Example Project Findings and Impact on Recommended Design Practices

FRA Tie and Fastening System BAA - Industry Partners Meeting

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Federal Railroad Administration

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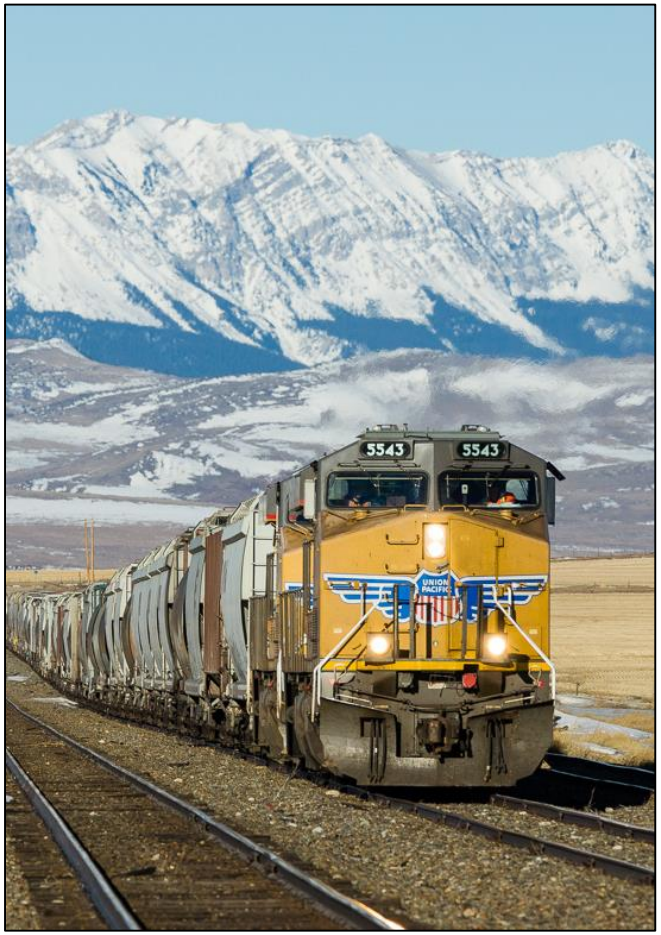
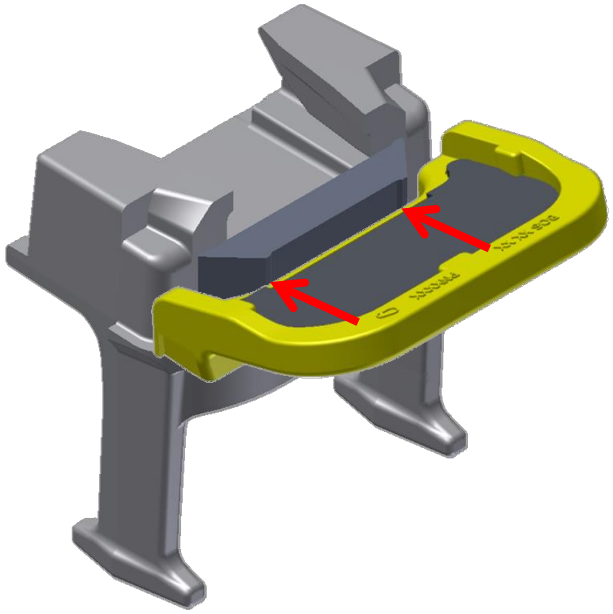
Outline

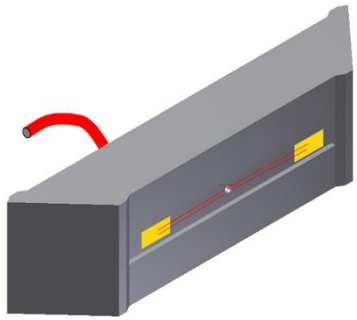
- Lateral Force Distribution
- Rail Seat Pressure Distribution

