



National Transportation Safety Board

Highway-Railroad Grade Crossing Collision
Commerce Street, Valhalla, New York
February 3, 2015
DCA15MR006

Michael Hiller, IIC







Third rail



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



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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

From		To		Elapsed Time
Date	Time	Date	Time	(Approximate)
February 1, 2015	1:27 a.m.	February 1, 2015	8:45 a.m.	7 hours 18 minutes
February 2, 2015	12:00 a.m.	February 2, 2015	9:00 a.m.	9 hours
February 3, 2015	12:00 a.m.	February 3, 2015	9:00 a.m.	9 hours

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

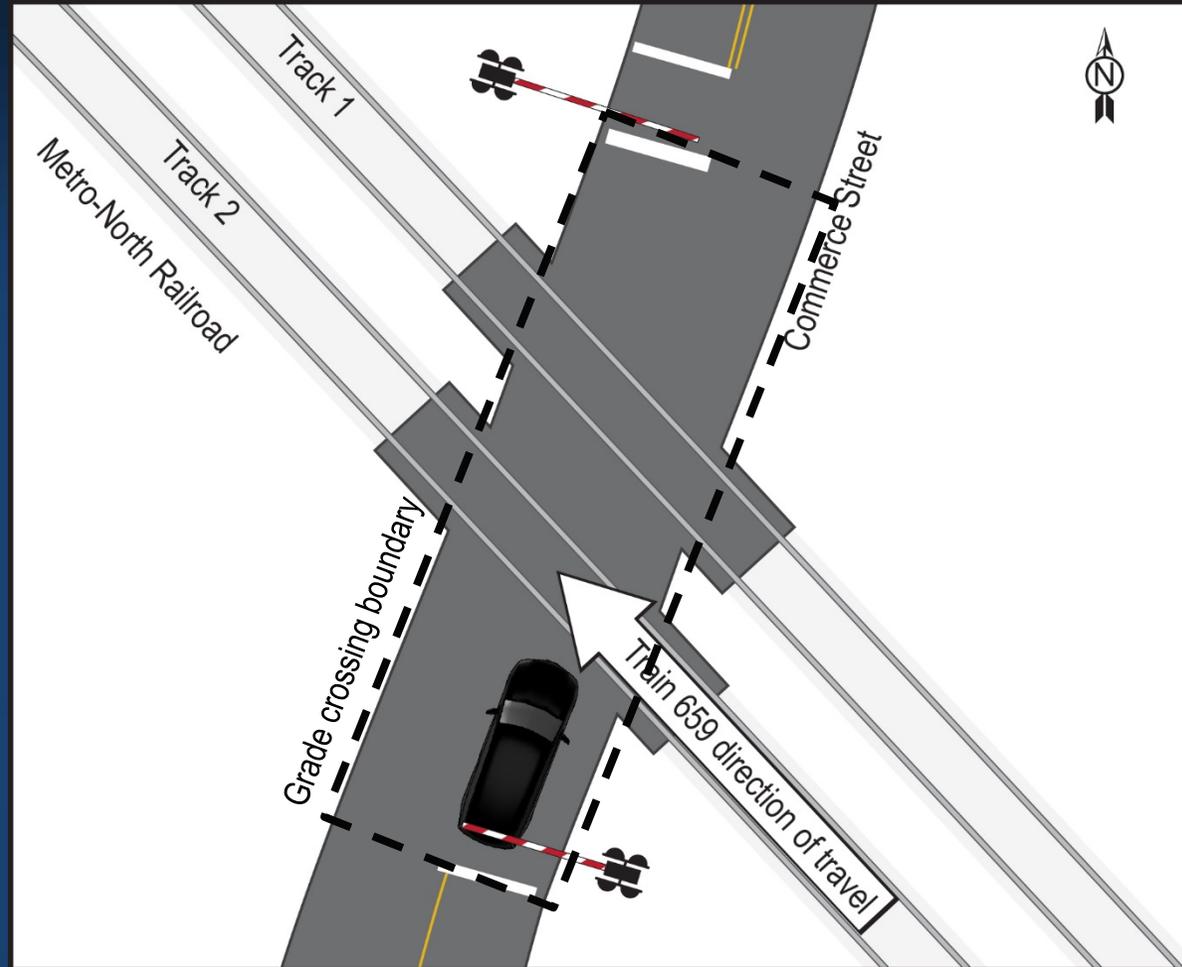
Driver's Cellphone Use

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

Driver Performance



Driver Performance



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



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Highway-Railroad Grade Crossing & Traffic Signals

