 39 | 1 | 21 | 144 | 63 | 298 | 1690 | C |
| | OLD SYBR | 59 | 0 | 56 | 317 | 0 | 70 | 399 | C |
| | WESTBROOK | 21 | 0 | 22 | 111 | 0 | 68 | 343 | C |
| | CLINTON H | 43 | 1 | 23 | 161 | 60 | 285 | 1671 | C |
| | CLINTON | 67 | 0 | 62 | 364 | 0 | 69 | 407 | C |
| | MADISON H | 16 | 0 | 9 | 59 | 60 | 282 | 1430 | C |
| | MADISON | 26 | 0 | 27 | 137 | 0 | 68 | 348 | C |
| | GILFORD H | 270 | 4 | 104 | 939+ | 60 | 306 | 2355* | A |
| | GILFORD | 554 | 0 | 316 | 2433+ | 0 | 74 | 573* | A |
| | BRANFORD | 75 | 0 | 159 | 427 | 0 | 70 | 188 | C |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CT | EAST HAVEN | 63 | 0 | 101 | 334+ | 0 | 73 | 242* | A |
| | NW HAVEN 1 | 356 | 0 | 761 | 1104+ | 0 | 96 | 140* | A |
| | NW HAVEN 2 | 171 | 0 | 466 | 787+ | 0 | 59 | 100* | |
| | WEST HAVEN | 182 | 0 | 434 | 853+ | 0 | 54 | 106* | |
| | ORANGE | 10 | 0 | 0 | 68 | 0 | 0 | 349 | C |
| | MILFORD | 192 | 0 | 311 | 1044+ | 0 | 52 | 175* | A |
| | STRATFRD 1 | 52 | 0 | 93 | 264+ | 0 | 53 | 152* | A |
| | STRATFRD 2 | 99 | 0 | 145 | 368+ | 0 | 83 | 212* | A |
| | BRIDGEPORT | 655 | 0 | 1682 | 2029+ | 0 | 100 | 120* | A |
| | FAIRFIELD | 243 | 0 | 360 | 1111+ | 0 | 95 | 294* | A |
| | WESTPORT | 180 | 0 | 280 | 915 | 0 | 93 | 305 | B |
| | NORWALK | 369 | 0 | 588 | 1311+ | 0 | 92 | 206* | A |
| | DARIEN | 131 | 0 | 206 | 693+ | 0 | 81 | 272* | B |
| | STAMFORD | 249 | 0 | 379 | 1031+ | 0 | 84 | 228* | A |
| | GREENWCH 1 | 72 | 0 | 123 | 422 | 0 | 79 | 272 | B |
| | GREENWCH 2 | 83 | 0 | 137 | 458 | 0 | 88 | 295 | B |
| | TOTAL: | 5778 | 144 | 8201 | 22258 | | | | |
| NY | PORT CHSTR | 152 | 0 | 410 | 498+ | 0 | 96 | 117* | A |
| | RYE 1 | 43 | 0 | 79 | 208+ | 0 | 60 | 158* | A |
| | RYE 2 | 84 | 0 | 129 | 301+ | 0 | 98 | 229* | A |
| | HARRISON | 39 | 0 | 66 | 220 | 0 | 89 | 298 | B |
| | MAMARONECK | 251 | 0 | 451 | 728+ | 0 | 100 | 161* | A |
| | LARCHMONT | 116 | 0 | 223 | 337+ | 0 | 100 | 150* | A |
| | PELHAM | 111 | 0 | 229 | 323+ | 0 | 100 | 141* | A |
| | NW ROCHLLE | 384 | 0 | 939 | 1186+ | 0 | 100 | 126* | A |
| | BRONX 1 | 2184 | 0 | 6050+ | 6050+ | 0 | 100* | 100* | A |
| | BRONX 2 | 41 | 0 | 3085+ | 3085+ | 0 | 51* | 51* | A |
| | QUEENS | 593 | 0 | 2892 | 2892+ | 0 | 78 | 78* | A |
| | MANHATTAN | 0 | 0 | 0 | 0+ | 0 | 0 | 0* | A |
| | TOTAL: | 3995 | 0 | 14553 | 15828 | | | | |
| NJ | WEEHAWKEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | A |
| | UNION CITY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | A |
| | N BERGEN | 181 | 0 | 322 | 498+ | 0 | 100 | 154* | A |
| | SECAUCUS | 0 | 0 | 0 | 0 | 0 | 101 | 471 | C |
| | KEARNY | 0 | 0 | 0 | 0 | 0 | 101 | 471 | C |
| | HARRISON | 0 | 0 | 0 | 0 | 0 | 100 | 190 | C |
| | NEWARK 1 | 336 | 0 | 1165 | 1165+ | 0 | 100 | 100* | A |
| | NEWARK 2 | 1342 | 7 | 1894 | 1894+ | 0 | 212 | 212* | A |
| | ELIZABTH 1 | 773 | 31 | 631 | 1307+ | 56 | 169 | 296* | A |
| | ELIZABTH 2 | 731 | 14 | 590 | 1236+ | 52 | 161 | 283* | A |
| | LINDEN | 772 | 7 | 359 | 1887+ | 51 | 126 | 453* | A |
| | RAHWAY 1 | 474 | 7 | 300 | 870+ | 52 | 144 | 326* | A |
| | RAHWAY 2 | 467 | 4 | 295 | 866+ | 51 | 142 | 322* | A |
| | WOODBRIDGE | 86 | 0 | 47 | 288 | 0 | 114 | 441 | C |
| | EDISON | 656 | 2 | 280 | 2153+ | 0 | 119 | 583* | A |
| | METUCHEN 1 | 437 | 3 | 248 | 849+ | 51 | 137 | 347* | A |
| | METUCHEN 2 | 420 | 0 | 378 | 958+ | 0 | 132 | 335* | A |
| | HIGHLND PK | 349 | 0 | 369 | 747+ | 0 | 144 | 291* | A |
| | NW BRNSW 1 | 556 | 0 | 585 | 1195+ | 0 | 143 | 293* | A |
| | NW BRNSW 2 | 580 | 6 | 402 | 1033+ | 51 | 148 | 303* | A |
| | N BRNSWK 1 | 205 | 0 | 89 | 771 | 0 | 117 | 630 | B |
| | N BRNSWK 2 | 200 | 0 | 152 | 818 | 0 | 114 | 616 | B |
| | S BRNSWK | 242 | 0 | 174 | 926 | 0 | 228 | 1212 | C |
| | PLAINSBORO | 65 | 0 | 49 | 239 | 0 | 226 | 1106 | C |
| | W WINDSOR | 131 | 0 | 97 | 490 | 0 | 227 | 1149 | C |
| | LAWRENCE | 40 | 0 | 36 | 159 | 0 | 112 | 492 | C |
| | HAMILTON | 519 | 0 | 381 | 1951+ | 0 | 116 | 594* | A |
| | TRENTON 1 | 452 | 4 | 642 | 650+ | 51 | 222 | 224* | A |
| | TRENTON 2 | [illegible] | 7 | 652 | 660+ | 52 | 224 | 226* | A |
| | TRENTON 3 | [illegible] | 0 | 573 | 579+ | 0 | 153 | 155* | A |
| | TOTAL: | 10733 | 92 | 10710 | 24197 | | | | |
| DE | NW CSTL CO | 1652 | 0 | 1105 | 6996 | 0 | 192 | 1219 | C |
| | WILMNGTN 1 | 223 | 0 | 237 | 560+ | 0 | 120 | 237* | A |
| | WILMNGTN 2 | 249 | 0 | 257 | 607+ | 0 | 109 | 257* | A |
| | WILMNGTN 3 | 245 | 0 | 254 | 600+ | 0 | 107 | 254* | A |
| | NEWPORT | 58 | 0 | 47 | 192+ | 0 | 100 | 402* | A |
| | NEWARK 1 | 84 | 0 | 69 | 262+ | 0 | 100 | 378* | A |
| | NEWARK 2 | 91 | 0 | 73 | 278+ | 0 | 105 | 400* | A |
| | TOTAL: | 2599 | 0 | 2042 | 9495 | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PA | MORRISVLLE | 236 | Ø | 287 | 599+ | Ø | 100 | 208* | A |
| | FALLS TWP | 18 | Ø | 15 | 75 | Ø | 138 | 658 | C |
| | TULLYTOWN | 206 | Ø | 107 | 1014 | Ø | 145 | 1380 | E |
| | BRSTL TP 1 | 458 | Ø | 1066+ | 1066+ | Ø | 100* | 100* | A |
| | BRSTL TP 2 | 462 | Ø | 1066+ | 1066+ | Ø | 100* | 100* | A |
| | BRISTOL | 1539 | Ø | 2047 | 3727+ | Ø | 108 | 197* | A |
| | BENSALEM | 384 | Ø | 379 | 1568+ | Ø | 100 | 413* | A |
| | PHILA 1 | 2641 | Ø | 5717 | 5717+ | Ø | 156 | 156* | A |
| | PHILA 2 | 3142 | Ø | 6341 | 6341+ | Ø | 173 | 173* | A |
| | PHILA 3 | 3731 | Ø | 7114 | 7114+ | Ø | 195 | 195* | A |
| | COLWYN | 389 | Ø | 742 | 742+ | Ø | 182 | 182* | A |
| | DARBY 1 | 31 | Ø | 60+ | 60+ | Ø | 175* | 175* | A |
| | DARBY 2 | 27 | Ø | 54+ | 54+ | Ø | 157* | 157* | A |
| | SHARON HLL | 436 | Ø | 577 | 978+ | Ø | 126 | 214* | A |
| | FOLCROFT | 57 | Ø | 61 | 137+ | Ø | 111 | 249* | A |
| | GLENOLDEN | 347 | Ø | 433 | 790+ | Ø | 121 | 221* | A |
| | NORWOOD | 139 | Ø | 180 | 315+ | Ø | 124 | 217* | A |
| | PROSPCT PK | 287 | Ø | 361 | 632+ | Ø | 124 | 217* | A |
| | RIDLEY PK | 512 | Ø | 618 | 1189+ | Ø | 117 | 225* | A |
| | RIDLEY TWP | 103 | Ø | 106 | 242+ | Ø | 109 | 248* | A |
| | EDDYSTONE | 127 | Ø | 110 | 435+ | Ø | 100 | 392* | A |
| | CHESTER | 1421 | Ø | 2420 | 3001+ | Ø | 150 | 186* | A |
| | TRAINER | 123 | Ø | 106 | 452+ | Ø | 100 | 422* | A |
| | MRCUS HOOK | 5 | Ø | 4 | 18+ | Ø | 100 | 370* | A |
| | LINWOOD | 50 | Ø | 52 | 223 | Ø | 100 | 423 | C |
| | TOTAL: | 16850 | Ø | 30023 | 37555 | | | | |
| MD | CECIL CO | 1 | Ø | Ø | 4 | Ø | 187 | 871 | C |
| | ELKTON | 213 | Ø | 166 | 782+ | Ø | 100 | 474* | A |
| | NORTHEAST | 448 | Ø | 245 | 1083+ | Ø | 224 | 991* | A |
| | CHARLESTWN | 179 | Ø | 94 | 815 | Ø | 193 | 1670 | C |
| | PERRYVLL 1 | 3 | Ø | 3 | 14 | Ø | 176 | 839 | C |
| | PERRYVLL 2 | 4 | Ø | 3 | 15 | Ø | 196 | 934 | C |
| | HARFORD CO | 527 | Ø | 393 | 2038 | Ø | 198 | 1028 | C |
| | HAVR DGRCE | 521 | Ø | 441 | 1248+ | Ø | 120 | 341* | A |
| | ABERDEEN | 290 | Ø | 229 | 733+ | Ø | 117 | 374* | A |
| | BALT CO 1 | 509 | Ø | 417 | 2262 | Ø | 106 | 574 | B |
| | BALT CO 2 | 517 | Ø | 422 | 2288 | Ø | 107 | 581 | B |
| | BALT CTY 1 | 1949 | Ø | 2410 | 4082+ | Ø | 145 | 245* | A |
| | BALT CTY 2 | 1737 | Ø | 2224 | 3766+ | Ø | 133 | 226* | A |
| | ANN ARN CO | 546 | Ø | 477 | 2372 | Ø | 103 | 512 | C |
| | PR GEO CO | 1101 | Ø | 845 | 4529 | Ø | 105 | 562 | B |
| | BOWIE 1 | 338 | Ø | 177 | 864+ | Ø | 237 | 1152* | A |
| | BOWIE 2 | 313 | Ø | 164 | 800+ | Ø | 219 | 1067* | A |
| | NW CARLTN | 82 | Ø | 144 | 162+ | Ø | 176 | 198* | A |
| | LNDVR HL 1 | 17 | Ø | 23 | 36+ | Ø | 145 | 221* | A |
| | LNDVR HL 2 | 4 | Ø | 16 | 16+ | Ø | 100 | 100* | A |
| | CHEVERLY | 34 | Ø | 89 | 116+ | Ø | 89 | 117* | A |
| | TOTAL: | 9321 | Ø | 8982 | 28025 | | | | |
| DC | WASHINGTON | 777 | Ø | 2690 | 2690+ | Ø | 100 | 100* | A |
| | TOTAL: | 777 | Ø | 2690 | 2690 | | | | |

