TRANSNET

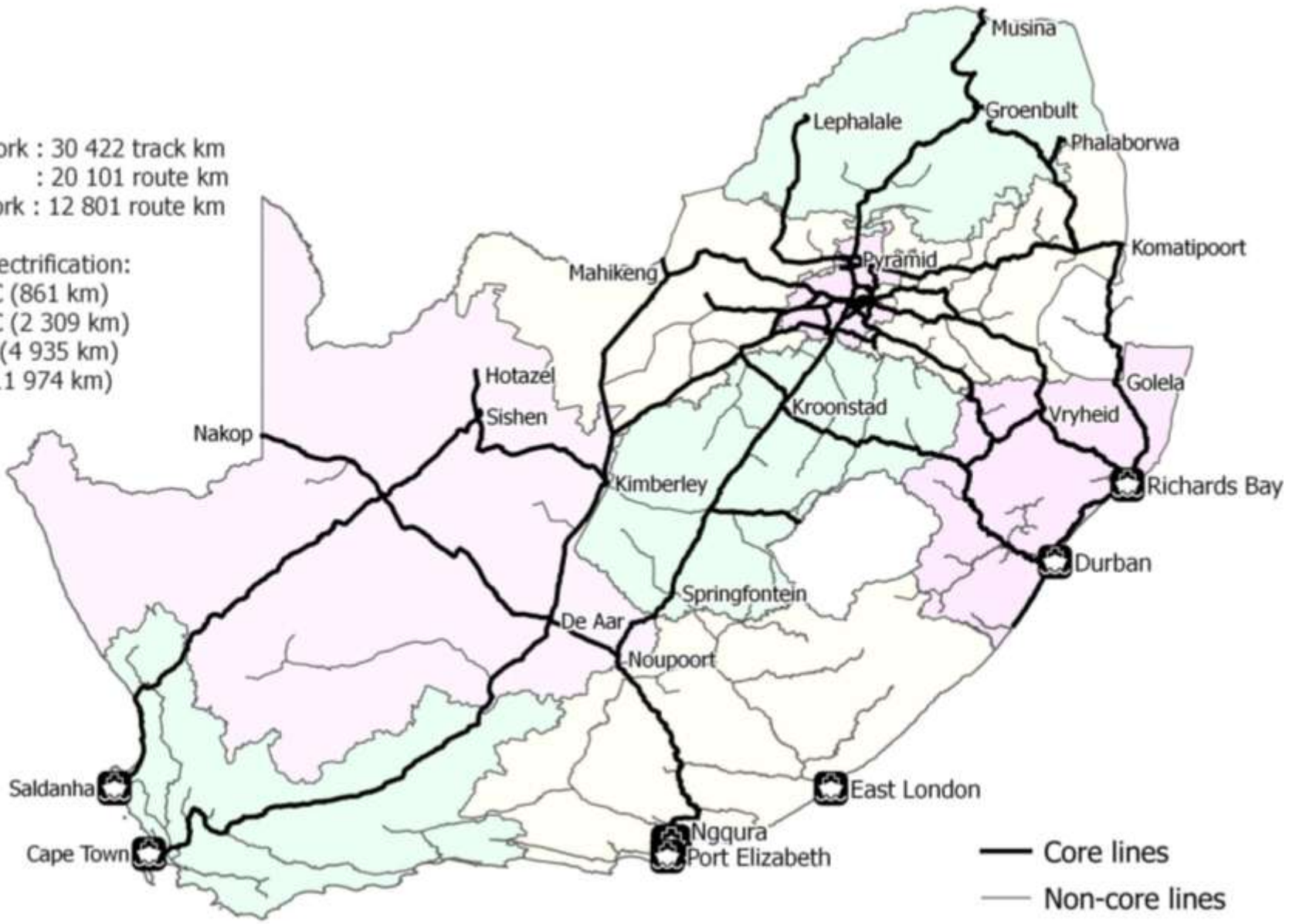
delivering freight reliably

Rail Development Plan

Infrastructure overview

Total network : 30 422 track km
: 20 101 route km
Core network : 12 801 route km

Network electrification:
- 50 kV AC (861 km)
- 25 kV AC (2 309 km)
- 3 kV DC (4 935 km)
- Diesel (11 974 km)



Development planning principles

1. Match capacity to demand

Provide adequate corridor and terminal capacity at the right place ahead of demand.

2. Align infrastructure to freight type

Heavy haul or light industrial standards depending on the freight type.

3. Improve operational characteristics

Reconfigure line infrastructure and layouts to remove bottlenecks.

4. Ensure network connectivity

Link complementary ports with inland connections. Support connectivity to SADC/regional railways.

5. Standardise infrastructure

Use similar technologies across the network to improve safety, maintainability and operational performance.

6. Align with PRASA/non-Transnet operator requirements

Separate, re-route and enhance services where needed. Consider inter-operability with branch-line services

Options for capacity creation (Principle 1)

Run more trains
- Upgrade train control systems
- Improve electrification system
- Add trackside monitoring equipment
- Improve asset security systems

Run heavier trains
- Install higher axle load track
- Upgrade structures
- Match traction type – 25 kVA
- Increase electrical supply
- Flatten gradients and ease curves

Increased volumes

Reduce throughput time
- Equalise demand and scheduling
- Improve terminal processes
- Improve track maintenance planning
- Improve rolling stock reliability
- Improve average speed (limited)

Run longer trains
- Increase length of passing loops
- Reconfigure terminal infrastructure
- Increase electrical supply
- Improve traction force distribution
- Improve braking systems

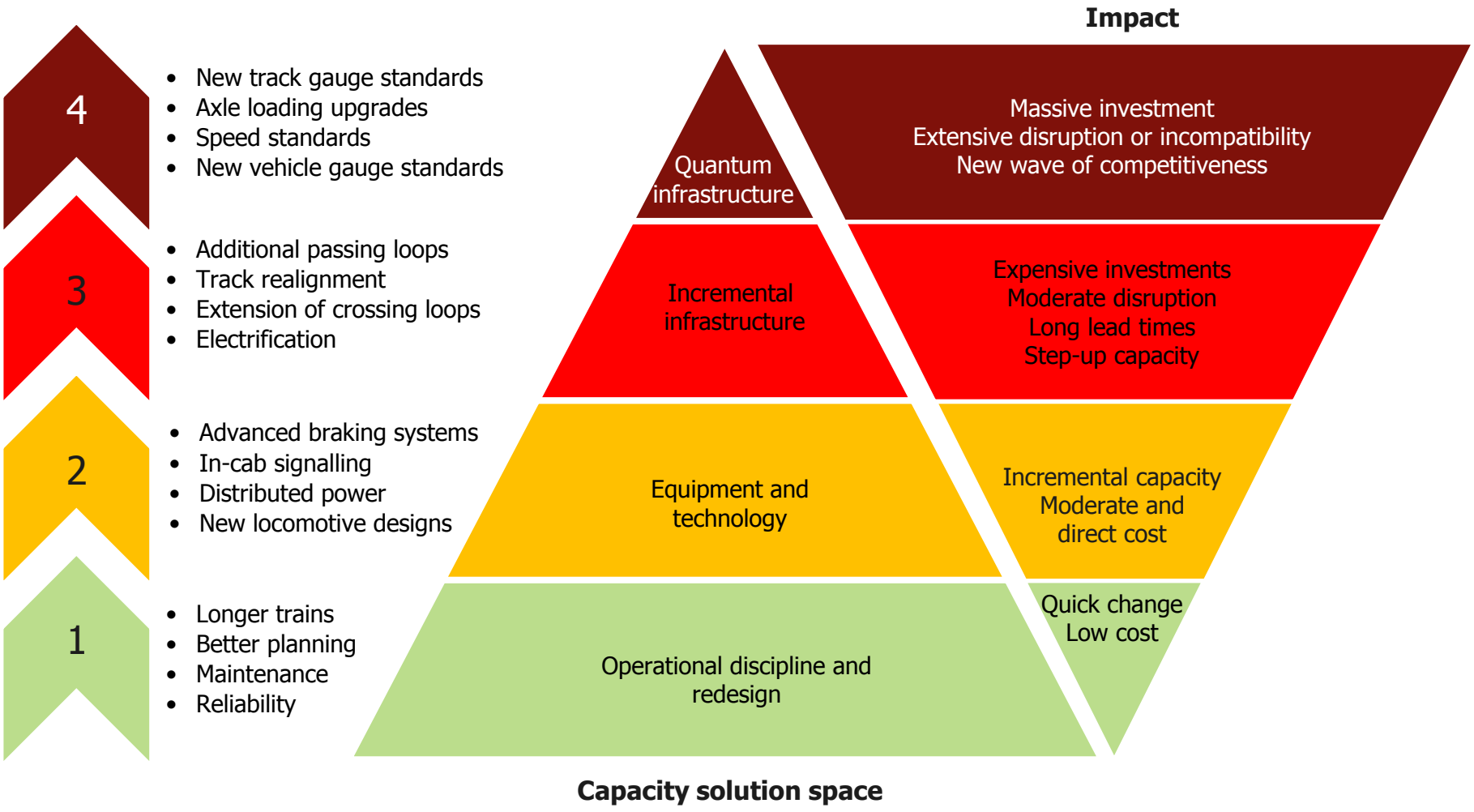
Supporting technologies

Standardisation
- Train configuration
- Traction type
- Axle load
- ECP/DP
- Train control
- Electrification
- Wagon types

Integrated system approach
- Reliability of rail sub systems
- Terminals, rail and port systems sustainability

Operational planning
- System redundancy
- Consolidated bulk loading terminals
- Long-term Planning Framework

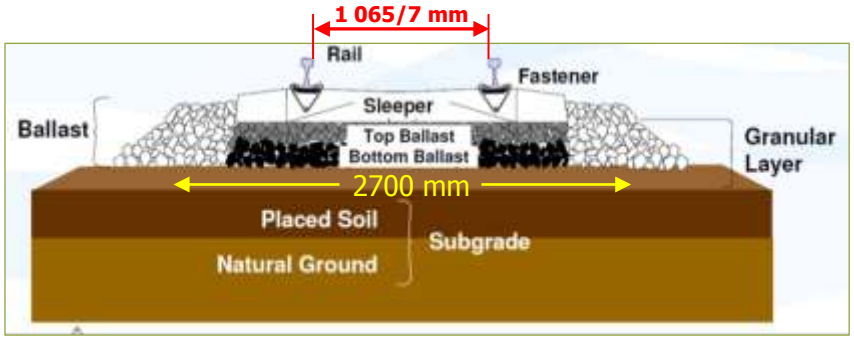
Capacity creation logic



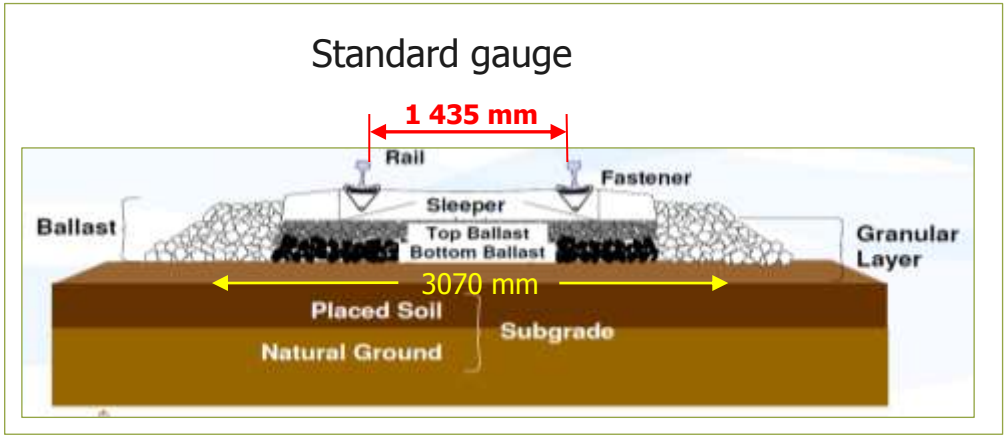
Bottom-up solutions are the most affordable and provide the best fit to existing systems
Consider the operational improvements prior to implementation of major and costly new infrastructure solutions

Rail gauge context: What is it and why is it important?

