OVERVIEW OF PAVEMENT TYPES CURRENTLY USED ON BRT's

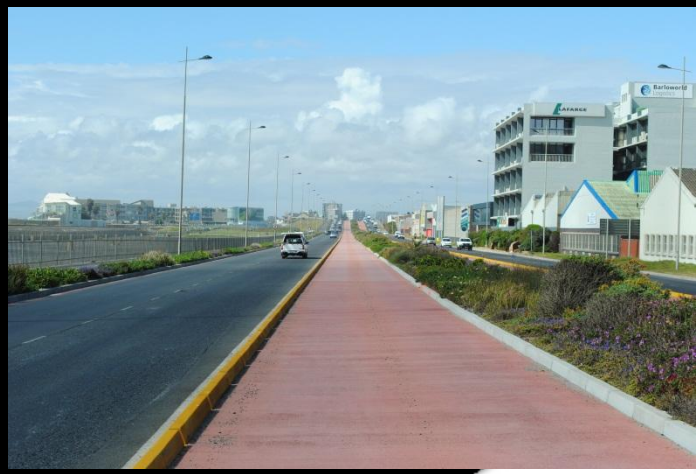
Dr L J Ebels PrEng

26th Road Pavements Forum

05 and 06 November 2013

Outline

- Introduction
- BRT systems in South Africa
- Type of buses
- Axle load, wheel load and tyre pressure
- Pavement types
- Concluding remarks



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INTRODUCTION

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Bus Rapid Transit (BRT)

- Flexible (road-based vehicles)
- High performance rapid transit
- Integrated system with a quality image and unique identity
- High passenger volumes

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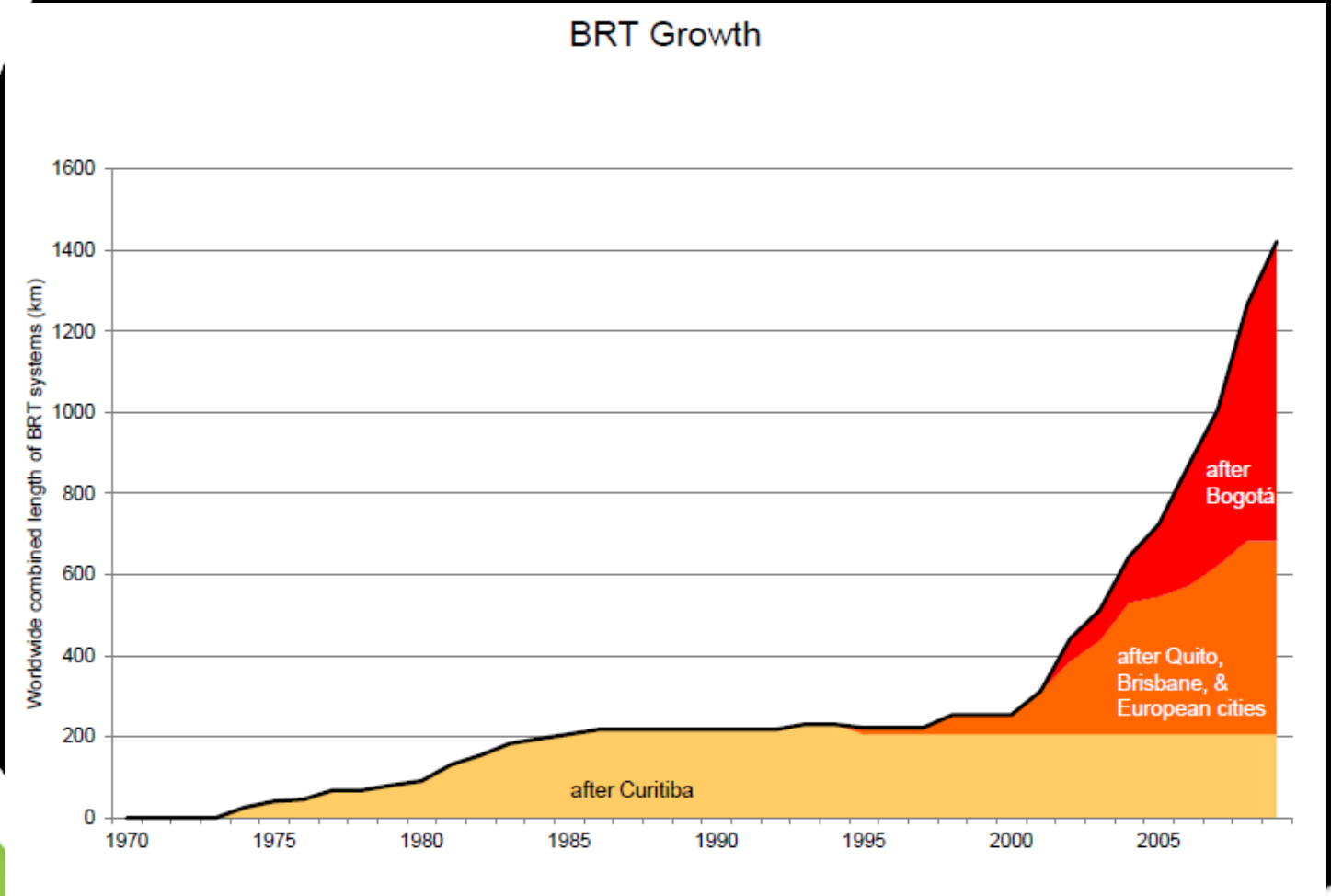
BRT 101

