ENCONTRO ANTF DE FERROVIAS

EDIÇÃO DIGITAL

Analytically Investigating Derailment Incidents

Presented by: Walter Rosenberger, Scientist

TTCI – Transportation Technology Center, Inc.

Overview

- Investigating incidents scientifically is the best way to prevent future incidents.
- Gather data from Infrastructure, Equipment, and Operations viewpoints.
- Analyzing this data will point to a hypothesis.
- Use simulations as needed to “recreate” what happened.
- Confirm the data, analyses, and simulations support your hypothesis.
- Develop a cause statement that expresses the root cause(s) and conditions that led to the derailment.

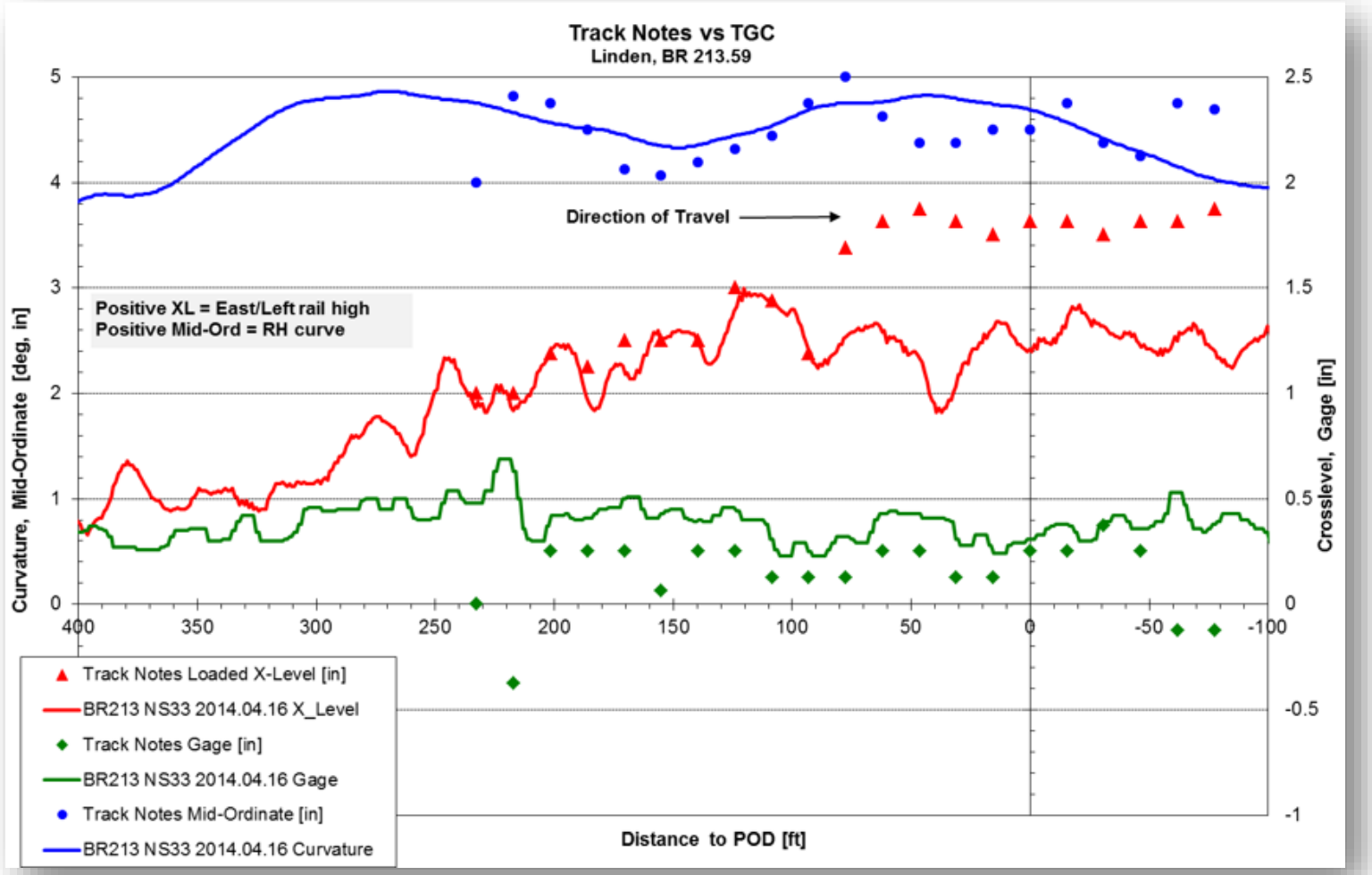
Infrastructure

Analyzing Track Data

Track Analysis

- Obtain digital copy of most recent track geometry test.
  - Review and plot in MultiVu or a spreadsheet program
- Obtain and plot track station measurements.
  - “Track notes” usually taken after an incident
    - Gage, Crosslevel, Alignment measured with level board and 62-ft chord or equivalent
- Plot station measurements and track geometry test data together to document POD location and confirm conditions at the time of the incident.