Cape gauge



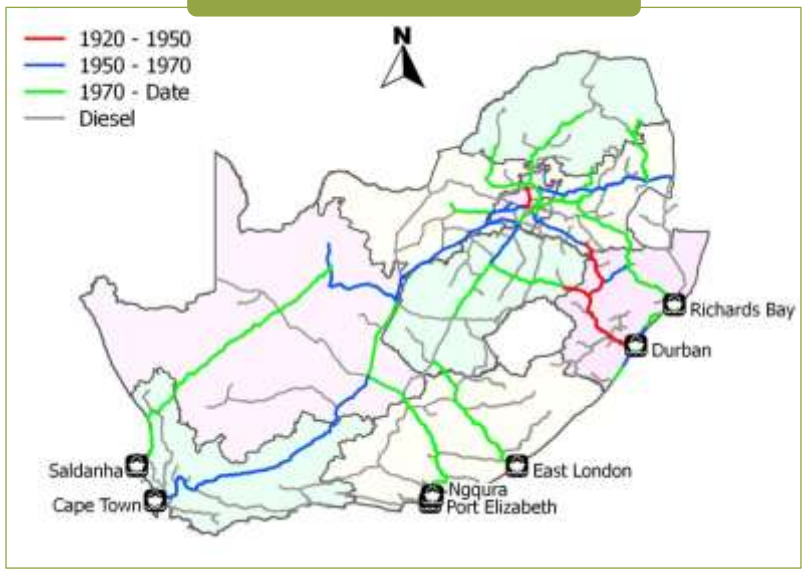
Standard gauge



- Rail gauge is the distance between the inner sides of the two parallel rails.
- It affects train axle load, maximum speeds and stability.
- Wider gauges are more expensive to construct but are more suited to heavier axle loads and faster train services as:
  - Forces are spread over a larger surface area.
  - Train stability is enhanced due to the greater distance between wheels.
  - Larger rolling stock with higher carrying capacity can be deployed.
- Two of the more commonly found gauges are:
  - Cape gauge: 1 065/7 mm
  - Standard Gauge : 1 435mm

Historic development

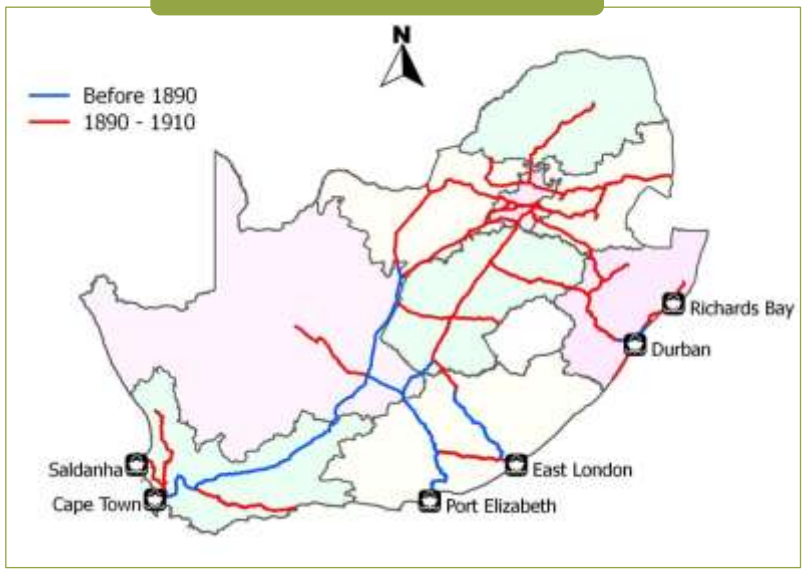
Network electrification



By 1910, most of the core network was already built connecting the ports with the hinterland mining areas

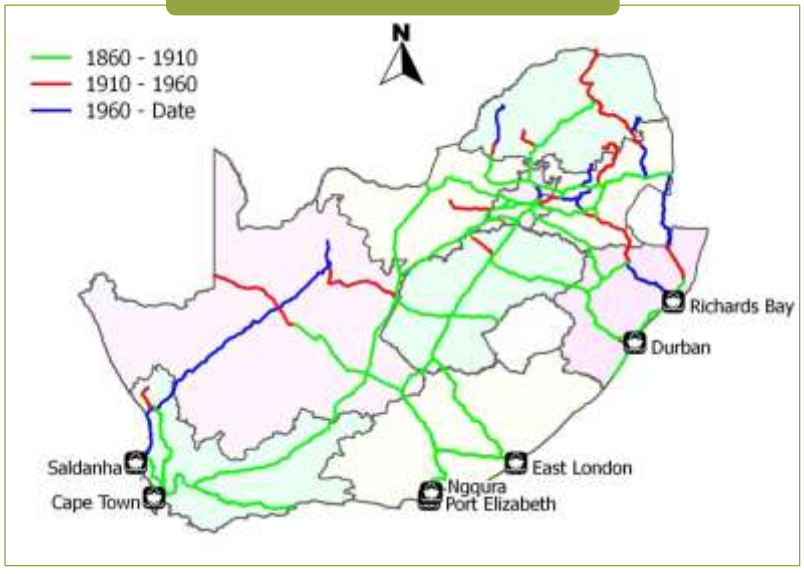
Beyond 1910, the export iron ore and coal heavy haul lines, Zimbabwe and Namibian links were commissioned. Most investments after 1930 were aimed at upgrading existing routes.

Network before 1910



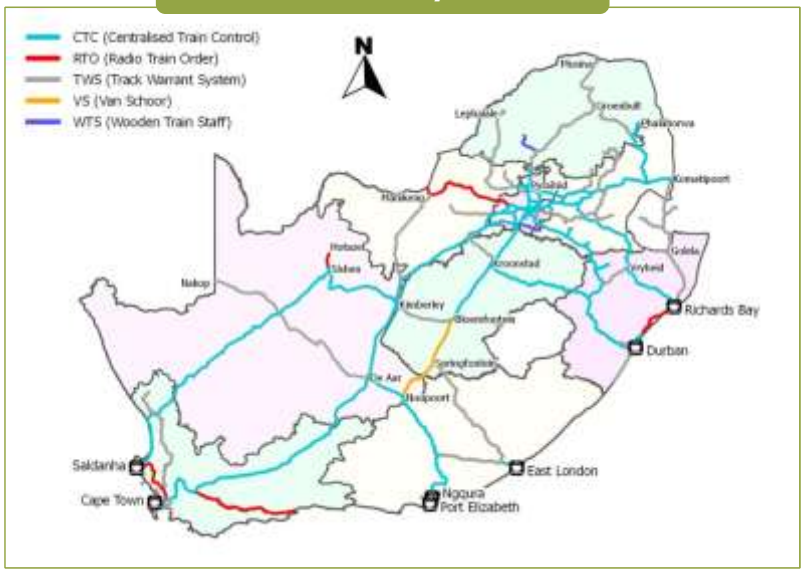
By 1990, most of the core network was already electrified, with only Kimberley – De Aar commissioned later on

Network after 1910



Installed technology

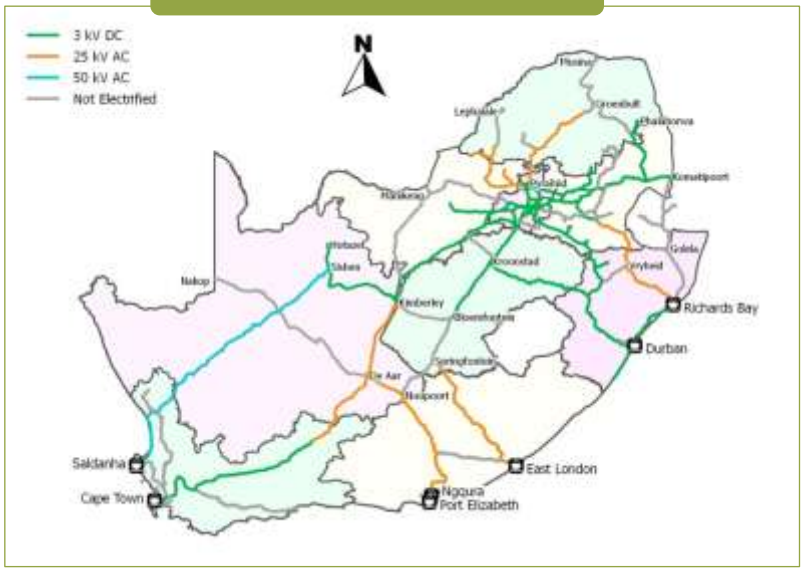
Train control systems



The core network is a mix of older 3kV DC and the preferred 25kV AC standard. The 50kV AC Ore line works well for this isolated application

The core network is predominantly 20 t/axle and heavy haul lines are built at 26-30 t/axle standards

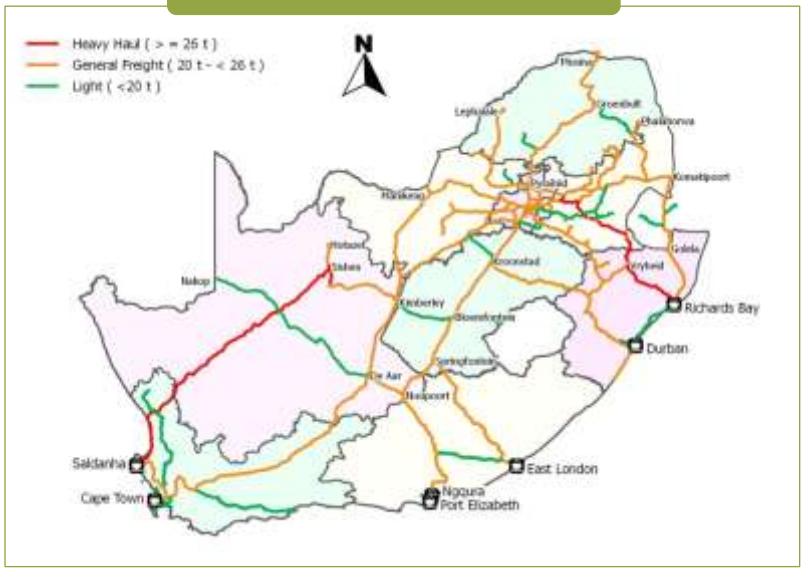
Electrification



Many legacy train control systems are in use. Ideally there should be two or three standardised systems only.

The main corridors are mostly using CTC (Centralised Traffic Control).

Axle Load



Installed technology: Standardisation

Topic	Comments	Status
Gauge	Single gauge on main lines	
Axle load	Main corridors 20 t/axle.	
Traction types	Corridors not standardised	
Gradients & curves	Corridors not standardised	
Train control	Corridors not standardised	
Locomotives	± 20 main classes	
Wagons	> 80 groups	
Operating philosophy	Unit loads, wagon loads	
Customer base	> 800 Consolidate.	
Commodity base	Substantial	

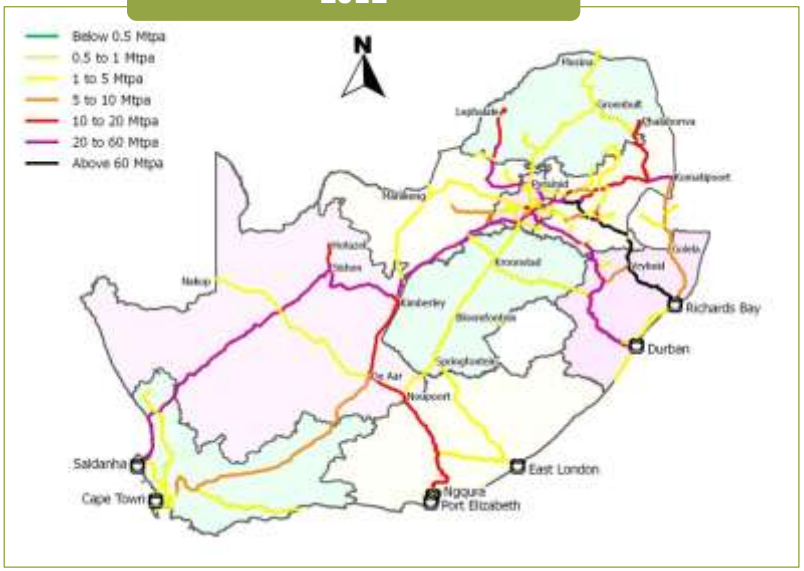
Legend

Good	Acceptable	Not acceptable

- **Gauge:** Virtually the whole Southern African network is on Cape gauge and connectivity is excellent.
- **Axle load:** Axle load on virtually all the main corridors is at 20 t/axle or more. Most branch lines at less than 20 t/axle but have sufficient capacity if maintained in good condition.
- **Traction types:** Many main corridors are a mixture of 3 kV DC, 25 kV AC and Diesel. This detrimentally affects consignment throughput times and locomotive utilisation as substantial time is lost during locomotive changeovers.
- **Gradients & curves:** Many corridor design characteristics are not standardised, resulting in underutilisation of locomotives as traction power on trains are provided to cope with the steepest gradients along the route and are not required for most or the time. Non-standardised curves result in different speed profiles between trains that further limit line capacity.
- **Locomotives:** The large number of different locomotive types in use increase maintenance training and spares requirements.
- **Wagons:** Different wagon types are required deal with the large number of commodities transported. Dedicated wagons are most suited for bulk flows such as iron ore and coal, but multi purpose wagons are more suitable where flow variations are more greater.
- **Operating philosophy:** TFR traffic is categorised in megaRail (large, regular consignments), accessRail (regular wagon loads handled on a hub-and-spoke principle) and flexiRail (irregular ad-hoc consignments). These allow tailor made designs for all Customer and traffic types.
- **Customer and commodity base:** Consolidation will result in lost revenues but may increase profitability. Many smaller consignments are not rail friendly and transported at a loss. Consolidation will significantly reduce operational complexities but result in further loads on and deterioration of the road network. This will be contrary to our mandate as an enabler to economic development.

