GAUTENG PROVINCE
ROADS AND TRANSPORT
REPUBLIC OF SOUTH AFRICA

GAUTENG ON THE MOVE

GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

25-YEAR INTEGRATED TRANSPORT MASTER PLAN
Annexure J: Strategic Road Network

November 2013

Final

GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

ROAD NETWORK

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

The 2037 Consortium has been appointed to develop a 25-year Integrated Transport Master Plan for Gauteng. This section discusses the status quo of road network planning, implementation, management and maintenance.

1.2 METHODOLOGY

This following methodology has been adopted to prepare this document:

- A scan of existing national, provincial and local planning documents, policy frameworks, strategies and plans, with a view of determining the status quo of the total road network.
- An assessment of the status quo of planning and current transport realities, existing problems and issues;
- Evaluation of the base year (2012) road peak hour operational conditions;
- Development of an initial future road network, considering the road needs as identified by the various road authorities of all three tiers of government of the various through the upgrading of the existing road network and the introduction of new road links;
- Evaluation of the performance of the road network with different land use and public transport supply scenarios;
- Development of the 2037 road network.

1.3 Investing in Infrastructure

The Government's "New Growth Path" outlines an approach to accelerate growth and employment, focusing on job-creation targets and sector-based actions that will help to achieve them. Jobs drivers are identified as:

- Continuing public investment in **infrastructure**, creating employment directly in construction, operation, maintenance and the production of inputs, and indirectly by improving efficiency across the economy.
- Targeting more labour-absorbing activities in the agricultural and mining value chains, manufacturing, construction and services.
- Promoting innovation through "green economy" initiatives.
- Supporting rural development and regional integration.

Government believes that prudent macroeconomic policy that takes into account global volatility and the need to sustain growth will support the New Growth Path. While many countries are tightening their fiscal belts, it is thought that South Africa's macroeconomic approach affords government the space to grow expenditure at a moderate pace to support social and economic priorities. Public spending in support of social programmes has been strong and, if combined with more rapid job creation, will significantly increase inclusion and income equality.

As shown in ***Table 1-1*** public-sector spending on infrastructure has increased from 4.6 per cent of GDP in 2006/07 to 9.8 per cent of GDP in 2010/11, and is expected to average 8.4 per cent of GDP over the forecast period, totalling R808.6 billion. Economic services make up 82.1 per cent of infrastructure development over the medium term, of which transport and logistics investment, which covers transport network expansion and upgrades, continues to hover at 25% of the total investment.

Table 1-1: Public sector infrastructure expenditure and estimates by sector (R Million)

Sector	2010/11 Revised Estimate	2011/12 Medium Term estimates	2012/13	2013/14	MTEF Total	% of Total
Economic Services	**228 657**	**216 181**	**219 380**	**228 507**	**664 067**	**82.1**
Energy	102 782	96 500	98 140	96 769	291 409	36.0
Water and sanitation	20 990	26 836	25 367	28 196	80 400	9.9
Transport and logistics	80 530	67 452	69 096	75 554	212 102	26.2
Other economic services	24 356	25 393	26 777	27 987	80 157	9.9
Social services	**26 249**	**29 519**	**34 932**	**44 268**	**108 719**	**13.4**
Health	8 546	10 256	15 114	20 624	45 993	5.7
Education	6 757	9 155	10 092	11 487	30 735	3.8
Community facilities	6 045	6 360	5 873	7 952	20 185	2.5
Other social services	4 902	3 749	3 853	4 205	11 806	1.5
Justice and protection services	**3 100**	**3 322**	**7 080**	**10 171**	**20 573**	**2.5**
Central government administrative and financial services	**2 104**	**3 827**	**7 946**	**3 474**	**15 248**	**1.9**
Total	**260 109**	**252 850**	**269 337**	**286 420**	**808 608**	**100**
Percentage of GDP	**9.8 %**	**8.7 %**	**8.4 %**	**8.1 %**		

Source: Budget Review 2011

2 PRINCIPLES AND DEPARTURE POINTS

The Gauteng road network remains one of the most important infrastructure assets of the province that underpins and support local economic growth and the resultant growth in job opportunities within the identified corridors and nodes. It is thus vitally important that the Gauteng Province **develop** and **maintain** an integrated road network that, inter alia:

- Creates a hierarchy that provides mobility roads (Class 1 and Class 2) and roads providing accessibility (Class 4 and 5) with Class 3 roads that provided a balance between mobility and accessibility.
- Provides a road network that allows continuity of travel across the province;
- Provides for acceptable levels of service during peak periods for especially road based public transport and to a lesser extent private transport to encourage the utilisation of public transport.
- Provides for adequate levels of safety;
- Promote environmental sustainability through the modes and technologies deployed on the road network,
- Provides for heavy vehicles (freight), private vehicles and public transport.
- Provides for non-motorised users on the Class 2 to 5 road network;
- Provides priority measures for higher occupancy vehicles where appropriate;
- Provides a safe and reliable strategic road network system which would optimize the movement of freight and passengers;
- Manage congestion and focus on the promotion public transport through the efficient and effective use of existing and future freeway road space.
- Optimisation of the existing road infrastructure through the implementation of: - -
  - Intelligent Transportation Systems (ITS)
  - Incident Management Systems
  - Travel Demand Management (TDM)

3 THE GAUTENG ROAD NETWORK

The total road network in Gauteng represents about 7.4% of the total South African road network of approximately 741 000 km. SANRAL[28] is currently responsible for a road network of 19 704 km (2.7%) of the total road network in South Africa. The national roads under SANRAL's jurisdiction comprises of 16 5894 km of non-toll roads, 1 832 km of agency toll roads and 1 288 km of concession toll roads.

Table 3-1: Extent of the R S A Road Network

Province	Municipal Urban Roads & Streets	National & Numbered Provincial Roads	Prov. Rural Access Roads	Total Roads & Street lengths	% of RSA
Gauteng	40 917	3 759	10 333	55 009	7.4%
KwaZulu-Natal	33 237	9 938	54 734	97 909	13.2%
Western Cape	31 830	10 293	50 057	92 180	12.4%
Eastern Cape	10 124	10 505	57 855	78 484	10.6%
Free State	11 484	9 836	90 033	111 353	15.0%
Mpumalanga	11 471	8 444	36 110	56 025	7.6%
North West	10 920	9 137	52 556	72 613	9.8%
Limpopo	10 401	7 936	48 066	66 403	9.0%
Northern Cape	9 145	12 173	89 877	111 195	15.0%
RSA	169 530	82 019	489 623	741 172	100.0%

Source: RTMC Annual Report

The Gauteng Province has a total road network of about 55 000 km of which 1.0% is national roads, 9% provincial roads and the remainder are local municipal roads i.e. 90 % of the total road network. The mix and split of roads in the Gauteng Province are shown in the table below:

Table 3-2: Approximate extent of road networks in Gauteng [1]

Road Authority	Length (km)	Network Split
National Roads	470	0.9%
Provincial Roads	4 830	8.8 %
Local Roads	28 885	90.5%
TOTAL	***55 000***	***100%***

NATMAP data adjusted

4 THE GAUTENG NATIONAL ROAD NETWORK

4.1 Background

The national road network in Gauteng, albeit a small percentage of the road network carries large traffic volumes and provides the mobility network and especially freight network for the Gauteng Province The national network is managed by the South African National Roads Agency. SANRAL is an independent, statutory company registered in terms of the Companies Act. The South African government, represented by the Minister of Transport, is the sole shareholder and owner of SANRAL.

SANRAL operates in terms of its founding legislation, The South African National Roads Agency Limited and National Roads Act (Act No. 7,1998). It is governed by a Board of eight people, six of whom are appointed by the Minister of Transport; the Chief Executive Officer, who is appointed by the Board; and a representative of the Minister of Finance.

SANRAL has a distinct mandate – to finance, improve, manage and maintain the national road network (the "economic arteries" of South Africa). SANRAL introduced and consolidated the concept of Public Private Partnerships that culminated in the internationally acclaimed Maputo Development Corridor, the N3 Corridor and the Platinum Corridor.

SANRAL has two primary sources of income. Non-toll roads are funded from allocations made by the National Treasury. Toll roads are funded from borrowings on the capital and money markets – bonds issued on the Bond Exchange of South Africa (BESA) in the name of the South African National Roads Agency Limited, or through the concessioning of roads to private sector consortia.

SANRAL manages assets worth in excess of R30 billion, without land values.

The SANRAL road network is shown in below, indicating the current SANRAL road network of 16 170 km, the strategic roads (2907 km) that will be incorporated to increase the national road network to 19 077 km.

The former Minister of Transport Mr Mr S Ndebele said that SANRAL's mandate should be broadened and the organisation repositioned so that it could provide support to provinces where capacity remained a problem. *"We cannot have as a country a good national road network whilst provincial and municipal roads remain in a sorry state,"* he said. It is thus anticipated that SANRAL will further increase their road network with a further 13 806 km of mostly strategic provincial roads to a total road network of 32 883 km.

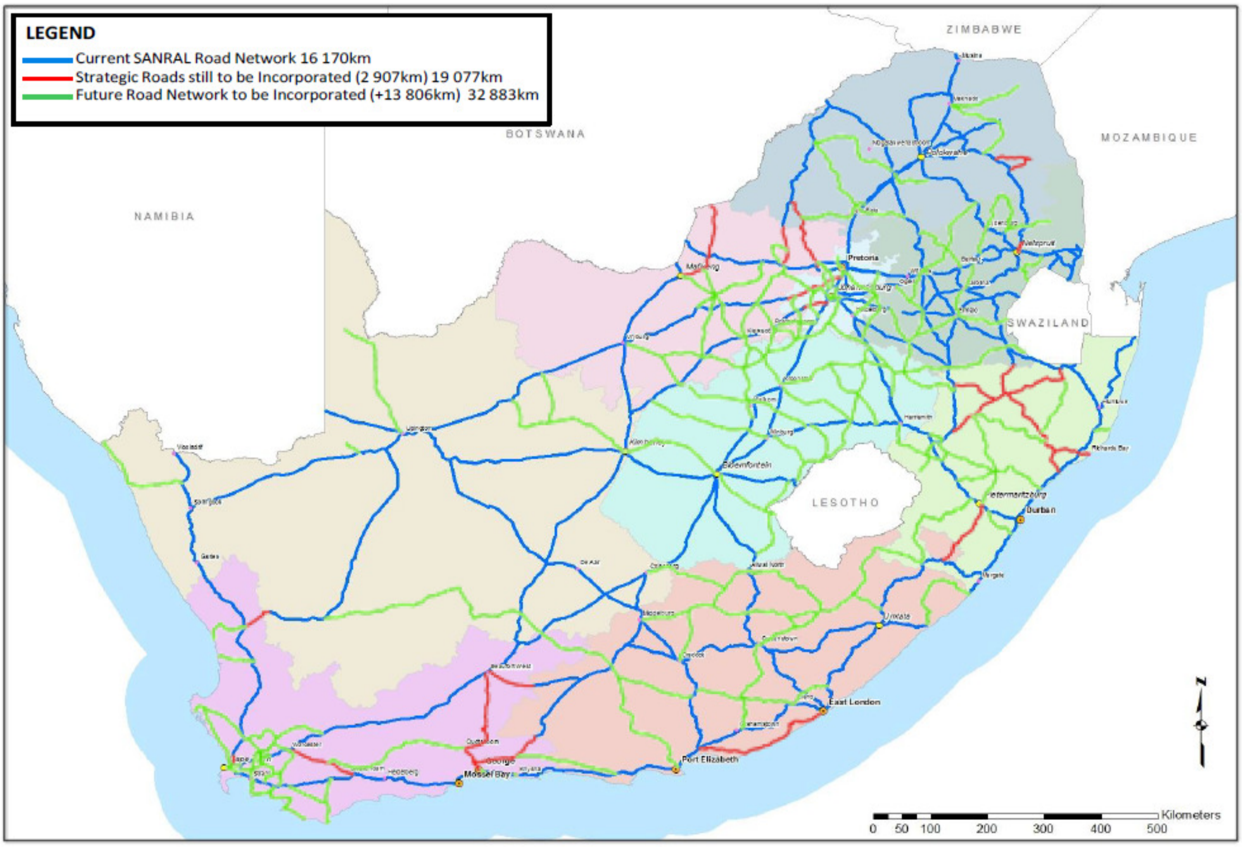


Figure 1: Proposed SANRAL Road Network

4.2 Gauteng Freeway Improvement Project

4.2.1 Overview of the Project[25]

The Gauteng Freeway Improvement Project (GFIP) comprises different phases to upgrade and implement new freeways of an ultimate 560km freeway network. The first phase, comprising the upgrading of 185km of the most congested freeways has been completed in 2012.

Apart from widening of the freeways, the GFIP project also ensured that bottlenecks at interchanges are resolved. For the first phase of the GFIP, 34 interchanges were significantly upgraded, including infamous interchanges such as the Allandale, Rivonia, William Nicol, Gillooly's and Elands interchanges. The Albertina Sisulu Highway (R21), previously a provincial road has been incorporated into the GFIP and has been declared as a national road in April 2008.

Apart from the R21 the following other freeways has been upgraded to minimum 4 lanes per direction:

- N12 between Gillooly's and the border between Gauteng and Mpumalanga;
- N1 between Golden Highway and Proefplaas IC;
- N4 between the Proefplaas IC and Swartkoppies;
- N3 between Heidelberg IC and Buccleugh Interchange; and
- N12 between Diepkloof IC and the Elands Interchange

With the planning of the Gauteng Freeway Improvement Project, SANRAL took other transport modes into consideration (the Gautrain, Metrorail and Bus Rapid Transport) and strived to create links with other transport modes to provide citizens with the choice of using public transportation or car-pooling that will alleviate congestion caused by single-passenger vehicles.

The project was approved by cabinet in 2007 after which SANRAL followed the Intent to Toll process. Amongst other requirements, SANRAL widely advertised the details of the project, the intent to toll, the proposed toll points, expected toll tariffs, upon which the public were given the opportunity to comment. The comments were considered by the Minister of Transport where after the related road sections were declared as toll roads.

Following the declaration of these freeway sections as toll roads, SANRAL could continue to raise funding from the capital markets and procure contractors to commence with construction.

The following figure indicated the extent of GFIP Phase 1:

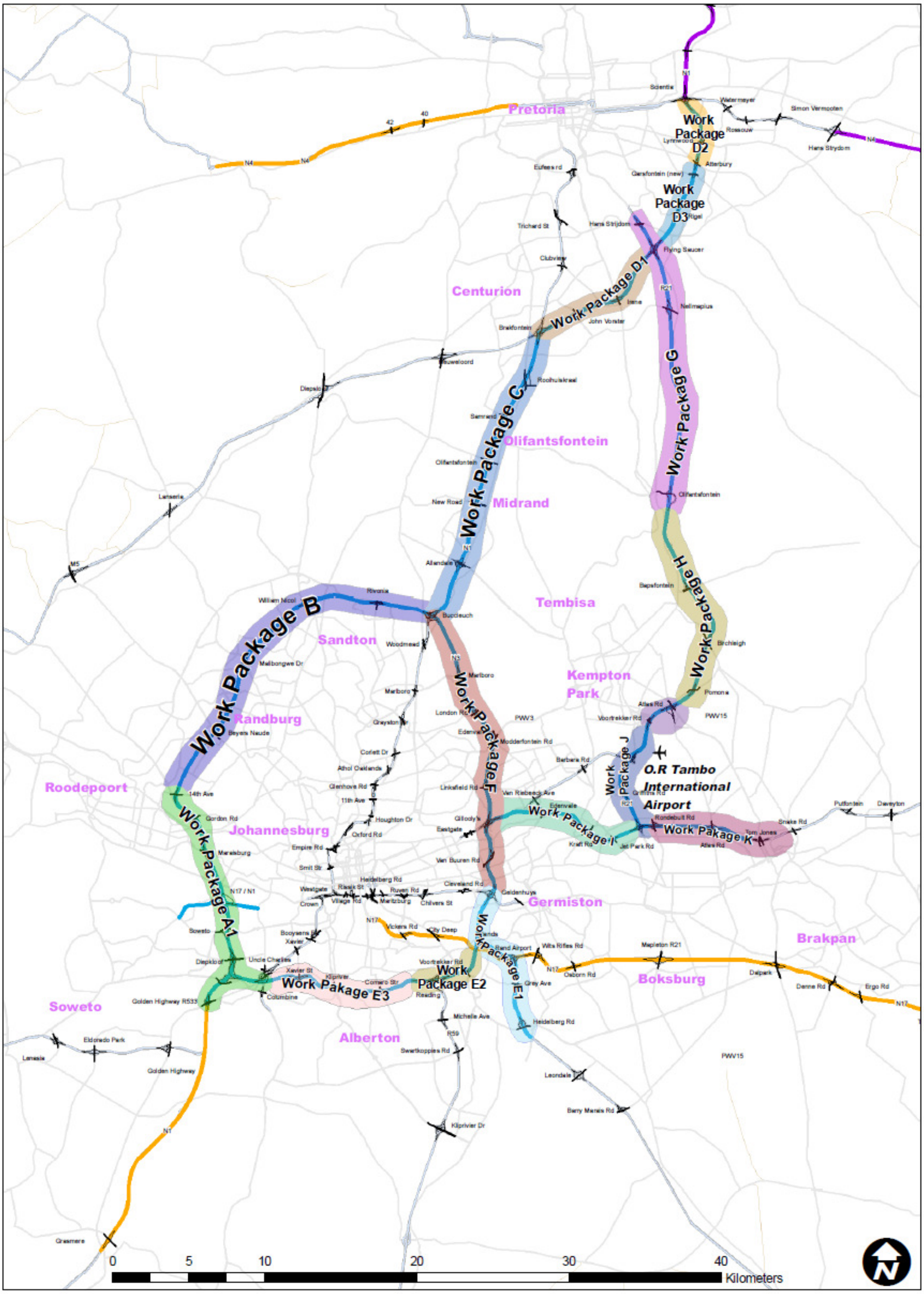


Figure 2: GFIP Phase 1

Figure 3 below indicates the further phases of the GFIP project:

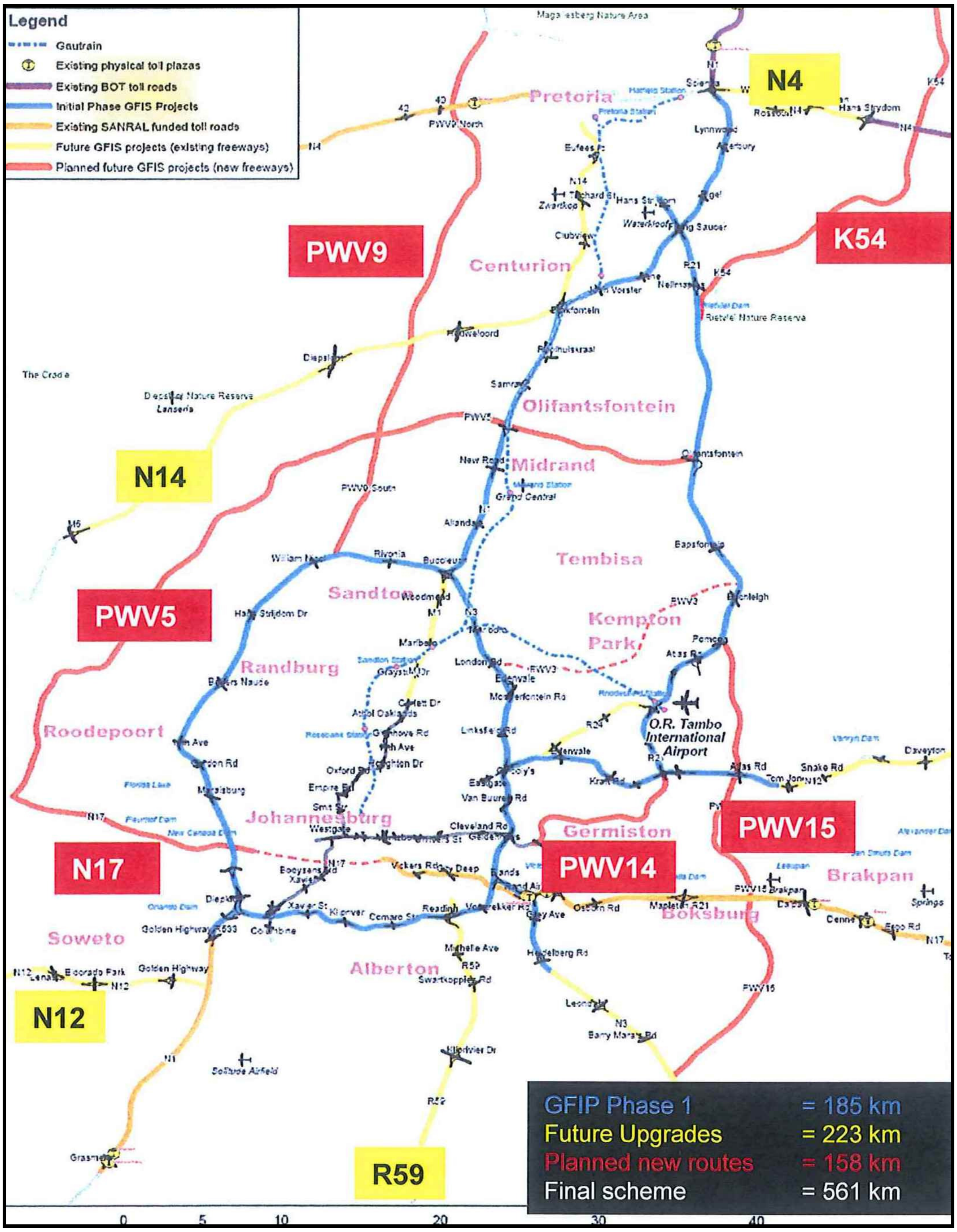


Figure 3: GFIP Phase 1-3

All the roads listed in the further phases of the GFIP project have been highlighted in the various planning documents as priority routes and vital for the further development of the Gauteng Province. Considering the importance of the freeway mobility network, the following extract from SANRAL's 2011 Annual Report with regard to the funding of the GFIP roads as a toll roads in important. The implications of the significant delay of the implementation of the further phases of the GFIP project has major implications for the Gauteng Province as both the GDRT and the Metropolitan, District and Local Councils relied on the GFIP network as the backbone mobility road network of the province.

It should further be considered that it takes at least 2-3 years to undertake the detail design of a section of a freeway and the Environmental Impact Study if the road reserve is available and even longer if sections of the road reserve still have to be expropriated.

"Since the publishing of the toll tariffs there was a great deal of public debate on one of South Africa's major transport infrastructure projects – the GFIP. The Gauteng project responds to the needs of a growing economy and a transforming society in our economic heartland. From its inception in 2005, the project was based on the "user-pay" principle. This approach is applied to several segments of the road network: it is the only way that a developing country such as ours can afford to expand and maintain its primary national road infrastructure. Given the enormous demands on public finances, using tax based revenues to build and maintain roads is simply not sustainable.

SANRAL awarded the first GFIP contract in the first quarter of 2008. At the close of the reporting period, 93 percent of the road works had been completed, including the accelerated aspects of the project to meet the country's World Cup needs. Progress has, however, been slower than projected as a result of two factors beyond our control: the two rainiest seasons in Gauteng since records have been kept, and erratic supply of bitumen, an essential material for building roads.

The network design includes space for a dedicated high-occupancy vehicle lane.

Comprehensive consultation on the GFIP began in 2006. National government, the Gauteng provincial government, and local governments in the affected municipalities were part of these discussions. The intergovernmental consultations paved the way for a public participation process.

It is useful to review the history of the tariff structure. In October 2007, the then Minister of Transport announced that the tariff for light vehicles would be 50 cents per kilometre. The undiscounted tariff gazetted in February 2011 is 66 cents per kilometre. Motorists who use the e-tag, however, will receive a 25 percent discount, which translates into a tariff of 49.5 cents per kilometre. In other words, the tariff gazetted during the reporting period is in nominal terms the same as the tariff announced in 2007. Additional frequent-use and time-of-day discounts will apply.

After the tariffs were gazetted in early 2011, in the spirit of our young democracy, the Minister of Transport suspended the tariffs and appointed a task team to review the fee structure. The task team held public hearings where interested parties, including business and organised labour, made representations.

SANRAL remains committed to transparency, and agreed to the request of the Gauteng provincial government that it appoints independent auditors to review the pricing model. Two internationally recognised firms were appointed to conduct the review. The two reports confirmed SANRAL's sound methodology in the GFIP. The auditors noted that "the scenario analysis was performed correctly by Tolplan across both models under review", and pointed out the appropriateness of "a measure of prudence in the mode to allow for risks". (GFIP Steering Committee Report, 2011) The task team reported its recommendations to the Minister of Transport after the close of the reporting period.

While we appreciate the public concerns that have been expressed, we note that during the period of intense public debate on the GFIP, no credible, sustainable alternative to the equitable "user-pay" principle has been proposed." [(26)])

5 THE GAUTENG PROVINCIAL ROAD NETWORK

5.1 Extent of the Road Network

The provincial road network consists of a surfaced road network of 4 248 km.

The network classes according to RIFSA can be seen in ***Table 5-1*** below.

Table 5-1: Gauteng Network by RIFSA Class [(3)]

Class	Type of roads	Length (km)	% of network
1	Primary Distributor	274	7%
2	Regional Distributor	1 173	32%
3	District Distributor	1 031	28%
4	District Collector	926	25%
5	Access Road	1 89	5%
No Data	No Data	107	3%
	Total	3 700	100%

The current road lengths, by road type of provincial roads under jurisdiction of the Department, are shown in ***Table 5-2***.

Table 5-2: Network Length by Road Type [(3)]

Road Type	Road Length (km)	Single carriageway Length (km)
Freeway Dual Carriageway	196	392
Freeway Single Carriageway	13	13
Dual Carriageway	396	792
High Standard Single Carriageway	715	715
Average Standard Single Carriageway	2 222	2,222
Low Standard Single Carriageway	158	158
Total	**3 700**	**4 292**

The paved road network of GDRT has decreased in length due to the recent transfer of some roads to SANRAL. This includes the R21 from the Tshwane Metropolitan Municipality past OR Tambo International Airport. T [(3)]

5.2 Condition of the Road Network

The Gauteng Pavement Management System shows that about 80% of the total road network in Gauteng has a pavement structure older than 20 years, which is normally considered the design life of a pavement. In other words, 3 100 km have already reached the end of their design life. In the 20 years since 1985, the proportion of substandard roads has increased from 4% to 24% and the proportion of those in acceptable or better condition has reduced from 96% to 76%.

In order to maintain and preserve the provincial road network diligently, about 100 to 200 km of road (for a 40-year to 20-year life span target respectively) should be reconstructed or rehabilitated each year. Since 1990, the rate of repair/rehabilitation has decreased markedly, averaging only 22 km per year. [(1)]

During the 2009 visual assessment the total length of the paved provincial network assessed was, 4,092 km. This represents 95% of the paved carriageways shown on the RNMS as being under jurisdiction of GDRT. The assessment data, expressing the condition of the surfacing, the structural condition and functional condition through the degree (seriousness) and extent of occurrence of distresses, are used to calculate a single Visual Condition Index (VCI) for each visual segment.

This index expresses the condition of the road segment as a percentage between 0% for very poor, to 100% for very good. The VCI is furthermore grouped into five condition categories that are used to describe the condition distribution of the visual segments in the road network. The categories adopted in GDRT (and the rest of South Africa) are [(3)]:

- Very Good = 86% to 100%
- Good = 71% to 85%
- Fair = 51% to 70%
- Poor = 36% to 50%
- Very Poor = 0% to 35%

Figure 4, Figure 5 and Figure 6 shows the VCI for the road network, the road class and per area respectively. [(3)]

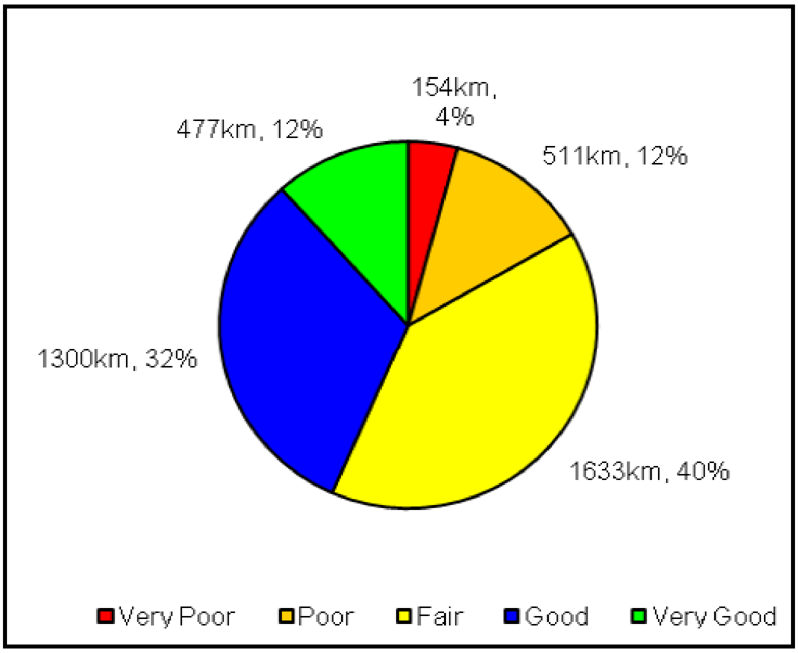


Figure 4: VCI Distribution of the Network (% Length and km) for 2009[(3)]

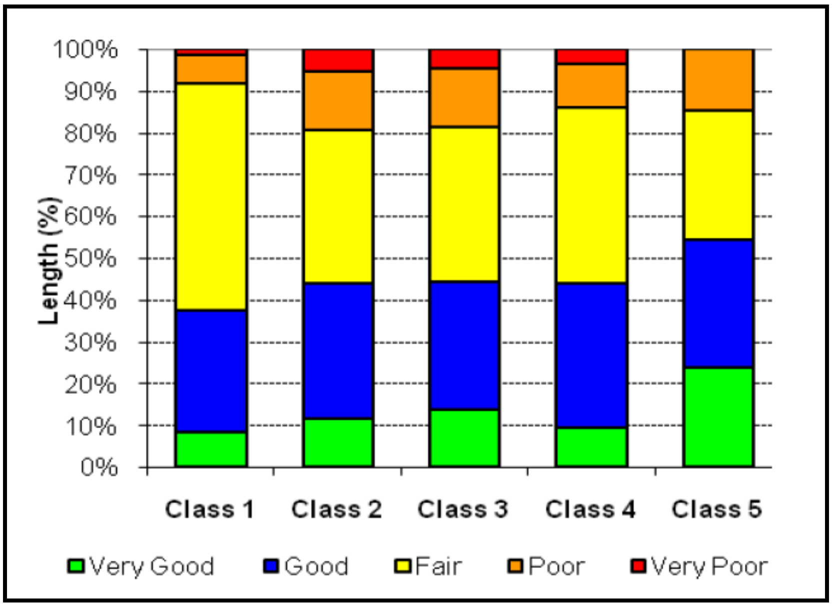


Figure 5: VCI per RISFSA Road Class (% Length) for 2009[3]

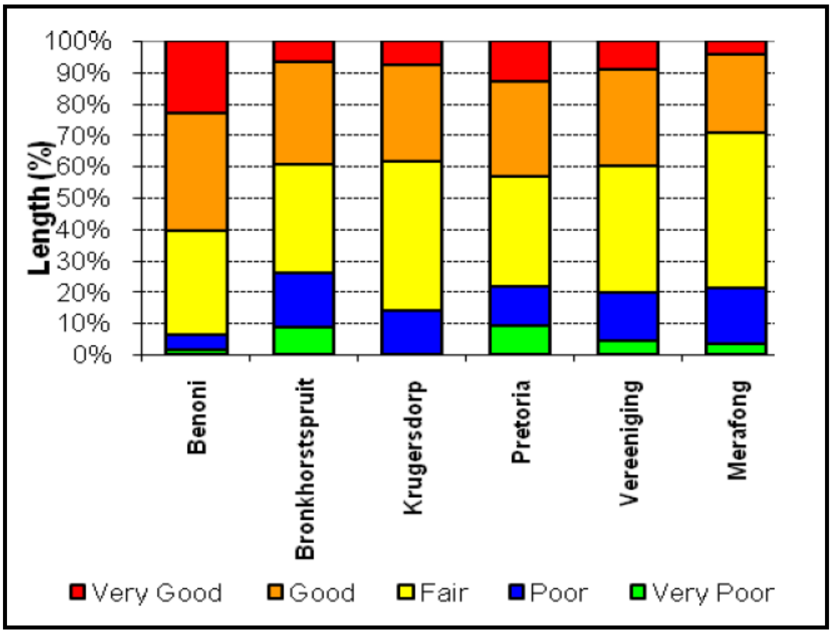


Figure 6: VCI per Area (% Length) for 2009[3]

The following table gives the road condition in both 2009 and 2010 [29]:

Table 5-3: Gauteng VCI Index [29]

Condition	2009	2010	Recommended[#]
Very poor	4%	11%	<5-10%
Poor	12%	20%	
Fair	40%	33%	
Good	32%	27%	
Very Good	12%	9%	

- RISFSA, 2005

It can be seen that a significant portion of the provincial network deteriorated further from 2009 to 2010 with 31% of the road network in a poor to very poor condition. Internationally the benchmark of road quality is that no more than 5 to 10 per cent of the road networks be in a poor to very poor state (according to the VCI key performance indicator) for a limited period before remedial action is executed.

5.3 NATMAP Road Network Planning Priorities

The National Transport Master Plan identified the following key strategic road projects for the Gauteng province:

Strategy 1: Develop a link between Johannesburg and Rustenburg via Lanseria Airport and the N4 Platinum Corridor [(2)]

The Lanseria Airport region is envisaged to become a significant mixed-use node in Johannesburg within the near future. This node will serve the entire north-western quadrant of Johannesburg and most likely be similar in size to Midrand. Due to the size and significance of this node, regional linkages will be of critical importance. These regional linkages will not only involve linkages to surrounding nodes, such as Midrand, Sandton and Centurion, but will also involve linkages to nodes further afield, such Brits and Rustenburg. This requires linking the Lanseria node to the N4 Platinum Corridor.

The current Oberon Road (R512) link will most probably be insufficient to harness the full potential of linking Lanseria to Rustenburg. The PWV3 alignment, planned by the provincial government, is ideally suited to link Johannesburg and Rustenburg via Lanseria Airport and the N4 Platinum Corridor. This will require national government to consider the PWV3 as an extension of the N4 corridor. This freeway between Lanseria and the N4 will have to be designed to cater for freight haulage, because it will link the commercial sector of Lanseria, the industrial sector of Brits and the mining sector of Rustenburg.

Strategy 2: Provide a link between Sandton and the N4 Platinum Corridor. [(2)]

Additional linkages between the core economic region (Johannesburg, Tshwane and OR Tambo triangle) of Gauteng and the N4 Platinum Corridor will be necessary to support and supplement the current N1 linkage. The planned PWV9 freeway is of relevance and can be considered as an extension of the N4 corridor, linking Johannesburg to the N4 corridor. Linking Sandton to the N4 Platinum Corridor will also improve the linkages between former settlements of exclusion and the economic opportunities found within the core economic region of Gauteng. Constructing this long-awaited freeway will enable the settlements of Soshanguve and Winterveld to access employment opportunities in Centurion, Sandton and Fourways. Also, it will help integrated the larger Johannesburg-Tshwane urban conurbation.

Strategy 3: Link the N3 to the N4 Maputo Corridor through Ekurhuleni, specifically catering for freight haulage. [(2)]

Consideration may be given to linking the N3 south of Heidelberg to the N4 Maputo corridor south of Roodeplaat Dam. This will create a linkage between the Durban harbour and the N4 corridor (to link to localities such as Brits and Rustenburg), bypassing the Johannesburg and Tshwane metropolitan areas. This link will also provide the strong industrial sector of Ekurhuleni to directly access to the N4 corridor. This will require this link to be designed for freight haulage. In particular, this freight route will pass the Sentrarand rail junction, which was earmarked by Spoornet to become a future alternative container depot to City Deep. This freeway will facilitate road to rail transfer at Sentrarand.

The proposed link between the N3 and the N4 freeway will also improve the linkage to former settlements of exclusion. The alignment of this road will pass the settlements of Kwa-Thema, Tshakane and Daveyton, located in the Ekurhuleni Municipality, and Mamelodi, located in the Tshwane Municipality. The planned PWV17 freeway alignment will be suited for the proposed link between the N3 and N4 freeway, as it links all the settlements and industrial areas mentioned above. Accepting the PWV17 as the appropriate link will require National government to consider the PWV17 to be an extension of the N4 corridor.

5.4 Provincial Road Network Planning

The Gauteng Strategic Road Network was reviewed in 2010 and again in 2013.

The Gauteng Strategic Road Network (GSRN) 2010 Review [27] has produced the following:

- The Strategic Road Network map
- An updated Transportation Demand Model (GTS 2000)
- A Prioritization plan for Class 1, 2 and 3 roads
- A review of Geometric Design Standards
- A schedule of Planning Issues requiring upgrading or amendment

During the process, the following documents were consulted:

- Gauteng Strategic Road Network Review, Phases 1, 1a and 1b
- Strategic Agenda for Transport, Gauteng
- Intergovernmental Transport Charter
- Gauteng Transport Study, GTS 2000
- Gauteng (Strategic) Integrated Public Transport Network (GSPTN)
- Gauteng Spatial Development Plan (GSDP)
- Growth and Development Strategy for Gauteng
- 2010 TDM
- Gauteng Roads Development Plan
- Towards an Integrated Public Transport Strategy for Gauteng Province
- Local Authority Integrated Transport Plans (ITP), Integrated Development Plans (IDP) and Strategic Development Frameworks (SDF)
- Gauteng Road Design Manual and Typical Plans
- National Transport Master Plan (NATMAP)
- Transnet National Infrastructure Plan (TNIP)
- Gauteng Strategic Secondary Road Network

Extensive consultation was also held with all relevant role-players including officials from:

- The Gauteng Provincial Departments of
    - Roads and Transport
    - Agriculture and Rural Development
    - Economic Development
- Limpopo Province
- Northwest Province
- Free State Province
- Mpumalanga Province
- Johannesburg Metro
- Tshwane Metro
- Ekurhuleni Metro
- West Rand District Council

- Sedibeng District Council
- Metsweding District Council
- Local Councils
- SA National Roads Agency
- Passenger Rail Association SA

The Strategic Road Network map of all national, provincial and municipal Class 1, 2 and 3 roads to a scale of 1:150 000 was developed through the following process:

- Review of previous work, including Phase 1
- Decision on which roads were considered strategic and hence qualify for inclusion on the map
- Consultation with authorities
- Production of an initial map
- Modelling of the network to test compatibility and ability to serve existing and future land use and public transport (typical land use plan attached)
- Testing of the roads for environmental acceptance (typical environmental plan attached)
- Required amendments to alignment or preliminary design of existing routes and conceptual alignments of new routes

A Prioritization plan was developed considering:

i) An evaluation of the modelling;
ii) A prioritization procedure taking into account economic importance, social values, national and provincial policies, public transport, commuter needs and traffic volumes; gave the top twenty Class 1, top thirty Class 2 and top forty Class 3 routes listed in the attached tables.

