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Recent Examples of the Performance Based Standards Approach to Weights and Dimensions

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Overview

- Performance Based Standards in Australasia
- 22m log trucks
- Quad-axle semitrailer
- Conclusions

Performance Based Standards

- Performance Standard = Performance Measure + Acceptance Level
- Basic Concept not new e.g. Braking requirements
- Performance Measures relating to Stability and Manoeuvrability have been developed
- NZ led way in applying these to permit vehicles
- SRT requirement for all large heavy vehicles
- Australia is developing an alternative compliance regime based on PBS

Australian PBS System

- SAFETY RELATED
  - Longitudinal Performance (Low Speed) (3)
  - Longitudinal Performance (High Speed) (3)
  - Directional Performance (Low Speed) (4)
  - Directional Performance (High Speed) (8)
- INFRASTRUCTURE RELATED
  - Pavements (2)
  - Bridges (1)

22m Log Trucks Problem

- Unacceptably high rollover rate
- Increased demand for shorter log lengths leading to higher loads
- Difficult roading environment

22m Log Trucks Solution

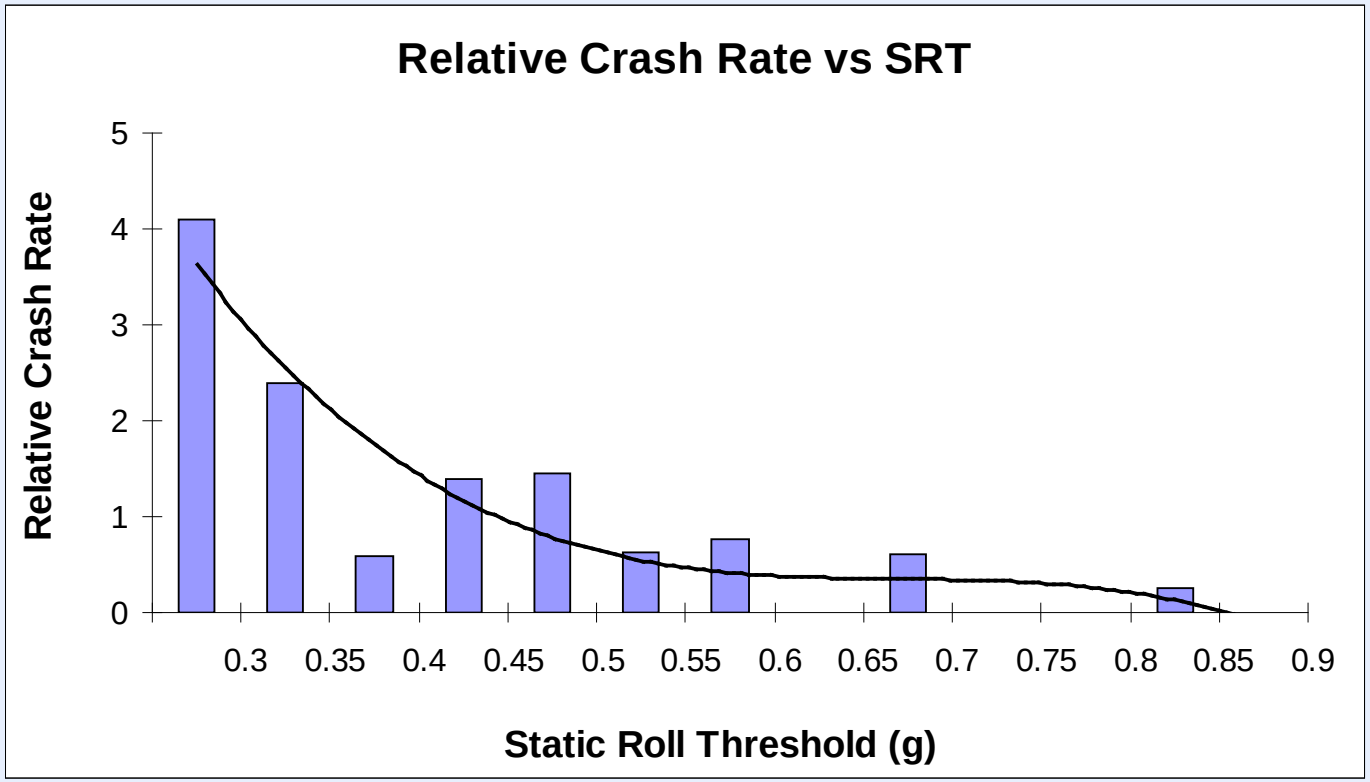
Crash Data Analysis

- 61 on-highway rollover crashes in 14 months
- 70% of these truck-trailers with a single packet of logs on trailer
- In crashes where rollover is the result not the cause, more stable vehicles may help.

Performance Assessment

- Compare 20m vehicle with same vehicle carrying same load in 22m configuration
- Six measures unchanged
- Six measures slightly poorer
