ANNEXURE N10:
TRAFFIC STUDY BY BURMEISTER AND PARTNERS

Traffic Impact Assessment
Rio Tinto Rössing Uranium Limited

FINAL REPORT
MARCH 2010

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Traffic Impact Assessment
Rio Tinto Rössing Uranium Limited

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List of abbreviations

ADT	average daily traffic
CBD	central business district
D	district road
EIA	environmental impact assessment
HV	heavy vehicles (above 3.5 ton)
LV	light vehicles (less than 3.5 ton)
MVA Fund	Motor Vehicle Accident Fund
PMP	Port Master Plan
RA	Roads Authority
RFA	Road Fund Administration
Rössing Uranium	Rio Tinto Rössing Uranium Limited
RSA	Road Safety Audit
SADC	Southern African Development Community
TIA	traffic impact assessment

List of road numbers

B2	The tourist route number for the trunk road from Okahandja to Walvis Bay via Swakopmund
C14	The tourist route number for the last section of the direct link road between Windhoek and Walvis Bay via the Us Pass
C34	The tourist route number for the road behind the dunes between Swakopmund and Walvis Bay
D1911	The district road number for the road from the B2 to Arandis/Rössing Uranium
D1984	The district road number for the road behind the dunes

1. EXECUTIVE SUMMARY

A traffic impact assessment (TIA) was requested in order to assess how Rio Tinto Rössing Uranium Limited's (Rössing Uranium) proposed mineexpansion would affect the transportation infrastructure environment in which it operates.

The effect of an increase in transportation needs due to the mine's expansion was assessed by investigating the current traffic conditions on the affected road network, the transportation of staff, and the transport logistics relating to the delivery of sulphuric acid. The assessment was conducted against the background of traffic growth in the network concerned in general, and the effect of imposed traffic due specifically to the direct influence that increased mining activities would have on the road network used by Rössing Uranium.

The assessment was done for a planning horizon up to 2026, the mine's expected lifetime.

It is predicted that traffic volumes on the B2 will increase in the order of 40% due to the Rössing Uranium expansion and by a further ± 40% due to general expected growth in traffic on the road network. Based on this, two growth scenarios of 40% and 80% respectively were used to increase the current traffic volumes at the critical intersections. These scenarios were then analysed by means of Sidra, a traffic engineering simulation program, in order to determine the degree of impact. Using Sidra, the level of service at which an intersection operates can be determined for different traffic conditions. The level of service is used as a criterion to quantify the impact on an intersection due to increase in traffic.

The expected increase in staff was assigned to place of residence in the same proportions as that for current places of residence. Based on this, the number of additional bus trips was used to determine the number of additional buses required.

Rail as an alternative to road transport in respect of transporting workers to the mine was assessed from a total transport solution approach.

The report also reviews the current logistics with regard to the delivery of sulphuric acid to the mine.

In addition, the capacity of emergency services was determined in order to establish the potential risk should a major operations-related incident take place at the mine.

The collision data on the affected roads were also analysed to assess types of vehicle collision, and to relate that information to improving traffic management and/or infrastructure.

As part of the TIA, a suitably specialised traffic engineer conducted an independent road safety audit. The findings of the audit are summarised by way of a list of traffic management issues that need immediate attention, and road infrastructure shortcomings that need to be addressed with time. It is suggested that the audit findings be conveyed to the relevant authorities at an appropriate forum.

Since there is still a large amount of spare capacity on the national road network, increased traffic due to increased operations at Rössing Uranium and other developments would not impact the general road network negatively, but there are certain intersections where an increase in traffic might have a negative impact.

Furthermore, the inconsistency of the geometric standard at intersections along the B2 was observed and identified as a potential problem associated with an increase in traffic.

To mitigate the effect of the traffic increase and to improve on safety, a concept traffic management and geometric improvement proposal was developed for the Arandis/Rössing Uranium intersection with the B2, in which the road-over-road bridge is used to eliminate all right-turning movements on the B2.

2. PURPOSE AND SCOPE

The objective of the consultancy was to undertake a traffic impact assessment (TIA) for Rio Tinto Rössing Uranium Limited (Rössing Uranium) on their intended increase in production at the Rössing mine.

The concern is whether the transport infrastructure would be adequate to accommodate the increased development activities in the Erongo Region, particularly as regards the infrastructure related to Rössing Uranium activities.

The planning horizon used is 2026, based on the current projected life of the mine.

The Consultant was requested to draft the terms of reference for the TIA, and did so based on the normal items that are expected in such an assessment. As the study progressed, a better understanding was obtained of the transport environment to which Rössing Uranium is exposed.

It also came to light that several other new mines in the area would undertake their own TIAs.

3. INTRODUCTION

The following extract is taken from the Rössing Uranium document entitled “How we operate”:

Safety is a core value and a major priority; our goal is zero injuries.

Although this goal is interpreted to be applicable to the mining operation and on-site activities, Rössing Uranium also expresses the following commitment in that document:

We are building a supportive safety culture that requires visible leadership.

It is against this background that the TIA is important: it deals with the transport environment in which Rössing Uranium employees have to operate.

Rössing Uranium is accessible via the B2, which is the main road between Swakopmund and Usakos, and leads into the B1 which courses through Namibia from north to south. Currently, the B2 is the only surfaced road linking Swakopmund and Walvis Bay with the interior of the country.

With the development of Rössing Uranium in around 1976, an access road of approximately 70 km was created on the northern side of the B2 from Swakopmund. This access leads to Arandis on the northern side of the B2, and to Rössing Uranium on the southern side of the B2 via a road-over-road bridge.

Traffic volumes on the B2 are relatively low, but there are large seasonal fluctuations. High traffic flows are common during long weekends and school holidays, but especially during the December–January festive season.

The Walvis Bay Corridor Group is also very successful in marketing Namibia as a transport corridor to landlocked African countries through the Port of Walvis Bay along the Trans-Kalahari Highway to Botswana and South Africa, and the Trans-Caprivi Highway to Zambia and Angola.

The Port of Walvis Bay serves as the import/export point for Rössing Uranium mining supplies and commodities.

Rössing Uranium is also served by a dedicated rail line that has a turn-off point from the Swakopmund–Usakos line operated by TransNamib.

Air transport links constitute the Rössing Uranium landing strip for smaller aircraft, and the national Walvis Bay Airport operated by the Namibia Airports Company. The Rössing Uranium landing strip was originally developed by the company, but it has recently been privatised.

Rössing Uranium employees reside in Arandis, Swakopmund and Walvis Bay, and transport is provided for all employees from these towns to the mine. Arandis, which was developed by Rössing Uranium exclusively for its employees, was proclaimed a local authority in 1994, and houses could from then on be privately owned. This could lead to a situation where houses change ownership to non-Rössing Uranium employees, which would in turn result in a different travel pattern over time.

Given the background, this report will mainly address the impact on the road access to the mine and the roads mainly used for Rössing Uranium activities. The report will also focus on the Port of Walvis Bay and the railway line linking the port with the mine.

The road safety audit conducted by an independent traffic engineer forms part of this TIA. The safety audit was also conducted on the internal roads of the mine itself.

The report will also deal with a potential improvement to the B2 access that could contribute to the safety of road users.

4. RURAL ROADS

4.1 EXISTING RURAL ROAD NETWORK

The roads directly affected by Rössing Uranium activities are the B2 between Walvis Bay and Swakopmund, and the B2 between Swakopmund and the access road to Arandis and the mine.

The B2 between Walvis Bay and Swakopmund, also referred to as the *coastal road*, has long been a topic of discussion with regard to its safety, capacity, and the high percentage of heavy vehicles that use it. To relieve the traffic on this road, the road behind the dunes (the C34) was recently upgraded from a gravel road to a saltwearing course. This constituted an attempt to specifically divert heavy vehicle traffic from the B2. However, according to the Roads Authority, they cannot prohibit certain types of traffic on the coastal road if the road behind the dunes is not bitumen-surfaced. There are apparently no immediate plans to upgrade the C34 to a bitumen surfaced road.

The B2 route through Swakopmund towards Usakos is also a controversial issue. Although it is earmarked as a preferred route for heavy vehicles, it remains a route through a residential area, and passes an old age home.

4.2 FUTURE RURAL ROAD NETWORK

Although the B2 is currently the only bitumen-surfaced road to the interior, there are other medium- and long-term possibilities for new surfaced roads. These roads are mentioned here as they would have an impact on the traffic situation on the B2.

The direct road link between Windhoek and Walvis Bay via the Us Pass, namely the C14, would be an extension of the Trans-Kalahari Highway, a regional Southern African Development Community (SADC) corridor.

The concept of such a direct link was initiated in the early 1980s for strategic reasons. After some investigation, the Us Pass route was found to be technically the most practical. The route was then defined, and a high-standard gravel road was constructed for the first 70 km from Windhoek. Construction of the gravel road was shelved in about 1986, however.

In 2003, the Roads Authority conducted a pre-feasibility study to find the most appropriate route to extend the Trans-Kalahari Highway from Windhoek with a direct link to Walvis Bay. The study also found the Us Pass option to be the most attractive.

The advantage of this road is that it would be in the order of 80 km shorter than the existing link between Windhoek and Walvis Bay via Okahandja. A road project like this would require time to mature and become a priority. Should this road become a reality, it would attract most of the Windhoek–Walvis Bay traffic, and would substantially decrease traffic volumes on the B2.

The Roads Authority has also conducted a pre-feasibility study on the potential upgrading of the Swakopmund–Henties Bay–Kamanjab road to bitumen standard. The outcome of this study is not yet known. Although the intention is to improve this road as a tourist route, it would create a more direct option between Walvis Bay/Swakopmund and northern Namibia. One can safely assume that, should this road become a reality, it would also attract traffic from the B2 route.

However, since the future of both roads discussed above is still too uncertain, their effect on the B2 will not be accounted for in the framework of this study.

The upgrading of the road behind the dunes (the C34) will also possibly improve the rural road network, but it seems that the Roads Authority does not have any immediate plans to do so.

Both the C14 and the C34 would in future be classified as Trunk Roads, but no final planning has been done as regards where they would intersect behind Dune 7.

4.3 RURAL ROAD MAINTENANCE

Periodic and routine maintenance on the rural road network is managed by the Roads Authority's regional offices. The subject roads in this study fall under the care of the regional office in Swakopmund/Walvis Bay.

Major rehabilitation programmes are planned and initiated by the Roads Authority head office in Windhoek.

An initial enquiry at the Roads Authority indicated that consideration had been given to call for consultancy tenders in respect of investigating the benefits of rehabilitating the B2 between Walvis Bay and Swakopmund. A follow-up enquiry revealed that, after a visual inspection of the road, the investigation was postponed.

No other major rehabilitation programmes are planned for the roads under discussion.

4.4 TRAFFIC CALMING THROUGH TOWNS

The situation in most towns is that the main road, which falls under the jurisdiction of the Roads Authority, runs through the middle of the town. The conflict between ‘fast’ through traffic and ‘slow’ local traffic constitutes an unsafe situation. In 2005, Burmeister & Partners conducted a traffic calming study for the towns of Karibib and Usakos. A manual was also compiled that could be used as a guideline for traffic calming measures in other towns. Although the proposed measure was accepted, it could not be implemented due to budget constraints until now. The Roads Authority has recently called for construction tenders to affect the proposals made in the 2005 study.

4.5 COST-RECOVERY PRINCIPLES

National roads are funded by road users through road-user charges, namely licence fees, fuel levies, and mass distance charges, which are managed by the Road Fund Administration. Any upgrading or other improvement of national roads is the responsibility of both the Road Fund Administration (funding) and the Roads Authority (management).

In some instances where isolated developments are undertaken, the Roads Authority might require the developer to improve the access at his own expense.

In cases where there is more than one development that necessitates an improvement, it would be reasonable to expect that the cost of improvements is shared.

However, the Roads Authority recently upgraded the Aus–Rosh Pinah road to bitumen standards at its own cost when mine activities at Rosh Pinah were increased.

The above should be kept in mind when traffic improvements are suggested.

5. URBAN ROAD NETWORK

5.1 URBAN ROAD NETWORK PLANNING PRINCIPLES

The national roads network falls under the jurisdiction of the Roads Authority. It is important, therefore, to be aware of the Roads Authority’s policy with regard to access from trunk roads and main roads. Briefly, the policy guideline is as follows:

- No direct access to individual erven is permitted from a trunk or main road within a town
- Access should be via a proclaimed and approved township road network, and
- National roads under the Roads Authority’s jurisdiction should be continuous through a town.

Within a town, the best practice employed in transportation planning is to have a hierarchy of roads with different functions and of an appropriate design. For the purpose of this study, the following main hierarchy of roads is evident in Walvis Bay and Swakopmund:

- **National roads/freeways under the jurisdiction of the Roads Authority:** These are characterised by high volumes, high speeds, and access only to second-order roads via intersections with highgeometricstandard intersections.
- **Urban arterials:** These are characterised by high mobility, high speeds, no direct erf accesses, and access only to third-order roads.
- **Collector/distributor roads:** These roads collect or distribute traffic from the urban arterial to local access roads. They are characterised by medium mobility, low speeds, and limited erf accesses.
- **Local access roads:** These are characterised by low mobility, low speeds, and their primary function of giving erf access.

If the above hierarchy is applied, any road in question can be designed to complement its function. In older towns where the hierarchy was not applied, one finds certain streets being used as collector roads and even urban arterials, despite not being suited to such functions. In newly planned areas, the hierarchy concept is normally one of the planning instruments applied to harmonise traffic within the urban environment.

5.2 WALVIS BAY

The urban roads from the B2 to the harbour are problematic since there is no defined hierarchy of roads.

Walvis Bay is experiencing an increase in traffic volumes in its central business district (CBD) as well as in the older residential areas immediately adjacent to the CBD. New regional developments would have a secondary increase in business and other activity in Walvis Bay, and would result in a further general increase in traffic. Walvis Bay would need to do a comprehensive traffic flow study of the CBD and other arterial roads to proactively address traffic increases that arise due to developments in the Erongo Region.

The Walvis Bay Municipality has done some forward planning in order to effectively introduce some of these principles in their road network. One relevant example is the 'gateway' concept, where a new entrance from the B2 to the CBD is planned. The proposal is to have the access road run past Kuisebmond and the planned future residential areas north of Walvis Bay. The gateway road would then form a T-junction with the B2 between Walvis Bay and Swakopmund.

The existing entrance to Walvis Bay via the traffic circle would remain as a secondary access.

The shortcoming in the Walvis Bay CBD road network would not necessarily affect Rössing Uranium operations, as most of the transport from the harbour would be by rail, with occasional truck trips.

The Rössing Uranium buses operate mainly in the residential areas where traffic should not be problematic.

5.3 SWAKOPMUND

The B2 between Walvis Bay and Swakopmund is known for its perceived high traffic volumes. An option would be to upgrade this route to a divided dual-lane road. The controversy around this option is that the coastal road should be a scenic route for tourists, while heavy vehicles should preferably make use of the C34, the road behind the dune belt.

Pedestrians from Narraville also cross this road on home-to-work and home-to-school trips. Any increase in traffic on this section of the B2 would therefore increase risk to these pedestrians,.

The C34 was recently upgraded to a salt road, but because it is a longer route compared with the B2, it is not used to its full extent. The question is whether to –

- upgrade the B2, which would then attract more traffic, or
- limit the capacity of the B2, prohibit heavy vehicles on it, and upgrade the C34 instead.

Given this, Swakopmund's urban roads have to fulfil the function of arterial roads – despite not necessarily having been designed for such a function.

In order to manage through traffic, especially in terms of heavy vehicles, Nathaniel Maxuilili Street and Rhode Allee Street were earmarked as the preferred through route for such vehicles. This is not an ideal solution, however.

6. TRAFFIC DATA

6.1 TRAFFIC COUNTS

To get an indication of the extent of traffic on the road network, 12-hour traffic counts were conducted at the following intersections in November 2008:

▪ Sam Nujoma Drive–Nelson Mandela Avenue	Monday	03/11/2008
▪ B2–C34 (D1984)	Monday	03/11/2008
▪ Sam Nujoma Drive–Moses Garoëb Street	Tuesday	04/11/2008
▪ Walvis Bay Traffic Circle	Wednesday	05/11/2008
▪ Nathaniel Maxuilili Street–Rhode Allee Street	Thursday	06/11/2008
▪ Arandis–Rössing Uranium	Friday	07/11/2008
▪ B2–Arandis–Rössing Uranium (D1911)	Friday	07/11/2008

Additional 12-hour traffic counts were conducted at the following intersections in April 2009:

▪ B2–Langstrand Intersection 1	Thursday	23/04/2009
▪ B2–Langstrand Intersection 2	Thursday	23/04/2009

The traffic counts were done from 06:00 to 18:00 and were recorded in 15-minute intervals. Light and heavy vehicles were recorded separately, as were all movements. A light vehicle is defined as a vehicle weighing less than 3500 kg and a heavy vehicle as weighing above 3500 kg. A bus certified to carry 16 passengers or more would be classified as a heavy vehicle.

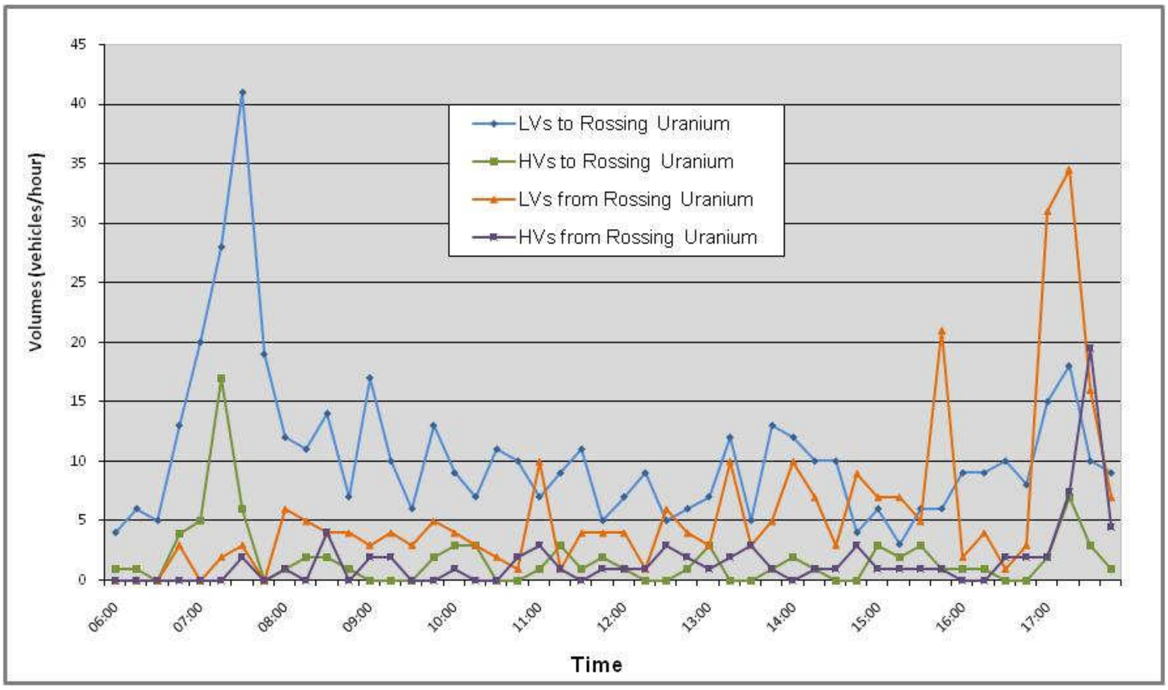
The traffic count data are presented in ***Annexure A*** as follows:

▪ Arandis–Rössing Uranium	**Annexure A1**
▪ B2–D1911	**Annexure A2**
▪ Sam Nujoma Drive–Nelson Mandela Avenue	**Annexure A3**
▪ B2–D1984	**Annexure A4**
▪ Sam Nujoma Drive–Moses Garoëb Street	**Annexure A5**
▪ Nathaniel Maxuilili Street–Rhode Allee Street	**Annexure A6**
▪ B2–Langstrand Intersection 1	**Annexure A7**
▪ B2–Langstrand Intersection 2	**Annexure A8**
▪ Walvis Bay Traffic Circle	**Annexure A9**

These traffic counts were used in the Sidra analysis (see paragraph 7.2 below).

6.2 TRAFFIC ON THE RÖSSING URANIUM ACCESS ROAD

From the traffic count at the T-junction off the B2, the traffic volumes on the Rössing Uranium access road could be derived and are presented in *Figure 1* below.



LVs = Light vehicles. HVs = Heavy vehicles

Figure 1: Current traffic on the Rössing Uranium access road

This graph represents Rössing Uranium's current traffic impact on the B2, with clear morning and afternoon peaks.

6.3 TRAFFIC ON THE B2

The latest traffic volume data on the relevant sections of the B2, C14 and C34 were obtained from the Roads Authority's Road Surveillance System.

The data were analysed, and selections extracted to obtain an indication of typical traffic flow patterns.

6.3.1 B2: Swakopmund–Usakos

The daily traffic volumes for a typical week in February 2008 were extracted for the following situations:

- Swakopmund to Usakos: Light vehicles *Figure 2*
- Usakos to Swakopmund: Light vehicles *Figure 3*
- Swakopmund to Usakos: Heavy vehicles *Figure 4*
- Usakos to Swakopmund: Heavy vehicles *Figure 5*

The Figures are interpreted below.

Figure 2: The high morning peak is significant and expected, while the afternoon peak flattens over a longer period.

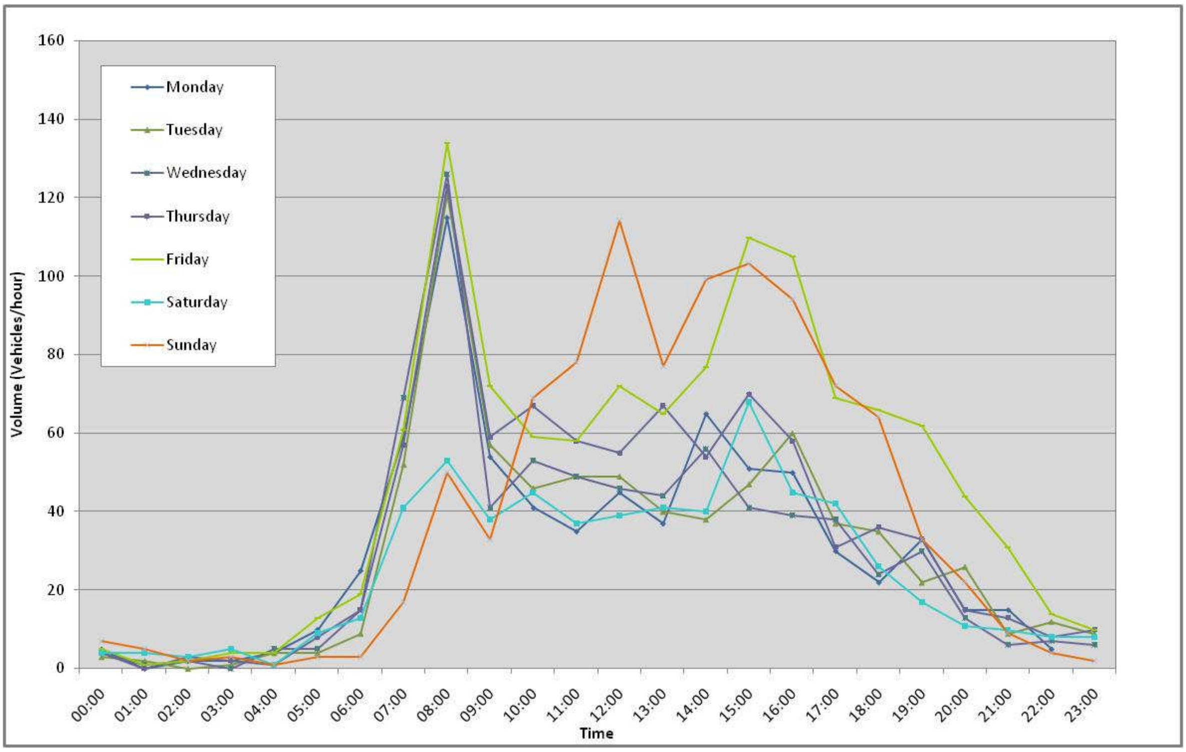


Figure 2: Swakopmund to Usakos: Light vehicles per week, February 2008

In *Figure 3*, the afternoon 'return' traffic over a much longer period is typical. Secondly, the fact that the Friday peak is the highest is significant and could be the typical weekend traffic from Windhoek.

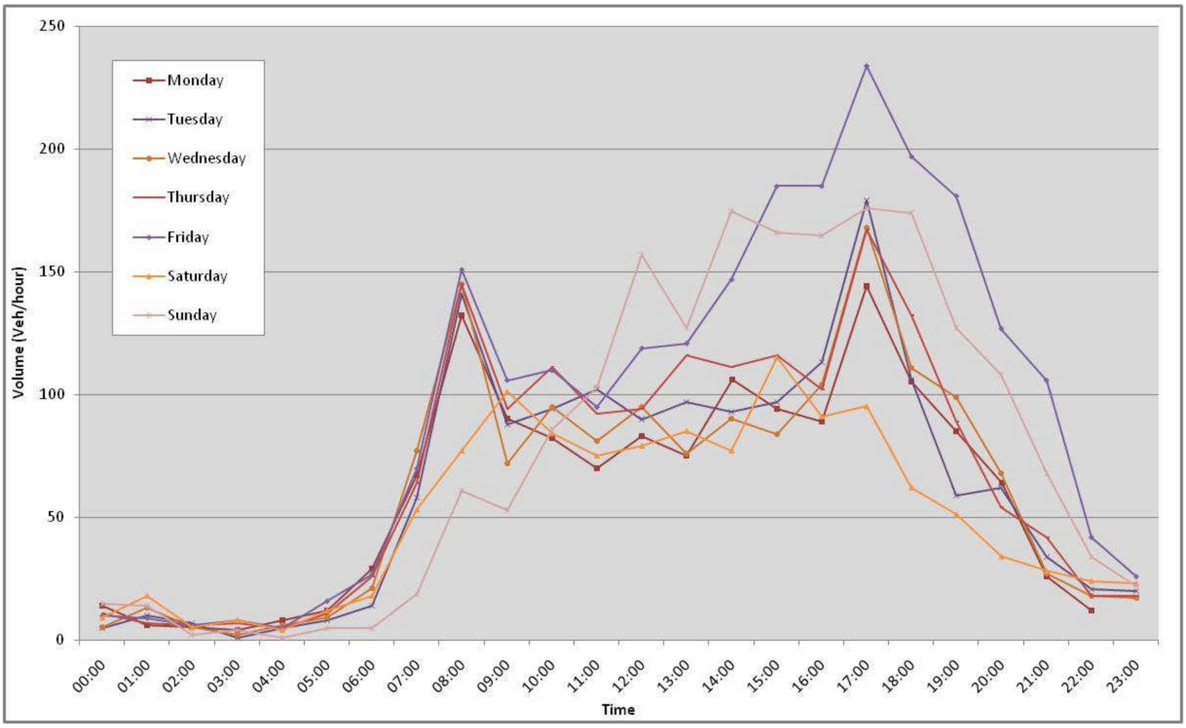


Figure 3: Usakos to Swakopmund: Light vehicles per week, February 2008

The heavy vehicle traffic flow from Swakopmund in *Figure 4* shows a very sharp morning peak at 09:00, flattening for the rest of the day to between 5 to 10 heavy vehicles per hour until 22:00.

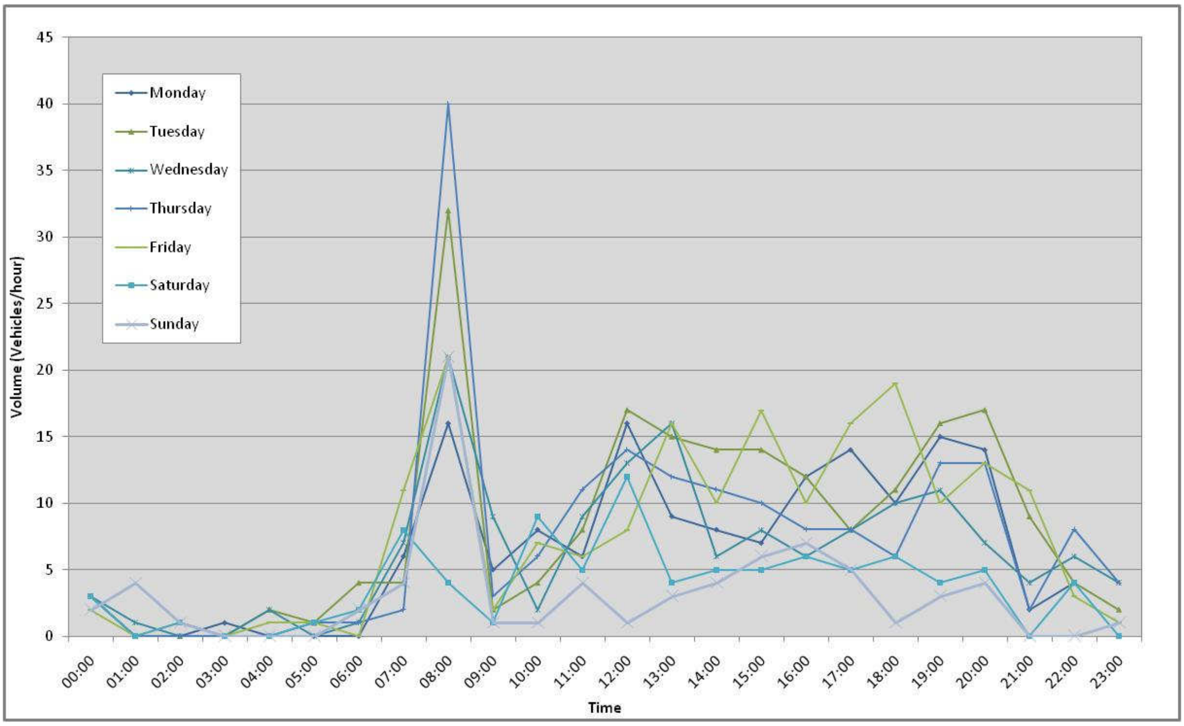


Figure 4: Swakopmund to Usakos: Heavy vehicles per week: February 2008

The west-bound heavy vehicle traffic as shown in *Figure 5* differs from the east-bound in that two significant short peaks occur at 09:00 and 18:00, respectively, with a relatively constant flow between those two peaks.

