

# Freight Truck System Qualification

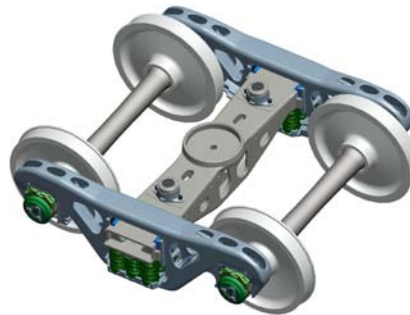
Presented By:

**Nathan Reese**

**Vice President - Engineering**

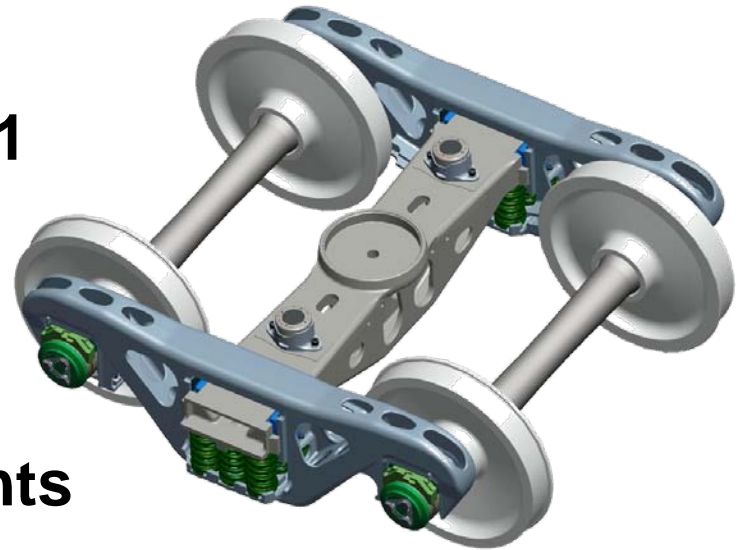
**Truck & Coupling Systems**

***Amsted Rail***

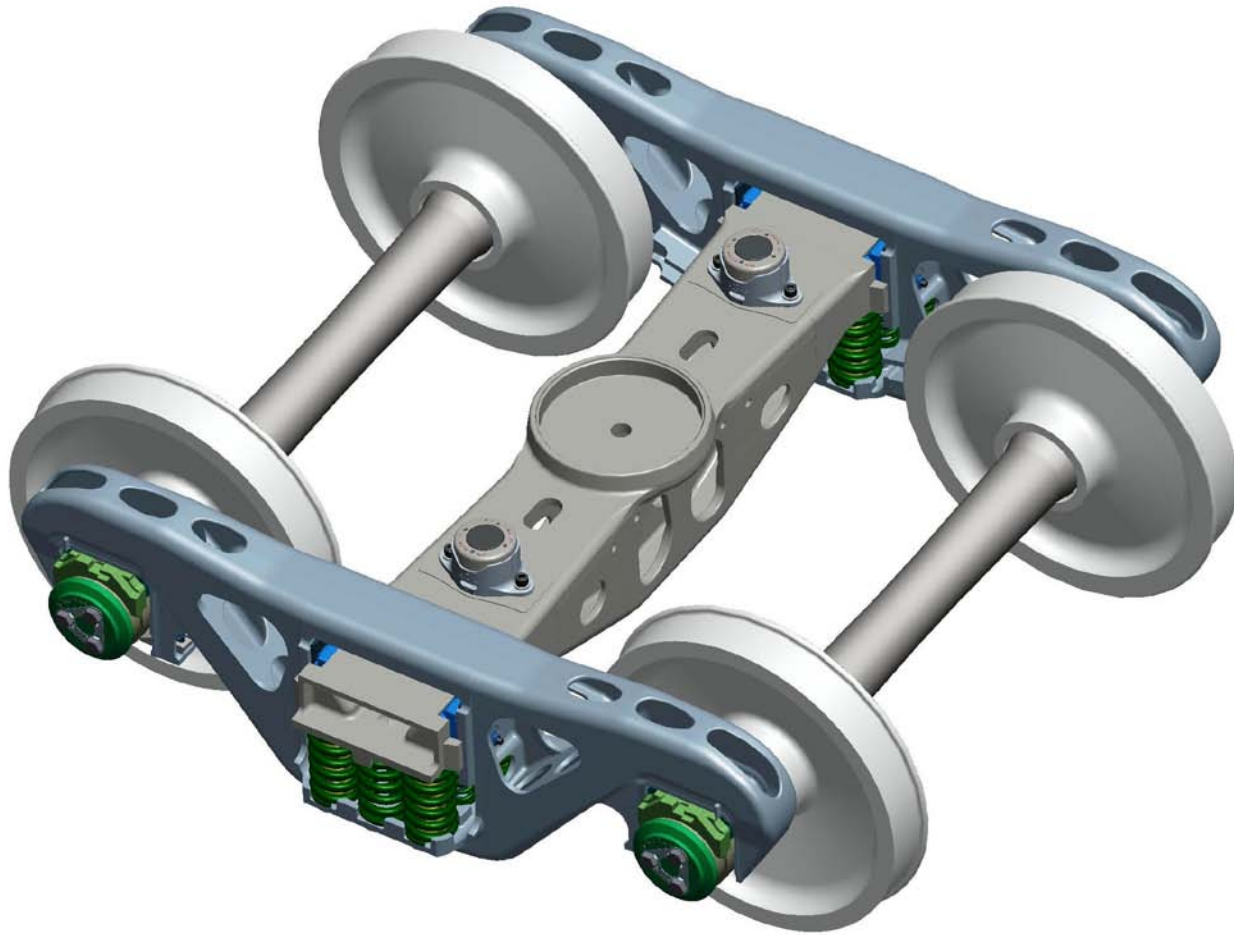


