



THE R300 TOLL STRATEGY CONCEPT AND ITS POTENTIAL EFFECT ON EXISTING ALTERNATIVE ROUTES

AUGUST 2002



1 INTRODUCTION

In October 1998 the Peninsula Expressway Consortium (Penway) submitted an Unsolicited Proposal to the South African National Roads Agency Ltd. (SANRAL) for the granting of a concession to develop, finance, operate and maintain the R300 Ring Road in Cape Town. Following the review of this proposal by the SANRAL, the Penway Consortium was awarded Scheme Developer Status for this concession in February 2000. In terms of the Unsolicited Proposal process, it is a requirement that on attaining Scheme Developer Status, a detailed traffic and toll feasibility study be conducted for the concession/project route. Consequently such a study was undertaken for the R300 Ring road, this study being completed at the end of 2000.

Since the beginning of 2001 and up to the present time, the development planning process for the R300 Ring Road has progressed. In this regard and by way of example, the scoping process for the required Environmental Impact Assessment (EIA) has been completed and additional study work has been undertaken for the purposes of determining the project's socio-economic merits. In addition, a considerable amount of preliminary design related work has also been undertaken, for the following purposes:

- a) To obtain greater clarity on the project's physical and geometric requirements;
- b) To provide sufficient information to enable specialists to conduct their investigations as part of the Environmental Impact Assessment (EIA);
- c) To provide sufficient information to enable the general public and other interested and affected parties (I & APs) to comment on the project as part of the Public Participation Process (PPP); and
- d) To obtain greater clarity on the project's cost implications and to assist with the verification by the authorities of the project's financial and economic feasibility.

Stemming from the continuing planning process outlined above, the public in general have become better informed on the R300 Ring Road project and as such various interested and affected parties have raised concerns whilst others have requested or sought to obtain additional information on the project. In this regard a significant number of concerns and/or requests for information have been raised with respect to traffic and toll related issues and hence it is in this context, that this report has been produced.



In compiling this report it is not the intention to reproduce and report on work undertaken and reported on in other studies (e.g. the original Traffic and Toll Feasibility Study, the Socio Economic Study etc.) but rather to report solely on issues that have emerged as a result of the publication of these and other studies and ongoing work. Consequently and for its greater part, this report presents information on the following:

- The theory of a ring road system
- The R300 toll strategy concept
- The traffic impact on the surrounding road network

2 THE THEORY OF A RING ROAD SYSTEM

Many cities around the world have a ring road system(s). This aside, the pertinent question is how would Cape Town benefit from the development of the proposed R300 Ring Road?

By way of formulating a response to the above question it is important to note that Cape Town's existing primary freeway system;

- Radiates outwards from the Central Business District (CBD), the N1 following a north-easterly alignment and the N2 a south-easterly alignment.
- Incorporates the N7 which follows a north south alignment and which crosses the N1 in the north but which terminates in the south at its junction with the N2.
- Incorporates segregated sections of Metropolitan freeways (e.g. the M3, the M5) which follow north-south alignments and which are located south of the N2.
- Incorporates that part of the Ring Road that already exists, namely the R300, which extends from the N1 in the north, crosses the N2 in the south and which terminates some 6km south-west of the N2/R300 Interchange at Vanguard Drive.

Apart from the N1 to N2 section of the N7 and the existing section of the R300, the fact that the remaining freeway sections radiate from the CBD or conversely merge as they approach the CBD, resulting in;

