Federal Railroad Administration
Office of Safety
Headquarters Assigned
Accident Investigation Report
HQ-2005-83

Amtrak (ATK)
New London, Connecticut
September 28, 2005

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report made by the Secretary of Transportation/Federal Railroad Administration under 49 U.S.C. §20902 may be used in a civil action for damages resulting from a matter mentioned in the report.

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2005-83

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Amtrak [ATK]	ATK	098361
2. Name of Railroad Operating Train #2	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
N/A	N/A	N/A
3. Name of Railroad Responsible for Track Maintenance (single entry)	3a. Alphabetic Code	3b. Railroad Accident/Incident No.
Amtrak [ATK]	ATK	098361

4. U. S. DOT-AAR Grade Crossing Identification Number	5. Date of Accident/Incident (month / day / year)	6. Time of Accident/Incident
500307S	09 / 28 / 2005	07:42: AM [X] PM [ ]

7. Type of Accident/Incident (single entry in code box): 1. Derailment; 2. Head on collision; 3. Rear end collision; 4. Side collision; 5. Raking collision; 6. Broken Train collision; 7. Hwy-rail crossing; 8. RR grade crossing; 9. Obstruction; 10. Explosion-detonation; 11. Fire/violent rupture; 12. Other impacts; 13. Other (describe in narrative) — Code: 07

8. Cars Carrying HAZMAT	9. HAZMAT Cars Damaged/Derailed	10. Cars Releasing HAZMAT	11. People Evacuated	12. Division
0	0	0	0	New England

13. Nearest City/Town	14. Milepost (to nearest tenth)	15. State Abbr.	15. State Code	16. County
Waterford	120.2	CT		NEW LONDON

17. Temperature (F) (specify if minus)	18. Visibility (single entry) 1. Dawn 2. Day 3. Dusk 4. Dark — Code	19. Weather (single entry) 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code	20. Type of Track 1. Main 2. Yard 3. Siding 4. Industry — Code
53 °F	2	1	1

21. Track Name/Number	22. FRA Track Class (1-9, X) — Code	23. Annual Track Density (gross tons in millions)	24. Time Table Direction 1. North 2. South 3.East 4. West — Code
Main Track No. 2	4	N/A	4

OPERATING TRAIN # 1

25. Type of Equipment Consist (single entry) 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/switching 8. Light loco(s). 9. Maint./inspect. car A. Spec. MoW Equip. — Code	26. Was Equipment Attended? 1. Yes 2. No — Code	27. Train Number/Symbol
2	1	2153

28. Speed (recorded speed, if available) R - Recorded E - Estimated — Code	29. Trailing Tons (gross tonnage, excluding power units)	30. Method(s) of Operation (enter code(s) that apply)	30a. Remotely Controlled Locomotive?
71 MPH R	N/A	a. ATCS; b. Auto train control; c. Auto train stop; d. Cab signals; e. Traffic control; f. Interlocking; g. Automatic block; h. Current of traffic; i. Time table/train orders; j. Track warrant control; k. Direct traffic control; l. Yard limits; m. Special instructions; n. Other than main track rules; o. Positive train control; p. Other (specify in narrative) — Code(s): b c d e g	0= Not a remotely controlled operation; 1 = Remote control portable transmitter; 2 = Remote control tower operation; 3 = Remote control portable transmitter - more than one remote control transmitter: 0

31. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)	32. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box. Alcohol	Drugs
(1) First involved (derailed, struck, etc)	2009	1	N/A	N/A	N/A
(2) Causing (if mechanical cause reported)	N/A	N/A	N/A	33. Was this consist transporting passengers ? (Y/N)	Y

34. Locomotive Units	a. Head End	b. Mid Train Manual	c. Mid Train Remote	d. Rear End Manual	e. Rear End Remote	35. Cars	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Train	1	0	0	1	0	(1) Total in Equipment Consist	0	6	0	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	0	0	0	0	0

36. Equipment Damage This Consist	37. Track, Signal, Way, & Structure Damage	38. Primary Cause Code	39. Contributing Cause Code
$25,000.00	$0.00	M302	N/A

Number of Crew Members / Length of Time on Duty

40. Engineers/ Operators	41. Firemen	42. Conductors	43. Brakemen	44. Engineer/Operator	45. Conductor
2	N/A	1	1	Hrs: 2 Mins: 07	Hrs: 2 Mins: 07

