



TECHNOLOGY & INFRASTRUCTURE

Rapid change, constrained frameworks

REPORT ON THE B-TRAIN PBS TRIAL

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Outline

- PBS low speed turning performance requirements for HPMVs
- Proposed new pro-forma designs
- Trials and Results
- Implementation

Low Speed Turning Performance Rqmts

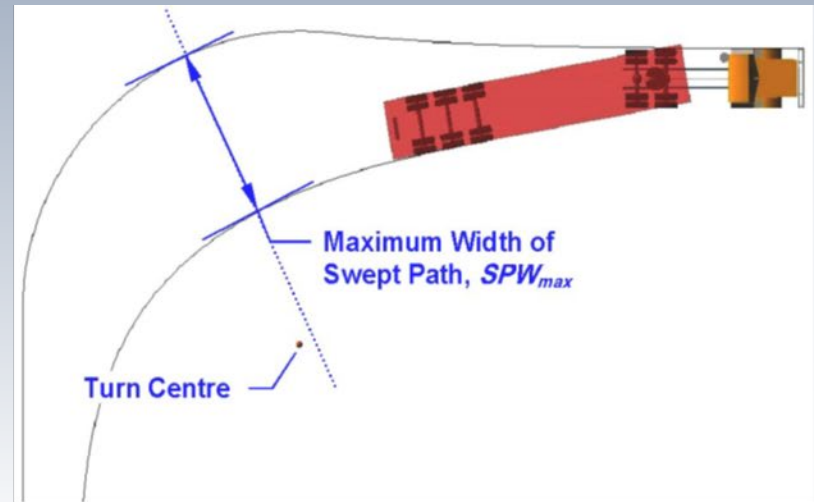
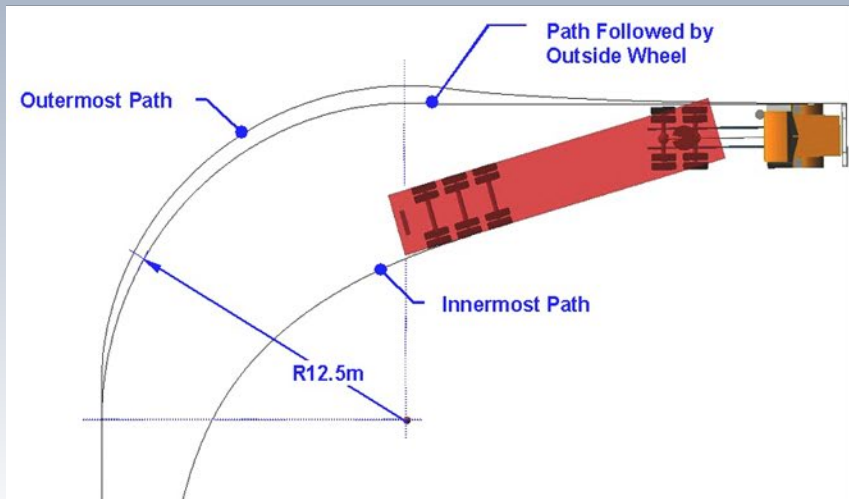
- 2010 VDAM Amendment for HPMVs
 - 12.5m outside radius 120° wall-to-wall turn maximum swept width of 7.6m – based on 19m quad semi performance
 - 12.5m outside radius 90° kerb-to-kerb turn maximum off-tracking of 4.2m
 - Maximum truck/tractor frontal swing of 0.7m
 - Maximum tail swing of 0.3m

2016 VDAM Review

- Formalise New Zealand PBS requirements and tailor them to New Zealand conditions
- Concerns about road width occupied by large HPMVs on tight highway curves
- Proposed that low speed turning requirements should be based on old 18m tridem semi-trailer rather than the quad.

