National Transportation Safety Board

# Welcome to the NTSB

MICHIGAN STATE UNIVERSITY
Broad College of Business

RMP
RAILWAY MANAGEMENT PROGRAMS

# NTSB's Role in Railroad Accident Investigation

Robert Sumwalt

- NTSB is an independent federal agency
  - investigate transportation accidents
  - determine probable cause
  - issue safety recommendations

**In 1974, Congress made the NTSB completely independent of the DOT.**

# Independence

The NTSB reports directly to Congress.

The NTSB has no regulatory authority.

NTSB

# NTSB's Rail Accident Investigation Authority

- The NTSB shall investigate or have investigated…
  - A railroad accident in which there is a fatality or substantial property damage, or involves a passenger train.

Source: 49 *USC* 1131

NTSB

# NTSB Railroad Division

## 2 Supervisory Personnel

## 12 Rail Investigators

# The Board

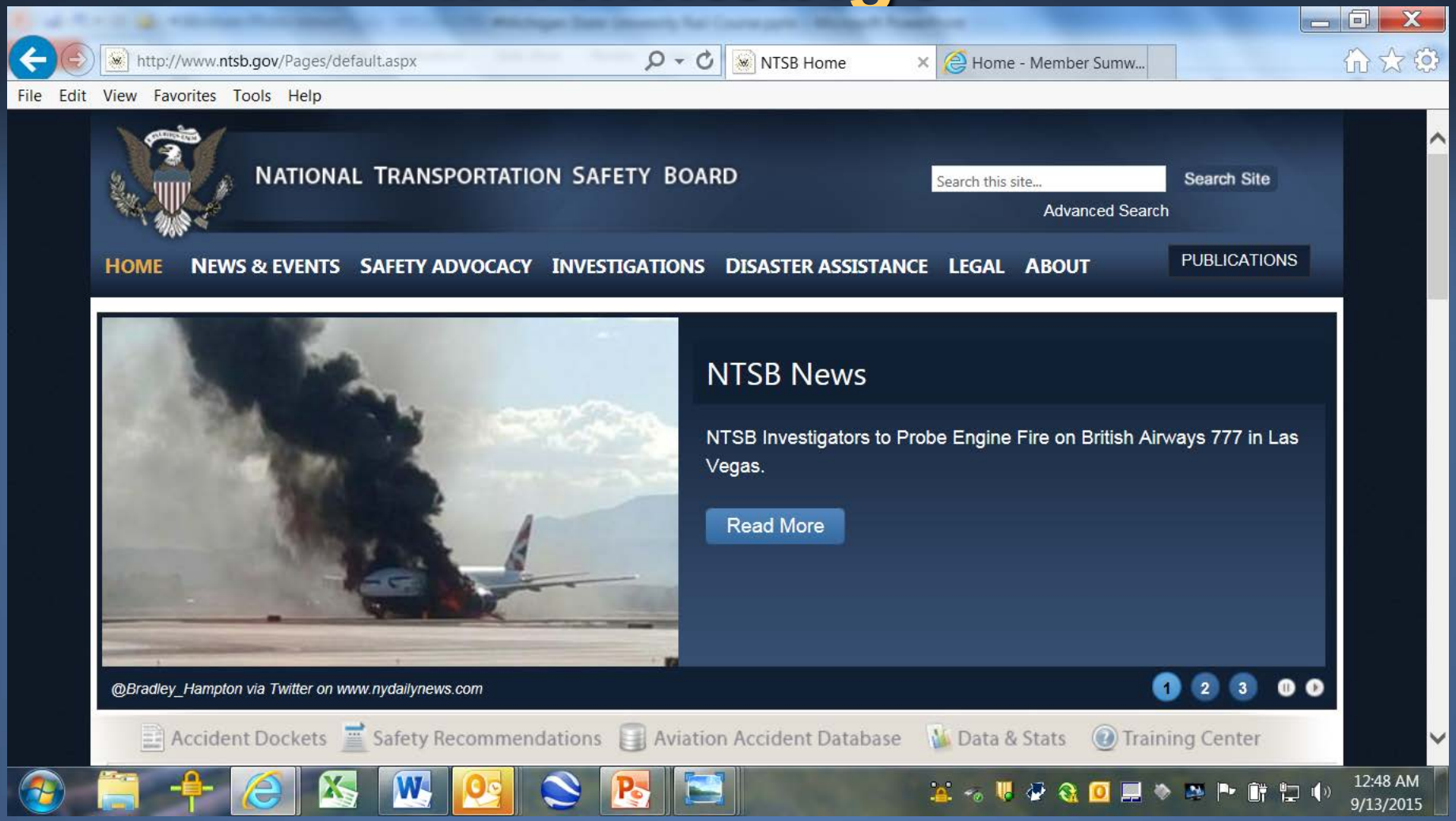
Earl Weener

Bella Dinh-Zarr
Vice Chairman

Christopher Hart
Chairman

Robert Sumwalt

# www.ntsb.gov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1 2 3
Accident Dockets
Safety Recommendations
Aviation Accident Database
Data & Stats
Training Center
12:48 AM
9/13/2015

HOME NEWS & EVENTS SAFETY ADVOCACY INVESTIGATIONS DISASTER ASSISTANCE LEGAL ABOUT PUBLICATIONS

## NTSB News

NTSB Investigators to Probe Engine Fire on British Airways 777 in Las Vegas.

Read More

# SCROLL DOWN

LA PIETRA, with Subsequent Sinking

8/25/2015 - : Allision of Offshore Supply Vessel Tristan Janice with Natural Gas Platform

8/19/2015 - : Marine Accident Brief: Sinking of Towing Vessel NALANI

Cessna 150 in wooded terrain in Atco, N.J.