Casualties to:	46. Railroad Employees	47. Train Passengers	48. Other	49. EOT Device? 1. Yes 2. No	50. Was EOT Device Properly Armed? 1. Yes 2. No
Fatal	0	0	3	2	N/A
Nonfatal	0	0	0	51. Caboose Occupied by Crew? 1. Yes 2. No: N/A	

OPERATING TRAIN # 2

52. Type of Equipment Consist (single entry) 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/switching 8. Light loco(s). 9. Maint./inspect. car A. Spec. MoW Equip. — Code	53. Was Equipment Attended? 1. Yes 2. No — Code	54. Train Number/Symbol
N/A	N/A	N/A

55. Speed (recorded speed, if available) R - Recorded E - Estimated — Code	56. Trailing Tons (gross tonnage, excluding power units)	57. Method(s) of Operation (enter code(s) that apply)	57a. Remotely Controlled Locomotive?
0 MPH N/A	N/A	a. ATCS; b. Auto train control; c. Auto train stop; d. Cab signals; e. Traffic control; f. Interlocking; g. Automatic block; h. Current of traffic; i. Time table/train orders; j. Track warrant control; k. Direct traffic control; l. Yard limits; m. Special instructions; n. Other than main track rules; o. Positive train control; p. Other (specify in narrative) — Code(s): N/A N/A N/A N/A N/A	0= Not a remotely controlled operation; 1 = Remote control portable transmitter; 2 = Remote control tower operation; 3 = Remote control portable transmitter - more than one remote control transmitter: N/A

FORM FRA F 6180.39 (Revised July 2003)

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2005-83

OPERATING TRAIN # 2 (CONTINUED)

58. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)	59. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.	Alcohol	Drugs
(1) First involved (derailed, struck, etc)	0	N/A	N/A		N/A	N/A
(2) Causing (if mechanical cause reported)	0	N/A	N/A	60.Was this consist transporting passengers ? (y/n)		N/A

61. locomotive Units	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End e. Remote	62. Cars	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Train	0	0	0	0	0	(1) Total in Equipment Consist	0	0	0	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	0	0	0	0	0

63. Equipment Damage This Consist	64. Track, Signal, Way, & Structure Damage	65. Primary Cause Code	66. Contributing Cause Code
$0	$0	N/A	N/A

Number of Crew Members				Length of Time on Duty	
67. Engineers/ Operators	68. Firemen	69. Conductors	70. Brakemen	71. Engineer/Operator	72. Conductor
N/A	N/A	N/A	N/A	Hrs: 0 Mins: 0	Hrs: 0 Mins: 0

Casualties to:	73. Railroad Employees	74. Train Passengers	75. Other
Fatal	0	0	0
Nonfatal	0	0	0

76. EOT Device? 1. Yes 2. No N/A

77. Was EOT Device Properly Armed? 1. Yes 2. No N/A

78. Caboose Occupied by Crew? 1. Yes 2. No N/A

Highway User Involved

79. Type — A. Auto, B. Truck, C. Truck-Trailer, D. Pick-Up Truck, E. Van, F. Bus, G. School Bus, H. Motorcycle, J. Other Motor Vehicle, K. Pedestrian, M. Other (spec. in narrative) — Code: A

80. Vehicle speed (est. MPH at impact): 10

81. Direction (geographical) 1. North 2. South 3. East 4. West — Code: 1

82. Position — 1. Stalled on Crossing 2. Stopped on Crossing 3. Moving Over Crossing 4. Trapped — Code: 3

86a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

Rail Equipment Involved

83. Equipment — 1. Train (units pulling), 2. Train (units pushing), 3. Train (standing), 4. Car(s) (moving), 5. Car(s) (standing), 6. Light Loco(s) (moving), 7. Light Loco(s) (standing), 8. Other (specify in narrative) — Code: 1

84. Position of Car Unit in Train: 1

85. Circumstance — 1. Rail Equipment Struck Highway User 2. Rail Equipment Struck by Highway User — Code: 1

86b. Was there a hazardous materials release by — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

86c. State here the name and quantity of the hazardous materials released, if any.