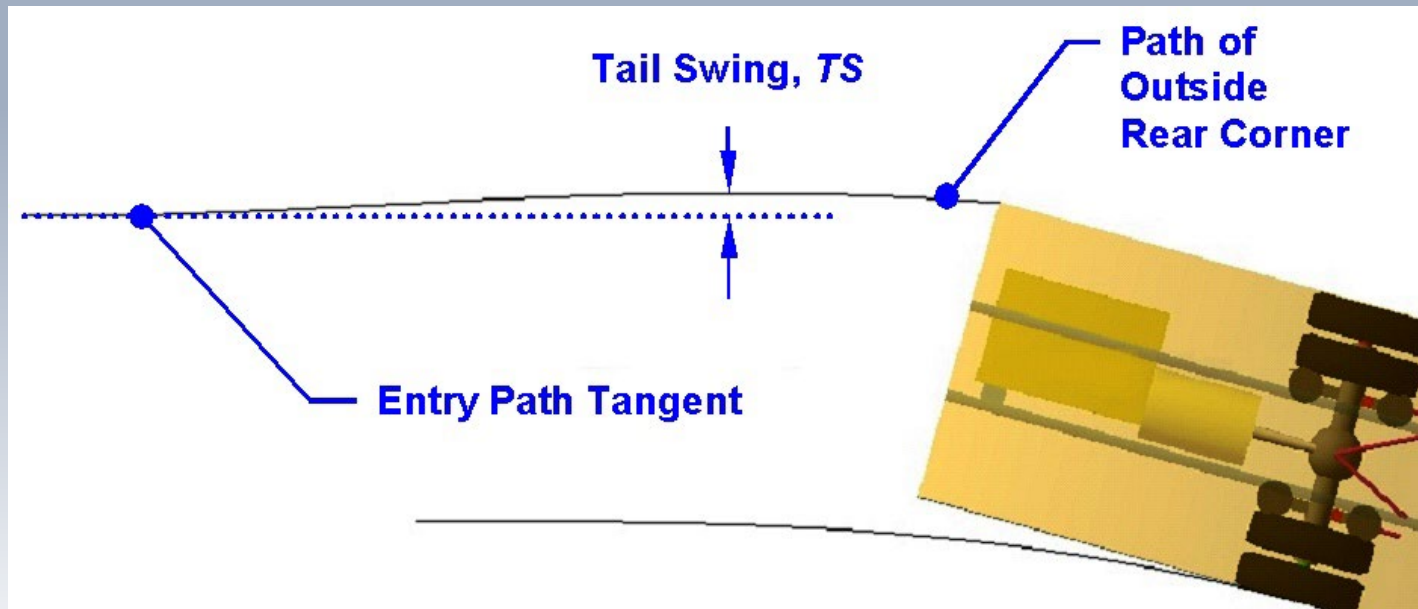
New Low Speed Turning Rqmts

Swept Width



Maximum width of swept path $\leq 6.95m$

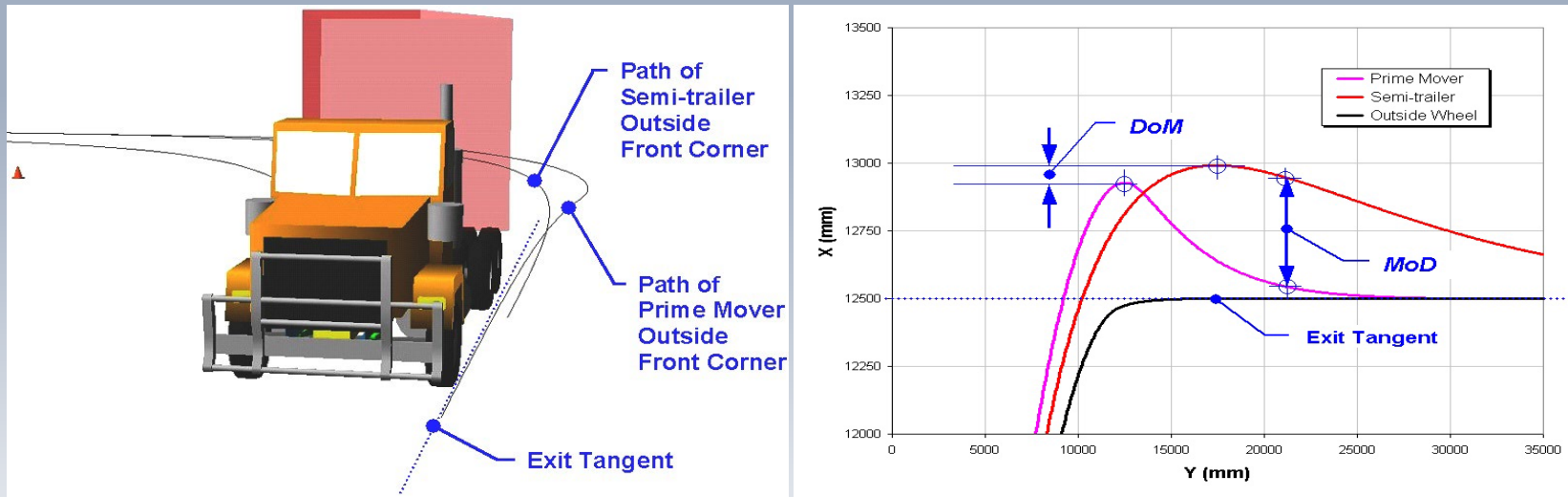
Tail Swing