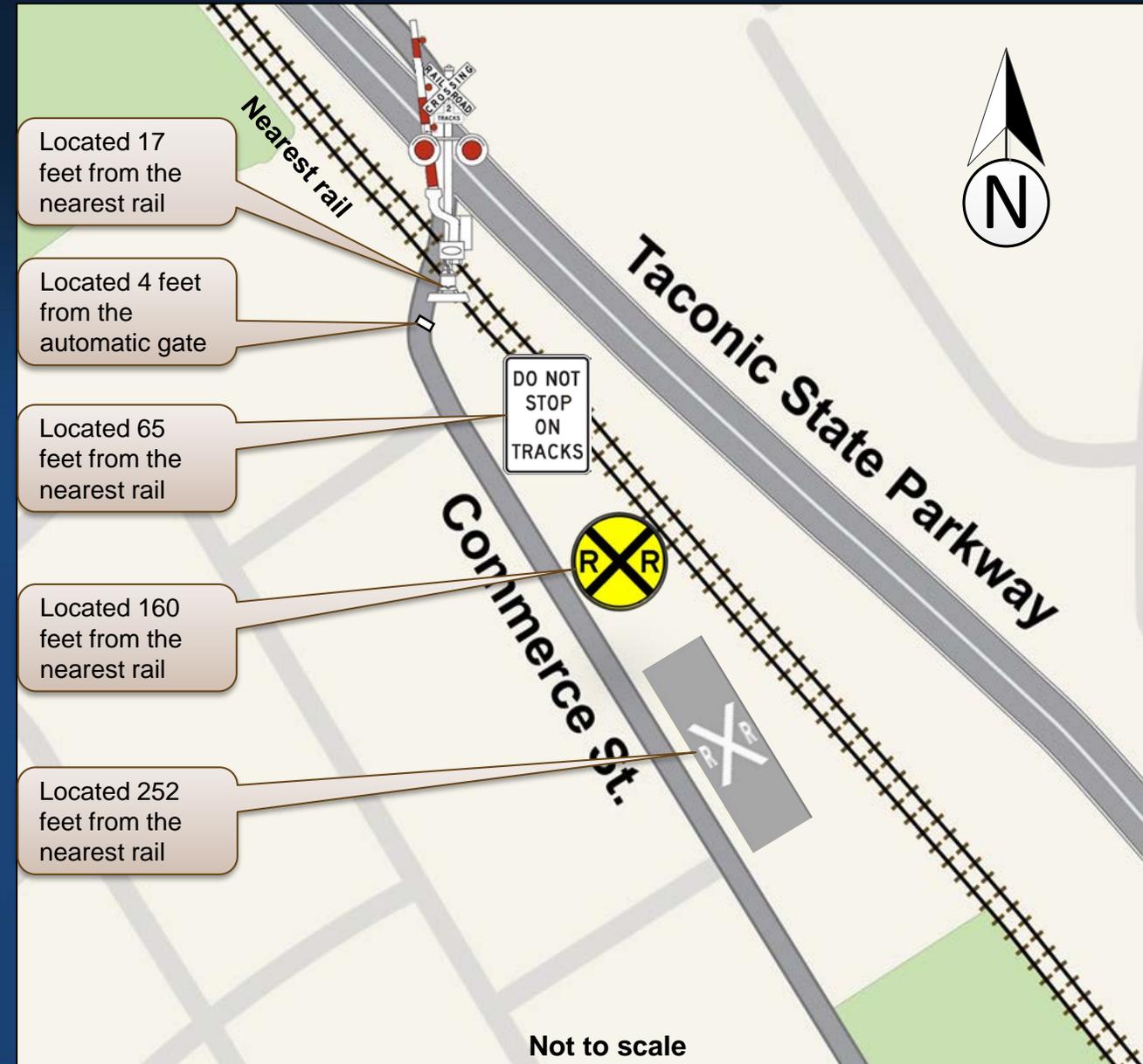
Dan Walsh

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

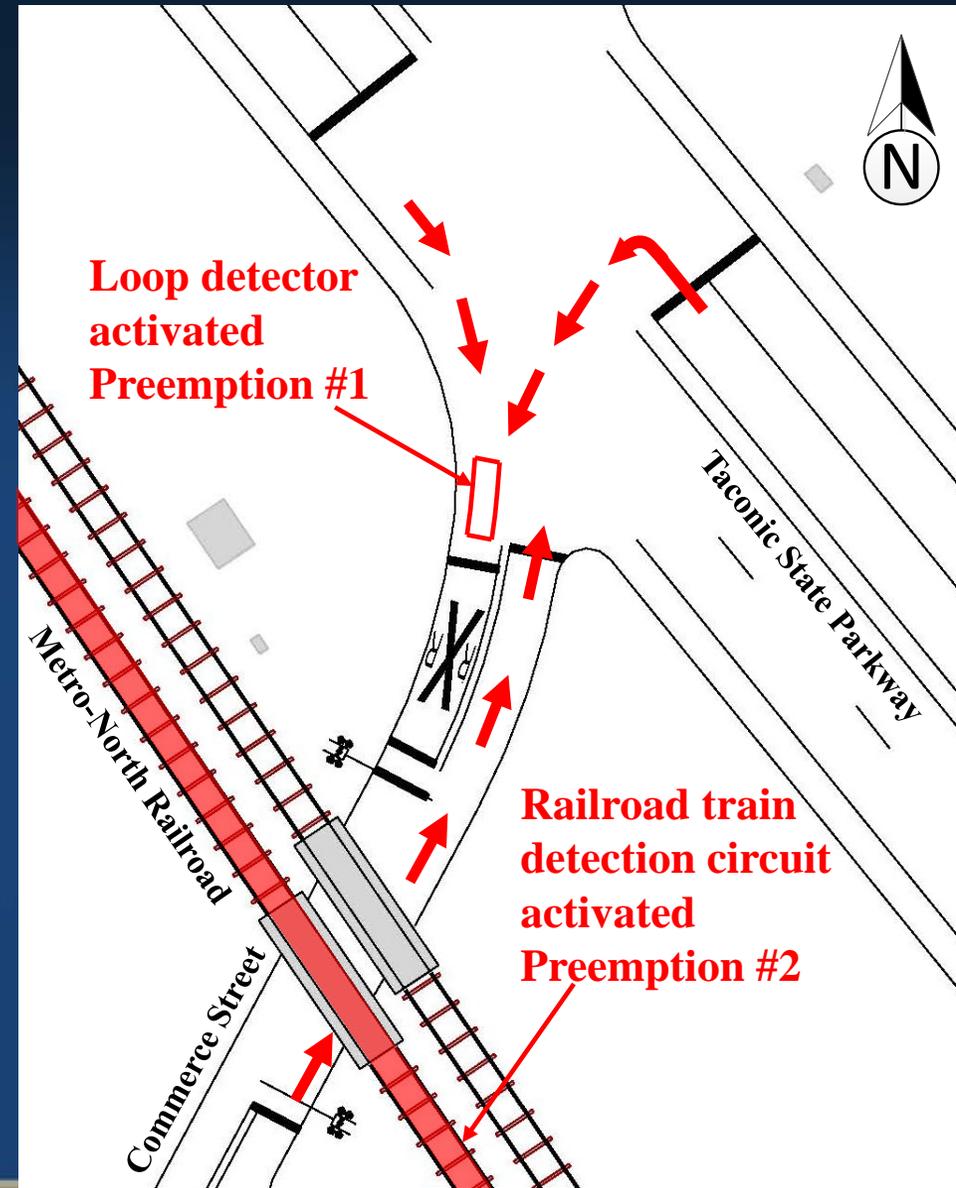


Railroad Grade Crossing Warning System

- 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



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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