These routes are also shown in the following tables and figures:

Table 5-4: NGSRN Top Twenty Class 1 Priority Roads (27)

	Route	From	To
1.	PWV9 Southern	N1	N14
2.	PWV5 Eastern / Central	PWV9	R21
3.	N17 Western	Soweto	M1 Crownwood
4.	PWV14 Entire	M2	N12
5.	PWV16 Eastern	K133	N3
6.	PWV9 Remainder	N14	K16
7.	PWV5 Central	N12	PWV9
8.	PWV15 Northern	N12	R21
9.	PWV13 Entire	N3	PWV14
10.	PWV2 Eastern	N1	PWV17
11.	PWV17 Northern	PWV2	N4
12.	PWV17 Central	N4	PWV5
13.	PWV5 Eastern	R21	PWV17
14.	PWV15 Southern	N12	N3
15.	PWV17 Central	PWV5	N12

	Route	From	To
16.	PWV1 and 8	PWV12a / N17	N14
17.	PWV12a / N17	PWV1	PWV5
18.	PWV6	N1	PWV17
19.	PWV3 Eastern	N3	R21
20.	PWV3 Western	N14	N1

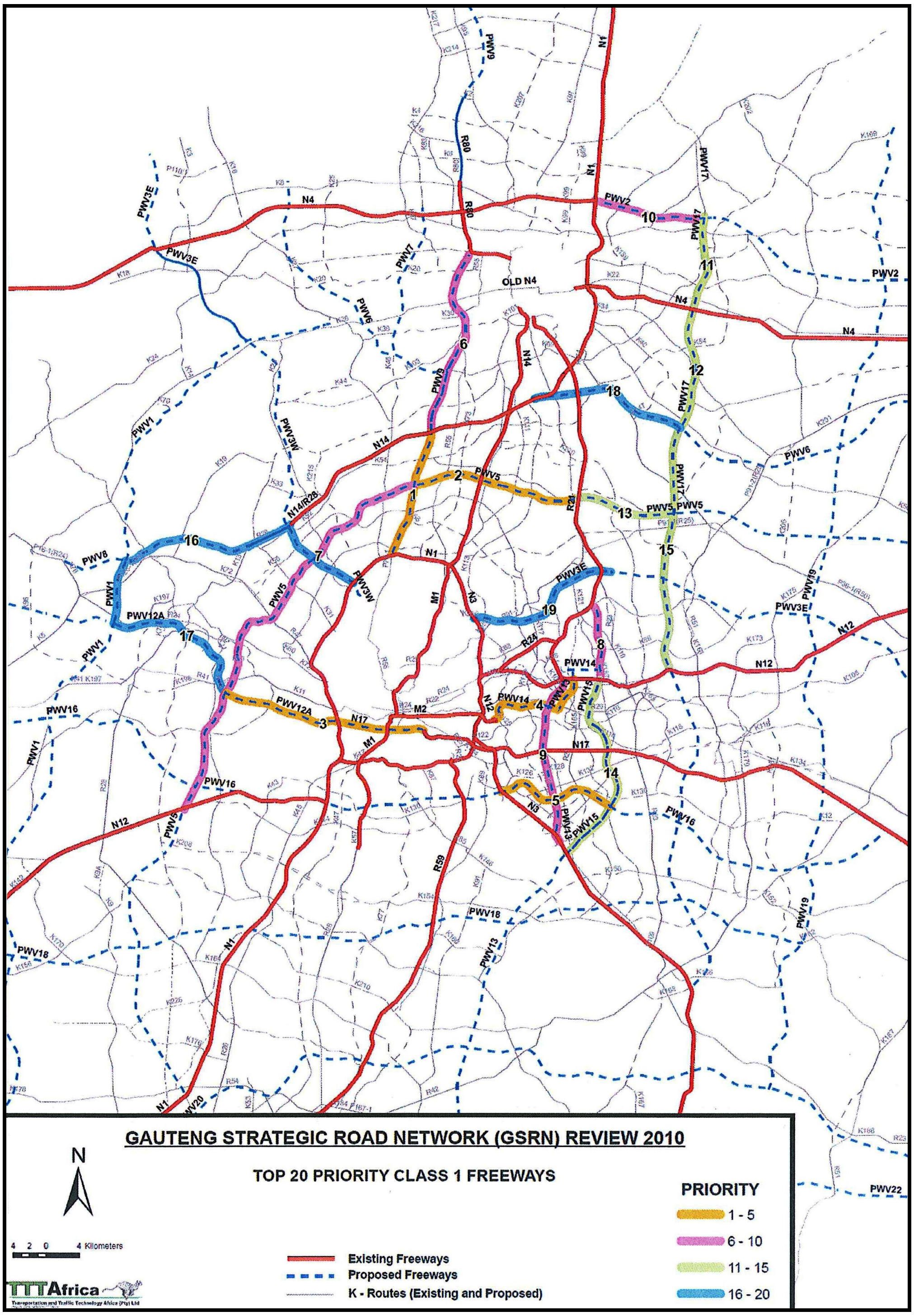


Figure 7: Gauteng SRN Class 1 Road Priorities

Table 5-5: NGSRN Top Thirty Class 2 Priority Roads [27]

	Route	From	To
1.	K57	K142	K158
2.	K71	K103 North	D49
3.	K105	K220	K121
4.	K145	K22	K34
5.	K69	K34	K16
6.	K71	N14	P206-1 (M1)
7.	K111	Nellmapius	PWV5
8.	K60	K74	K46
9.	K46	K60	N14
10.	K60	K46	K73
11.	K73	K71 North	K60
12.	K101	K38	K71
13.	K109	K101 South	K101 North
14.	K43	K142	K122
15.	K56	K101	K117
16.	K60	K71	K105
17.	K11	Old P42-1	K102
18.	K139	K14	K16
19.	K69	Rubenstein	Atterbury
20.	K54	PWV6	D964
21.	K97	PWV2	K14
22.	K121	K105	K68
23.	K58	K71	K117
24.	K56	K72	Cedar
25.	K16	30th Avenue	Baviaanspoort
26.	K54	K52	K101
27.	K216	PWV9	K95
28.	K117 / K127	N17	K88
29.	K115	K58	Terrace
30.	K27	K46	K101

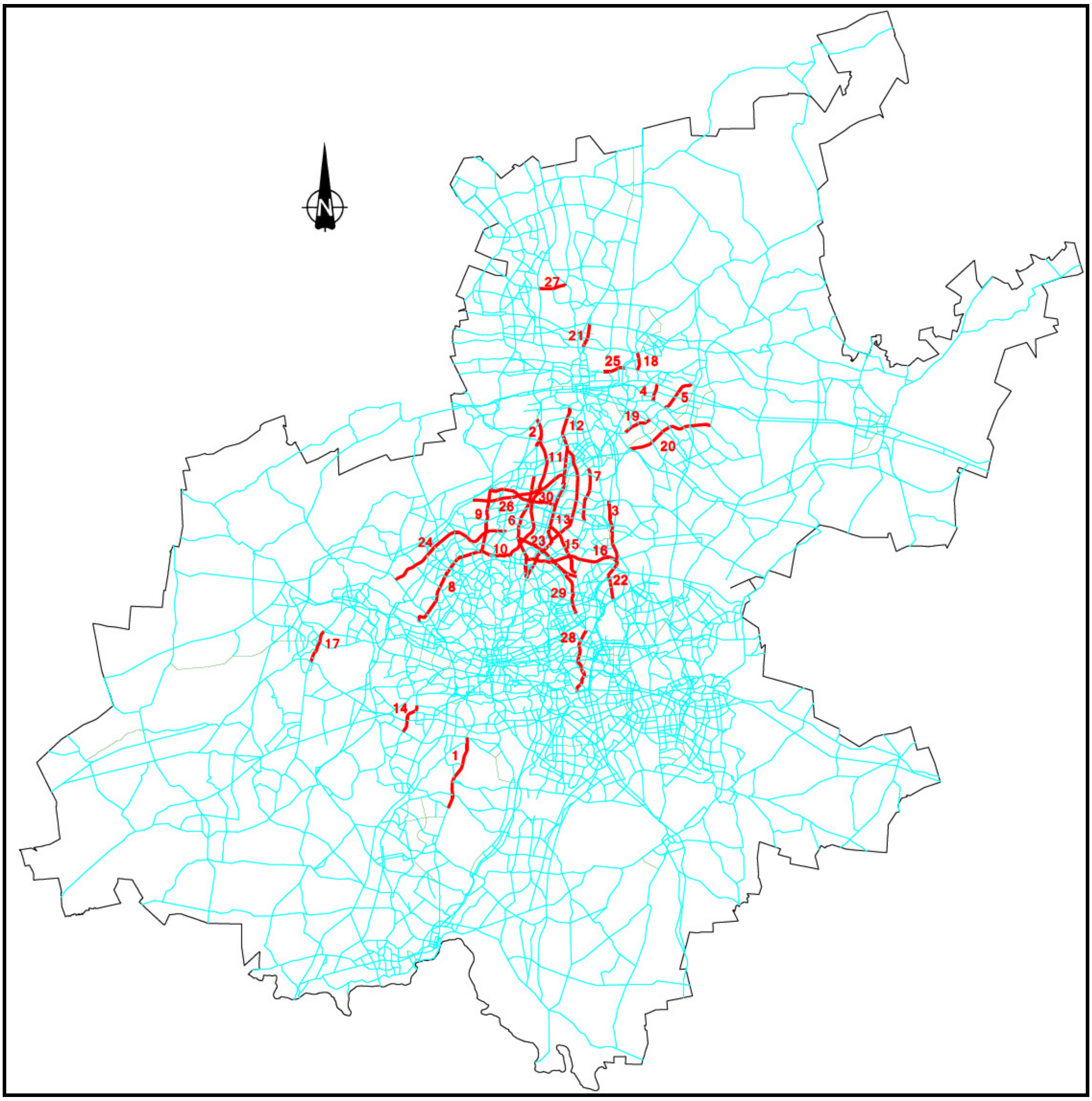


Figure 8: Gauteng SRN Class 2 Road Priorities

Table 5-6: GSRN Top Forty Class 3 Priority Roads [27]

	Route	From	To
1.	Upgrade D2150	Stretford Station	K45
2.	De Villebois Mareuil	K151	K40
3.	Portion of Midvaal Spine Road	K164	K210
4.	Main / New Canada Rd	Main Reef Rd	Soweto Highway
5.	Wit Deep Rd	Main Reef Rd	Commissioner Str
6.	Link Odendaal-Westlake Rd	Main Reef Rd	Vincent Rd
7.	D162 / D665	K211 / K213	Homestead
8.	Olievenhoutbosch Rd	Botha Ave	R21
9.	Dualling Jan Smuts Ave	7^{th} Ave	Bompas Rd
10.	North-south Class 3 Spine Rd Savannah City	K158 / D786	K47
11.	Olievenhoutbosch Rd	Brakfontein Rd	Nellmapius Drive
12.	East-west Class 3 in Savannah City	D2150	P1-1 / K57
13.	East-west Class 3 in Klip River Housing Project	D786	D766 / K2529
14.	Trichardts Rd	Kingfisher Rd	Barry Marais Rd
15.	K101 (Old Warmbaths Rd)	K212	Tshwane Border
16.	Kelvin-Northway Link	Bowling Ave	Marlboro Drive
17.	D92	Welverdiend	P61-1
18.	Link N4 West to PWV9	DF Malan Drive	PWV9
19.	Samrand Rd	Rooihuiskraal Rd	K71
20.	Thami Mnyele	Brian Mazibuko West	K105
21.	Alexander Rd	Henry Rd	K16
22.	Main Rd, Comptonville	Golden Highway	Columbine Ave
23.	Andrew Mapheto / Rev RTJ Namane	DM Morakane	Axel
24.	Pretoria Rd	K109	K68
25.	Spencer Rd	Main Reef Rd	Modise Str
26.	Road D223	K34	K16
27.	Zwane St Class 3 Link with Hendrik v Eck Blvd	Zwane Str (Sharpville)	K55
28.	Ravenswood	K90	K155
29.	Trichardts Rd	Ridge	Paul Smit
30.	Ascot Rd North of K174 & Part of Kariba Str	K174	Sharpville
31.	D2377	K40	D670
32.	Stanley / Knights	Main Reef Rd	Pretoria Rd

33.	Bierman	MC Botha	Sontonga
34.	Dely / Brooklyn Roads	Lynwood Rd	Lois
35.	8th St Vrededorp	Brixton Rd	Solomon Str
36.	D1197	P1-1 / K57	D904
37.	D37 / D2106	K14	K6
38.	Class 3 Road in Ratanda	K135	K174 / P25-1
39.	Ndabeztha	Vlakfontein Rd	Modjadi
40.	Lintvelt Ave	Lavender Rd	Wonderboom Airport

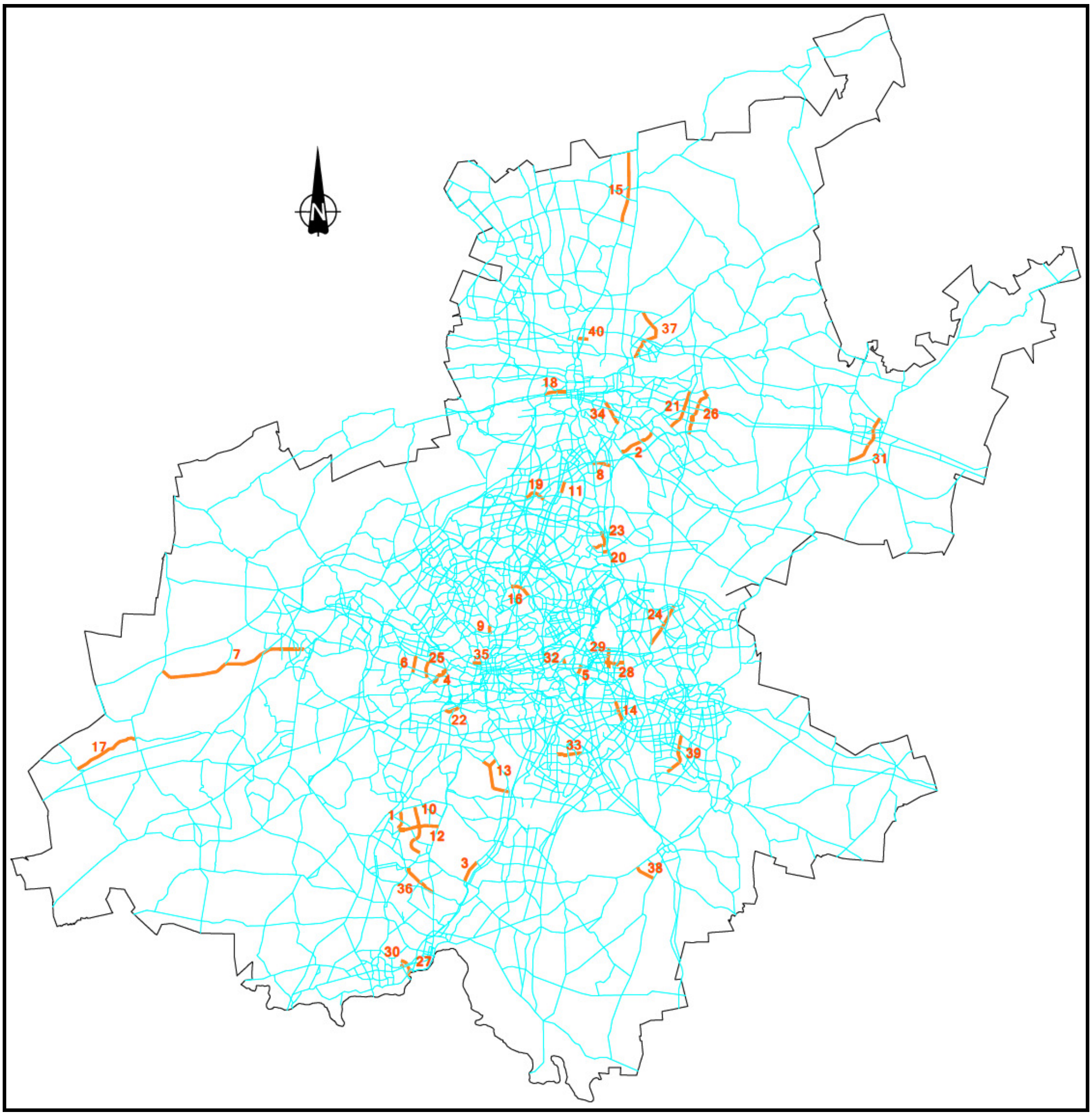


Figure 9: Gauteng SRN Class 4 Road Priorities

5.5 Gauteng Department of Roads and Transport – Current Road Projects

The current (2012/13) budget allocation of the GDRT is R4.36 billion, which includes R1.245 billion for infrastructure. The infrastructure budget is further allocated as follows:

- Maintenance R783 million
- Construction R276 million
- Design R72 million
- Transport Branch R114 million

It can be seen that a relatively small amount is available for road upgrading and new roads. The road upgrading list as prioritised by the GDRT is shown below:

Table 5-7: GDRT Road Priorities

No	Project	Description	Funding Source	Municipal Area
1	K71 (R55)	K71 Between K103 (Wierda Rd) and Laudium (doubling of existing road) (P66-1)	DRT	TMM
2	D2529	Surfacing of Cayman road as an access road to the Eye of Africa Development	DRT	Sedibeng
3	K46	K46 William Nicol: Doubling of road K46 from Fourways to PWV 5 (Erling road) (P79-1)	Dept / Developer	JMM
4	K46	K46:PWV 5 to Diepsloot/N14: Doubling of road	Dept / Developer	JMM
5	K15 (R512)	Doubling of Adcock Str (R55) from Dobsonville to Protea Glen. (Last section) (D524)	DRT	JMM
6	K72/P126-1	K72/P126-1: Construction of P126-1 N14 interchange including 3km approaches		Mogale City
7	K142	Construction of road over rail to provide a link with Lenasia Protea Glen	DRT / JMM / PRASA	JMM
8	K133 (P4-1) (R103)	Doubling of road K133 (P4-1) between road P58-1 (R554) and road P140-1 (Nigel road)	DRT	EMM
9	K97 (R101)	Link between N4 to P1-3. Construction of (R101) northwards	DRT	TMM
10	P1-1 (K57) (R82)	P1-1 (R82) Old Vereeniging road: Upgrading of road to new dual carriage road from D766 (Eikenhof) to D1073	DRT	Sedibeng
11	P1-1 K57 (R82)	P1-1 (R82) Old Vereeniging road : Upgrading of road between Walkerville (D1073) and De Deur (K164)	DRT	Sedibeng
12	K164 (R551)	D473 (K164): Upgrading of the intersection at De Deur. (from D904 to D905) Vereeniging	DRT	Sedibeng
13	K148 / N3	Construction of interchange K148 / N3 and access to Tambo Springs	DRT / Developer	EMM
14	K154 (D1313)	Upgrading of road K154 from a gravel road to a surfaced dual carriageway road. Gauteng Highland (Eikenhof) 850m	Developer	Sedibeng / Midvaal
15	K154 (D1313)	Upgrading of road K154 from R59 toK57 (R82)	Developer	Sedibeng / Midvaal
16	K11	Construction of new road linking Meyerton to Sebokeng to link to industries		Sedibeng
17	K60 (P70-1)	Section between Megawatt Park and (Kyalami Rd to Corporate Park) Kyalami/N1		JMM
18	K60	Construction of a single carriageway between Rivonia Rd K73 (M9) and Main Rd (PWV9)		JMM
19	K60	New road from P66-1 (R55) across N3 to D51 (Allandale road) M39	DRT / SANRAL /	JMM
20	K60	Access Rd to Ivory Park and Tembisa between K56 (D51)and Chapman Rd (K117)		JMM

21	K60	Access Rd to Ivory Park and Tembisa between Chapman RD (K117) and K105		JMM
22	K101	Upgrade of interchange K101 (M39)(R101) (P1-1) and K58		JMM
23	P219-1 (K43)	Upgrading of Klipspruit Valley Rd (M10 between N12 and Nirvana Rd (Lenasia South) To improve the link between		JMM
24	K69	Upgrading and doubling of Hans Strijdom from the N4 to Mamelodi to K54		TMM
25	K69 / K34	Construction of interchange Lynwood / Hans Strijdom ()		TMM
26	K198	Construction of new road from Leratong to Corlett St (Witpoortjie)		JMM
27	K170	Construction of interchange at N1/19 and Golden High way, Access to Sebokeng and Evaton		
28	K16	New Rd from Waltloo to Mamelodi (K69)		TMM
29	K101	Doubling of existing road P1/2 from K54 (R101) to Lenchen Ave (Rooihuiskraal)		TMM
30	K101	Doubling of existing road P1/2 from N1 to road D795 (Midrand)		JMM
31	K101	Doubling of existing road between road 795 and New Rd		JMM
32	K101	Doubling of existing road P1/1 (R101) from K103 (M10) to the end of dual carriageway 1853 (Eeufees road)		TMM
33	K101	Doubling of Road P1-1 (R101) from M10 (K103) to N1		TMM
34	K103/K69	Doubling of existing road (Waterkloof Air Force Base Pta) K103 (M10) From Kloofsig to R21		TMM
35	K122	New road south of Naturena from road K45 (Golden Highway)(Nance field) to P1/2 (Vereeniging road)		
36	P91/1	Doubling of R91-1 (R25) Wikus to M57 (P58-1)		
37	P3-6 (N12)	Doubling of P3-6 and railway bridge from P41-1 (R501) to Provincial Border		
38	P2-5 (K54) (R513)	K54 (P2-5) From Tsamay road to K22 Zambezi Ave to Tsamay Ave, from D713 to K54 Road rehab.		TMM
39	K102	Phase 4: New Construction (Hopewell St) from Maimane St to 56th St. Dobsonville.		JMM
40	K102	Phase 5: New construction (Hopewell St) from 56th St. Dobsonville to Roodepoort		JMM
41	K14	Upgrading of P2-5 (R513) Chris Hani to Cullinan		TMM
42	P66-1 (K71) R55	Doubling of road P66-1from N14 Diepsloot to Kyalami		JMM
43	K77	Elizabeth road to K154 (Part of Highlands project)		Sedibeng / Midvaal

6 GAUTENG LOCAL MUNICIPALITY ROAD NETWORKS

Map 1 below indicates the metropolitan, district and local municipality borders in Gauteng. Please note that the City of Tshwane has taken over the Metsweding District Municipality in 2011 and is now responsible for the municipal road planning, upgrading and maintenance in the area.

Map 1: Geographical contexts of metropolitan, district and local municipalities in Gauteng [(3)]

6.1 Road Network City of Tshwane

The City of Tshwane Metropolitan Municipality (CTMM) has a well-developed road network, although many roads in the previously disadvantaged areas to the north are not paved. CTMM is also centrally situated on the national road network with direct links to Mozambique, Botswana and Namibia along the east-west N4 route, and with Zimbabwe along the south-north N1 route. [(5)]

The CTMM is currently responsible for all Municipal Roads in Tshwane (a limited number of Class 2 roads, but mainly Class 3 and lower order roads). [5]

There are 5 209 km surfaced municipal roads (lane-kilometres) and 2 231 km gravel roads in the CTMM. The surfaced road network consists of 18 % primary roads, 13 % secondary roads, 19 % are main tertiary roads and 49 % are minor tertiary roads. The gravel road network consists of 4 % secondary roads, 4 % are main tertiary roads and the remainder is minor tertiary roads. [5]

The main road network follows a radial system centred on the CBD of Pretoria, which is the dominant economic node. The strong urban decentralisation trend towards suburban nodes during the last few decades has created a demand for concentric roads. The greatest deficiency in the main road network is the lack of a continuous major ring road around the city, with supporting routes, to serve suburban nodes. [5]

The N1 eastern by-pass, the N14 (Krugersdorp freeway) and the new N1/N4 Platinum toll route, form part of the ring road to the south, east and the north. The remaining missing link is the planned north-south PWV9 to the west, which could also forms the central mobility spine of the Mabopane-Centurion Development Corridor (MCDC). [5]

The responsibility for the main road network is shared between South African National Roads Agency Limited (SANRAL), GDPTRW and the CTMM. The pace of growth and the lack of funds at metropolitan level resulted in the increased use of the national and provincial roads by local urban traffic. This situation is exacerbated by the negative impact on urban traffic of tolling the urban sections of the existing N1. This calls for a more integrated approach between the various spheres of government to the planning, management and funding of roads. These tolls are overloading some of the Tshwane roads whilst the Tshwane transport budget cannot cope with the imposed burden. [5]

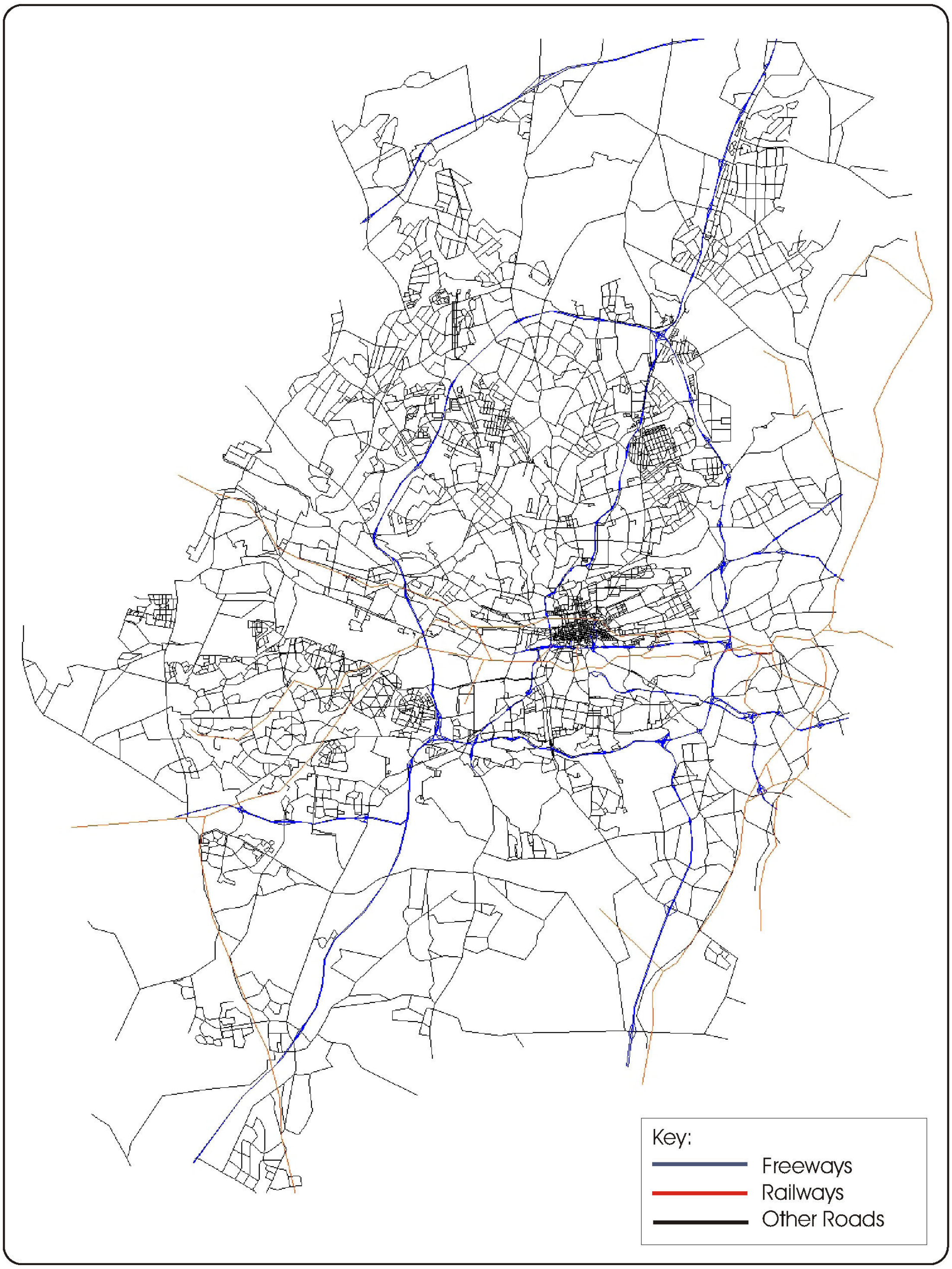
The existing road infrastructure is over-extended in parts of the city which are experiencing development pressure. This is particularly evident in areas like Olievenhoutbos, Irene/Highveld, Menlyn, Hatfield, Brooklyn and Zambezi/Montana. [5]

Backlogs in regard to unpaved roads are significant, especially in the northern parts of Tshwane, such as Ga-Rankuwa, Mabopane, Soshanguve, Winterveld, Temba and Hammanskraal. [5]

It is also worthwhile to mention that the overall structural index of CTMM surfaced roads has decreased since 1991 from 0,9 to 0,85 and the surfaced index from 0,75 to 0,72 over the same period due to a lack of funds for road maintenance. In other words, the quality of the roads has decreased in the said period. [5]

6.2 City of Johannesburg

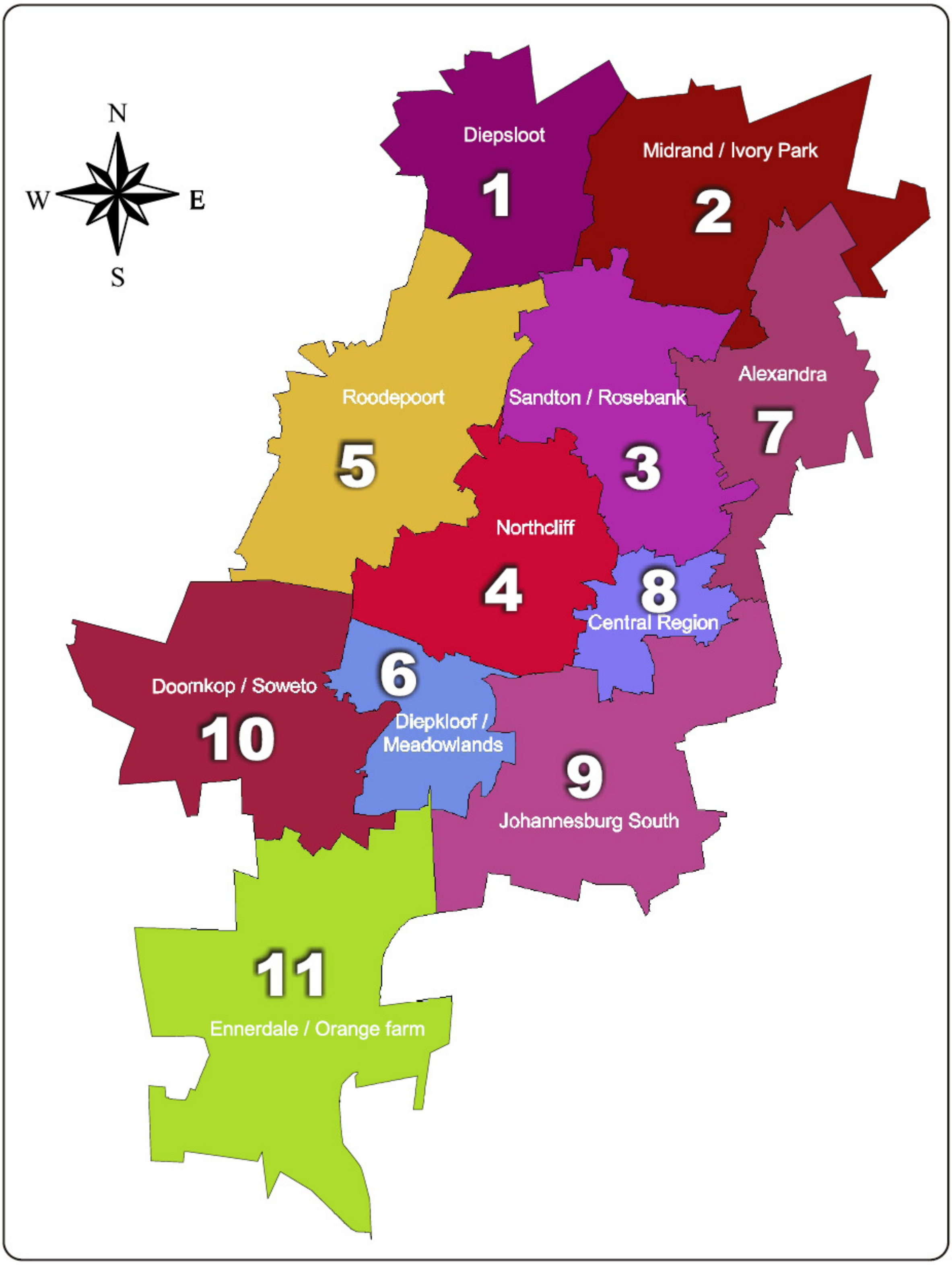
The road network of the City of Johannesburg can be seen in Map 2 and comprises of 9 247km roads, of which approximately 10% (922 km) are not tarred. The Johannesburg Roads Agency are responsible for approximately 1 800 traffic lights and malfunctioning is a common problem due to rain, power cuts and power distribution faults [6]



Map 2: City of Johannesburg Road Network

The City of Johannesburg is divided into 11 regions. These regions can be seen in Map 3. A summary of the road condition in each region is given ***Table 6-1***.

in



Map 3: City of Johannesburg Regions (7)

Table 6-1: Summary COJ Road Conditions (7)

Region	Very Poor		Poor		Average		Good		Very Good	
	Total (km)	% per Region	Total (km)	% per Region	Total (km)	% per Region	Total (km)	% per Region	Total (km)	% per Region
Region 1	-	-	-	-	-	-	-	-	-	-
Region 2	5	5,6	21	23,6	49	55,0	10	11,3	4	4,5
Region 3	10	1,1	74	7,9	452	48,5	257	27,6	139	14,9
Region 4	6	4,3	15	10,8	73	52,5	32	23,0	13	9,4
Region 5	2	3,7	6	11,1	24	44,4	12	22,2	10	18,6
Region 6	10	1,9	30	5,6	120	22,4	235	43,9	140	26,2
Region 7	2	0,5	29	7,6	181	47,5	118	31,0	51	13,4
Region 8	1	0,8	11	9,0	61	50,0	38	31,2	11	9,0
Region 9	13	1,3	95	9,3	353	34,5	364	35,5	199	19,4
Region 10	6	2,0	29	9,9	67	22,8	132	44,9	60	20,4
Region 11	6	1,6	29	7,6	180	47,4	127	33,4	38	10,0
Total	**61**	**1,6**	**339**	**8,6**	**1560**	**39,5**	**1325**	**33,5**	**665**	**16,8**

Notes: At the time of compilation of the above data no information was available for Region 1 (Diepsloot). It is noted from the information presented above that Region 9 (Johannesburg South) has more kilometres of roads in a very poor and poor condition. Region 9, interestingly also includes more kilometres of roads in very good condition, although it will be noted that this is a relatively densified area within the City. On a percentage basis, Region 6 (Sandton/Rosebank) has a higher proportion of roads in a very good condition than any other region.

6.3 Ekurhuleni Metropolitan Municipality

Ekurhuleni Metropolitan Municipality (EMM) has some 8 300 km of roads, including 6 700 km of tarred roads and 1 600 km of gravel roads. The great length of roads in the EMM is largely the result of the extensive provincial road network of some 1 310 km.

EMM has the greatest length of freeway, 0.43 lane km per 1000 population compared with 0.29 in Johannesburg and 0.42 in Tshwane. Freeway and arterial road provision per square kilometre in EMM is comparable with both Johannesburg and Tshwane (0.46 lane km/km² of freeway and 1.05 lane km/km² of arterial road compared with 0.59 and 1.67 in Johannesburg and 0.37 and 1.09 in Tshwane). Considering the amount of vacant and rural land in the EMM, the foregoing indicates good road provision in the EMM with adequate spare capacity. (8)

The extent and condition of the Municipal roads as reflected on the EMM Roads Management System are given in

Table 6-2: Extent of the Ekurhuleni Municipal Road Network (8)

	Road type	Road Class	Very good km	Good km	Fair km	Poor km	Very poor km	Total length km
Paved	Freeways							
	Dual carriageway roads / streets	Primary (P)	672.7	256.2	53.4	42.7	42.7	1067.7
	Access roads	Secondary (S)	609.3	222.5	48.4	29.0	58.0	967.2

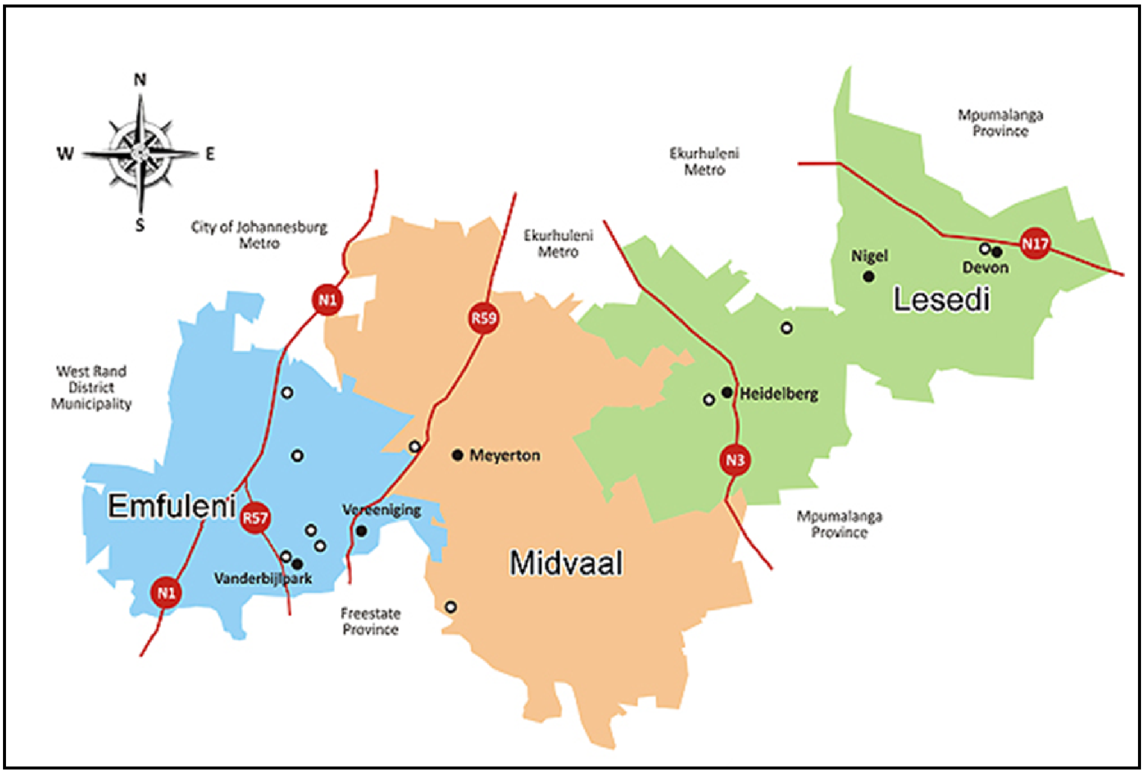
Road type		Road Class	Very good km	Good km	Fair km	Poor km	Very poor km	Total length km
	Other single carriageway	Main Tertiary (T) and Tertiary (t)	2775.7	1206.5	269.3	139.8	269.3	4660.6
Sub Total (Paved)			4057.7	1685.2	371.1	211.5	370.0	6695.5
Gravel	Normal urban	Primary (P) and Secondary (S)	0.4	0.0	4.9	0.0	1.0	6.3
	Access roads	Main Tertiary (T) and Tertiary (t)	14.0	87.1	335.6	489.3	255.2	1181.2
Sub Total (Unpaved)			14.4	87.1	340.5	489.3	256.2	1187.5
Total			4072.1	1772.3	711.6	700.8	626.2	7883.0

The extent of National and Provincial roads is estimated at 1 310km (Metropolitan Spatial Development Framework, 2005). It should also be noted that the extent of gravel roads is considered to be underestimated in the above table, mainly due to the omission of roads in informal settlements and some outlying areas of the Metropole. (8)

6.4 Sedibeng

The SDM comprises of three Local Municipalities (LMs) – see Map 4: (9)

- Emfuleni LM (commercial nodes are Vereeniging and Vanderbijlpark);
- Lesedi LM (commercial node is Heidelberg); and
- Midvaal LM (commercial node is Meyerton).