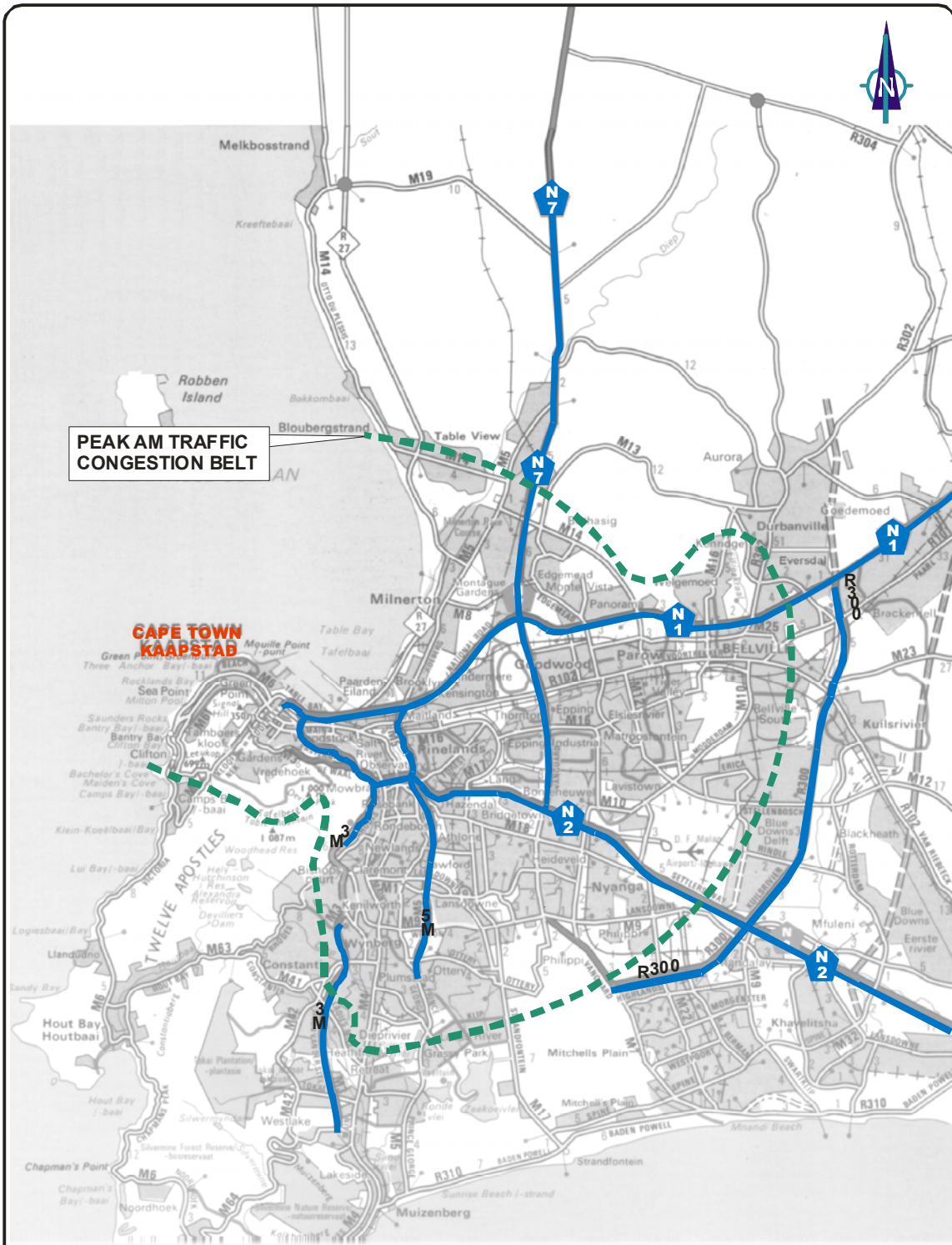


- The traffic demands on these routes merging onto a lesser number of routes (i.e. in many instances the freeways merge to form a unitary / common freeway) as they approach the CBD.
- Essentially what can best be described as a congestion ring, which forms on the freeway system in peak periods, particularly along the N1 & N2 corridors, and which extends eastwards towards the R300 corridor. (Refer to Figure 1).

This congestion ring results not only in serious delays and costs for those motorists who use routes such as the N1 and N2 to access / egress the Cape Town (CBD) but also creates similar problems for those motorists whose trip origin or destination is not the CBD but who must pass through this congestion ring to reach their desired destination. Trips in this latter category include those motorists travelling between the northern areas and the southern areas of Cape Town but depending on exact location, also includes trips between the north-east and south-west, the north and south-east etc.

In terms of addressing the above problem, it is important to recognise that if the traverse trips can be accommodated by an alternative option which can offer a higher level of service then not only will benefits accrue to these “transverse trip” motorists but also to those motorists who continue to use routes such as the N1 and N2 to access/egress the Cape Town CBD. This can be reasoned since the removal of the traverse trips, many of which “double-load” sections of the freeway network radiating from the CBD, will result in improved operating conditions for the “more captured” N1 and N2 road users.

In promoting the completion of the R300 Ring Road, that is, extending the existing R300 northwards from the N1, through Durbanville and across the N7 to Bloubergstrand, and westwards and southwards from Vanguard Drive to the southern suburbs of Cape Town and Muizenberg, the objective is to attain the above goal. In this regard and in terms of providing a high standard route which can offer a higher level of service outside the ring of congestion, it has been demonstrated that the R300 Ring Road will be extremely beneficial and it is for this reason that the development of this route is being entertained.



