Road Pavements Forum, Salt Rock Hotel,
4-5 May 2010

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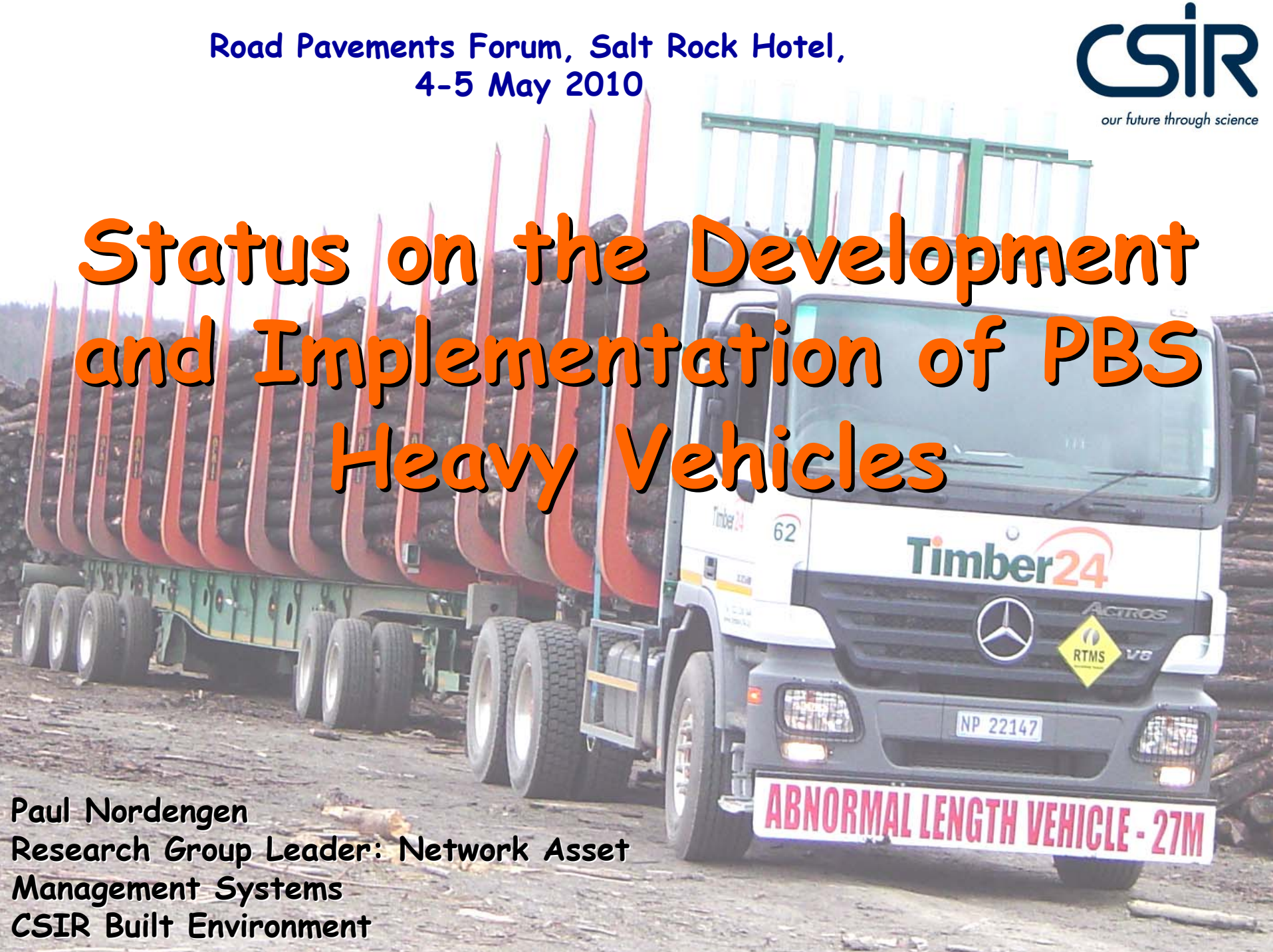
Status on the Development and Implementation of PBS Heavy Vehicles

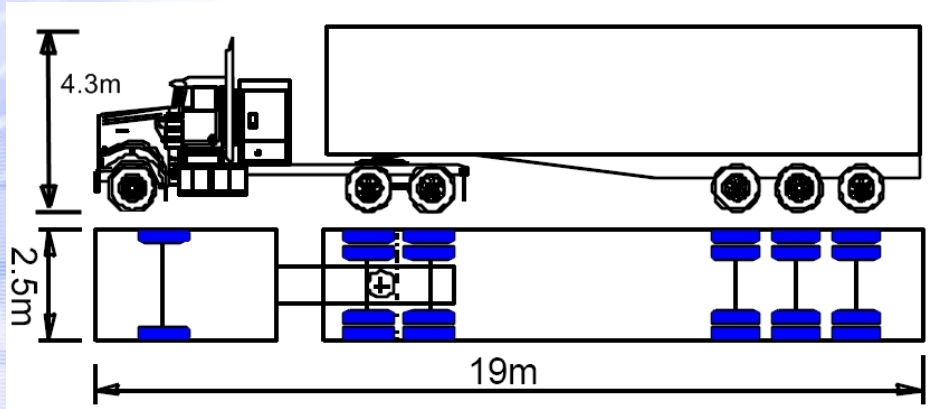


Paul Nordengen
Research Group Leader: Network Asset Management Systems
CSIR Built Environment

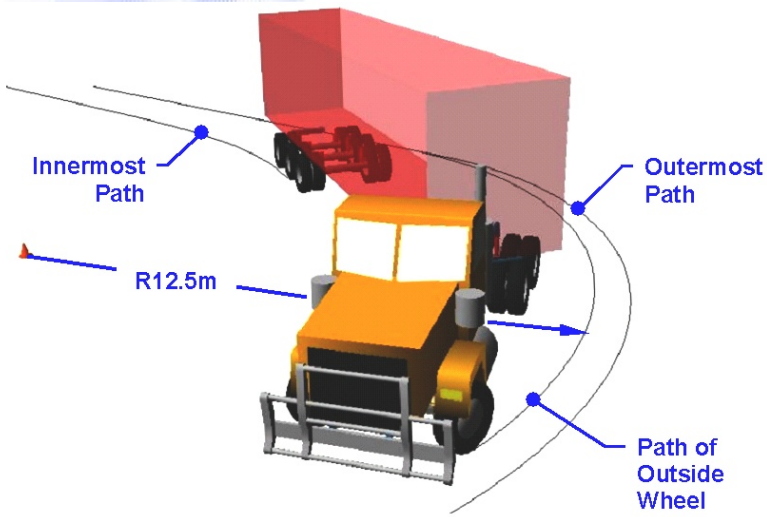
KEY ELEMENTS IN HEAVY VEHICLE ROAD TRANSPORT