# Agenda

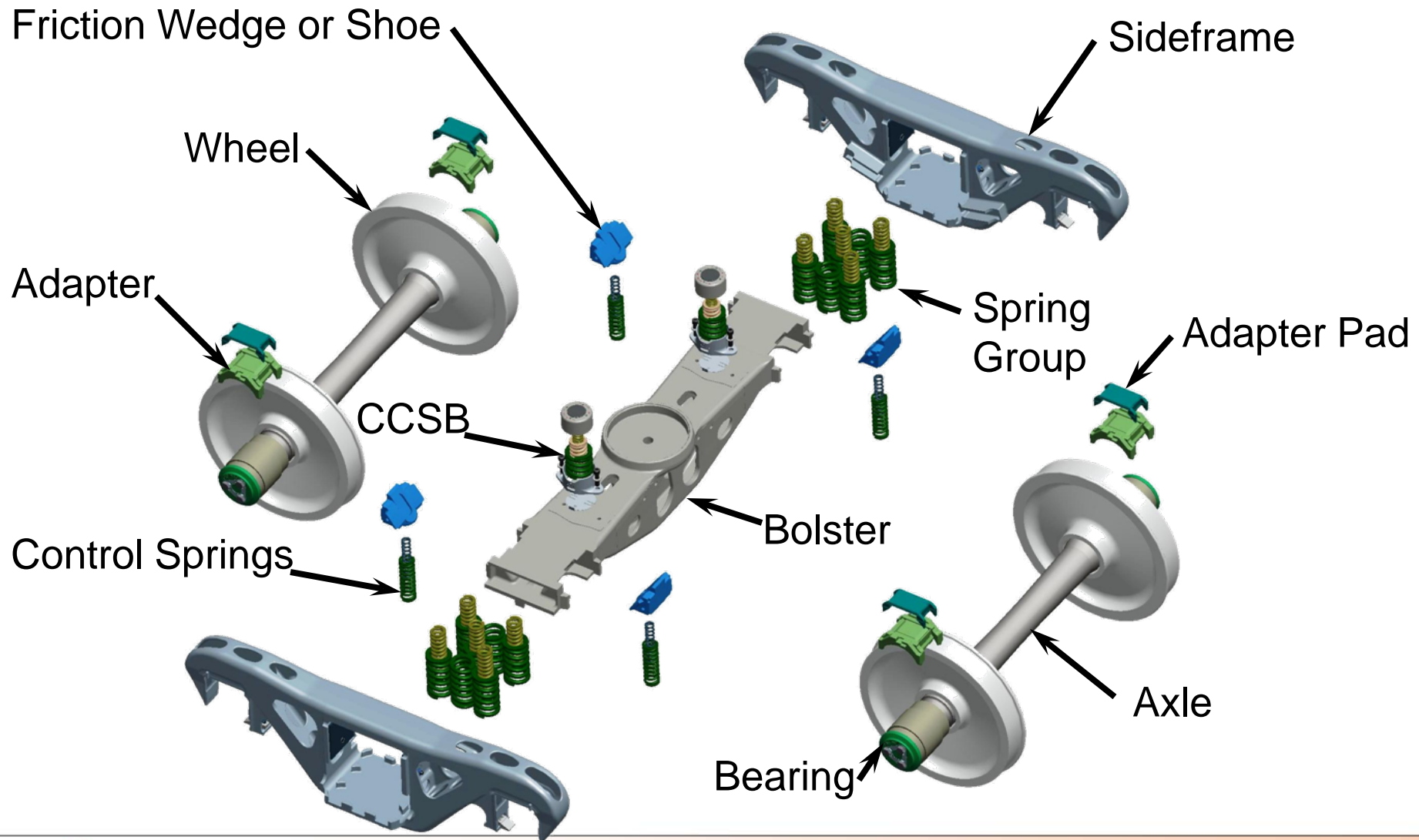
- **3-Piece Freight Truck Definition**
- **Truck Approval History**
  - **AAR M-965**
  - **AAR M-1001 Chapter 11**
- **AAR M-976 Specification**
  - **Test Requirements**
  - **Inspection Requirements**
- **Future Truck Approval**



