Investigative Team

- Robert Sumwalt - Board Member on Scene
- Michael Hiller - IIC
- Robert Accetta - Asst. IIC
- Kenny Bragg - Highway HP
- Ruben Payan - Signals and Grade Crossing
- Dan Walsh - Signals and Grade Crossing
- Dana Sanzo - Crashworthiness
- Cyril Gura - Track and Power
- George Haralampopoulos - Event Recorders and Sound Study
- Tom Barth - Survival Factors
- Dave Bucher - Operations
- Nancy McAtee - Fire Science
- Mary Pat McKay - Medical Officer
- Joey Rhine - Mechanical
- Kristin Poland - 3-D Laser Scanning
Staff

- Ben Allen-General Counsel
- Shannon Bennett-General Counsel
- LaSean McCray-Confidential Asst.
- Rafael Marshall-Program Manager
- Adrienne Lamm-Materials Engineer
- Xiaohu Liu-Materials Engineer
- Eric Weiss-Media Relations
- Nicholas Worrell-Media Relations
- Max Green-TDA
- Katy Chisom-TDA
- Jane Terry-GA
- John Whitener-CIO
- Christy Spangler-Graphic Developer
- Gena Evans-Editor
- Gloria Noguera-Visuals and timing
Parties to the Investigation

• Federal Railroad Administration
• Metro-North Railroad
• Association of Commuter Rail Employees
• Town of Mount Pleasant, New York
• New York Public Transportation Safety Board
Presentation Topics

• Engineer’s and SUV driver’s performance
• Highway-railroad grade crossing and traffic signals
• Metro-North’s third rail and traction power
• Railcar crashworthiness
Human Performance Factors

Kenny Bragg
Overview

• Engineer’s performance
• Driver performance at the grade crossing
• Ability to hear the train
• Driver response to train warnings
• Vehicle familiarity
Engineer’s Performance

- Fatigue
- Cellphone use
- Alcohol and other drugs
- Engineer’s response
## Driver’s Fatigue

<table>
<thead>
<tr>
<th>From Date</th>
<th>From Time</th>
<th>To Date</th>
<th>To Time</th>
<th>Elapsed Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 1, 2015</td>
<td>1:27 a.m.</td>
<td>February 1, 2015</td>
<td>8:45 a.m.</td>
<td>7 hours 18 minutes</td>
</tr>
<tr>
<td>February 2, 2015</td>
<td>12:00 a.m.</td>
<td>February 2, 2015</td>
<td>9:00 a.m.</td>
<td>9 hours</td>
</tr>
<tr>
<td>February 3, 2015</td>
<td>12:00 a.m.</td>
<td>February 3, 2015</td>
<td>9:00 a.m.</td>
<td>9 hours</td>
</tr>
</tbody>
</table>

SUV Driver’s Opportunity for Rest
Driver’s Medical Issues

• No contributing medical conditions
• No recent complaints of health issues
• Negative for alcohol and other drugs
Driver’s Cellphone Use

• Hands-free vehicle feature
• Call received 15 minutes prior to crash
• No phone use at the time of crash
Driver Performance

Commerce Street highway-railroad grade crossing

Earlier automobile crash that led to detour
Ability to Hear Train

- Driver’s hearing normal
- Train horn sounded 4 times as train approached crossing
- Sound study of ambient vehicle and train horn sounds
Driver Response to Active Train Warnings

• Driver exited vehicle
• Moved about the crossing
• Attention focused on assessing damage to vehicle
• Unaware of train proximity
Vehicle Familiarity
Summary

- Fatigue, medical issues and cellphone use excluded
- Audibility of train horn excluded
- Active warnings did not influence driver behavior
Highway-Railroad Grade Crossing & Traffic Signals

Dan Walsh
Overview

• Signage and pavement markings
• Railroad grade crossing warning system
• Preemption of the traffic signal
• Closure of the Commerce Street grade crossing
Signage and Markings

- Grade crossing pavement marking symbol
- Grade crossing advance warning symbol
- “Do Not Stop on Tracks” sign
- White stop line
- Grade crossing warning crossbuck
Railroad Grade Crossing Warning System

- Flashing lights and two breakaway gate arms
- Configured to provide a minimum of 35 seconds warning time
  - FRA’s regulation require minimum of 20 seconds
- Data logs indicated 39 second warning time
Preemption of Traffic Signal

• Traffic signal contained two preemptions
• Preemption #1 – activated by loop detector in the pavement of the southwest approach to the grade crossing
• Preemption #2 – activated by railroad train detection circuit
Results and Post-accident Actions

• Post-accident examinations revealed
  – Preemption #1 did not comply with MUTCD
  – Changed clearance time to 29 seconds
  – Based on guidance in the Railroad Highway Grade Crossing Handbook
Results and Post-accident Actions continued

• NYSDOT could not explain the guidance used to determine preemption timing on the day of the accident
  – A similar location was identified in Region 8
  – NYSDOT is currently examining all grade crossings with preemption in the state
Closure of Commerce Street Grade Crossing

• Town of Mount Pleasant study to close the Commerce Street grade crossing
  – Poor angle of approach, poor visibility, high train volumes, and 2 fatal crashes resulting in 7 fatalities
  – Was in compliance with NYSDOT and FHWA guidance regarding closure of grade crossings
Summary

• Grade crossing warning system functioned as designed when the accident occurred

• Adjustments made by NYSDOT on May 1, 2015
  – Activation of the railroad preemption received first priority
  – Clearance time met current industry guidance

• NYSDOT proceed with the necessary adjustments to the preemption timing
Metro-North Third Rail Traction Power System

Ruben Payan & Dr. Xiaohu Liu
Third Rail Configuration

- Electrical power
- Conducting surface is under-running
- 700-volt, direct current
### Traction Power System Data

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:26:21 pm</td>
<td>Substation B26 detected the first fault</td>
<td>8 seconds after collision</td>
</tr>
<tr>
<td>6:27:02 pm</td>
<td>Power Director's Office sent an open command for Substation B29</td>
<td>41 seconds later</td>
</tr>
<tr>
<td>6:27:50 pm</td>
<td>Power Director's Office sent an open command for Substation B26</td>
<td>1 minute 29 seconds later</td>
</tr>
</tbody>
</table>
Modeling of the Third Rail Assembly

• Objective
  • Study the structural behavior of the third rail assembly under simulated loading conditions

Why did the third rail penetrate the railcars without breaking away?
Third Rail Assembly Finite Element Model

Study focused on the joints between third rail sections
Simulated Loading Conditions

Up and Down Bending

Side to Side Bending
Simulation Results: Up and Down Bending

Regions with large plastic deformation
Simulation Results: Side to Side Bending

Regions with large plastic deformation

Front view
Third Rail Assembly Modeling Summary

- The third rail assembly structure was not constructed to fail in a controlled manner or break away under undesirable overloaded conditions.
  - The third rail assembly would have undergone large deformation before failing.
  - Both the splice bars and the bolts could fail under these overloaded conditions.
Summary

• Third rail substation power was de-energized in a timely manner

• Third rail systems at or near grade crossings may increase the severity of damages and injuries

• Other railroad and transit properties with grade crossings and third rail systems could pose similar risks
Railcar Crashworthiness

Dana Sanzo
Overview

- Accident sequence
- Postaccident fire
- Emergency evacuation
Substation B26
2N

Substation B29
2S

Center line of track 2

250 feet

East third rail

West third rail

Transition jumper 2266

Train 659 direction of travel

Approximate distance 2.7 miles Between substations
Fire Ignition

- Cab quickly filled with smoke
- Engineer saw fire in passenger area
- Fire described as spot fires