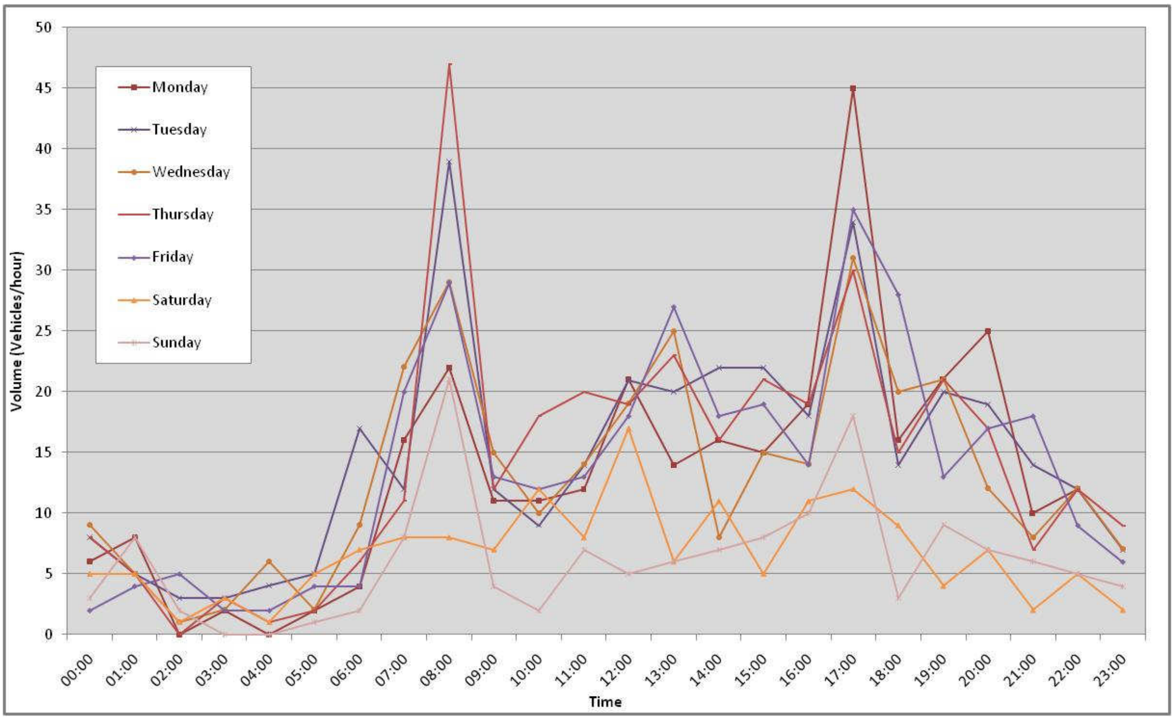


Figure 5: Usakos to Swakopmund: Heavy vehicles per week, February 2008

6.3.2 B2: Walvis Bay–Swakopmund (Coastal road)

The daily traffic volumes for a typical week in February 2008 were extracted for the following situations:

- Walvis Bay to Swakopmund (Light vehicles) *Figure 6*
- Swakopmund to Walvis Bay (Light vehicles) *Figure 7*
- Swakopmund to Walvis Bay (Heavy vehicles) *Figure 8*
- Walvis Bay to Swakopmund (Heavy vehicles) *Figure 9*

The light vehicle traffic flow from Walvis Bay to Swakopmund as presented in *Figure 6* differs significantly from a typical road. It shows the pattern expected on an urban arterial road, where the peaks are relatively flat, but there is a constantly high flow between peaks. In this case, the flow increases towards the afternoon peak. This traffic pattern confirms the importance of this road as transportation link for economic interaction between the two towns. Should this road be upgraded, it should be designed as a major urban arterial road and not as a rural road between two towns.

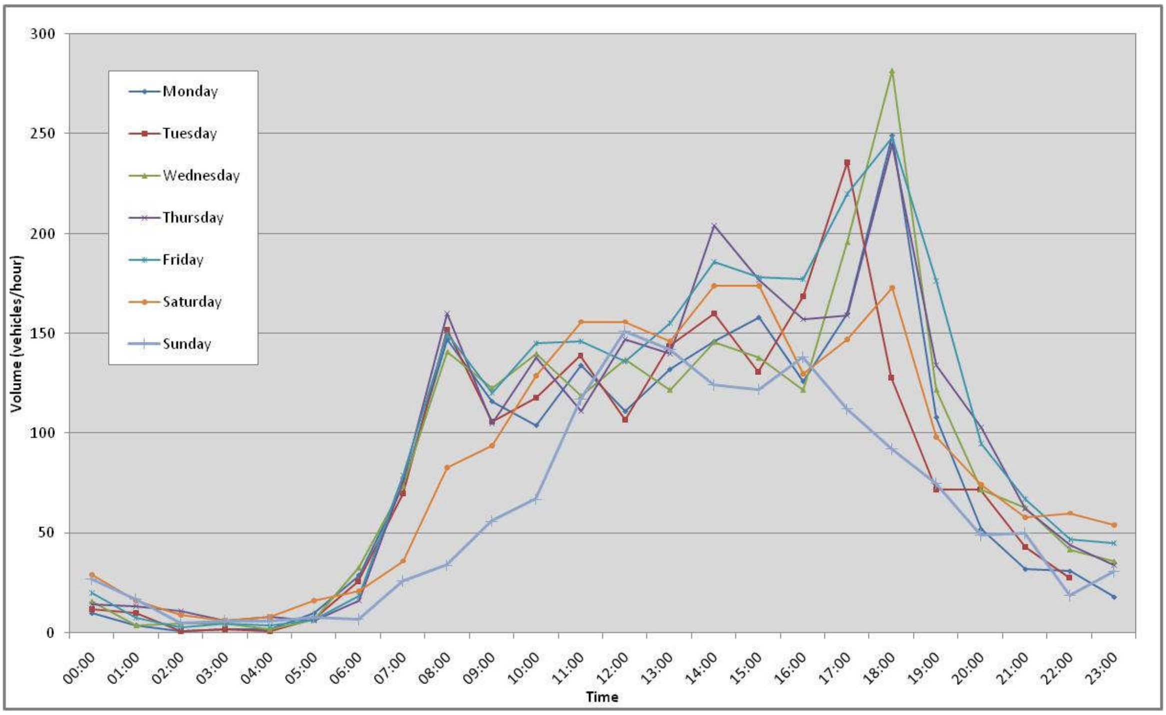


Figure 6: Walvis Bay to Swakopmund: Light vehicles per week, February 2008

Figure 7 has the typical morning peak, with a lower flow during the day and an increase in the afternoon. The morning peak might be typical home-to-work trips.

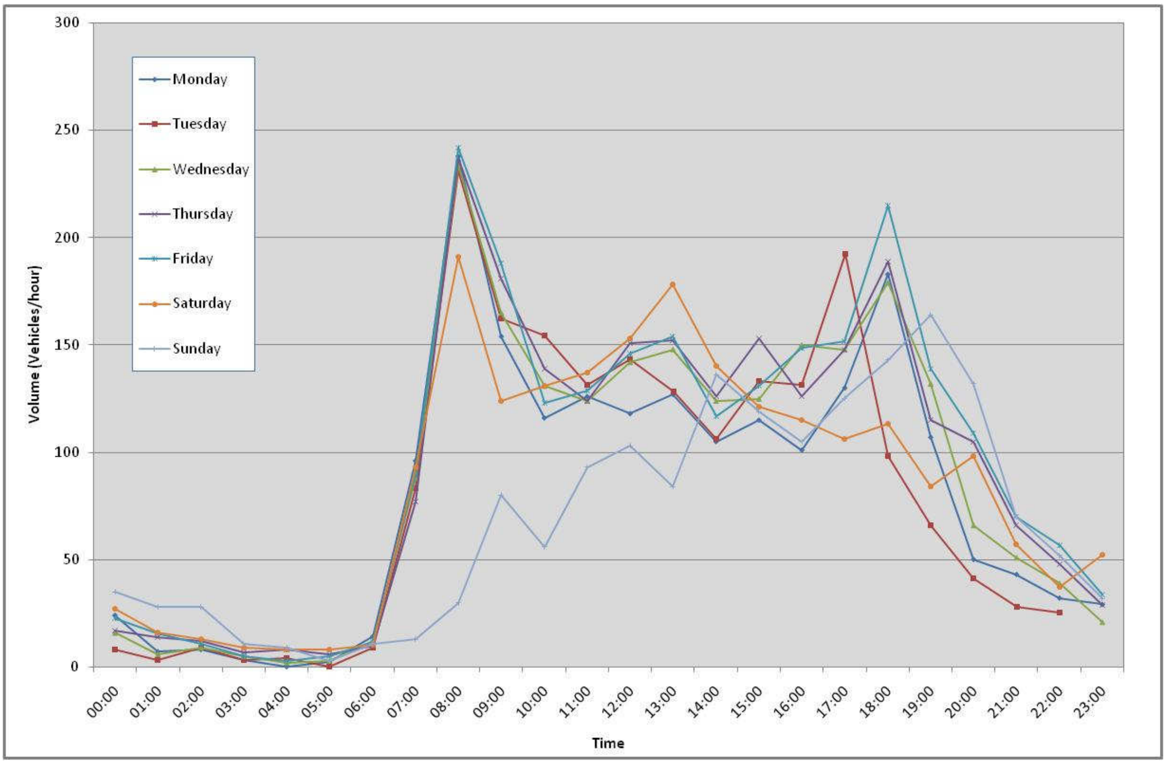


Figure 7: Swakopmund to Walvis Bay: Light vehicles per week, February 2008

As shown in *Figure 8*, the heavy vehicle traffic flow is totally different from Figure 7. The volumes are relatively high throughout the day, except for Saturday and Sunday afternoons.

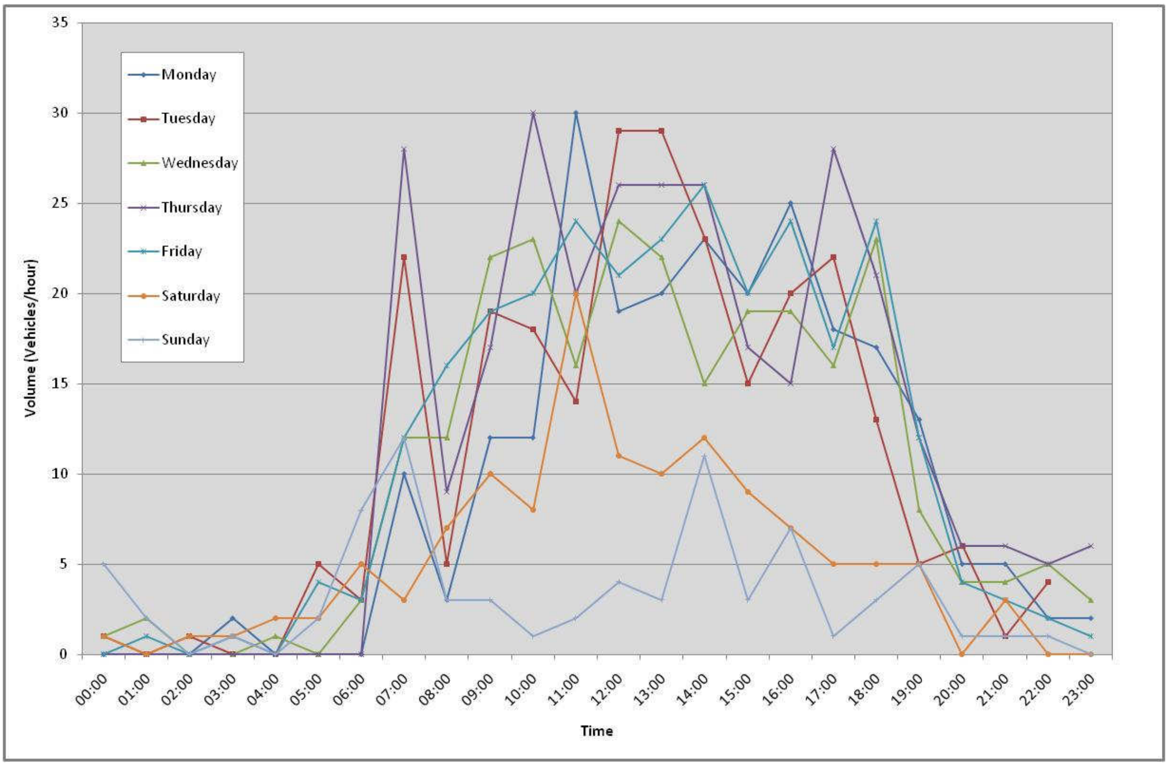


Figure 8: Swakopmund to Walvis Bay: Heavy vehicles per week, February 2008

The heavy vehicle traffic flow in the opposite direction has the same tendency, as shown in *Figure 9*.

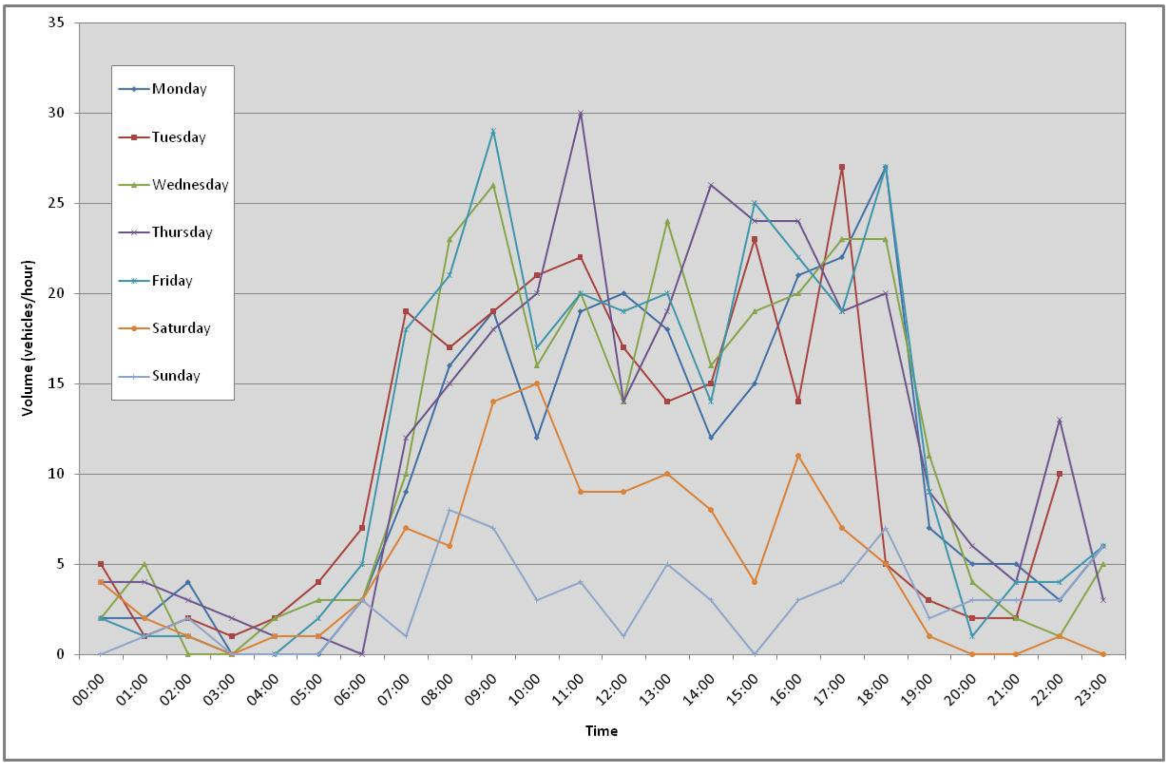


Figure 9: Walvis Bay to Swakopmund: Heavy vehicles per week, February 2008

6.3.3 C34: Walvis Bay–Swakopmund (Road behind the dunes)

As expected, the traffic flow on this road is much lower. The daily average, based on weekdays only, is 128 light vehicles and 55 heavy vehicles. Thus, 30% of all vehicles are heavy vehicles. This indicates that the road is indeed being used by heavy vehicle traffic, and that it might experience an increase in such traffic.

6.4 TRAFFIC GROWTH ON THE B2

To determine traffic growth on the B2, traffic data were obtained from the Roads Authority's Road Management Surveillance Section. These data can be summarised as follows:

- Average daily traffic (ADT) values for counting station 021, Swakopmund to Arandis, 1985–2008, including regression growth rates
- ADT values for counting station 023, Karibib to Usakos, 1985–2008, including regression growth rates
- ADT values for counting station 070, Okahandja to Wilhelmstal, 1985–2008, including regression growth rates
- Daily traffic counts for counting station 021 during July 2007
- Daily traffic counts for counting station 023 from 04 April 2007 to 02 May 2007
- Daily traffic counts for counting station 070 for 01 July 2007 and 07 July 2007
- Hourly traffic counts for counting station 021for 07 July 2007
- Hourly traffic counts for counting station 023 for 04 July 2007, and
- Hourly traffic counts for counting station 070 for 07 July 2007.

The detailed data, as obtained from the Roads Authority's Road Management Surveillance Section, have not been included in this report; only the data as analysed for the purposes of this study are included.

Figure 10: Locality of traffic counting stations

6.4.1 **Average daily traffic**

For the purpose of this study, counting station 023 data were analysed. Counting station 023 is situated between Karibib and Usakos and should give the most representative traffic figures for predicting increase in traffic levels on the B2 road.

The light and heavy traffic were analysed separately, as their growth rates might differ.

Actual counts only took place during 1992, 1996 and 2000, as well as from 2002 to 2008. For the intermediate years, the Roads Authority extrapolated regression values from these data. The regression extrapolation of the light traffic numbers corresponds with historical growth years and was used as a basis for future estimates. However, the regression values for heavy traffic were approximately 25% above the actual counts for 2008. A graph was tailored to fit the actual counts for heavy traffic, and was used as a basis for future estimates.

From 2009, different growth rates were applied to heavy and light traffic to match the most representative growth rate. Light and heavy traffic grew at a rate of 3.5% and 4%, respectively. Table 1 and Figure 11 indicate a combination of the base ADT values up to 2009 as well as the expected future ADT values.

Year	Heavy	Light	Total	Heavy (%)
2009	**309**	**1,297**	**1,606**	**19**
2010	**321**	**1,342**	**1,663**	**19**
2011	**334**	**1,389**	**1,723**	**19**
2012	**347**	**1,438**	**1,785**	**19**
2013	**361**	**1,488**	**1,850**	**20**
2014	**376**	**1,540**	**1,916**	**20**
2015	**391**	**1,594**	**1,985**	**20**
2016	**406**	**1,650**	**2,056**	**20**
2017	**423**	**1,708**	**2,130**	**20**
2018	**440**	**1,767**	**2,207**	**20**
2019	**457**	**1,829**	**2,287**	**20**
2020	**476**	**1,893**	**2,369**	**20**
2021	**495**	**1,960**	**2,454**	**20**
2022	**514**	**2,028**	**2,543**	**20**
2023	**535**	**2,099**	**2,634**	**20**
2024	**556**	**2,173**	**2,729**	**20**
2025	**579**	**2,249**	**2,827**	**20**
2026	**602**	**2,327**	**2,929**	**21**
2027	**626**	**2,409**	**3,035**	**21**
2028	**651**	**2,493**	**3,144**	**21**

Table 1: Projected traffic volumes (ADT) and percentage annual increase

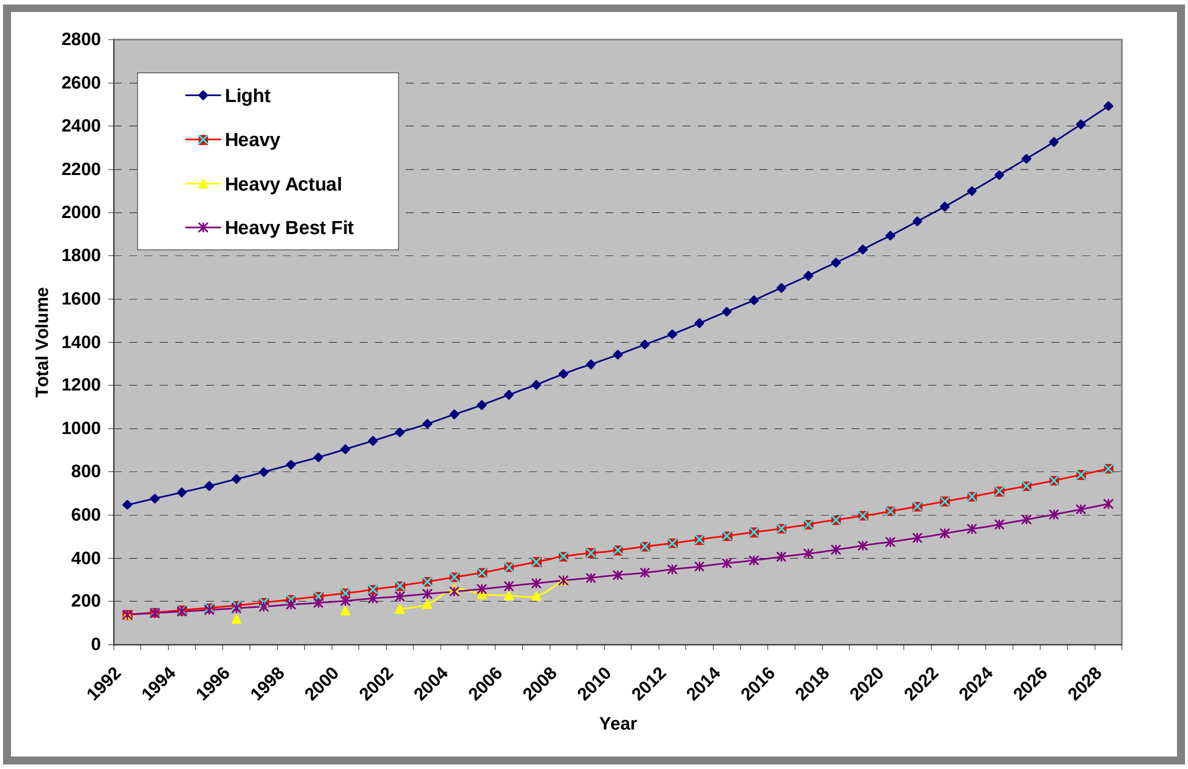


Figure 11: Forecast traffic volumes – B2

6.4.2 Weekly and daily traffic distribution

The weekly traffic data were averaged on calendar days to obtain a weekly distribution.

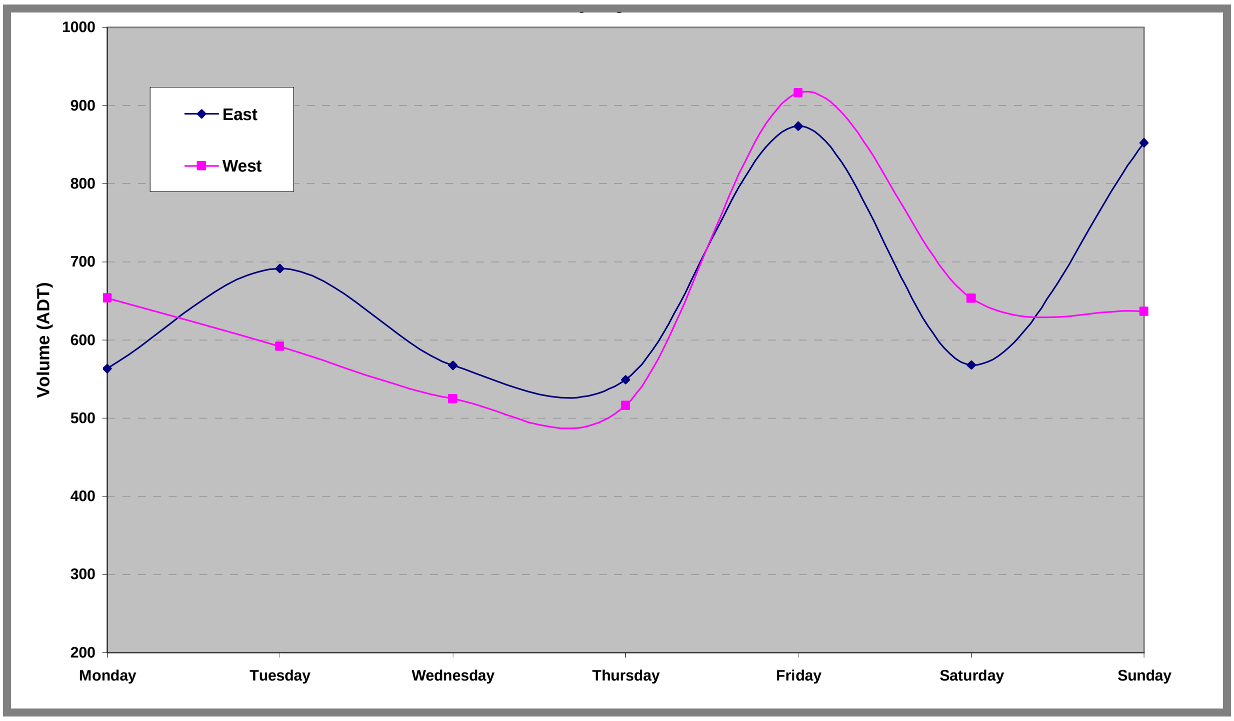


Figure 12: Weekly light vehicle distribution – B2

Figure 12 indicates traffic peaks on Fridays and Sundays for light vehicles in both directions.

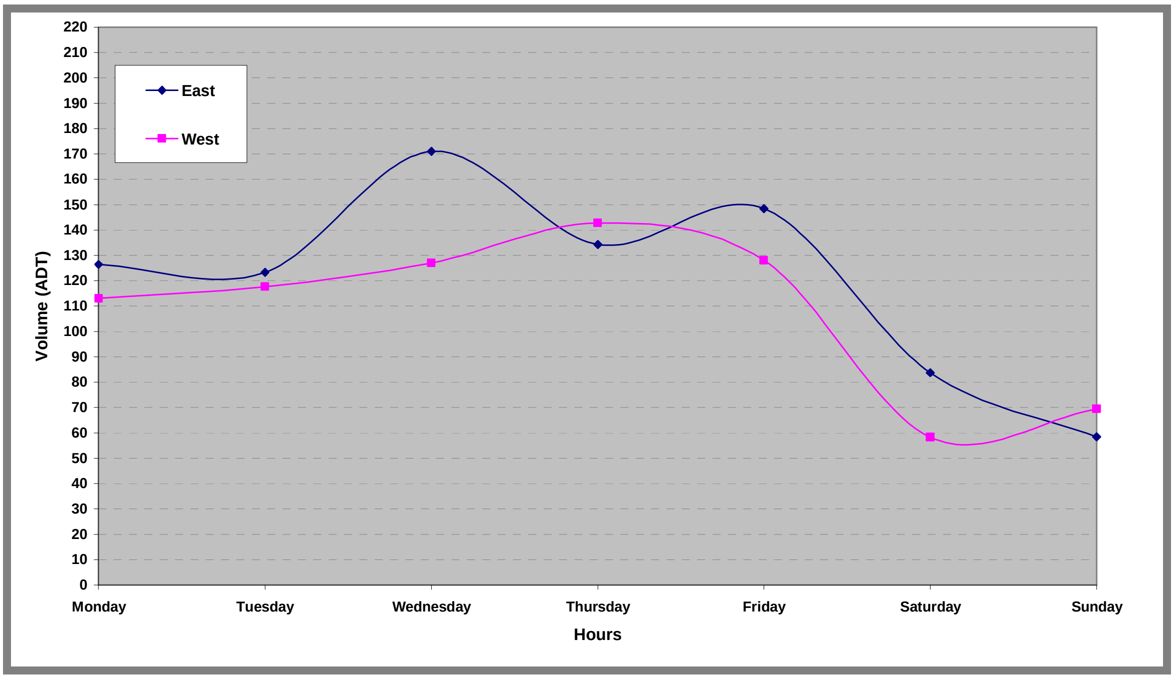


Figure 13: Weekly heavy vehicle distribution – B2

Figure 13 indicates relatively constant heavy traffic volumes from Monday to Friday and a decrease over weekends.