Expand

NTSB @NTSB 11 Sep

Preliminary report on the

Tweet to @NTSB

## Upcoming Events

10/14/2015 - Forum: Humans and Hardware: Preventing Inflight Loss of Control in General Aviation

NTSB Conference Center

Webcast of Events

## Speeches and Testimony

Board member and staff remarks concerning transportation safety:

Chairman Christopher Hart
Vice Chairman T. Bella Dinh-Zarr
Member Robert Sumwalt
Member Earl F. Weener

NTSB 2015
MOST WANTED
LIST OF TRANSPORTATION
SAFETY IMPROVEMENTS
Critical changes needed to reduce
transportation accidents and save lives
NATIONAL TRANSPORTATION SAFETY BOARD
Education
DEAD END
SAFE FIRS
www.ntsb.gov/mostwanted

NTSB

# NTSB 2015 Most Wanted List

- Disconnect from Deadly Distractions
- End Substance Impairment in Transportation
- Enhance Public Helicopter Safety
- Implement Positive Train Control
- Improve Rail Tank Car Safety
- Make Mass Transit Safer
- Prevent Loss of Control in General Aviation
- Require Medical Fitness for Duty
- Strengthen Commercial Trucking Safety
- Strengthen Procedural Compliance in Aviation

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# Disconnect from Deadly Distractions

Chatsworth, California
September 2008

NTSB

# Disconnect from Deadly Distractions

Two Harbors, Minnesota
September 2010

"The use of cell phones by crewmembers on the southbound train and by the engineer on the northbound train was a distraction to the safe operation of both trains and an indication of a clear disregard for CN Railway rules and FRA regulations."

# Implement Positive Train Control

Philadelphia
May 2015

NTSB

# Implement Positive Train Control

New York City
December 2013

NTSB

# Improve Rail Tank Car Safety

Casselton, North Dakota
December 2013

NTSB

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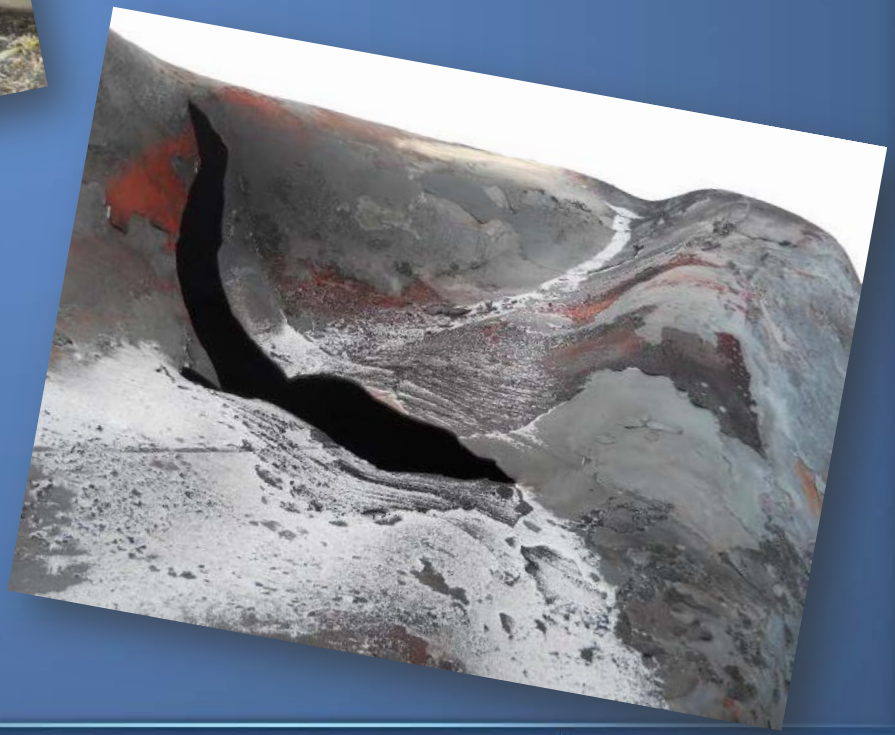
Casselton, North Dakota
December 2013