**Cape Town
Congestion Envelope**

**Fig.
1**



3 THE R300 TOLL STRATEGY CONCEPT

3.1 TOLLING SYSTEM CONCEPTS

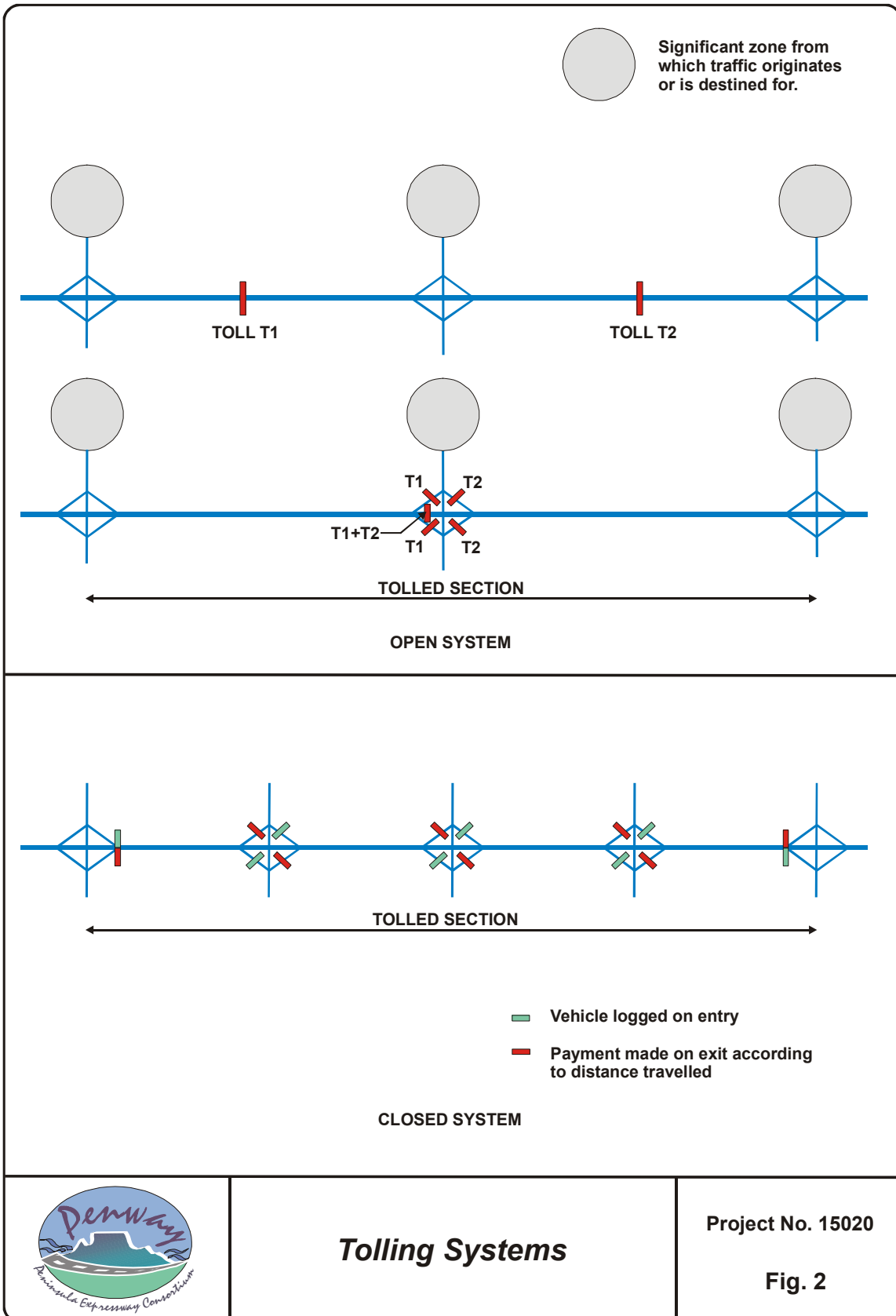
There are three fundamental tolling system concepts, namely:

Open Systems which are normally applied on rural roads where travel movements are dominated by longer “through” trip movements and where for the greater part, an equitable charging mechanism can be attained simply by installing toll plazas between major trip origins and destinations or alternatively by utilizing a combination of ramp plazas and mainline plazas (refer to Figure 2).

Closed Systems which are normally applied on urban roads where the distance travelled on the facility can vary greatly, because of the varied trip origin / destination patterns existing within the urban environment. Consequently and in order to ensure total equitability of the system the concept of tolling every on and off-ramp is employed (i.e. the vehicle is logged/ recorded at point of entry and payment is made at point of exit according to the length travelled along the facility). (Refer to Figure 2)

Intermediate Systems which essentially expand the Open System concept to incorporate further plazas which can provide a more equitable charging mechanism for more varied trip origin / destination patterns. The advantages of this system compared to the Closed System are:

- The recording of vehicles is only required at one location only (i.e. not at both point of entry and point of exit).
- In addition to the equipment costs savings resulting from the above, the reduced number of plazas incorporated in Intermediate Systems when compared to Closed Systems, results in further savings in toll plaza development costs, toll collection / operational costs etc.





The tolling system proposed for the R300 Ring Road in Cape Town falls into the category of Intermediate Systems as defined above. In developing the system or alternatively the tolling strategy, the pursued objective has in essence been to optimise equitability and cost. Maximising equitability is obviously important since one wants to ensure that the charging mechanism is equitable. This aside it needs to be acknowledged that an inequitable system is not in the best interest of the concessionaire or the road authority since it will reduce the use of the facility (by those who object to its unfair charging mechanism) and hence it will have a direct negative impact on revenue. Minimising cost is of equal importance since savings made in this regard will ultimately get passed on to users in the form of lower toll rate charges.

