Report to the 34th Meeting of the Railroad Safety Advisory Committee (RSAC)
February 20, 2008

PASSENGER SAFETY VEHICLE TRACK INTERACTION TASK FORCE

By John J Mardente, Task Force Leader,
(FRA-Office of Safety, Assurance, Compliance)

Update FRA's 1998 Issuance of TSS

RSAC Vehicle Track Interaction Task Force (TF) Convened, April 2004; tasked by the Passenger Safety Working Group to consider revising 49 CFR 213, Part G, issued in 1998 to reflect experience gained from qualifying several vehicles for high speed and high cant deficiency operation

- 25 Task Force Meetings to Date
- Numerous Technical Subgroup Meetings
- Regular Updates to the Passenger Safety WG (WG saw this presentation and approved proposed draft rule text at the December 11, 2007 WG meeting in Ft Lauderdale)

Update FRA's 1998 Issuance of TSS

Key Issues Addressed:

1. VTI Safety criteria (acceleration and wheel force limits)
2. Qualification requirements
3. Requirements for high cant deficiency operations
4. Track geometry limits
5. Inspection and monitoring requirements
6. Controls on wheel profile and truck equalization
7. Consolidation of inconsistencies between:
   - Low speed track safety standards (49CFR Part 213, Subparts A-F)
   - High speed track safety standards (49CFR Part 213, Subpart G)
   - Passenger equipment safety standards (49CFR Part 238)

Task Force Participants

Industry, Labor, Government

John Mardente FRA, Office of Safety, **Task Force Leader**

Cynthia Gross FRA, Office of Safety, **Facilitator**

- Dan Alpert FRA, RCC
- Al Bieber STV
- Lou Cerny Consultant/AAR
- Steve Chrismer LTK Engineering
- Mike Coltman Volpe
- Gary Fairbanks FRA, Office of Safety
- Magdy El-Sibaie FRA, R&D
- Jason Heineman ENSCO
- Rick Inclima BMWE
- Larry Kelterborn Interfleet
- Kevin Kesler ENSCO
- Peter Klauser Consultant
- Jon LeBlanc Volpe
- Nicolas Lessard Bombardier
- Eric Magel NRC-CSTT
- Brian Marquis Volpe
- Ron Newman FRA, Office of Safety
- Tom Peacock APTA
- Frank Roskind FRA, RRS
- Satya Singh FRA, Office of Safety
- Mark Stewart Interfleet
- Dave Staplin Amtrak
- Phil Strong PS Consulting
- Ali Tajaddini FRA, R&D
- Mike Trosino Amtrak
- Brian Whitten ENSCO

Task Force Approach

- Consider results of current research, VTI test data, and international practices to address safety (derailment) criteria
- Use models to conduct dynamic simulation studies
- Maintain and improve public safety without introducing unnecessary burdens on industry
  - Realistic limits and requirements that are practically attainable
  - Regulations that permit new technology and are reflective of existing equipment with established safety record
  - Minimize impact of proposed changes on current operations
- Remove onerous requirements that have no added safety benefit
- Develop proposed NPRM language & achieve consensus amongst TF

- Submit Technical Recommendations Package to Working Group for approval (WG granted approval in Ft Lauderdale December 11, 2007), then up to RSAC Main Body- see Volume 1, draft 10

Vehicles and Data Utilized

Vehicles Simulated

- Acela Powercar
- Acela Coach Car
- Amfleet Coach Car
- AEM-7 Locomotive
- Genesis P42 Locomotive
- Surfliner
- BiLevel
- DOTX-216
- Material Handling Car

Field Data Analyzed

- Acela Powercar
- Acela Coach Car
- Amfleet Coach Car
- AEM-7 Locomotive
- Multi-Level
- PL42AC Locomotive
- X2000
- MARC-III Coach Car
- DOTX-216
- HHP Locomotive
- Roadrailer
- Material Handling Car

Update FRA's 1998 Issuance of TSS

RSAC VehicleTrack Interaction Task Force Convened to Consider Revising 49 CFR 213, Subpart G, issued in 1998 to reflect experience gained in qualifying several vehicles for high speed and cant deficiency operation

1. VTI Safety criteria (acceleration and wheel force limits)
2. Qualification requirements
3. Requirements for high cant deficiency operations
4. Track geometry limits
5. Inspection and monitoring requirements
6. Controls on wheel profile and truck equalization
7. Consolidate inconsistencies amongst and within the low speed and high speed track safety standards and the passenger equipment safety standards

Revise VTI Safety Criteria (§213.333)

- Revised wheel-rail force limits (NAL, Vmin) to align with the findings from current research
- Separated acceleration limits between single events (transient) and repeated harmonic events in response to vehicle qualification experience (MARC-III)
- Relaxed the carbody transient acceleration limits to more accurately reflect vehicle and ride safety thresholds
- Established separate acceleration limits for passenger and non-passenger carrying equipment to reflect unique occupant safety requirements
- Revised truck lateral acceleration limit to better identify the occurrences of truck hunting

Existing VTI Safety Criteria

Wheel-Rail Force Criteria

Passenger Carrying and Non Passenger Carrying Equipment		
Parameter	**Safety Limit**	**Filter/Window**
Single Wheel Vertical Load Ratio	≥ 0.1	5 ft window Low pass filter minimum cutoff 25 Hz[1] sampling rate at least 250 samples/sec
Single Wheel L/V Ratio	$\leq \frac{\tan(\delta) - 0.5}{1 + 0.5\tan(\delta)}$ δ = wheel flange angle	
Net Axle Lateral L/V Ratio	≤ 0.5	
Truck Side L/V Ratio	≤ 0.6	

[1]The lateral and vertical wheel forces shall be measured with instrumented wheelsets with the measurements processed through a low pass filter with a minimum cutoff frequency of 25 Hz. The sample rate for wheel force data shall be at least 250 samples/ second.

Acceleration Criteria

Passenger Carrying and Non Passenger Carrying Equipment		
Parameter	**Safety Limit**	**Filter/Window**
Truck Lateral Acceleration	≤ 0.4 g RMS	10 Hz low pass filter 2 sec window

Proposed VTI Safety Criteria

Wheel-Rail Forces [1]			
Parameter	**Safety Limit**	**Filter/ Window**	**Requirements**
Single Wheel Vertical Load Ratio	≥ 0.15	5 ft	No wheel of the vehicle shall be permitted to unload to less than 15% of the static vertical wheel load for five or more continuous feet. The static vertical wheel load is defined as the load that the wheel would carry when stationary on level track.
Single Wheel L/V Ratio	$\leq \frac{\tan(\delta) - 0.5}{1 + 0.5\tan(\delta)}$	5 ft	The ratio of the lateral force that any wheel exerts on an individual rail to the vertical force exerted by the same wheel on the rail shall not be greater than the safety limit calculated for the wheel's flange angle (δ) for five or more continuous feet.
Net Axle Lateral L/V Ratio	$\leq 0.4 + \frac{5.0}{Va}$	5 ft	The net axle lateral force, in kips, exerted by any axle on the track shall not exceed a total of 5 kips plus 40% of the static vertical load that the axle exerts on the track for five or more continuous feet. *Va* – static vertical axle load (kips)
Truck Side L/V Ratio	≤ 0.6	5 ft	The ratio of the lateral forces that the wheels on one side of any truck exert on an individual rail to the vertical forces exerted by the same wheels on that rail shall not be greater than 0.6 for five or more continuous feet.