NTSB

# Improve Rail Tank Car Safety



Casselton, North Dakota
December 2013

NTSB

# Improve Rail Tank Car Safety

Lynchburg, Virginia
April 2014

NTSB

# Make Mass Transit Safer

Chicago O'Hare International Airport
March 2014

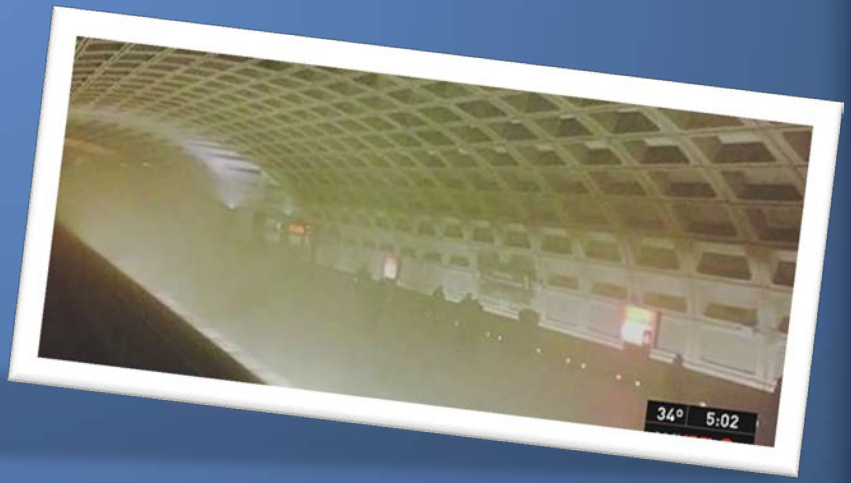