Table E3

1990 NECIP NOISE IMPACT

| STATE | COMMUNITY/ MILEPOST | ENI | PEOPLE WITHIN IMPACT CORRIDOR EXPOSED TO LDN VALUES ABOVE 75 | 65 | 55 | DISTANCE (IN FEET) TO LDN CONTOURS WITHIN IMPACT CORR 75 | 65 | 55 | COR CRI |
|---|---|---|---|---|---|---|---|---|---|
| MA | BOSTON 1/229-225 | 2547 | 0 | 4123 | 5137+ | 0 | 162 | 201* | A |
| | BOSTON 2/225-220 | 1588 | 0 | 3123 | 3866+ | 0 | 121 | 151* | A |
| | DEDHAM 1/220-219 | 68 | 0 | 80 | 262+ | 0 | 100 | 324* | A |
| | DEDHAM 2/219-217 | 71 | 0 | 80 | 271+ | 0 | 100 | 335* | A |
| | WESTWOOD 1/217-216.5 | 0 | 0 | 0 | 0 | 0 | 100 | 211 | C |
| | WESTWOOD 2/216.5-216 | 0 | 0 | 0 | 0 | 0 | 100 | 197 | C |
| | CANTON/216-213 | 107 | 0 | 176 | 541 | 0 | 100 | 306 | C |
| | SHARON 1/213-211 | 37 | 0 | 72 | 175 | 0 | 100 | 241 | C |
| | SHARON 2/211-208 | 28 | 0 | 60 | 156 | 0 | 84 | 208 | C |
| | FOXBORO/208-205 | 5[illegible] | 0 | 98 | 281 | 0 | 85 | 244 | C |
| | MASFLD 1/205-201 | 37 | 0 | 76 | 198 | 0 | 84 | 218 | C |
| | MANSFLD 2/201-199.5 | 38 | 0 | 79 | 203 | 0 | 87 | 223 | C |
| | ATLBORO 1/199.5-196 | 126 | 0 | 209 | 658 | 0 | 88 | 295 | B |
| | ATLBORO 2/196-191 | 9[illegible] | 0 | 154 | 554 | 0 | 65 | 234 | B |
| | TOTAL: | 4787 | 0 | 8310 | 12336 | | | | |
| RI | CNTRL FLLS/191-190 | 160 | 0 | 545 | 612+ | 0 | 88 | 99* | A |
| | PAWTCKET 1/190-189 | 95 | 0 | 240 | 364+ | 0 | 65 | 100* | A |
| | PAWTCKET 2/189-187.5 | 83 | 0 | 226 | 364+ | 0 | 61 | 100* | A |
| | PRVIDNCE 1/187.5-182.5 | 287 | 0 | 784 | 1217+ | 0 | 64 | 100* | A |
| | PRVIDNCE 2/182.5-181 | 273 | 0 | 0 | 1217+ | 0 | 0 | 100* | A |
| | CRANSTON 1/181-179.5 | 35 | 0 | 63 | 177+ | 0 | 59 | 167* | A |
| | CRANSTON 2/179.5-179 | 129 | 0 | 106 | 430+ | 0 | 100 | 405* | A |
| | WARWICK 1/179-172 | 450 | 0 | 385 | 1547+ | 0 | 100 | 401* | A |
| | WARWICK 2/170-165 | 431 | 0 | 385 | 1495+ | 0 | 100 | 387* | A |
| | E GRNWCH 1/172-171.5 | 24 | 0 | 28 | 102 | 0 | 100 | 362 | C |
| | E GRNWCH 2/171.5-170 | 24 | 0 | 28 | 102 | 0 | 100 | 362 | C |
| | N KNGSTN 1/165-163 | 0 | 0 | 0 | 1 | 0 | 173 | 806 | C |
| | N KNGSTN 2/163-161 | 0 | 0 | 0 | 0 | 0 | 79 | 368 | C |
| | EXETER/161-160 | 0 | 0 | 0 | 0 | 0 | 79 | 368 | C |
| | S KNGSTN 1/160-158 | 12 | 0 | 14 | 74 | 0 | 57 | 292 | C |
| | S KNGSTN 2/158-155.5 | 12 | 0 | 14 | 74 | 0 | 57 | 292 | C |
| | RICHMOND/155.5-152.5 | 4 | 0 | 5 | 23 | 0 | 56 | 268 | C |
| | CHARLESTWN/152.5-147 | 0 | 0 | 0 | 0 | 0 | 0 | 199 | C |
| | HOPKINGTON/147-146 | 0 | 0 | 0 | 0 | 0 | 0 | 138 | C |
| | WESTERLY 1/146-142 | 19 | 0 | 44 | 103 | 0 | 81 | 188 | C |
| | WESTERLY 2/142-141 | 9 | 0 | 0 | 63 | 0 | 0 | 114 | C |
| | TOTAL | 2037 | 0 | 2867 | 7695 | | | | |
| CT | STO[illegible]ON/141-132 | 31 | 0 | 73 | 181 | 0 | 0 | 126 | C |
| | GROT[illegible]/132-130 | 47 | 0 | 0 | 307 | 0 | 0 | 165 | B |
| | GROTN T[illegible]130-127 | 47 | 0 | 0 | 307 | 0 | 0 | 165 | B |
| | GRTN CTY 1/[illegible]-125 | 6 | 0 | 0 | 48+ | 0 | 0 | 100* | A |
| | GRTN CTY 2/125-124 | 14 | 0 | 24 | 75+ | 0 | 0 | 154* | A |
| | NW LNDN H1/122.5 | 5 | 0 | 0 | 38+ | 0 | 0 | 89* | A |
| | NW LNDN 1/124-123 | 93 | 0 | 182 | 337+ | 0 | 74 | 138* | A |
| | NW LNDN H2/122.5 | 16 | 0 | 32 | 59+ | 0 | 74 | 138* | A |
| | NW LNDN 2/123-121 | 93 | 0 | 182 | 337+ | 0 | 74 | 138* | A |
| | WATERFRD 1/121-117.5 | 17 | 0 | 39 | 95 | 0 | 76 | 183 | C |
| | WATERFRD 2/117.5-117 | 12 | 0 | 28 | 74 | 0 | 54 | 142 | C |
| | EAST LYME/117-112.2 | 18 | 0 | 42 | 107 | 0 | 52 | 132 | C |
| | OLD LYME/112.2-106.5 | 33 | 0 | 38 | 198 | 0 | 56 | 291 | C |
| | OLD SYBR 1/106.5-106 | 47 | 0 | 40 | 228 | 0 | 91 | 518 | C |
| | OLD SYBR 2/106-102.5 | 36 | 0 | 33 | 190 | 0 | 76 | 431 | C |
| | WESTBRK 1/102.5-100 | 11 | 0 | 11 | 59 | 0 | 73 | 365 | C |
| | WESTBRK 2/100-99 | 12 | 0 | 12 | 61 | 0 | 75 | 377 | C |
| | CLINTON/99-95 | 96 | 0 | 83 | 436 | 0 | 83 | 489 | C |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CT | MADISON/95-89.5 | 32 | 0 | 32 | 167 | 0 | 75 | 382 | C |
| | GILFORD/89.5-85.8 | 934 | 0 | 494 | 3796+ | 0 | 106 | 816* | A |
| | BRANFORD 1/85.8-82 | 31 | 0 | 66 | 186 | 0 | 58 | 163 | C |
| | BRANFORD 2/82-79 | 35 | 0 | 73 | 201 | 0 | 64 | 177 | C |
| | EAST HAVEN/79-77 | 53 | 0 | 85 | 295+ | 0 | 62 | 213* | A |
| | NEW HAVN 1/77-76 | 111 | 0 | 291 | 523+ | 0 | 55 | 100* | A |
| | NEW HAVN 2/76-73 | 126 | 0 | 339 | 544+ | 0 | 64 | 103* | A |
| | NEW HAVN 3/73-71 | 188 | 0 | 434 | 654+ | 0 | 82 | 125* | A |
| | WST HAVN 1/71-70 | 176 | 0 | 333 | 588+ | 0 | 83 | 147* | A |
| | WST HAVN 2/70-68 | 237 | 0 | 398 | 699+ | 0 | 102 | 175* | A |
| | ORANGE 1/68-67.5 | 11 | 0 | 8 | 61 | 0 | 88 | 635 | C |
| | ORANGE 2/67.5-67 | 10 | 0 | 7 | 56 | 0 | 80 | 579 | C |
| | MILFORD 1/67-63 | 151 | 0 | 239 | 720+ | 0 | 80 | 241* | A |
| | MILFORD 2/63-60.5 | 151 | 0 | 239 | 720+ | 0 | 80 | 241* | A |
| | STRATFRD 1/60.5-60 | 51 | 0 | 92 | 261+ | 0 | 52 | 150* | A |
| | STRATFRD 2/60-57.5 | 94 | 0 | 150 | 377+ | 0 | 86 | 217* | A |
| | BRIDGPRT 1/57.5-56 | 227 | 0 | 563 | 695+ | 0 | 100 | 123* | A |
| | BRIDGPRT 2/56-54 | 231 | 0 | 563 | 703+ | 0 | 100 | 124* | A |
| | BRIDGPRT 3/54-52 | 253 | 0 | 563 | 744+ | 0 | 100 | 132* | A |
| | FAIRFIELD/52-48 | 203 | 0 | 313 | 1002+ | 0 | 83 | 265* | A |
| | WESTPORT/48-43.5 | 198 | 0 | 299 | 969 | 0 | 100 | 323 | B |
| | NORWALK 1/43.5-41 | 184 | 0 | 294 | 655+ | 0 | 92 | 206* | A |
| | NORWALK 2/41-38 | 170 | 0 | 276 | 626+ | 0 | 87 | 197* | A |
| | DARIEN 1/38-37 | 75 | 0 | 115 | 375+ | 0 | 90 | 295* | B |
| | DARIEN 2/37-35.5 | 71 | 0 | 109 | 363+ | 0 | 86 | 285* | B |
| | STAMFORD/35.5-32 | 180 | 0 | 305 | 877+ | 0 | 67 | 194* | A |
| | GRENWICH 1/32-29 | 66 | 0 | 112 | 394 | 0 | 72 | 254 | B |
| | GRENWICH 2/29-26 | 78 | 0 | 131 | 442 | 0 | 84 | 285 | B |
| | | 4961 | 0 | 7742 | 26880 | | | | |
| NY | PORT CHSTR/26-24.5 | 201 | 0 | 424 | 592+ | 0 | 100 | 139* | A |
| | RYE/24.5-24 | 155 | 0 | 244 | 575+ | 0 | 92 | 219* | A |
| | HARRISON 1/24-23 | 19 | 0 | 32 | 107 | 0 | 87 | 291 | B |
| | HARRISON 2/23-22 | 20 | 0 | 33 | 111 | 0 | 91 | 301 | B |
| | MAMARONECK/22-19.5 | 302 | 0 | 451 | 836+ | 0 | 100 | 185* | A |
| | LARCHMONT/19.5-18 | 141 | 0 | 223 | 387+ | 0 | 100 | 173* | A |
| | PELHAM/17.5-16 | 119 | 0 | 229 | 339+ | 0 | 100 | 147* | A |
| | NEW ROCHEL/18-16.5 | 474 | 0 | 939 | 1362+ | 0 | 100 | 145* | A |
| | BRONX 1/16.5-13 | 1455 | 0 | 4041+ | 4041+ | 0 | 100* | 100* | A |
| | BRONX 2/13-9 | 1933 | 0 | 4387+ | 4387+ | 0 | 108* | 108* | A |
| | BRONX 3/9-8.5 | 1483 | 0 | 4041+ | 4041+ | 0 | 100* | 100* | A |
| | QUEENS 1/8.5-E4.5 | 677 | 0 | 1956 | 1956+ | 0 | 106 | 106* | A |
| | QUEENS 2/E4.5-E1.5 | 745 | 0 | 2048 | 2048+ | 0 | 111 | 111* | A |
| | MANHATTAN/E1.5-W2.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | C |
| | TOTAL: | 7724 | 0 | 19048 | 20782 | | | | |
| NJ | WEEHAWKEN/W1-W2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | C |
| | UNION CITY/W2-W3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | C |
| | N BERGEN/W3-W4 | 231 | 0 | 322 | 592+ | 0 | 100 | 184* | A |
| | SECAUCUS/W4-W6 | 0 | 0 | 0 | 0 | 0 | 146 | 681 | C |
| | KEARNY/W6-W7 | 0 | 0 | 0 | 0 | 0 | 146 | 681 | C |
| | HARRISON/7-8.6 | 0 | 0 | 0 | 2 | 0 | 160 | 251 | C |
| | NEWARK 1/8.6-10 | 503 | 0 | 1361 | 1361+ | 0 | 116 | 116* | A |
| | NEWARK 2/10-12.5 | 1483 | 74 | 2102 | 2102+ | 56 | 230 | 230* | A |
| | ELIZABTH 1/12.5-14 | 846 | 60 | 695 | 1419+ | 61 | 181 | 318* | A |
| | ELIZABTH 2/14-16 | 731 | 14 | 590 | 1236+ | 52 | 161 | 283* | A |
| | LINDEN/16-18.5 | 884 | 47 | 431 | 2146+ | 60 | 142 | 508* | A |
| | RAHWAY 1/18.5-19.5 | 543 | 34 | 356 | 1084+ | 60 | 162 | 365* | A |
| | RAHWAY 2/19.5-20.7 | 536 | 31 | 352 | 991+ | 59 | 160 | 361* | A |
| | WOODBRIDGE/20.7-21 | 103 | 6 | 57 | 328 | 58 | 128 | 494 | C |
| | EDISON/28-29.5 | 744 | 32 | 332 | 2410+ | 57 | 132 | 646* | A |
| | METUCHEN/21-28 | 924 | 25 | 534 | 1792+ | 54 | 143 | 363* | A |
| | HIGHLND PK/29.5-30.5 | 417 | 26 | 301 | 739+ | 60 | 167 | 330* | A |
| | NEW BRNSWK/30.5-34.5 | 1349 | 90 | 967 | 2402+ | 61 | 168 | 344* | A |
| | N BRUNSWCK/34.5-38 | 477 | 25 | 220 | 1769 | 59 | 133 | 716 | B |
| | S BRUNSWCK/38-43 | 305 | 7 | 175 | 1092 | 59 | 279 | 1479 | C |
| | PLAINSBORO/43-46 | 81 | 2 | 49 | 281 | 59 | 276 | 1350 | C |
| | W WINDSOR/46-51 | 165 | 4 | 97 | 577 | 59 | 277 | 1403 | C |
| | LAWRENCE/51-52 | 48 | 3 | 26 | 169 | 59 | 130 | 571 | C |
| | HAMILTON/52-54 | 617 | 32 | 278 | 2101+ | 59 | 134 | 690* | A |
| | TRENTON 1/54-58 | 812 | 69 | 1159 | 1173+ | 62 | 237 | 260* | A |
| | TOTAL: | 11786 | 581 | 10402 | 25684 | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DE | NW CSTL CO/18-24.7 | 2045 | 0 | 1329 | 8411 | 0 | 231 | 1466 | C |
| | WILMNGTN 1/24.7-25.5 | 299 | 0 | 291 | 688+ | 0 | 122 | 288* | A |
| | WILMNGTN 2/25.5-27.5 | 249 | 0 | 257 | 606+ | 0 | 107 | 254* | A |
| | WILMNGTN 3/27.5-28 | 397 | 19 | 248 | 747+ | 58 | 154 | 363* | A |
| | NEWPORT/28-32.5 | 72 | 0 | 55 | 225+ | 0 | 115 | 472* | A |
| | NEWARK 1/32.5-38.6 | 195 | 0 | 81 | 308+ | 0 | 116 | 444* | A |
| | NEWARK 2/38.6-41 | 111 | 0 | 84 | 322+ | 0 | 122 | 465* | A |
| | TOTAL: | 3277 | 19 | 2345 | 11307 | | | | |
| PA | MORRISVILL/58-59 | 302 | 0 | 336 | 704+ | 0 | 116 | 244* | A |
| | FALLS TWP/59-62 | 31 | 0 | 24 | 117 | 0 | 216 | 1327 | C |
| | TULLYTOWN/62-64 | 347 | 0 | 169 | 1607 | 0 | 231 | 2187 | B |
| | BRISTLE T 1/64-65.3 | 603 | 83 | 664+ | 664+ | 57 | 112* | 112* | A |
| | BRISTL T 2/65.3-67 | 603 | 83 | 664+ | 664+ | 57 | 112* | 112* | A |
| | BRISTOL/67-68.3 | 2422 | 0 | 2793 | 5686+ | 0 | 148 | 269* | A |
| | BENSALEM/70-74.5 | 549 | 0 | 411 | 2068+ | 0 | 138 | 545* | A |
| | PHILA 1/74.5-87.5 | 6565 | 70 | 9372 | 9372+ | 51 | 221 | 221* | A |
| | PHILA 2/87.5-5.5 | 3867 | 0 | 8376 | 8376+ | 0 | 153 | 153* | A |
| | COLWYN 1/5.5-6.2 | 157 | 0 | 323 | 323+ | 0 | 158 | 158* | A |
| | COLWYN 2/6.2-6.5 | 174 | 0 | 342 | 342+ | 0 | 168 | 168* | A |
| | DARBY 1/5.5-6.2 | 29 | 0 | 56+ | 56+ | 0 | 165* | 165* | A |
| | DARBY 2/6.2-6.5 | 27 | 0 | 54+ | 54+ | 0 | 157* | 157* | A |
| | SHARON HLL/6.5-8 | 486 | 0 | 618 | 1048+ | 0 | 135 | 229* | A |
| | FOLCROFT/8-8.5 | 68 | 0 | 68 | 154+ | 0 | 124 | 279* | A |
| | GLENOLDEN/8-9 | 426 | 0 | 498 | 907+ | 0 | 139 | 254* | A |
| | NORWOOD/8.8-9.3 | 171 | 0 | 206 | 362+ | 0 | 142 | 249* | A |
| | PROSPCT PK/9.3-10 | 339 | 0 | 410 | 717+ | 0 | 141 | 246* | A |
| | RIDLEY PK/10-11.1 | 622 | 0 | 701 | 1350+ | 0 | 133 | 256* | A |
| | RIDLEY TWP/11.1-11.5 | 125 | 0 | 123 | 281+ | 0 | 126 | 289* | A |
| | EDDYSTON 1/11.5-12.1 | 78 | 0 | 60 | 252+ | 0 | 108 | 456* | A |
| | EDDYSTON 2/12.1-12.9 | 78 | 0 | 60 | 252+ | 0 | 108 | 456* | A |
| | CHESTER/12.9-16 | 1771 | 0 | 2811 | 3486+ | 0 | 174 | 216* | A |
| | TRAINER 1/16-16.3 | 75 | 0 | 57 | 262+ | 0 | 107 | 491* | A |
| | TRAINER 2/16.3-16.5 | 77 | 0 | 58 | 268+ | 0 | 109 | 502* | A |
| | MRCUS HOOK/16.5-17.1 | 6 | 0 | 5 | 26+ | 0 | 107 | 420* | A |
| | LINWOOD/17.1-17.9 | 68 | 0 | 54 | 256 | 0 | 103 | 485 | C |
| | TOTAL: | 19598 | 236 | 29313 | 39048 | | | | |
| MD | CECIL CO/41-44.3 | 1 | 0 | 0 | 5 | 51 | 239 | 1113 | C |
| | ELKTON/44.3-46.5 | 268 | 0 | 115 | 847+ | 0 | 119 | 563* | A |
| | NORTHEAST/46.5-53.5 | 578 | 1 | 254 | 1309+ | 0 | 282 | 1248* | A |
| | CHARLESTWN/53.5-54.8 | 199 | 0 | 108 | 936 | 0 | 221 | 1917 | C |
| | PERRYVILLE/54.8-60 | 12 | 0 | 7 | 37 | 0 | 229 | 1290 | C |
| | HARFORD CO/60-61.6 | 665 | 3 | 331 | 2390 | 51 | 242 | 1255 | C |
| | HAVR DGRAC/61.6-65 | 606 | 12 | 318 | 1234+ | 53 | 137 | 387* | A |
| | ABERDEEN/65-78.5 | 337 | 6 | 162 | 734+ | 53 | 132 | 425* | A |
| | BALT CO/78.5-91; 101-105 | 1312 | 68 | 633 | 5173 | 58 | 130 | 707 | B |
| | BALTIMOR 1/91-95.5 | 2341 | 73 | 1968 | 3910+ | 54 | 168 | 285* | A |
| | BALTIMOR 2/95.5-101 | 2664 | 0 | 2524 | 4275+ | 0 | 151 | 257* | A |
| | ANN ARN CO/105-118 | 528 | 0 | 467 | 2318 | 0 | 120 | 500 | C |
| | PR GEO CO/118-120.2 | 1294 | 9 | 557 | 4738 | 51 | 119 | 638 | B |
| | BOWIE/120.2-121.2 | 816 | 2 | 345 | 1971+ | 51 | 280 | 1364* | A |
| | NEW CRLTN/121.2-127.8 | 97 | 0 | 164 | 184+ | 0 | 200 | 225* | A |
| | LNDOVR HL/127.8-130 | 39 | 0 | 52 | 80+ | 0 | 159 | 242* | A |
| | CHEVERLY/130-131 | 149 | 0 | 142 | 303+ | 0 | 142 | 304* | A |
| | TOTAL: | 11295 | 174 | 8197 | 30444 | | | | |
| DC | WASHNTN DC/131-135 | 743 | 0 | 2650 | 2690+ | 0 | 98 | 100* | A |
| | TOTAL: | 743 | 0 | 2650 | 2690 | | | | |