3.2 THE R300 STRATEGY IN MORE DETAIL

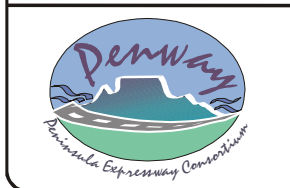
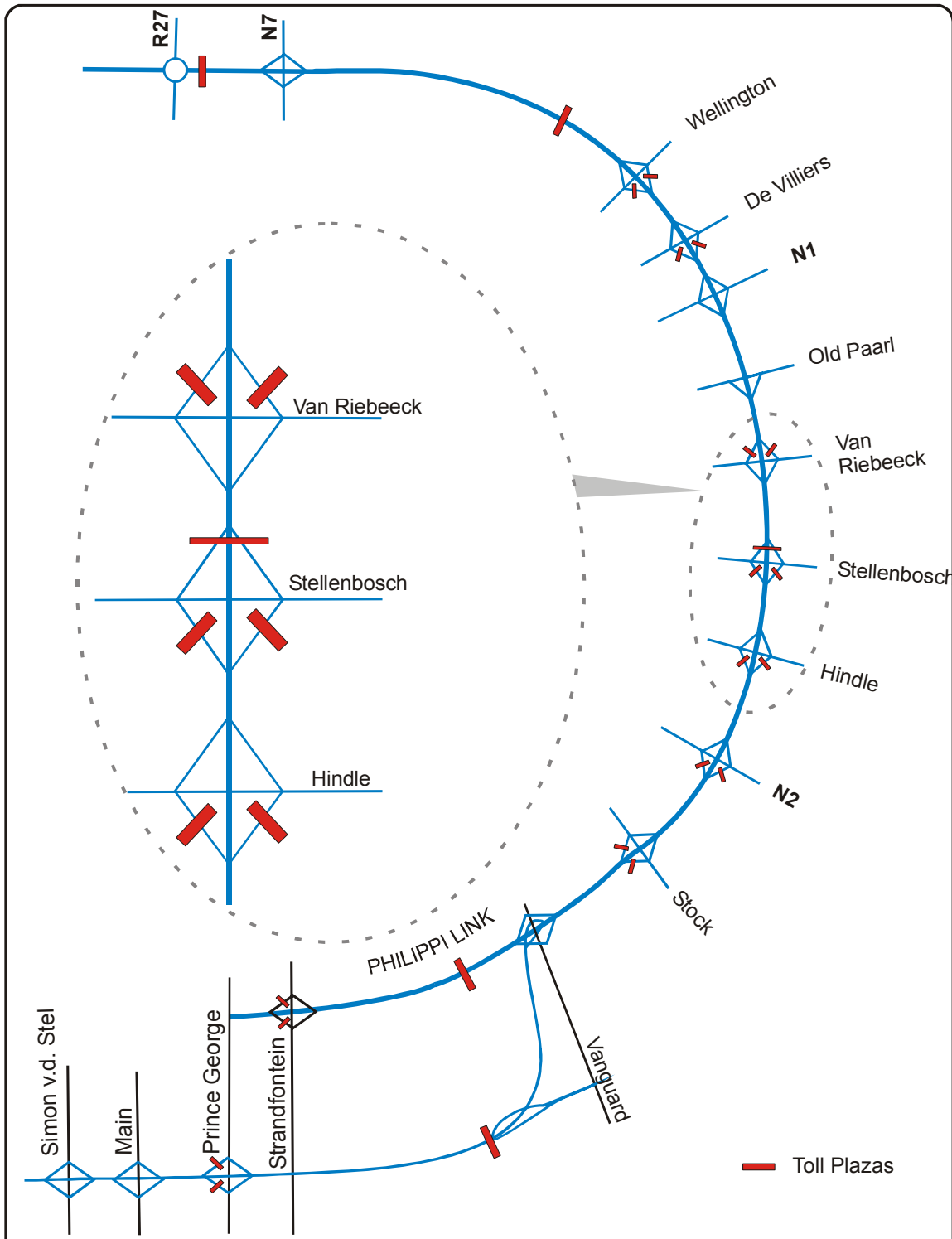
The proposed R300 strategy is shown in Figure 3. In developing this strategy note has been taken of the fact that many of the trips utilizing the R300 will emanate from or be destined for the three major national routes which cross / will cross the R300 (i.e. the N1, the N2 & the N7) and consequently the strategy incorporates five mainline plazas, as follows:

- One west of the N7
- One between the N7 and the N1
- One between the N1 and the N2
- One on each of the two proposed southern links which will extend the existing R300 from the N2 at Vanguard Drive, to the southern areas and Muizenberg.

Four of the above mainline plazas are located on proposed new sections (extensions) of the R300, the one between the N1 and N2 being located on the existing but upgraded and widened R300.

The above five mainline toll plazas will enable those users of the R300 who travel between the national routes to be equitably charged, that is:

- If one travels between the West Coast (Bloubergstrand) and the N7 one will be charged at the mainline plaza located west of the N7.



Tolling Strategy

Project No. 15020

Fig. 3



- If one travels between the N7 and the N1 one will be charged at the mainline plaza located between the N7 and the N1.
- If one travels between the West Coast (Bloubergstrand) and the N1 one will be charged at the mainline plaza located west of the N7 and at the mainline plaza located between the N7 and the N1.
- Etc, etc.