- Four measures slightly better
- Two key stability measures significantly better. SRT by 27% and DLTR by 35%

Stability Performance and Crash Rates



Potential Impact on Crash Rate

- SRT improves from 0.37g to 0.47g implies a 55% reduction in crash rate
- DLTR improves from 0.66 to 0.49 implies a 67% reduction in crash rate
- Applying this to the 70% of rollover crashes that involve these vehicles gives a potential crash reduction between 39% and 47%

Current Status

- Operational trial has been completed
- As of 1 July 2002, approved vehicles can operate at 22m
- Monitoring of performance is on-going to ensure safety objectives are achieved

Quad Axle Semi-Trailers

- Yellow draft of D&M Rule proposed allowing 22 tonnes quad axle with at least one steering
- Trial vehicle was built and is being operated
- Transit NZ raised concerns over road surface damage from scuffing
- Simulation and testing was undertaken to compare lateral tyre force with standard tridem vehicle

Tridem Axle Test Vehicle

Quad Axle Test Vehicle

Methodology

- Wheel force comparisons done by simulation modelling
- Model validation done by measuring off-tracking on both vehicles through 90º and 450º low speed turns
- On-road observations also undertaken

Measurement Tests

Validation Results

Table 1. Maximum Low Speed Off-tracking, 90-degree turn

	Simulated Offtracking Axle Number						Trial Offtracking Rear Axis
	2	3	4	5	6	7	Axle 5
Tri Axle	0.80	0.79	3.44	**3.52**	3.47		3.4
Quad Axle	0.82	0.81	3.46	**3.50**	3.44	3.31	3.3
Quad Axle (16 degree)	0.82	0.81	3.46	**3.50**	3.44	3.31	-

