WASHINGTON
UNION STATION
STATION EXPANSION

Supplemental Draft Environmental Impact Statement

Appendix S2

Description of Alternative F

U.S. Department of Transportation
Federal Railroad Administration

May 2023

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Acronyms and Abbreviations

Amtrak	National Railroad Passenger Corporation
DDOT	District Department of Transportation
DEIS	Draft Environmental Impact Statement
EV	Electric Vehicle
FRA	Federal Railroad Administration
MARC	Maryland Area Regional Commuter
REA	Railway Express Agency
SOE	Support of Excavation
VRE	Virginia Railway Express
WUS	Washington Union Station

Appendix S2 presents more detailed descriptions of the major components and features of Alternative F to supplement the summary in **Chapter 3**, **Section 3.3**, *Description of Alternative F*.

S.1 Tracks and Platforms/Rail Support Function

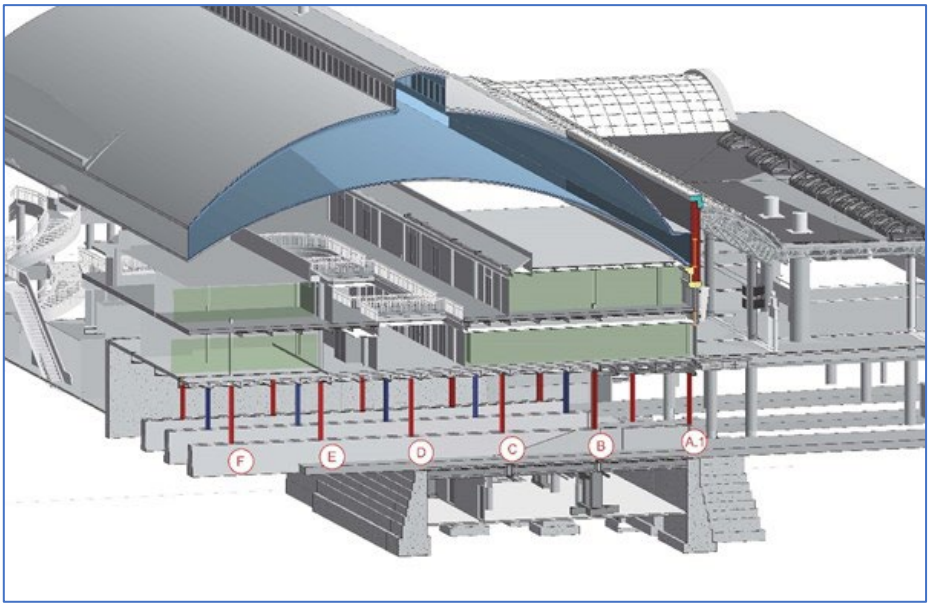
Alternative F would replace the existing tracks with 19 new tracks: 12 stub-end tracks on the west side and seven run-through tracks on the east side. There would be 10 new platforms. The Central Concourse (see **Section S.3***, Concourses and Retail,* below) would separate the stub-end tracks and platforms from the run-through tracks and platforms. The stub-end platforms would be at the same elevation as Concourse A,[1] allowing direct access for passengers coming in through the southern end of the station. The run-through platforms would be at a lower elevation. Passengers would reach them via vertical circulation elements (such as stairs, escalators, or elevators). Vertical circulation elements in the middle of all the platforms would bring passengers down to the H Street Concourse. The tracks and platforms would be open on both the east and west sides of the rail terminal to let light and air in.

The run-through tracks pass through the First Street Tunnel underneath the east side of the historic station building as they converge toward the two-track portion of the tunnel via Interlocking A. Construction of the new tracks and platforms would require reconfiguring Interlocking A and realigning the tracks. To accomplish this, 18 of the 28 building-supporting columns that currently extend from the track bed to the floor of the Retail and Ticketing Concourse would have to be removed.

From north to south, the existing columns are arrayed in one east-west line of three columns (Column Line A.1) and five east-west lines of five columns (Column Lines B through F). The track bed in the portion of the tunnel between Columns Lines A.1 through D rests on a structure—the Subbasement Structure—that spans a lower-level space—the Subbasement Area—presently housing electrical substations and utility conduits (see **Figure S-1**).[2]

[1] Concourse A generally is encompassed within the train hall, adjacent to, but distinct from, the historic Retail and Ticketing Concourse.
[2] The condition of the Subbasement Structure has deteriorated over time. It is slated for replacement as part of a separate and independent project that would be completed before work on the tracks and platforms starts.

Figure S-1. Model Showing Subbasement and Columns to be Removed



Source: Amtrak. May 10, 2019. *Project Definition Report. Washington Union Station Subbasement Structural Replacement Project*.

Column removal would require installing temporary shoring towers and foundations[3]; potentially demolishing the Retail and Ticketing Concourse floor as well as the retail shops above the tunnel; potentially removing the historic terracotta and concrete floor structure and installing new transfer girders; removing three of the five columns in Column Lines B through F; strengthening some of the remaining ten columns; reconstructing crash walls between the tracks; and replacing the three columns of Column Line A.1 with two new columns. Column Line A.1 supports the barrel vault roof of the Retail and Ticketing Concourse and the heaviest loads. Like the existing columns, the two new columns in Line A.1 would rest on the northern abutment of the Subbasement Structure.

The construction of temporary shoring towers on Column Lines E and F, which are not above the Subbasement Area, would potentially require the installation of foundations. Column removal would also likely require replacing a portion of the First Street tunnel's existing east wall. In its current condition, this brick masonry wall may not be able to adequately support future transferred loads. If this is confirmed, it would likely be reconstructed as a concrete wall (like the existing west tunnel wall) or steel support system with adequate load-bearing capacity.

Alternative F would place rail support spaces primarily north of the H Street Concourse, on the lower concourse level and just below existing street grade. Rail support would have access to the tracks and platforms via dedicated service elevators without having to cross any tracks and with minimal disruption to passengers. This would also support more efficient train servicing and, therefore, shorter dwell times.[4]

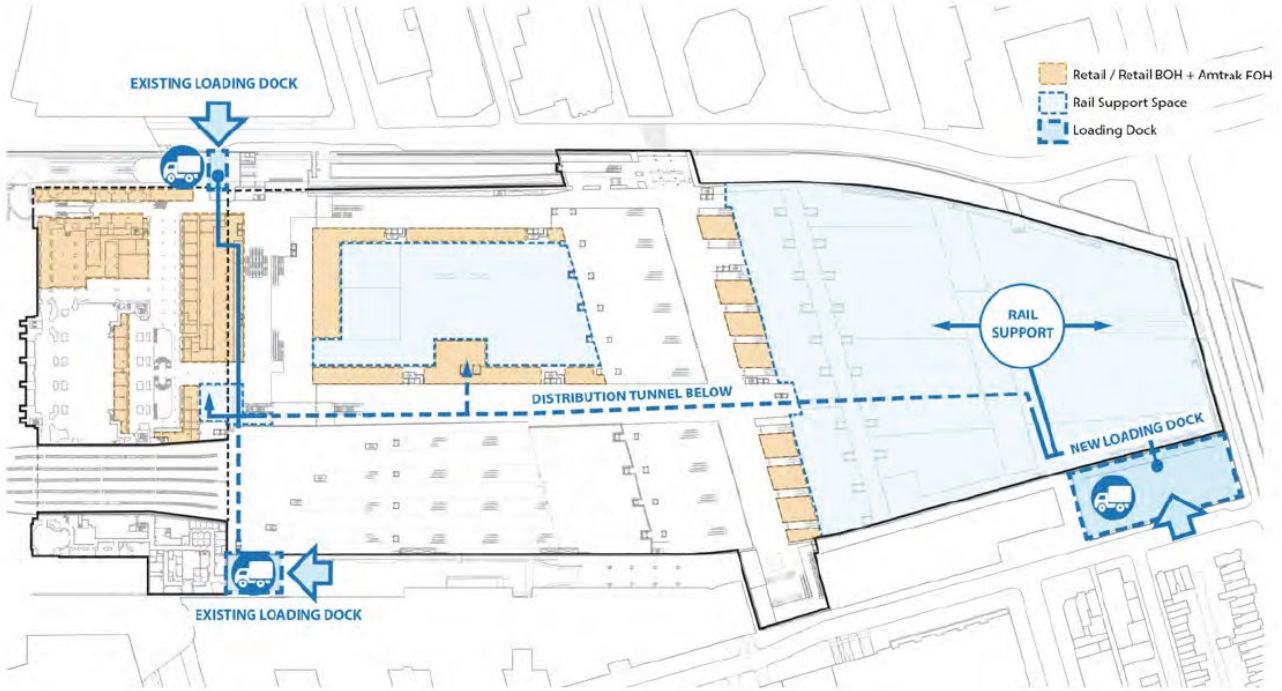
[3] Depending on how design progresses, some foundations may be left permanently in place.
[4] Dwell time is the time that trains sit at platforms during loading and unloading operations.