- Maximum tail swing $\leq 0.30\text{m}$



Frontal Swing



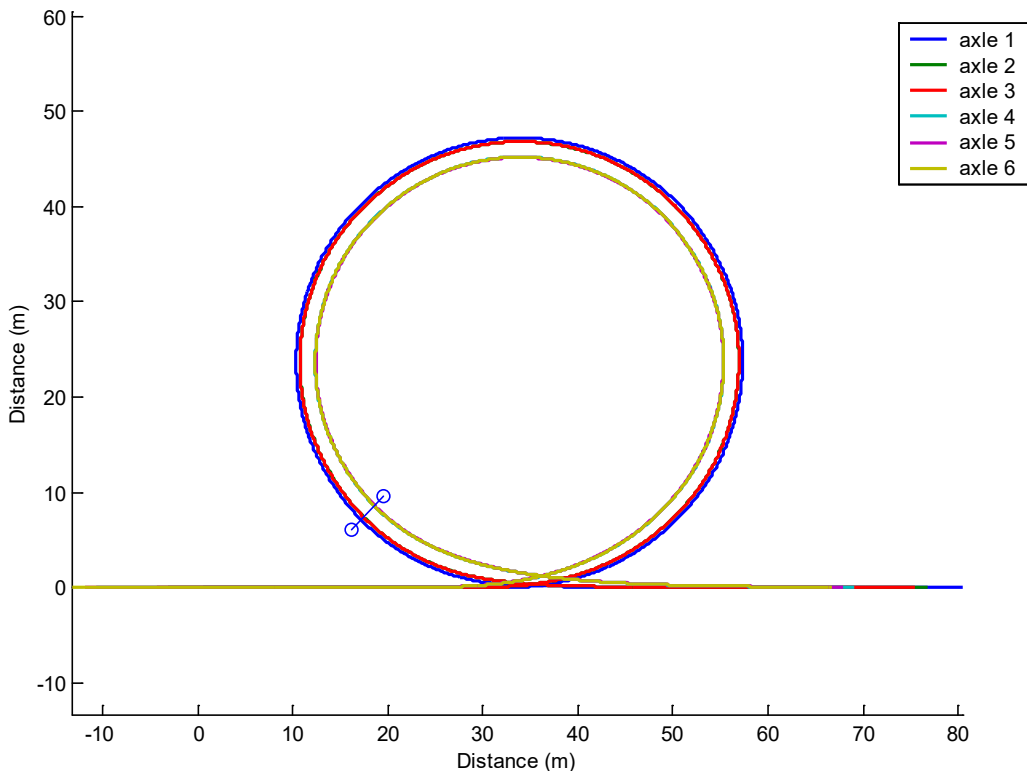
Maximum frontal swing $\leq 0.75\text{m}$ for trucks and trailers