Analyzing Track Notes & Track Geometry Data



Equipment

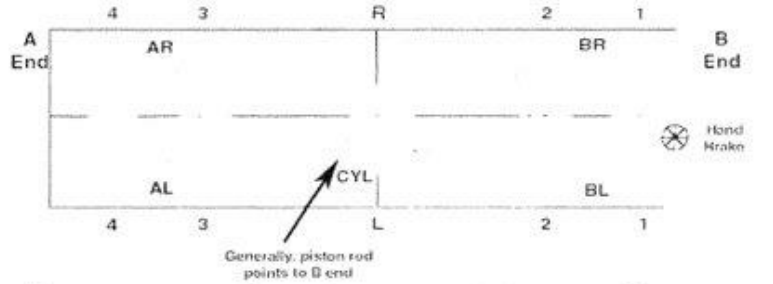
Assessing Vehicle Conditions

Equipment Assessment

- Determine the first vehicle and first wheel to derail.
- Measure key vehicle conditions as much as possible.
  - Suspension components, side bearings, wheel profiles, etc.
- Review wayside detector data
  - Wheel force detectors (i.e., “WILD” data)
  - Optical geometry detectors
  - Wheel profile detectors
- Synthesize all available information to deduce car condition, especially if simulations will be needed.

Equipment Inspection

MECHANICAL DERAILMENT INSPECTION SHEET
(STANDARD CAR)



Date: 7-17-14 Inspector: W. D. Foster Train: 236 Div.: VA

1. Car Initial and Number: ETTX 701262 Inspection Location: ROANOKE VA
Car Type: F Leading End: A ☐ or B ☒
Loaded: ☒ or Empty: ☐ Truck Center Distance: 64'

2. Wheel Conditions (AAR Rule 41):
A. Tread Profile: Measure tread hollowing with "Tread Worn Hollow Gage" (Rule 41) ***NOT Tread Thickness***

B-TRUCK		A-TRUCK	
L1	L2	L3	L4
0	.5	2	0
R1	R2	R3	R4
2.5	2	0	0

B. Flange Wear: (Finger gage)

B-TRUCK		A-TRUCK	
L1	L2	L3	L4
0	0	0	0
R1	R2	R3	R4
7	0	0	0

C. Tapeline Circumference: [inches]

B-TRUCK		A-TRUCK	
L1	L2	L3	L4
88 1/4	88 1/4	84 7/8	89 1/8
R1	R2	R3	R4
91 15/16	88 3/8	84 1/2	89 1/4

D. Back-to-Back Wheel Spacing at 3 locations: [inches]

B-TRUCK		A-TRUCK	
1	2	3	4
52 15/16	53	53	52 15/16
52 15/16	53	53	52 15/16
52 15/16	53	53	52 15/16

3. Side Bearings: (AAR Rule 62)
Type: Non-Contacting: Roller ☐ or Solid Block ☐ - OR- Constant Contact: ☒

Manufacturer/model: MICR TCC-111-60LT Metal Capped?: YES ☒ NO ☐

Side Bearing **Clearance** (Non-Contacting) or Side Bearing **Set-Up Height**

B-TRUCK		A-TRUCK	
BL	BR	AL	AR
5 1/8 in	4 15/16 in	4 15/16 in	4 15/16 in

4. Truck Type, Friction Wedges, Springs & Bolster Pockets: (AAR Rules 4
Note: Name on side frame does not necessarily indicate type of truck. Consult AAR Field M
Type: ASF RideControl ☐ (constant damping) ASF RideMaster ☐ (vari
Type: Barber S2 ☐ Barber S-2-C ☐ Barber S-2-HD ☐ Barber S
Type: National Swing Motion ☒ Buckeye ☐ Other:
Friction Wedge Type: Steel ☒ or Non-Metallic Backed ☐
Spring Arrangement: 5085.0, 3-05-IN 2 SPECIAL IN # 0 Stenciled on Car, i 5,1741
Supplemental Snubbing: Example: HS-7 Hy
Note number and location of any missing or additional coils differing from st

Friction Wedge Rise Measurements: [inches] ***Important Measurement***

B-TRUCK		A-TRUCK	
BL	BR	AL	AR

Measure from top "land" on R shoulder on RideMaster and B top of bolster surface. (See A

Column Wear Plate Condition: (Note hollow wear depth, unusual wear patter

B-TRUCK				A-TRUCK		
L1	L2	R1	R2	L3	L4	
✓	✓	✓	✓	OK	OK	

A. Measure depth of center plate and bolster bowl: (inches)

	B-TRUCK	A-TRUCK
Center Plate Height*	1 1/2	1 1/2
Center Bowl Depth**	1 1/4	1 1/4

* Measure to centerplate casting (horizontal surface) not to toe of plate fillet weld.
** Measure to top of shim(s), if present. Measure at most shallow location.