NTSB

# Make Mass Transit Safer

Washington, DC
June 2009

NTSB

# Make Mass Transit Safer



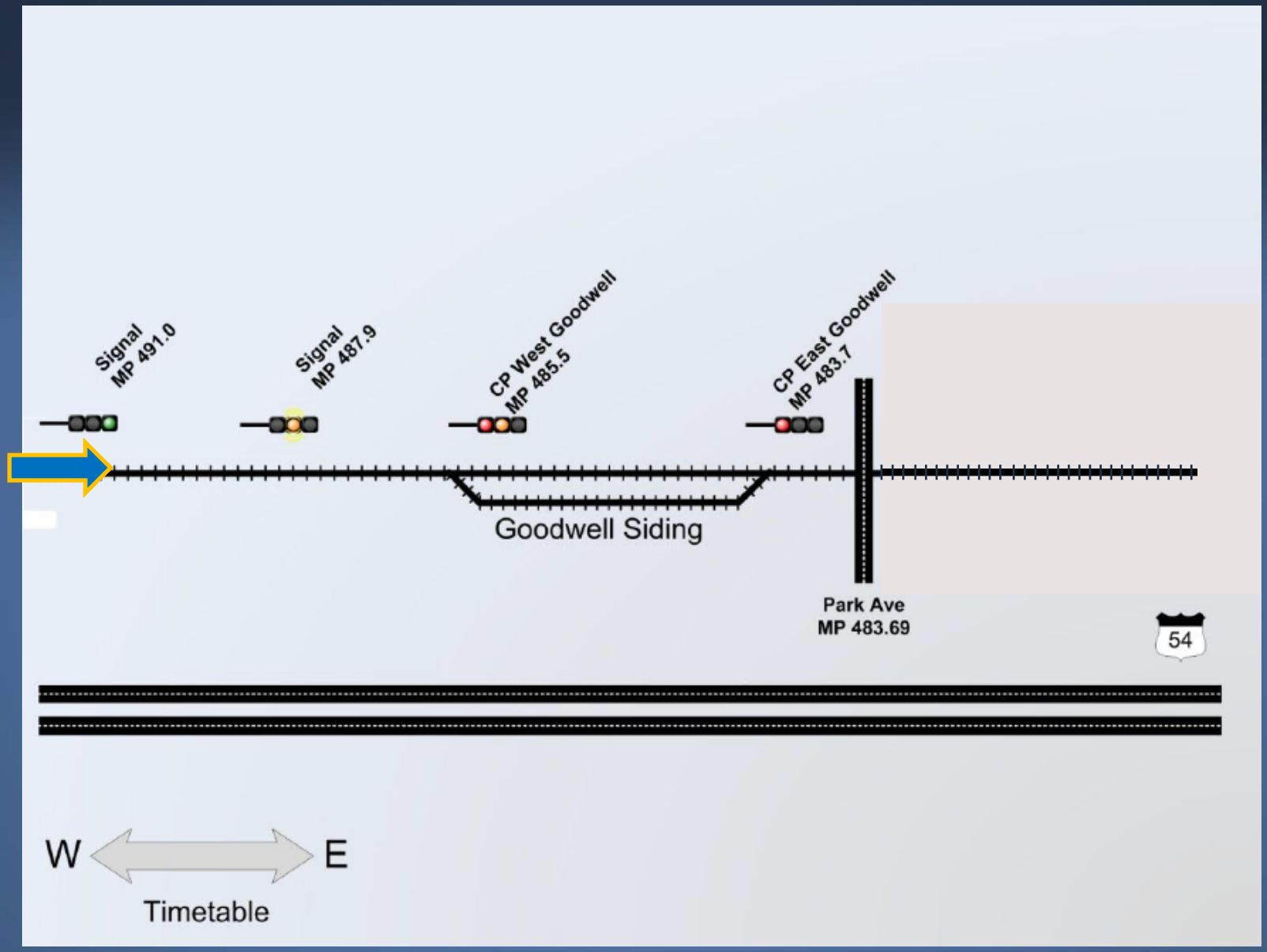

L'Enfant Plaza Metro Station
January 2015

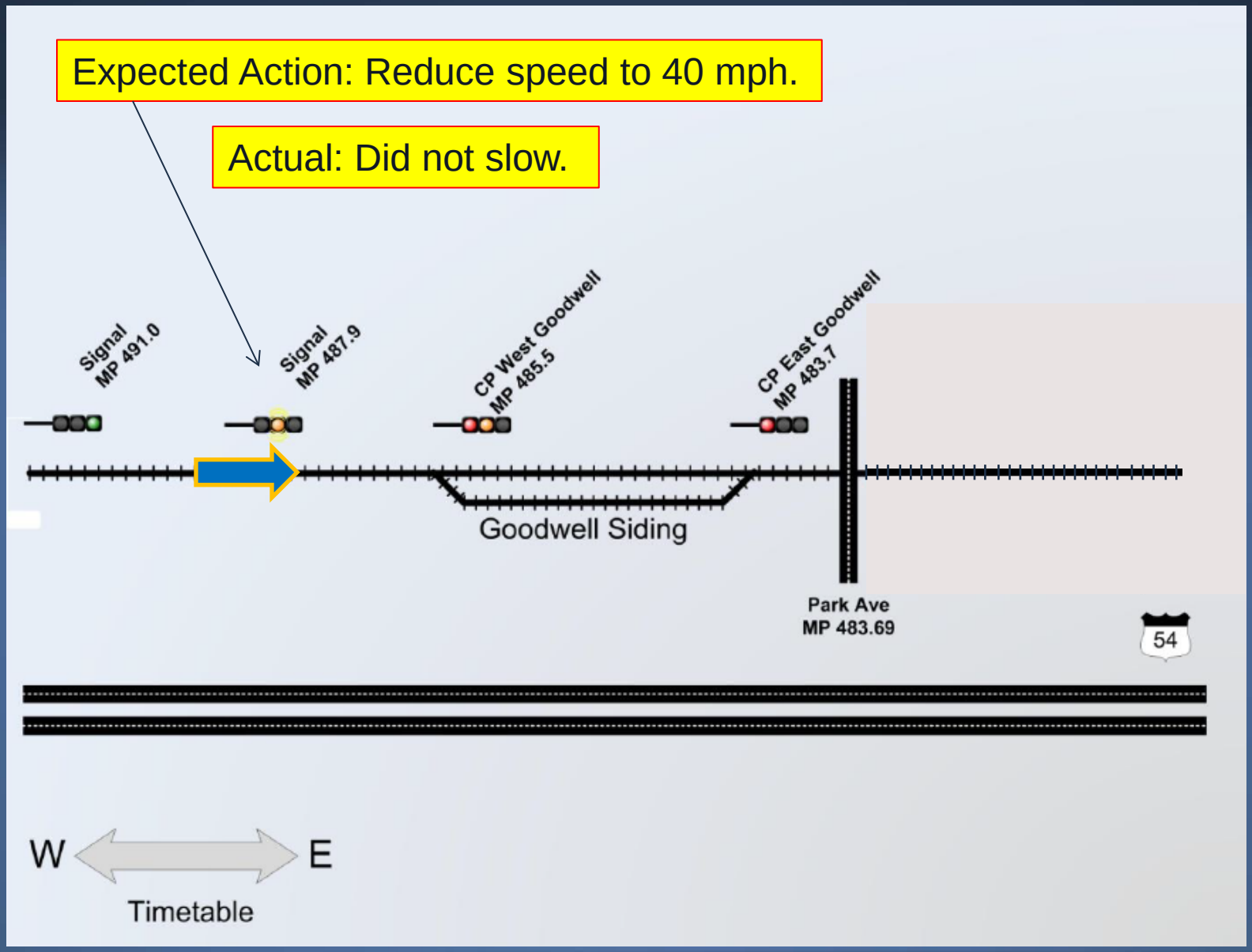
NTSB

# Require Medical Fitness for Duty

Goodwell, Oklahoma
