Transport Technology & Productivity 2015

Performance-Based Standards in South Africa: Access and asset management systems to manage PBS vehicles

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Principal Researcher
CSIR Built Environment

Access and asset management systems to manage PBS vehicles

- Background and problem statement
- Road Infrastructure
- Structures
- Route assessments
- Road Transport Management System accreditation scheme
- Conclusions

Africa is big....

The True Size of Africa

A small contribution in the fight against rampant *Immappancy*, by **Kai Krause**

Graphic layout for visualization only (some countries are cut and rotated)
But the conclusions are very accurate: refer to table below for exact data

COUNTRY	AREA x 1000 km²
China	9.597
USA	9.629
India	3.287
Mexico	1.964
Peru	1.285
France	633
Spain	506
Papua New Guinea	462
Sweden	441
Japan	378
Germany	357
Norway	324
Italy	301
New Zealand	270
United Kingdom	243
Nepal	147
Bangladesh	144
Greece	132
TOTAL	**30.102**
AFRICA	**30.221**

In addition to the well known social issues of *illiteracy* and *innumeracy*, there also should be such a concept as "*immappancy*", meaning *insufficient geographical knowledge*.

A survey with random American schoolkids let them guess the population and land area of their country. Not entirely unexpected, but still rather unsettling, the majority chose *"1-2 billion"* and *"largest in the world"*, respectively.

Even with Asian and European college students, geographical estimates were often off by factors of *2-3*. This is partly due to the highly distorted nature of the predominantly used mapping projections (such as *Mercator*).

A particularly extreme example is the worldwide misjudgement of the true size of *Africa*. This single image tries to embody the massive scale, which is larger than the *USA, China, India, Japan* and *all of Europe..... combined!*

Top 100 Countries

Area in square kilometers, Percentage of World Total
Sources: Britannica, Wikipedia, Almanac 2010

		AREA km²	%
1	Russia	17.098.242	11,50
2	Canada	9.984.670	6,70
3	China	9.596.961	6,40
4	United States	9.629.091	6,40
5	Brazil	8.514.877	5,70
6	Australia	7.692.024	5,20
7	India	3.287.263	2,30
8	Argentina	2.780.400	2,00
9	Kazakhstan	2.724.900	1,80
10	Sudan	2.505.813	1,70
11	Algeria	2.381.741	1,60
12	Congo	2.344.858	1,60
13	Greenland	2.166.086	1,50
14	Saudi Arabia	2.149.690	1,40
15	Mexico	1.964.375	1,30
16	Indonesia	1.860.360	1,30
17	Libya	1.759.540	1,20
18	Iran	1.628.750	1,10
19	Mongolia	1.564.100	1,10
20	Peru	1.285.216	0,86
21	Chad	1.284.000	0,86
22	Niger	1.267.000	0,85
23	Angola	1.246.700	0,85
24	Mali	1.240.192	0,83
25	South Africa	1.221.037	0,82
26	Colombia	1.141.748	0,76
27	Ethiopia	1.104.300	0,74
28	Bolivia	1.098.581	0,74
29	Mauritania	1.025.520	0,69
30	Egypt	1.002.000	0,67
31	Tanzania	945.087	0,63
32	Nigeria	923.768	0,62
33	Venezuela	912.050	0,61
34	Namibia	824.116	0,55
35	Mozambique	801.590	0,54
36	Pakistan	796.095	0,53
37	Turkey	783.562	0,53
38	Chile	756.102	0,51
39	Zambia	752.612	0,51
40	Myanmar	676.578	0,45
41	Afghanistan	652.090	0,44
42	Somalia	637.657	0,43
43	France	632.834	0,43
44	C. African Rep	622.984	0,42
45	Ukraine	603.500	0,41
46	Madagascar	587.041	0,39
47	Botswana	582.000	0,39
48	Kenya	580.367	0,39
49	Yemen	527.968	0,35
50	Thailand	513.120	0,34
51	Spain	505.992	0,34
52	Turkmenistan	488.100	0,33
53	Cameroon	475.442	0,32
54	Papua New Guinea	462.840	0,31
55	Uzbekistan	447.400	0,30
56	Morocco	446.550	0,30
57	Sweden	441.370	0,30
58	Iraq	438.317	0,29
59	Paraguay	406.752	0,27
60	Zimbabwe	390.757	0,26
61	Japan	377.930	0,25
62	Germany	357.114	0,24
63	Rep o.t. Congo	342.000	0,23
64	Finland	338.419	0,23
65	Vietnam	331.212	0,22
66	Malaysia	330.803	0,22
67	Norway	323.802	0,22
68	Côte d'Ivoire	322.463	0,22
69	Poland	312.685	0,21
70	Oman	309.500	0,21
71	Italy	301.336	0,20
72	Philippines	300.000	0,20
73	Burkina Faso	274.222	0,18
74	New Zealand	270.467	0,18
75	Gabon	267.668	0,18
76	Western Sahara	266.000	0,18
77	Ecuador	256.369	0,20
78	Guinea	245.857	0,17
79	United Kingdom	242.900	0,16
80	Uganda	241.038	0,16
81	Ghana	238.539	0,16
82	Romania	238.391	0,16
83	Laos	236.800	0,16
84	Guyana	214.969	0,14
85	Belarus	207.600	0,14
86	Kyrgyzstan	199.951	0,13
87	Senegal	196.722	0,13
88	Syria	185.180	0,12
89	Cambodia	181.035	0,12
90	Uruguay	176.215	0,12
91	Suriname	163.820	0,11
92	Tunisia	163.610	0,11
93	Nepal	147.181	0,10
94	Bangladesh	143.998	0,10
95	Tajikistan	143.100	0,10
96	Greece	131.957	0,09
97	Nicaragua	130.373	0,09
98	North Korea	120.538	0,08
99	Malawi	118.484	0,08
100	Eritrea	117.600	0,08
	TOP 100 TOTAL	132.632.524	89,34


United States


Europe


India


Japan


China

CSIR
our future through science

Africa is different….

Africa is different….

PBS in Africa ??? ….

New technology not always appropriate in Africa ….

our future through science

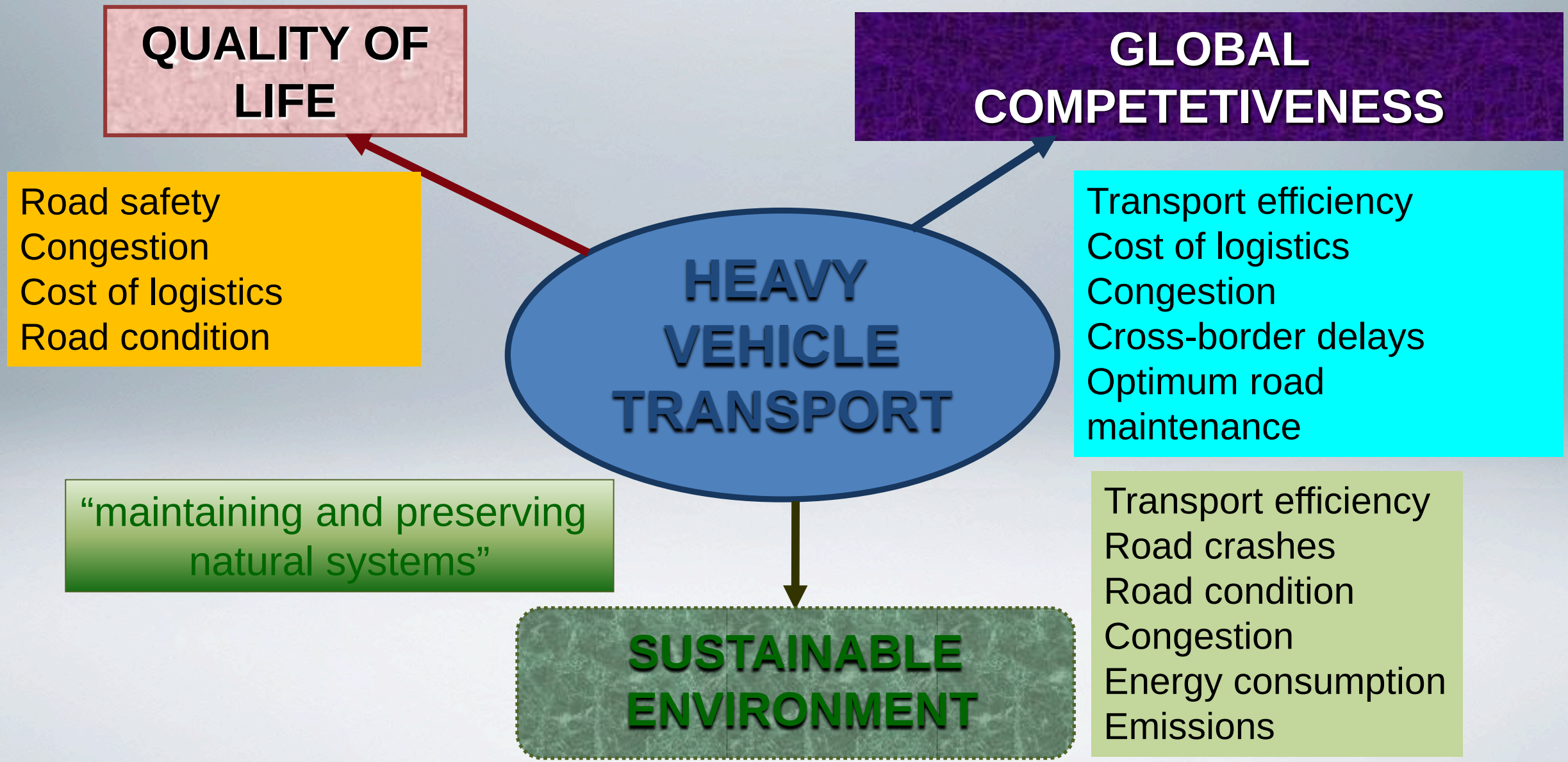
Road Freight Challenges: an African Perspective

- Inputs
  - Overloading
  - Vehicle fitness (servicing & maintenance)
  - Driver fitness (fatigue, health, training)
  - Driver behaviour
  - Border post delays
  - Bribery & corruption – impact on compliant and non-compliant operators
  - Inadequate periodic maintenance (roads)
- Outputs
  - Poor road safety
  - High cost of road transport/logistics
  - Deterioration of infrastructure
  - High levels of emissions

The Culture of Non-compliance

- Overloading
- Speeding
- Vehicle maintenance (brakes, tyres, lights)
- Driver hours
- Reckless driving
- False licenses (vehicles & drivers)
- Load securement
- Bribery & corruption