1. Exclusive lanes
2. Median aligned
3. Priority at intersections
4. Level boarding
5. Off-board fare collection

Development of BRT



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BHNS / BHLS

- Bus à haut niveau de service
- Buses with a high level of service
- BRT-lite:
  - Quality bus systems
  - Reliable and fast
  - Comfortable buses
  - Good facilities, stops and stations

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BRT References

Bus Rapid Transit Workshop

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BRT Systems in South Africa

CREAMER MEDIA'S ENGINEERING NEWS

http://www.engineeringnews.co.za/article/transport-2013-10-18

SA cities investing heavily in public-transport networks

PUBLISHED 18 OCT 13 BY: IRMA VENTER

In the 2013/14 financial year, more than R5-billion will be spent in 13 South African cities on planning, building and operating integrated public transport networks, says Transport Minister **Dipuo Peters**.

She says Cape Town and Johannesburg have already constructed more than 20 km of dedicated bus rapid transport (BRT) lanes, supported by more than 100 km of feeder and distribution services.

In the 2013/14 financial year, Cape Town and Johannesburg will expand operations on the Rea Vaya and My CiTi services respectively to do up to 100 000 passenger trips a day on each system.

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BRT Systems in South Africa

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Cape Town IRT

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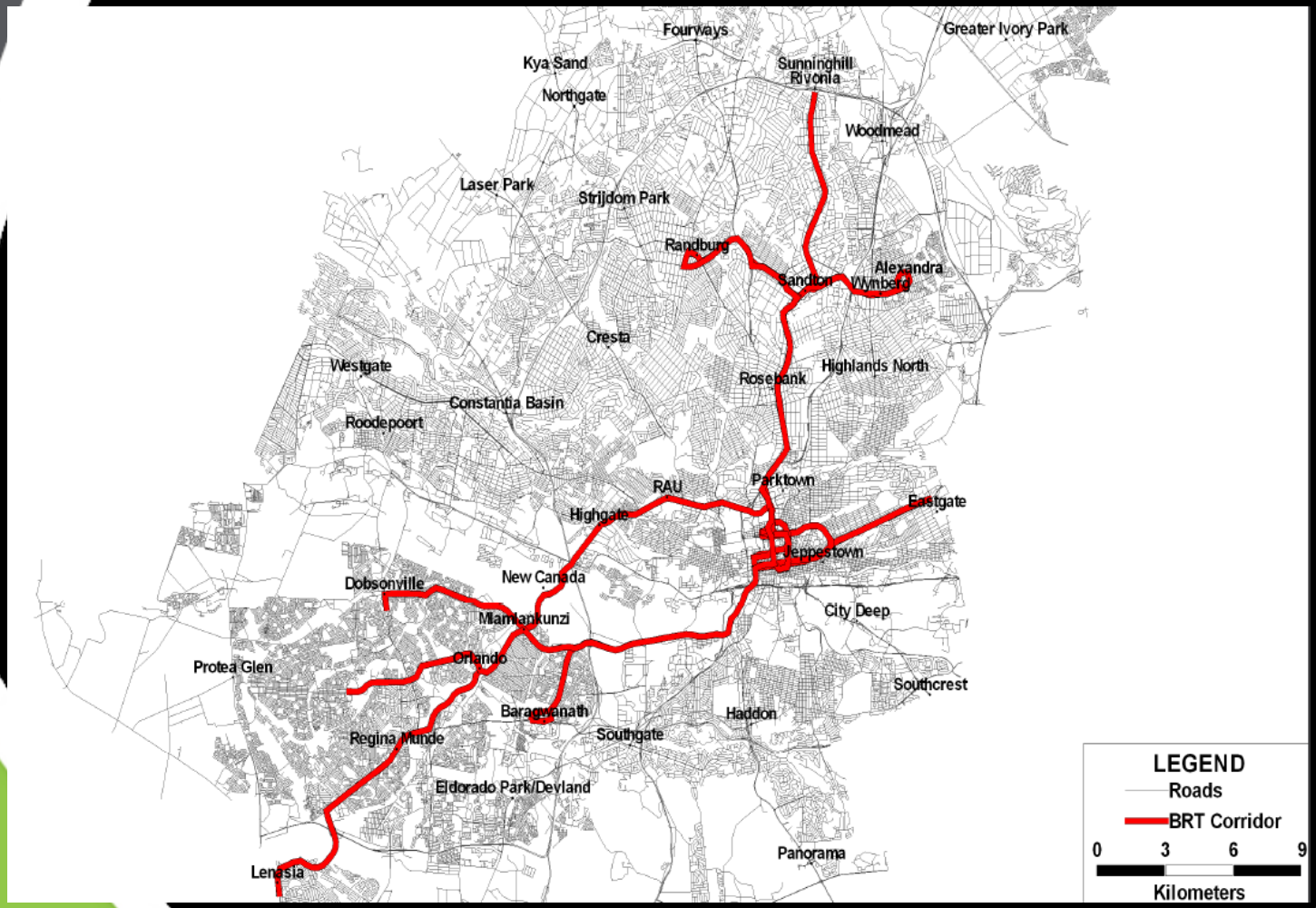
JOHANNESBURG REA VAYA