June 2012

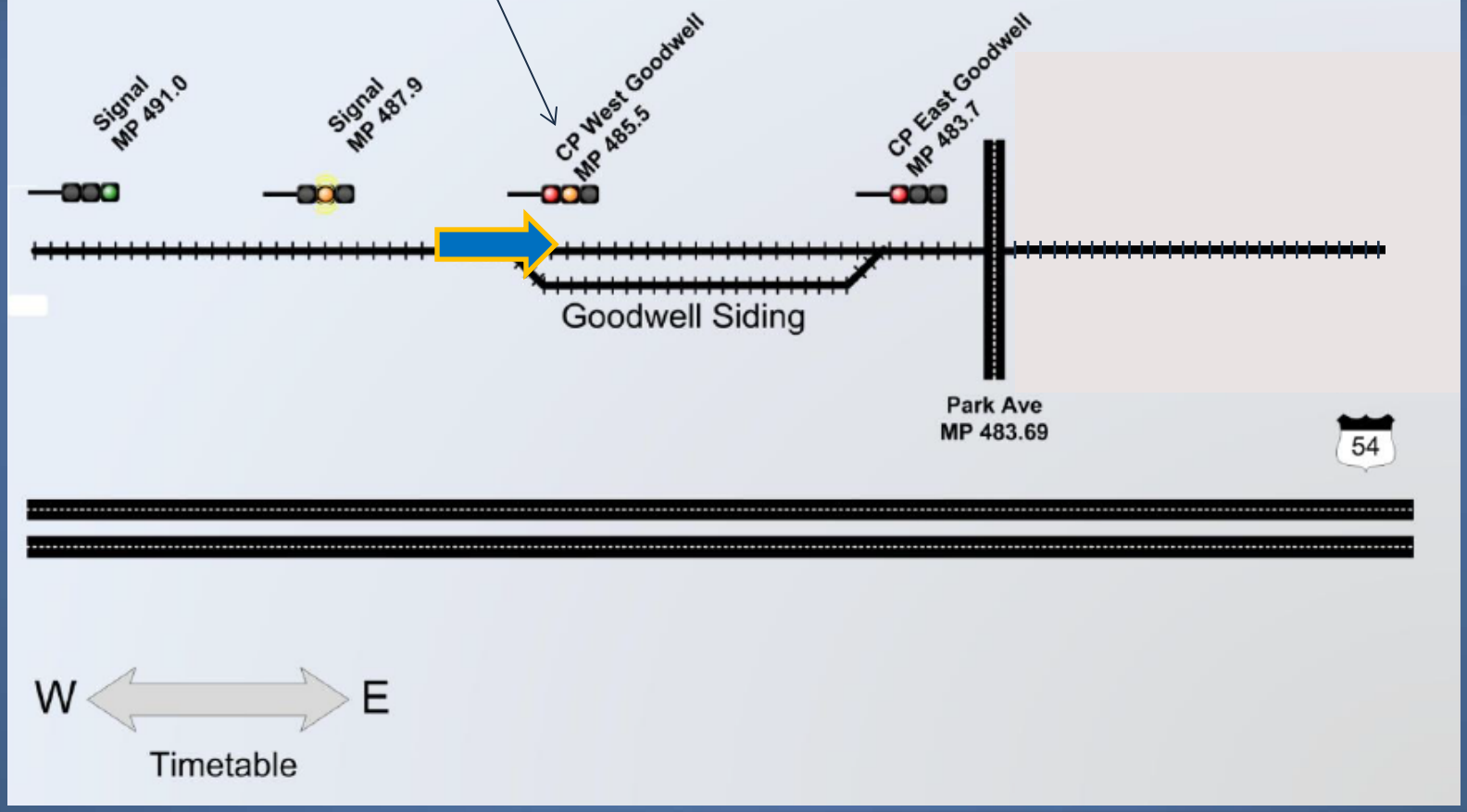
NTSB

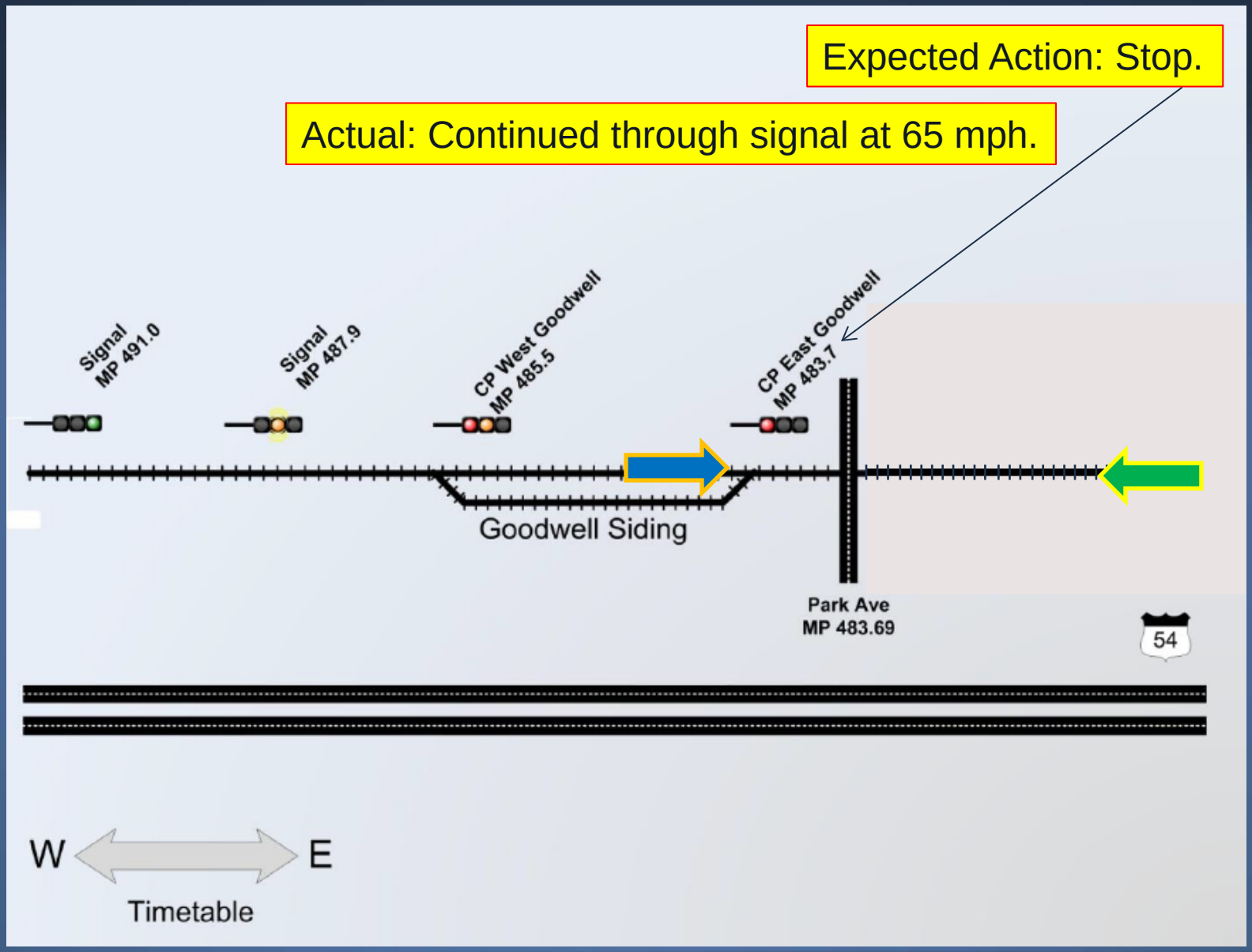

Signal
MP 491.0
Signal
MP 487.9
CP West Goodwell
MP 485.5
CP East Goodwell
MP 483.7
Goodwell Siding
Park Ave
MP 483.69
54
W
E
Timetable

