

Freight Truck System Qualification

Presented By:

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Vice President - Engineering

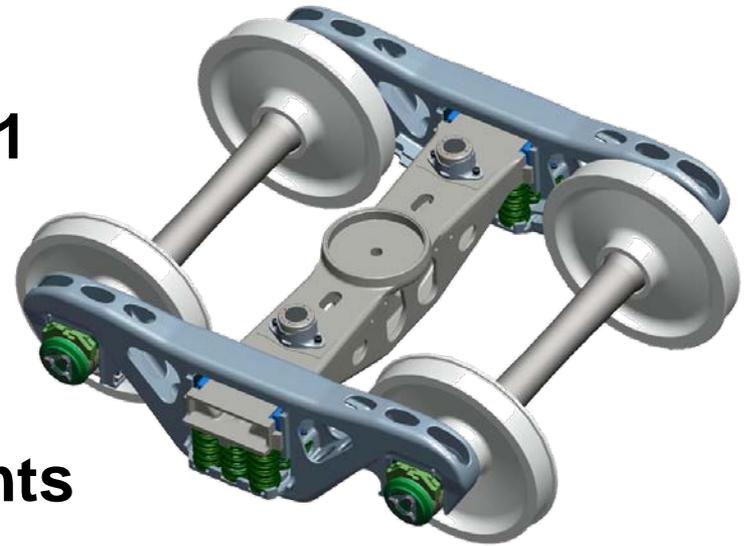
Truck & Coupling Systems

Amsted Rail

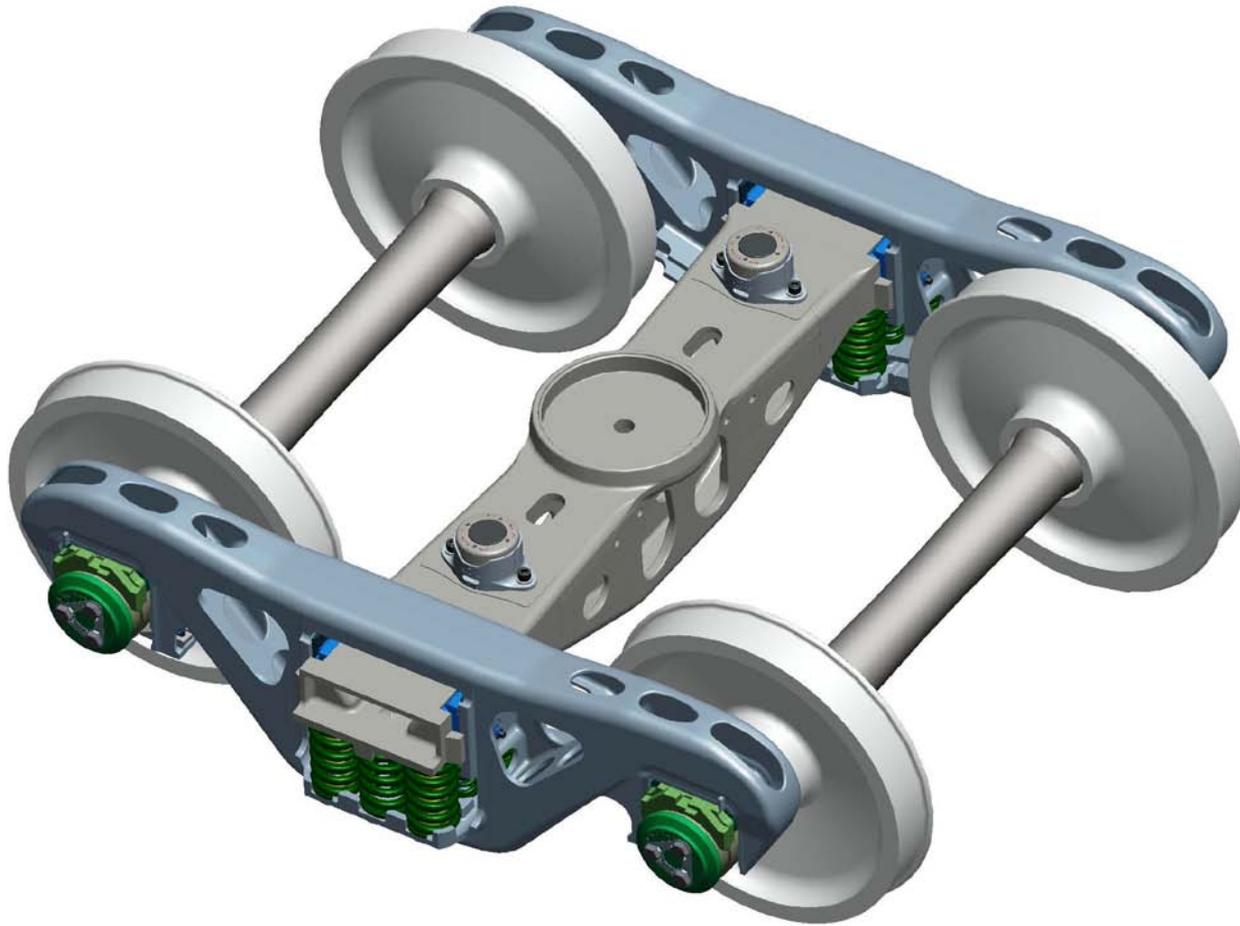


Agenda