# 3-Piece Freight Truck



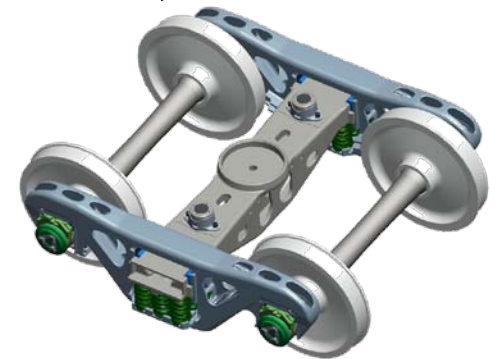
# Freight Truck Nomenclature



# **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***

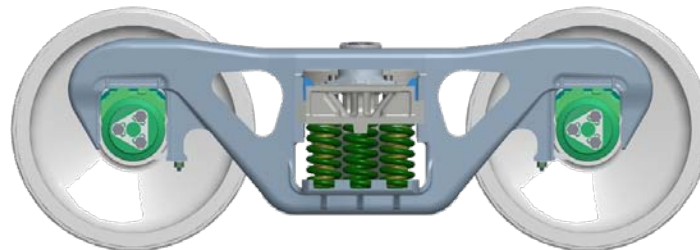
- **Applies to new freight car designs**
- **Provides on-track test requirements**
- **Car and truck suspension tested together**