Table E-4

BRIDGE REPAIR CONSTRUCTION NOISE IMPACTS

UNDERGRADE BRIDGES

| STATE | TOWN | NUMBER OF BRIDGES | PEOPLE IMPACTED |
|---|---|---|---|
| MASSACHUSETTS | Boston | 1 | 20 |
| | Mansfield | 5 | 0 |
| | Attleboro | 2 | 0 |
| | TOTAL | 8 | 20 |
| RHODE ISLAND | Central Fl | 1 | 4 |
| | Providence | 4 | 284 |
| | Warwick | 2 | 1 |
| | Exeter | 1 | 0 |
| | East Greenwich | 4 | 4 |
| | Richmond | 2 | 0 |
| | Charlestown | 1 | 0 |
| | Westerly | 2 | 1 |
| | TOTAL | 17 | 294 |
| CONNECTICUT | Stonington | 5 | 1 |
| | Groton City | 1 | 20 |
| | Groton Town | 1 | 0 |
| | New London | 5 | 121 |
| | Waterford | 1 | 3 |
| | East Lyme | 3 | 7 |
| | Old Lyme | 1 | 1 |
| | Old Saybrook | 2 | 6 |
| | Clinton | 4 | 40 |
| | Madison | 2 | 8 |
| | Guilford | 1 | 14 |
| | Branford | 2 | 7 |
| | East Haven | 1 | 0 |
| | New Haven | 6 | 48 |
| | Milford | 3 | 23 |
| | Stratford | 1 | 4 |
| | Bridgeport | 8 | 33 |
| | Westport | 1 | 0 |
| | Norwalk | 1 | 5 |
| | Greenwich | 4 | 5 |
| | TOTAL | 53 | 341 |

| STATE | TOWN | NUMBER OF BRIDGES | PEOPLE IMPACTED |
|---|---|---|---|
| NEW YORK | Port Chester | 2 | 26 |
| | Pelham | 2 | 5 |
| | Bronx | 6 | 102 |
| | Queens | 9 | 104 |
| | TOTAL | 19 | 237 |
| NEW JERSEY | N. Bergen | 2 | 134 |
| | Secaucus | 5 | 0 |
| | Kearny | 4 | 0 |
| | Harrison | 4 | 0 |
| | Newark | 16 | 306 |
| | Elizabeth | 6 | 73 |
| | Linden | 2 | 6 |
| | Rahway | 3 | 32 |
| | Metuchen | 5 | 21 |
| | New Brunswick | 4 | 17 |
| | S. Brunswick | 1 | 0 |
| | Lawrence | 1 | 0 |
| | Hamilton | 1 | 2 |
| | Trenton | 2 | 41 |
| | TOTAL | 56 | 632 |
| PENNSYLVANIA | Chester | 10 | 176 |
| | Eddystone | 1 | 3 |
| | Ridley Twp | 1 | 1 |
| | Ridley Park | 2 | 4 |
| | Prospect Park | 1 | 2 |
| | Norwood | 1 | 2 |
| | Glenolden | 1 | 12 |
| | Philadelphia | 18 | 377 |
| | Bensalem | 3 | 1 |
| | Bristol | 2 | 12 |
| | Morrisville | 4 | 22 |
| | TOTAL | 44 | 612 |

| STATE | TOWN | NUMBER OF BRIDGES | PEOPLE IMPACTED |
|---|---|---|---|
| DELAWARE | Newark | 2 | 9 |
| | Newport | 1 | 4 |
| | Wilmington | 19 | 130 |
| | New Castle | 3 | 8 |
| | TOTAL | 25 | 151 |
| MARYLAND | Anne Arundel | 3 | 1 |
| | Cecil County | 3 | 0 |
| | Baltimore County | 1 | 1 |
| | Baltimore City | 13 | 125 |
| | Hartford County | 3 | 0 |
| | Havre de Grace | 1 | 5 |
| | Perryville | 1 | 0 |
| | Charlestown | 1 | 0 |
| | Northeast | 2 | 5 |
| | Elkton | 1 | 2 |
| | TOTAL | 29 | 139 |
| WASHINGTON, D.C. | Washington, D.C. | 1 | 3 |
| | TOTAL | 1 | 3 |

TABLE E-5

CURVE REALIGNMENT
(2-1/2 ft)

CONSTRUCTION NOISE IMPACT

| STATE | TOWN | POPULATION IMPACT |
|---|---|---|
| MASSACHUSETTS | Boston | 132 |
| | Sharon | 8 |
| | TOTAL | 140 |
| RHODE ISLAND | Cranston | 70 |
| | South Kingston | 6 |
| | North Kingston | 0 |
| | Providence | 216 |
| | Pawtucket | 72 |
| | TOTAL | 364 |
| CONNECTICUT | New Haven | 53 |
| | Madison | 22 |
| | Old Lyme | 16 |
| | East Lyme | 12 |
| | New London | 47 |
| | Groton City | 30 |
| | Groton Town | 12 |
| | Stonington | 8 |
| | Stamford | 19 |
| | TOTAL | 219 |
| NEW YORK | Queens | 299 |
| | TOTAL | 299 |
| NEW JERSEY | New Brunswick | 51 |
| | Woodbridge | 8 |
| | Rahway | 144 |
| | TOTAL | 203 |

| STATE | TOWN | POPULATION IMPACT |
| --- | --- | --- |
| PENNSYLVANIA | Chester | 82 |
| | Norwood | 85 |
| | Philadelphia | 179 |
| | Bristol | 25 |
| | TOTAL | 371 |
| DELAWARE | Newark | 226 |
| | New Castle Co. | 23 |
| | Newport | 20 |
| | TOTAL | 269 |
| MARYLAND | Landover Hills | 289 |
| | Prince George Co. | 5 |
| | Bowie | 185 |
| | Ann Ar. Co. | 15 |
| | Baltimore Co. | 11 |
| | Baltimore | 876 |
| | Harford Co. | 12 |
| | Perryville | 2 |
| | Northeast | 237 |
| | TOTAL | 1,633 |

# APPENDIX F

# HISTORICAL AND ARCHEOLOGICAL DATA

APPENDIX F

TABLE OF CONTENTS

The Commonwealth of Massachusetts
Office of the Secretary
Massachusetts Historical Commission
PAUL GUZZI
Secretary of the Commonwealth
294 Washington Street Boston, Massachusetts 02108
(617) 727-8470

December 8, 1977

Ms. Janice Artemel
Cultural Resources Specialist
DeLeuw, Cather/Parsons
1201 Connecticut Avenue, NW
Washington, D.C. 20036

Dear Ms. Artemel:

The Massachusetts Historical Commission has reviewed the report evaluating the Northeast Corridor Improvement Project's impacts on historic districts in Massachusetts. We commend you for the thoroughness and clarity of the report and are generally in agreement with your findings.

We do request that in future reports, each photograph is keyed to the corresponding sketch map. You may also wish to omit the first of the four photos you have included of the Back Bay District as Symphony and Horticultural Halls are outside the district's bounds. They should be discussed separately, although we foresee no effects on either.

We agree that there will be no adverse effect on the Dodgeville Mill district in Attleboro. The introduction of catenary equipment will be minimal in visual effects. It will not change the character of the district significantly or obstruct major elements of the district.

We foresee no effect on the Neponset Cotton Mills in Canton. However, we will be interested in effects on the Canton stone viaduct and will look forward to reviewing the assessment for that structure.

There will be no effect on the Sharon Historic District. The new equipment is close to only one edge of the district, and because of its distance, intervening structures, and the area's topography, it will not be visible from the district. Any traffic increases would be temporary in nature.

As outlined in the report, the project will not affect the Olmsted Park System. However, will the effects by any different when the existing stone viaduct is removed as part of the planned Southwest Corridor improvement project? What should be the relation between the tracks and historic areas without the viaduct route?

There will be no effect on the Forest Hills Cemetery. The project will not be visible or audible from the cemetery because of the distance between and the heavy landscaping in that area.

There is no anticipated effect on the Boston Garden and Boston Common as the project is nine blocks away.

Neither do we foresee any effects on the Roxbury Highlands area. Although the catenary equipment will be visible from the westerly section of the district, it will not seriously obstruct major views in any way.

We also concur that there will be no effects on the John Eliot Square Historic District, the South End District, the Back Bay Historic District, Arnold Arboretum or Bay Village.

In the St. Botolph Street Area, the lessened noise and vibration levels which will result from the project will improve the system's effects on the area. Visually, however, the new equipment may adversely affect the area. This will depend on whether a covered deck is proposed as part of the Southwest Corridor project. We are unable to sign off on this until you can provide us with a final plan.

You may also wish to know that the Roxbury Highlands Area and the St. Botolph Street Area have recently been determined eligible for the National Register by the Secretary of the Interior.

Sincerely yours,

Elizabeth Reed Amadon

Elizabeth Reed Amadon
Executive Director
Massachusetts Historical Commission
State Historic Preservation Officer

ERA/MBW/etd

xc: Marcia Myers

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

HISTORICAL PRESERVATION COMMISSION
Old State House
150 Benefit Street
Providence, R. I. 02903
(401) 277-2678

June 3, 1977

Ms. Janice Artemel, Cultural Resources Planner
Deleuw, Cather/Parsons & Associates
1201 Connecticut Avenue, N.W.
Washington, D.C. 20036

Re: Northeast Corridor Improvement Project

Dear Ms. Artemel:

In response to your letter of 24 May to Mr. Eric Hertfelder, I fully concur in the finding that Deleuw, Cather/Parsons & Associates is proceeding in accordance with all federal regulations regarding the protection of cultural resources in the Northeast Corridor.

The surveys you have undertaken (historical, architecuural and archeological), combined with the data we have supplied and the ongoing consultation with this office, will provide you with the information needed to evaluate corridor properties for their historical significance in compliance with section 4 (f) of the D.O.T. Act (49 USC 1653(f), the Procedures of the Advisory Council on Historic Preservation (36 CFR Part 800) and Executive Order 11593.

Yours truly,

Frederick C. Williamson
State Historic Preservation Officer

FCW/afc

*Office of the*
STATE
HISTORIC
PRESERVATION
OFFICER
*for Connecticut*

*59 SOUTH PROSPECT STREET • HARTFORD, CONNECTICUT 06106 • 203 566-3005*

January 12, 1978

Ms. Janice Artemel
Cultural Resources
DeLeuw, Cather/Parsons & Associates
1201 Connecticut Avenue, N.W.
Washington, D.C. 20036

Dear Ms. Artemel:

The State Historic Preservation Officer has reviewed documentation on the effects of certain activities of the Federal Railroad Administration on cultural resources in Connecticut. The documents in question "evaluate the effect of program-site activities on the special quality of historic districts." The documentation was prepared by DeLeuw, Cather/Parsons & Associates and is intended to satisfy the procedural responsibilities of the Federal Railroad Administrationunder Section 106 of the National Historic Preservation Act of 1966.

The State Historic Preservation Officer concurs that the program will have no adverse effect on the following historic districts:

| | |
|---|---|
| Cos Cob Historic District (Strickland Road, Greenwich, CT) | Local historic district; nominated to the National Register of Historic Places |
| Fairfield Historic District (Fairfield, CT) | Local historic district; National Register of Historic Places |
| Washington Park Historic District (Bridgeport, CT) | Local historic district in process |
| New Haven Green Historic District (New Haven, CT) | National Historic Landmark |
| Wooster Square Historic District (New Haven) | Local historic district; National Register of Historic Places |
| Old Lyme Historic District (Old Lyme) | Local historic district; National Register historic district |

| | |
|---|---|
| Whale Oil Row (New London) | National Register district |
| Groton Bank historic district (Groton) | Local historic district in process; National Register nomination in process |

The State Historic Preservation Officer does not concur with the finding of no adverse effect with respect to the following areas:

| | |
|---|---|
| Southport Historic District, Fairfield | Local historic district; National Register of Historic Places |
| Guilford Town Center, Guilford | National Register |
| Mystic Historic District, Groton | Local historic district; National Register nomination in process |
| Mystic Bridge Historic District, Stonington | National Register nomination in process |

The State Historic Preservation Officer for Connecticut believes that the documentation supporting the finding of no adverse effect for this group of historic areas is inadequate to support a finding of no adverse effect. In addition, it appears that certain potentially adverse effects have not been addressed.

In particular, the question of the vertical profile of the right-of-way has not been addressed. The visual impact of the installation of fencing along the right-of-way is not addressed. The question of the disruption of historic traffic patterns, accessibility to the historic district and the limitation of possible functions within the historic district caused by the elimination of grade crossings is not treated in these findings. Some of these matters may be the subject for additional findings of effect; the Federal Railroad Administration should be aware that these possible adverse effects must be addressed.

The installation of new catenary equipment will introduce a visual element which may disrupt the setting of the historic districts east of New Haven. The introduction of such visual elements in certain situations is likely to be an adverse effect.

In addition, the documentation does not address the impact of program improvements on railroad related structures within the proposed historic district. Several structures utilized for the operation of the railroad exist within the historic districts identified in the documentation Within the boundaries of the Guilford historic district are found various structures along the right-of-way, including an octagonal brick water tower immediately adjacent to the tracks. At Mystic, in the Town of Stonington, a small 19th century railroad station is situated on the right-of-way.

This office recommends that DeLeuw, Cather/Parsons & Associates prepare additional documentation which will address the questions listed in this letter. In addition, the Advisory Council on Historic Preservation must be given an opportunity to comment on these findings of effect in accordance with 36 CFR, Part 800. In addition, several of these historic districts are not listed on the National Register of Historic Places and have not been determined by the Secretary of the Interior to be eligible for the National Register. These districts are Strickland Road, Washington Park, Groton Bank, Mystic, Mystic Bridge and Stonington.

If you have any questions on this letter, please contact Clark Strickland of my staff.

Sincerely,

John W. Shannahan
State Historic Preservation
Officer

CJS/eb

NEW YORK STATE PARKS & RECREATION Agency Building 1, Empire State Plaza, Albany, New York 12238 Information 518 474
Orin Lehman, Commissioner
3176

December 6, 1977

Ms. Janice Artemel
Cultural Resources
DeLeuw, Cather/Parsons & Associates
1201 Connecticut Avenue, N.W.
Washington, D.C. 20036

Dear Ms. Artemel:

Re: Northeast Rail Corridor Improvement Project
Historic Districts, New York

The State Historic Preservation Officer (SHPO) has reviewed the report which you submitted on November 25 concerning the effect of the above project on historic districts: Sniffen Court Historic District, and Hunters Point Historic District.

Based upon this review, the SHPO concurs with your finding that the project will have no adverse effect upon these districts.

Should you have any questions, please contact the project review staff at 518-474-3176.

Sincerely,

F.L. Rath, Jr.
Deputy Commissioner for
Historic Preservation

LRK:mr

cc: Advisory Council

State of New Jersey

**DEPARTMENT OF ENVIRONMENTAL PROTECTION**

**TRENTON 08625**

**OFFICE OF THE COMMISSIONER**

FEB [illegible] 1978

Ms. Janice Artemel
Cultural Resources
DeLeuw, Cather/Parsons & Associates
1201 Connecticut Avenue, NW
Washington, D. C. 20036

Dear Ms. Artemel:

As State Historic Preservation Officer for New Jersey, in accordance with procedure for the protection of properties on the National Register as outlined in the Federal Register, Tuesday, February 10, 1976 (Vol. 41. No. 28, pp. 5902-5914), I am attaching consultation comments for the following project:

NECIP - Impact on Historic Districts - Queen's Campus
Rutgers University, New Brunswick, Middlesex County, New Jersey
Federal Railroad Administration, USDOT

If you have any questions after reviewing the attached comment sheet, please feel free to contact the Office of Environmental Review in this department at (609) 292-2662.

Sincerely,

Betty Wilson

Betty Wilson
Deputy State Historic
Preservation Officer

BW:DP:rk
Enclosure

## NEW JERSEY STATE PRESERVATION OFFICE

Deputy State Historic Preservation Officer
P-tty Wilson
ity Commissioner
D-partment of Environmental Protection
Box 1390, Trenton, New Jersey 08625

## ADVISORY COUNCIL ON HISTORIC PRESERVATION

## SECTION 106: SHPO Consultation and Comments (36 CFR Part 800)

PROJECT TITLE: NECIP - Impact on Historic Districts - Queen's Campus
Rutgers University, New Brunswick, Middlesex County, New Jersey
Federal Railroad Administration, USDOT

FEDERAL AGENCY: Federal Railroad Administration
United States Department of Transportation
c/o DeLeuw, Cather/Parsons and Associates
1201 Connecticut Aveue, NW
Washington, D. C. 20036

I. 800.4 (a)

The SHPO has identified Queen's Campus, Rutgers University, New Brunswick, Middlesex County, New Jersey, within the area of the project's potential environmental impact as being listed on the National Register of Historic Places.

II. 800.4 (b)

The SHPO is of the opinion that the project, as proposed will have an effect on the Queen's Campus, in accordance with the criteria of the Advisory Council on Historic Preservation, as promulgated in 36 CFR Part 800.8.

III. 800.4 (c-e)

The SHPO is of the opinion that the effect of the project on Queen's Campus will not be adverse.

Additional Comments:

N/A

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION
P. O. BOX 1026, HARRISBURG, PENNSYLVANIA 17120

EXECUTIVE DIRECTOR

December 20, 1977

Ms. Janice Artemel
Cultural Resources
DeLeuw, Cather/Parsons & Associates
1201 Connecticut Avenue, N.W.
Washington, D.C. 20036

Dear Ms. Artemel:

We have reviewed the Federal Railroad Administration's Northeast Corridor Improvement Project report evaluating impacts on historic districts and concur with its findings.

Sincerely yours,

WILLIAM J. WEWER

STATE OF DELAWARE
**DIVISION OF HISTORICAL AND CULTURAL AFFAIRS**
HALL OF RECORDS • DOVER • 19901
(302) 678-5314

February 22, 1978

Mr. J. A. Caywood
DeLeuw, Cather/Parsons & Associates
1201 Connecticut Avenue, N.W.
Washington, D.C. 20036

Dear Mr. Caywood:

The staff of the Bureau of Archaeology and Historic Preservation has reviewed "Evaluation of Effect: Historic Sites in Delaware." It is our opinion that the effects of the described actions have been adequately evaluated, and we concur with your conclusions.

Thank you for this opportunity to participate in the review process. We have been very pleased with the coordination maintained by DeLeuw, Cather/Parsons on the Northeast Corridor Improvement Project within the State of Delaware.

Sincerely yours,

Lawrence C. Henry
Director/State Historic
Preservation Officer

Maryland Historical Trust

December 5, 1977

Ms. Janice Artemel
Cultural Resources
DeLeuw, Cather/Parsons & Associates
1201 Connecticut Avenue, N.W.
Washington, D. C. 20036

Dear Ms. Artemel: Janice

In response to your letter of November 25, 1977, concerning the evaluation of the Northeast Corridor Improvement project on historic districts, the State Historic Preservation Office would concur with determination by the Federal Railroad Administration of no adverse effect on the Charlestown and Bolton Hill Historic Districts.