N/A

87. Type of Crossing Warning — 1. Gates, 2. Cantilever FLS, 3. Standard FLS, 4. Wig Wags, 5. Hwy. traffic signals, 6. Audible, 7. Crossbucks, 8. Stop signs, 9. Watchman, 10. Flagged by crew, 11. Other (spec. in narr.), 12. None

Code(s)	01	03	06	07	11	N/A	N/A

88. Signaled Crossing Warning (See instructions for codes) Code: 01

89. Whistle Ban — 1. Yes 2. No 3. Unknown — Code: 2

90. Location of Warning — 1. Both Sides, 2. Side of Vehicle Approach, 3. Opposite Side of Vehicle Approach — Code: 1

91. Crossing Warning Interconnected with Highway Signals — 1. Yes 2. No 3. Unknown — Code: 2

92. Crossing Illuminated by Street Lights or Special Lights — 1. Yes 2. No 3. Unknown — Code: 2

93. Driver's Age: 61

94. Driver's Gender — 1. Male 2. Female — Code: 2

95. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train — 1. Yes 2. No 3. Unknown — Code: 2

96. Driver — 1. Drove around or thru the Gate, 2. Stopped and then Proceeded, 3. Did not Stop, 4. Stopped on Crossing, 5. Other (specify in narrative) — Code: 1

97. Driver Passed Standing Highway Vehicle — 1. Yes 2. No 3. Unknown — Code: 2

98. View of Track Obscured by (primary obstruction) — 1. Permanent Structure, 2. Standing Railroad Equipment, 3. Passing Train, 4. Topography, 5. Vegetation, 6. Highway Vehicles, 7. Other (specify in narrative), 8. Not obstructed — Code: 8

Casualties to:	Killed	Injured
101. Highway-Rail Crossing Users	3	0

99. Driver Was — 1. Killed 2. Injured 3. Uninjured — Code: 1

100. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

102. Highway Vehicle Property Damage (est. dollar damage): $2,000

103. Total Number of Highway-Rail Crossing Users (include driver): 3

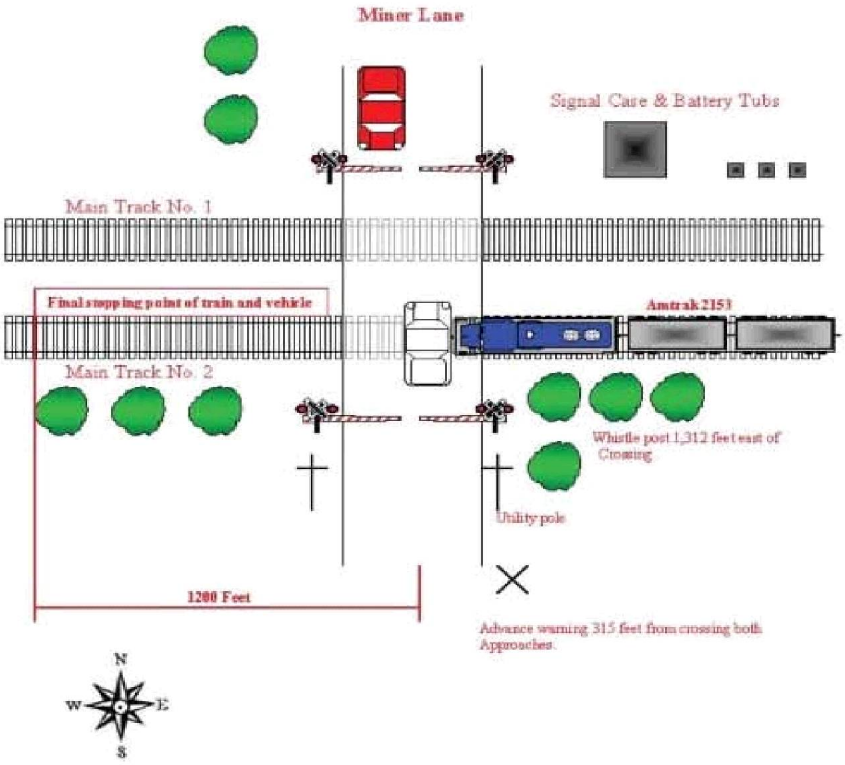
104. Locomotive Auxiliary Lights? 1. Yes 2. No — Code: 1