B. Center plate and bolster bowl diameters: (inches)

		Longitudinal	Lateral
A-End	Center Plate Diameter	13 3/4	13 3/4
A-End	Bolster Bowl Diameter	14 1/8	14 1/8
B-End	Center Plate Diameter	13 3/4	13 5/8
B-End	Bolster Bowl Diameter	14 1/8	14 1/8

Note conditions such as broken rim liners or uneven centerplate sides.

C. Contact between center plate fillet and edge of truck bolster rim (Yes/No)?
B-Truck: NO A-Truck: NO

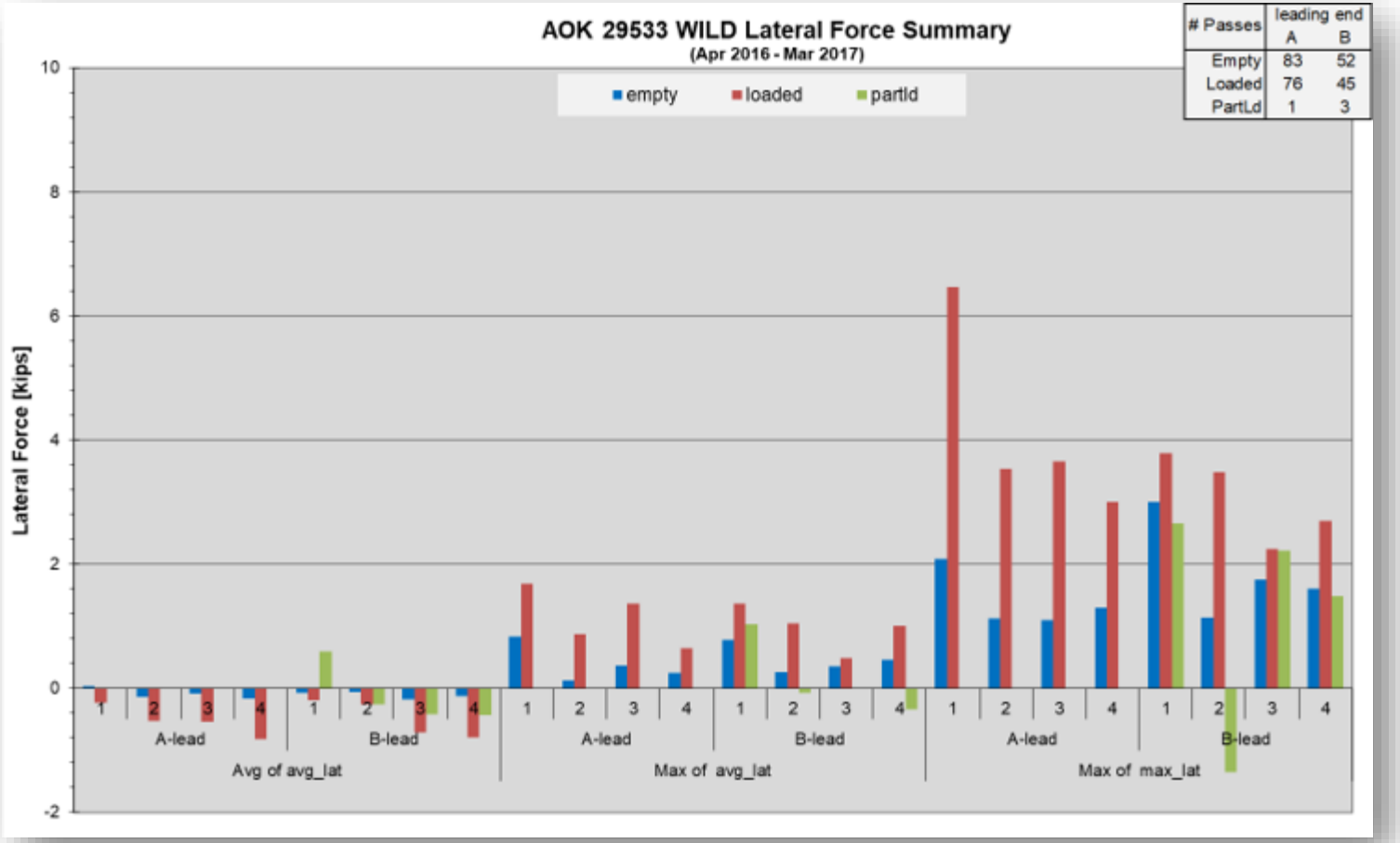
8. Center plate lubrication: (jack car and inspect)