We shall be glad to review the effects of the general program and specific projects on historic properties as necessai

Sincerely,

Nancy

Nancy Miller
Deputy State Historic
Preservation Officer

NAM:mms

cc: Prof J. Walter Fisher
Mr. John C. Gleason
Mrs. Walter E. Black, Jr.
Mrs. Jean T. Crolius
Mr. John E. Clark
Mrs. Hubert Ryan

Shaw House, 21 State Circle, Annapolis, Maryland 21401 (301) 269-2212, 269-2438
Department of Economic and Community Development

GOVERNMENT OF THE DISTRICT OF COLUMBIA
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
WASHINGTON, D.C

Reply To

28 MAR 1978

Mr. J. A. Caywood
Project Director
DeLeuw, Cather/Parsons & Associates
1201 Connecticut Avenue, N.W.
Washington, D.C. 20036

Dear Mr. Caywood:

I am writing in response to your letter of February 2, 1978, requesting my review of the Federal Railroad Administration's Northeast Corridor Improvement Project as it may affect historic sites within 500 feet of the right-of-way in the District of Columbia. This review is in accordance with procedures for the protection of historic and cultural properties established by the Advisory Council on Historic Preservation.

After reviewing the materials which you submitted, I concur in your determinations that (1) there is no effect on the Kenilworth Aquatic Gardens and United Clay Products Brickyard; and (2) there is no adverse effect on the City Post Office and the National Arboretum.

Thank you for consulting me in this historic preservation matter.

Sincerely yours,

LORENZO W. JACOBS, JR.
State Historic Preservation Officer
for the District of Columbia

Table F-1

SENSITIVE ARCHEOLOGICAL ZONES

| | Type | Milepost |
|---|---|---|
| **WASHINGTON, D.C.** | | |
| | Prehistoric (P3)* | 132.6 - 131.7 |
| **MARYLAND** | | |
| Prince Georges and Anne Arundel Counties | | |
| | Prehistoric (P2) | 131.7 - 130.8 |
| | Prehistoric (P3) | 130.4 - 129.8 |
| | Prehistoric (P2) | 129.0 - 128.6 |
| | Historic (H3) | 128.7 - 128.4 |
| | Prehistoric (P3) | 123.8 - 123.2 |
| | Historic (H3) | 123.1 - 122.9 |
| | Historic (H2) | 121.2 - 120.3 |
| | Prehistoric (P3) | [illegible] - 119.6 |
| | Historic (H[illegible] | [illegible] |
| | Prehistoric (P2) | [illegible] - 115.7 |
| | Prehistoric (P2) | 110.3 - 104.0 |
| Baltimore County | | |
| | Prehistoric (P3) | 99.3 - 98.9 |
| | Historic (H1) | 97.5 - 95.8 |
| | Historic (H3) | 92.5 - 91.8 |
| | Prehistoric (P3) | 88.9 - 88.1 |
| | Historic (H3) | 85.7 - 85.3 |
| | Prehistoric (P2) | 83.0 - 82.6 |
| | Historic (H3) | 82.6 - 82.3 |
| | Prehistoric (P2) | 80.5 - 79.7 |

| | Type | Milepost |
|---|---|---|
| Hartford and Cecil Counties | | |
| | Prehistoric (P2) | 78.3 - 77.4 |
| | Historic (H2) | 77.0 - 76.6 |
| | Prehistoric (P3) | 74.8 - 74.6 |
| | Prehistoric (P3) | 74.1 - 72.8 |
| | Historic (H3) | 72.0 - 71.8 |
| | Prehistoric (P3) | 72.0 - 71.3 |
| | Historic (H3) | 60.7 - 59.5 |
| | Prehistoric (P3) | 59.8 - 59.1 |
| | Prehistoric (P3) | 57.2 - 56.9 |
| | Prehistoric (P3) | 56.7 - 56.3 |
| | Prehistoric (P3) | 56.2 - 55.9 |
| | Historic (H3) | 54.8 - 53.5 |
| | Prehistoric (P2) | 53.2 - 52.6 |
| | Prehistoric (P3) | 52.5 - 51.1 |
| | Historic (H3) | 51.2 - 51.0 |
| | Prehistoric (P2) | 51.3 - 50.4 |
| | Historic (H3) | 49.0 - 48.5 |
| | Prehistoric (P3) | 47.2 - 45.7 |
| | Prehistoric (P2) | 45.7 - 43.5 |
| DELAWARE | | |
| New Castle County | | |
| | Historic (H2) | 41.3 - 41.2 |
| | Prehistoric (P2) | 42.3 - 39.9 |
| | Prehistoric (P3) | 34.2 - 33.0 |
| | Prehistoric (P2) | 36.7 - 32.3 |
| | Historic (H2) | 32.6 - 31.8 |
| | Historic (H1) & (H2) | 30.9 - 30.2 |
| | Prehistoric (P2) | 29.8 - 29.1 |
| Wilmington through Pennsylvania Border | | |
| | Historic (H1) | 27.5 - 26.8 |
| | Historic (H1) & (H2) | 26.4 - 25.7 |
| | Prehistoric (P3) | 26.1 - 25.6 |

| | Type | Milepost |
|---|---|---|
| Wilmington through Pennsylvania Border (cont'd) | | |
| | Prehistoric (P3) | 23.5 - 21.5 |
| | Prehistoric (P2) | 21.5 - 18.6 |
| PENNSYLVANIA | | |
| Delaware County | | |
| | Historic (H2) | 17.3 - 16.7 |
| | Prehistoric (P3) | 13.8 - 13.6 |
| | Prehistoric (P3) | 12.7 - 11.4 |
| | Historic (H3) | 12.1 - 11.3 |
| | Historic (H3) | 8.3 - 8.1 |
| Philadelphia County | | |
| | Prehistoric (P3) | 89.0 - 87.3 |
| | Prehistoric (P3) | 81.6 - 81.2 |
| | Historic (H1) | 80.1 - 79.5 |
| | Prehistoric (P3) | 77.3 - 77.0 |
| Bucks County | | |
| | Historic (H3) | 74.6 - 74.3 |
| | Prehistoric (P3) | 74.6 - 74.3 |
| | Prehistoric (P3) | 70.1 - 69.9 |
| | Historic (H3) | 67.8 - 67.3 |
| | Historic (H1) | 66.3 - 65.8 |
| | Prehistoric (P3) | 62.7 - 60.5 |
| | Historic (H1) | 61.1 - 58.5 |
| | Historic (H3) | 58.3 - 57.9 |
| NEW JERSEY | | |
| Trenton | | |
| | Historic (H3) | 57.6 - 56.8 |
| | Prehistoric (P3) | 56.8 - 56.3 |

| | Type | Milepost |
|---|---|---|
| Trenton to North Brunswick | | |
| | Historic (H3) & Prehistoric (P3) | 53.7 - 53.4 |
| | Historic (H3) | 51.8 - 51.3 |
| | Prehistoric (P3) | 51.6 - 50.9 |
| | Prehistoric (P3) | 49.1 - 48.7 |
| | Prehistoric (P2) | 47.7 - 45.9 |
| | Prehistoric (P3) | 44.7 - 44.2 |
| | Prehistoric (P3) | 41.1 - 40.8 |
| | Prehistoric (P3) | 39.5 - 39.1 |
| | Prehistoric (P3) | 38.2 - 36.9 |
| New Brunswick and South Brunswick | | |
| | Historic (H2) | 31.3 - 31.0 |
| Borough of Metuchen, Edison Township, Woodbridge Township | | |
| | Prehistoric (P3) | 30.9 - 28.7 |
| | Historic ([illegible] | 25.9 - 25.2 |
| | Prehistoric (P3) | 23.4 - 20.8 |
| Rahway | | |
| | Prehistoric (P3) | 19.4 - 18.8 |
| | Historic (H3) | 19.0 - 18.4 |
| Linden | | |
| | Prehistoric (P3) | 16.5 - 16.3 |
| Elizabeth | | |
| | Historic (H3) | 14.6 - 14.2 |
| Newark to Harrison | | |
| | Historic (H1) | 8.9 - 8.5 |
| | Historic (H3) | 8.8 - 8.5 |
| Hackensack Meadows | | |
| | Prehistoric (P3) | W6.0 - W5.3 |
| | Prehistoric (P3) | W4.0 - W3.6 |

| | Type | Milepost |
|---|---|---|
| **NEW YORK** | | |
| Bergen Hill Tunnel | | |
| East River to Byram River | | |
| | Prehistoric (P2) | E5.2 - E5.8 |
| | Prehistoric (P3) | 8.2 - 8.8 |
| | Historic (H3) | 8.2 - 9.1 |
| | Historic (H2) | E3.0 - E3.2 |
| | Prehistoric (P2) | 15.6 - 16.6 |
| | Historic (H3) | 16.9 - 17.3 |
| | Prehistoric (P3) | 16.5 - 17.4 |
| | Historic (H3) | 16.3 - 16.8 |
| | Prehistoric (P3) | 19.4 - 20.9 |
| | Prehistoric (P3) | 20.4 - 20.8 |
| | Prehistoric (P3) | 23.8 - 24.3 |
| | Historic (H1) | 23.8 - 24.4 |
| | Historic (H3) | 25.9 - 26.2 |
| **CONNECTICUT** | | |
| Town of Greenwich through Town of Darien | | |
| | Prehistoric (P3) | 26.7 - 27.5 |
| | Prehistoric (P2) | 27.9 - 28.4 |
| | Prehistoric (P3) | 28.4 - 28.9 |
| | Prehistoric (P2) | 29.3 - 29.7 |
| | Prehistoric (P3) | 29.7 - 30.2 |
| | Historic (H2) | 31.4 - 31.5 |
| | Prehistoric (P2) | 32.4 - 33.0 |
| City of Norwalk through Town of Westport | | |
| | Prehistoric (P2) | 38.1 - 39.4 |
| | Historic (H3) | 41.4 - 41.1 |
| | Prehistoric (P3) | 41.5 - 42.0 |
| | Prehistoric (P2) | 42.5 - 43.9 |
| | Historic (H2) | 44.4 - 44.9 |
| | Prehistoric (P3) | 46.0 - 46.7 |
| | Prehistoric (P2) | 46.7 - 48.7 |

| | Type | Milepost |
|---|---|---|
| Town of Fairfield through Town of Milford | | |
| | Historic (H1) | 48.9 - 49.9 |
| | Prehistoric (P2) | 49.8 - 50.2 |
| | Historic (H3) | 49.8 - 50.5 |
| | Prehistoric (P2) | 51.7 - 53.8 |
| | Prehistoric (P3) | 53.8 - 54.4 |
| | Historic (H1) | 55.1 - 55.2 |
| | Prehistoric (P2) | 54.4 - 55.65 |
| | Historic (H3) | 54.4 - 55.8 |
| | Historic (H2) | 55.8 - 56.2 |
| | Prehistoric (P3) | 55.65 - 56.7 |
| | Prehistoric (P2) | 56.7 - 59.4 |
| | Prehistoric (P2) | 60.4 - 60.9 |
| | Prehistoric (P2) | 63.2 - 63.4 |
| | Prehistoric (P2) | 64.7 - 64.9 |
| | Prehistoric (P3) | 65.7 - 66.3 |
| Greater New Haven | | |
| | Prehistoric (P3) | 67.4 - 68.2 |
| | Prehistoric (P3) | 69.4 - 69.8 |
| | Prehistoric (P2) | 71.4 - 71.7 |
| | Historic (H2) | 72.4 - 73.1 |
| | Historic (H1) | 72.8 - 73.1 |
| | Prehistoric (P3) | 73.5 - 74.7 |
| | Prehistoric (P2) | 75.2 - 75.9 |
| | Prehistoric (P3) | 75.9 - 77.7 |
| | Prehistoric (P2) | 78.0 - 79.0 |
| | Prehistoric (P5) | 82.0 - 83.7 |
| | Historic (H2) | 85.8 - 86.4 |

| | Type | Milepost |
|---|---|---|
| Town of Guilford through Old Lyme | | |
| | Prehistoric (P3) | 83.7 - 86.7 |
| | Prehistoric (P3) | 87.0 - 97.9 |
| | Prehistoric (P2) | 87.9 - 88.1 |
| | Prehistoric (P2) | 88.8 - 98.2 |
| | Historic (H1) | 87.8 - 98.4 |
| | Prehistoric (P2) | 90.7 - 90.0 |
| | Historic (H2) | 91.6 - 91.7 |
| | Prehistoric (P2) | 94.6 - 97.5 |
| | Prehistoric (P2) | 98.9 - 101.1 |
| | Historic (H3) | 102.8 - 103.9 |
| | Prehistoric (P2) | 103.4 - 104.9 |
| | Historic (H3) | 106.3 - 106.5 |
| | Historic (H3) | 106.7 - 106.9 |
| | Historic (H2) | 107.5 - 197.7 |
| | Prehistoric (P2) | 105.9 - 109.9 |
| Metropolitan New London | | |
| | Prehistoric (P3) | 112.3 - 113.0 |
| | Prehistoric (P2) | 113.0 - 113.8 |
| | Historic (H2) | 114.1 - 114.4 |
| | Prehistoric (P2) | 114.8 - 115.4 |
| | Historic (H3) | 115.3 - 115.5 |
| | Prehistoric (P3) | 115.4 - 116.4 |
| | Historic (H3) | 116.7 - 117.0 |
| | Prehistoric (P2) | 116.7 - 117.1 |
| | Historic (H2) & Prehistoric (P3) | 121.2 - 123.4 |
| | Historic (H2) | 123.6 - 124.3 |
| Village of Groton to Village of Westerly | | |
| | Prehistoric (P2) | 126.6 - 127.7 |
| | Historic (H2) | 127.1 - 127.8 |
| | Prehistoric (P3) | 127.7 - 128.8 |

| | Type | Milepost |
|---|---|---|
| Village of Groton to Village of Westerly (cont'd) | | |
| | Historic (H3) | 129.8 - 130.3 |
| | Historic (H3) | 131.3 - 131.9 |
| | Historic (H3) | 132.1 - 132.6 |
| | Prehistoric (P2) | 132.5 - 134.0 |
| | Historic (H2) | 135.2 - 136.0 |
| | Prehistoric (P3) | 139.8 - 141.2 |
| | Historic (H2) | 140.3 - 141.9 |
| Interior, Rural Rhode Island | | |
| | Prehistoric (P2) | 142.9 - 143.2 |
| | Prehistoric (P3) | 142.5 - 143.7 |
| | Historic (H2) | 145.5 - 146.2 |
| | Prehistoric (P3) | 146.1 - 147.6 |
| | Prehistoric (P3) | 148.4 - 149.5 |
| | Prehistoric (P2) | 149.5 - 149.8 |
| | Historic (H2) | 149.7 - 150.1 |
| | Prehistoric (P1) | 149.7 - 152.1 |
| | Prehistoric (P2) | 152.7 - 152.9 |
| | Prehistoric (P3) | 152.4 - 154.0 |
| | Historic (H2) | 142.7 - 154.0 |
| | Prehistoric (P3) | 154.2 - 157.6 |
| | Historic (H2) | 158.4 - 158.6 |
| | Historic (H2) | 161.2 - 161.5 |
| | Historic (H2) | 161.5 - 163.3 |
| | Historic (H1) | 163.1 - 165.2 |
| | Historic (H2) | 165.5 - 166.0 |
| | Historic (H2) | 167.9 - 168.4 |
| Providence Urban Area | | |
| | Prehistoric (P2) | 170.4 - 170.6 |
| | Historic (H1) | 171.7 - 172.1 |
| | Historic (H2) | 172.3 - 173.8 |
| | Prehistoric (P3) | 170.9 - 174.4 |

| Type | Milepost |
|---|---|
| **Providence Urban Area (cont'd)** | |
| Prehistoric (P2) | 175.3 - 175.4 |
| Historic (H3) | 174.4 - 175.6 |
| Historic (H2) | 176.2 - 176.7 |
| Prehistoric (P3) | 178.3 - 179.1 |
| Historic (H3) | 179.2 - 179.5 |
| Prehistoric (P2) | 180.6 - 180.9 |
| Historic (H2) | 181.2 - 182.7 |
| Historic (H2) | 183.9 - 185.0 |
| **Bristol and Norfolk Counties** | |
| Prehistoric (P3) | 192.9 - 193.1 |
| Prehistoric (P2) | 193.6 - 193.9 |
| Historic (H3) | 193.5 - 194.0 |
| Prehistoric (P2) | 194.4 - 195.5 |
| Historic (H2) | 195.0 - 195.9 |
| Prehistoric (P2) | 196.4 - 197.5 |
| Prehistoric (P2) | 197.9 - 198.1 |
| Prehistoric (P3) | 198.9 - 201.3 |
| Prehistoric (P3) | 202.1 - 203.3 |
| Historic (H3) | 203.4 - 204.5 |
| Prehistoric (P3) | 205.2 - 206.0 |
| Historic (H2) | 206.5 - 206.7 |
| Prehistoric (P3) | 206.8 - 208.6 |
| Prehistoric (P3) | 211.9 - 211.6 |
| Historic (H3) | 211.6 - 212.0 |
| Prehistoric (P3) | 212.0 - 212.7 |
| Prehistoric (P3) | 212.8 - 212.9 |
| Historic (H2) | 213.5 - 213.8 |
| Prehistoric (P3) | 214.3 - 215.3 |
| Prehistoric (P3) | 215.3 - 218.3 |

| | Type | Milepost |
|---|---|---|
| Boston Urban Area | | |
| | Historic (H2) | 218.4 - 219.1 |
| | Historic (H3) | 218.8 |
| | Prehistoric (P3) | 219.9 - 220.2 |
| | Prehistoric (P3) | 221.2 - 221.7 |
| | Prehistoric (P2) & Historic (H1) | 223.2 - 224.0 |
| | Historic (H2) | 224.4 - 224.9 |
| | Historic (H1) | 225.8 - 226.1 |
| | Historic (H1) | 227.0 - 227.5 |
| | Historic (H3) | 226.3 - 227.7 |
| | Historic (H1) | 228.1 |
| | Historic (H2) | 228.3 - 228.8 |

*A descriptive rating of each of the zones; "P" refers to prehistoric and "H" refers to historic zones.

P1 Zone containing a site or sites on the National Register of Historic Places.

P2 Zone containing known sites not evaluated for eligibility for the National Register of Historic Places.

P3 Zone considered to be likely to contain prehistoric materials owing to environmental setting.

H1 Zone containing structures, sites, or surroundings on the National Register of Historic Places.

H2 Zone containing structures or sites eligible for and usually on a state or local register.