# AAR M-976 Specification

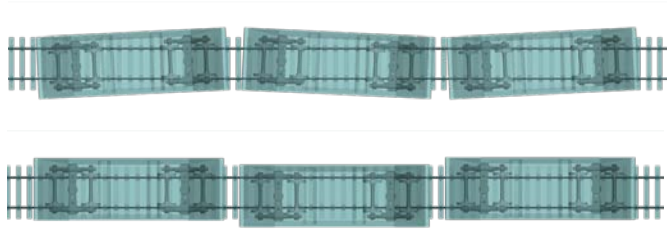
## *Truck Performance for Rail Cars*

- 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

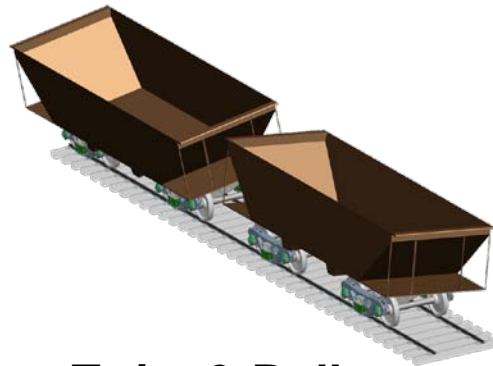




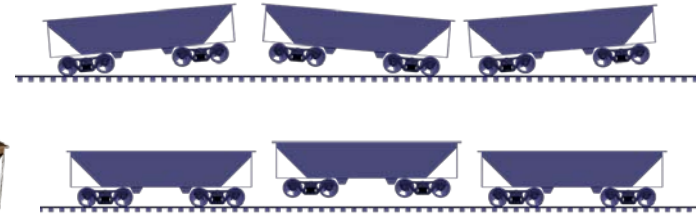
# Truck Performance Overview



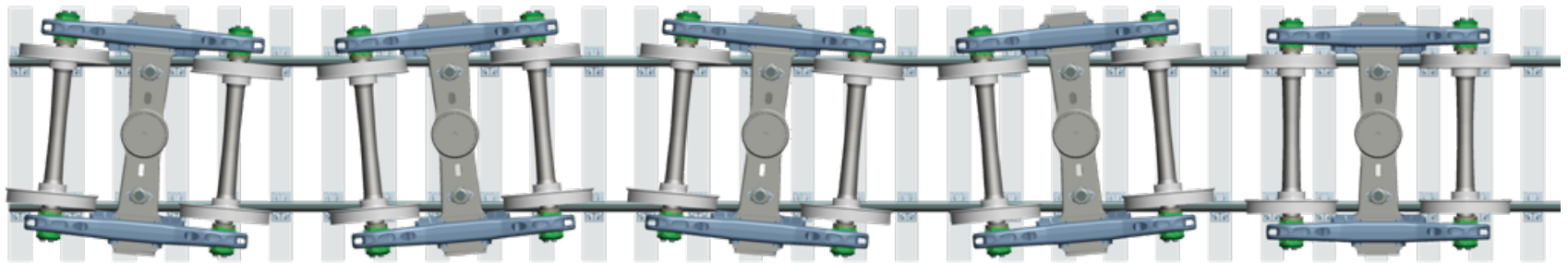
**Yaw & Sway**  
**Car / Suspension Specific**



**Twist & Roll**  
**15-25, 50-60 mph**



**Pitch & Bounce**  
**50-70 mph**



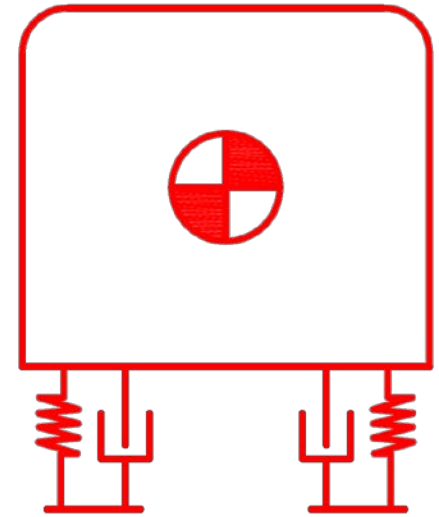
**Truck Hunting**  
**Truck Warp, Truck Rotation, Wheelset Movement**  
**40+ mph**



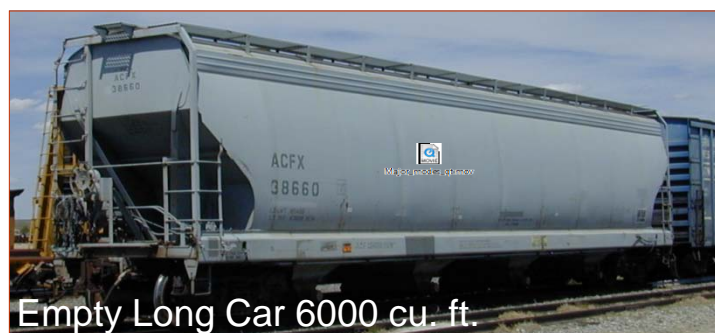
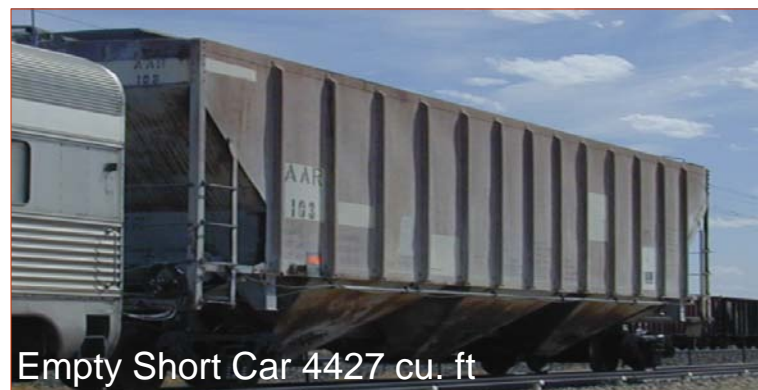