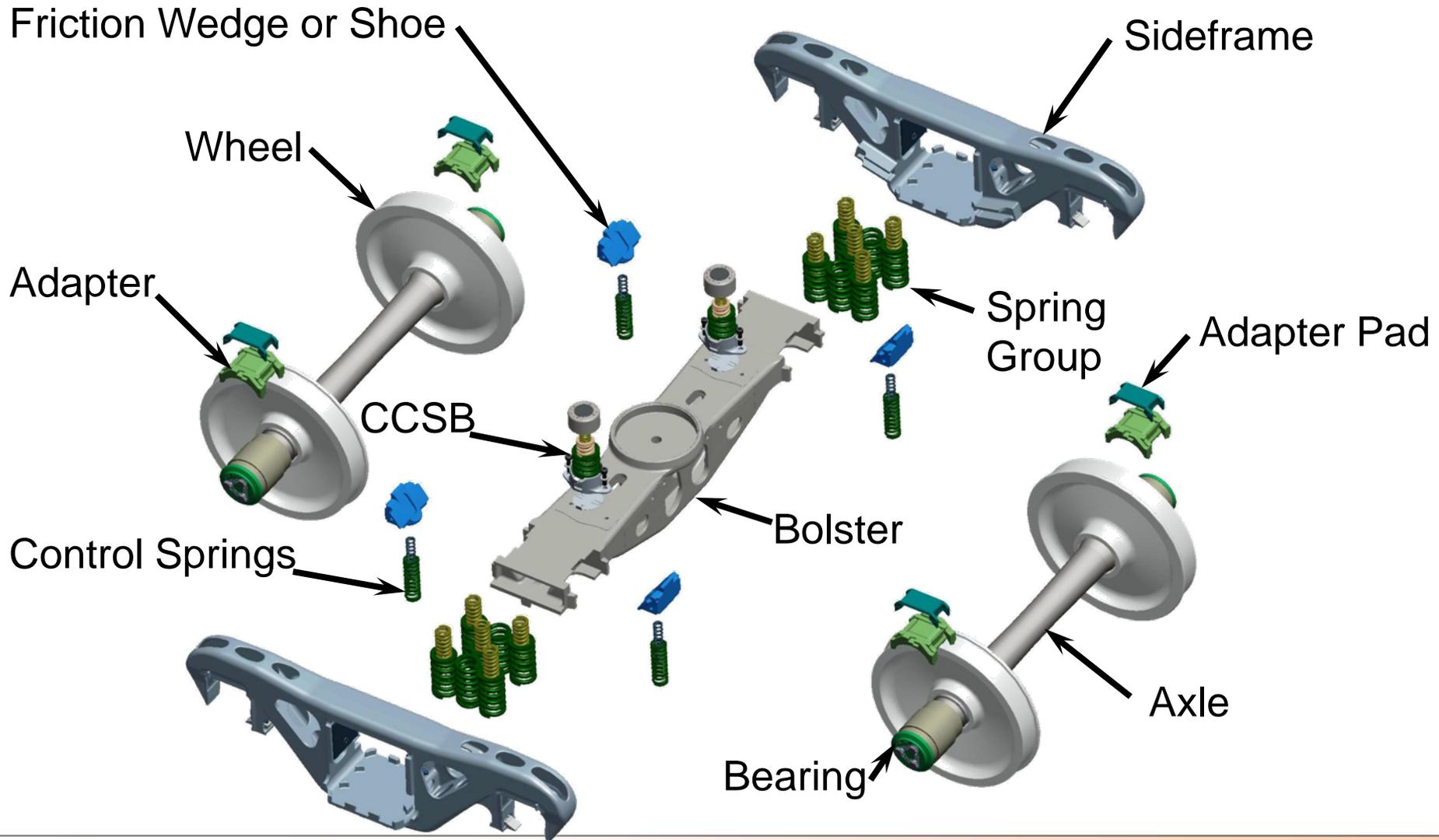
- **3-Piece Freight Truck Definition**
- **Truck Approval History**
 - **AAR M-965**
 - **AAR M-1001 Chapter 11**
- **AAR M-976 Specification**
 - **Test Requirements**
 - **Inspection Requirements**
- **Future Truck Approval**