Amtrak would use the dedicated service elevators for train servicing, baggage movement to trains, and commissary support.

S.2 Loading

In Alternative F, the two existing Washington Union Station (WUS) loading docks would continue to support the unloading and distribution of goods at the station. On First Street NE, in the section that would become one-way north (See **Section S.8**, *Pedestrian and Bicycle Access*), a pull-out lane by the U.S Post Office Building across the street from the First Street loading dock would facilitate turns into the dock. Additionally, a new loading dock would be provided on Second Street NE, adjacent to the Railway Express Agency (REA) building (see **Figure S-2**).[5] Users of the new loading dock, which would have 6 berths and 2 trash compactors, may include new retail and Amtrak's back of house activities.[6] A new service building would be constructed above the new loading dock. The height of this structure would approximately align with the cornice line of the REA Building and would occupy the area of the current substation (which would be removed under a separate and independent project).

Figure S-2. Location of Existing and New Loading Facilities



[5] The Amtrak-owned REA Building is located just west of Second Street NE and north of the H Street Bridge.
[6] "Back of house activities" include the servicing of trains, the storage of equipment for maintenance and operations, and the provision of operational space for staff.

S.3 Concourses and Retail

Several new concourses would facilitate public access to, and circulation through, WUS. The concourses would connect the various transportation modes serving the station, including the train platforms, the bus facility, the Metrorail station, and the DC Streetcar. Additionally, the concourses would offer various services and amenities, such as information, ticketing, and baggage services. Waiting areas would provide secure and organized access to the platforms. Retail would be available for passengers and visitors circulating through the station. **Figure S-3** and **Figure S-4** show the proposed concourses. Brief descriptions follow:

- **Concourse A:** This east-west concourse, which would replace the Claytor Concourse and be integrated with the train hall, would connect directly to the existing Retail and Ticketing Concourse and the stub-end platforms as well as to the Metrorail station. The concourse would have room for passenger amenities, including waiting areas and retail. It would also provide access to the other concourses via vertical circulation elements.
- **Central Concourse:** This north-south concourse would connect Concourse A and the train hall to the H Street Concourse. It would have new retail uses for passengers and visitors.
- **H Street Concourse:** This east-west concourse would run below H Street NE and provide access to the train platforms. Passenger amenities and services would include information, police station, ticketing, baggage services, and retail. New waiting areas would facilitate movements up the escalators or elevators connecting to the platforms. The concourse would also connect the neighborhoods east and west of WUS with entrances at First Street NE and Second Street NE. Vertical circulation elements would bring people up to H Street NE, providing a transfer point to the DC Streetcar and other transit on H Street.
- **First Street Concourse**: This north-south concourse would run parallel to First Street NE and connect the H Street Concourse to Concourse A and the Metrorail station. Retail would be available along the concourse.

Figure S-3. New Concourses in Alternative F – Upper Level

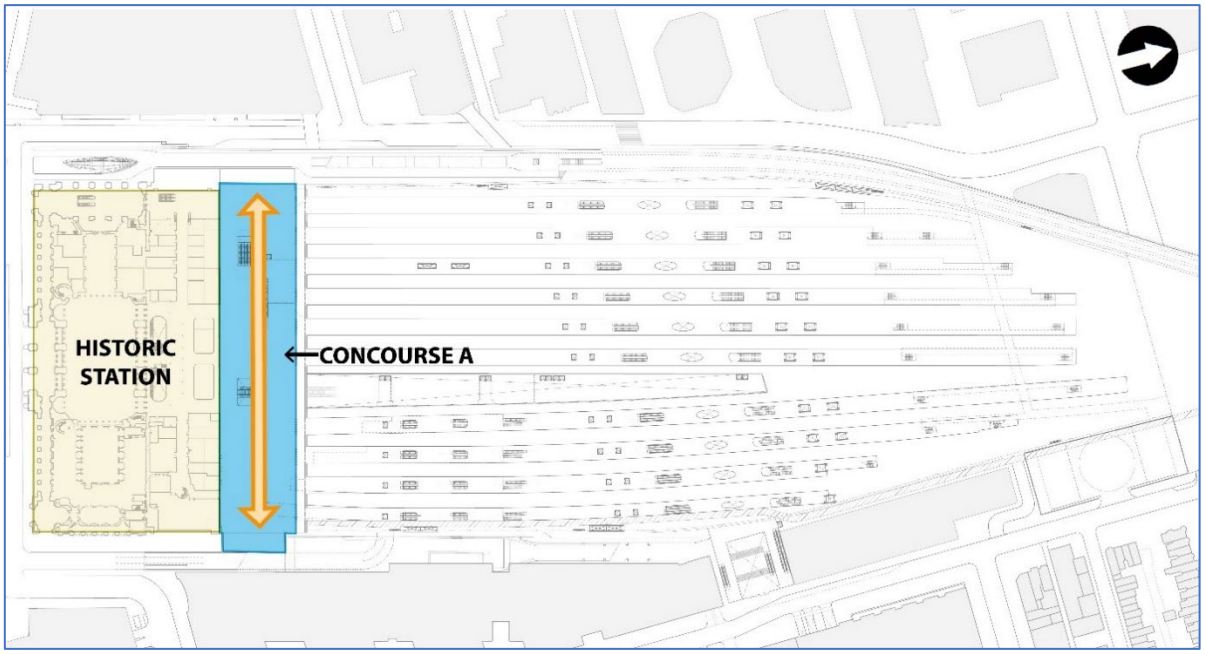
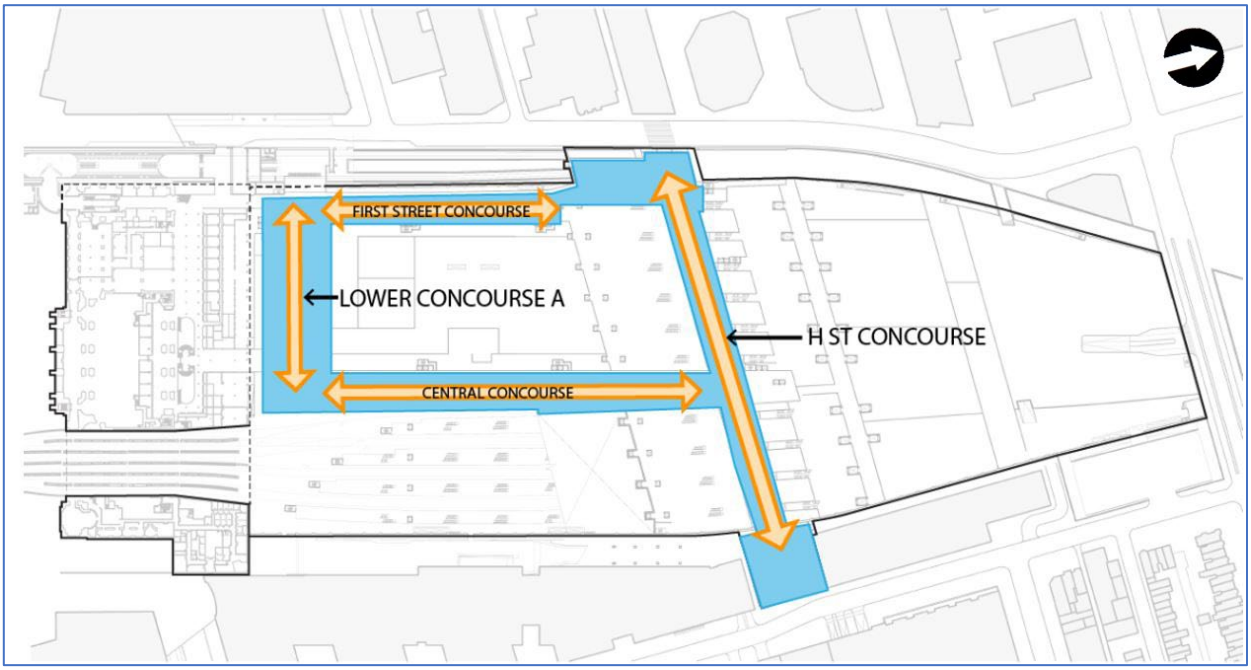


Figure S-4. New Concourses in Alternative F – Lower Level



S.4 Train Hall

In Alternative F, an east-west train hall would encompass Concourse A and part of the southern end of the tracks and platforms, including the area currently occupied by the Claytor Concourse. To the south, it would

open onto the historic station building. A vertical glazed wall would separate the platforms from the train hall, which would be sealed and ventilated. Although the design of the train hall is in development, it is anticipated that it would not duplicate the form, material, or architectural features of the historic station to avoid compromising or competing with it. **Figure S-5** shows a conceptual rendering of the train hall's interior.