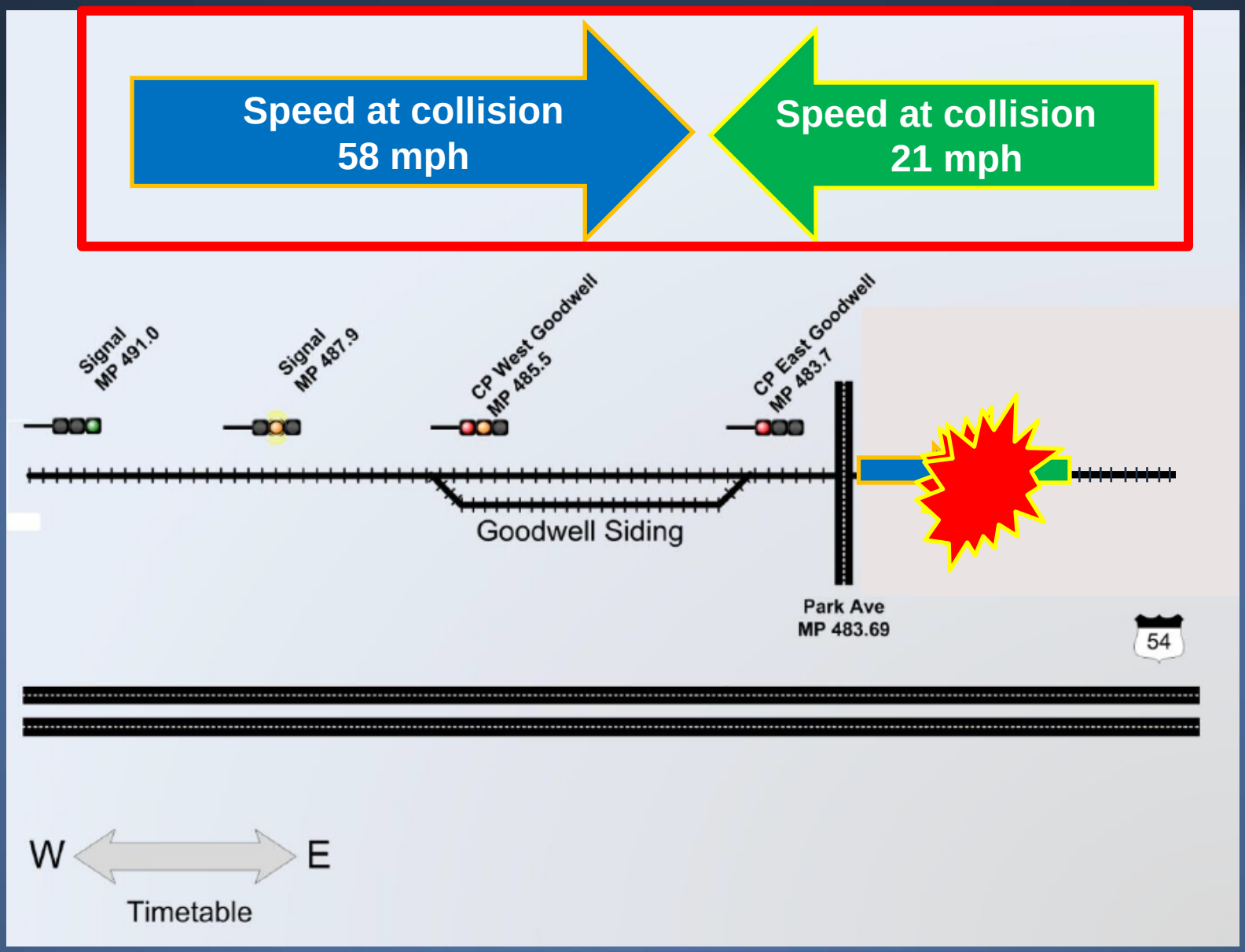

Expected Action: Reduce speed to 40 mph.
Actual: Did not slow.
Signal
MP 491.0
Signal
MP 487.9
CP West Goodwell
MP 485.5
CP East Goodwell
MP 483.7
Goodwell Siding
Park Ave
MP 483.69
54
W
E
Timetable

Expected Action: Reduce speed to 30 mph; be prepared to stop at next signal.

Actual: Did not slow.




Expected Action: Stop.
Actual: Continued through signal at 65 mph.
Signal
MP 491.0
Signal
MP 487.9
CP West Goodwell
MP 485.5
CP East Goodwell
MP 483.7
Goodwell Siding
Park Ave
MP 483.69
54
W
E
Timetable


Speed at collision
58 mph
Speed at collision
21 mph
Signal
MP 491.0
Signal
MP 487.9
CP West Goodwell
MP 485.5
CP East Goodwell
MP 483.7
Goodwell Siding
Park Ave
MP 483.69
54
W
E
Timetable

NTSB

# Eastbound Engineer: Vision Problems

- Cataract surgery as a child
- Required contacts and glasses <u>at the same time</u>
- Between 2006 and 2009, underwent a series of medical and surgical interventions for uncontrolled glaucoma.
- Uveitis
- Vitreitis
- Retinal detachment right eye 2002

# Eastbound Engineer: Vision Problems

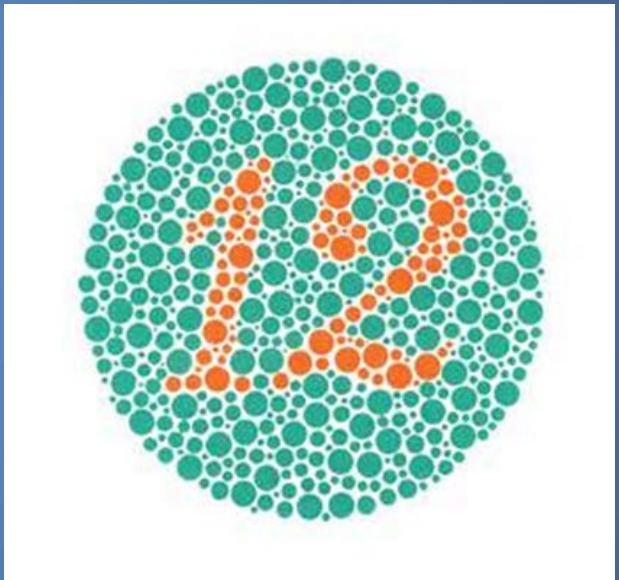
- Cystoid macular edema
- Epiretinal membranes
- Eye care:
  - Optometrist
  - Ophthalmologist
  - Retinal Specialist

# Eastbound Engineer: Vision Problems

- August 2010 – Texas Dept. of Motor Vehicles restricted driver's license to daytime driving only.