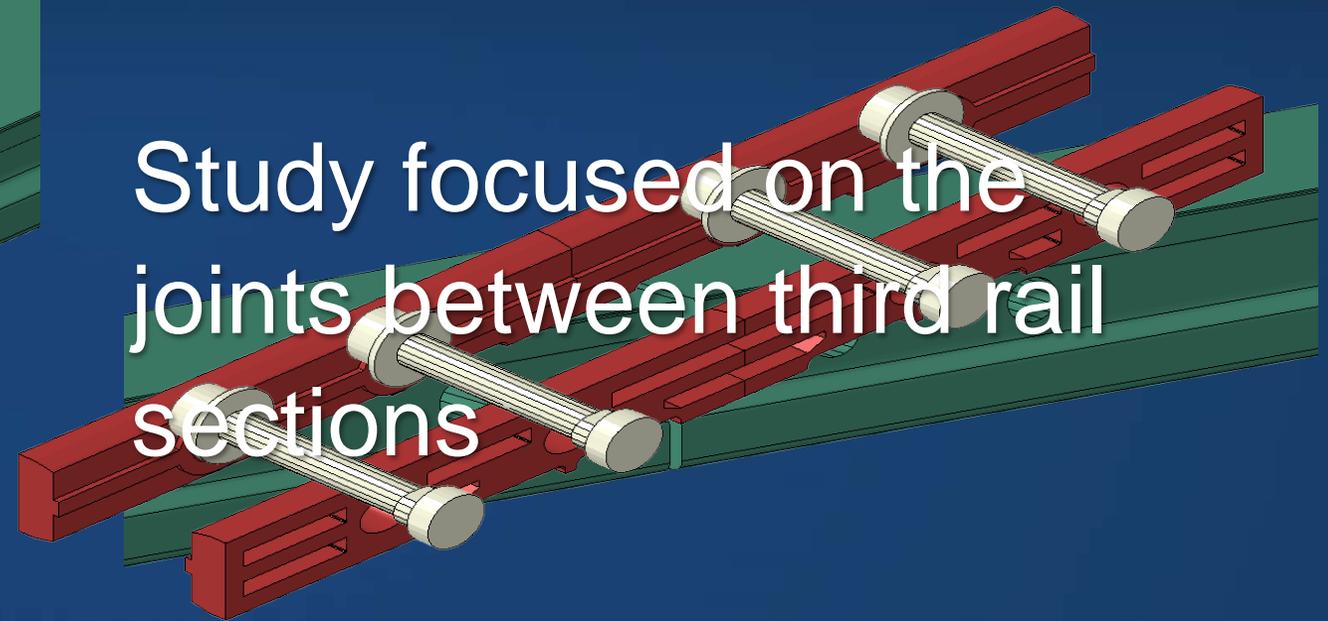
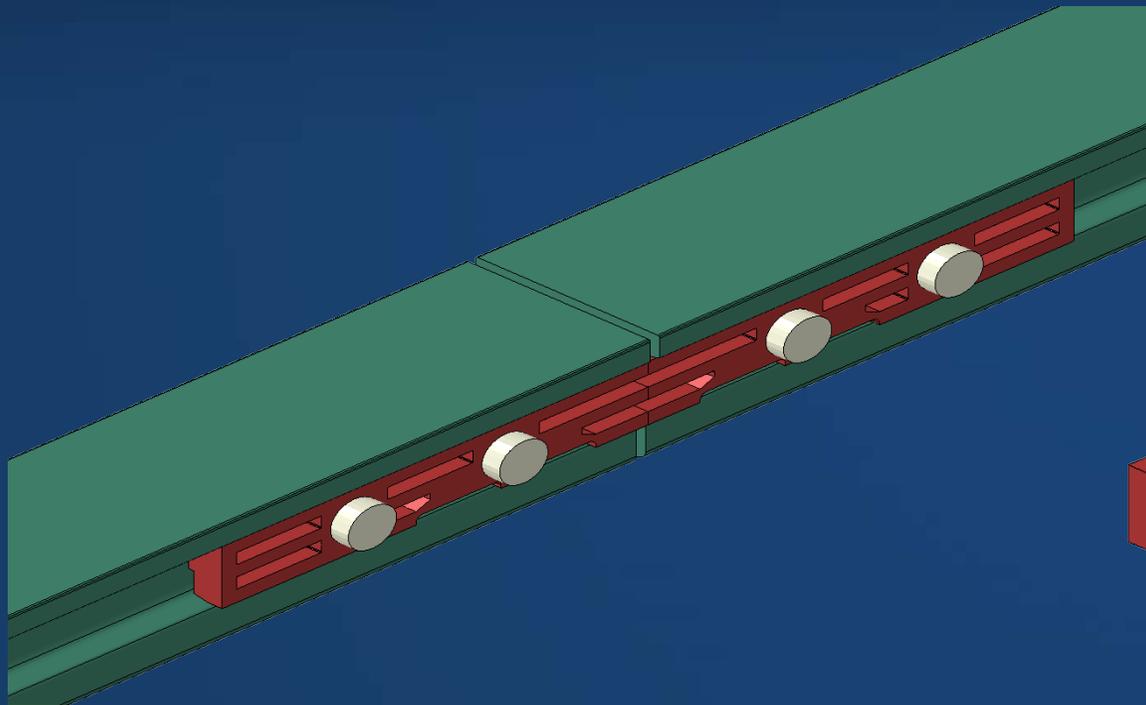
6:26:21 pm	Substation B26 detected the first fault	8 seconds after collision
6:27:02 pm	Power Director's Office sent an open command for Substation B29	41 seconds later
6:27:50 pm	Power Director's Office sent an open command for Substation B26	1 minute 29 seconds later

