

# Rail Vehicle Track Interaction Standards

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RAIL TRANSIT SEMINAR • APRIL 30, 2018



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# Outline

- Importance of Industry Standards
- APTA's Role in Industry VTI Standards
  - Highlights of the program
- Impact on Recent Procurements
  - Qualification process
- Some Future Standards



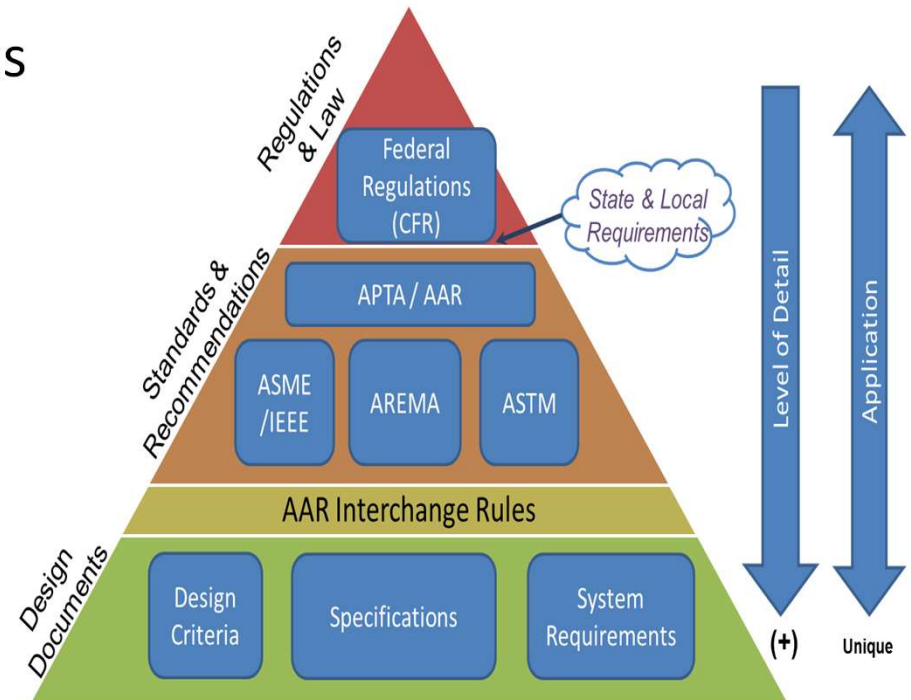
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# What is the value of standardization?

- Interchangeability of similar assets
- Decreased production and procurement costs
- Predictable characteristics of products
  - Behavior/interaction
  - Lifespan
  - Maintenance
- Less hassle



# Written in Blood, Ash, and Fire

- The development of APTA standards began in 1996 in response to a significant need for standardized equipment safety criteria.
- It began as an agreement between the stakeholders of the North American transit industry to self-regulate in a transparent, consensus-driven forum and abide by that consensus.
- Around 300 documents have been published and are available free of charge.



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A Brief Look at VTI Related APTA Standards & Recommended Practices

# DOCUMENT SPOTLIGHTS



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# New Truck Design

- Purpose: Gives guidance for the design of new commuter and intercity rail car trucks with application speeds not exceeding 125 (mph) (200 kph) and for the application of existing truck designs significantly different from the prior application(s) in terms of load, speed, track geometry, carbody and significant combinations of these factors.
- Importance: Provides safety-related design factors, design analysis methodology, and qualification testing regimes for new or unproven truck designs.

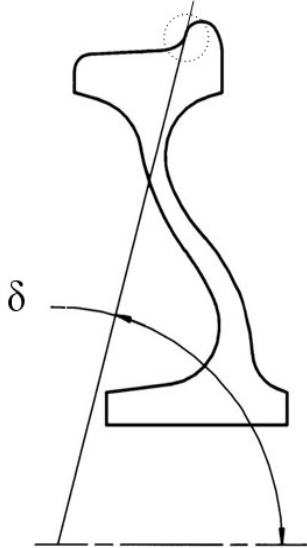


## Wheel Load Equalization of Passenger Railroad Rolling Stock

- Purpose: Establishes static wheel load equalization requirements to provide passenger equipment with the wheel unloading characteristics necessary to reduce the risk of low-speed wheel climb derailments. Includes requirements for testing to verify compliance.
- Importance: Contains minimum requirements for wheel load equalization for non-articulated railroad passenger equipment of all types employing two axle trucks



# Wheel Flange Angle for Passenger Equipment



- Purpose: Defines the minimum flange angle and the minimum length of surface on the flange, over which the angle must be maintained.
- Importance: Indicates an industry minimum flange angle of  $72^{\circ}$  maintained over at least 0.1". Also provides drawings of wheel profiles that are compliant with the requirements of this standard including the APTA 120, 140, 140M, 220, 240, 320, & 340 wheel profiles.





## APTA-PR-M-S-017-06

## Definition and Measurement of Wheel Tread Taper

- Purpose: Provides a definition and practice for the measurement of wheel tread taper on wheels used in railroad passenger service in relation to vehicle and truck stability, and guidance to the maintenance of the wheel profile acceptable for safe dynamic performance.
- Importance: Standardizes the expression measurement of conicity, tread taper, rolling radius difference, and stability taper.