[1] The lateral and vertical wheel forces shall be measured and processed through a low pass filter with a minimum cut-off frequency of 25 Hz. The sample rate for wheel force data shall be at least 250 samples per second.

Truck Lateral Acceleration[3]			
Parameter	**Safety Limit**	**Filter/ Window**	**Requirements**
Truck Lateral Acceleration	≤ 0.30 g RMS_t[1]	2 sec window[2] 2 sec sustained	Truck hunting shall not develop below the maximum authorized speed. Truck hunting is defined as a sustained cyclic oscillation of the truck evidenced by lateral accelerations exceeding 0.3 g root mean squared for more than 2 seconds. Root mean squared values are to be determined over a sliding 2 second window with linear trend removed.

[1] RMS_t = RMS with linear trend removed.

[2] Acceleration measurements shall be processed through a low pass filter (LPF) with a minimum cut-off frequency of 10 Hz. The sample rate for acceleration data shall be at least 100 samples per second.

[3] Truck lateral acceleration shall be measured on the truck frame by accelerometers oriented and located as per § 213.333(k).

Existing VTI Safety Criteria

Acceleration Criteria

Passenger Carrying and Non Passenger Carrying Equipment		
Parameter	**Safety Limit**	**Filter/Window**
Carbody Lateral Acceleration	**≤ 0.5 g**	10 Hz low pass filter 1 sec window
Carbody Vertical Acceleration	**≤ 0.6 g**	10 Hz low pass filter 1 sec window

Proposed VTI Safety Criteria

Carbody Accelerations [3]			
Parameter	**Passenger Cars**	**Other Vehicles**	**Requirements**
Carbody Lateral (Transient)	≤ 0.65 g peak-to-peak 1 sec window[2] excludes peaks < 50 msec	≤ 0.75 g peak-to-peak 1 sec window[2] excludes peaks < 50 msec	The peak-to-peak accelerations, measured as the algebraic difference between the two extreme values of measured acceleration in any one second time period, excluding any peak lasting less than 50 milliseconds, shall not exceed 0.65 g and 0.75 g for passenger cars and other vehicles, respectively.
Carbody Lateral (Sustained Oscillatory)	≤ 0.10 g RMS_t[1] 4 sec window[2] 4 sec sustained	≤ 0.12 g RMS_t[1] 4 sec window[2] 4 sec sustained	Sustained oscillatory lateral acceleration of the carbody shall not exceed the prescribed (root mean squared) safety limits of 0.10 g and 0.12 g for passenger cars and other vehicles, respectively. Root mean squared values are to be determined over a sliding 4 second window with linear trend removed and shall be sustained for more than 4 seconds.
Carbody Vertical (Transient)	≤ 1.0 g peak-to-peak 1 sec window[2] excludes peaks < 50 msec	≤ 1.0 g peak-to-peak 1 sec window[2] excludes peaks < 50 msec	The peak-to-peak accelerations, measured as the algebraic difference between the two extreme values of measured acceleration in any one second time period, excluding any peak lasting less than 50 milliseconds, shall not exceed 1.0 g.
Carbody Vertical (Sustained Oscillatory)	≤ 0.25 g RMS_t[1] 4 sec window[2] 4 sec sustained	≤ 0.25 g RMS_t[1] 4 sec window[2] 4 sec sustained	Sustained oscillatory vertical acceleration of the carbody shall not exceed the prescribed (root mean squared) safety limit of 0.25 g. Root mean squared values are to be determined over a sliding 4 second window with linear trend removed and shall be sustained for more than 4 seconds.

1 RMS_t = RMS with linear trend removed.

2 Acceleration measurements shall be processed through a low pass filter (LPF) with a minimum cut-off frequency of 10 Hz. The sample rate for acceleration data shall be at least 100 samples per second.

3 Carbody accelerations in the vertical and lateral directions shall be measured by accelerometers oriented and located as per § 213.333(k).

Update FRA's 1998 Issuance of TSS

RSAC Vehicle Track Interaction Task Force Convened to Consider Revising 49 CFR 213, Subpart G, issued in 1998 to reflect experience gained in qualifying several vehicles for high speed and cant deficiency operation

1. VTI Safety criteria (acceleration and wheel force limits)
2. Qualification requirements
3. Requirements for high cant deficiency operations
4. Track geometry limits
5. Inspection and monitoring requirements
6. Controls on wheel profile and truck equalization
7. Consolidate inconsistencies amongst and within the low speed and high speed track safety standards and the passenger equipment safety standards

Qualification Requirements

Issues Worked Through

- What are the Appropriate Tests and Analyses?
  - Static Lean Tests *(213.57 & 213.329)*
  - Acceleration Testing *(213.345)*
  - Instrumented Wheelset (IWS) Testing *(213.57, 213.329, and 213.345)*
  - Computer Simulation of Vehicle Performance *(213.345)*

- Address Qualification Needs for High Cant Deficiency Operations

- Differentiate between New Vehicle Qualification and moving Previously Qualified Equipment to Another Route

Qualification Requirements

Title §213.57: Curves, Elevation and Speed Limitations

- Applies to all vehicle types intended to operate below Class 6 speeds
  - Provides requirements for particular cant deficiency
  - Aligned with requirements for high speed operations
- Now includes static or dynamic testing option
  - 0.15g steady state lateral acceleration limit (equates to 8.6° carbody roll)
- Vmax formula no longer limited to 4-inches of cant deficiency
  - Low speed vehicles can now operate at high cant deficiency, provided the new requirements are achieved
  - Qualification requirements in §213.345 are referenced

Qualification Requirements

Title §213.57: Curves, Elevation and Speed Limitations (cont…)

- Limiting cant deficiency is equal to qualified cant deficiency **+1"**
  - Provides a tolerance to account for crosslevel variances that would otherwise put railroad in violation

- "Grandfathering" clause has been added
  - Addresses current vehicle/track (route) systems