H3 Zone in which documentary evidence of past historic activities exists, but no archeological survey or determination of eligibility of any registers has been made.

TABLE F-2

HISTORIC SITES AND DISTRICTS
WITHIN 500 FEET OF THE ROW

| | |
|---|---|
| **DISTRICT OF COLUMBIA** | |
| City Post Office | Massachusetts and N. Capitol Street |
| U.S. National Arboretum* | 24th and R Streets, NE |
| Kenilworth Aquatic Gardens | Douglas Street, NE |
| United Clay Products Brickyard | New York Avenue, NE |
| **MARYLAND** | |
| Lanham/Seabrook | |
| Lanham Mansion | 8901 Old Annapolis Road |
| Henry King House | 9409 Dubarry Avenue |
| Residence | 9425 Dubarry Avenue |
| Lincoln Station | Dubarry and Seabrook Road |
| St. Georges Chapel | Glendale Road and Route 564 |
| Baltimore | |
| Bolton Hill Historic District* | North Ave., Eutaw Pl., & RR tracks |
| Aberdeen | |
| Poplar Hill* | 115 Poplar Hill Road |
| Perryville | |
| Rogers Tavern* | West Main Street |
| Charlestown | |
| Charlestown Historic District* | Tasker and Ogle Sts., Louisa Lane, and Northeast River |
| Northeast | |
| Greenhill | Route 7 |
| McCullough Iron Co. and Rolling Mill | Route 7 |

DELAWARE

| | |
|---|---|
| Stanton | |
| Hale-Byrnes House* | DE 7 and 4 |
| Newport | |
| Galloway House | 107 Johns Street |
| Stidham House | 607 West Newport Pike |
| Residence | 16 Market Street |
| Newport National Bank | 100 Market Street |
| Banning Park and Woodstock House | 102 Middleborough Road |
| Residence | 215 Ayne Street |
| Wilmington | |
| Thomas Mendenhall House* | 205 East Front Street |
| Old Asbury ME Church* | 3rd and Walnut Streets |
| Friends Meeting House* | 4th and West Streets |
| Old Swedes Church* | 7th and Church Street |
| Fort Christina Monument* | Fort Christina State Park |
| South Market Street Bridge | Christina River |
| Third Street Bridge | Christina River |
| Claymont | |
| Robinson House* | Naaman's Corner |

PENNSYLVANIA

| | |
|---|---|
| Marcus Hook | |
| Marcus Hook Historic District | Route 13 |
| Chester | |
| Chester Courthouse | Market Street below 5th Street |
| Madison Street Methodist Church | 7th and Madison Streets |
| Ridley Park | |
| Christ Church | Sellers Ave. at Nevins Street |
| Philadelphia | |
| Fairmount Park* Historic District | East and West banks of Schuylkill River |
| Solitude | Fairmont Park in Zoological Gardens |

| | |
|---|---|
| Letitia Street House | Fairmong Park, Lansdowne Drive |
| Girard Avenue Bridge | Fairmont Park, Girard Avenue or Schuylkill River |
| <u>Morrisville</u> | |
| Delaware Division of the Pennsylvania Canal* | West bank of the Delaware River from Bristol to Morrisville |
| Residence | Delaware River north of RR Bridge |
| NEW JERSEY | |
| <u>Trenton</u> | |
| Old Eagle Tavern* | 431 - 435 Broad Street |
| <u>New Brunswick</u> | |
| Queens Campus Historic District* | College Avenue, George, Hamilton, and Somerset Streets |
| Old Queens Building* | Queens Campus, Rutgers University |
| New Jersey Hall* | 73 Hamilton Street |
| Rutgers Prep School* | 101 Somerset Street |
| Henry Guest House* | 58 Livingston Street |
| <u>Metuchen</u> | |
| Old Presbyterian Cemetery | Main Street |
| Presbyterian Church | Woodbridge Road |
| Daniels House | Homer Place |
| Shoemaker's House | 27 Home Street |
| John Hampton House | 280 Amboy Avenue |
| Rev. T. Bradford House | 296 Amboy Avenue |
| Cartwright House | 328 Amboy Avenue |
| Residence | 304 Amboy Avenue |
| Old Henneman's Bakery | Main Street |
| Old Crowell's Livery Stable | Main Street |
| Eagle Hook and Ladder Co. | Main Street |
| Annex of Old High School | Holly Street |
| Ayres House | 104 Hillside Avenue |
| Van Sicle House | 103 Hillside Avenue |
| Fox House | 101 Hillside Avenue |

| | |
|---|---|
| Railroad Station* | Woodbridge Road |
| Soper House | 351 Main Street |
| Residence | 355 Main Street |

<u>Elizabeth</u>

| | |
|---|---|
| Old First Presbyterian Church | Broad Street and Caldwell Place |

<u>Newark</u>

| | |
|---|---|
| Murphy Varnish Complex | Johnson, Vesey, Chestnut and McWhorter |
| Central Graphics Building | 765 McCarter Highway |

NEW YORK

<u>New York</u>

| | |
|---|---|
| Sniffen Court Historic District* | E. 36th Street between Lexington and 3rd Avenues |
| Church of the Transfiguration and Rectory* | 1 East 29th Street |
| Pierpont Morgan Library* | 33 East 36th Street |
| U.S. General Post Office* | 8th Ave. between 31st and 33rd Streets |
| Hunters Point Historic District* | 45th Avenue between 21st and 23rd Streets |

CONNECTICUT

<u>Greenwich</u>

| | |
|---|---|
| Cos Cob Historic District | Strickland and Mill Pond Roads |
| Justus Bush House | 186 Hamilton Avenue |
| Bruce Museum | Museum Drive |
| Doran Storehouse | Arch Street |
| Davis Benson House | Davis Avenue |
| Clark House | Strickland Road |
| Atwater House | Club Road and Riverside Avenue |
| John Lockwood House | 33 Sound Beach Road |
| Deacon Ferris House | Tomac Avenue |

Norwalk

| | |
|---|---|
| Firehouse | Van Zant Street |
| East Norwalk Historical Cemetary | East Avenue |
| East Avenue United Methodist Church | 244 East Avenue |
| Washington Street Cluster | Nos. 68-157 Washington Street |
| South Main Street Cluster | Nos. 2-85 South Main Street |
| Residence | 8 Haviland Street |
| Residence | 10 Haviland Street |
| Residence | 12 Haviland Street |
| Norwalk Lock Co. | Water Street |

Fairfield

| | |
|---|---|
| Southport Historic District* | Vicinity of Southport Harbor |
| Fairfield Historic District* | Old Post Road from junction of Post Road to Turner Road |

Bridgeport

| | |
|---|---|
| Washington Park Historic District | Harriet, Maple, Beach and Clarence Streets |
| Barnum Institute of Science and History* | 805 Main Street |

Stratford

| | |
|---|---|
| Sterling Homestead* | 2225 Main Street |

Milford

| | |
|---|---|
| Federal Style House | 49 Clark Street |
| Taylor Library | Broad and River Streets |

West Haven

| | |
|---|---|
| Ward Heitman House | 277 Elm Street |

New Haven

| | |
|---|---|
| New Haven Green Historic District* | College, Elm and Church Streets |
| Wooster Square Historic District* | Wooster Square Park and surrounding area |
| Timothy Bishop House | 32 Elm Street |
| John Cook House | 35 Elm Street |

| | |
|---|---|
| Eli Whitney House | 275 Orange Street |
| Trinity Lutheran Church | Orange and Wall Streets |
| Lafayette B. Mendel House* | 18 Trumbull Street |
| <u>East Haven</u> | |
| Residence | 50 High Street |
| Hubbard Scranton House | 101-103 High Street |
| Residence | 193 North High Street |
| <u>Branford</u> | |
| Cape Cod Residence | 474 Harbor Street |
| Thomas Harrison House | 464 Harbor Street |
| John Rose House | Bradley and Harbor Streets |
| Timothy Bradley House | 12 Bradley Street |
| Howd Homestead | 72-74 South Main Street |
| Abraham Rogers House | 14 Sachem Road |
| <u>Guilford</u> | |
| Guilford Town Center* | Village of Guilford |
| Leete Homestead | Route 146 |
| Peletiah Leete III House | Route 146 |
| Residence | 588 Leete's Island Road |
| Simeon Leete's Grave | Moose Hill Road |
| Cemetery | Moose Hill Road |
| Meyers House | Wingate Road and Route 146 |
| Residence | Old Quarry Road |
| <u>Clinton</u> | |
| 1765 House | 131 East Main Street |
| Eben Merrill House | 130 East Main Street |
| Capt. Elisha White House | 103 East Main Street |
| Wright House | 101 East Main Street |
| 1800 House | 15 Liberty Street |
| "Early Settler" House | Liberty Street |
| Early 18th C. House | 17 Liberty Street |
| Stanton House | East Main and Church Streets |
| Town Hall | Commerce Street |

Westbrook

| | |
|---|---|
| Post Family House | Willard Avenue |
| Residence | Willard Ave. and Pond Meadow Road |
| Philip Kirtland House | Old Clinton Road |
| Jonathan Lay House | Old Clinton Road |
| Lay House | Old Clinton Road |
| Early 18th C. House | Old Clinton Road |
| Greek Revival House | Old Clinton Road |
| Jeremiah Lay House | Old Clinton Road |
| Dee House | Old Clinton Road |
| Marks Dee House | Old Clinton Road |
| John Murdock House | Old Clinton Road |
| Elijah Dee House | Old Clinton Road |
| 1775 House | Old Clinton Road |

Old Saybrook

| | |
|---|---|
| Samuel Jones House | 3 Stage Road |
| Edward Sanford House | 15 North Main Street |
| Coulter House | Route 1 and Main Street |

Old Lyme

| | |
|---|---|
| Old Lyme Historic District* | Lyme Street from Shore Road to Sill Lane |
| Enoch Noyes House | Ferry Road |
| Rueben Champion House | Ferry Road |

New London

| | |
|---|---|
| Whale Oil Row Historic District* | 105-119 Huntington Avenue |
| New London Custom House* | 150 Bank Street |
| Shaw Mansion* | 11 Blinman Street |
| Antientest Burial Ground | Huntington Street |
| Bulkeley School | 178 Huntington Street |
| First Church of Christ | 209 State Street |
| St. James Episcopal Church | 125 Huntington Street |

Groton

| | |
|---|---|
| Groton Bank Historic District* | Broad, North, Baker and Thames Streets |

Stonington

| | |
|---|---|
| Mystic Bridge Historic Distric* | Cottrel, Holmes, Dension, Rossevelt, Washington Streets |

Mystic

| | |
|---|---|
| Mystic Historic District | Main Street and Noank Road Area |

RHODE ISLAND

Westerly

| | |
|---|---|
| Westerly Armory | Railroad and Dixon Avenues |
| Greek Revival House | High Street |
| Early 20th C. House | High Street |
| Early 19th C. House | Westerly-Bradford Road |
| Wilcox Park Historic District* | Area surrounding Wilcox Park |
| Main Street Extension District* | Main Street |
| Central Business District* | Canal Street |

adford

| | |
|---|---|
| Bradford Historic District | Area surrounding mills |

Richmond

| | |
|---|---|
| Wood River Junction Historic District | Both sides of Hope Valley Road, north and south of Highway 91 |
| Shannock Historic District | Both sides of Shannock Road |
| Kenyon Historic District | The mill area of Kenyon |
| Columbia Heights | Off Kenyon-Shannock Road |
| Former School | Sherman Avenue |
| Carr Farm | South County Trail |

South Kingstown

| | |
|---|---|
| Kenyon Homestead | Waites Corner Road |
| Oliver Watson House | Waites Corner Road |

Exeter/Slocum

| | |
|---|---|
| Yawgoo Mill | Yawgoo Road off Slocum Road |
| Greek Revival House | Liberty Road |

North Kingstown

Slocum Agricultural/ Historical District

Hatchery-Kettle Hole Natural Historical District

| | |
|---|---|
| Lawton House | 750 Stony Lane |
| Late 19th Century House | 491 Old Baptist Church |
| Wickford Junction Historic District | Both sides of Ten Rod Road |
| <u>East Greenwich</u> | |
| East Greenwich Historic District | Division Street, Greenwich Cove, London Street, Peirce Street |
| Elizabeth Spring | Forge Road |
| <u>Warwick</u> | |
| B. R. Vaughn House | 51 Hesper Drive |
| Capt. Oliver Gardner House | 4451 Boston Post Road |
| House | 4456 Boston Post Road |
| Arthur B. Lisle Estate | 4365 Boston Post Road |
| House | 4177 Boston Post Road |
| House | 4019 Boston Post Road |
| House | 3987 Boston Post Road |
| House | 3960 Boston Post Road |
| Gateway to former Sprague Estate | Cowsett Road |
| <u>Apponaug</u> | |
| House | 3188 Boston Post Road |
| House | 3214 Boston Post Road |
| House | 101 Spruce Street |
| House | Spruce Street and Boston Post Road |
| <u>Greenwood</u> | |
| Greenwood Inn | 1350 Jefferson Blvd. |
| Pontiac Railroad Station | 2245 Boston Post Road |
| Elizabeth Mill | 745 Jefferson Blvd. |
| Mill Housing | Cottage, Greystone, Kilvert, and Thurber Streets |
| <u>Norwood</u> | |
| H. C. Budlong House | 72 Pettaconsett Avenue |

## Cranston

| | |
|---|---|
| Torino Creations | Wellington and Elmwood Avenue |
| People's Baptist Church | Park and Elmwood Avenue |
| St. Mathews Church | Park and Elmwood Avenue |
| General Electric Co. | Knowles Street |
| Narragansett Brewery | 737-739 Cranston Street |
| Former Trolley Barn | Cranston Street |

## Providence

| | |
|---|---|
| Roger Williams Park | Roger Williams Park |
| Broadway-Armory Historic District* | Messer, Broadway, Bridgham Streets |
| College Hill Historic District* | South Water and Canal, Olney, Hope Streets, and G.M. Cohan Blvd. |
| Moshassuck Square Historic District* | Charles, Randall, North Main, Street |
| Kennedy Exhange Plaza* | |
| Roger Williams National Monument* | |
| North Burial Ground* | Branch Ave., I-95, Cemetery St., North Main Street |
| Custom House Historic District* | |
| Gorham Manufacturing Co. | 333 Adelaide Street |
| Elmwood Station | Adelaide Street |
| Howe-Metcalf House | 572 Elmwood Avenue |
| Emma F. Babcock House | 638 Elmwood Avenue |
| House | 259-261 Lenox Avenue |
| Thomas B. Reynolds House | 254 Adelaide Avenue |
| House | 243 Adelaide Avenue |
| House | 242 Adelaide Avenue |
| Charles E. Hancock House | 239 Adelaide Avenue |
| Albert E. Remington House | 224 Adelaide Avenue |
| William H. Perry House | 225 Adelaide Avenue |
| Gustave Mensing House | 218 Adelaide Avenue |
| Samuel A. Otis House | 203 Adelaide Avenue |
| House | 185 Adelaide Avenue |
| House | 188 Adelaide Avenue |

| | |
|---|---|
| House | 183 Adelaide Avenue |
| House | 236 Atlantic Avenue |
| John Howe House | 211 Atlantic Avenue |
| House | 184-186 Atlantic Avenue |
| Edwin O. Chase House | 183 Lexington Avenue |
| House | 186 Lexington Avenue |
| George P. Hussey House | 179 Ontario Avenue |
| George Wilkinson House | 153 Ontario Avenue |
| Union Railroad Co. Car Barns and Stable | 333 Bucklin Street |
| Caleb Farnum House | 433 Elmwood Street |
| Edmund D. Cheseboro House | 421 Elmwood Street |
| William Sanford Hoyt House | 215 Bucklin Street |
| House | 46 Vineyard Street |
| House | 50 Vineyard Street |
| Vineyard St. School | 1-33 Vineyard Street |
| John and Thomas Hope Co. | 1 Mashpaug Street |
| House | 41 Madison Street |
| House | 36 Carter Street |
| House | 34 Carter Street |
| House | 29 Carter Street |
| Houses | 20, 22, 28 Hawthorne Street |
| Church of the Epiphany | 542 Potters Street |
| Thomas Hope House | 552 Potters Avenue |
| James M. Johnson House | 572 Potters Avenue |
| Humes Block | 644-650 Potters Avenue |
| William H. Mairs House | 32 Anthony Place |
| Commercial Block | 737-747 Cranston Street |
| Henry Potter House | 4-6 Avon Street |
| Greek Revival House | 9 Marvin Street |
| Greek Revival House | 2 Ellery Street |
| Concrete Storage Elevators | Olneyville |
| Church of the Messiah | Troy and Westminster Streets |
| Church of the Master | Broadway and Valley Streets |
| Weybosset Mills | Troy and Dike Streets |
| Ross Mill | Troy and Mill Streets |

| | |
|---|---|
| House | 276 Grove Street |
| Providence Dyeing, Bleaching and Calendaring Co. | 50-54 Valley Street |
| Nicholson File Col | 23 Acorn Street |
| City Machine Co. | Harris and Acorn Streets |
| Merchant's Cold Storage | 65 Harris Avenue |
| University of RI Extension Building | Promenade at Gaspee Street |
| Fire Alarm Signal Building | Gaspee, Stillman, and Promenade Streets |
| Providence and Worchester RR Freight Station | Canal Street |
| Rhode Island State House* | 90 Smith Street |
| State Office Building | Smith Street |
| St. Patrick's Church | 83 Smith Street |
| United States Post Office | Corliss Street |
| Oriental Cotton Mills | Admiral and Whipple Streets |
| Silver Spring Bleaching and Dyeing Co. | 387 Charles Street |
| Providence Tool Co. | 148 West River Street |