3-Piece Freight Truck



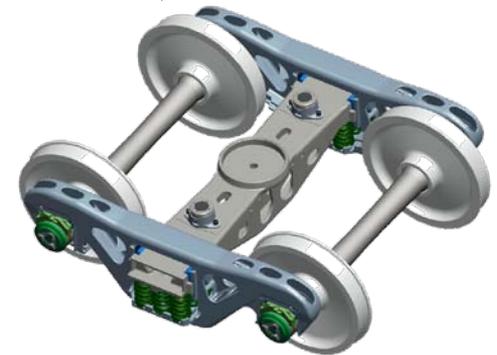
Freight Truck Nomenclature



AAR M-965 Specification

Truck Systems To Control Roll Stability In Freight Cars

- **For 263,000 lbs. gross rail load or higher**
- **Includes on-track testing requirements for twist and roll**
- **Includes in-service inspections up to 36,000 miles**



AAR M-1001 Chapter XI

Service-Worthiness Tests and Analyses For New Freight Cars

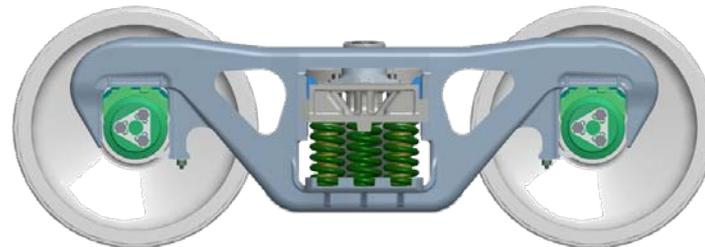
- **Applies to new freight car designs**
- **Provides on-track test requirements**
- **Car and truck suspension tested together**



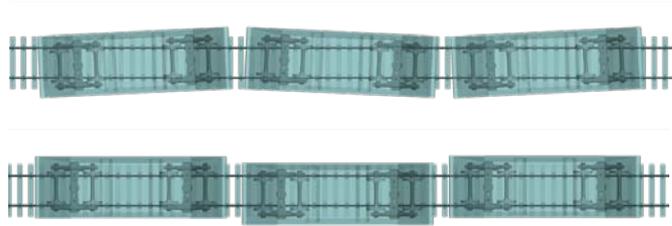
AAR M-976 Specification

Truck Performance for Rail Cars

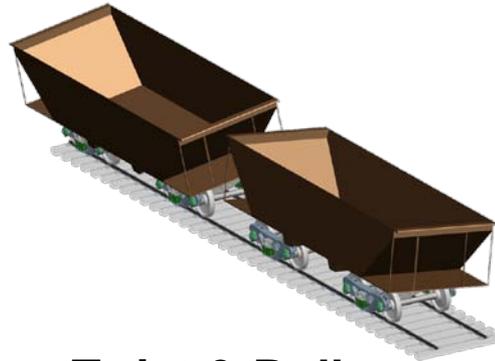
- **Required for all trucks used on 286,000 lbs. gross rail load freight cars**
- **Mandatory after July 2004**
- **Consists of an on-track test requirement and an in-service inspection requirement**