- Road infrastructure
- Vehicles (design, maintenance & operation)
- Drivers

Prescriptive vs Performance-based Standards

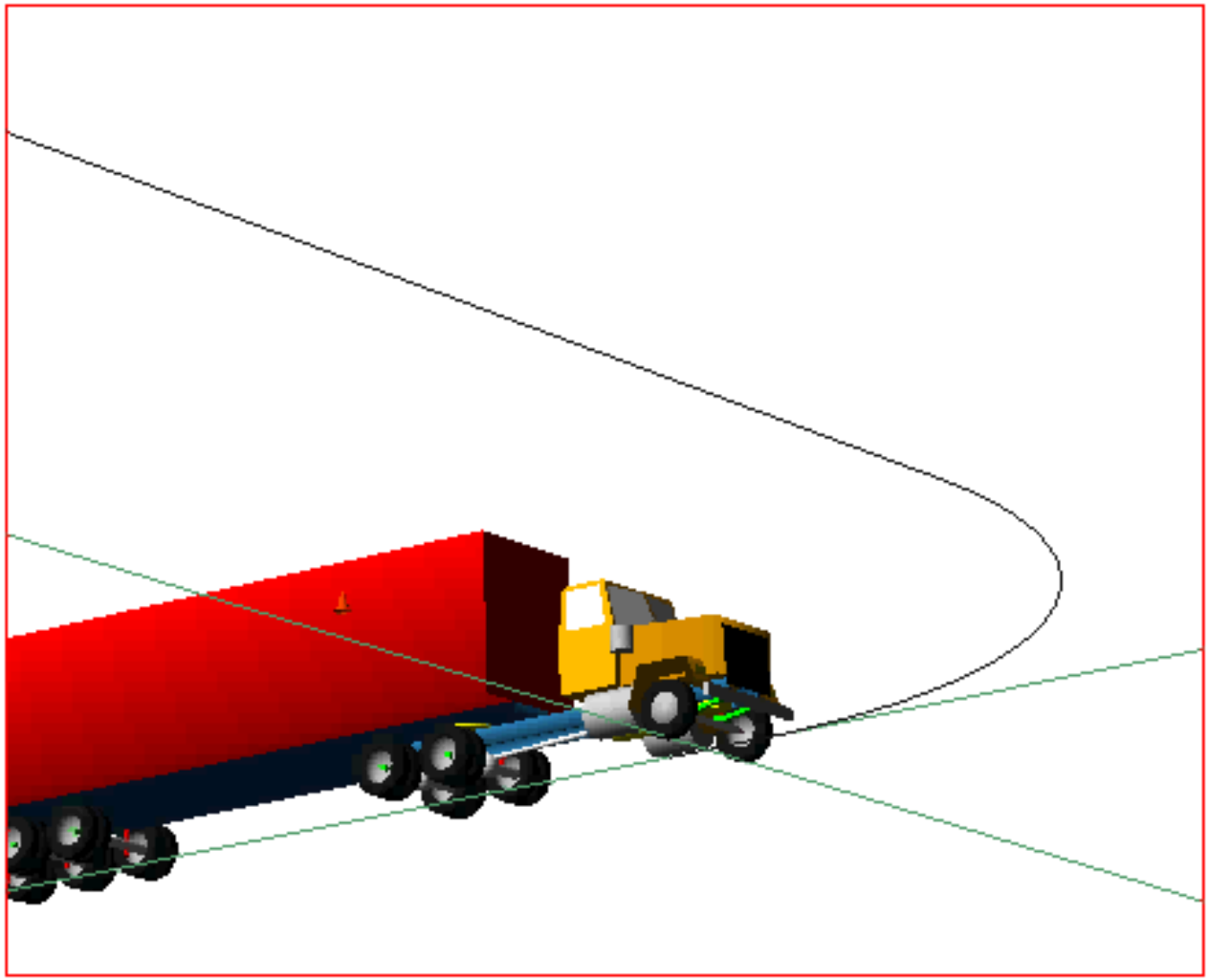


- What the vehicle looks like



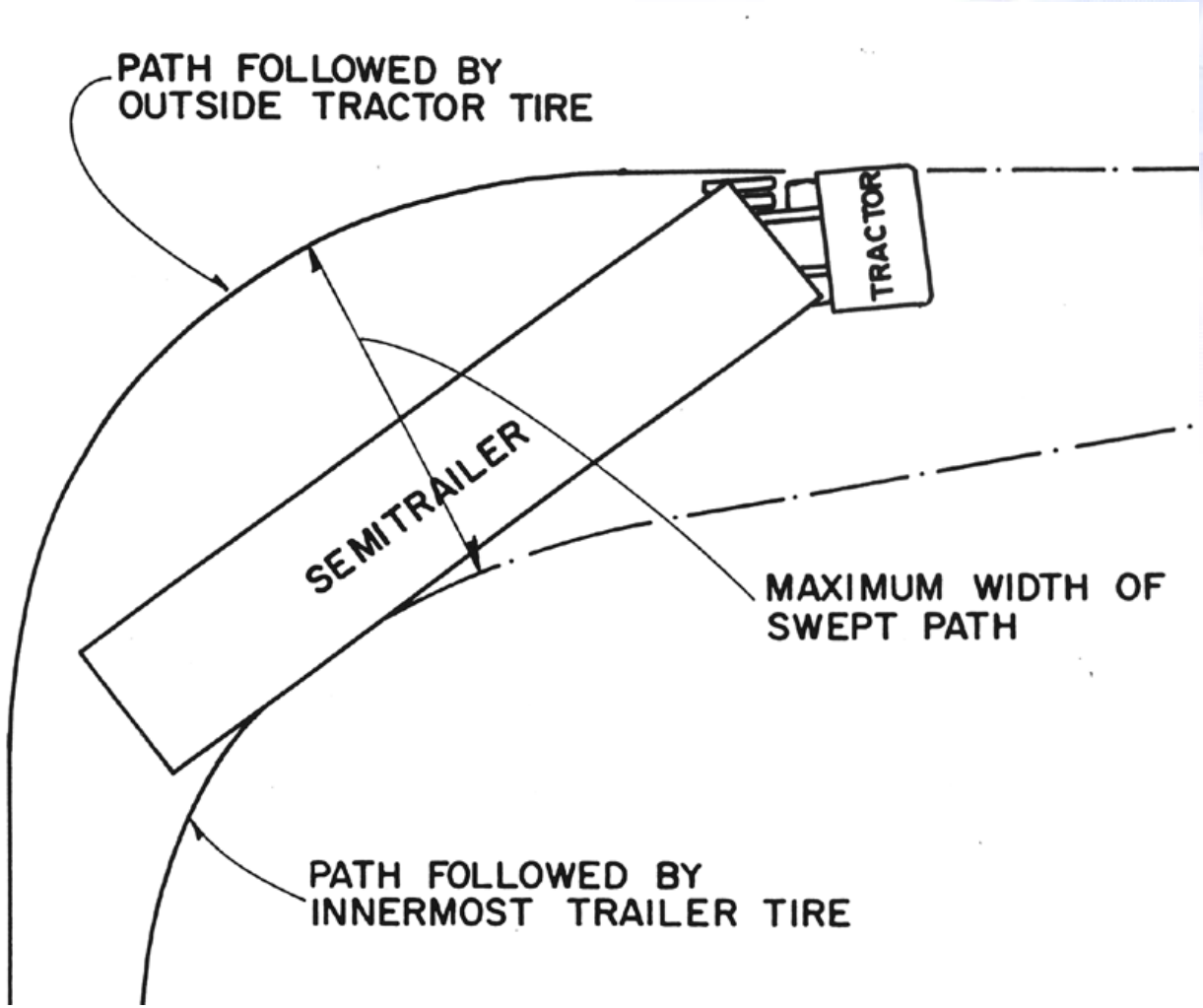
- What the vehicle can do

Low-Speed Offtracking



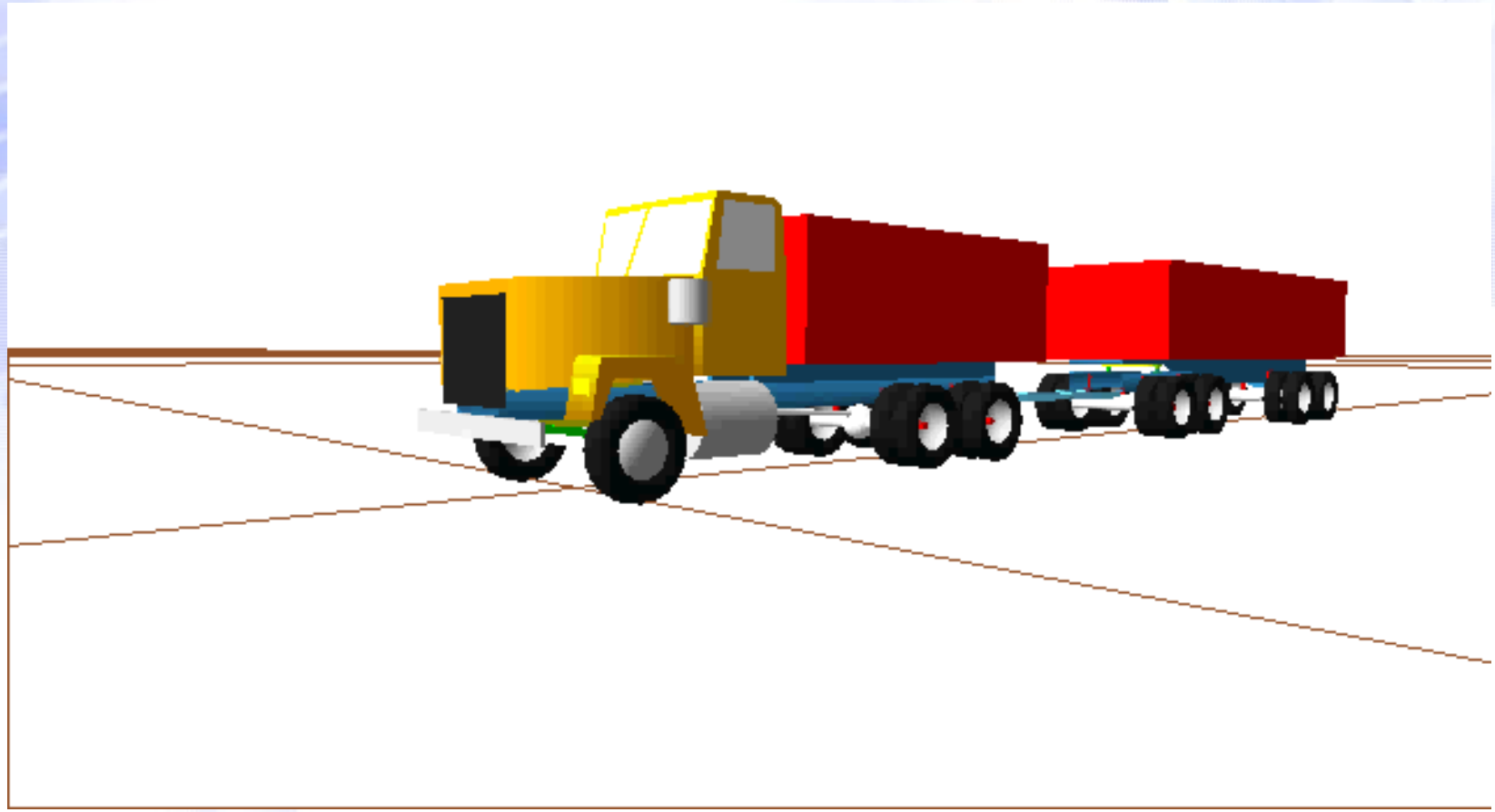
from NTC/Austroads PBS National Workshops

Maximum Width of Swept Path



from Ervin and Guy (1986)

Static Rollover Threshold (SRT)