Further to the above, it is recognised that many trips on the R300 do not originate from or are destined for the national routes but that they access / egress the R300 at various intermediate interchanges. To insure that the vast majority of these trips do not have to pay the full “national road” to “national road” toll tariff, a large number of ramp toll plazas which will incorporate lower toll tariff charges (i.e. in comparison to the mainline plazas) are included. Using the N7 to N1 section of the R300 as an example, one will therefore pay one tariff if one travels between the N7 and the N1, a lower tariff if one travels between the Wellington Interchange and the N1 and an even lower tariff if one travels between the De Villiers Interchange and the N1.

3.3 TOLL EQUIPMENT

Urban tolled motorways carry daily traffic volumes far in excess of those encountered on rural tolled motorways and hence it is imperative that toll plazas located on the former, are designed to ensure efficient operation with minimum delays being experienced at the toll plazas. In this regard it is also important to acknowledge that Concession Contracts like the R300 (and unlike those roads funded by more traditional means) have stipulated conditions with respect to the Level of Service (LoS) which must be provided on the road and at interchanges (i.e. these conditions triggering the requirement as to when additional capacity must be provided) and which must also be provided at toll plazas (i.e. minimum acceptable service rates, incorporating maximum allowable queue lengths, delays etc).

In order to ensure conformity with the above conditions, not forgetting the fact that for cost/economic reasons it is beneficial to incorporate “built-in” spare capacity in any initial development phase, there will be the need for the R300 project to incorporate the full range of payment mechanisms. Consequently the tolling proposals for the R300 project have taken cognisance of the need to provide for manual tolling (payment by cash), automatic tolling (payment by credit card, garage card etc.) and electronic tolling (payment by means



of tags in vehicles and Dedicated Short Range Communication (DSRC) technology which obviates the need for vehicles to stop at toll plazas).

3.4 TOLL PLAZA TRAFFIC VOLUMES

When submitting tenders for the proposed R300 Ring Road Concession, potential concessionaires will evaluate the benefits of the R300 project, the costs associated with financing, constructing, operating and maintaining this project, determine what they conclude can be equitably charged in terms of toll rates and in the event where they conclude the project to be feasible and viable, subsequently submit a tender.

Since the R300 project is still in the pre-tender stage it is not possible at the present time to categorically state that the project will ultimately be adopted by the SANRAL and if it were to be adopted, what the final outcome on toll rate levels will be. Consequently without this clarity, it is somewhat difficult to be specific regarding the levels of traffic demand that the proposed plazas shown on Figure 3 will be required to service/accommodate. This aside, using the transportation model developed to study the R300 project, it is a more straightforward task to predict the traffic demands, that will pass through the toll plaza locations, assuming zero toll (i.e. assuming the road is not tolled). The representative figures in this regard, expressed in terms of Year 2000 traffic demands, are shown in Table 1.

Table 1: Representative Traffic volumes at Toll Plaza Locations - Zero Toll : 2000 Traffic Demands Both Directions Combined

Plaza Location	Daily Volume	A.M. Peak Hour Volume
Westcoast Mainline (west of N7)	8460	1035
Vissershok Mainline (east of N7)	7890	935
Wellington Southern Ramps	14900	1740
De Villiers Southern Ramps	14660	1680
Van Riebeeck Northern Ramps	20300	2790
Stellenbosch Mainline	42250	5760
Stellenbosch Northern Ramps	12710	1590
Stellenbosch Southern Ramps	15310	2340
Hindle Southern Ramps	9920	1170
N2 Southern Ramps	19670	2600
Stock Southern Ramps	10170	1560
Philippi Mainline	34350	5280
Strandfontein Western Ramps	5540	800
Southern Alignment Mainline	17620	2720
Prince George Western Ramps	9760	1480



4 THE TRAFFIC IMPACT ON THE SURROUNDING ROAD NETWORK

4.1 INTRODUCTION

In general when developing toll road projects, the three most asked questions are:

- Where will the toll stations / plazas be located?
- What is the level of toll that will be charged?
- What will be the effect on the existing alternative routes or road network as a result of toll diversion?

Information on the first question above was presented in Section 3 and as mentioned previously, clarity on the toll rates to be levied will only be attained on award of the tender or upon signature of the concession contract. The third or last of the above questions is addressed hereunder.

4.2 ASSESSMENT METHODOLOGY

By way of formulating a response to the third question above, it is important to recognise that:

- a) As a result of extending the R300 northwards (i.e. from the N1 to Bloubergstrand) and westwards and southwards (i.e. from Vanguard Drive to the southern areas and Muizenberg), traffic will be attracted to these new sections. The concentration of traffic on these new sections, which will provide direct access/egress to the existing section of the R300, will therefore increase the traffic volumes on the existing section of the R300.
- b) The fact that the existing R300 section is to be upgraded, initially to provide 6 lanes and thereafter 8 lanes, will also result in traffic demands along the existing R300 section increasing.
- c) Offsetting the above traffic increases, there will be traffic diversion resulting from the fact that the R300 is to be tolled.