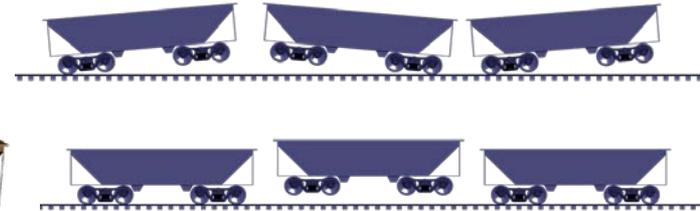
Truck Performance Overview



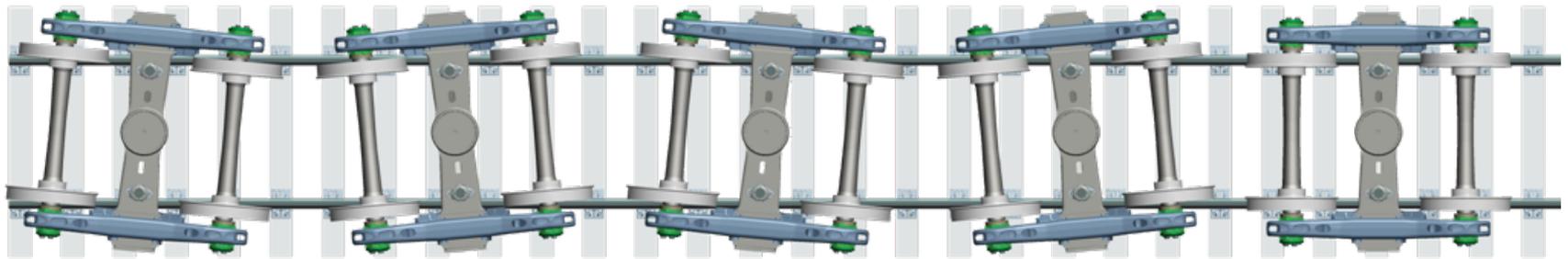
Yaw & Sway
Car / Suspension Specific



Twist & Roll
15-25, 50-60 mph



Pitch & Bounce
50-70 mph

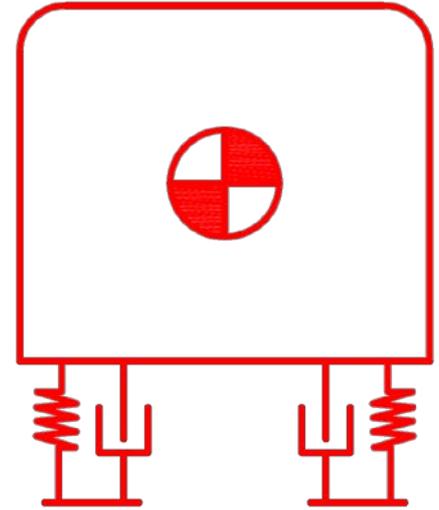


Truck Hunting
Truck Warp, Truck Rotation, Wheelset Movement
40+ mph

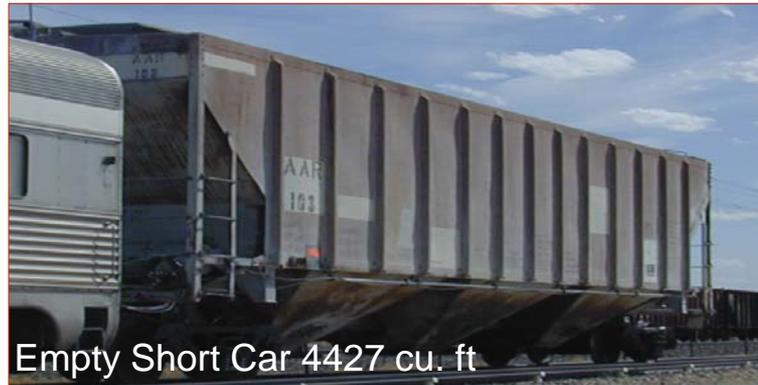


Dynamic Influences

- **Wheel to Rail Contact**
- **Primary Suspension**
- **Secondary Suspension**
- **Speed**
- **Track Input**
- **Mass/Inertias (Car Body, Truck Components)**
- **Friction**



M-976 Test Car Types / Regimes



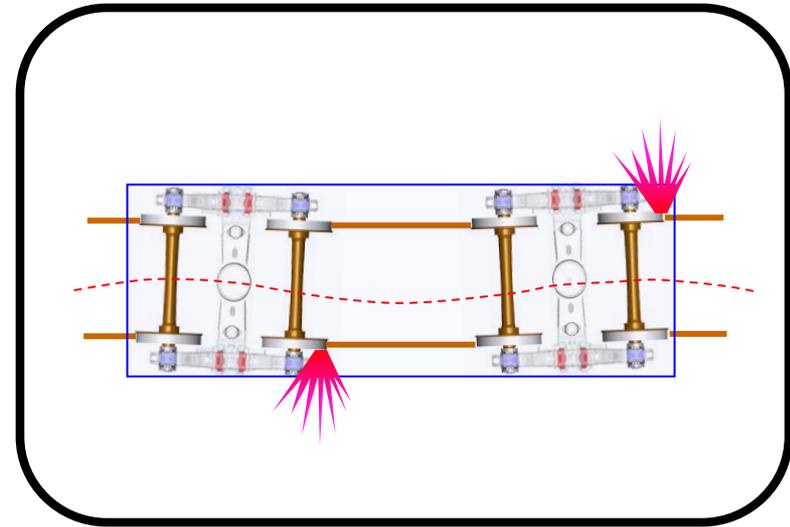
<i>Regime</i>	<i>Covered Hoppers Empty / Loaded Short / Long</i>
Hunting	Short Empty
Steady State Curving	Short Empty Short Loaded
Curve Resistance	Short Loaded
Spiral	Short Empty Short Loaded Long Empty
Twist / Roll	Short Empty Short Loaded
Pitch / Bounce	Short Empty Short Loaded
Yaw / Sway	Short Loaded
Dynamic Curving	Short Loaded



