

# Example Project Findings and Impact on Recommended Design Practices



**FRA Tie and Fastening System BAA - Industry Partners Meeting**

**Colorado Springs, CO**

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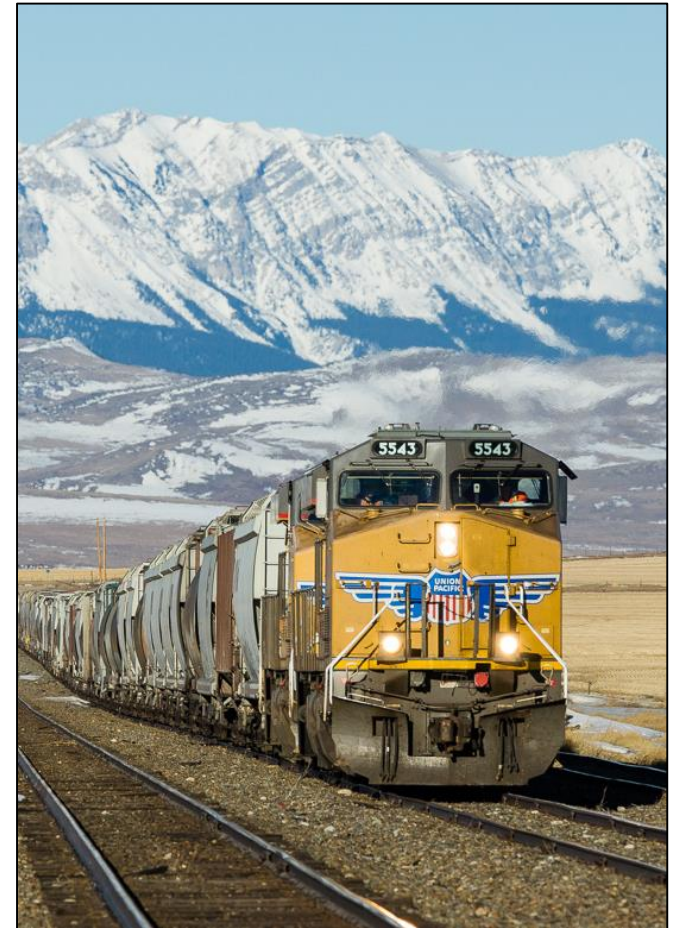


U.S. Department of Transportation  
Federal Railroad Administration

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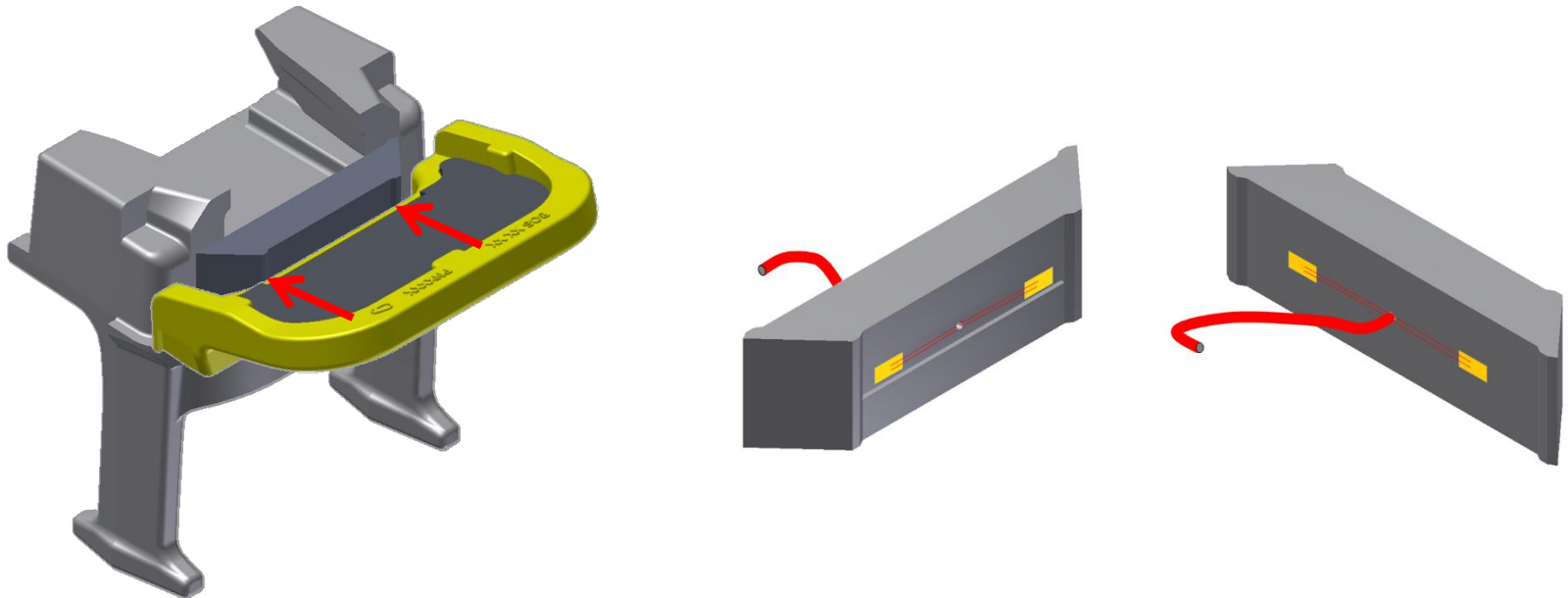
# Outline