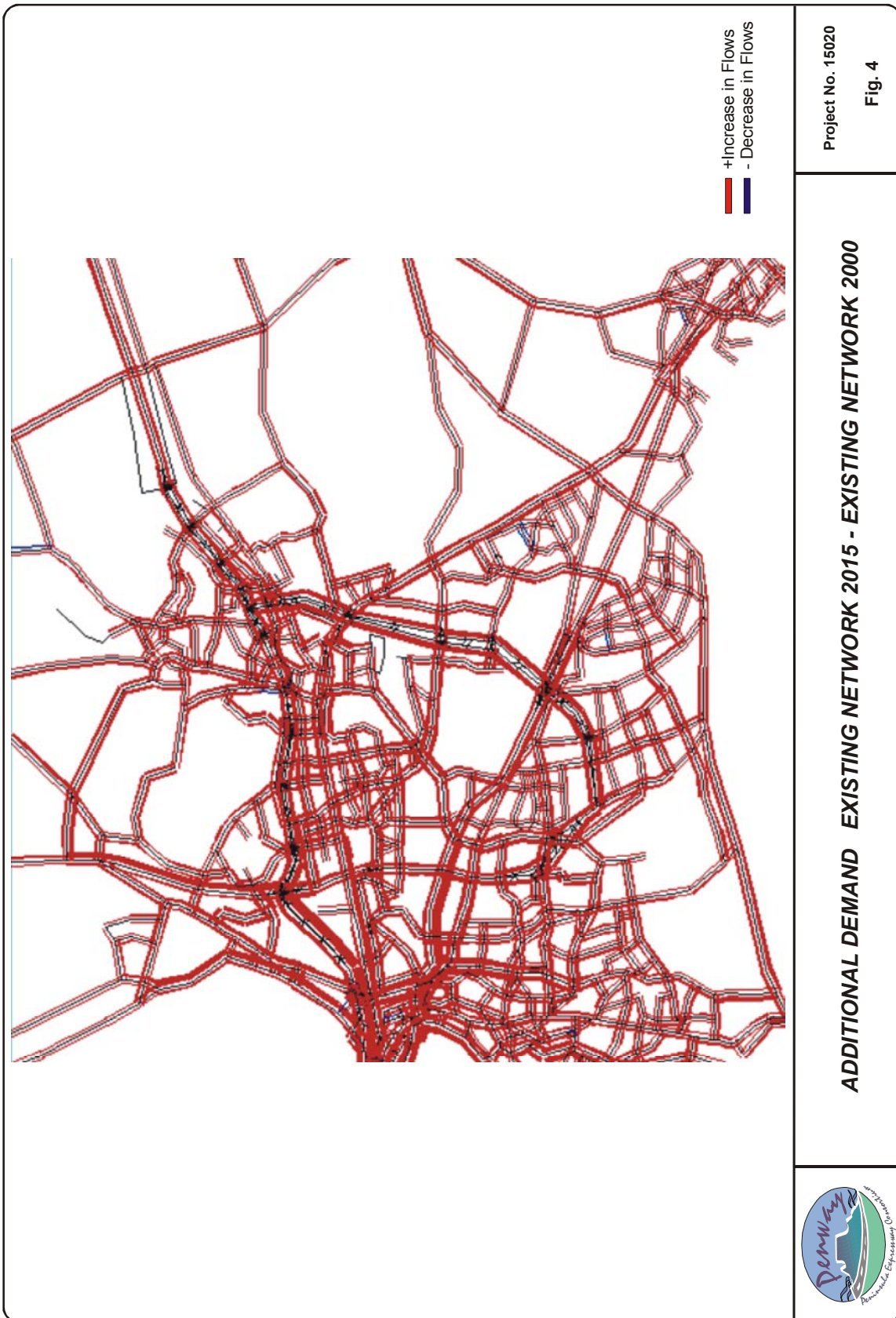
In terms of the above perspective and acknowledging that the tolled new sections of the R300 will attract traffic (i.e. if this was not the case the current R300 DBoT initiative would not have been entertained), it can be simply concluded that the tolled new sections of the