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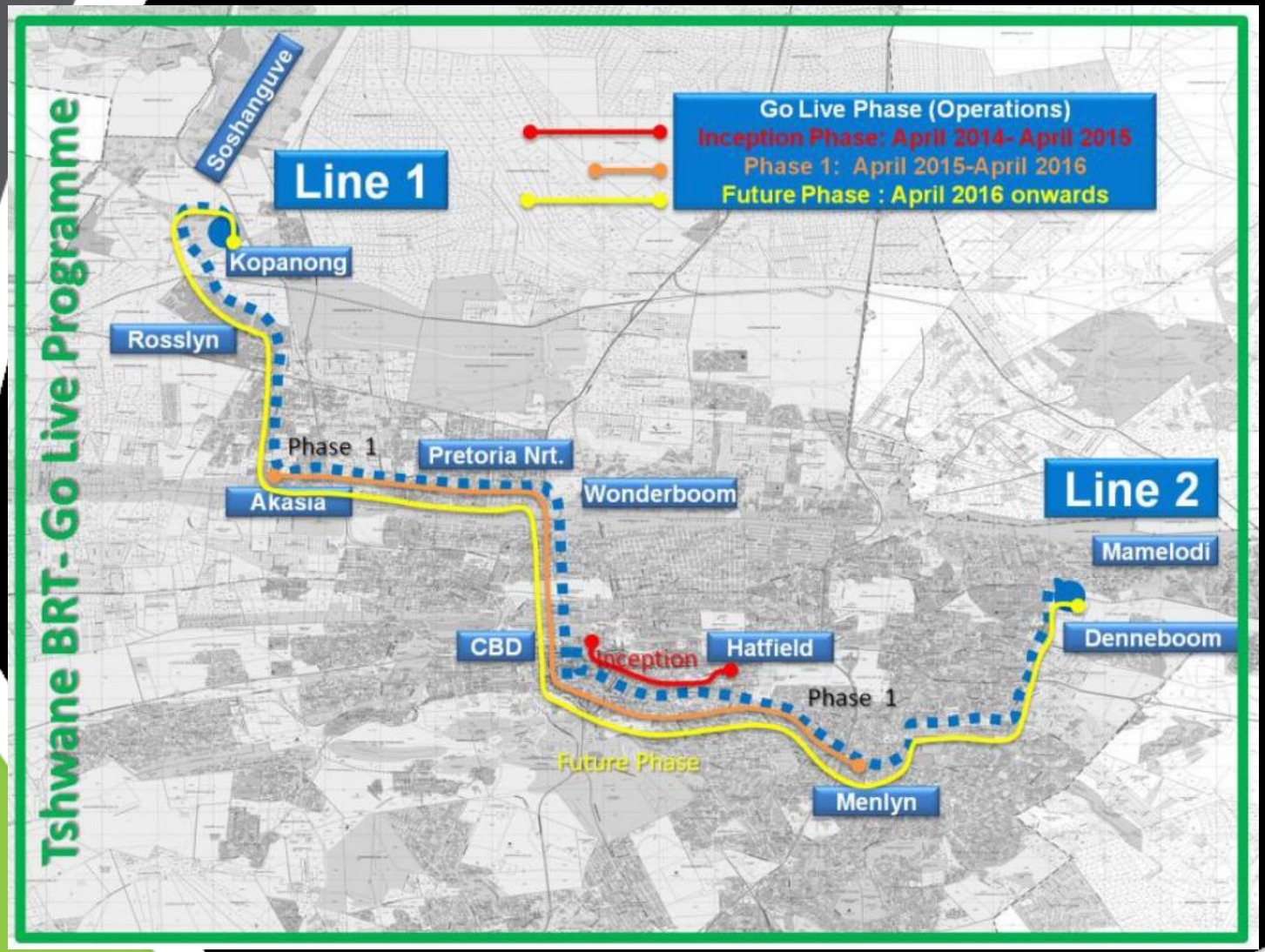
TSHWANE TRT