'awtucket

| | |
|---|---|
| Mineral Spring Park and Collyer Monument | North Main and Lenant Streets |
| Hope Webbing Co. | 102 Main Street |
| House | 62 Lonsdale Avenue |
| Gasoline Station | 57 Lonsdale Avenue |
| House | Mineral Spring Avenue |
| Conant Thread Co. | Conant Street |
| House | 72 Mineral Spring Avenue |
| Mineral Spring Cemetary | Mineral Spring Avenue |
| Campbell Machine Co. | 28 Bayley Street |
| Freight Station | Pine Street |
| Union Wadding Co. | Pine Street |
| Modern Diner* | 15 Dexter Street |
| Leroy Theater | 66 Broad Street |
| Fanning Building | 70-100 Broad Street |

| | |
|---|---|
| Former Universalist Church | 226 High Street |
| House | 221 High Street |
| House | 200 High Street |
| House | 178 High Street |
| House | 27 Miller Street |
| House | 49 Darrow Street |
| House | 44 Darrow Street |
| House | 17 Nickerson Street |
| House | 5 Nickerson Street |
| Pumping Station | Armistice Boulevard |
| House | 11 Nickerson Street |

Central Falls

| | |
|---|---|
| Central Falls Mill District | Mill Area |
| Stearnes House | 88 Clay Street |
| Beede House | 84 Clay Street |
| Moies House | 69 Clay Street |
| Stetson House | 10 Clay Street |
| Horton House | 78 Jenks Street |
| Flagg House | 86 Cross Street |
| Greene House | 85 Cross Street |
| Triple-Decker | 59-61 Cross Street |
| Mill House | 34-36 Cross Street |
| Daniels House | 206 Central Street |
| Cobb House | 189 Central Street |
| Rice House | 159 Central Street |
| Wood House | 153 Central Street |
| Grant House | 143 Central Street |
| Crocker House | 144 Central Street |
| Triple-Decker | 61-63 Pacific Street |
| Dennis House | 1 Pacific Street |
| Linnell House | 80 Summit Street |
| Lincoln Town Hall | 26 Summit Street |
| Stafford House | 371 High Street |
| Central Falls Congregational Church | 376 High Street |

| | |
|---|---|
| Church of St. Joseph | 391 High Street |
| McCartney House | 427 High Street |
| Fales House | 476 High Street |
| Grant House | 324 Broad Street |
| Broad Street School | 405 Broad Street |
| Daniels House | 428 Broad Street |
| Police Station/Courthouse | 507 Broad Street |
| Fire Station | 551 Broad Street |
| Central Falls City Hall | 580 Broad Street |
| Falcon House | 597 Broad Street |
| Jenks Park and Cogswell Tower* | Broad Street |
| Notre Dame | 666 Broad Street |
| Denevers Building | 702-706 Broad Street |
| Cartier Building | 708 Broad Street |
| Monast Building | 753-755 Broad Street |
| Blackstone Veterans Building | Charles Street |
| Murdock-Webbing Co. | 27 Foundary Street |

MASSACHUSETTS

| | |
|---|---|
| Hebronville | |
| Hebronville Methodist Church | 152 Church Street |
| Attleboro | |
| East Attleboro Academy | 28 Sanford Street |
| Dodgeville Mill Area | South Main Street |
| Foxborough | |
| Pratt Mansion House | 141 East Street |
| 19th Century House | Cocassett Street |
| Sharon | |
| Sharon Historic District | N. Main Street from Post Office Square to School Street |
| The Homestead | 247 North Main Street |
| John Savels House | 178 North Main Street |
| Darius Lothrup House | 184 NOrth Main Street |

| | |
|---|---|
| **Canton** | |
| Neponset Cotton Mille District | Neponset and Walpole Streets |
| **Boston** | |
| Forest Hills Cemetary | Adjacent to Franklin Park |
| Arnold Arboretum* | 22 Divinity Avenue |
| Olmstead Park System/ Franklin Park* | Off the Arborway |
| Roxbury Highlands Area* | Washington Street to Marcella Street, Highland to Center |
| John Elliot Square* | Area surrounding John Eliot Square |
| South End District* | Claremont, Yarmouth, Columbus, RR tracks, Berkeley, Tremont, Massachusetts |
| St. Botolph Street Area* | Both sides of St. Botolph Street between Harcourt and Cumberland |
| Ellis Street Historic District | Ellis Street |
| Bay Village Area | Tremong, Arlington, Peidmont, Broadway and Charles Street |
| Back Bay Historic District* | Arlington, Beacon, Newbury, Boylston, Stuart, and the Charles River |
| Boston Common Public Public Garden* | Beacon, Park, Tremont, Boylston, and Arlington Streets |
| Boston Public Library* | Copley Square |
| Dudley Mansion | 167 Centre Street |
| Old Police Station No. 10 | 1170 Columbus Street |
| Cahners Building | 221 Columbus Avenue |
| Youths Companion Building* | 197-217 Columbus Avenue |
| Armory of the First Corps of Cadets* | 130 Columbus Avenue |

*On or eligible for the National Register of Historic Places.

TABLE F-3

HISTORIC RAILROAD STRUCTURES*

| Milepost | Location | Structure | Date |
|---|---|---|---|
| | | DISTRICT OF COLUMBIA | |
| 136.00 | Washington | Union Station | 1905 |
| 135.50 | Washington | "A" Tower | 1905 |
| 134.50 | Washington | Ivy City Yards | 1905 |
| 134.00 | Washington | Ivy City Roundhouse | 1905 |
| | | MARYLAND | |
| 128.76 | Landover | Beaver Dam Bridge | 1871 |
| 127.88 | Landover | Beaver Dam Bridge | 1871 |
| 127.65 | Landover | Beaver Dam Bridge | 1871 |
| 125.32 | Lanham | Muddy Hole Bridge | 1871 |
| 120.50 | Bowie | Bowie Tower | |
| 116.04 | Odenton | Little Patuxent River Bridge | 1882 |
| 115.61 | Odenton | Rogues Harbor Bridge | 1910 |
| 112.17 | Mayfield | Severn Run Culvert | 1873 |
| 100.59 | Violetville | Wilkens Ave. Bridge | 1929 |
| 100.33 | Baltimore | Maidens Choice Bridge | 1871 |
| 99.20 | Baltimore | Gwynns Falls Bridge | 1913 |
| 97.56 | Baltimore | Fulton Ave. Bridge/Tunnel | 1873 |
| 97.45 | Baltimore | Vincent St. Bridge | 1873 |
| 96.00 | Baltimore | B&P Tunnel - E. Portal | 1873 |
| 95.84 | Baltimore | Tower | |
| 95.50 | Baltimore | Station | 1911 |
| 95.95 | Baltimore | Jones Falls Bridge | 1916 |
| 95.94 | Baltimore | Howard St. Bridge | 1938 |
| 95.41 | Baltimore | Guilford Ave. Bridge | |

| | | | |
|---|---|---|---|
| 95.49 | Baltimore | Tower | |
| 92.09 | Baltimore | Bayview Bridge | 1885 |
| 91.00 | Baltimore | Bayview Yard | |
| 82.57 | Chase | Earles Rd. Bridge | 1916 |
| 78.86 | Harewood | Gunpowder River Bridge | 1913 |
| 75.50 | Edgewood | Edgewood Tower | |
| 72.14 | Bush River | Bush River Bridge | 1913 |
| 63.97 | Aberdeen | Swan Creek Bridge | |
| 62.70 | Aberdeen | Mill Run Bridge | 1886 |
| 62.09 | Havre de Grace | Rte. 7 Bridge | 1905 |
| 61.35 | Havre de Grace | Lewis Road Bridge | 1905 |
| 60.85 | Havre de Grace | Stone Arch Bridge | 1905 |
| 60.61 | Havre de Grace | Centennial Alley Bridge | 1905 |
| 60.51 | Havre de Grace | Freedom Alley Bridge | 1905 |
| 60.07 | Havre de Grace | Susquehanna R. Bridge | 1906 |
| 59.39 | Perryville | Stauton Arch Bridge | 1905 |
| 59.20 | Perryville | Perryville Station | |
| 59.00 | Perryville | Mill Creek Bridge | 1904 |
| 58.34 | Principio | Condons Road Bridge | 1906 |
| 57.85 | Principio | Condons Road Bridge | 1906 |
| 59.10 | Perryville | Perryville Tower | |
| 57.60 | Principio | Bromwell's Rd. Bridge | 1906 |
| 54.29 | Charlestown | Brick Arch Bridge | 1891 |
| 52.96 | Northeast | Broad Creek Bridge | 1898 |
| 52.64 | Northeast | Pedlers Run Bridge | 1898 |
| 51.94 | Northeast | Stony Run Bridge | 1898 |
| 51.88 | Northeast | Route 7 | 1931 |
| 51.12 | Northeast | McCullough's Bridge | 1927 |
| 51.03 | Northeast | Northeast Creek Bridge | 1898 |
| 48.60 | Northeast | Truss Bridge | 1903 |

| | | | |
|---|---|---|---|
| 48.15 | Northeast | Pole Cat Run | 1898 |
| 47.70 | Northeast | Mill Creek Bridge | |
| 46.67 | Elkton | Tillison Run Bridge | |
| 44.80 | Elkton | Elkton Station | |
| 43.33 | Elkton | Cow Run No. 1 Bridge | 1896 |

DELAWARE

| | | | |
|---|---|---|---|
| 39.50 | Newark | Newark Yards | |
| 38.80 | Newark | Newark Station | |
| 37.52 | Newark | Morrows Road Bridge | 1913 |
| 36.42 | Newark | Ogletown Road Bridge | 1885 |
| 27.85 - 25.97 | Wilmington | Wilmington Viaduct | 1905-( |
| 27.50 | Wilmington | West Yard & Roundhouse | |
| 27.40 | Wilmington | B&O RR Freight Station | 1879 |
| 26.80 | Wilmington | Station | 1905 |
| 25.97 | Wilmington | Brandywine Cr. Bridge | 1904 |
| 25.00 | Wilmington | Amtrak Yards & Shops | |
| 18.62 | Naaman | Naaman Creek Bridge | 1902 |

PENNSYLVANIA

| | | | |
|---|---|---|---|
| 14.28 | Chester | Lloyd St. Bridge | 1899 |
| 13.07 | Chester | Chester Station | |
| 13.07 | Chester | Potter & Morton St. Brs. | 1904 |
| 12.92 | Chester | Caldwell St. Bridge | 1904 |
| 12.65 | Chester | Ridley Creek Bridge | |
| 11.70 | Lynne | Crum Creek Bridge | 1872 |
| 11.70 | Lynne | Tower | |
| 11.69 | Lynne | B&O Railroad Bridge | 1872 |
| 11.08 | Lynne | Little Crum Creek | 1872 |
| 11.05 | Lynne | Stone Creek | 1872 |
| 10.52 | Ridley Park | Swarthmore Ave. Bridge | |
| 8.73 | Glenolden | Muckinipattis Cr. Bridge | 1884 |
| 6.44 | Darby | Darby Creek Bridge | 1892 |
| 5.73 | Colwyn | Cobbs Creek Bridge | 1872 |

| | | | |
|---|---|---|---|
| 5.58 | Colwyn | Island Ave. Bridge | 1919 |
| 3.50 | Philadelphia | Brill Tower | |
| 3.11 | Philadelphia | B&O Bridge | 1910 |
| 2.55 | Philadelphia | P.W.B. RR Marker | |
| 89.00 | Philadelphia | Brill Tower | |
| 88.11 | Philadelphia | 30th St. Station Powerhouse | 1933 |
| 88.10 | Philadelphia | 30th St. Station | 1933 |
| 87.25 | Philadelphia | Zoo Substation | |
| 87.14 | Philadelphia | Schuylkill River Bridge | 1868 |
| 86.98 | Philadelphia | Reading Railroad Bridge | 1868 |
| 84.69 | Philadelphia | Reading Railroad Bridge | 1889 |
| 84.55 | Philadelphia | North Philadelphia Sta. | |
| 81.69 | N. Phila-delphia | Kensington Ave. Bridge | 1917 |
| 80.29 | Frankford Jct. | Frankford Creek Bridge | 1883 |
| 80.71 | Frankford Jct. | Adams Ave. Bridge | 1883 |
| 76.70 | Holmesburg Jct. | Pennypack Creet Bridge | 1917 |
| 76.07 | Holmesburg Jct. | Stonearch Bridge | 1882 |
| 74.20 | Hólmesburg Jct. | Poquessing Creek Bridge | |
| 68.46 | Croydon | Central Ave. Bridge | 1924 |
| 57.75 | Morrisville | Delaware River Bridge | 1903 |

## NEW JERSEY

| | | | |
|---|---|---|---|
| 57.61 | Trenton | Bloomsbury St. Bridge | 1903 |
| 56.77 | Trenton | Clinton St. Bridge | 1891 |
| 56.20 | Trenton | Typical Signal Bridge | |
| 55.51 | Trenton | Assunpink Creek Bridge | 1882 |
| 46.83 | Princeton Jct. | Princeton Jct. Station | |
| 46.30 | Princeton Jct. | Millstone River Bridge | 1913 |
| 46.47 | W. Windsor Twp. | Swinger Race Bridge | 1866 |

| | | | |
|---|---|---|---|
| 39.35 | S. Brunswick | Lawrence Brook Bridge | 1881 |
| 39.27 | S. Brunswick | Dean Pond Rd. Bridge | 1887 |
| 32.61 | New Brunswick | One mile Run Bridge | 1902 |
| 31.36 | New Brunswick | Easton Ave. Bridge | 1903 |
| 31.30 | New Brunswick | New Brunswick Station | |
| 31.12-31.01 | New Brunswick | Stone arch bridges | 1903 |
| 30.92 | New Brunswick | Raritan River Bridge | 1903 |
| 30.80 | Highland Park | Bound Brook Rd. Bridge | 1900 |
| 24.08 | Edison Twp. | Evergreen Ave. Bridge | |
| 23.42 | Woodbridge Tp. | South Wood Ave. Bridge | |
| 21.90 | Woodbridge Tp. | Sucker Brook Bridge | 1883 |
| 19.41 | Rahway | Irving & Cherry St. Bridges | 1913 |
| 19.13 | Rahway | Rahway River Bridge | 1914 |
| 16.28 | Linden | S.I.R.T. Bridge | 1888 |
| 15.60 | Elizabeth | Park Ave. Bridge | 1913 |
| 14.49 | Elizabeth | Rahway Ave. Bridge | 1894 |
| 14.22 | Elizabeth | W. Jersey St. Bridge | 1894 |
| 14.12 | Elizabeth | W. Grand St. Bridge | 1894 |
| 14.06 | Elizabeth | Station Roadway Bridge | 1894 |
| 14.05 | Elizabeth | CRR of NJ RR Bridge | 1908 |
| 14.04 | Elizabeth | Morris Ave. Bridge | 1893 |
| 14.03 | Elizabeth | Broad St. Bridge | 1893 |
| 13.90 | Elizabeth | Chestnut St. Bridge | 1894 |
| 13.83 | Elizabeth | Magnolia St. Bridge | 1894 |
| 12.20 | Newark | Lane Tower | |
| 11.39 | Newark | Haynes Ave. Bridge | 1931 |
| 10.56 | Newark | Lehigh Valley RR Bridge | 1938 |
| 8.95 | Newark | Lafayette St. Bridge | 1935 |
| 8.84 | Newark | CRR of NJ RR Bridge | 1903 |
| 8.60 | Newark | Newark Station | 1935 |
| 8.50 | Newark | Passaic River Bridges | 1935 |
| 6.10 | Secaucus | Hackensack R. Bridge | 1910 |
| 4.61 | Secaucus | Erie RR Bridge | 1910 |
| 2.90 | N. Bergen | North River Tunnel-West Portal | 1906 |

## NEW YORK

| | | | |
|---|---|---|---|
| 3.50 | Queens | Sunnyside Yards | 1910 |
| 3.55 | Queens | Honeywell St. Bridge | 1910 |
| 3.80 | Queens | Station Powerhouse | |
| 3.82 | Queens | Harold Ave. Bridge | 1910 |
| 5.83 | Queens | 45th St. Bridge | 1917 |
| 5.99 | Queens | 41st St. Bridge | 1917 |
| 6.08 | Queens | Steinway St. Bridge | 1917 |
| 6.15 | Queens | 38th St. Bridge | 1917 |
| 6.21 | Queens | 37th St. Bridge | 1917 |
| 6.26 | Queens | 36th St. Bridge | 1917 |
| 6.31 | Queens | 35th St. Bridge | 1917 |
| 6.37 | Queens | 33rd St. Bridge | 1917 |
| 6.45 | Queens | 31st St. Bridge | 1917 |
| 6.62 | Queens | 27th St. Bridge | 1917 |
| 6.71 | Queens | 25th St. Bridge | 1917 |
| 7.29 | Manhattan | Hell Gate Bridge | 1917 |
| 7.65 | Manhattan | Wards Island Bridge | 1917 |
| 8.02 | Manhattan | Little Hell Gate Bridge | 1917 |
| 8.31 | Manhattan | Randalls Island Viaduct | 1917 |
| 8.54 | Manhattan | Bronx Kill Bridge | 1917 |
| 9.62 | Bronx | E. 149th St. Bridge | 1907 |
| 9.99 | Bronx | Leggett Ave. Bridge | 1908 |
| 10.11 | Bronx | E. 136th St. Bridge | 1909 |
| 10.25 | Bronx | Longwood Ave. Bridge | 1907 |
| 10.30 | Bronx | Lafayette Ave. Bridge | 1908 |
| 11.40 | Bronx | Bronx River Bridge | 1906 |
| 11.99 | Bronx | Cross Bronx Bridge | |
| 12.65 | Bronx | Garfield St. Bridge | 1909 |
| 12.75-12.78 | Bronx | Unionport/White Plains Road Bridges | 1907 |
| 13.00 | Bronx | Van Nest Shops | 1908 |
| 15.20 | Bronx | Bychester Ave. Bridge | 1908 |

| | | | |
|---|---|---|---|
| 15.73 | Bronx | Hutchinson R. Bridge | 1917 |
| 19.10 | Larchmont | Circuit breaker gantry and substation | |
| 19.15 | Larchmont | Weaver St. Bridge | 1886 |
| 19.76 | Larchmont | Rockland Ave. Bridge | 1886 |
| 20.50 | Mamaroneck | Mamaroneck Station | |
| 20.57-20.59 | Mamaroneck | Mamaroneck R. Bridge | 1887 |
| 20.75 | Mamaroneck | Hillside Ave. Bridge | 1887 |
| 20.91 | Manaroneck | Barry Ave. Bridge | 1887 |
| 23.40 | Rye | Pike Tower | 1917 |
| 24.22 | Rye | Boston Post Rd. Bridge | 1888 |