Modeling of the Third Rail Assembly

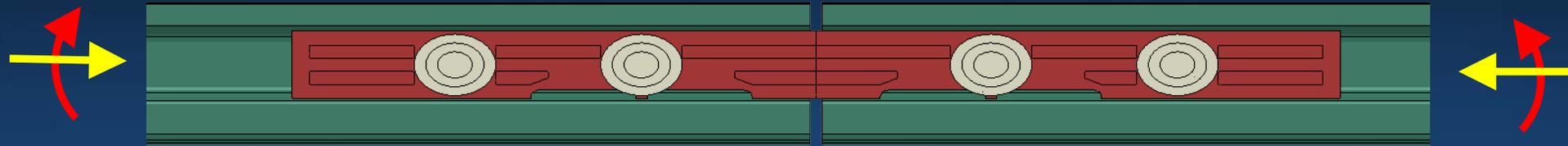
- Objective
 - Study the structural behavior of the third rail assembly under simulated loading conditions

Why did the third rail penetrate the railcars without breaking away?

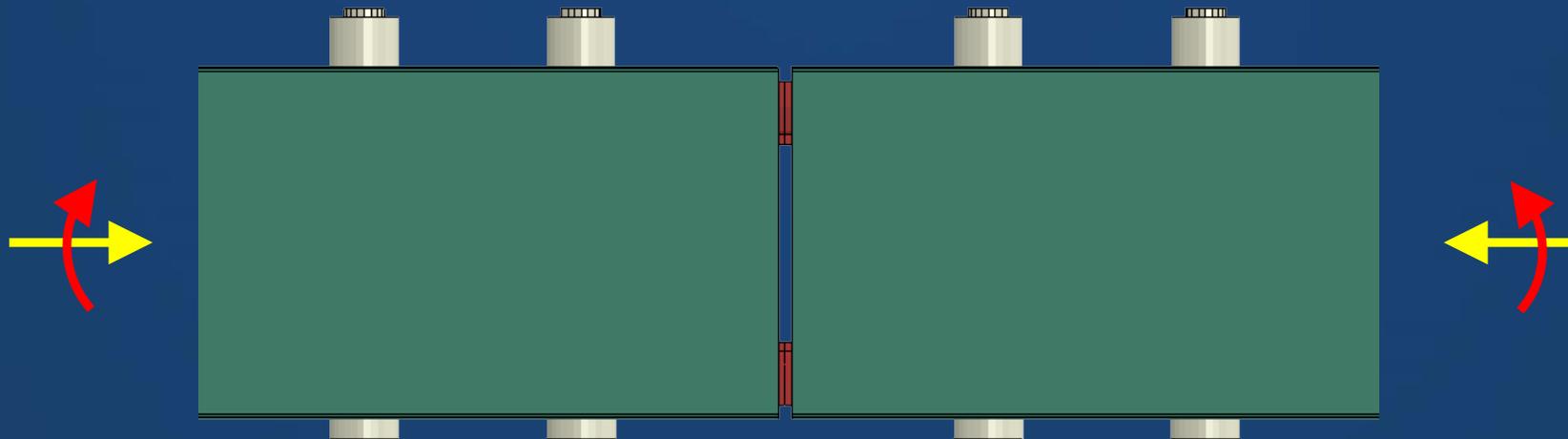
Third Rail Assembly Finite Element Model