Planned demand

2012



2022

2032

2042

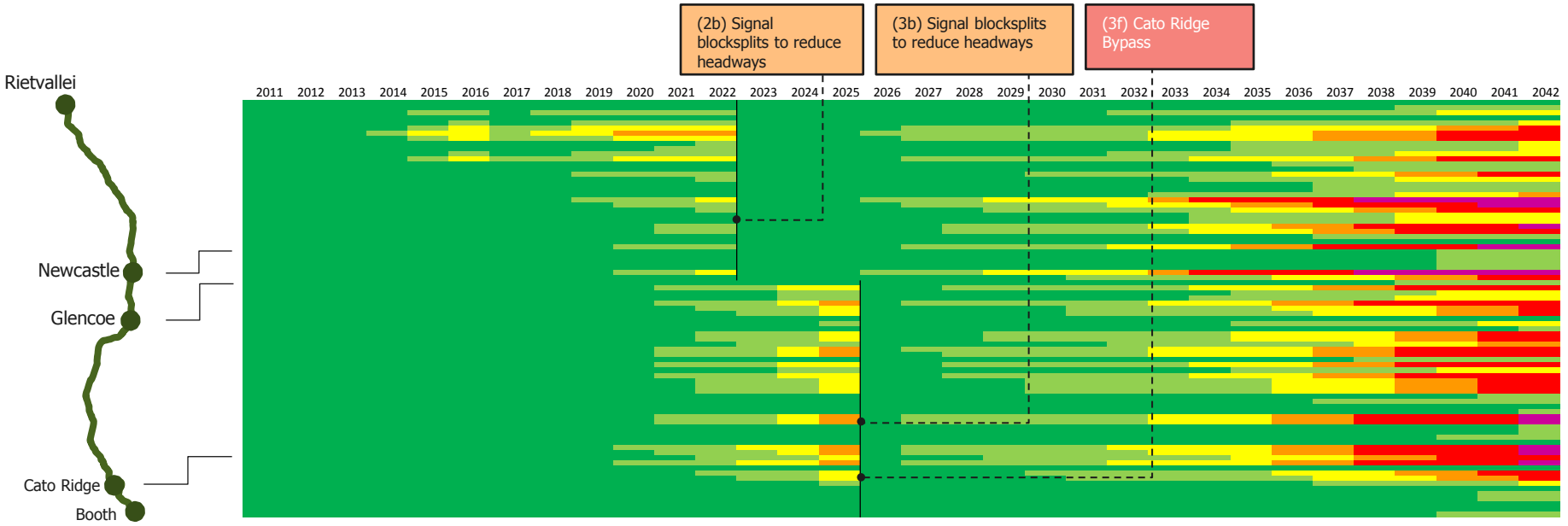
Gauteng – Durban system context

- The Gauteng to Durban section is a general freight line, but carries substantial high volumes tonnages.
- The volumes on the northern section (Gauteng to Glencoe) of Natcor are dominated by coal, iron ore and containers.
- Capacity interventions involves train control upgrading, axle load (heavy haul) upgrading, new links, Cato ridge bypass, upgrading of the electrification, doubling of single lines, and improving the connectivity of the rail network with existing and proposed intermodal terminals

Gauteng – Durban: capacity interventions

Notes

- Volumes along the Natal Corridor are expected to increase dramatically in the next 30-years. As the line is already double the strategy to create additional capacity is to install signal blocksplits between existing signals thereby reducing headways between trains. These interventions are proposed to come into effect on the Rietvallei to Glencoe section by 2022 and the Glencoe to Booth section by 2025
- Investigations into the possibility of a bypass at Cato Ridge on the difficult terrain section of the Glencoe to Booth line, as well as the implications surrounding lengthening container train consists, are currently underway



Gauteng – Durban: cost summary

Strategy

Axle	Train control	Electrical	Capacity expansion	Alignments
Upgrade Natcor North to 26 t/axle	Signal infill scheme	Upgrade to 25 kV AC	Reduce headway	Gradients, curves, bypass /links

Expansion and investment

Section	Phase	Intervention	ETC (Rm)
Pyramid to Sentrarand	1a	Double remainder of line (40 km)	1 209
Sentrarand to Skansdam	1b	Signal infill scheme to reduce the running time over this section to achieve a headway of 8mins	350
Skansdam to Houtheuwel	1c	New double track, 3 kV DC, CTC signalling (PRASA bypass)	1 600
Donkerhoek – Pienaarsrivier	1d	New single track chord from South to East (To facilitate the routing of Freight traffic travelling North from Sentrarand onto the Maputo corridor)	60
Rietvallei to Glencoe	2a	Transformer replacement	458
Rietvallei to Glencoe	2b	Implement CTC signal infill scheme to reduce headway	400
Rietvallei to Glencoe	2c	Upgrade to 25 kV AC and voltage changeover at All DC traction intersections	2 247
Rietvallei to Glencoe	2d	Train Control system	2 366
Glencoe to Booth	3a	Transformer replacement	458
Glencoe to Booth	3b	Implement CTC signal infill scheme to reduce headway	400
Glencoe to Cato Ridge	3c	Relieve Gradients and Curves	13 511
Glencoe to Booth	3d	Upgrade to 25 kV AC and voltage changeover at All DC traction intersections	2 247
Glencoe to Booth	3e	Train Control system	2 366
Cato Ridge to Durban	3f	Cato Ridge bypass	28 383
Durban to Stanger	4a	PRASA interface within eThekwini area	603
Durban to Richards Bay	4b	Double single line between Stanger and Richards Bay, 3 kV DC, and CTC signalling	5 190

Development plan

Section	Phase	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Pyramid to Sentrarand	1a			12	24	86	180	308	551	48																			
Sentrarand to Skansdam	1b							3	8	90	206	228	56																
Skansdam to Houtheuwel	1c				8	25	86	249	458	576	459	70																	
Donkerhoek – Pienaarsrivier	1d						1	1	11	23	25	6																	
Rietvallei to Glencoe	2a	2	6	78	154	170	49																						
Rietvallei to Glencoe	2b																2	5	30	83	140	123	17						
Rietvallei to Glencoe	2c						9	30	160	466	785	689	108																
Rietvallei to Glencoe	2d								10	30	125	303	555	698	560	85													
Glencoe to Booth	3a	2	6	78	154	170	49																						
Glencoe to Booth	3b																			2	5	30	83	140	123	17			
Glencoe to Cato Ridge	3c				56	166	486	892	2 178	3 456	3 414	2 426	437																
Glencoe to Booth	3d											9	30	160	466	785	689	108											
Glencoe to Booth	3e								10	30	125	303	555	698	560	85													
Cato Ridge to Durban	3f										114	350	1 355	3 627	6 658	8 370	6 672	1 237											
Durban to Stanger	4a			3	8	100	207	228	57																				
Durban to Richards Bay	4b										21	64	188	342	837	1 328	1 312	932	166										
Total cash flow (Rm)	**62429**	4	12	171	404	717	1 067	1 711	3 443	4 719	5 274	4 448	3 284	5 525	9 081	10 653	8 675	2 282	196	85	145	153	100	140	123	17	0	0	0