Validation Results

Table 1. Maximum Low Speed Off-tracking, 450 degree turn

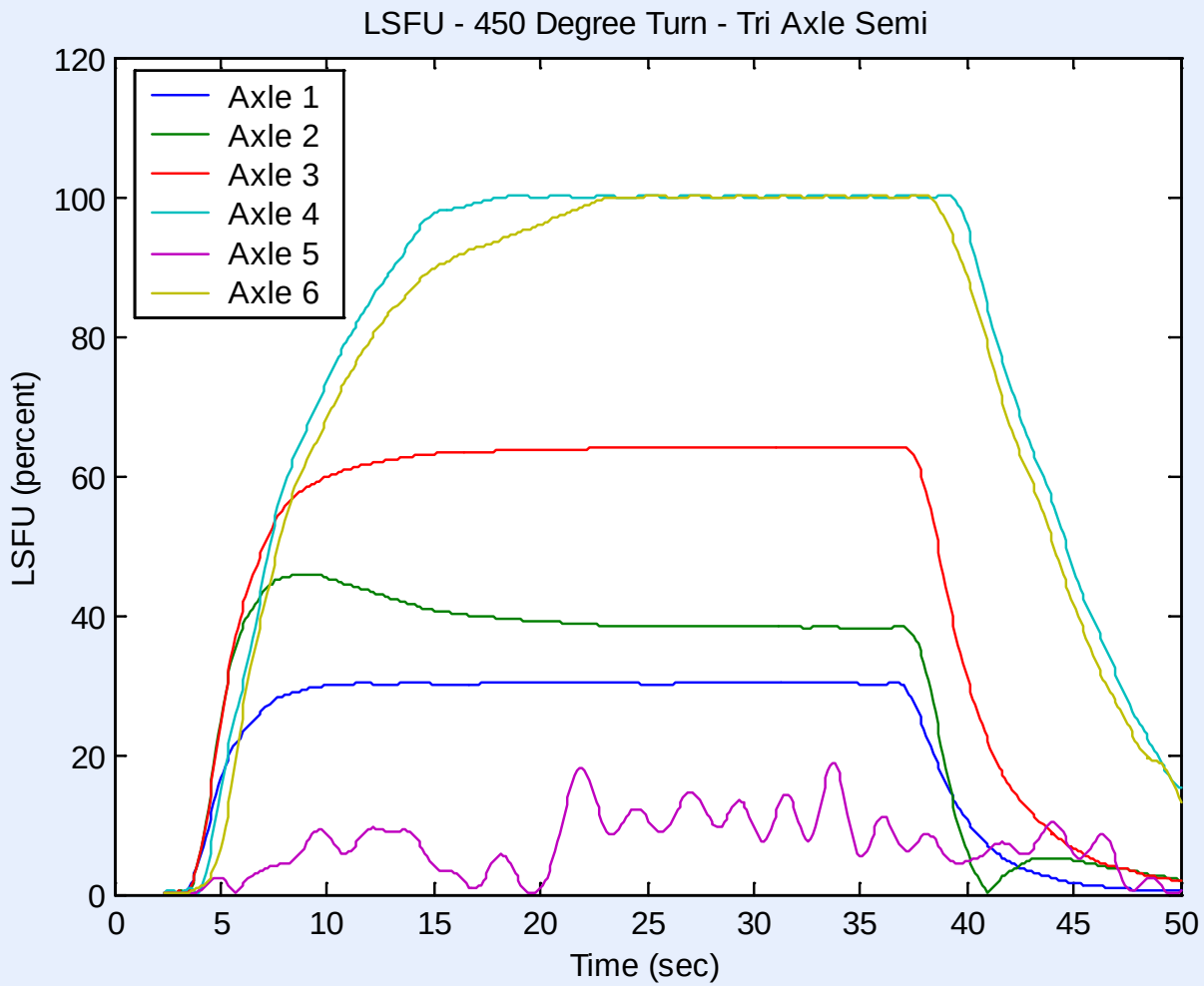
	Simulated Offtracking Axle Number						Trial Offtracking Rear Axis Axle 5
	2	3	4	5	6	7	
Tri Axle	0.81	0.78	5.46	**5.68**	5.52		5.7
Quad Axle	0.83	0.81	5.97	**6.28**	6.22	5.91	6.3
Quad Axle (16 degree)	0.84	0.82	5.88	**6.16**	6.07	5.74	-