# Dynamic Influences

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



# M-976 Test Car Types / Regimes



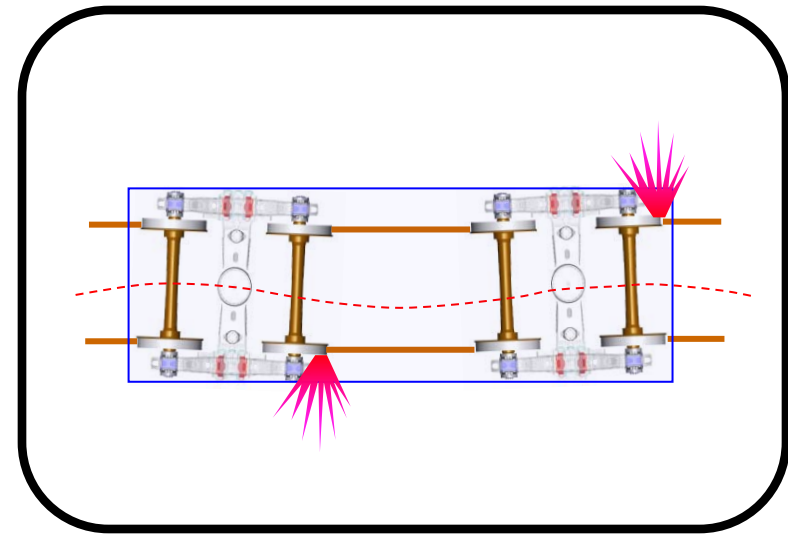
<i>Regime</i>	<i>Covered Hoppers Empty / Loaded Short / Long</i>
Hunting	Short Empty
Steady State Curving	Short Empty Short Loaded
Curve Resistance	Short Loaded
Spiral	Short Empty Short Loaded Long Empty
Twist / Roll	Short Empty Short Loaded
Pitch / Bounce	Short Empty Short Loaded
Yaw / Sway	Short Loaded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