105. Locomotive Auxiliary Lights Operational? 1. Yes 2. No — Code: 2

106. Locomotive Headlight Illuminated? 1. Yes 2. No — Code: 1

107. Locomotive Audible Warning Sounded? 1. Yes 2. No — Code: 1

108. DRAW A SKETCH OF ACCIDENT AREA INCLUDING ALL TRACKS, SIGNALS, SWITCHES, STRUCTURES, OBJECTS, ETC., INVOLVED.



109. SYNOPSIS OF THE ACCIDENT

A westbound Amtrak (National Railroad Passenger Corporation) Acela express train (2153) collided with a northbound automobile at a highway-rail grade crossing on September 28, 2005, at 7:42 a.m., EDT. The accident occurred on Amtrak's New England Division, Northeast Corridor, at Miner Lane, located in Waterford, Connecticut, at milepost 120.2. Miner Lane is a four quadrant gated system with smart crossing technology. Smart crossings are designed with a set of loops buried in the crossing pavement which detect a vehicle on the tracks after the crossing has been activated (lights and gates). When a vehicle is detected, the system is designed to set the cab signals to restricting and lift the exit gate to allow an escape route for the vehicle to leave the tracks. At the time of the accident, the warning devices at Miner Lane were functioning as designed.

There were three (3) occupants in the motor vehicle; the driver and one (1) passengers suffered fatal injuries. The second passenger was transported to Connecticut Children's Medical Center in Hartford, Connecticut and succumbed to injuries October 7, 2005. The automobile was completely destroyed. There were no injuries to the train crew or passengers on board the train. There was approximately $25,000 in damage to the lead power car (2009), and there was no derailment.

At the time of the accident, it was daylight, sunny, with calm winds. The temperature was 53 degrees F.

The crossing warning system was activated and all gates were in the down position. The automobile traveled under the northbound gate, which is 3 feet 10 inches above the crown of the road surface. The automobile continued north onto Main Track No. 2 and was struck by westbound train 2153, which was traveling at 71 mph. The train came to a stop 1,200 feet west of the crossing with the motor vehicle pinned underneath the nose cone of the power car.

110. NARRATIVE

Circumstances Prior to the Accident

Westbound Amtrak National Railroad Passenger Corporation Acela express train 2153 originated in Boston, Massachusetts and was destined for Washington, DC. It departed Boston's South Station terminal on time at 6:15 a.m. EDT on September 28, 2005 after having received the prescribed brake, cab signal, and ACSES test. At 6:18 a.m. EDT, it arrived at Back Bay Station and departed on time at 6:20 a.m. EDT. Arriving at its next scheduled stop (Route 128) at 6:29 a.m. EDT, it departed at 6:31 a.m. EDT two minutes late. It arrived at Providence, Rhode Island at 6:52 a.m. EDT and departed at 6:54 a.m. EDT four minutes late. The next scheduled stop was to be New Haven, Connecticut. Train 2153 consisted of two power cars (one on each end), a first class car, a quiet car, a café car, and three coach cars. It was 684 feet long and weighed 585 tons. The maximum authorized speed for this train was 150 mph.

The crew consisted of two locomotive engineers (one assigned to the job and one qualifying engineer), a conductor, an assistant conductor, and two on-board service personnel. The qualifying engineer was fully qualified on the physical characteristics between Boston, Massachusetts and New Haven, Connecticut; however, he was qualifying on the high speed equipment between these locations. He also planned to get off the train at New Haven to meet a Metro North roadforeman to qualify on Metro North territory. The crew first went on duty at South Station terminal in Boston, Massachusetts at 5:35 a.m., EDT, September 28, 2005, after having received an off duty period in excess of that required by statute. This was the home terminal for all crew members.

As the westbound train approached the accident scene, the qualifying engineer was seated at the controls on the north side of the leading power car and the engineer assigned to the train, assignment EBN 504, was seated on the south side. The conductor and assistant conductor were stationed throughout the train. One on-board service person was in the first class car while the other in the café car.

In this area of the railroad there are two adjacent main tracks, from north to south identified as Main Track 1 and 2. Westbound trains on Main Track No. 2 negotiate a 4-degrees 15 minute compound curve on the east end and transition into a 1-degree 15 minute curve before entering tangent track 3,168 feet east of Miner Lane. There is a 0.57 descending grade throughout the westward approach to Miner Lane with the crossing near the bottom of the descent. 792 feet west of the crossing at milepost 120.05, the track is at level grade and continues to milepost 119.65. From this point, there is a descending grade of 0.53 extending throughout the length of the eastward approach and ending at milepost 118.85. A permanent speed restriction of 60 mph is in effect throughout the curve between milepost 121.6 and 120.8. There is a permanent speed restriction of 75 mph between milepost 123.0 and 116.5 (Nan Interlocking) for the Acela train sets. Traveling south to north on Miner Lane from the pavement markings, there is a slight ascending grade and the two lane highway is straight.