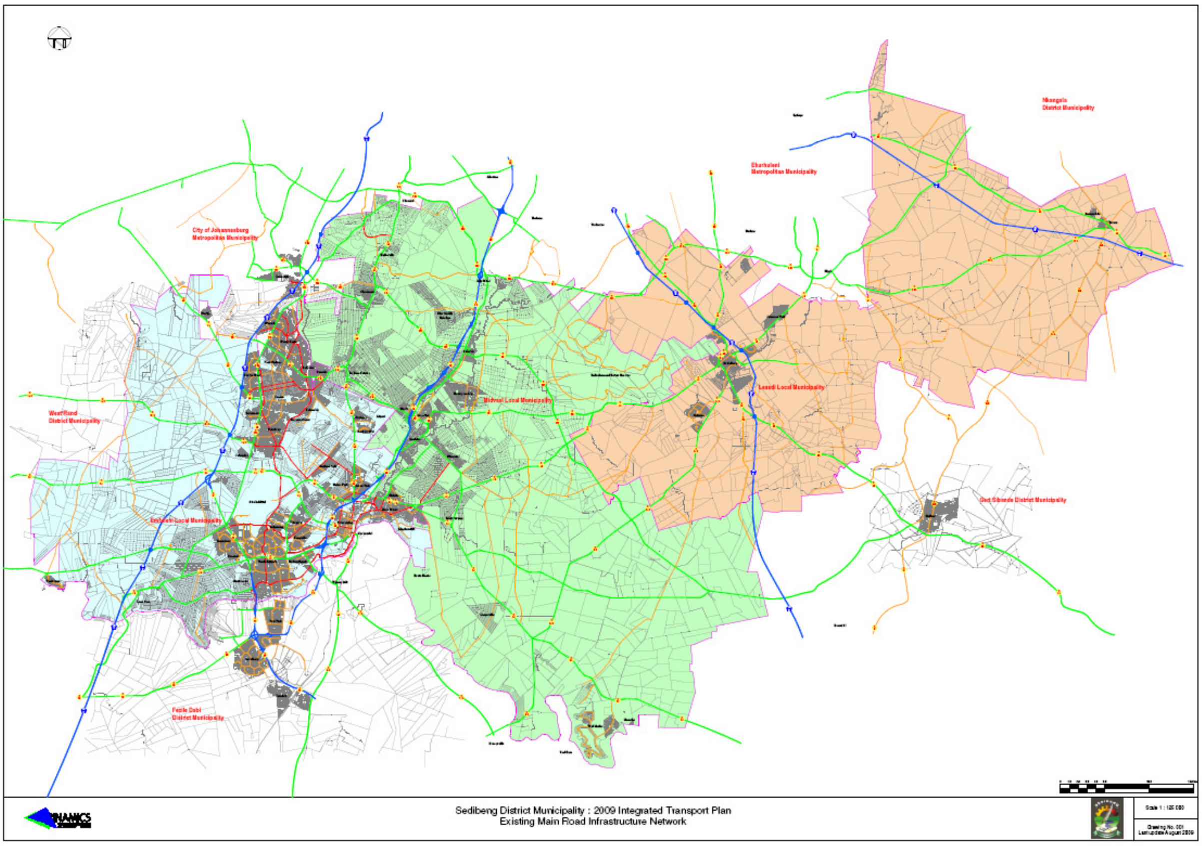
Map 4: Sedibeng Local Municipalities

The Sedibeng main road network can be seen in Map 5. The following road linkages are considered the main **north-south road links** in support of the major nodes in Sedibeng: [9]

- National Route N1 – Linking Vanderbijlpark and the Free State with Johannesburg in the north;
- National Route N3 – Linking Johannesburg/Ekurhuleni in the North to Heidelberg and Mpumalanga towards the south;
- Provincial Route R59 – Linking Vereeniging with Meyerton and northwards towards Alberton in Ekurhuleni;
- Provincial Route R553 (Golden Highway) – Linking Vanderbijlpark through Sebokeng/Evaton towards Johannesburg in the north;
- Provincial Route R82 – Linking Vereeniging with De Deur and Walkerville towards Johannesburg in the north;
- Provincial Route R23 – Alternative to the N1 linking Benoni in the north to Balfour in the south;
- Provincial Route R51 – Linking Springs in the north to Balfour and Vaal Dam in the south; and
- Provincial Route R549 – Linking Heidelberg and Ratanda with Deneysville and the Vaal Dam.

The following road linkages are considered the main **east-west road links** in support of the major nodes in Sedibeng. [9]

- Provincial Route R42 – Main east-west linking Lochvaal in the southwest through Vanderbijlpark, Vereeniging, Heidelberg, and Nigel to Vischkuil/Endicott in the north-east towards Delmas;
- Provincial Route R29 - Linking Devon/Impumelelo with Vischkuil/Endicott and further west with Springs in Ekurhuleni;
- Provincial Route R54 - Linking Vereeniging and Vaal Marina towards the south;
- Provincial Route R551 - Prominent east-west link between Evaton/Sebokeng in the west and Meyerton towards the east, further along to Heidelberg within Lesedi Local Municipality, continuing further along the R42 National Route N1;
- Provincial Route R557- Linking Walkerville in the west with the Suikerbosrand Nature Reserve in the east;
- Provincial Route R550 - Linking Kliprivier with Nigel; and
- Provincial Route R557 - Linking Walkerville in the east with the Grassmere (N1) toll gate and Ennerdale.



Map 5: Existing Sedibeng Main Road Network

6.5 West Rand District Municipality

The West Rand District Municipality comprises of the four local municipalities i.e. Mogale City Local Municipality, Merafong City Local Municipality, Randfontein Local Municipality and Westonaria Local Municipality. Each Local Municipality is responsible for the upgrading and maintenance of its own road network. (10)

Table 6-3: West Rand District Municipality Major Road Network (10)

Classification of Roads	Kilometre		
	Paved	Gravel	Totals
Class 1-3: Freeways (National Roads), Major arterials (Provincial) and Minor arterials (Municipal)	185.9	0	185.9
Class 4a: Collector roads (CBD's, Municipal roads)	156.2	6.6	162.8
Class 4b: Collector roads (Residential areas, municipal roads)	159.1	34	193.1
Class 5: Access roads (municipal roads)	871.2	473.4	1344.6
TOTAL	1372.4	514	1886.4

Table 6-4: West Rand District Municipality Roads and Responsible Authority [(10)]

Classification of Roads	Municipality				
	Mogale	Randfontein	Westonaria	Merafong	Total
National & Provincial Paved	101	63	22	287	473
National & Provincial Unpaved	0	0	0	110	110
Local Paved	596	333	258	324	1511
Local Unpaved	274	141	100	102	617
Total	971	537	380	823	2711

Merafong City

There are two National and four Provincial roads providing mobility and access function to the local municipalities. These are as follows [(11)]:

- N12 - The north-south route linking Gauteng and North West
- N14 - Links Merafong City Local Municipality with North West Province, Mogale City LM and Tshwane
- R501- Links Carletonville – Fochville – Parys(Free State)
- R500 - Access from N12 and N14 to Carletonville
- R559 - Links Local Municipality with Randfontein
- R41 – Links Local Municipality with Randfontein

The main freight route, within the local municipality, includes the N12, N14, R500, and R501 which carries significant traffic of heavy vehicles per day in and out of Merafong City LM.

Table 6-5: Merafong City Road Conditions [(10)]

Township	Roads		Length of Roads (m)	Condition of Roads	Comments
	Paved (km)	Unpaved (km)			
Carltonville	141,8	0	141,8	Fair to Good	Keep up maintenance
Khutsong	42,0	57,0	99,0	Fair to Poor	Pave unpaved roads and maintenance of SW and existing roads.
Fochville	65,6	0	65,7	Good	Keep up maintenance
Kokosi	13,2	43,0	56,3	Fair to Poor	Main road into Kokosi turn into a river once it starts raining. It needs to be redesign and constructed. Majority of roads are Gravel.
Wedel	28,9	0	28,9	Fair	Few storm water problem
Greenspark	3,3	1,5	4,8	Fair	Keep up maintenance
Welverdien	28,9	0	28,9	Fair	Keep up maintenance
Total	323,8	101,5	425,3		

Merafong City Local Municipality comprises of Carletonville, Khutsong proper, Khutsong South, Fochville, Kokosi, Oberholzer, Wedela and Welverdiend. Carletonville, Welverdiend, Oberholzer and Fochville road conditions are fair to good paved roads. These roads will need maintenance to ensure that they do not deteriorate to the stage where they will need to be rehabilitated. [(10)]

Khutsong Proper has a good road network on in main roads through the township. The rest of the area has bad and non-maintained gravel roads. In Khutsong Proper, there are road signs as well as speed calming measures. Road sign marking for school areas are visible. The majority of roads in Khutsong Proper and Khutsong South are gravel. (10)

It is the correct time to update the 2002/3 PMS to confirm that the road condition have stayed the same or improved as a result of maintenance effort. It is however expected that the condition of roads have deteriorated as the local municipalities do not have enough funding to maintain the road network. (10)

Table 6-6 reflects the Paved Road Condition as per Visual Condition Index (VCI) for all roads within the Merafong city lm and also indicates the road lengths within various ranges of the VCI. (11)

Table 6-6: Condition of Merafong Paved Roads (11)

Very Good	Good	Fair	Poor	Very Poor
14%	8%	38%	39%	0%

Based on the above table and from the inspections carried out by the consultants, the following can be reported (11):

- It is urgent that the PMS be updated to reflect the current status as this helps in planning for projects and budgets.
- The road network is in a fairly good condition despite lack of continuous maintenance program due to inadequate funding.
- There are more poor roads in Kokosi Township compared to the neighbour Fochville due to the past apartheid government administration.
- Has a higher present of fair and poor roads.
- There are pockets of pot holes but these are being dealt with as funds become available.

Mogale City

There are two National and Provincial roads providing mobility and access function to the Mogale City Local municipalities. These are as follows (12):

- N14 - Links Mogale City with North West Province and Tshwane MM
- R28 - Links Mogale City Local Municipality and Randfontein
- M18 - Links with N14
- R563 - Links with N14
- M36 - Mobility with Krugersdorp
- R24 - Links Mogale City with Rustenburg

The main freight route, within Mogale City, includes the N14, R28, and R24 which carries significant traffic of heavy vehicles per day in and out of Mogale City

Table 6-7: Condition of Mogale City Roads [(10)]

Mogale City	Length of Roads (km)	Condition of Roads	Comments
Primary routes	93.6	Fair to Good	Keep up maintenance
Secondary routes	85.5	Fair to Good	Keep up maintenance
Main Tertiary routes	72.3	Fair to Good	Keep up maintenance
Tertiary routes	568.2	Fair to Poor	Keep up maintenance
Total	**819.6**		

In spite of the length of the primary, secondary, main tertiary and tertiary routes that are under the jurisdiction of Mogale City Local Municipality, the 2010 Pavement Management System results show that, the Mogale City Local Municipality to keep the road network in a fair to good condition by instituting a strict maintenance regime policy. [(10)]

Table 6-8 reflects the Paved Road Condition as per Visual Condition Index (VCI) for all roads within the Mogale City LM and also indicates the road lengths within various ranges of the VCI. [(12)]

Table 6-8: Condition of Mogale City Paved Roads [(12)]

Very Good	Good	Fair	Poor	Very Poor
26%	35%	23%	12%	3%

Based on the above table and from the inspections we carried out, the following can be reported [(12)]:

- The road network is in a fairly good condition despite lack of continuous maintenance program due to inadequate funding.
- There are more roads in good and very good conditions in the Krugersdorp area compared to the Rietvallei due to the type of development.
- Mogale City Local Municipality has a higher percentage of very good and good roads despite the unpaved roads problems around rural areas of the municipality.
- There are pockets of poor roads and pot holes but these are being dealt with as funds become available.

Randfontein

There is National and Provincial roads providing mobility and access function to the West Rand district municipalities. These are as follows [(13)]:

- N14 – links Randfontein with Northwest and Tshwane MM
- R28 – links Randfontein, Westonaria and Sedibeng LM in Gauteng
- M13 – links Randfontein with Johannesburg through Soweto
- R41 – links Randfontein to Northwest
- R559 – links Randfontein with Southern Soweto

The main freight route, within Randfontein, includes the N14 and R28 which carries significant traffic of heavy vehicles per day in and out of Randfontein.

Table 6-9: Condition of Mogale City Paved Roads[10]

Road Network	Condition of the surfacing					Condition of the structure				
	Very Good	Good	Fair	Poor	Very Poor	Very Good	Good	Fair	Poor	Very Poor
Class 3: minor arterials	18%	22%	19%	19%	14%	41%	44%	4%	6%	5%
Class 4a: Connector Roads (CBD areas)	27%	27%	18%	18%	1%	68%	23%	7%	0%	3%
Class 4b: Connector Roads (Residential areas)	33%	20%	19%	19%	1%	65%	29%	4%	1%	0%
Class 5: Access roads	27%	39%	9%	9%	1%	63%	35%	2%	0%	0%
Total Network	**26%**	**32%**	**14%**	**14%**	**4%**	**59%**	**35%**	**3%**	**1%**	**1%**

South Africa has had an unusually rainy season in the 2008/09 year and thus the majority of the roads in Randfontein are in a state of very poor condition. There is a need to control the load on heavy vehicles as well as to create a road dedicated to heavy vehicles. This will be able to slow down the rapid rate of road deterioration. Randfontein Local Municipality needs to develop road maintenance and upgrading programme in order to minimise the further destruction of the road surface and structure. [10]

Table 6-5 reflects the Paved Road Condition as per Visual Condition Index (VCI) for all roads within the Randfontein LM and also indicates the road lengths within various ranges of the VCI. [13]

Table 6-10: Condition of Randfontein Paved Roads[13]

Very Good	Good	Fair	Poor	Very Poor
26%	32%	24%	14%	4%

Based on the above table and from the inspections we carried out, the following can be reported. [13]

- It is urgent that the PMS be updated to reflect the current status as this helps in planning for projects and budgets.
- The road network is in a fairly good condition despite lack of continuous maintenance program due to inadequate funding.
- There are more good roads in Randfontein than they are poor roads.
- Randfontein has a higher percentage of very good and good roads despite the storm water problems around Toekomsrus Township
- There are pockets of poor roads and pot holes but these are being dealt with as funds become available.

Westonaria

There are two National and Provincial roads providing mobility and access function to the Westonaria Local municipalities. These are as follows [14]:

- N12 - the east-west route linking Gauteng and the West Rand
- R28 - links Westonaria and Randfontein

The main freight route, within Westonaria, includes the N12 and R28 which carries significant traffic of heavy vehicles per day in and out of Westonaria.

Table 6-11: Condition of Westonaria Paved Roads [(10)]

Road Network	Condition of the surfacing					Condition of the structure				
	Very Good	Good	Fair	Poor	Very Poor	Very Good	Good	Fair	Poor	Very Poor
Class 3: minor arterials	44%	15%	31%	11%	0%	77%	21%	1%	0%	0%
Class 4a: Connector Roads (CBD areas)	36%	33%	25%	6%	0%	81%	16%	3%	0%	0%
Class 4b: Connector Roads (Residential areas)	37%	31%	19%	9%	4%	72%	22%	3%	0%	4%
Class 5: Access roads	31%	39%	25%	5%	0%	74%	25%	0%	1%	0%
Total Road Network	34%	34%	25%	6%	1%	75%	23%	1%	0%	1%

Although the road condition of the structure seems to be very good, without quick intervention, the condition could deteriorate. The unusual weather change in South Africa is also a factor that has impact on the road surface and structure in the district and Westonaria in particular. The uncontrolled movement of heavy vehicles and the lack of overloading control should be attended to. [(10)]

Table 6-12 reflects the Paved Road Condition as per Visual Condition Index (VCI) for all roads within the Westonaria LM and also indicates the road lengths within various ranges of the VCI. [(14)]

Table 6-12: Condition of Westonaria Paved Roads [(14)]

Very Good	Good	Fair	Poor	Very Poor
34%	34%	25%	6%	1%

Based on the above table and from the inspections we carried out, the following can be reported [(14)]:

- It is urgent that the PMS be updated to reflect the current status as this helps in planning for projects and budgets.
- The road network is in a fairly good condition despite lack of continuous maintenance program due to inadequate funding.
- There are more good and poor roads in Bekkersdal Township compared to the Simunye Township due to the incomplete Bekkersdal Renewal Project (BRP)
- Westonaria has a higher percentage of very good and good roads despite the storm water problems around Simunye Township

There are pockets of poor roads and pot holes but these are being dealt with as funds become available.

7 MUNICIPAL ROAD NETWORK PLANNING AND PRIORITIES

7.1 City of Tshwane

The areas where the Ward Committee meetings called for upgrading of the major roads are of interest. These were, without exception, in the affluent residential areas and followed two general patterns. In the north, demands for additional road capacity tend to be associated with those wards which are impacted by the building of major toll roads (N4 and N1). These include Weavind Park, Montana, Sinoville and Waverley to the east and the Orchards area to the North West. In the south the areas adjacent to the N1, including Rietvlei, Irene and Rooihuiskraal, called for major road upgrading. (16)

There is only limited access to the north of Tshwane caused by the physical barrier, the Magalies Mountain. The accesses are indicated in Figure 10.

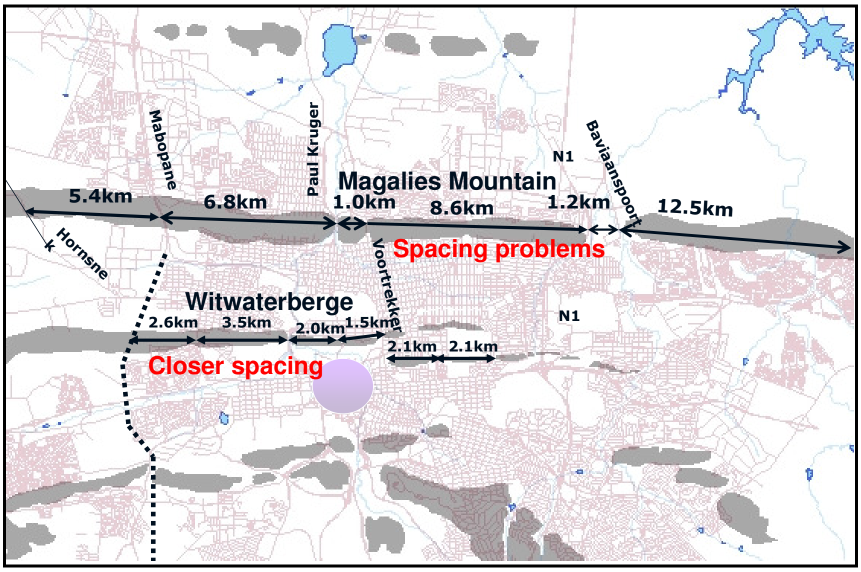


Figure 10: Points of Access through the Magaliesberg

The total traffic on the nine roads (15 lanes) represents 83.5% (18 500 Car Passenger Units-CPU) of the total road capacity (24 200 PCUs). It is expected that the traffic demand will increase to 39 800 PCUs (97%) within the next 15-20 years. (5)

Given the expected demand and the possibility to increase the number of lanes across the mountain by 5 lanes per direction, the overall demand will exceed the supply within the next 10 to 15 years, as shown in ***Table 7-1***.

Table 7-1: Existing and Future Capacity Utilisation (5)

	Northbound			Southbound		
	2004	Increase	Future	2004	Increase	Future
Number of road links	9	1	10	9	1	10
Current/ Available lanes	14	6	20	15	5	20
AM Peak hour vehicles	12,100	5,600	17,700	18,500	18,000	36,500
Average lane utilisation	860	930	890	1,230	3,600	1,830
Equivalent Car Passenger	13,200	6,200	19,400	20,200	19,600	39,800

units						
Capacity	22,800	10,800	33,600	24,200	9,400	33,600
Percentage lane utilisation	57.9%		57.7%	83.5%		118.5%

Table 7-2: Projects of Provincial Responsibility *[19]*

Project Name		Est. Cost (Million)
1	New K97 link (N4 southwards)	R 90.0
2	K14 link (part of area road network development for regional inter-modal facility, which includes the Paul Kruger Street Extension upgrading and re-alignment)	R 60.0
3	Upgrading of Rietvlei Dam Road (as K54) (R21 to Delmas Road)	R 20.0
4	One carriageway of K54 (Garstfontein Road to Delmas Road)	R 32.0
5	Upgrading of Rietvlei Dam Interchange (R21)	R 20.0
6	Doubling of Old Johannesburg Road (K101, from Wawiel Interchange/Eeufees Rd to M31 in the south)	R 70.0
7	Second carriageway of Hans Strijdom East (K69) (from Atterbury Road to Genl Louis Botha Drive)	R 45.0
8	Second carriageway of Hans Strijdom East (K69) (from Lynnwood Road to Mamelodi)	R 50.0
	TOTAL	R 387.00

Note: The PWV 9 is not included in this list, due to the cost estimate exceeding R1.2 billion (previous best estimate). It is a project of its own significance, and is very strongly emphasised in the City Development Strategy (CDS) as important for development in Tshwane. However it is also included in the Gauteng (Toll0 Freeway Improvement Scheme of SANRAL, and may thereby even become a national project. [19]

Table 7-3: Summary of Local Road Projects per Area *[19]*

Geographic Area	Cost (Million)
Akasia	R 4.55
Atteridgeville	R 1.25
Ga-Rankuwa	R 3.2
Mabopane	R 48.40
Mamelodi	R 29.95
Soshanguve	R 13.85
Temba/Hammanskraal	R 92.35
TOTALS	**R ,193.55**

The local roads projects included in the summary do not reflect the total backlog that needs to be addressed, but focuses on the more important projects within the areas. The approach to backlog eradication needs to be refined, particularly regarding minimum standards and packaging of projects in such a way as to make a noticeable, significant impact on an area at a time. Thus projects to improve local roads will gain in more significance and specific budget allocation in due course. [19]

The current main road projects within CTMM address the construction of new links as well as upgrading the capacity of major roads. Projects on the capital budget include:

i. Menlyn area road network, including a proposed interchange on the N1 at Garstfontein Road and major expansion of the existing Atterbury Road as well as cross-streets. (The scheme is developed in partnership with SANRAL and the local business community)
ii. Extend Nelson Mandela Drive (From Edmond street to Soutpansberg Road)
iii. Doubling of Simon Vermooten Road (between Alwyn Road and N4): To improve accessibility of Samcor Park/Waltloo to the freeway network. This upgrading is supportive of freight movements and an automotive facility.
iv. Doubling of a portion of Stormvoël Road from Hans Coverdale to Simon Vermooten Extension
v. Extension of Derdepoort Avenue to link Stormvoël Road to Zambezi Drive via portion of existing Baviaanspoort Road
vi. Improving of Hans Strijdom Drive West (P36 Delmas Road up to R21 interchange)
vii. Doubling of Lynnwood Road (Rubida St to Hans Strijdom Drive)
viii. Doubling of Church Street (East) over railway line

Strategic Road Network

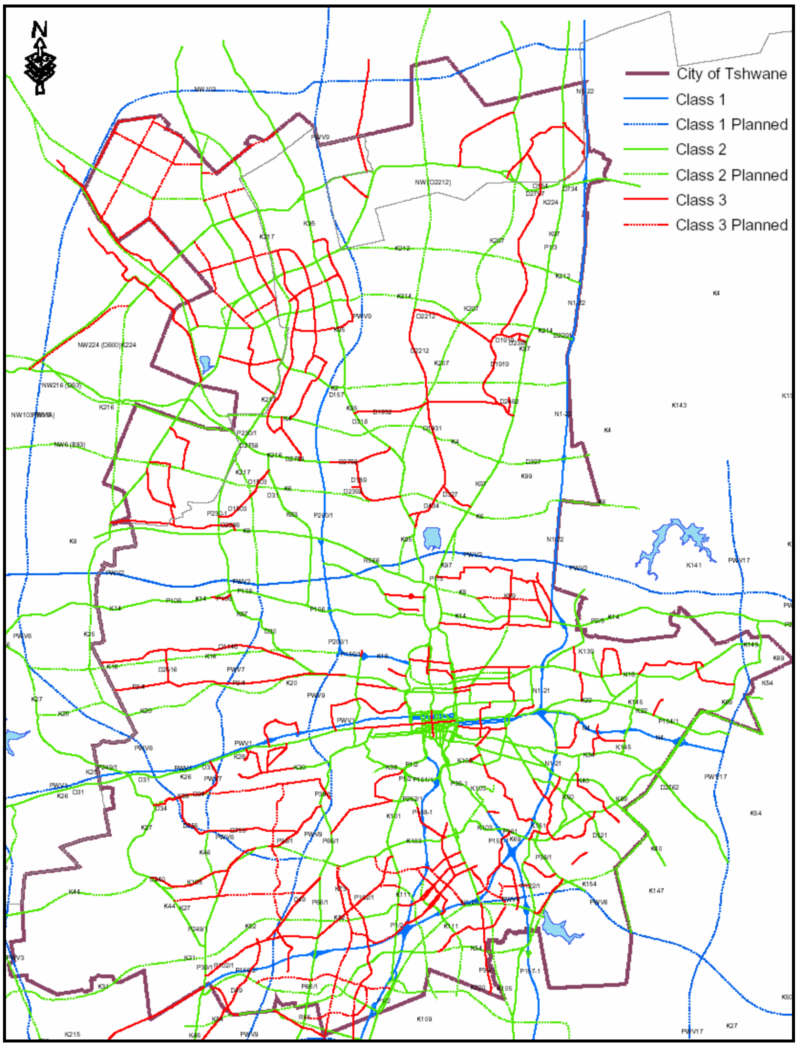
The Tshwane Strategic Road Network Plan is shown on Map 6. It shows the current road network master plan indicating the existing and planned class 1, 2 and 3 road links. The planned road network also includes the important missing link to the west of the CBD, which is the planned north-south PWV9 freeway, as well as the activity spine/street(s) for this corridor. (5)

Completion of the Tshwane Mobility Ring (PWV 9) (17)

The extension of the PWV9 Freeway southwards to create the Western Bypass of Tshwane, will open up a North-South axis for the flow of people and goods. Such a developmental corridor will draw investors who would like to capitalize on the mostly untapped development potential of the western reaches of the City. This attractive location will be close to the capital core, and will be linked to its southern decentralized nodes and the Zone of Choice. At the same time it will complete the Tshwane Mobility Ring (N1, N4 West; PWV9 and N14).

The PWV9 mobility link has been planned to cater for between 5 000 to 7 000 vehicles per hour, with a cost benefit ratio of more than one (for all scenarios) and the annual economic benefit exceeds R1,2 billion (in 1999 Rand). The extension of the “Mabopane Freeway” across the Magaliesberg creating a link with the old N4 (PWV1), Atteridgeville and further south with Centurion, Midrand, Randburg and Sandton will unlock the Zone of Choice and give it better provincial-wide accessibility.

A major emphasis is at present being placed on enabling the construction of the link through Daspoortrand. A study has been initiated to implement tunnels rather than a massive cutting, as this is more environmentally acceptable (visual impact, severance of communities, noise etc.).



Map 6: CTMM Interim Strategic Road Network [(5)]

Planning Projects of a Strategic Nature

There are a number of strategic roads projects. The strategic planning projects include:

i. K99 link - Zambezi Drive southwards across the Magaliesberg Mountain to link to the bulk of the area to the south. The alignment options include the road link going south-west (Frates Road and hence towards the CBD and Sunnyside) or south (Codonia Street and onwards to Hatfield). This is a very important link, as it provides only the third north-south option to cross the physical barrier of the mountain. Due to the high cost of this link including tunnelling options, the feasibility as a toll route is being investigated.

ii. Olievenhoutbosch Road Activity spine (Development and construction of the East section and West section, since the central section already constructed as single carriageway). As indicated above, it is related to the N1 corridor.

iii. Proposed Rooihuiskraal Road interchange on N14 and regional linkages. An interchange on the N14 freeway at the current Rooihuiskraal Road crossing, as well as new link roads such as the proposed Lenchen Avenue Extension, will improve accessibility of the quadrants and possibly relieve pressure on the Old Johannesburg Road.

Transport lead projects [17]

The City of Tshwane has identified the following lead transport projects:

The K8

The improvement of the K8 and its further extension south of Wonderboom Airport via Third Road and Sakabuka Avenue to Moloto Road (K139), instead of bringing it into Zambesi Drive, needs to be considered seriously. This is necessary to act as a second east-west local spine:

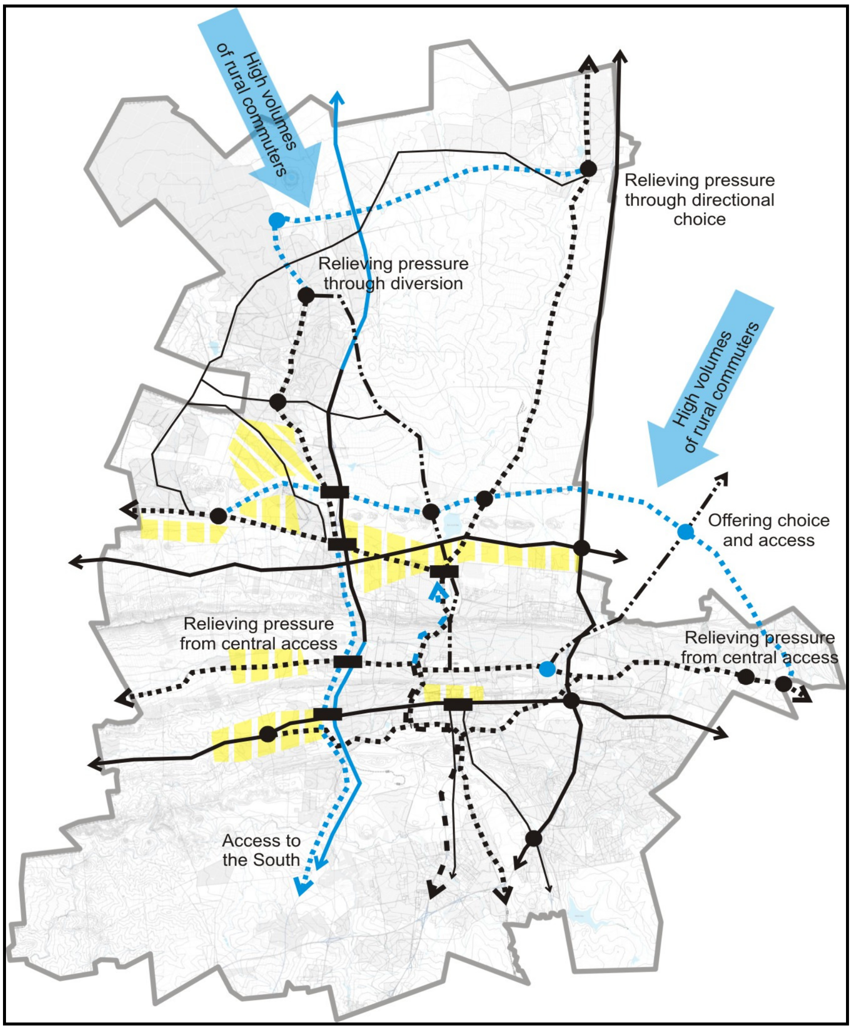
- ensure adequate mobility,
- alleviate traffic on Zambesi Drive,
- give impetus to the further development between Zambesi and the N4, and
- reinforce the public transport network, by providing a road facility which could be developed in part as a high capacity public transport corridor

N4 - K97 Link to Rainbow Junction

The Zone of Choice will be further "opened up" and local access and mobility will be bettered by linking the Rainbow Junction Node with the new N4 toll road through the construction of the much needed K97. This link will also provide access from the N4 to Wonderboom Airport via Lindvelt Road.

K99 Link to the South (Dr Swanepoel Drive)

Similarly, the accessibility to and mobility within the Zone of Choice could be greatly improved by redeveloping Dr Swanepoel Drive, with a possible extension through the Magaliesberg to link up with Frates Avenue on the southern side of the mountain. However, the linkage to Frates will be a very expensive option and may not be viable in the short to medium term. It however lends itself to be developed as a metropolitan urban toll road. To this effect SANRAL has been requested to investigate such a possibility, taking into account that within Gauteng only SANRAL can currently develop toll roads.



Map 7: Potential transport interventions (17)

7.2 City of Johannesburg

Salient findings in examining private (car) transport demands and current road network conditions regard are [6]:

- Both within and outside the N1/N3/N12 Ring Road, roads are operating at low levels of service and many road sections are operating at capacity or at over-capacity conditions in peak hours.
- In addition to the above there are many congestion "hot-spots" at intersections and interchanges.
- In recent years little progress has been made with regard to promoting public transport nor has emphasis been given to furthering road development, and as a result most of the existing mobility spines have major traffic problems.
- The City has 1 780 traffic lights and malfunctioning is a common problem due to rain, power cuts and power distribution faults, and many do not have correct signal plans. The estimated cost of correcting traffic signal cable and power distribution faults is R0,5bn.

- In terms of the objectives of the SDF on-going attention needs to be given to the upgrading/surfacing of gravel roads and looking after the maintenance and rehabilitation of existing road infrastructure.
- As a consequence of the above and in association with other interventions, which will be of a capital intensive nature, there is the need to embark upon travel demand management. (In this regard current initiatives are identified in the main report.)

It is evident that regardless if one is talking about roads within or external to the N1/N3/N12 Ring Road system, operating conditions in peak hours are poor, the prevailing Level of Service (LoS) on average, being LoS D. Further examination of the data does however highlight that many road sections are running at capacity (i.e. LoS E) and many at over-capacity conditions (i.e. LoS F). [7]

While the present work programme for the ITP has not progressed to the stage where there is a comprehensive data base available which would enable one to undertake a detailed assessment of interchange / intersection performance, the following information is relevant: [7]

- While there are a few exceptions, most interchanges are congested during peak hours. The demand to use the freeway / motorway system is such that there are long queues on roads which provide access to the freeway system and long queues on the off-ramps of the freeway system, many of these tailing back onto the freeway lanes themselves. Both of this point to the fact that interchange capacity is a serious problem and that the capacity of interchanges is not consistent with that of neither the adjacent freeway nor the routes which provide access to the freeway network.
- While the existence of the freeway system improves accessibility and mobility, it also needs to be remembered that freeways present barriers which need to be crossed. Both in terms of cross access and access to the freeway system itself, various problems are evident, some of these being related to double loading (i.e. cross traffic and traffic accessing the freeway system being concentrated on one route) and the different access standards applied to the freeway system (i.e. access and interchange spacing requirements on the M1 & M2 as opposed to those on the N1 & N3).
- With respect to intersections, there are some 1 820 traffic signal controlled intersections in the CoJ and problems with traffic lights receive substantial media attention.