Qualification Requirements

Title §213.329: Curves, Elevation and Speed Limitations

- Applies to all vehicle types intended to operate above Class 5 speeds
  - Provides requirements for particular cant deficiency
  - Aligned with requirements for low speed operations
- Now includes static or dynamic testing option
  - 0.15g steady state lateral acceleration limit (equates to 8.6° carbody roll)
- Qualification requirements in §213.345 are referenced

Qualification Requirements

Title §213.329: Curves, Elevation and Speed Limitations (cont…)

- Limiting cant deficiency is equal to qualified cant deficiency +½"
  - Provides a tolerance to account for crosslevel variances that would otherwise put railroad in violation
- "Grandfathering" clause has been added
  - Addresses current vehicle/track (route) systems

Qualification Requirements

Title §213.345: Vehicle-Track System Qualification

- Applies to:
  - All vehicle types intended to operate at Class 6 speeds or above
  - All vehicle types intended to operate at any curving speed producing more than 5 inches of cant deficiency
  - New vehicles, and qualified vehicles on other routes

Qualification Requirements

Title §213.345: Vehicle-Track System Qualification (cont…)

- Removed additional acceleration limits
  - Vehicle now qualifies to the §213.333 revised VTI safety limits
- Over-speed testing was adjusted from +10mph to +5mph above proposed speed
  - Align with existing speed regulation standards
- IWS Testing for Class 6 replaced with Computer Simulations
- Simulation of performance, IWS measurements, and/or accelerometer measurements will be conducted on a ***track segment representative of the full route*** on which the equipment is intended to operate
- Any IWS or accelerometer test must be accompanied by a track geometry survey within a period not exceeding 30 calendar days prior to start of the test.

Qualification Requirements

(§§ 213.57, 213.329, & 213.345)

VQR - New Equipment

Cant Deficiency (in)	Existing					Proposed				
	Lean Test	*Accel Test*		*Simu*	*IWS Test*	*Lean Test* [3]	*Accel Test*		*Simu*	*IWS Test*
		Car	*Truck* [2]				*Car*	*Truck* [2]		
Eu ≤ 3	Not Req'd	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	Not Req'd	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	> 110 mph
3 < Eu ≤ 4	All Speeds	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	All Speeds	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	> 110 mph
4 < Eu ≤ 5	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	All Speeds	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	> 110 mph
5 < Eu ≤ 6	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	All Speeds	All Speeds	> 90 mph[1]	> 90 mph[1]	> 110 mph
Eu > 6	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	All Speeds	All Speeds	> 90 mph[1]	All Speeds	All Speeds

≤ 90 mph Waiver Required (unless contiguous to HST)

[1] > 80 mph for freight equipment

[2] See also §§ 238.227 & 238.427 relating to truck lateral acceleration

[3] Lean test requirements may be met by static or dynamic testing

Qualification Requirements

(§§ 213.57, 213.329, & 213.345)

VQR - Qualified Equipment

Cant Deficiency (in)	Existing					Proposed			
	Lean Test	*Accel Test*		*Simu*	*IWS Test*	*Lean Test*	*Accel Test*		*Simulation or IWS Test*
		Car	*Truck* [2]				*Car*	*Truck* [2,3]	
Eu ≤ 3	Not Req'd	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	Not Req'd	Not Req'd	> 110 mph	> 110 mph
3 < Eu ≤ 4	All Speeds	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	Not Req'd	Not Req'd	> 110 mph	> 110 mph
4 < Eu ≤ 5	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	Not Req'd	> 90 mph[1]	> 110 mph	> 110 mph
5 < Eu ≤ 6	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	Not Req'd	All Speeds	> 110 mph	> 110 mph
Eu > 6	> 90 mph[1]	> 90 mph[1]	> 90 mph[1]	Not Req'd	> 90 mph[1]	Not Req'd	All Speeds	> 110 mph	All Speeds

≤ 90 mph Waiver Required (unless contiguous to HST)

[1] > 80 mph for freight equipment

[2] See also §§ 238.227 & 238.427 relating to truck lateral acceleration

[3] Truck lateral acceleration may be evaluated by measurement or simulation

Simulation Requirements

- Simulation Objective
  - Identify Vehicle Dynamic Performance Issues Prior to Service and Validate Suitability for Operation at a Particular Class
  - Augment On-Track Vehicle Performance Assessment

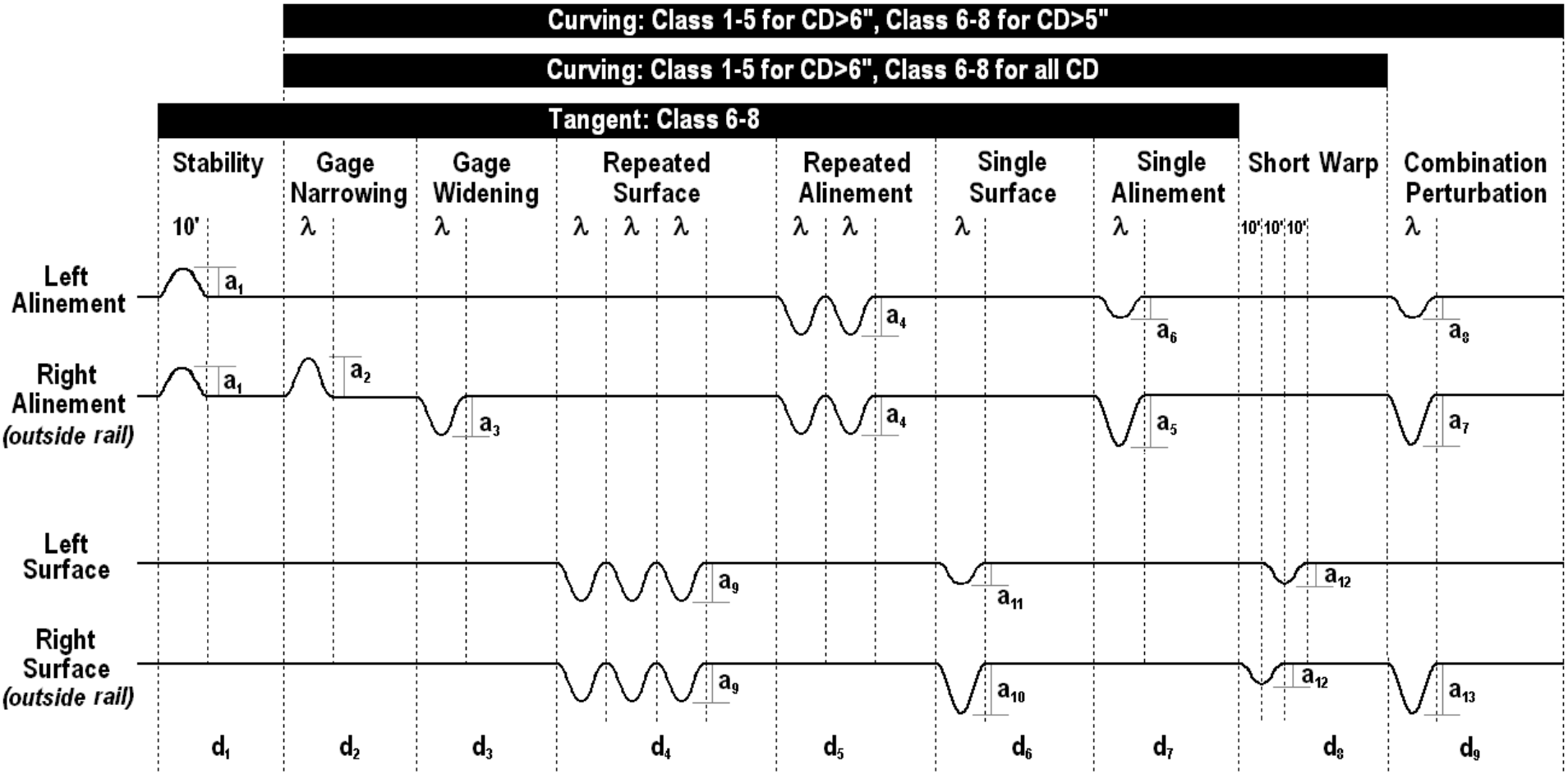
- Simulations will be conducted using:
  - Measured track geometry ***segment representative of full route***
  - Analytically defined track segment representative of minimally compliant track conditions for the respective class.
    (MCAT – Minimally Compliant Analytical Track)