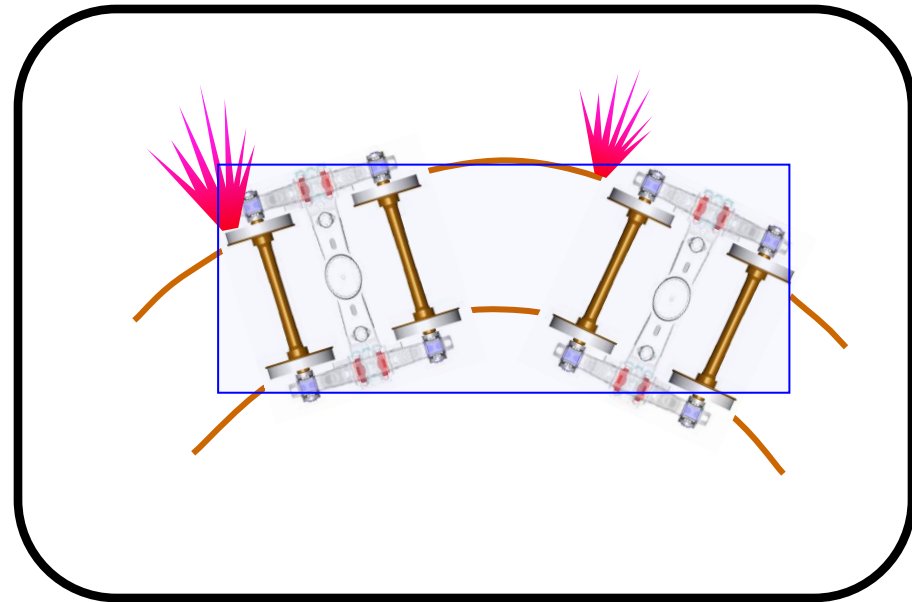


# M-976 Test Conditions

## Steady State Curving

**95<sup>th</sup> percentile Max. Wheel L/V** **0.8**

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



# M-976 Test Conditions

## Curving Resistance

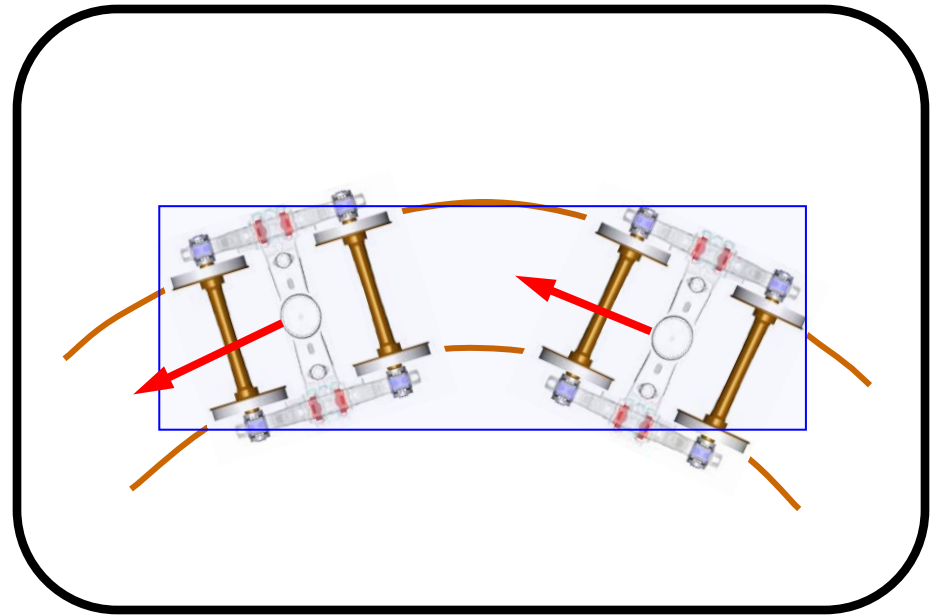
**Average Pounds \ Ton \ Degree 0.4**

**1.5 Degree Curve**

**4.0 Degree Curve**

**7.5 Degree Curve**

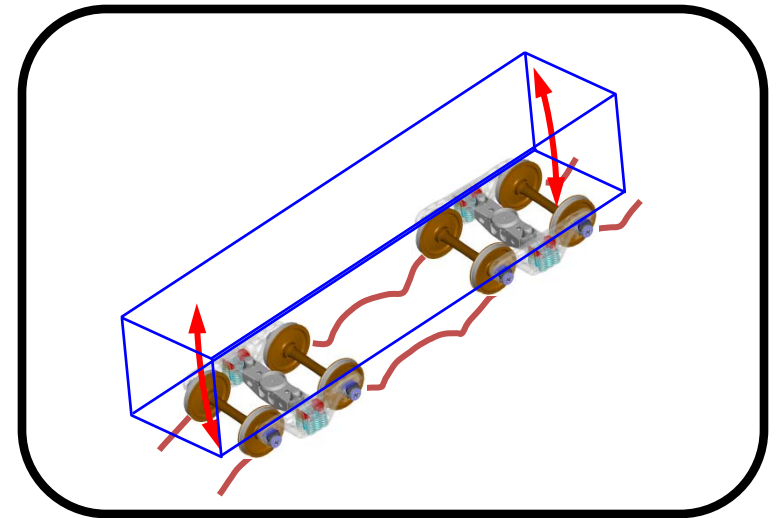
**10 Degree Curve**



# M-976 Test Conditions

## Pitch / Bounce

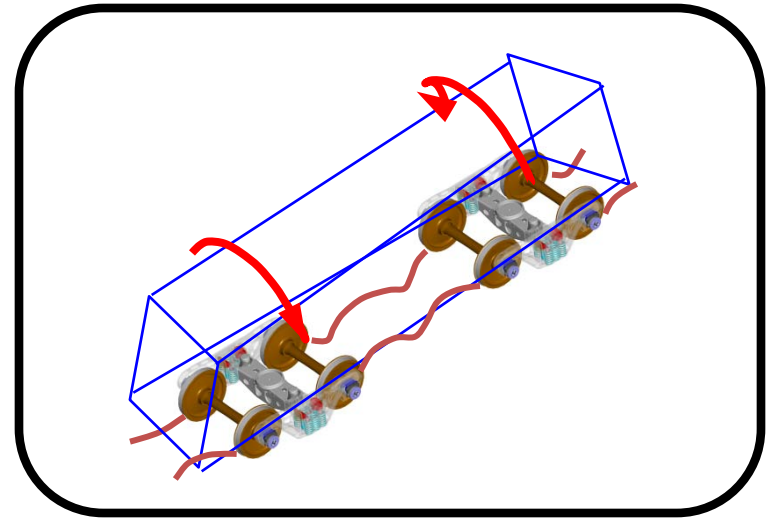
Vertical load	10%
Dynamic Acceleration	1.0 g
Spring Capacity	95%