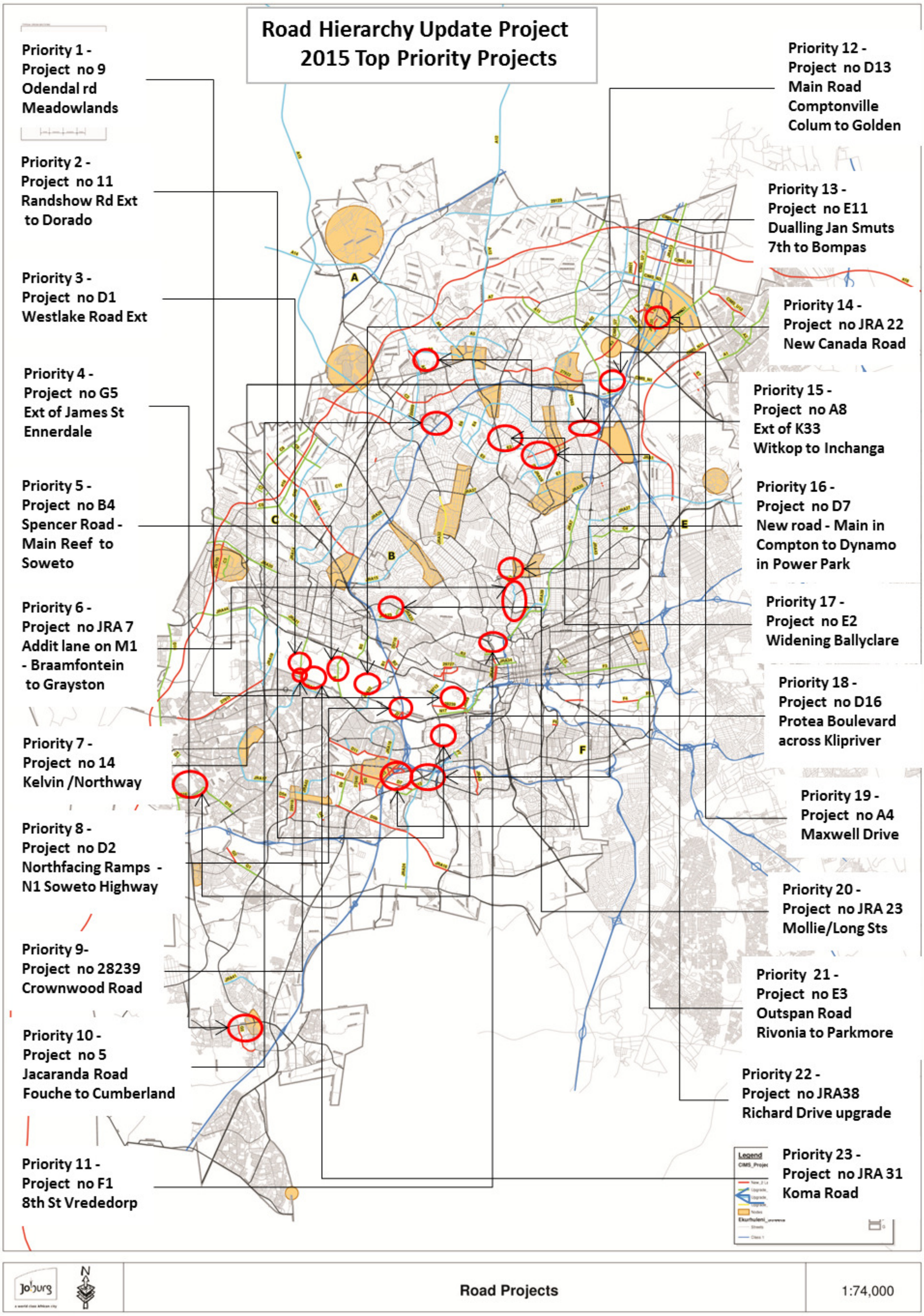
Key interventions identified by the City of Johannesburg directly applicable on transport planning are the following: [7]

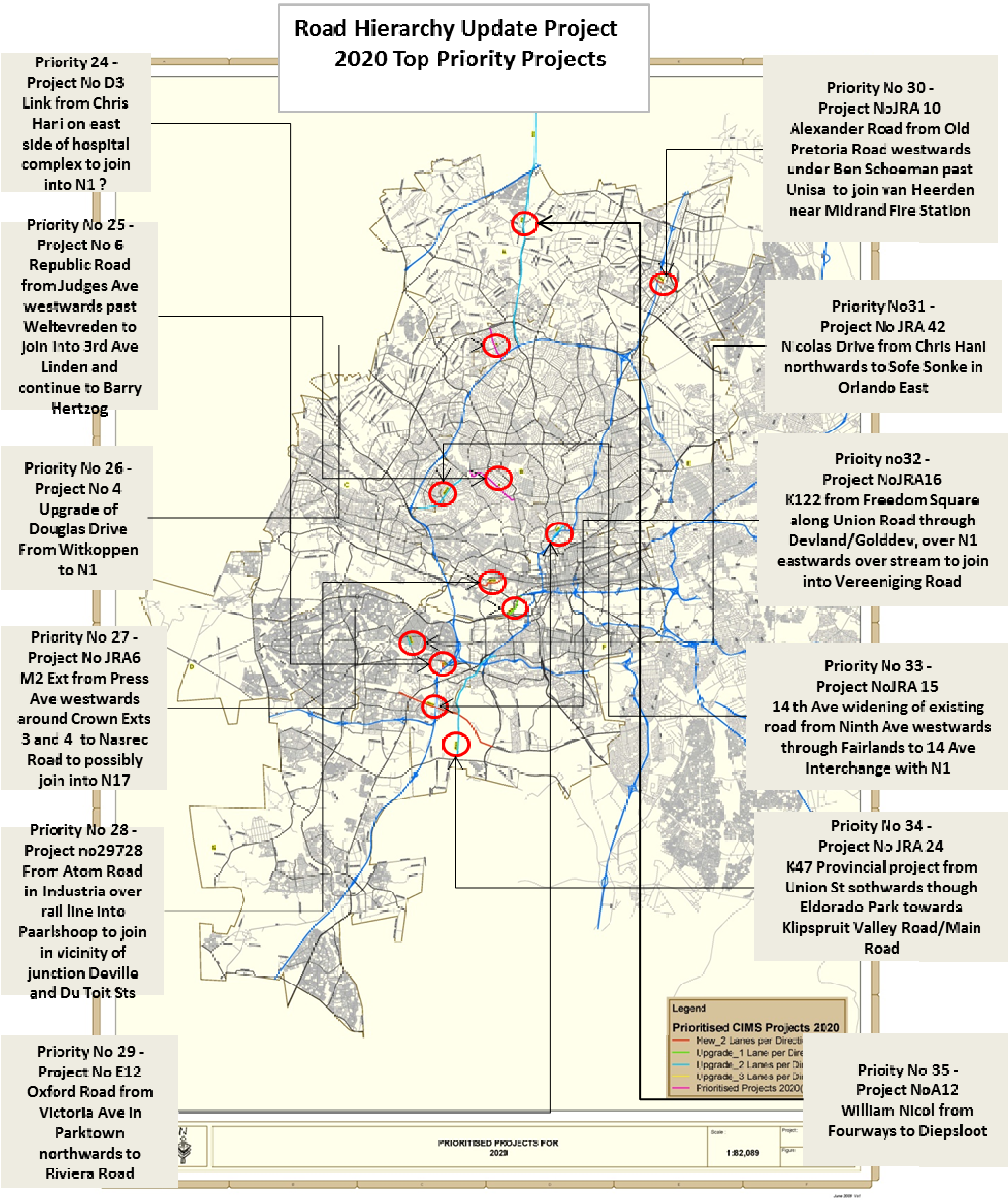
- Kazerne Precinct
  - Construction of Vickers – Heidelberg link road
  - Upgrade of Maraisburg interchange
- City Deep Trade Port Precinct
  - Rosherville Rd extension to lower Germiston Rd
  - Bonsmara Rd Upgrade
  - Heidelberg Rd Upgrade
  - Lower Germiston Rd upgrade
  - Vickers-Heidelberg loop road
  - The Cleveland Road Link extending Cleveland Road through to Lower Germiston Road
  - The westward extension of Rosherville Road through to Vickers Road
  - Local upgrading of Lower Germiston Road in the vicinity of Jupiter

- Market Precinct
  - Heidelberg – Vickers loop service road
  - Vickers Rd upgrade
  - N17 on/off ramps
- Heriotdale Precinct
  - M2/Main Reef / Cleveland interchange upgrade
- George Goch Precinct
  - Vickers – Paullus Rd link
- Rosherville Precinct
  - Cleveland Rd extension and N17 interchange
- Construction of the N17 and extension of the M2 westward;
- Construction of north-south linkages such as Nic Tolmey Road Extension, Westlake, Spencer and Cemetery Road Extension;
- Construction of the K102 linking the K15 on the west and north towards Roodepoort; and
- Development of transit-orientated focal points that provides inter-modal facilities at key points such as the Roodepoort Station.
- Construction of the K60 should be supported to serve as an alternative mobility corridor from Woodmead Drive to William Nicol Drive;
- Upgrading of William Nicol and Rivonia interchanges with N1 and the portion of William Nicol from Montecasino to the N1;
- Improve access onto Nasrec Road and Main Reef Road;
- Investigate dangerous Kingsway/University Road intersection and improve;
- Proposed access to University of Johannesburg at Twickenhan Avenue;
- Improve functioning of Artillery Road to improve access and parking during peak periods;
- Establish and promote strong east-west linkages with specific reference to: Traffic management in Gleneagles Road, Greenhill Road, Tana Road and Victory Road in support of east-west mobility links.
- Traffic management strategy and urban design for Sixth Street, including traffic calming;
- Explore connectivity links between Moira Street in Cosby and Hamilton Road in Coronationville;
- Develop Randburg Regional Node as a destination by altering mobility patterns to and through the Node:
  - Close Hendrik Verwoerd Drive between Selkirk and Jan Smuts Avenue.
  - Reopen Hill Street (between Kent Avenue and Pretoria Avenue) to vehicular traffic.
  - Upgrade Pretoria Avenue to facilitate public transport and pedestrian access.
  - Develop a new taxi rank on site bounded by Retail Avenue, Hill Street, Pretoria Avenue and Oak Avenue and integrate with the flagship SPTN.
- Improve road access from Riverlea to Main Routes such as the extension of N17, Nasrec Road; and
- Determine the alignment and implementation programme for proposed major arterials such as the PWV 3 and PWV 5;
- Construct the new Westlake Extension Road;
- Upgrade Randfontein Road and intersections with specific reference to passing lanes, pedestrian crossings, informal trade, signage and traffic and transport management (including taxi's);
- Support main Reef Road as an economic corridor in the EWDC;
- Realign and upgrade the existing New Canada Road;
- Realign and upgrade Spencer Road;

- Upgrade and realign Dobsonville Road, with reference to the N17 and K102;
- Construction of N17, Golden Highway;
- Construction of north/south linkages to maximise integration with northern regions;
- Upgrading of K43 to improve accessibility;
- Construction of K102 linking the K15 on the west and north to Roodepoort Road; and
- Determine the alignment and programme proposed for the K122
- Construct the proposed K60/k113 and PWV 3;
- Construct the proposed K60/K111/K113/K115/K232;
- Proposed interchange to be constructed at the intersection of Main Road and the N1 Highway;
- Undertake measures to improve mobility and relieve congestion on Woodmead Drive between the M1 interchange and Woodlands Drive;
- Upgrade and improve the following routes to increase linkages and integration thus reducing isolation of Alexandra: Vasco da Gama – Far East Bank, London Road, Grayston Drive/Watt Avenue/Roosevelt Road, Corlett Drive-Ninth Road, Wynberg – Canning Road;
- Upgrade the N3 interchanges at London Road and Marlboro Drive;

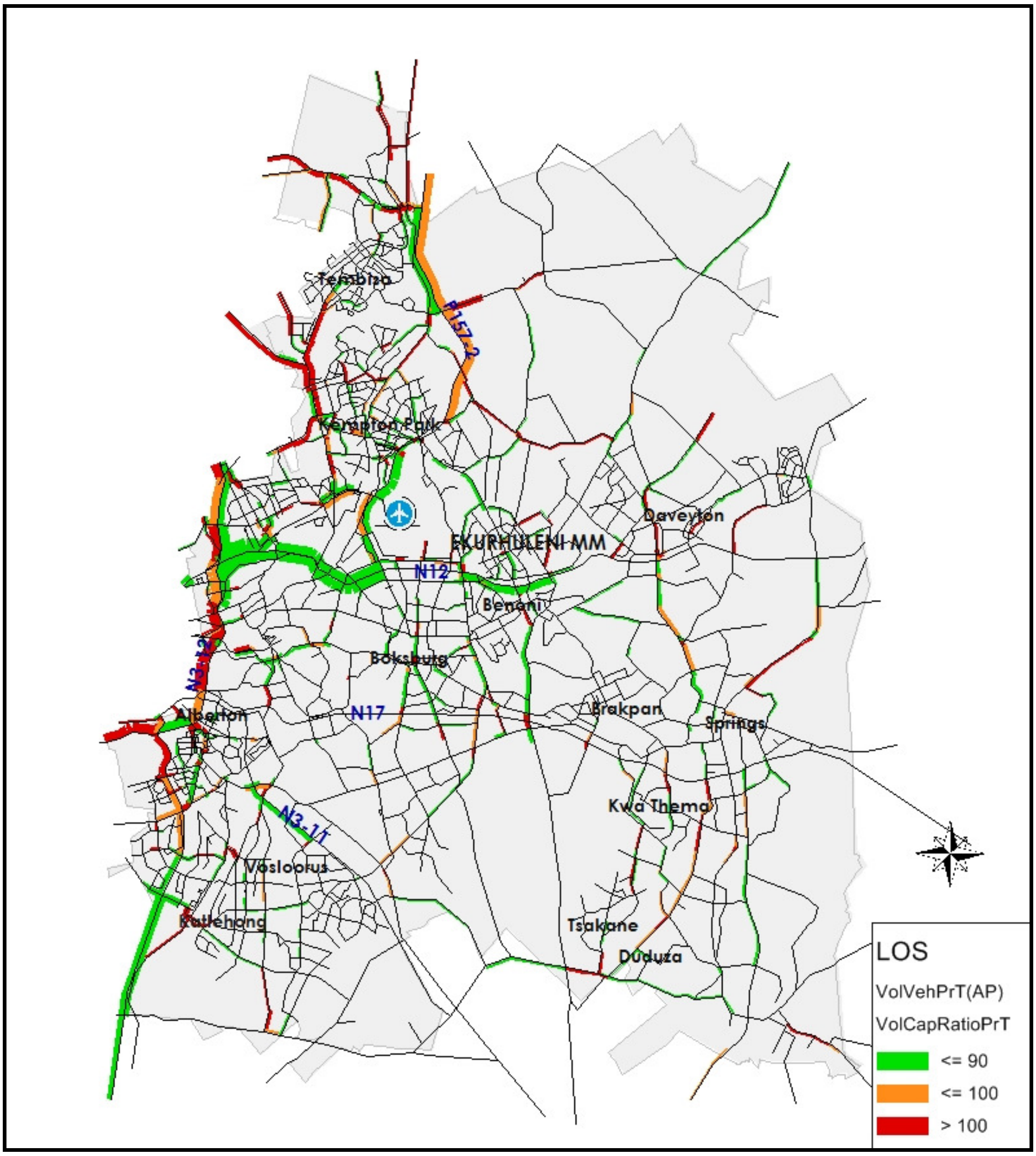
Aurecon developed a Functional Road Hierarchy for the City of Johannesburg for the Base Year and 5 and 10 Year Horizon, and as part of the study identified the priority roads projects in the City of Johannesburg for 2015 and 2020 which are given below.


Road Hierarchy Update Project
2015 Top Priority Projects
Priority 1 - Project no 9 Odendal rd Meadowlands
Priority 2 - Project no 11 Randshow Rd Ext to Dorado
Priority 3 - Project no D1 Westlake Road Ext
Priority 4 - Project no G5 Ext of James St Ennerdale
Priority 5 - Project no B4 Spencer Road - Main Reef to Soweto
Priority 6 - Project no JRA 7 Addit lane on M1 - Braamfontein to Grayston
Priority 7 - Project no 14 Kelvin /Northway
Priority 8 - Project no D2 Northfacing Ramps - N1 Soweto Highway
Priority 9- Project no 28239 Crownwood Road
Priority 10 - Project no 5 Jacaranda Road Fouche to Cumberland
Priority 11 - Project no F1 8th St Vrededorp
Priority 12 - Project no D13 Main Road Comptonville Colum to Golden
Priority 13 - Project no E11 Dualling Jan Smuts 7th to Bompas
Priority 14 - Project no JRA 22 New Canada Road
Priority 15 - Project no A8 Ext of K33 Witkop to Inchanga
Priority 16 - Project no D7 New road - Main in Compton to Dynamo in Power Park
Priority 17 - Project no E2 Widening Ballyclare
Priority 18 - Project no D16 Protea Boulevard across Klipriver
Priority 19 - Project no A4 Maxwell Drive
Priority 20 - Project no JRA 23 Mollie/Long Sts
Priority 21 - Project no E3 Outspan Road Rivonia to Parkmore
Priority 22 - Project no JRA38 Richard Drive upgrade
Priority 23 - Project no JRA 31 Koma Road
A
B
C
E
F
Legend
Joburg
N
Road Projects
1:74,000


Road Hierarchy Update Project
2020 Top Priority Projects
Priority 24 - Project No D3 Link from Chris Hani on east side of hospital complex to join into N1 ?
Priority No 25 - Project No 6 Republic Road from Judges Ave westwards past Weltevreden to join into 3rd Ave Linden and continue to Barry Hertzog
Priority No 26 - Project No 4 Upgrade of Douglas Drive From Witkoppen to N1
Priority No 27 - Project No JRA6 M2 Ext from Press Ave westwards around Crown Exts 3 and 4 to Nasrec Road to possibly join into N17
Priority No 28 - Project no29728 From Atom Road in Industria over rail line into Paarlshoop to join in vicinity of junction Deville and Du Toit Sts
Priority No 29 - Project No E12 Oxford Road from Victoria Ave in Parktown northwards to Riviera Road
Priority No 30 - Project NoJRA 10 Alexander Road from Old Pretoria Road westwards under Ben Schoeman past Unisa to join van Heerden near Midrand Fire Station
Priority No31 - Project No JRA 42 Nicolas Drive from Chris Hani northwards to Sofe Sonke in Orlando East
Prioity no32 - Project NoJRA16 K122 from Freedom Square along Union Road through Devland/Golddev, over N1 eastwards over stream to join into Vereeniging Road
Priority No 33 - Project NoJRA 15 14 th Ave widening of existing road from Ninth Ave westwards through Fairlands to 14 Ave Interchange with N1
Prioity No 34 - Project No JRA 24 K47 Provincial project from Union St sothwards though Eldorado Park towards Klipspruit Valley Road/Main Road
Prioity No 35 - Project NoA12 William Nicol from Fourways to Diepsloot
Legend
Prioritised CIMS Projects 2020
PRIORITISED PROJECTS FOR 2020
1:82,089

7.3 Ekurhuleni Metropolitan Municipality

Levels of service E and F on a road network indicate a high level of congestion. Only 7.2 % of roads experience a level of service E and another 3.5 % level of service F. The congestion index for all roads in Ekurhuleni is considerably lower than in either Johannesburg or Tshwane as can be seen below. (8)



Map 8: Predicted Levels of Service (LOS) in 2010(8)

The proposed capital expenditure budget for major roads infrastructure in Ekurhuleni are given in the table below :(23)

Table 7-4: Ekurhuleni Metropolitan Municipality – Road Projects [23]

Project	Estimated Total Cost (R million)	Proposed Start Year	Budget Years (2007 R million) 1	2	3	4	5	>5
NEW ROADS INFRASTRUCTURE:								
K115 (M59 Driefontein Rd/Lunik Drive extension) from K155 (Modderfontein Rd) to M16 Brabazon Rd	38.4	2008	5.76	8	12	12.64		
K146 (Rivett-carnett St extension) from M7 (Kliprivier Drive) to D817	71.8	2008	11.76	11	15	14	20	
K86 from K157 (M43 Atlas Rd) to P67-1 (R51 Putfontein Rd) - second phase by GDPTRW	74	2008	11	11	15	17	20	
K89 (M61 Vereeniging Rd) from Delphinium St to Potgieter Rd	7.8	2010			7.8			
K92 (M52 Van Buuren/North Reef) from M97 Nicol Rd to K113 (M37 A.G. de Witt Rd)	21.4	2010			3	18.36		
K121 (Dann Road) from K105 (M57 Pretoria Rd) to Van Riebeek Rd	34.6	2010			3.62	20	11	
K68 (Vermeulen St) from P67-1 (Du Randt Road) to Esselen St	15.2	2010			2	13.24		
K117 from Tinney Rd to 0.8 km North	2.4	2011				2.4		
K117/K127 from North Reef Rd to Webber Rd	76.9	2011				8	40	28.92
K132 (R554 Springs Rd extension) from Glamorgan Ave to M56 South Main Reef Rd	69.7	2012					40	29.72
K60 from M18 Andrew Mapheto Rd to K105 (M57 Pretoria Rd)*	82.2	2012					40	42.2
UPGRADING OF GRAVEL ROADS:	(Including external funding)							
Northern Region	757	2008	81	81	81	81	81	352
Southern Region	757	2008	81	81	81	81	81	352
Eastern Region	757	2008	81	81	81	81	81	352
PUBLIC TRANSPORT: HOV LANES								
Tembisa - Kempton Park	85	2008	9	20	20	20	16	
Katlehong – Germiston	85	2012					9	76
Vosloorus – Boksburg	80	2008	9	20	20	20	11	
R23 from R554 Dalpark – Benoni	35	2012					5	30
Daveyton – Benoni	95	2008	9	20	20	20	26	
TOTAL	3 145		299	333	361	409	481	1263

Here it is important to note that EMM is obliged to ensure SARTSM compliance of all road signs and traffic signal installations by 2010.

The estimated cost of this work was sourced from a previous report “Development of a traffic signal control strategy for the Ekurhuleni Metropolitan Municipality” in 2005. Tenders have already been advertised for the execution of this work. [23]

The total annual capital expenditure resulting from these proposals amount to:

- Year 1 R390 million
- Year 2 R422 million
- Year 3 R442 million
- Year 4 R475 million
- Year 5 R529 million

The proposed road infrastructure construction programme as identified by the Ekurhuleni Metropolitan Municipality is given in ***Table 7-5***.

Table 7-5: EMM proposed road infrastructure programme [15]

Road	From	To
By 2010		
K115 *	K155	Brabazon Rd
K146	817	P72-1
K121	K105	van Riebeeck Rd
K89	K133	K124
K124	K89	K125
K155	Kwartel Rd	K119
K60 *	A Mapheto	K105
K89	Delphinium St	Potgieter Rd
K86	K157	P67-1
K132	Springs Rd	South Main Reef Rd
K105 *	781	K121
K92	Nicol Rd	K113
K68	P67-1	K86
K68	Elm St	K105
By 2015		
K117	Tunney Rd	0.80 km north
K117/K127	North Reef Rd	Webber Rd
By 2020		
K27	R21	K151
K94	Elizabeth Rd	Atlas Rd
K161	Stone Rd	Paul Kruger Highway
K125	N3	Wits Rifles Rd
K62	K27	K169
K169	P6-1	Geldenhuys Rd
K163	Main Reef Rd	Koot Rd
By 2020		

Road	From	To
K113	Meyer St	A G de Witt Rd
K109	K27	P6-1
By 2025		
K92	North Rand Rd	Sarel Hattingh St
K105	Andre Greyvenstein Av	North Rand Rd

Note: * - Assumes that section of road outside Ekurhuleni is constructed.

Roads with only a short section in Ekurhuleni were not included, e.g. K113, K111

7.4 West Rand District Municipality

Merafong City

This specific section for the Merafong City Local Municipality was not completed as the funding for implementation and maintenance was captured in their annual budget. The following information however reflects the needs as indicated in the District IDP Document for the period 2010/11: (11)

Table 7-6: Merafong Local Municipality (11)

PROJECT	ESTIMATED BUDGEY	SOURCE OF FUNDING
Upgrading of existing roads	R10 million	Not reflected
Upgrading of existing storm water	R5 million	Not reflected
Construction of walkways	R3 million	Not reflected
Khutsong 1,2,3 Construction of new road	R10 million	Not reflected
Road bridge over rail	R18 million	Not reflected
Rehabilitation of current services in old Khutsong Ext 2 and 3. Loading zones along taxi routes.	R52 million needed as part of resettlement plan	Not reflected
Resealing of roads	R6,8 million	MIG grant
Speed calming	R500 000	MIG grant
Construction of roads (Losberg Area)	R6,5 million	MIG Grant
Kokosi Ext 5 Road Construction	R50 000 000	MIG
Kokosi Ext 6 Road Construction	R25 500 000	MIG
Wedela Road Construction	R20 000 000	MIG
Kokosi Ext 5 Ring Road Construction	R1 000 000	MIG savings
Construction of new taxi rank Wedela	R5 386 159	MIG
Construction of new taxi rank: Blybank	R5 386 159	MIG
Construction of new taxi rank: Kokosi	R5 251 504	MIG

The following roads have been planned for the Merafong City LM by the provincial Gauteng Department of Public Transport Roads and Works (GDPTR&W) for the near future (11):

- K211 – Links Carletonville with N14
- K213 – Links Carletonville with Fochville

- K140 – Links MCLM with to the East Merafong LM
- PWV18 – Links Merafong City LM with North West and the City of Johannesburg
- Metropolitan Municipality (CoJMM)

Mogale City

The following information reflects the road needs as indicated in the District IDP Document for the period 2010/11: (12)

Table 7-7: Mogale Local Municipality Road Projects (12)

PROJECT	ESTIMATED BUDGET	SOURCE OF FUNDING
Road Construction: Kutlhanong Road Rehabilitation / Rietvallei Ext 2 and Rangeview Ext 2	Not reflected	Own funding
Construction of rural roads	Not reflected	MIG
Access roads to Ethembalethu Village/ Rietfontein Village	Not reflected	MIG

The following roads have been planned for the Mogale City LM by the provincial Gauteng Department of Public Transport Road and Works for the near future (12):

- K74 – Links Mogale City with City of Johannesburg MM
- K11– Links Mogale City with Randfontein LM
- K17 – Links Mogale City with North West Province
- K76 – Links Mogale City with North West Province
- K15 – Links Mogale City with Soweto
- PWV12A – Links Mogale City with City of Johannesburg and North West Province
- K198 – Links Mogale City with City of Johannesburg MM and Randfontein LM

Randfontein

The following information however reflects the needs as indicated in the District IDP Document for the period 2010/11: (13)

Table 7-8: Randfontein Local Municipality Road Projects (13)

PROJECT	ESTIMATED BUDGET	SOURCE OF FUNDING
Road Master Plan	R 1,2 million	Not reflected
Rehabilitation of bridge structures	R800 000	Not reflected
Implementation of freight movement and overloading control	R800 000	Not reflected
Reconstruction/rehabilitation of primary roads and arterials	R700 million	Not reflected
Construction of K11 by pass	R55 million	Not reflected
Construction of road over rail and road bridge (Arend Drive Extension)	R85 million	Not reflected

The following roads have been planned for the Westonaria LM by the provincial Gauteng Department of Public Transport Road and Works (GDPTR&W) for the near future (13)

- K11– Links Randfontein with Westonaria LM and Mogale City LM
- K197 – Links Randfontein with Mogale City LM
- K96 – Links Randfontein with PWV12A

- K198 – Links Randfontein with City of Johannesburg MM
- PWV1 – Links Randfontein with Mogale City LM and Westonaria LM.
- PWV16 – Links Randfontein with City of Johannesburg MM

Westonaria

The following table reflects the needs as indicated in the District IDP Document for the period 2010/11: (14)

Table 7-9: Westonaria Local Municipality Road Projects (14)

Project	Estimated budget	Source of Funding
Simunye Internal Road upgrading and construction	R 3 390 347	Not reflected
Construction of new Taxi Rank in Westonaria	R200 000	Not reflected
Resurfacing of roads: Westonaria	R500 000	Not reflected
Walkways : Extension Simunye	R200 000	Not reflected
Walkways: Upgrading Westonaria CBD	R100 000	Not reflected
Walkways: Upgrading Glenharvie	R400 000	Not reflected

The following roads have been planned for the Westonaria LM by the provincial Gauteng Department of Public Transport Road and Works (GDPTR&W) for the near future (14):

- K9 – Links Westonaria with K156 and PWV18
- K11– Links Westonaria with to the North Randfontein and to the South Sedibeng LM
- K140 – Links Westonaria with to the West Westonaria LM
- K170 – Links Westonaria with Sedibeng to the south
- K142 – Links Westonaria with to the West Westonaria LM and to East Johannesburg MM
- PWV1 – Links Westonaria with the rest of WRDM

7.5 Road Network Planning in Sedibeng District Municipality

The major strategic future roads in Midvaal are: (9)

- PWV 13: A major north-south road running from Benoni and Boksburg through Midvaal linking up with the proposed PWV 22 in the south.
- PWV 18: A major east-west road running along the northern boundary of Midvaal. This road will connect the East Rand and the West Rand and traverses the R59 freeway.
- PWV 20: A major east-west road running through the south of Midvaal and traversing the R59 freeway.

The existing road network provides good connectivity between the north and south of Midvaal, but there is a lack of proper east-west connections at regional level. The most significant routes at a regional level include: (9)

- The N1 national route running from Cape Town to Musina.
- The N3 national route between Durban and Johannesburg. This route runs through Midvaal in the east.

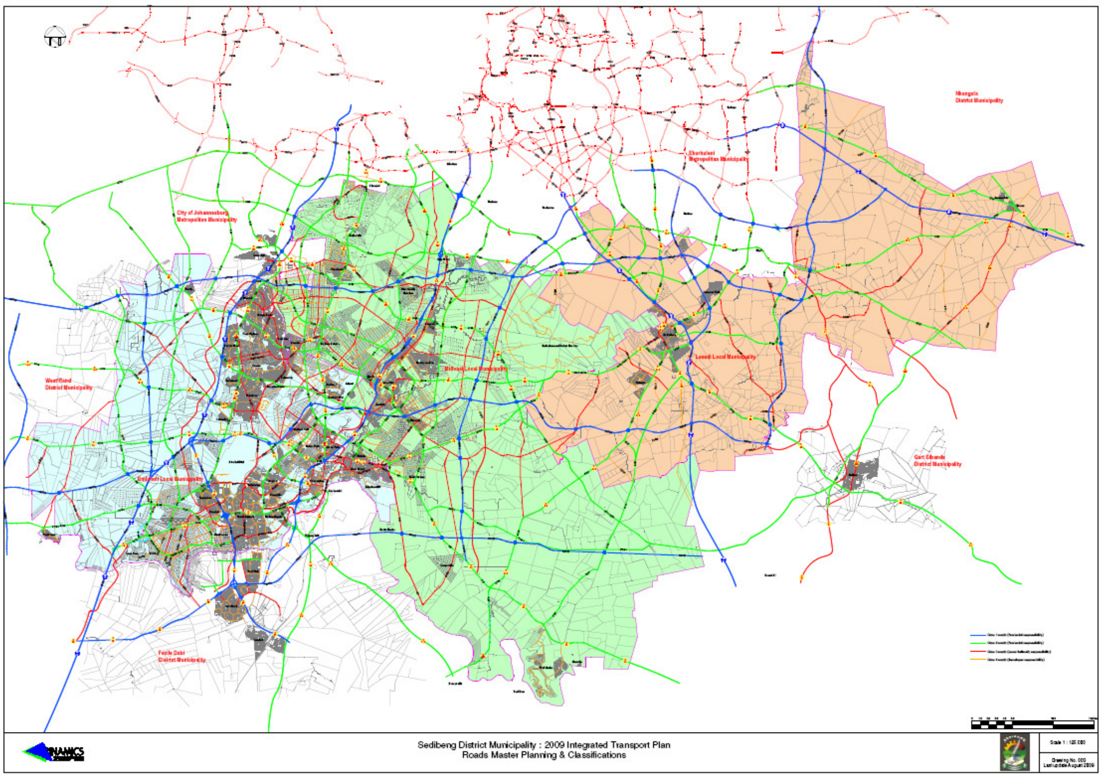
- The Golden Highway (R553) being a major north-south route which runs parallel to the N1 in the west of Sedibeng and past Sebokeng and Evaton.
- The R59 north-south route which links Alberton and Vereeniging and runs through the east of Midvaal past Meyerton.
- The R82 north-south route which links Johannesburg and Vereeniging via Walkerville and De Deur in the west of Midvaal.
- The K89 being a secondary route running parallel to the R59 linking Alberton and Vereeniging through Meyerton. This was the main route until the R59 freeway was constructed.
- The R42 being an east-west route which links Meyerton with Heidelberg and the N17 in Ekurhuleni.
- The R551 being an east-west route between the N1 and the Suikerbosrand Nature Reserve. This road merges with the R42 at the Nature Reserve.
- The R550 being an east-west link between the N3, R59 and R82.
- The R54 which links Vaal Marina in the south of Midvaal with the R82.

Route K89 runs more or less parallel to the R59 freeway and will thus in future act as an Activity Spine which will unlock the development potential of the land parallel to the east of the freeway in future. As this was originally the only road through the area, most of the land uses occurred along this road and front onto this road. Route K89 has lower mobility than the R59 freeway, but higher accessibility through more intersections and direct access at spacing intervals of about 600 metres. The upgrading of the current road to the standards of a K route will however have the effect that no direct access to land uses will be possible from this road in future. The construction of an additional lower order (third and fourth order) road network around the corridor to supplement the K89 and provide direct access to land uses along the R59 freeway will thus be required. [(9)]

Due to the high development pressure experienced in the area, there is currently an initiative underway to design a third and fourth order road network for the R59 Corridor and surroundings. This work is still in progress, and involves extensive discussions with representatives from GDPTRW. [(9)]

The important principles relevant to the R59 Corridor illustrated in the figure below are: [(9)]

- the fact that a third order route, parallel to the west of the R59 freeway, will be required in future in order to unlock the development potential of land to the west of the freeway (similar to K89 to the east of the freeway);
- the need for local east-west crossings across the R59 freeway between the interchanges in order to separate regional and local traffic and to enhance interaction between future land uses to the east and the west of the freeway;
- The westward extension of a third order road network from the R59 freeway in order to enhance future east-west movements.



Map 9: Sedibeng Road Master Plan

8 DEVELOPMENT OF THE 2037 GAUTENG STRATEGIC ROAD NETWORK

8.1 ROAD NETWORK REALITIES, PROBLEMS AND ISSUES

Considering the evaluation of the current planning and road network priorities of all three tiers of government and the current status of the road network in the Gauteng Province the following overall conclusions can be made:

- The broad road network planning are in place In Gauteng and the Gauteng Strategic Road Network Plan provides structure to the development of the province

- The Strategic Road Network Plan has to a large extent been taken into account in the road master planning undertaken by both SANRAL, the Metropolitan and District/Local Municipalities i.e. there is a general cohesion with regard to road planning between the three spheres of Government

- The current road planning is an extremely valuable element to enable and ensure economic growth in Gauteng.

- Available road reserves may be utilised differently than originally anticipated i.e. the emphasis shifted from a historically private car planning to integrated transport planning with integrated transport corridors where public transport and non-motorised transport and freight transport plays an equal if not more important role than private cars.

- Due to a lack of funding the Gauteng Department of Transport and the Metropolitan, District and Local municipalities rely on SANRAL to implement the mobility/freight backbone road network of which i.e. the GFIP Phase 2 & 3 is vitally important in the short to medium term.

- The maintenance back log on the all classes of roads is increasing on a yearly basis;

- Lack of sufficient funding for both preservation of the road network as well as the expansion of the road network. SANRAL relies on toll financing to finance the Gauteng Freeway Improvement Scheme (Phase 1-3). The implementation of e-tolls has been postponed for a few times and opposition against e-tolling are significant. The GDRT funding for the development of new roads and the upgrading of existing roads is limited at approximately R500 million per year with the bulk of their funding going towards road maintenance. Similarly the Metropolitan, District and Local Authorities again relies on both SANRAL and the Province to upgrade and provide the higher order (Class 1 and 2) road infrastructure in their respective jurisdictions.

- General poor road safety environment and high crash and incidence rate on the road network.

- Historically dispersed spatial and development patterns resulting in long commuting travel distances. The so-called “Gauteng City” is actually three cities (Tshwane, Johannesburg & Ekurhuleni) each with their own with satellite towns eg. Tshwane with Soshanguve and Moloto acting as a major urban city with significant interaction between these cities. People live in one city and work in another resulting in long travel distances, requiring significant transport infrastructure compared to a dense single city with similar population and one central area.

- Relatively high directional split in peak periods with resultant under-utilisation of road infrastructure in one direction and congested conditions in the other direction.

8.2 KEY POINTS OF DEPARTURE

The Gauteng road network remains one of the most important infrastructure assets of the province that underpins and support local economic growth and the resultant growth in job opportunities within the identified corridors and nodes. It is thus vitally important that the Gauteng Province **develop** and **maintain** an integrated road network that, inter alia:

- Creates a hierarchy that provides mobility roads (Class 1 and Class 2) and roads providing accessibility (Class 4 and 5) with Class 3 roads that provided a balance between mobility and accessibility.
- Provides a road network that allows continuity of travel across the province;
- Provides for acceptable levels of service during peak periods for especially road based public transport and to a lesser extent private transport to encourage the utilisation of public transport.
- Provides for adequate levels of safety;
- Promote environmental sustainability through the modes and technologies deployed on the road network,
- Provides for heavy vehicles (freight), private vehicles and public transport.
- Provides for non-motorised users on the Class 2 to 5 road network;
- Provides priority measures for higher occupancy vehicles where appropriate;
- Provides a safe and reliable strategic road network system which would optimize the movement of freight and passengers;
- Manage congestion and focus on the promotion public transport through the efficient and effective use of existing and future freeway road space.
- Optimisation of the existing road infrastructure through the implementation of: - -
  - Intelligent Transportation Systems (ITS)
  - Incident Management Systems
  - Travel Demand Management (TDM)

8.3 THE DEVELOPMENT OF THE 2037 STRATEGIC ROAD NETWORK

Proper integrated transportation planning and the timeous implementation of the planning is an extremely important element to enable and sustain economic growth in Gauteng.

The planning of the Gauteng road network commenced in the seventies and during the period 1970 to 2000 three separated major transportation studies were completed for the Gauteng region. The first study had 1975 as the base year, the second 1985 as the base year. The third study, known as the Vectura study had 1991 as the base year and was the first attempt to model public transport. The GTS 2000 study was completed in 2010 and was the last major update of the data and parameters used in the Gauteng Transportation model.

The GTIMP transportation model is again an upgrade of the GTS 2000 model with major enhancements in the modeling of an integrated transport system where the modal choice of Gauteng's inhabitants are modeled, assuming that in 2037 all the public transport modes will be totally integrated in all aspects.

The methodology followed to develop the 2037 road network plan was as follows:

- The initial 2037 road network were based on an assessment of the base year (2011) operating conditions and a wide range of inputs (see below);
- The initial 2037 road transport was modelled network with:
  - Different land use scenarios; and
  - Different levels of investment in the public transport network.
- The performance of the initial road network was evaluated in terms the peak hour operating conditions on the road network.
- The extent of road network was increased through either the upgrading of existing roads or the addition of new road links to ensure "acceptable" operating conditions
- The adjusted road network was modelled, re-evaluated and finalised.

Please note that acceptable operating conditions is not a Level of Service D – it is totally unaffordable to provide a road network for a major urban city that is congestion free, especially considering the size of the "Gauteng City". Congestion further acts as a driver to influence people choices and to increase the utilisation of higher occupancy transport modes.

The role of "travel-demand-management" and the implementation of a wide range of measures to influence people's travel choices will become increasingly important in the future. These travel choices are not only confined to mode choices but also to choices in terms of inter alia working time, place of work/home, the increase in private vehicle occupancies through travel clubs, telecommuting etc.

The following inputs were combined and evaluated to determine the initial 2037 road network that was used in the EMME Runs 1 to 4 (see also the GTIMP document on *"Travel Demand Modeling"*) with various scenarios:

- Evaluation of the Class 1,2 and 3 road network priorities as defined in the 2010 Strategic Road Network Review [(27)] study;
- Gauteng Freeway Improvement Project (GFIP) identified Phase 2 & 3 freeway network;
- Gauteng Department of Roads and Transport identified road priorities;
- Gauteng Freight Infrastructure Strategy road priorities;
- Municipal authority road priorities as defined in their Integrated Transport Plans;
- Evaluation of the modelled peak hour operational conditions of the base year road network with the base year demand and 2025 demand

The 2025 modelled flows on the base year road network are shown in **Appendix A**. The importance of the high mobility road network, i.e. the Class 1 road network can clearly be seen in terms of the high peak hour traffic volumes assigned. The implications of not further developing the Class 1 road network is a road network will experience grid lock and travel times below 10 kph for sustained periods during the AM and PM peak periods with a negative impact on economic growth and the prosperity of the Gauteng Province. The V/C ratios of the 2025 assignment are also attached in **Appendix A** and it is clear that without major investment in the road network a significant portion the road network will experience V/C ratios exceeding 1.0 i.e. the demand on the road links exceed the capacity available on the road network.

The road network was then adjusted by upgrading highly congested road links if possible or alternatively the road network was expanded in the area to accommodate the high demand. Please note that the public transport supply was also dramatically increased to accommodate the future demand for travel in the province. It should, however, be remembered that more than 80% of the public transport trips are undertaken by road-based public transport which consists of mini-bus taxis and a range of buses from BRT buses operating on their own dedicated lane to buses sharing the road network with all other modes.

The following input was also considered in adjusting the road network:

- Road network upgrading proposals as given in the Gauteng Strategic Road Network 2013 – Alignment with Gauteng SDF & Municipal SDFs
- Updated Freight Strategy & Logistics Hubs (Wesrand, ORTIA, Aerotropolis, Tambo Springs, City Deep, Rosslyn, Sentrarand & Pyramid) road requirements – see **Appendix B**;
- Various GTIMP modelling runs with an interventionist densified land use strategy, increased public transport provision and the decreasing in the generalised cost of public transport (meaning an increased subsidy component) as well as the increase in the generalised cost of private transport by increasing the vehicle operating cost and the toll fees. Please note that only the freeway network was modelled as a tolled network.