The railroad timetable direction of the train was west. The geographic direction was southwest. Timetable directions are used throughout this report.

The Accident

Acela Express Train 2153

The train was operating at a recorded speed of 71 mph approaching the accident area. The engineer had an unobstructed view of the Miner Lane crossing, however, his view of northbound approaching traffic was obstructed by dense vegetation until the train was at the crossing. The engineer was sounding the horn and bell. Both locomotive engineers stated that while approaching Miner Lane, the crossing warning system appeared to be functioning normally and that there was at least one southbound motor vehicle stopped at the crossing. Just prior to the train occupying the highway grade crossing, the engineers stated that a northbound motor vehicle came "out of nowhere" and entered the crossing in foul of Main Track No. 2. At this time, the engineer put the train into an emergency braking application and struck the vehicle. The train was operating between 65 and 71 mph at the time of impact as recorded by the event recorder for the power car.

Highway Vehicle

The automobile, a 1996 white Ford Taurus, was traveling south to north on Miner Lane. As the automobile traversed the highway-rail grade crossing, it struck the northward entrance gate (gate 2) at approximately mid-windshield level which caused the gate to rise and the vehicle passed underneath it. Witness statements indicate that the vehicle did not appear to slow for the crossing warning system as it approached and occupied the highway-rail grade crossing. One witness stated that he believed the vehicle to be traveling between 10 and 15 mph. The posted speed limit is 25 mph.

The train struck the right side of the vehicle causing it to become pinned underneath the nose cone of the leading power car. The vehicle remained in this position and the train came to a stop 1,200 feet west of the crossing. The vehicle's occupants remained inside the vehicle. The driver and one passenger sustained fatal injuries, the second passenger was transported to Connecticut Children's Medical Center in Hartford, Connecticut in critical condition and succumbed to injuries October 7, 2005. There were no injuries reported by the train crew or the 116 passengers aboard the train.

The engineer seated on the south side of the power car notified the train dispatcher of the accident and checked to see if the adjacent track was fouled. A witness in a motor vehicle at the grade crossing called 911 on his cellular telephone to alert local authorities, while another went to where the train stopped to try and assist. Town of Waterford police, fire, and EMS personnel arrived on the scene within minutes followed by Amtrak police and Connecticut State police. The local road foreman inspected the power car for damage and downloaded the event recorder. The train was backed away

from the motor vehicle and was taken to New London station (milepost 122.50) where passengers disembarked. The Connecticut Medical Examiner's unit arrived on the scene while Waterford Fire Department personnel cut away the vehicle to extract the deceased occupants. Efforts then turned to removing the motor vehicle from the railroad tracks. There was no damage to the track structure or signal appurtenances. The motor vehicle was removed from the scene by a local towing company.

Analysis and Conclusions

Analysis

The driver of the motor vehicle was a 61 year old female. The passengers were an 8 year old male and a 4 year old female and the grandchildren of the driver.

The highway-rail crossing at grade is equipped with a Union Switch and Signal (US&S) four-quadrant gated warning system with what is referred to as smart crossing technology (motor vehicle incursion detection loops interconnected with the railroad cab signal system). The warning system consists of 16 LED flashing lights, cross bucks, multiple track signs, red and white reflectorized automatic gates (two (2)entrance gates and two (2)exit gates). In addition there are six inductance loops buried in the crossing pavement, three for northbound motor vehicle traffic and three for southbound motor vehicle traffic. These inductance loops are designed to detect the presence of a motor vehicle within the confines of the grade crossing, and subsequently raise the exit gates and set the onboard cab signal system of the locomotive to its most restrictive state in an attempt to stop the inbound train prior to its arrival at the crossing. For westbound train movement, the crossing warning system is activated when the train enters the approach circuit 6,559 feet east of the crossing. With a maximum speed of 75 mph, this provides a warning time to the highway user of slightly more than one minute. There is an approach warning sign and pavement markings 315 feet south of the crossing. The roadway in the vicinity of the accident is maintained by the town of Waterford.

Amtrak Communications and Signal (C&S) personnel arrived at Miner Lane shortly after the accident and downloaded the event recorder information from the Union Switch and Signal (US&S) Microlok II system and General Electric Transportation Systems (GETS) Global Signaling Highway Crossing Analyzer (HCA-1). Amtrak C&S personnel awaited the arrival of an FRA Signal and Train Control inspector prior to performing any crossing warning system testing.