- Simulation Parameters that are Varied:
  - Speed
  - Cant Deficiency
  - Gage
  - Wheel Profiles

Minimally Compliant Analytical Track (MCAT)

- A track containing geometry perturbations at the limit of what is permitted for a class of track to evaluate safety performance
- MCAT consists of nine sections, each designed to test a vehicle's performance in response to a specific type of perturbation
  - Stability
  - Gage Narrowing, Gage Widening
  - Repeated & Single Perturbations (surface & alinement)
  - Short Warp
  - Combination Perturbations (down & out)
- MCAT Used for approval to operate new vehicles and previously qualified vehicles on other routes

MCAT Layout

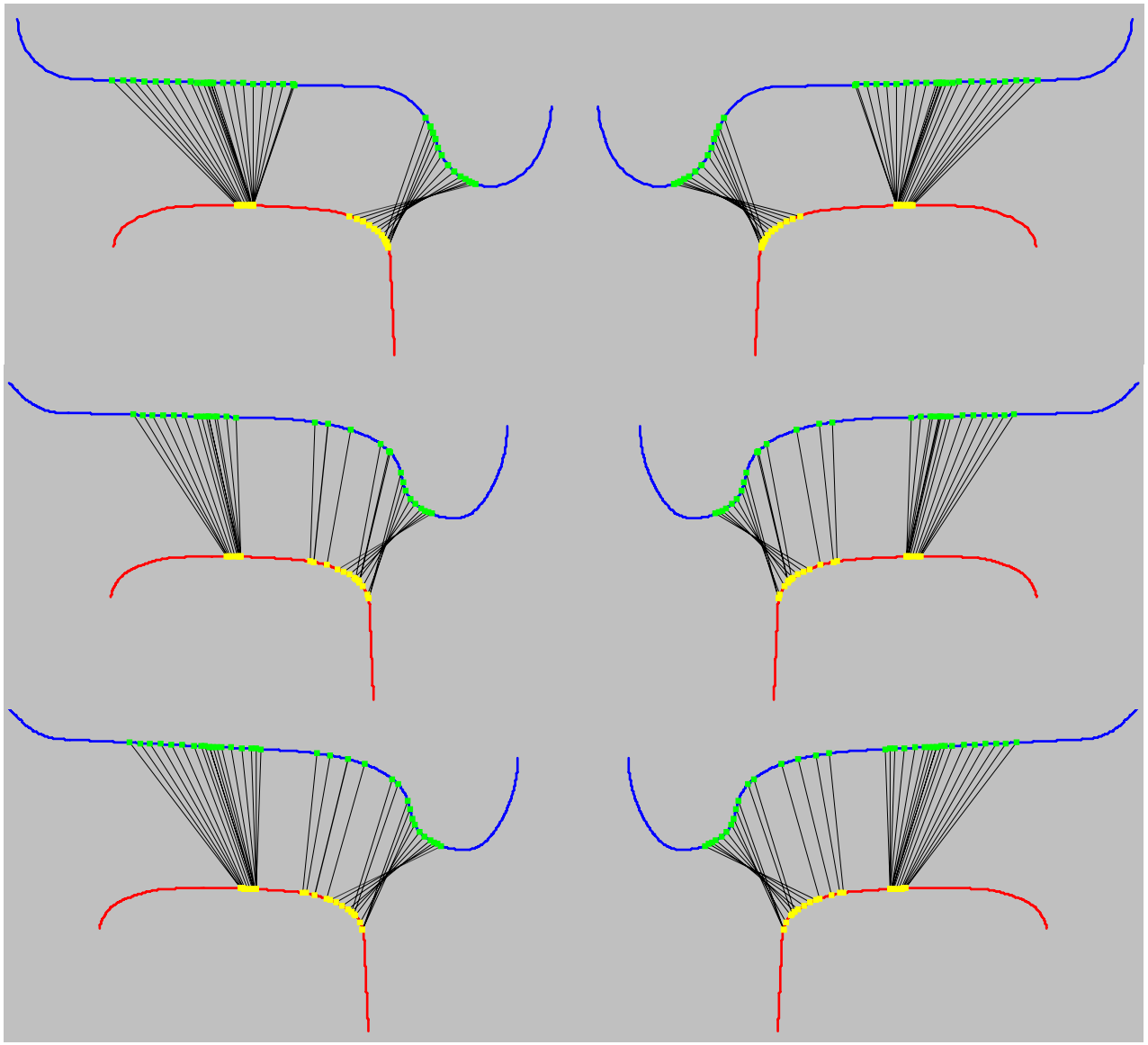

Curving: Class 1-5 for CD>6", Class 6-8 for CD>5"
Curving: Class 1-5 for CD>6", Class 6-8 for all CD
Tangent: Class 6-8
Stability
Gage Narrowing
Gage Widening
Repeated Surface
Repeated Alinement
Single Surface
Single Alinement
Short Warp
Combination Perturbation
10'
λ
10' 10' 10'
Left Alinement
Right Alinement (outside rail)
Left Surface
Right Surface (outside rail)
a1
a2
a3
a4
a5
a6
a7
a8
a9
a10
a11
a12
a13
d1
d2
d3
d4
d5
d6
d7
d8
d9