from NTC/Austroads PBS National Workshops

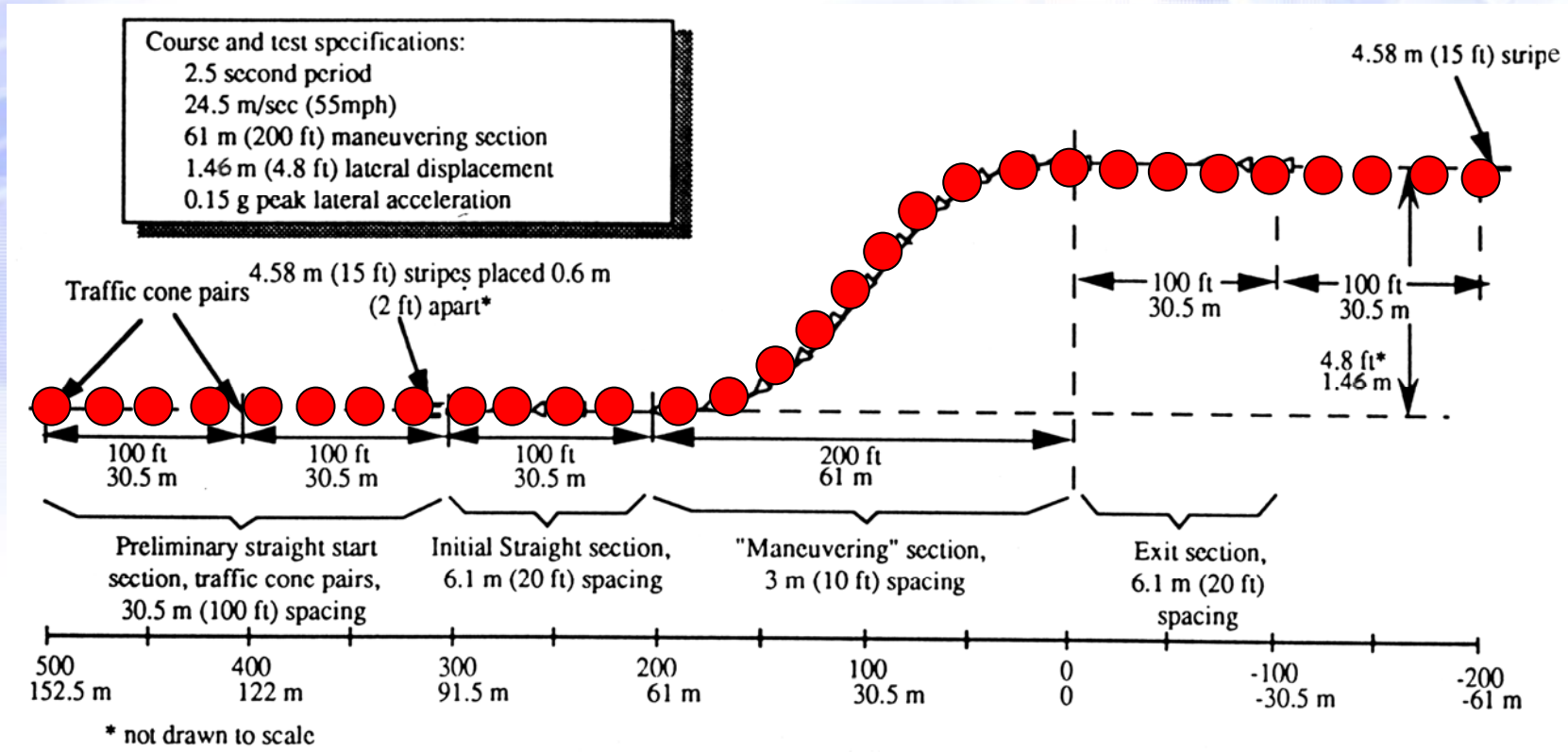
Rollover in a steady turn


ABNORMAL LENGTH
VEHICLE - 27m
AFRIT
QUALITY ON TIME


ABNORMAL LENGTH
VEHICLE - 27m


Timber24
62
Timber24
ACTROS
V8
RTMS
NP 22147
ABNORMAL LENGTH VEHICLE - 27M

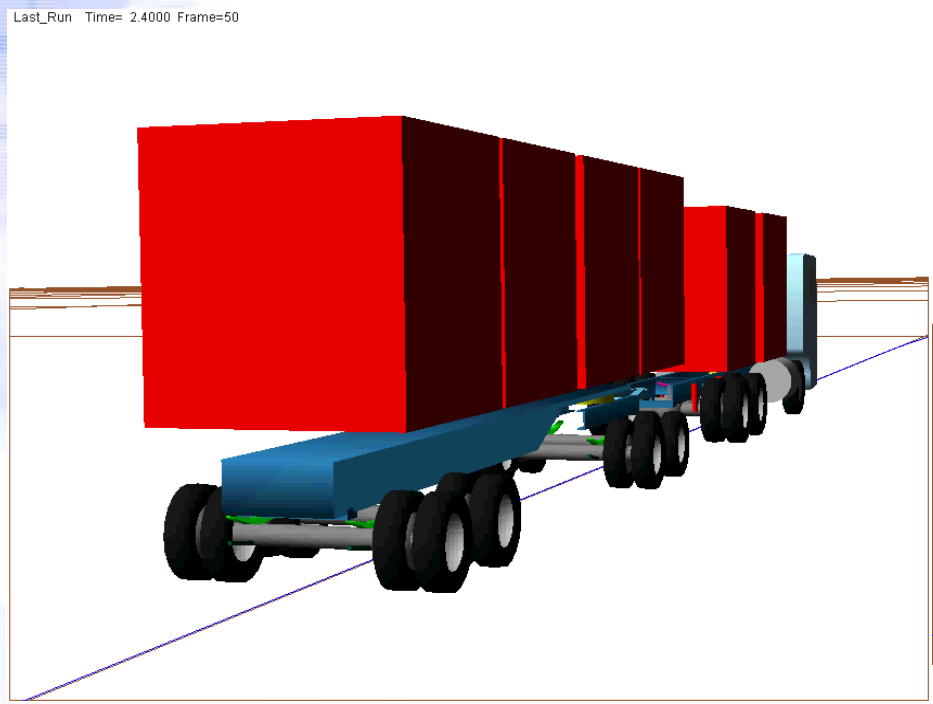
PBS Lane Change Manoeuvre
(SAE J2179)