The train hall would be approximately 55 feet above H Street NE, and about 40 feet lower than the vaulted roof of the historic station. As illustrated in **Figure S-5**, the train hall would have three levels of passenger circulation: the ground level (Concourse A) would connect directly to the historic station building to the south and to the stub-end track platforms to the north. This level would provide access to the lower concourses and the run-through tracks and platforms via vertical circulation elements. Overhead, the lower mezzanine level would provide access to, and passenger facilities for, the bus facility. Finally, above the lower mezzanine, the upper mezzanine level would open onto the deck and the deck-level pick-up and drop-off area. Entrances to the train hall would be located on its east and west sides.

Figure S-5. Conceptual Rendering of Train Hall Interior in Alternative F (Looking Northwest)

S.5 H Street Bridge Intersections and Deck-Level Circulation

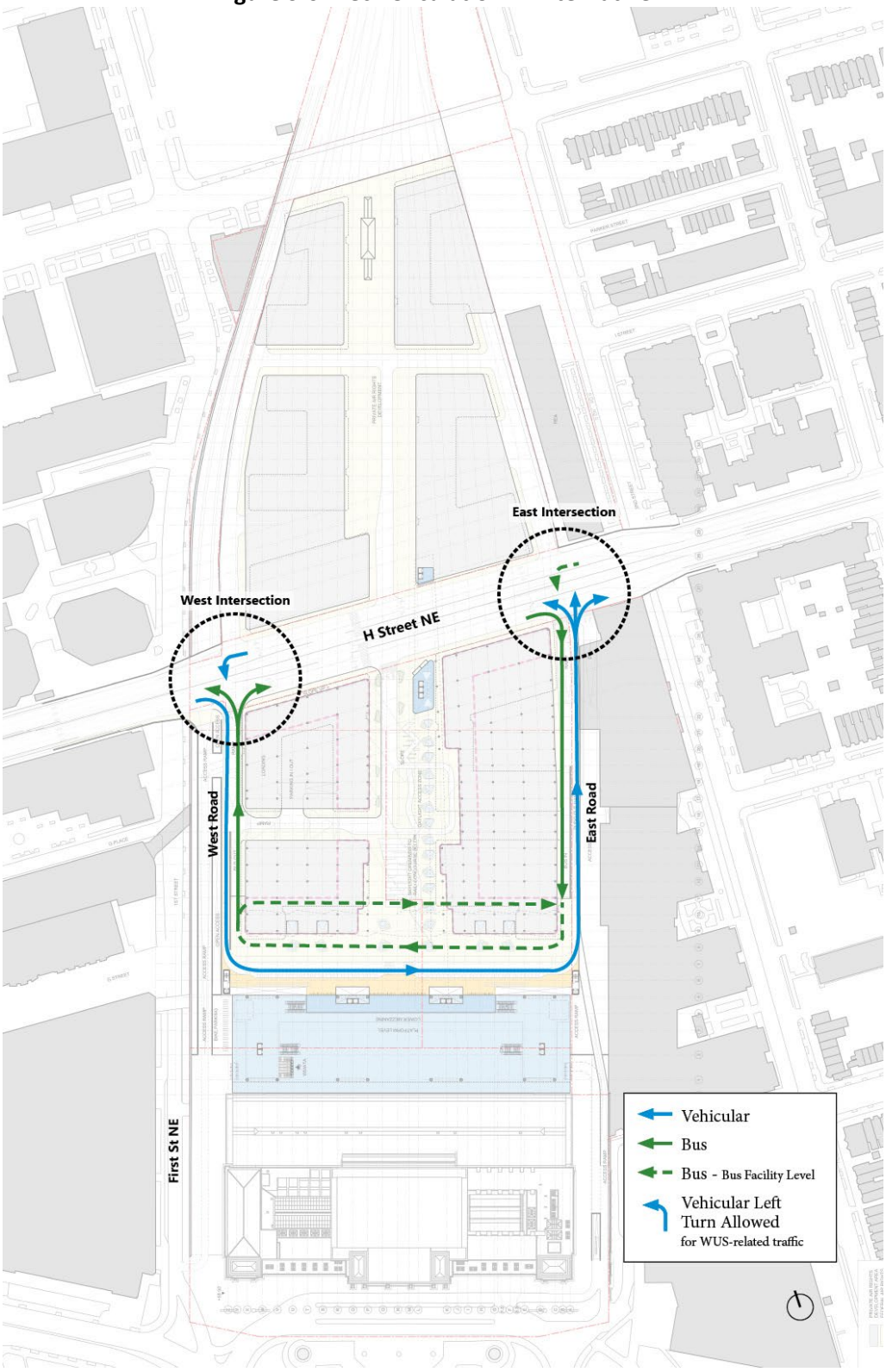
Alternative F deck-level circulation patterns are illustrated in **Figure S-6**.[7] Two new intersections (west and east) would be established to connect the H Street Bridge to the deck via two new roads WUS-traffic would use:[8]

- **West Intersection**: The new west intersection would be used by inbound car traffic and outbound bus traffic to circulate between H Street and the deck. The intersection would be approximately where the existing parking garage entrance is located. Its south leg would have two inbound lanes and one outbound lane. The intersection would provide access from H Street to a new road along the west side of the Project Area (west road). Private and for-hire cars would use it to reach the pick-up and drop-off area adjacent to the train hall via a ramp rising above the bus facility. Bus leaving the bus facility would use it to leave the site. At the intersection, outbound buses could turn left (westbound) or right (eastbound) onto H Street NE.
- **East Intersection**: The new east intersection would be used by outbound car traffic and inbound bus traffic. It would be just to the west of the existing driveway serving the nearby Kaiser Permanente building. Its south leg would have one inbound lane and two outbound lanes. The east intersection would be used by private and for-hire vehicles leaving the pick-up and drop-off area adjacent to the train hall via the new east road. It would also be used by buses entering the bus facility from H Street NE.

As the result of the proposed intersections' configuration, WUS-related pick-up and drop-off traffic would travel counterclockwise on the deck, looping from west to east via the train hall's pick-up and drop-off area. Conversely, bus traffic would travel clockwise, looping from east to west via the bus facility. In case of planned or unplanned road or lane closures, these circulation patterns could be temporarily modified. The bicycle and pedestrian ramps on the east and west sides of WUS, respectively, could then be used by buses (east ramp) or cars (west ramp). This operating condition would be rare and temporary.

[7] **Figure S-6** is intended to illustrate WUS-related traffic movements only. Roadway alignments are approximate.
[8] Traffic to and from the private air rights development could also use these roadways if, as assumed in this EIS, both projects are built. Intersections and roadways exclusively needed for private air rights development use are not part of the Project and, as such, are not described in this section.

Figure S-6. Deck Circulation in Alternative F



S.6 Bus Facility

In Alternative F, the bus facility would be integrated into the deck and extend from east to west, parallel and adjacent to the entire length of the train hall. **Figure S-7** illustrates the layout of the bus facility. The facility would be for use by intercity and tour or charter buses only. It would not accommodate transit buses or hop-on/hop-off sightseeing buses.

The bus facility would be adjacent to and directly connected to the train hall's lower mezzanine level, where bus passenger amenities would be located. This would ensure optimal integration with the remainder of WUS and emulate the connectivity between the train hall and the tracks and platforms. Bus passengers would have convenient access to the vertical circulation elements that would bring them to Concourse A, the historic station, and lower-level concourses and Metrorail. **Figure S-8** and **Figure S-9** illustrate the relationship of the bus facility to the train hall.