- Lateral Force Distribution
- Rail Seat Pressure Distribution

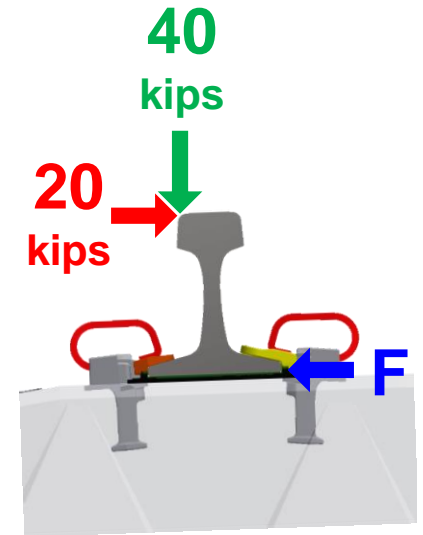
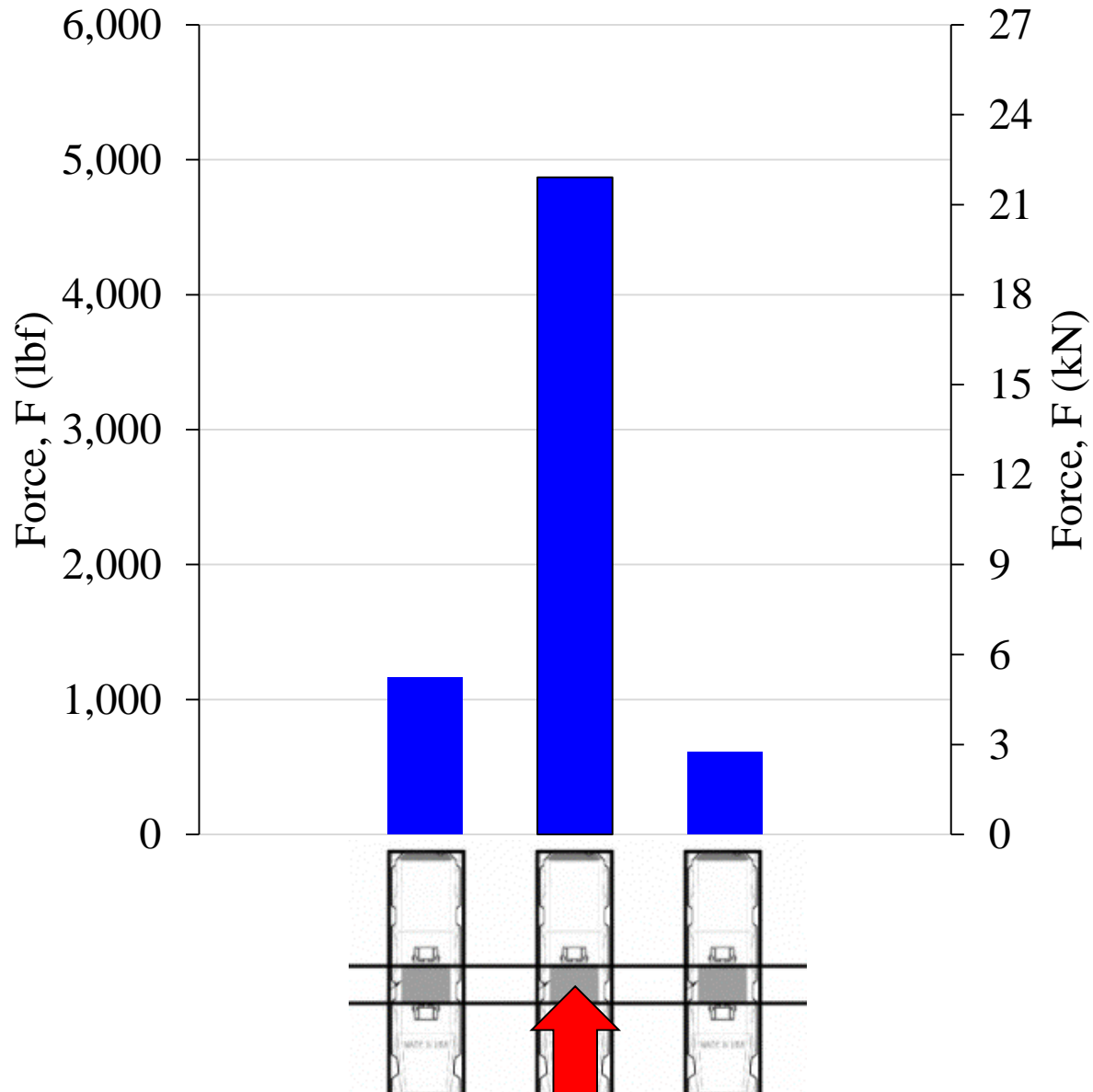