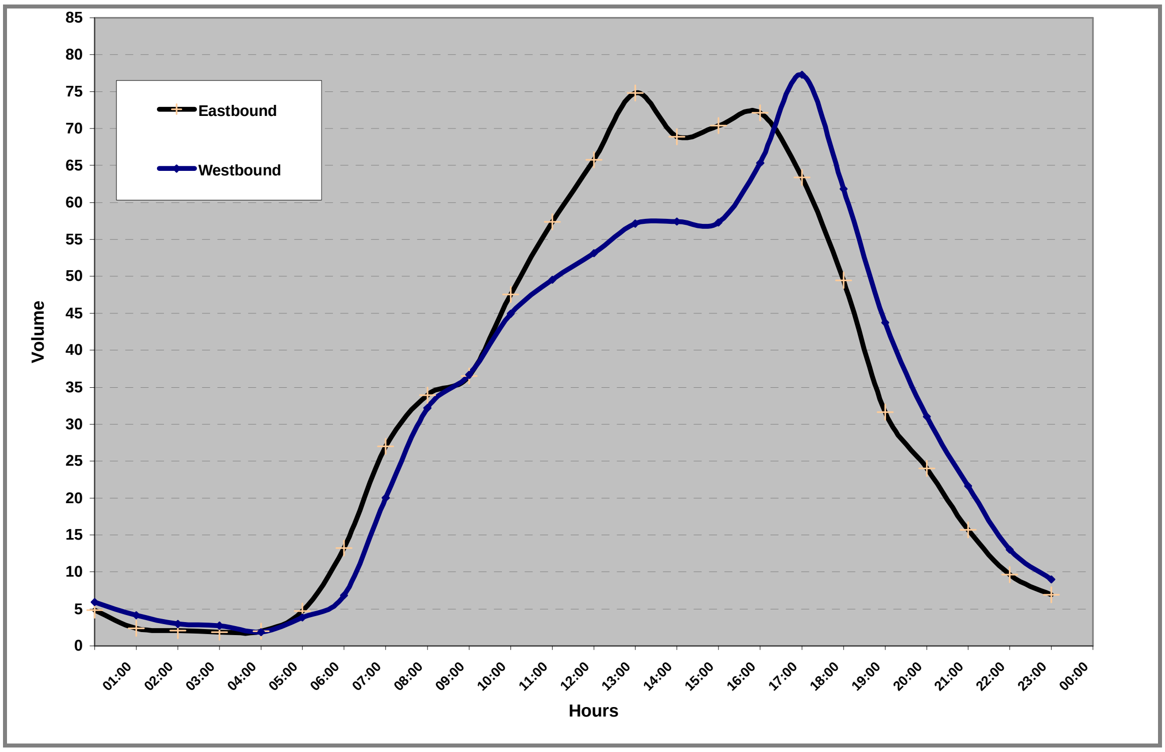


Figure 14: Hourly light vehicle distribution – B2

Figure 14 indicates almost no light traffic from 24h00 until 05h00 and then a steep increase until about 17:00. Thereafter the light traffic decreases quickly. East-bound traffic indicates a peak between 13:00 and 16:00, while west-bound traffic has a distinct peak at 17:00.

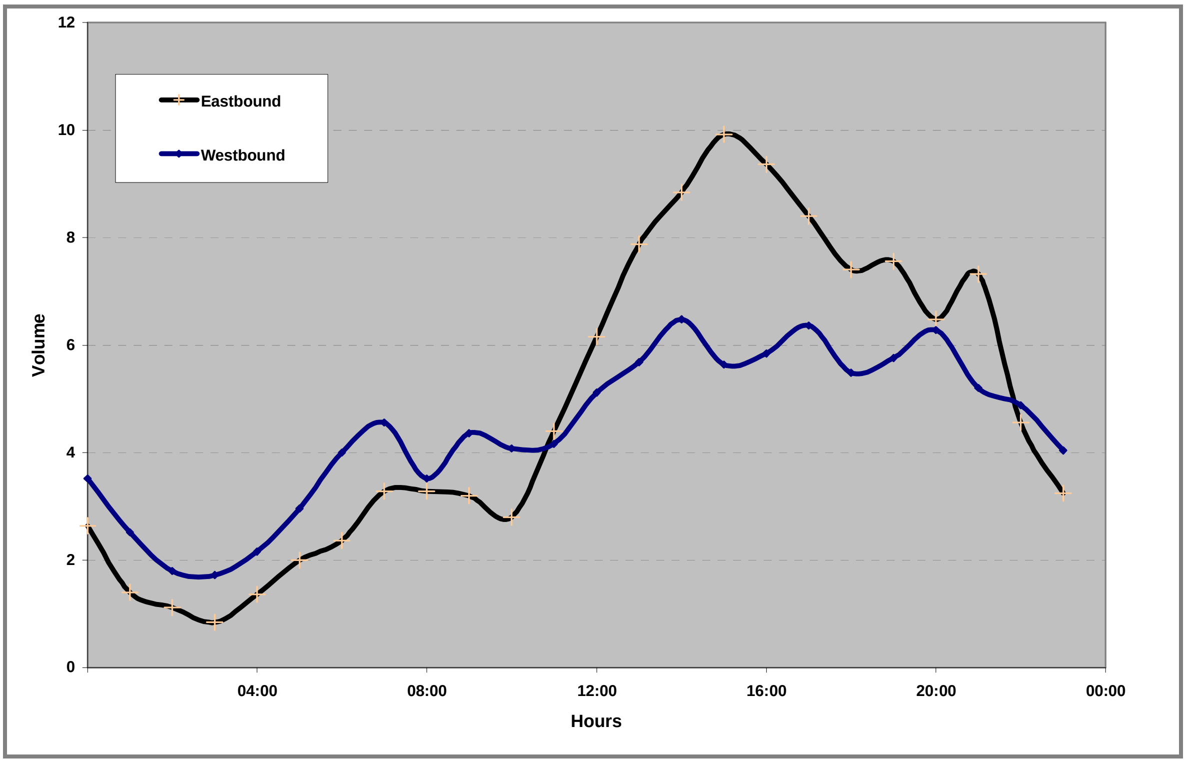


Figure 15: Hourly heavy vehicle distribution – B2

Figure ***15*** indicates a gradual increase in heavy traffic from about 03:00 until approximately 16:00 for both traffic directions. The east-bound traffic shows a more distinct peak at about 16:00, which could be related to harbour loading times.

The significance of the above analysis is as follows:

- Traffic on the B2 from 2009 to 2026 can be expected to increase by around 80%.
- Peak flow occurs on Friday afternoons.
- The daily peaks in light vehicles occur from 12:00 to 17:00.
- The daily peak in heavy vehicles occurs at 16:00.

6.5 TRAFFIC GROWTH: RÖSSING URANIUM

From the traffic counts conducted at the T-junction on the Arandis/Rössing Uranium road, traffic flow on the Rössing Uranium access road could be derived. The 12-hour traffic flow is presented in paragraph 6.2 above. This traffic volume is assumed to represent the traffic generated by the current operations at the mine.

To develop a trip generation model, one would have to consider variables that have a direct relationship between the mine activities and trips generated. The number of employees is a direct indication of such activities and of the transport demand. Therefore, the projected staff requirements as predicted in Marie Hoadley's (2007) *Rössing Uranium Expansion Project – Socio-economic Impact Assessment* were therefore used as an indicator to determine the expected increase in trips. The report predicts annual staff requirements for 2010 to 2026 as being 1,729 employees. Based on the current number of employees, namely around 1,440, this represents an increase in the order of 20%. The maximum number of employees is 1,894 is predicted for 2011, and represents an increase of 31.5% in the current number of employees.

Current traffic volumes should, therefore, be increased by a factor of at least 31.5% to assess the impact on the existing road network. For the Sidra analysis, current traffic volumes were increased in steps of 40% and 80%, respectively, with 40% representing Rössing Uranium's expansion and 80% representing the expected growth in traffic on the road network during the period of analysis.

6.6 COLLISION REPORT

Collision statistics were obtained from the National Road Safety Council's files in Windhoek. The intention was to extract data for the past three years; however, at the time of extracting the data, (November 2008), only the 2006 data were accessible. Nevertheless, the data indicate the extent and type of collisions that occur on the immediate roads used by Rössing Uranium on a daily basis.

The precise location of a collision on the roads Rössing Uranium uses is not included in the relevant reports: reference is only made to the towns between which the collision occurred, with an indication of how far from one of those towns the collision occurred.

The analysed collision data for 2006 were grouped and are presented in ***Annexure B*** hereto as follows:

- B2: Walvis Bay–Swakopmund–Usakos ***Annexure B1***
- Swakopmund through route (Walvis Bay–Usakos) ***Annexure B2***
- C14: Walvis Bay–Solitaire ***Annexure B3***
- C34: Road behind the dunes (D1984)(Walvis Bay–Swakopmund) ***Annexure B4***

From the collision report summary, the following information was yielded:

- B2: Walvis Bay–Swakopmund–Usakos
  - "Lost control" was a significant cause of accidents, and could be related to high speed.
  - Head–rear collisions were also high, and could be related to turning vehicles and the lack of exclusive turning lanes.
  - Head-on-head collisions due to overtaking were also significantly high.
- Swakopmund through route (Walvis Bay–Usakos)
  - Head–rear collisions were very high.
- C14 Walvis Bay–Solitaire
  - Seventy percent of the fatal accidents are due to loss of control over the vehicle which is common on gravel roads.
- C34: Road behind the dunes (Walvis Bay–Swakopmund)
  - Only six collisions is recorded of which five is due to loss of control over vehicle. This is also expected on road with a salt/gravel wearing course.

7. CAPACITY ANALYSIS

The ideal capacity of a single traffic lane in one direction is 1,800 vehicles per hour. This capacity is influenced negatively by various road environmental factors, such as inadequate road width, challenging topography, insufficient roadside clearance, and poor climatic conditions. A further factor is vehicle composition, i.e. the percentage of heavy vehicles. The combination of these factors determines the operational capacity a traffic lane.

Operational capacity is also determined by intersections where the same road area is shared by conflicting traffic movements. Capacity under these conditions can be reduced to between 800 to 1,200 vehicles per hour.

The capacity of the B2 between Usakos and Swakopmund is in the order of 1,400 vehicles per hour while the section between Swakopmund and Walvis Bay would be in the order of 1,150 vehicles per hour.

7.1 GEOMETRIC HARMONISATION OF INTERSECTIONS

The standard of the intersections and accesses as observed on the relevant sections of the B2 is not consistent. Over time, as the intersections were constructed, different standards were applied. It seems that only the more important intersections have an exclusive right-turning lane with a widened area on which vehicles can pass others turning right. In other instances, no provision was made for turning vehicles.

The general approach is to determine the standard of the access according to the expected traffic volume on the secondary road. The fact remains that any turning vehicle poses a danger to motorists travelling on the main road. Unexpected turning movements at minor accesses are sometimes a greater potentially unsafe situation, compared with accesses where there are high turning volumes.

Having a consistent approach in how intersections are designed could enhance the safety and confidence of the road user.

Thus, an attempt was made to record the variations in intersections/access on the section of B2 under review. Accordingly, a line diagram of the intersections and accesses was prepared, with insets to show the geometric layout and lane configurations. This is presented on Plan W1141/CP–01 to 04, attached in ***Annexure J***. To enhance readability, Google Earth photos were used as a background.

The line diagram is supported by photographs of some of the intersections, presented on Plan W1141/CP–05 to 07 in ***Annexure J***.

7.2 SIDRA ANALYSIS

Sidra is a traffic engineering software programme used by traffic engineers to analyse, plan and evaluate the performance of intersections and different intersection controls. The option exists to change the geometric configuration of an intersection and to evaluate its performance under different traffic conditions. The output file has various indicators that could be used to compare and evaluate different scenarios. A typical output sheet is presented in ***Annexure C*** hereto.

Sidra was used to analyse the intersection where traffic counts where conducted. Two scenarios were tested, namely where traffic volumes were increased by 40% and 80%, respectively.

In general, these scenarios represent the estimated impact due to Rössing Uranium's expansion on the one hand, and the background increase in traffic on the affected road network on the other.

The results are summarised in Table 2 below.

INTERSECTION: B2–Rössing/Arandis (D1911) Existing layout, morning peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	359	501	646
Percentage of heavy vehicles	%	15.3	15.2	15.3
Degree of saturation	n/a	0.12	0.199	0.304
Effective intersection capacity	Vehicles/hour	2,992	2,524	2,123
Control delay (average)	Seconds/vehicle	9	9.6	10.2
Level of service (worst movement)	n/a	C	D	D
Effective stop rate	Per vehicle	0.55	0.56	0.58

Table 2: Sidra analysis results

Table 2 shows that, with a 40% increase, the level of service for the worst movements deteriorates from level of service “C” to “D”. The specific movement in question is the right turn from the Rössing Uranium/Arandis road onto the B2.

The above results were based on an approach speed of 120 km/h, namely the legal speed limit. To check the sensitivity of the approach speed on the level of service of the intersection, an analysis was made in respect of an approach speed of 140 km/h, which is closer to the operating speed on the road. The result is that, for all three traffic volume scenarios, the level of service drops to the next lowest level.

The remainder of the results, with a short discussion on the impact and definition of level of service, are presented in ***Annexure D***.

The Level of Service C is the ideal and preferred planning norm although level D would be acceptable for short periods in a peak hour.

7.3 RÖSSING URANIUM/ARANDIS ACCESS FROM THE B2

When the Rössing Uranium and Arandis accesses were developed in 1976, a T-junction was created from the northern side of the B2. This access road also ends in a T-junction, with access to Arandis on the left and access to Rössing Uranium on the right. The Rössing Uranium access road then crosses the B2 with a road-over-road bridge. The situation is that all traffic from Arandis and Rössing Uranium to the west have to cross the east-bound traffic and merge with the west-bound traffic. This is a potentially unsafe movement and, as traffic on the B2 increases, it would become more difficult to get a safe gap to cross and merge into oncoming traffic. Furthermore, gap acceptance is made more difficult with the operating speeds on the B2 being in excess of the legal speed limit of 120 km/h.

It is proposed that the existing capital infrastructure, namely the road-over-road bridge, could be used more effectively to improve the traffic flow and improve safety if the intersection layout were to be changed.

The idea would be to prohibit all right-turning movements at the B2 intersection. This could be achieved by creating a new road from the south to form a new T-junction with the B2 (see theblue line in Figure 16 below). Right turns would then be prohibited by way of a raised dividing barrier in the middle of the B2 (see the red line in Figure 16 below). The layout would function as a partial interchange. Traffic movements on the B2 would be limited to left-only movements. The number of conflict points on B2 would be reduced significantly in this way, and would therefore contribute to safer traffic flow. The concept is indicated on plans W1141/CP–08 and 09, attached as ***Annexure J***.

Figure 16: T-junction at the B2

It needs to be pointed out, however, that there are two possible situations where the proposed intersection could be used incorrectly, namely –

- making U-turns at the end of the dividing barrier, instead of following the correct route, and
- the dividing barrier could form an obstacle for traffic on the B2.

Both situations could be addressed as follows:

- To avoid the making of U-turns after the construction of the dividing barrier, an information campaign could be launched to inform road users of how to use the partial interchange correctly. Law enforcement would obviously also be required.
- By applying sound geometric design principles and the use of road marking and road traffic signs, the dividing barrier could be designed in such a manner as not to cause an unsafe situation.

Implementation would depend on the Roads Authority, since this road falls under their jurisdiction. The Consultant has not discussed this concept with the Roads Authority, however. It was felt that, since the Consultant's reporting would be to Rössing Uranium, the Client's acceptance of the proposal in principle would be required before the Roads Authority could be officially approached.

This concept, if accepted by Rössing Uranium in principle, could be an agenda point at a future Roads Committee meeting. However, it might be advisable to apply to the Roads Authority head office first.

The revised configuration of the proposed change was also analysed with Sidra. This analysis was done for both the 40% and 80% growth scenarios, which effectively includes the expected traffic from the Areva development. The results of this analysis are presented in *Table 3*.

INTERSECTION: B2–Rössing Uranium/Arandis (D1911): Proposed changes to Intersection B2–Rössing Uranium/Arandis access road turn-off, morning peak at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	273	383	491

INTERSECTION: B2–Rössing Uranium/Arandis (D1911): Proposed changes to Intersection B2–Rössing Uranium/Arandis access road turn-off, morning peak at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Percentage of heavy vehicles	%	18.3	18.3	18.3
Degree of saturation	n/a	0.076	0.107	0.137
Effective intersection capacity	Vehicles/hour	3,581	3,568	3,586
Control delay (average)	Seconds/vehicle	9.3	9.4	9.4
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.64	0.65	0.62

Table 3: Revised configuration: Sidra analysis results

The most significant observation is the increase in the effective intersection capacity of the B2 intersection, namely from 2,992 to 3,581 vehicles per hour. The main reason for this increase is the elimination of right-turning movements on the B2 from high-speed opposing movements to two secondary T-junctions, where traffic flow would be at low operating speed.

Given the proposed modifications to the intersection of the B2/D1911, it should now meet the desired Level of Service C for the predicted increase in traffic.

8. TRANSPORT SERVICE FOR STAFF

8.1 THE RÖSSING URANIUM BUS FLEET

Rössing Uranium provides a bus service to its staff from home to the mine and back. This service is voluntary: employees have the choice to use their own transport.

The current bus fleet consists of the following:
- 16 x 48-seater buses
- 8 x 18-seater buses
- 3 x new 48-seater buses (added in July 2009)

The bus drivers are either full-time or part-time employees. A total of 16 full-time bus drivers operate from Walvis Bay and Swakopmund, while 9 operate between Arandis and the mine. There are also about 36 part-time bus drivers. These drivers are mostly full-time Rössing Uranium employees in other positions.

Most of the buses are kept at the Transport Centre in Swakopmund overnight, while three are kept in Walvis Bay and four in Arandis.

8.2 TRANSPORT DEMAND: NEW TRIP ORIGINS

Most Rössing Uranium employees reside in one of the following places: Arandis, Swakopmund or Walvis Bay. Since Arandis was originally developed for Rössing Uranium staff, a large percentage of mine employees still live there.

Marie Hoadley's (2007) *Socio-economic Baseline Study for Rössing Uranium's Mine Expansion Project* gives an indication of the percentage of employees, by grade, resident in Arandis.

In addition, the projected staff requirements given in the report were used to determine the possible distribution of place of residence of future staff in Arandis and Swakopmund/Walvis Bay. The projected additional staff was assigned proportionally to these destinations.

Additional buses based on the average expected staff members			
	Number of staff	Place of residence	
		Swakopmund/ Walvis Bay	Arandis
Current	1,440	915	525
Average (2010–2026)	1,729	1,099	630
Additional staff	289	184	105
Additional bus trips	48 per bus	3.8	2.18
Additional buses		**4**	**1**

Notes

1. *For the short travel distance from Arandis, one bus could make two trips.*
2. *The assignment is based on the assumption that the required number of new houses would be developed in Arandis.*

Table 4: Additional buses required, based on the average expected staff increase

Additional buses based on maximum expected staff members			
	Number of staff	Place of residence	
		Swakopmund Walvis Bay	Arandis
Current	1,440	915	525
Maximum (2011)	1,894	1,187	707
Additional Staff	454	272	182
Additional bus trips	48 per bus	5.67	3.78
Additional buses		**6**	**2**

Notes

1. *For the short travel distance from Arandis, one bus could make two trips.*
2. *The assignment is based on the assumption that the required number of new houses would be developed in Arandis.*

Table 5: Additional buses required, based on the maximum expected staff increase

Since the acquisition of buses could take a relatively long time, advance notice would need to be given of staff increases in order for the Transport Division to initiate the purchase of new buses.

8.3 BUS STOP: LANGSTRAND

It is understood that some staff now reside at Langstrand as well, which means the bus route needs to enter the Langstrand residential area. The right turn into Langstrand in the afternoon as well as the right turn out at that time are regarded as problematic. When this was pointed out by the Transport Manager, a peak traffic count was conducted at the two Langstrand T-junctions with the B2. The T-junctions were also subjected to a Sidra analysis, where it was found that right-turn movements functioned at a “C” level of service.

It is also understood that Rössing Uranium applied for a bus stop on the B2 opposite the Langstrand access, but the Roads Authority either did not approve or has not yet responded to the request. If the aim of the bus stop is to avoid the right-turning movement, it would imply that employees would need to cross over the road (the B2) from the bus stop to the residential area, which in itself would create an unsafe situation.

8.4 GENERAL BUS OPERATIONAL ISSUES

It seems that misty conditions remain a concern for general road safety. However, the general rule of the road is that speed should be adjusted according to prevailing conditions. Thus, motorists should simply reduce speed during misty conditions.

Of concern was the following distance of Rössing Uranium buses. The policy is that buses should keep a distance of 120 m between them. There is a need to control and check this.

8.5 RAIL AS AN ALTERNATIVE TO THE TRANSPORT DEMAND

To consider rail as an alternative, the following are of importance:

- Trip duration, and

- Convenience.

Both principles play a role when the user is faced with a choice of transport.

With the rail option, there would be a feeder system of buses to the nearest rail station. Then there would be time lost while the passenger waited at the transfer to the rail system. The same process would apply to the return trip.

The operational speed of a passenger train between Walvis Bay/Swakopmund to Arandis would, on average, not be more than 40 km/h. This, together with the transfers, would make the trip duration significantly longer than the current bus trip. (Estimated 120 minutes versus the current 45 minutes). The transfer would also be regarded as an inconvenience.

Furthermore, the rail alternative would require a substantial investment in rolling stock, whereas the bus fleet is already operational.

Further discussion on the viability of upgrading the rail network for commuter transport is presented under Section 12.

9. TRAFFIC GENERATED FROM NEW DEVELOPMENTS

9.1 AREVA/URAMIN

Areva would have the most direct impact on the road infrastructure used by Rössing Uranium, since the indication is that their access road will start at Arandis, thus having an effect on the Arandis/Rössing Uranium intersection with the B2.

The estimated number of trips that Areva will generate are given in*Table 6.*.

Purpose of trip	Number of trips per vehicle delivery type		
	Heavy vehicle (Payload greater than 5 t)	Medium delivery vehicle delivery vehicle (Payload up to 5 t)	Light delivery vehicle
Normal operations	12	18	41
Bus transport: Staff	9	n/a	n/a
Sulphuric acid (if by road)	30	0	0
Total	**51**	**18**	**41**

Table 6: Estimated deliveries/trips to Areva per day

The indication is that Areva staff will mostly live in Arandis and Swakopmund, and will be transported in buses. This would entail about 450 persons, resulting in 9 buses. Since the buses would depart from Arandis directly to the Areva Mine, they would not need to use the B2; thus, there would be no effect on Rössing Uranium traffic on the B2.

They are still considering their options for the transport of sulphuric acid by road or by rail. If rail is used, it would be offloaded at Arandis and transported by truck to the mine on the access road to be constructed.

If these traffic volumes were imposed on the current traffic volumes at the Arandis/Rössing Uranium T-junction, the total increase in 12-hour volume through the intersection would amount to around 15.5%.

The worst impact would be felt from returning heavy vehicles. For example, the right-turn movement from Arandis to the B2 would increase by around 150% if sulphuric acid were to be transported by road. This in itself would also increase the right-turn movement onto the B2 by approximately 88%.

This would support the case for the proposed changes to the traffic arrangements at the B2 intersection, as set out in paragraph 7.2 above.

9.2 OTHER

The location of other uranium mines relative to Rössing Uranium is shown on the drawing No. W1141/CP–10, attached as ***Annexure J***. The only mine that would have a direct impact on Rössing Uranium would be Trekkopje, but also possibly Valencia. It seems that the option for access to Rössing South is still under consideration. The drawing also shows the two potential problem intersections that have been identified in this report.

10. RAIL TRANSPORT

10.1 THE CURRENT RAILWAY LINE

The current line has certain technical and physical limitations, of which the following are important in this context:

- Namibia, like other southern African countries, uses the 1.067-m Cape gauge, whereas most other countries use the Standard gauge of 1.435 m. Therefore, equipment for the Cape gauge is made on order only, while equipment for the Standard gauge is readily available on the market.
- The axle load limit is 16.5 t per axle. TransNamib is investigating the viability of having this increased to 18.5 t.
- Bridge structures might be a problem in respect of carrying the high axle loads.
- The network is not signalised. The indication is that even if traffic increases threefold, it would still be difficult to justify signalling in economic terms.
- The total Walvis Bay–Rössing Uranium travel time is in the order of 3 hours. The standard travel times to the various stops on the line are as follows:
    - ***Walvis Bay–Swakopmund:*** This takes 77 minutes, but sand on the rail could increase the travel time. There are also unauthorised road crossings, which add to the safety risk.
    - ***Swakopmund–Arandis:*** This takes 87 minutes, but travelling time is influenced by the volume of opposing traffic. Time lost due to opposing traffic varies between 15 and 30 minutes.
    - ***Arandis–Rössing Uranium:*** This takes between 20 and 30 minutes.
- The sleepers on the section between Walvis Bay and Swakop need to be replaced; however, due to budget shortfalls, this has been delayed.

- TransNamib has done the planning for a new siding for Areva as part of their consideration to use a hybrid system to transport acid to the mine, i.e. by rail up to Arandis, and then by Areva's private access road to the mine.

10.2 AFFECTED NETWORK

The transportation of low-value bulk commodities by rail is only cost-effective over long distances. The capacity of a railway line is determined by the permissible axle load of the rail, its traction capacity, and the gradient of the route. The length of trains is limited by the horizontal geometric design of the railway line. The absence of signalling on a single-line route negatively affects the line's capacity.

The current limitations on the existing railway line are as follows:

- The total mass per train should not exceed 1,600 t, and
- The total number of wagons per train is limited to 35.

At the time of writing, eight trains operated in both directions (four in each direction) daily on the Walvis Bay–Swakopmund–Arandis track. This could be increased to twenty per day (twelve in each direction) with the current method of radio control.

Rössing Uranium's tonnage per train is 1,600 t, which is approximately 1,000 net t per train.

TransNamib is expecting a 25% increase in traffic due to the new uranium mines. The new cement factory at Otavi and a possible Manganese mine at Otjizondu would result in a further 50% increase in rail transport.

If Namibia exports cement, the current import of this commodity might be terminated. Therefore, rail capacity would become available in the opposite direction.

The railway line between Walvis Bay, Swakopmund and Arandis has no signalisation. This implies that operations from the harbour to Rössing Uranium are subject to a clear line between stations where trains can pass. This situation is a limitation on the capacity of the railway line, and is a major time constraint in the service.

If excessive delays are experienced and operational capacity is negatively affected, the installation of signals would definitely improve matters. It seems that TransNamib does not have immediate plans to install signalisation, however.

It is also not quite clear from the Walvis Bay town plan whether provision has been made for a rail connection to the proposed future bulk terminal on the northern side of the harbour, as envisaged by Namport.

The non-availability of excess rolling stock is another limitation. To accommodate an increase in traffic, TransNamib would have to obtain additional rolling stock. The delivery period is in the order of two years and is relatively costly.

10.3 TRANSPORTATION OF SULPHURIC ACID TO RÖSSING URANIUM

To transport commodities from the harbour by rail, companies contract with TransNamib directly, or through agents. TransNamib does not want the transport by rail to pass into private ownership, so it will expand its fleet of locomotives and specific wagons as the need arises. Currently, only

Rössing Uranium is supplied with sulphuric acid via rail. One of the new mines has requested TransNamib to transport sulphuric acid, but negotiations have only just begun on this issue.

TransNamib has about 48 wagons in total dedicated to transporting acid. Some 10% of the fleet is allocated for routine maintenance on a daily basis. All wagons and locomotives are the property of TransNamib.

A wagon's capacity is approximately 46.67 t. One locomotive can haul 12 wagons to Arandis. The ultimate limit is 30 wagons per train trip in order to meet Rössing Uranium's safety regulations as far as braking power and axle-mass load are concerned. If two locomotives haul 24 wagons, the third effectively only hauls 6, which is not cost-effective. The limit of 30 wagons can only be increased by means of an entire railway realignment in order to flatten the up-gradients and to ensure a higher axle-mass load.

The number of trips can be increased, however. With a fleet of 48 wagons, TransNamib would be able to deliver 4 320 t per day (96 wagons, 4 trips, with 24 wagons each trip). The fleet of wagons is sufficient for current operations.

10.4 THE PLANNED CIC RAILWAY LINE

It is understood that CIC Energy are planning a new, direct railway link from Botswana to Walvis Bay to export coal. Information obtained from the CIC Project Manager revealed that four possible sites had been identified for the rail terminal/shunting yard and stockpile area for the coal before shipment. The docking point would be Namport's planned bulk terminal, but the port would require further extension and enhancement.

The relevance of the CIC railway line in this context is the opportunity it presents to attract the transportation of containers on returning trains from Namport to Botswana/South Africa, which could free capacity on the Walvis Bay–Swakopmund–Arandis line.

Although the pre-feasibility study for the railway line seems to have been completed, the final go-ahead is still required from the Botswana and Namibian Governments.

10.5 UPGRADING OF THE WALVIS BAY–ARANDIS RAILWAY LINE

TransNamib is in the process of calling for tenders for consulting services for the investigation on the Walvis Bay–Tsumeb railway lines. The purpose of this consultancy would be to investigate a type of public–private partnership for upgrading the line.