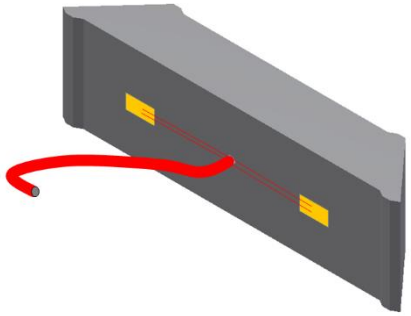


Lateral Force Measurement Methodology

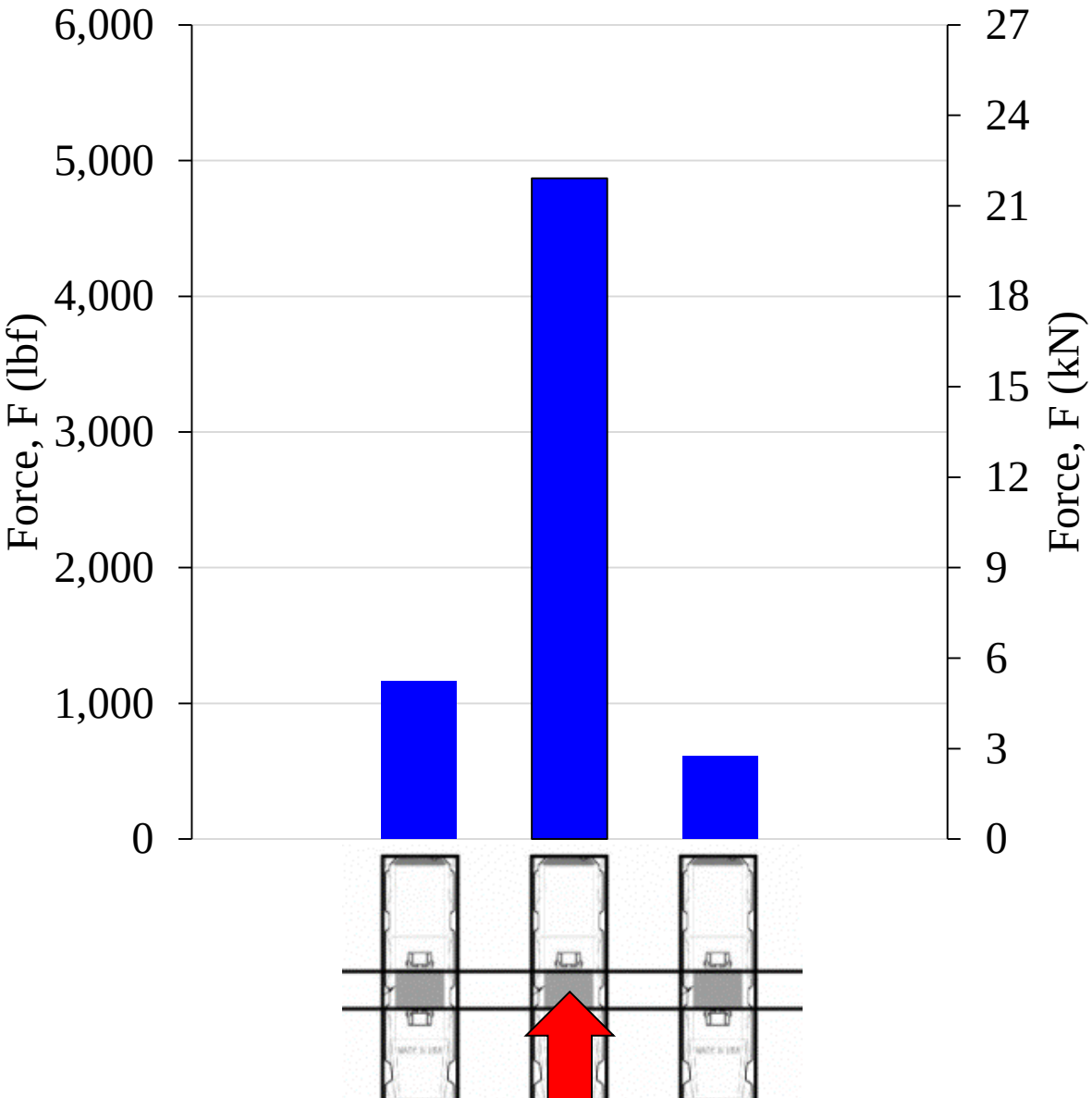
- Lateral Load Evaluation Device (LLED)
  - Original shoulder face is removed
  - Insert designed as a beam and optimized to replace removed section and maintains original geometry
  - Measures bending strain of beam under 4-point bending
    - Measuring bending strain is a proven technique