# Lateral Force Measurement Methodology

- Lateral Load Evaluation Device (LLED)
  - Original shoulder face is removed
  - Insert designed as a beam and optimized to replace removed section and maintains original geometry
  - Measures bending strain of beam under 4-point bending
    - Measuring bending strain is a proven technique

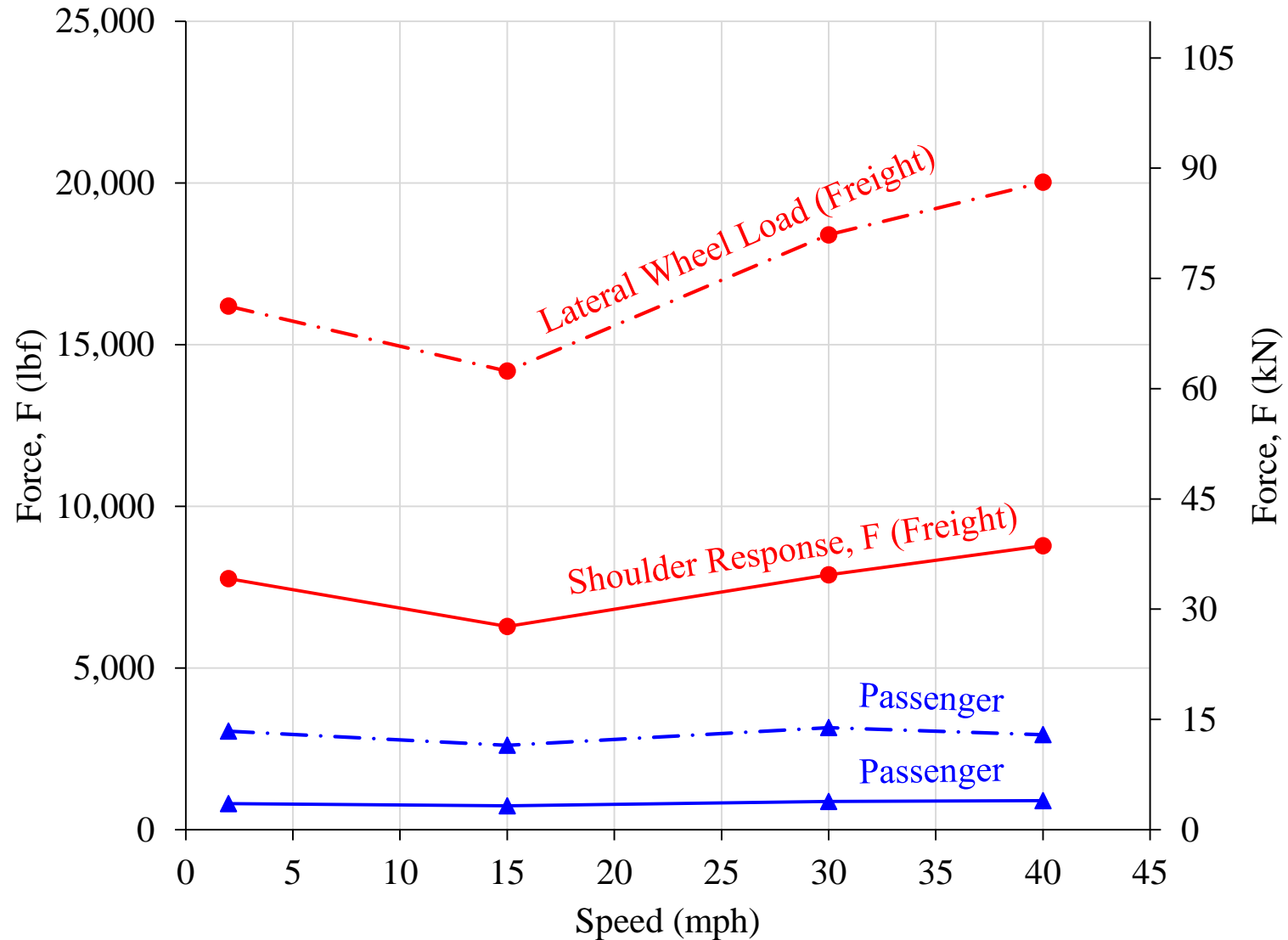


# Tie-to-Tie Lateral Load Distribution



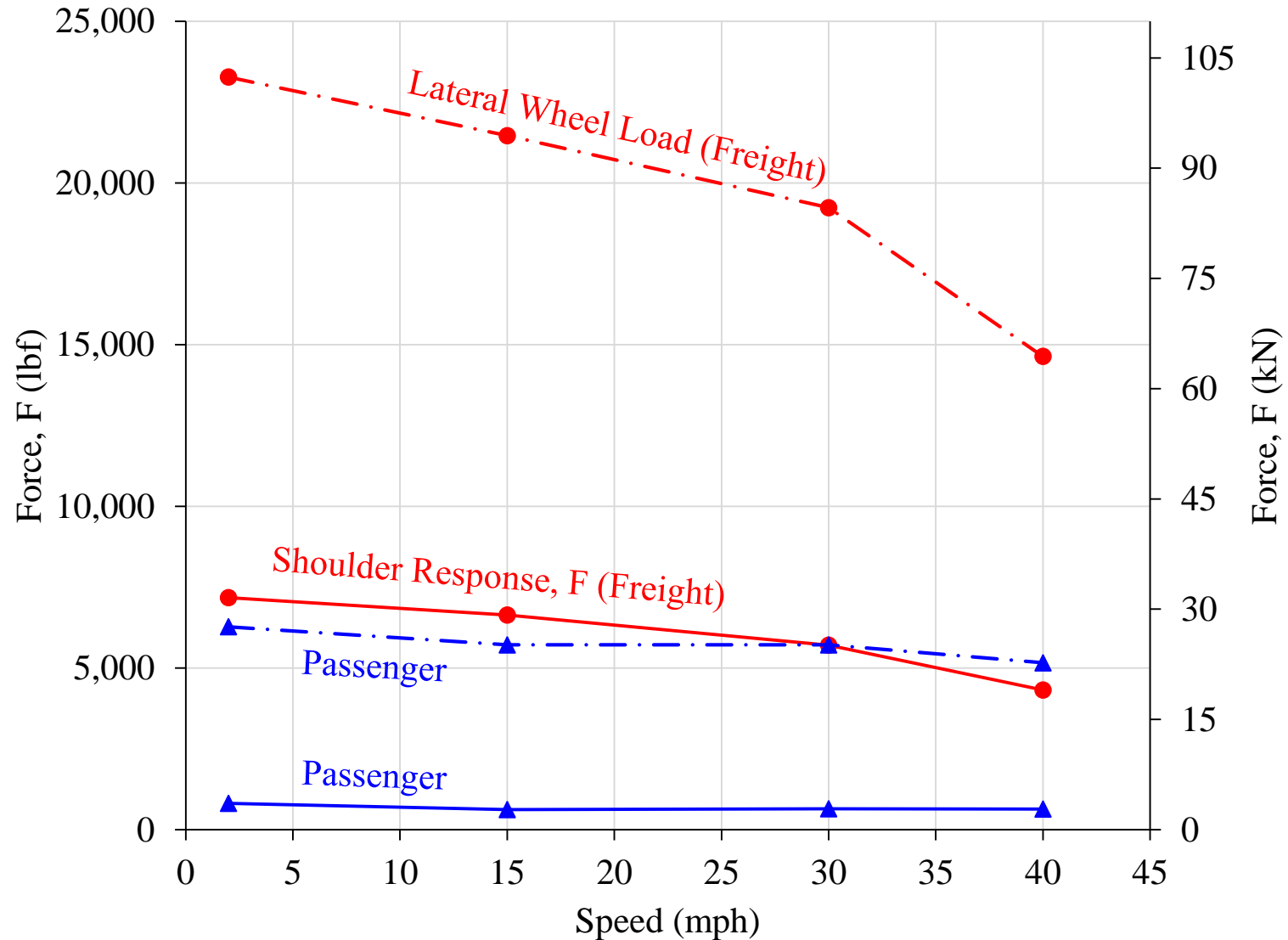
# Lateral Loads Within Fastening System