Validation Results

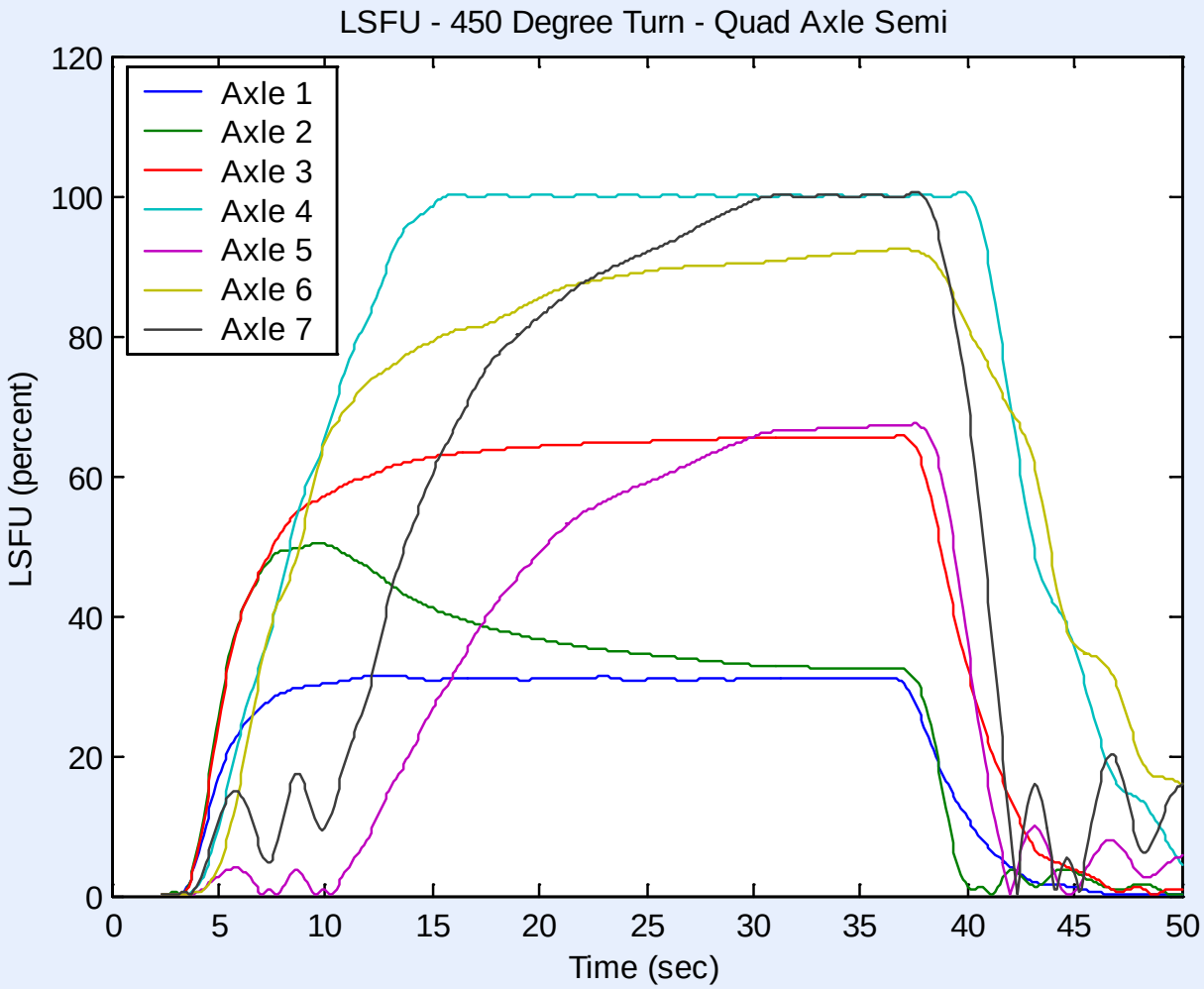
Table 1. Low Speed Off-tracking at quadrant points a, b, c and d during 450 degree turn.

		Point			
		a	b	c	d
Tri Axle	Simulation	4.30	5.25	5.60	5.70
	Trial	4.25	5.76	5.58	5.89
Quad Axle	Simulation	4.75	5.60	6.05	6.25
	Trial 1	5.01	5.78	6.12	6.32
	Trial 2	5.11	5.51	5.97	6.30