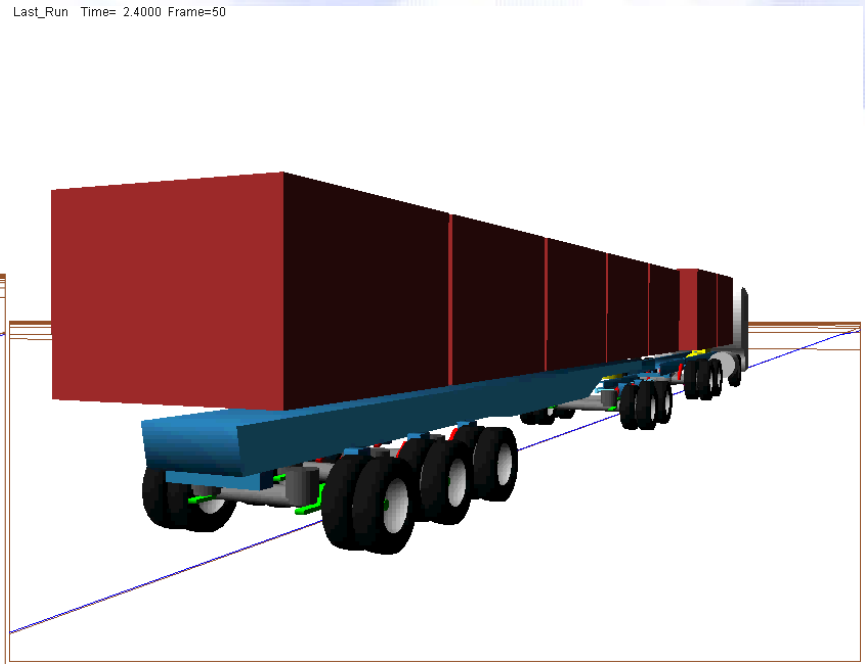


Baseline cf. PBS vehicle

baseline

PBS



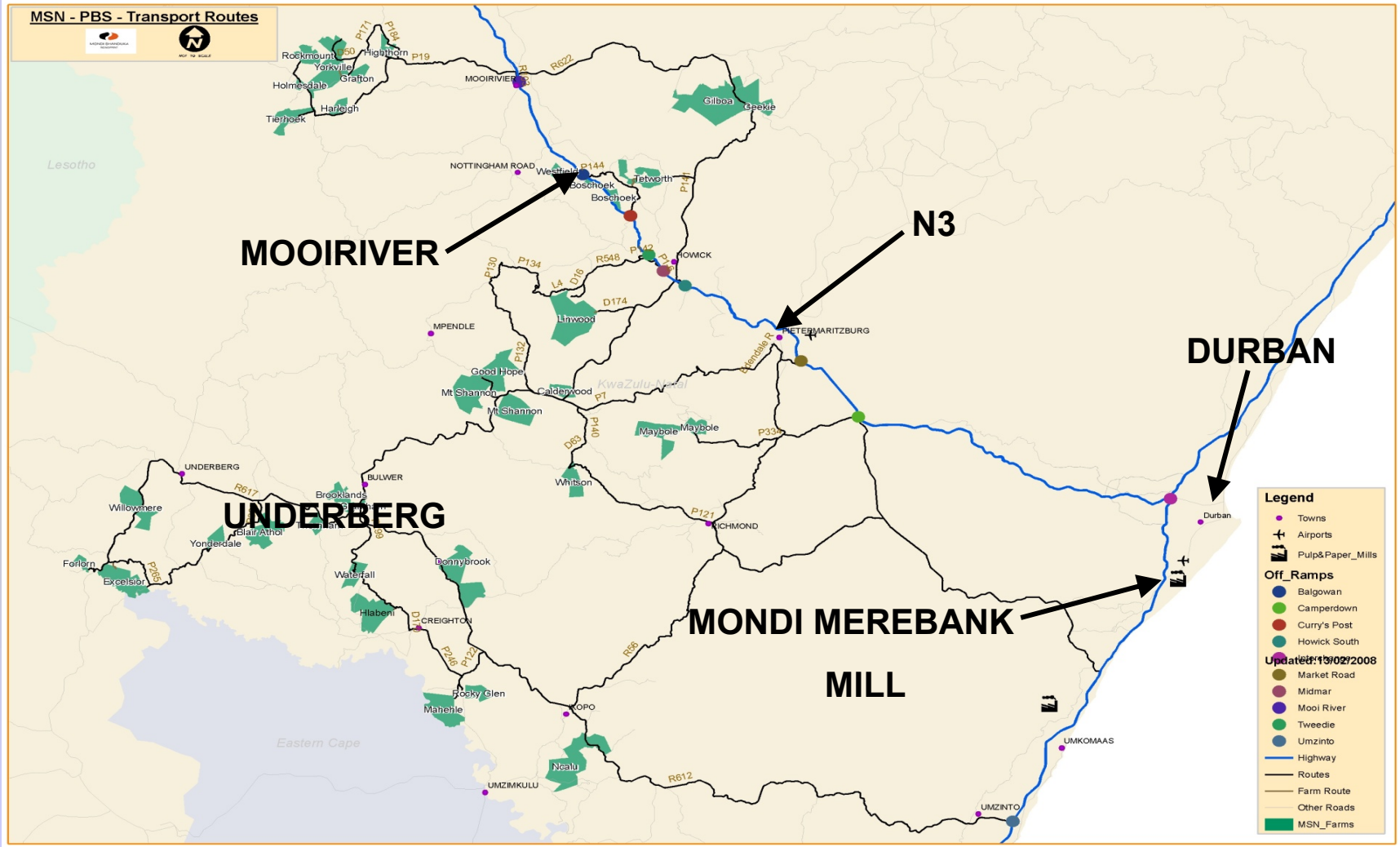



supergroup
ABNORMAL LENGTH VEHICLE 24m
ACTROS
RTMS
V8
NP 157-944
supergroup

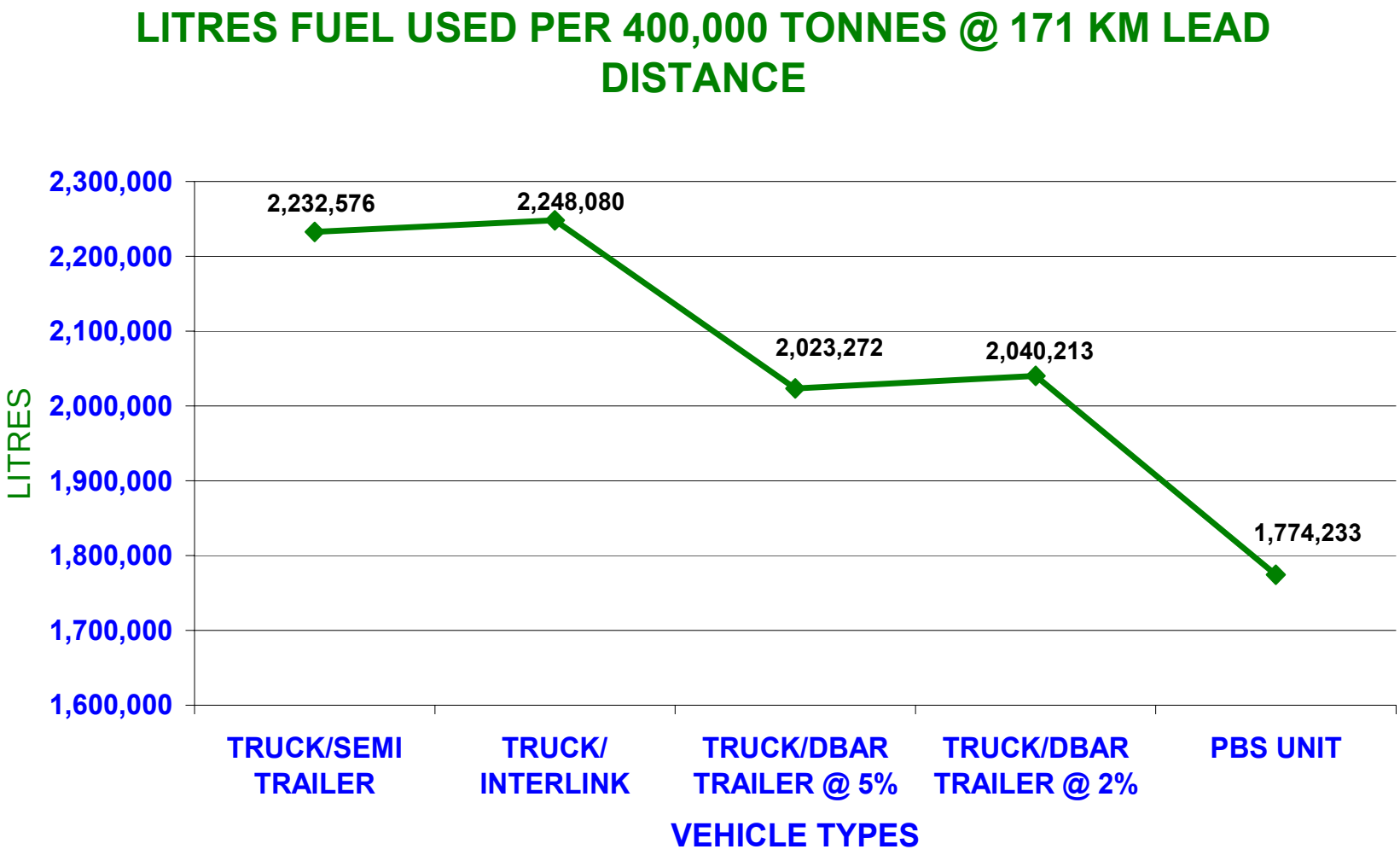

ABNORMAL LENGTH VEHICLE 24m


TH VEHICLE 24m

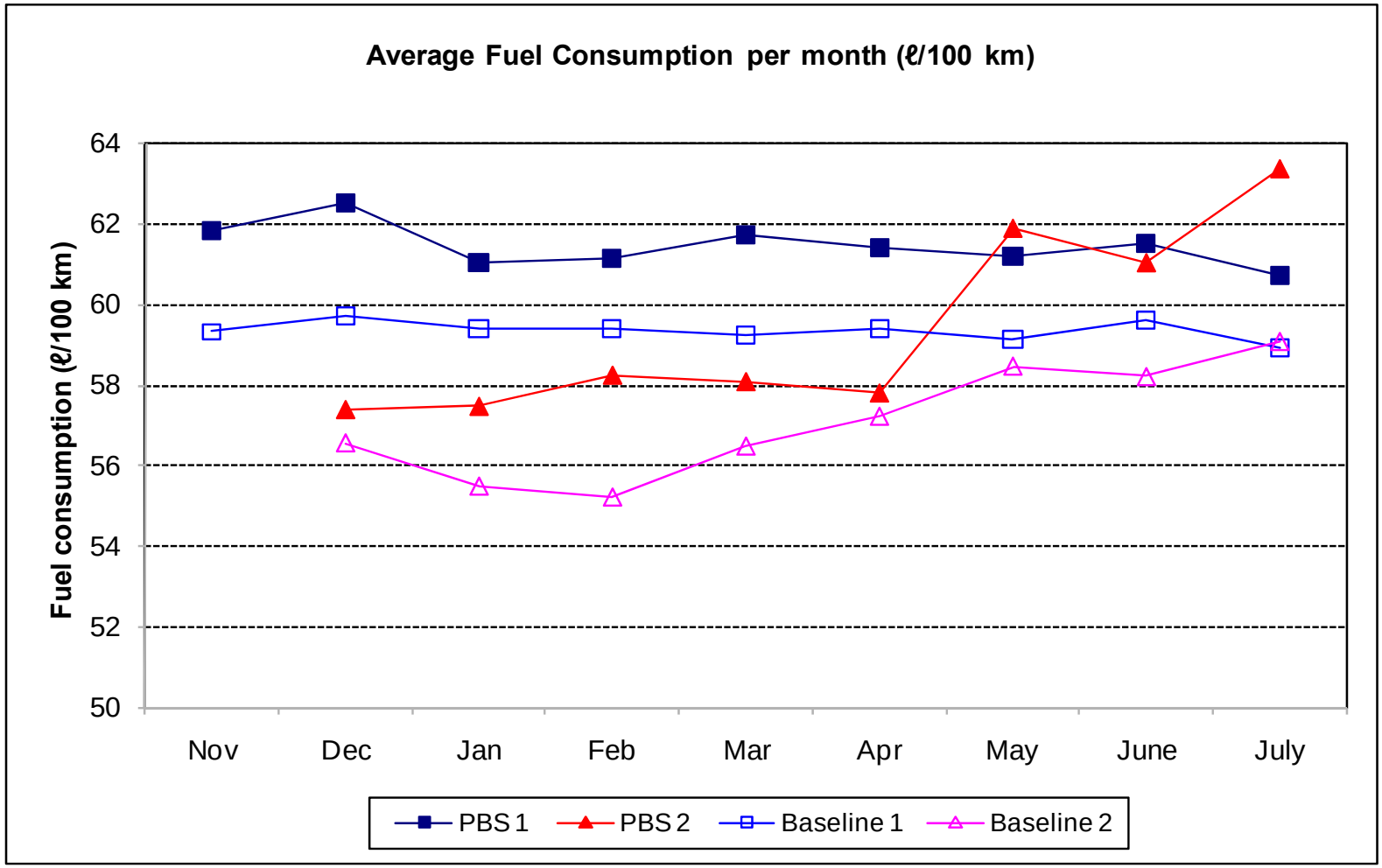
Mondi PBS Vehicle Route



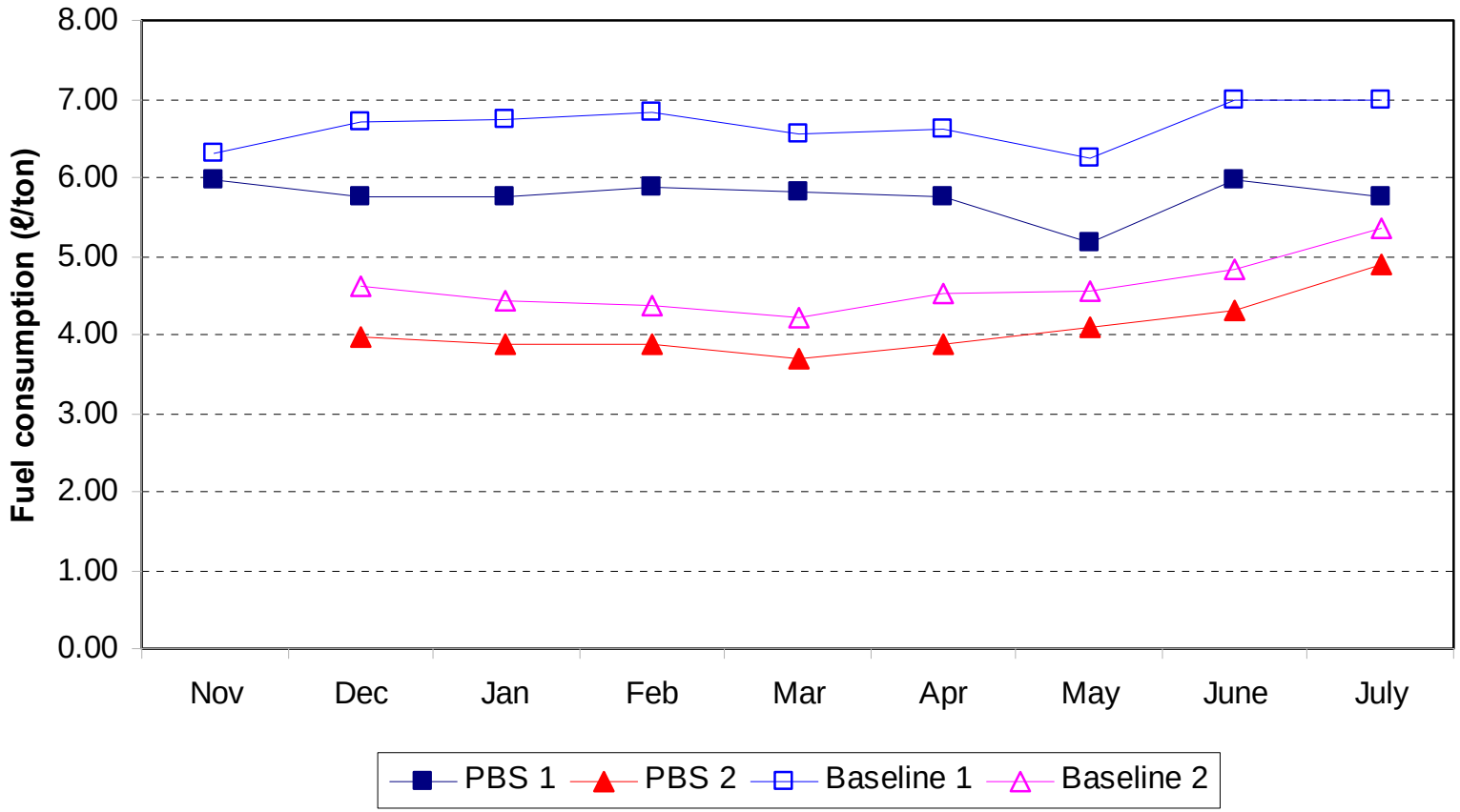
Fuel Usage Comparisons



Fuel Consumption