Wheel/Rail Profiles

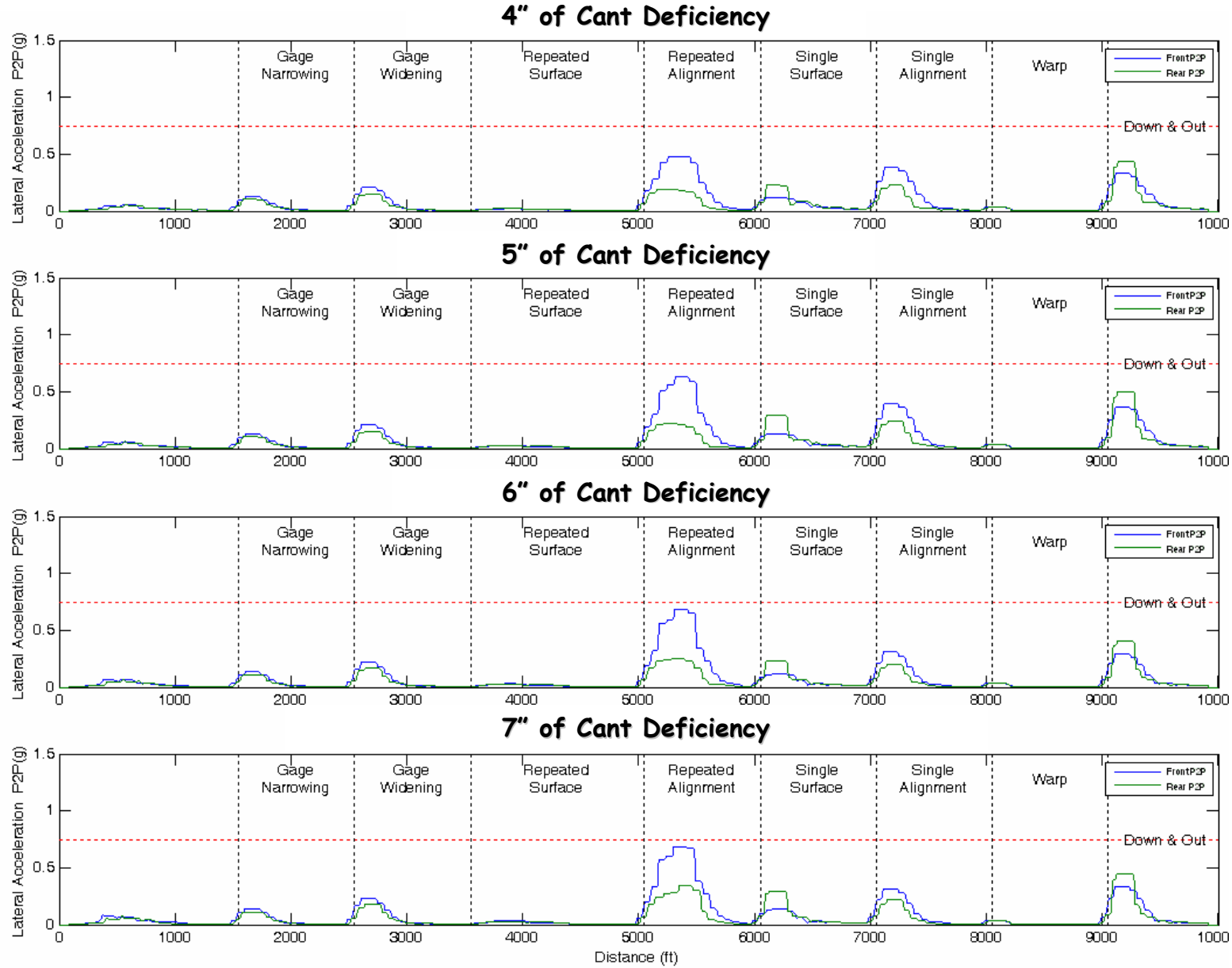
Amtrak Standard

APTA 340

APTA 320



124' Class 7 (120mph), μ=0.5 – Carbody Lat Acc P-P



Acela Powercar

Class 7 MCAT Summary

For Illustrative Purposes Only

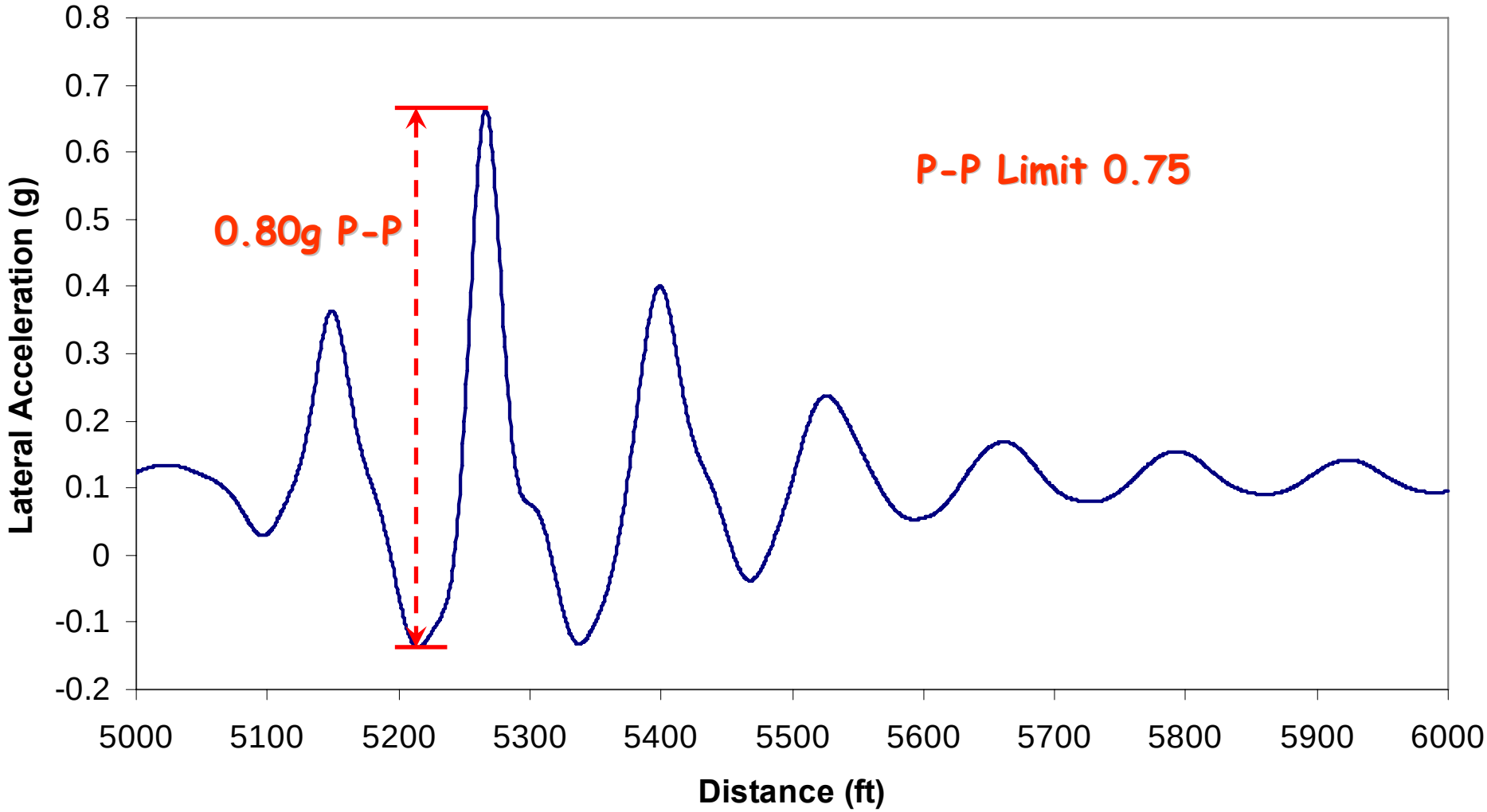
		Class 7 - New Wheel					Class 7 - APTA 340					Class 7 - APTA 320				
		Tangent	4" CD	5" CD	6" CD	7" CD	Tangent	4" CD	5" CD	6" CD	7" CD	Tangent	4" CD	5" CD	6" CD	7" CD
Safety Criteria	L/V	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph
	Vmin	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph
	NAL	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph
	T-Side L/V	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph
	Truck RMS	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph
	Car Lat RMS	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph
	Car Vert RMS	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph
	Car Lat P-P	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	120mph
	Car Vert P-P	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph	125mph