## Passenger Wheel Set Assembly

- Purpose: Provides the minimum requirements for the assembly of rail vehicle wheel sets. Also addresses training requirements, safety implications and the technical rationale for certain practices.
- Importance: Establishes a standard for minimum requirements for passenger wheel set assembly. Combines industry best practices and establishes limits and ranges on certain parameters associated with wheel set assembly.



Availability of Tools

# TOOLS FOR ASSESSING TRACK WORTHINESS OF DESIGNS



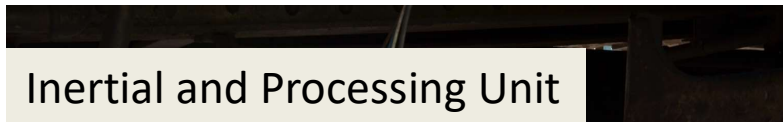
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# Track Geometry Measurements

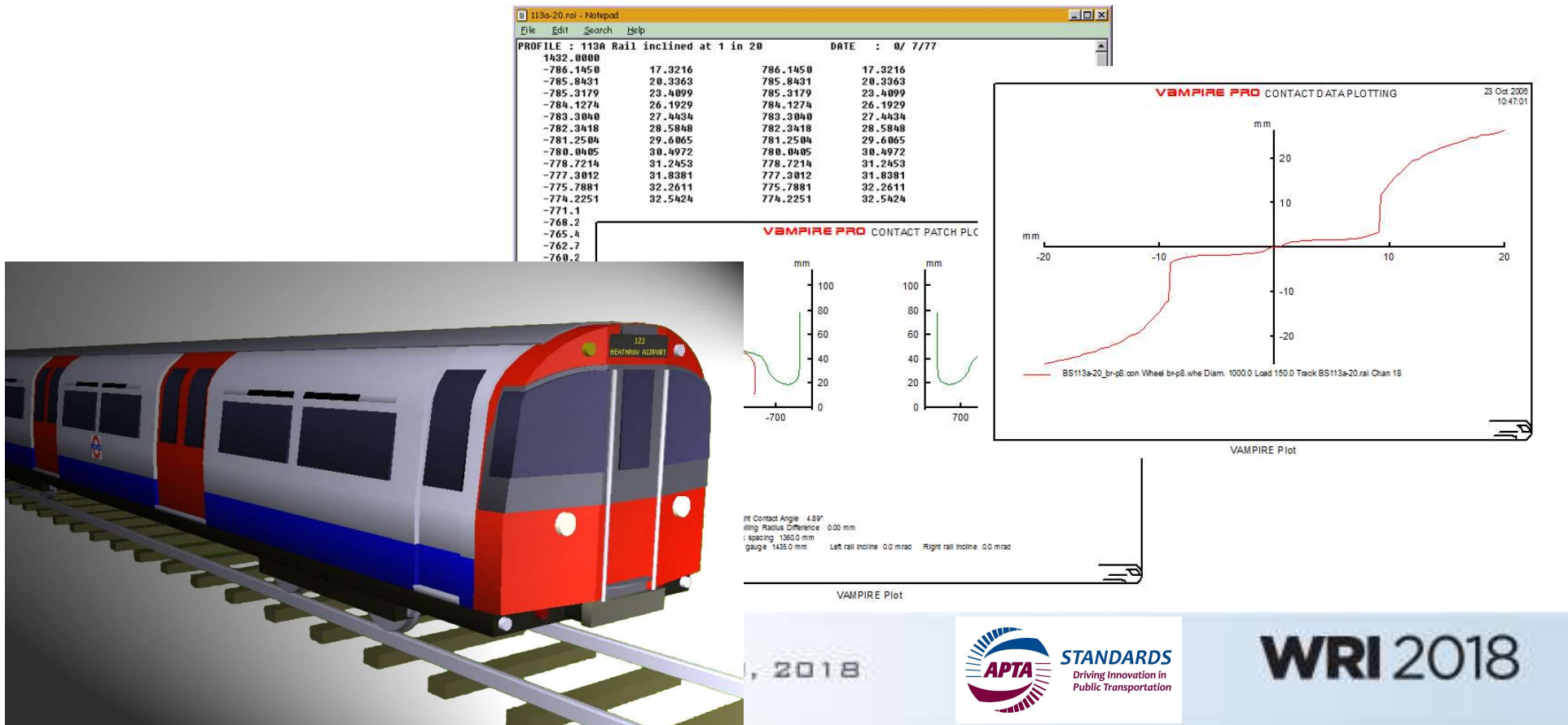


Rail Sensors

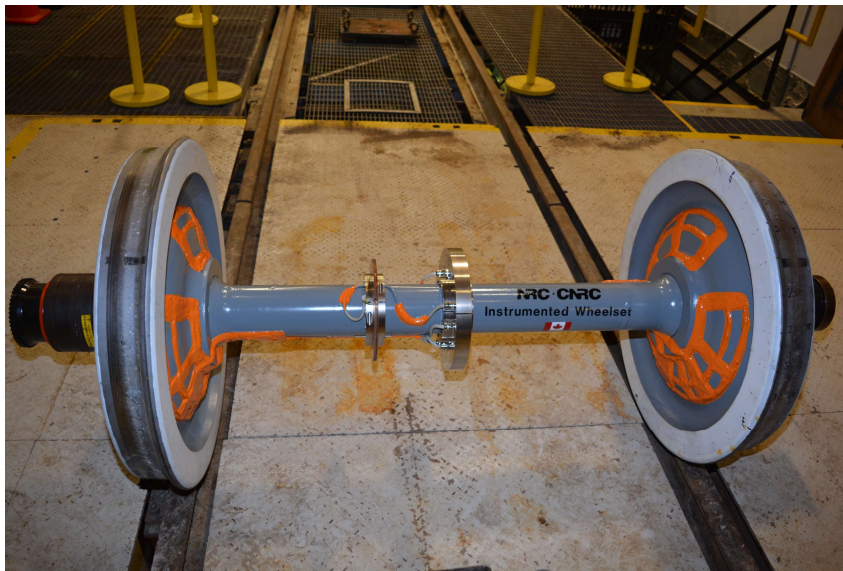


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# Dynamic Simulations



# Instrumented Wheelsets (IWS) and Testing



- Testing to verify dynamic simulations and design
- Performance measurements under actual design



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A Look at Recent Procurements

# STANDARDS IN PRACTICE AND POTENTIAL AREAS OF OPPORTUNITY



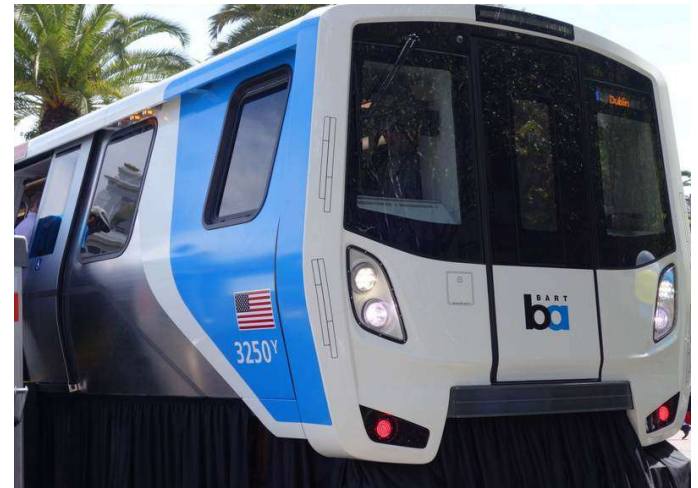
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# BART Heavy Rail Vehicles

- BART contracted in 2012 for a total of 775 vehicles from Bombardier
- APTA Standards Used: Truck design standard; truck equalization (with changes)
- Track geometry measurements
- Dynamic analysis done but not to a specific standard
- IWS done to prove design



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# MBTA Heavy Rail Vehicles

- CRRC contract in 2014-16 for a total of about 400 vehicles
- APTA Standards Used: Truck equalization (with changes); parts of truck design standard
- Track geometry measurements
- Dynamic analysis done but not to a specific standard
- IWS measurements



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# LA MTA

- CRRC contract in 2014-16 for a total of about 60 units
- APTA Standards Used: Truck equalization; parts of truck design standard
- Track geometry measurements
- Dynamic analysis done but not to a specific standard
