Transition from Bridge End to Bridge

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AGENDA

- Damage from Low Bridge Ends
- Loadmaster Timber Tie
- Track and Bridge Survey
- Ballast Deck Bridge and Problems
- Line Change and Test Section

AGENDA

- Ballast Mat for Ballast Deck Bridges
- Loadmaster Direct Fixation
- Track Modulus
- Typical Low Bridge Ends
- Reduce Impact Loading
- Reduce Wheel and Rail Wear

Alignment on Bridge Due to Low Bridge End


PRIVATE PROPERTY
NO TRESPASSING
PROPIEDAD PRIVADA
PROHIBIDA LA ENTRADA

Alignment On Bridge

Low Bridge End
Due to Blocked Drainage

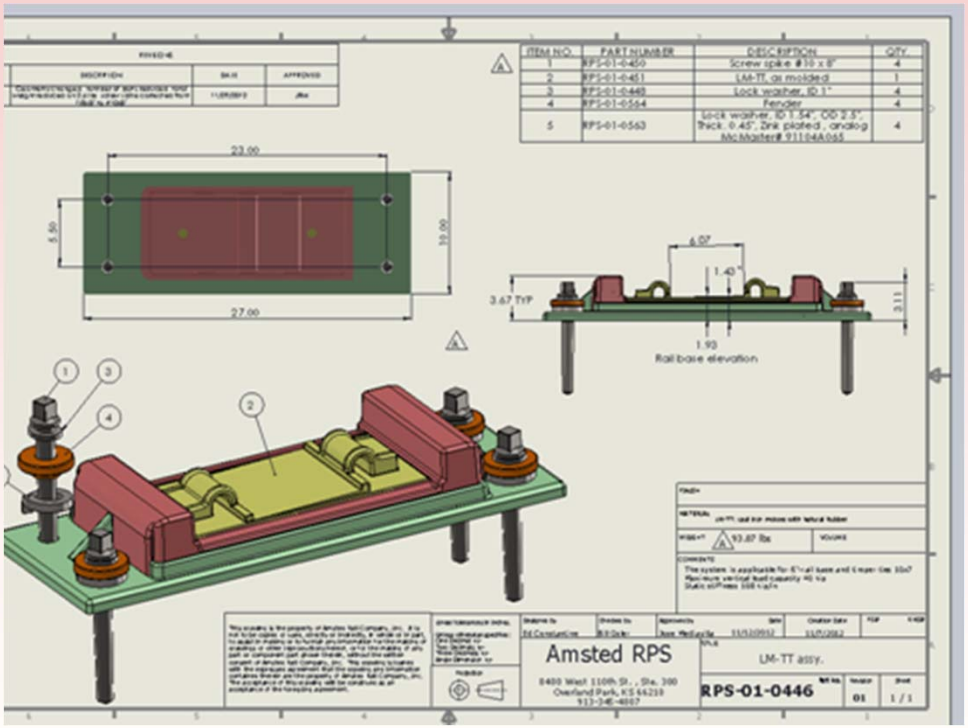
Severe Mud Causing Impact Loading on Bridge

Severe Mud Causes Damage

Mud in Transition Area

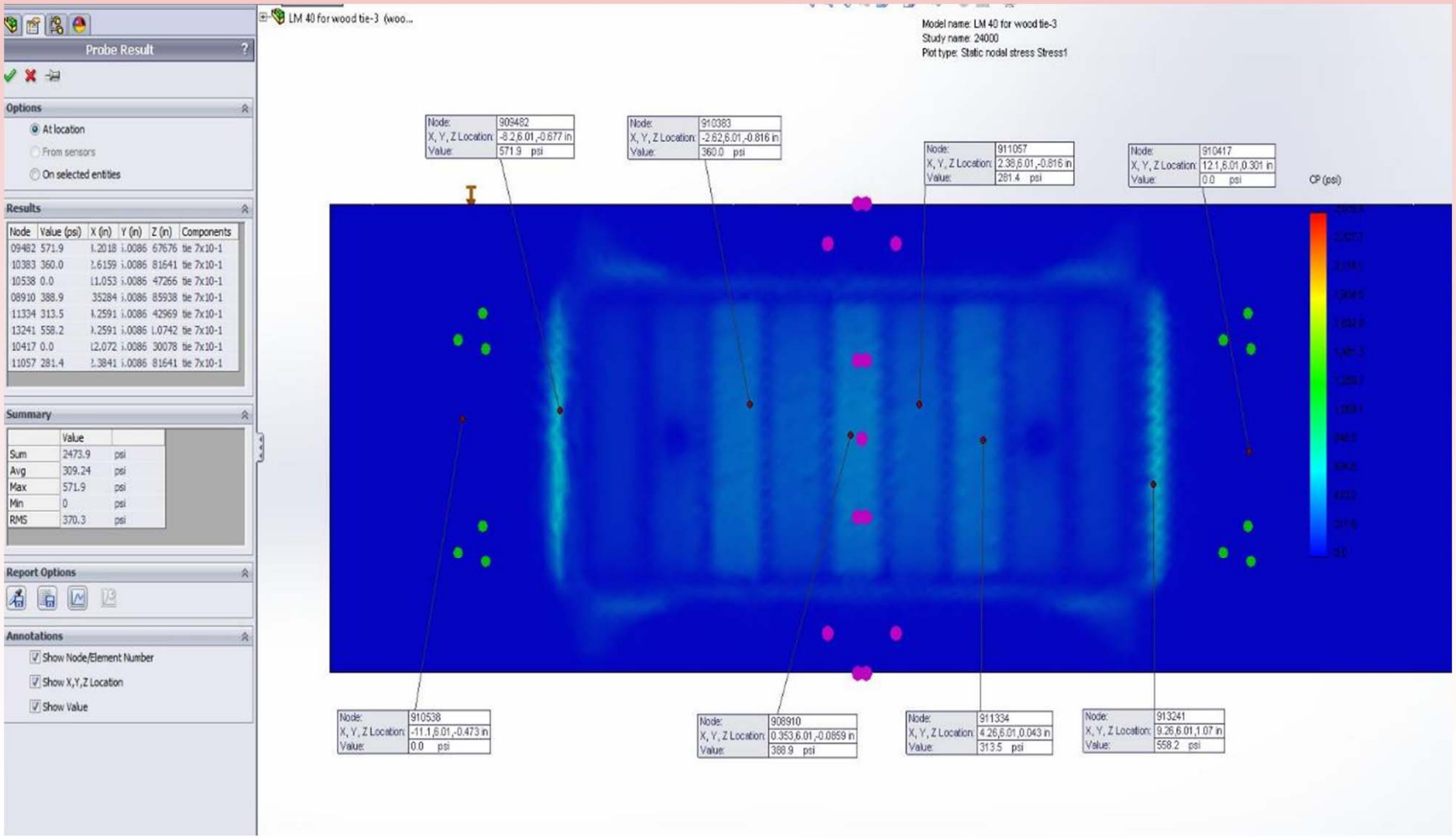
Back Filled Wing Wall with Road Mix Material