Maximum frontal swing $\leq 1.50\text{m}$ for buses

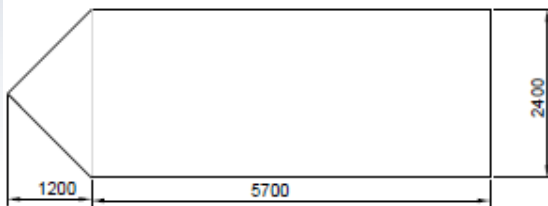
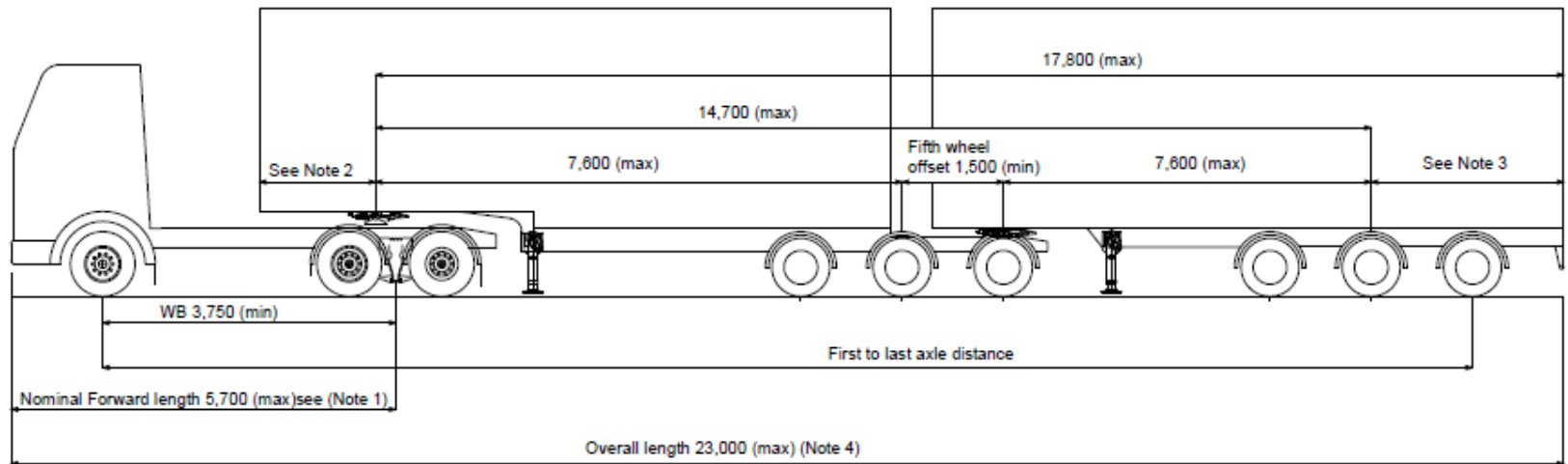
Steady State Low-Speed Swept Width

- On lower speed highway curves, actual off-tracking is a combination of low speed and high speed effects.
- Standard 90° turn does not reliably capture steady state low speed off-tracking performance.
- Proposed manoeuvre is 25m radius wall-to-wall turn EC (1992)
- Performance measure is swept width
- Maximum allowable level is 5.20m

Steady State Low-Speed Swept Width



50MAX-23m 9 axle B Train



Note 1; The nominal forward length is measured from the rear axis to two points at 1200mm mm off the vehicle centreline. The front of the vehicle must lie with the bound of an symmetric triangle based on the two points with a height of 1200mm as illustrated in the above diagram.