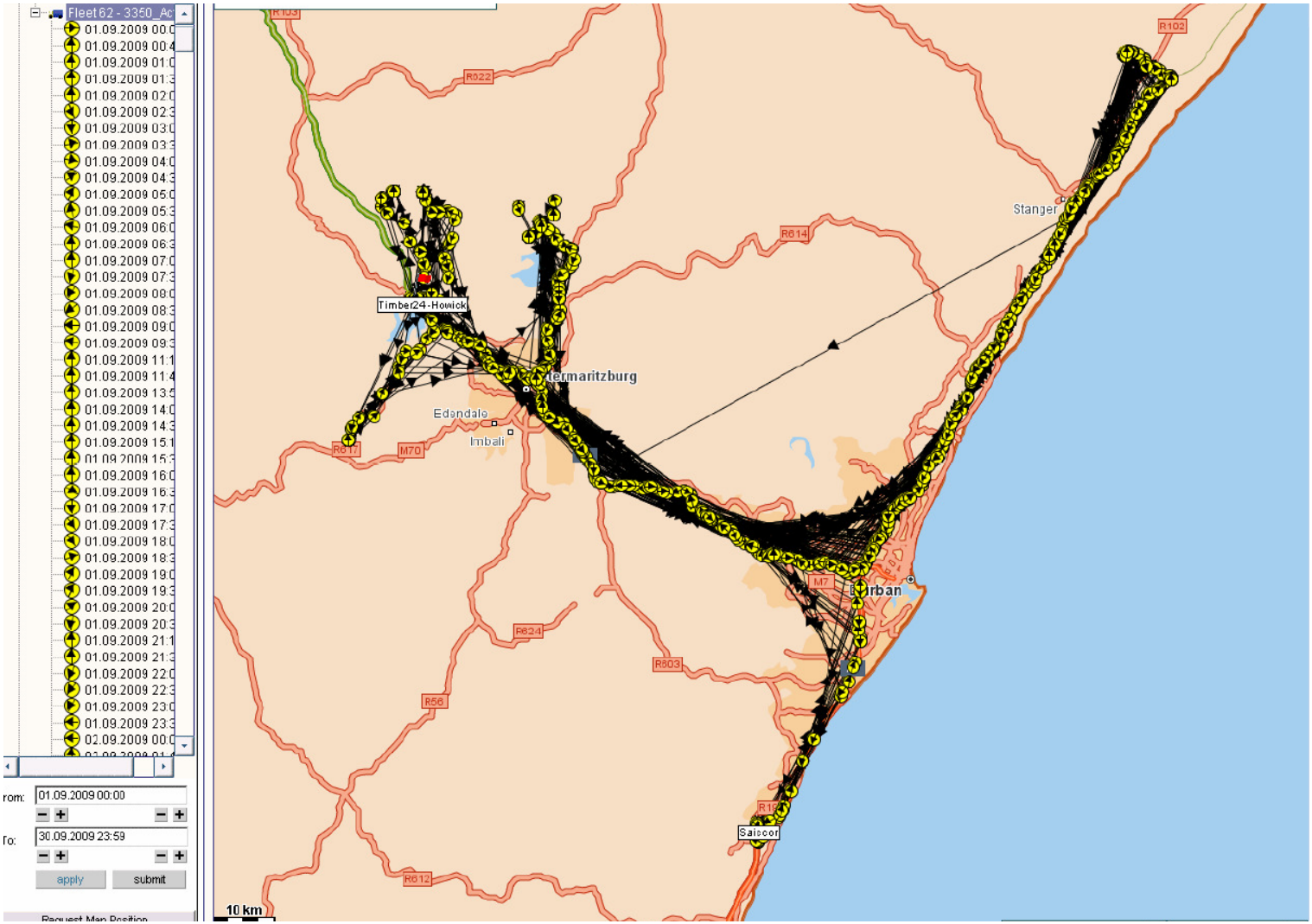
Fuel Efficiency



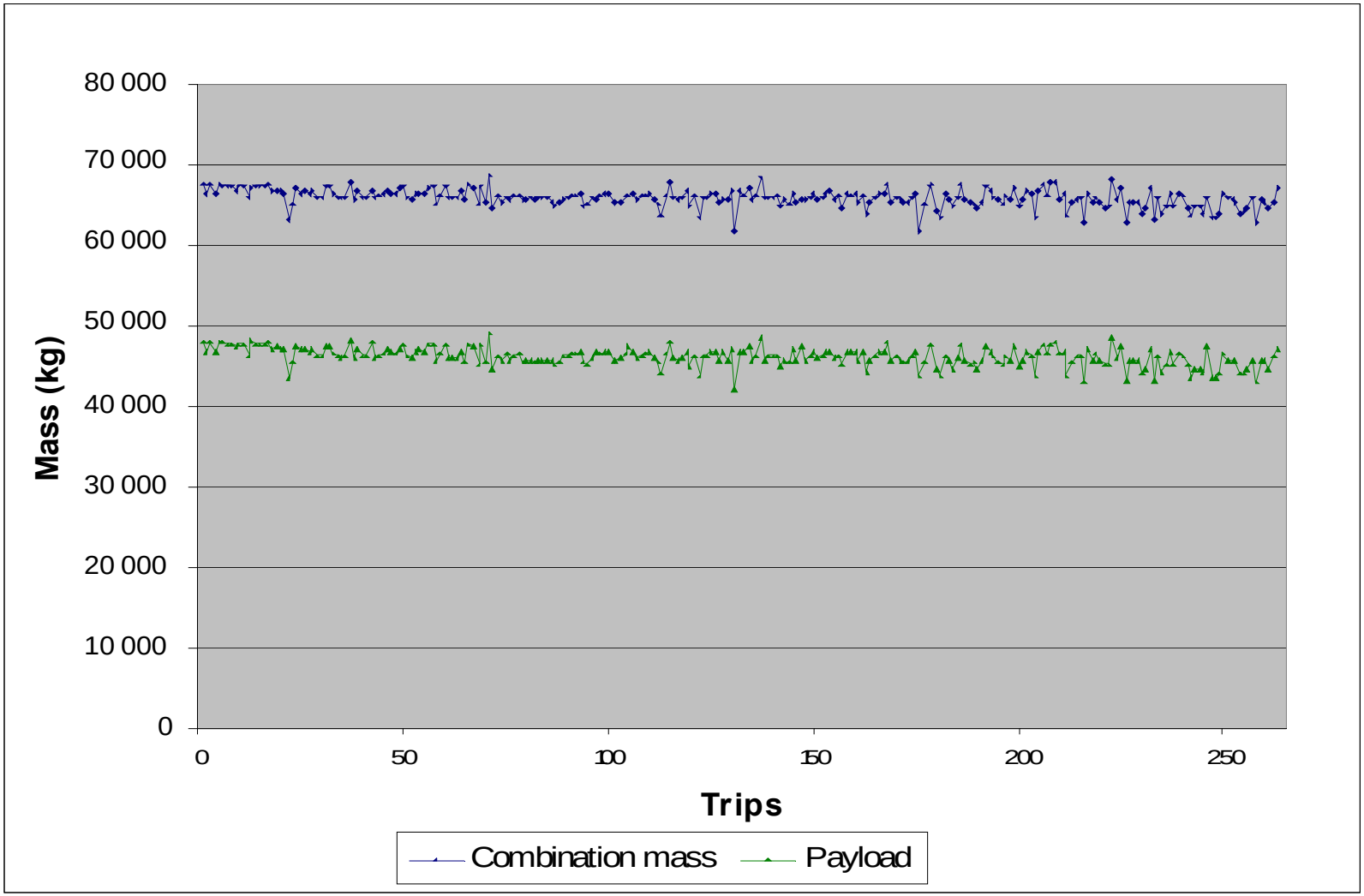
Parameters to Monitor

- Routes travelled
- Distance travelled per month and lead distance per trip
- Combination mass and payload
- Average speeds (loaded & unloaded)
- Trip duration
- Fuel consumption & efficiency
- Incidents/accidents, Breakdowns
- Tyre life and costs
- Life cycle of foundation brakes, Suspension life
- Community reaction