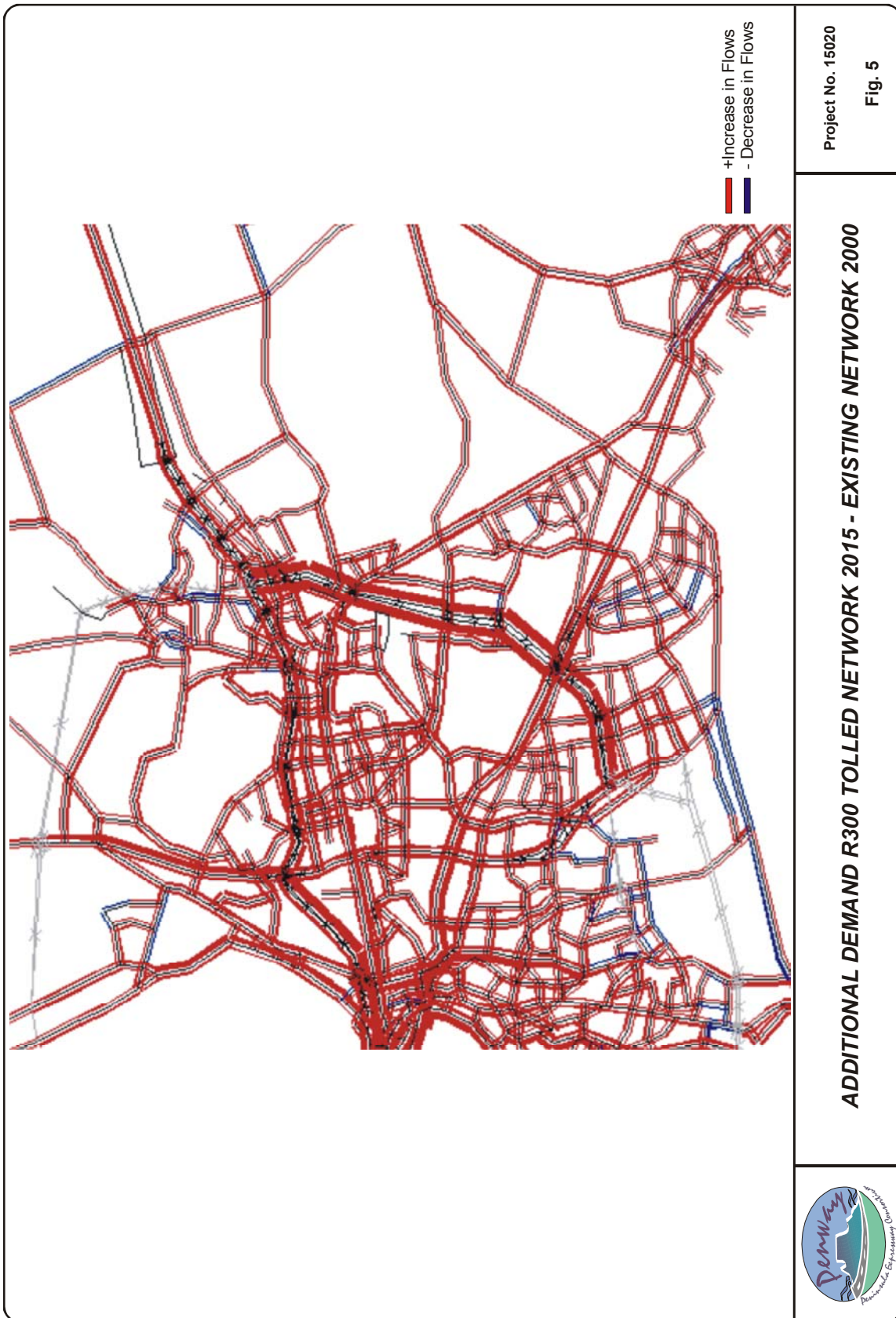


R300 will bring about improved operating conditions on the alternative road network to the three new road sections. This being the case, the only pertinent issue that needs to be resolved is how do the positive traffic implications in a) and b) above compare to the negative implications in c) above, with respect to the upgrading and tolling of the existing section of the R300 between the N1 and Vanguard Drive.

In order to provide more detailed information on the pros and cons of an upgraded / tolled existing R300 and the resulting effect on the alternative road network and bearing in mind that upon the opening of the full R300 project, the R300 will at least initially, have to provide sufficient capacity up to Year 2015, it was deemed appropriate to perform model tests using the Year 2000 base year and Year 2015 design year scenarios. In this regard the following tests were performed:

- i) An assignment was produced for the Year 2000 traffic demand on the existing road network and thereafter a further assignment produced for the Year 2015 traffic demand on the existing road network. Subsequently the demands predicted in these two assignments were subtracted in order to produce a plot that shows the increased traffic demands that will be experienced on the existing road network (R300 upgrading, extensions and tolling excluded) in the period 2000 to 2015 (refer to Figure 4).
- ii) The above process was repeated, however, in this instance comparisons were made between the Year 2015 traffic demand (existing road network and R300 upgraded, extended and tolled included) with the Year 2000 traffic demand on the existing road network. In this regard certain assumptions had to be made with respect to toll rate levels, these being that they would generally be in line with those prevailing on other urban toll road projects. Here again the demands predicted in these two assignments were subtracted and a plot produced in order to show the increased traffic demands that will be experienced on the existing road network in the period 2000 to 2015 but with the R300 upgrading, extensions and tolling included. (Refer to Figure 5).