Loadmaster Timber Tie Plate

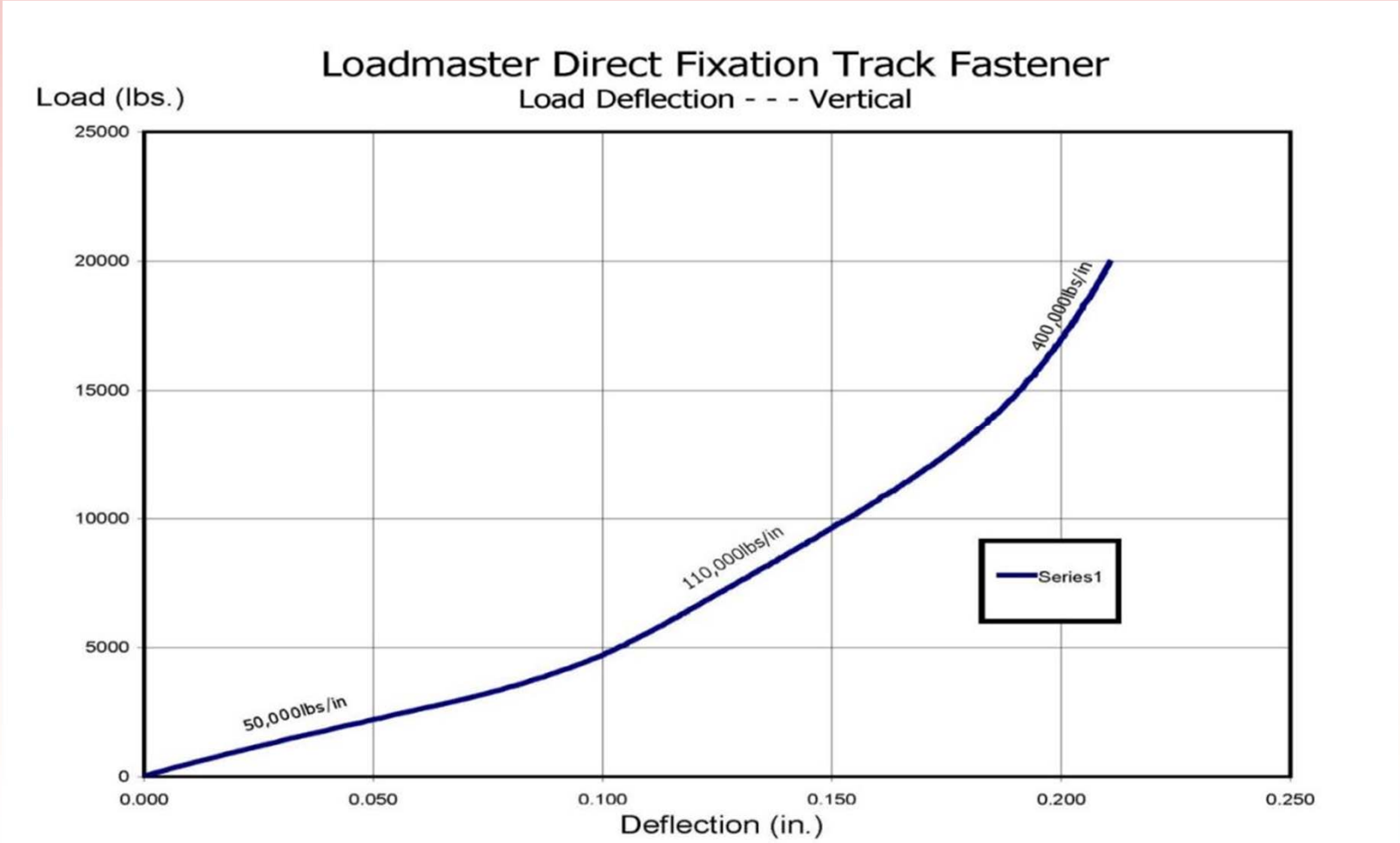


Inspection of Plates

Pressure Points 24KIP Vertical Loading



Vertical Load Deflection



Broken Plates Due To Impact Loading

Drive Screw Torque

It is imperative that the drive screws are torqued to 250 foot pound

Compressed Lock Washers

Loadmaster Timber Tie Bridge

Gauge Widening Affects Wheels

Loadmaster Plate on Bridge
Case : MP193.7 Edson Subdivision

- **Loadmaster plate investment $971,400**
- **Cost reduction**
  - **Bridge plate maintenance (avg $51,500 / yr)**
  - **Gauging track (approx. $2,000 /yr)**
  - **Rail replacement deferral savings ($10,000 /yr)**
    - **Previously replaced rail every 2 years, estimate 5 years now**

Loadmaster Plate on Bridge
Case : MP193.7 Edson Subdivision

- **Spot tie replacement ($46,000 /yr)**
- **Bearing seat repair on concrete pier ($20,000 every 5 yr**

Benefits

- **Cost Savings – long term**
- **Safety improvements**
  - **Derailment prevention**
  - **Reduction in wide gauge issues**
  - **Elimination of broken tie plates**
  - **Elimination of broken lag screws**

Benefits

- **Improved ride quality**
- **Reduced impact load on bridge span at transition from track to bridge**
- **Increased life span of bridge ties**

CN Track Geometry Car

Accelerometers

- Located on left and right side of the same wheel axle
- Positioned directly above the center of the wheel axle
- Post-processed to calculate continuous vertical axle displacement

TETRA TECH
RAIL SERVICES

Track Testing Survey Program

- Edmonton to Vancouver
- July 11, 2014 - July 16, 2014
- Approx. 700 miles
- 82GBytes of left and right vertical acceleration, GPS, and track video
- Acceleration measured continuously at 2000Hz (0.5 mSec)

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Track Testing Survey Program

Vancouver to Edmonton (return)

July 22, 2014- July 28,2014

TETRA TECH
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Track Testing Survey Program

Two bridge structures to review:

1. Magnolia Bridge Structure (MP61.1 CN Edson East Subdivision)

- **Length: 1364 feet (416m)**
- **Transition Zone Plates: Conventional**

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Track Testing Survey Program

Two bridge structures to review:

2. Athabasca River Crossing (MP193.7 CN Edson West Subdivision)
- **Length: 611 feet (186.6m)**
- **Transition Zone Plates: Resilient**