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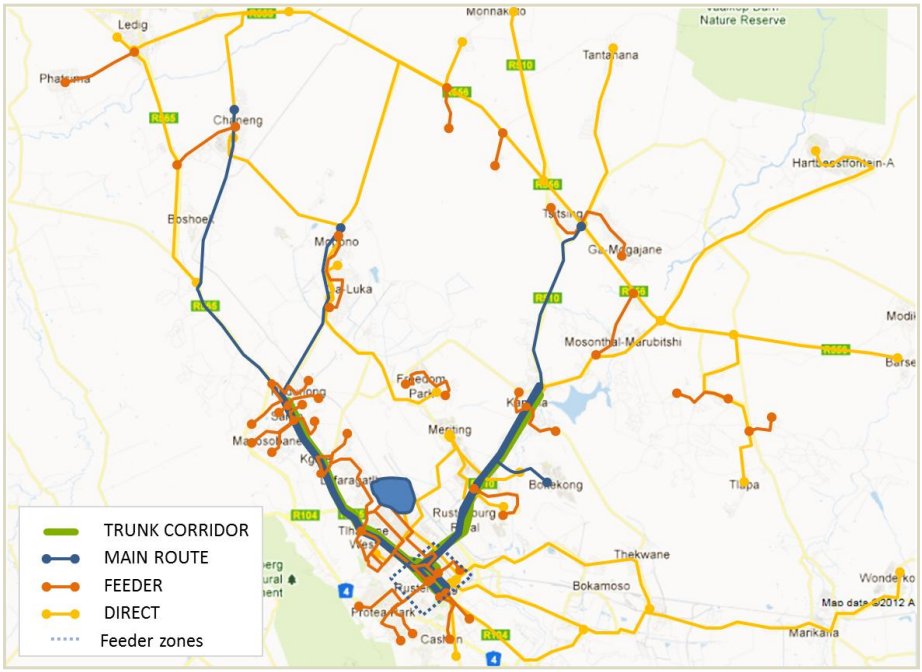
RUSTENBURG RRT

Full RRT Network



TRUNK CORRIDOR
MAIN ROUTE (6)
DIRECT (19)
FEEDER (26)

99
640
115
854 buses

500,000 passenger trips

89% coverage

RUSTENBURG RAPID TRANSPORT
TAKING TRANSPORT FURTHER

Rustenburg Local Municipality

version 1

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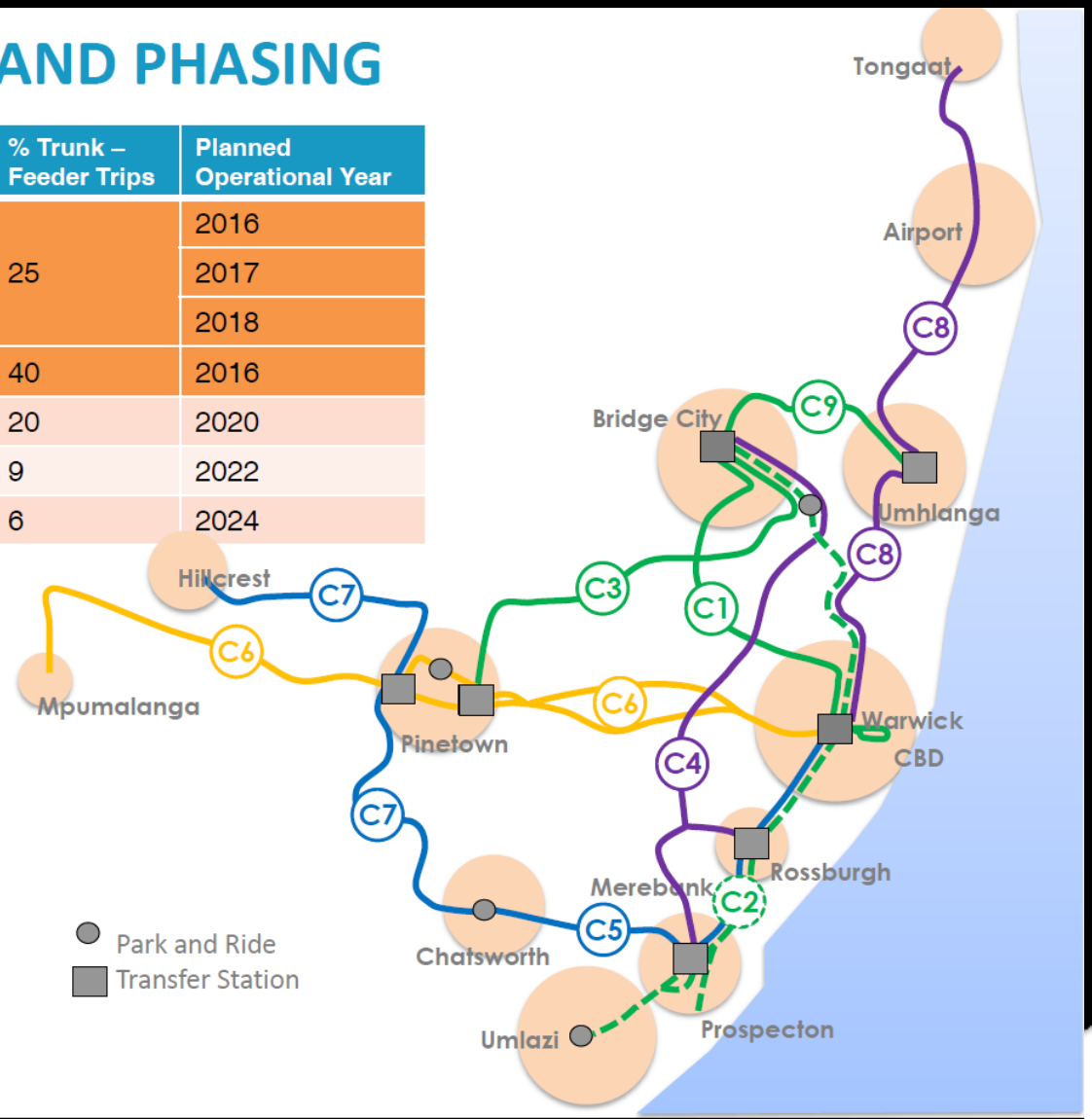
eThekwini IRPTN