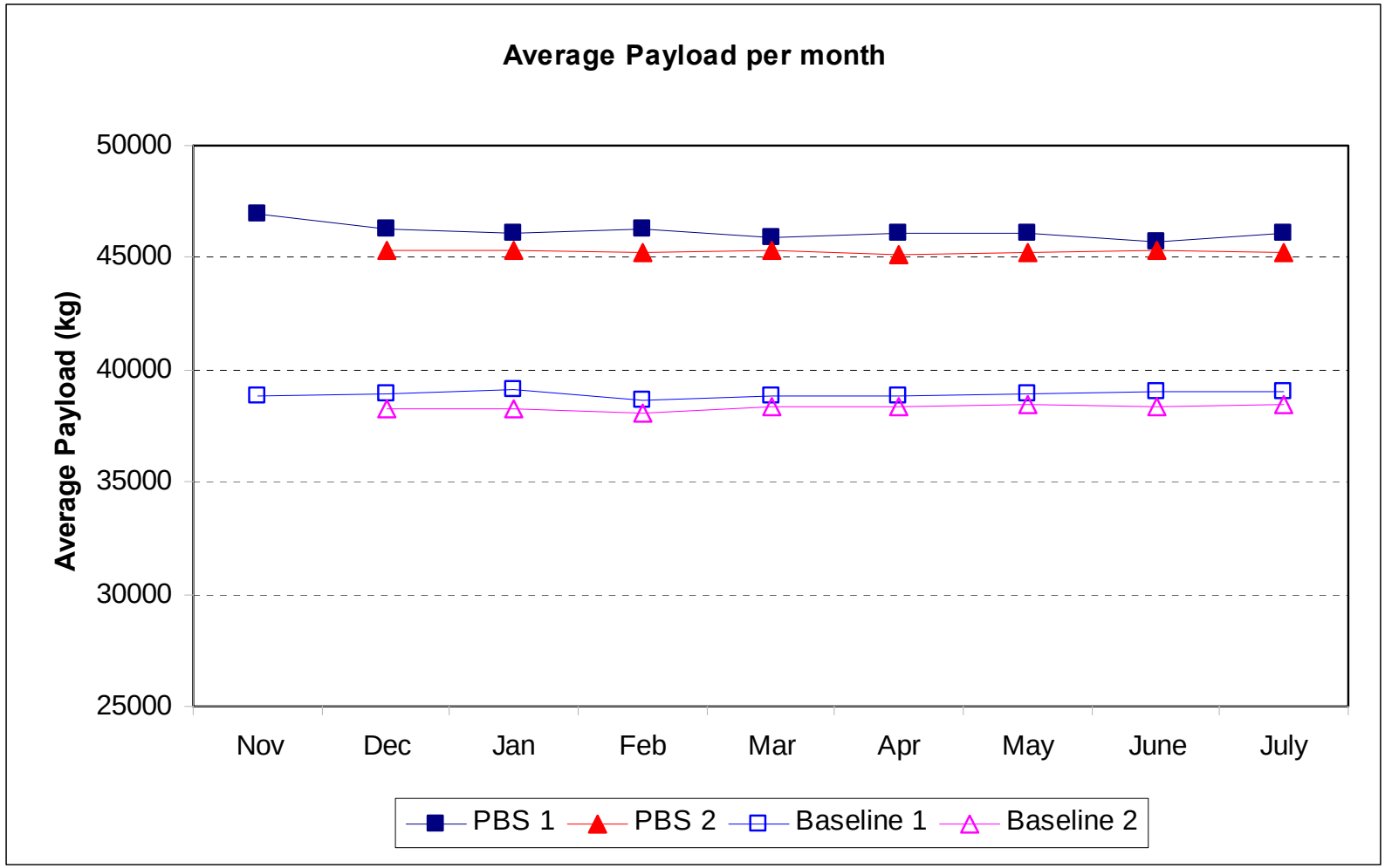
Route Monitoring



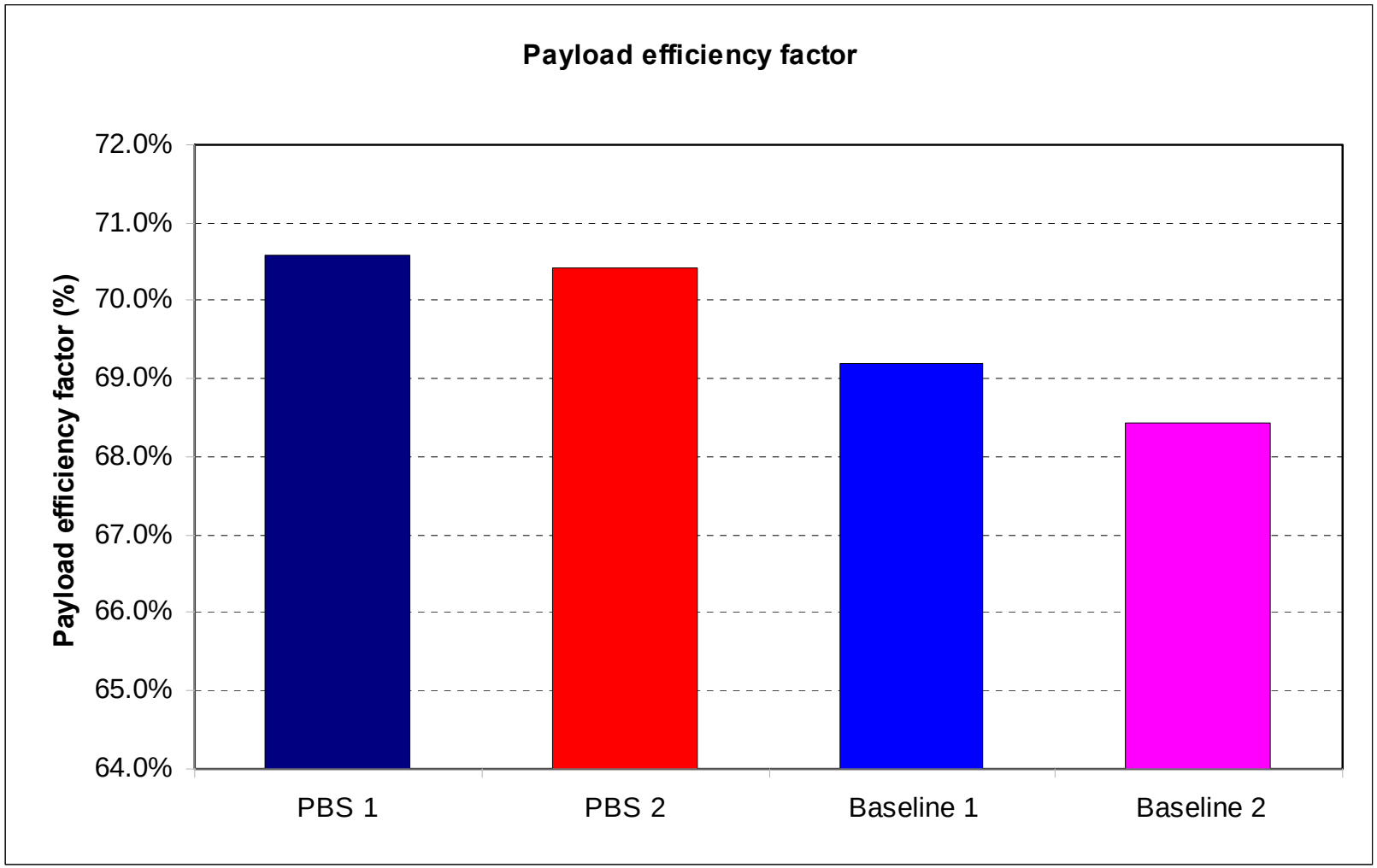
Payload and Combination Mass per trip



Average Payload



Payload Efficiency Factor (PEF)



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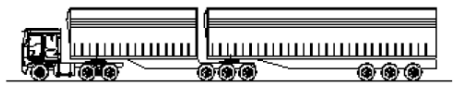
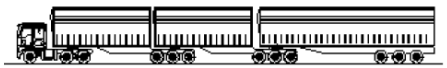
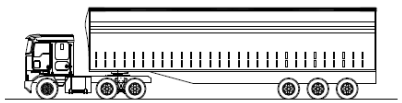
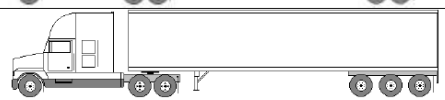
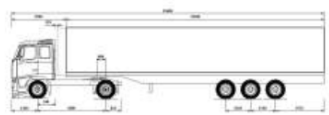
LIST OF TRUCKS PROPOSED BY MEMBERS OF THE WORKING GROUP

Country	Description	Axle	lenght	Max weight	
Australia 1	Australian B Double Tractor + 2 trailers	9	26	68	
Australia 2	Australian B-Triple Tractor + 3 trailers	12	35 or 36.5	90.5	
Australia 3	Australian semi trailer	6	19	45.5	
Belgium 1 (same as Germany 1? And Denmark 1)	Tractor + trailer	5	15.5 – 16.5 m	44 t in Belgiuù 40 t in EU	
Belgium 2 (same as France 1 ?)	Tractor + trailer	4	15.5 – 16.5 m	39 t in Belgiu m 38 t in EU	
Belgium 3 (same as Denmark 5)	Tractor + 2 trailers	8	25.25	60 t	
Canada 1	Tractor + trailer	5	23 (max)	39.5	
Canada 2	Tractor + Trailer	6	23 (max)	46.5	
Canada 3	Tractor + 2 trailers	8	25 (max)	62.5	
Canada 4	Tractor +2 trailers	8 or 9	40 to 42 m	62.5	
Denmark 1	Tractor + trailer,	5	16.5	40	

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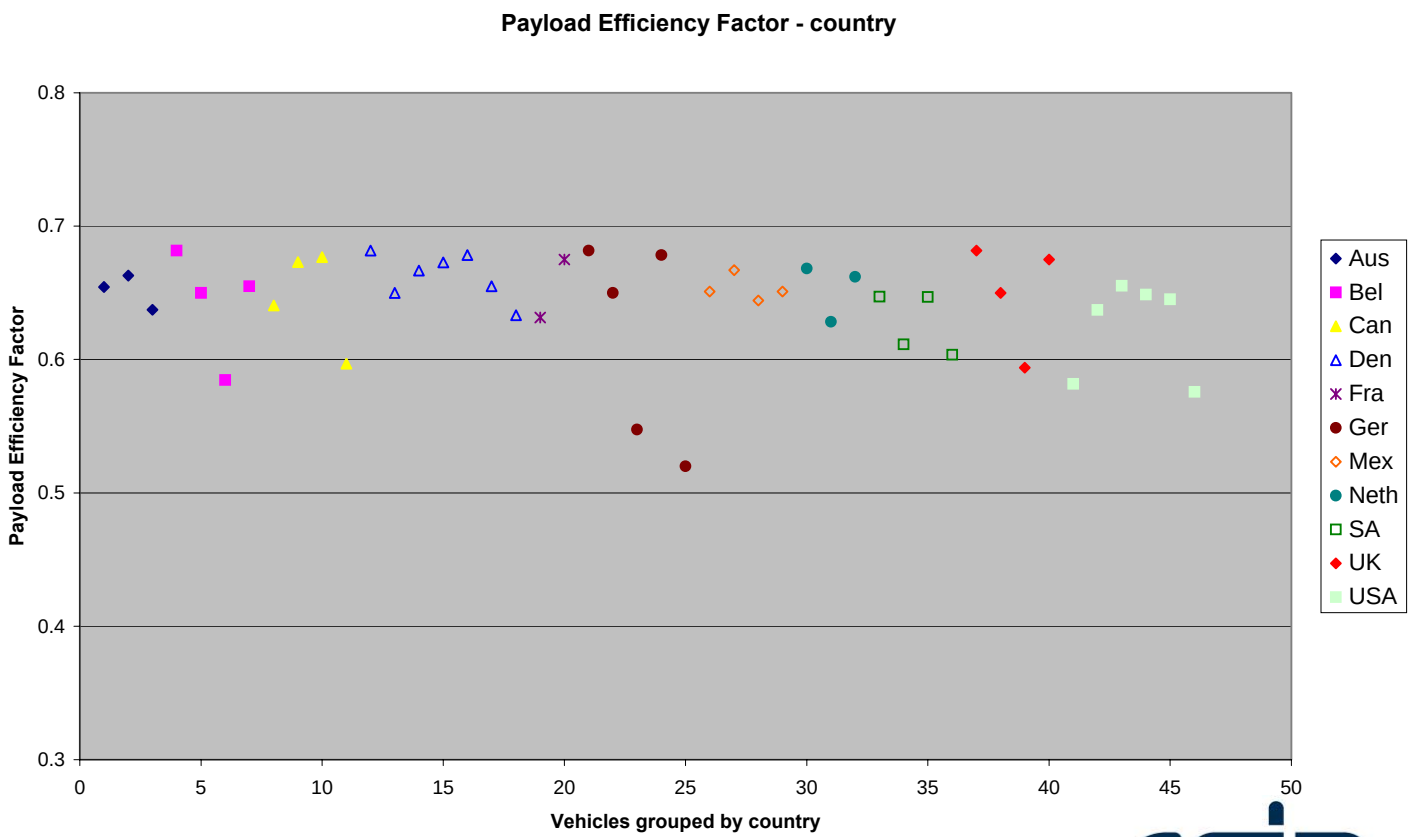

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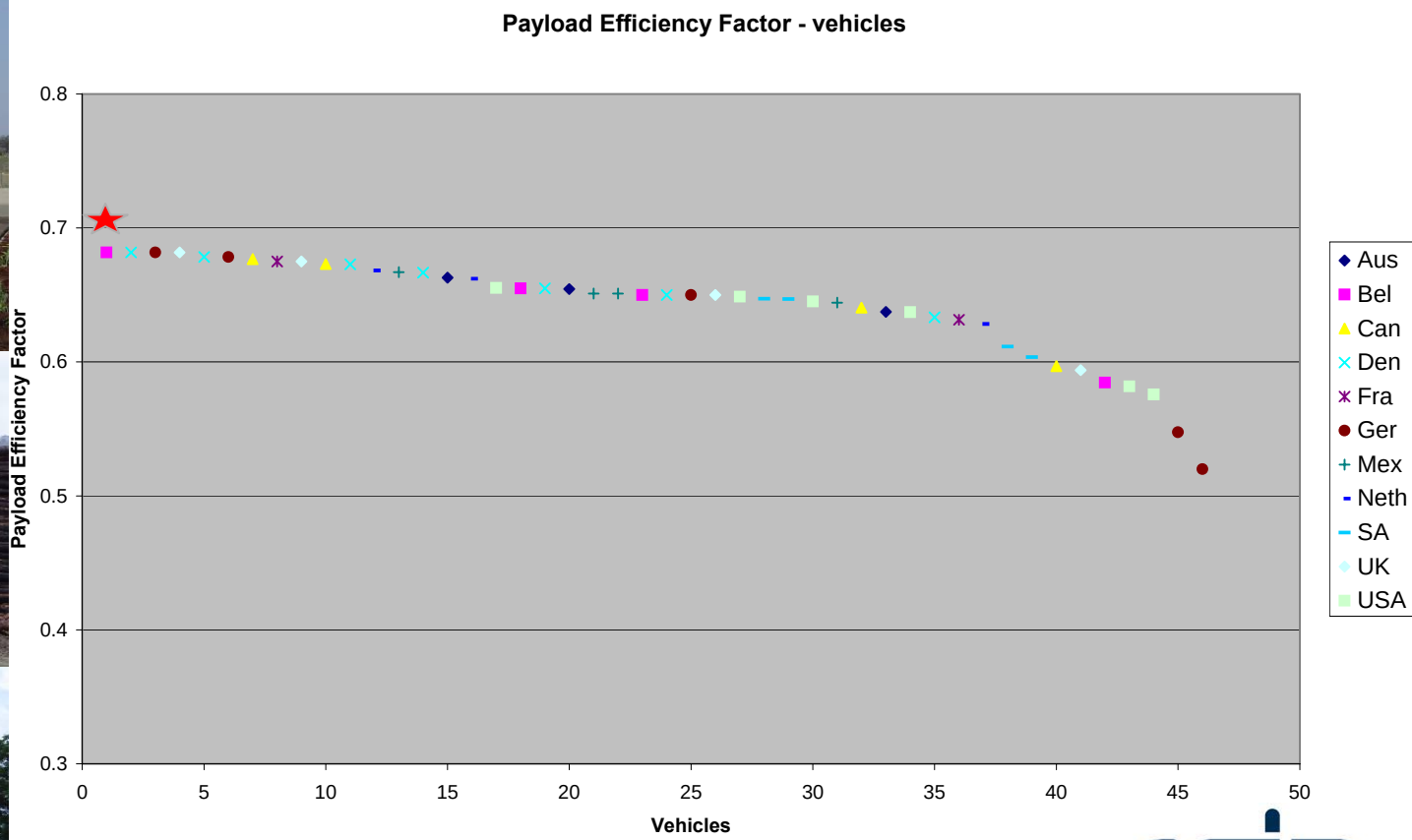