# M-976 Test Conditions

## Twist / Roll

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



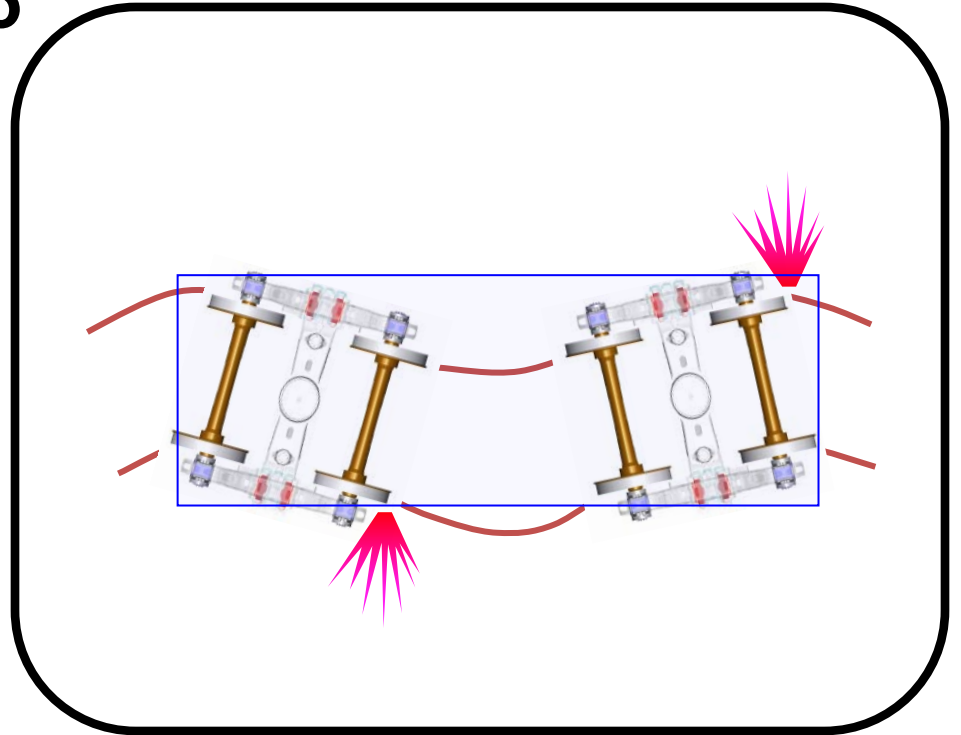


# M-976 Test Conditions

## Yaw / Sway

**Max. Truck Side L/V 0.7**

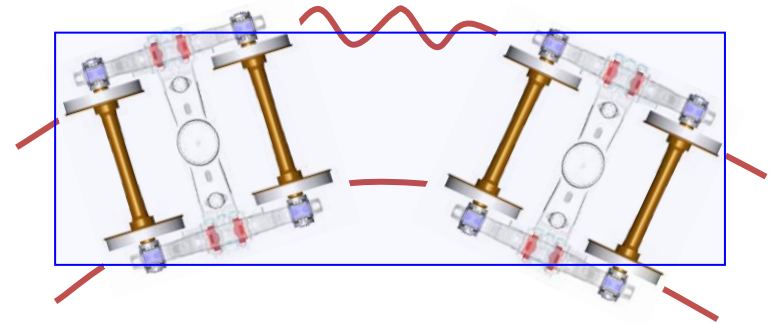
**Max. Axle Sum L/V 1.5**



# M-976 Test Conditions

## Dynamic Curving

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



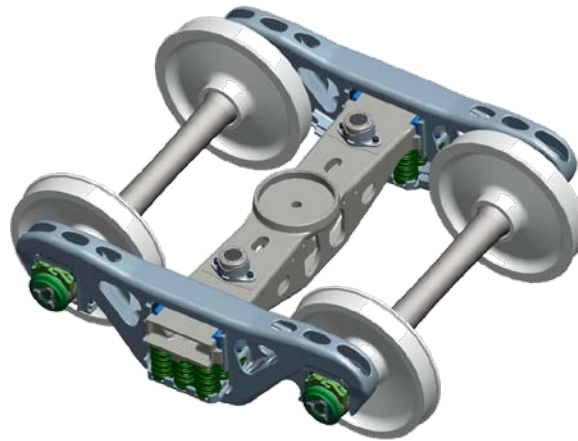