Figure S-7. Conceptual Layout of the Bus Facility in Alternative F

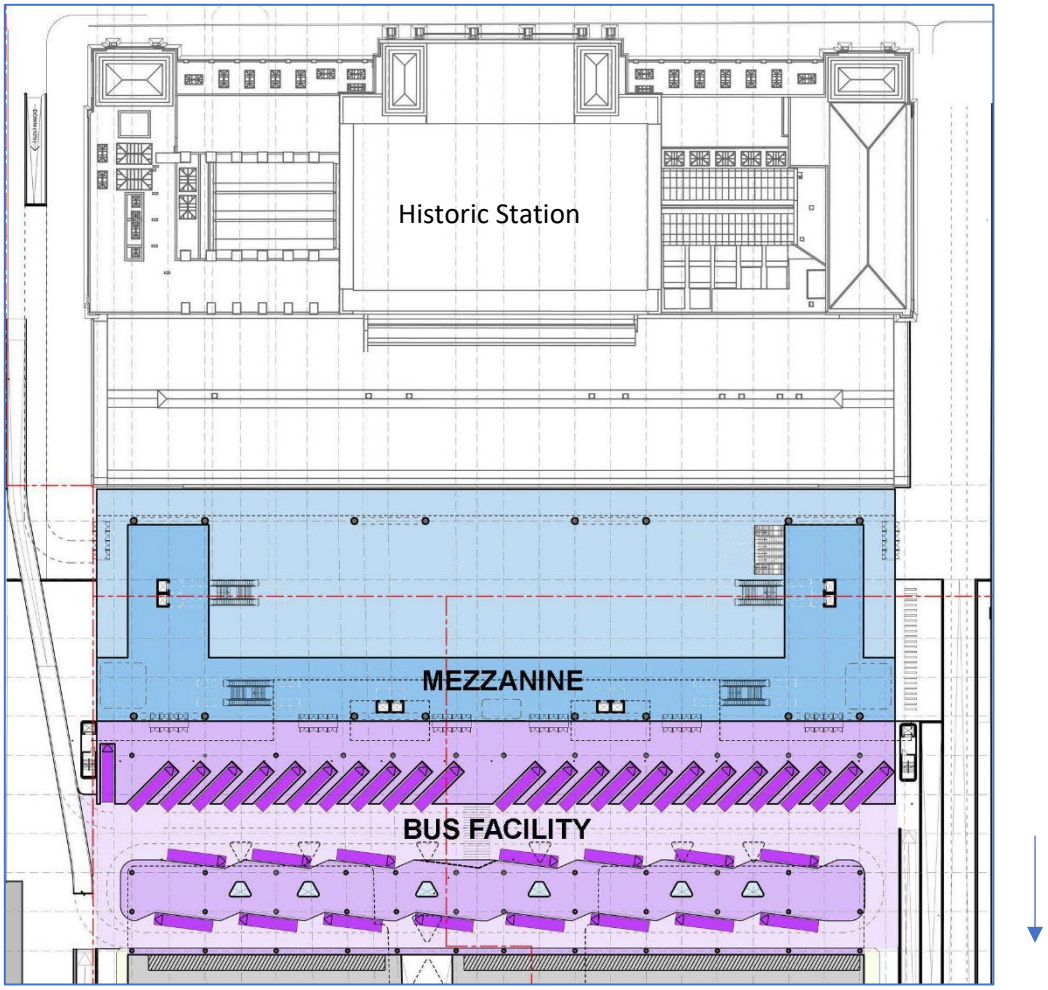


Figure S-8. Conceptual Rendering of Mezzanine Level of Train Hall in Alternative F (Looking East)

Figure S-9. Conceptual Rendering of Bus Facility in Alternative F (South Side, Looking East)

A glazed wall would separate the mezzanine from the bus facility, which would be semi-opened and ventilated. The facility would consist of two loading/unloading areas. Along the south side, directly adjacent to the mezzanine, a total of 23 angled bus slips would be provided. Across the bus circulation lane from this area, another 15 slips would be arrayed around an island, with room for a 16th slip for use if and as needed, for a total of 38-39 bus slips.

Buses would reach the facility from H Street NE eastbound only via the new east intersection and east road. They would exit the facility toward H Street NE via the new west road and the west intersection. At the west intersection, buses could turn left onto H Street NE westbound or right onto H Street NE eastbound.

The Federal Railroad Administration (FRA) and the Project Proponents (Union Station Redevelopment Corporation [USRC] and Amtrak) anticipate that the bus facility operations would employ a dynamic management approach, but that dedicated slips may also be provided. FRA and the Proponents will continue coordinating with the bus operators on the most effective management approach. The facility would provide infrastructure for bus electric charging.

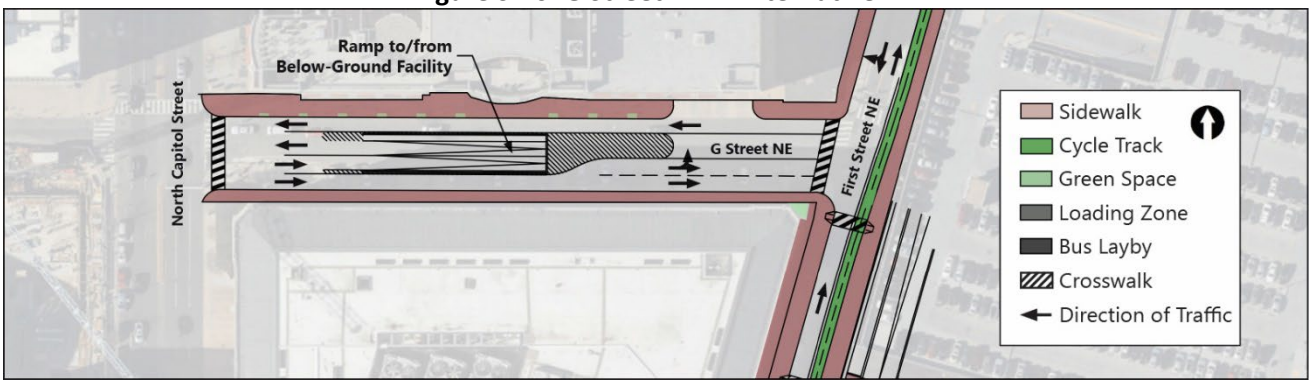
FRA and the Project Proponents have determined that the size of the facility would be sufficient to meet anticipated future (peak) intercity demand, including during holidays and other periods of predictable high travel demand such as large events in the area. However, it is possible that occasionally (exceptional peak) tour and charter bus demand may exceed the capacity (for instance, during the Cherry Blossom Festival or large demonstrations in the District of Columbia). In such cases, which are anticipated to be infrequent, the deck-level pick-up and drop-off area alongside the train hall (above the bus facility) could be used to load and unload bus passengers. This area could provide the equivalent of approximately 15 slips for additional charter buses. FRA and the Project Proponents would coordinate with the bus operators to develop procedures for how and when these 15 slips would be used.

S.7 Parking

In Alternative F, all automobile parking would be on one below-ground level, underneath the tracks and the concourses, along the west side of the rail terminal. Parking would be collocated with a pick-up and drop-off facility (See **Section S-9**, *Pick-up and Drop-off Areas*, below). The exact layout of both uses is still under development. As a result, the exact number of parking spaces that would be provided has not yet been determined but would be between approximately 400 and 550. These spaces would be for long-term parking, short-term parking, and rental car parking. Again, the exact distribution among these three types of parking has not yet been determined. In general, most parking would be in the portion of the below-ground facility north of H Street NE, while most of the portion south of H Street NE would be used for pick-up and drop-off activities. Provisions for electric vehicle (EV) charging would be made in the parking facility.

Vehicles would enter or exit the parking facility either via a new ramp on G Street NE or via a new ramp on First Street NE. The ramp on G Street NE would have two lanes. It would be in the middle of the right-of-way. Inbound vehicles would reach the ramp via North Capitol Street. Outbound vehicles would turn right or left from the ramp onto North Capitol Street. There would be a surface lane on each side of the ramp for traffic between First Street NE and North Capitol Street. Reconfigured G Street NE is illustrated in **Figure S-10**.

Figure S-10. G Street NE in Alternative F



The ramp on First Street NE would be located between H Street NE and K Street NE, creating an opening in a non-original portion of the Burnham Wall. It would be bidirectional and served by a signalized intersection.[9] Outbound vehicles could turn left or right onto First Street. Inbound access would be via a right turn from First Street NE northbound only. The location of the First Street Ramp is shown in **Figure S-14** below.