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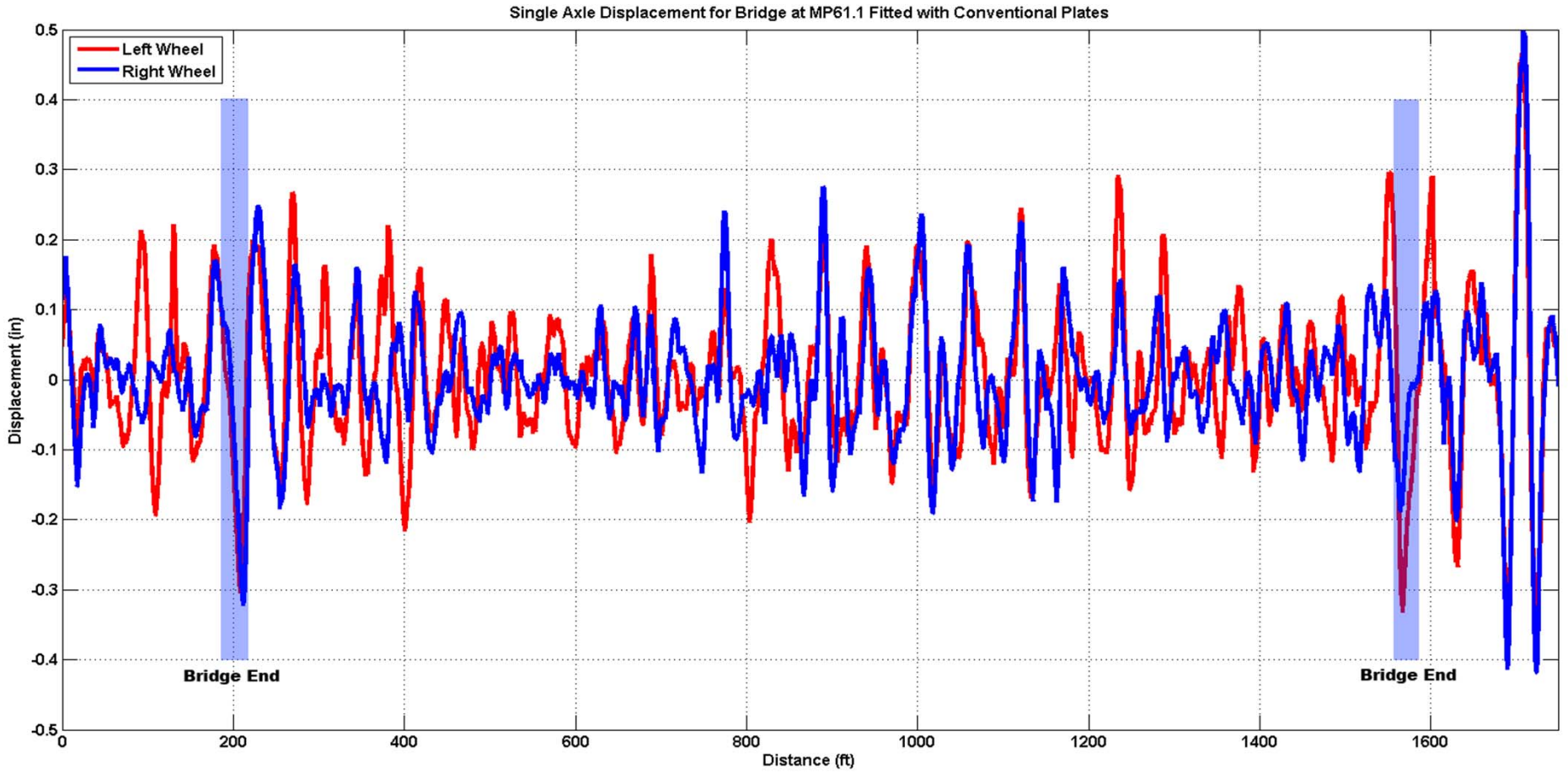
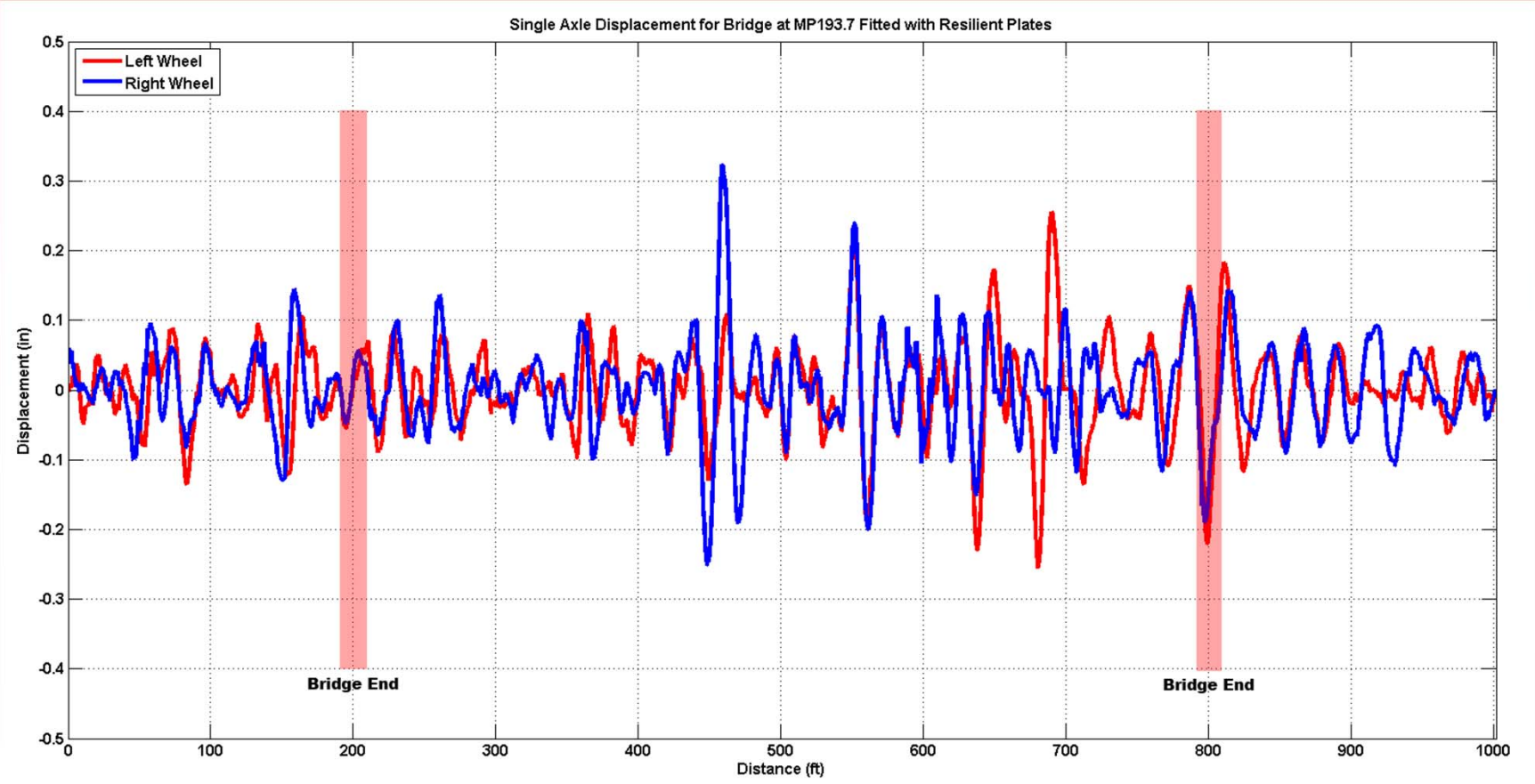
Magnolia Bridge Conventional Plates