Repeated Alinement

124ft Chord Only

Acela Powercar, APTA 320 Profile

Repeated Alignment
Class 7, 120mph, 7" Cant Deficiency



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Revise Track Geometry Limits for High Speed and High Cant Deficiency Operations

- Proposed Removal of Track Class 9 and Adjustment of Class 8 to be Consistent with RPA Requirements
- No Changes to the Existing Track Geometry Limits for Low Speed / Low Cant Deficiency Operations
- Minor Revisions to Track Geometry Limits for High Speed
- Introduced New Track Geometry Limits for:
  - High Cant Deficiency (> 5"CD)
  - Combined Surface and Alignment Perturbations
  - Short Warp (Difference in Crosslevel in 10 ft)

Revise Track Geometry Limits for High Speed and High Cant Deficiency Operations

Proposed Track Geometry Limits are based on Simulation Studies using Proposed VTI Safety Limits

- Acela Power Car, Acela Coach Car, Amfleet Coach, AEM-7, and P42 modeling results

Affected Track Geometry Sections

- 213.55 Track Alinement (high CD only)
- 213.63 Track Surface (high CD only)
- 213.65 Combined Alinement and Surface Deviation (high CD only)
- 213.323 Track Gage
- 213.327 Track Alinement
- 213.331 Track Surface
- 213.332 Combined Alinement and Surface Deviation (high CD only)

Proposed VTI Safety Limits

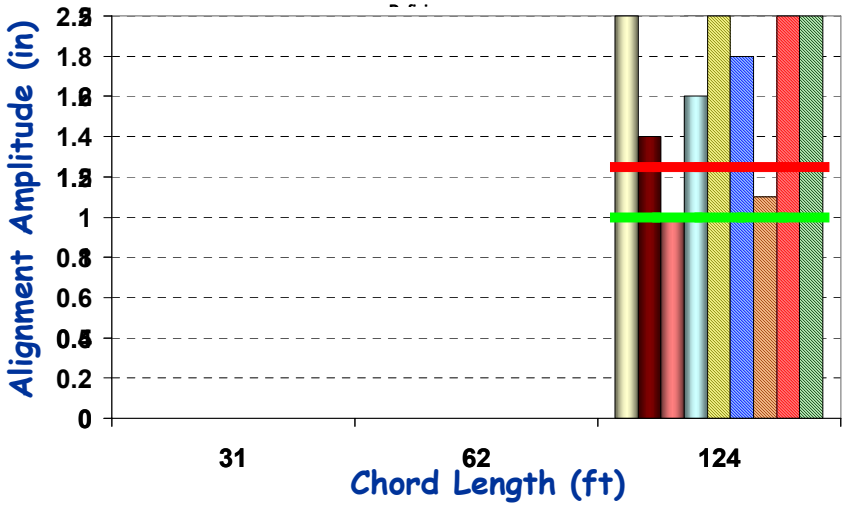
	Acela Powercar	Acela Coach	Amfleet Coach	AEM-7 Locomotive	P42 Locomotive
Wheel Unloading	15%	15%	15%	15%	15%
Wheel L/V (72° Flange Angle)	1.03 (μ=0.5) 2.33 (μ=0.1)	1.03 (μ=0.5) 2.33 (μ=0.1)	1.03 (μ=0.5) 2.33 (μ=0.1)	1.03 (μ=0.5) 2.33 (μ=0.1)	1.03 (μ=0.5) 2.33 (μ=0.1)
Net Axle L/V	0.48	0.52	0.53	0.48	0.46
Truck Side L/V	0.60	0.60	0.60	0.60	0.60
Truck Lat Acc RMS	0.30	0.30	0.30	0.30	0.30
Carbody Lat Acc P-P	0.75	0.65	0.65	0.75	0.75
Carbody Vert Acc P-P	1.00	1.00	1.00	1.00	1.00
Carbody Lat Acc RMS	0.12	0.10	0.10	0.12	0.12
Carbody Vert Acc RMS	0.25	0.25	0.25	0.25	0.25

Example of Simulation-Developed Geometry Limits

Acela Powercar Class 7 (125+5mph)