S.8 Pedestrian and Bicycle Access

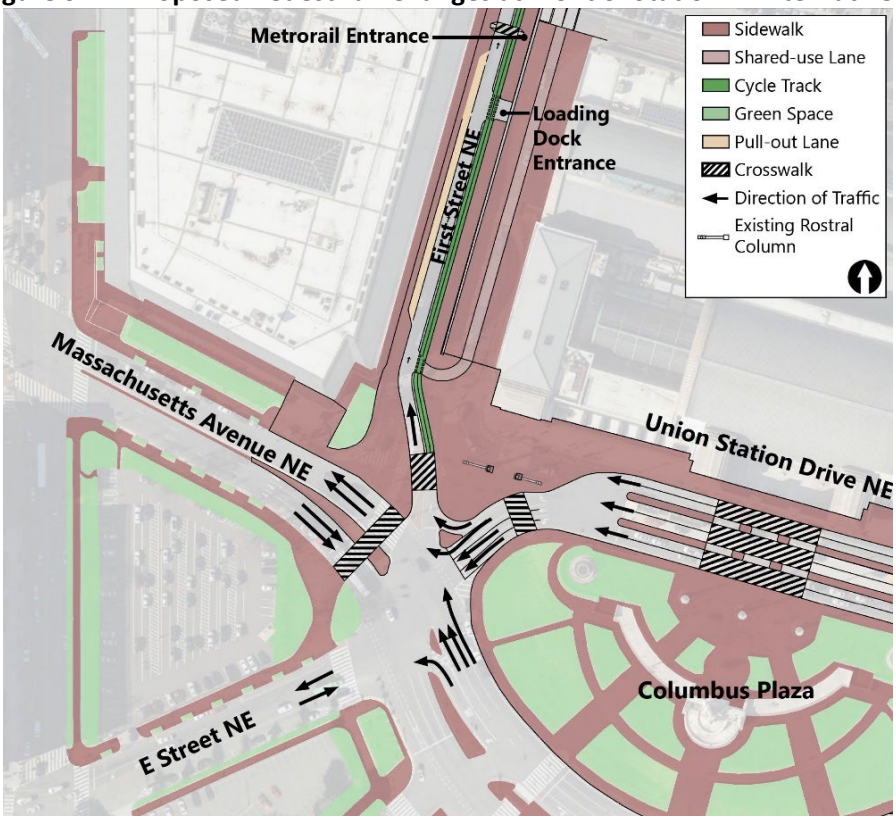
S.8.1 Front of WUS

The front of WUS is the main access point to the station for pedestrians and cyclists. It would largely remain so in alternative F, due to its direct connection to the District of Columbia's larger pedestrian and bicycle network and to Capitol Hill. Existing pedestrian and bicycle facilities at the historic station building include a wide sidewalk in front of the building; pedestrian islands on both its east and west sides for easier and safer navigation; a two-way cycle track starting on First Street NE; and a Capital Bikeshare station on the east side.

Currently, pedestrians must use four crosswalks to cross from WUS to the west side of First Street NE. In Alternative F, pedestrians would need to navigate only one crossing, as illustrated in **Figure S-11**. First Street NE, currently a two-way road, would become one-way northbound up to G Street NE, eliminating the need for a right-turn lane to Massachusetts Avenue NE and widening the pedestrian zone in the southwest corner of the station.

[9] Signalization approach subject to warrant analysis and coordination with DDOT.

Figure S-11. Proposed Pedestrian Changes at Front of Station in Alternative F

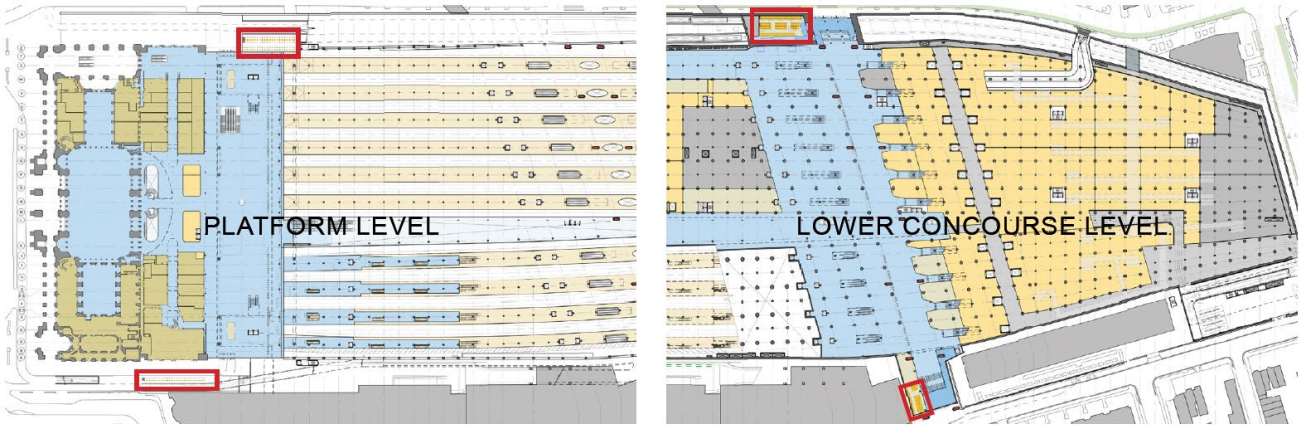


The existing cycle track would remain on the east side of First Street NE, with modifications to improve safety by minimizing conflicts with pick-up and drop-off activities at the new entrance at First and H Streets NE. The existing ramp along the west side of WUS, which connects H Street NE to the western end of Columbus Circle and First Street NE, would be replaced with a pedestrian and bicycle ramp to the deck level and H Street. On the east side of WUS, another pedestrian and bicycle ramp would provide access to the bus facility. [10]

Bicycle storage and parking facilities would be constructed in the undercroft of both ramps, adjacent to the train hall. Bicycle storage and parking space would also be provided in the H Street Concourse, near the entrances from First and Second Streets NE, respectively, and accessible from the bicycle facilities on either street. Bicycle storage capacity would be approximately 900 bicycles, including at least 50 short-term bicycle racks. Additionally, approximately 100 additional bikeshare spots with electrical power would be provided. The location of the bikeshare spots and short-term racks would be coordinated with the District Department of Transportation (DDOT). Bicycle storage facilities are shown in **Figure S-12**. These facilities would be built in compliance with District of Columbia's bicycle parking guidelines.[11]

[10] As noted above, these ramps could occasionally be used to move vehicles when needed, but this would not be a common occurrence. Because of this possibility, the ramps are shown as a shared-use facility in **Figures S-11 and S-13**.
[11] DDOT. 2018. *Bike Parking Guide.* Accessed from https://ddot.dc.gov/sites/default/files/dc/sites/ddot/publication/attachments/DDOT%20bike%20parking%20guide_060118_Screen.pdf. Accessed on March 12, 2023.

Figure S-12. Location of Proposed Bicycle Storage Facilities



Red boxes indicate bicycle storage locations.

S.8.2 First Street NE

Alternative F would feature an entrance to the new H Street Concourse on First Street NE. This entrance would have to accommodate a high number of pedestrians; therefore, the sidewalk at this location would be widened. As noted above, new bicycle storage would be provided at this location. There would also be a new bikeshare station on the west side of the street, under the H Street Bridge. The First Street cycle track would remain on the east side of the street.

S.8.3 Second Street NE

Similarly, an entrance to the H Street Concourse would be provided on Second Street NE, under the H Street Bridge. Like the First Street entrance, the Second Street entrance would feature a wider sidewalk. New bicycle storage and a new bikeshare station on the west side of the street under the bridge would also be provided. Together, the east and west entrances to the H Street Concourse would provide pedestrian connectivity between the neighborhoods to the east and west of WUS.

S.8.4 H Street NE

Alternative F includes pedestrian access to the new concourses from H Street NE via two headhouses. These headhouses would be on the south and north sides of the street, respectively, about mid-block. They could be integrated with the surrounding private air rights development.

S.9 Pick-up and Drop-off Areas

S.9.1 Below-Ground Pick-up and Drop-off Facility

The primary location of pick-up and drop-off activities in alternative F would be the below-ground facility collocated with parking under the tracks and concourses. This facility would account for approximately half of all WUS-related pick-ups and drop-offs.

The exact layout of, and circulation patterns within, the below-ground pick-up and drop-off facility would be defined as part of the design process. In general, the facility would include an area for vehicle staging and queueing at its southern end, and an area for passenger loading and unloading adjacent to the queuing area. Vehicles would enter and exit the facility via the G Street NE ramp and First Street ramp described in **Section S.7**, *Parking*, above. As technically feasible, provisions for EV charging would be made in the queueing and staging areas.

In the boarding area, passengers would wait for their rides on one of several islands. From the staging and queuing area, vehicles would proceed to the boarding islands within the facility. Taxis would also exit via a new ramp on the east side of the station to pick up passengers at the main station's entrance on Columbus Circle. The location of this ramp on the east side of the station can be seen in **Figure S-13** below.

S.9.2 Front of WUS

There are currently six lanes of traffic on the north side of Columbus Circle in front of WUS. Traffic moves counterclockwise around the circle. Upon reaching the front of the station, the two-lane approach from the southeast splits into a two-lane pick-up and drop-off area (south lanes) and a two-lane bus area (central lanes) for hop-on/hop-off sightseeing buses. North of the two bus lanes are two more lanes (north lanes) used for taxi pick-up activity. These taxis access the circle using the east ramp that connects to the existing parking garage and H Street NE. The east ramp currently allows vehicle flow in both directions. However, taxis may only circulate southbound and general traffic may only circulate northbound.