Regional Road Transport Issues



Key Elements in Road Freight Transport

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

Excess heavy vehicle maintenance and repair costs

Road condition	Average maintenance and repair cost (R/km)	Average percentage increase in the truck maintenance and repair cost	Average percentage increase in company logistics cost
Good	R 0.96	-	-
Fair	R 1.24	30%	2.6%
Bad	R 2.11	121%	10.4%

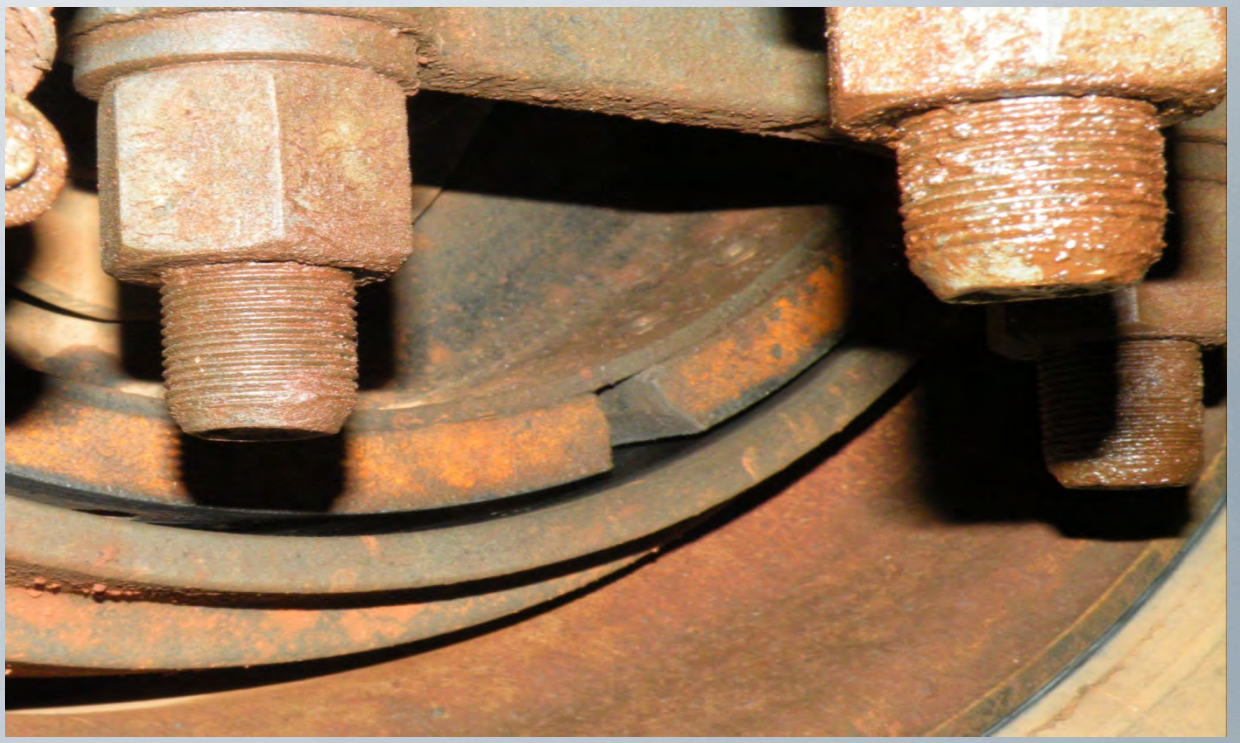
Brake & Tyre Watch Results

Location	Inspected	Discontinued	%
City Deep	24	21	88%
Middelburg	35	24	69%
Centurion	41	17	42%
Midway KZN	26	10	38%
Kroonstad	8	7	92%
Brackenfell, W. Cape	25	25	100%
Pietermaritzburg	12	11	92%
Port Elizabeth	15	6	40%
Rustenburg	7	5	72%
Polokwane	11	10	91%
Midway KZN	24	20	83%
Bloemfontein	24	20	83%
Nelspruit/Komati	13	12	92%
TOTAL (27 events)	**594**	**397**	**67%**

27 B&TW events from Feb. 2006 to date

A FleetWatch Initiative

Brake & Tyre Watch



A FleetWatch Initiative

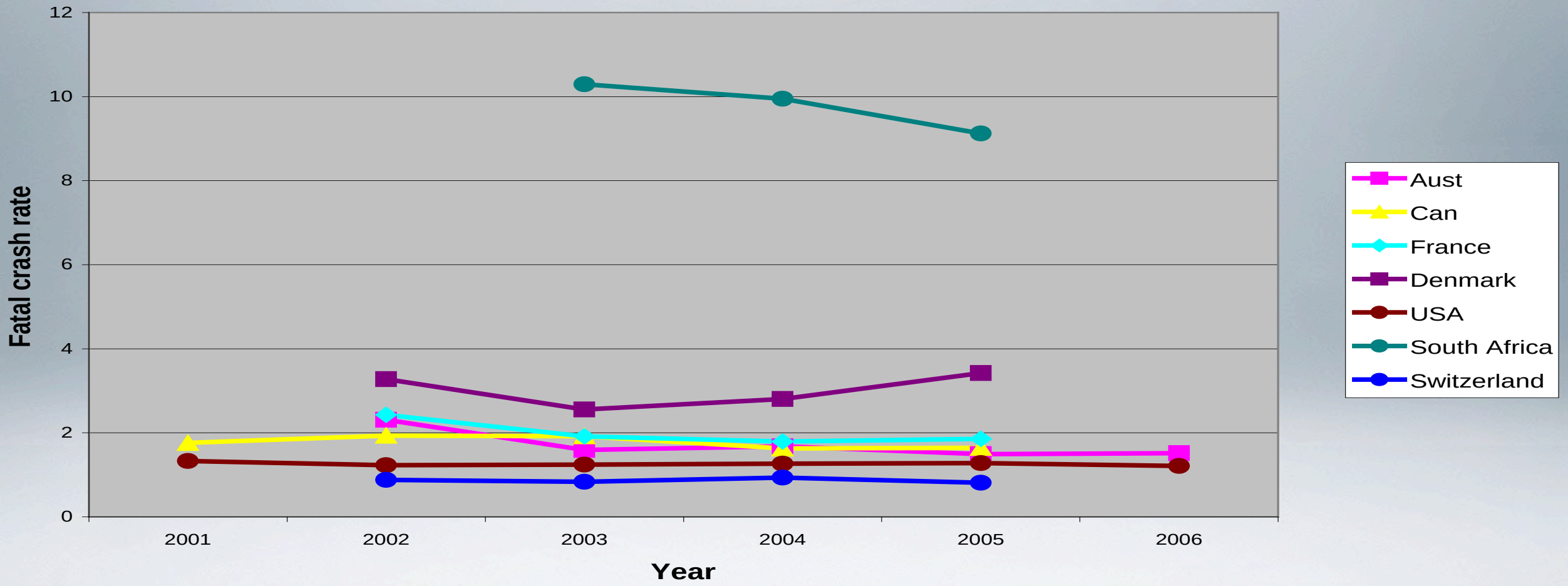
Brake & Tyre Watch

A FleetWatch Initiative

Brake & Tyre Watch


POLICE

Heavy Vehicle Fatal Crash Rates



Fatal truck crash per 100 million vehicle kilometres travelled

Source: OECD report, Moving Freight with Better Trucks, 2010

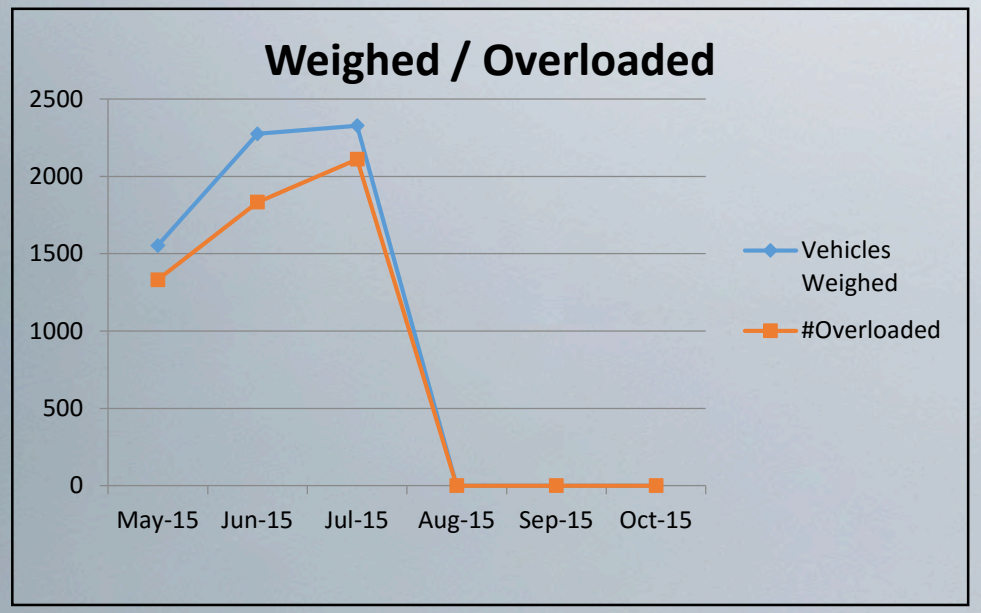
North West Province, South Africa, 5 Nov 2004, 23h00

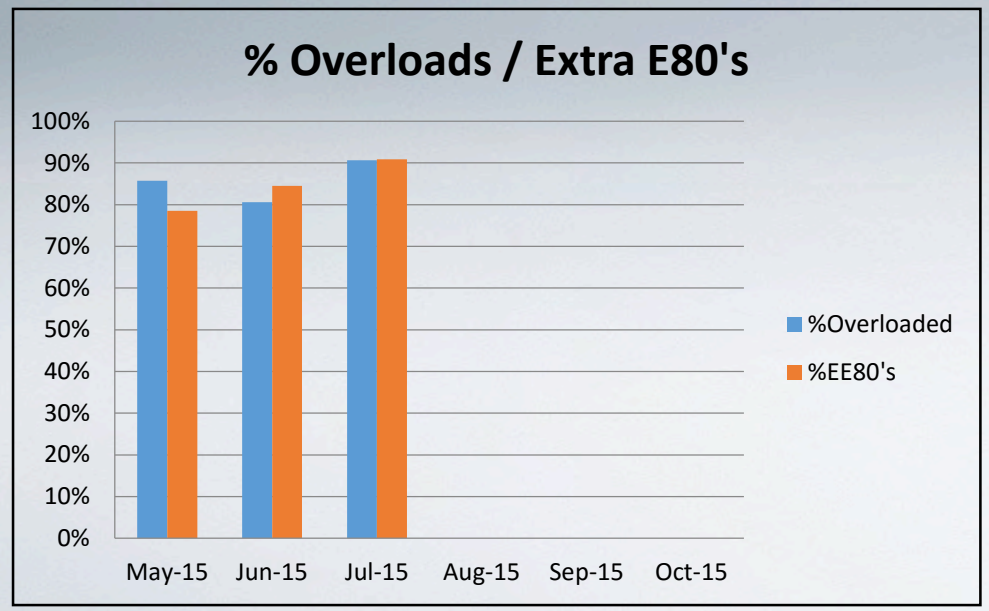
Six trucks carrying cobalt concentrate from DRC to Johannesburg (3 500 km). Overloads ranged from 30 780kg to 37 640kg (65%)


F685


SCANIA

Overloading in Mozambique





	Max Axle O/L (t)	%	Max GVM O/L (t)	%
May-15	19.80	220%	44.92	134%
Jun-15	20.76	231%	44.96	130%
Jul-15	25.12	279%	52.91	125%
Aug-15				

Congo truck with a record overload of 115 tonnes held

BY NATION REPORTER

A trailer with a record weight of 171.3 tonnes was on Sunday night intercepted in Westlands, Nairobi.