Results would only be available towards the end of 2010.

11. THE PORT OF WALVIS BAY

11.1 PORT MASTER PLAN

Namport compiled a Port Master Plan (PMP) in 2006. The company is dynamic and seems to be proactive in planning the expansion of port facilities in line with demand. In terms of the PMP, the principal long-term changes would be the possible relocation of the bulk terminal to the north of the harbour.

Namport is also in the process of providing a new container terminal as part of the PMP.

11.2 SULPHURIC ACID: STORAGE AND FACILITIES

Rössing Uranium leases a portion of land from Namport for sulphuric acid storage as indicated in Figure 17.

The portion of land has a total area of 15,398 m^2, and consists of 4 storage tanks, each with a 7,500 t capacity (total = 30,000 t). Ships carrying sulphuric acid dock in the harbour, connect to a manhole on land, and pump sulphuric acid into the tanks via the manhole. The portion of land in question has rail siding facilities.

Rössing Uranium has a contract with TransNamib for the daily delivery of 1,080 t of sulphuric acid (24 wagons). This can be increased to a maximum of 1,680 t per day, or 36 wagons. The rail gantry consists of two sidings, each accommodating 10 wagons. These 20 wagons are loaded in the morning at approximately 07:00. The loading is finished at approximately 10:00. Thereafter, the 20 wagons are switched and the remaining 4 wagons are loaded. The 24-wagon rail leaves the harbour at about 11:00 and arrives at Rössing Uranium Mine at between 14:50 and 15:00. If necessary, a further 12 wagons can be loaded at about 12:00 and sent to the mine.

The arrival of ships supplying the sulphuric acid has to be booked far in advance, and at stages the supply cannot be immediately accommodated. In such cases, the ship is docked for longer than necessary, and Rössing Uranium consequently incurs additional harbour costs. A ship consignment constitutes approximately 30,000 t. The offloading rate in the harbour is 500 t/h, leaving an offloading time of 60 hours. The offloading rate at Rössing Uranium is 300 t/h, leaving an offloading time of between 3 and 4 hours. The offloading lines at Rössing Uranium would have to be increased to accommodate higher offloading rates.

At the time of writing, Rössing Uranium was able to repeatedly offload 24 wagons and 36 wagons, respectively, on consecutive days. This results in an average of 1,350 t per day.

Rössing Uranium has two storage tanks on the mine itself, each tank having a capacity of 14,500 t (29,000 t in total). A top priority for Rössing Uranium is to increase its on-site storage capacity. It also plans to add another tank at the harbour.

It is understood that Rössing Uranium has applied for additional land from Namport, adjacent to the current facilities, but that the application is still under negotiation.

Note: Blue = current storage; Red = requested storage under negotiation

Figure 17: Namport: Sulphuric acid storage facilities

11.3 FUTURE MINES

The Langer Heinrich and Trekkopje Uranium Mines also need sulphuric acid. However, since the uranium is found in a different rock type, the mining process differs. Thus, Langer Heinrich and Trekkopje need sulphuric acid during the final processes of the uranium extraction, rather than at an earlier stage, as Rössing Uranium does. Langer Heinrich would need about 60 t of sulphuric acid per month, compared with Rössing Uranium's daily requirement of 1,000 t. Trekkopje would need slightly more than Rössing Uranium. The sulphuric acid for Langer Heinrich is transported by road, while Trekkopje still needs to decide on which mode of transport to use.

Protea Chemicals currently buys sulphuric acid from Rössing Uranium and supplies it to Langer Heinrich and Trekkopje. Only Rössing Uranium has sulphuric acid storage facilities at the harbour.

Potential mines such as Rössing South, Bannerman and Valencia would need substantial amounts of sulphuric acid. Protea Chemicals have been negotiating with Valencia, but this is still in the preliminary phases.

Should any of the above mines open, the capacity of sulphuric acid storage in the harbour and the rail capacity towards Arandis would have to expand. The first priority would be for TransNamib to attain more acid wagons in order to exceed a daily supply capacity of 4,320 t.

11.4 ACID PLANT

A planning and investigation unit exists at Rössing Uranium for manufacturing sulphuric acid on site for its own use. The status of this investigation is not known, but its findings would have an effect on how to deal with some of the shortcomings identified above.

12. TOTAL TRANSPORT APPROACH

Rail transport was put forward as a possibly safer alternative to roads in respect of conveying Rössing Uranium employees between home and work. This option should be evaluated within the greater transport context with the aim of optimising transport costs overall. Alternatively, the funds spent need to obtain the maximum transport benefit.

The following are some of the factors that were taken into account in determining the total transport approach:

- The Rössing Uranium bus fleet has a very good safety record. Only one minor accident with minor vehicle damage has occurred in the mine's 30-year history, according to the current Transport Manager, Mr Mike Loots.
- The trip time between Walvis Bay/Swakopmund to the mine is relatively short.
- The B2 is underutilised and, even with expected increase in traffic from the 'uranium rush', there would still be spare capacity.
- With increased traffic volumes, certain intersections on the B2 might show signs of congestion during peak hours.
- The current railway line has significant spare capacity.
- Sections of the railway line need maintenance, but this has been postponed due to budget constraints.
- The current railway lines have operational limitations, i.e. operational speed and total travel time.
- Hybrid road–rail passenger vehicles are available in the market for Standard gauge lines. The Cape-gauge hybrid vehicles Namibia uses are made on order and are, therefore, costly.
- The stability of hybrid vehicles on the Cape gauge is questionable; thus, the vehicles could be unsafe for passenger transport.
- Railway transport needs large volumes and high frequency to be economically viable.
- A rail passenger service is associated with a feeder service that transports passengers to various stations en route.
- Rössing Uranium's employee numbers are relatively low, and a limited number of passenger transport trips occur per day. Since rolling stock would be underutilised, this would be an uneconomical option.
- New passenger wagons would have to be bought or old TransNamib wagons could be refurbished.
- TransNamib does not have spare locomotives. Thus, should a passenger transport service be considered, an additional locomotive would be required.

In conclusion, considering all transport options, any investment in a transport system should be cost-effective, and the benefits should be enjoyed by all users.

A passenger rail service does not offer any additional safety that the existing Rössing Uranium bus service does not already have. Moreover, travel time would be longer, and is a negative benefit in a cost–benefit analysis. Thus, it would be hard to justify expenditure on a rail passenger service where there is no direct additional benefit.

It is our opinion that, instead of spending funds on a rail passenger transport service, if the equivalent amount were to be spent on upgrading sections of the national road network, the gain in benefits would serve a much wider group of infrastructure users, and the Rössing Uranium buses would operate on an improved road network. If the mine houses joined forces, the extent of improvement that could be effected would be significant.

Rössing Uranium could consider offering a loan to the Road Fund Administration to execute the required improvements to the road infrastructure.

13. EMERGENCY RESPONSE AND EVACUATION

13.1 ON SITE FACILITIES

Rössing Uranium has sufficient medical staff and equipment on site. Furthermore the mine has a Disaster Management & Recovery (DMR) manual. The DMR's main components are to provide rescue and emergency medical assistance at any multi-casualty accident scene. These accidents include on-site accidents and off site accidents such as a road accident of one of the buses on road.

The DMR sets out the exact procedure to be followed in case of an emergency. When an accident is reported the Protection Services Control Room is informed about the incidents, they then inform the standby duty manager, who in turns informs the DMR Team Leader who will, depending on the gravity of the situation, call a DMR.

The DMR procedure is communicated to new employees during their first induction. Protection Services members are inducted on an annual basis and the rest of the mine employees undergo annual mock drills.

The DMR was first compiled in the early 90's and is reviewed on a monthly basis by the Managing Director. The manual is revised on request or at least annually. The complete DMR manual could not be attained and it is advised that the DMR should be scrutinised to see if it is up to date. This assessment therefore does not deal with the on site emergency procedures.

In case of an emergency, stabilizing the patients is of utmost importance. The response time can therefore be divided into the response time to stabilize the patients and the response time to get the stabilized patients to further medical attention such as a hospital or intensive care unit (ICU). Severely injured persons would have to be stabilized even if admitted to a hospital.

Although the mine is remotely located the response time needed to stabilize patients is sufficient. The mine is equipped with a portable/ inflatable medical tent that can house between 15 and 20 people. Furthermore the mine has 2 ambulances and a 4x4 rescue tender that are fully equipped. The ambulances have capacity of 3 and 2 patients respectively.

An accident on site can therefore be stabilized within minutes. Should a bus accident occur, the ambulances and tent could be deployed and reach the accident within 20 to 25 minutes. Simultaneously ambulances from within the region can be deployed and should arrive on the accident scene within 40 minutes. The Rössing Uranium ambulances would be able to transport between 6 and 7 patients towards the Swakopmund hospital while the regional ambulances could service some additional patients.

No major bus accidents have occurred to date.

13.2 REGIONAL FACILITIES

13.2.1 Hospitals

The Swakopmund Cottage Hospital has undergone recent expansions and future expansions are planned.

The hospital beds available near Rössing Uranium are as follows:

▪ State Hospital, Swakopmund	±35
▪ Cottage Hospital, Swakopmund	75
▪ State Hospital, Walvis Bay	140
▪ Welwitschia Private Hospital, Walvis Bay	45
▪ Arandis	1
Total	**296**

The Cottage hospital is of high standard and most severe cases and operations can be dealt with within Swakopmund.

13.2.2 Emergency Vehicles

Apart from the Rössing Uranium's ambulances the following local and regional ambulance services are available:

▪ State Hospital, Swakopmund	1
▪ State Hospital, Walvis Bay	1
▪ SOS International	1 (2x4), and 1 (4x4)
▪ St Gabriel Ambulance Trust (Walvis Bay)	2
▪ EMED	1 (2x4), and 1 (4x4)
▪ Christian Lighthouse	1
Total	**9**

The Motor Vehicle Accident Fund cooperates with EMED and SOS in providing assistance to persons injured in vehicle collisions.

13.2.3 Evacuation facilities

An emergency aircraft is on standby only in Windhoek, with a response time of 1 hour 45 minutes.

The following aircraft owned by International SOS are available in Windhoek:

- Cessna 402
- King Air 90, and
- Cessna 441.

These aircraft are also used by a medical rescue operation known as *EMED*.

The Arandis Airport, which is no longer owned by Rössing Uranium, is understood to be able to accommodate a Boeing 737. The airport undergoes a civil aviation inspection every year, and is currently in possession of a valid certificate.

The Ministry of Fisheries uses the airport on a daily basis for their patrol aircrafts. The airport has landing lights making night operation possible.

Some private aircraft operators from Swakopmund use the Arandis airport in the mornings due to the regular occurrence of coastal fog. The asphalt runway is in a good condition and is approximately 2000m in length.

The owner of the airport is contemplating bringing a King Air aircraft (seating approximately 14 passengers) from Johannesburg to be stationed at Arandis, for chartering by local mines. The owner is in possession of a charter license. Furthermore a Lear jet is also available for chartering.

The costs of supplying a helicopter and/ or aircraft permanently on site or in Swakopmund would be extremely costly and rarely used. The option of chartering a plane should rather be investigated. The landing of a helicopter adjacent to the offices on site is sufficient, and an additional helicopter pad is not necessary. It would be recommended that the area be demarcated as such.

14. STAKEHOLDER CONSULTATION

The approach, in most cases, was to make contact with stakeholders via e-mail, giving the purpose of the information required. In other cases, interviews were necessary. The institutions that were consulted during the study are as follows:

Roads Authority

- Mr Tinashe Kandandara, a Senior Engineer in the Construction Section, provided information on the rehabilitation programme for roads in the Erongo Region.
- Mr Rudolf Rittmann from the Road Surveillance Section assisted with the historic traffic counts.

TransNamib

- Several discussions took place with Mr Jack Dempsey, the Operations Manager, who gave a wide factual situation with regard to the deficiencies and limitations of the current rail network.
- Mr Jefta Kangumba from the Walvis Bay office was also consulted with regard to operations.

Swakopmund Municipality

- Mr Frikkie Holtzhausen, the City Engineer at the time of the study, was consulted on the Road Master Plan for Swakopmund, and their approach on how to accommodate heavy vehicles through Swakopmund.
- The Traffic Department was consulted prior to the traffic counts, and was informed of the results.

National Road Safety Council

- Through Mr Eugene Tendulkar, contact was made with the staff assisting with the extraction of the collision data.

Walvis Bay Municipality

- Mr André Muller was consulted to obtain information on road network planning in Walvis Bay.
- The Traffic Department was informed prior to the traffic count

NamPort

- Information with regard to the Port Master Plan and expansion programmes was obtained from Mr Elsevir Gelderblom.
- Mr Elias Mwenyo assisted with information on operational issues.

Protea Chemicals

- Since they deliver sulphuric acid to all the mines, they provided some background information on their operations.

Trekkopje Mine (Areva)

- Mr Daniel Limpitlaw, consultant for Areva, who was first contacted, referred us to Ms Sandra Müller, their Environmental Manager.
- Ms Sandra Müller was helpful in providing the basic transport information that was available at the time of the study.

Other consultants

- Mr Cronjé Lofty-Eaton was involved in the Erongo Region Environmental Impact Assessment (EIA) and tasked to assess the infrastructure.

15. ROAD SAFETY AUDIT

An independent road safety auditor was appointed and briefed by Burmeister & Partners, and an audit was duly conducted in November 2008.

15.1 AUDIT REPORTS

15.1.1 Report A: Route B2 from Swakopmund to Arandis

The following reports are attached hereto:

- Road Safety Audit Report A: Route B2 from Swakopmund to Arandis ***Annexure E1***
- Road Safety Audit Report A: Statement ***Annexure E2***
- Road Safety Audit Report A: Exhibits ***Annexure E3***

15.1.2 Report B: Route B2 from Swakopmund to Walvis Bay

The following reports are attached hereto:

- Road Safety Audit Report B: Route B2 from Swakopmund to Walvis Bay ***Annexure F1***
- Road Safety Audit Report B: Statement ***Annexure F2***
- Road Safety Audit Report B: Exhibits ***Annexure F3***

15.1.3 Report C: Arandis Town

The following reports are attached hereto:

- Road Safety Audit Report C: Arandis Town ***Annexure G1***
- Road Safety Audit Report C: Statement ***Annexure G2***
- Road Safety Audit Report C: Exhibits ***Annexure G3***

15.1.4 Report D: Rössing Uranium Mine

The following reports are attached hereto:

- Road Safety Audit Report D: Rössing Uranium Mine ***Annexure HI***
- Road Safety Audit Report D: Statement ***Annexure H2***
- Road Safety Audit Report D: Exhibits ***Annexure H3***

15.1.5 Report E: Swakopmund Urban Area

The following reports are attached hereto:

- Road Safety Audit Report E: Swakopmund Urban Area ***Annexure I1***
- Road Safety Audit Report E: Statement ***Annexure I2***
- Road Safety Audit Report E: Exhibits ***Annexure I3***

15.2 INTERPRETATION OF ROAD SAFETY AUDIT REPORTS

A Road Safety Audit (RSA) was done in November 2008 by Louis Roodt (Pr. Eng.) on routes used by Rössing Uranium staff buses. The audit was a subset of the traffic and transportation assessment, which formed part of the EIA for the expansion of operations at the mine.

The magnitude of the RSA necessitated that five subsections were defined, grouping similar conditions and environments for ease of reporting. The five reports were as follows:

- Report A: Route B2 from Arandis to Swakopmund
- Report B: Route B2 from Swakopmund to Walvis Bay
- Report C: Arandis Township
- Report D: Rössing Uranium Mine
- Report E: Swakopmund Urban Area

The reports on the subsections are appended to this covering statement. Each report consists of a checklist with remarks and references to exhibits to illustrate the findings, the exhibits themselves, and a statement highlighting the most pertinent issues.

The issues identified in the RSA subsections are general safety issues. Some of these imply risks to the operation of the Rössing Uranium staff bus service. These risks will be discussed in the following paragraphs.

15.2.1 Background

Rössing Uranium's remote location and the nature of its products and mining operations originally required that staff be housed in the nearest town, Swakopmund, and a specially created off-site residential area dubbed *Arandis*. The mine developed an efficient and safe bus transport operation catering for its workers. This is in line with global best practice to limit private vehicles on and to mines.

The proposed expansion of the mine in terms of operations and its lifespan required an EIA to determine the effects of all aspects of impacts, and propose mitigating measures for them, as defined by law and environmental best practice. The traffic and transportation aspects of the EIA deal with the roads infrastructure and operations.

The RSA, on the other hand, was introduced to assess current conditions and identify problems that should be addressed under current operations and which would mitigate expanded operations. The RSA will be interpreted in view of the bus operations and their possible expansion in order to propose mitigation measures.

15.2.2 Findings

The current bus service reduces the number of vehicles on the main road from Walvis Bay to Arandis. Road safety research indicates that enhanced safety is achieved with reduction of exposure: fewer vehicles on the road means fewer kilometres travelled. The B2 route does not have a capacity problem, but the tendency of trucks to form platoons limits passing opportunities and other drivers take chances to pass.

Rössing Uranium bus drivers, who are trained to follow standard operating procedures, do not drive in platoons. They are familiar with the road and can be made aware of existing hazards such as rock cuttings and high culverts where the clear-zone width is limited. The increase in the number of buses, as envisaged, will not create capacity problems or increase the risk of traffic conflict on the routes, as the flow is of a tidal nature: all buses drive in the same direction and, thus, are not in conflict with each other. If operations expand and the number of workers in the residential areas increases, consideration can be given to higher-capacity buses to limit the number of vehicles on the road.

The main collection points are in Walvis Bay and Swakopmund. Safety at bus stops requires that these stops be off the road, provided with lighting, and limited. Care needs to be taken to discourage settlement in isolated areas where unsafe stops will have to be made, such as the Langstrand area.

The risks on the B2 relate to vehicles passing on no-passing zones or in the face of oncoming traffic, running of the road where there is no safe clear zone, and at intersections and junctions. Driver discipline can be imposed on staff bus drivers by means of training and monitoring. General driving discipline has to be enforced by the traffic police, with whom it seems a good relationship has been established. In general, there is enough of a clear zone next to the road, but some rock cuttings that are dangerous and some high fills over culverts need to be marked with hazard warning signs. The intersections and junctions on the routes currently carry light traffic, but the development of other mines in the area may influence demand. Where such developments occur, the intersections need to be upgraded to provide safe passing and merging.

The risks in Arandis are limited due to low vehicle ownership and low speeds, but the approach road past the training college has to be controlled to a lower speed. The Arandis bus stop was upgraded and the pedestrian crossing will enhance safety. In other respects, the expansion of operations will not impact much on the traffic in Arandis, as the base traffic flow is low.

Road safety within the controlled mine area can be enhanced by updating and maintaining signs and markings, as indicated in the RSA. The expansion of operations will have a limited impact in the mine area, as the volume of traffic is low there. Care nonetheless needs to be taken in the routing of buses, especially through hazardous areas such as the proposed sulphuric acid plant. Bus routes and stops should be on the periphery of such a plant and not through it.

The interaction of the bus service with the traffic in Swakopmund is such that the expansion of operations will not affect peak traffic in the town, as the morning shift departs before the local peak and the return from work is after the local peak. Capacity is, thus, not at issue. Drivers can be trained to keep a lookout for the known hazards and anomalies of the street system in Swakopmund, as identified in the RSA.

15.2.3 Conclusion

The proposed expansion of operations at Rössing Uranium will not add to the risk of travel on the routes or in nearby towns if the commuting staff is contained in a safe and efficient bus system.

Existing problems in terms of road safety were identified in the RSA, but these are not fatal flaws and can be corrected as normal maintenance. Bus drivers can be made aware of. The upgrading of the Nelson Mandela Road in Swakopmund would be a local Swakopmund municipal project.

15.3 ACTIONS REQUIRED BASED ON THE FINDINGS OF THE ROAD SAFETY AUDIT

The Road Safety Audit (RSA) identified numerous shortcomings and deficiencies in the road environment. These problems can be grouped and classified in order to assist with a logical and practical action plan. The various authorities responsible need to take ownership of these problems, as addressing them remains their responsibility. Although certain regular maintenance functions have been delegated to the Roads Authority's regional offices, the involvement of the RA Head Office would also be necessary.

15.3.1 Road and traffic management

This entails the day-to-day management of roads and road furniture, as well as traffic management. The RSA report identified the following common problems in regard to road and traffic management:

- Road traffic signs and road marking
  - Faded road signs not effective at night
  - Faded road markings
  - Too many road signs for tourist destinations; this is confusing, and important signs could be overlooked
  - There is a lack of compliance with Southern African Development Community (SADC) regulations, where the old blue backgrounds are still being used for signs instead of the new white background
  - Wrong application of signs
    - Sharp turn chevron at the start of a dividing median
    - Chevron pointing to the wrong direction (Rio Tinto arch)
    - Access road: S-curve road sign instead of sharp-curve road sign
    - Construction-sign speed limits, but there is no construction
    - Sharp curve chevrons are used as hazard markers
    - Hazard markers at culverts need to be installed
  - Road studs are required for misty conditions
  - Missing signs
    - Speed limit sign at the entrance to Arandis
    - Sharp curve on the road to the mine turn-off
    - T-junction chevron signs
    - Deflection and splitter island signs at roundabouts
  - The 'salt road' (behind the dunes) is not clearly signed; since the use of this road is to be encouraged, correct signage should be made a priority
  - Inconsistency in destinations and road numbers

- Safety features
  - Sand on the road/cleaning of road
  - Obstruction of road signs and sight lines by vegetation, which should be trimmed back
  - The road sign poles themselves should be drilled to break on impact
  - Absence of hazard delineator plates at culverts
  - Absence of road studs
  - Guardrail at culverts where there is no recovery area
  - Guardrail end treatment should be rectified
  - Guardrails not fixed to bridge balustrade
  - The Arandis bus stop is not pedestrian-friendly enough
  - Non-standard roadside barriers (gum pole barrier at the mine)
  - Positioning of bus and taxi stops within development off the B2 (Langstrand, etc.)

- Example of "all wrong": The traffic circle at the entrance of Arandis
  - Geometric of no standard

- Non-SADC-compliant road signs
- Incorrect application of road signs
- Incorrect application of road marking

- Law enforcement
  - Disregard for non-passing sections leads to head-on collisions, as confirmed in the analysis of the collision data. Since head-to-head collisions are prone to being fatal, this is an aspect that should be enforced.

- Education
  - Convoy-forming limits the road user's chances of passing safely. To educate road users appropriately, information campaigns that focus on following distances should be developed. Road users can also be made aware of the correct following distance by means of road marking. The Global Road Safety Partnership, which has an office in Namibia, could be involved in such a safety campaign. The Motor Vehicle Accident Fund could also be a partner in this effort, as the safety of the road user is their concern.

The Road Committee initiative (see below) would be a way of bringing this situation to the attention of the authorities responsible. However, decision-making management should attend.

15.3.2 Infrastructure upgrading and improvements

All shortcomings identified as creating potentially unsafe situations due to increased traffic volumes should be contained in a medium- to long-term planning programme. Road infrastructure improvements are normally capital-intensive and need to be programmed and phased in. Such improvements can also be coordinated with pavement rehabilitation programmes. Rössing Uranium can only suggest the way forward, however: ultimately the actions need to be taken by the RA. In terms of its enabling legislation, the RFA is obliged to consult with road users when they compile their five-year business programme. This is a forum where Rössing Uranium – representing road users – can request that provision be made to address the medium- to long term budget needs for the items listed below.

- Planning
  - Any new development on the eastern side of the B2 (Walvis Bay–Swakopmund) will result in cross-movement of people and traffic, and should be avoided; alternatively, it should be coupled with adequately improved intersections.
  - The roadside stalls at the Arandis/Rössing Uranium T-junction should be relocated so that they are further away from the B2. If the proposed changes at this intersection are accepted, they should then be implemented.
  - Improved pedestrian-friendly facilities at bus stops and places of high pedestrian movement are required.

- Geometric improvements
  - Consistency of geometric layout of intersections: The standard and typical intersection types as per RA standards should be implemented. This should be harmonised with widening/doubling of sections of the B2.
  - Provision of passing lanes or doubling of the B2 at selected sections: The length of the existing passing lanes and the length of converging lanes at intersections that are substandard should also be upgraded. This will prevent road users from disregarding the non-passing sections.

- The absence of shoulders, especially in curves: Excavations in curves should be widened in order to improve vertical sight distances and to provide an inner shoulder.
- Kerbstones should be provided at the Langstrand intersections in order to define them and to separate traffic and pedestrian thoroughfares.
- The Arandis entrance circle needs to be re-planned to resolve all the geometric, road marking and road sign deficiencies.
- The internal intersection at the mine offices needs to be re-planned in order to eliminate the identified shortcomings.

16. ROAD COMMITTEES

It is understood that Rössing Uranium set up a Roads Committee to create a forum for, among many other things, implementing recommendations from the socio-economic impact assessment as soon as possible. The current TIA report would contain recommendations that could also be discussed at this forum. It might be advisable to involve the Roads Authority's head office in such discussions as well.

17. REGIONAL PLANNING

Walvis Bay and Swakopmund could experience a period of high growth with the Erongo Region's increase in mining activities, and the concomitant need for support services to accommodate the resulting increase in the demand for power, rail transport, port facilities, housing, and social services (schools, hospitals, etc.).

It is now understood that consultants have been appointed to do an assessment of the Erongo Region's infrastructure. This was necessitated by the various developments and expansion envisaged at this stage.

Currently, several individual assessments are being done by the various mines focusing on their impact. There is a definite need to have the impact assessed on a regional scale.

18. SUMMARY OF IMPACTS

The impacts identified were assessed against certain criteria and summarised in Table 7 below.

Impacts	Road network	Transport of staff	Transport of sulphuric acid Sea /Rail	Emergency evacuation
Assessment Criteria	Level of Service	Capacity & safety	Reliability (Long term)	[1] In case of a major incident
Extent or Spatial influence of impact	Regional	Regional	Regional	Local
Magnitude of Impact	Medium	Medium	Low	Medium
Duration of impact	Long term	Long term	Long term	Long term

Table 7 : Assessment criteria of impacts

Notes: *1: A Major incident is where 10 or more injuries have to be treated or where the capacity of the medical facilities exceeds the number of injured.*

The impacts on the road network are measured in terms of the Level of Service (LoS).

The transport of staff, since safety is the main objective can be assessed in terms of fatal collisions per million kilometers traveled.

The transport of sulfuric acid is assessed by the different modes of transport in the supply chain together with the storage facilities.

The emergency evacuation the reaction time is assessed against the probability of a major incident.

The impacts are rated for significance, probability, confidence and reversibility and the outcome are summarised in Table 8.

Ratings	Road network	Transport of staff	Transport of sulphuric acid Sea /Rail	Emergency evacuation
Significance	Medium	Medium	Medium	Medium
Probability	Probable	Probable	Probable	Low
Confidence	Certain	Sure	Sure	Unsure
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible

Table 8 : Ratings of impacts

The significance of the impact on the road network is rated as medium, since there is spare road capacity. The capacity problems that may occur can be mitigated with geometric and capacity improvements.

The demand to transport staff will increase and as a result, the number of busses on the road and the kilometres travelled will increase. Since safety is the main consideration, the impact would be the probability of being involved in a collision. Collision statistics can be expressed in the "*number of fatal collisions per million kilometres travelled per annum"* for assessment purposes. The Rössing Uranium bus fleet has had zero fatal accidents.

19. ASSESSMENT OF RISK EXCEEDANCES

19.1 ROAD NETWORK

With the increase in activities at Rössing Uranium, the traffic on the roads normally used by Rössing Uranium will increase. In addition the background traffic will also increase due to other developments in the region resulting in two intersections where the LoS will deteriorate to a level below the acceptable norm of LoS C.

The two intersections are the T-junction of DR1911 with the B2 and the T-junction of C34 with B2. This can however be mitigated with appropriate geometric improvements at the appropriate time.

The purpose of such improvements would be ensure the functioning of the intersections remain at a LoS C or better.

19.2 TRANSPORT OF STAFF

With the increase in the number of staff employed, more buses will be required and hence more kilometres will be travelled. This will expose Rössing Uranium buses to potential collisions, however the involvement of Rössing Uranium buses in road collision is virtually zero. If the same safety standard is maintained with regard to driver training this should not exceed any additional risks.

The risk can further be reduced if buses with a higher passenger capacity are considered in order to have fewer vehicles on the road.

19.3 TRANSPORT OF SULPHURIC ACID

There is reserve capacity in the transport supply chain (harbour and rail) of sulphuric acid to the mine. The harbour and rail authorities are aware of the increase in demand of sulphuric acid and should be able to provide the transport. However, Rössing Uranium currently investigates the capacity of the storage facilities, at the harbour, which forms an important link in the supply chain.

19.4 EMERGENCY RESPONSE AND EVACUATION

Although remotely located, the response time to stabilize severely injured persons is acceptable due to the on site facilities. The medical capability of the Cottage Hospital in Swakopmund is increasing and can deal with most severe injuries. The evacuation, by air, response times are limited, but the availability of a dedicated aircraft in Arandis, available for chartering could be investigated and mitigate such response times. Furthermore, the strict safety precautions and Disaster Management & Recovery procedure (DMR) at the mine limit the risk of major incidents and hence neutralise this risk.

The DMR should be kept updated at all times, especially when the mine changes medical service providers.