M-976 Test Conditions

Hunting Criteria

Acceleration **1.5 g's peak to peak**
Standard Deviation **0.13 g's rms**

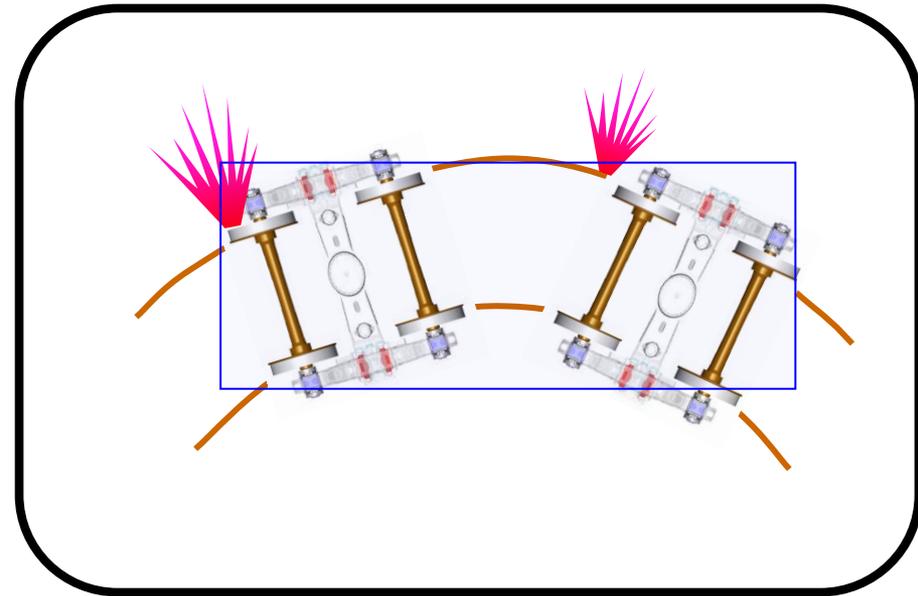


M-976 Test Conditions

Steady State Curving

95th percentile Max. Wheel L/V **0.8**

95th percentile Max. Axle Sum L/V **1.5**



M-976 Test Conditions

Curving Resistance

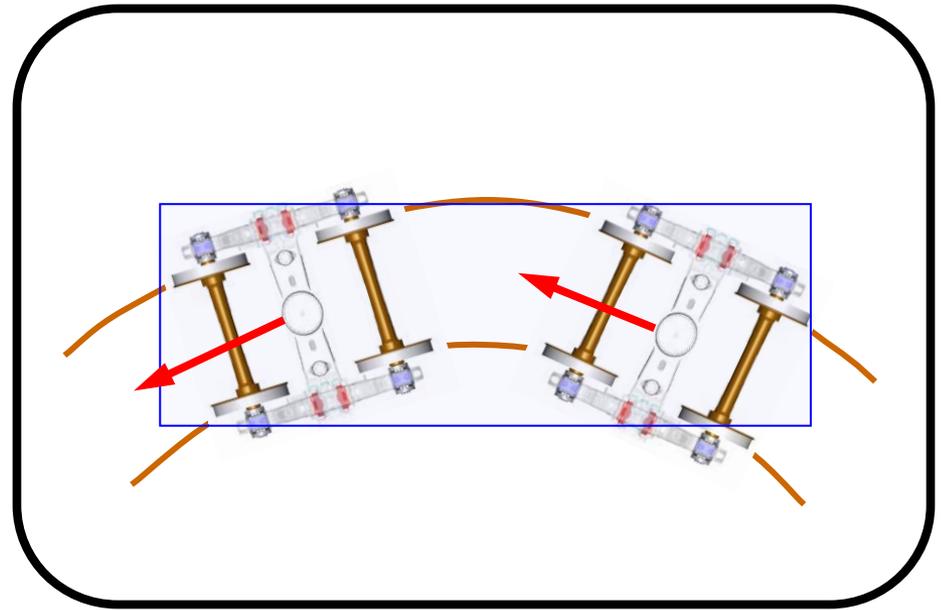
Average Pounds \ Ton \ Degree 0.4