Magnolia Bridge

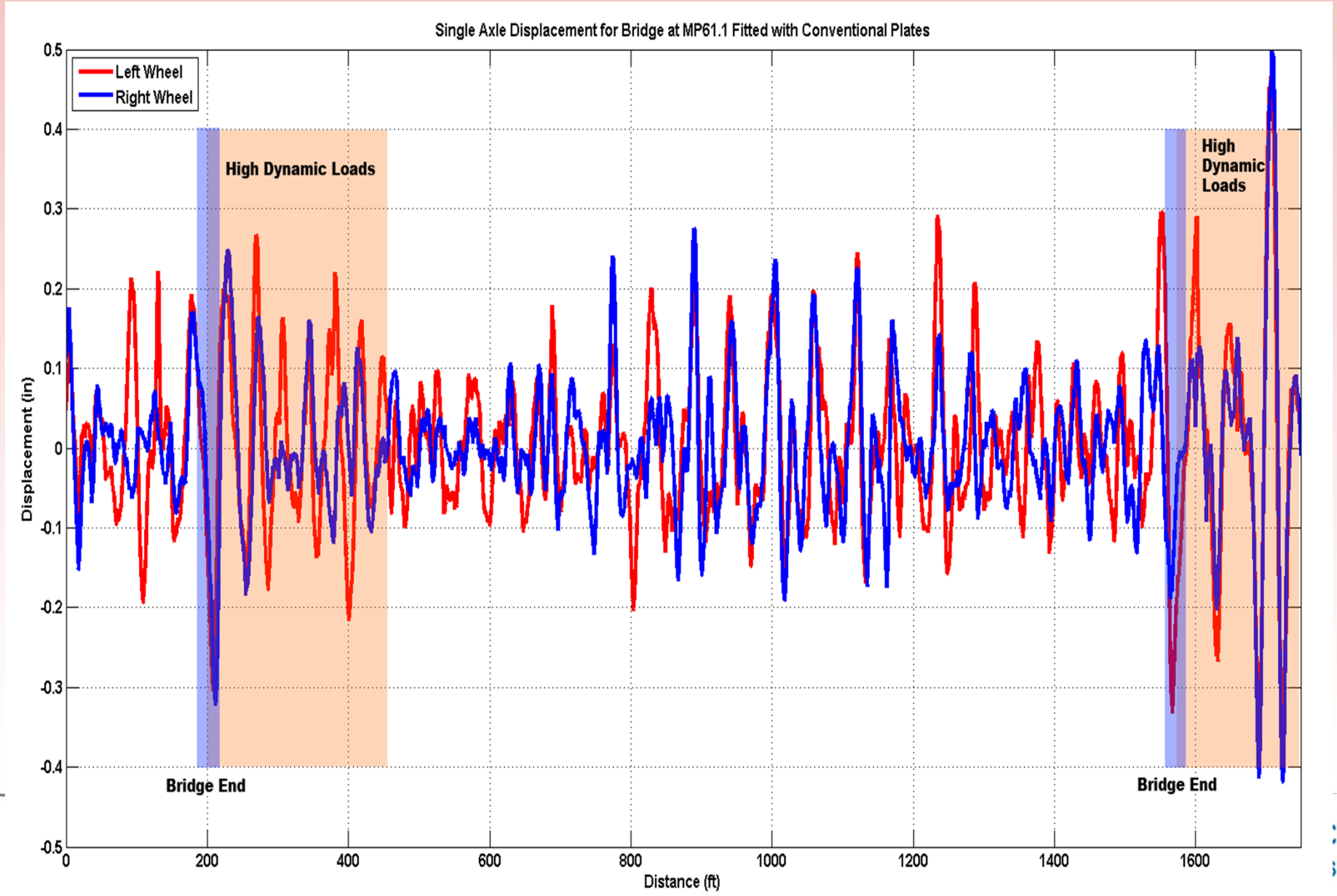
Athabasca Crossing Bridge

Resilient Transition Zone Plates



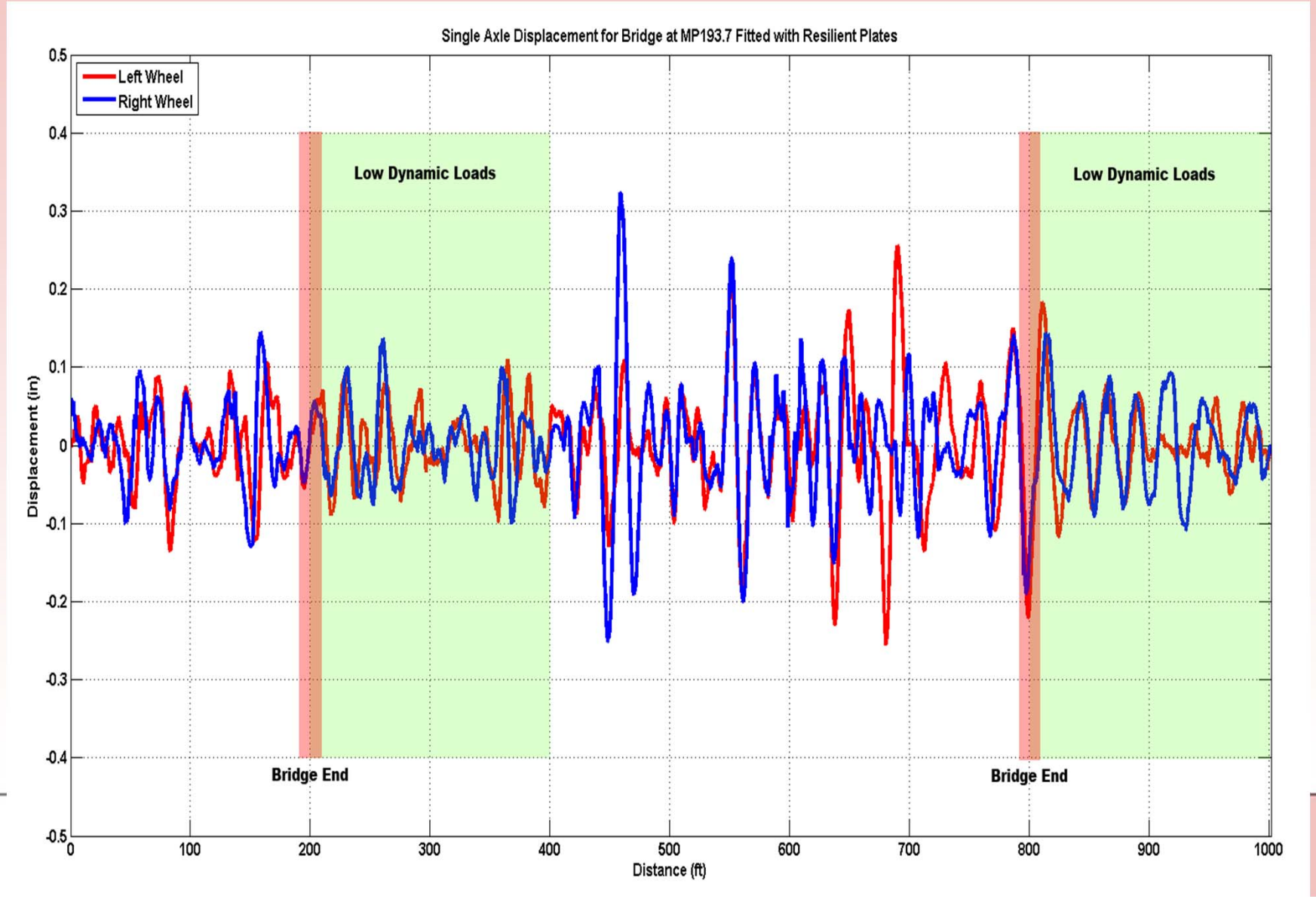
Magnolia Bridge

Conventional Transition Zone Plates



Athabasca Crossing Bridge

Resilient Transition Zone Plates



Observations

- Magnolia Bridge typical of bridge structures with conventional transition zone plates in CN's western region
- Magnolia Bridge has large wheel/axle vertical displacement events at the transition zones at each end of the structure
- These large vertical displacement events introduce large dynamic loads following the transition in some cases for more than 200 feet