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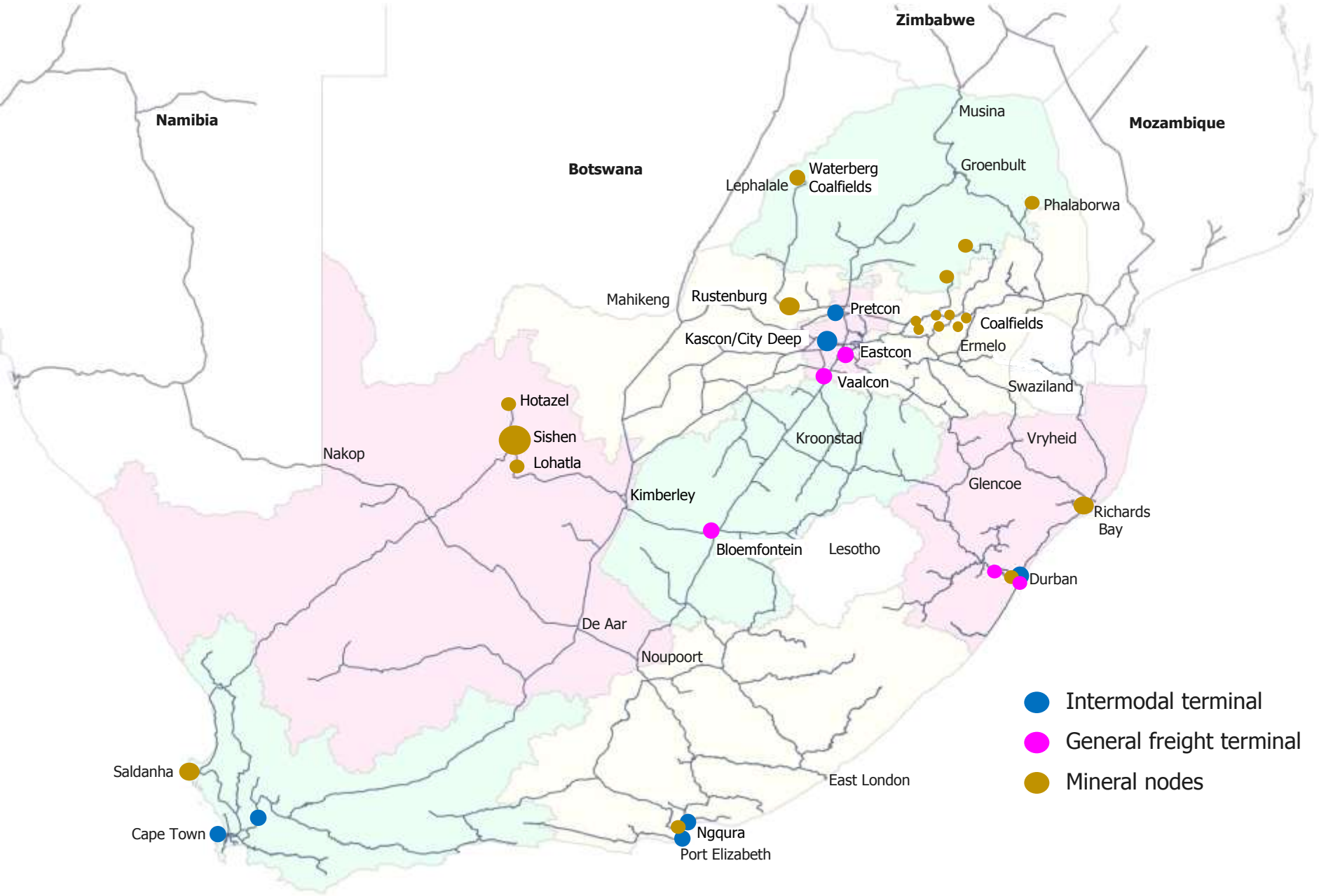
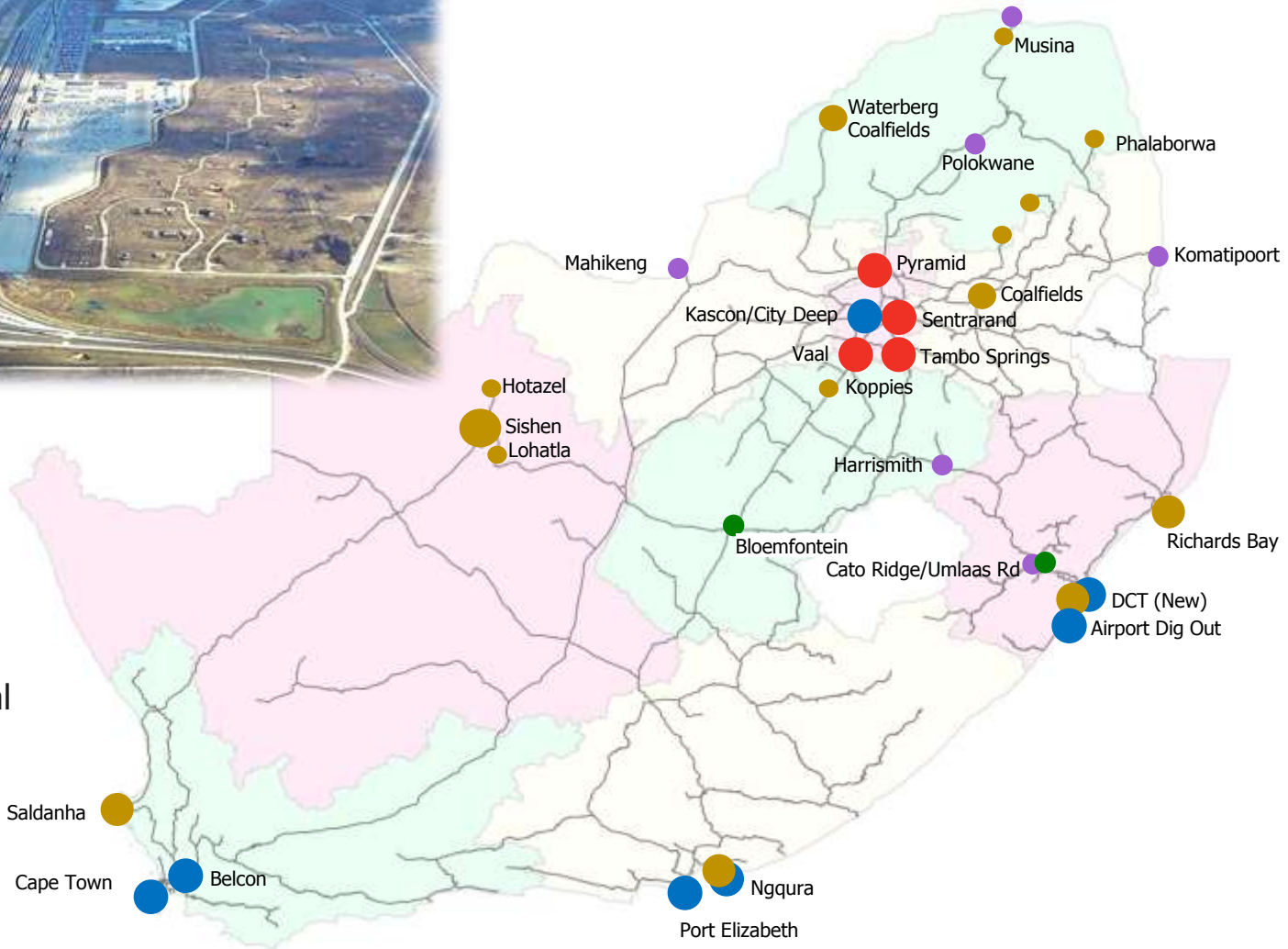
FEL-3 and Construction

Hubs and terminals: status quo



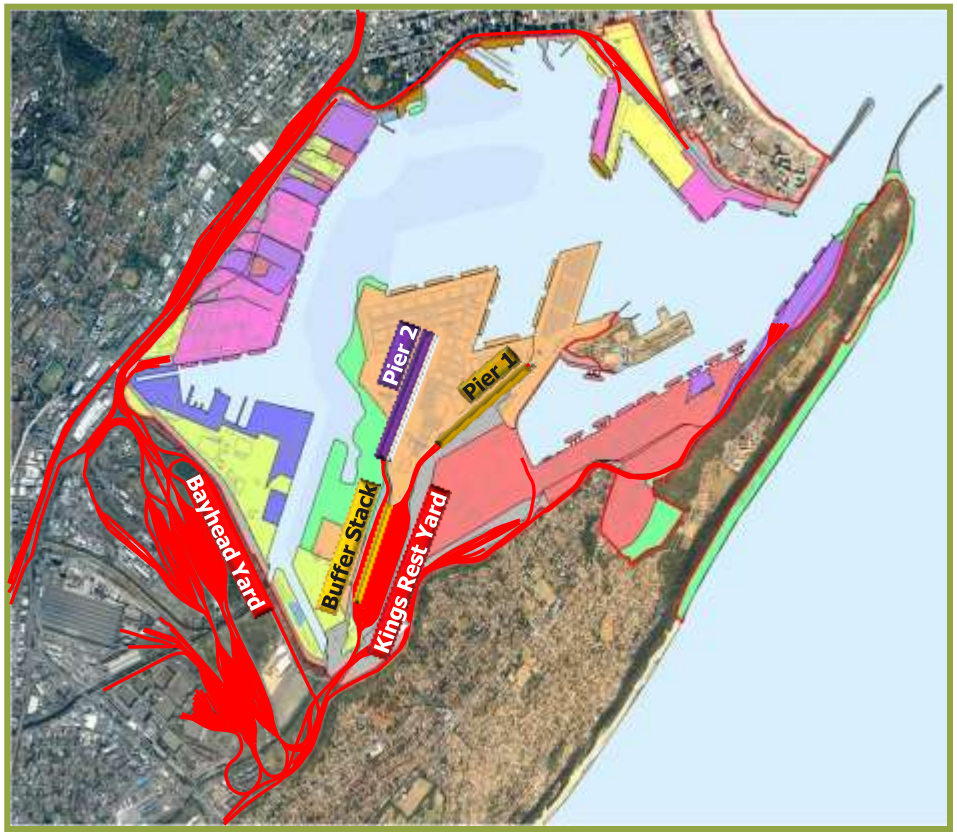
Hubs and terminals: proposed locations 2041

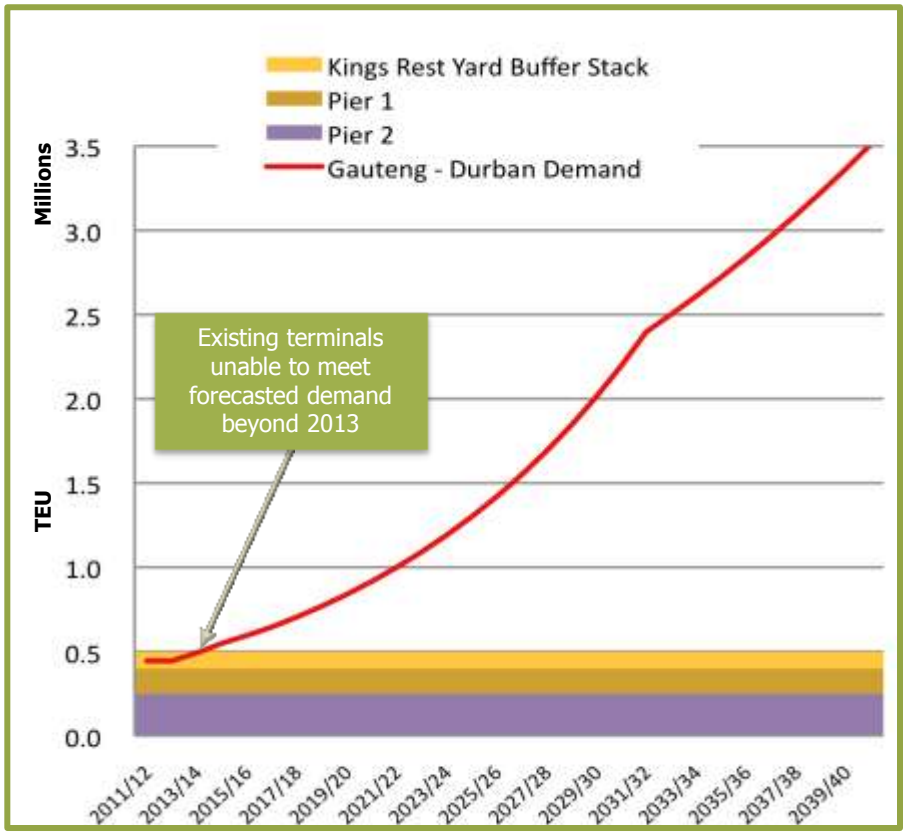
- Super terminal
- Intermodal terminal
- Freight nodes
- Mineral nodes
- General freight terminal



The indicated freight nodes are not necessarily informed by demand but are proposed by public sector in support of economic development

Durban terminals: capacity vs demand



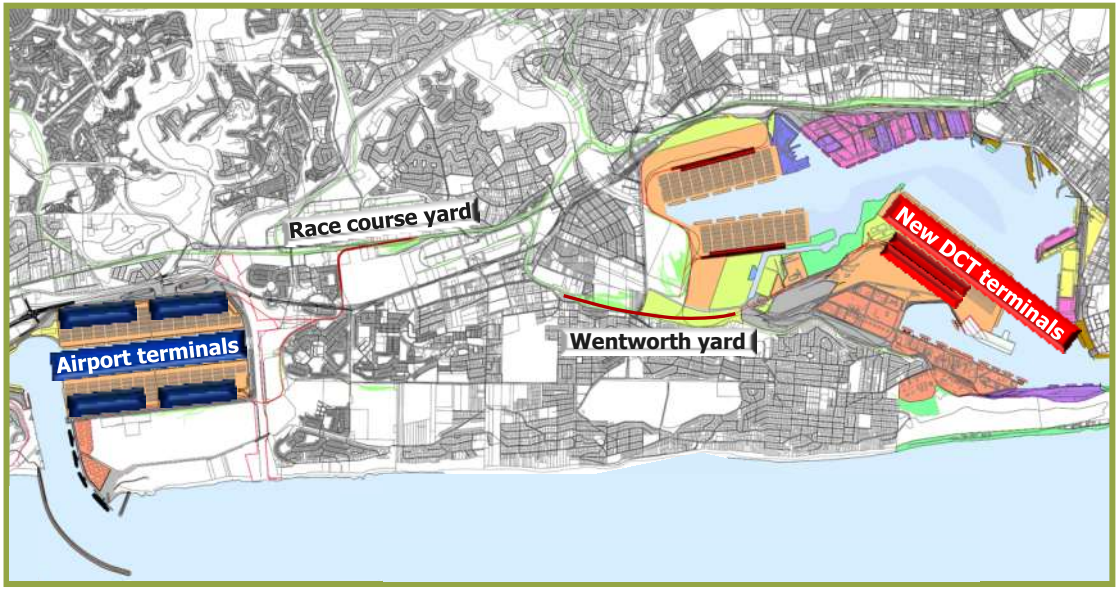


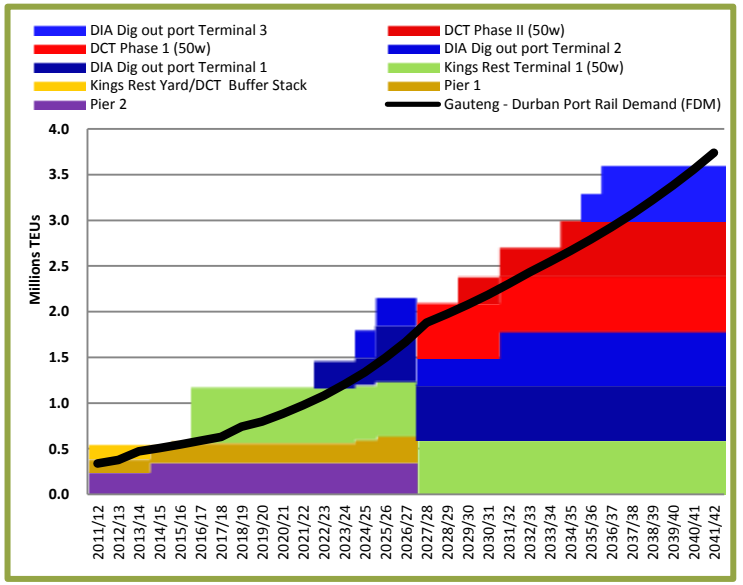
The port of Durban has two rail container terminals at Pier 1 and DCT with 150 000 and 250 000 TEUs capacity respectively.