Along the right-of-way, there is a whistle post 1,312 feet east of the crossing signifying the approach of the highway-rail grade crossing. The train's horn and bell were sounding for 18 seconds prior to impact as indicated by the event recorder.

The current warning system was put into service on January 15, 2001 and incorporates a combination of three separate and distinct GETS Global Signaling Audio Frequency Train Activated Circuit (AFTAC II) frequency modulated (FM) audio overlay circuits for each track, with a US&S Microlok II wayside control system. These systems work in tandem to provide train detection and crossing activation. The crossing approaches are extended in length by utilizing GETS Global Signaling Electro Code 4 (plus) track coding equipment for a positive start to the crossing warning system (crossing activates upon train occupation of approach circuit).

Each AFTAC II overlay has its own distinct frequency, chosen to avoid interference with harmonic signals from adjacent circuits or other wayside interference sources. On Main Track No. 2, the frequencies are as follows: westbound approach circuit is 9.5khz with a standard sub-tone frequency of 66hz, the island circuit has a frequency of 20.2khz, and the eastbound approach has a frequency of 1.9khz with a standard sub-tone frequency of 31hz. The length of the westbound overlay circuit is 892 feet defined by insulated rail joints at an automatic wayside signal, and the length of the eastbound overlay circuit is 3,748 feet defined by insulated rail joints.

The Microlok II wayside control system is a microprocessor based system that functions as a vital/non-vital processor. It executes the vital logic required for gate operation, motor vehicle detection, and cab signal indications received by the approaching train. It also performs loop detector integrity tests and checks for broken gates. When a train occupies one of the highway crossing warning system's approach track circuits, the track relay is de-energized, the warning lights begin to flash, the bell begins to ring, and the loops are checked for motor vehicle presence. If the crossing is clear, the gates will descend seven seconds after crossing activation. If, however, a motor vehicle is detected, the entrance gates will descend but the exit gate for that direction of movement will remain in the up position to allow for an escape route for the motor vehicle. If the crossing has been activated and the gates are down (Footnote 1) when a loop detects a motor vehicle, the Microlok II wayside control system will drop the cab signal to its most restrictive state with a train occupying the corresponding track (Footnote 2), but will not raise the exit gate unless the entrance gate indicates that it is not in the down position.

FootNote:
1 Manufacturer's specifications for gate down indication call for an angle of 0 degrees to 5 degrees from horizontal, however, the entrance gates at Miner Lane were set to indicate a gate down position at 10 degrees from horizontal.

FootNote:
2 Corresponding track refers to the track closest to the entrance gate inductance loop. At Miner Lane, loops A and F are on the track 1 side of the crossing, and loops C and D are on the track 2 side of the crossing.

Testing of the highway-rail grade crossing warning system was performed on September 28, 2005, post incident, with an FRA Signal and Train Control inspector present. All components of the warning system functioned as designed during these tests. A re-enactment of the accident was performed using the same type of vehicle and it was determined that the front end of the vehicle occupied the presence detector loop prior to the northbound entrance gate being struck by the vehicle's windshield. Re-enactment also confirmed that, by lifting the entrance gate to the point to which it does not indicate in the down position, there was ample room for the vehicle to travel underneath the entrance gate and into the path of the oncoming train.

The event recorder from the lead power car was downloaded by an Amtrak road foreman and indicates that the bell and horn were sounding for 18 seconds prior to impact with the motor vehicle and that the engineer had applied an emergency application of the braking system just prior to impact. It also shows that the cab signals went to there most restrictive state 2 seconds after the emergency brake application. The train crew complied with all applicable railroad operating rules and federal regulations. It should be noted that there is approximately a 2-minute discrepancy between the events noted in the power car's event recorder and that of the highway grade crossing event recording equipment.

The event recorder from the Microlok II wayside control system was downloaded by Amtrak C&S personnel at Miner Lane. It should be noted that a time stamp was performed in reference to the dispatching office located at South Station terminal, Boston, Massachusetts and it was found that the Microlok II event recorder was 8 minutes and 01 second faster than that of the dispatching office. In the following chronological time line of the Microlok II event recorder, the time has been adjusted to correspond with that of the dispatching office.