Observations

- The Athabasca River Crossing Bridge structure was retrofitted with compliant resilient plates

- The Athabasca River Bridge structure transition zone at the east end of the structure produces no large vertical displacement events

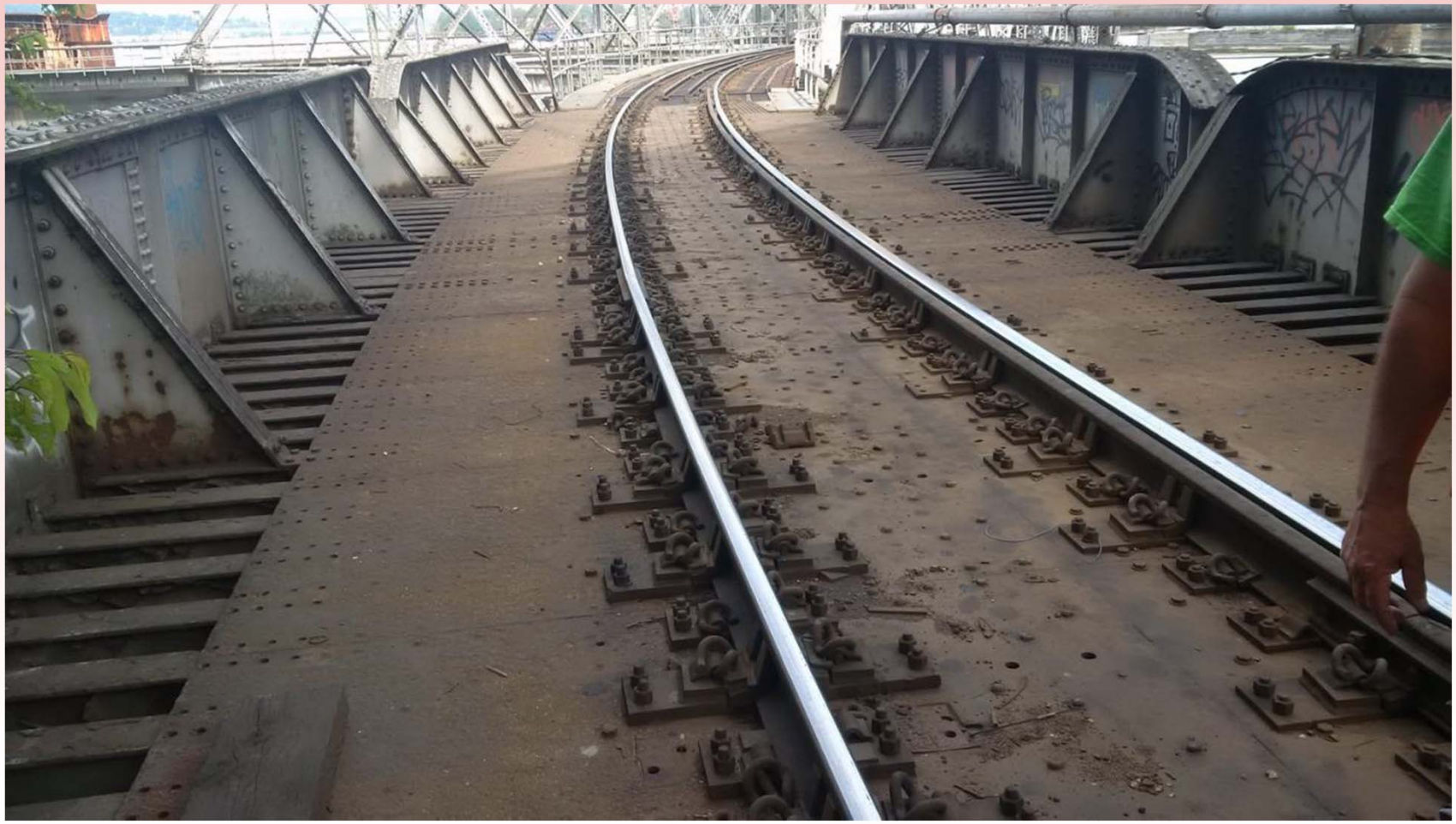
Observations

- **There is a significant reduction of vertical displacement event induced dynamic loads following the resilient plate transitions on the Athabasca River Crossing bridge**