# Eastbound Engineer: Vision Testing

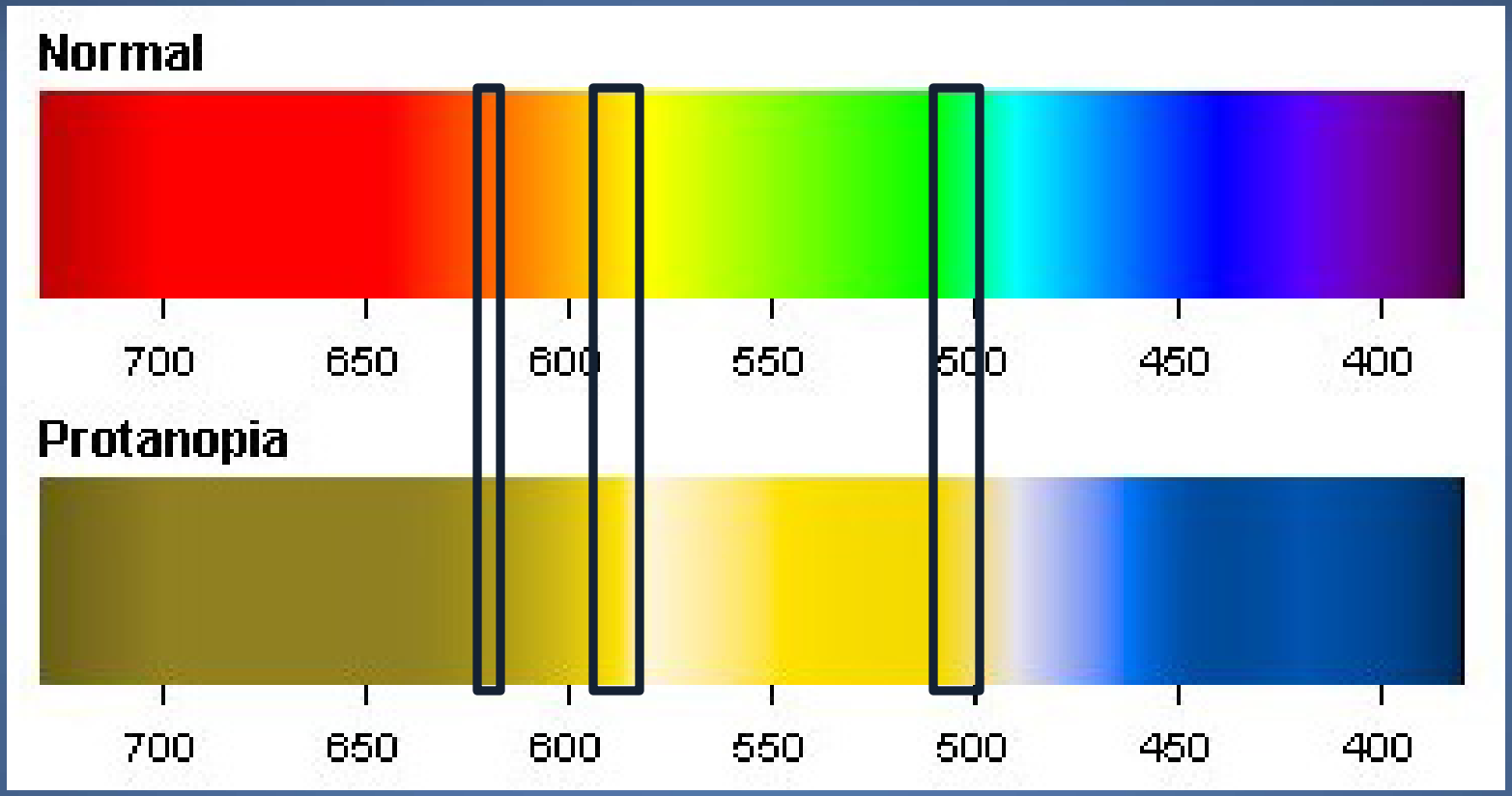
- Color vision August 2009:
  - Missed 10 out of 17 Ishihara plates



# Eastbound Engineer: 2009-2012

- More than 50 visits for eye care
- 12 separate eye procedures
- Fluctuating visual acuity
  - Right: 20/40 to 20/80 with glasses + contacts
  - Left: 20/80 to 20/200 with glasses + contacts
- July 2010: the engineer reports “difficulty reading train signals”

# August 2010: Unable to see red or green




Wavelength, nm

# Probable Cause

- “The eastbound Union Pacific Railroad train crew’s lack of response to wayside signals because of the engineer’s inability to see and correctly interpret the signals;
- the conductor’s disengagement from his duties;
- and the lack of positive train control, which would have stopped the train and prevented the collision regardless of the crew’s inaction.”

# Probable Cause

- “Contributing to the accident was a medical examination process that failed to decertify the engineer before his deteriorating vision adversely affected his ability to operate a train safely.”