The resultant travel speeds for the various modelled scenarios is given in ***Table 8-1*** below:

Table 8-1: Modelled Road Network Average Travel Speeds)

Scenario	Land Use Matrix	Road Network (Lane kms)	New lane kms	Avg travel Speed	% Base Year speed
Base yr	2011	23 803		47.1 km/hr	
Run 3e	2037 Intervention	30 044	6241	11.1 km/hr	24%
Run 4a	2037 Intervention	30 044	6241	17.5 km/hr	37%
Run 4b	2037 Intervention	31 542	1498	28.6 km/hr	61%

A more detailed breakdown of the performance of the road network during the AM peak hour in terms of the weighted averaged travel speeds on the various road classes for Scenario 4b is shown in ***Table 8-2***:

Table 8-2: Modelled Road Network Average Travel Speed (Scenario 4b)

Road Class	Travel speed	Road km	% Road km	Lane km	% Lane km
Class 1 (Freeway)	57 km/hr	1 150	12%	6 778	22%
K-routes	33 km/hr	2 227	24%	10 645	34%
Major roads > 1 lane /direction	28 km/hr	626	7%	2 618	8%
Major roads = 1 lane /direction	21 km/hr	4 194	45%	8 388	27%
Local roads > 1 lane /direction	18 km/hr	244	3%	1 153	4%
Local roads = 1 lane /direction	6 km/hr	968	10%	1 937	6%
Total modelled road network	**29 km/hr**	**9 410**	**100%**	**31 519**	**100%**

8.4 THE 2037 ROAD NETWORK

The proposed 2037 road network is shown in the following figures and the details of the road network are given in **Appendix C**:

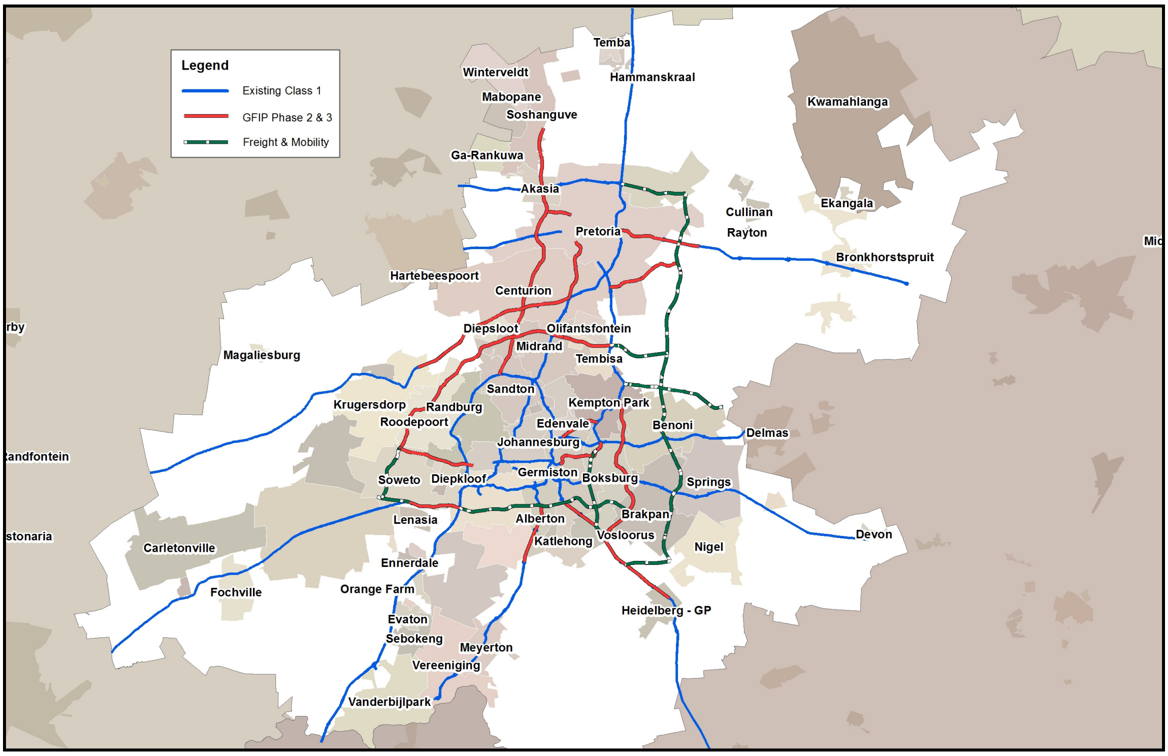


Figure 11: Proposed 2037 Class 1 Road Network

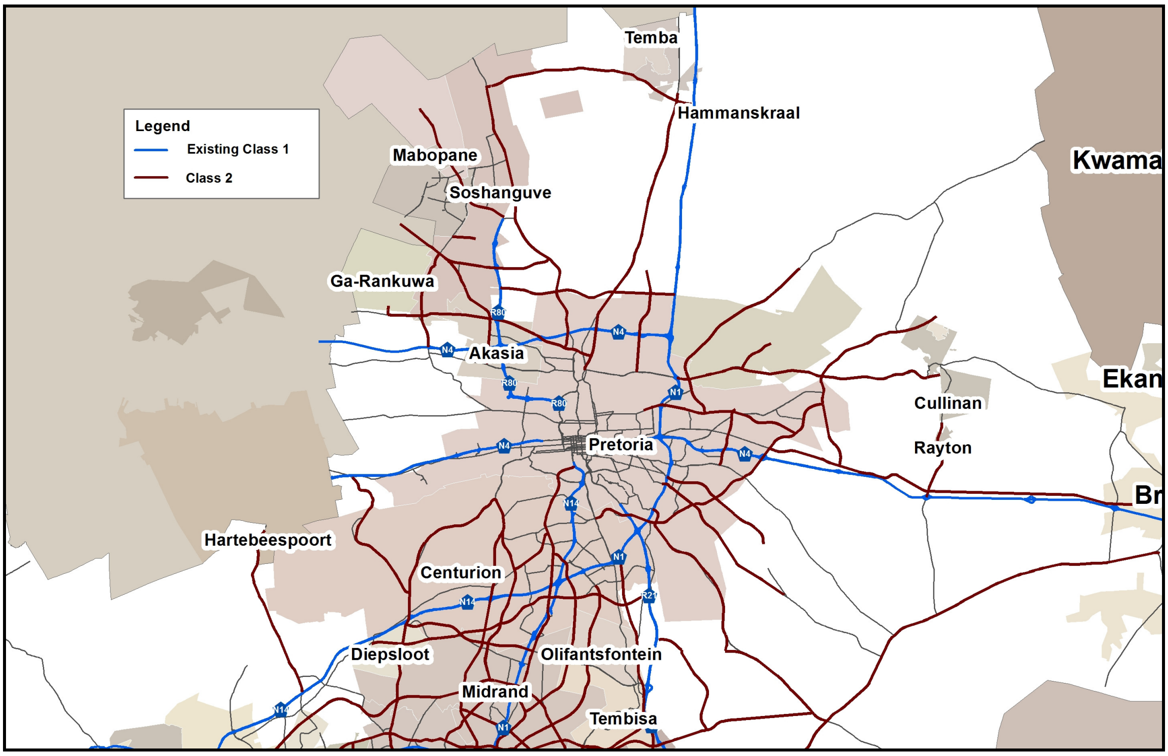


Figure 12: Proposed 2037 Class 2 Road Network (North Gauteng)

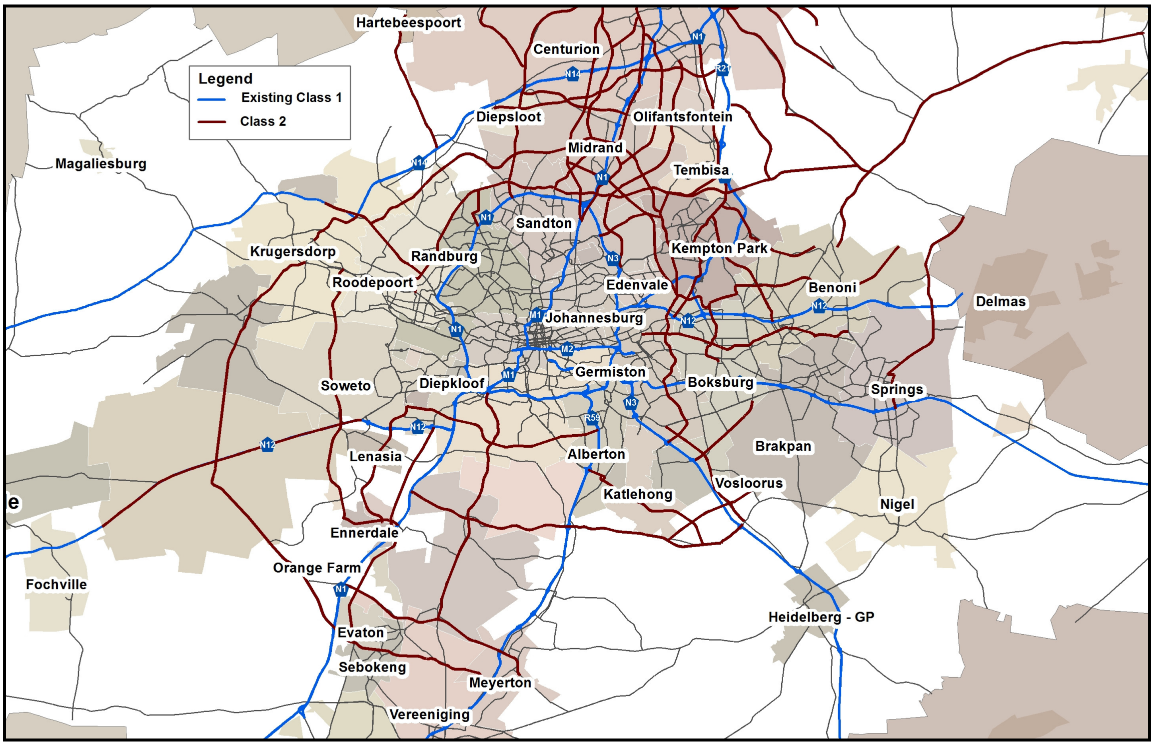


Figure 13: Proposed 2037 Class 2 Road Network (South Gauteng)

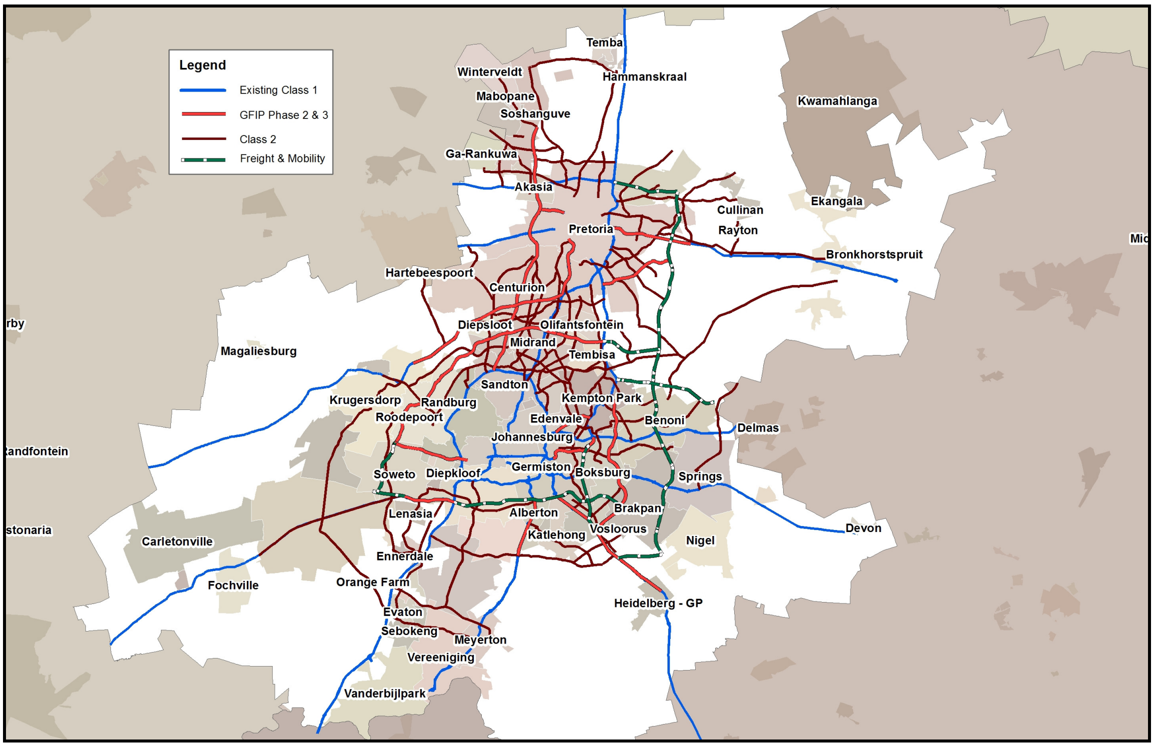


Figure 14: Proposed 2037 Class 1 & 2 Road Network

8.5 ESTIMATED COST – 2037 ROAD NETWORK

The extent of the road network modelled in terms of lane-kms is given in ***Table 8-3***:

Table 8-3: 2037 Modelled Road Network (Scenario 4b)

Road	Network (Lane km)			
TYPE	**Base**	**2012**	**2025**	**2037**
Class 1 (Freeway)	4 106	4 640	5 175	6 778
Other	19 698	20 706	21 715	24 740
Total	**23 804**	**25 346**	**26 890**	**31 518**
Incremental		1 542	3 086	7 714

The extent of the additional lane-km and an estimate of the capital costs to construct the road, assuming a typical cost of R28 million per freeway km and R12 million per lane km for other are given in in ***Table 8-4***:

Table 8-4: Estimated Costs 2037 Modelled Road Network

TOTAL ADD NETWORK (Lane km)			R mill / lane km	Capacity improvements (R million)		
2012	**2025**	**2037**	**Lane km**	**2012**	**2025**	**2037**
534	1 069	2 672	28.0	R 14 952	R 29 932	R 74 816
1 008	2 017	5 042	10.0	R 10 080	R 20 170	R 50 420
1 542	3 086	7 714		R 25 032	R 50 102	R 125 236

The R125.2 billion required in 2013 rand includes the proposed upgrading of the Class 1 and Class 2 road network.

8.6 ROAD STANDARDS

A detailed review of the road standards has been undertaken in 2010 in a document entitled *"Gauteng Strategic Road Network Review - Review of Road Standards"* and no further changes to the standards are recommended. It is, however, important to stress that the lack of non-motorised facilities along a large percentage of the current road network should be addressed and all new Class 2-5 roads should specifically prioritise formalised NMT facilities considering the provincial; Guideline document entitled *"Walking and Cycling on Roads in Gauteng"*.

The above-mentioned document is attached as **Appendix D**.

The following table gives a summary of the applicable standards for roads with provision for NMT and dedicated public transport lanes:

Table 8-5: Benchmark Values for Road Elements and Road Reserve Widths

Class and Type of Road/Element	Class 1 Freeways, with dedicated Public Transport Lanes	Class 2 Roads Kerbed, with dedicated Public Transport Lanes	Class 3 Roads Kerbed. Urban
Number of lanes	8 + 4 PT	6 + 2 PT	4
Number of turning lanes	N/A	2	1
Number of sidewalks	N/A	2	2
Number of verges	2	2	2
Road reserve width	80 m	62 m	35 m
Lane width	3,6 m	3,6 m & 4,0 m	3,5 m
Turning lane width	N/A	3,4 m	3,3 m
Inner shoulder width	2,8 m	0,6 m	0,6 m
Outer shoulder width	2,8 m	0,6 m	0,6 m
Median width (Inclusive of inner shoulders)	30,6 m	21,0 m	6,1 m
Sidewalk width	N/A	1,5 m	1,5 m
Sidewalk separation width	N/A	1,5 m	1,5 m
Verge / Remainder of verge width	7,5 m	5,5 m	3, 85 m

9 CATALYTIC ROAD NETWORK PROJECTS

9.1 Introduction

Considering the evaluation of the planning documents and the different priorities given to the sections of the road network by all tiers of government the following road projects has been identified as important projects that are catalytic in nature and that would unlock and stimulate growth and thus job opportunities in the Gauteng Province:

9.2 Tambo Springs Road Accessibility

The Cabinet has approved the Presidential Infrastructure Coordinating Commission's (PICC's) second *"Infrastructure Implementation Plan" (#)* report, which includes a framework outlining an integrated management and delivery system for the 17 Strategic Infrastructure Projects (SIPS) across all three spheres of government. Over the coming three years, some R845-billion has been budgeted for public infrastructure projects and the PICC, which is chaired by President Jacob Zuma, has been established to support the delivery of the projects.

The second SIP is an initiative to improve the movement of goods through the Durban-Free State-Gauteng logistics and industrial corridor by prioritising a range of rail and port improvements, supported significantly by a R300-billion investment programme by Transnet over the coming seven years.

The Tambo Springs Hub is one of the projects associated with the Durban-Free State– Gauteng Logistics and Industrial Corridor as one of the major freight hubs on the Gauteng side of the corridor. The following short term road projects are directly associated with Tambo Springs and is critical to provide the road accessibility to the Tambo Springs Freight Hub:

- Detail design of the K148/N3 interchange at a cost of R25m.
- Construction of K148/N3 interchange will commence in year 2013 when detailed design is completed.
- Detail design and EIA of K148, K146 and PWV15 – Cost of R60m.

The roads that are required to improve the accessibility to Tambo Springs and the proposed phasing are shown in *Figure 15* below:

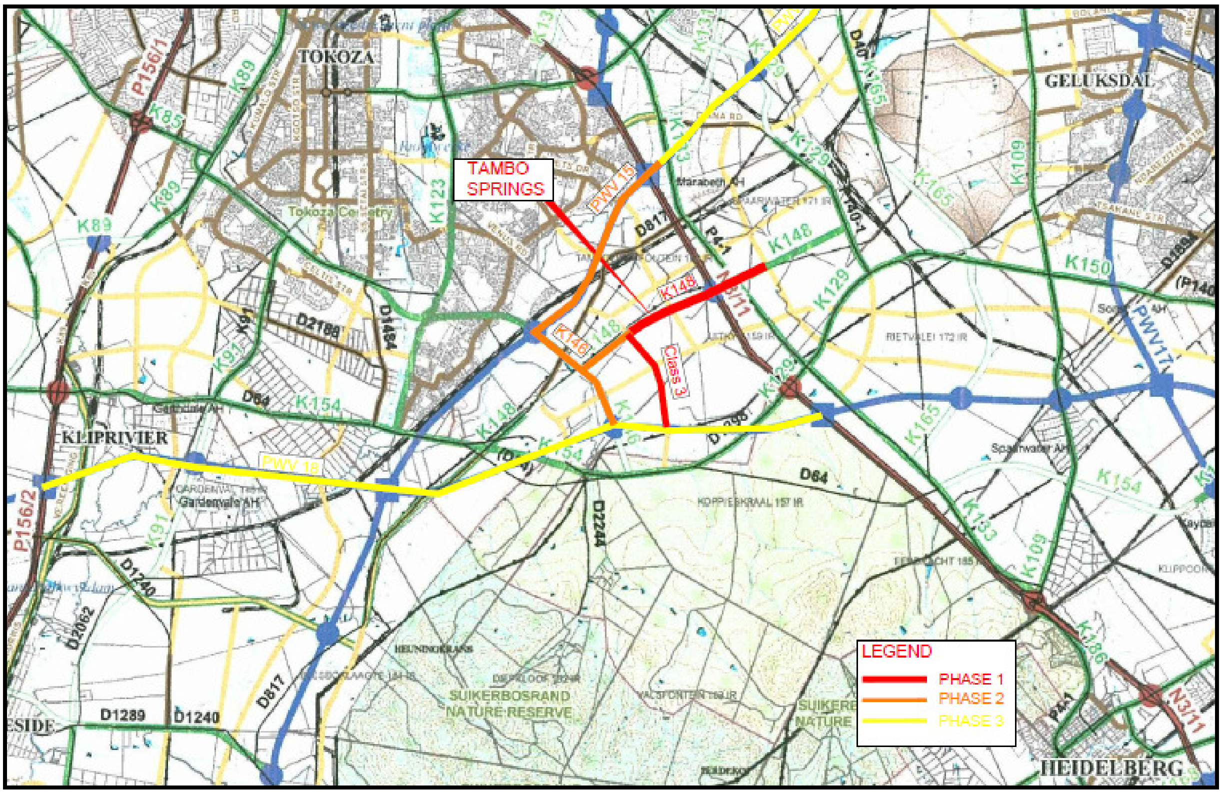


Figure 15: Tambo Springs Proposed Road Network Upgrading

It can be seen that the construction of PWV 18 between the N3 and P156/2 (R59) is listed as Phase 3 – see the further discussion w r t PWV 18 below:

9.3 SOUTHERN RING ROAD

The Gauteng Spatial Development Framework (2010) highlights the need to create a concentric functional road link in the southern parts of Gauteng Province.

The purpose of this is to connect the emerging new node at Kagiso-Chamdor-Leratong to the proposed new activity node along the N1 south at Ennerdale/Grasmere; from where the disadvantaged communities of Orange Farm, Ennerdale and Evaton can have a functional link and access to the new activity node along route R59 at the Klip River/Waterval Business Node. This section also creates an effective east-west link between the N1 south and R59 freeways.

From the R59 at the Klip River Business Park the new link should extend northwards where it will serve the Kathlehong-Tokoza-Vosloorus communities, link to the N3 freeway, N17 and N12, and eventually link up with the emerging OR Tambo Aerotropolis in Ekurhuleni, and the R21 development corridor – see *Figure 16* below:

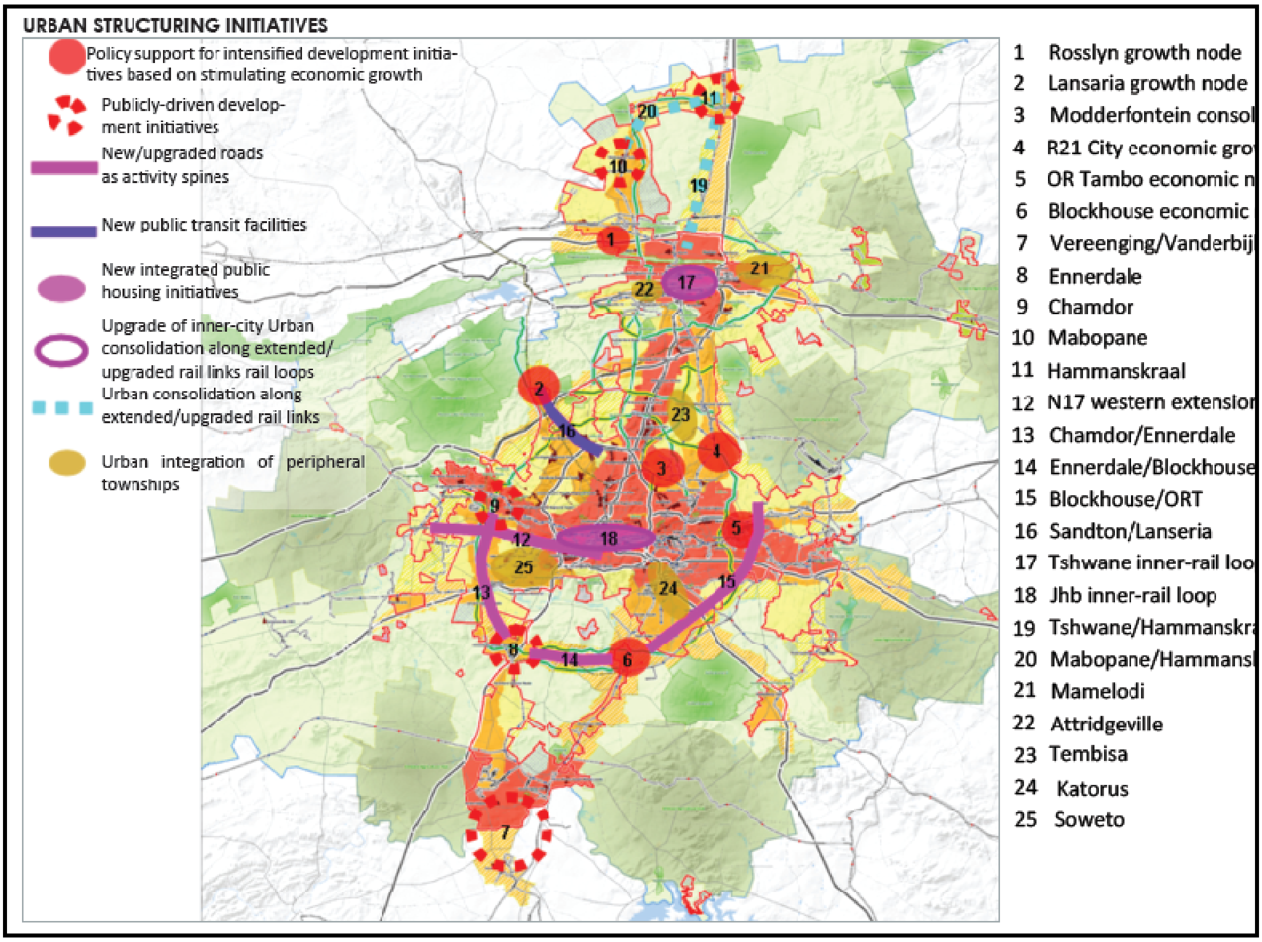


Figure 16: Gauteng Urban Structuring Initiatives

Apart from serving several large concentrations of disadvantaged communities, this link also connects several freeways/development corridors as well as a number of existing and emerging activity nodes located in the southern parts of Gauteng Province to one another, effectively enhancing the development potential of these areas.

It is envisaged that sections of routes PWV5, PWV3, PWV16, PWV18, PWV13, PWV15 and PWV17 could be considered to create a new ring road for Gauteng.

The Gauteng Freight Implementation Strategy (GFIS) was developed to assess the state of freight in the province and develop an intervention strategy to ensure alignment of the provincial freight strategy with the national freight and logistics strategy.

The Freight Strategy identified key interventions areas that will address logistic inefficiencies in the logistic system. These interventions were preconditions to manage freight without constraining economic growth in the province. The interventions are also informed by freight demand volumes which are expected to increase from 210 million tonnes to 415 million tonnes by 2020.

The PWV 16 and the K-routes running parallel to the PWV 18 (K154) in the short to medium term and in the longer term the PWV18 between the N3 and the N1 is also seen as a crucial links from a freight point of view. These east-west road links connect the three major north-south corridors i.e. the N1, the R59 and the N3 and will thus improve accessibility from Tambo Springs to Vereeniging/Van der Bijlpark via the R59 and to Klerksdorp/Potchefstroom via the N1.

It is thus recommended that the detail design of the proposed ring road be undertaken.

9.4 GFIP Phase 2

The need for the implementation of the proposed further phases of the GFIP road is essential to reduce the logistics cost of the province and to provide the road infrastructure required for the optimal functioning and growing of the province.

Irrespective of whether the freeway road network will be funded through Road User Charges or through the normal fiscus it is important that the detail planning and Environmental Impact Assessment of the following roads be undertaken to be able to start with construction when funding is available.

It is this recommended that between the Provincial Government and SANRAL the detailed design and EIA of the following road links be undertaken:

Table 9-1: GFIP Phase 2 Road network

Road	Description	Km	Estimated Project Costs (R million)	GFIP – Phase 2
PWV 9 North	(R80/P159-1 to N14/P158-1)	29.41	4 118	2/3
PWV 9 South	(from the N14/P158-1 to N1)	18.12	2 537	2
PWV 5 East	(between PWV 9 and R21)	21.00	2 940	2
PWV 17	K54 to N4	4.00	560	2
K54	(R21 to PWV 17)	25.00	3 500	2
N17west	N1 to Soweto (PWV 5)	15.30	2 142	2
PWV 14	N12(Rietfontein I/C to M2(Refinery Road I/C)	11.75	1 645	2
		124.58	17 442	

10 REFERENCES

1. Department of Transport, 2009, National Transport Master Plan (NATMAP2050), Phase 2: Analysis. Province: Gauteng. Third Draft: October 2009

2. Department of Transport, 2009, National Transport Master Plan (NATMAP2050), Phase 3: Forward Planning. Province: Gauteng. Draft Version 1: December 2009

3. Gauteng Provence Department of Roads and Transport, 2009, Gauteng Land Transport Framework, August 2011

4. Gauteng Provence Department of Roads and Transport, 2008, Gauteng Infrastructure Renewal And Investment Plan (GIRIP), An Overview

5. City of Tshwane, 2006, City of Tshwane Integrated Transport Plan 2006 – 2011, Chapter 3: Land Transport Status Quo

6. City of Johannesburg, 2007, City of Johannesburg Integrated Transport Plan 2003/2008, Final, Executive Summary (Booklet)

7. City of Johannesburg, 2003, City of Johannesburg Integrated Transport Plan 2003/2008, Volume 1

8. Ekurhuleni Metropolitan Municipality, 2010, MSDF Review 2010/11, Report 1 - Status Quo, City Development Department, Spatial Planning Directorate

9. Sedibeng District Municipality, 2010, District Integrated Transport Plan for 2008 to 2013 for The Sedibeng District Municipality, 31 Aug 2010

10. West Rand District Municipality, District Integrated Transport Plan for 2010 – 2015, Chapter 3, Transport Register

11. Merafong City Local Municipality, Local Integrated Transport Plan, Final: LITP, 2010 – 2011

12. Mogale City Local Municipality, Local Integrated Transport Plan, Final: LITP, 2010 – 2011

13. Randfontein Local Municipality, Local Integrated Transport Plan, Final: LITP, 2010 – 2011

14. Westonaria Local Municipality, Local Integrated Transport Plan, Final: LITP, 2010 – 2011

15. Ekurhuleni Metropolitan Municipality, 2006, Draft Integrated Transport Plan, Executive Summary

16. City of Tshwane, 2006, City of Tshwane Integrated Transport Plan 2006 – 2011, Chapter 5: Transport Needs Assessment

17. City of Tshwane, 2006, City of Tshwane Integrated Transport Plan 2006 – 2011, Chapter 4: Spatial Framework

18. City of Tshwane, 2006, City of Tshwane Integrated Transport Plan 2006 – 2011, Chapter 6: Spatial Framework

19. City of Tshwane, 2006, City of Tshwane Integrated Transport Plan 2006 – 2011, Chapter 8: Road and Freight Proposals

20. City of Tshwane, 2006, City of Tshwane Integrated Transport Plan 2006 – 2011, Chapter 12: Implementation Plan

21. City of Tshwane, 2006, City of Tshwane Integrated Transport Plan 2006 – 2011, Chapter 13: Financial Plan

22. City of Johannesburg, 2003, City of Johannesburg Integrated Transport Plan 2003/2008, Volume 2

23. Ekurhuleni Metropolitan Municipality, 2006, Draft Integrated Transport Plan, Volume 3: Infrastructure Plan

24. Presidential Infrastructure Coordinating Commission - Provincial and Local Government Conference, A summary of the Infrastructure Plan, 13 April 2012

25. SANRAL, http://www.nra.co.za

26. SANRAL, SANRAL Annual Report, 2011

27. Gauteng Provincial Government – Department of Roads and Transport, review of the Strategic Road Network for Gauteng – Phase 2 Summary Report, May 2010

28. Engineering News, “Toll Portfolio and only Toll Portfolio in distress”, 28 July 2013

29. GPDRT, Paved Roads Annual Maintenance needs Analysis – 2010. January 2011.

30. A National department of Transport, RISFS Road Infrastructure Strategic Framework for South Africa, July 2005

31.

Appendix A
EMME Modelling Results

AW/0008M/2013 (J01821)

GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

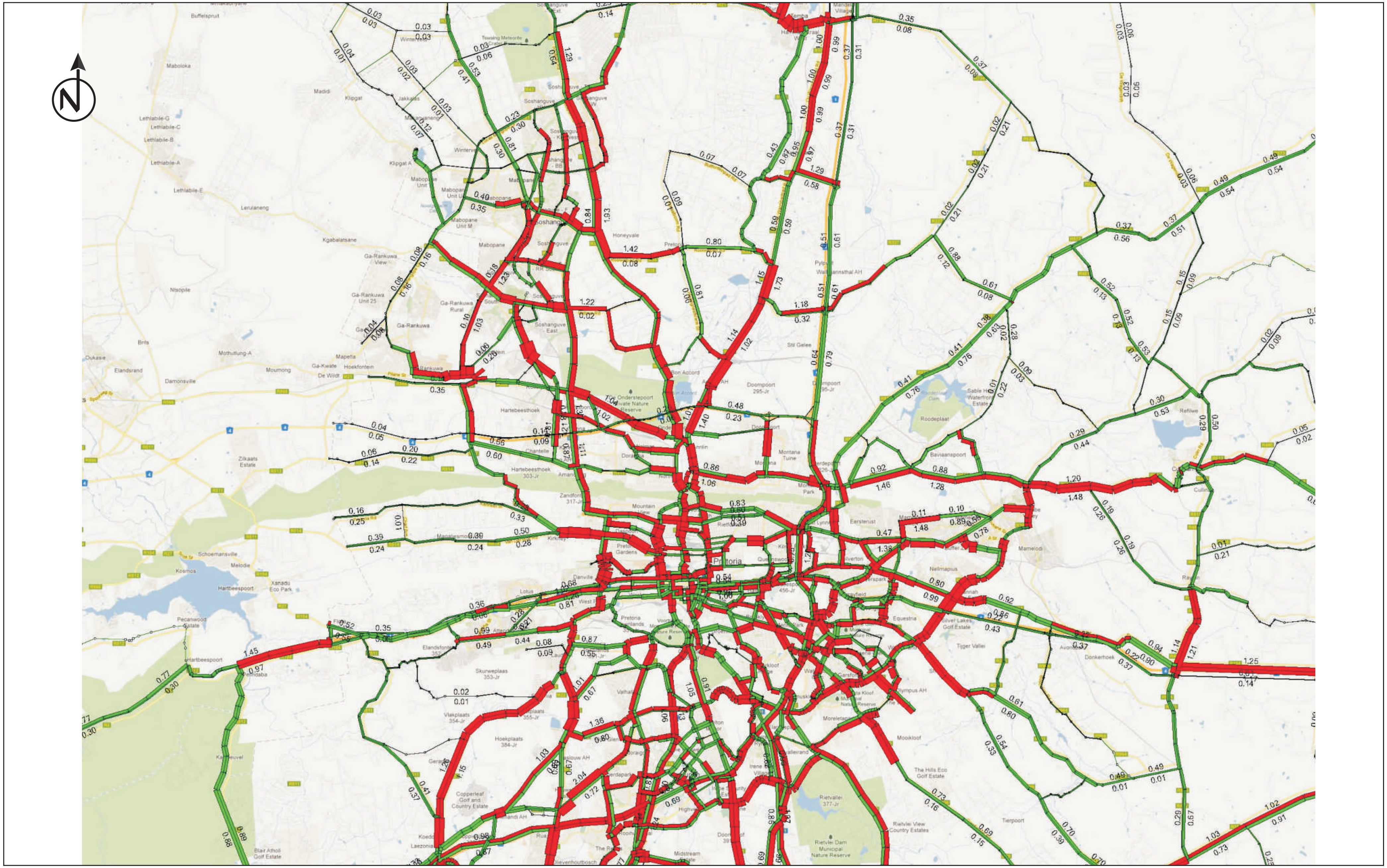
2025 Assignment: Pretoria

AW/0008M/2013 (J01821)

AW/0008M/2013 (J01821)

GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

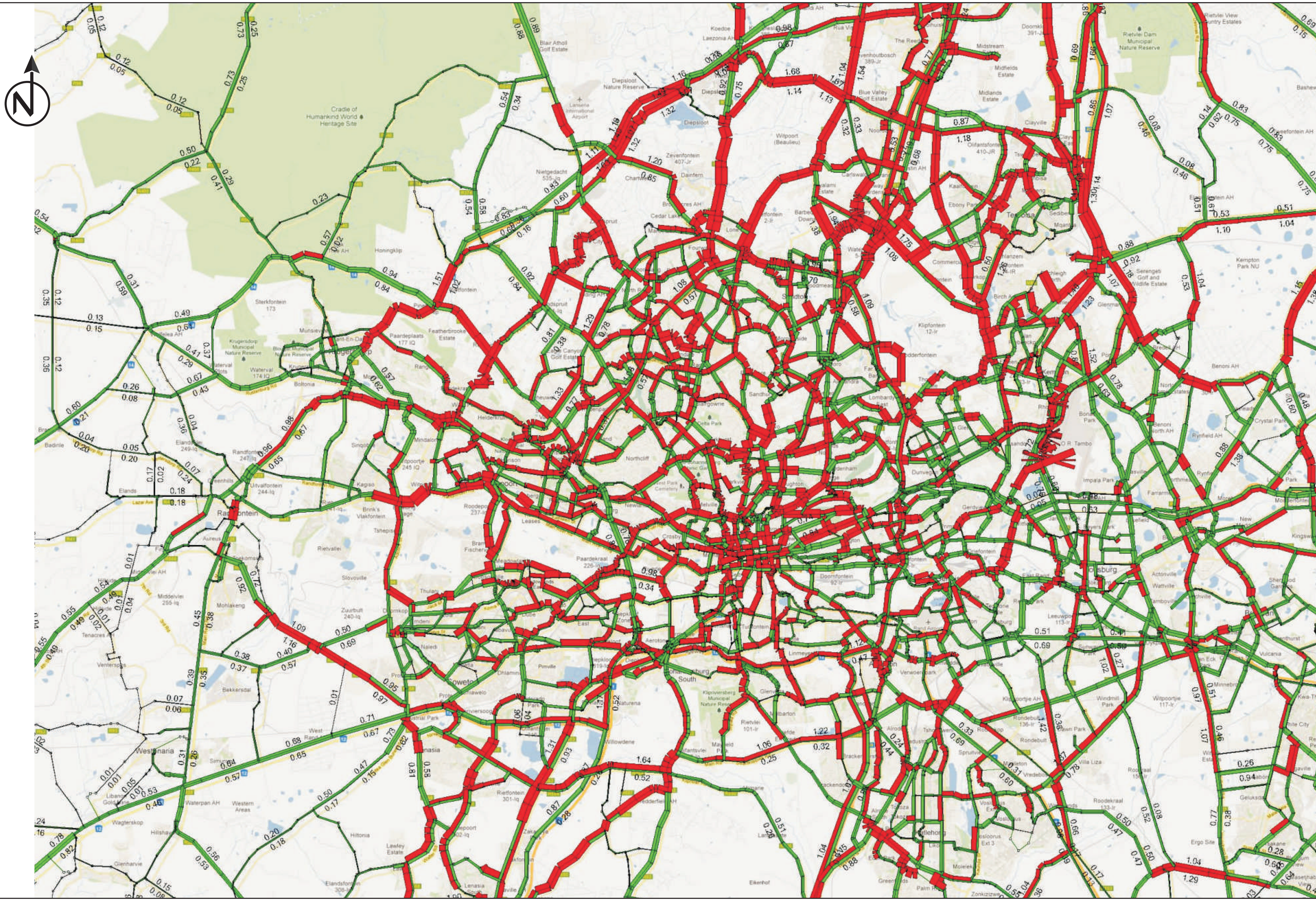
2025 Assignment: Johannesburg South



AW/0008M/2013 (J01821)