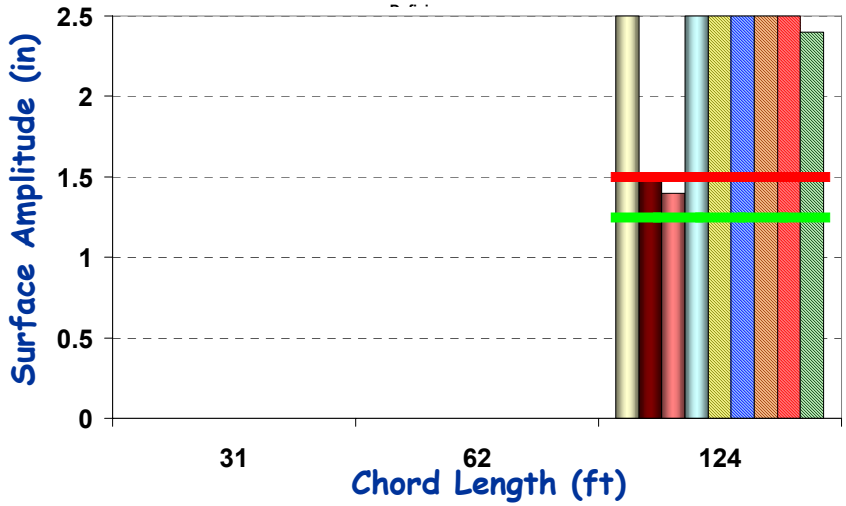
Isolated Alignment Variation

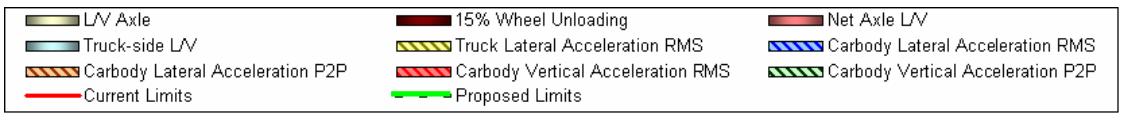
9" of Cant Deficiency



Isolated Surface Variation

9" of Cant Deficiency

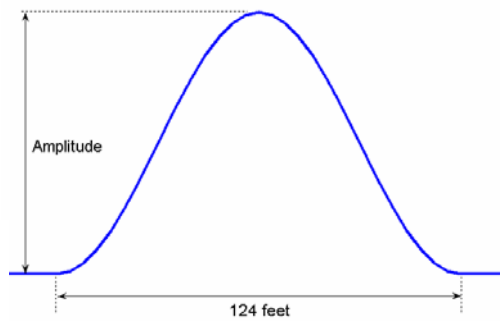




Acela Powercar Class 7 (125+5mph)

6" Superelevation, 124' Bump

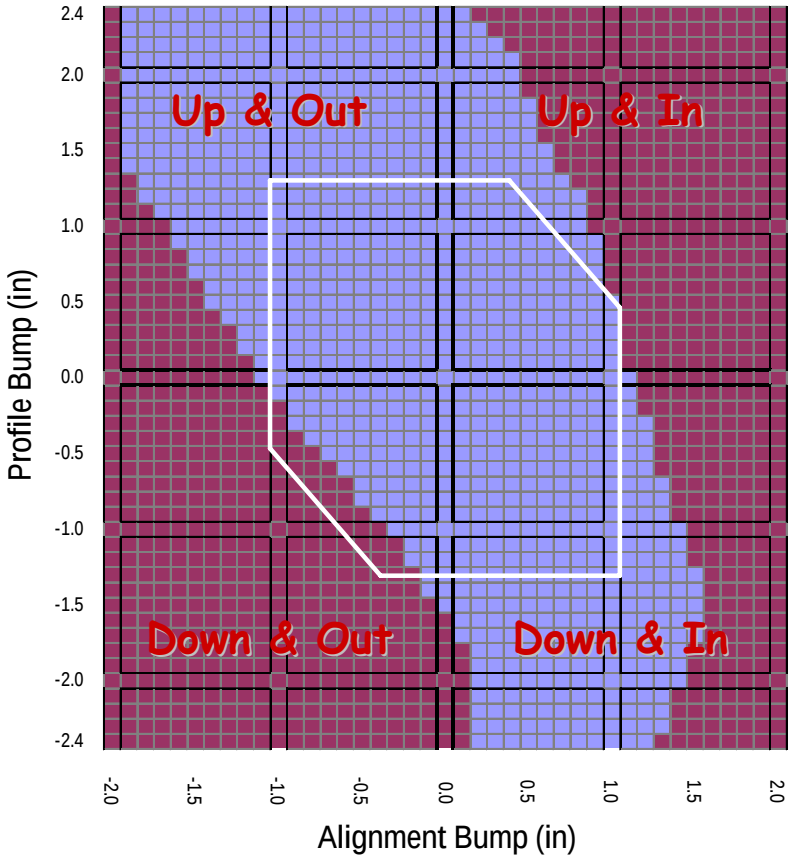
9" Cant Deficiency (1.37 Degree Curve)



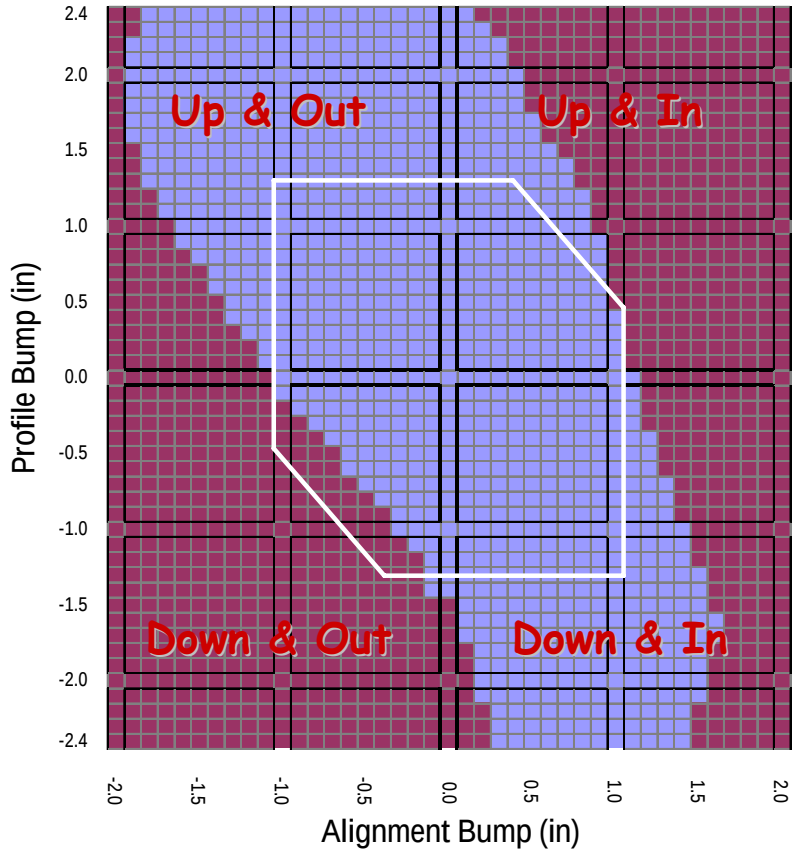
Geometry Cross Plot

Combined Limits on Combined Geometry Results

μ=0.1



μ=0.5



Alinement Limits

Existing

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
31 ft			C 1.25	C 1.0	C 0.5	0.5	0.5	0.5
62 ft	5	3	1.75	1.5	C 0.625 T 0.75	0.75	0.5	0.5
124 ft						1.5	1.25	0.75