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Comparison of Baseline and PBS vehicles on Road Wear: Input data

Pavement A: ES100

	Poisson's Ratio	Elastic Moduli (MPa)		
		Phase I	Phase II	Phase III
50 AG*	0.44	2000	2000	1500
150 G1*	0.35	450	450	350
150 C3*	0.35	2000	2000	500
150 C3	0.35	1500	550	250
SUBGRADE	0.35	180	180	180

Pavement B: ES100

	Poisson's Ratio	Elastic Moduli (MPa)		
		Phase I	Phase II	Phase III
50 AG*	0.44	2000	1800	1500
150 G1*	0.35	250	250	240
150 C3*	0.35	2000	1700	160
150 C3	0.35	1500	120	110
SUBGRADE	0.35	90	90	90

Pavement C: ES0.1

	Poisson's Ratio	Elastic Moduli (MPa)	
		Phase I	Phase II
S*	0.44	1000	1000
100 G4*	0.35	300	225
125 C4*	0.35	1000	200
SUBGRADE	0.35	140	140
-	-	-	-

Pavement D: ES0.1

	Poisson's Ratio	Elastic Moduli (MPa)	
		Phase I	Phase II
S*	0.44	1000	1000
100 G4*	0.35	200	180
125 C4*	0.35	1000	120
SUBGRADE	0.35	70	70
-	-	-	-

Pavement E: ES30/ES50

	Poisson's Ratio	Elastic Moduli (MPa)		
		Phase I	Phase II	Phase III
40 AG*	0.44	2500	2500	1600
120 BC*	0.44	3500	3500	1500
450 C3*	0.35	2200	1000	300
200 G7*	0.35	300	300	200
SUBGRADE	0.35	150	150	140

Pavement F: ES1.0

	Poisson's Ratio	Elastic Moduli (MPa)	
		Phase I	Phase II
S*	0.44	2000	1600
80 BC*	0.44	2000	1600
150 C4*	0.35	1000	300
SUBGRADE	0.35	140	140
-	-	-	-

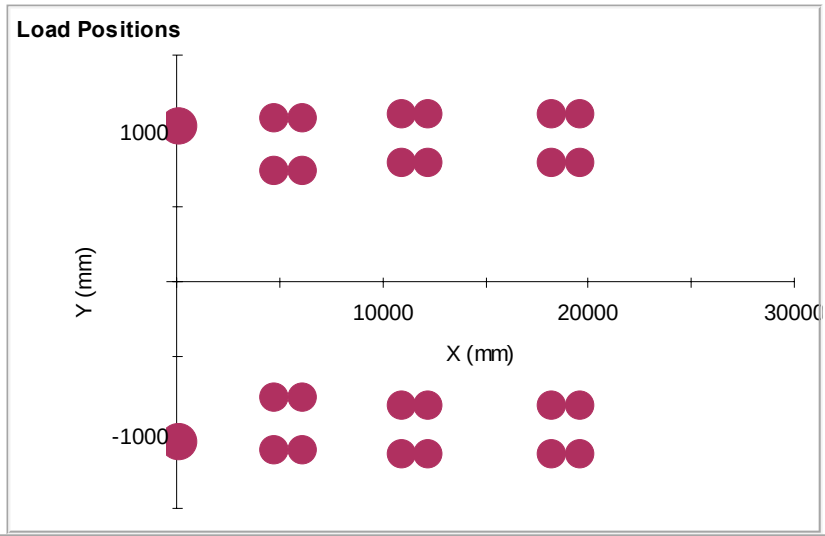
Pavement G: ES10

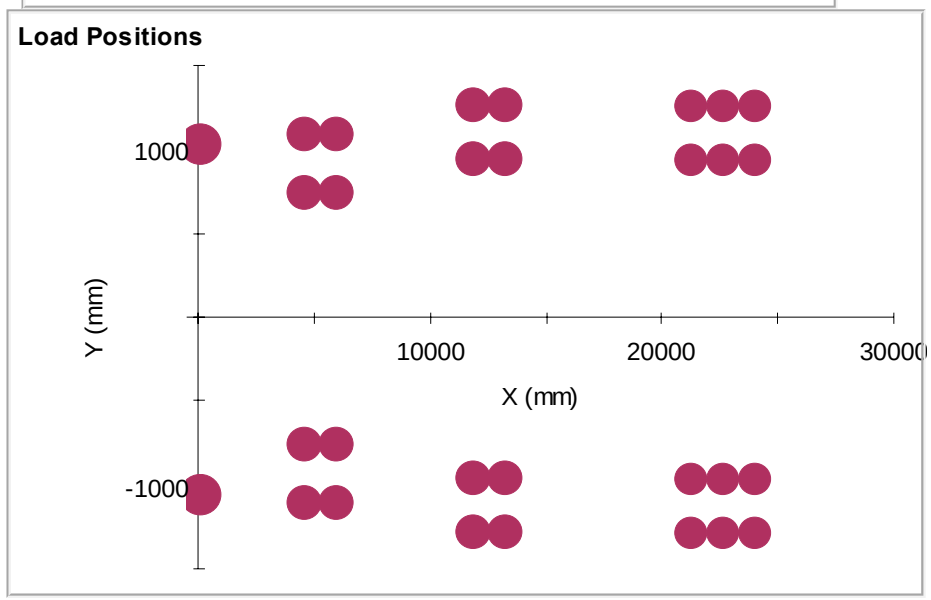
	Poisson's Ratio	Elastic Moduli (MPa)		
		Phase I	Phase II	Phase III
30 AG*	0.44	2400	2000	1600
150 C3*	0.35	2000	1800	250
300 C4*	0.35	1000	300	100
SUBGRADE	0.35	180	140	100
-	-	-	-	-

Pavement H: ES0.3

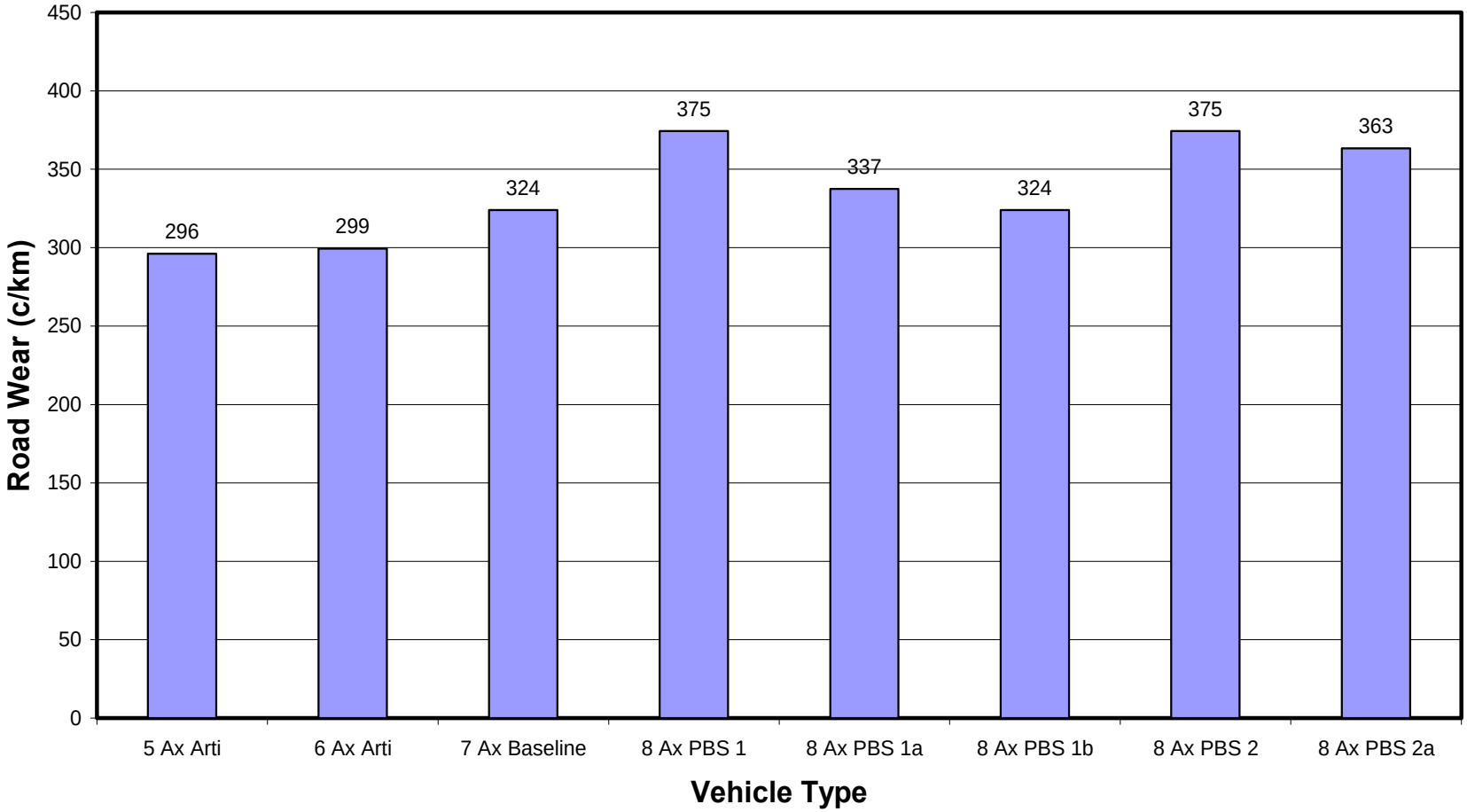
	Poisson's Ratio	Elastic Moduli (MPa)		
		Phase I	Phase II	Phase III
S1*	0.44	2000	1000	200
100 C4*	0.35	2000	1500	100
100 C4*	0.35	1000	300	100
SUBGRADE	0.35	140	140	100
-	-	-	-	-

* Classification according to TRH 14 (CSRA, 1985)