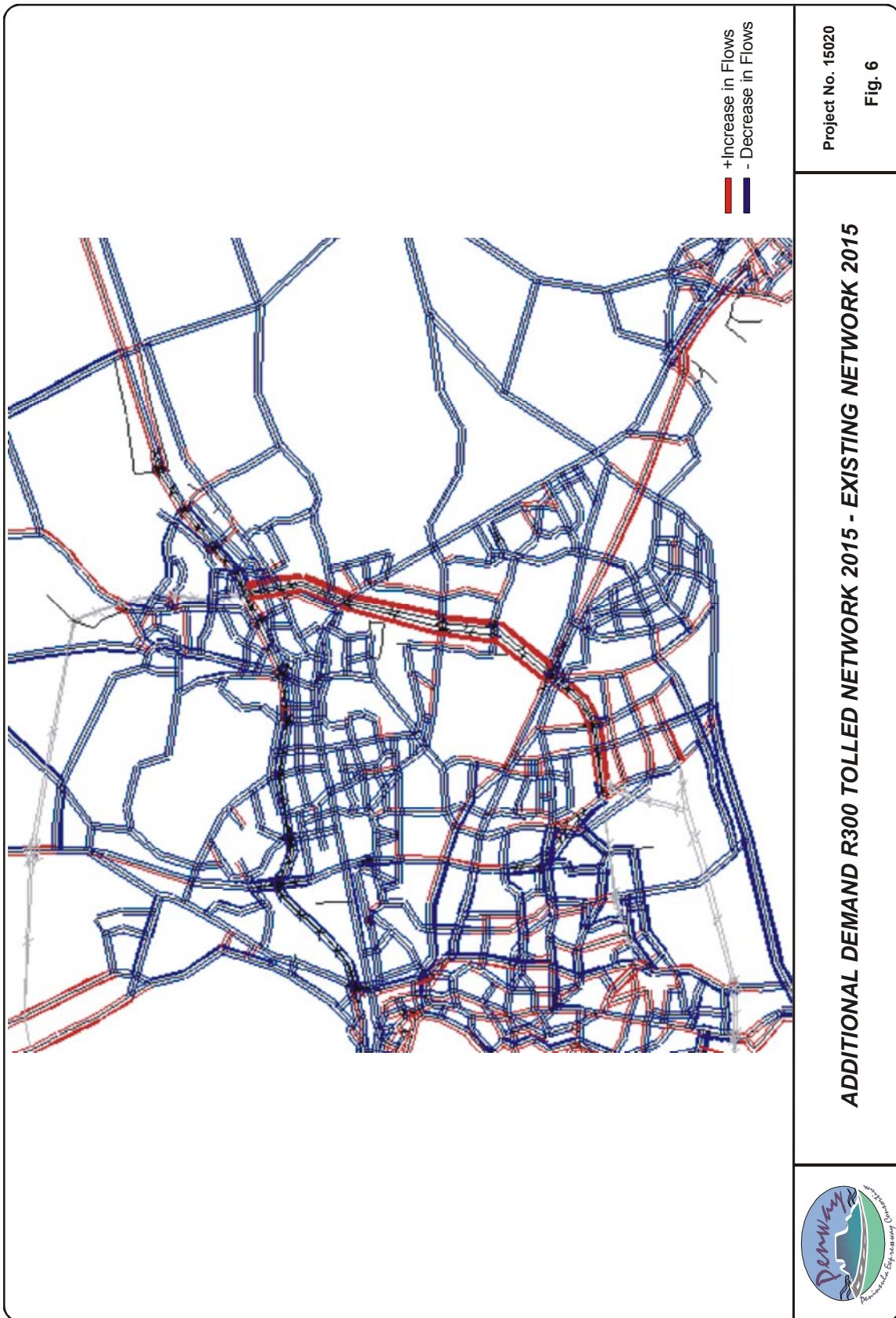




Examination of the information contained in Figure 4 & 5 shows that the increase in traffic on the alternative network with the R300 not upgraded, extended and tolled is very similar to the increase in traffic on the alternative network in the case where the R300 is upgraded, extended and tolled. To obtain further clarity in this regard a further plot was compiled, this plot showing the differences in traffic volumes as depicted in Figures 4 & 5. In Figure 6 those roads that carry less traffic when the R300 is upgraded, extended and tolled are shown in blue and those roads that carry more traffic when the R300 is upgraded, extended and tolled are shown in red.

From examination of the information contained in Figure 6 the following can be concluded:

- In the period 2000 to 2015 and with the R300 upgraded, extended and tolled, seventy two percent of the road network incorporated in the R300 transport model can be expected to experience lower traffic volumes than it would have done had the R300 not been upgraded, extended and tolled.
- In the period 2000 to 2015 and with the R300 upgraded, extended and tolled, twenty eight percent of the road network incorporated in the R300 transport model can be expected to experience higher traffic volumes than it would have done had the R300 not been upgraded, extended and tolled.
- With respect to those roads which can be expected to experience higher traffic volumes, it is not unexpected that the existing section of the R300 is anticipated to experience the greatest traffic volume increase (i.e. for the reasons outlined in a) and b) above). In this regard it is therefore important to re-emphasise that in terms of any Concession Contract, it will be the responsibility of the Concessionaire not only to upgrade the existing R300 but to all times ensure acceptable operating conditions / levels of service. Consequently it can be concluded that the higher traffic volumes on the R300 do not have a negative connotation.





-
- Of the remaining alternative routes which can be expected to experience higher traffic volumes, those which probably draw the most attention the most are the Nooiensfontein and Delft Main Belhar corridors which lie adjacent to and east and west respectively of the mainline toll plaza location proposed on the existing section of the R300. Detailed inspection of these higher volume increases does however reveal that the relative increase is not dramatic (i.e. < 150 veh/hr in the peak hour). As a result of examining this aspect further, it is concluded that this result stems from the fact that the diversion around the mainline plaza is local in nature and that those longer based trips who choose not to use the R300 or who choose to deviate from the R300 because of toll, do so at locations removed from the existing section.