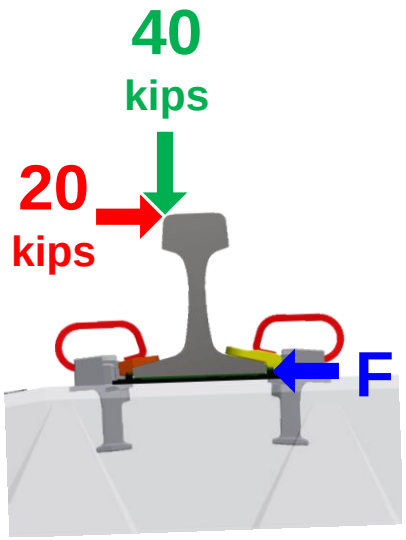






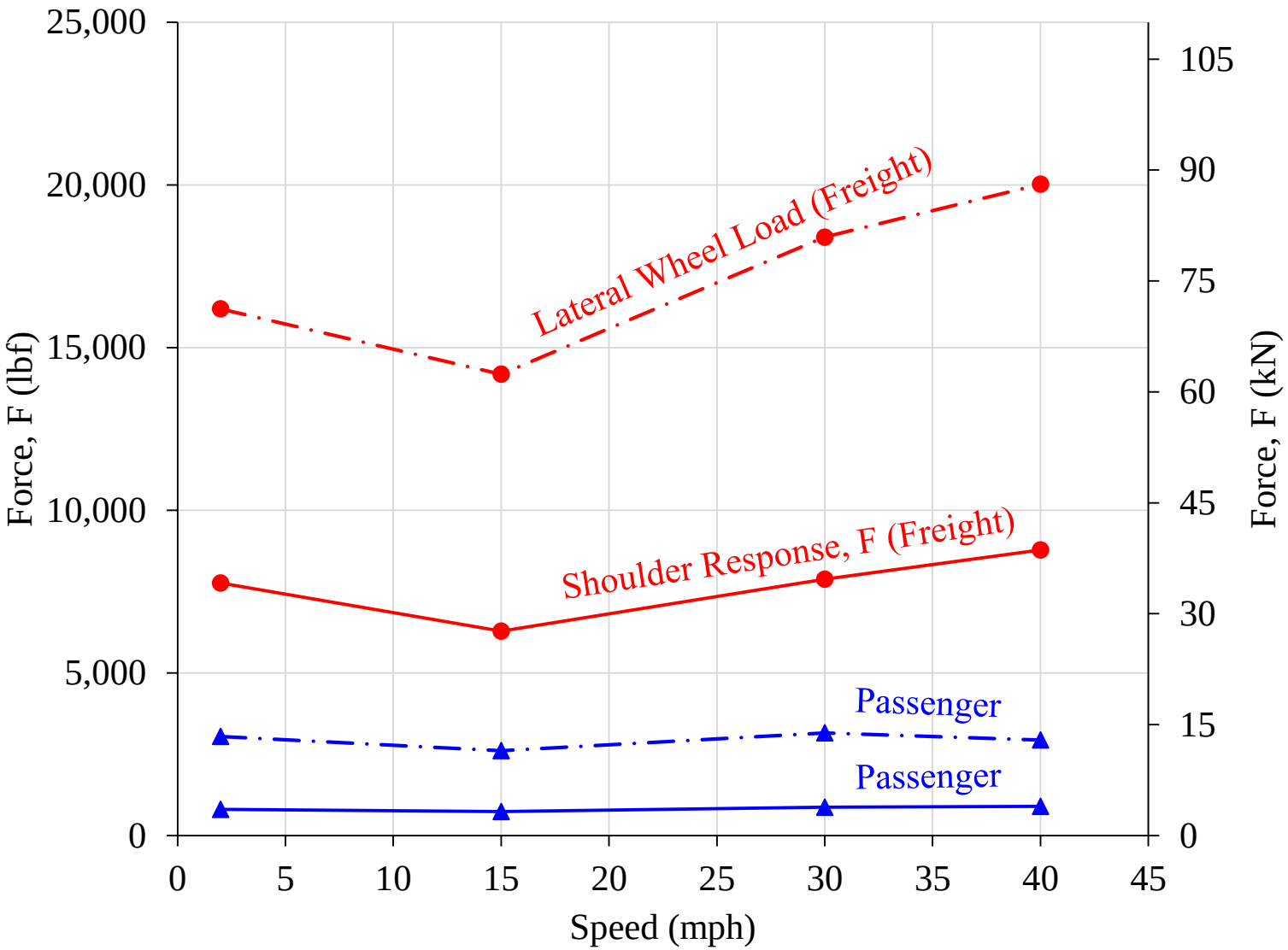
Tie-to-Tie Lateral Load Distribution





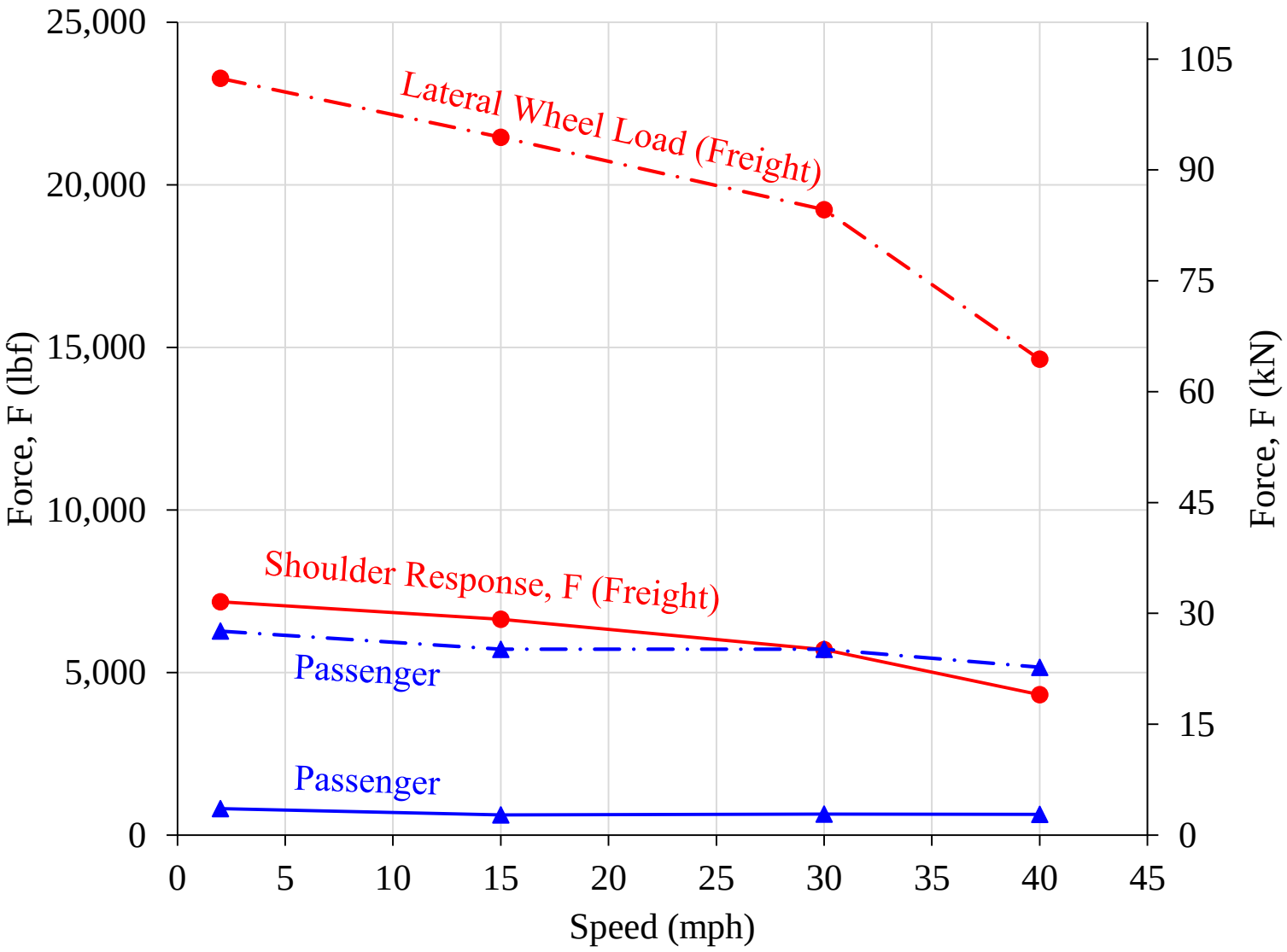
Lateral Loads Within Fastening System

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