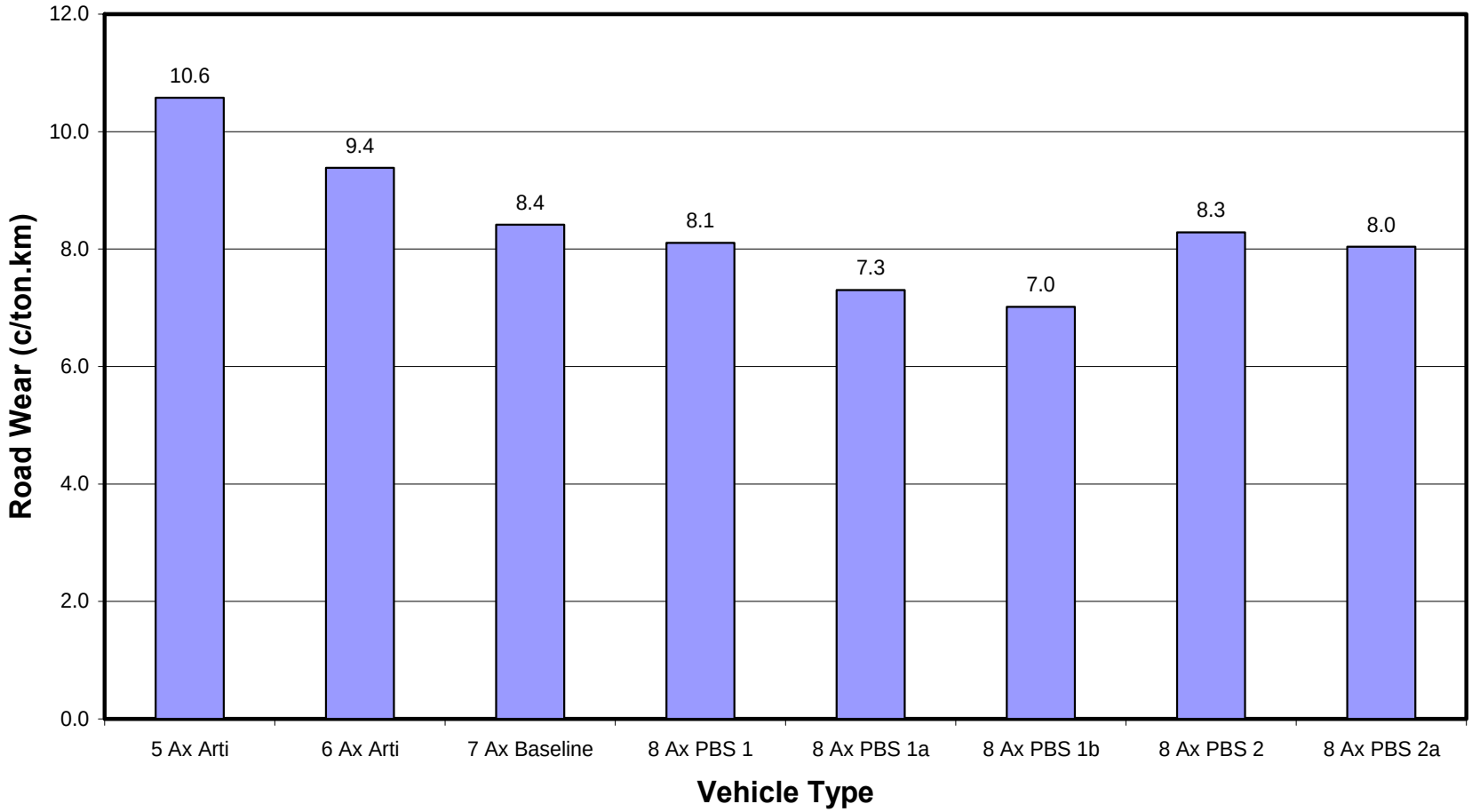




Road Wear Effects



Road Wear Effects



Summary of Performance Outcomes

Two vehicles, 8 months operation

Performance indicator	Measured result
Payload	Average improvement: 19.3 %
Payload Efficiency Factor	Increase from 69.3 % to 70.5 %
Tons transported per month	Average increase: 19.3 %
Fuel consumption	Average savings: 12.7 %
Fuel savings (based on 700 000 tons/annum contract)	485 000 litres per annum
Fleet size	Reduction of 17 %
Incident/accidents*	Reduction from 3.1 to 1.1 per month
CO_2 emissions (based on 700 000 tons/annum contract)	Reduction of 1 280 tons of CO_2 per annum
Road wear	Reduction varies from 2 to 23 %

* Based on a fleet of 45 new vehicle combinations incorporating a number of PBS design features

Way Forward

- KZN DoT approved 30 additional permits in Feb 2009
- 15 additional PBS vehicles commissioned by Dec 2009
- Others are in the design phase
- Other PBS demonstration projects in the concept/ design phase:
  - General freight (vehicle parts)
  - Mining
  - Steel pipes
  - Sugar
  - Car carriers
- Route classification
- Manage negative publicity from rail lobbyists and others

OECD Project: Moving Freight with Better Trucks

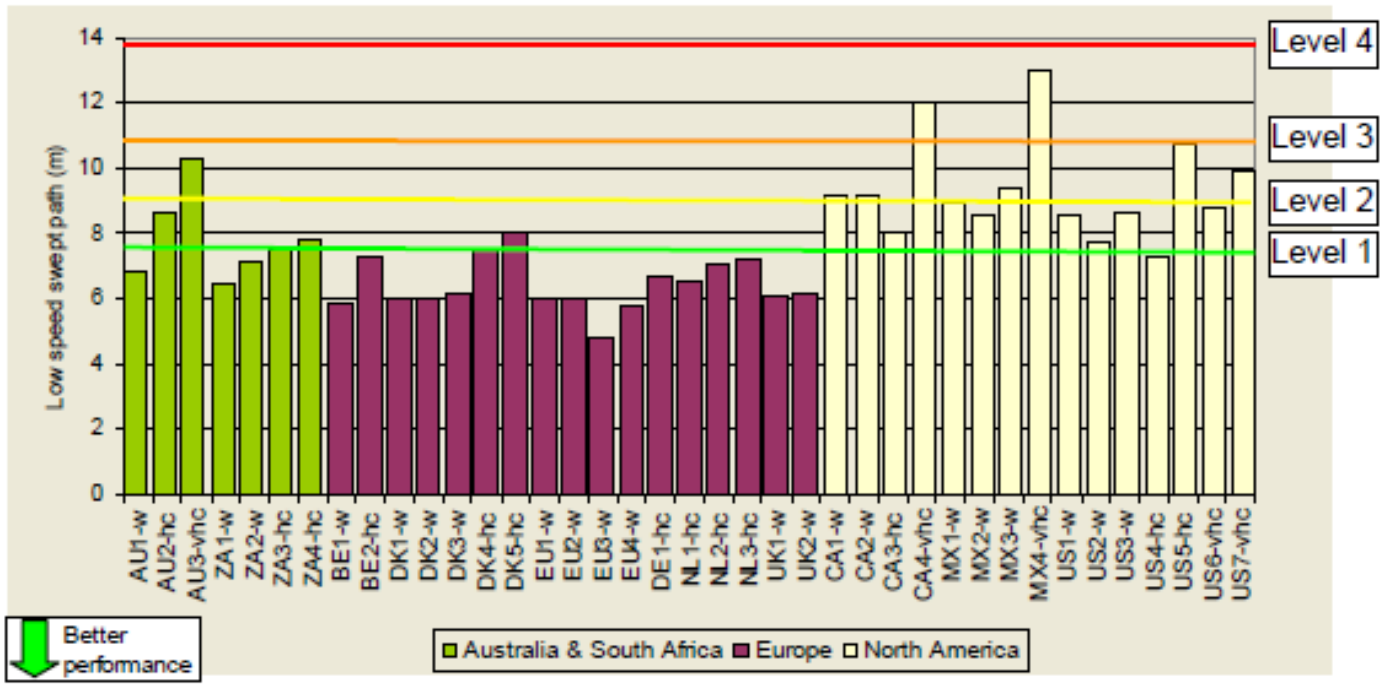


Figure 21: Low speed swept path performance by region

OECD Project: Moving Freight with Better Trucks

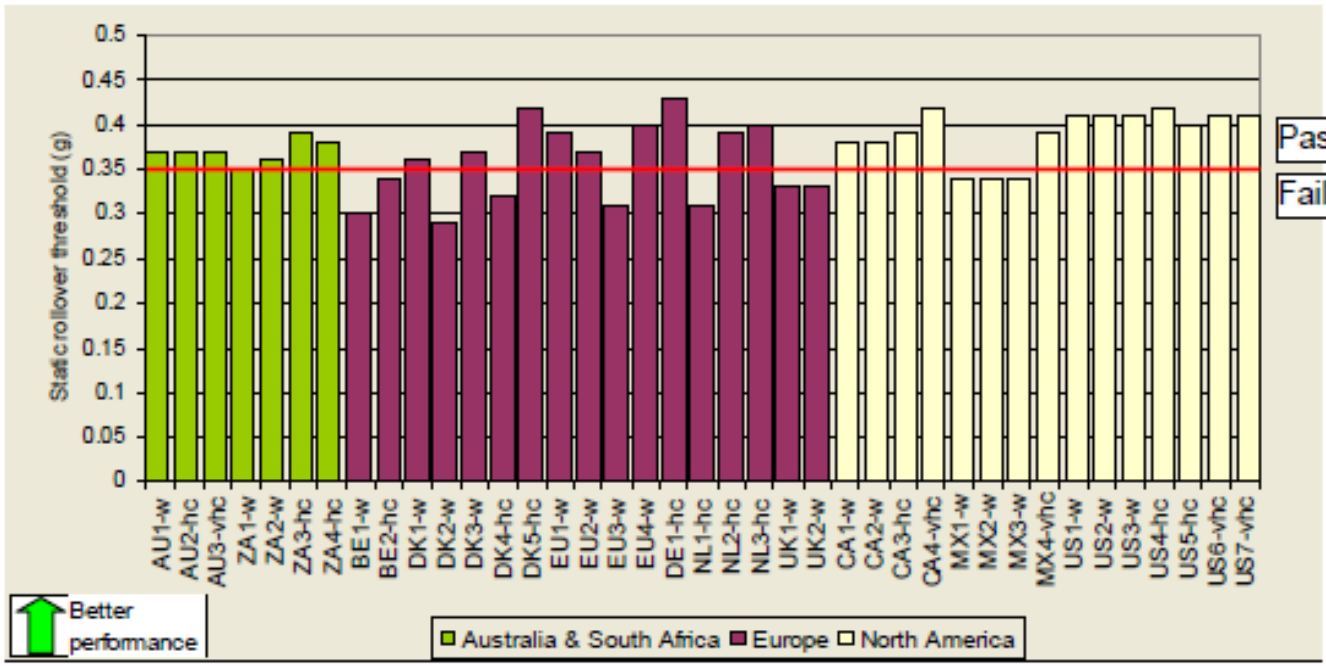


Figure 24: Static rollover threshold performance by region

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Thank you for your attention