1.5 Degree Curve

4.0 Degree Curve

7.5 Degree Curve

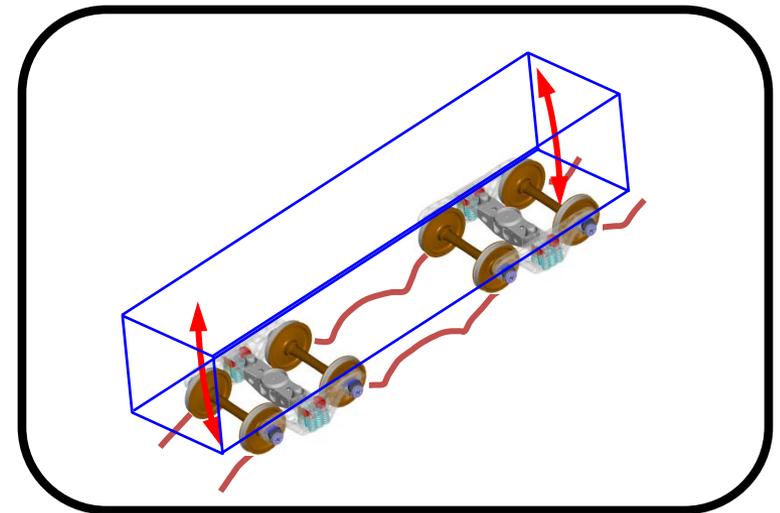
10 Degree Curve



M-976 Test Conditions

Pitch / Bounce

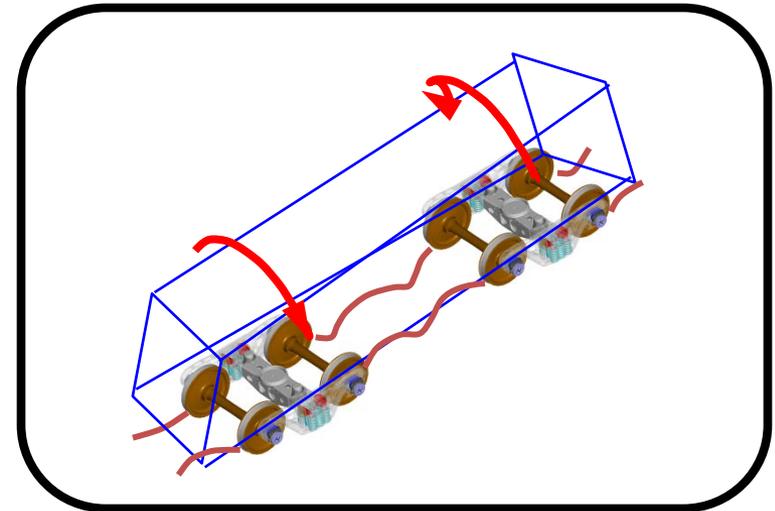
Vertical load	10%
Dynamic Acceleration	1.0 g
Spring Capacity	95%



M-976 Test Conditions

Twist / Roll

Max. Axle Sum	1.5
Min. Vertical load	10%
Dynamic Acceleration	1.0 g
Spring Capacity	95%