- No explicit IWS measurements



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# Devil is in the Details

- High speed stability is required to be demonstrated but tracks do not exist
  - Dynamic simulations are used in lieu but no accepted process/specifications for rail transit
  - FRA regulations has a well-accepted path for demonstrating compliance with high speed stability but no Rail Transit accepted method
- Worn condition simulations
- Truck equalization requirements vary



# What about Tracks?

- Rail shape is extremely important
- Gage face angle does not have a standard/ recommended practice
  - Shallower gage face angle (measured) -> Higher propensity for derailments
  - Measurement in general similar but varies
- Restraining rail usage with respect to radius of curvature
- Wheel profiles among other things need to complement rail profile



# Ongoing efforts

- Low speed curving performance standard in development
  - Predominantly for commuter and high speed passenger rail but applicable to rail transit
  - Performance envelope development as opposed to pass/fail criteria
- APTA/AREMA MOU signed last year
- Regulatory language being developed to reduce costs for the industry for passenger equipment (49 CFR 238)



# Room to Grow: The need for Standardized Acceptance Practices

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- Standardized vehicle qualification procedures would reduce quite a bit of costs for the industry
- Development of procedures for rail transit application
- Tools exist and are widely available to aid in the process
- Parallel in FRA regulations exist and accepted by industry



# In Summation

- Standards are critical to continued industry viability
- APTA standards are created by consensus and are in widespread use; many of these address critical needs for the wheelrail interface
- Recent procurements show a need for standardized acceptance practices for new equipment qualification for running dynamics and wheel/rail interaction



# Questions?

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