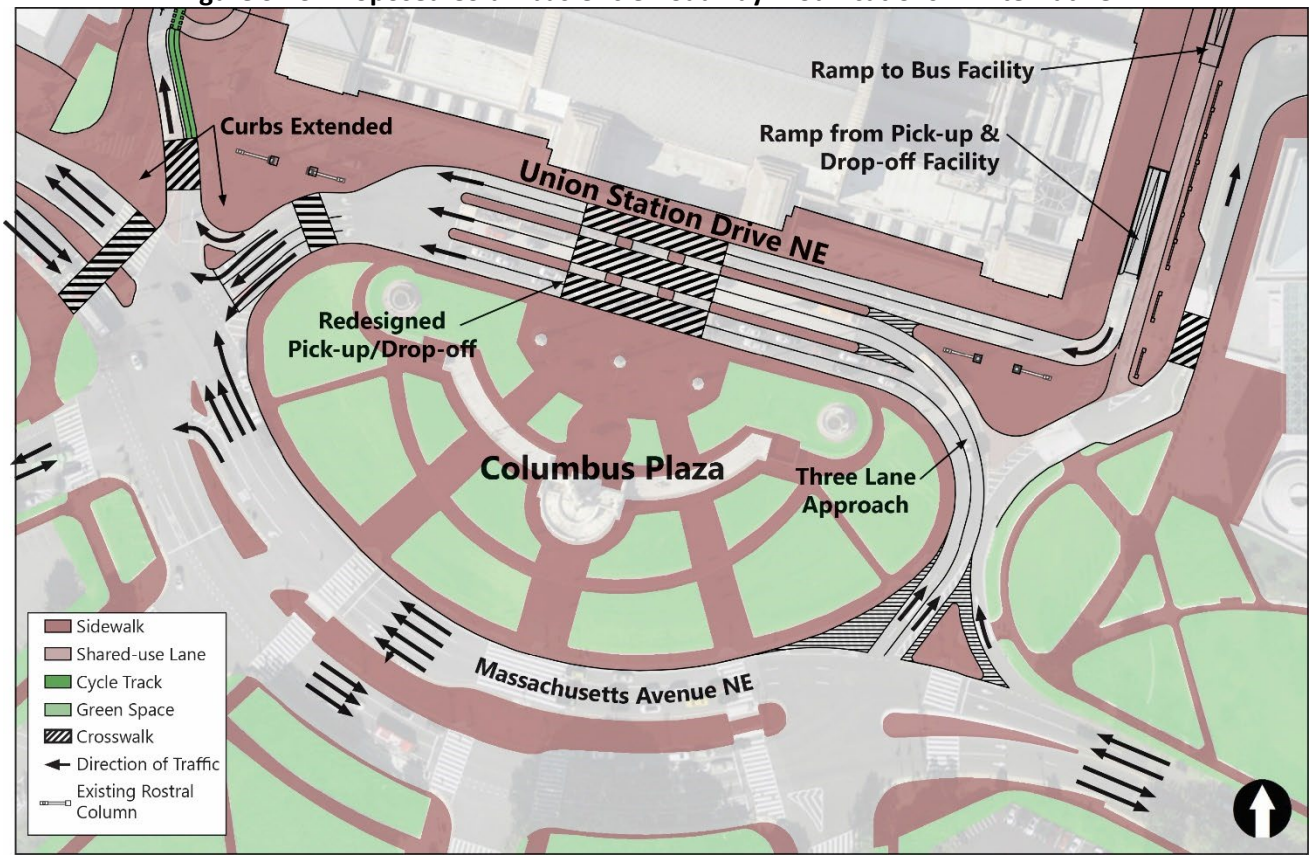
The pick-up and drop-off lanes (south lanes) and the taxi lanes (north lanes) are 9 feet wide each and the bus lanes (central lanes) are 12 feet wide. Eight-foot-wide medians separate the three sets of lanes. At the western end of the circle, the three sets of lanes, together with the existing southbound ramp from H Street NE, merge into three lanes by which vehicles can exit to Massachusetts Avenue (eastbound or westbound) or E Street NE (southbound).

In Alternative F, the six existing lanes in front of the historic station building would remain. The south lanes would be used for passenger drop-off and the central lanes for transit bus stops. Taxis would continue to have the exclusive use of the north lanes. As explained above, taxis would reach the front of WUS via a ramp from the below-ground pick-up and drop-off facility.

At the western end of the circle, three exit lanes to Massachusetts Avenue and E Street would be maintained. The existing connection with the southbound ramp would be eliminated and replaced with a fourth exit lane providing northbound access to First Street NE.

Alternative F also includes changes to the circle's approaches on the east side. A third lane would be added to the approach from the southeast to minimize queuing. The connection for vehicles traveling northbound from Massachusetts Avenue NE and Columbus Circle to F Street NE would stay as it is now. However, on the left side of that segment, there would be two pick-up and drop-off spaces for use by WUS commercial tenants. **Figure S-13** illustrates the proposed improvements in front of WUS.

Figure S-13. Proposed Columbus Circle Roadway Modifications in Alternative F



S.9.3 Deck Level

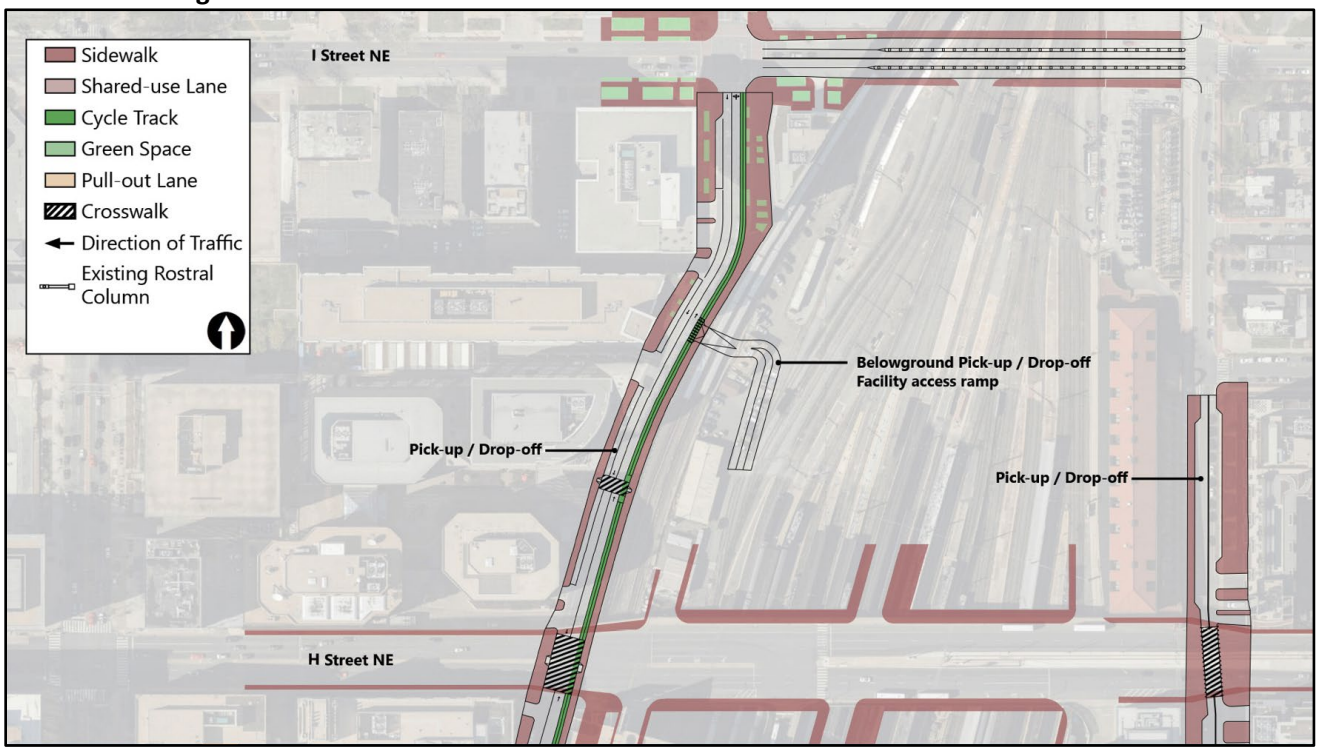
At deck level, there would be a pick-up and drop-off area along the north side of the train hall, above the bus facility, just outside the upper mezzanine. Vehicles would access this area via the west intersection and west road and exit it via the east road and east intersection. The deck-level pick-up and drop-off area would provide space for approximately 22 cars. As noted above in **Section S.6**, *Bus Facility*, on days of exceptionally high demand for intercity bus travel, the area could be used infrequently for bus rather than car loading and unloading.