New Installation

Installing Plates

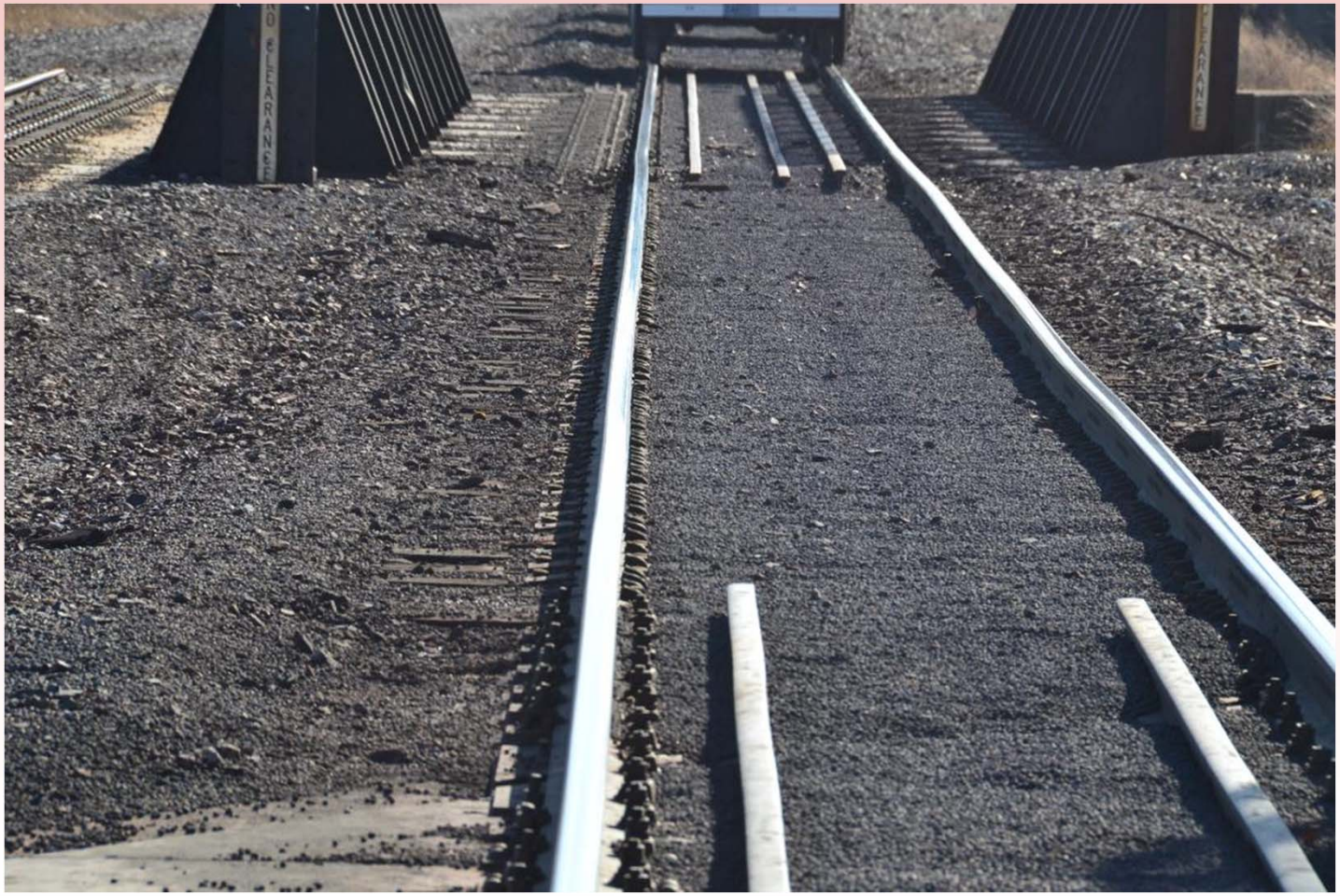
Before



Wood Timber to Floor Beam

Direct Fixation

Low Bridge End Contributes to Wheel and Rail Wear



Low Muddy Bridge End

Impact Loading Damages Bridge Support and Wheels

Alignment Damages Wheels and Rail Initiates Truck Hunting

Impact Damages Pier

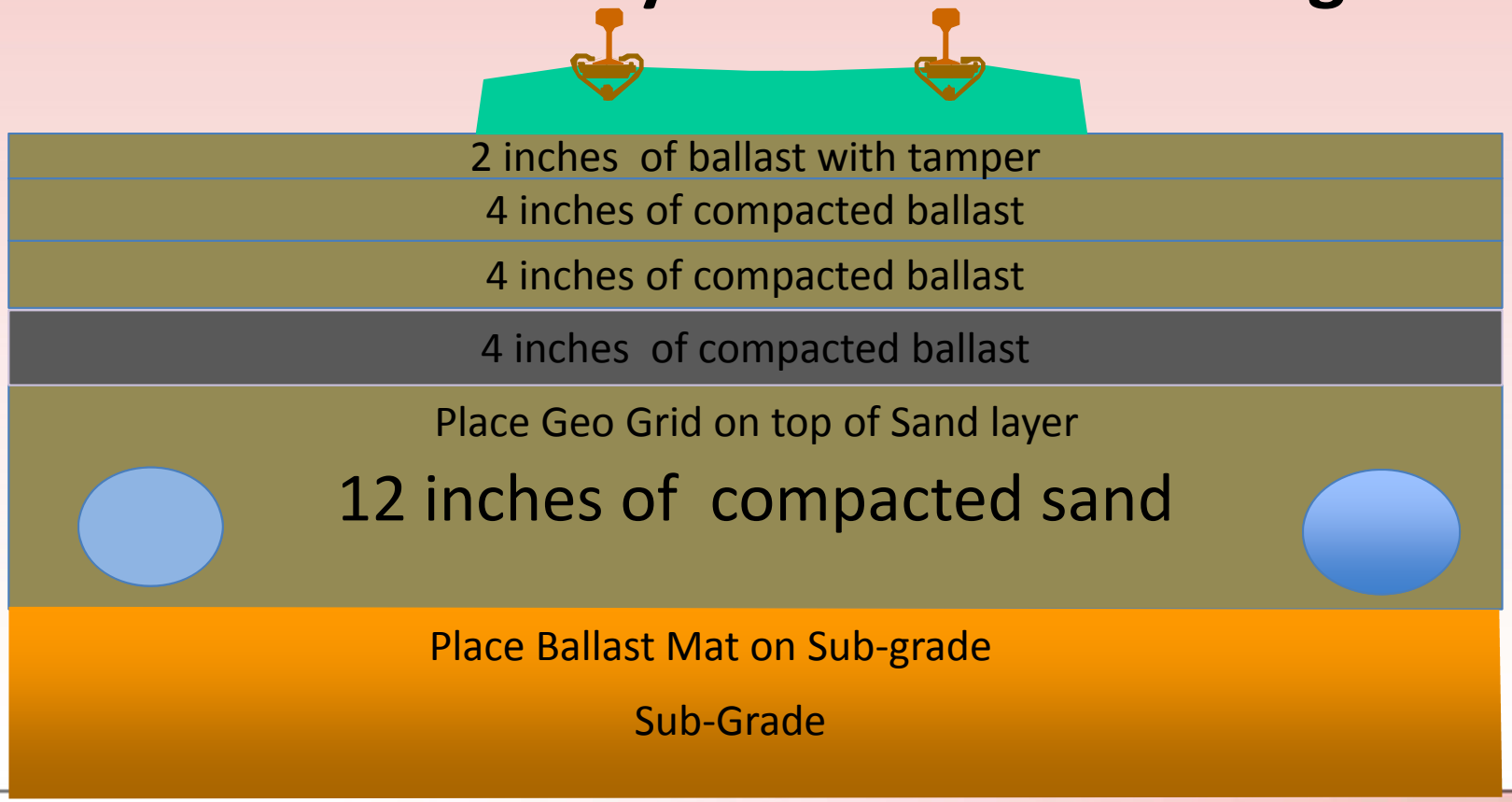
Recommended Line Change

Line Change on Four Bridges

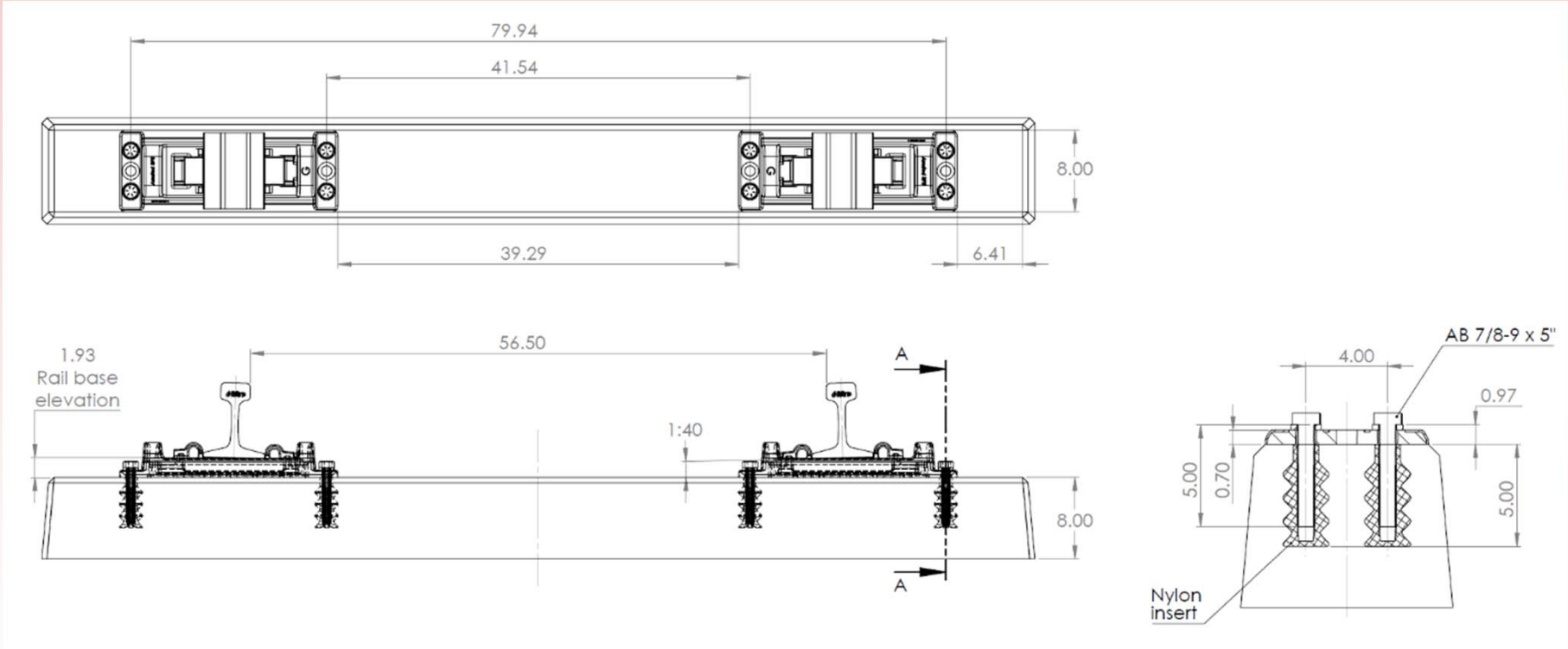
- Place new track onto abandon track on Bridges
- Set up Test section, New Sub-Structure, Concrete Ties with Loadmaster Plates, Concrete Transition Ties 10 foot long
- Re-Establish Inner guard rail and extend off end of Bridge (25 feet). Fasten Inner Guard Rail with Elastic Fasteners.