A buffer stack exists at Kings Rest yard which increases the overall capacity to about 450 000 TEUs.

Both Bayhead and Kings Rest yards can accommodate 50 wagon container trains which presents a problem for the current 75 wagon Anaconda trains running along the corridor. With the increase in container traffic forecasted over the next 30 years it is vital to increase the port's current rail intermodal capacity to match the corridor and inland capacities.

Durban terminals: development plan



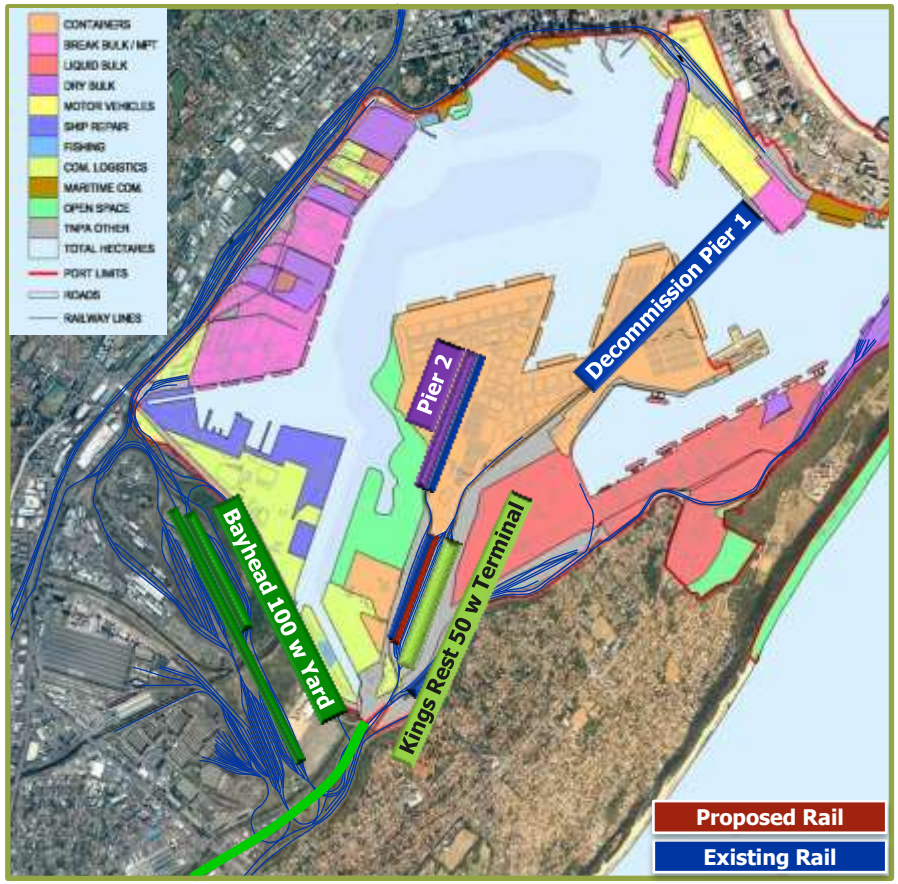


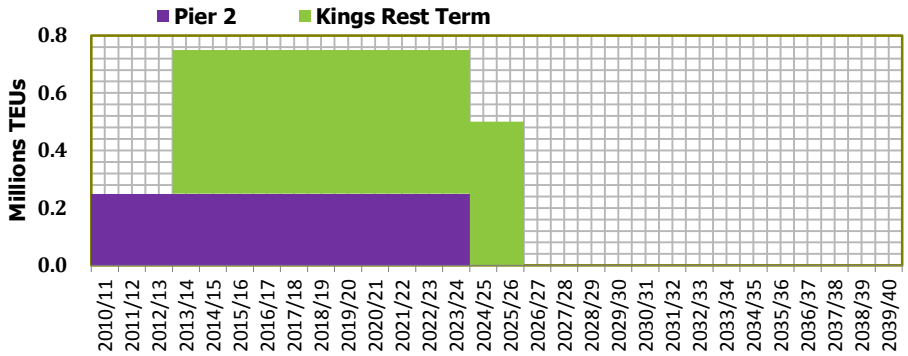
Development plan

Location	Terminal type	Capacity created (TEUs)	ETC (Rm)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Bayhead	100 W yard	N/A	677		406	271																							
Kings Rest	Container	600 000	1 641		985	656																							
Umbogintwini	100 W yard	N/A	574		6	11	56	139	195	111	56																		
Airport 1	Container	600 000	1 282						12	25	125	311	436	249	125														
Airport 2	Container	600 000	1 010										10	20	294	491	196												
DCT 1	Container	600 000	1 929											19	37	187	468	656	375	187									
DCT 2	Container	600 000	1 065															10	21	310	517	207							
Airport 3	Container	600 000	1 002																					10	19	292	486	195	
Total cash flow (Rm)		**4 200 000**	**9 181**		**1397**	**938**	**56**	**139**	**207**	**136**	**181**	**311**	**446**	**288**	**456**	**678**	**664**	**666**	**396**	**497**	**517**	**207**		**10**	**19**	**292**	**486**	**195**	

FER: Front End Research
FEL–1: Concept study
FEL–2: Pre-feasibility
FEL-3 and Construction

Durban future terminals: Pier 1 2019 concept





Sequencing:

- 2013/14 – Increase Kings Rest buffer stack
- 2013/14 – Kings Rest 50 wagon terminal
- 2013/14 – Bayhead 100 wagon Arrivals and Departures yard
- 2016/17 – Decommission Pier 1

Development plan

Location	Terminal type	Capacity created (TEUs)	ETC (Rm)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Bayhead	100 W yard	N/A	677		406	271																							
Kings Rest	Container	600 000	1 641		985	656																							
Total cash flow (Rm)		**600 000**	**2 318**		**1391**	**927**																							

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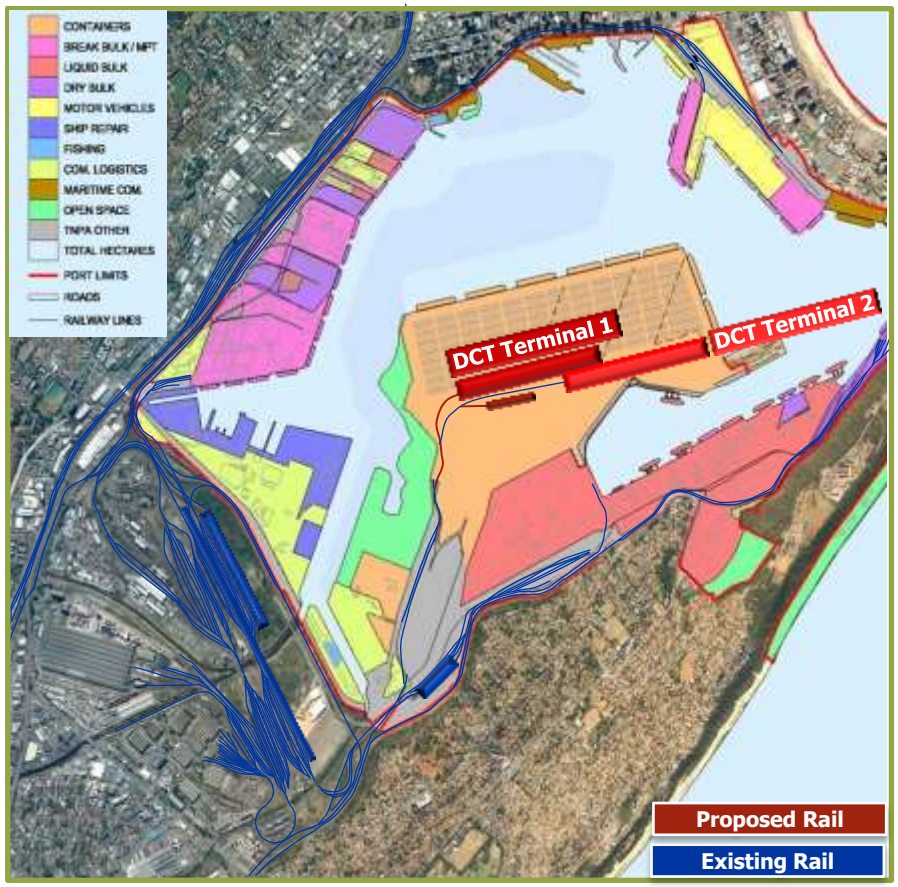
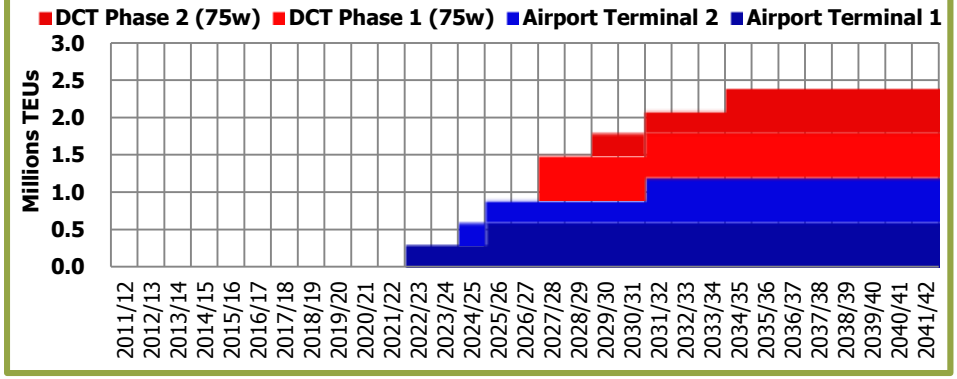
FEL–2: Pre-feasibility
FEL-3 and Construction

Durban future terminals: Pier 1 2027 concept





Sequencing:

- 2022/23 – Airport Terminal (1)
- 2024/25 – Airport Terminal (2)
- 2024/25 – Decommission Pier 2
- 2026/27 – Decommission Kings Rest
- 2027/28 – DCT 75 wagon terminal (1)
- 2029/30 – DCT 75 wagon terminal (2)
- 2035/26 – Airport Terminal (3)