7:38:17.00 Highway-rail crossing activates, bell sounds and lights flash
7:38:23.30 All inductive loops indicate no presence of motor vehicles
7:38:24.00 Crossing gates begin to descend
7:38:31.80 Crossing gates indicate in the down position
7:39:23.80 Loop D indicates motor vehicle presence at southeast entrance gate (gate 2), 2WBCAB relay drops sending restricting cab signal to train
7:39:24.70 2XGDN (gate 2 down) relay clears, indicating that the gate is not in the down position (vehicle strikes gate causing it to rise). 3GCR clear, indicates command sent to lift exit gate 3. LOOPZ relay set allowing 2WBCAB to set (clearing cab restriction) while in time out.
7:39:24.90 Loop E indicates motor vehicle presence between main track 1 and 2. (Vehicle on track 2)
7:39:25.20 2XOTP relay clears indicating train at crossing on main track 2 and is westbound. 2XGDN relay sets indicating gate 2 is in the down position. Loops B and C detect presence indicating movement through the crossing (motor vehicle and train). 4GCR relay clear, indicates command sent to lift gate 4.
7:39:25.80 2WAP relay clears indicating that the head end of the train is west of the crossing.
7:39:26.10 Gates 3 and 4 indicate NOT in the down position.
7:39:27.10 2WBCAB relay clears, restricting cab signals to train.
7:39:31.40 Gate 3 indicates in the up position
7:39:32.10 Loop D no longer detects presence
7:39:32.20 Gate 4 indicates in the up position. Gate 3 begins to descend. Loop E no longer detects presence.
7:39:34.20 Loop B no longer detects presence.
7:39:34.30 Gate 4 begins to descend. Loop C no longer detects presence.
7:39:35.70 2EAP relay set, indicating train is no longer on the westbound approach circuit.
7:39:36.40 2XOTP set indicating train is west of crossing. Crossing begins to deactivate. 2WBCAB set clearing cab signal restriction to train.
7:39:44.60 Crossing is up and clear
7:44:25.20 2EBCAB clear restricting cab signals due to train stopped within approach circuitry for more than 5 minutes (west of crossing).

Geographically oriented information of the highway-rail grade crossing is as follows:

Southbound motor vehicular traffic:
- Gate 1; NW quadrant of crossing (entrance gate)
- Gate 4; SW quadrant of crossing (exit gate)
- Loop between gate 1 and main track 1; A
- Loop between main tracks; B
- Loop between main track 2 and gate 4; C

Northbound motor vehicular traffic:
- Gate 2; SE quadrant of crossing (entrance gate)
- Gate 3; NE quadrant of crossing (exit gate)
- Loop between gate 2 and main track 2; D
- Loop between main tracks; E
- Loop between main track 1 and gate 3; F

The lead power car (2009) was inspected by Amtrak personnel at the accident site. Although, the power car's event recorder was not provided with an input from the auxiliary lights at the time of the incident, the headlights, auxiliary lights, and audible warning devices functioned as intended. The train set was taken to Amtrak's high speed facility at South Hampton Street Yard, Boston, Massachusetts. A subsequent inspection of the power car was performed by Amtrak mechanical personnel at this facility. It was found that there was approximately $12,012 in damage to the power car with labor costs estimated at $13,000 for a total of $25,000 in estimated damage.

Connecticut General Statute § 14-235 (1998) is in effect for highway users at highway-rail grade crossings in Connecticut. This law applies to the Miner Lane highway-rail grade crossing.

Connecticut General Statute § 14-235

When approaching within one hundred feet of, or crossing any highway-rail crossing, Connecticut law prohibits drivers from driving to the left side of the highway.

Connecticut requires motorists to stop at crossings but does not prescribe a specific stopping distance from the crossing.

Any driver who fails to come to a full stop at a highway-rail crossing, when warned of an approaching train by flashing lights erected at the crossing, may be fined one hundred and fifty dollars. Connecticut General Statute § 14-249 (1999).

Conclusions

The accident was caused by failure of the motor vehicle operator to stop for the crossing warning system and yield to the westbound approaching train as required by Connecticut General Statute. The crossing warning system was activated and all gates were in the down position. The automobile traveled under the northbound entrance gate, which is 3 feet 10 inches above the crown of the road surface and into the path of the oncoming train, which was traveling at a speed of 71 mph. This action caused the train to strike the motor vehicle's right side, center, and push it 1,200 feet west of the crossing where the train came to a stop.

Probable Cause and Contributing Factors

The accident was caused by failure of the motor vehicle operator to stop for the crossing warning system and yield to the train.