The trailer was on its way to the Democratic Republic of Congo.

Kenya National Highways Authority Axle Load Control Manager Muita Ngatia said it was supposed to have a maximum gross weight of 54 tonnes, meaning it was overloaded by 115.3 tonnes.

54

The maximum gross weight of a seven-axle lorry. The one intercepted on Sunday was 171.3 tonnes

"These are almost four trucks in one," he said.

He said the trailer, which was carrying construction materials, plastic basins and other items has passed Mlolongo weighbridge with the required load.

After passing the weighbridge, it was driven to a nearby parking yard for more goods.

"Our officers and the police got the information and tracked it down to Westlands where we ordered it to return to Mlolongo," Mr Ngatia said.

SALATON NJAU | NATION

The Congolese registered truck intercepted by police and KeNHA officials on Sunday. It was overloaded by 115.3 tonnes .

He said arybody involved in the deal would be taken to court.

Mr Ngatia said many truck drivers were avoiding major weighbridges by using other routes.

which had also evaded the weigh bridge was intercepted at City Cabanas. It had exceeded the required weight by about 14 to[illegible]es.

"The legal maximum pavement damage factor for the

KeNHA/MTCE/ALC/F2

Kenya National Highways Authority

ORIGINAL

No. JJA 61819

WEIGHBRIDGE TICKET

Date: 23/2/15

VEHICLE REG. NO.	TYPE	OWNER	ADDRESS
	Benz	KAMBALE MUJIRA	CONGO 844 BUKAVU

TYPE OF CARGO	FROM	TO	TIME

CONFIGURATION	A1	A2	A3	A4	A5	A6	GVW
	14380	45920	60200	48000			171300

I certify that the vehicle whose particulars are entered above has been weighed and the readings are as shown

Date 22/2/2015

OFFICIAL STAMP

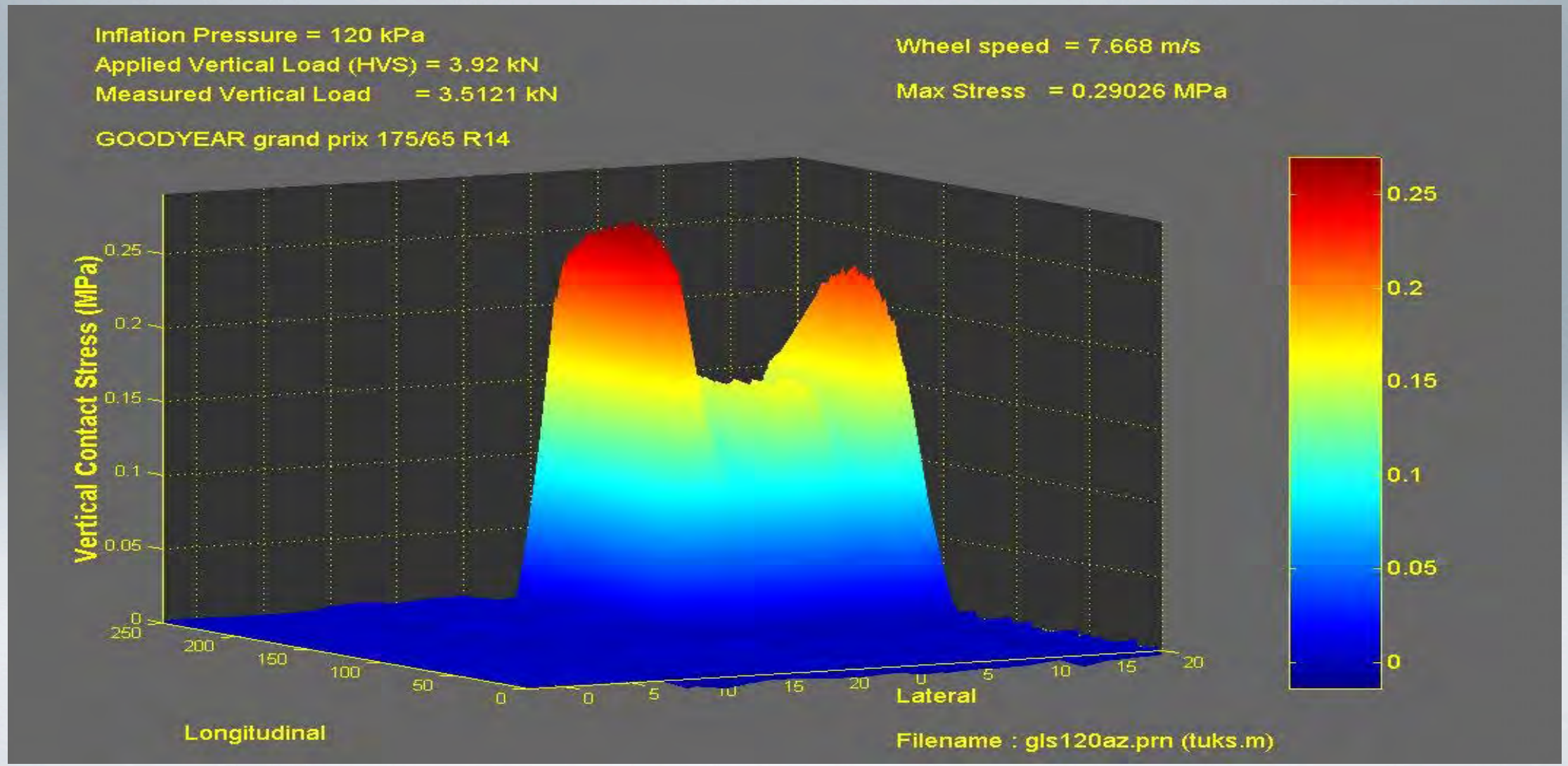
KENYA NATIONAL HIGHWAYS AUTHORITY
23 FEB 2015
MANAGER - ATH RIVER WEIGHBRIDGE STATION


Restaurant
& Takeaway
KAMEZA
LODGE
TUSE'S SALON
& BARBERSHOP
Carlsberg
Probably the best beer in the world
BD 2021

Road Wear Performance Standard

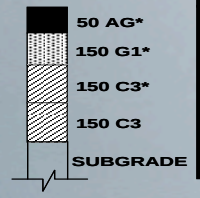
- Based on SA Mechanistic-Empirical Design & Analysis Methodology (SAMDM)
- Combines a stress-strain computational engine and pavement engineering models (developed at CSIR)
- Design outputs include each pavement layer’s life and stress/strain plots
- Layer life based on linear-log damage functions (“transfer functions”) – derived from Heavy Vehicle Simulator (APT) testing on pavement types since 1975
- “Load Equivalency Factors” are calculated for a whole vehicle

Road Wear


Inflation Pressure = 120 kPa
Applied Vertical Load (HVS) = 3.92 kN
Measured Vertical Load = 3.5121 kN
GOODYEAR grand prix 175/65 R14
Wheel speed = 7.668 m/s
Max Stress = 0.29026 MPa
Vertical Contact Stress (MPa)
0.25
0.2
0.15
0.1
0.05
0
250
200
150
100
50
0
Longitudinal
0
5
10
15
20
Lateral
0.25
0.2
0.15
0.1
0.05
0
Filename : gls120az.prn (tuks.m)

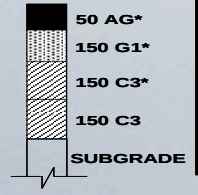
Road Wear Performance Standard

Pavement A: ES100



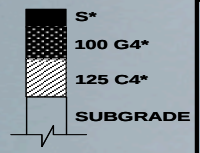
Poisson's Ratio	Elastic Moduli (MPa)		
	Phase I	Phase II	Phase III
0.44	2000	2000	1500
0.35	450	450	350
0.35	2000	2000	500
0.35	1500	550	250
0.35	180	180	180

Pavement B: ES100



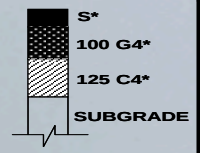
Poisson's Ratio	Elastic Moduli (MPa)		
	Phase I	Phase II	Phase III
0.44	2000	1800	1500
0.35	250	250	240
0.35	2000	1700	160
0.35	1500	120	110
0.35	90	90	90

Pavement C: ES0.1



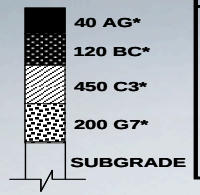
Poisson's Ratio	Elastic Moduli (MPa)	
	Phase I	Phase II
0.44	1000	1000
0.35	300	225
0.35	1000	200
0.35	140	140
-	-	-

Pavement D: ES0.1



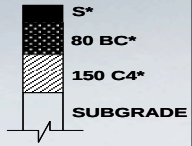
Poisson's Ratio	Elastic Moduli (MPa)	
	Phase I	Phase II
0.44	1000	1000
0.35	200	180
0.35	1000	120
0.35	70	70
-	-	-