# Safety Recommendations

- 9 safety recommendations issued
  - 5 pertaining to improved color vision testing

# Pop Quiz

NTSB is a division of the U.S. Department of Transportation.

a. True

b. False

# Pop Quiz

NTSB is a division of the U.S. Department of Transportation.

a. True

b. False

# Pop Quiz

Select the most correct answer

NTSB investigations are for the purpose of:

a. apportioning blame

b. finding fault

c. determining liability

d. all of the above

e. none of the above

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National Transportation Safety Board

# *Train Braking Simulation Study*

BNSF Petroleum Tank Car Unit Train Derailment
Casselton, ND
December 30, 2013

Kevin Renze
Carl Schultheisz

# Motivation

- Exponential growth in rail tank car shipments (petroleum and ethanol)
- Recent unit tank car train derailments
- Flammable liquids release that endangers persons, property, and environment
- Recent Pipeline and Hazardous Materials Safety Administration NPRM and final rule

# Methods to Improve Tank Car Safety

- Operational speed constraints (lower energy)
- Build a better product wrapper
  - tank car wall thickness
  - head shields
  - inflow/outflow valve protection
  - pressure relief valves
  - thermal insulation
- Improve track inspection and maintenance
- <u>Advanced brake systems</u>

# Advanced Brake Systems

- Improve brake signal propagation rate
  - Conventional pneumatic (CONV)
  - Distributed power pneumatic (DP)
  - Electronically-controlled pneumatic (ECP)
- Increase the car net braking ratio (NBR)
  - Higher brake force (brake shoe against wheel tread)
  - Brake shoe and wheel thermal loads increase (effects not evaluated)

# Study Variables

- Train Properties
  - Mass/length (52, 78, 104, 130, 156 tank cars)
  - Track grade (-2 to +2 percent)
  - Speed (20 to 70 mph)
- Brake configuration (CONV, DP, ECP)
- Net Braking Ratio (10, 12.8, 14 percent)
- Emergency or Full Service Braking

# Study Assumptions

- Uniform grade (-2 to +2 percent)
- Tangent track
- Clean, dry rail
- No inoperative brakes
- Head-end, engineer-induced emergency
- No derailment, collisions among cars, or collisions with other obstacles
- No loss of communications

# Simulation Tool

- Train Energy and Dynamics Simulator (TEDS)
- Funded by the Federal Railroad Administration (FRA)
- Developed under contract by Sharma & Associates, Inc.
- Validated using publicly available laboratory, field, and train empirical data

# Results, Brake Signal Propagation Rate

| Relative to CONV 10% NBR baseline, bailed off | | Stopping Distance Reduction, Percent | |
|---|---|---|---|
| **Braking Configuration** | Speed, mph | DP | ECP |
| **Emergency** | 20 | 4 to 17 | 5 to 26 |
| | 30 | 4 to 11 | 5 to 19 |
| | 40 | 3 to 9 | 4 to 15 |
| | 50 | 3 to 8 | 4 to 13 |
| **Full Service** | 20 | 7 to 46 | 37 to 75 |
| | 30 | 11 to 39 | 37 to 68 |
| | 40 | 10 to 39 | 30 to 64 |
| | 50 | 9 to 37 | 25 to 60 |

# Results, Increased NBR

| Relative to respective 10% NBR baseline, bailed off, level grade | | Stopping Distance Reduction, Percent | | | | | |
|---|---|---|---|---|---|---|---|
| | | 12.8% NBR | | | 14% NBR | | |
| **Braking Configuration** | Speed, mph | CONV | DP | ECP | CONV | DP | ECP |
| **Emergency** | 20 | 12 | 14 | 15 | 16 | 18 | 19 |
| | 40 | 15 | 17 | 17 | 20 | 22 | 23 |
| | 60 | 17 | 18 | 19 | 22 | 24 | 24 |
| **Full Service** | 20 | 8 | 8 | 16 | 11 | 11 | 21 |
| | 40 | 10 | 11 | 18 | 13 | 15 | 24 |
| | 60 | 11 | 13 | 19 | 15 | 18 | 25 |

# Results, ECP and Increased NBR

| Relative to CONV 10% NBR baseline, bailed off | | Stopping Distance Reduction, Percent | | |
|---|---|---|---|---|
| **Braking Configuration** | Speed, mph | ECP 10% NBR | ECP 12.8% NBR | ECP 14% NBR |
| **Emergency** | 20 | 5 to 26 | 13 to 39 | 16 to 43 |
| | 30 | 5 to 19 | 17 to 33 | 21 to 38 |
| | 40 | 4 to 15 | 17 to 31 | 22 to 36 |
| | 50 | 4 to 13 | 19 to 30 | 24 to 36 |
| **Full Service** | 20 | 37 to 75 | 42 to 80 | 45 to 82 |
| | 30 | 37 to 68 | 45 to 74 | 48 to 76 |
| | 40 | 30 to 64 | 41 to 71 | 44 to 73 |
| | 50 | 25 to 60 | 40 to 68 | 44 to 71 |

# Summary

- Due to faster brake signal propagation rates, ECP out-performed DP, which in turn out-performed CONV
- Increasing the NBR for a given brake system (CONV, DP, ECP) yields substantial (and comparable) stopping performance improvements
- Results were peer-reviewed (within the NTSB investigative party system)

# For more Information:

Train braking simulation study:

http://dms.ntsb.gov/pubdms/search/document.cfm?docID=429570&docketID=55926&mkey=88606

Attachments to the study:

http://dms.ntsb.gov/pubdms/search/document.cfm?docID=429571&docketID=55926&mkey=88606

Press Release:

http://www.ntsb.gov/news/press-releases/Pages/PR_20150723c.aspx

# National Transportation Safety Board