NETWORK AND PHASING

Phasing		% Trunk – Feeder Trips	Planned Operational Year
Phase 1	C3	25	2016
	C1		2017
	C9		2018
	C2 (Rail)	40	2016
Phase 2	C5, C7	20	2020
Phase 3	C4, C8	9	2022
Phase 4	C6	6	2024



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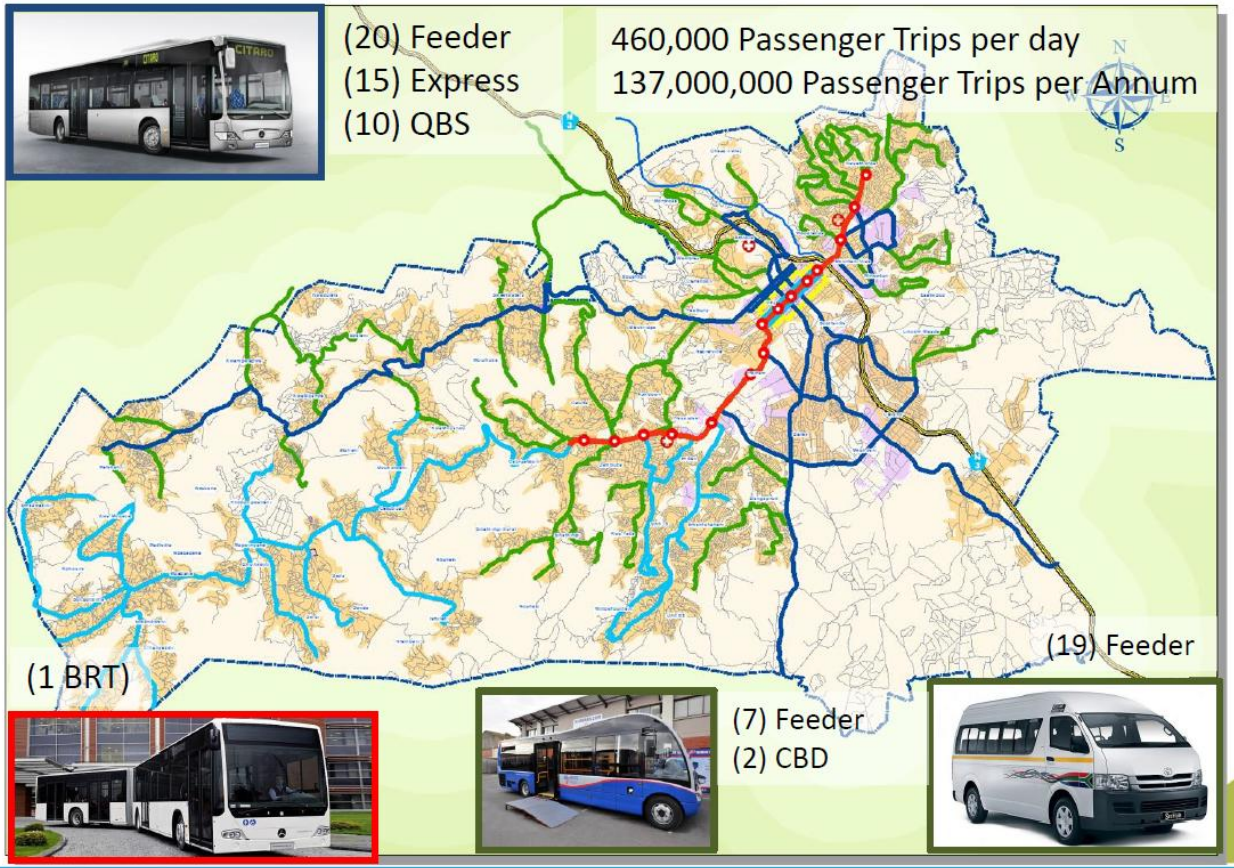
MSUNDUZI IRPTN

The Total System 2015(Routes)

(20) Feeder
(15) Express
(10) QBS

460,000 Passenger Trips per day
137,000,000 Passenger Trips per Annum



(19) Feeder

(1 BRT)