# M-976 Inspection Criteria

- **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**



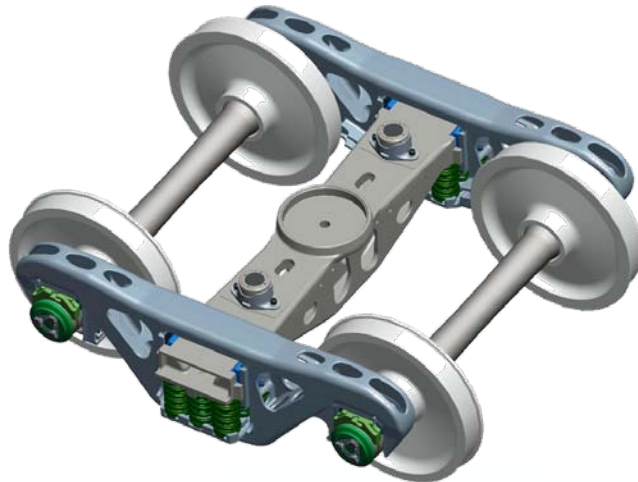
# Next Specification M-9??

- **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**



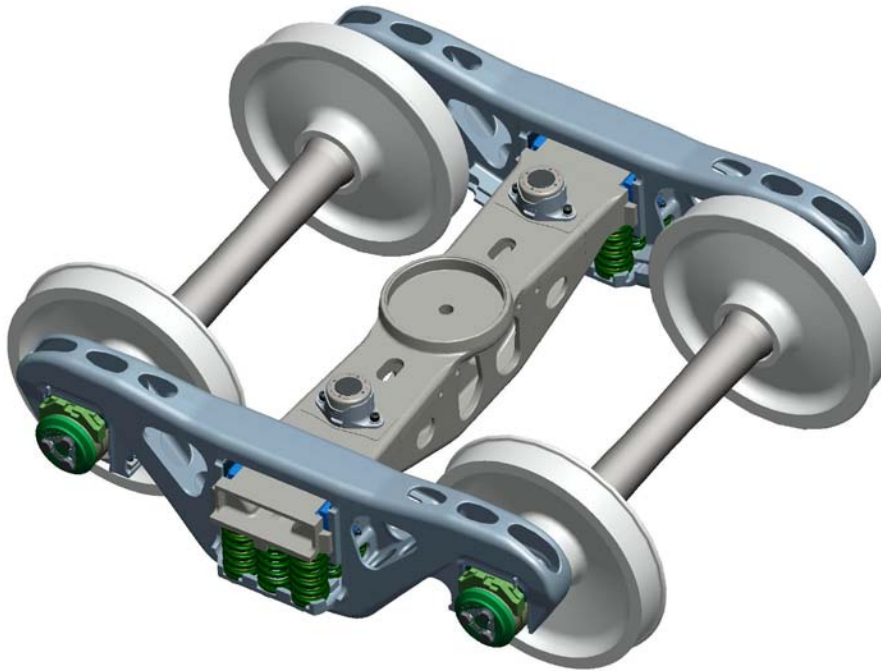
# Summary

- 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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