Modified

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
31 ft			C 1.25	C 1.0	C 0.5	0.5	0.5	0.5
62 ft	5	3	1.75	1.5	C 0.625 T 0.75	C 0.625 T 0.75	C 0.5 T 0.75	C 0.5 T 0.75
124 ft						1.5	1.25	C 0.75 T 1.0

Proposed High CD
more than 5"

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
31 ft			0.75	0.75	0.5	0.5	0.5	0.5
62 ft	1.25	1.25	1.25	0.875	0.625	0.625	0.5	0.5
124 ft						1.25	1	0.75

Surface Limits

Existing

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
31 ft						1	1	0.75
62 ft	3	2.75	2.25	2	1.25	1	1	1
124 ft						1.75	1.5	1.25

Modified

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
31 ft						1	1	0.75
62 ft	3	2.75	2.25	2	1.25	1	1	1
124 ft						1.75	1.5	1.25

Proposed High CD
more than 5"

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
31 ft			1	1	1	1	1	0.75
62 ft	2.25	2.25	1.75	1.25	1	1	1	1
124 ft						1.5	1.25	1.25

Short Warp

- Limits have been added based on international practices and variations in truck equalization performance

- On curves, the difference in crosslevel between any two points less than 10 feet apart (short warp) shall not be more than:

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
CCD CD <= 5						1.25	1.125	1
HCD CD > 5	2	2	1.75	1.75	1.5	1.25	1	1[a]

a. On curves with Eu more than 7 inches, the difference in crosslevel between any two points less than 10 feet apart (short warp) shall not be more than 3/4 inch

Note that the existing limits for the difference in crosslevel between any two points less than 62 feet apart are effective and remain unchanged.

...BM

Update FRA's 1998 Issuance of TSS

RSAC Vehicle Track Interaction Task Force Convened to Consider Revising 49 CFR 213, Subpart G, issued in 1998 to reflect experience gained in qualifying several vehicles for high speed and cant deficiency operation

1. VTI Safety criteria (acceleration and wheel force limits)
2. Qualification requirements
3. Requirements for high cant deficiency operations
4. Track geometry limits
5. Inspection and monitoring requirements
6. Controls on wheel profile and truck equalization
7. Consolidate inconsistencies amongst and within the low speed and high speed track safety standards and the passenger equipment safety standards

Inspection and Monitoring Requirements

- §213.333, For Operation on Track Classes 6 through 8, or at cant deficiencies > 5 inches, require periodic:
  - Automated track inspections
    - Added TGMS for Class 6 and high cant deficiency
  - Monitoring of carbody and truck accelerations
    - Clarified application and reporting
- Track Class 8, annual IWS test, only if required by FRA, based on periodic inspection/monitoring reports
- GRMS updated to use Gage Widening Projection (GWP) formulation for high speed or high cant deficiency

Inspection and Monitoring Requirements

Issues Identified that are Outside the Scope of this Task Force

This Task Force has identified the following items as needing review, although they fall outside of the currently assigned scope

1. Use of GWP Formulation in Low Speed GRMS Testing

   Recommend adopting the usage of GWP in § 213.110

2. Alternate Tie Standard for High Speed Track

   Recommend developing a new requirement for Subpart G that is similar to the alternate tie standard in § 213.110

3. Crosstie Requirement Modifications

   Recommend updating § 213.335 based on latest industry research

Update FRA's 1998 Issuance of TSS

RSAC Vehicle Track Interaction Task Force Convened to Consider Revising 49 CFR 213, Subpart G, issued in 1998 to reflect experience gained in qualifying several vehicles for high speed and cant deficiency operation

1. VTI Safety criteria (acceleration and wheel force limits)
2. Qualification requirements
3. Requirements for high cant deficiency operations
4. Track geometry limits
5. Inspection and monitoring requirements
6. Controls on wheel profile and truck equalization
7. Consolidate inconsistencies amongst and within the low speed and high speed track safety standards and the passenger equipment safety standards

Wheel Profile and Truck Equalization

Controls were needed to establish limits for wheel profile and truck equalization

- TF agreed that these issues be controlled by industry
- 3 APTA Standards were developed by the APTA PRESS Mechanical Committee Working Groups and have been approved for industry use
  - Wheel Load Equalization… SS-M-14-06
  - Wheel Flange Angle… SS-M-15-06
  - Wheel Tread Taper… SS-M-17-06

These standards are accessible at:
http://www.aptastandards.com/PublishedDocuments/PublishedStandards/PRESS/tabid/85/Default.aspx

Update FRA's 1998 Issuance of TSS

RSAC Vehicle Track Interaction Task Force Convened to Consider Revising 49 CFR 213, Subpart G, issued in 1998 to reflect experience gained in qualifying several vehicles for high speed and cant deficiency operation

1. VTI Safety criteria (acceleration and wheel force limits)
2. Qualification requirements
3. Requirements for high cant deficiency operations
4. Track geometry limits
5. Inspection and monitoring requirements
6. Controls on wheel profile and truck equalization
7. Consolidate inconsistencies amongst and within the low speed and high speed track safety standards and the passenger equipment safety standards

Consolidation of Rule Inconsistencies

- TF consolidated the requirements within and amongst:
  - Low speed track standards (49 CFR 213, Subparts A-F)
  - High speed track standards (49 CFR 213, Subpart G)
  - Passenger Equipment Safety Standards (49 CFR 238)

- Cross-references established in *49 CFR 238*
  - Appendix C of Part 238 has been removed
  - Now refer to the Vehicle/Track Interaction limits and truck hunting definition contained in § 213.333
  - Steady state lateral acceleration limit increased to 0.15g

- Duplicate requirements have been removed

Next Steps of the RSAC VTI Task Force

- Received approval from WG in December 2007. Now seeking approval of same proposed recommendations set forth in "Final Report Volume 1 – Proposed Rule Text", draft 10 dated December 3, 2007, from this RSAC Main body.
- Finalizing Volume 2 of the Technical Recommendations Report
  - Contains the technical bases and analyses that support the recommendations made in Volume 1
- Developing a cost analysis of these recommendations
- Next TF meeting is February 2008