(7) Feeder
(2) CBD

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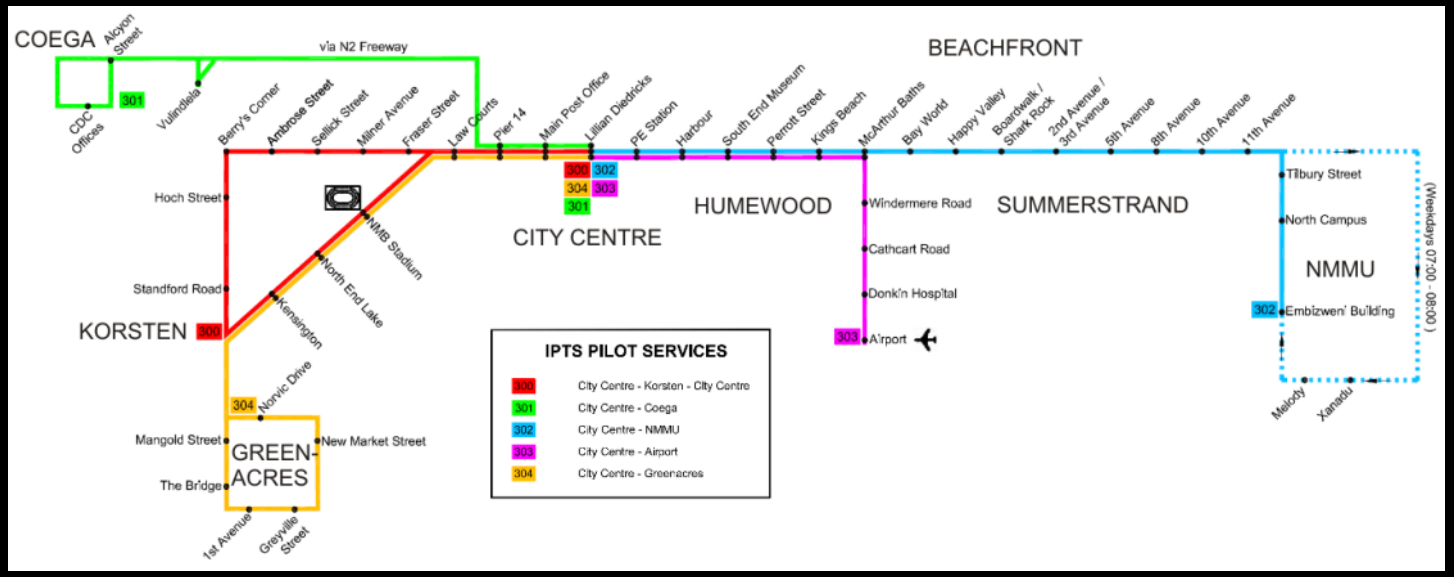
NELSON MANDELA BAY IPTS



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Standard Bus (12m)

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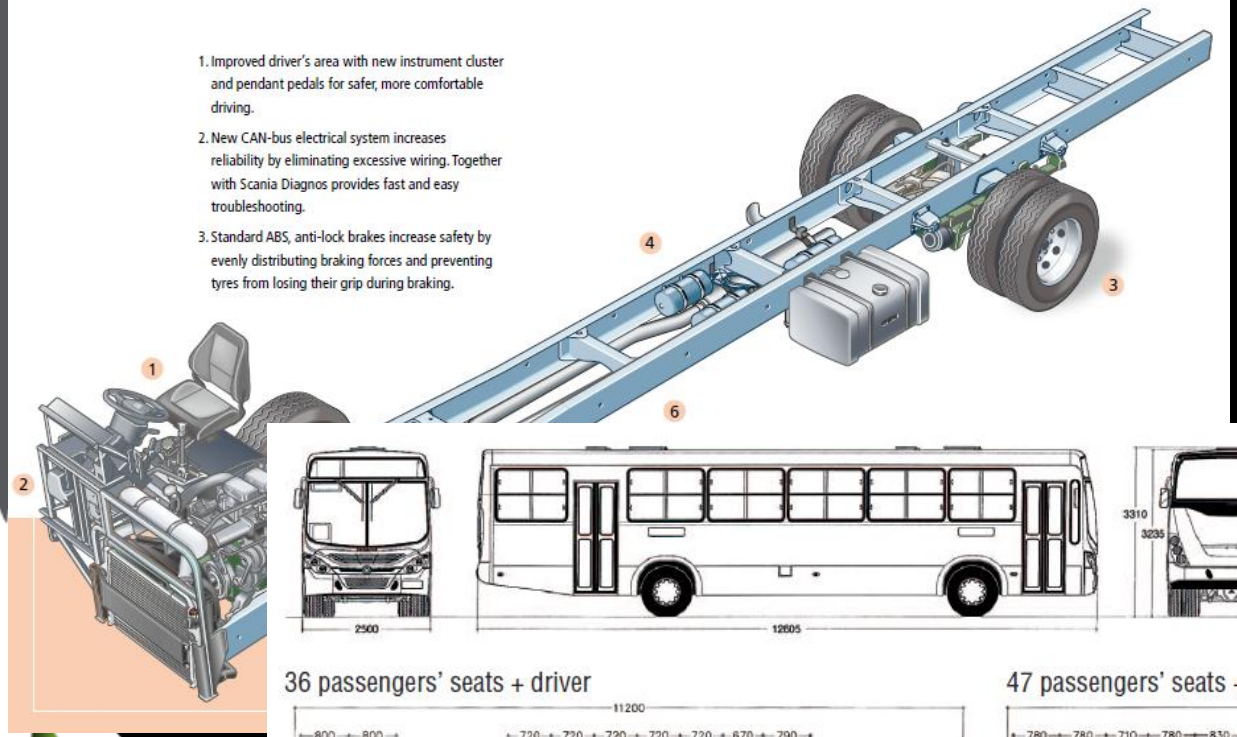
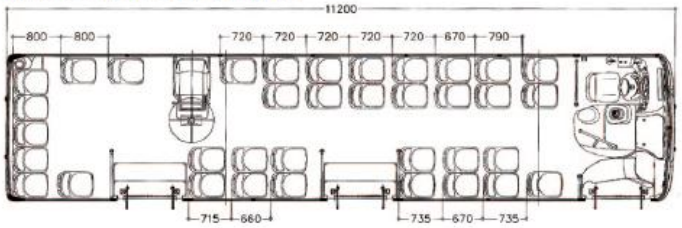
Standard Bus (12m)