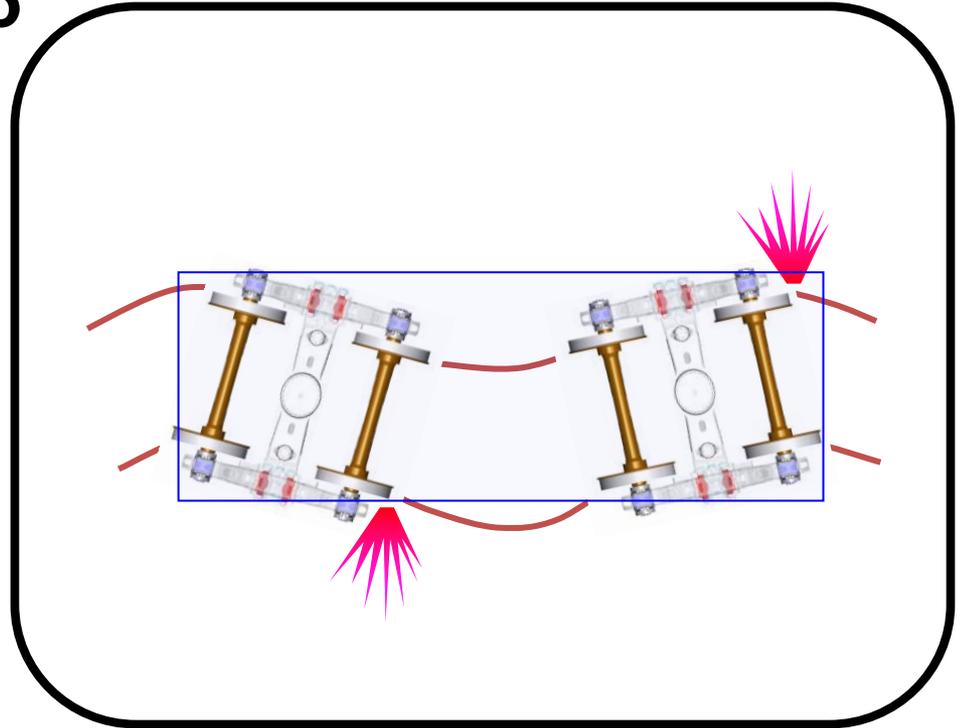


M-976 Test Conditions

Yaw / Sway

Max. Truck Side L/V 0.7

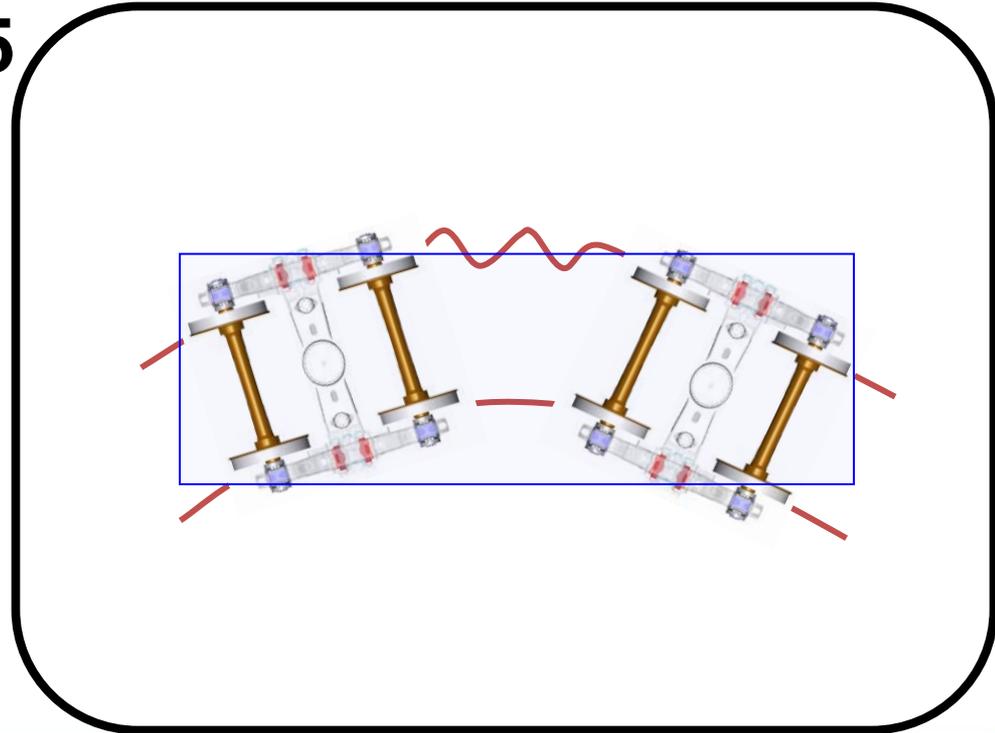
Max. Axle Sum L/V 1.5



M-976 Test Conditions

Dynamic Curving

Min. Vertical load	10%
Max. Wheel L/V	1.0
Max. Axle Sum	1.5



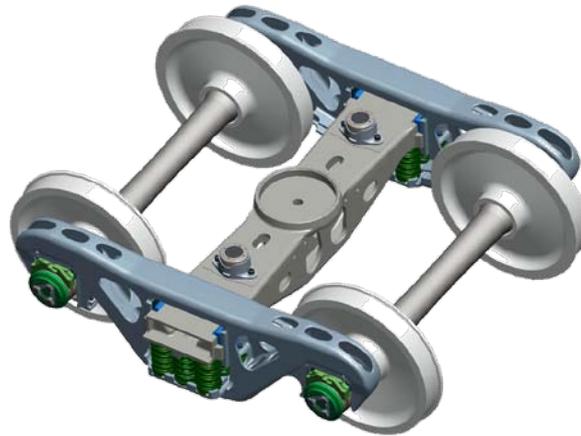
M-976 Inspection Criteria

- **Preliminary Approval**
 - **Pass on-track testing at TTCl in Pueblo, CO**
 - **10 carsets with at least 6 months or 20,000 service miles**
- **Conditional Approval**
 - **100 carsets with at least 36,000 service miles**
- **Full Approval**
 - **Service inspection report on two randomly selected trucks at mileage intervals of 36,000, 100,000 and 250,000**