S.9.4 First and Second Streets NE

In addition, room for limited pick-up or drop-off activities would be provided on First Street NE (approximately 13 spaces) and Second Street NE (approximately eight spaces). The below-ground pick-up and

drop-off facility, deck-level pick-up and drop-off area, and the front of WUS would account for most pick-up and drop-off activity at WUS. The areas on First and Second Streets NE would be near the entrances to the H Street Concourse. On First Street NE, the pick-up and drop-off spaces would be provided on the west side of the street, north of the H Street Concourse. The First Street cycle track would remain on the east side of the street. To accommodate this pick-up and drop-off space, the existing parking and loading lane along the west curb would be converted to an active pick-up and drop-off curbside. This change would be accommodated within the existing curbs and there would be no change to other existing lanes. As needed, lane shifting and restriping would be used to facilitate safe operations and to limit congestion. Pick-up and drop-off facilities on First and Second Streets NE are illustrated in **Figure S-14**.

Figure S-14. First Street and Second Street NE North of H Street in Alternative F



S.10 Intercity and Commuter Rail Operations and Ridership

Alternative F would allow intercity, commuter and transit rail passenger volumes to grow as shown in **Table S-1.** The estimates are the same across all Action Alternatives, with Virginia Railway Express (VRE) having the greatest projected increase: 187 percent increase in service accommodating an almost 250 percent increase in passengers. Amtrak and Maryland Area Regional Commuter (MARC) trains would also experience substantial increases in passenger volumes and service.

Table S-1 shows the changes in levels of service that would occur for each service to accommodate the increased ridership. To accommodate these increased volumes, each full day, Amtrak would operate 57 high-speed trains per direction, 23 intercity trains per direction, and 6 long distance trains per direction.

Additionally, Amtrak would run 58 Metropolitan trains per direction daily. MARC full-day service would consist of 57 Penn Line trains, 30 Camden Line trains, and 38 Brunswick Line trains per direction. Of 14 peak-hour Penn Line trains, it is anticipated that eight would continue to Virginia. For VRE, daily, 23 trains per direction would run on the Fredericksburg Line and 23 trains per direction would run on the Manassas Line.

Table S-1. Estimated Train Passengers and Volumes by Service

Service	Existing Passenger Volumes	2040 Passenger Volumes	Train Volume Increase over Existing
Amtrak	16,400 daily 5.033 million annually	32,000 daily (+95%) 9.070 million annually	148%
MARC	28,100 daily 7.683 million annually	70,700 daily (+152%) 19.293 million annually	163%
VRE	3,900 daily 1.060 million annually	13,600 daily (+249%) 3.706 million annually	187%

S.11 Construction Methods and Activities

FRA and the Project Proponents evaluated the constructability of the Project by considering the following factors: sequencing, duration, needed equipment, staging, traffic routing, materials removal, excavation, and dewatering. A detailed constructability analysis concluded that all the Action Alternatives presented in the 2020 Draft Environmental Impact Statement (DEIS) are constructible. However, they would vary in their construction duration and cost based primarily on the depth of excavation associated with each alternative.[12]

Alternative F would be similar to the 2020 DEIS Action Alternatives with regard to the key constructability factors. This section presents a summary of the construction activities associated with Alternative F.

S.11.1 Construction Phasing and Sequence

After reviewing different potential approaches for construction, the Project Proponents, with participation from FRA, determined that in all Action Alternatives, construction would proceed in four sequential phases. This approach would adequately balance the need to maintain an acceptable level of train service throughout the construction period while allowing construction to proceed in a reasonable amount of time. At a minimum, three low-level, run-through platforms would be in operation at all times, which is necessary to adequately maintain VRE, long-distance train operations, and regional run-through service. During each phase, a set number of tracks and platforms would be taken out of service and become an active construction zone. The width of the construction area during each phase would be dependent on the maximum number of tracks that can be removed while maintaining adequate rail operations and space for construction activities. The minimum average phase width would be approximately 90 feet.

The construction sequence would follow the same general approach within each phase. A set of tracks would be taken out of service. Temporary tracks and connections would be constructed as needed to maintain

[12] Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project Constructability Report*.

operations and potentially support the operation of work trains. Cut-off and support walls (see **Section S.11.2,** *Support of Excavation*, for more details) would be installed to support excavation and keep groundwater out. Following excavation, drilled shafts would be constructed to provide deep foundations for the slabs supporting the new tracks and the columns supporting the deck on which the Project elements would stand. As construction moves to the next phase, the deck-level Project elements would be constructed.

The First Street Tunnel column removal work (see **Section S.1**, *Tracks and Platforms/Rail Support Function*) would take place in three sequential phases, also from east to west. Work would follow approximately the same pattern during each phase: strengthening and modifying the structural connections of the tunnel columns to be maintained; replacing or strengthening the overhead tunnel roof beams to span across the gaps created by the removal and replacement of the existing columns and crash walls; removing select existing columns and crash walls; finalizing tunnel deck substructure improvements as needed; and shifting the tracks.

The column removal work would be conducted simultaneously, and largely overlap, with the main construction effort. The first phase of the column removal work would take place during Phase 1 of the main construction and the third phase would take place during main construction Phase 2. To maintain adequate levels of rail service, the second phase of the column removal work must start after main construction Phase 1 is complete and be finished before main construction Phase 2 begins. Therefore, there would be a period – anticipated to extend over approximately 12 months – between Phase 1 and Phase 2 during which only column removal work would be conducted.

S.11.2 Support of Excavation

Construction of Alternative F would require excavating the stub-end portion of the rail terminal. The maximum depth of excavation would be approximately 49 feet below existing grade (3 feet above mean sea level).

Walls would be needed to support the excavation and control groundwater seepage. The constructability review for Alternative F indicated that the appropriate support of excavation (SOE) would involve a 100-foot-deep slurry wall around the stub-end tracks portion of the rail terminal, which would be excavated to build the proposed below-ground pick-up and drop-off and parking facility.[13] This wall would reach down to the Potomac Clay layer underneath WUS. As such, it would isolate the construction site from the underlying upper aquifer and would be sufficient to prevent excessive groundwater seepage into the Project area.

[13] Constructing a slurry wall involves excavating a trench that is simultaneously filled with a mix of bentonite and water (slurry), which keeps the trench from collapsing. The trench is then filled with concrete from the bottom up after installation of reinforcing steel. The concrete displaces the slurry as the trench fills up and hardens around reinforcement to form a structural wall.

The excavated portion of the run-through tracks area of the rail terminal would be surrounded by a 64-foot-deep secant-pile wall.[14] Sixty-four-foot-deep sheet-pile walls would be used to separate construction phases and establish passageways for construction trucks and equipment.[15]

S.11.3 Excavation Method

The constructability analysis of the Project assessed both open-cut and top-down construction techniques. Open-cut, or traditional excavation methods, would build the Project by excavating a trench within the construction area and then building upwards to the completion of each phase. Top-down construction would build the Project by first rebuilding the track level, structural supports, and deck above, then completing the below-ground portions after the above-grade elements are sufficiently complete.

FRA determined that the EIS would assess the open-cut construction approach for all Action Alternatives, including Alternative F, for the following reasons. Open-cut construction would be less expensive and take less time than top-down construction. The open-cut approach would also allow for easier access to the excavation area; provide more staging space; and make it easier to use work trains for excavation spoil removal.

S.11.4 Drilled Shaft Construction

Drilled shafts would be the foundation for track support and other Project elements, including supporting decks. Drilled shafts for the Project in Alternative F would range in diameter from 4.33 feet to 10.5 feet.[16] Average depth would be up to approximately 150 feet. Construction of a drilled shaft would involve drilling a hole, stabilizing it using either a casing or a slurry, installing reinforcing bars, and filling the hole with concrete.

S.11.5 Construction Equipment

Several elements of the Project would require the use of large construction equipment:

- Three major construction operations would require large cranes: SOE, drilled shaft construction, and construction of the superstructure supporting the Project's above-ground elements. These operations would require cranes with boom lengths of 150 to 250 feet.
- Construction of drilled shafts would involve the use of large drilling rigs. A typical drilling rig would be approximately 88.5 feet tall.