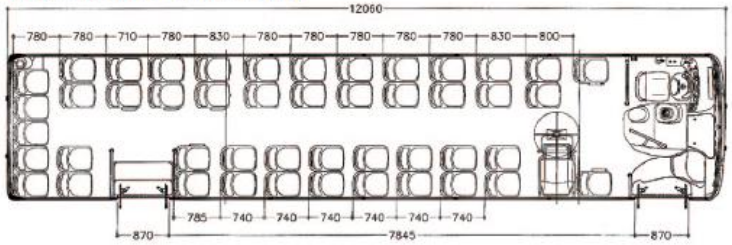
1. Improved driver's area with new instrument cluster and pendant pedals for safer, more comfortable driving.
2. New CAN-bus electrical system increases reliability by eliminating excessive wiring. Together with Scania Diagnos provides fast and easy troubleshooting.
3. Standard ABS, anti-lock brakes increase safety by evenly distributing braking forces and preventing tyres from losing their grip during braking.



36 passengers' seats + driver



47 passengers' seats + driver



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Standard Bus (12m)

- Chassis:
  - Volvo B7R
  - Scania F-type
- Coach:
  - Marcopolo

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Standard Bus (12m)

- 45 seater
- Steering axle : 7.1 t
- Single dual wheel drive axle : 12.0 t
- GVM : 19 t
- Axle equivalency factor : ± 5 E80's/HV

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ARTICULATED BUS (16.5 -18M)

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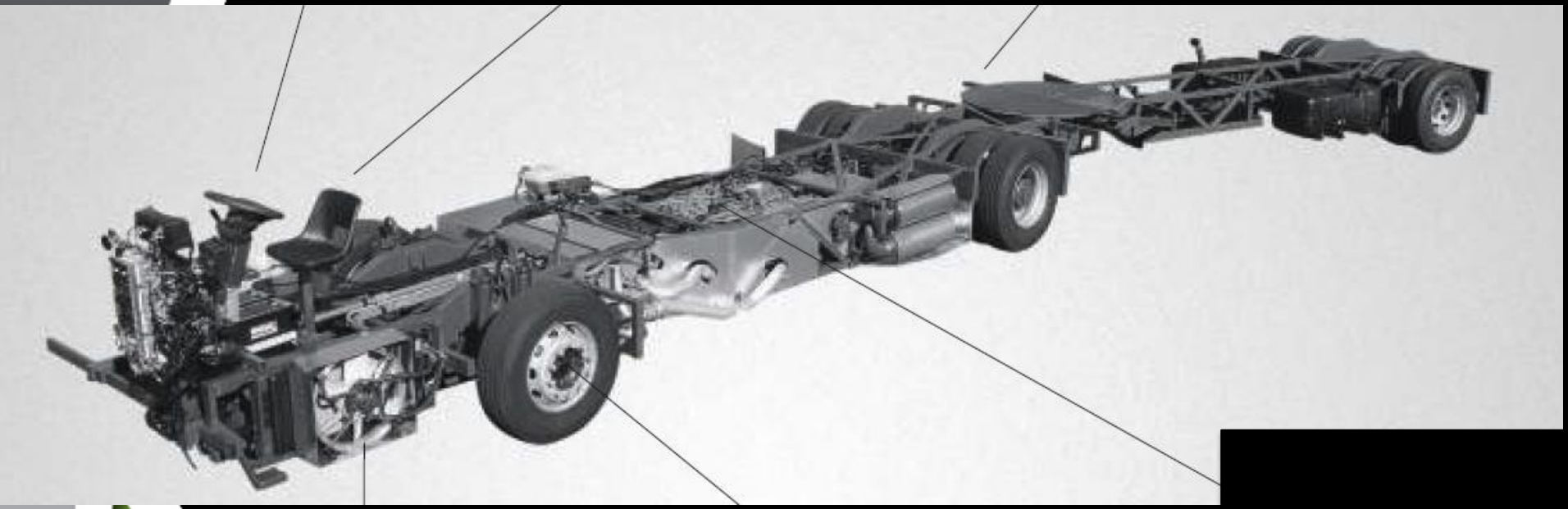
Articulated bus (16.5 -18m)



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Articulated Bus (16.5 -18m)

- 55 seater
- Steering axle : 7.5 t
- Centre drive axle : 12.0 t
- Trailer axle : 10.5 t
- GVM : 30 t (full with ± 120 passengers)
- Axle equivalency factor : ± 8 E80's/HV
- 1.5 E80's/HV when empty !!!