Pavement E: ES30/ES50



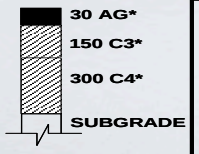
Poisson's Ratio	Elastic Moduli (MPa)		
	Phase I	Phase II	Phase III
0.44	2500	2500	1600
0.44	3500	3500	1500
0.35	2200	1000	300
0.35	300	300	200
0.35	150	150	140

Pavement F: ES1.0



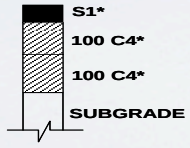
Poisson's Ratio	Elastic Moduli (MPa)	
	Phase I	Phase II
0.44	2000	1600
0.44	2000	1600
0.35	1000	300
0.35	140	140
-	-	-

Pavement G: ES10



Poisson's Ratio	Elastic Moduli (MPa)		
	Phase I	Phase II	Phase III
0.44	2400	2000	1600
0.35	2000	1800	250
0.35	1000	300	100
0.35	180	140	100
-	-	-	-

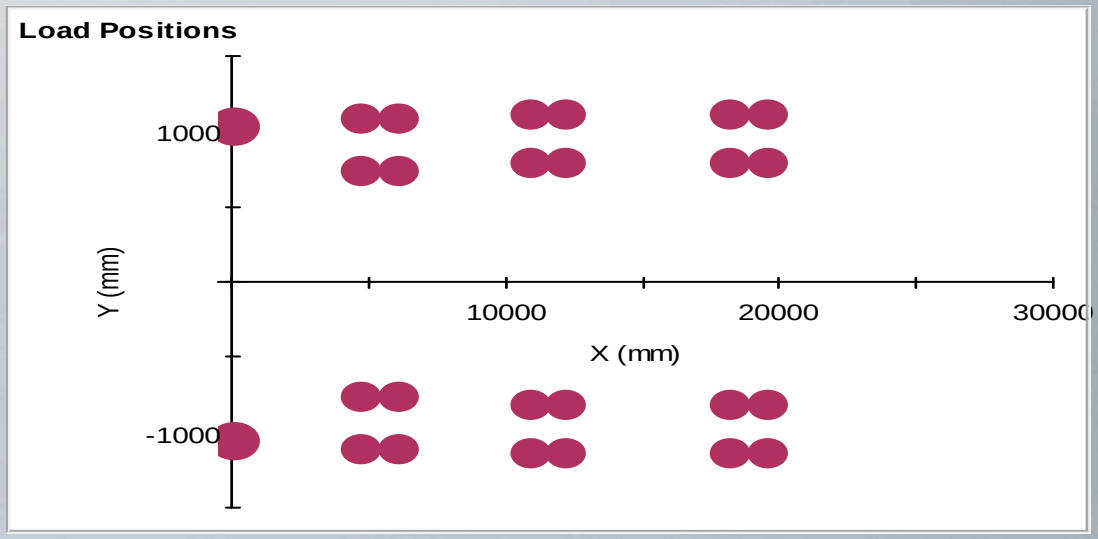
Pavement H: ES0.3

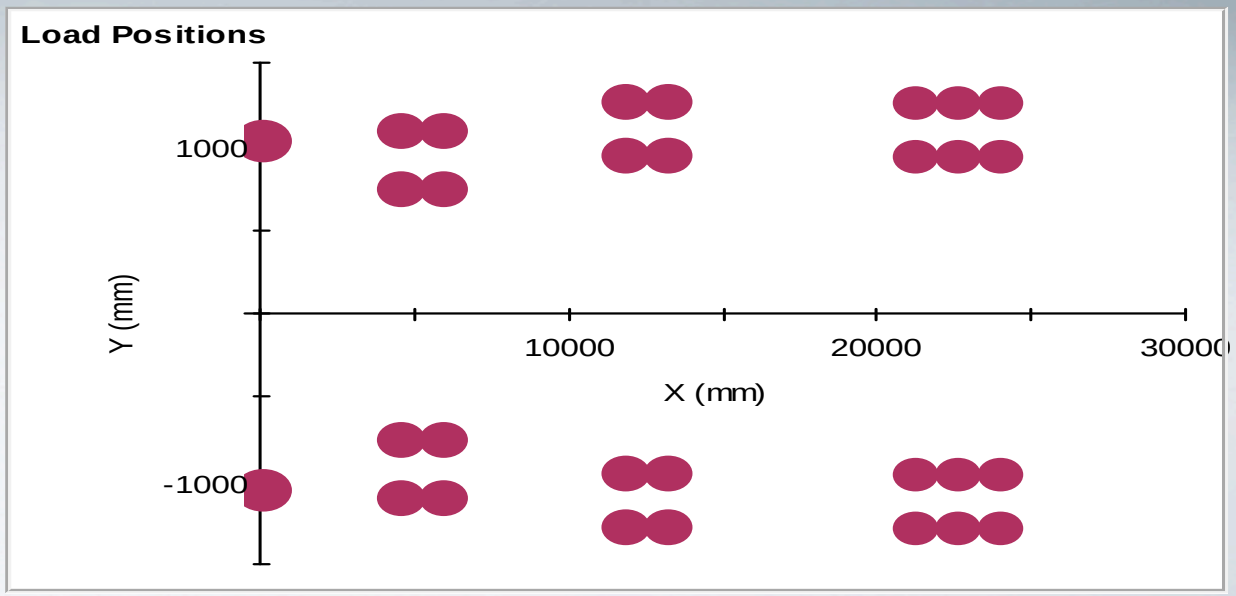


Poisson's Ratio	Elastic Moduli (MPa)		
	Phase I	Phase II	Phase III
0.44	2000	1000	200
0.35	2000	1500	100
0.35	1000	300	100
0.35	140	140	100
-	-	-	-

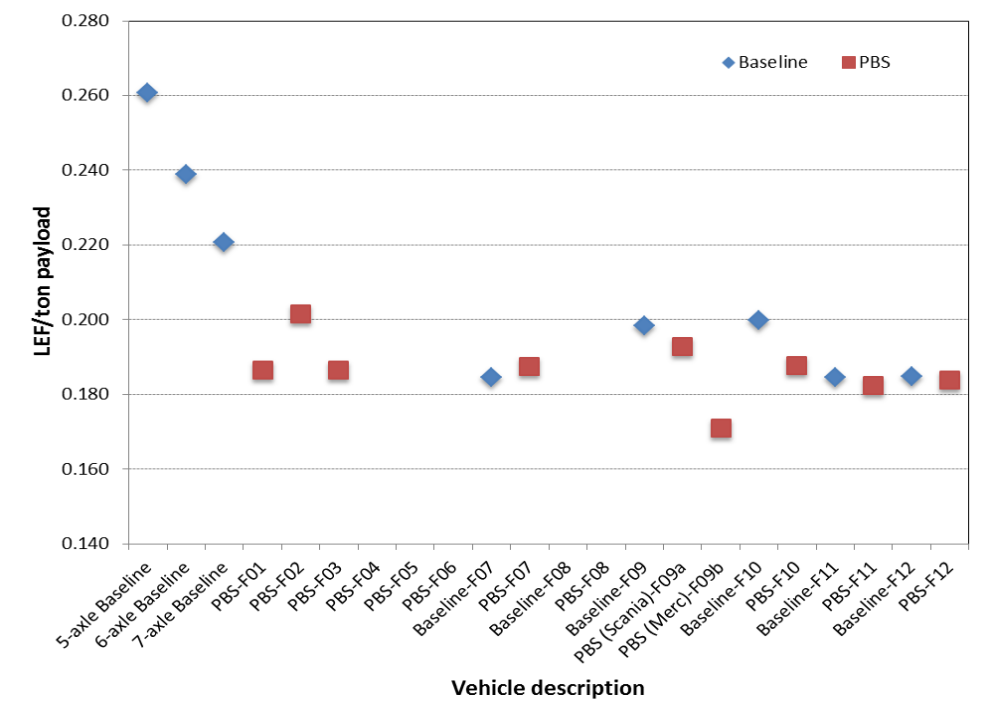
* Classification according to TRH 14 (CSRA, 1985)