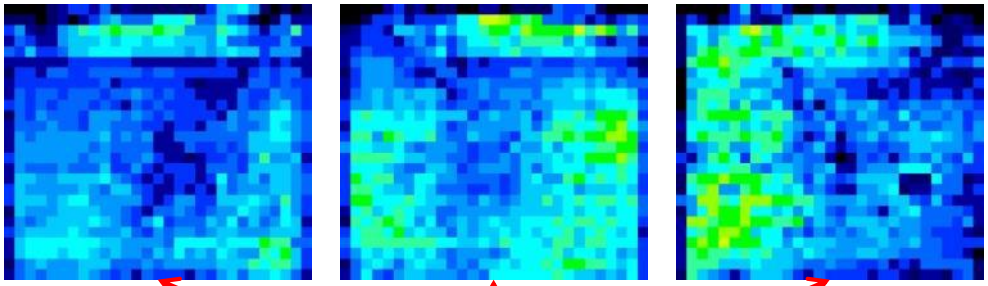


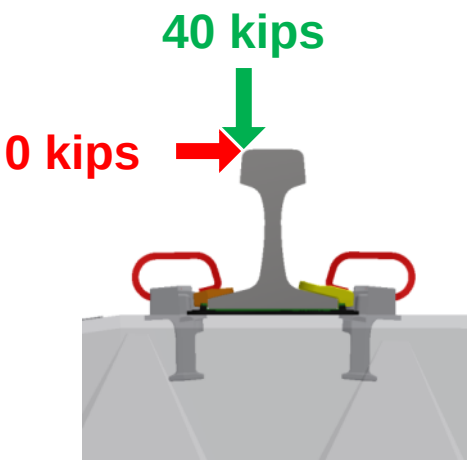
Lateral Loads Within Fastening System

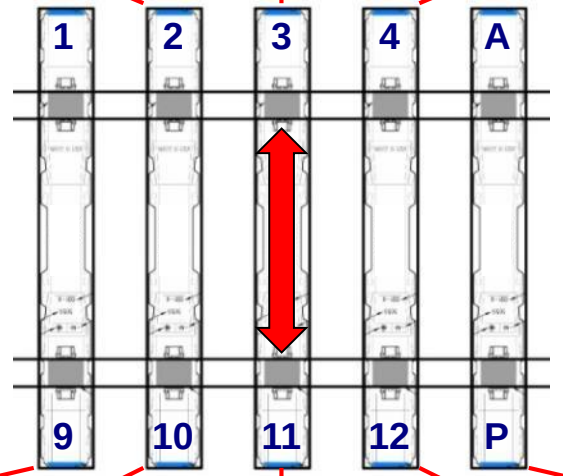
Curved Track (Low Rail), Passenger and Freight Peak Loads