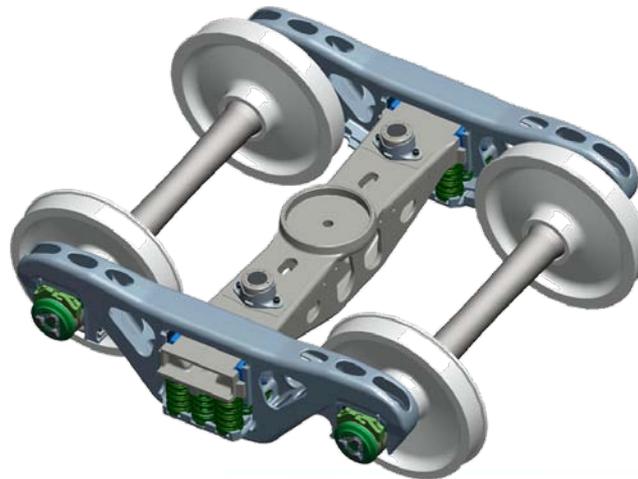
Next Specification M-9??

- **AAR with supplier input is determining next level of achievable performance**
- **Specification to improve on M-976 (lessons learned)**
- **Test values expected to be tightened for improved performance**



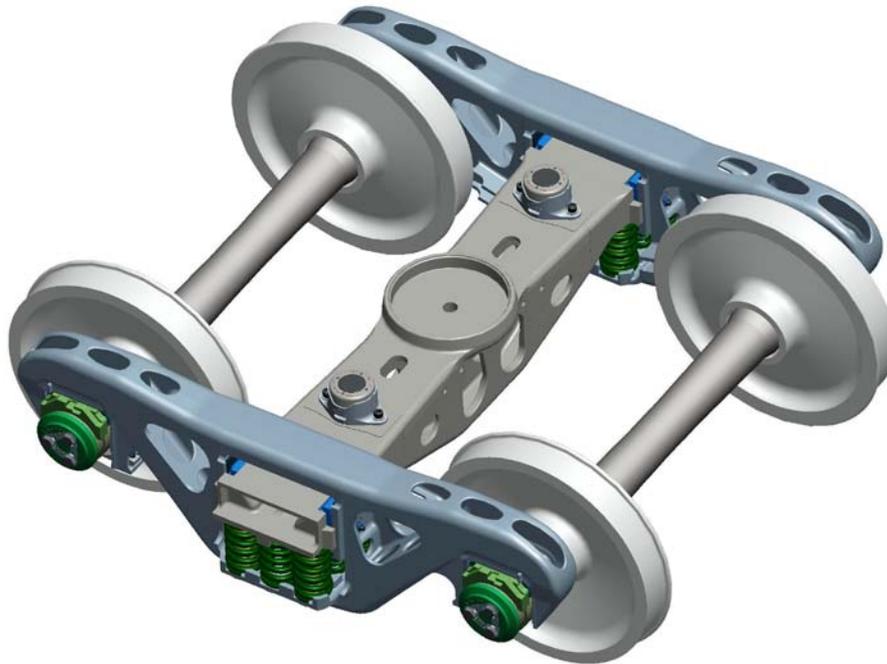
Summary

- Latest freight truck system qualification specification is AAR M-976
- AAR M-976 includes on-track testing and in-service inspections
- Next AAR specification for freight truck performance currently being evaluated



Thank You

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Amsted Rail