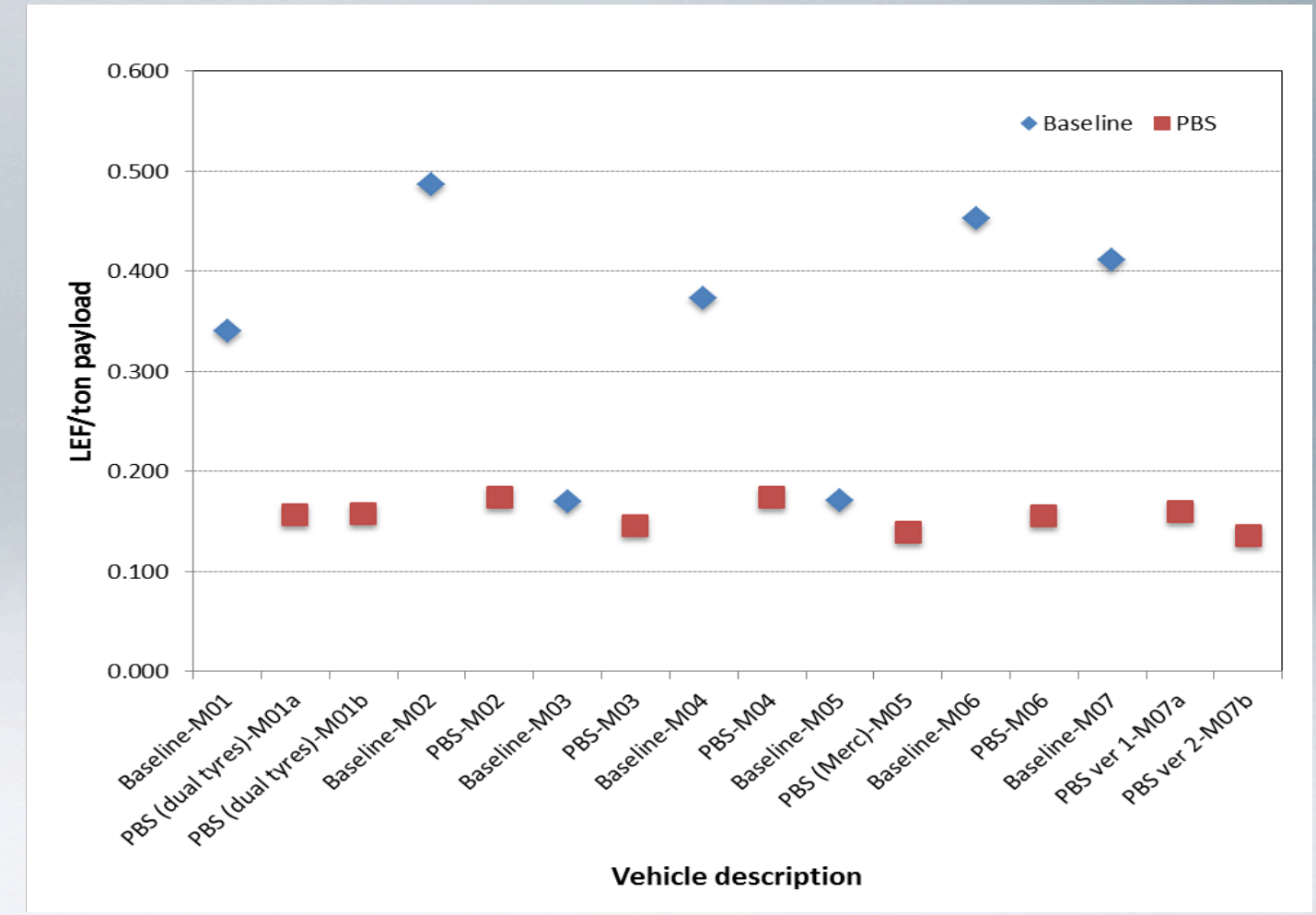
8 Pavement Structures-1.ppt





Road Wear Performance Standard

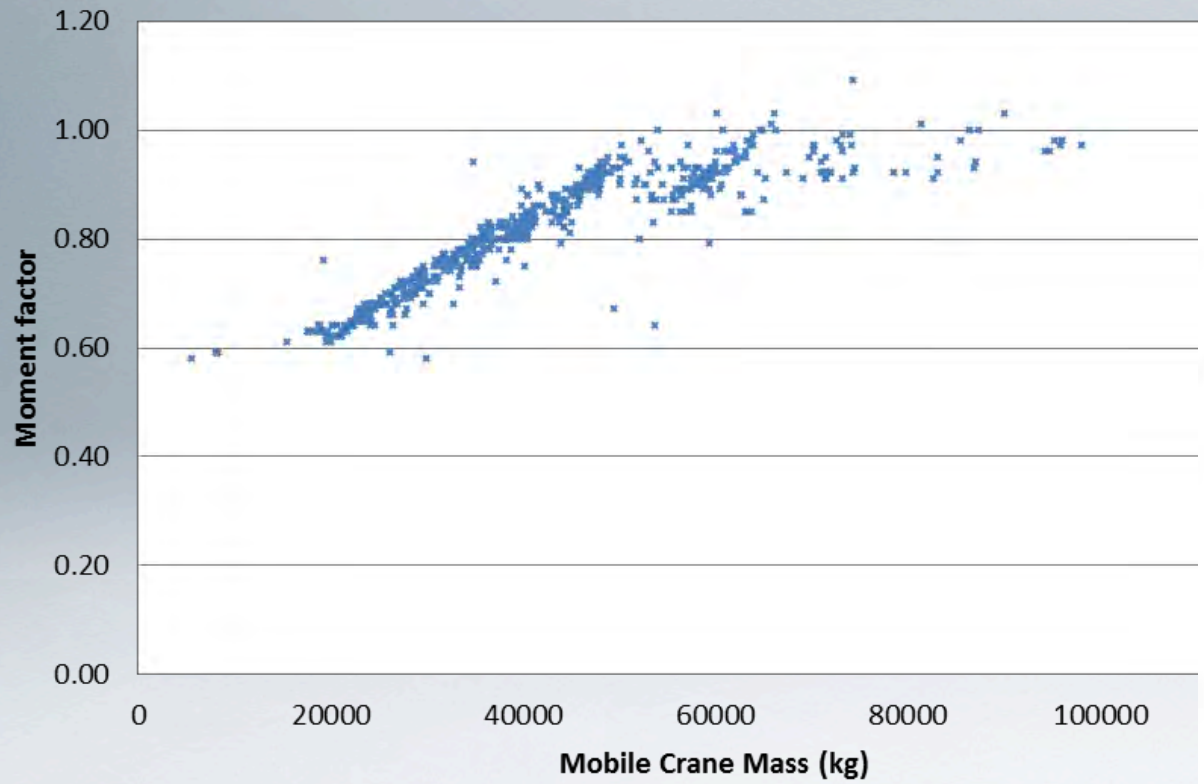


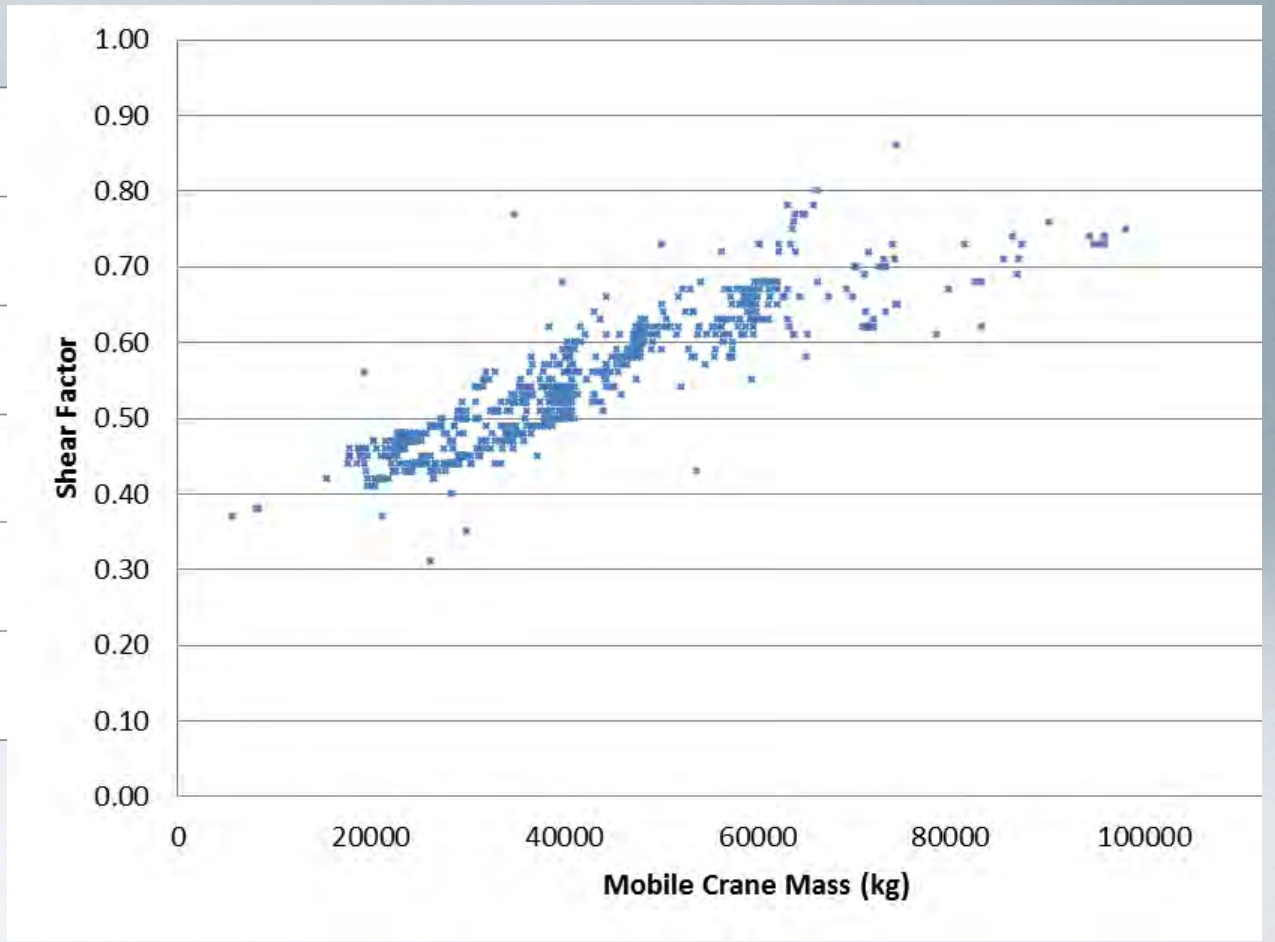


Structures Performance Standard

- Compare maximum bending moments and shear forces generated the by the proposed PBS vehicle with those of a reference bridge design load (NA + NB30) from the SA Bridge Design Code