Simulated Loading Conditions

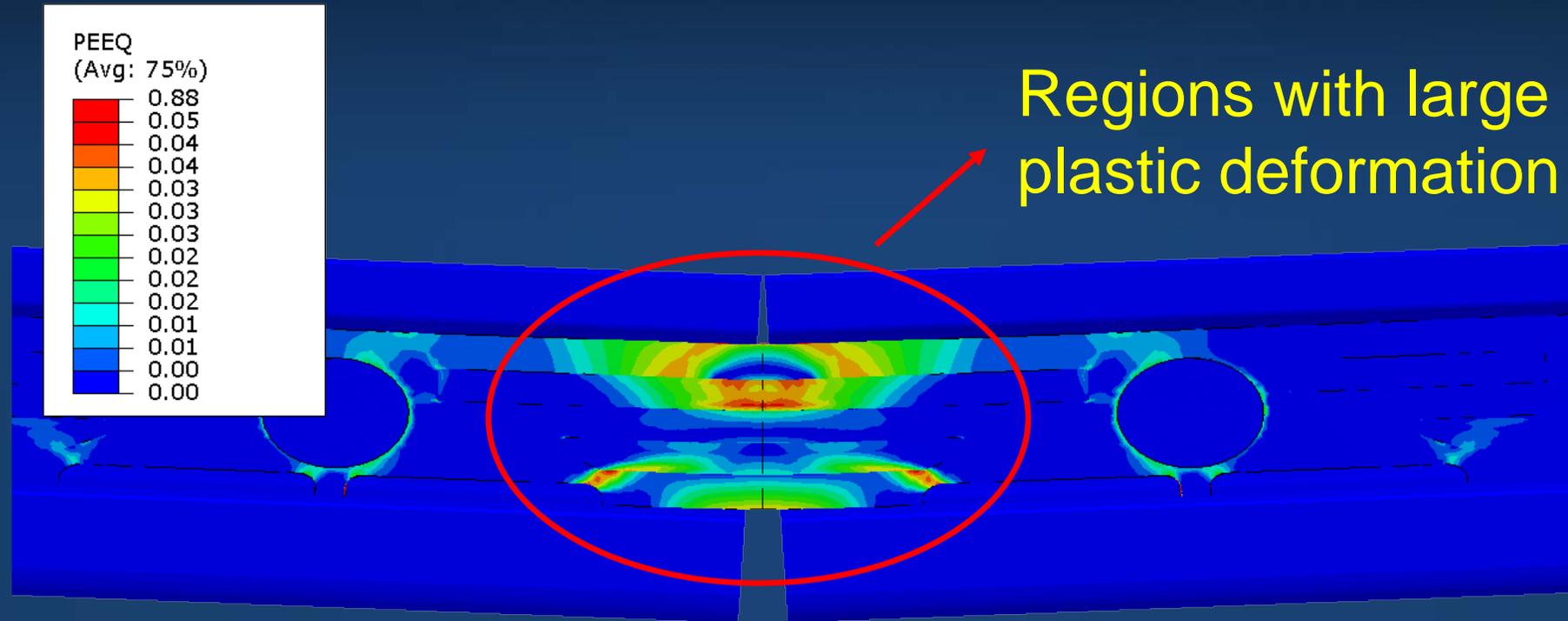


Up and Down Bending

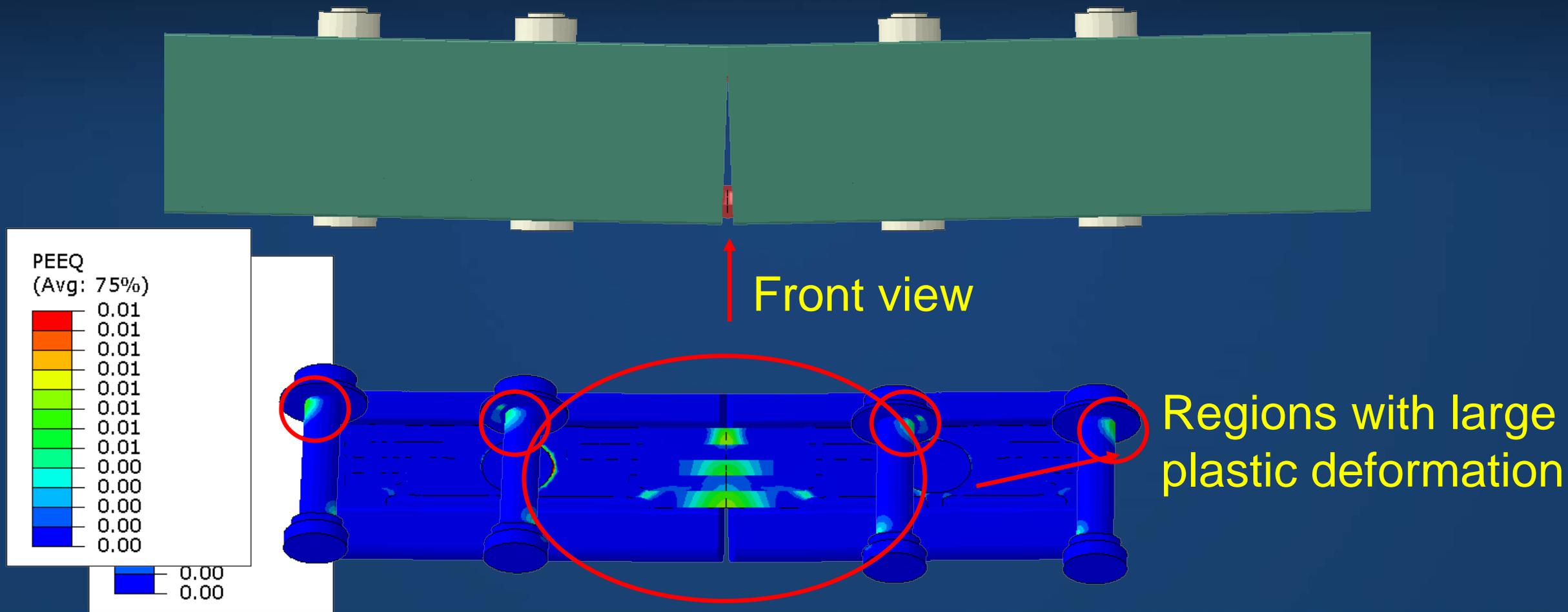


Side to Side Bending

Simulation Results: Up and Down Bending



Simulation Results: Side to Side Bending