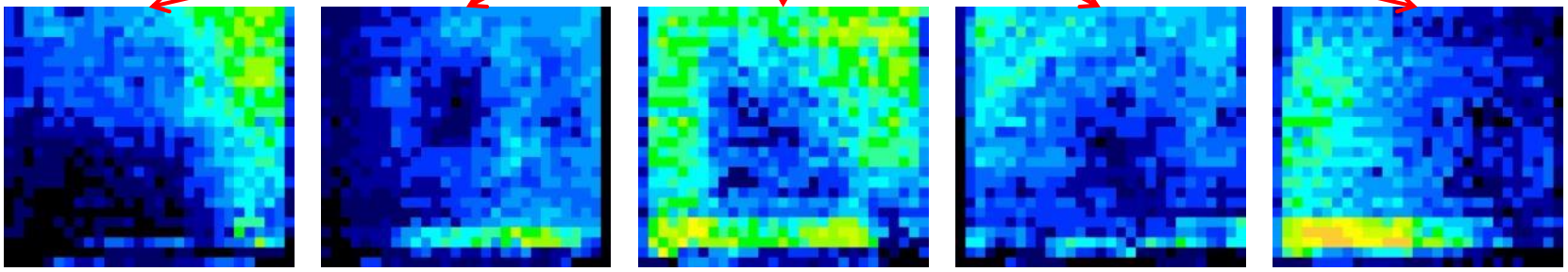
Rail Seat Load Concentration

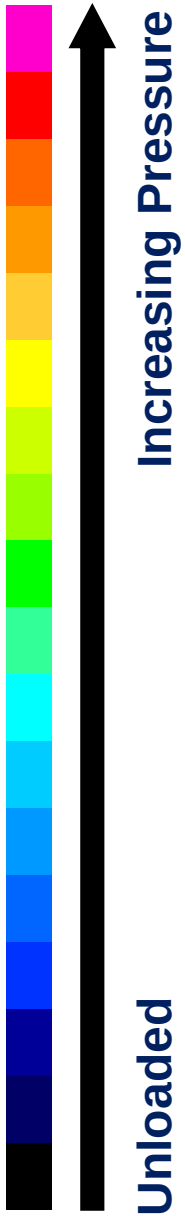






% Initial Contact Area	
3:	100%
11:	100%





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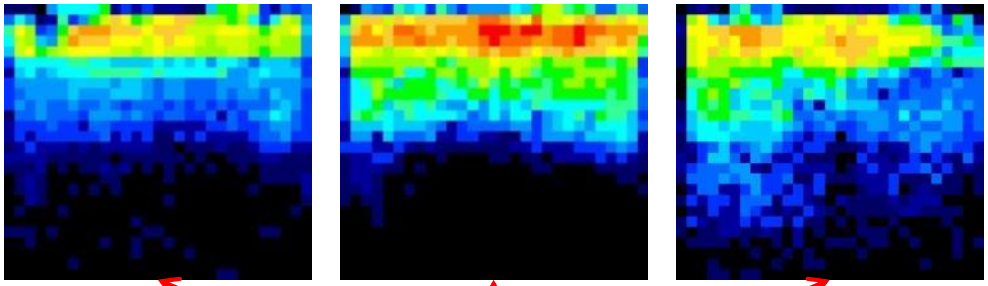
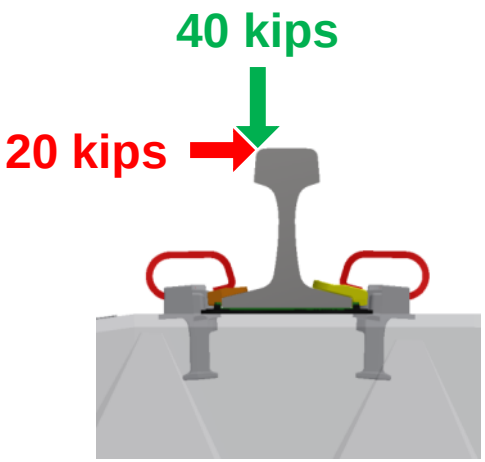
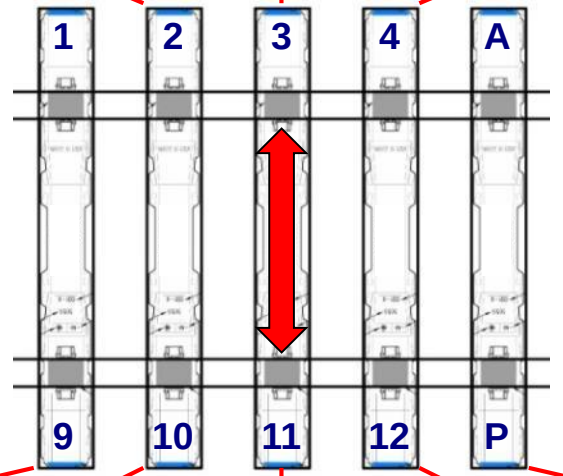
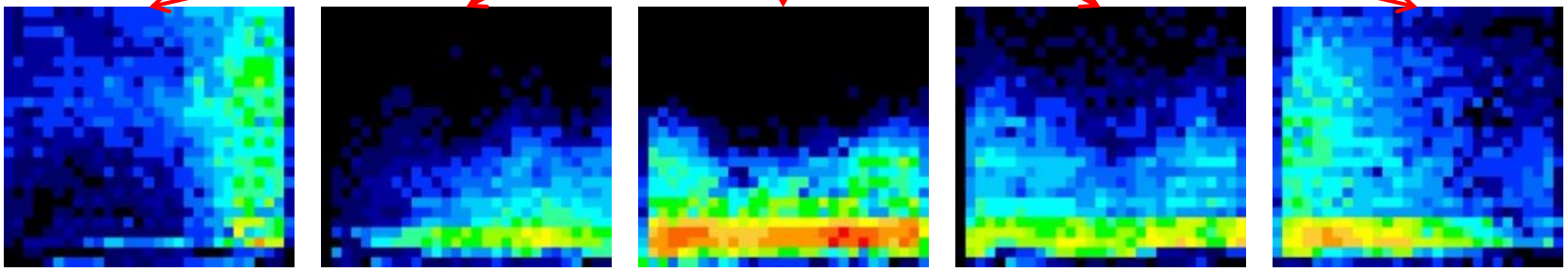
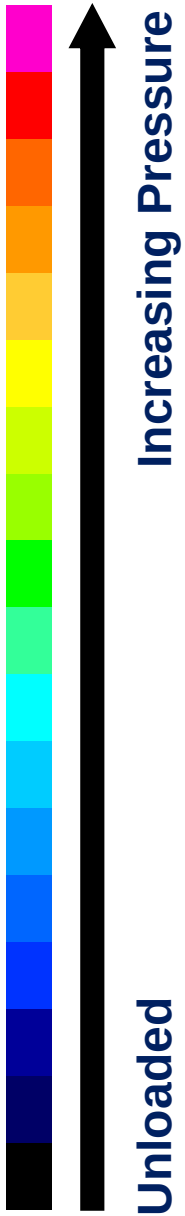