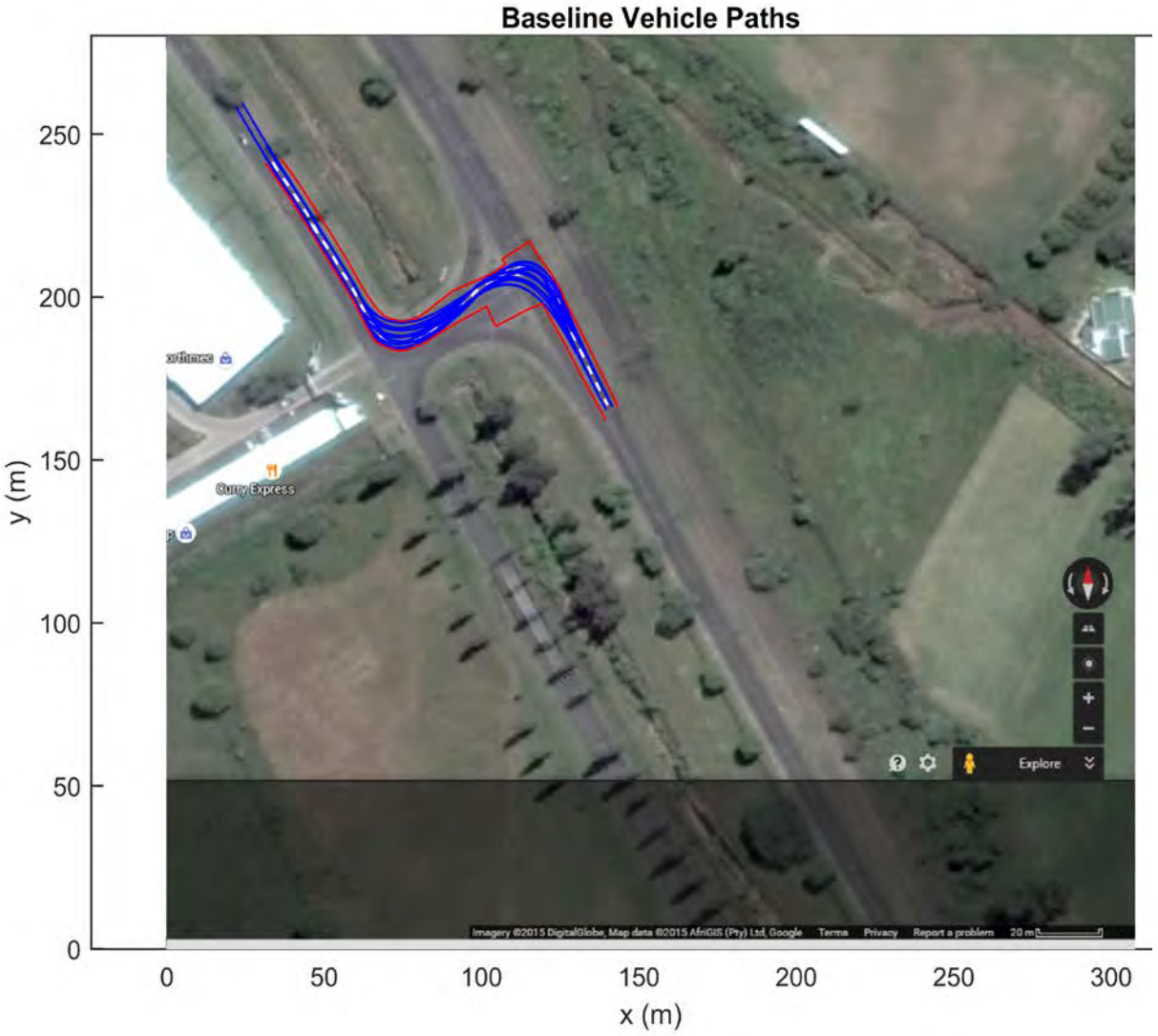
Structures Performance Standard

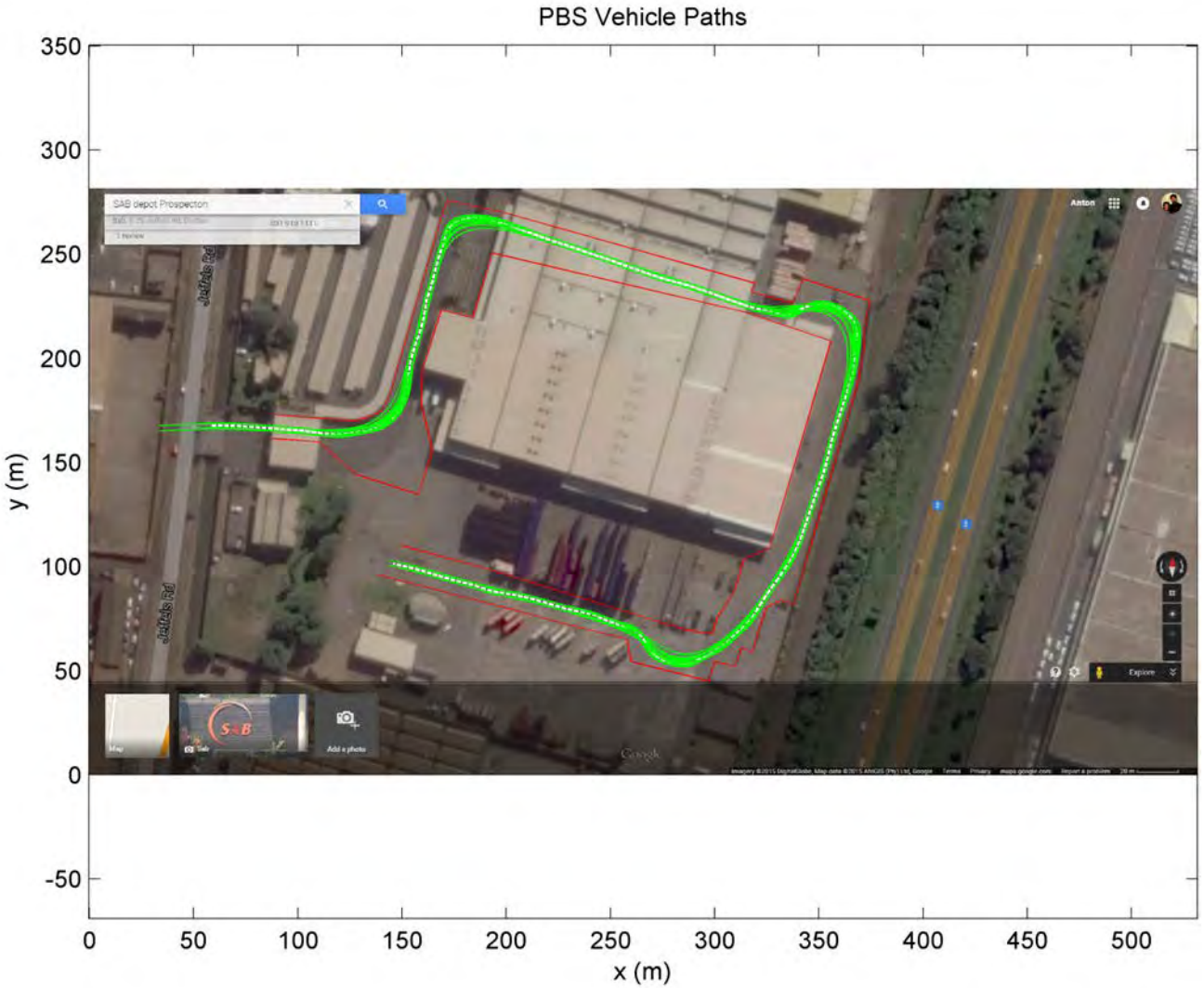




Access: Route assessments

Access: Route assessments





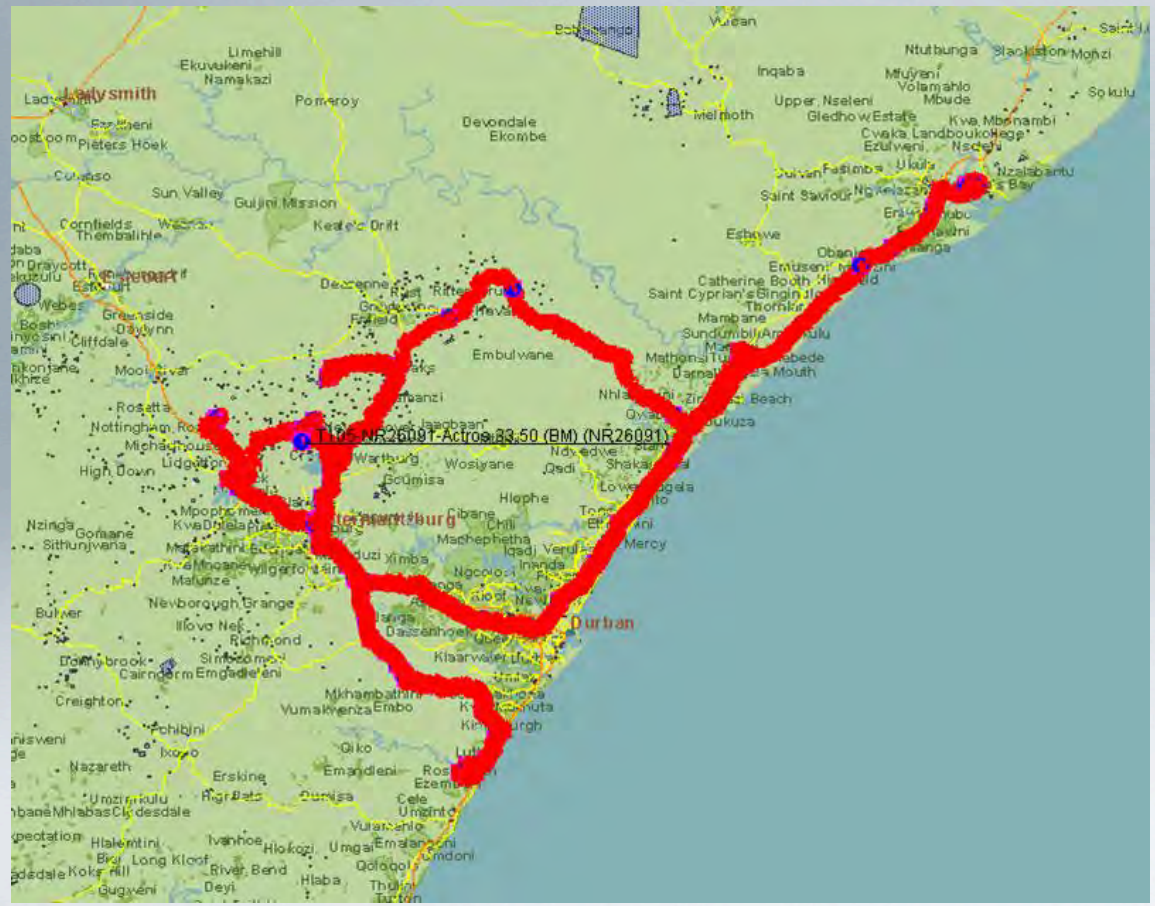
Access: Route assessments

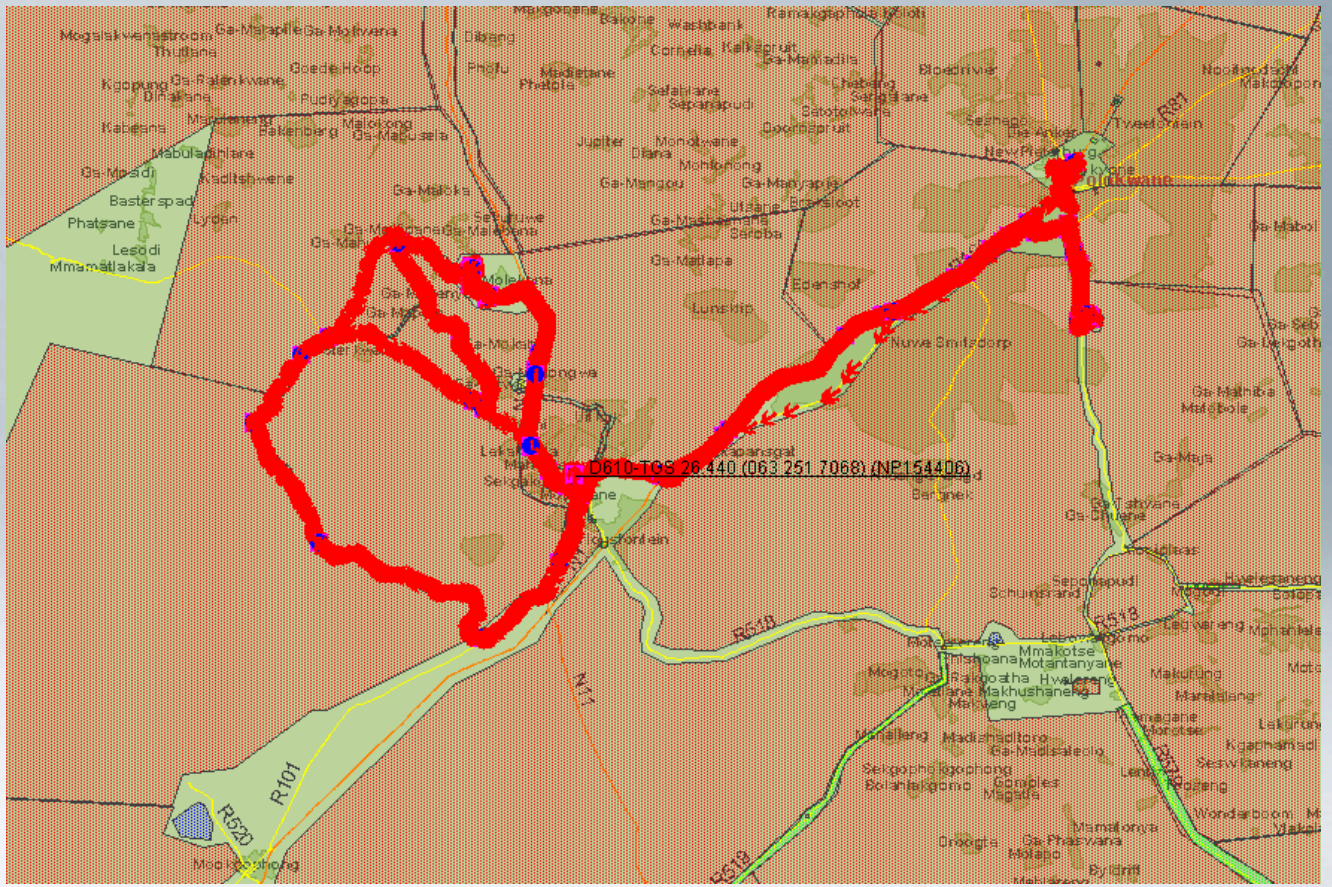
SAB Prospecton Depot to SAB Springfield Depot:

Joyner Road onto N2 on-ramp

Using AutoTURN software application

Access: Route compliance





The Road Transport Management System

- RTMS is an industry–led, government-supported, voluntary, self-regulation scheme that encourages consignees, consignors and road transport operators to implement a management systems standard with outcomes that contribute to preserving road infrastructure, improving road safety and increasing productivity.
- Key focus areas are:
  - load optimisation (minimise over- and under-loading)
  - driver wellness
  - vehicle maintenance
  - productivity

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SANS 1395-1:2014
Edition 1

SOUTH AFRICAN NATIONAL STANDARD

Road transport management systems

Part 1: Operator requirements — Goods

Published by SABS Standards Division
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Tel: +27 12 428 7911 Fax: +27 12 344 1568
www.sabs.co.za

SABS

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RTMS Standard Summary

(SANS 1395-1:2014)

Loading Control

Fleet Inventory

Control of loading

Prevent Overloads

Optimise Payload

Safety/ Compliance

Vehicle Maintenance

Basic Roadworthiness

Minimising breakdowns

Speeding Controls

Accident Analysis

Traffic violations

Risk Management

Driver Wellness

Medical Fitness

Chronic illness Management

Fatigue Management

Driving hours

Wellness Initiatives (Nutrition etc.)

Support