Note 2; FOH to fit inside 2250mm radius arc ahead of centre of kingpin

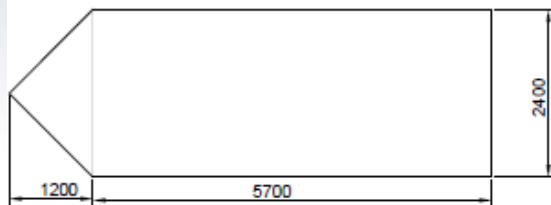
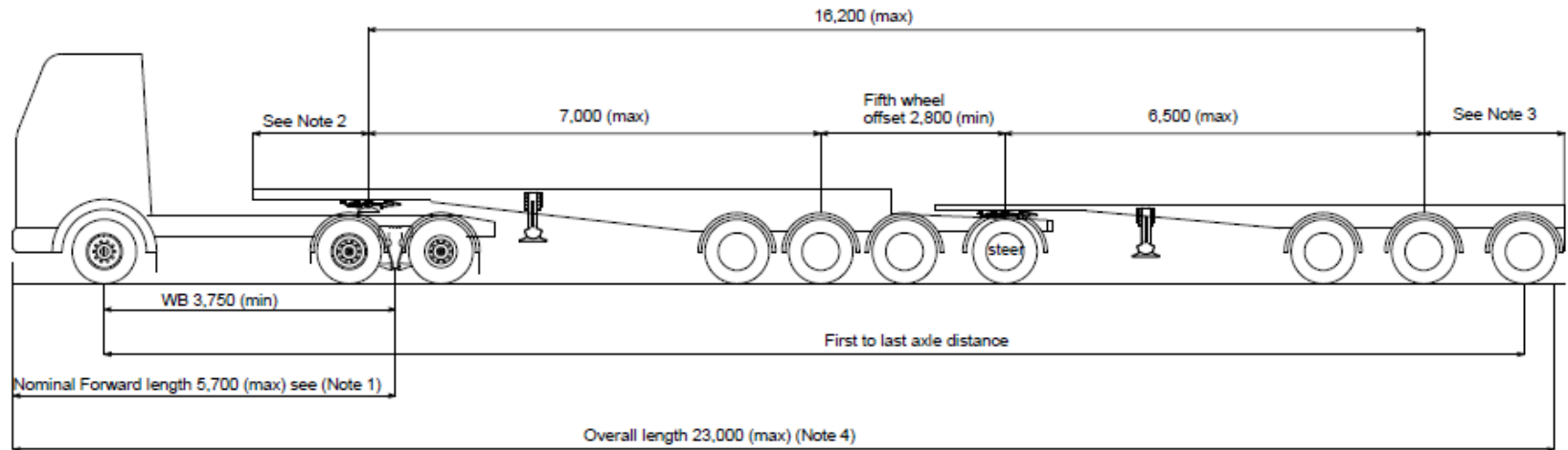
Note 3; ROH maximum of 60% of Forward distance or less than 4300mm

Note 4; Total length of combination is from foremost point on truck to rearmost part of rear trailer

Note 5; For 50Max trailers must have all trailer axles on Dual wheels



50MAX-23m 10 axle B Train



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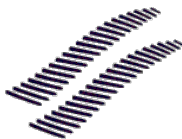
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Validation Trials

- Measured swept width, frontal swing and tail swing
- Measured steady state swept width
- Video recorded on-road behaviour over 50-60km trip included low speed highway curves
- Tests done with an empty vehicle
- Driver feedback was sought

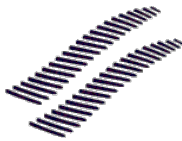
9-axle B-train



Front corner path



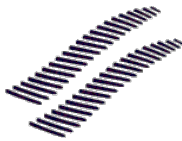
Rear inner path



Comparison of Simulated and Measured Performance

Performance Measure	Simulation Results	Measurement Results
Low Speed Swept Width (m)	6.91	6.73
Tail Swing (m) - Load	0.04	0.12
Frontal Swing (m)	0.53	0.52
Steady State Low Speed Swept Width (m) - 20m radius turn	5.76	5.77

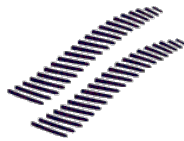
35 km/h curve on-highway



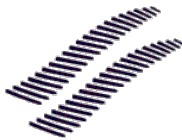
Oncoming vehicle in moderate curve



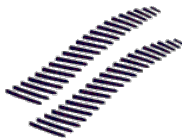
Oncoming truck and trailer in a 35 km/h curve



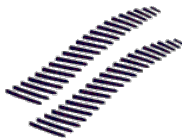
10-axle B-train



Front corner path



Rear inner path



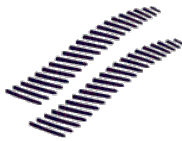
Comparison of Simulated and Measured Performance

Performance Measure	Simulation Results	Measurement Results
Low Speed Swept Width (m)	6.98	6.60
Tail Swing (m) - Load	0.05	0.12
Frontal Swing (m)	0.32	0.34
Steady State Low Speed Swept Width (m) - 25m radius turn	5.11	5.07

On-Road Performance (1)



On-Road Performance (2)



Conclusions

- The new pro-forma B-train designs have better low speed turning performance than the previous designs
- There was good match between the simulated performance and the measured performance
- The observed on-road performance was very good
- Driver feedback was positive