Development plan

Location	Terminal type	Capacity created (TEUs)	ETC (Rm)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Airport 1	Container	600 000	1 283						12	25	125	311	436	249	125														
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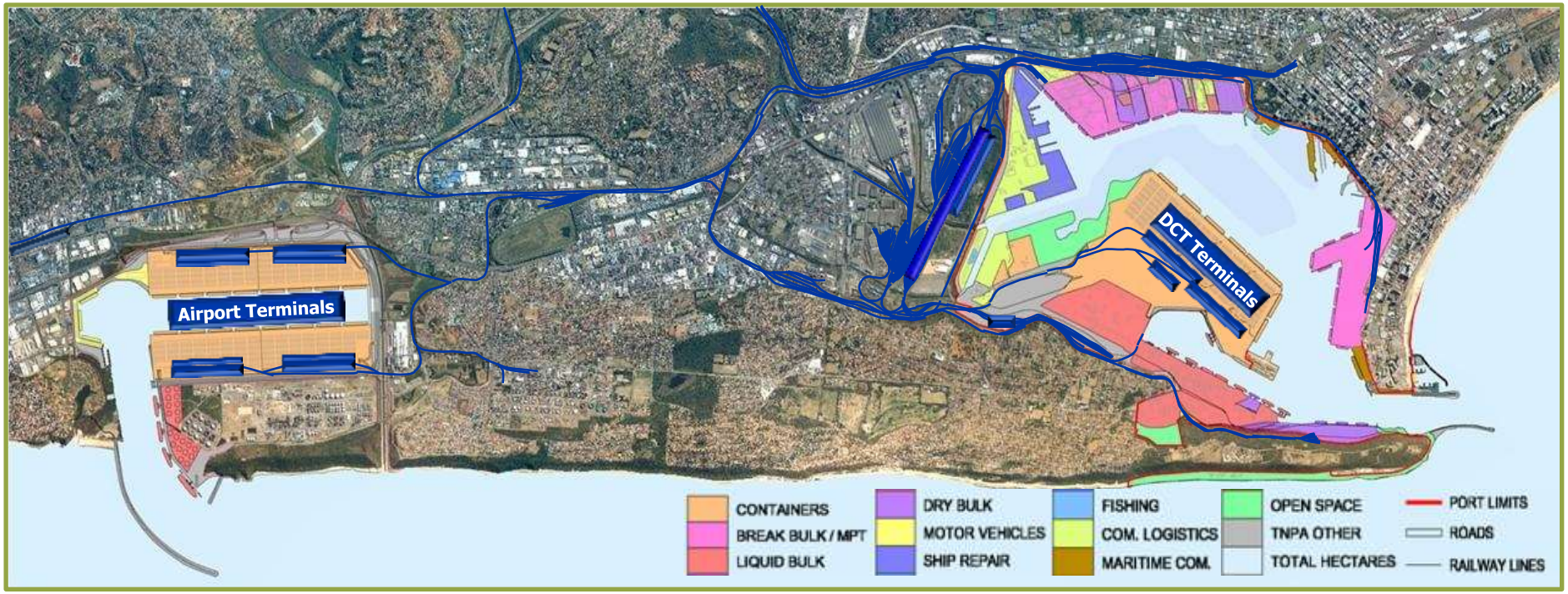
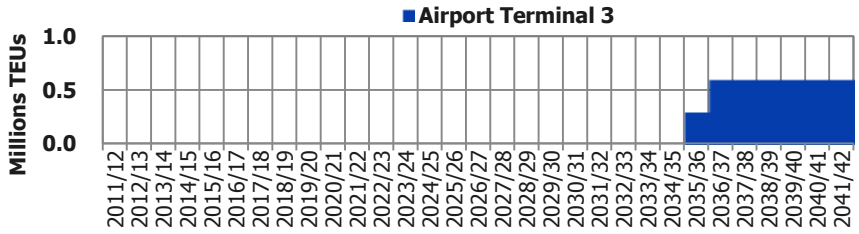
DCT 2	Container	600 000	1 065															10	21	310	517	207							
Total cash flow (Rm)		**4 200 000**	**5288**						**12**	**25**	**125**	**311**	**446**	**288**	**456**	**678**	**664**	**666**	**396**	**497**	**517**	**207**							

FER: Front End Research
FEL–1: Concept study
FEL–2: Pre-feasibility
FEL-3 and Construction

Durban future terminals: Pier 1 and DIA 2042 concept





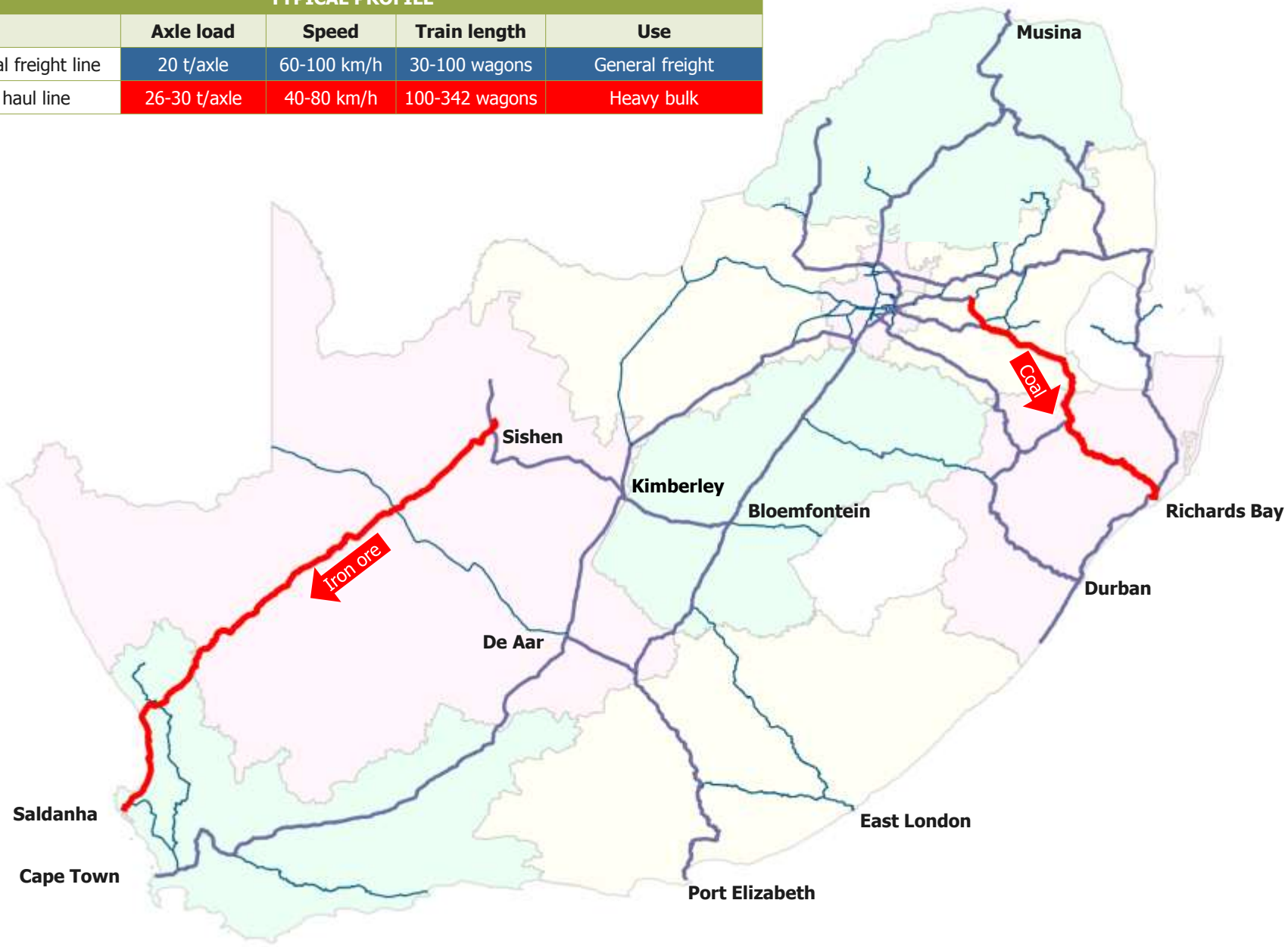
Sequencing:
2035/36 – Airport Terminal (3)

Development plan

Location	Terminal type	Capacity created (TEUs)	ETC (Rm)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Airport 3	Container	600 000	1 002																					10	19	292	486	195	
Total cash flow (Rm)		**600 000**	**1 002**																					**10**	**19**	**292**	**486**	**195**	

Current network

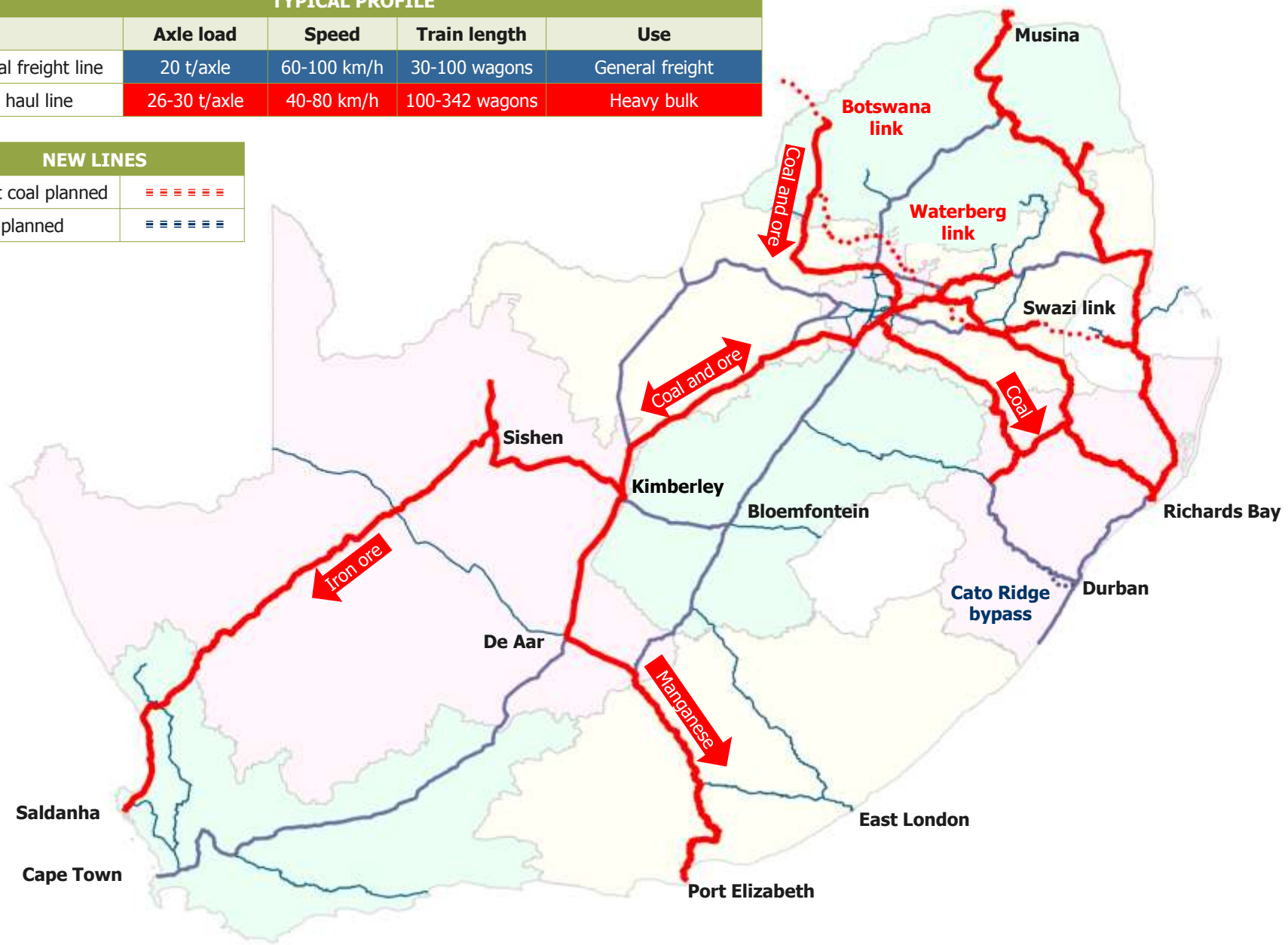
TYPICAL PROFILE				
	Axle load	**Speed**	**Train length**	**Use**
General freight line	20 t/axle	60-100 km/h	30-100 wagons	General freight
Heavy haul line	26-30 t/axle	40-80 km/h	100-342 wagons	Heavy bulk



Planned network (30 years)

TYPICAL PROFILE				
	Axle load	Speed	Train length	Use
General freight line	20 t/axle	60-100 km/h	30-100 wagons	General freight
Heavy haul line	26-30 t/axle	40-80 km/h	100-342 wagons	Heavy bulk