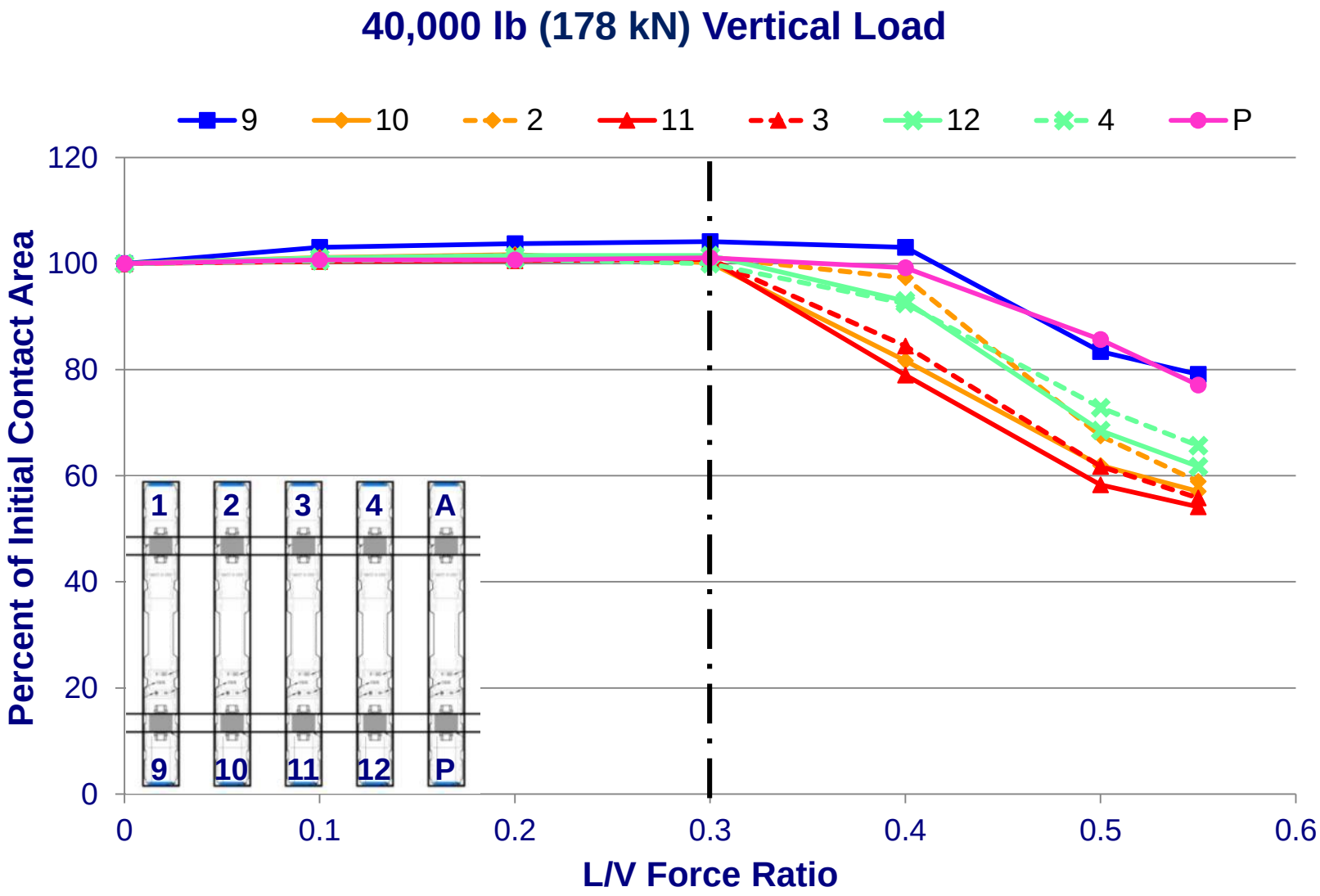


% Initial Contact Area	
3:	62%
11:	58%

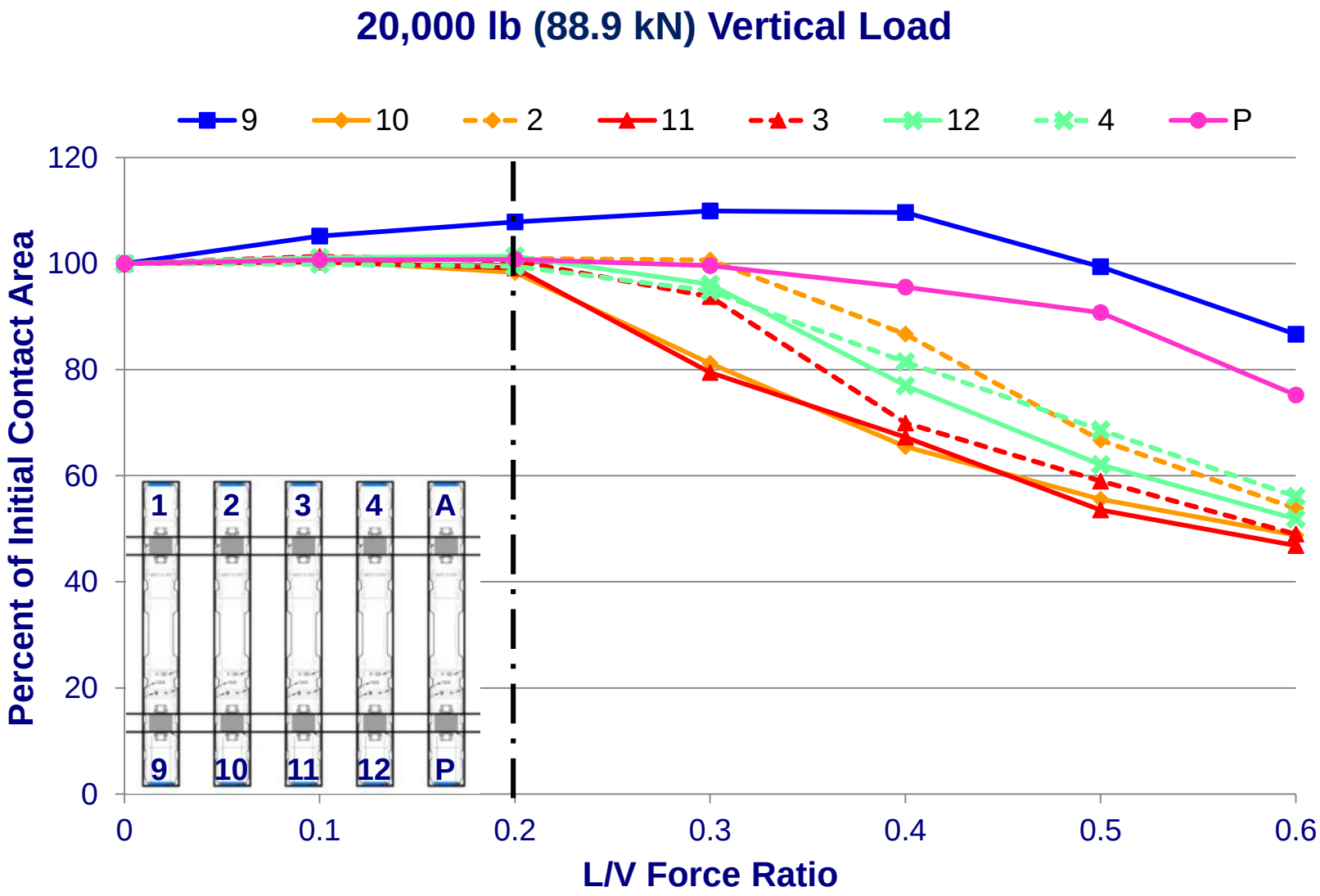




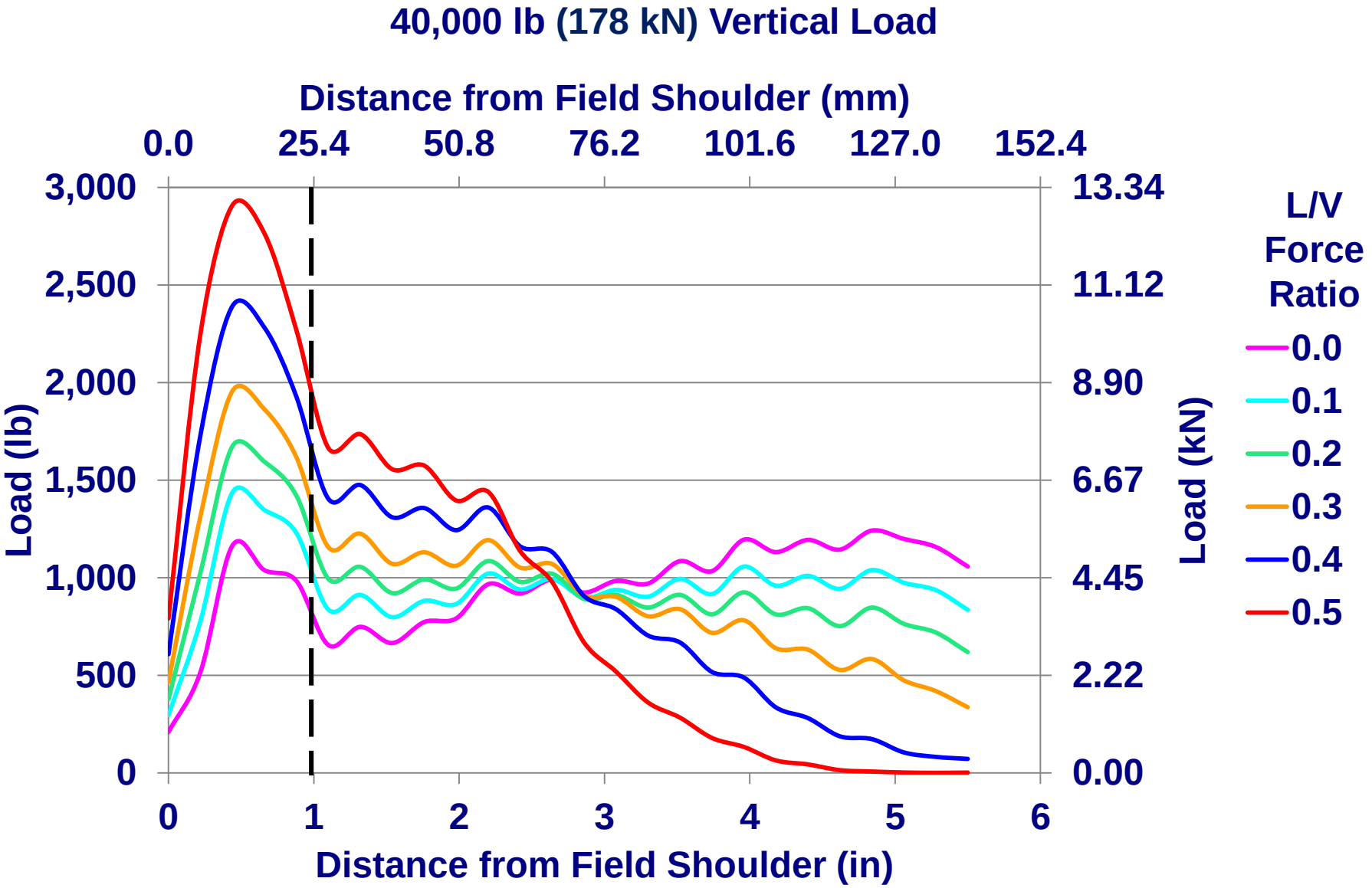