Providing skills development to ensure drivers obtain and retain competency to be safe, compliant and a minimal risk on public roads

Procedures, Policies, Documents + Records + Monitoring + Corrective Actions + Internal Audit = Continual Improvement

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FATIGUE

1 Probable Causes

Insufficient sleep

Poor nutrition

Drugs

Alcohol

2 What may go wrong?

Accident

3 Potential Hazards

Death
Injury
Financial Loss
Environment

Frequency

High

4 Risk Assessed if hazard occurs

High

5 Risk can be

Minimized

6 How can we achieve Minimal Risk?

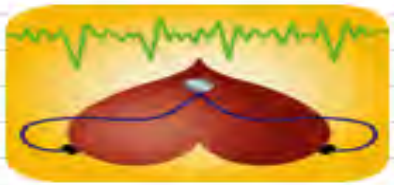
Check load before departure
Check load during journey
Get sufficient rest

Proper Nutrition
Drug/Alcohol Test
Medical Test
9 Hour Rest Interval
Training/Education

Controller/Phone Check
Sleep on Route

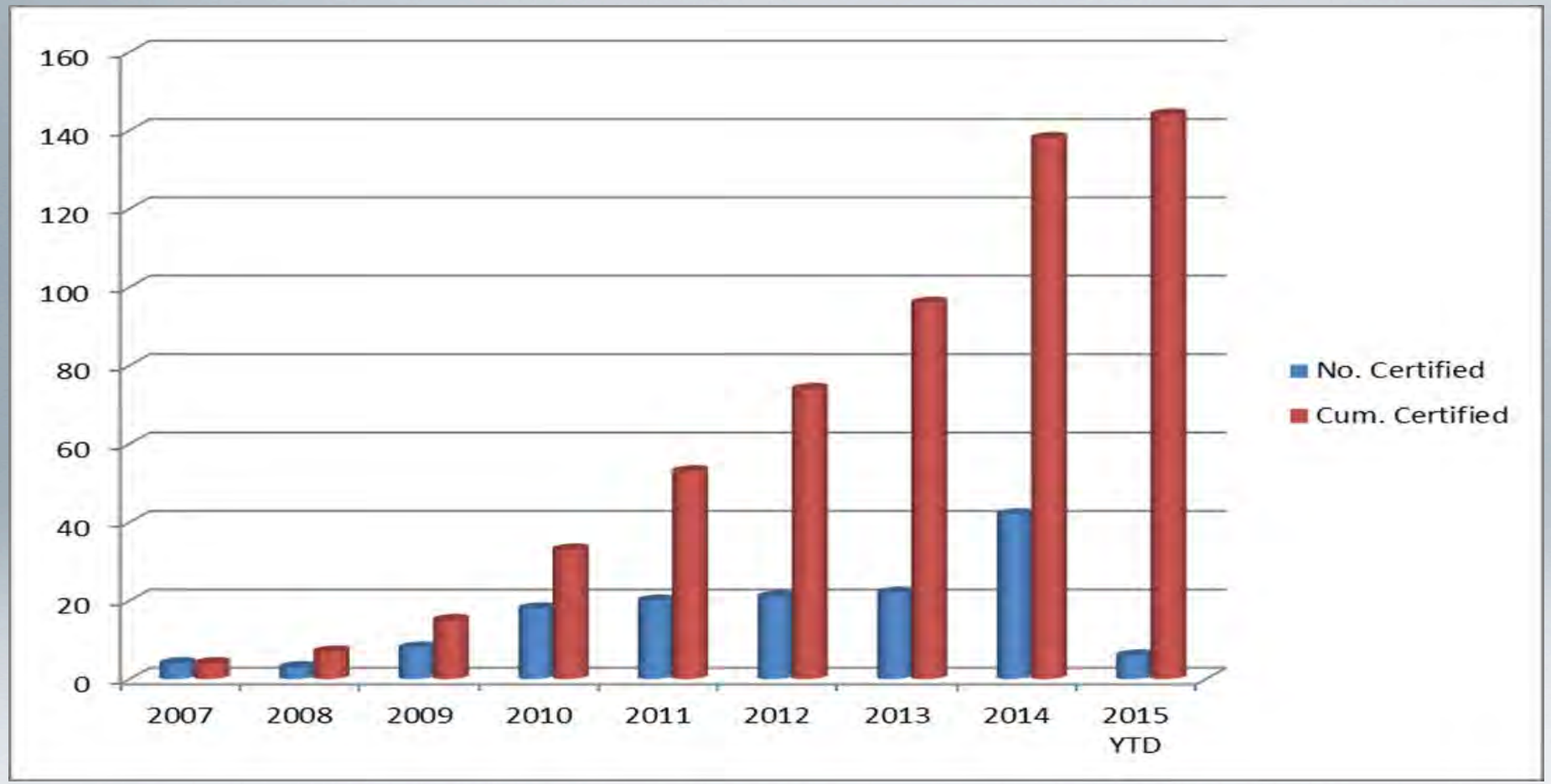
MODULE ONE

NUTRITION

1 Probable Causes	2 What May Go Wrong	3 Potential Hazards	7 How can we achieve Minimal Risk?
 Education Culture	 Fall Asleep	 Death Injury	1 Nutrition from part of training 2 Canteen on depot 3 Subsidised Meals 4 Medical Tests
 Bad Habits Poverty Planning Unbalanced Diet Hydration	 Get Sick Irritable Impatient Poor Senses Unsafe Stops	 Financial Loss Environmental Illness	 5 Water Compulsory
		4 Frequency High	 6 Vitamins
 Take Aways/ Facilities	 Accidents Stress Diabetes  Heart Problems	5 Risk - if hazard happens High 6 Risk Can Be Minimized	 7 Prohibit Stops

MODULE TWO

Growth of the RTMS in SA



161 fleets representing over 8 100 trucks & buses (In 2007 their were 74 certified vehicles)

Three bus operators:

- Buscor 404 buses
- Intercape 152 coaches
- GABS Over 1000 buses

24 abnormal load operators:

- 258 vehicles
- Plant hire, construction, engineering, mobile cranes
- 2 commercial A/L operators (108 vehicles)