Curved Track (High Rail), Passenger and Freight Peak Loads

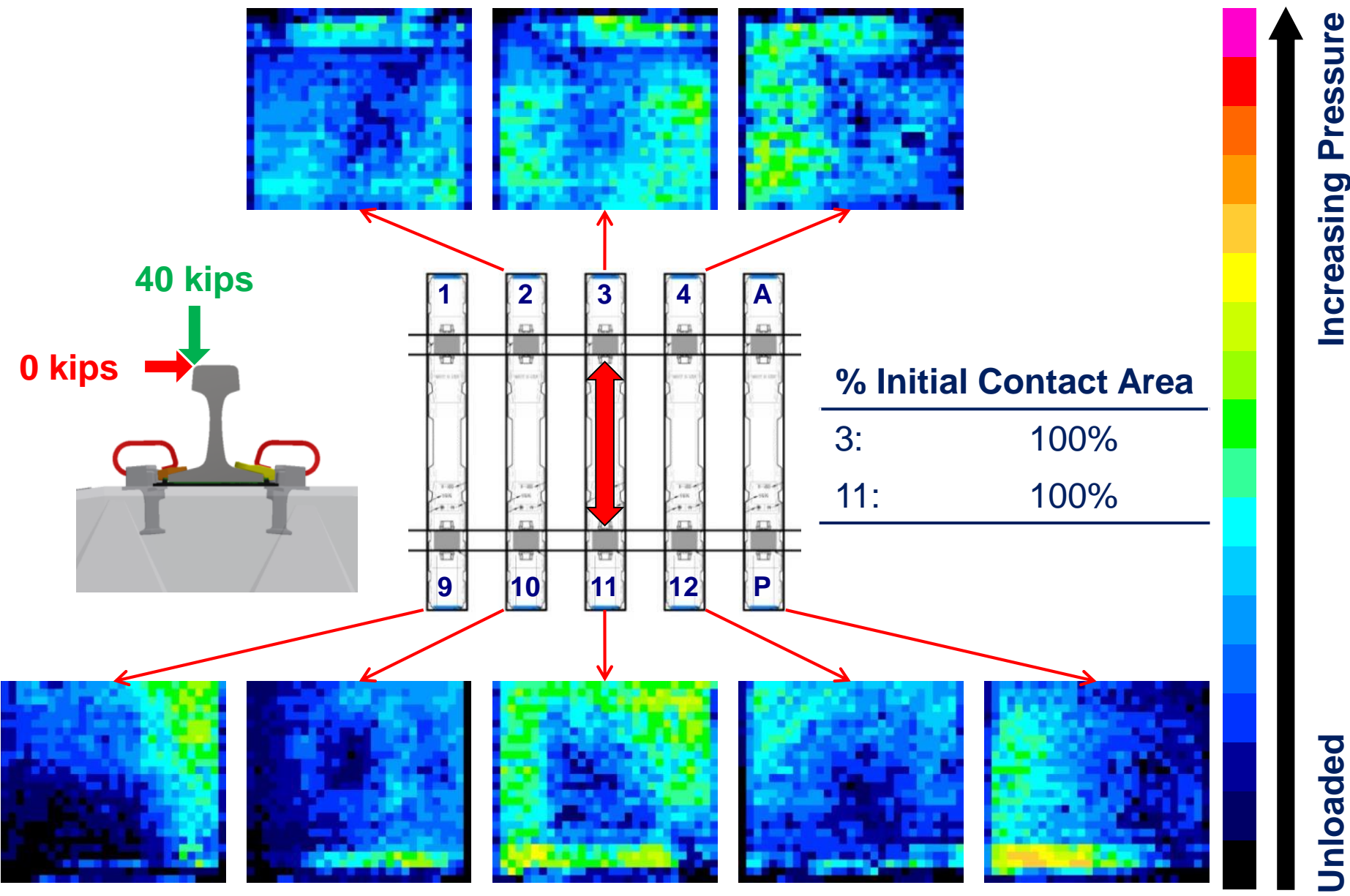


# Lateral Loads Within Fastening System

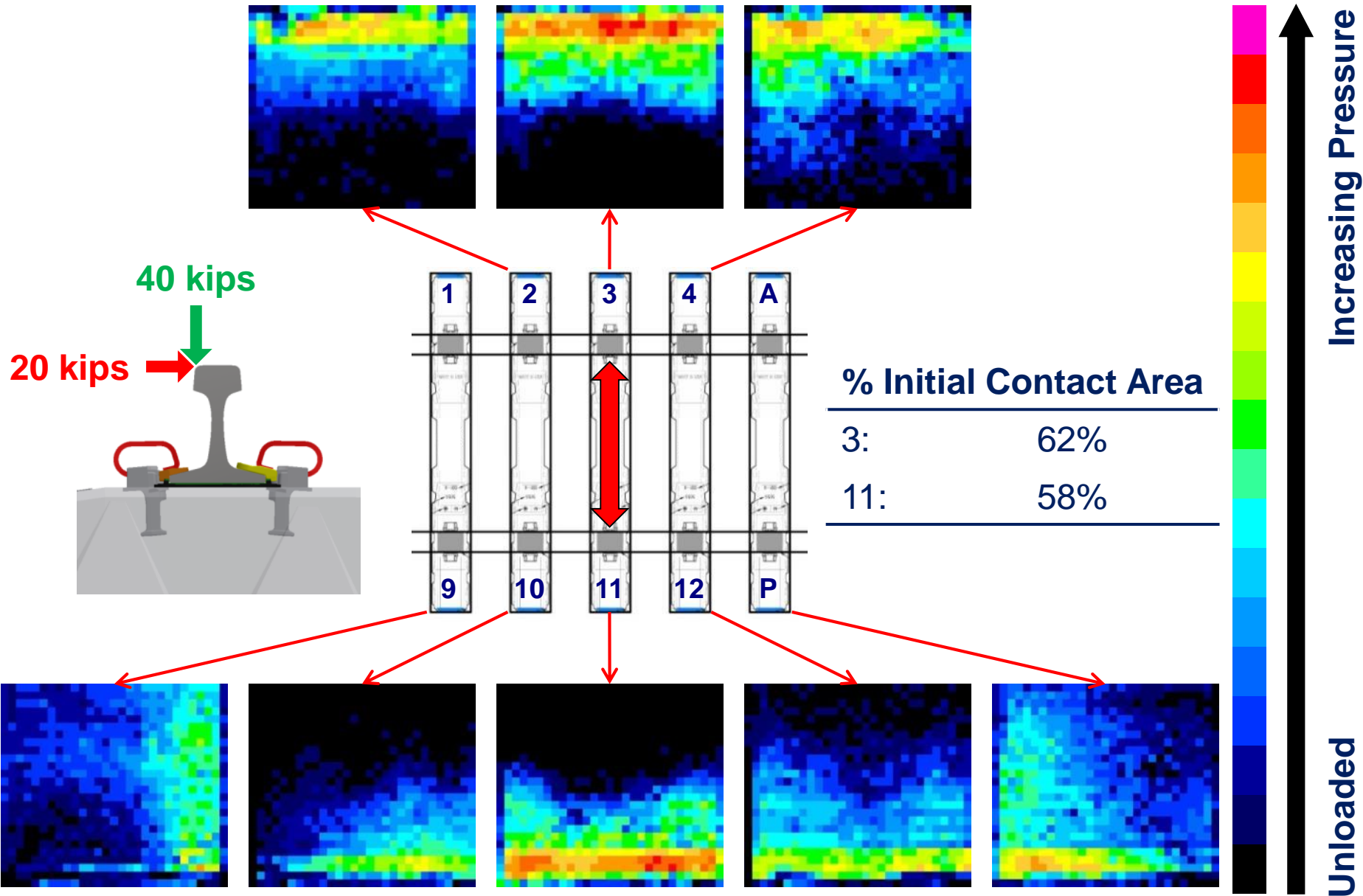
Curved Track (Low Rail), Passenger and Freight Peak Loads