	B-End	A-End
Dry	☐	☐
Lube present	☒	☒
Rusty	☐	☐
Shiny	☒	☒
Galled	☐	☐
Non-metallic Liner	☐	☐

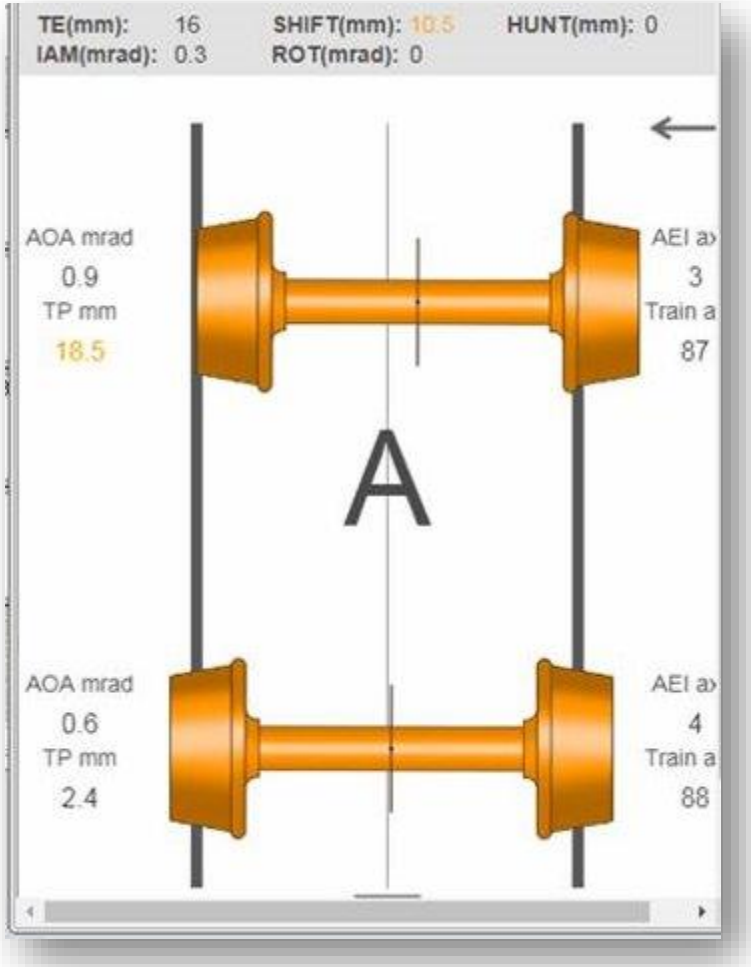
9. Couplers and Draft Gear:
Coupler Style (e.g., "E60" "E67" etc.): E69
Cushion Unit: YES ☒ NO ☐ Cushion Unit: End-of-Car ☒ Center Sill ☐
Cushion unit travel [inches] and markings: 10" E662