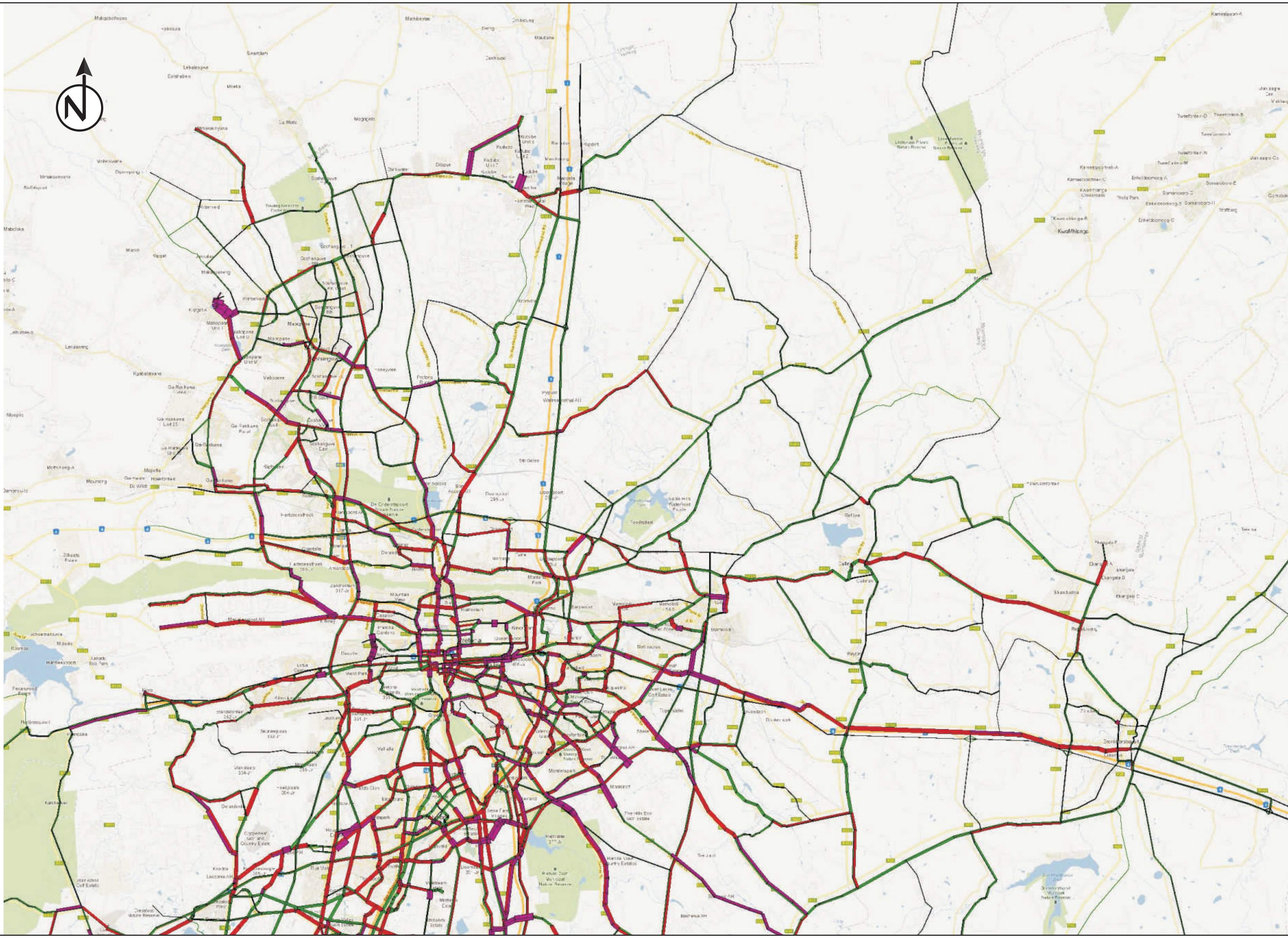
GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

2025 Volume / Capacity Ratio: Pretoria (Version 2)



AW/0008M/2013 (J01821)

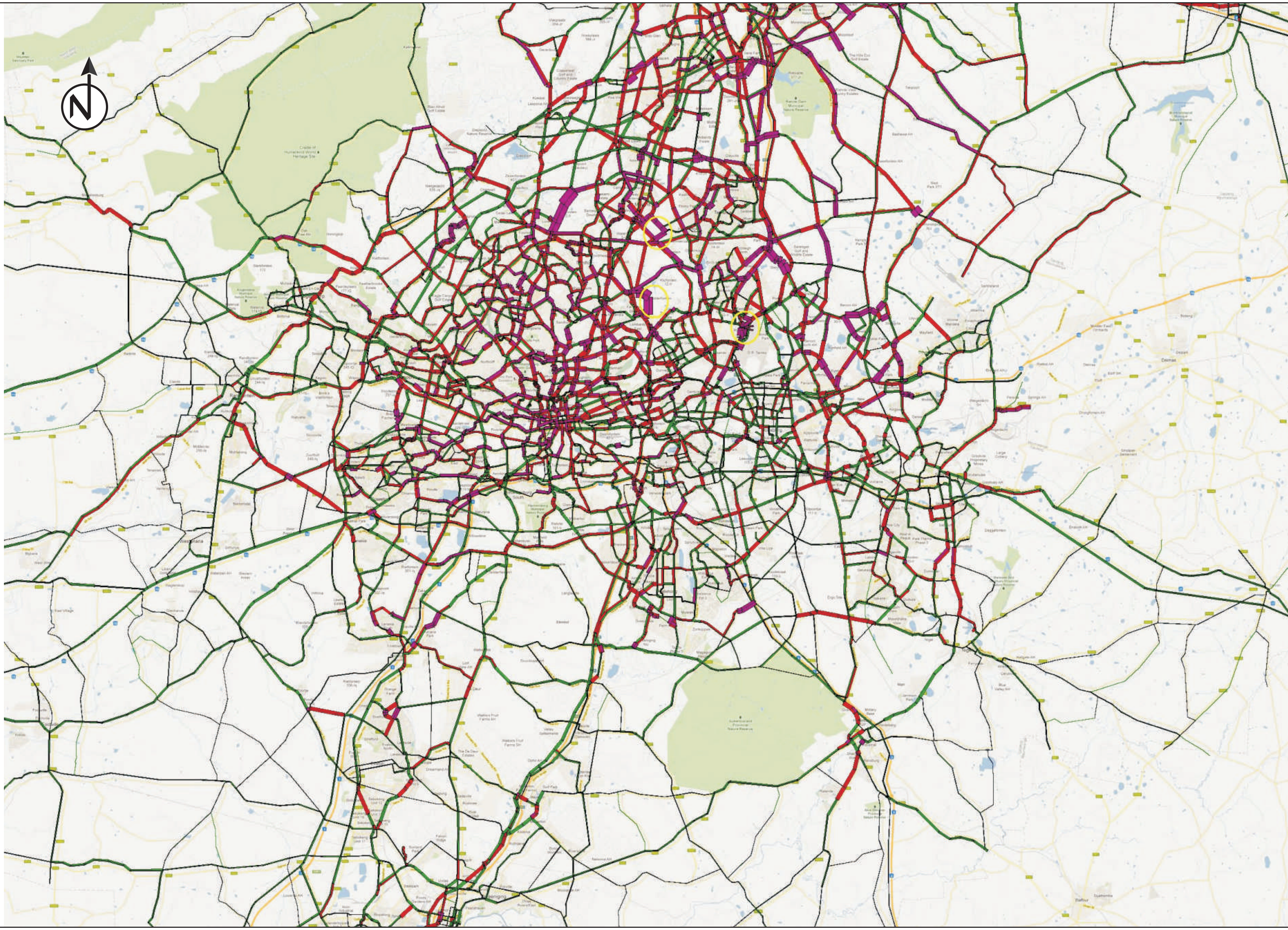
2025 Volume / Capacity Ratio: Johannesburg (Version 2)



AW/0008M/2013 (J01821)

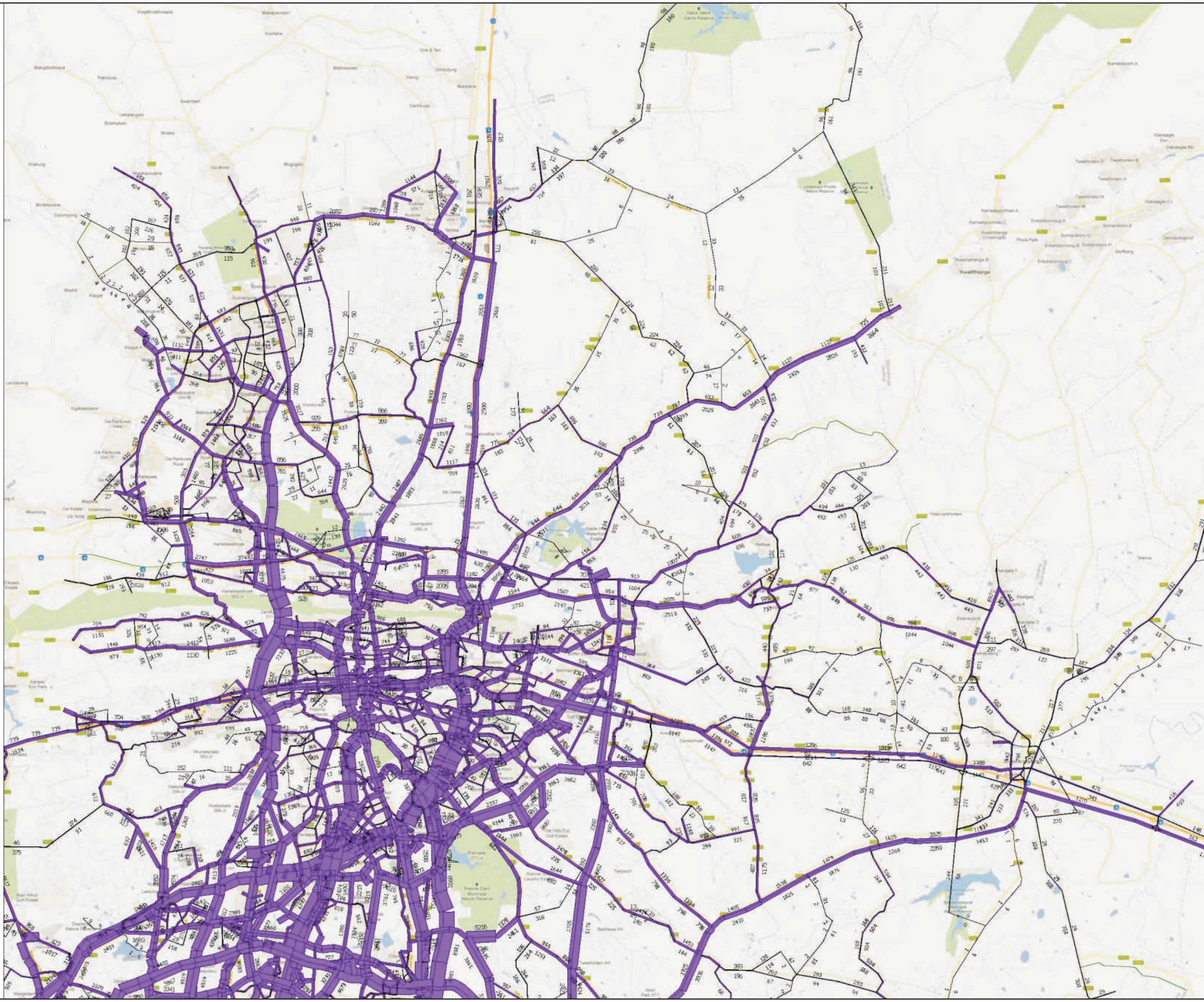
GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

2037 Run 4b Volume / Capacity Ratios: Gauteng North



AW/0008M/2013 (J01821)

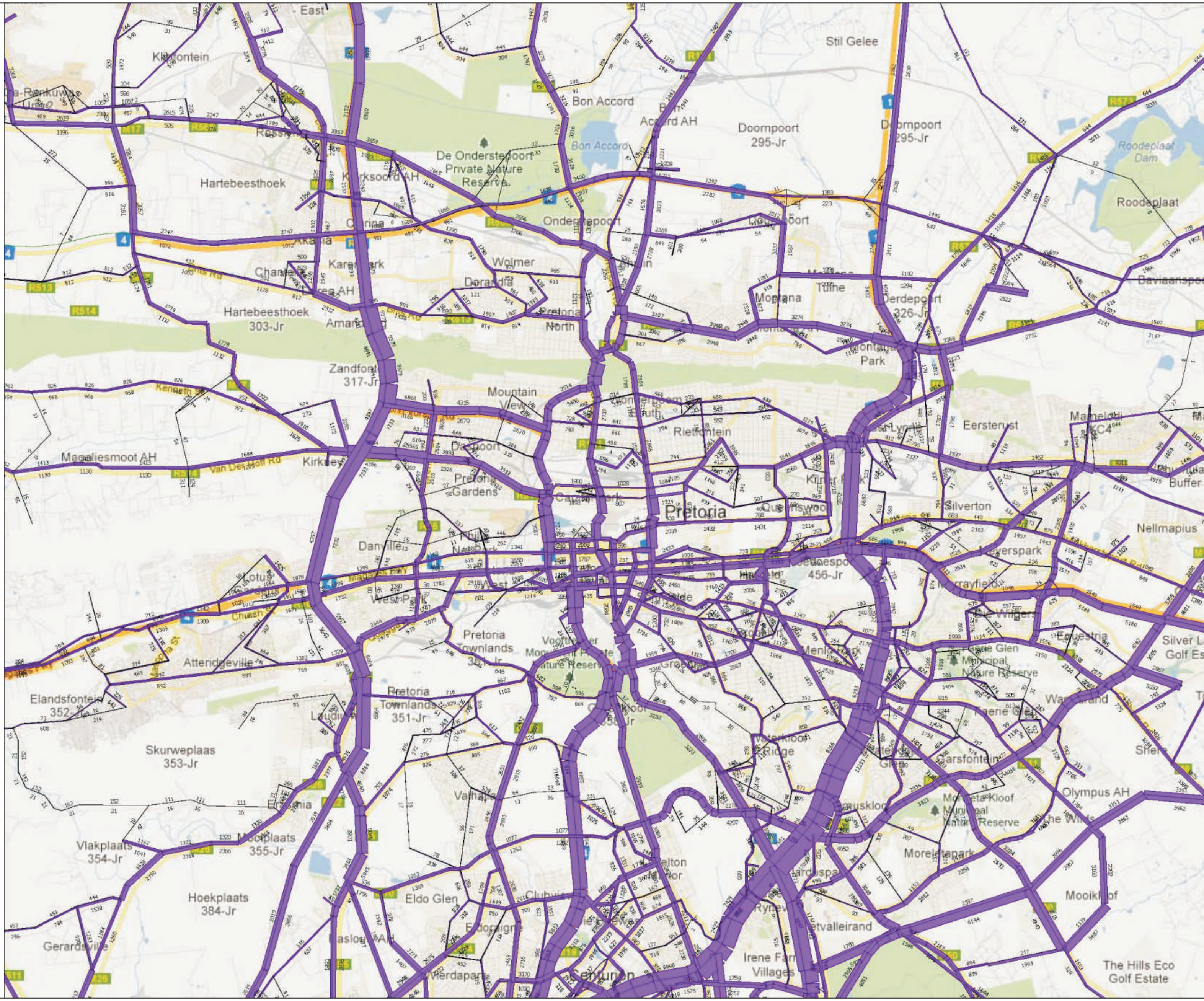
2037 Run 4b Volume / Capacity Ratios: Gauteng South



AW/0009M/2013 (J01821)

GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

2037 Volume / Capacity Ratio: Pretoria



AW/0009M/2013 (J01821)

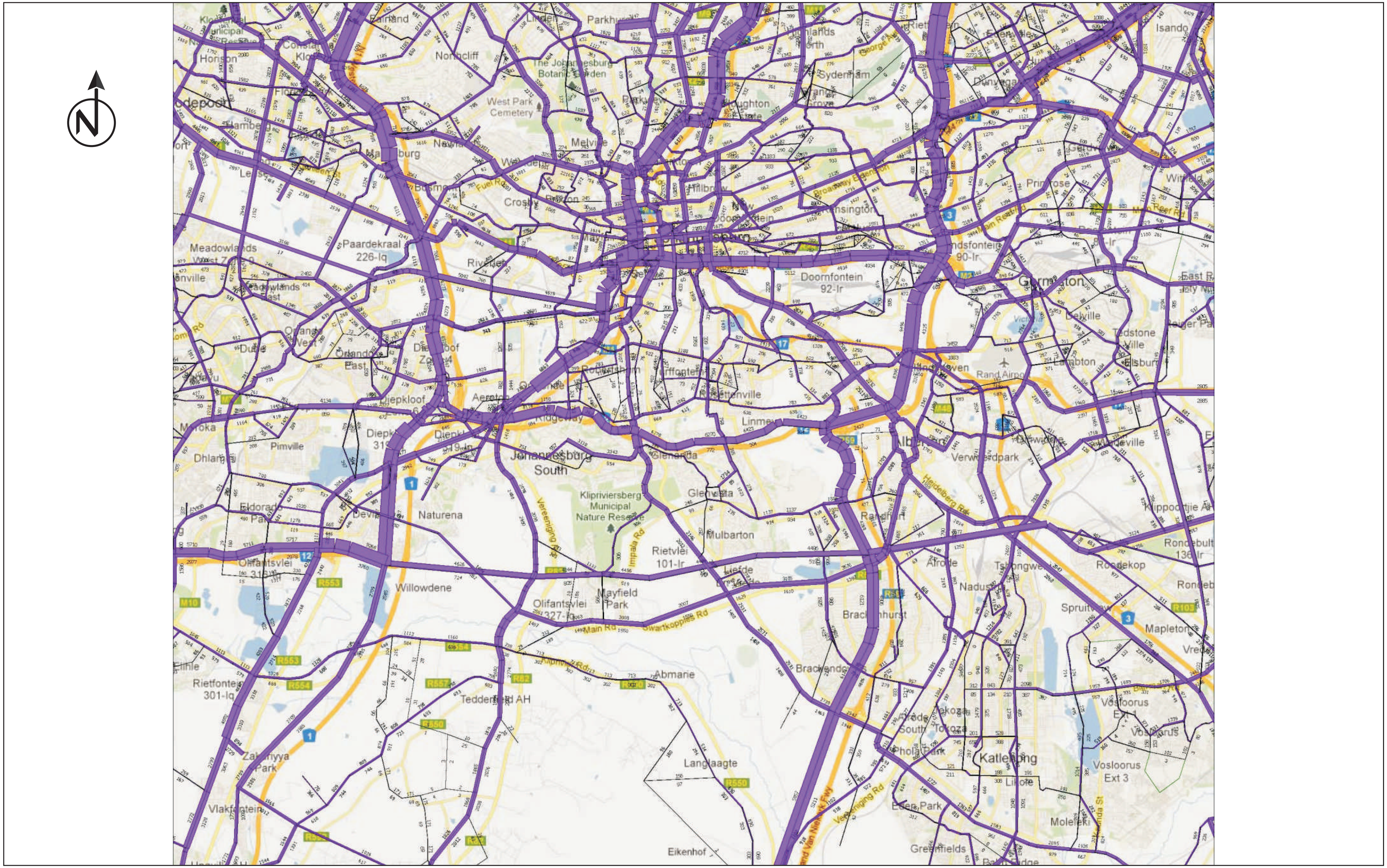
GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

2037 Volume / Capacity Ratio: Pretoria (Zoom)

AW/0009M/2013 (J01821)

GAUTENG 25-YEAR INTEGRATED TRANSPORT MASTER PLAN

2037 Volume / Capacity Ratio: Johannesburg North



AW/0009M/2013 (J01821)

2037 Volume / Capacity Ratio: Johannesburg South

Appendix B
Road Network Supporting Freight Strategies and Logistics Hubs

PROPOSED FREEWAYS and SECONDARY ROADS SUPPORTING FREIGHT STRATEGIES AND LOGISTICS HUB PRIORITISED LIST

Phase 1: 2011 – 2019 **Phase 2: 2020 – 2037** **Phase 3: 2038 - 2050**

Description	Road Status	Description	Km	Estimated Cost @ Freeway R100mil/km K Route: R40mil/km (Excluding Land Acquisition)	Phase (Priority)	Design Stage	Construction Phase
WEST RAND HUB							
PWV1 - PWV8 (north-south freeway);	New Road – 4 Lanes	(from N14 to PWV16) Western Bypass Route	40	R4 000mil	3	Prelim Design completed	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
PWV5 (north-south freeway);	New Road – 4 Lanes	(from N17 to PWV16) Westrand freeway southwards towards Zuurbekom	13	R1 300mil	3	Prelim Design completed	**GFIP Phase 3**
PWV16 (east-west freeway);	New Road – 4 Lanes	(from PWV5 to N12)	6	R600mil	3	Prelim Design completed	**GFIP Phase 4**
N17 (east-west freeway, formerly known as PWV12A).	New Road – 4 Lanes	(from N1 to K11 and K11 to PWV1) New freeway link to Mogale City (west Rand	25+9	R3 400mil	2+3	Prelim Design completed	**GFIP Phase 2**
N17 (east-west freeway, formerly known as PWV12A).	New Road- 2 Lanes	(PWV1 to N14(K5)) New freeway link from Mogale City (west Rand) to N14	6	R480mil	3	Route design Completed	**Not programmed – to confirm need, capacity and timeframe in feasibility study**

Description	Road Status	Description	Km	Estimated Cost @ Freeway R100mil/km K Route: R40mil/km (Excluding Land Acquisition)	Phase (Priority)	Design Stage	Construction Phase
R28 (K11) (Randfontein Bypass)	New Road – 4 Lanes	Mogale City road to Westonaria	5	R200mil	1	Prelim Design completed	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
K96 (upgrading existing road)	Upgrade existing road – 2 lanes	(from N17 to K11) - extension as freight route	18	R720 mil	1	Route Design completed	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
K197 (new link)	New Road; 2 lanes	(from K76 to K11)	7	R280 mil	2	New Route design required	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
<u>ACCESS TO ORTIA</u>	Status	Description					
R24 Rehab	Rehabilitation of existing Freeway	(N12 extension westwards to Eastgate)	1.1	R 100 mil	1	No designs	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
PWV 14 New Road	New Freeway 4 Lanes divided Road	(R21 to N12 Geldenhuys I/c)	12	R1 200 mil	1	Prelim Design completed	**GFIP Phase 2**
PWV 15 (R21 to N3) New Road	New Freeway 4 Lanes divided Road	(from R21 to N12; N12 to N17 and N17 to N3) From R21 Freeway to N3	10.5+10 +15.5	R3 600 mil	1+2+3	Prelim Design completed	**GFIP Phase 3**
K88 (access to R21)	Upgrading existing roads	(from K90 ORTIA southern access to K115 Isando)	6	R240 mil	1	New amendment required	**ORTIA Transport Plan**
K86 (Access to PWV 15)	New Road	(from K90 ORTIA southern access to access PWV15)	7	R280 mil	1	Draft route proposal done	**ORTIA Transport Plan**
K90 (Access to freight Terminal)	Upgrading	New access interchange from R21 into midfield freight terminal	2.5	R100 mil	1	Prelim Design completed	**ORTIA Transport Plan**

Description	Road Status	Description	Km	Estimated Cost @ Freeway R100mil/km K Route: R40mil/km (Excluding Land Acquisition)	Phase (Priority)	Design Stage	Construction Phase
Upgrading R21/Voortrekker I/C	Upgrading	Increased capacity	2	R100 mil		Route designs completed	**EMM request**
<u>AEROTROPOLIS</u>							
K94	Mostly new road	Trichardts Rd to K92	3.5	R70mil	1	Prelim Design completed	**Was on EMM budget at one stage. Nil now.**
Ravenswood Rd	New road	Trichardts - Bartlett	1.2	R 30mil	1	Prelim Design completed	**PDR completed. R4m available on EMM budget in 2015/16.**
Albertina Sisulu Expressway	New road	Constantia Rd - First Rd	5	R 150mil	1	Route alignment completed	**Sections can be constructed earlier. R46m on EMM budget.**
Ridge/ Yaldwin	Upgrade to 4 lanes	K92-K90	7	R 50 mil	1	None	**Support further development of N12 corridor**
K105	Upgrade to dual carriageway	K60 - Kempton Park Civic	9	R 300 mil	2	Prelim Design completed	**Not programmed**
K115	New and Upgrade	R24 - K155	4.5	R 100 mil	2	Prelim Design completed	**Not programmed**
K68	New/Upgrade	Kelvin - Albatross	1.5	R 100 mil	2	Prelim Design completed	**Not programmed**
R21 One Stop	New interchange	Thami Mnyele Interchange	0	R 120 mil	2	Conceptual Design completed. SANRAL consulted	**Not programmed**
K68	New road	K117 - K115	1.5	R 150 mil	3	?	**Not programmed**

Description	Road Status	Description	Km	Estimated Cost @ Freeway R100mil/km K Route: R40mil/km (Excluding Land Acquisition)	Phase (Priority)	Design Stage	Construction Phase
K92	New	Germiston Rd - Tunney	1.7	R 80 mil	3	Prelim Design completed	**Not programmed**
K94	New road/Upgrade	Trichardts - K119 (Great North Road)	4.5	R 300 mil	3	Prelim Design completed	**Not programmed**
TAMBO SPRINGS HUB							
N3/K148 Interchange	New access interchange	Access interchange on N3		R250 mil	1	Detail design in process	**Funding available for Detail design 12/13FY**
K148	2 Lanes	Access Road from N3 to Tambo Springs Hub (From R103 – K133 to K146)	3.5+1.5	R200 mil	1	Detail design in process	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
K146	2 Lanes	K148 to Existing Road D817	0,6	R24mil	1	Detail design in process	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
N3	2 lanes	Additional lanes on N3 from K148 to OLD BARN I/C	12,7	R720mil	1	No designs	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
K146	4 lanes	PWV 15 to PWV 18 - Southern Access Road for Tambo Springs	6.5	R140 mil	2	Prelim Design completed	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
PWV15 (COVERED ABOVE)	New Freeway 4 Lanes divided Road	(from R21 to N12; N12 to N17 and N17 to N3) From R21 Freeway to N3	9.5+6	R1 550 mil	2+3	Prelim Design completed	**GFIP Phase 2**

Description	Road Status	Description	Km	Estimated Cost @ Freeway R100mil/km K Route: R40mil/km (Excluding Land Acquisition)	Phase (Priority)	Design Stage	Construction Phase
PWV18	New Road – two lanes initially	New Freeway as southern bypass from N3 to N12	22	R2 200 mil	3	Prelim Design completed	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
Class 3 NS road	Upgrading existing road	Access Road – two lanes	3.8	R60mil		No designs EMM road	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
Class 3 EW road	Upgrading existing road	Access Road – two lanes plus bridge over N3	5	R100mil		No designs EMM road	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
CITY DEEP		See City Deep SIP2 Projects by CoJ					
N17 (east-west freeway) PWV12A	Upgrading of Interchanges and link to N1 4 lanes	Improved accessibility from City Deep to N17	8	R800 mil	2	Prelim Design completed	**GFIP Phase 2**
ROSSLYN							
PWV9 (Southwards to N14)	New Freeway 4 Lanes divided Road	Extension of Mabopane freeway south wards K16 – K30 (R55)	10	R1 000 mil	1	Prelim Design completed	**GFIP Phase 2**
		Extension to N14	14.5	R1 450mil	2	Prelim Design completed	**GFIP Phase 2**
K8 (Doubling of existing road) Access to PWV 9	New double road – 4 lanes	Link to Pta North Rosslyn to N4	4.5	R480 mil	1	Prelim Design completed	**Not programmed – to confirm need, capacity and timeframe in**

Description	Road Status	Description	Km	Estimated Cost @ Freeway R100mil/km K Route: R40mil/km (Excluding Land Acquisition)	Phase (Priority)	Design Stage	Construction Phase
							feasibility study
	New double road – 4 lanes	Rosslyn to K217/K67	5.5	R111mil	2	Prelim Design completed	
	New double road – 4 lanes	N4 to Pretoria North - K97	5	R100mil	2	Prelim Design completed	
K63 (upgrading existing road)	Addition of 2 lanes	Rosslyn southwards to Brits Road	6.5	R260 mil	1	Prelim Design completed	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
K67 (Interchange + new link) (from K8 to N4)	Addition of 2 lanes	Upgrading of link road from Medunsa to N4 and Brits Road	5	R250+R140 mil	3	Route Design completed	**Not programmed – to confirm need, capacity and timeframe in feasibility study**
K6 (new link) (from K63 to PWV9)	**New double road – 4 lanes**	**Access to Mabopane Freeway**	**3**	**R120 mil**	**3**	**Prelim Design completed**	**Not programmed – to confirm need, capacity and timeframe in feasibility study**

Appendix C
2037 Road Network
- New & Upgraded Road Links

ITMP 2037 ROAD UPGRADING & NEW ROAD LINKS

Class	Road	From	To	Lanes / direction	Link Types	Construction
Class 1	**K16 (R80)**	PWV9	D F Malan (M1)	4	fd12	Upgrade
Class 1	**K54**	PWV6	PWV17	3	fd12	Upgrade
Class 1	**K54/PWV6**	R21 (P157/1)	PWV17	3	fd12	New
Class 1	**M1**	Graystone IC	Buccleugh IC	4	fd12	Upgrade
Class 1	**N12**	K142	N1	4	fd12	Upgrade
Class 1	**N17**	PWV5	M1	2	fd12	New
Class 1	**N3**	K129	K133	4	fd12	Upgrade
Class 1	**N4**	K54	N1	4	fd12	Upgrade
Class 1	**N4 (PWV1)**	PWV9	DF Malan	3	fd12	Upgrade
Class 1	**P156/1 (R59)**	K130	N12	4	fd12	Upgrade
Class 1	**P156/1 (R59)**	K164	K130	3	fd12	Upgrade
Class 1	**P158/2 N14**	K31 (D374)	Dequar Road	4	fd12	Upgrade
Class 1	**PWV3**	R21 / P157/2	PWV17 (new alignment)	3	fd12	New
Class 1	**PWV5**	N17	R21 (P157/1)	3	fd12	New
Class 1	**PWV9**	N1	K16	3	fd12	New
Class 1	**PWV9 (R80)**	K16	K4	3	fd12	Upgrade
Class 1	**PWV13**	N3	N12	2	fd12	New
Class 1	**PWV14**	M2	N12	3	fd12	New
Class 1	**PWV15**	N3	R21 (P157/2)	3	fd12	New
Class 1	**PWV16**	N1	PWV15	3	fd12	New
Class 1	**PWV16 (N12)**	PWV5	N12	3	fd12	New
Class 1	**PWV17**	PWV5	N4	3	fd12	New
Class 1	**PWV17**	PWV5	PWV18	2	fd12	New
Class 1	**PWV17**	N4	PWV2	2	fd12	New
Class 1	**PWV17**	PWV5	PWV18	3	fd12	New
Class 1	**PWV18**	N3	PWV17	2	fd12	New
Class 1	**PWV2**	N1/22	PWV17	2	fd12	New
Class 1	**PWV5**	R21 (P157/1)	PWV17	3	fd12	New
Class 1	**PWV9**	K2	K224	2	fd12	New
Class 1	**PWV5**	N17	PWV16	3	fd12	New
Class 1	**N17**	PWV5	K11	2	fd12	New
Class 1	**PWV3**	PWV17 (new alignment)	N12	2	fd12	New
Class 1	**PWV5**	R21 (P157/1)	R50 (K151)	2	fd12	New
Class 1	**PWV18**	N1	N3	2	fd12	New
Class 2	**K101**	K38	K71 (M1)	3	fd22	Upgrade
Class 2	**K102**	K15	K11 (P42-1)	3	fd22	New
Class 2	**K103**	K46	K71 (P39-1)	3	fd22	Upgrade
Class 2	**K105**	K121	K92 / K94 (N12)	3	fd22	
Class 2	**K105**	K121	N1	3	fd22	Upgrade & New
Class 2	**K106**	K113	K161	3	fd22	Upgrade + New
Class 2	**K109**	K101 South	K101 North	3	fd22	New
Class 2	**K109**	K60 (R25)	R21 (P157/1)	3	fd22	Upgrade +New
Class 2	**K11**	K102	K13	3	fd22	Upgrade
Class 2	**K11**	P156/1 (R59)	N1/19	2	fd22	New
Class 2	**K11**	K102	N12	3	fd22	Upgrade
Class 2	**K11**	N12	N1	2	fd22	Upgrade
Class 2	**K11**	K13	PWV5	3	fd22	Upgrade + New
Class 2	**K111**	PWV5	Nelmapius	3	fd22	New
Class 2	**K111**	N1	Nelmapius	3	fd22	
Class 2	**K111 / K113**	K56	K155	3	fd22	
Class 2	**K113**	N3	K58	3	fd22	New
Class 2	**K115**	K58	Terrace (near K58 Edited from previous)	3	fd22	Upgrade & New
Class 2	**K117**	K60	K88	3	fd22	Upgrade
Class 2	**K117 / K127 (Webber Rd M53)**	N17	K88	3	fd22	Upgrade
Class 2	**K119**	N12	P157/2 (R21)	3	fd22	Upgrade
Class 2	**K121**	K105	K68 (Pomona)	3	fd22	
Class 2	**K122**	K45	K57 (P1/1)	2	fd22	New
Class 2	**K123 (South of K127)**	N17	N3	3	fd22	New
Class 2	**K124**	N12	K125	2	fd22	Upgrade
Class 2	**K13**	K74 (P61-1 Ontdekkers)	K31	3	fd22	Upgrade & New
Class 2	**K133**	K129	K132 (R554)	3	fd22	Upgrade & New
Class 2	**K139 (Baviaanspoort)**	K14	K16	3	fd22	New & Upgrade
Class 2	**K139 (Moloto)**	K14	PWV17	3	fd22	Upgrade
Class 2	**K14**	K139	K141	3	fd22	Upgrade
Class 2	**K14**	K141	K169	2	fd22	Upgrade
Class 2	**K14**	K97	K139	3	fd22	Upgrade
Class 2	**K141**	K14	D628	2	fd22	Upgrade
Class 2	**K142 (N12 - P3-6)**	K11	PWV16 / N12	3	fd22	Upgrade
Class 2	**K142 (N12 - P3-6)**	K11	D335 (Prov Border)	2	fd22	Upgrade
Class 2	**K145**	K34	K16	3	fd22	Upgrade
Class 2	**K146**	K154	K89	2	fd22	Upgrade
Class 2	**K147**	K50	K40	2	fd22	
Class 2	**K148**	K129	K154	2	fd22	Upgrade & New
Class 2	**K15**	K142 / N12	P61-1 / K74 (Barrat Rd)	3	fd22	Upgrade & New
Class 2	**K15**	N12	K158	2	fd22	New
Class 2	**K154**	P156/1 (R59)	N1/19	2	fd22	Upgrade & New
Class 2	**K154**	R59 (P156/2)	N3	2	fd22	Upgrade
Class 2	**K155**	K105	K68	3	fd22	Upgrade
Class 2	**K155**	N3	K116	2	fd22	Upgrade
Class 2	**K155 / Bierman**	N3/12	Sontonga	2	fd32	Upgrade Class 2
Class 2	**K158**	K15	N1	3	fd22	Upgrade
Class 2	**K16**	30th Avenue	K69	3	fd22	New & Upgrade
Class 2	**K164**	N1/19	P156/2 (R59)	2	fd22	Upgrade & New
Class 2	**K169**	N4	D483	2	fd22	Upgrade
Class 2	**K169**	K201	K68	3	fd22	Upgrade +New
Class 2	**K174 (R42)**	P155/1 (R57)	K55 West	2	fd22	Upgrade
Class 2	**K175**	K134 (R29)	K151 (R50)	2	fd22	Upgrade
Class 2	**K178 (P88-1)**	Moshoeshoe (D2271)	Kariba St	2	fd22	Upgrade
Class 2	**K180**	K174	K57	2	fd22	Upgrade
Class 2	**K198**	K13	Corlett	3	fd22	Upgrade
Class 2	**K2**	K95	D621	2	fd22	Upgrade
Class 2	**K20**	K67	DF Malan Drive	3	fd22	Upgrade
Class 2	**K22 (R104)**	K177	Waltloo	2	fd22	
Class 2	**K201**	K169	N4	2	fd22	Upgrade
Class 2	**K212**	K95	K216	2	fd22	Upgrade+new
Class 2	**K212**	Ga-rankuwa	K8	2	fd22	New
Class 2	**K216**	PWV9	K95	2	fd22	Upgrade
Class 2	**K216**	K224	K212	2	fd22	Upgrade
Class 2	**K216**	K212	PWV9	2	fd22	Upgrade
Class 2	**K224**	N1	K95	2	fd22	Upgrade
Class 2	**K232**	N3	K117	2	fd22	New
Class 2	**K26 (R104)**	DF Malan	Bremer / Transoranje Rd	3	fd22	Upgrade
Class 2	**K27**	K46	K101	3	fd22	New
Class 2	**K29**	P158/2 (R28 N14)	K26	2	fd22	Upgrade
Class 2	**K30**	Transoranje	Atteridgeville	3	fd22	Upgrade
Class 2	**K31**	K46	K73	2	fd22	
Class 2	**K33**	K29	Leslie Ave (Increase to K60)	2	fd22	
Class 2	**K4**	K217	K95 (not to N1)	2	fd22	
Class 2	**K40**	N1	K54 (not to K147)	3	fd22	
Class 2	**K43**	K142	K122	2	fd22	Upgrade
Class 2	**K43**	PWV16 / N12	K158	3	fd22	Upgrade
Class 2	**K45 (R553) Golden Highway**	N12	K11	3	fd22	Upgrade
Class 2	**K45**	Rand Show Rd past N17	K164	2	fd22	Upgrade
Class 2	**K46**	P158/2 (R28 N14)	K44	3	fd22	Upgrade
Class 2	**K46 (W Nicol)**	N1	P158/2 (R28 N14)	3	fd22	Upgrade