Bridge End Foundation

From Center line of track go 11 feet each way and 30 feet beyond the end of bridge

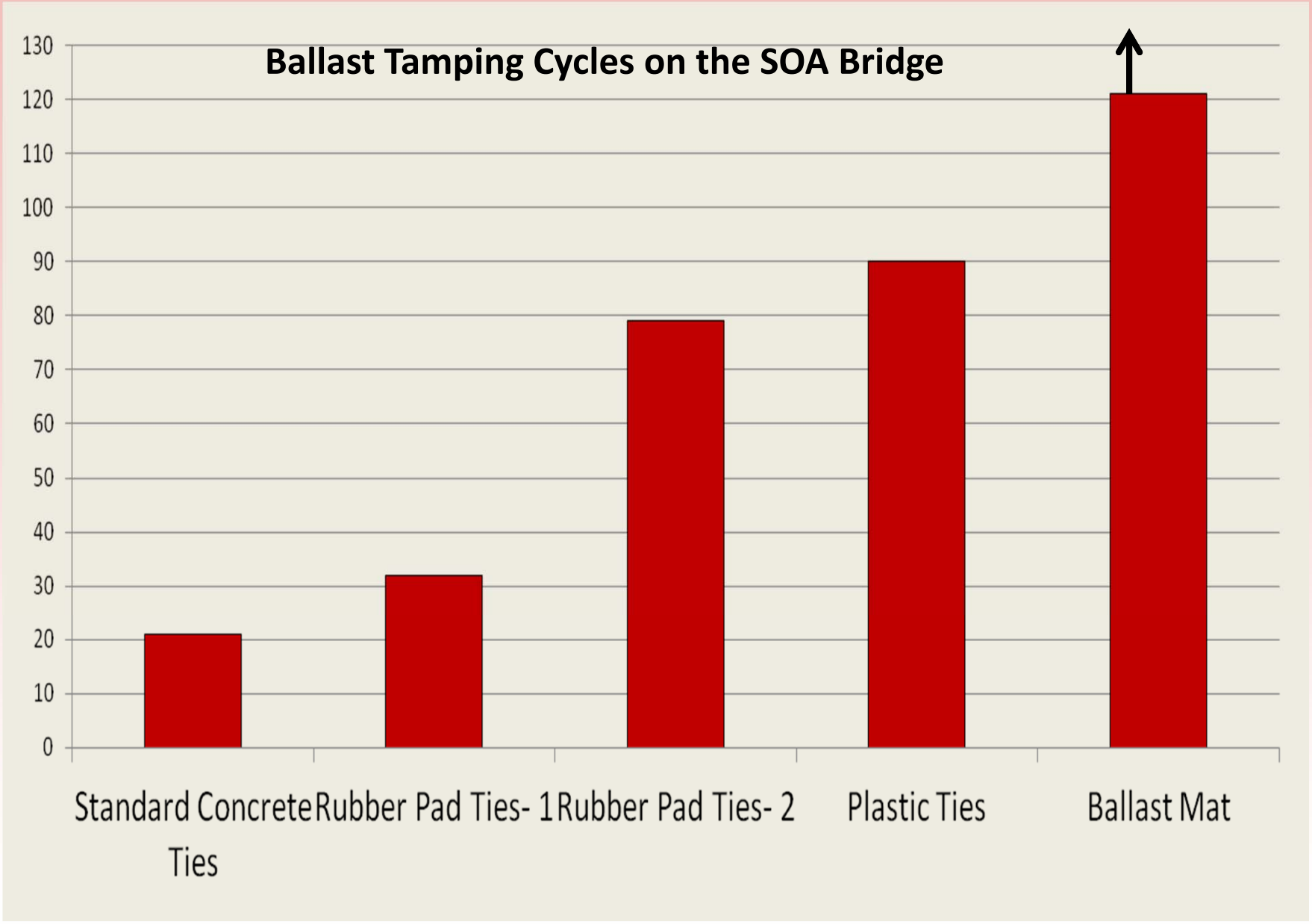


10’ Concrete Tie

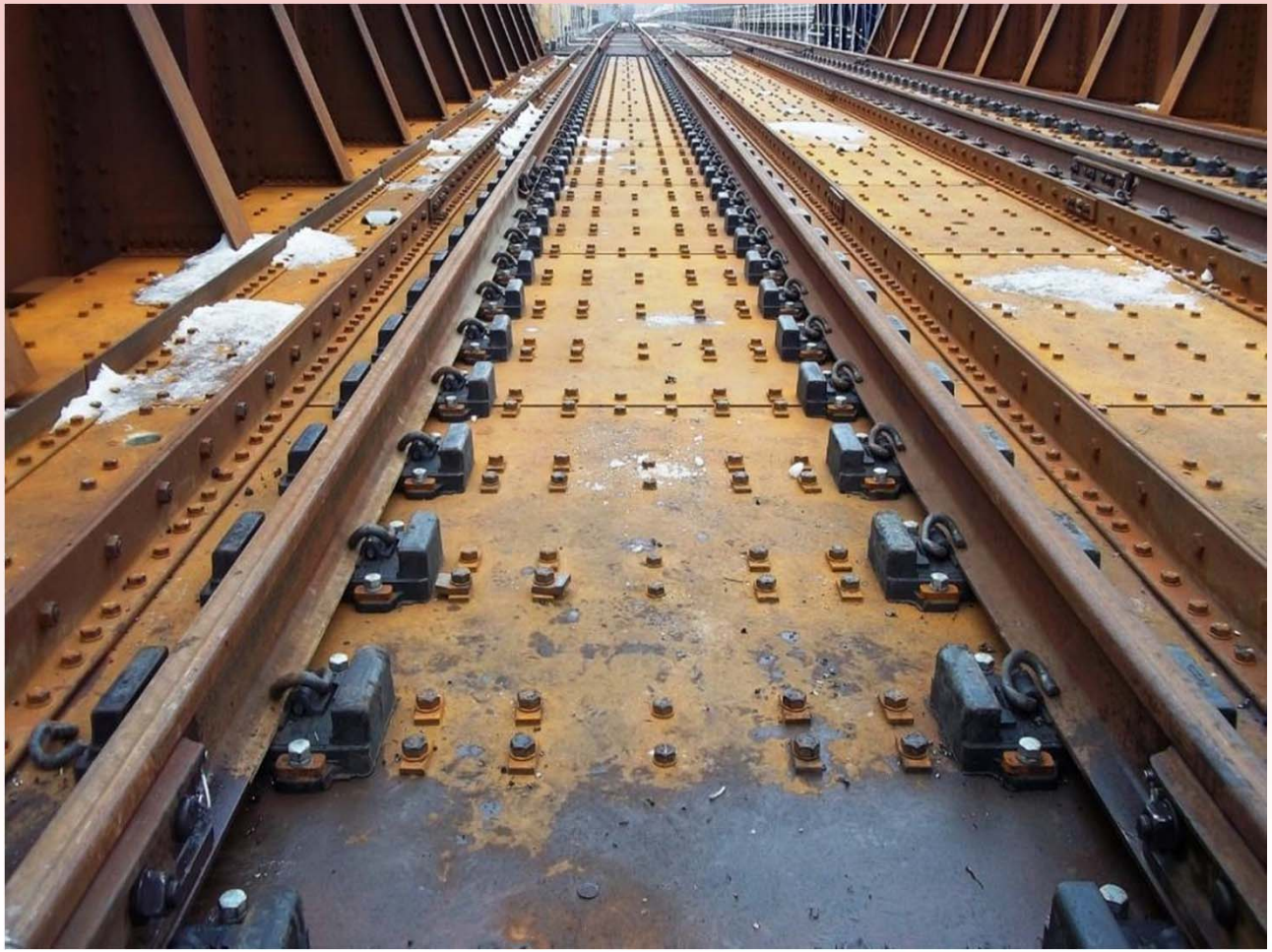


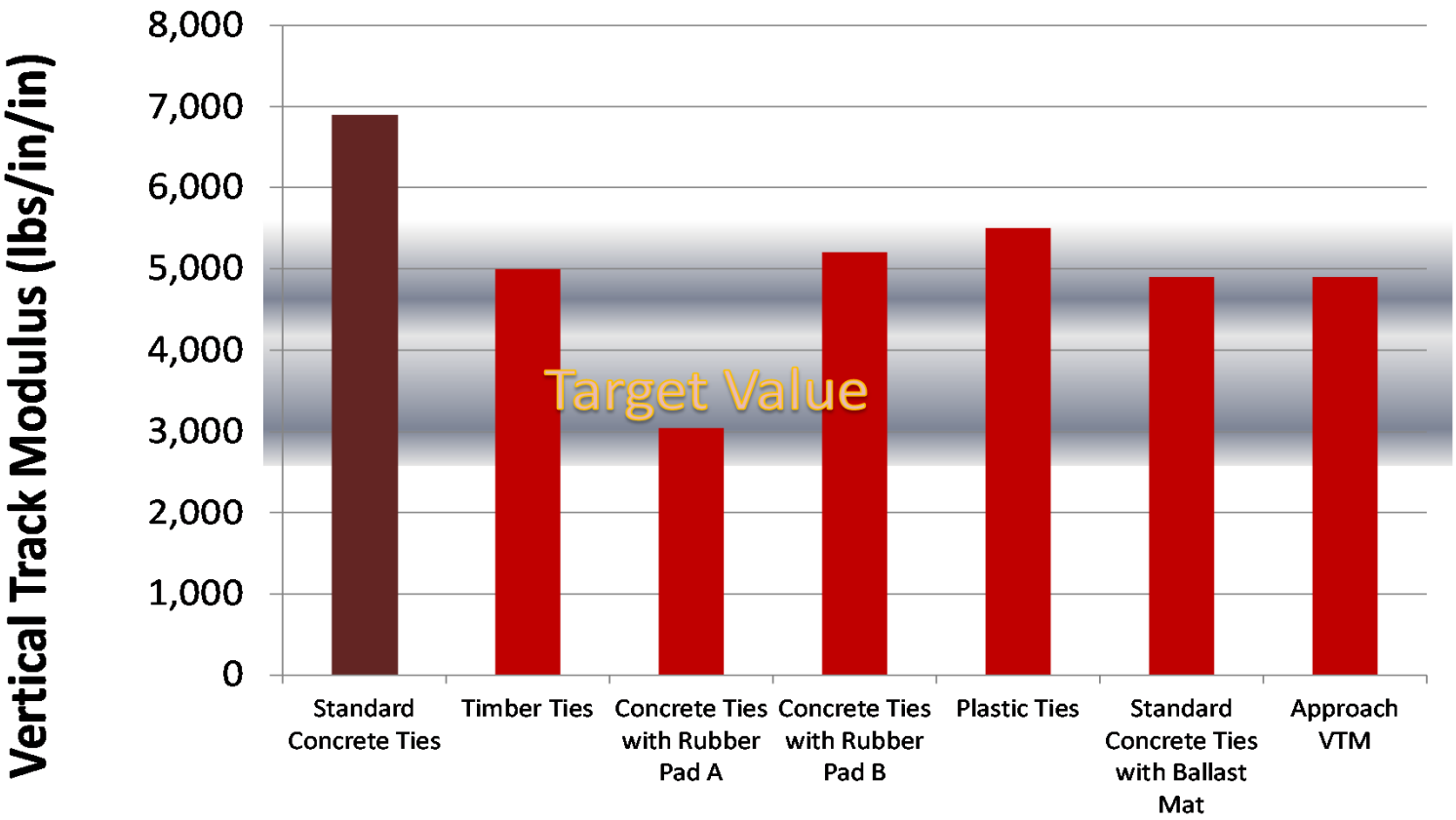
Mud on Ballast Deck Bridge

Ballast Mat on Steel Ballast Deck


Ballast Tamping Cycles on the SOA Bridge
Average MGT
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Standard Concrete Ties
Rubber Pad Ties- 1
Rubber Pad Ties- 2
Plastic Ties
Ballast Mat

Loadmaster Direct Fixation Plate





Average VTM of the test spans at FAST with Plastic Ties and Concrete Ties with a ballast mat (VTM from previous test are shown)

Credit: Technology Digest TD-08-032, August 2008

Conclusion

- Work to Match Vertical Track Modulus on Bridge and Bridge Ends with Loadmaster Plate
- Improve Drainage at Bridge Ends
- Reduce Vibration on Steel Bridges

Conclusion

- Improve Drainage on Ballast Deck Bridges
- Improve Tamping Cycles on Ballast Deck Bridges with Use of Ballast Mat
- Reduce Wheel and Rail Wear