CONNECTICUT

| | | | |
|---|---|---|---|
| 27.78 | Ryram | Field Point Rd. Bridge | 1895 |
| 29.70 | Cos Cob | Cos Cob Generating Plant | 1907 |
| 29.91 | Cos Cob | Mianus River Bridge | 1904 |
| 30.26 | Riverside | Riverside Ave. Bridge | 1871 |
| 30.77 | Riverside | Darkwater Place Bridge | 1895 |
| 31.04 | Riverside | Arch St. Bridge | 1895 |
| 32.85 | Stamford | Mill River Bridge | 1896 |
| 35.21 | Glenbrook | Cortland Ave. Bridge | 1897 |
| 35.21+ | Glenbrook | Experimental Catenary poles | 1910 |
| 35.58 | Glenbrook | Noroton River Bridge | 1894 |
| 39.06 | Rowaton | Mile River Bridge | 1893 |
| 37.16 | Noroton | Stony Brook Bridge | 1893 |
| 39.72 | Rowaton | Highland Ave. Bridge | 1893 |
| 40.78 | S. Norwalk | Lowe St. Bridge | 1938 |
| 41.20 | Norwalk | (typical) circuit breaker gantry | 1914 |
| 41.28 | Norwalk | Washington & Main Sts. Bridges | 1897 |
| 41.47 | Norwalk | Norwalk R. Bridge | 1886 |
| 42.67 | E. Norwalk | Bridge St. Bridge | 1891 |
| 44.30 | Saugatuck | Saugatuck River Bridge | 1905 |

| | | | |
|---|---|---|---|
| 45.09 | Westport | Hales Rd. Bridge | 1890 |
| 45.48 | Westport | Hill Pt. Rd. Bridge | 1890 |
| 46.94 | Green Farms | Beechside Ave. Bridge | 1891 |
| 47.00 | Green Farms | Saga Tower | 1905/14 |
| 47.85 | Green Farms | Sasco Creek Rd. Bridge | 1890 |
| 49.42 | Southport | Mill Hill Rd. Bridge | 1890 |
| 41.83 | Fairfield | Grassmere Ave. Bridge | 1890 |
| | Fairfield | Fairfield Station | |
| 52.56 | Fairfield | Black Rock Tnpk: Bridge | 1890 |
| 55.68 | Bridgeport | Fairfield Ave. Bridge | 1903 |
| 55.70 | Bridgeport | Bridgeport Station | |
| 55.82 | Bridgeport | Poquonnock R. Bridge | 1902 |
| 55.86 | Bridgeport | Viaduct, east bank | 1902 |
| 56.77 | Woodmont | Marsh Hill Bridge | 1894 |
| | Stratford | Stratford Station | |
| 60.44 | Stratford | Housatonic R. Bridge | 1905 |
| 63.55 | Milford | Wepawaug R. Bridge | 1893 |
| | Milford | Milford Station | |
| 71.40 | New Haven | Grant St. Bridge | 1907 |
| 71.90 | New Haven | Circuit breaker gantry & substation | |
| 72.00 | New Haven | New Haven Station | |
| 72.50 | New Haven | Yards and shops | |
| 72.47-72.49 | New Haven | Water St. & Rte. 34 Bridge | |
| 72.63 | New Haven | Crown St. Bridge | |
| 72.71 | New Haven | Chapel St. Bridge | |
| 72.80 | New Haven | Court St. Bridge | |
| 72.94 | New Haven | Grand Ave. Bridge | |
| 73.08 | New Haven | Oliver St. Bridge | |
| 74.18 | New Haven | Blatchley Ave. Bridge | 1887 |
| 74.38 | New Haven | Ferry Street Bridge | 1926 |
| -- | E. New Haven | East New Haven Roundhouse | |
| -- | E. New Haven | Cedar Hill Yards | |
| 74.41 | E. New Haven | last catenary gantry on main line | 1914? |

| | | | |
|---|---|---|---|
| 76.24 | E. New Haven | Clifton St. Bridge | |
| 77.00 | East Haven | East Haven Tunnel | |
| 78.69 | East Haven | Lake Road Bridge | 1888 |
| 87.27 | Leetes Island | Island Creek Bridge | 1891 |
| 89.50 | Guilford | Guilford Station | |
| 93.63 | Madison | Horse Pond Rd. Bridge | 1890 |
| 97.04 | Clinton | Indian River Bridge | 1884 |
| 101.22 | Westbrook | Westbrook River Bridge | 1882 |
| 105.00 | Old Saybrook | Old Saybrook Station | |
| 105.00 | Old Saybrook | Old Saybrook Tower | 1913 |
| 106.89 | Old Lyme | Connecticut R. Bridge | 1907 |
| 109.43 | Blackhall | Slates Crossing Bridge | |
| 113.18 | Lyme | Bridges Brook Bridge | 1890 |
| 116.74 | Waterford | Niantic R. Bridge | 1907 |
| 122.65 | New London | Shaw's Cove Bridge | 1928 |
| 123.00 | New London | New London Station | |
| 123.80 | New London | Central Vermont RR Bridge | 1915 |
| 124.09 | New London | Thames River Bridge | 1919 |
| 124.50 | Groton | Groton Tower | 1919 |
| 124.60 | Groton | Semaphore signal | |
| 132.16 | Mystic | Mystic River Bridge | 1919 |
| 132.25 | Mystic | Mystic Station | |
| 141.35 | Pawcatuck | Pawcatuck R. Bridge | 1909 |

## RHODE ISLAND

| | | | |
|---|---|---|---|
| 141.67 | Westerly | West St. Bridge | 1913 |
| 141.77 | Westerly | High St. Bridge | 1934 |
| 141.44 | Westerly | Station | 1912 |
| 141.44 | Westerly | Canal Street Bridge | 1912 |
| 142.00 | Westerly | Signal Tower | 1912 |
| 147.45 | Burdickville | Pawcatuck R. Bridge | 1906 |
| 149.47 | Alton | Pawcatuck R. Bridge | 1906 |
| 158.20 | West Kingston | Kingston Station | 1875 |

| | | | |
|---|---|---|---|
| 158.40 | West Kingston | Kingston Tower | |
| 171.00 | Warwick | Forge Road Bridge | |
| 171.06 | East Greenwich | Plains Pond Culvert | |
| 171 | East Greenwich | E. Greenwich Station | |
| 172.13 | East Greenwich | King Street Bridge | 1837 |
| 174.54 | Apponaug | Apponaug Cove Bridge | 1905 |
| 179.16 | Cranston | Pawtuxet River Bridge | 1915 |
| 185.34-185.35 | Providence | Gaspee & Francis St. Bridges | 1895 |
| 185.36 | Providence | Providence Station | 1892 |
| 185.46 | Providence | Woonasquatucket R. Bridge | 1895 |
| 185.47 | Providence | Promenade St. Bridge | 1909 |
| 185.48 | Providence | Providence Tower | |
| 185.66 | Providence | Tefft Freight House | 1848 |
| 185.78 | Providence | Smith St. Bridge | 1890 |
| 186.44 | Providence | Charles St. Bridge | 1892 |
| 186.95 | Providence | Branch Ave. Bridge | 1920 |
| 187.25 | Providence | Yards N. of Branch Ave. | |
| 187.60 | Providence | Cemetary Ave. Bridge | |
| 188.91 | Pawtucket | Lonsdale Ave. Bridge | 1908 |
| 189.88 | Pawtucket | Pawtucket Station | |
| 190.40 | Pawtucket | Lawn Tower | |
| 190.49 | Central Falls | High St. Bridge | |
| 190 | Central Falls | Tower | |
| 190.55 | Central Falls | Blackstone R. Bridge | 1897 |

MASSACHUSETTS

| | | | |
|---|---|---|---|
| 192.76 | Hebronville | Seven Mile Run Bridge | 1908 |
| 193.79 | Hebronville | Truss bridge | 1898 |
| 195.55 | Dodgeville | Ten Mile Run Bridge | 1880 |
| 195.58 | Dodgeville | Mill Trailrace Bridge | 1880 |
| 196.59 | Dodgeville | 10 Mile R. Bridge | 1905 |
| 196.36 | Thatcher | Thatcher St. Bridge | 1888 |
| 197.13 | Attleboro | S. Main Street Bridge | 1880 |

| | | | |
|---|---|---|---|
| 197.21 | Attleboro | Mill St. Bridge | 1880 |
| 197.38 | Attleboro | Park St. Bridge | 1905 |
| 197.40 | Attleboro | Attleboro Tower | 1908 |
| 197.40 | Attleboro | Attleboro Station | |
| 197.64 | Attleboro | Peck St. Bridge | 1906 |
| 312.74 | Canton | Canton Viaduct | 1835 |
| 214.22 | Canton | Spaulding St. Bridge | 1888 |
| 214. 22 | Canton | Canton Jct. Station | |
| 214.33 | Canton | Chapman St. Bridge | 1888 |
| 218.57 | Readville | Spraugues Brook Bridge | 1887 |
| 219.41 | Readville | Franklin Branch Bridge | 1898 |
| 219.80 | Readville | Readville Station | |
| 219.80 | Readville | Readville Tower | 1901 |
| 220.14 | Hyde Park | River St. Bridge | 1914 |
| 221.20 | Hyde Park | West St. Bridge | 1886 |
| 223.15 | Mt. Hope | Underpass | 1888 |
| 223.17 | Mt. Hope | Morton St. Bridge | 1895 |
| 223.99 | Mt. Hope | Parkway Bridge | 1895 |
| 224.65 | Forest Hills | Brick arch bridge | 1896 |
| 225.20 | Boylston St. | Brick arch bridge | 1896 |
| 226.15 | Boylston St. | Stony Brook Bridge | 1889 |
| 226.27 | Boston | Tremont St. Bridge | 1896 |
| 226.35 | Boston | Station Bridge | 1896 |
| 226.29 | Boston | Station Bridge | 1896 |
| 226.30 | Boston | Back Bay Station | 1896 |
| 226.65 | Boston | Ruggles St. Bridge | 1896 |
| 227.09 | Boston | Chick Tower | 1911 |
| 227.40 | Boston | Durham St. Bridge | 1882 |
| 229.00 | Boston | South Bay Tower | 1896 |
| 229.50 | Boston | South Station | 1899 |

*Not Final

## Table F-4

## DETERMINATION OF EFFECT ON RAILROAD-RELATED STRUCTURES

| Milepost | Structure | SHPO Determination: No Effect | SHPO Determination: Adverse Effect | SHPO Determination: No Adverse Effect | Advisory Council Concurrence |
|---|---|---|---|---|---|
| | **1977 Amtrak Bridge Improvement Program** | | | | |
| **DISTRICT OF COLUMBIA** | | | | | |
| 132.26 | Stone arch bridge | X | | | |
| **MARYLAND** | | | | | |
| 127.88 | Beaverdam Creek Bridge | X | | | |
| **DELAWARE** | | | | | |
| 36.42 | Ogelton Rd. Bridge | X | | | |
| 27.73 | Wilmington Viaduct | X | | | |
| 27.52 | Wilmington Viaduct | X | | | |
| 26.07 | 8th St. Bridge | X | | | |
| 18.70 | Naaman stone arch bridge | X | | | |
| **PENNSYLVANIA** | | | | | |
| '1.08 | Little Crum Creek Bridge | X | | | |
| .73 | Muckinipattis Creek Bridge | X | | | |
| 74.20 | Poquessing Creek Bridge | | | | |
| 58.11 | Tunnel | X | | | |
| 57.75 | Delaware River Bridge | X | | | |
| **NEW JERSEY** | | | | | |
| 57.61 | Bloomsbury St. Bridge | X | | | |
| 55.61 | Assunpink Creek Bridge | X | | | |
| 46.47 | Swinger Race Bridge | X | | | |
| 32.61 | One Mile Run Bridge | X | | | |
| 31.36 | Easton Ave. Bridge | X | | | |
| 31.12 | Nellson St. Bridge | X | | | |
| 31.08 | Viaduct | X | | | |
| 31.03 | Water St. Bridge | X | | | |
| 31.02 | River Rd. Bridge | X | | | |

Table F-4 (Continued)

| Milepost | Structure | SHPO Determination: No Effect | SHPO Determination: Adverse Effect | SHPO Determination: No Adverse Effect | Advisory Council Concurrence |
|---|---|---|---|---|---|
| 31.01 | D&R Canal | X | | | |
| 30.92 | Raritan River Bridge | X | | | |
| 30.80 | Bound Brook Bridge | X | | | |
| 24.08 | Evergreen Ave. Bridge | X | | | |
| MASSACHUSETTS | | | | | |
| 197.21 | Mill St. Bridge | X | | | |
| 197.13 | So. Main St. Bridge | X | | | |
| 192.76 | Seven Mile River Bridge | X | | | |
| 200.66 | Wading River Bridge | X | | | |
| 223.97 | Morton St. Bridge | X | | | |
| 223.99 | Parkway | X | | | |
| | 1978 Amtrak Bridge Improvement Program | | | | |
| MARYLAND | | | | | |
| 43.33 | Cow Run No. 1 | X | | | |
| 48.15 | Polecat Run Bridge | X | | | |
| 51.03 | Northeast Creek Bridge | X | | | |
| 52.64 | Pedlers Run Bridge | X | | | |
| 52.96 | Broad Creek Bridge | X | | | |
| 59.00 | Mill Creek Bridge | X | | | |
| 59.39 | Stauton Arch Bridge | X | | | |
| 63.97 | Swan Creek Bridge | X | | | |
| 95.95 | Jones Falls Bridge | X | | | |
| 100.33 | Maiden Choice Run Bridge | X | | | |
| 112.17 | Severn Run Bridge | X | | | |
| DELAWARE | | | | | |
| 18.62 | Naaman Creek Bridge | X | | | |
| 27.64 | Beech St. Bridge | | | X | X |
| PENNSYLVANIA | | | | | |
| 87.14 | Schuylkill River Bridge | X | | | |
| 86.98 | Reading RR Bridge | X | | | |

Table F-4 (Continued)

| Milepost | Structure | SHPO Determination: No Effect | SHPO Determination: Adverse Effect | SHPO Determination: No Adverse Effect | Advisory Council Concurrence |
|---|---|---|---|---|---|
| 70.69 | Neshaminy Creek Bridge | X | | | |
| 62.59 | Belsford Run Bridge | X | | | |
| 10.05 | Stone Creek | X | | | |
| 11.69 | B&O RR Bridge | X | | | |
| 11.70 | Crum Creek Bridge | X | | | |
| 16.49 | Marcus Hook Bridge | X | | | |
| NEW JERSEY | | | | | |
| 13.90 | Chestnut St. Bridge | X | | | |
| 13.83 | Magnolia St. Bridge | X | | | |
| NEW YORK | | | | | |
| 5.60 | 49th St. Bridge | X | | | |
| 5.66 | 48th St. Bridge | X | | | |
| 5.78 | 46th St. Bridge | X | | | |
| 5.83 | 45th St. Bridge | X | | | |
| [illegible].21 | 37th St. Bridge | X | | | |
| 6.26 | 36th St. Bridge | X | | | |
| 6.45 | 31st St. Bridge | X | | | |
| 15.69 | Hutchinson River Bridge | X | | | |
| CONNECTICUT | | | | | |
| 97.04 | Indian River Bridge | X | | | |
| RHODE ISLAND | | | | | |
| 188.27 | Moshassuck River Bridge | X | | | |
| 172.74 | Arch Rd. Bridge | X | | | |
| 171.06 | Pain's Pond Bridge | X | | | |
| 159.37 | Hundred Acre Pond | X | | | |
| MASSACHUSETTS | | | | | |
| 224.94 | Lawnsdale Ave. Bridge | X | | | |
| 223.89 | Station Subway Bridge | X | | | |

Table F-4 (Continued)

| Milepost | Structure | SHPO Determination: No Effect | SHPO Determination: Adverse Effect | SHPO Determination: No Adverse Effect | Advisory Council Concurrence |
|---|---|---|---|---|---|
| 197.64 | Peck St. Bridge | X | | | |
| 197.19 | Park St. Bridge | X | | | |
| 197.19 | Station Subway Bridge | X | | | |
| 196.59 | Ten Mile River Bridge | X | | | |
| 195.58 | Ten Mile River Bridge | X | | | |
| 195.55 | Canal Bridge | X | | | |

| Structure | Action | No Effect | Adverse Effect | No Adverse Effect | Advisory Council Concurrence |
|---|---|---|---|---|---|
| Hell Gate Bridge | Anti-Climb Barriers | | | X | X |
| Pelham Bay Bridge | New Operator's House | X | | | |
| Baltimore Station | Interim Concourse Cooling System | | | X | X |
| | Platform Painting | X | | | |
| Wilmington Station | Roof Replacement and Repair | | | X | X |
| MP 58.8-62.0, PA | Rehabilitation of Access Roads | X | | | |
| Philadelphia 30th Street Station | HVAC Installation | X | | | |
| | Roof Repair | X | | | |
| | Emergency Lighting | X | | | |
| | Chandelier Renovation | X | | | |
| Newark Station | Work Program | | | X | X |
| | Escalator Replacement | X | | | |
| New Haven Station | Work Program | | | X | X |

TABLE F-5

ANALYSIS OF PROGRAMMATIC EFFECT ON HISTORIC SITES AND DISTRICTS

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| **DISTRICT OF COLUMBIA** | | | | | |
| City Post Office | | X | | | |
| National Arboretum | | X | | | |
| Kenilworth Gardens | X | | | | |
| United Clay Products Brickyard | X | | | | |
| **MARYLAND** | | | | | |
| *Lanham/Seabrook* | | | | | |
| Lanham Mansion | | X | | | |
| Henry King House | | X | | | |
| Residence, Dubarry Ave. | | X | | | |
| Lincoln Station | | X | | | |
| St. Georges Chapel | | X | | | |
| *Baltimore* | | | | | |
| Bolton Hill Historic District | | X | | | |
| *Aberdeen* | | | | | |
| Poplar Hill | | X | | | |
| *Perryville* | | | | | |
| Rogers Tavern | | X | | | |
| *Charlestown* | | | | | |
| Charlestown Historic District | | X | | | |
| **DELAWARE** | | | | | |
| *Stanton* | | | | | |
| Hale-Byrnes House | | X | | X | |
| *Newport* | | | | | |
| Galloway House | | X | | X | |
| Stidham House | X | | | | |