ITMP 2037 ROAD UPGRADING & NEW ROAD LINKS

Class	Road	From	To	Lanes / direction	Link Types	Construction
Class 2	**K47**	K154	K55 (P156/2 R59)	3	fd22	Upgrade
Class 2	**K50 (Garsfontein Rd)**	Dely Rd	PWV 17 (not to K27)	3	fd22	
Class 2	**K50 (Garsfontein Rd)**	Louis Botha	PWV17	3	fd22	Upgrade
Class 2	**K52 (Should be K31)**	K101	K31	2	fd22	
Class 2	**K52**	K71	K101	2	fd22	Upgrade
Class 2	**K52 (R114)**	N14 / P158/2	K31	2	fd22	Upgrade
Class 2	**K54**	K111	K151	3	fd22	Upgrade
Class 2	**K54**	K52	K101	3	fd22	New & upgrade
Class 2	**K54**	K101	K111	3	fd22	New
Class 2	**K54**	K14	D52	2	fd22	Upgrade
Class 2	**K55**	K47	K174	2	fd22	New
Class 2	**K56**	K117	K101	3	fd22	Upgrade & New
Class 2	**K56**	K72 (P126/1(Hendrik Potgieter	Cedar	3	fd22	New
Class 2	**K56**	Cedar(Near PWV5)	K101	3	fd22	
Class 2	**K56**	K101	PWV5	3	fd22	Upgrade
Class 2	**K57**	K164	P1-1 (K174)	2		Upgrade
Class 2	**K57 (R82)**	K164	N12	3	fd22	Upgrade
Class 2	**K58 (Allandale)**	K71	K117	3	fd22	Upgrade & new
Class 2	**K60**	K74 (P61-1 Ontdekkers)	K46 (P79/1, R511 W Nicol)	3	fd22	Upgrade
Class 2	**K60**	K46	K71	3	fd22	New & Upgrade
Class 2	**K60**	K71	K105	3	fd22	New
Class 2	**K60 (P91/1 - R25)**	K105	K151 (R50 Delmas)	2	fd22	Upgrade
Class 2	**K63**	K216	K14	2	fd22	Upgrade
Class 2	**K67 (D2234 / P230/1)**	N4	K216	2	fd22	Upgrade & New
Class 2	**K68**	R21	PWV17	3	fd22	Upgrade & New
Class 2	**K69**	K34	K54	3	fd22	Upgrade
Class 2	**K69**	K105 - Botha	K34 - Lynnwood	3	fd22	
Class 2	**K69**	K34	K54	3	fd22	Upgrade
Class 2	**K71 (P66-1) R55**	N14	K103 North	2	fd22	Upgrade
Class 2	**K71 (P66-1) R55**	N1	N14	3	fd22	Upgrade
Class 2	**K71 (P66-1) R55**	P206-1 (M1)	N1	3	fd22	Upgrade
Class 2	**K71 (P66-1) R55**	N14	K103 North	3	fd22	Upgrade
Class 2	**K72**	K13	K60	3	fd22	Upgrade & New
Class 2	**K72**	K19	K13	3	fd22	
Class 2	**K73**	K60	K71 North	3	fd22	Upgrade
Class 2	**K74**	K15	K60	3	fd22	Upgrade
Class 2	**K77 (Kliprivier Rd - R55)**	K154	K144	2	fd22	Upgrade
Class 2	**K8**	K63	K97	2	fd22	Upgrade
Class 2	**K8**	K212	D2266	2	fd22	Upgrade
Class 2	**K86**	K90/N12	PWV15	2	fd22	New
Class 2	**K86**	PWV15	PWV3	2	fd22	
Class 2	**K88**	K90/N12	K115/K117	2	fd22	New
Class 2	**K90**	P157/2 / R21	ORTIA Freight Terminal	2	fd22	New
Class 2	**K95**	K224	N4	2	fd22	Upgrade
Class 2	**K95 (Verlengde)(M36)**	N4	K8	2	fd22	Upgrade
Class 2	**K97**	PWV2 (N4)	K14	3	fd22	Upgrade & New
Class 2	**K97**	K212	N4 / PWV2	2	fd22	Upgrade
Class 2	**K97**	N4	Van Der Hoff	3	fd22	Upgrade
Class 2	**K99**	Frates	K14	2	fd22	
Class 2	**K99**	N4 (PWV2)	K14	2	fd22	Upgrade
Class 2	**R28 / K13 / P39-1**	K72 (P126-1)	K31	3	fd22	Upgrade
Class 2	**K105**	K121	K92 / K94 (N12)	3	fd22	
Class 2	**K6**	PWV 9	N1	2	fd22	
Class 2	**K99**	PWV2	K4	2	fd22	
Class 2	**K151**	N1	K169	2	fd22	
Class 2	**K130**	K57	R59 (P156/1)	2	fd22	
Class 2	**K27 (R511)**	K46	K26	2	fd22	New
Class 2	**K220**	K101	P157/1	2	fd22	New
Class 3	**8th St Vrededorp**	Brixton Rd	Solomon Str	2	fd32	Upgrade
Class 3	**Alexander Rd**	Graham Rd (M6, K34, D2762)	K16	2	fd32	New
Class 3	**Andrew Mapheto / Rev RTJ Namane**	DM Morakane	R562 (Olifantsfontein Rd/ K27)	2	fd32	Upgrade
Class 3	**Ascot On Vaal Rd North of K174 & Portion of**	K174 (R42, Barrage Rd)	Sharpville	2	fd32	Upgrade
Class 3	**Class 3 Road in Ratanda**	K135 (R549)	K174 / P25-1 (R42)	2	fd32	New
Class 3	**D1197 Vereniging Road**	P1-1 / K57 (R82)	D904 (Union Str/ Johannesburg Rd)	2	fd32	Upgrade
Class 3	**D2377 (Bronkhorstspruit)**	D2254 (R513)	D670 (R513)	2	fd32	Upgrade & New
Class 3	**D37 / D2106**	K14 / D29 (R513)	K6	2	fd32	Upgrade & New
Class 3	**D384**	K169	K16	2	fd32	Upgrade
Class 3	**D52**	K54	K202	2	fd32	Upgrade
Class 3	**D628 (Crossing PWV2)**	K141	PWV17	2	fd22	Upgrade
Class 3	**D762 / D665 / K197 (R41)**	K211 / K213 (P61-3)	Homestead Ave (K11)	2	fd32	Upgrade (Class 3 + 2)
Class 3	**De Villebois Mareuil**	K151 (Delmas Rd, R50)	K40 (Atterbury Rd, M11, P199-1)	3	fd32	Upgrade
Class 3	**Dely / Brooklyn Rds (M30)**	Lynwood Rd (M6)	Lois	2	fd32	Upgrade
Class 3	**Dualling Jan Smuts Ave (K46)**	7th Ave	Bompas Rd (M30)	2	fd32	Upgrade
Class 3	**East-west Class 3 in Savannah City**	D2150 (Stretford)	P1-1 / K57 (R82)	2	fd32	New
Class 3	**Kelvin-Northway Link**	Bowling Ave (D1580)	Marlboro Drv	2	fd32	Upgrade & New
Class 3	**Link Westlake Rd**	Main Reef Rd (R41)	Vincent Rd (M70)	2	fd32	New
Class 3	**Lintvelt Ave**	Lavender Rd (K97, P1-3)	Wonderboom Airport	2	fd32	Upgrade
Class 3	**Main / New Canada Rd**	Main Reef Rd (K11, M70, P42-1)	Soweto Highway	2	fd32	Upgrade
Class 3	**Main Rd, Comptonville (M38)**	Golden Highway (K45, P73-1)	Columbine Ave (P3-7)	2	fd32	Upgrade
Class 3	**Ndabeztha**	Vlakfontein Rd (K136)	Modjadi Rd	2	fd32	Upgrade
Class 3	**North-south Class 3 Spine Rd Savannah City**	K158 / D786	K47	2	fd32	New
Class 3	**Olievenhoutbosch Rd**	Botha Ave (K105, P38-1))	R21 (P157/1)	2	fd32	New
Class 3	**Olievenhoutbosch Rd**	Brakfontein Rd	Nellmapius Drv	2	fd32	Upgrade
Class 3	**Olievenhoutbosch Rd**	John Vorster Dr	Nellmapius Rd	2	fd32	
Class 3	**Pretoria Rd (M44, P6-1)**	K109 (D822)	K68	2	fd32	Upgrade
Class 3	**R101 (Old Warmbaths Rd, K97**	K212 (P62-1)	Tshwane Border (K230)	2	fd32	Upgrade
Class 3	**Ravenswood (Benoni)**	K90 (Rondebult Rd	K155 (Atlas Rd)	2	fd32	Upgrade
Class 3	**Road D223**	Graham Rd (M6, K34, D2762)	K16	2	fd32	Upgrade & New
Class 3	**Samrand Rd**	Rooihuiskraal Rd	K71 (P66-1)	2	fd32	New
Class 3	**Spencer Rd**	Main Reef Rd (K11, M70, P42-1)	Modise Str / Soweto Highway	2	fd32	New
Class 3	**Stanley / Knights**	Main Reef Rd (R29, K106)	Pretoria Rd (K104)	2	fd32	Upgrade
Class 3	**Thami Mnyele**	Brian Mazibuko West	K105	2	fd32	Upgrade & New Bridge over railway line to K105
Class 3	**Third Rd (Link with IC on N1)**	K99	K139	2	fd32	Upgrade + IC N1
Class 3	**Trichardts Rd**	Ridge	Paul Smit	2	fd32	Upgrade
Class 3	**Trichardts Rd (K165)**	Kingfisher Rd	Barry Marais Rd (K155,	2	fd32	New
Class 3	**Upgrade D2150**	Stretford Station	K45 (Golden Highway, R553, P73-1)	2	fd32	Upgrade
Class 3	**Welverdien Rd (D92)**	Welverdiend	P61-3 (R500, Ada Steet)	2	fd32	Upgrade
Class 3	**Wit Deep Rd**	Main Reef Rd (K106, R29)	Commissioner Str (K110, Lower Boksburg)	2	fd32	Upgrade
Class 3	**Zwane St Class 3 Link with Hendrik v Eck Bl**	Zwane Str (Sharpville)	K55 (Ascot on Vaal Rd, R716)	2	fd32	New

Appendix D
Provincial Road Standards

Department of Roads and Transport

GAUTENG STRATEGIC ROAD NETWORK REVIEW

REVIEW OF ROAD STANDARDS

Final

Prepared by:

GSTN Joint Venture
P O Box 72927
LYNNWOOD RIDGE
0040

Prepared for:

Head of Department
Private Bag X87
MARSHALLTOWN
2107

TABLE OF CONTENTS

TABLES:

FIGURES:

EXECUTIVE SUMMARY

1. TERMS OF REFERENCE

This review of the current Gauteng Department of Roads and Transport's road design standards, have been undertaken by the GSTN Joint Venture as part of the Gauteng Strategic Road Network review.

2. SCOPE

The document discusses the current standards and previous investigations in this regard and assesses this work in view of the latest development in this field of civil engineering. It identifies aspects of standards that require reconsideration but stops short of making specific recommendations, remaining on a strategic level. However, in view of an apparent urgency in this regard, recommendations are made with regard to road reserve widths.

3. ISSUES

The aspects that have been identified for reconsideration are listed below with an indication of the issues involved:

3.1 Human factors, Context Sensitive Design and concept of the Design Domain :

These considerations should be incorporated in the new design manual.

3.2 K-values and gradients:

Pay more attention to balancing the road reserve requirements of steeper gradients with climbing lanes versus easier gradients without climbing lanes.

3.3 Services strip:

Obtain input from the national investigation.

3.4 Interchange elements:

Consider changing to SANRAL requirements.

3.5 Lane widths:

Obtain national agreement on 3,5 or 3,6 m as new standard for Class 2 roads and 3,4 or 3,5 m for Class 3 roads.

3.6 Other cross-sectional elements:

Obtain agreement on benchmark values as per Table 3.2.

3.7 Design speed, sight distance and object height:

Adopt SANRAL/AASTHO philosophy.

3.8 Type of doorways of BRT vehicle to be operated on dedicated facilities:

Should only special vehicles with right hand side doors be considered, a narrower cross-section than the current standard would result.

3.9 Number of normal traffic lanes to be operated in conjunction with BRT/dedicated public transport lanes:

A decision in principal to continue with 6 normal lanes, or reducing to 4 normal lanes, is required.

3.10 Provision of road shoulders at the six lane stage:

A decision in principal is required whether to provide or not. It is recommended that shoulders not be provided in the six lane stage.

3.11 Shoulder sight distance:

It should be carefully considered whether or not to reduce the current nominal 300 m requirement in conjunction with the design speeds adopted.

3.12 Design speed:

Carefully consider speeds to be designed for. Design speeds should match driver expectations. Generally in urban conditions the design speed should exceed the speed limit by the order of 10 km/h, but could be equal in rural conditions.

The benchmark design speed for Class 2 roads should be 100 km/h but incorporating AASHTO/SANRAL object height criteria. On a Class 3 road it should be 80 km/h. Where traffic signals will be incorporated from inception in the construction of a road, the relevant benchmark design speeds could be reduced by 10 km/h. Routes identified for BRT and other forms of public transport should also be subject to these requirements.

3.13 Design parameters generally:

Design parameters generally should match the topographical environment.

3.14 Road lighting:

Class 2 and Class 3 roads should be lit where road shoulders are not provided.

3.15 Land use:

Sensitive land uses such as schools, crèches and other pedestrian-intensive development should not be permitted adjacent to mobility roads.

3.16 Road reserve widths:

The benchmark values of various roads are envisaged as follows, acknowledging that the proposals referring to public transport routes are based on the provision of six normal traffic lanes and the use of conventional vehicles and not special vehicles with right hand side doors.

Freeways with dedicated public transport: 80 m

Other freeways: 70 m

Conventional dual carriageway roads (Class 2) with dedicated public transport : 62 m, unless it is decided to reduce the number of normal traffic lanes from six lanes to four lanes.

Other Conventional dual carriageway roads (Class 2): 48,4 m.

Class 3 roads; Urban with public transport in mixed traffic: 40 m.

Class 3 roads; Urban not serving public transport: 35 m.

Class 3 roads; Rural: 30 m.

3.17 Other cross-sectional values

Benchmark values envisaged for the widths of other cross-sectional road elements appear in Table 6.2.

4. A NEW GEOMETRIC DESIGN MANUAL

It is further recommended that the Department develops a new Geometric Design Manual, taking cognisance of the deliberation and recommendations of this review document.

REVIEW OF ROAD STANDARDS

1. INTRODUCTION

In the second half of 2008, the Gauteng Department of Roads and Transport (Gautrans) embarked on a review of the Gauteng Strategic Road Network and has awarded a contract in this regard to the GSTN Joint Venture to assist them.

Amongst the deliverables of the contract is a review of the current departmental standards applicable to various classes of routes forming part of the strategic road network, and an indication of how dedicated and shared public transport facilities should be accommodated in each instance.

During the course of the project meetings with the department it was established that the main motivations for a review of standards are:

- The cost of land involved in procuring road reserves meeting current standards.
- A new South African National Roads Agency Limited (SANRAL) Geometric Design Guidelines (G2 Manual) appeared in 2004. This inter alia incorporated new approaches followed by AASHTO in their "Green Books" of 2001 and 2004.
- The fact that Gauteng is moving in the direction of a city region, whereas some of the standards in use have been developed for rural conditions.
- The strategic roads generally are constructed in response to development and traffic demand, i.e. once township development has already taken place or is taking place. New roads are seldom if ever constructed under rural conditions.
- Urban roads generally are lit.
- Under congested conditions there is a tendency for road shoulders to be used as additional lanes by motorists, negating their original purpose and creating unsafe driving conditions.
- The municipalities do not provide for road shoulders in their standards, but for kerbed verges. This is also related to the philosophy pertaining to the handling of stormwater.
- Difficulties have been experienced with regard to road drainage designs incorporating open side drains in areas that have since become built up, yet in other instances an open side drain in support of a kerbed cross section has been incorporated successfully in an urban road design.

- In certain cases, the application of current departmental road standards resulted in a perception of money wasted on unnecessarily high fills and/or deep cuttings. It also seemed to create an impression with motorists that they are on a freeway, resulting in inappropriately high operating speeds.
- Bus Rapid Transit (BRT) facilities were being implemented by municipalities in rather narrow roads and streets with cross sections different from that of the department.

It also has to be mentioned that standards pertaining to intersection and interchange spacing are often questioned.

This brief document considers the information to hand and indicates the way forward for the development of new design standards, including cross-sectional proposals for Class 1, Class 2 and Class 3 routes, with particular reference to aspects that influence road reserve width.

2. BACKGROUND

2.1 Relevant documentation

The current road design standards of the department are contained in the Gautrans Road Design Manual Volume 1: Geometrics (BB1), dated December 2001 and its accompanying book of Typical Plans for Road Design: Plan GTP 1/1.

In recent years, the Gauteng Department of Roads and Transport has had various aspects of the standards applicable to provincial roads investigated on a number of occasions. These investigations also covered the Class 2 "K" roads for which the Department acts as custodian with respect to the protection of the routes and road reserves. These investigations resulted amongst others in the following reports:

(i) BB3: Cross Sectional Standards and Road Reserve Widths for K Roads in Exceptional Circumstances (December 1994).

(ii) TCC WG3 01/2004: Public Transport in the Road Cross Section (March 2004).

(iii) BB10: Walking and Cycling on Roads in Gauteng. (August 2006)

(iv) BL108: Road Cross Section and Road Reserve Width. (May 2006)

The above-mentioned documents deal predominantly with Class 1 and Class 2 roads. Other documentation pertinent to this discussion are the draft National Guidelines for Road Access Management in South Africa (April 2005), which cover all classes of roads and the SANRAL Geometric Design Guidelines, mentioned earlier.

For the purposes of the current review, these documents were perused together with municipal documents such as the City of Tshwane's "Standard Construction Details and Design Standards for Roads and Stormwater Drainage Infrastructure". A number of other Gautrans reports and documents have also been consulted on specific issues as mentioned in the following discussions. In addition a workshop on geometric standards was conducted with personnel of the department on 24 July 2009. Cognisance has also been taken of the proceedings of the PIARC International Symposium promoting road safety for Vulnerable Road Users (VRUs) held in Cape Town during the 25^{th} to 27^{th} of October 2009.

2.2 Current approach to determine road reserve requirements

It is current departmental practice to finalise road reserve coordinates during preliminary design, based on the ultimate road facility envisaged for a particular route. For a Class 1 road the ultimate cross section envisaged comprises an eight lane dual carriageway freeway. The ultimate cross section for Class 2 road comprises a nominal six lane dual carriageway road. On Class 1 and Class 2 roads forming part of the Gauteng Strategic Public Transport Network, dedicated space in the road median is also set aside for public transport lanes.

Stormwater drainage design is based on an open side drain approach. Detail design, in most cases, follows much later and generally represents a phased implementation of the facility, e.g. initially one carriageway acting as an undivided two lane road, followed by the construction of a second carriageway bringing the road to the four-lane stage and finally adding additional lanes for the six lane stage.

It has to be noted further that preliminary designs have been completed for the vast majority of Class 1 and Class 2 roads falling within the current urban edge and are protected under the Gauteng Transport Infrastructure Act (GTIA).

Preliminary designs are commissioned long in advance of road construction, mainly to provide guidance to land use developers as to the exact road reserve requirements that have to be taken into account. It is considered impractical to revisit completed preliminary designs, should design standards change. Obviously the most current design standards are applied at every design stage.

The current approach relating to the determination of road reserve requirements is considered good practice and should be continued.

3. LITERATURE REVIEW

3.1 Current departmental standards

The current departmental standards of particular interest to the study i.e. standards that have a major impact on road reserve widths, are summarised in Table 3.1 and discussed below. The current standards are related to type of road rather than Class of road, but generally "Freeways" relate to Class 1 roads and "Conventional dual carriageway" relate to Class 2 roads. It has to be stressed, however, that it is not predicated that Class 1 and Class 2 roads would be freeways and conventional dual carriageway roads respectively.

3.1.1 Design speed

It is of significance to note that "design speed", i.e. the "tool" used in geometric design to ensure uniformity in design, primarily only determines one factor in Table 3.1 that may have a direct influence on road reserve widths. This is "Minimum K Values" that are stipulated to ensure that adequate stopping sight distances are achieved over vertical curves. K-values may influence the depth of cut or height of fill at changes in vertical grades, should it be necessary to cut or fill to meet the required values.

It has to be noted also that should there be an intersection on a road, the shoulder sight distance requirements (see 3.9.3) also comes into consideration and generally exceeds the stopping sight distance requirements.

The other major aspect determined by the design speed, namely, the minimum horizontal radius, generally plays no role in determining the road reserve width. An exception would be a combination of short radius curves and deep cuttings, where it may be necessary to widen the road reserve to accommodate the sightline inside the road reserve, but such conditions seldom occur in Gauteng.

3.1.2 K-values and Gradients

The topography of Gauteng generally can be described as slightly to medium rolling. . Under these circumstances certain design standards such as K- values do not play a significant role in determining road reserve widths. The maximum permissible vertical gradient has much more significance in this regard. However, increases in the permissible gradient to reduce depths of cut and heights of fill in order to reduce the road reserve width, will have a detrimental effect on the Level of Service and influence operating speeds of public transport vehicles negatively. This in turn might require the provision of climbing lanes, which would increase the road reserve requirements.

It nevertheless appears necessary to pay more attention to balancing these conflicting demands in preliminary design.

3.1.3 Service strips

The purpose of the two 3,0 m wide "service" strips forming part of the current road cross section have long been a point of debate. The one and currently predominant view held by the department sees this as space for service (maintenance) equipment only, allowing it to operate off the road shoulder and side drain and hence away from creating a risk to passing traffic. The other viewpoint is that this space also makes provision for utilities (services) in the road reserve.

In the argument against allowing utilities in the road reserve it is said that although access to these utilities would not affect the road pavement structure, it may well result in utility maintenance vehicles, stopping on the road shoulder, in contravention of road markings, with associated risks to passing traffic.

This issue, apparently, has also become the subject of a national investigation.

3.1.4 Lane widths

The 3,7 m lane width was adopted as a South African standard at the time of metrication, rounding up the metric equivalent of the then standard 12 ft lane width. Rounding down to 3,6 m as was done by the USA much later in their efforts to metricate, would also be possible. The standard lane width adopted by SANRAL for the Gauteng Freeway Improvement Project (GFIP) is 3,5 m.

3.1.5 Side drain and earthworks

Only a nominal allowance is made in the 48,4 m urban cross section for a side drain and earthworks. In contrast, a relatively generous provision for earthworks is made in the 62 m rural K road cross section, as well as in the freeway cross sections, inter alia owing to wider recovery areas for out of control vehicles being provided.

Table 3.1 : Current departmental standards

Road Type	Environment	Min Reserve Width (m)	Max Gradient (%)	Min K Values		No lanes	Lane Width (m)	Median width (including inner shoulders) (m)	Width outer shoulders	Side drain and earthworks	Service Strips	Design Speed *
				Crest	Sag							
Freeway	Urban with dedicated public transport lanes	80	4,0	81	44	8	3,7	20,0	2 x 3,0	2 x 11,7	2 x 3,0	110
	Rural	80	4,0	105	50	8	3,7	20,0	2 x3,0	2 x 11,7	2 x 3,0	120
Conven-tional dual carriagew ay roads	Urban	48,4	6,0	62	37	6	3,7	9,2	2 x 3,0	2 x 2,0	2 x 3,0	100
	Urban with dedicated public transport lanes	62	6,0	62	37	8	3,7	18,0	2 x 3,0	2 x 7,4	2 x 3,0	100
	Rural	62	7,0	62	37	6	3,7	9,2	2 x 3,0	2 x 8,8	2 x 3,0	100
Single carriage-way roads	High Std	40	7,0	62	37	2	3,7	N/A	2 x 2,7	N/A	2 x 3,0	100
	Low Std	30	7,0	62	37	2	3,7	N/A	2 x 2,7	N/A	2 x 3,0	100

* In terms of the current Gautrans design philosophy as reflected in this table, the corresponding 85th percentile values of the design speeds shown are used to determine design parameters, e.g. stopping sight distances and K-values.

3.1.6 Single carriageway roads, gravel roads and "D" roads

The single carriageway roads referred to in Table 3.1 in essence comprise the surfaced two lane roads under provincial jurisdiction, of which quite a number exist in the province. In general, these roads currently function as Class 2 or Class 3 roads, but can generally be expected to function as Class 3 roads in future where not indicated to be upgraded to K-road status.

The standards for gravel roads are not quoted in Table 3.1, as these roads would in all probability have become surfaced roads by the time they have to function as Class 3 roads.

It may be noted here that the provincial district or "D" road indicator, unfortunately only indicates "ownership" and does not indicate whether a road is surfaced or not. It is nevertheless envisaged that all "D" roads would eventually form part of the Class 3 road category and be surfaced. In the rural environment they would probably remain single carriageway roads, but in an urban environment would probably eventually be doubled.

3.1.7 Class 3 Road Standards

Currently Gautrans has no standards for Class 3 roads, other than the standards for the single carriageway roads.

The document BB3, referred to earlier, mentions a 30,0 m road reserve used by Johannesburg City Council for urban arterials, predicated on a 4-lane facility. The then City Council of Pretoria used a 40,0 m road reserve predicated on 6 x3,3 m lanes, a 5,3 m median and 7,6 m verges.

It is clear that cross-sectional standards for Class 3 urban roads are very much determined by local circumstances and hence it is not considered necessary (or advisable) for Gautrans to develop Standards for Class 3 roads. Class 3 road reserve widths appear to be of the order of 30 m to 40 m.

3.1.8 Other aspects

Not reflected in the table are factors pertaining to intersection spacing as well as interchange spacing and design, e.g. minimum radii of loop ramps. The current Gautrans minimum loop ramp radius requirement of 75 m, stands opposed to a SANRAL requirement of 45 m.

The minimum interchange spacing is determined by the type of interchanges involved and for planning purposes is nominally set at 2,4 km between access interchanges and 3,6 km between an access and systems interchange. For design purposes reference can be made to Report BB6 which deals with this matter in greater detail.

Intersection spacing on conventional roads is stipulated at a minimum of 600 m which can be reduced to 550 m in exceptional circumstances.

The current Gautrans standards make no provision for non-motorised, i.e. bicycle or pedestrian movements in the direction of travel. However, standards have been developed in Report BB7 for bus stops and ranks.

3.2 Report BL108 "Road Cross-Sectional Elements and Road Reserve Widths"

This report goes into fine detail on elements contributing directly to the nominal road reserve widths currently in use.

The report advocates a flexible and pragmatic design approach to road cross-sectional design within firm safety and cost limits, built around a series of benchmark values. These are shown in Table 3.2.

The report accepts the current design speeds applicable to freeways and K-roads, and indicates that the "minimum values should only be adopted under "exceptional circumstances".

It is not clear from the report what the influence of lower design speeds would be on the cross-sectional parameters discussed. The fact that there is very little, if any, difference between the dimensions given for 120 km/h freeway elements and the corresponding dimensions of elements for 100 km/h K-roads, seems to indicate that this aspect is of little consequence for mobility roads. This is in line with the AASHTO approach that the speed selected for design purposes should correlate directly with pertinent features such as horizontal and vertical curvature, sight and stopping sight distances and super-elevation, and only to a lesser extent with pavement (lane) and shoulder widths and clearances. The Highway Capacity Manual 2000, also mentions only nominal reductions of 1 km/h to 2 km/h in free flow speeds for lane widths reducing from 3,6 m to 3,5 m to 3,4 m. However, when lane widths are reduced to 3,2 m or 3,0 m, the free flow speeds drop by as much as 5,6 km/h to 10,5 km/h.

Report BL 108, being mainly concerned with the widths of the various individual road elements, does not consider the number of lanes required and in the cross-sectional figures follow the number of lanes currently allowed for in the Gauteng Road Design Manual.

Table 3.2 (Quoted from Report BL108): Envisaged range of road cross section standards for Freeways and K-roads

Road cross section elements	Minimum value (m)	Benchmark value (m)	Maximum value (m)	Comments
Freeways: 110 / 120 km/h				
Lane width	3,5	3,6	3,7	
Auxiliary lane	3,4	3,5	3,7	Passing, HOV and public transport lanes, but excluding public transport lanes in the median.
Outside shoulder width	2,6	2,8	3,0	Excluding shoulder rounding (0,5 m) and provision for guardrails (0,3m)
Inside shoulder width	2,6	2,6	3,0	Surfaced portion could be 0,6 m
Median width	6,2	11,0	14,0	Including width of inside shoulder, but excluding provision for public transport.
Side form slope : fill	1:2	1:1,5	1:1,5	Stability, economic, maintenance & environmental considerations.
Side form slope : cut	1:2	1:1,5	1:1,5	
Provision for drainage	1,0	2,75	3,0	Depend on type of drainage.
Verge	1,5	3,0	3,0	Include provision for rounding (top of cut or bottom of fill) and cut-off drains.
K-roads: 100 km/h				
Lane width	3,5	3,6	3,7	
Auxiliary lane	3,3	3,5	3,6	Passing, HOV and public transport lanes, but excluding public transport or right-hand turn lanes in the median.
Outside shoulder width	2,6	2,8	3,0	Excluding shoulder rounding (0,5 m) and provision for guardrails (0,3 m).
Inside shoulder width	2,6	2,6	3,0	Surfaced portion could be 0,3 m.
Median width	8,8*	9,2	9,8	Including width of inside shoulder, but excluding provision for public transport.
Side form slope : fill	1:2	1:1,5	1:1,5	Stability, economic, maintenance & environmental considerations.
Side form slope : cut	1:2	1:1,5	1:1,5	
Provision for drainage	1,0	2,75	3,0	Depend on type of drainage.
Verge	1,5	3,0	3,0	Include provision for rounding (top of cut or bottom of fill) and cut-off drains.
* With one right turning lane, the median width can be reduced to 5,5 m, but this is not recommended.				

With regard to side form slopes mentioned in the table, it may be noted that slopes of 1:3 have had to be used in instances in Tshwane in recent cases, owing to environmental considerations.

In considering the proposals of this table, without allow for a recovery area (see first bullet below), the resultant road reserve widths for the “benchmark case” are 62,1 m for freeways and 53,0 m for K-roads.

Other points of relevance touched upon in the report are listed below and where appropriate remarked on:

- "From a road safety point of view a 9,0 m clear recovery area should exist between the edge of the travelled way and any obstacle on major arterials with operational speeds of the order of 100 km/h to 120km/h". Analysing this requirement, based on a quadratic relationship between the operational speed and the lateral distance required to bring an out-of-control vehicle to a safe stop/ under control, the following lateral distance requirements transpire:

Operational Speed	Lateral distance
100 km/h	9,0 m
90 km/h	7,3 m
80 km/h	5,8 m
70 km/h	4,4 m

  Accepting that the outside shoulder and side drain form part of the recovery area, the road reserve widths mentioned above for the "benchmark case" increase to 69,4 m for freeways and 60,3 m for K-roads operating at 100 km/h. For a K-road with an operating speed of 90 km/h, the reserve width reduces to 56,9 m.

- "Where intersections are relatively infrequent, e.g. 1,0 km or more apart, the median width could be varied by using a narrower width between intersections and then gradually widening the median at the intersections to accommodate right turn lanes".

  The report continues to note that "This solution is rarely practicable, however, and should not be used where intersections are relatively closely spaced".

  This remark is supported, as the resulting curved or zig-zagging alignment associated with a varying median or road reserve, is confusing to drivers, particularly at night and especially in wet conditions. The practice of narrowing the road reserve between intersections and widening it at intersections is also frowned upon by developers as it complicates town planning. Changes in direction of property boundaries also incur extra costs for developers as services such as sewers, which are generally linked by a standard offset to the property boundary, require additional manholes at each change in direction.

- There must be adequate space for road sign placement. The preferred minimum-distance from the edge of the travelled way and the edge of the sign should be 4,0 m, with an absolute minimum of 2,5 m.

- The minimum island width at intersections should be 2,2 m with an absolute minimum of 2,0 m, in order to accommodate double headed traffic signals.

- The acquisition of land to widen the road reserve at intersections once development has taken place "is both costly and disruptive in built-up areas". This statement could be expanded to read or practically impossible. Enforced widening of the roadway often results in aesthetically unacceptable encroachments on the sidewalks, that also have a negative effect on pedestrian movement and safety.

- "Distinction between rural and urban roads in Gauteng appears unnecessary".

  In this regard it has to be cautioned that although Gauteng is often seen as an urban complex, approximately 60% of the provincial roads are outside proclaimed townships. The efforts of the Gauteng Spatial Development Framework to contain development within an urban edge, also implies that Gauteng will have rural roads for time to come. Hence it appears necessary to allow for an urban/rural distinction when it comes to road design standards and to have recommendations for roads inside and outside the urban edge.

- "With running speeds of 30 - 70 km/h, the pertinent design speed of arterial streets would be of the order of 50 - 100 km/h", according to AASHTO 2004.

  It may be noted, however, that AASHTO 2004 also states that the design speed selected for an urban arterial should depend largely on the spacing of signalized intersections, the median cross section, the presence of kerbs and gutters and the type of access to the street.

- "The design speed should be of the order of 8 km/h to 16 km/h higher than the posted or legal speed limit according to the Florida DoT 1986".

  It is probable that this requirement quoted in BL108 was influenced by the then position of using the 85th percentile speed as design speed in determining design parameters.

3.3 Report BB3: Cross Section Standards and Road Reserve Widths for K-routes in Exceptional Circumstances

The study that culminated in the above-mentioned document was conducted in 1993 and revisited in 1994. The study established cross-sectional standards for road reserves elements in existing high-density built-up areas and recommended that a 40,0 m reserve width be used in "exceptional circumstances". The "exceptional circumstances", apparently are often conveniently ignored, with the result that the cross section proposed seems to have become a norm for proponents of a narrower road reserve.

The cross section in case was premised on a kerbed roadway (see Figure 3.3) and comprises 6 x 3,5 m lanes; a single dedicated right turn lane of 3,4 m at intersections; a median of 6,2 m consisting of a kerbed island of 5,0 m and 2 x 0,6 m inner shoulders; 2 x 0,6 m outer shoulders; 2 x 5,8 m verge strips, each consisting of a 1,5 m buffer, a 1,5 m sidewalk, and allowing 2,8 m for earthworks and maintenance/services activities. It may be noted that in this configuration it would not be possible to provide for a bus lay-by.

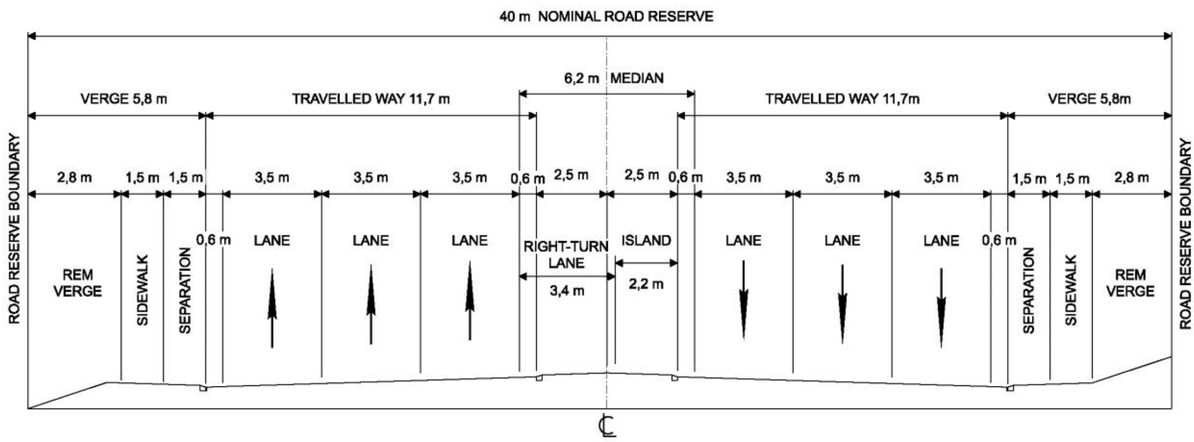


FIGURE 3.3

BB3 CROSS-SECTION

It was also recommended that a design speed of 80 km/h should be applicable to designs, incorporating this cross section. The premise was that where space was at a premium and existing development densities and circumstances in any case predicated running speeds of 65 km/h to 70 km/h (i.e. design speed of 80 km/h), it would be appropriate to apply a 40 m cross section in lieu of the standard 48,4 m one.

The report further argues that this (40 m) cross section is applicable to so-called K_B roads, bordering on being minor arterials, with a commensurate closer spacing of intersections. No indication of intersection spacing is given, however.

3.4 Report BB10: Walking and Cycling on Roads and Streets in Gauteng

This report dated August 2005 was based on a study undertaken in conjunction with the municipal authorities in Gauteng. The report formulates policy guidelines pertaining to the type of pedestrian and bicycle facilities to be provided along the various classes of urban and rural roads and streets in Gauteng. The report builds on the South African Department of Transport Manual "Pedestrian and Bicycle Facility Guidelines: Engineering Manual to Plan and Design Safe Pedestrian and Bicycle Facilities".

The report finds that walking and recreational cycling are neighbourhood activities to be accommodated on local streets and collector roads. Walking and cycling as a way of commuting could happen over relatively short to medium distances on Class 3 and Class 2 roads. Deficiencies in the urban environment and topographical features may dictate that in some cases there is no alternative but to provide for such movements on Class 2 roads, but this should be the exception.

The report further states that the minimum sidewalk width is to be 1,5 m, with preference given to a width of 1,8 m. It also states that it is advisable to separate cycle and pedestrian movements along Class 3 and Class 2 roads; that pedestrian walkways rather than sidewalks should be provided on mobility routes, but that sidewalks should always be separated from the road edge by a buffer of 1,5 m minimum width. Where required on Class 3 and Class 2 roads, clearly marked cycle lanes could be provided on the road surface. The minimum width of a one-way cycle lane is 1,2m.

Another pertinent recommendation of the report is that pedestrians should not be expected to cross more than 5 traffic lanes before finding a shelter such as a kerbed island. This equates to a trafficable roadway width of approximately 18 m to 20 m between kerbs. At a walking speed of 1,2 m/s, this distance would take approximately 15 to 17 seconds to cover.

The report further cautions that adequate road reserve must be available for bus stops.

Report BB7 dealing with bus and taxi facilities indicates that stops of up to 24,0 m in length and a width of 3,5 m, plus a 1,0 m separation, would be required for a public transport stop. Normally a further width of 1,5 m to 2,5 m is required for a shelter and setback. The sidewalk should also continue behind the shelter. The footprint of a bus stop thus amounts to a width of 7,5 m to 8,5 m, less the width of the outer shoulder.

3.5 Draft National Guidelines for Road Access Management in South Africa: October 2005

This COTO document is predominantly focussed on access spacing, based on functional classification of the road system, and recognises Class 1 freeway road reserves of between 60 m and 80 m; six-lane Class 2 road reserves of between 40 m and 60 m in width; and four-lane Class 3 road reserves of between 25 m and 40 m in width. Corresponding travelling speeds referred to are 110 km/h – 120km/h; 80 km/h – 90 km/h; and 70 km/h – 80 km/h. Intersection spacings of the order of 800 m ± 10% for Class 2 and 600 m ± 20% for Class 3 roads are recommended.

These spacings are premised on integrated traffic signals permitting uninterrupted travelling speeds of 80 km/h and 60 km/h respectively. Such conditions are seldom achieved in a closely knit road and street network such as in Gauteng, where the integration of traffic signals are also made problematic by the need for three or even four phases at some signals. Preference is thus given to the results of the modelling study contained in Report BL01/01/1, indicating minimum systems delay being experienced with an intersection spacing of 600 m.

3.6 SANRAL G2 Manual: Geometric Design Guidelines, 2004

3.6.1 Design approach

The SANRAL document contains a wealth of information and departs from the more prescriptive stances of traditional design manuals. The Guidelines introduce the principle of a “Design Domain” and mentions “Human Factors” and “Context Sensitive Design” as “paradigm shifts of note” in the design process. Unfortunately these philosophies were still in their infancy when the G2 Manual was drafted and it does not deal with them in any depth. However much progress has been made over the last 5 years in this regard, and it should be possible to incorporate these developments in any future revision of the G2 Manual, or for that matter any other design guideline.

The principle of context sensitive design requires the designer to select appropriate design parameters for the road or road section in question and includes issues of public participation, cultural, environmental and aesthetic values held by both the road user as well as the surrounding community. It promotes a multidisciplinary approach to design including systems analysis, problem definition and value engineering.

Design domain derives from the Canadian and Australian practice and makes provision for the application of “Design Exceptions”, which allow for relaxations of standards, should circumstances so dictate, as opposed to the previous prescriptive approach. The countries mentioned and most States of the USA have set up formal processes whereby conscious decisions are taken and recorded on design exceptions by the road authority in consultation with the designer. Design exceptions are, however, limited to the range between driver expectations, i.e. human factors, and vehicle capabilities which constitute the outer boundaries of design parameters.