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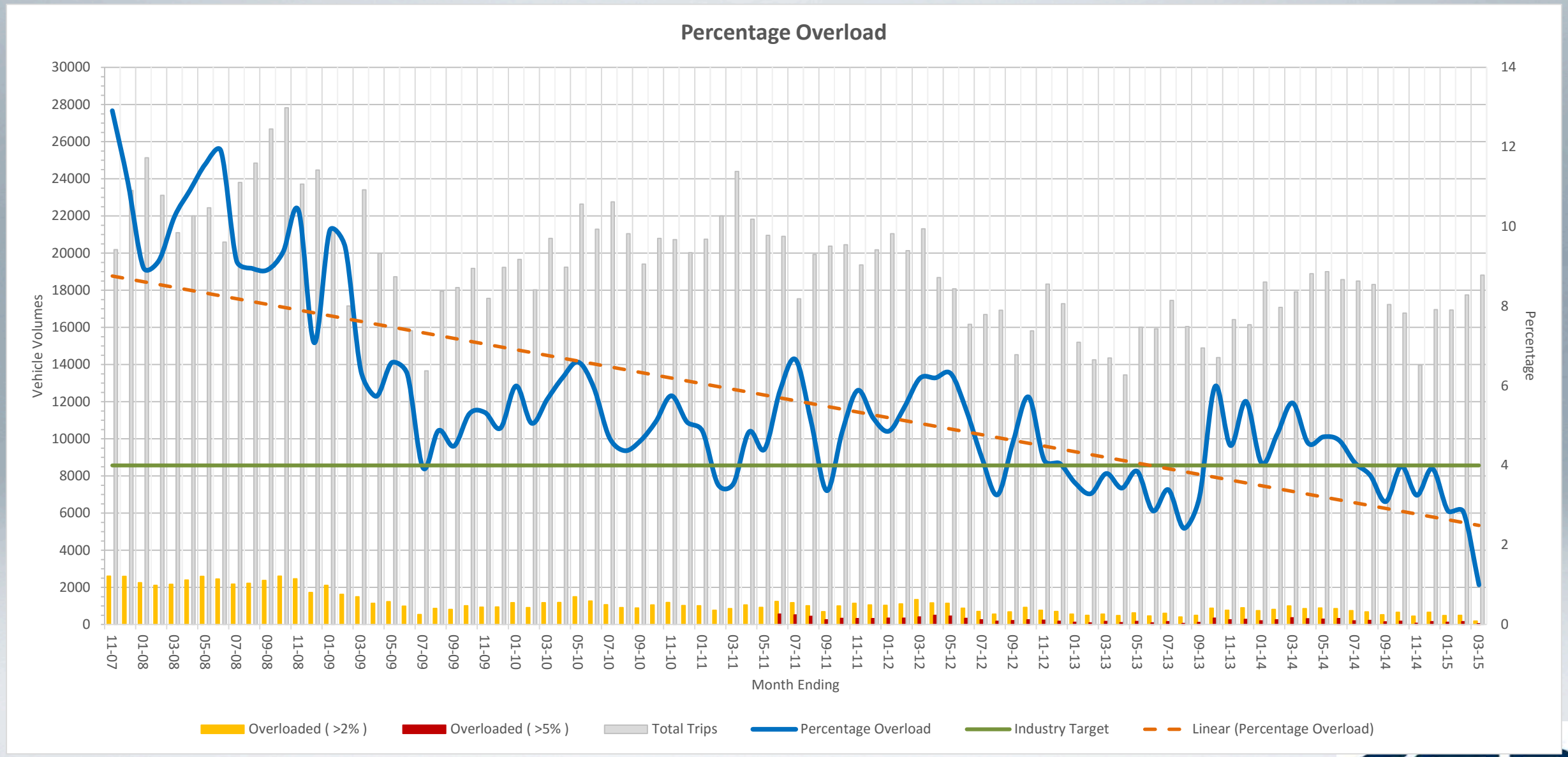

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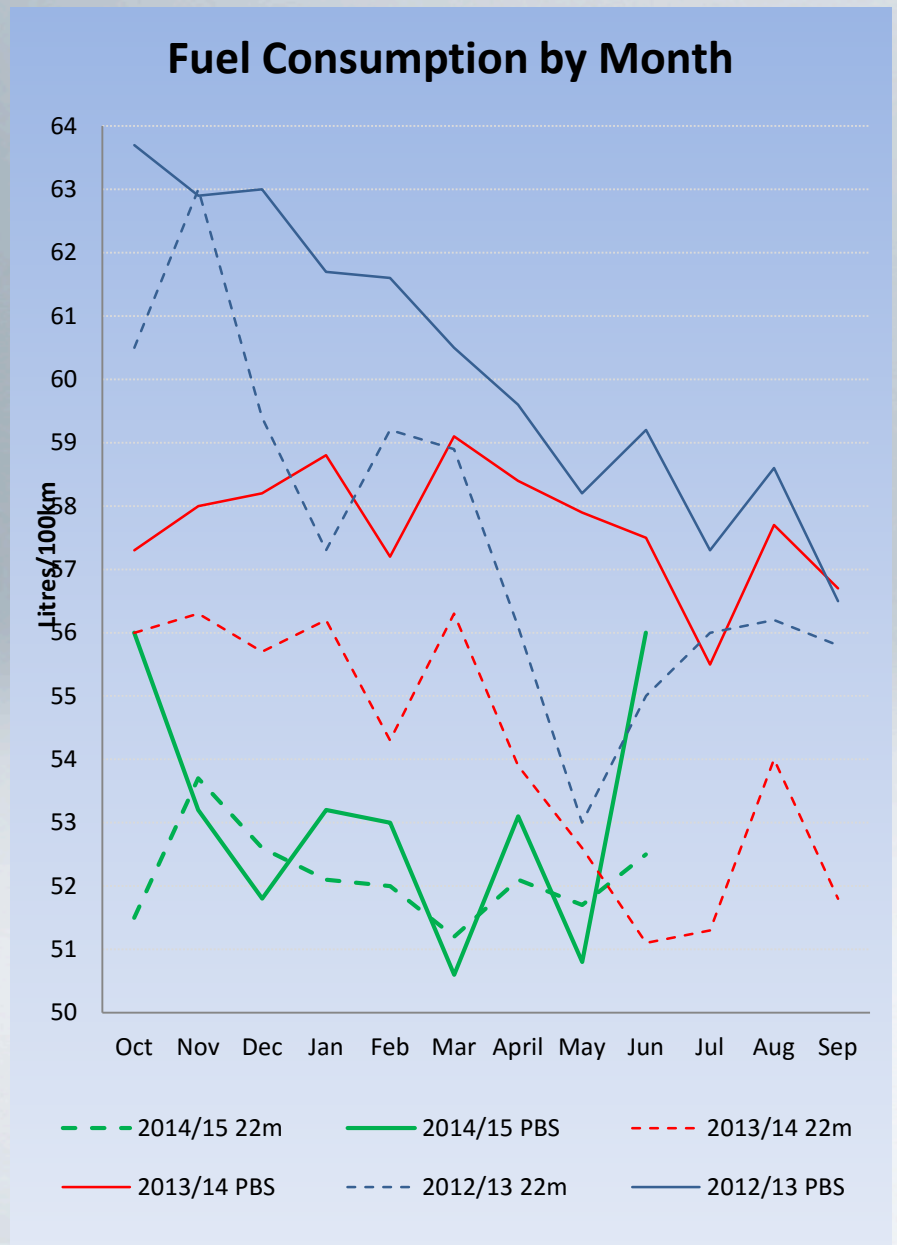
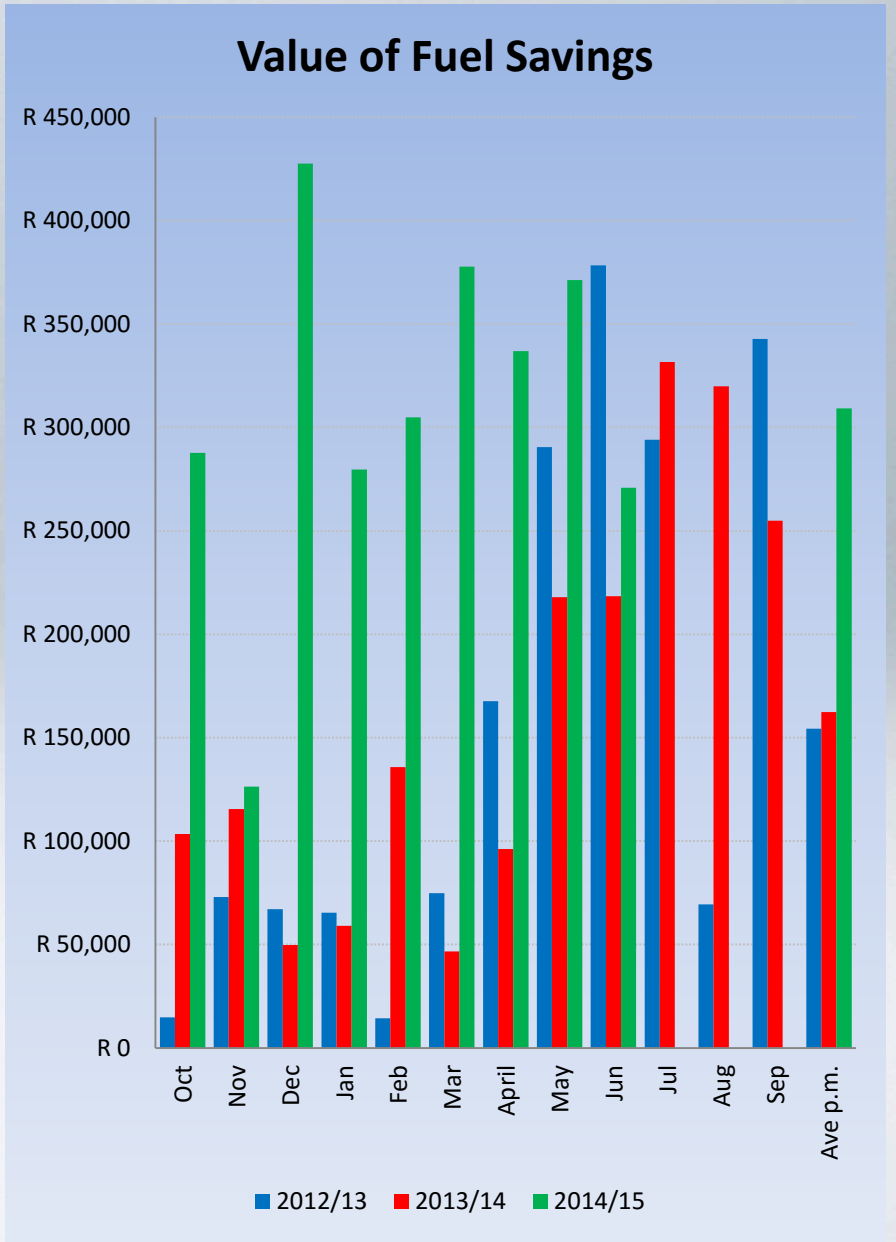
Driver Training and Fuel Consumption





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Thank you