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Feeder / Mini Bus (9m)

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Feeder / Mini Bus (9m)

- 33 seater
- Steering axle : 3.8 t
- Rear drive axle : 8.0 t
- GVM : 11.3 t
- Axle equivalency factor : ± 1 E80's/HV

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MARCOPOLO VIALE BRT

- 21 m
- Up to 145 passengers

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Bus tyre

- 22.5” rims
- 295/80
- 825 – 850 kPa
- Max load:
  - 3.5 t single
  - 3.0 t dual

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BRT Pavement Types

- Rigid vs. Flexible
- Initial cost, design life
- Concrete pavements (CP):
  - Continuously reinforced (CRCP)
  - Jointed (JCP)
  - Ultra-thin continuously reinforced (UTCRCP)
- Flexible pavement
  - Conventional asphalt
  - Modified Asphalt (rut resistance e.g. A-E2, A-P1)
  - HiMA

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Cape Town CRCP

- 1000 daily buses, 40 yrs, ES190
- Pavement structure
  - 280 mm CRCP, Y25-160 ctc
  - 250 mm C3
  - 150 mm G6
  - G8 subgrade

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Cape Town CRCP

- 300 daily buses, 40 yrs, ES60
- Pavement structure
  - 200 mm CRCP, Y20-180 ctc
  - 200 mm C3
  - 150 mm G6
  - G8 subgrade

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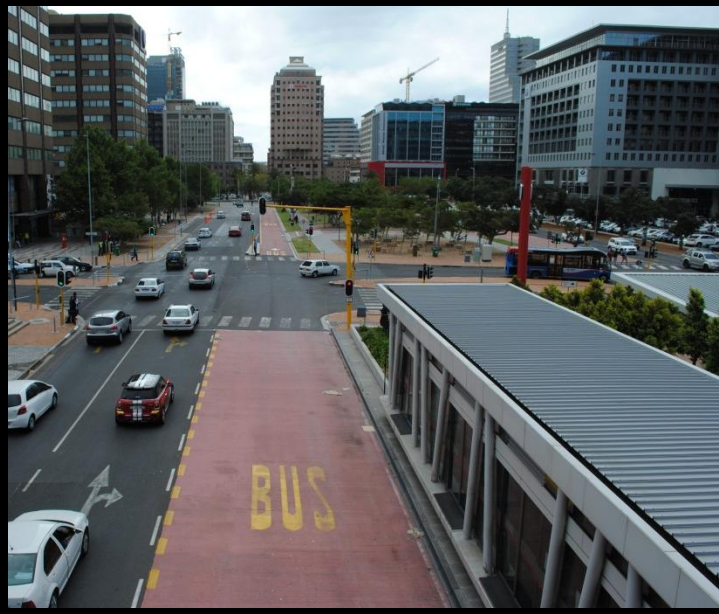
Cape Town HMA (Intersections)

- 20 yrs, ES30
- Pavement structure
  - 40 mm AC (A-E2)
  - 3 x 90 mm BC (A-P1)
  - 150 mm G6
  - G8 subgrade



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Johannesburg (Ellis Park)

- 200 daily buses, 20 yrs, 18-22 MESA
- Flexible pavement:
  - 40 mm BRASO
  - 125 mm BC (12% RA)
  - 150 mm C3
  - 150 mm C4
  - 150 mm G7
  - G7 subgrade

- Grout-filled OG at bus stops

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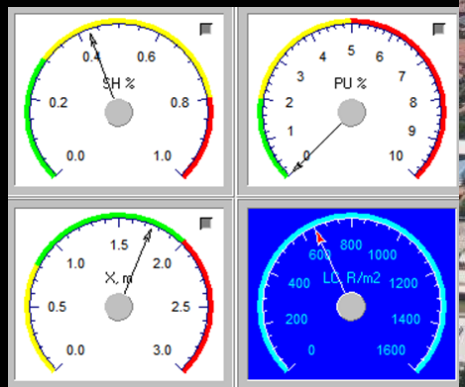
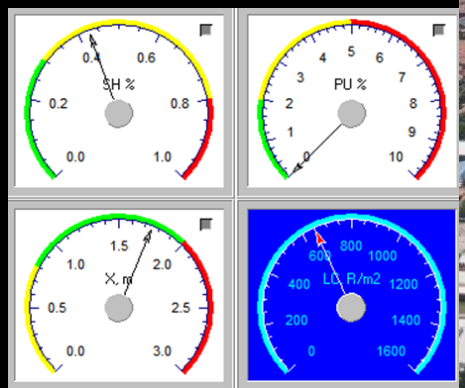
RUSTENBURG CRCP

- 384 + 192 daily buses, 30 yrs, 34 MESA
- Pavement structure:
  - 220 mm CRCP, Y16-150 ctc
  - 150 mm C3
  - 150 mm C4
  - 150 G7
  - In situ subgrade



RUSTENBURG CRCP

No. of Buses and E80's per day	Full buses	½ full buses	¼ full buses	TOTALS
Standard Bus No.'s	260	90	34	384
Standard Bus E80's	1 270	200	50	1 520
Articulated Bus No.'s	*145*	*48*	*20*	*192*
Articulated Bus E80's	*1 495*	*440*	*55*	*1 990*



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Concluding Remarks

- BRT vs. BHLS (BRT-Lite)
- Considerable investment into quality bus system
- High axle loads (up to 12 t)
- CRCP favoured, but HMA alternatives
- Conservative ??
  - Over-estimating No. daily trips
  - Bus occupancy levels

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Questions ?

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