[14] Secant-pile walls are made of intersecting reinforced concrete piles reinforced with either steel rebar or steel beams. The piles are installed by drilling into the ground.
[15] Sheet-pile walls consist of prefabricated steel wall sections driven into the ground. The joints of adjacent sections are connected to form the full wall.
[16] Amtrak. August 2022. *Washington Union Station Terminal Infrastructure Project Cost and Schedule Analysis: Revised Alternative.*

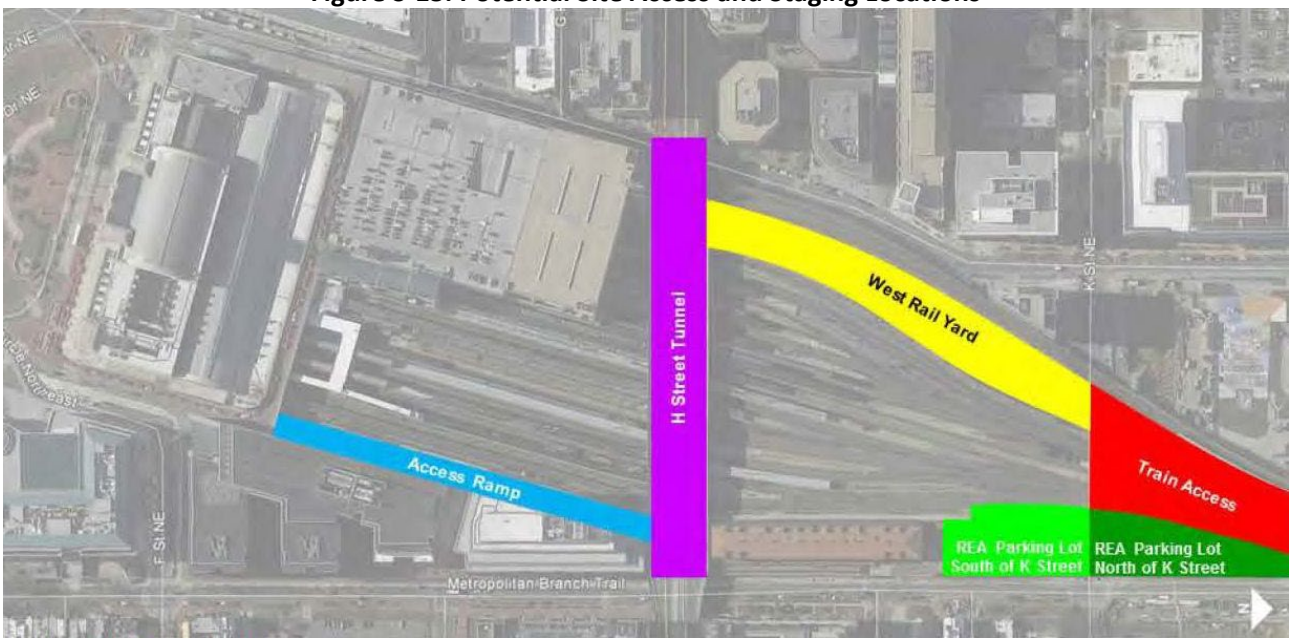
- Concrete production may require the installation of a small concrete batch plant, likely in the West Rail Yard. [17]
- Construction of a slurry wall would require setting up a slurry plant. [18]

The setting of the Project in a dense urban environment and active rail terminal would affect the type of equipment used for construction. Equipment must be able to maneuver in cramped conditions and minimize disruption to adjacent areas.

S.11.6 General Construction Site Access and Staging

The constructability analysis identified five potential areas for construction site access and staging (see **Figure S-15**). Construction staging areas would be used to lay down materials, stage equipment and personnel, and set up concrete batch plants. Other construction activities, such as the slurry plant, would move with the construction work from phase-to-phase.

Figure S-15. Potential Site Access and Staging Locations



[17] A concrete batch plant is a piece of equipment that combines various ingredients to produce large amounts of concrete. Ingredients include but are not limited to water, air, sand, aggregate (such as rocks or gravel), and cement. The concrete batch plant would be a different piece of equipment from the slurry plants mentioned in the following bullet.

[18] A slurry plant or slurry mix plant is a piece of equipment that produces the slurry used for the construction of slurry walls. Bentonite slurry is produced by mixing bentonite powder and water in a high-shear mixer.

The five staging areas are:

- **Access Ramp:** The east loading dock access ramp and local roads (First Street, Second Street, H Street) would serve as access points for personnel, minor equipment, and limited material.
- **H Street Tunnel:** The H Street Tunnel would serve as a major access point for all phases of construction. It would serve as access for personnel, equipment, and materials. After the completion of Phase 1, construction access would be at First Street NE only.[19]
- **West Yard:** The west yard would serve as a major staging area for all phases. It would be used for deliveries and potential excavation spoil removal by work trains. It may also potentially serve as a location for the small concrete batch plant.
- **REA Parking Lot:** The REA Parking Lot would serve as a major access point during construction for personnel, equipment, and materials. It may also serve as a potential staging area for construction materials.
- **Train Access Area:** This area would provide access for work trains during the construction period. Materials may be delivered and removed by train to reduce truck volumes during construction.

As construction proceeds, some space on the deck may be available for construction staging as well.

S.11.7 Station Access During Construction

Construction activities would disrupt the various transportation modes serving WUS, though the modes affected, and the level of disruption would vary with the phase. Operations would be maintained, as much as possible, to minimize disruptions to the traveling public.

S.11.7.1 Taxi

Construction would require the closure and removal of the taxi queue along the east ramp and back of the Claytor Concourse starting in Phase 1. Passenger pick-up and drop-off would remain available in front of WUS. Alternative routes and queuing locations would be provided. Depending on the construction phase, these may include the west ramp to the front of the historic station building, Second Street NE, and the completed portions of the desk via H Street NE.

S.11.7.2 Bus

During Phase 3 of Project construction, partial demolition of the existing parking garage would require the relocation of the bus facility to the unaffected portion of the structure. In Phase 4, the remainder of the existing parking structure would be demolished. If needed during Phase 3 and during the entirety of Phase 4, a temporary bus facility or temporary bus loading zones would be established on the completed portion of the structural deck, including the private air rights deck. These temporary facilities would be of sufficient size to maintain an adequate level of operations. Prior to beginning demolition of the existing structure, USRC

[19] The H Street tunnel is the former alignment of H Street NE between First and Second Streets, now under the rail terminal.

and the private air rights developer would develop an agreement establishing the conditions under which some of the private air rights deck would be made available for WUS bus operations.

S.11.7.3 Parking

Starting in Phase 1, construction would eliminate vehicular access to the existing parking garage via the existing east ramp. Pedestrian access would remain available. Partial demolition of the existing garage would start during Phase 3 and the remainder of the facility would be demolished during Phase 4. During Phase 4, parking would be unavailable at WUS.

S.11.7.4 Construction Equipment and Access

Construction equipment and material staging would take place in the REA Building Parking Lot south of K Street NE (Phase 1) and the West Yard (Phases 1 through 3 and half of Phase 4). After completion of Phase 1, parts of the east deck would potentially be available for staging as well. The west side of the H Street Tunnel would be the main access point during all phases. The east side of the tunnel would provide access during Phase 1, but it would be demolished as part of the excavation of this phase.

S.11.8 Duration of Construction

The construction analysis for Alternative F estimated that it would take a total of approximately 13 years to complete. **Table S-2** shows the respective durations of the various construction phases**,** along with how much of each phase would be devoted to excavation activities.

Table S-2. Estimated Construction Schedule of Alternative F

Phase	Duration	Excavation Duration
Phase 1	2 years 4 months	5 months
Intermediate Phase (column Removal)	12 months	None
Phase 2	2 years 8.5 months	10 months
Phase 3	2 years 8.5 months	11 months
Phase 4	4 years 3 months	2 years 1 month
Total	13 years	4 years 3 months

S.11.9 Removal and Transport of Materials

Spoils containing rocks and soils would be removed throughout excavation operations. Hydrocarbons, heavy metals, and polychlorinated biphenyls may be present in the spoil in excess of regulatory thresholds. Contaminated materials would be disposed of in compliance with applicable laws and regulations. The estimated amount of spoil materials that would be removed in Alternative F is approximately 1,507,102 cubic yards.

Removal of excavation spoil from the site would be by trucks or work trains, or a combination of both. Based on the estimated amount of spoil that would need to be disposed of, removal by trucks only would require up to 120 truck trips a day, spread over a 20-hour day, in addition to 10 to 20 truck trips for deliveries. Alternatively, spoil removal could be by work train. Two 20-gondola work trains a day would be sufficient to

haul off the same amount of spoil as 120 trucks. This would limit daily truck traffic to the 10 to 20 delivery trips a day previously mentioned. The work trains would be scheduled in a manner that does not interfere or conflict with Amtrak, VRE, or MARC operations. Amtrak has not yet determined the feasibility of using work trains for spoil disposal while maintaining an adequate level of operations. Therefore, where appropriate, the impact analysis considers two removal scenarios: removal by trucks only and removal by work trains.