TLV Varying Lateral Load at RTT



TLV Varying Lateral Load at RTT

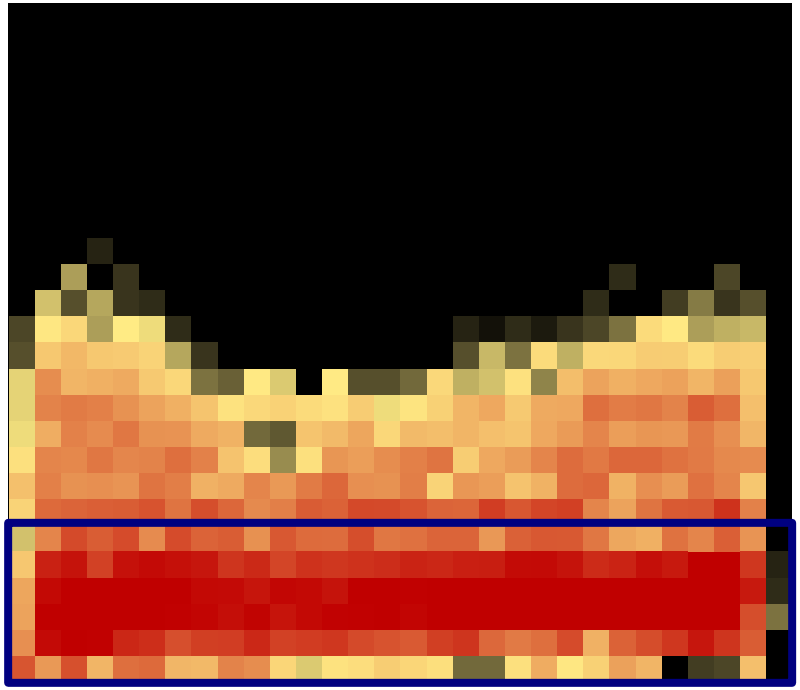


Concentration of Rail Seat Load



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.



$$RSI = \frac{\frac{[Load\ in\ Critical\ Area]}{[Total\ Rail\ Seat\ Load]}}{\frac{1}{6}} = 6 * \frac{[Load\ in\ Critical\ Area]}{[Total\ Rail\ Seat\ Load]}$$

Theoretical Optimized RSLI