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



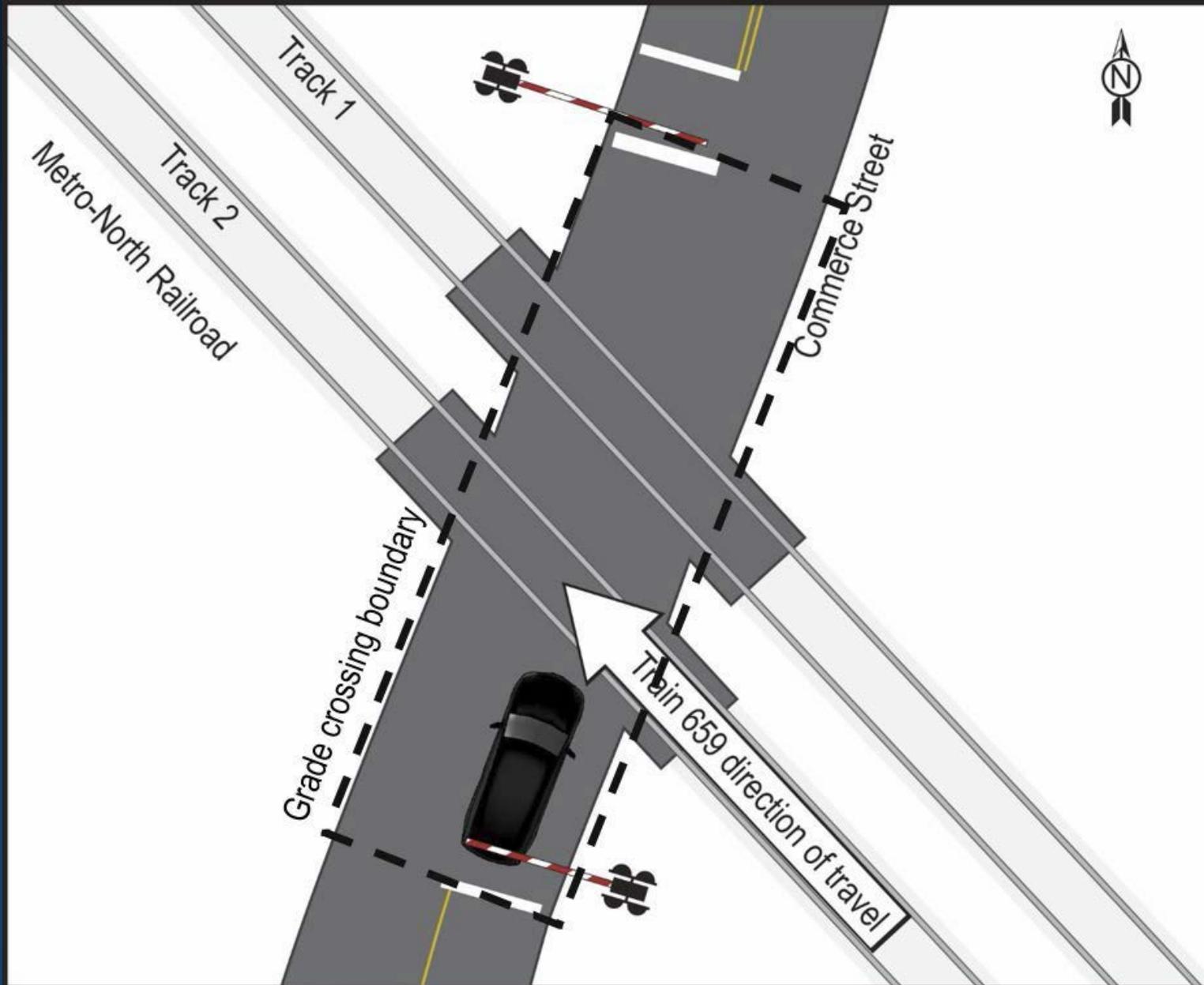
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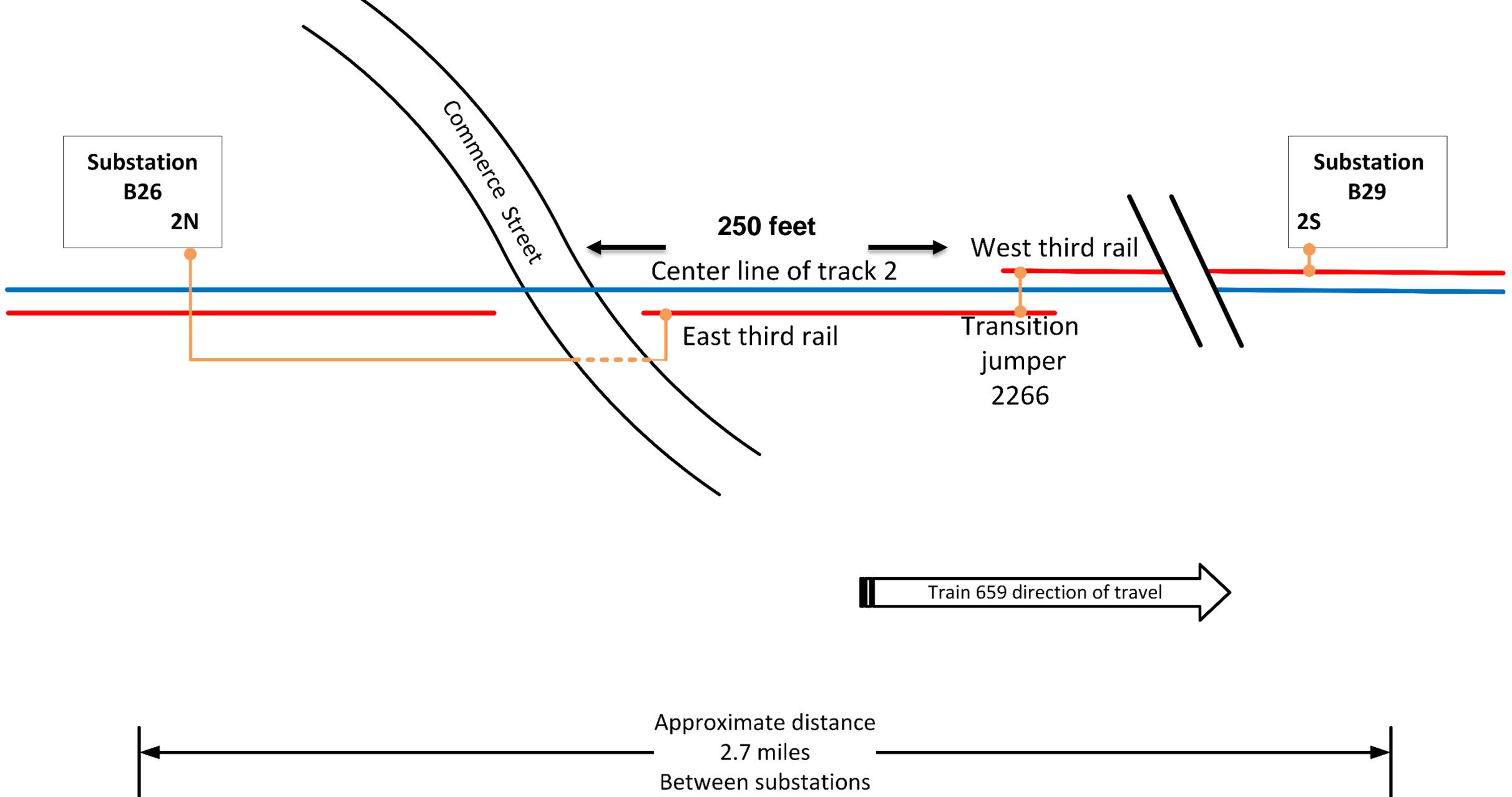
Railcar Crashworthiness

Dana Sanzo

Overview

- Accident sequence
- Postaccident fire
- Emergency evacuation







Third rail

Direction of travel



Third rail entry locations



Fire Ignition

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