10. Other Observations:
(Built-up tread, spalling, shelling, etc.)

Wayside Data Analysis



# Passes	leading end A	B
Empty	83	52
Loaded	76	45
PartLd	1	3



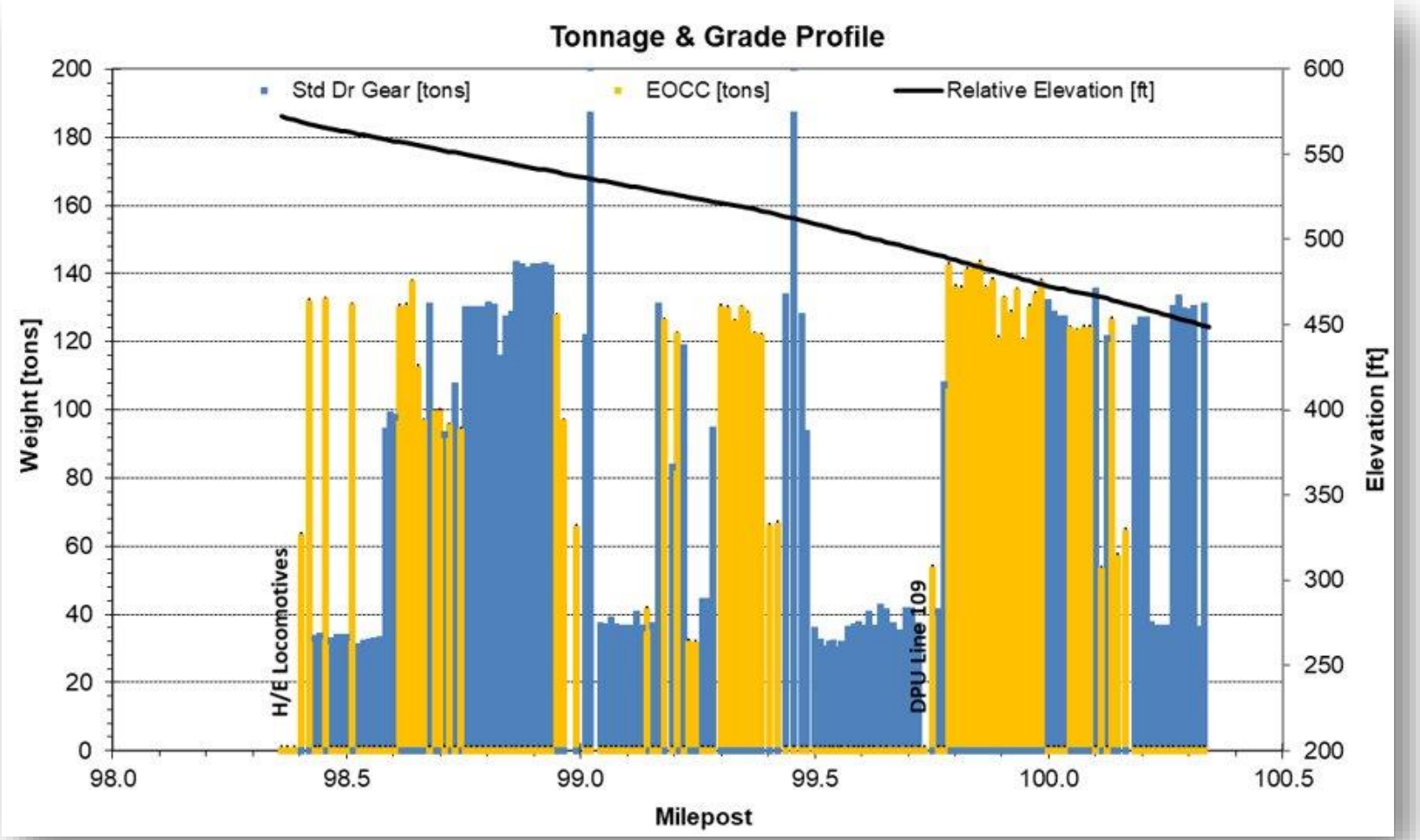
Operations

Analyzing Train Handling

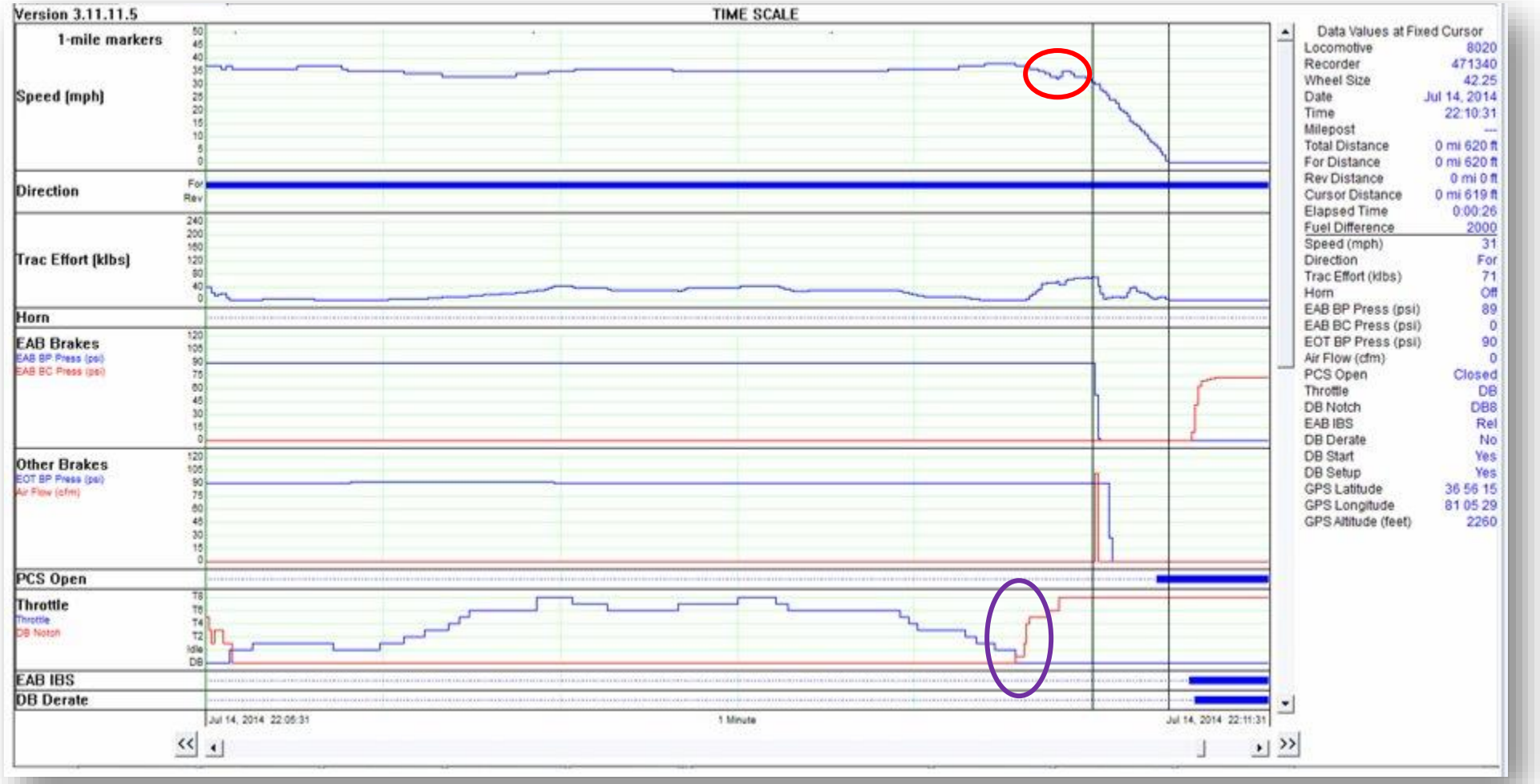
Analyze Train Handling and Makeup

- Obtain details of the train consist.
  - Car/wagon types, weights, and draft gear types
  - Locomotive types, active in power or braking
- Obtain records of train operation.
  - Event recorder files, locomotive GPS coordinates and final resting location