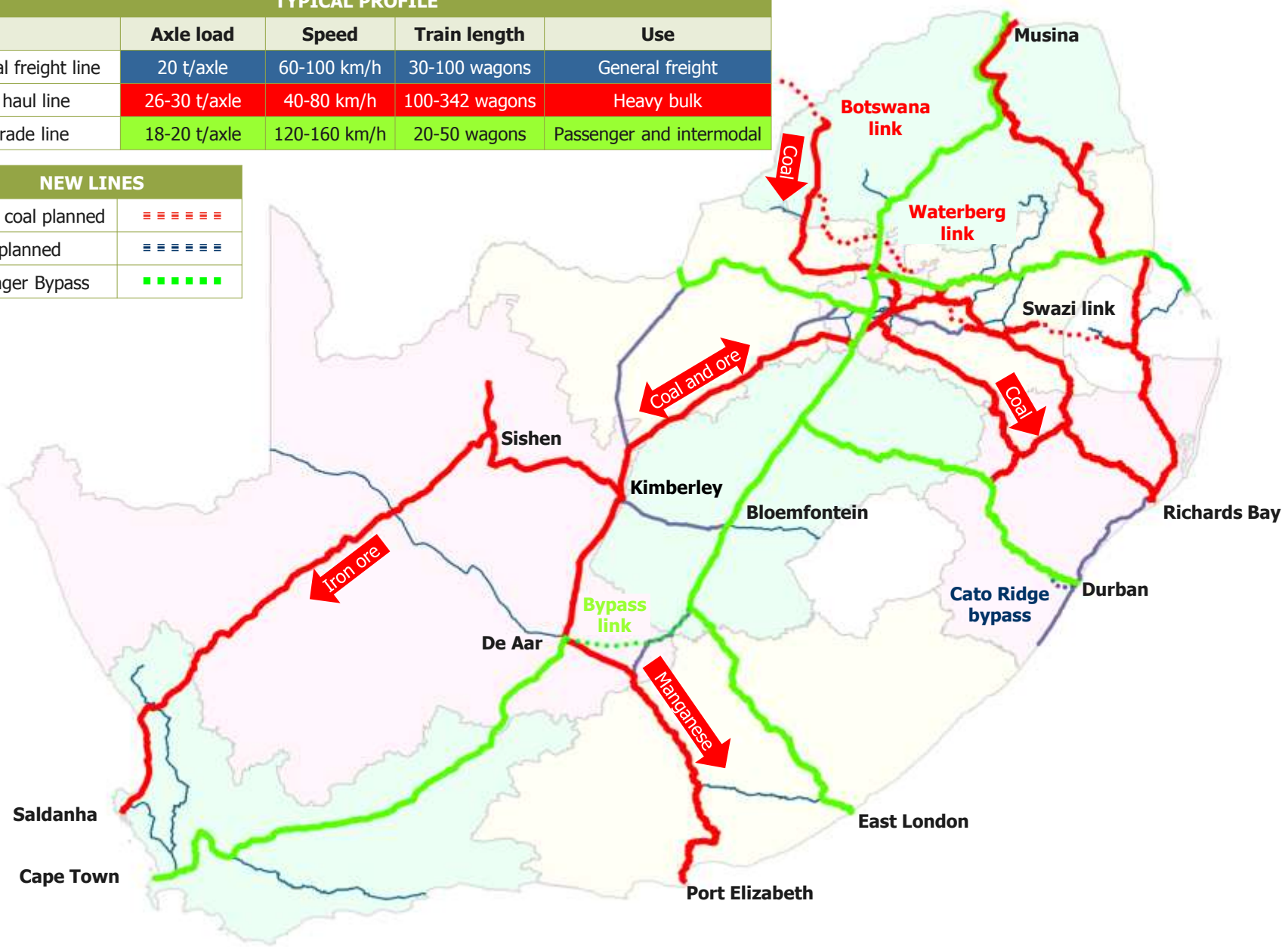
NEW LINES	
Export coal planned	
Other planned	



Long-term shared network – PRASA/Transnet

TYPICAL PROFILE				
	Axle load	Speed	Train length	Use
General freight line	20 t/axle	60-100 km/h	30-100 wagons	General freight
Heavy haul line	26-30 t/axle	40-80 km/h	100-342 wagons	Heavy bulk
High grade line	18-20 t/axle	120-160 km/h	20-50 wagons	Passenger and intermodal

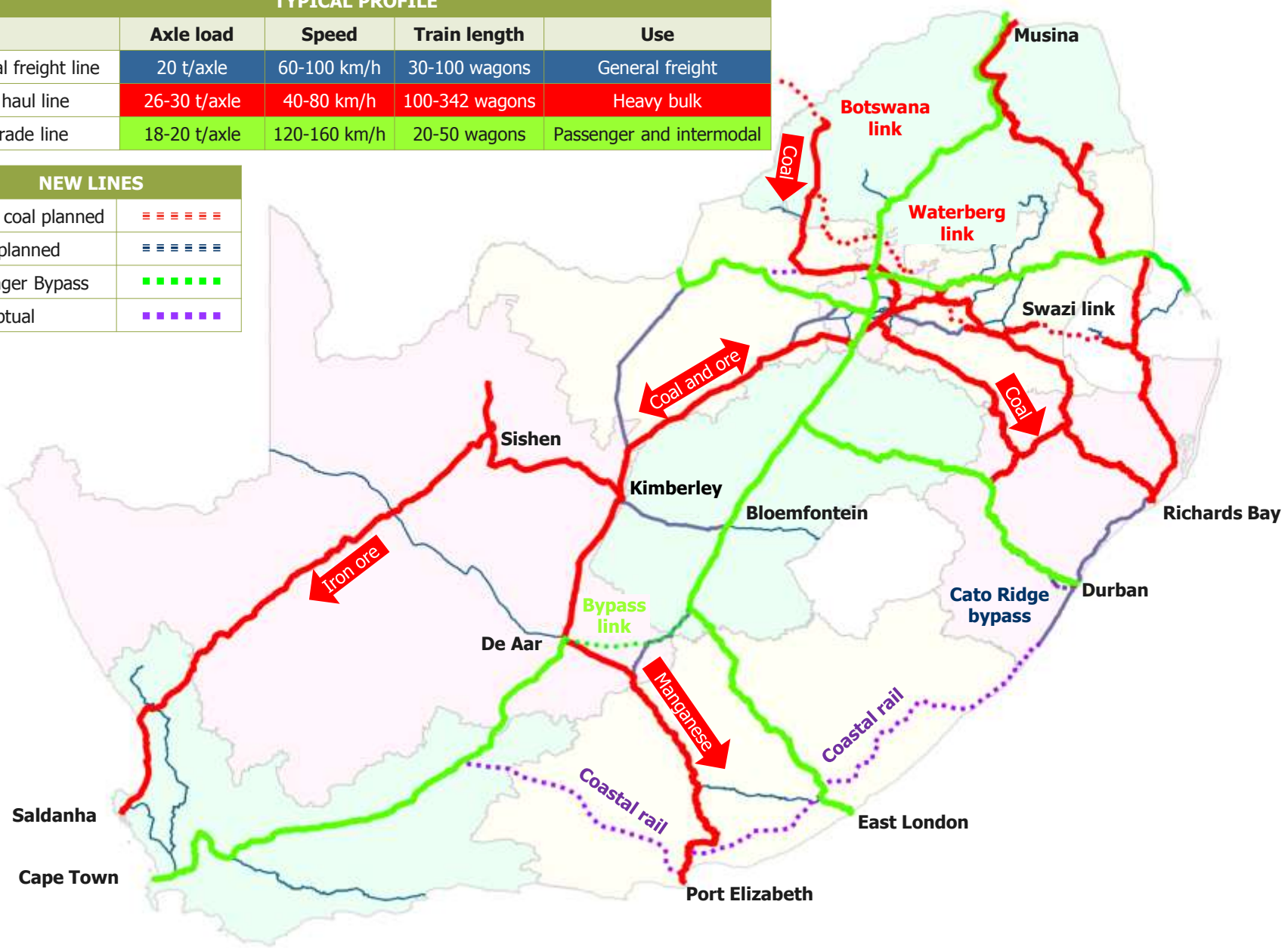
NEW LINES	
Export coal planned	
Other planned	
Passenger Bypass	



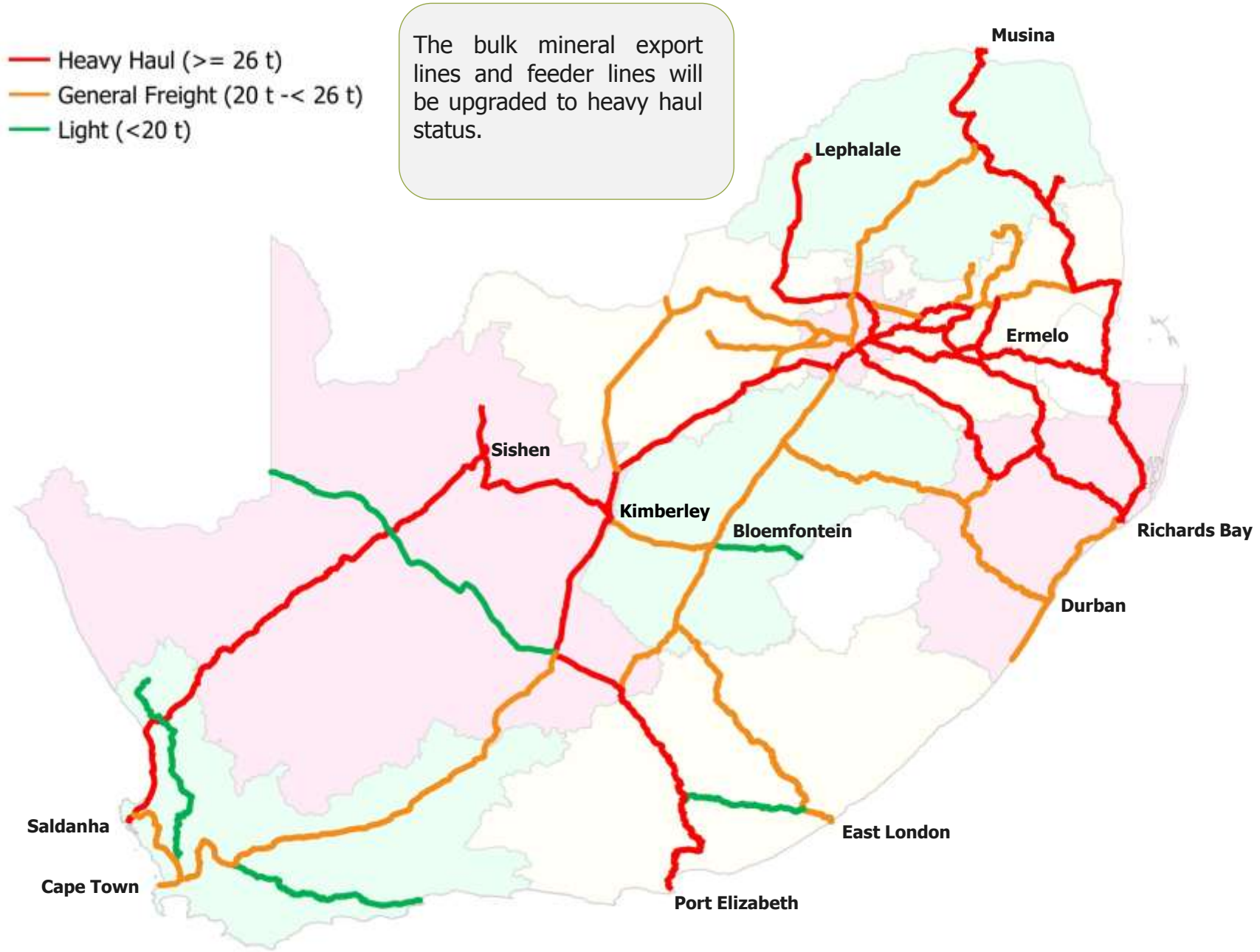
Long-term network potential

TYPICAL PROFILE				
	Axle load	Speed	Train length	Use
General freight line	20 t/axle	60-100 km/h	30-100 wagons	General freight
Heavy haul line	26-30 t/axle	40-80 km/h	100-342 wagons	Heavy bulk
High grade line	18-20 t/axle	120-160 km/h	20-50 wagons	Passenger and intermodal