# Rail Seat Load Concentration



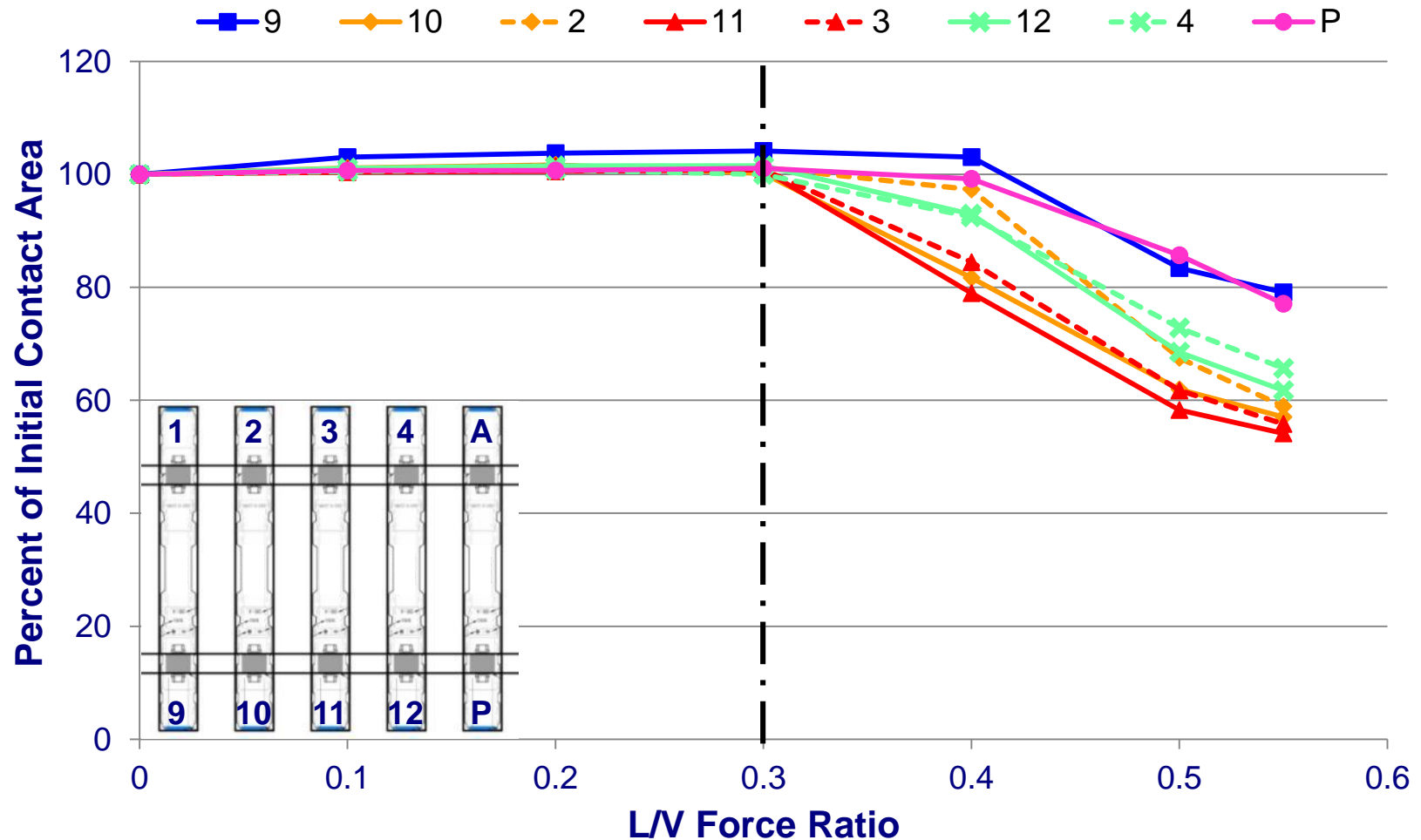
# Rail Seat Load Concentration





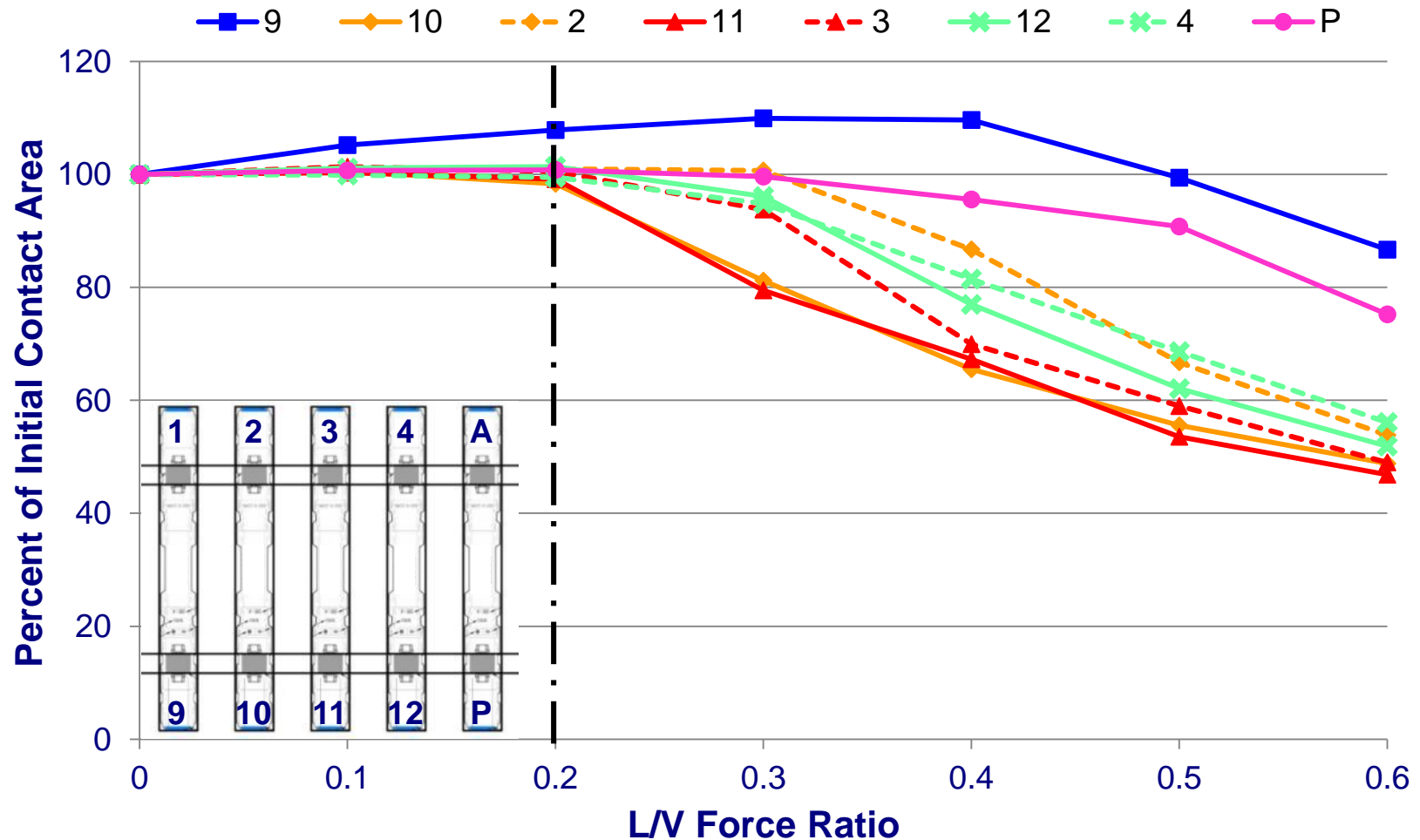
# TLV Varying Lateral Load at RTT

40,000 lb (178 kN) Vertical Load



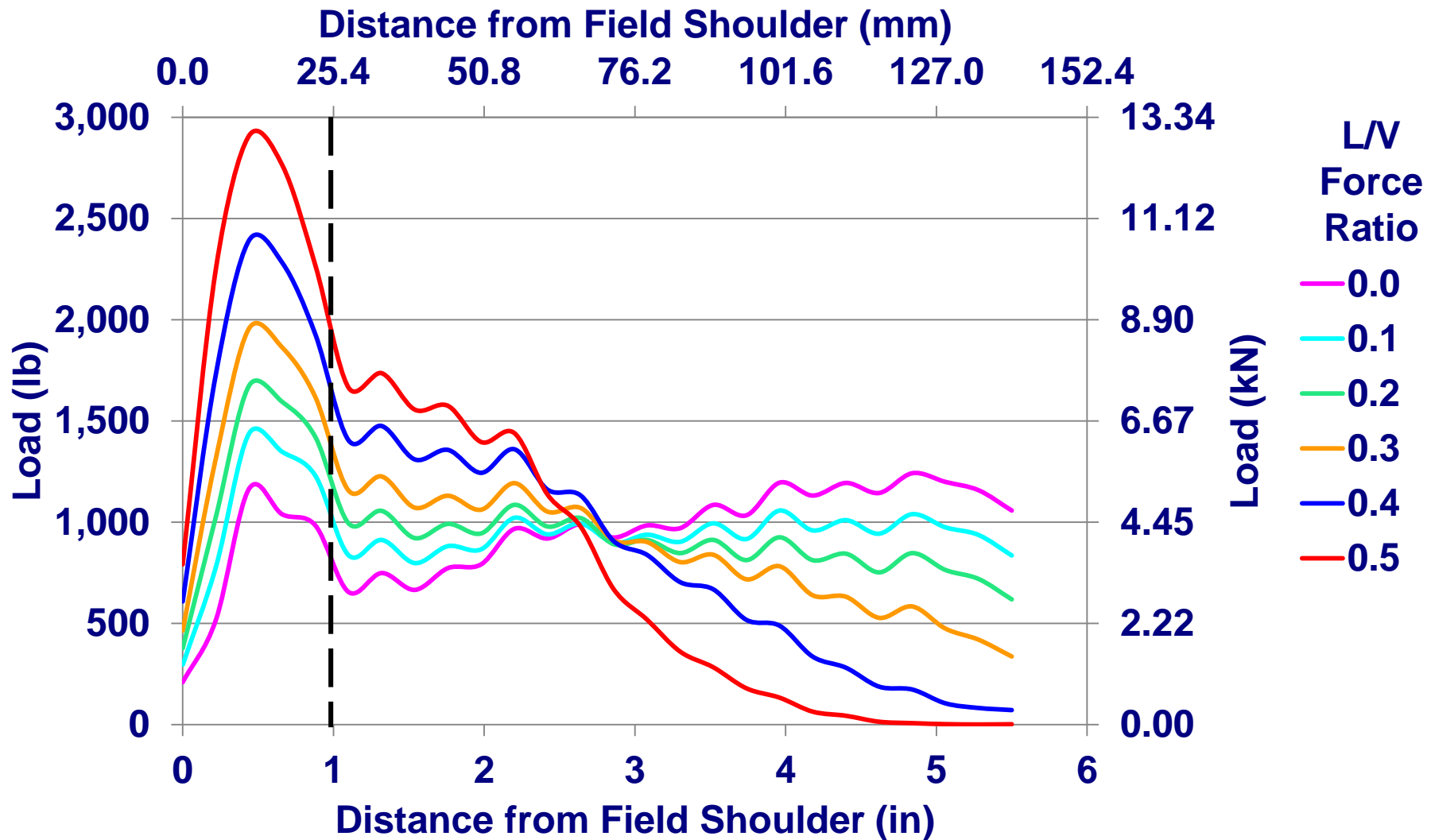
# TLV Varying Lateral Load at RTT

20,000 lb (88.9 kN) Vertical Load



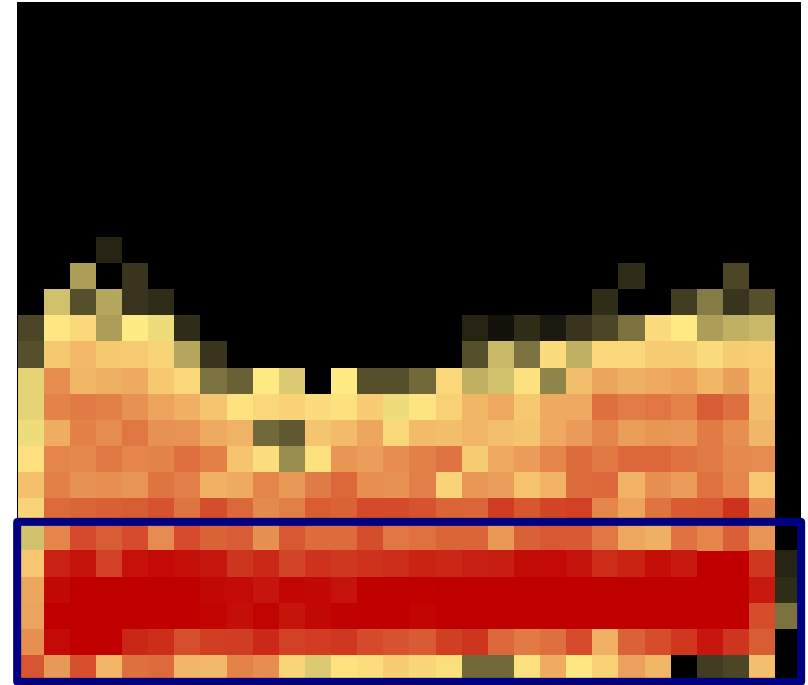
# Concentration of Rail Seat Load

40,000 lb (178 kN) Vertical Load



# Definition of Rail Seat Load Index (RSLI)

- A quantifiable design value which describes the sensitivity of the rail seat load distribution to changes in the L/V force ratio
- Rail Seat Load Index (RSLI) is defined as the percent of total rail seat load imparted onto a critical region of the rail seat, defined as the area of the rail seat not more than 1 inch (25.4 mm) from the field side shoulder, normalized to a theoretical, uniform distribution.



$$RSI = \frac{[Load\ in\ Critical\ Area]}{[Total\ Rail\ Seat\ Load]} = 6 * \frac{[Load\ in\ Critical\ Area]}{[Total\ Rail\ Seat\ Load]}$$

# Theoretical Optimized RSLI