Train Consist: Tonnage & Draft Gear Profile



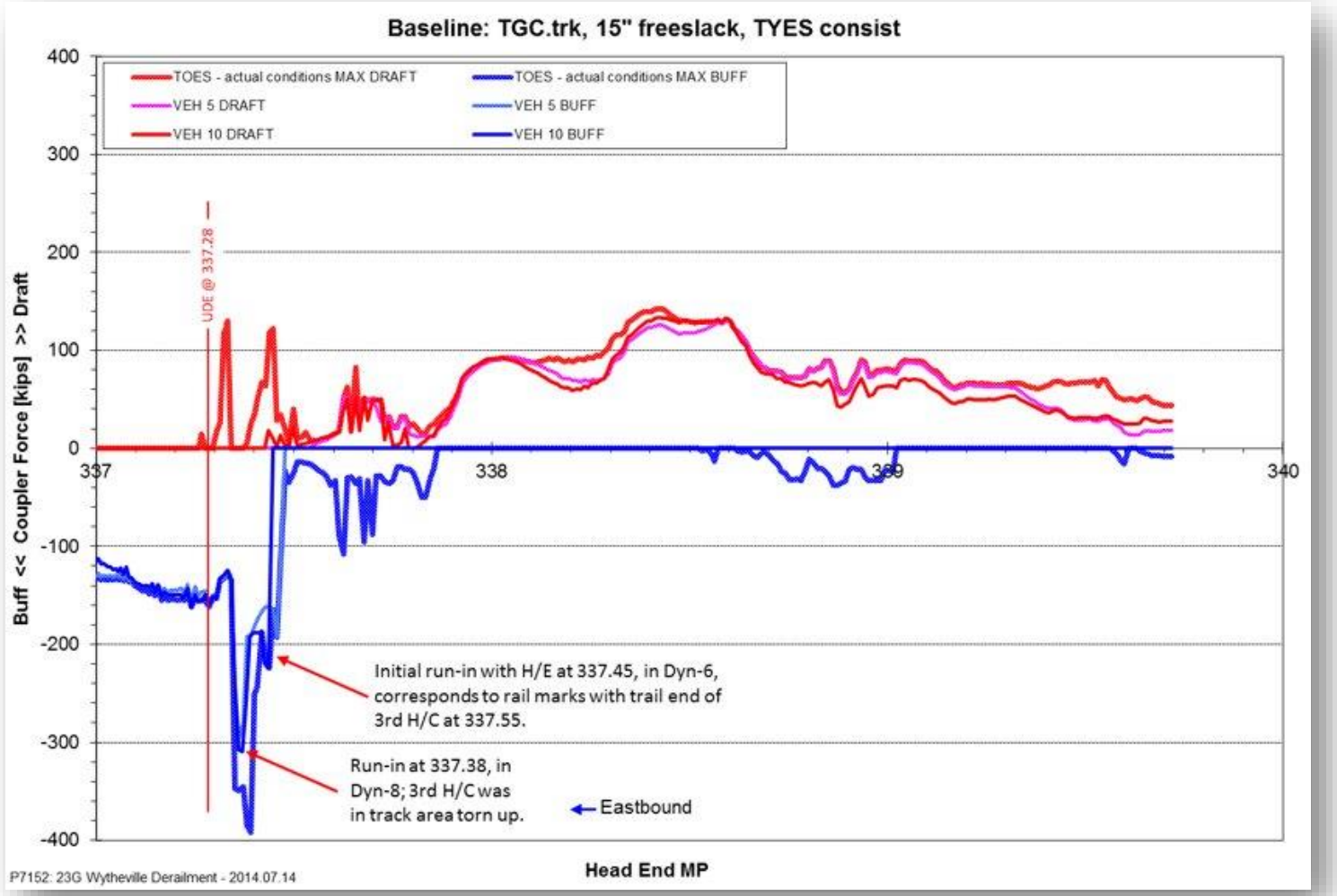
Analyzing Event Recoder Data



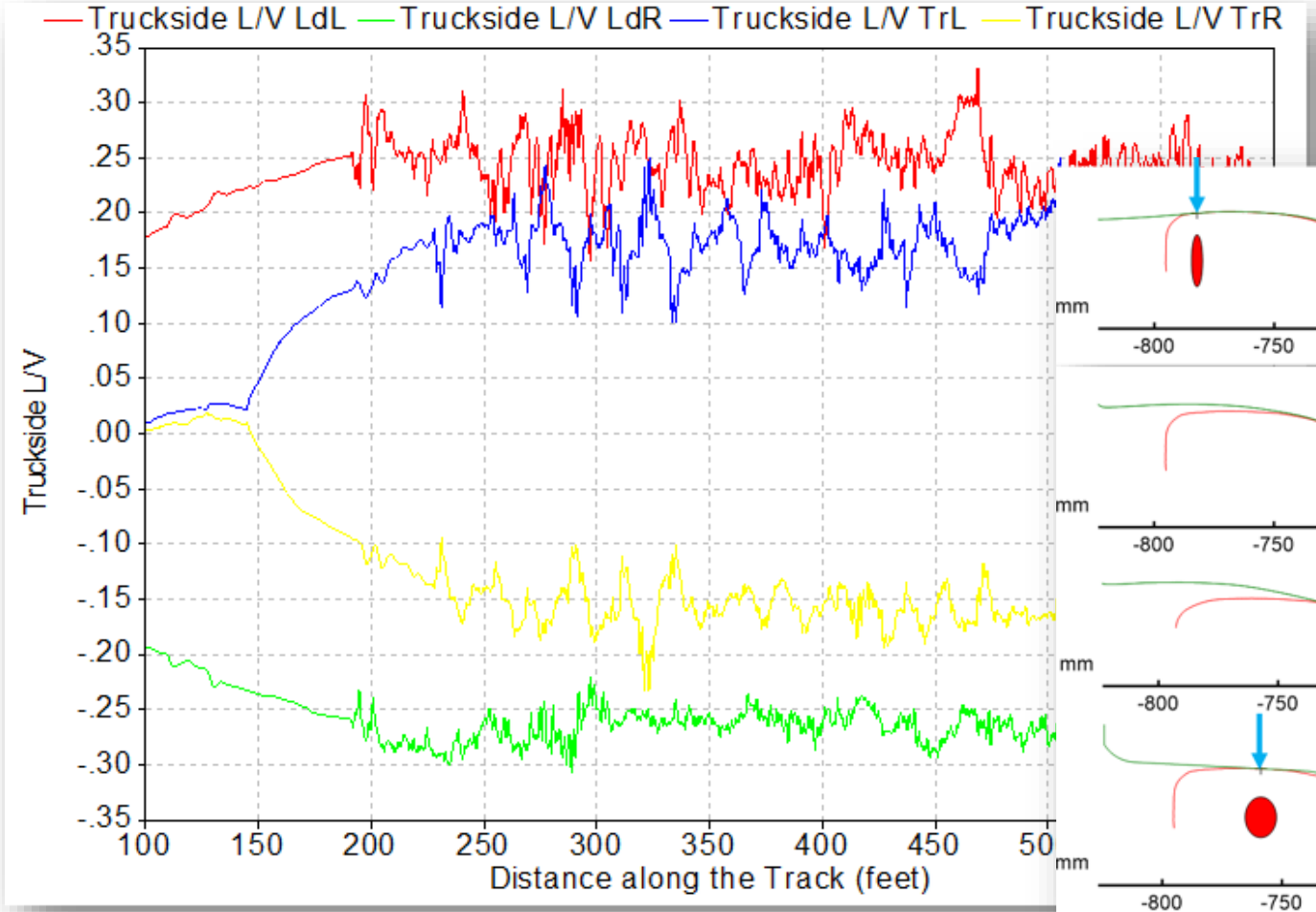
Simulations

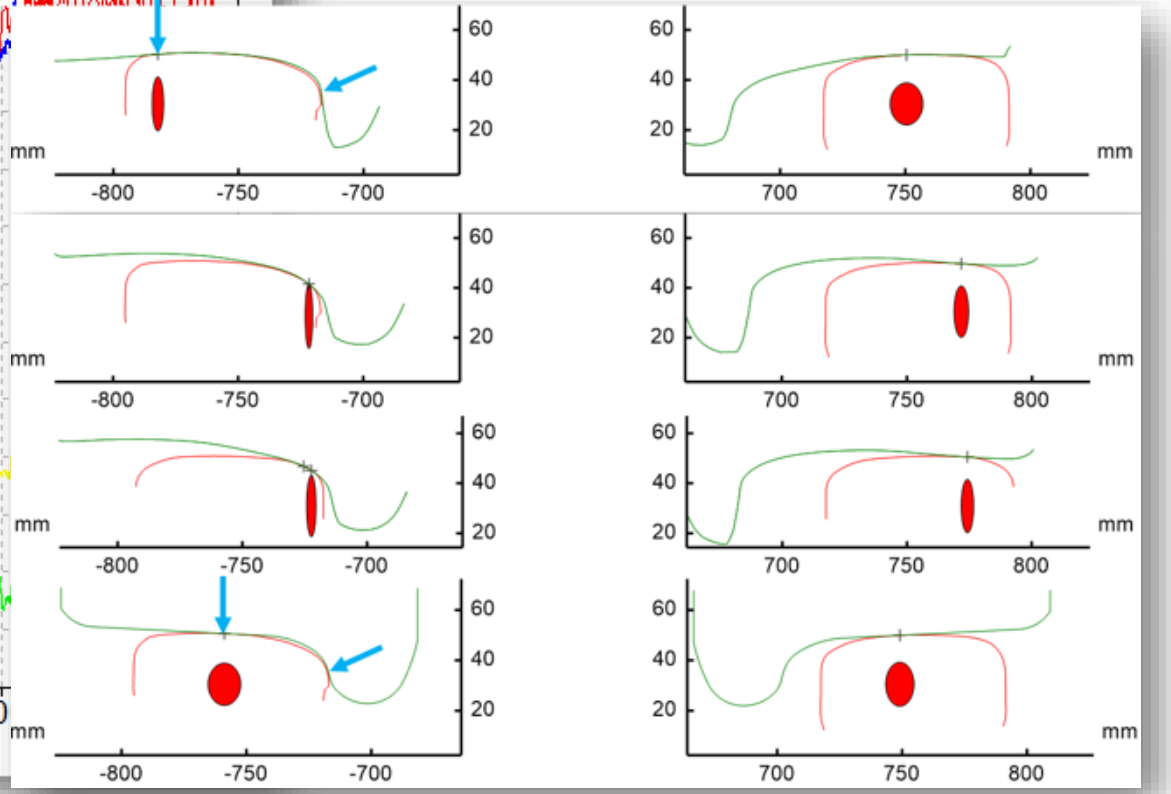
Train Dynamics, Vehicle Dynamics

TOES™ Simulation Results



NUCARS® Simulation Results





Summary

- Collect, assess, and analyze the evidence, measurements, and data
  - Do you have the right data, and is it complete?
  - What is the data telling you?
- Understand and apply the physics
  - L/V ratio, Nadal limit, rolling radius differential, etc.
- Run the simulations as needed
  - TOES™, NUCARS®
- Develop and report the cause statement

Thank You!

Realização

ANTF
www.antf.org.br

Apoio editorial

TM EDITORA

Organização

MF
MARCELO FONTANA
PROMOÇÕES & EVENTOS