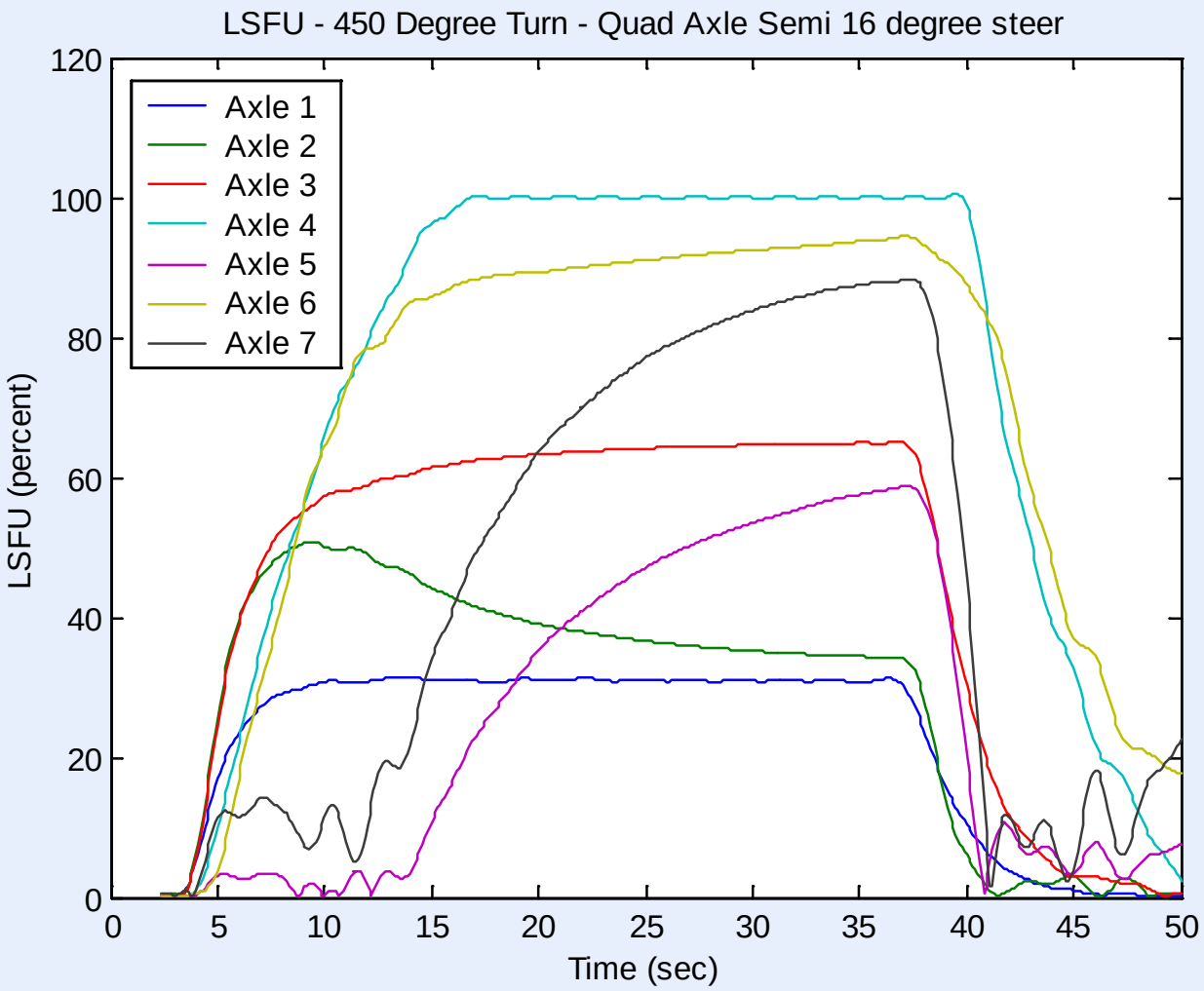
LSFU Tridem Axle



LSFU Quad Axle



LSFU Quad Axle with 16º Steer



Results – Quad Axle Semi

- Good match between simulation and measurement results
- For LSO quad better than tridem for 90° turns but worse for 450° turns
- LSFU better for quad than for tridem up to 180° turns i.e. lower tyre scrubbing forces

Conclusions

- Performance assessments are a valuable tool for evalating innovative vehicles
- NZ has used a mixture of testing and simulation. Gives good confidence in results
- 22m log trucks show very good potential for large safety gains
- Quad axle semis with a steer axle generate lower tyre scrubbing forces than tridem axle semis in normal operating conditions