The Arandis airport is vital for air evacuation and therefore important that it be kept in a good operational condition.

20. CONCLUSION AND RECOMMENDATIONS

The following conclusions were reached and recommendations are made according to the findings:

- **Road network**
  The general road network would cope with the increase in traffic in terms of available capacity. However, the following local improvements would be needed in the short term:
  - With the increase in traffic volumes, certain movements at two intersections in particular proved they would become problematic, namely –
    - ***the Rössing Uranium/Arandis intersection with the B2 (DR1911/B2) :*** This would need to be improved to accommodate the expected increase in traffic. This could best be done by way of changes in the intersection layout, as proposed in this report. It is recommended that the proposal be formally submitted to the

Roads Authority and that an agreement be reached between them and Rössing Uranium with regard to the proposed development.

  - ***the B2 T-junction with the C34 (the road behind the dunes DR 1984):*** This also needs to be improved in order to enhance the attractiveness and to promote the use of the C34, especially by heavy vehicles.

- o In the medium- to long-term, the other intersections and accesses on the B2 need to be upgraded to a higher and more harmonised geometric standard.
- o The heavy vehicle route through Swakopmund could become problematic and needs further investigation with the relevant authorities. The most appropriate step would be to upgrade the C34 (the road behind the dunes) to bitumen standard.

- **Road traffic management and road safety**

  The road safety audit has revealed major shortcomings and deficiencies that need to be addressed and brought to the attention of the authorities responsible. The best would be to present the findings of the RSA report to the newly formed Road Committees, and obtain authorities' commitment to an implementation plan.

- **Traffic on the Rössing Uranium Mine**

  Implementation of the RSA report findings in terms of traffic management issues on Rössing Uranium internal and private roads should be considered.

- **Staff transportation demand**

  To accommodate the increased demand for staff transportation, additional buses would be required. Based on the average increase in the expected staff component, five buses would be needed. Based on the maximum staff increase, expected in 2011, eight buses would be required. Prior to a final decision in sourcing additional buses, however, the predicted staff requirement should be confirmed.

  The transport demand is based on the assumption that additional housing would be made available at Arandis. Rössing Uranium should perhaps consider facilitating the development of further housing, as there would be a direct logistical benefit from the viewpoint of providing transport.

- **Rail passenger transport as option**

  Transporting passengers by rail was also debated as an option in the report. The criteria looked at were safety, cost, and convenience. Since the Rössing Uranium buses have proved safe, switching to rail transport would not improve on safety. The cost of the rolling stock required would not be justified economically, and travelling time would be much longer. From a total transport viewpoint, investing in the upgrading of the B2 route instead of in a passenger rail transport would offer more benefit to road users in general; Rössing Uranium staff would benefit from these directly.

- **Railway network**

  The railway network operated by TransNamib fulfils its dedicated functions, and has extensive spare capacity. Operation and travel times are negatively affected due to the absence of signalisation, however. Moreover, periodic and routine maintenance seems to be lacking due to budget shortfall, which could have a negative effect on safe operations. In order to address some of these issues, TransNamib has launched a study on whether to involve the private sector in the upgrading and management of the Walvis Bay–Tsumeb railway line.

- **Rail and harbour facilities for the delivery of sulphuric acid**
  With an increase in demand for sulphuric acid, storage facilities would become critical in the supply chain. Whether storage should to be upgraded at the harbour or at the mine needs to be investigated in more detail, with inputs other than transportation considerations.

- **Emergency response and evacuation**
  An assessment was made of the emergency response and evacuation support systems. The on site facilities are deemed sufficient. The continual updating of the Disaster Management & Recovery procedure (DMR) is of utmost importance. The possibility of chartering an aircraft from the Arandis airport should be investigated. The monitoring of the operational condition of the Arandis airport should include in the DMR. (i.e. Ensure the civil aviation inspection is done every year, and that the airport is in possession of a valid certificate.

  The demarcation of a suitable area to serve as a helicopter-landing pad should be investigated.

Prepared by:
AC van der Merwe
Burmeister & Partners
Final report submitted in March 2010

Traffic Impact Assessment
Rio Tinto Rössing Uranium Limited

INDEX TO THE ANNEXURES

The following reports are attached hereto:

- Road Safety Audit Report E: Swakopmund Urban Area *Annexure I1*
- Road Safety Audit Report E: Statement *Annexure I2*
- Road Safety Audit Report E: Exhibits *Annexure I3*

List of Plans **Annexure J**

Intersection layouts:

W1141–CP–01; W1141–CP–02; W1141–CP–03; W1141–CP–04

Photographic Report of the intersections

W1141–CP–05: W1141–CP–06; W1141–CP–07

Proposed changes to the B2–Rössing Uranium/Arandis intersection

W1141/CP–08; W1141/CP–09

Potential problem intersections and location of uranium mines in the Erongo Region:

W1141/CP-10

ANNEXURE A

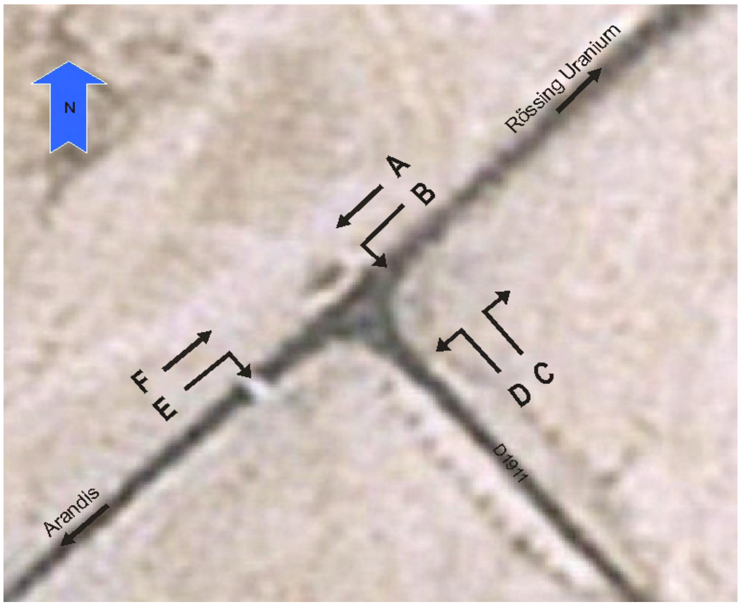
TRAFFIC COUNT DATA

Annexure A1	Arandis – Rossing Uranium
Annexure A2	B2 – D1911
Annexure A3	Sam Nujoma Drive – Nelson Mandela
Annexure A4	B2 – D1984
Annexure A5	Sam Nujoma Drive – Moses Garoëb Street
Annexure A6	Natäniel Maxuilili – Rhode Allee Street
Annexure A7	B2 Langstrand Intersection 1
Annexure A8	B2 Langstrand Intersection 2
Annexure A9	Walvis Bay Traffic Circle

Annexure A1
Arandis – Rossing Uranium

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	ARANDIS & ROSSING URANIUM	
DATE:	Friday, 07/11/2008	TOWN : Arandis



TRAFFIC COUNT SUMMARY

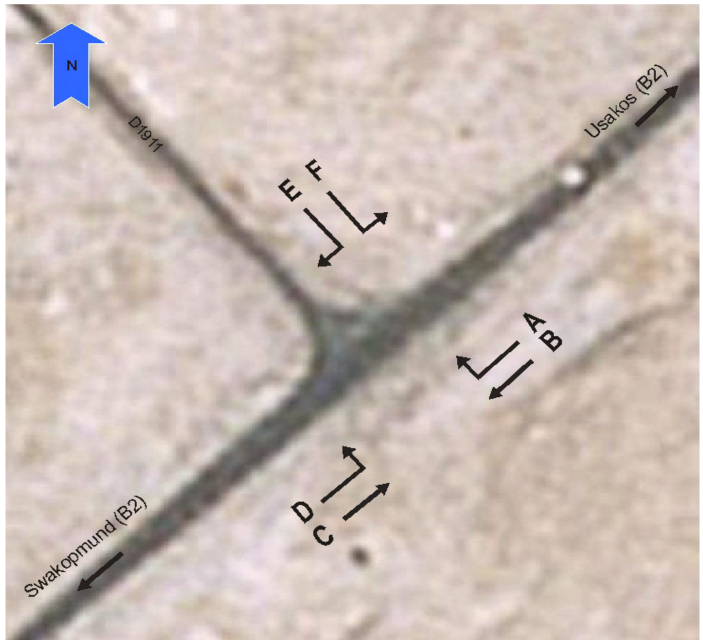
Approach	From B2 (Swakopmund - Usakos)				From Arandis				From Rossing Uranium			
	D		C		E		F		A		B	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (07:00 - 08:00) :	25	11	79	24	51	12	29	4	1	0	4	2
Midday peak (13:00 - 14:00) :	19	2	4	0	2	2	33	4	12	5	9	2
Afternoon peak (17:00 - 18:00) :	24	2	1	0	5	0	51	13	42	21	93	25
12 Hour Volume												
Movement	242	35	166	43	102	34	338	45	139	46	182	46
Approach	486				519				413			
Intersection	1418											

W1141-Taffic Impact Assessment Rössing Uranium												
INTERSECTION:	ARANDIS & ROSSING URANIUM											
DATE:	Friday, 07/11/2008						TOWN : Arandis					
TRAFFIC COUNT												
APPROACH:	From B2 (Swakopmund - Usakos)				From Arandis				From Rossing Uranium			
	D		C		E		F		A		B	
TIME	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
06:00 - 06:15	2	0	2	0	0	0	2	1	0	0	0	0
06:15 - 06:30	0	2	3	0	1	1	3	1	0	0	0	0
06:30 - 06:45	6	0	3	0	0	0	2	0	0	0	0	0
06:45 - 07:00	4	1	10	4	6	3	3	0	2	0	1	0
07:00 - 07:15	4	6	15	3	20	3	5	2	0	0	0	0
07:15 - 07:30	8	2	21	17	19	6	7	0	0	0	2	0
07:30 - 07:45	8	2	30	4	10	1	11	2	1	0	2	2
07:45 - 08:00	5	1	13	0	2	2	6	0	0	0	0	0
08:00 - 08:15	1	2	5	1	4	0	7	0	4	0	2	1
08:15 - 08:30	1	0	4	0	1	0	7	2	2	0	3	0
08:30 - 08:45	3	2	8	0	1	2	6	2	2	2	2	2
08:45 - 09:00	0	0	2	0	2	0	5	1	1	0	3	0
09:00 - 09:15	2	0	5	0	1	0	12	0	0	0	3	2
09:15 - 09:30	2	1	2	0	2	1	8	0	1	2	3	0
09:30 - 09:45	1	0	3	0	0	3	3	0	2	0	1	0
09:45 - 10:00	5	0	5	1	0	0	8	1	3	0	2	0
10:00 - 10:15	5	0	3	3	2	1	6	0	2	0	2	1
10:15 - 10:30	5	3	2	1	2	0	5	2	3	0	0	0
10:30 - 10:45	3	0	3	0	0	0	8	0	1	0	1	0
10:45 - 11:00	4	0	3	0	0	0	7	0	0	1	1	1
11:00 - 11:15	3	1	1	0	2	0	6	1	6	3	4	0
11:15 - 11:30	9	1	2	2	2	0	7	1	0	1	1	0
11:30 - 11:45	7	0	0	0	2	0	11	1	0	0	4	0
11:45 - 12:00	6	2	0	1	0	1	5	1	1	1	3	0
12:00 - 12:15	10	0	1	0	0	0	6	1	3	0	1	1
12:15 - 12:30	3	0	2	0	1	0	7	0	1	1	0	0
12:30 - 12:45	11	0	1	0	0	0	4	0	5	3	1	0
12:45 - 13:00	7	0	1	1	0	0	5	0	2	1	2	1
13:00 - 13:15	3	0	0	0	2	1	7	3	3	0	0	1
13:15 - 13:30	7	0	1	0	0	1	11	0	5	2	5	0
13:30 - 13:45	3	1	1	0	0	0	4	0	1	2	2	1
13:45 - 14:00	6	1	2	0	0	0	11	1	3	1	2	0
14:00 - 14:15	3	0	4	0	1	0	8	2	5	0	5	0
14:15 - 14:30	8	0	1	0	1	0	9	1	3	1	4	0
14:30 - 14:45	10	0	1	0	1	0	9	0	2	0	1	1
14:45 - 15:00	3	2	1	0	2	0	3	0	5	2	4	1
15:00 - 15:15	8	0	0	1	1	4	6	2	5	1	2	0
15:15 - 15:30	8	1	0	2	3	1	3	0	6	0	1	1
15:30 - 15:45	8	1	2	2	1	0	4	1	3	1	2	0
15:45 - 16:00	4	0	1	0	2	0	5	1	10	0	11	1
16:00 - 16:15	5	0	0	0	1	1	9	1	1	0	1	0
16:15 - 16:30	4	1	0	0	1	1	9	1	3	0	1	0
16:30 - 16:45	8	0	1	0	1	1	9	0	0	0	1	2
16:45 - 17:00	5	0	0	0	0	0	8	0	0	0	3	2
17:00 - 17:15	6	0	0	0	2	0	15	2	16	1	30	2
17:15 - 17:30	6	0	0	0	2	0	18	7	17	2	35	11
17:30 - 17:45	5	1	1	0	1	0	9	3	6	15	20	9
17:45 - 18:00	7	1	0	0	0	0	9	1	3	3	8	3
DAY TOTAL	242	35	166	43	102	34	338	45	139	46	182	46

Annexure A2
B2 – D1911

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	B2 & D1911	
DATE:	Friday, 07/11/2008	TOWN : Arandis



TRAFFIC COUNT SUMMARY

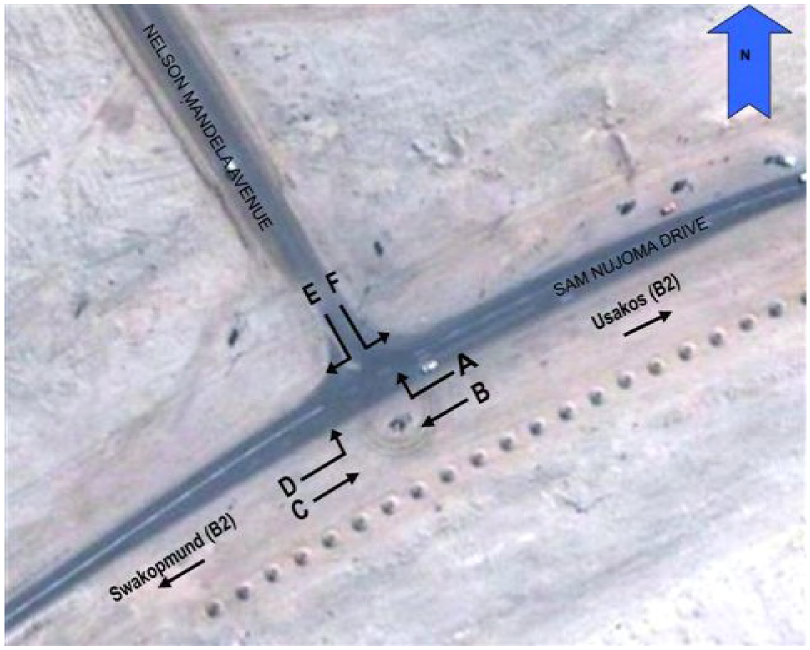
Approach	From Arandis - Rossing Uranium				From Swakopmund				From Usakos			
	F		E		D		C		B		A	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (07:00 - 08:00) :	5	1	30	0	109	19	41	1	14	12	4	4
Midday peak (14:00 - 15:00) :	12	1	31	4	26	1	76	11	39	11	5	1
Afternoon peak (17:00 - 18:00) :	16	2	82	22	22	3	54	17	114	10	7	0
12 Hour Volume												
Movement	123	22	338	58	358	44	615	98	498	95	49	15
Approach	541				1115				657			
Intersection	2313											

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	B2 & D1911											
DATE:	Friday, 07/11/2008						TOWN : Arandis					
TRAFFIC COUNT												
APPROACH:	From Arandis - Rossing Uranium				From Swakopmund				From Usakos			
	F		E		D		C		B		A	
TIME	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
06:00 - 06:15	0	0	0	1	1	0	1	0	1	0	1	1
06:15 - 06:30	1	0	1	1	3	0	6	2	2	3	2	0
06:30 - 06:45	0	0	2	0	7	0	7	3	4	2	0	0
06:45 - 07:00	2	0	3	0	14	4	18	1	1	2	1	0
07:00 - 07:15	2	0	6	0	20	4	18	0	0	5	0	2
07:15 - 07:30	0	0	6	0	32	15	5	1	5	3	2	0
07:30 - 07:45	2	1	9	0	39	0	7	0	5	1	1	1
07:45 - 08:00	1	0	9	0	18	0	11	0	4	3	1	1
08:00 - 08:15	2	0	5	0	6	0	8	0	6	3	0	1
08:15 - 08:30	2	0	10	0	6	0	4	0	2	1	0	0
08:30 - 08:45	0	2	2	2	13	0	5	0	4	0	2	0
08:45 - 09:00	0	0	0	9	4	0	13	0	7	0	0	0
09:00 - 09:15	0	3	7	0	4	0	9	2	7	2	1	0
09:15 - 09:30	1	0	7	1	1	0	12	1	7	1	0	2
09:30 - 09:45	2	0	5	0	7	3	11	1	4	2	1	0
09:45 - 10:00	8	0	4	0	3	1	10	0	8	0	0	0
10:00 - 10:15	4	0	4	0	6	1	9	5	7	3	0	3
10:15 - 10:30	3	1	5	0	3	2	8	0	7	2	1	1
10:30 - 10:45	2	0	9	0	5	1	17	2	8	2	1	0
10:45 - 11:00	1	1	6	1	5	1	13	2	3	0	0	0
11:00 - 11:15	3	2	9	1	3	0	12	1	19	2	1	0
11:15 - 11:30	6	2	3	1	6	2	11	4	9	2	1	1
11:30 - 11:45	6	0	3	0	7	0	15	4	7	1	0	0
11:45 - 12:00	2	0	2	2	3	2	13	1	13	3	1	0
12:00 - 12:15	3	0	6	0	11	0	24	1	12	2	1	0
12:15 - 12:30	3	0	2	1	4	0	14	2	11	8	0	0
12:30 - 12:45	2	1	6	1	7	1	8	1	11	2	2	0
12:45 - 13:00	3	0	8	1	7	0	17	3	9	2	2	0
13:00 - 13:15	3	0	5	3	1	0	17	0	12	2	1	0
13:15 - 13:30	6	0	7	2	6	0	12	4	5	1	1	0
13:30 - 13:45	1	1	5	0	3	1	9	5	10	1	0	0
13:45 - 14:00	1	4	12	1	8	0	19	2	9	4	0	0
14:00 - 14:15	3	0	11	1	7	0	22	2	6	6	2	0
14:15 - 14:30	2	1	9	1	5	0	17	2	9	1	3	0
14:30 - 14:45	2	0	7	0	10	1	10	2	7	1	0	0
14:45 - 15:00	5	0	4	2	4	0	27	5	17	3	0	1
15:00 - 15:15	3	1	8	1	7	0	21	6	15	3	3	0
15:15 - 15:30	1	0	5	0	7	2	21	4	7	4	1	0
15:30 - 15:45	3	0	7	0	10	0	18	3	13	1	1	0
15:45 - 16:00	6	0	12	0	5	0	15	2	15	0	0	0
16:00 - 16:15	4	0	11	1	6	0	11	1	14	0	2	0
16:15 - 16:30	3	0	7	1	2	0	14	3	14	0	4	1
16:30 - 16:45	2	0	4	0	5	0	11	1	26	1	0	0
16:45 - 17:00	1	0	3	1	5	0	11	2	22	0	2	0
17:00 - 17:15	4	1	30	1	3	0	8	2	23	0	2	0
17:15 - 17:30	5	1	28	5	2	1	18	4	28	3	2	0
17:30 - 17:45	3	0	17	13	9	1	15	6	33	4	1	0
17:45 - 18:00	4	0	7	3	8	1	13	5	30	3	2	0
DAY TOTAL	123	22	338	58	358	44	615	98	498	95	49	15

Annexure A3
Sam Nujoma Drive – Nelson Mandela

W1141-Taffic Impact Assessment Rössing Uranium		
INTERSECTION:	SAM NUJOMA & NELSON MANDELA AVENUE	
DATE:	Monday, 03/11/2008	TOWN : Swakopmund



TRAFFIC COUNT SUMMARY

Approach	From Nelson Mandela Avenue				From Swakopmund				From Arandis			
	F		E		D		C		A		B	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (09:00 - 10:00) :	68	15	21	9	34	4	114	53	58	11	67	12
Midday peak (13:00 - 14:00) :	42	9	28	5	45	5	96	13	56	7	67	10
Afternoon peak (17:00 - 18:00) :	47	10	39	1	34	5	68	7	100	29	104	12
12 Hour Volume												
Movement	715	184	272	45	434	47	958	185	755	154	791	111
Approach	1216				1624				1811			
Intersection	4651											

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	SAM NUJOMA & NELSON MANDELA AVENUE	
DATE:	Monday, 03/11/2008	TOWN : Swakopmund

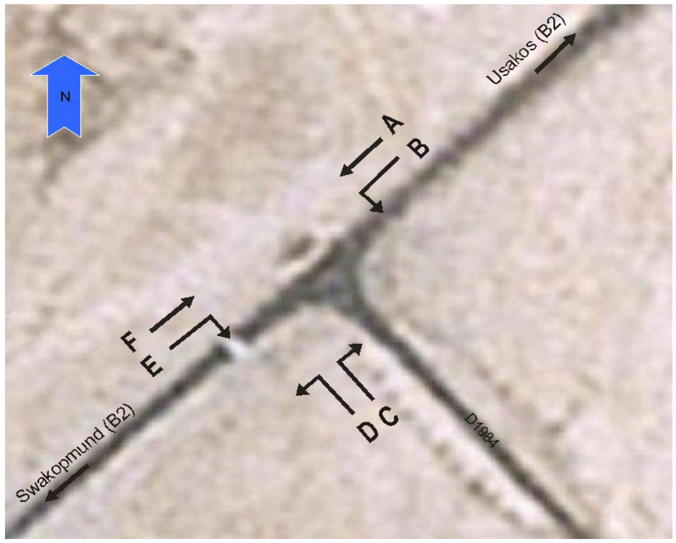
TRAFFIC COUNT

APPROACH:	From Nelson Mandela Avenue				From Swakopmund				From Arandis			
	F		E		D		C		A		B	
TIME	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
06:00 - 06:15	17	0	2	1	3	0	12	2	2	0	3	0
06:15 - 06:30	20	1	1	0	10	0	11	1	2	0	4	1
06:30 - 06:45	32	10	2	2	6	1	11	4	5	1	4	3
06:45 - 07:00	24	11	7	0	12	0	1	26	7	3	8	2
07:00 - 07:15	32	3	1	0	22	0	29	1	10	1	7	1
07:15 - 07:30	29	0	10	1	8	1	30	0	25	7	12	5
07:30 - 07:45	15	3	11	0	9	0	17	1	10	1	8	1
07:45 - 08:00	26	1	6	2	12	1	18	5	18	2	17	3
08:00 - 08:15	14	5	7	2	21	0	16	1	9	6	8	2
08:15 - 08:30	16	1	6	1	9	0	28	4	26	2	17	3
08:30 - 08:45	15	5	4	0	5	2	23	1	12	4	18	2
08:45 - 09:00	10	4	1	2	9	3	3	2	22	5	16	0
09:00 - 09:15	17	6	5	5	12	2	32	5	22	4	23	5
09:15 - 09:30	13	2	4	1	5	2	12	47	3	2	9	1
09:30 - 09:45	11	4	5	2	7	0	40	1	20	0	11	3
09:45 - 10:00	27	3	7	1	10	0	30	0	13	5	24	3
10:00 - 10:15	8	7	4	0	4	0	22	4	18	0	19	0
10:15 - 10:30	12	0	7	0	10	1	28	1	14	5	26	1
10:30 - 10:45	11	2	3	0	7	1	15	1	14	3	15	2
10:45 - 11:00	10	2	4	1	19	2	18	1	10	3	15	0
11:00 - 11:15	19	6	3	0	4	0	22	4	13	4	19	4
11:15 - 11:30	19	3	8	3	10	0	30	2	9	3	14	3
11:30 - 11:45	13	0	3	0	5	2	20	2	12	1	12	2
11:45 - 12:00	20	30	4	0	4	2	20	7	21	4	15	4
12:00 - 12:15	1	11	6	2	5	0	20	4	18	3	16	5
12:15 - 12:30	14	4	4	0	7	1	26	2	12	1	8	0
12:30 - 12:45	15	4	6	0	18	1	17	1	14	6	21	2
12:45 - 13:00	17	2	4	1	11	2	14	5	12	6	19	5
13:00 - 13:15	12	4	14	2	21	0	22	4	20	1	12	2
13:15 - 13:30	8	3	3	0	2	1	19	3	7	1	18	1
13:30 - 13:45	16	1	4	0	8	3	25	3	24	4	23	5
13:45 - 14:00	6	1	7	3	14	1	30	3	5	1	14	2
14:00 - 14:15	10	2	5	0	7	1	19	0	11	2	12	2
14:15 - 14:30	18	4	9	2	7	4	23	6	18	0	16	3
14:30 - 14:45	14	2	4	0	4	2	19	1	18	4	23	3
14:45 - 15:00	10	3	4	1	5	1	19	2	18	2	17	3
15:00 - 15:15	12	7	2	2	10	0	20	2	12	1	11	3
15:15 - 15:30	9	1	3	0	8	0	30	0	12	3	14	2
15:30 - 15:45	15	1	7	1	13	1	16	1	13	4	22	1
15:45 - 16:00	6	2	7	2	6	0	27	3	11	1	19	1
16:00 - 16:15	11	2	12	0	11	0	14	2	16	6	21	2
16:15 - 16:30	16	3	9	2	1	1	21	7	21	3	20	3
16:30 - 16:45	17	6	6	1	11	1	11	3	36	5	24	1
16:45 - 17:00	11	2	2	1	8	2	10	3	40	5	33	2
17:00 - 17:15	4	2	9	0	8	1	17	3	32	18	39	5
17:15 - 17:30	13	2	19	1	7	0	16	3	21	3	19	1
17:30 - 17:45	17	2	8	0	7	2	16	1	24	4	24	0
17:45 - 18:00	13	4	3	0	12	2	19	0	23	4	22	6
DAY TOTAL	715	184	272	45	434	47	958	185	755	154	791	111

Annexure A4
B2 – D1984

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	B 2 & D1984	
DATE:	Tuesday, 03/11/2008	TOWN : Swakopmund



TRAFFIC COUNT SUMMARY

Approach	From D1984				From Swakopmund				From Usakos			
	D		C		F		E		A		B	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (07:00 - 08:00) :	36	0	0	9	185	11	30	31	109	18	0	0
Midday peak (13:00 - 14:00) :	29	5	0	4	90	21	15	4	58	21	1	4
Afternoon peak (16:00 - 17:00) :	27	2	14	0	59	23	14	2	164	23	3	0
12 Hour Volume												
Movement	242	54	24	23	1210	202	188	97	1055	206	15	16
Approach	343				1697				1292			
Intersection	3332											