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| Residence, Market St. | | X | | X | |
| Banning Park & Woodstock House | | X | | X | |
| Newport National Bank | | X | | X | |
| Residence, Ayre St. | | X | | X | |
| Wilmington | | | | | |
| Thomas Mendenhall House | | X | | X | |
| Old Asbury ME Church | | X | | X | |
| Friends Meeting House | X | | | | |
| Old Swedes Church | | | X | X | |
| Fort Christina Monument | | X | | X | |
| So. Market St. Bridge | | X | | X | |
| Third St. Bridge | | X | | X | |
| Claymont | | | | | |
| Robinson House | | X | | X | |
| PENNSYLVANIA | | | | | |
| Marcus Hook | | | | | |
| Marcus Hook Historic District | | X | | | |
| Chester | | | | | |
| Chester Courthouse | | X | | X | |
| Madison St. Methodist Church | | X | | X | |
| Ridley Park | | | | | |
| Christ Church | | X | | X | |
| Philadelphia | | | | | |
| Solitude | X | | | | |
| Letitia House | | X | | X | |
| Fairmount Park Historic District | | X | | | |
| Girard Ave. Bridge | X | | | | |
| Morrisville | | | | | |
| Delaware Div. of Penn. Canal | | X | | X | |
| Morrisville Phoenix Bridge | X | | | | |
| Residence | | X | | X | |

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| NEW JERSEY | | | | | |
| Trenton | | | | | |
| Old Eagle Tavern | | X | | X | |
| New Brunswick | | | | | |
| Old Queens Bldg. | | X | | X | |
| Queens Campus Historic District | | X | | | |
| New Jersey Hall | | X | | X | |
| Rutgers Prep School | | X | | X | |
| Henry Guest House | X | | | | |
| Metuchen | | | | | |
| Old Presbyterian Cemetery | | X | | X | |
| Presbyterian Church | | X | | X | |
| Daniels House | | X | | X | |
| Shoemakers House | | X | | X | |
| John Hampton House | | X | | X | |
| Rev. T. Bradford House | | X | | X | |
| Cartwright House | | X | | X | |
| Residence, Amboy Ave. | | X | | X | |
| Former Borough Hall | | X | | X | |
| Old Hannemans Bakery | | X | | X | |
| Old Cromwell's Livery | | X | | X | |
| Eagle Hook & Ladder | | X | | X | |
| Old High School Annex | | X | | X | |
| Ayres House | | X | | X | |
| Van Sicle House | | X | | X | |
| Fox House | | X | | X | |
| Elizabeth | | | | | |
| Old First Presbyterian Church | | X | | X | |
| Newark | | | | | |
| Murphy Varnish Complex | | X | | X | |
| Central Graphics Bldg. | | X | | X | |

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| **New York** | | | | | |
| Church of the Transfiguration | X | | | | |
| Pierpont Morgan Library | X | | | | |
| U.S. General P.O. | | X | | | |
| Sniffen Court Historic District | | X | | | |
| Hunters Point Historic District | | X | | | |
| **CONNECTICUT** | | | | | |
| **Greenwich** | | | | | |
| Justus Bush House | X | | | | |
| Bruce Museum | X | | | | |
| Doran Storehouse | X | | | | |
| Davis Benson House | X | | | | |
| Clark House | | X | | | |
| Atwater House | | X | | | |
| Atwater House | | X | | | |
| John Lockwood House | | X | | | |
| Deacon Ferris House | | X | | | |
| Cos Cob Historic District | | X | | | |
| **Norwalk** | | | | | |
| Firehouse | | X | | | |
| E. Norwalk Historical Cemetery | | X | | | |
| E. Ave. United Methodist Church | | X | | | |
| Washington St. Cluster | | | X | X | |
| S. Main St. Cluster | | | X | X | |
| 8 Haviland St. House | X | | | | |
| 10 Haviland St. House | X | | | | |
| 12 Haviland St. House | X | | | | |
| Norwalk Lock Co. | | X | | | |
| **Bridgeport** | | | | | |
| Barnum Institute of Science & History | | X | | X | |
| Washington Park Historic District | | X | | | |

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| **Fairfield** | | | | | |
| Southport Historic District | | X | | | |
| Fairfield Historic District | | X | | | |
| **Stratford** | | | | | |
| Sterling Homestead | | X | | X | |
| **Milford** | | | | | |
| Federal Style House | | X | | X | |
| Taylor Library | | X | | X | |
| **West Haven** | | | | | |
| Ward Heitman House | X | | | | |
| **New Haven** | | | | | |
| Timothy Bishop House | | X | | X | |
| John Cook House | | X | | X | |
| Eli Whitney House | | X | | X | |
| Trinity Lutheran Church | | X | | X | |
| Lafayette B. Mendel House | | X | | X | |
| Wooster Square Historic District | | X | | | |
| New Haven Green Historic District | | X | | | |
| **East Haven** | | | | | |
| 50 High St. House | | X | | X | |
| Hubbard Scranton House | | X | | X | |
| 193 N. High St. House | | X | | X | |
| **Branford** | | | | | |
| Cape Cod Residence | | X | | X | |
| Thomas Harrison House | | X | | X | |
| John Rose House | | X | | X | |
| Timothy Bradley House | | X | | X | |
| Howd Homestead | | X | | | |
| Abraham Rogers House | X | | | | |

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| Guilford | | | | | |
| Leete Homestead | | | X | | * |
| Peletiah Leete III | | X | | | * |
| 588 Leetes Island Rd. | | X | | | * |
| Cemetery | X | | | | |
| Simeon Leetes Grave | X | | | | |
| Guilford Town Center | | X | | | * |
| Meyers House | | X | | X | |
| Old Quarry Rd. House | | X | | | * |
| Clinton | | | | | |
| 1765 House | X | | | | |
| Eben Merrill House | X | | | | |
| Capt. Elisha White House | X | | | | |
| Wright House | X | | | | |
| 1800 House | | X | | X | |
| "Early Settler" | | X | | X | |
| Early 18 C. House | | X | | X | |
| Stanton House | | X | | X | |
| Town Hall | | X | | X | |
| Westbrook | | | | | |
| Post Family House | | X | | X | |
| Willard Ave. Residence | | X | | X | |
| Philip Kirtland House | | X | | | * |
| Jonathan Lay House | | X | | | * |
| Lay House | | X | | | * |
| Early 18 C. House | | X | | | * |
| Greek Revival House | | X | | | * |
| Jeremiah Lay House | | X | | X | |
| Dee House | | X | | X | |
| Marks Dee House | | X | | X | |
| John Murdock House | | X | | X | |
| Elijah Dee House | | X | | X | |
| 1775 House | | X | | | * |

*Discussions underway to mitigate potential adverse effect of catenary pole placement

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| Old Saybrook | | | | | |
| Samuel Jones House | | X | | | |
| Edward Sanford House | X | | | | |
| Coulter House | X | | | | |
| Old Lyme | | | | | |
| Enoch Noyes House | | X | | | * |
| Rueben Champion House | | X | | | * |
| Old Lyme Historic District | | X | | | |
| New London | | | | | |
| New London Custom House | | X | | X | |
| Shaw Mansion | | X | | | |
| Antientest Buriel Ground | X | | | | |
| Bulkely School | X | | | | |
| First Church of Christ | X | | | | |
| St. James Episcopal Church | X | | | | |
| Whale Oil Row Historic District | | X | | | |
| Groton | | | | | |
| Groton Bank Historic District | | X | | | |
| Stonington | | | | | |
| Mystic Bridge Historic District | | X | | | * |
| Mystic | | | | | |
| Mystic Historic District | | X | | | * |
| RHODE ISLAND | | | | | |
| Westerly | | | | | |
| Westerly Armory | | X | | X | |
| Greek Revival House | | X | | X | |
| Early 20th C. House | X | | | | |
| Early 19th C. House | | | X | | * |
| Richmond | | | | | |
| Columbia Heights | | | | | |
| Former School | | | | | |
| Carr Farm | | | | | |

*Discussions underway to mitigate potential adverse effect of catenary pole placement

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| **South Kingston** | | | | | |
| Kenyon Homestead | | X | | | * |
| Oliver Watson House | | X | | X | |
| **Exeter/Slocum** | | | | | |
| Yawgoo Mill | | X | | | * |
| Greek Revival House | | X | | X | |
| **North Kingston** | | | | | |
| Lawton House | | X | | | * |
| Late 19th C. House | | X | | X | |
| **East Greenwich** | | | | | |
| Elizabeth Spring | | | | | * |
| **Warwick** | | | | | |
| B. R. Vaughn House | | X | | X | |
| Capt. Oliver Gardiner House | | X | | X | |
| House | | X | | | * |
| Arthur B. Lisle Estate | | X | | | * |
| House | | X | | | * |
| House | | X | | X | |
| House | | X | | | * |
| House | | X | | | * |
| Sprague Estate Gateway | | X | | X | |
| **Apponaug** | | | | | |
| House | | X | | X | |
| House | | X | | X | |
| House | X | | | | |
| House | X | | | | |
| **Greenwood** | | | | | |
| Greenwood Inn | | X | | X | |
| Pontiac RR Station | | X | | X | |
| Elizabeth Mill | | X | | X | |
| Mill Housing | | X | | X | |

*Discussions underway to mitigate potential adverse effect of catenary pole placement

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| Norwood | | | | | |
| H.C. Budlong House | | X | | X | |
| Cranston | | | | | |
| Torino Creations | | X | | X | |
| Peoples Baptist Church | X | | | | |
| St. Matthew's Church | X | | | | |
| General Electric Co. | | X | | X | |
| Narragansett Brewery | X | | | | |
| Former Trolley Barn | | X | | X | |
| Providence | | | | | |
| Gorham Manufacturing | | X | | X | |
| Elmwood Station | | X | | X | |
| Howe-Metcalf House | | X | | X | |
| Emma Babcock House | | X | | X | |
| House | X | | | | |
| Thomas Reynolds House | X | | | | |
| House | X | | | | |
| House | X | | | | |
| Charles B. Hancock | X | | | | |
| A.E. Remington House | X | | | | |
| William H. Perry House | X | | | | |
| Gustav Mensing House | X | | | | |
| Samuel A. Otis House | | X | | | |
| House | | X | | | |
| House | | X | | | |
| House | | X | | | |
| House | | X | | | |
| John Howe House | | X | | | |
| House | | X | | | |
| Edwin O. Chase House | | X | | | |
| House | | X | | | |
| George P. Hussey House | | X | | | |
| George Wilkinson House | | X | | | |

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| Union RR Company | | X | | X | |
| Caleb Barnum House | X | | | | |
| Edmund D. Cheesboro | X | | | | |
| W.S. Hoyt House | X | | | | |
| House | | X | | X | |
| House | | X | | X | |
| Vineyard St. School | X | | | | |
| J. & T. Hope Company | | X | | X | |
| House | | X | | X | |
| House | | X | | X | |
| House | | X | | X | |
| House | | X | | X | |
| Houses | X | | | | |
| Church of the Epiphany | X | | | | |
| Thomas Hope House | X | | | | |
| James M. Johnson House | X | | | | |
| Humes Block | | X | | X | |
| William H. Mairs House | X | | | | |
| Commercial Block | | X | | X | |
| Henry A. Potter House | X | | | | |
| Greek Revival House | X | | | | |
| Concrete Storage Elev. | | X | | X | |
| Church of the Messiah | | X | | X | |
| Church of the Master | | X | | X | |
| Weybossett Mills | | X | | X | |
| Ross Mill | | X | | X | |
| House | | X | | X | |
| Providence Dyeing & Bleaching Co. | | X | | X | |
| Nicholson File Co. | | X | | X | |
| City Machine Company | | X | | X | |
| Merchants Cold Storage | | X | | X | |

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| Univ. of Rhode Island Extensive Building | | | X | | * |
| Fire Alarm Signal Bldg. | | | X | | * |
| Blackstone Canal | | | X | | * |
| Kennedy Exchange Plaza | | X | | X | |
| Roger Williams Memorial | | | X | | * |
| Rhode Island State House | | X | | X | |
| State Office Building | | X | | X | |
| St. Patrick's Church | | X | | X | |
| U.S. Post Office | | X | | X | |
| Oriental Cotton Mills | X | | | | |
| Silver Spring Bleaching and Dyeing Co. | | X | | X | |
| Providence Tool Co. | | X | | X | |
| Pawtucket | | | | | |
| American Textile Co. | X | | | | |
| Hope Webbing Co. | X | | | | |
| House | X | | | | |
| Gasoline Station | X | | | | |
| House | X | | | | |
| Conant Thread Company | | X | | X | |
| House | | X | | X | |
| Mineral Spring Cemetery | | X | | X | |
| Campbell Machine Co. | X | | | | |
| Freight Station | | X | | X | |
| Union Wadding Company | | X | | X | |
| Modern Diner | X | | | | |
| Leroy Theater | X | | | | |
| Fanning Building | | X | | X | |
| Former Universalist | X | | | | |
| House | X | | | | |
| House | X | | | | |
| House | X | | | | |
| House | | X | | X | |

*Discussions underway to mitigate potential adverse effect of catenary pole placement

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| House | X | | | | |
| House | X | | | | |
| House | | X | | X | |
| Pumping Stations | | X | | X | |
| **Central Falls** | | | | | |
| Stearnes House | X | | | | |
| Beede House | | X | | X | |
| Moies House | | X | | X | |
| Stetson House | X | | | | |
| Norton House | | X | | X | |
| Flagg House | | X | | X | |
| Greene House | | X | | X | |
| Triple-Decker | | X | | X | |
| Mill House | | X | | X | |
| Daniels House | X | | | | |
| Cobb House | | X | | X | |
| Rice House | | X | | X | |
| Wood House | | X | | X | |
| Grant House | | X | | X | |
| Crocker House | | X | | X | |
| Triple-Decker | X | | | | |
| Dennis House | | X | | X | |
| Linnell House | X | | | | |
| Lincoln Town Hall | | X | | X | |
| Stafford House | | X | | X | |
| Central Falls Congregational Church | | X | | X | |
| Church of St. Joseph | | X | | X | |
| McCartney House | | X | | X | |
| Fales House | | X | | X | |
| Grant House | | X | | X | |

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| Broad Street School | | X | | X | |
| Daniels House | | X | | X | |
| Police Station | | X | | X | |
| Fire Station | | X | | X | |
| Central Falls City Hall | | X | | X | |
| Falcon House | | X | | X | |
| Jenks Park/Cogswell Tower | | X | | X | |
| Notre Dame | | X | | X | |
| DeNevers Building | | X | | X | |
| Cartier Building | | X | | X | |
| Blackstone Veterans Memorial | X | | | | |
| Murdock-Webbing Co. | | X | | X | |
| **MASSACHUSETTS** | | | | | |
| **Hebronville** | | | | | |
| Hebronville Methodist Church | | X | | X | |
| **Attleboro** | | | | | |
| E. Attleboro Academy | | X | | X | |
| Dodgeville Mill Area | | X | | X | |
| **Foxborough** | | | | | |
| Pratt Mansion House | | X | | X | |
| 19th Century House | | X | | | |
| **Sharon** | | | | | |
| The Homestead | X | | | | |
| The Savels House | X | | | | |
| Darius Lothrup House | X | | | | |
| Sharon Historic District | * | X | | | |
| **Canton** | | | | | |
| Neponset Cotton Mill District | * | X | | | |

*Discussions underway to mitigate potential adverse effect of catenary pole placement

| Site | No Effect | Construction Effect | Construction Adverse | Operation Effect | Operation Adverse |
|---|---|---|---|---|---|
| **Boston** | | | | | |
| Boston Public Library | X | | | | |
| Dudley Mansion | | X | | | * |
| Old Police Station #10 | | X | | | * |
| Cahners Building | | X | | X | |
| Youth's Companion Bldg. | | X | | X | |
| Armory of the First Corps of Cadets | | X | | X | |
| Forest Hills cemetery | * | X | | | |
| Arnold Arboretum | * | X | | | |
| Olmstead Park System/ Franklin Park | * | X | | | |
| Roxbury Highlands Area | * | X | | | |
| John Eliot Square District | * | X | | | |
| South End District | * | X | | | |
| St. Botolph Street Area | * | X | | | |
| Ellis St. Historic District | | | | | |
| Bay Village Area | * | X | | | |
| Back Bay Historic District | * | X | | | |
| Boston Commons & Public Gardens | * | X | | | |

*Discussions underway to mitigate potential adverse effect of catenary pole placement

Table F-6

NEC STRUCTURES DETERMINED ELIGIBLE
FOR THE NATIONAL REGISTER

| Name | Location |
|---|---|
| Bush River Bridges | Bush River, Cecil County, Maryland |
| Susquehanna River Bridge | Havre de Grace, Cecil County, Maryland |
| 30th Street Station | Philadelphia, Pennsylvania |
| Newark Station | Newark, New Jersey |
| Portal Bridge | Hackensack River, Kearny, New Jersey |
| Passaic River Bridge | Passaic River, Newark, New Jersey |
| Hell Gate Bridge and Approaches | Bronx, New York and Queens Counties, New York |
| Pelham Bay Bridge | Pelham Bay, Bronx, New York |
| Cos Cob Bridge | Mianus River, Cos Cob, Connecticut |
| Devon Bridge | Housatonic River, Devon, Connecticut |
| Pequonnock Bridge | Pequonnock River, Bridgeport, Connecticut |
| Norwalk River Bridge | South Norwalk, Connecticut |
| Saugatuck River Bridge | Westport, Connecticut |
| Connecticut River Bridge | Old Saybrook, Connecticut |
| Niantic River Bridge | East Lyme, Connecticut |
| Groton Bridge | Thames River, Groton, Connecticut |
| Mystic River Bridge | Mystic, Connecticut |
| Shaw's Cove Bridge | New London, Connecticut |
| Woonasquatucket Bridge | Providence, Rhode Island |

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