3.6.2 Design speed, stopping sight distance and K-values

The G2 Manual also moves away from using the 85th percentile of the nominal design speed as input in calculating sight distances. It follows the current AASHTO (2001 – 2004) approach of using the nominal design speed directly as the input figure in the equation for calculating sight distances. In another departure from previous design approaches it requires the designer to select the object height to be used for determining the stopping sight distance from a series of values influenced by the roadside environment. Unless there are risks of fallen trees or rocks on the road, an object height of 0,6 m is recommended. In terms of current Gautrans design manual the object height is 0,15 m.

In terms of the current Gautrans Road Design Manual, the stopping sight distance on a Class 2 road with a design speed of 100 km/h is based on the 85th percentile speed, i.e. 85 km/h, requiring a stopping sight distance of 153 m (155 m rounded). For an object height of 0,15 m, the corresponding vertical curve crest K-value is 62 (60 rounded). .

In terms of the SANRAL and current AASHTO approach, a design speed of 100 km/h requires a crest K-value of 60 for an object height of 0,6 m. (An object height of 0,15m would require a K-value of 100 which would be difficult to achieve in practise). The combination of SANRAL and current AASHTO design speed and 0,6 m object height thus seems to replicate the existing standard, which incidentally has been perceived as generous.

In this regard, it may be noted that a SANRAL and current AASHTO design speed of 90 km/h would require a K-value of 45 for an object height of 0,6 m, for a crest vertical curve. A K-value of 45 for an object height of 0,15 m relates to a design speed in terms of the current SANRAL and AASHTO approach of just below 80 km/h.

Similar considerations apply to sag vertical curves.

3.6.3 Gradients

The standards relating to vertical gradients are not directly related to design speed. The norm in determining vertical gradient is the empirical rule linking the length of the grade to a maximum reduction in truck speeds of 15 km/h, and cost considerations of accepting a steeper gradient coupled to a climbing lane. This is a prime instance for the application of value engineering, which, in essence, is aimed at achieving similar outcomes at minimum cost.

3.7 TCC Report WG3 01/2004: Public Transport in the Road Cross Section: February 2004

This report only focused on facilities for public transport in the road cross section and did not consider issues relating to the cross section without public transport.

3.7.1 Dedicated Public Transport Facilities

The drafting of the mentioned TCC report preceded by a number of years the advent of BRT systems, such as being rolled out currently in Johannesburg. It was predominantly focussed on a “green fields” situation, rather than retrofitting as in the case of Johannesburg. The goal of the study was to develop guidelines for road reserve requirements, which would complement the aims of the Gauteng Strategic Public Transport Network. The report recognised the value of dedicated public transport lanes that would increase the reliability and average travel speed of public transport by reducing the effect of other traffic. It also recognised that the public transport vehicle could be either bus or light rail. The classes of road considered included Class 1 (freeways) and Class 2 (K-roads). No attempt was made to develop a cross section for Class 3 (municipal) arterials.

The study found in favour of an ultimate 80 m cross section for freeways incorporating dedicated public transport facilities and an ultimate 62 m cross section for K-roads (Class 2 roads), with such facilities.

It is of interest to note that the TCC report differs appreciably from the current Gauteng Roads Design Manual in as far as the number of lanes to be provided for dedicated public transport on freeways. The proposal is for two lanes per direction, with a full left hand side shoulder, a nominal right hand side one and allowance for a median barrier, as shown in Figure 3.7.1.

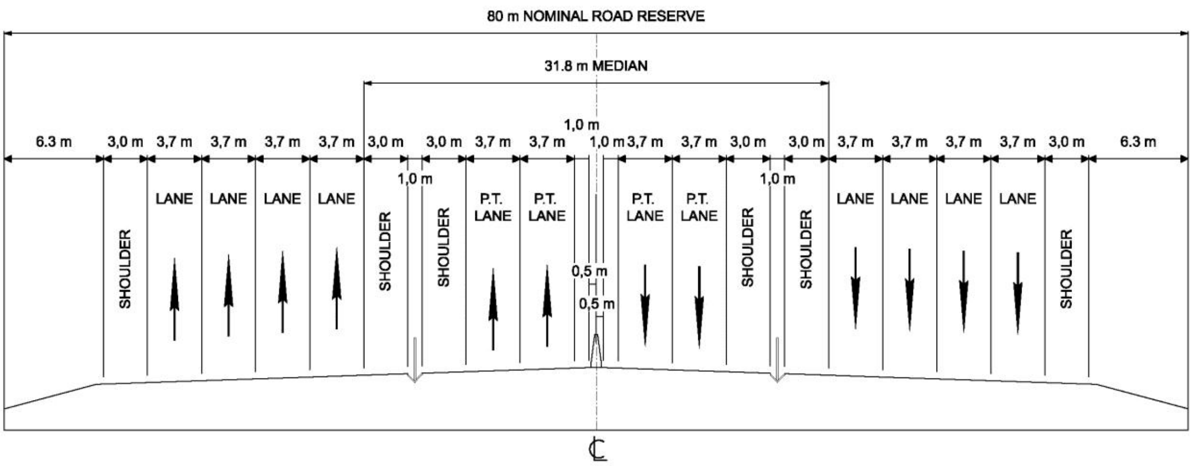


FIGURE 3.7.1

TYPICAL CROSS SECTION WITH PUBLIC TRANSPORT LANES IN MEDIAN

The cross section for Class 2 roads is shown in Figure 3.7.2 and is premised on the principles of providing two x 4,0 m wide dedicated public transport lanes in the road median, separated from normal traffic by two x 6,5 m wide islands; six x 3,7 m wide normal traffic lanes and two inner and two outer shoulders of 2,7 m in width, leaving two x 3,0 m wide strips for drainage and earthworks, and two x 1,0 m wide strips for “services”, resulting in a 62 m road reserve. In this layout there are two public transport stops, one for each direction, situated downstream of the intersection and adjacent to it. A public transport lay-by is provided of 3,5 m width. In order to provide for two right turning lanes at the intersection, the inner shoulders are reduced in width to 0,9 m, up to a point just past the public transport stop.

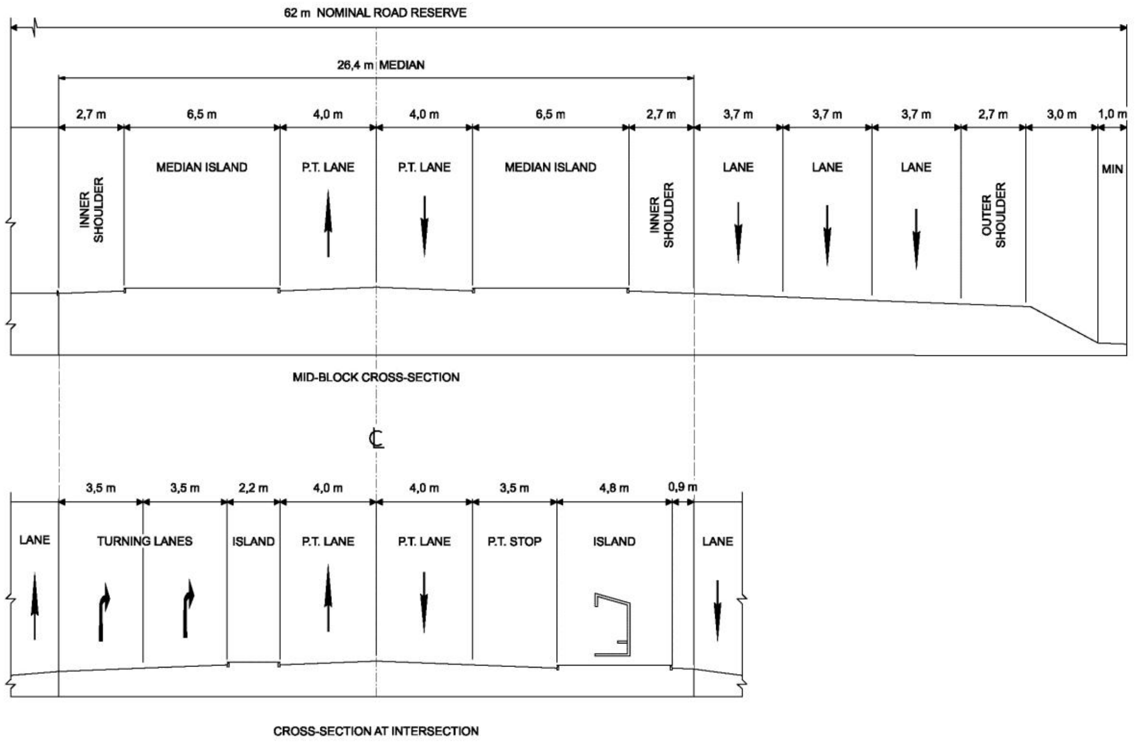


FIGURE 3.7.2

62m CLASS 2 ROAD WITH PUBLIC TRANSPORT IN MEDIAN

An important point of departure in the development of this cross section was that the public transport facility would be used by normal busses and the like, with entrance and exit doors on the left hand side. The Johannesburg BRT uses specially procured vehicles with right hand side doors and a single island in the middle to accommodate the rapid access transit halts. No provision is made for lay-bys either.

A decision in principle with regard to the operational use of the public transport facility provided in the road cross section thus would have to be taken a long time prior to implementation, should it be desired to reduce the cross section described above during preliminary design by adopting a single island approach as used for the Johannesburg BRT.

The proposals of the TCC report regarding retrofitting a dedicated public transport facility to a 48,4 m reserve, are also enlightening for the purposes of this review study. These proposals are shown in Figure 3.7.3. In this instance the two x 4,0 m wide public transport lanes are retained, but the two islands separating public transport from normal traffic are only 5,0 m wide. This width is just sufficient to accommodate a 3,0 m wide transit stop and a 2,0 m wide island for the stop shelter and set back. The six normal traffic lanes are 3,5 m wide each. The two inner shoulders are 0,6 m wide each, as are the two outer shoulders. Two x 2,5 m wide sidewalks and two x 1,0 m services strips make up the 48,4 m nominal road reserve. The cross section makes provision for one right turning lane only. There is no provision for earthworks and local widening would be necessary at intersections to accommodate a left turning slip road or a second right turning lane and the associated deceleration lanes.

Although the report itself does not cover narrower nominal road reserves, it is clear from a consideration of the elements described above that it would require sacrificing two of the normal traffic lanes, reducing the two dedicated lanes to 3,7 m each and reducing the four 0,6 m nominal shoulders to 0,4 m each, to fit the configuration into a 40,0 m nominal road reserve. This leads to the question whether the current policy of providing six normal traffic lanes in addition to the dedicated public transport lanes, should not be discontinued in favour of providing four normal lanes only.

Using a Johannesburg BRT approach with a single central island and special public transport vehicles with right hand side doors, a further 5,0 m reduction in the nominal road reserve would be possible.

Such drastic reductions in road reserve width would obviously reduce options and operational flexibility in future and do not appear warranted, especially in greenfields situations.

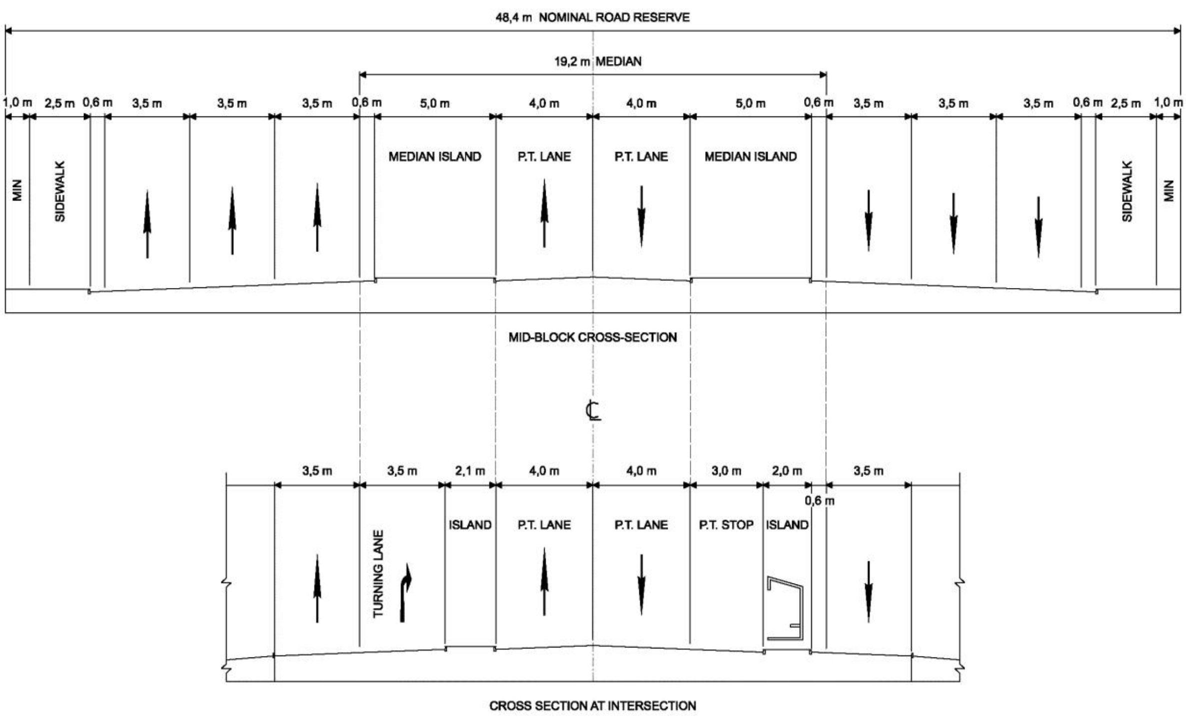


FIGURE 3.7.3

48,4m CLASS 2 ROAD WITH PUBLIC TRANSPORT IN MEDIAN

From a road capacity and traffic engineering point of view it is further considered essential to provide for two right turning lanes at intersections on roads incorporating dedicated public transport lanes. Should a narrower road reserve width be adopted, it would require local widening of the road reserve at intersections, in excess of the splays normally provided. As mentioned earlier in this report, local widening generally incurs safety risks for motorist and is not favoured by developers.

3.7.2 Public Transport in Mixed Traffic

The TCC Report also considered facilities for public transport in mixed traffic in a 48,4 m road reserve, with four and six traffic lanes. In the six lane instance (see Figure 3.7.4), the normal 3,7 m lanes are retained, but the inner shoulder is reduced to a width of 0,9 m at the intersection. The normal outer shoulder of 2,7 m is widened at the transit stop to provide a 1,0 m separation from normal passing traffic and a 3,5 m wide bay. A further 3,0 m is allowed for a shelter structure and set back, as well as a 1,5 m width at an easy cross fall behind the shelter plus 1,0 m for “services”. The total width required exceeds that available in the normal cross section by approximately 4 m in total. This would require local widening at intersections and may be difficult to implement.

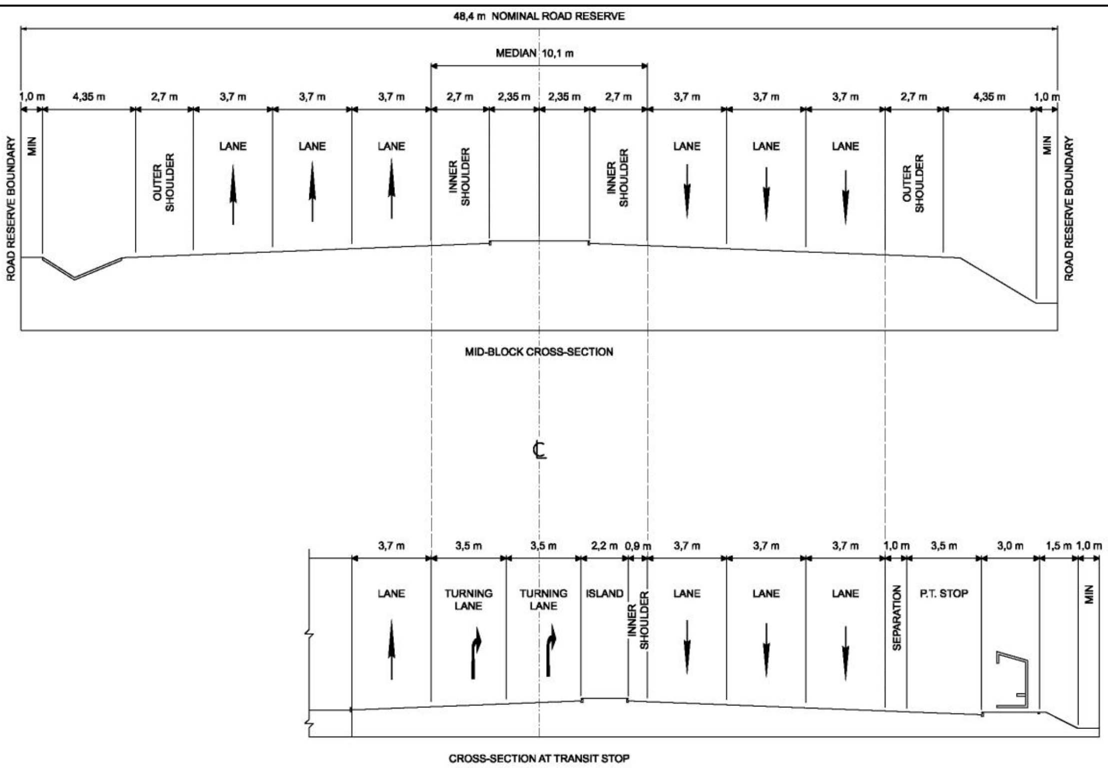


FIGURE 3.7.4

48,4m CLASS 2 ROAD WITH PUBLIC TRANSPORT IN MIXED TRAFFIC

What is of interest to the current study is the space allowed for the stop, which amounts to some 9,0 m less the width of the outside shoulder. In the case of a nominal outside shoulder of 0,6 m this space would amount to a width of 8,4 m. Even with a narrower shelter, requiring less space, a verge width requirement of the order of 7.5 m to 8,0 m seems indicated to accommodate public transit stops.

3.8 Southern African Road Traffic Signs Manual (SARTSM)

A factor often raised during discussions of geometric design, is the statement in SARTSM Volume 3. Subsection 2.2.2(a) that the speed limit on any approach to a signalised junction, or pedestrian or pedal cyclist crossing shall not exceed 80 km/h. No approach distance is specified over which the speed limit should apply, hence it is generally accepted that the speed limit applies to the full length of road section. However, this is not strictly necessary or true.

There are many instances where there are either no traffic signals and/or the operating speeds on K-roads and other Class 2 roads exceed 80 km/h. To employ a general design speed of 80 km/h under these circumstances, could result in artificially tight horizontal curves and restricted sight distances when least expected by the motorist. As such it would simply come down to designing a facility less safe than considered desirable.

3.9 Miscellaneous Considerations

When considering cross sectional elements and their widths, a number of miscellaneous considerations not necessarily discussed above have to be considered.

3.9.1 Emergency use of road shoulders

One of the purposes of a road shoulder is to provide for emergency vehicles. The provision of road shoulders for this purpose is particularly relevant in the two- and four-lane stages of road implementation.

In the six-lane stage, the need for a road shoulder to accommodate emergency vehicles is less pronounced and to a degree compensated for by having three lanes that emergency vehicles can use for manoeuvring. Other vehicles could also pull over onto the verge to allow emergency vehicles to pass. A further alleviating factor for not providing a road shoulder in the six-lane stage is that emergency evacuations in urban conditions could be effected by helicopter.

With regard to the issue of a broken down vehicle blocking a lane, it is accepted practice in urban conditions for such a vehicle to find refuge on the verge. It could also be argued that a broken down vehicle stranded in a lane of a three lane, would have less of a detrimental effect on the road capacity than in the case of a four lane road with no shoulders and hence the risk may be acceptable in view of the savings in road reserve width. Breakdown services are also fairly prolific in urban areas and hence broken down vehicles are generally removed fairly rapidly.

3.9.2 Crossing or turning into roads from a stop sign

In order to cross a Class 2 road or execute a right turn from a stop controlled side street in two stages by stopping in the median, a sufficient width of median is required. The length of a SU design vehicle is 9,15 m. (Incidentally the length of a bus is 12,0 m).

It is not considered feasible to provide for a larger design vehicle, such as SU+T, as the number of such vehicles using stop controlled side streets would be very small and the width implication exorbitant.

3.9.3 Shoulder Sight Distance (Intersection Sight Distance) and Decision Sight Distance

Although “Intersection Sight Distance” has become the generally accepted phrase, for the purposes of this document the term “shoulder sight distance” is used as this is the term used in the current Gautrans Geometric Design Manual.

For a stop-controlled intersection, shoulder sight distance is defined as the distance measured from a point 5 m back from the edge of the travelled way of the main route to the centre of the outside approaching lane measured from an observation height of 1,05 m to an object height of 1,3 m. The Manual states that it is preferred that this distance should be at least 300 m and stipulates that there “shall be no obstruction inside the sight triangle”. This distance has been set to enable a motorist approaching an intersection and observing a vehicle pulling into the traffic stream in front of him adequate opportunity to take evasive action without discomfort to himself or his passengers.

With reference to Table 3.9, it can be seen that the 300 m shoulder sight distance equates more or less to the decision sight distance required on suburban roads for an actual operating speed of 85 km/h (Design speed of 100 km/h in terms of the current Gautrans Manual). Yield-sign controlled intersections require greater sight triangles, but for the purposes of this review it is accepted that all intersections on Class 2 roads will be stop controlled on the minor road, if not controlled by traffic signals.

In effect the shoulder sight distance requirement also determines the minimum horizontal radius of 1 500 m as well as the K-value of a crest vertical curve on which intersections can be provided, required by the Manual.

The provision of a kerbed verge with sidewalk would not have a detrimental effect on this requirement.

Decision sight distances for different “true” speeds are given in Table 3.9 below, together with the corresponding stopping sight distances and shoulder sight distances for crossing. When considering these values it may be borne in mind that lack of decision sight distance may be compensated for by the provision of appropriate early warning signs.

Table 3.9: Sight distances (AASHTO 2004)

Speed	Decision Sight Distance on a suburban road	Decision Sight Distance on an urban road	Stopping Sight Distance	Intersection Sight Distance to cross
60 km/h	205 m	235 m	85 m	110 m
70 km/h	235 m	275 m	105 m	130 m
80 km/h	270 m	315 m	130 m	145 m
90 km/h	315 m	360 m	160 m	165 m
100 km/h	355 m	400 m	185 m	185 m

4. DELIBERATION

4.1 Design Approach

From the foregoing overview of aspects pertaining to standards, it is clear that developments in the field of geometric design of roads have overtaken the current Gautrans approach, particularly as far as the issue of determining "design speed" and the associated sight distances are concerned. Both AASHTO and SANRAL have adopted a new approach and it is considered desirable that Gautrans follows suit.

4.2 Design speed and speed limits

The next question to be answered is whether the speed limit should be used as design speed. In this regard it is to be emphasised that road surfaces, tyre conditions, vehicles and drivers differ and the input parameters used in the equations in use are based on the expectation that the friction available and the capabilities of most vehicle systems can provide the assumed values. Hence it would not be amiss to make some allowance for a safety factor as discussed in Section 4.4 below. Adoption of a "Human Factors" approach to design would permit such an approach.

4.3 Topography and Environment

With a few exceptions the Gauteng topography, with its gentle rolling terrain, easy grades, and good sight distances, lend itself to relatively high operating speeds on roads. The instances where the design speed in reality controls the operating speed, are the exceptions rather than the rule. As such the selection of a design speed must match the driver expectations and it would be counter-productive to prescribe artificial low design speeds.

The design parameters must further match the topography in order to give expression to the philosophy of blending the road into its environment. In those parts of Gauteng where heavy rolling and even mountainous topography occur, all the design parameters and not only the design speed should be adjusted to suit, even though it may require the provision of a climbing lane to balance a steeper maximum gradient in order to reduce earthworks.

The SANRAL geometric design guidelines place much more onus on the design engineer to select appropriate design parameters and a similar approach by Gautrans is proposed. In report BL108 a more flexible and pragmatic design approach is also advocated, allowing the design engineer to motivate a reduction or an increase in cross-sectional benchmark values on merit to suit prevailing and forecasted conditions. This approach should be extended to cover all design parameters, within a formal framework of "Design Exceptions".

4.4 Traffic signals, posted speed and design speed

Traffic signals (and the associated speed limits) are facts of life on urban arterials. However, their advent generally follows later in the life of a road, when the major design parameters have long been established to wit sight distances and curvature. Hence it is believed that the benchmark design speed for a Class 2 road in rural and even peri-urban areas should remain at 100 km/h, but incorporating the new AASHTO/SANRAL object height criteria. Similarly on a Class 3 road it should be 80 km/h. In urban conditions, particularly when there is certainty that traffic signals will be incorporated from inception in the construction of the road, the relevant design speeds could be reduced by 10 km/h, to 90 km/h and 70 km/h respectively.

As indicated earlier in this document design speed has a minimal footprint implication and hence there is little merit in reducing it in the hope of achieving savings in road reserve width.

A further factor against lowering design speed to the level of a posted speed, is the higher workload on a driver in urban conditions. Thus in urban areas (with posted speed limits) a difference of the order of 10 km/h is indicated between posted and design speeds, whilst the two may be equal in rural conditions.

4.5 Drainage

It is obvious that the traditional rural road design approach of simply getting the water off the road surface as quickly as possible, providing cross drainage and grading the road high enough above ground level to permit discharging of stormwater at ground level within the road reserve, will not be practicable in the long run in an urban environment. In the urban environment it is still important to get the water off the road surface as quickly as possible, but the road/street becomes an integral part of the drainage system of the entire area served by the road in question and hence is generally graded at or below ground level. However, this consideration is mainly applicable to detail design. For preliminary design, i.e.

to determine the road reserve requirements, it could well suffice to grade the road as close as possible to ground level, using a cross section incorporating open side drains. The space taken up by underground and open surface drainage systems does not differ too much.

In this regard a critical assessment shows that a kerbed verge with underground drainage, and an open V-shaped side drain, virtually occupy the same space, namely 3,45 m for instance for underground drainage, if the detail provided in the City of Tshwane document referred to earlier is followed, or 3,8 m in the case of a typical open drain as required in the Gautrans typical plans.

However, in terms of context sensitive design and particularly in case of environmentally sensitive areas, it may already be necessary to consider underground drainage from the outset in preliminary design, in order to get the necessary “Record of Decision” from the environmental authorities.

Drainage design must be done in consultation with the municipality involved to ensure compatibility with the overall drainage plan of the area crossed by the road and may even have to make provision for local widening of road reserves to allow for attenuation.

4.6 Number of lanes

With regard to Class 1 roads, the recommendations of the TCC report discussed above appear appropriate for freeways with dedicated public transport lanes, namely 8 lanes for normal traffic and a further 4 dedicated to public transport. For other Class 1 freeways, the current standard of 4 lanes per direction remains indicated.

Currently Class 2 roads provide for a maximum of 6 through (normal) lanes, i.e. 3 per direction. This is considered to be the maximum that should be provided. More lanes, together with the associated turning lanes, would be difficult to cross for pedestrians and require traffic signals with long inter-green phases in order for vehicles to clear the intersection. This would affect intersection capacity negatively and increase the risk of red-light running.

Reducing the number of lanes to 2 per direction may in theory require an increase in the number of roads to provide the same capacity, with concomitant less efficient use of the road reserve footprint, as all the other cross-sectional elements would remain the same. However, the question about the number of normal traffic lanes on roads incorporating dedicated public transport lanes appears to be more of a policy issue than an engineering / road geometric design issue. Prudence would indicate allowing for six lanes, unless public money is dedicated to the provision of dedicated public transport systems on the roads in question.

There are no standards set for the number of lanes on Class 3 roads, but the lesser need for mobility on Class 3 roads seems to indicate that 2 lanes per direction should suffice, with one right turning lane at intersections. If, in a true inner-city urban setting, more lanes were to be required, it would be appropriate to use an undivided roadway and/or one-way system.

4.7 Lane and shoulder widths

The benchmark values given in Table 3.2, extracted from report BL 108, appear most appropriate with regard to lane and shoulder widths where kerbing is not provided.

A nominal shoulder width of 0,6 m is used in the TCC report referred to above in conjunction with kerbed K-roads.

4.8 Median width

On Class 2 roads, a median width of 9,6 m would provide for two right turning lanes of 3,4 m each and a space for traffic signals and pedestrian refuge of 2,2 m width, premised on nominal 0,6 m inner shoulders. This width would also accommodate a SU design vehicle.

On Class 3 roads, with only one right turning lane and a turning lane width of 3,3 m the corresponding median width would be 6,1 m.

4.9 Aesthetics and earthworks

Urban design and landscaping require space to create vistas and also need a minimum amount of space for working in. On Class 2 roads, a 9,6 m median width, based on two turning lanes of 3,4 m width each, 2,2 m to accommodate traffic signals and 0,6 m as inside shoulder, would translate to a working width of 8,4 m between kerbs away from the intersections. This is considered sufficient for this purpose. In the case of Class 3 roads a median width of 6,1 m, based on one turning lane of 3,3 m, 2,2 m as pedestrian refuge/space for traffic signals and a 0,6 m shoulder, translates to an island width between kerbs of 4,9 m away from intersections. This would still be adequate for minor landscaping activities. In both instances, however, the 2,2 m width at the intersections will have to be paved as it is too narrow for landscaping.

With regard to verge areas, it is considered necessary in urban and peri-urban areas to set aside a minimum of 3,0 m for sidewalks (1,5 m width each), as well as a further 3,0 m (1,5 m each), for separation strips between pedestrians and traffic (1,5 m each).

On the assumption of a kerbed cross section with six 3,6 m wide lanes, a 9,6 m median as described above, outside shoulders of 0,6 m and provision of sidewalks and sidewalk separation strips, each of 1,5 m in width, the two remainder-of-verge areas would be 5,0 m wide each in a 48,4 m nominal cross section. This should be sufficient for the purposes of earthworks, landscaping and the provision of roadside furniture

Premised on the same cross-sectional elements and dimensions described above, a 40 m nominal road reserve would provide only two 0,8 m wide remainder-of-verge areas for roadside furniture, landscaping and earthworks after the provision of sidewalks and sidewalk separation strips.

In the case of a four lane road with 3,5 m wide lanes and one turning lane, a 35 m nominal road reserve would provide for two 3,85 m wide remainder-of-verge areas for landscaping and roadside furniture, after provision of sidewalks and sidewalk separation strips, whilst a 40 m road reserve would provide for 6,35 m wide remainder-of verge areas. A 30 m nominal road reserve in contrast would only provide for 1,35 m wide remainder of verge strips.

4.10 Bus (or rail) Rapid Transit (BRT)

The BRT routes recently developed and being developed in Johannesburg and Tshwane, comprise retrofitting, often into Class 3, sometimes even Class 4 roads. A BRT route section is only being retrofitted to a Class 1 road in the case of PWV9 in Tshwane. In Johannesburg some of the Class 2 roads being used as BRT routes function as Class 2 roads, but comprise narrow road reserves.

The lane widths used are of the order of 3,5 m. Posted speed limits of 60 km/h apply to most of these roads and streets. Freeway speeds are expected to apply to the BRT route on PVW9.

Should BRT routes eventually be extended to follow a Class 2 K-route, the roadside regime will dictate the speed to be posted. If the posted speed is lower than the design speed, there should be gains in terms of rider comfort and operational efficiency.

4.11 Road lighting

Road lighting plays an important part in urban road and street traffic safety. In the absence of full width road shoulders and to ensure that stranded vehicles or other obstacles are observed well in time by motorists at night, road lighting is considered imperative. This is particularly pertinent to the six lane stage of Class 2 roads, but also to urban Class 3 roads that generally would not have shoulders, except in a transitional single carriageway two lane phase.

5. PIARC SEMINAR ON VULNERABLE ROAD USERS

The recent, October 2009, PIARC Seminar, held in Cape Town, has once again highlighted the need for due consideration of traffic safety in the design and operation of roads, particularly that of vulnerable road users (VURs) such as pedestrians, cyclists and scooter users. Aspects considered relevant to this review from the papers presented are:

- the need for adequate sight distance;
- the value of adequate road reserve widths to separate VRUs from general traffic;
- not to plan/allow strip development over long lengths of road;
- the appropriate planning and provision of different functional road classes;
- creating appropriate speed regimes;
- the provision of non road based public transport in order to reduce interfacing conflicts; and
- provision of adequate numbers of pedestrian overpasses on mobility routes.

In conjunction with the matters raised above, the long standing requirements that no schools, crèches or other pedestrian-intensive development initiatives, should be permitted adjacent to mobility roads, needs re-emphasis.

In a departure from past departmental thinking, it appears necessary to make allowance for pedestrian movements alongside Class 2 roads. Pedestrian movements along Class 3 roads are well established. In section 4.8, mention has been made of the road reserve implications of providing for such movements. In this section it is advocated that the construction of sidewalks become an integral part of road construction. It is also proposed that landscaping and the separation strip between pedestrian and vehicular movements, be combined in places to create more pleasing roadside aesthetics and reduce the starkness of parallel sidewalks.

6. RECOMMENDATION

6.1 Approach

Following from the above review, it is recommended that the department revises its current geometric design guidelines, accepting the latest AASHTO/SANRAL design approach related to design speed and sight distance. It is also recommended that the philosophies of Human Factors and Context Sensitive Design be adopted. Similarly, a more flexible and pragmatic design approach regarding the selection of design parameters should be adopted, as allowed for by the Design Domain concept. In this regard it is envisaged that a range of acceptable design parameters be established, built around a set of benchmark values. This will also require the establishment of a formal framework of Design Exceptions.

As indicated earlier, it is not considered necessary for the Department to develop standards for Class 3 roads, but guidance could be provided, with particular reference to road reserve widths to be protected for future Class 3 roads.

6.2 Road reserve widths

Developing a new Roads Design Manual along the lines indicated above will take some time to complete. There also appears to be some urgency to get clarity on the issue of nominal road reserve widths. Hence in view of the foregoing review analysis, proposals are made below in this regard.

6.2.1 Class 2 roads

With regard to nominal conventional road reserve widths, it is considered feasible to abandon the current 62 m Class 2 rural category, as it is most unlikely that a rural Class 2 road would be developed to the six lane stage.

The 62 m width could be retained as benchmark value for Class 2 routes forming part of the Gauteng Strategic Public Transport Network and incorporating dedicated lanes, subject to a conscious policy decision with regard to the number of normal traffic lanes to be provided, i.e. a reduction from six to four, or the retention of six as the norm.

For Class 2 roads without dedicated public transport lanes it appears preferable to retain the nominal road reserve width of 48,4 m as benchmark value. A width of 40 m appears just too tight, particularly if the installation of roadside furniture in an urban setting is considered, whilst there appears to be little merit in creating a new cross-sectional standard, for instance of 44 m. The 48,4 m reserve is also more amenable to the accommodation of public transport lay-bys and shelters, in cases where public transport is provided in mixed traffic conditions.

6.2.2 Class 3 roads

The nominal benchmark road reserve width for four-lane Class 3 roads could be 35 m. A width of 40 m appears generous and possibly best suited for use where public transport services are envisaged in mixed traffic, for the establishment of boulevards and/or where for particular reasons six lane roads are envisaged in the Class 3 category.

A road reserve width of 30 m such as those of some of the current singe carriageway provincial roads, ideally, should be widened once these roads are incorporated in the urban fabric as Class 3 roads. The 30 m road reserve width should suffice for rural single carriageway roads in the Class 3 category.

It is known that the municipal authorities at times are forced by circumstances to use 25 m wide road reserves for Class 3 roads, in which case a further 0,2 m would have to be pruned off the widths of each of the constituent elements forming the road cross section / and or local widening at intersections would have to be resorted to. In such cases a concomitant reduction in operating speed is indicated to match the speeds applicable to collector roads normally provided in 25 m wide road reserves.

6.2.3 Freeways

With regard to freeway road reserve widths, it appears desirable that the nominal 80 m width be retained where dedicated transport lanes are envisaged. A nominal width of 70 m could be considered for freeways not forming part of the Strategic Public Transport Network, but current experiences with the GFIP process and the costs being incurred to accommodate the required infrastructure within existing road reserves, by erecting retaining walls and similar measures, caution against a reduction of the current freeway road reserve widths. Obviously a more flexible design approach would enable reduced widths, e.g where a freeway is not envisaged to be developed past the four lane stage.

6.2.4 Special cases

The formal adoption of a context sensitive design approach and a more pragmatic approach to the selection of design parameters, would do away with the need for standards for special cases.

6.2.5 Retrofitting

Retrofitting is the art of the possible/affordable and no specific guidelines are envisaged in this regard.

6.2.6 Summary Table

The main recommendations with regard to envisaged benchmark values for road reserve elements and road reserve widths are summarised in Table 6.2.

6.3 Developing a new Geometric Design Manual

It is lastly recommended that the department embark on drawing up a new Geometric Design Manual, in terms of the deliberations and recommendations put forward above, i.e. thoroughly revising the current geometric design manual, using this review document as guideline.

The new manual should distinguish more clearly between preliminary design and detail design and should also focus wider than only road traffic movements to include all community movement needs.

The ideal would be to aim towards a national standard, e.g. SANRAL, supported where necessary by Gauteng specific standards, based on these recommendations.

Table 6.2 : Envisaged Benchmark Values for Road Elements and Road Reserve Widths

Class and Type of Road/Element	Class 1 Freeways. No dedicated Public Transport Lanes	Class 1 Freeways, with dedicated Public Transport Lanes	Class 2 (K) Roads. Kerbed. No dedicated Public Transport Lanes	Class 2 (K) Roads. Kerbed, with dedicated Public Transport Lanes	Class 3 Roads Kerbed. Urban	Class 3 Roads. Rural
Number of lanes	8	8 + 4 PT	6	6 + 2 PT	4	2
Number of turning lanes	N/A	N/A	2	2	1	1
Number of sidewalks	N/A	N/A	2	2	2	N/A
Number of verges	2	2	2	2	2	2
Road reserve width	70 m	80 m	48,4 m	62 m	35 m	30 m
Lane width	3,6 m	3,6 m	3,6 m	3,6 m & 4,0 m	3,5 m	3,5 m
Turning lane width	N/A	N/A	3,4 m	3,4 m	3,3 m	3,5 m
Inner shoulder width	2,8 m	2,8 m	0,6 m	0,6 m	0,6 m	N/A
Outer shoulder width	2,8 m	2,8 m	0,6 m	0,6 m	0,6 m	2,8 m *
Median width (Inclusive of inner shoulders)	20,0	30,6 m	9,6 m	21,0 m	6,1 m	N/A
Sidewalk width	N/A	N/A	1,5 m	1,5 m	1,5 m	N/A
Sidewalk separation width	N/A	N/A	1,5 m	1,5 m	1,5 m	N/A
Verge / Remainder of verge width	7,8 m	7,5 m	5,0 m	5,5 m	3, 85 m	6,95 m

* Generally shoulders are surfaced, except Class 3 rural roads, which would normally be gravelled.

Note : 1. The above widths make no provision for cycle lanes. Should it be desirable to provide cycle lanes; the outside shoulder should be widened by 1,2 m and the verge/remainder verge width reduced by this number.

2. The provision of public transport lay-bys with shelters will require approximately 8,0 m of verge width (inclusive of the sidewalk and sidewalk separation)