W1141-Taffic Impact Assessment Rössing Uranium												
INTERSECTION:	B 2 & D1984											
DATE:	Tuesday, 03/11/2008						TOWN : Swakopmund					
TRAFFIC COUNT												
APPROACH:	From D1984				From Swakopmund				From Arandis			
	D		C		F		E		A		B	
TIME	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
06:00 - 06:15	0	0	0	0	35	0	9	0	1	4	0	0
06:15 - 06:30	1	1	1	1	20	0	3	0	7	4	0	0
06:30 - 06:45	1	0	0	1	35	0	8	7	7	2	0	0
06:45 - 07:00	0	0	0	0	40	3	8	8	10	5	0	2
07:00 - 07:15	3	0	0	2	50	2	8	8	43	3	0	0
07:15 - 07:30	13	0	0	2	45	2	11	8	21	6	0	0
07:30 - 07:45	17	0	0	3	60	2	8	8	16	5	0	0
07:45 - 08:00	3	0	0	2	30	5	3	7	29	4	0	0
08:00 - 08:15	4	0	3	2	17	5	3	7	18	2	1	0
08:15 - 08:30	5	0	3	2	22	5	1	1	24	6	0	0
08:30 - 08:45	2	0	0	0	30	0	5	0	20	5	1	0
08:45 - 09:00	1	0	0	2	18	3	0	0	18	3	0	0
09:00 - 09:15	0	1	0	1	22	2	0	2	15	2	0	0
09:15 - 09:30	1	0	0	0	25	5	4	2	25	5	0	0
09:30 - 09:45	2	0	0	0	21	1	0	1	15	4	0	0
09:45 - 10:00	4	7	0	0	30	3	5	4	25	8	1	0
10:00 - 10:15	1	0	3	1	18	2	2	2	18	0	1	2
10:15 - 10:30	2	2	0	0	24	4	3	1	25	5	0	0
10:30 - 10:45	4	2	0	0	22	3	3	2	26	3	0	0
10:45 - 11:00	4	0	0	0	27	6	2	0	14	2	0	0
11:00 - 11:15	5	0	0	0	25	7	0	0	18	5	0	0
11:15 - 11:30	9	3	0	0	20	5	4	0	15	4	0	1
11:30 - 11:45	7	2	0	0	35	8	6	0	23	3	1	0
11:45 - 12:00	2	2	0	0	29	7	2	0	20	3	2	0
12:00 - 12:15	4	2	0	0	25	5	6	0	18	4	1	1
12:15 - 12:30	9	1	0	0	30	7	7	0	15	4	0	0
12:30 - 12:45	5	2	0	0	20	9	5	0	17	4	0	0
12:45 - 13:00	7	0	0	0	20	3	0	0	23	6	0	1
13:00 - 13:15	4	1	0	0	8	3	4	2	10	2	0	0
13:15 - 13:30	8	2	0	0	29	7	4	0	15	8	0	2
13:30 - 13:45	10	2	0	4	32	9	7	2	19	5	1	2
13:45 - 14:00	7	0	0	0	21	2	0	0	14	6	0	0
14:00 - 14:15	0	0	0	0	18	2	3	0	21	5	0	1
14:15 - 14:30	8	3	0	0	16	3	2	2	23	2	0	0
14:30 - 14:45	3	2	0	0	22	2	5	2	23	6	0	1
14:45 - 15:00	5	3	0	0	20	8	7	4	19	1	0	0
15:00 - 15:15	3	2	0	0	25	7	2	3	11	3	1	0
15:15 - 15:30	4	1	0	0	27	3	5	4	17	2	0	1
15:30 - 15:45	2	0	0	0	27	8	7	3	27	1	0	1
15:45 - 16:00	0	0	0	0	15	4	0	0	20	2	0	0
16:00 - 16:15	4	0	0	0	18	4	0	0	28	8	2	0
16:15 - 16:30	12	2	2	0	22	7	12	2	30	5	0	0
16:30 - 16:45	0	0	12	0	7	5	2	0	55	2	1	0
16:45 - 17:00	11	0	0	0	12	7	0	0	51	8	0	0
17:00 - 17:15	7	4	0	0	15	4	5	0	45	15	1	1
17:15 - 17:30	10	3	0	0	25	3	0	0	28	2	0	0
17:30 - 17:45	11	4	0	0	27	7	0	0	35	3	1	0
17:45 - 18:00	17	0	0	0	29	3	7	5	38	9	0	0
DAY TOTAL	242	54	24	23	1210	202	188	97	1055	206	15	16

Annexure A5
Sam Nujoma Drive – Moses Garoëb Street

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	SAM NUJOMA & MOSES GAROEB	
DATE:	Tuesday, 04/11/2008	TOWN : Swakopmund

TRAFFIC COUNT SUMMARY

Approach	From Moses Garoeb Str (South)						From Moses Garoeb Str (North)						From Sam Nujoma Avenue (East)						From Sam Nujoma Avenue (West)					
	J		K		L		F		E		D		I		H		G		C		B		A	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (07:00 - 08:00) :	20	0	92	6	130	1	36	0	188	6	5	6	98	1	185	9	112	1	10	14	79	2	93	4
Midday peak (12:00 - 13:00) :	29	0	120	14	188	3	41	0	136	20	17	20	89	5	126	16	107	2	19	5	87	3	68	4
Afternoon peak (16:00 - 17:00) :	29	1	68	2	192	4	44	1	144	13	22	9	65	1	145	12	135	6	27	12	92	2	65	1
12 Hour Volume																								
Movement	304	3	1050	47	2009	23	442	8	1704	148	157	103	845	32	1632	135	1447	31	229	103	875	48	795	25
Approach	3436						2562						4122						2075					
Intersection	12195																							

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	SAM NUJOMA & MOSES GAROEB	
DATE:	Tuesday, 04/11/2008	TOWN : Swakopmund

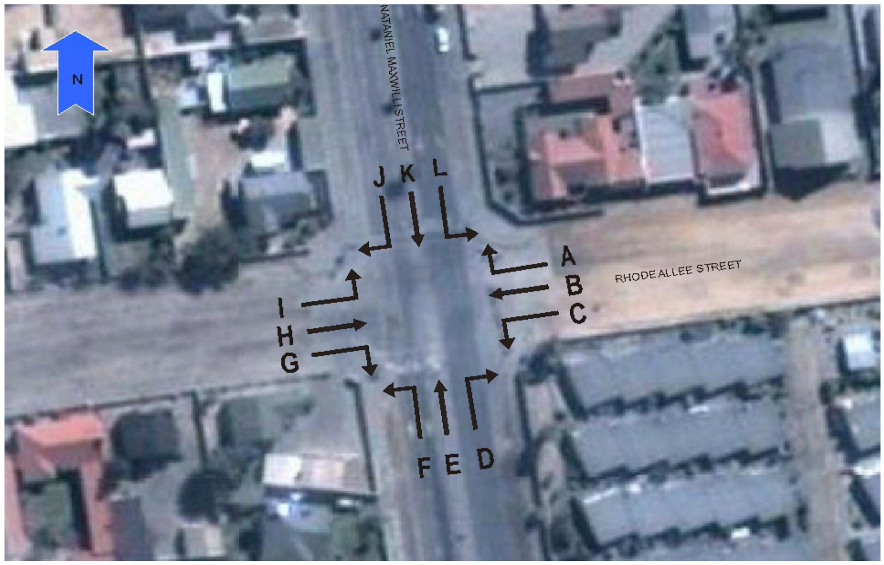
TRAFFIC COUNT

APPROACH:	From Moses Garoeb Str (South)						From Moses Garoeb Str (North)						From Sam Nujoma Avenue (East)						From Sam Nujoma Avenue (West)					
	J		K		L		F		E		D		I		H		G		C		B		A	
TIME	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
06:00 - 06:15	4	0	6	0	3	0	0	0	8	0	1	0	4	0	6	0	4	0	1	1	0	1	0	0
06:15 - 06:30	5	0	10	0	8	1	0	0	13	2	2	0	10	1	11	0	4	0	2	4	14	2	1	0
06:30 - 06:45	3	0	20	1	9	0	2	0	16	5	0	4	10	0	22	1	4	0	3	1	3	0	6	0
06:45 - 07:00	14	0	55	0	34	0	5	0	36	1	1	0	38	0	51	0	19	0	0	4	7	0	19	1
07:00 - 07:15	7	0	29	0	23	0	19	0	49	3	0	0	45	0	54	3	18	0	3	1	19	1	24	2
07:15 - 07:30	7	0	28	5	34	0	7	0	61	2	3	0	18	0	50	2	20	1	3	5	25	1	25	1
07:30 - 07:45	1	0	20	0	28	1	4	0	40	0	1	3	22	1	33	3	33	0	2	5	22	0	22	1
07:45 - 08:00	5	0	15	1	45	0	6	0	38	1	1	3	13	0	48	1	41	0	2	3	13	0	22	0
08:00 - 08:15	5	0	19	2	45	0	10	1	60	4	0	3	13	0	41	2	35	0	5	1	14	1	21	0
08:15 - 08:30	3	0	12	0	30	1	7	0	45	2	3	1	19	1	34	4	35	0	3	0	20	0	15	6
08:30 - 08:45	8	0	19	1	41	0	12	0	46	1	1	2	9	2	37	2	28	0	6	5	24	0	12	0
08:45 - 09:00	5	0	22	2	31	1	9	1	25	3	6	1	11	0	32	0	38	2	2	3	16	4	22	0
09:00 - 09:15	5	0	22	1	46	0	17	2	30	5	5	5	20	1	36	4	35	1	5	2	18	1	18	0
09:15 - 09:30	7	0	16	0	38	0	7	0	25	6	7	2	12	1	30	7	30	0	3	3	13	0	12	1
09:30 - 09:45	5	0	20	0	30	0	7	2	30	1	4	3	22	2	30	3	26	1	6	2	12	1	12	1
09:45 - 10:00	3	0	26	1	51	0	9	0	32	2	5	2	20	2	38	2	43	0	8	1	23	1	7	0
10:00 - 10:15	6	0	22	1	37	2	6	0	34	1	2	1	17	1	36	3	45	0	6	2	25	1	19	1
10:15 - 10:30	6	0	28	0	35	1	6	0	40	2	2	2	17	1	35	3	36	2	6	1	23	0	18	0
10:30 - 10:45	6	0	13	1	36	0	18	0	35	6	2	5	20	1	35	1	31	0	6	2	19	0	17	1
10:45 - 11:00	6	0	27	0	52	0	17	0	23	2	5	1	15	1	37	3	46	3	8	0	24	1	23	1
11:00 - 11:15	4	0	17	0	39	0	12	0	49	3	1	2	23	0	35	2	45	1	7	1	19	0	11	0
11:15 - 11:30	9	0	18	0	57	0	5	0	17	3	5	2	12	1	20	3	30	1	2	3	20	0	10	2
11:30 - 11:45	5	1	22	0	41	0	9	0	32	4	3	3	21	0	36	3	38	1	4	4	31	0	18	0
11:45 - 12:00	7	0	20	1	45	1	14	0	25	7	2	2	26	1	28	3	34	1	4	2	16	0	16	0
12:00 - 12:15	6	0	25	1	44	1	10	0	28	6	7	3	14	2	24	8	30	1	2	0	21	1	16	0
12:15 - 12:30	6	0	23	1	49	0	16	0	38	5	3	5	18	3	29	3	27	1	2	3	21	1	12	1
12:30 - 12:45	6	0	27	11	49	2	9	0	37	3	6	6	17	0	36	3	27	0	10	1	19	0	21	1
12:45 - 13:00	11	0	45	1	46	0	6	0	33	6	1	6	40	0	37	2	23	0	5	1	26	1	19	2
13:00 - 13:15	8	0	26	0	54	0	11	0	51	2	3	0	23	0	30	1	36	1	2	1	23	1	52	0
13:15 - 13:30	5	0	33	1	45	0	7	0	29	3	3	0	17	1	22	1	31	0	2	3	24	0	17	0
13:30 - 13:45	5	0	24	1	47	1	4	0	17	2	1	1	8	0	17	2	18	0	0	0	23	0	11	0
13:45 - 14:00	11	1	16	0	46	1	9	0	60	4	1	0	11	0	43	2	38	0	2	5	29	0	28	0
14:00 - 14:15	4	0	20	1	53	0	10	1	26	2	7	3	16	0	39	3	21	1	11	1	19	0	15	0
14:15 - 14:30	2	0	23	3	45	1	10	0	42	6	4	1	18	0	31	5	29	2	5	3	16	1	12	1
14:30 - 14:45	6	0	7	0	47	0	5	0	26	2	4	0	17	2	39	4	31	0	10	3	13	0	17	0
14:45 - 15:00	9	0	15	1	50	0	7	0	34	2	0	1	18	1	34	5	20	2	6	0	21	1	13	0
15:00 - 15:15	2	0	23	0	53	1	10	0	40	5	2	6	9	0	32	5	46	0	3	2	0	18	19	0
15:15 - 15:30	7	0	12	0	54	1	8	0	35	7	5	2	19	3	37	7	41	1	4	2	10	4	14	0
15:30 - 15:45	6	0	19	1	60	1	14	0	34	5	2	1	6	0	35	4	25	2	7	1	16	0	14	0
15:45 - 16:00	5	0	25	0	43	2	10	0	33	4	5	2	15	0	35	5	28	0	6	1	17	0	10	0
16:00 - 16:15	4	0	14	1	50	1	15	0	38	6	7	2	16	0	36	3	25	1	4	4	31	1	12	1
16:15 - 16:30	8	0	15	0	49	2	11	0	18	3	5	3	18	0	26	0	34	1	5	3	16	0	17	0
16:30 - 16:45	10	0	19	0	63	1	6	1	40	2	4	3	16	1	37	6	43	4	8	1	24	1	16	0
16:45 - 17:00	7	1	20	1	30	0	12	0	48	2	6	1	15	0	46	3	33	0	10	4	21	0	20	0
17:00 - 17:15	6	0	29	1	69	0	17	0	48	3	9	3	17	1	46	3	33	0	8	4	18	0	20	1
17:15 - 17:30	25	0	35	5	28	0	6	0	44	0	4	4	25	0	35	5	28	0	8	2	9	1	20	0
17:30 - 17:45	6	0	25	0	53	0	15	0	51	2	4	1	15	1	39	0	32	0	4	1	11	2	16	0
17:45 - 18:00	3	0	24	0	44	0	6	0	45	0	2	2	20	0	32	0	30	0	8	1	27	0	14	0
DAY TOTAL	304	3	1050	47	2009	23	442	8	1704	148	157	103	845	32	1632	135	1447	31	229	103	875	48	795	25

Annexure A6
Natäniel Maxuilili – Rhode Allee Street

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	NATANIEL MAXWILLI & RHODE ALLEE	
DATE:	Thursday, 06/11/2008	TOWN : Swakopmund



TRAFFIC COUNT SUMMARY

Approach	From Nataniel Maxwilli Str (North)						From Nataniel Maxwilli Str (South)						From Rhode Allee Str (West)						From Rhode Allee Str (East)					
	F		E		D		L		K		J		C		B		A		I		H		G	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (11:00 - 12:00) :	1	0	105	4	32	22	15	0	80	7	6	2	31	8	8	2	8	0	5	0	3	0	6	1
Midday peak (13:00 - 14:00) :	6	1	135	7	31	13	6	0	77	6	5	1	48	7	15	0	4	0	5	0	6	0	10	0
Afternoon peak (17:00 - 18:00) :	4	0	152	10	64	21	13	0	103	9	33	3	73	6	28	0	10	6	7	0	25	1	5	0
12 Hour Volume																								
Movement	33	1	1276	91	422	144	123	1	1061	81	108	9	569	145	175	14	60	8	50	0	169	16	73	4
Approach	1967						1383						971						312					
Intersection	4633																							

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	NATANIEL MAXWILLI & RHODE ALLEE
DATE:	Thursday, 06/11/2008 — TOWN : Swakopmund

TRAFFIC COUNT

APPROACH:	From Nataniel Maxwilli Str (North)						From Nataniel Maxwilli Str (South)						From Rhode Allee Str (West)						From Rhode Allee Str (East)					
	F		E		D		L		K		J		C		B		A		I		H		G	
TIME	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
06:00 - 06:15	2	0	3	1	5	0	1	0	10	1	1	0	8	0	0	0	0	0	0	0	0	0	0	0
06:15 - 06:30	0	0	10	8	7	2	0	0	7	0	1	0	9	4	1	2	0	0	0	0	5	0	0	0
06:30 - 06:45	0	0	10	10	8	3	1	0	19	0	0	0	9	1	0	0	0	0	1	0	2	0	0	0
06:45 - 07:00	0	0	26	7	7	2	3	0	16	3	1	0	15	8	1	0	1	0	0	0	4	0	0	0
07:00 - 07:15	0	0	16	0	10	0	1	0	33	0	0	0	20	4	0	0	0	0	0	0	1	0	2	0
07:15 - 07:30	0	0	34	0	9	0	2	0	44	3	1	0	7	4	6	0	1	0	0	0	9	0	1	0
07:30 - 07:45	2	0	20	0	8	1	0	0	29	0	0	0	26	2	4	0	0	0	2	0	5	0	4	1
07:45 - 08:00	0	0	39	1	13	2	1	0	32	1	2	0	7	3	3	0	0	0	2	0	1	0	0	0
08:00 - 08:15	0	0	24	2	9	1	3	0	22	2	1	1	19	6	3	0	1	0	3	0	5	1	3	0
08:15 - 08:30	2	0	26	1	14	0	3	0	40	5	0	0	19	3	2	1	2	0	0	0	1	0	4	0
08:30 - 08:45	2	0	25	1	8	1	1	0	20	0	4	0	18	2	7	1	0	0	0	0	8	0	1	0
08:45 - 09:00	0	0	19	0	19	2	1	0	10	3	0	0	10	3	4	0	3	0	2	0	2	2	2	1
09:00 - 09:15	1	0	29	2	10	3	2	0	20	0	1	0	14	3	6	0	3	0	1	0	3	0	1	0
09:15 - 09:30	0	0	19	0	7	1	1	0	25	3	4	0	9	7	2	0	1	0	1	0	4	0	2	0
09:30 - 09:45	0	0	17	2	6	1	5	0	20	2	2	0	8	3	1	1	2	0	0	0	2	0	0	0
09:45 - 10:00	1	0	25	3	5	5	1	0	18	0	0	0	6	2	6	0	0	0	0	0	4	0	1	1
10:00 - 10:15	0	0	19	1	5	2	0	0	16	1	3	0	11	7	2	2	1	0	1	0	2	0	2	0
10:15 - 10:30	0	0	29	3	3	3	3	0	16	3	0	0	8	3	2	0	2	0	1	0	1	0	0	0
10:30 - 10:45	0	0	29	1	5	6	2	0	23	1	1	0	6	6	4	0	0	0	0	0	5	0	1	0
10:45 - 11:00	1	0	19	1	5	3	2	0	27	1	2	0	11	2	3	0	3	0	2	0	3	2	2	0
11:00 - 11:15	0	0	24	4	10	9	4	0	21	1	2	0	3	3	2	0	2	0	2	0	1	0	0	0
11:15 - 11:30	0	0	26	0	6	6	2	0	19	3	0	0	14	3	3	1	3	0	0	0	0	0	4	1
11:30 - 11:45	1	0	29	0	7	2	7	0	25	3	2	1	7	0	1	1	0	0	2	0	2	0	0	0
11:45 - 12:00	0	0	26	0	9	5	2	0	15	0	2	1	7	2	2	0	3	0	1	0	0	0	2	0
12:00 - 12:15	1	0	23	2	3	2	6	0	15	1	1	0	12	5	8	1	0	0	1	0	4	1	1	0
12:15 - 12:30	0	0	21	1	4	3	2	0	14	1	5	0	8	1	1	0	0	0	4	0	6	1	2	0
12:30 - 12:45	0	0	19	0	10	2	3	0	15	1	0	0	11	6	1	0	0	0	2	0	6	0	0	0
12:45 - 13:00	0	0	31	4	6	5	1	0	17	1	4	0	7	0	5	0	0	0	1	0	5	0	1	0
13:00 - 13:15	2	0	37	2	9	4	4	0	23	1	0	0	10	1	6	0	0	0	1	0	1	0	2	0
13:15 - 13:30	2	0	26	2	9	4	1	0	16	0	2	0	12	2	1	0	2	0	1	0	1	0	2	0
13:30 - 13:45	2	0	36	2	6	3	1	0	21	2	1	0	14	0	0	0	0	0	0	0	2	0	2	0
13:45 - 14:00	0	1	36	1	7	2	0	0	17	3	2	1	12	4	8	0	2	0	3	0	2	0	4	0
14:00 - 14:15	0	0	26	2	7	0	1	0	22	0	4	0	12	5	5	1	2	0	2	0	2	2	4	0
14:15 - 14:30	3	0	38	0	17	1	4	0	34	3	2	0	5	4	4	0	3	0	0	0	3	0	2	0
14:30 - 14:45	2	0	25	1	11	4	0	0	19	3	4	1	9	1	5	0	0	0	0	0	1	0	1	0
14:45 - 15:00	0	0	17	3	10	1	7	1	13	1	0	1	13	3	3	1	2	0	0	0	9	1	0	0
15:00 - 15:15	0	0	43	2	15	6	9	0	28	2	3	0	15	5	3	1	5	0	1	0	4	2	1	0
15:15 - 15:30	2	0	24	1	9	3	5	0	20	3	2	0	16	1	4	0	1	1	2	0	4	3	2	0
15:30 - 15:45	0	0	26	1	4	4	3	0	26	0	2	0	10	6	4	1	1	0	0	0	2	0	0	0
15:45 - 16:00	0	0	26	3	5	5	5	0	30	0	2	0	17	3	6	0	2	0	0	0	4	0	3	0
16:00 - 16:15	1	0	20	1	6	3	2	0	18	2	2	0	13	7	8	0	0	0	1	0	2	0	4	0
16:15 - 16:30	0	0	30	3	8	5	2	0	29	3	2	0	11	2	1	0	1	0	0	0	7	0	1	0
16:30 - 16:45	2	0	43	1	6	4	3	0	17	7	5	0	6	1	5	0	0	0	1	0	7	0	4	0
16:45 - 17:00	0	0	34	1	11	2	3	0	37	2	2	0	12	1	4	0	1	1	2	0	2	0	0	0
17:00 - 17:15	0	0	20	2	6	7	2	0	48	5	3	0	18	1	10	0	4	6	3	0	10	0	0	0
17:15 - 17:30	1	0	34	4	13	6	3	0	0	0	28	3	24	2	9	0	3	0	3	0	8	1	4	0
17:30 - 17:45	3	0	54	2	29	4	6	0	28	3	1	0	18	0	4	0	3	0	0	0	4	0	0	0
17:45 - 18:00	0	0	44	2	16	4	2	0	27	1	1	0	13	3	5	0	0	0	1	0	3	0	1	0
DAY TOTAL	33	1	1276	91	422	144	123	1	1061	81	108	9	569	145	175	14	60	8	50	0	169	16	73	4

Annexure A7
B2 Langstrand Intersection 1

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	LANGSTRAND & B1 (INTERSECTION 1)	
DATE:	Thursday, 23/04/2009	TOWN : Langstrand

TRAFFIC COUNT SUMMARY

Approach	From Swakopmund				From Walvisbay				From Langstrand			
	B		A		C		D		F		E	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (07:00 - 08:00) :	190	18	5	0	142	5	13	1	23	0	43	0
Afternoon peak (17:00 - 18:00) :	167	10	32	0	234	14	31	0	7	0	14	0
12 Hour Volume												
Movement	562	57	53	2	593	44	65	1	55	2	83	1
Approach	674				703				141			
Intersection	1518											

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	LANGSTRAND & B1 (INTERSECTION 1)	
DATE:	Thursday, 23/04/2009	TOWN : Langstrand

TRAFFIC COUNT

APPROACH:	From Swakopmund				From Walvisbay				From Langstrand			
	B		A		C		D		F		E	
TIME	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
06:00 - 06:15	3	1	1	0	10	3	1	0	3	0	1	0
06:15 - 06:30	9	3	0	0	13	0	1	0	4	1	0	0
06:30 - 06:45	28	7	0	0	30	5	3	0	4	0	4	0
06:45 - 07:00	27	3	1	1	20	2	2	0	6	0	5	0
07:00 - 07:15	37	4	2	0	22	1	5	0	6	0	7	0
07:15 - 07:30	50	4	2	0	35	0	3	0	5	0	17	0
07:30 - 07:45	53	5	1	0	43	4	2	1	5	0	9	0
07:45 - 08:00	50	5	0	0	42	0	3	0	7	0	10	0
16:00 - 16:15	31	3	2	0	33	3	4	0	2	0	5	0
16:15 - 16:30	32	5	3	1	37	4	1	0	1	1	5	1
16:30 - 16:45	38	3	6	0	22	3	4	0	3	0	5	0
16:45 - 17:00	37	4	3	0	52	5	5	0	2	0	1	0
17:00 - 17:15	39	1	3	0	38	3	5	0	1	0	2	0
17:15 - 17:30	63	3	9	0	63	6	6	0	2	0	4	0
17:30 - 17:45	36	5	12	0	78	4	10	0	1	0	4	0
17:45 - 18:00	29	1	8	0	55	1	10	0	3	0	4	0
DAY TOTAL	562	57	53	2	593	44	65	1	55	2	83	1

Annexure A8
B2 Langstrand Intersection 2

W1141-Taffic Impact Assessment Rössing Uranium

INTERSECTION:	LANGSTRAND & B1 (INTERSECTION 1)	
DATE:	Thursday, 23/04/2009	TOWN : Langstrand

TRAFFIC COUNT SUMMARY

Approach	Langstrand Incoming				Langstrand Outgoing			
	From Swakopmund		From Walvisbay		To Swakopmund		To Walvisbay	
	A		B		D		C	
	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (07:00 - 08:00) :	1	0	11	0	5	0	37	1
Afternoon peak (17:00 - 18:00) :	9	1	26	3	7	1	5	2
12 Hour Volume								
Movement	18	1	45	6	28	4	74	4
Approach	70				110			
Intersection	180							

W1141-Taffic Impact Assessment Rössing Uranium										
INTERSECTION:			LANGSTRAND & B1 (INTERSECTION 1)							
DATE:			Thursday, 23/04/2009					TOWN : Langstrand		
TRAFFIC COUNT										
APPROACH:			FROM SWAKOPMUND		FROM WALVIS BAY		TO SWAKOPMUND		TO WALVIS BAY	
			A		B		D		C	
TIME			LV	HV	LV	HV	LV	HV	LV	HV
06:00	-	06:15	0	0	0	0	0	0	0	0
06:15	-	06:30	0	0	0	0	3	0	1	0
06:30	-	06:45	0	0	0	0	4	0	7	0
06:45	-	07:00	0	0	0	0	4	0	13	0
07:00	-	07:15	0	0	3	0	2	0	15	0
07:15	-	07:30	1	0	4	0	0	0	6	0
07:30	-	07:45	0	0	1	0	3	0	12	0
07:45	-	08:00	0	0	3	0	0	0	4	1
16:00	-	16:15	1	0	2	0	1	0	4	0
16:15	-	16:30	1	0	2	1	2	1	2	0
16:30	-	16:45	5	0	3	2	0	1	1	0
16:45	-	17:00	1	0	1	0	2	1	4	1
17:00	-	17:15	1	0	5	1	0	0	0	1
17:15	-	17:30	3	1	8	1	2	0	1	0
17:30	-	17:45	3	0	5	1	2	1	2	1
17:45	-	18:00	2	0	8	0	3	0	2	0
DAY TOTAL			18	1	45	6	28	4	74	4

Annexure A9
Walvis Bay Traffic Circle

W1141-Traffic Impact Assessment Rössing Uranium		
INTERSECTION:	WALVISBAY TRAFFIC CIRCLE	
DATE:	Wednesday , 05/11/2008	TOWN: Swakopmund

TRAFFIC COUNT SUMMARY

Approach	From Swakopmund						From Walvisbay (North)						From Walvisbay (East)						From Walvisbay Airport					
	C		B		A		I		H		G		LV		K		J		F		E		D	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Morning peak (07:00 - 08:00) :	5	3	222	3	172	7	99	6	174	7	0	0	144	4	8	10	17	6	3	0	2	4	5	9
Midday peak (13:00 - 14:00) :	18	3	134	9	133	8	63	6	226	7	1	2	162	11	32	16	24	8	35	5	11	8	20	4
Afternoon peak (17:00 - 18:00) :	9	0	206	4	84	21	30	5	288	3	0	1	211	4	26	21	35	19	13	3	6	14	18	12
12 Hour Volume																								
Movement	146	52	1683	97	1198	115	493	93	1819	104	9	10	1348	96	270	154	215	81	206	38	98	86	163	123
Approach	3291						2528						2164						714					
Intersection	8697																							

W1141-Traffic Impact Assessment Rössing Uranium

INTERSECTION:	WALVISBAY TRAFFIC CIRCLE	
DATE:	Wednesday , 05/11/2008	TOWN: Swakopmund