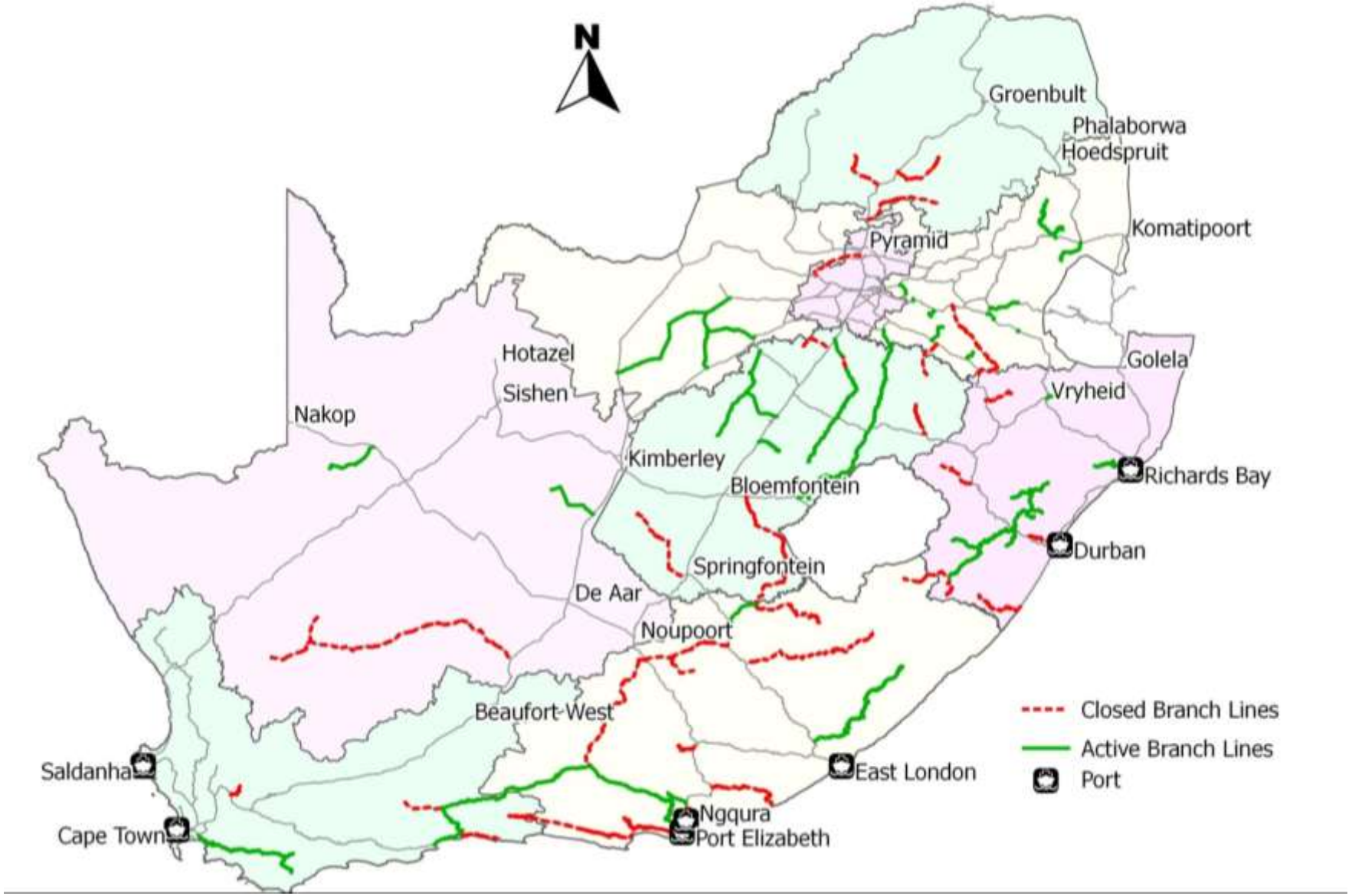
NEW LINES	
Export coal planned	
Other planned	
Passenger Bypass	
Conceptual	



Axle Load


Heavy Haul (>= 26 t)
General Freight (20 t -< 26 t)
Light (<20 t)
The bulk mineral export lines and feeder lines will be upgraded to heavy haul status.
Musina
Lephalale
Ermelo
Sishen
Kimberley
Bloemfontein
Richards Bay
Durban
Saldanha
Cape Town
East London
Port Elizabeth

Branch lines context and status quo



Re-instatement of the KwaZulu – Natal branch lines

Project description

- The development of a new line to link the Makatini flats with the Golela – Richards Bay line in support of the National Planning Commission and New Growth Path.

Project detail & issues

- This area is renowned for its agriculture potential and especially genetically modified crops.
- The immediate traffic potential is 0,2 mtpa of sugar cane for Felixston, and can grow substantially.
- The Umkhanyakude District Municipality is investigating potential future linkages with Mozambique and new the proposed new deep water port at Techobanine (22 km from the KZN border) are contemplated.

Project description

- Possible re-instatement of the line between Somkele and Mtubatuba closed in 1928.
- Re-instatement of the line between Mtubatuba and Riverview (Umfolozi sugar mill).

Project detail & issues

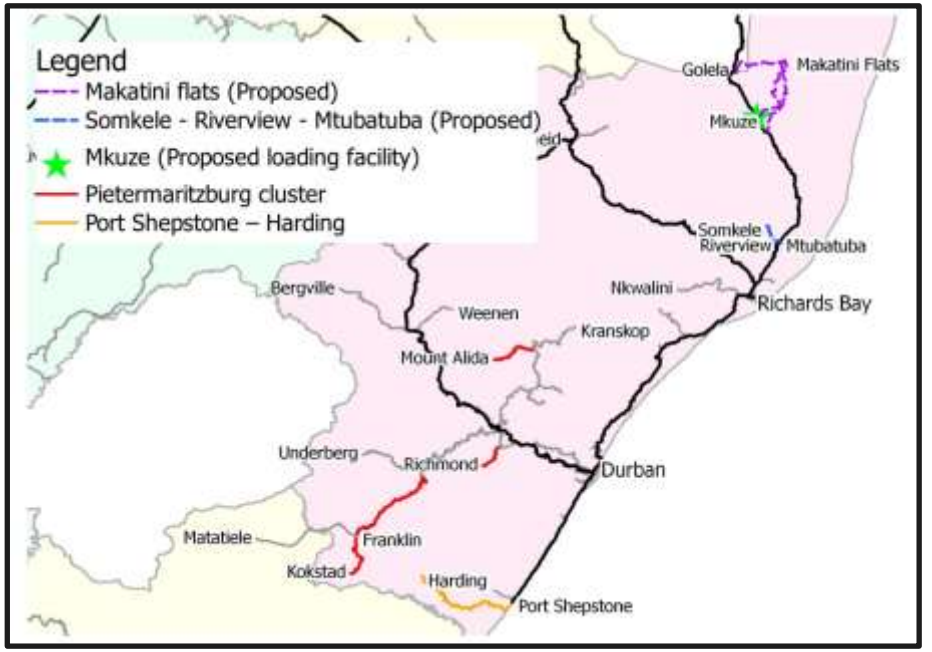
- To be used for the export of 2,5 mtpa for the next 20 years of antracite from Somkele through the Port of Richards Bay.
- Alternatively, the creation of a loading facility at Mtubatuba or Dukuduku.
- Transport of potentially 0,2 mtpa of Umfolozi sugar and molasses to Durban.

Project description

- Development of loading facilities at Mkhuze (on the Golela – Richards Bay coal line) for 0,8 mtpa of sugar cane destined for the Felixston sugar mill.

Project detail & issues

- The Senekal Family and their Employee Empowerment Trust within the Umkhanyakude District Municipality (KZN), have a 20 year agreement with the sugar mill at Felixston for the exclusive supply of cane.



Project description

- Upgrade and re-instatement of the line from Mt. Alida to Greytown, Donnybrook to Kokstad and potentially Pietermaritzburg to Richmont.

Project detail & issues

- The focus will be to increase timber traffic from 0,2 mtpa to 1,5 mtpa and to develop other agricultural and general freight opportunities.
- Current interaction with Forestry SA to regain business.

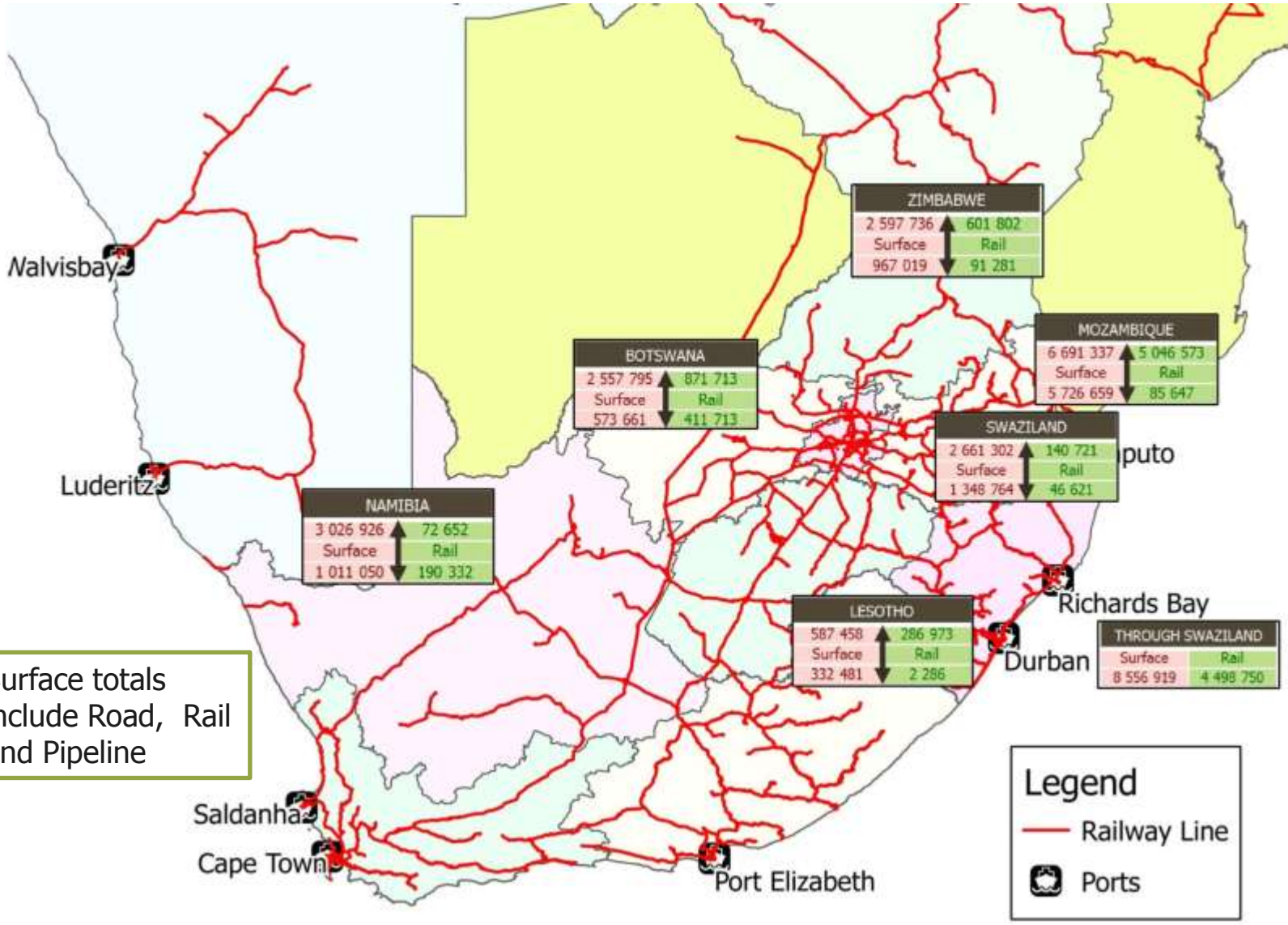
Project description

- Potential reinstatement of the line and safeguard the right of way.

Project detail & issues

- Potential re-opening of the Banana Express (passengers) and some timber.
- Investigate the potential for dual gauge to promote regional and business integration.
- Potential rail link between KZN and the Eastern Cape provinces through a proposed connection with Umtata.

2012 Cross-border freight flows (tpa)



Surface totals include Road, Rail and Pipeline