TRAFFIC COUNT

APPROACH:	From Swakopmund						From Walvisbay (North)						From Walvisbay (East)						From Walvisbay Airport					
	C		B		A		I		H		G		LV		K		J		F		E		D	
TIME	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
06:00 - 06:15	2	1	5	0	3	0	4	1	4	2	1	1	3	2	2	2	3	0	1	0	1	2	2	1
06:15 - 06:30	5	3	29	1	28	3	0	0	10	0	0	0	11	4	3	1	0	0	2	0	2	0	0	0
06:30 - 06:45	13	0	42	0	46	0	9	0	20	0	0	0	13	2	2	5	2	1	0	2	4	1	0	3
06:45 - 07:00	1	0	60	3	49	2	15	1	27	0	0	0	33	1	6	4	3	1	0	0	1	0	1	0
07:00 - 07:15	0	0	74	1	63	3	26	2	63	1	0	0	41	1	2	4	1	1	1	0	0	0	0	3
07:15 - 07:30	4	0	58	1	40	3	23	1	43	3	0	0	55	2	3	5	1	5	1	0	0	2	3	3
07:30 - 07:45	1	3	58	1	47	1	26	1	35	2	0	0	27	0	2	1	2	0	1	0	1	1	1	1
07:45 - 08:00	0	0	32	0	22	0	24	2	33	1	0	0	21	1	1	0	13	0	0	0	1	1	1	2
08:00 - 08:15	1	0	42	0	38	0	20	1	47	3	0	0	19	2	3	2	3	3	3	0	0	2	1	2
08:15 - 08:30	6	2	43	1	36	2	9	1	25	0	0	0	22	0	9	2	3	3	2	3	0	0	1	1
08:30 - 08:45	1	1	38	1	23	0	13	1	30	5	0	0	28	0	1	2	4	1	5	1	1	1	5	8
08:45 - 09:00	0	2	42	4	15	4	8	1	19	0	0	0	42	1	4	3	5	2	0	0	0	1	0	2
09:00 - 09:15	2	3	36	0	25	0	9	3	37	1	0	0	33	1	10	6	2	4	1	0	0	1	1	5
09:15 - 09:30	2	3	37	4	27	8	11	3	29	4	0	0	33	2	2	2	3	3	3	5	0	2	2	5
09:30 - 09:45	1	1	15	5	17	0	7	2	30	7	0	0	33	2	5	7	1	0	3	2	1	2	2	3
09:45 - 10:00	0	1	24	1	14	4	5	2	30	3	0	0	10	4	6	2	2	0	6	0	3	1	5	6
10:00 - 10:15	3	1	19	3	16	1	2	2	18	1	0	0	15	3	12	4	5	2	0	0	2	2	1	0
10:15 - 10:30	4	1	27	2	15	1	11	1	38	2	0	0	18	2	8	3	8	2	4	1	2	3	1	2
10:30 - 10:45	10	4	25	3	19	3	8	2	41	3	1	0	22	2	15	2	2	2	1	0	2	1	1	1
10:45 - 11:00	0	1	25	1	23	0	6	1	30	1	0	0	25	3	2	3	3	2	4	1	3	2	5	3
11:00 - 11:15	3	3	28	2	20	2	3	1	38	3	0	0	23	1	5	4	4	0	3	1	1	1	5	3
11:15 - 11:30	0	0	23	0	15	1	9	1	37	2	0	2	25	3	1	3	1	0	7	0	0	1	3	8
11:30 - 11:45	1	0	20	4	18	0	8	3	35	1	0	0	35	4	3	2	3	0	3	0	0	3	5	1
11:45 - 12:00	1	1	33	7	21	2	5	4	23	3	0	0	27	4	6	1	4	2	6	0	4	1	5	1
12:00 - 12:15	5	1	53	4	42	2	6	0	44	3	0	0	16	4	8	2	6	2	5	3	3	3	7	2
12:15 - 12:30	2	1	10	3	10	0	7	8	37	7	0	0	21	1	9	3	6	2	6	2	3	3	9	0
12:30 - 12:45	4	3	27	2	26	4	9	5	33	6	1	1	30	2	10	2	4	3	9	3	2	3	8	3
12:45 - 13:00	3	1	42	2	37	0	5	3	38	3	0	0	21	2	10	12	8	4	14	0	4	1	2	3
13:00 - 13:15	3	0	14	3	16	0	2	3	66	2	0	0	70	2	9	3	8	2	11	0	5	4	7	1
13:15 - 13:30	4	0	24	0	17	2	7	2	85	2	0	1	40	3	6	3	9	4	10	0	2	1	4	1
13:30 - 13:45	6	1	42	2	25	0	6	1	33	2	1	1	32	2	12	10	1	1	11	4	1	3	5	1
13:45 - 14:00	5	2	54	4	75	6	48	0	42	1	0	0	20	4	5	0	6	1	3	1	3	0	4	1
14:00 - 14:15	5	0	31	3	19	0	27	2	34	1	0	0	20	3	3	3	3	0	9	0	2	1	3	4
14:15 - 14:30	5	2	54	6	38	2	14	1	23	3	1	0	42	4	9	1	7	0	12	1	6	4	6	1
14:30 - 14:45	3	0	19	1	4	1	5	1	25	3	0	0	9	1	5	1	1	1	4	1	5	2	7	3
14:45 - 15:00	3	1	37	1	25	2	4	3	37	0	0	0	35	2	2	2	4	0	6	0	6	1	8	1
15:00 - 15:15	1	3	29	0	15	4	8	3	35	2	0	0	23	3	8	3	5	2	7	0	5	2	8	5
15:15 - 15:30	2	0	32	2	16	3	5	3	20	3	0	1	10	1	3	4	3	0	5	0	1	1	1	1
15:30 - 15:45	6	0	38	0	19	0	9	4	37	0	2	0	29	1	9	1	5	2	5	1	3	2	3	4
15:45 - 16:00	2	1	29	6	16	1	8	3	41	5	0	1	22	2	4	5	6	2	2	0	1	1	1	0
16:00 - 16:15	7	2	30	3	15	7	6	3	33	2	1	0	16	2	5	2	4	2	0	0	4	2	0	3
16:15 - 16:30	7	0	26	0	16	2	10	1	30	2	1	1	16	0	3	2	5	0	6	1	2	1	2	5
16:30 - 16:45	1	2	22	4	25	15	12	1	36	2	0	0	22	3	4	2	5	0	4	0	3	5	6	4
16:45 - 17:00	2	1	29	2	18	3	4	4	60	4	0	0	29	3	7	2	6	0	7	2	2	1	3	4
17:00 - 17:15	1	0	39	1	19	3	18	4	110	3	0	1	68	2	11	2	8	2	0	0	1	4	5	5
17:15 - 17:30	4	0	59	2	21	11	7	0	77	0	0	0	62	1	6	2	11	2	5	1	1	4	4	2
17:30 - 17:45	1	0	60	1	21	7	4	0	56	0	0	0	65	1	4	16	10	3	6	2	1	4	5	3
17:45 - 18:00	3	0	48	0	23	0	1	1	45	0	0	0	16	0	5	1	6	12	2	0	3	2	4	2
DAY TOTAL	146	52	1683	97	1198	115	493	93	1819	104	9	10	1348	96	270	154	215	81	206	38	98	86	163	123

ANNEXURE B

COLLISION DATA

Annexure B1	**Walvis Bay – Swakopmund - Usakos**
Annexure B2	**Swakopmund through route (Walvis Bay – Usakos)**
Annexure B3	**Walvis Bay - Solitaire**
Annexure B4	**Road behind dunes (Walvis Bay – Swakopmund) B2 – D1984**

Annexure B1
Walvis Bay – Swakopmund – Usakos

W1141 : TRAFFIC IMPACT ASSESSMENT : ROSSING URANIUM									
Collision Data : Swakopmund (Through route - Walvisbay - Usakos)									
2006									
Date	**Day**	**Time**	**Fatal**	**Serious injury**	**Vehicle Damage**	**Vehicles involved**	**Location**	**Remarks**
07/01/2006	Saturday	14H00	0	0	2	2	Sam Nujoma Drive	Parked Car hit at back
08/01/2006	Sunday	13H00	0	0	2	2	Sam Nujoma Drive	Parked Car hit at back
09/01/2006	Monday	16H40	0	0	1	1	Mandume Ndemufayo	Pedestrian in Road
10/01/2006	Tuesday	12H15	0	0	2	2	Walvisbay Traffic Circle	Hit at Back
17/01/2006	Tuesday	13H00	0	0	2	2	Mandume Ndemufayo	Hit Parked car at Back
24/01/2006	Tuesday	19H00	0	0	2	2	Sam Nujoma Drive & Roons Street	Parked Car hit infront
29/01/2006	Sunday	15H20	0	0	2	2	Nataniel Maxiulli & Woermann str	Ignore stop sign-hit at RHS
30/01/2006	Monday	21H45	0	0	2	2		Hit Parked car at Back
16/02/2006	Thursday	11H00	0	0	2	2	Sam Nujoma-Kramersdorp	Hit at back
16/02/2006	Thursday	12H00	0	0	2	2	Mandume Ndemufayo	Bump in front
18/02/2006	Saturday	10H50	0	0	2	2	Sam Nujoma -CBD	Changing Lanes-Hit LHS
19/02/2006	Sunday	13H45	0	0	2	2		Parked Car hit at back
09/04/2006	Sunday	11H30	0	0	2	2	Nataniel Maxiulli	Hit Parked car at Back
10/04/2006	Monday	14H00	0	0	2	2	Sam Nujoma Drive	Hit Parked car at Back
11/04/2006	Tuesday	13H30	0	0	1	1	Anton Lubowski Str-Arandis Street	Lost Control-Hit Pole
15/04/2006	Saturday	10H30	0	0	2	2	Sam Nujoma & Moses Garoeb Intersection	Left Turn-Hit at RHS
02/05/2006	Saturday	11H00	0	0	2	2	Moses Garoeb Street	Hit Parked car at Back
05/05/2006	Friday	09H35	0	0	1	1	Sam Nujoma Drive	Pedestrian in Road
12/05/2006	Friday	06H50	0	0	1	1	Mandume Ndemufayo	Hit Danger Signs-Not Clear
13/05/2006	Saturday	00H30	0	0	1	1	Mandume Ndemufayo	Overtake-Lost Control
16/05/2006	Tuesday	16H45	0	1	1	1	Mandume Ndemufayo & Moses Garoeb Intersection	Pedestrian in Road
19/05/2006	Friday	15H20	0	0	2	2	Nataniel Maxiulli	Hit Parked car at Back
25/05/2006	Thursday	19H00	0	0	2	2	Mandume Ndemufayo Street	Hit Parked car at Back
30/05/2006	Tuesday	14H30	0	0	2	2	Sam Nujoma Drive	Brakes failed-hit car at Back
05/06/2006	Monday	15H30	0	0	2	2		Hit Parked car at Back
11/06/2006	Sunday	15H55	0	0	2	2	Libertine Amathila & Moses Garoeb Intersection	Ignore stop sign-hit at RHS
15/06/2006	Thursday	07H40	0	0	2	2	Bridge between Swakopmund & Walvisbay	Overtake-Hit car in Left Lane
19/06/2006	Monday	14H11	0	0	2	2	Moses Garoeb Street	Hit at back
24/06/2006	Saturday	10H25	0	0	2	2	Sam Nujoma Drive	Hit at back
26/06/2006	Monday	13H55	0	0	2	2	Mandume Ndemufayo Street	Reversed into parked vehicle
29/06/2006	Thursday	19H24	0	0	4	4	Sam Nujoma & Moses Garoeb Intersection	Reduced Speed- hit at back
08/07/2006	Saturday	10H45	0	0	2	0	Sam Nujoma & Ebony Street Intersection	Right Turn-Hit at back
09/07/2006	Sunday	15H00	0	0	2	2	Nelson Mandela Ave & Sam Nujoma Intersection	Hit at back
11/07/2006	Tuesday	13H10	0	0	2	2	Moses Garoeb Street & Hidipo Hamutenya Street	Changing Lanes-Hit LHS
15/07/2006	Saturday	04H15	0	0	1	1	Moses Garoeb Street	Lost Control- Overturned
22/07/2006	Saturday	08H00	0	0	2	2	Sam Nujoma & Moses Garoeb Intersection	Reduced Speed- hit at back
22/07/2006	Saturday	20H48	0	0	2	2	Sam Nujoma Drive	Hit at back
23/07/2006	Sunday	18H30	0	0	2	2	Sam Nujoma Drive	Hit at back
24/07/2006	Monday	10H40	0	0	2	2	Sam Nujoma Drive	Hit at back
31/07/2006	Monday	13H15	0	0	2	2	Sam Nujoma Drive	Hit at back
31/07/2006	Monday	10H00	0	0	2	2	Nataniel Maxiulli & Street no 50	Hit Parked car at Back
01/08/2006	Tuesday	11H15	0	0	2	2	Sam Nujoma Drive	Reversed into parked vehicle
04/08/2006	Friday	10H00	0	0	2	2	Langerheinrich mine Road-40km From Swakopmund	Overtake -Lost Control-Overturned
12/08/2006	Saturday	12H30	0	0	2	2	Sam Nujoma Avenue	Hit at back
16/08/2006	Wednesday	17H30	0	0	1	1	C28-49km From Swakopmund	Tyre Burst-Overturned
22/08/2006	Tuesday	10H45	0	0	2	2	Moses Garoeb	Reversed into parked vehicle
31/08/2006	Thursday	17H25	0	0	2	2		Hit at back
02/09/2006	Saturday	16H00	0	0	1	1	Sam Nujoma & Otavi Street Intersection	Lost Control-Hit Pavement
03/09/2006	Sunday	08H30	0	0	1	1	Moses Garoeb Street	Animal in Road
03/09/2006	Sunday	19H00	0	0	2	2	Nataniel Maxuilli Street	Hit at back
06/09/2006	Wednesday	11H00	0	0	2	2	Moses Garoeb & Nataniel Maxuilli	Reversed into parked vehicle
11/09/2006	Monday	06H38	0	0	2	2	Sam Nujoma Drive	Reduced Speed- hit at back
23/09/2006	Saturday	10H00	0	0	2	2	Sam Nujoma & Otavi Street Intersection	Ignore stop sign-hit at LHS
29/09/2006	Friday	15H30	0	0	2	2	Sam Nujoma Drive	Changing Lanes-Hit RHS
30/09/2006	Saturday	10H01	0	0	2	2	Sam Nujoma & Moses Garoeb Intersection	Changing Lanes-Hit RHS
30/09/2006	Saturday	12H20	0	0	2	2	Sam Nujoma Drive	Hit Parked car at Back
14/11/2006	Tuesday	10H45	0	0	2	2	Sam Nujoma Drive	Hit Parked car at Back
16/10/2006	Monday	12H50	0	0	2	2	Sam Nujoma Drive	Left Turn- bumped car infront
18/10/2006	Saturday	15H00	0	0	2	2	Rhode Allee Street	Change Lanes-hit LHs
31/10/2006	Tuesday	23H00	0	0	2	2	Nataniel Maxuilli & Anton Lubowski Intersection	Ignore stop sign-hit car at back

Collision Data : Swakopmund (Through route - Walvisbay - Usakos)

2006

Date	Day	Time	Fatal	Serious injury	Vehicle Damage	Vehicles involved	Location	Remarks
07/12/2006	Thursday	12H00	0	0	2	2	Sam Nujoma & Otavi Street Intersection	Ignore stop sign-hit at LHS
16/12/2006	Saturday	22H30	0	0	2	2	Sam Nujoma Drive	Ignore stop sign-bump into car infront
18/12/2006	Monday	06H00	0	0	2	2	Rhode Allee Street	Reversed into parked vehicle
23/12/2006	Saturday	15H45	0	0	2	2	Sam Nujoma Drive	Reduced Speed- hit at back
23/12/2006	Sunday	19H05	0	0	1	1	Nataniel Maxuilli & Woermann Street Intersection	Pedestrian in Road
27/12/2006	Wednesday	12H00	0	0	2	2	Sam Nujoma Drive	Reversed into parked vehicle
28/12/2006	Thursday	16H00	0	0	2	2	Moses Garoeb street	Change Lanes-hit LHs
29/12/2006	Friday	22H35	0	0	2	2	Moses Garoeb street	Turn at T-Junction,hit at LHS
TOTAL			**0**	**1**	**127**	**125**		

Summary of Collision by Type:		Fatal	Serious injury	Vehicle Damage	Vehicles involved		
	With animal	0	0	1	1		
	Lost control	0	0	6	6		
	Head/Rear	0	0	84	82		
	Other	0	0	32	32		
	With Pedestrians	0	1	4	4		
TOTAL:		**0**	**1**	**127**	**125**		

Annexure B2
Swakopmund through route (Walvis Bay – Usakos)

W1141 : TRAFFIC IMPACT ASSESSMENT : ROSSING URANIUM

Collision Data : B2 (Walvisbay via Swakopmund to Usakos)

2006

Date	Day	Time	Fatal	Serious injury	Vehicle Damage	Vehicles involved	Location	Remarks
29/01/2006	Sunday	15H20	0	0	2	2	B2/Sam Nujoma drive Bridge	Overtake -hit at back
29/01/2006	Sunday	21H10	0	0	3	3	B2-10km Swakopmund to Arandis	Overtake-Lost Control-Hit Rock
08/02/2006	Wednesday	16H15	0	0	2	2	B2-15km Walvisbay to Swakopmund	Hit at Back
09/02/2006	Friday	08H30	0	0	1	2	B2-10km Arandis to Swakopmund	Sand Material broke windscreen
19/02/2006	Sunday	20H45	0	0	1	1	B2-25km Swakopmund to Arandis	Car Burnt
24/02/2006	Saturday	00H00	0	0	1	1	B2-7km Walvisbay to Swakopmund	Tyre Burst-Overturned
28/02/2006	Tuesday	17H00	0	0	1	1	B2-12km Walvisbay to Swakopmund	Lost Control-Overturned
03/03/2006	Friday	02H30	0	0	2	2	B2-20km Arandis to Swakopmund	Mechanical Problem-Lost Control -Hit car at back
10/03/2006	Friday	17H00	4	5	1	1	B2-16km Arandis Usakos	Tyre Burst-Overturned
17/03/2006	Friday	21H30	0	0	2	2	B2-20km Arandis Usakos	Head on Head
22/03/2006	Wednesday	20H00	0	0	2	2	B2-10km Arandis to Swakopmund	Head on Head
23/03/2006	Thursday	18H20	0	0	2	2	B2-3km Swakopmund to Walvisbay	Overtake-head on
26/03/2006	Sunday	05H30	2	0	2	2	B2-4km Walvisbay to Swakopmund	Head on Head
01/04/2006	Saturday	14H26	0	0	1	1	B2-20km Arandis to Usakos	Lost Control-Overturned
01/04/2006	Saturday	23H55	0	0	1	1	B2-6km Arandis to Usakos	Lost Control-Overturned
02/04/2006	Sunday	08H00	0	0	1	1	B2-20km Arandis to Usakos	Lost Control-Overturned
08/04/2006	Saturday	07H45	0	0	1	1	B2-20km Arandis to Usakos	Tyre Burst-Overturned
09/04/2006	Sunday	18H00	0	0	1	1	B2-25km Swakopmund	Tyre Burst
16/04/2006	Sunday	11H45	0	0	2	2	B2-9km Swakopmund to Walvisbay	Right Turn-hit car on LHS
23/04/2006	Sunday	17H45	0	0	1	1	B2-17km Swakopmund to Walvisbay	Hit at Back
26/04/2006	Wednesday	14H40	0	0	1	1	B2-5km Swakopmund to Arandis	Tyre Burst-Overturned
26/04/2006	Wednesday	23H00	0	0	1	1	B2-30km From Swakopmund	Lost Control-Hit Rock
27/04/2006	Thursday	03H16	0	0	1	1	B2- 10km From Swakopmund	Lost Control-Overturned
29/04/2006	Saturday	13H20	0	0	1	1	B2-20km Arandis Usakos	Tyre Burst-Overturned
09/05/2006	Tuesday	08H45	0	0	2	2	B2-20km Walvisbay to Swakopmund	RHS turn-hit on LHS
09/05/2006	Wednesday	15H15	0	0	2	2	B2-8km Walvisbay to Swakopmund	Reduce Speed-Hit at back
11/05/2006	Thursday		0	0	2	2	B2-20km Arandis Usakos	Left Turn-Hit at back
12/05/2006	Friday	01H00	0	0	1	1	B2-25km Arandis to Swakopmund	Lost Control-Hit Rock
13/05/2006	Saturday	19H30	0	1	1	1	B2-Between Swakopmund and Walvisbay	Pedestrian in Road
15/05/2006	Monday	19H30	0	0	2	2	B2-60km Arandis to Usakos	Parked halfway on road-hit at back
18/05/2006	Thursday	18H10	0	0	2	2	B2-3km From Swakopmund	Overtake-Hit car in Left Lane
15/06/2006	Thursday	07H40	0	0	2	2	Bridge between Swakopmund & Walvisbay	Overtake-Hit car in Left Lane
20/06/2006	Tuesday	00H15	0	0	1	1	B2-15km Swakopmund to Walvisbay	Animal in Road
20/06/2006	Saturday	05H00	0	0	1	1	B2-3km Walvisbay to Swakopmund	Lost Control-Overturned
24/06/2006	Saturday	07H50	1	0	1	1	B2-25km Arandis to Swakopmund	Lost Control-Overturned
24/06/2006	Saturday	04H30	0	0	2	2	B2-12km Swakopmund to Walvisbay	Head on Head
29/06/2006	Thursday	17H30	0	1	2	2	B2-8km Swakopmund to Walvisbay	Overtake-Hit car LHS
04/07/2006	Tuesday	21H15	0	0	3	3	B2- 25km -Walvisbay to Swakopmund	Hit at Back
08/07/2008	Saturday	02H00	0	0	2	2	B2- Walvisbay@ T-Junction to Narraville	Hit at LHS Overturned
09/07/2006	Sunday	05H30	0	0	1	1	B2- Longbeach	Animal in Road
13/07/2006	Thursday	09H00	2	0	1	1	B2-27km From Swakopmund	Tyre Burst-Overturned
17/07/2006	Monday	01H30	0	0	2	2	B2-30km From Swakopmund	Both wheels got off & hit car at back
18/07/2006	Tuesday	14H00	0	0	1	1	B2-5km Walvisbay to Swakopmund	Tyre Burst - Lost Control
18/07/2006	Tuesday	15H00	0	0	1	2	B2-30km Arandis to Swakopmund	Parked halfway on road-drive off
22/07/2006	Saturday	04H10	0	1	2	2	B2-5km Walvisbay to Swakopmund	Head on Head
25/07/2006	Monday	23H00	0	0	1	1	B2-2km Walvisbay to Longbeach	Lost Control- Hit Pole
28/07/2006	Friday	16H30	0	0	1	1	B2-120km Arandis Usakos	Misty-Animal in Road
29/07/2006	Saturday	20H30	4	1	2	2	B2-5km From Swakopmund	Rear end Collision
31/07/2006	Monday	11H00	0	0	2	2	B2- at Road Block betw. Swakopmund & Walvisbay	Reduced Speed- hit at back
05/08/2006	Saturday	16H15	0	0	1	1	B2-20km Swakopmund to Arandis	Lost Control-Overturned
16/08/2006	Wednesday	10H15	0	0	2	2	B2-4km Swakopmund to Walvisbay	Reduce Speed-Hit at Back
19/08/2006	Saturday	18H00	0	0	1	1	B2-120km Arandis Usakos	Lost Control -
21/08/2006	Monday	07H35	0	0	1	1	B2-32km Swakopmund to Arandis	Overtake -Lost Control-Hit Pole
27/08/2006	Sunday	06H30	0	0	1	1	Rooibank Street -Walvisbay Traffic Circle	Lost Control -Overturn
28/08/2006	Monday	02H00	0	0	1	1	B2-10km Arandis Usakos	Feel asleep-lost control
28/08/2006	Monday	03H00	0	0	2	2	B2-5km Arandis to Swakopmund	Tyre Burst-Overturned
31/08/2006	Thursday	13H00	0	0	1	1	B2-120km Arandis Usakos	Stone in Road-Lost Control
31/08/2006	Thursday	06H15	0	0	2	2	B2-7km Swakopmund to Walvisbay	Reduce Speed-Hit at Back
03/09/2006	Sunday	04H00	0	4	2	2	B2-20km Walvisbay to Longbeach	Head on Head
05/09/2006	Tuesday	08H00	0	0	1	1	B2-30km Swakopmund to Arandis	Animal in Road
08/09/2006	Friday	12H45	0	1	1	1	B2-5km Arandis to Swakopmund	Windy-Lost Control
11/09/2006	Monday	03H00	0	0	1	1	B2-120km Arandis Usakos	Animal in Road
12/09/2006	Tuesday	12H30	0	0	1	1	B2-30km Swakopmund to Arandis	Animal in Road
13/09/2006	Wednesday	12H30	0	0	1	1	B2 - Walvisbay to Swakopmund	Lost Control - Hit Sand
14/09/2006	Thursday	17H30	0	0	2	2	B2-5km Swakopmund to Walvisbay	Reduce Speed-Hit at Back
15/09/2006	Friday	20H00	0	1	1	1	B2-20km Arandis to Swakopmund	Lost Control
16/09/2006	Saturday	20H10	0	2	1	1	B2-3km Arandis to Swakopmund	Overtake -Lost Control
16/09/2006	Saturday	11H00	0	0	2	2	B2-5km Walvisbay to Swakopmund	Lost Control-Overturned
27/09/2006	Wednesday	23H00	0	0	1	1	B2-10km Walvisbay to Swakopmund	Lost Control - Overturned
30/09/2006	Saturday	23H00	0	0	2	2	B2-10km Walvisbay to Swakopmund	Lost Control-Head on Collision
30/09/2006	Saturday	05H15	0	0	2	2	B2-23km Arandis to Swakopmund	Overtake-Lost Control-Hit at back

Collision Data : B2 (Walvisbay via Swakopmund to Usakos)

2006

Date	Day	Time	Fatal	Serious injury	Vehicle Damage	Vehicles involved	Location	Remarks
01/10/2006	Sunday	22H30	0	0	1	1	B2-30km Arandis Usakos	Lost Control
04/10/2006	Wednesday	07H50	0	0	2	2	Walvisbay Traffic Circle	Changing Lanes-Hit LHS
14/10/2006	Saturday	05H25	0	0	2	2	B2-20km Arandis to Swakopmund	Head on Head
26/10/2006	Thursday	01H10	0	0	1	1	B2-13km Walvisbay to Swakopmund	Lost Control-Overturned
03/11/2006	Friday	07H30	0	0	1	1	B2-Longbeach	Lost Control-Overturned
03/11/2006	Friday	17H30	3	3	1	1	B2-5km Arandis Usakos	Tyre Burst-Overturned
04/11/2006	Saturday	20H30	1	1	2	2	B2-22km Walvisbay-Swakopmund	Head on Head
05/11/2006	Sunday	01H00	0	0	1	1	B2-20km Walvisbay to Longbeach	Overtake-Lost Control-Overturn
11/11/2006	Saturday	20H45	0	0	2	2	B2- Walvisbay to Swakopmund	Head on Head
18/11/2006	Saturday	18H25	0	1	1	1	B2-5km Dolphin Park to Walvisbay	Lost Control-Overturned
23/11/2006	Friday	22H45	0	0	2	2	B2-Swakopmund to Walvisbay	Changing Lanes-Hit LHS
27/11/2006	Monday	09H15	0	0	1	1	B2-10km Swakopmund to Walvisbay	Car burnt
01/12/2006	Friday	11H20	0	0	2	2	B2-15km Longbeach to Walvisbay	Head on Head
03/12/2006	Sunday	14H55	0	0	2	2	B2 - Walvisbay Narraville Entrance	Head on Head
03/12/2006	Sunday	15H30	0	0	1	1	B2-10km Walvisbay to Swakopmund	Lost Control-Overturned
04/12/2006	Monday	05H45	0	0	2	2	B2-10km Arandis to Swakopmund	Hit at Back
09/12/2006	Saturday	08H00	0	0	1	1	B2-8km From Swakopmund	Lost Control Overturn
17/12/2006	Sunday	12H23	0	1	1	1	B2-15km Arandis Usakos	Tyre Burst-Overturned
22/12/2006	Friday	00H30	0	0	1	1	B2-1km Swakopmund to Walvisbay	Lost Control
18/12/2006	Friday	18H20	3	1	2	2	B2-24km Walvisbay to Swakopmund	Lost Control-Head on Collision
22/12/2006	Friday	13H45	0	0	2	2	B2-20km Arandis to Swakopmund	Overtake-hit LHS
23/12/2006	Saturday	18H30	0	1	1	1	B2-Walvisbay to Swakopmund	Pedestrian in Road
29/12/2006	Friday		0	3	2	2	B2-Swakopmund to Walvisbay	Hit at Back
TOTAL			**20**	**28**	**138**	**140**		

Summary of Collision by Type:		Fatal	Serious injury	Vehicle Damage	Vehicles involved		
	With animal	0	0	6	6		
	Lost control	1	5	41	41		
	Head/Rear	4	4	26	26		
	Other	9	10	35	37		
	With Pedestrians	0	2	2	2		
	Passing: Head on Head	6	7	28	28		
TOTAL:		**20**	**28**	**138**	**140**		

Annexure B3
Walvis Bay – Solitaire

W1141 : TRAFFIC IMPACT ASSESSMENT : ROSSING URANIUM

Collision Data : C14 (Walvisbay - Solitaire)

2006

Date	Day	Time	Fatal	Serious injury	Vehicle Damage	Vehicles involved	Location	Remarks
15/04/2006	Sunday	14H30	0	0	1	1	C14-3km from Walvisbay	Lost Control-Overturned
25/05/2006	Tuesday	07H45	0	0	2	2	Walvisbay Entrance from Transkalahari Highway	Hit at Back
14/06/2006	Wednesday	06H45	0	1	1	1	C14-73km From Walvisbay	Lost Control-Overturned
20/06/2006	Tuesday	17H10	0	0	1	1	80km From Maltahohe-Walvisbay(C14)	Lost Control
04/07/2006	Tuesday	15H00	2	0	2	2	Rooibank Street -Walvisbay	Hit at Back
12/07/2006	Wednesday	12H30	0	1	1	1	C14	Lost Control-Overturned
01/08/2006	Monday	10H00	0	0	1	1	C14	Stone hit Windscreen
04/08/2006	Friday	12H00	0	0	1	1	C14-100km to Walvisbay	Lost Control - Hit Rock
04/08/2006	Friday	14H00	3	0	1	1	C14-60km to Walvisbay	Lost Control - Overturned
12/08/2006	Saturday		0	0	1	1	C14	Lost Control - Hit Rock
04/09/2006	Monday	09H30	0	0	1	1	C14-46km Langerheinrich Rd to Swakopmund	Lost Control-Overturned
12/09/2006	Tuesday	11H30	1	3	2	2	C14-22km Walvisbay to Windhoek	Overtake-Head on Collision
30/09/2006	Saturday	09H30	0	0	1	1	C14-60km Walvisbay to Sossusvlei	Lost Control - Overturned
20/10/2006	Friday	18H10	0	1	1	1	C14-15km to Walvisbay	Lost Control - Overturned
27/10/2006	Friday	16H30	0	0	3	3	Rooikop Street-Walvisbay	Hit at Rear End
01/11/2006	Wednesday	12H05	0	0	1	1	C14- 5km to Walvisbay Airport	Overtake-Lost Control-Overturn
22/11/2006	Wednesday	12H20	0	0	1	1	C14-125km From Walvisbay	Tyre Burst - Lost Control
01/12/2006	Friday		0	0	1	1	Walvisbay Airport Road	Lost Control-Overturned
12/12/2006	Tuesday	01H45	0	1	1	1	C14-20km To Walvisbay	Lost Control-Overturned
20/12/2006	Wednesday	10H30	0	0	2	2	C14-140km Walvisbay to Sossusvlei	Hit at Back
26/12/2006	Tuesday	13H00	2	1	1	1	C14-80km Walvisbay - Khomas Hochland Rd	Lost Control-Overturned
20/10/2006	Friday	18H10	0	1	1	1	C14-15km to Walvisbay	Lost Control - Overturned
22/11/2006	Wednesday	12H20	0	0	1	1	C14-125km From Walvisbay	Tyre Burst - Lost Control
12/12/2006	Tuesday	01H45	0	1	1	1	C14-20km To Walvisbay	Lost Control-Overturned
20/12/2006	Wednesday	10H30	0	0	2	2	C14-140km Walvisbay to Sossusvlei	Hit at Back
26/12/2006	Tuesday	13H00	2	1	1	1	C14-80km Walvisbay - Khomas Hochland Rd	Lost Control-Overturned
26/12/2006	Tuesday	20H30	0	0	1	1	8km to Walvisbay-Rooikop Street	Lost Control-Overturned
TOTAL:			**10**	**11**	**34**	**34**		

Summary of Collision by Type:		Fatal	Serious injury	Vehicle Damage	Vehicles involved
	Lost control	7	8	20	20
	Head/Rear	2	0	11	11
	Other	0	0	1	1
	Passing: Head on Head	1	3	2	2
TOTAL:		**10**	**11**	**34**	**34**

Annexure B4
Road behind dunes
(Walvis Bay – Swakopmund)
B2 – D1984

W1141 : TRAFFIC IMPACT ASSESSMENT : ROSSING URANIUM

Collision Data : C34 (D1984) :Road behind Dunes (Walvisbay - Swakopmund)

2006

Date	Day	Time	Fatal	Serious injury	Vehicle Damage	Vehicles involved	Location	Remarks
15/07/2006	Saturday	14H30	0	0	1	1	D1984 - 4km to Swakop	Lost Control-Overturned
21/11/2006	Tuesday	12H00	0	0	1	1	C34	Tyre Burst - Lost Control
09/04/2006	Sunday	18H00	0	0	1	1	B2-25km Swakopmund	Tyre Burst
04/08/2006	Friday	10H00	0	0	2	2	Langerheinrich mine Road-40km From Swakopmund	Overtake -Lost Control-Overturned
06/08/2006	Sunday	21H00	0	0	1	1	Khomas Hochland Road- 40km From Swakopmund	Animal in Road
TOTAL			**0**	**0**	**6**	**6**		

Summary of Collision by Type:		Fatal	Serious injury	Vehicle Damage	Vehicles involved		
	With animal	0	0	1	1		
	Lost control	0	0	5	5		
TOTAL:		**0**	**0**	**6**	**6**		

ANNEXURE C

SIDRA OUTPUT SHEETS

- Sidra output sheets (Typical)

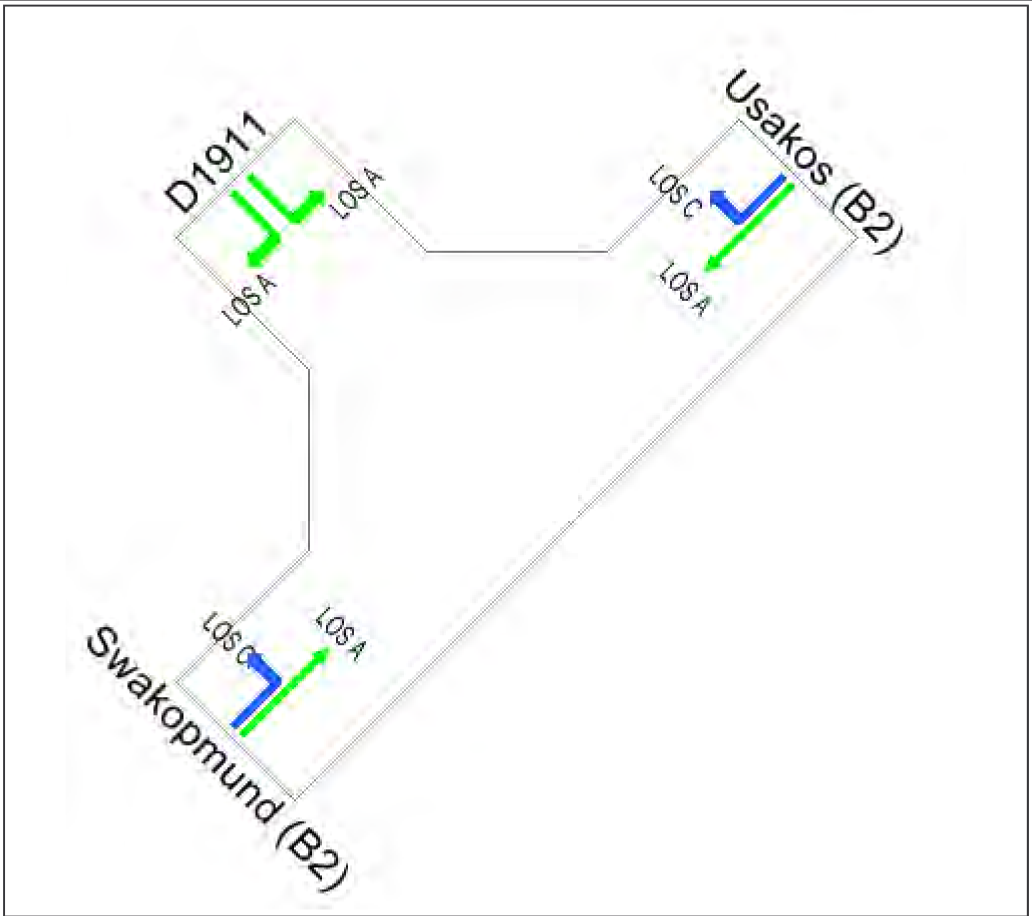
SIDRA INTERSECTION

Level of Service

Based on Delay (HCM method)

B2 D1911 Current configuration

Afternoon Peak @140km/h (+80% Traffic)



Intersection Type

Give-way

Color code based on Level of Service

- LOS A
- LOS B
- LOS C
- LOS D
- LOS E
- LOS F

SIDRA SOLUTIONS

Site: B2 & D1911 (+80% Traffic)
C:\Sidra Files\Intersections SIDRA\Arandis-Rossing-B2 Intersections\Afternoon Peak\@140km-h\current config @140km-h.aap
Processed Jul 01, 2009 04:30:33PM

A1920, Burmeister & Partners, Small Office
Produced by SIDRA Intersection 3.2.0.1455

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SIDRA INTERSECTION

Intersection Summary

B2 D1911 Current configuration

Afternoon Peak @140km/h (+80% Traffic)

Performance Measure	Vehicles	Persons
Demand Flows - Total	477 veh/h	716 pers/h
Percent Heavy Vehicles	12.4 %	
Degree of Saturation	0.132	
Effective Intersection Capacity	3604 veh/h	
95% Back of Queue (m)	5 m	
95% Back of Queue (veh)	0.6 veh	
Control Delay (Total)	0.48 veh-h/h	0.71 pers-h/h
Control Delay (Average)	3.6 s/veh	3.6 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS C	
Total Effective Stops	110 veh/h	166 pers/h
Effective Stop Rate	0.23 per veh	0.23 per pers
Proportion Queued	0.08	0.08
Travel Distance (Total)	474.7 veh-km/h	712.1 pers-km/h
Travel Distance (Average)	995 m	995 m
Travel Time (Total)	37.7 veh-h/h	56.5 pers-h/h
Travel Time (Average)	284.2 secs	284.2 secs
Travel Speed	12.6 km/h	12.6 km/h
Operating Cost (Total)	1243 $/h	1243 $/h
Fuel Consumption (Total)	159.2 L/h	
Carbon Dioxide (Total)	400.0 kg/h	
Hydrocarbons (Total)	0.571 kg/h	
Carbon Monoxide (Total)	10.53 kg/h	
NOX (Total)	0.784 kg/h	

SIDRA SOLUTIONS

Site: B2 & D1911 (+80% Traffic)
C:\Sidra Files\Intersections SIDRA\Arandis-Rossing-B2 Intersections\Afternoon Peak\@140km-h\current config @140km-h.aap
Processed Jul 01, 2009 04:30:33PM

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ANNEXURE D

SIDRA RESULTS AND DEFINITION OF LEVEL OF SERVICE

Annexure D

1. INTERPRETATION OF SIDRA RESULTS

1.1 DEFINITION OF *LEVEL OF SERVICE*

The following list offers definitions of *level of service* at an **unsignalised** intersection:

- **Level of service "A":** No traffic delays
- **Level of service "B":** Short traffic delays
- **Level of service "C":** Average traffic delays
- **Level of service "D":** Long traffic delays
- **Level of service "E":** Very long traffic delays
- **Level of service "F":** Insufficient gaps of a suitable size to allow a side-street demand to safely cross through a major street traffic stream. This is generally evident from extremely long delays experienced by side-street traffic, and by queuing on minor approaches.

The following list offers definitions of *level of service* at a **signalised** intersection:

- **Level of service "A":** Describes operations with very low delay, i.e. less than 0.5 seconds per vehicle. This occurs when progression is extremely favourable, and most vehicles arrive during the green phase and do not stop at all.

- **Level of service "B":** Describes operations with a delay in the range of 5.1 to 15.0 seconds per vehicle. This generally occurs with good progression. More vehicles stop than in the case of level of service "A", causing higher levels of average delay.

- **Level of service "C":** Describes operations with a delay in the range of 15.1 to 25.0 seconds per vehicle. These higher delays may result from fair progression. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

- **Level of service "D":** Describes operations with a delay in the range of 25.1 to 40.0 seconds per vehicle. At this level, the influence of congestion becomes more noticeable. Many vehicles stop and the proportion of vehicles not stopping declines.

- **Level of service "E":** Describes operations with a delay in the range of 40.1 to 60.0 seconds per vehicle. This is considered to be the limit of acceptable delay.

- **Level of service "F":** Describes operations with a delay in excess of 60.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs when arrival flow exceeds the capacity of the intersection.

1.2 INTERPRETATION OF SIDRA ANALYSIS

The following is an interpretation of the Sidra results at specific intersections where there were significant changes in the level of service due to the postulated increases in traffic:

- **B2–Rössing Uranium/Arandis (D1911) @ 120 km/h (Existing layout)**
  - With a 40% increase, the right-turning movement from Usakos onto the D1911 (Rössing Uranium/Arandis) falls to level of service "D". This is due to opposing traffic.

- **B2–Rössing Uranium/Arandis (D1911) @ 140 km/h (Existing layout)**
  - With an 80% increase, the right-turning movement from Usakos onto D1911 (Rössing Uranium/Arandis) falls to level of service “E”. This is due to opposing traffic and high approaching speed.

- **B2–Rössing Uranium/Arandis (D1911) @ 120 km/h (Proposed layout)**
  - For both the 40% and 80% increase, the level of service remains “C” for both morning and afternoon peaks. This is an indication that the proposed layout would be effective to have the intersection operating on the same level of service as the current situation.

- **B2–C34 (D1984) (Road behind the dunes) @ 120 km/h (D1984 Existing layout)**
  - For the morning peak, the level of service drops from “C” to “D” with a 40% increase in traffic, and from “C” to “F” for an 80% increase in traffic. The level of service decrease is due specifically the right-turning movement from Swakopmund onto the C34 (to Walvis Bay). Indications are that this intersection would need capacity upgrading with an improved intersection control. The deterioration of the level of service would make the road less attractive to heavy vehicles. To promote the road behind the dunes for heavy vehicles, the upgrading of this intersection would become necessary.

- **Sam Nujoma Drive–Nelson Mandela Avenue**
  - With an 40% increase in traffic, there is no drop in the level of service.
  - With an 80% increase in traffic, the level of service drops to “D”. This could be addressed with capacity upgrading and possibly optimising the traffic light phasing and setting.

- **B2–Langstrand Intersection 1**
  - This intersection seems to operate on an acceptable level of service. This could be due to the relatively low volumes from Langstrand. The fact that a second access was created to some extent distributes the traffic from Langstrand. However, with an increase in traffic on the B2, for safety reasons it might be more appropriate to combine these two entrances, and to introduce effective intersection control.

The following tables present a summary of the Sidra analysis results for the intersection investigated:

INTERSECTION: B2–Rössing/Arandis (D1911) Existing layout, morning peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	359	501	646
Percentage of heavy vehicles	%	15.3	15.2	15.3
Degree of saturation	n/a	0.12	0.199	0.304
Effective intersection capacity	Vehicles/hour	2,992	2,524	2,123
Control delay (average)	Seconds/vehicle	9	9.6	10.2
Level of service (worst movement)	n/a	C	D	D
Effective stop rate	Per vehicle	0.55	0.56	0.58

INTERSECTION: B2–Rössing/Arandis (D1911) Existing layout, afternoon peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	265	372	477
Percentage of heavy vehicles	%	12.5	12.4	12.4
Degree of saturation	n/a	0.067	0.094	0.132
Effective intersection capacity	Vehicles/hour	3,960	3,962	3,604
Control delay (average)	Seconds/vehicle	2.7	2.7	2.5
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.22	0.22	0.57

INTERSECTION: B2–Rossing Uranium/Arandis (D1911) Existing layout, morning peak, at 140 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	359	501	646
Percentage of heavy vehicles	%	15.3	15.2	15.3
Degree of saturation	n/a	0.12	0.199	0.304
Effective intersection capacity	Vehicles/hour	2,992	2,524	2,123
Control delay (average)	Seconds/vehicle	11.2	11.6	12.2
Level of service (worst movement)	n/a	D	D	E
Effective stop rate	Per vehicle	0.56	0.57	0.6

INTERSECTION: B2–Rössing Uranium/Arandis (D1911) Existing layout, afternoon peak, at 140 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	265	372	477
Percentage of heavy vehicles	%	12.5	12.4	12.4
Degree of saturation	n/a	0.067	0.094	0.132
Effective intersection capacity	Vehicles/hour	3,960	3,962	3,604
Control delay (average)	Seconds/vehicle	3.2	4	3.6
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.22	0.26	0.23

INTERSECTION: B2–Rössing Uranium/Arandis (D1911) Proposed layout, morning peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	273	383	491
Percentage of heavy vehicles	%	18.3	18.3	18.3
Degree of saturation	n/a	0.076	0.107	0.137
Effective intersection capacity	Vehicles/hour	3,581	3,568	3,586
Control delay (average)	Seconds/vehicle	9.3	9.4	9.4
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.64	0.65	0.62

INTERSECTION: B2–Rössing Uranium/Arandis (D1911) Proposed layout, afternoon peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	350	491	631
Percentage of heavy vehicles	%	15.7	15.7	15.7
Degree of saturation	n/a	0.067	0.094	0.12
Effective intersection capacity	Vehicles/hour	5,230	5,229	5,243
Control delay (average)	Seconds/vehicle	2.6	2.6	2.6
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.42	0.42	0.42

INTERSECTION: Rössing Uranium/Arandis – D1911 (where the RU and Arandis roads meet, without taking the B2 into account) Existing layout, morning peak, at 60 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	242	339	436
Percentage of heavy vehicles	%	21.6	21.6	22
Degree of saturation	n/a	0.202	0.303	0.417
Effective intersection capacity	Vehicles/hour	1,197	1,119	1,046
Control delay (average)	Seconds/vehicle	7.3	7.8	9.3
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.77	0.77	0.78

INTERSECTION: Rössing Uranium/Arandis – D1911 (where the RU and Arandis roads meet, without taking the B2 into account) Existing layout, afternoon peak, at 60 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	277	387	499
Percentage of heavy vehicles	%	22	22	22
Degree of saturation	n/a	0.112	0.157	0.203
Effective intersection capacity	Vehicles/hour	2,462	2,463	2,462
Control delay (average)	Seconds/vehicle	8.4	8.9	9.3
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.44	0.44	0.44

INTERSECTION: B2–C34 (Road behind the dunes, D1984) Existing layout, morning peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	430	597	773
Percentage of heavy vehicles	%	16	15.8	16
Degree of saturation	n/a	0.242	0.367	0.602
Effective intersection capacity	Vehicles/hour	1,775	1,625	1,284
Control delay (average)	Seconds/vehicle	6.6	9.8	21.9
Level of service (worst movement)	n/a	C	D	F
Effective stop rate	Per vehicle	0.21	0.22	0.34

INTERSECTION: B2–C34 (Road behind the dunes, D1984) Existing layout, afternoon peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	331	501	595
Percentage of heavy vehicles	%	15.1	15	15.1
Degree of saturation	n/a	0.105	0.167	0.189
Effective intersection capacity	Vehicles/hour	3,147	3,006	3,154
Control delay (average)	Seconds/vehicle	2.4	4.2	3.9
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.16	0.21	0.17

INTERSECTION: Sam Nujoma Drive–Nelson Mandela Avenue Existing layout, morning peak, at 60 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	466	653	838
Percentage of heavy vehicles	%	22.3	22.4	22.3
Degree of saturation	n/a	0.193	0.343	0.565
Effective intersection capacity	Vehicles/hour	2,420	1,908	1,490
Control delay (average)	Seconds/vehicle	5.7	6.8	9.8
Level of service (worst movement)	n/a	C	C	D
Effective stop rate	Per vehicle	0.41	0.46	0.46

INTERSECTION: Sam Nujoma Drive–Nelson Mandela Avenue Existing layout, afternoon peak, at 60 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	456	640	839
Percentage of heavy vehicles	%	14	14.1	15.7
Degree of saturation	n/a	0.219	0.344	0.58
Effective intersection capacity	Vehicles/hour	2,086	1,860	1,447
Control delay (average)	Seconds/vehicle	7.6	8.5	11.7
Level of service (worst movement)	n/a	C	C	D
Effective stop rate	Per vehicle	0.48	0.5	0.6

INTERSECTION: Sam Nujoma Drive–Moses Garoëb Street Existing layout, morning peak, at 60 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	1,098	1,536	1,977
Percentage of heavy vehicles	%	4.6	4.5	4.6
Degree of saturation	n/a	0.28	0.349	0.55
Effective intersection capacity	Vehicles/hour	3,927	4,400	3,591
Control delay (average)	Seconds/vehicle	17.9	17.9	19.7
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.68	0.68	0.73

INTERSECTION: Sam Nujoma Drive–Moses Garoëb Street Existing layout, afternoon peak, at 60 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	1,092	1,530	1,968
Percentage of heavy vehicles	%	5.9	5.8	5.9
Degree of saturation	n/a	0.28	0.41	0.596
Effective intersection capacity	Vehicles/hour	3,895	3,731	3,300
Control delay (average)	Seconds/vehicle	18	19.1	20.7
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.68	0.71	0.74

INTERSECTION: Nathaniel Maxuilili Street–Rhode Allee Existing layout, morning peak, at 60 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	356	483	624
Percentage of heavy vehicles	%	13.3	13.5	13.5
Degree of saturation	n/a	0.103	0.147	0.2
Effective intersection capacity	Vehicles/hour	3,354	3,284	3,120
Control delay (average)	Seconds/vehicle	12.8	13	13.2
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.52	0.53	0.55

INTERSECTION: Nathaniel Maxuilili Street–Rhode Allee Existing layout, afternoon peak, at 60 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	573	808	1,030
Percentage of heavy vehicles	%	9.8	10	9.8
Degree of saturation	n/a	0.163	0.234	0.316
Effective intersection capacity	Vehicles/hour	3,519	3,457	3,258
Control delay (average)	Seconds/vehicle	14.6	14.8	15.4
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.58	0.6	0.62

INTERSECTION: Langstrand–B2 (Intersection 1) Existing layout, morning peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	361	493	651
Percentage of heavy vehicles	%	6.9	6.9	6.9
Degree of saturation	n/a	0.083	0.116	0.201
Effective intersection capacity	Vehicles/hour	4,354	4,249	3,246
Control delay (average)	Seconds/vehicle	1.4	1.4	1.9
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.13	0.12	0.15

INTERSECTION: Langstrand–B2 (Intersection 1) Existing layout, afternoon peak, at 120 km/h				
Indicators	**Unit**	**Traffic volumes**		
		Current (Nov. 2008)	**40%**	**80%**
Demand flows – Total	Vehicles/hour	506	708	911
Percentage of heavy vehicles	%	5.7	5.6	5.7
Degree of saturation	n/a	0.143	0.2	0.257
Effective intersection capacity	Vehicles/hour	3,531	3,534	3,539
Control delay (average)	Seconds/vehicle	1.9	2	2.2
Level of service (worst movement)	n/a	C	C	C
Effective stop rate	Per vehicle	0.09	0.09	0.09

ANNEXURE E

REPORT A:
ROUTE B2 FROM SWAKOPMUND TO ARANDIS

Annexure E 1
Route B2 from Swakopmund to Arandis

ROAD SAFETY AUDIT — STAGE 5
AUDIT OF EXISTING ROADS

Swakopmund to Arandis: Surfaced road B2
November 2008

Checklist		Comment
Vertical and Horizontal Alignment		
□ General alignment standard		Speed limit 120km/h
– Check for consistency throughout the route, note any location where alignment standard changes abruptly and is not as expected by drivers		Generally smooth alignment parallel to railway in flat topography. No unexpected changes. See Exhibit 1
□ Substandard curves		
– Identify any curve with a speed value of more than 10 kilometers (km)/hour (h) below the 85th percentile approach speed; note any evidence of vehicles running off the roadway		No substandard curves on main road identified. Substandard vertical curves over pipeline at junctions from the south occurs. See Exhibit 2
□ Inadequate sight distance		
– Check and record any location with inadequate stopping sight distance		Inadequate stopping sight distance at junctions affected by pipeline. See Exhibit 2.
– Check and record any location with inadequate overtaking sight distance at which "no passing lines" have been marked		Overtaking sight distance affected by horizontal and vertical alignment. See Exhibit 3.
Cross-Section		
□ Note any location where the cross-section standard changes abruptly along the route, or is otherwise inconsistent with driver expectations		Cross section width of approximately 7,4m with no shoulders is inadequate for 120 km/h main road on curves. See Exhibit 4.
□ Identify any locations where the capacity of the roadway is restricted		Capacity is restricted at intersections / junctions where no auxiliary lanes are provided. See Exhibit 5.
□ Note locations of regular traffic congestion		No locations of regular congestion: slow moving heavy vehicles cause moving congestion. See Exhibit 6.
□ Note any absence of provisions protecting "turning vehicles" at intersections		See Exhibit 5.
□ Note any locations with inadequate shoulder width; check that the correct type of kerb has been used and note any location where speeds are greater than 50 km/h and "barrier kerb" has been used.		No shoulder provided. See Exhibit 7 no kerb at intersection and sand on road due to absence of a shoulder.
□ Check that the cross-section provides adequately for "vulnerable road users"		See Exhibit 8 for problem of hitch hikers at junctions with Nelson Mandela Street and Arandis access.
– Pedestrians—have paved footpaths, adequate refuge width on median and islands, and proper ramps up and down kerbs,		Rural road not catering for pedestrians.

where there is regular pedestrian traffic – Bicyclists—segregated areas (e.g., paved shoulders) where numbers are significant – Motorcyclists—segregated lanes (paved shoulders), separate roadways, where warranted by demand Lack of access control—Identify any location where the cross section does not allow the development of appropriate access control		Rural road not catering for bicyclist. Not warranted. No development next to main road.
Intersections Sight distances – Check that the sight distances are appropriate for speed limits – Approach (stopping) sight distance – Entering sight distance – Safe intersection sight distance		Sight distances are generally adequate due to flat topography, right angled intersections and lack of vegetation. See Exhibit 5 for problems on side approaches, refer to Swakopmund urban area audit for problems with signs obstructing sight.
General Layout Features Check That the general layout of the intersection caters safely for all road users (pedestrian, bicycles, motorcycles)		Intersections outside Swakopmund and Arandis have no significant pedestrian, bicycle and motorcycle users.
That the layout is logical for various traffic movements, that it correctly favors the major traffic movement		Intersections at right angles and favors main road.
For any lack of auxiliary (turning) lanes		See Exhibit 5. Turning lanes at intersection roads not consistently provided.
For any discontinuity of "through" traffic lanes		Not applicable.
For any instance where "through" vehicles have to change lanes to continue on through an intersection.		See Exhibit 5. Widening at intersections for right turning vehicles allows for through movement in both lanes.
For the occurrence of "trap" lanes, i.e., where a "through" lane is suddenly marked, or aligned, as a lane for traffic turning off a roadway		No such occurrences
Any location where the length and width of the "left turn" merge is substandard and instances where pedestrian movements across the continuous traffic flow movement are not properly catered for		See Exhibit 5 for comment on intersection layouts. No significant pedestrian movement.
For operational problems at roundabouts, e.g., inadequate deflection (and speed reduction) of traffic at entry point, high vehicle speeds within the roundabout, inadequate width of entry or circulating roadway, etc.		See Swakopmund urban area audit for issues with roundabout design.
For situations where channelization islands are too small to be easily seen by drivers, or for pedestrian refuge or for protecting traffic signs, signals, and other road furniture		See Swakopmund urban area audit for issues of poor island and channelization features.
That barrier kerbs are not used where traffic speeds are likely to be greater than 50 km/h		See Swakopmund urban area audit.
Traffic Signal Installations		Not applicable

Street Lighting		Not applicable on route in general. Street lighting can be better used to define the gateway to the town of Swakopmund
Traffic Signing		
General aspects Check		
☐ For cases of unauthorized traffic signs and use of nonstandard signs (color and shape)		Some old blue background warning signs were observed. Signs must conform with SADC Road Traffic Signs Manual. See Exhibit 9.
☐ The location and spacing of signs and note locations where there are too many signs, or the signs are too close together.		Refer to the Swakopmund urban area audit report for too many tourism signs
☐ That traffic signs are clearly visible and are prominently displayed to the intended road users		Obstruction of signs due to vegetation was observed in urban areas. See Exhibit 10.
☐ For instances where the legibility of the information on traffic signs is inadequate, bearing in mind the speed of vehicles and the amount of information displayed		Road traffic signs are legible. Inadequate legibility on information signs was observed. See Exhibit 11.
☐ For instances where signs contain too much information to be capable of being read by drivers traveling at normal operating speed		See Exhibit 12.
☐ The effectiveness of traffic signs by observing them at night and identifying any lack of reflectorization.		On the main route, most signs are effective at night. Some faded signs were observed. See Exhibit 13.
☐ The type of signposts used and record situations where sign posts constitute a fixed roadside hazard or where the use of frangible signposts should be considered		Wooden posts are not drilled to break on impact.
☐ For cases where there is a lack of clearance to traffic signs		Not observed on the main route.
☐ For situations where traffic signs themselves are obstructing essential "lines of sight" for drivers and pedestrians		Observed in Swakopmund: see urban area audit.
Regulatory and Warning Signs Check		
☐ That the appropriate regulatory signs are provided where necessary		General provisions of regulatory signs are adequate, some missing signs were observed. See Exhibit 14.
☐ That warning signs have been used only where they are warranted		Hazard delineator plates should be used at culverts. See exhibit 15.
Guide and Direction Signs Check		
☐ That guide and direction signing has been done on a systematic route or regional strategy, that it is logical and meets needs of unfamiliar drivers.		SADC route signs not consistently used. The "salt" road alternative to Walvisbay is not clearly signed, but as this route is known to local drivers, this is not a serious problem. See Exhibit 16
☐ That all important intersections are provided with – Advance direction signs – Intersection direction signs – Reassurance (distance) signs		Advance and intersection direction signage are adequate, reassurance signs may be less serious in view of the few regional destinations.

That these signs are correctly positioned to allow the required action to be taken by the intended drivers For instances where there are inconsistencies in destination names on consecutive signs, e.g., on "advance direction signs" followed by "intersection direction signs," followed by "reassurance direction signs" For any lack of providing "road names" on direction signs, particularly in urban areas, and "route numbers" For instances of poor legibility and poor arrangement of information on signs **Pavement Marking** Check The general adequacy and visibility of pavement marking, both at night and in wet weather **Checklist Comment** That the correct type of line marking has been used in the various situations, e.g., "continuity lines" at merge and diverge sections, "barrier lines" where overtaking is to be prohibited, etc. For any discontinuities in "through traffic lane" marking and the existence of any "trap" lanes For any deficiency in the delineation of merge and diverge areas, including situations where through traffic may inadvertently lead into auxiliary and turn lanes For locations where there is a lack of "hazard marking" at approach ends of islands and medians, etc. For locations where auxiliary "turn lanes" have been designated with appropriate pavement arrows and locations where the wrong type of arrow has been used For locations where pavement arrows and other markings are confusing to drivers, particularly where "old incorrect" markings have not been properly removed That the positioning of "stop" lines and "holding" lines are appropriate The effectiveness of road markings at night and in wet weather, consider the need for retro-reflective pavement markers or road studs to supplement line and hazard makings; identify inadequate provision of these devices and in the use of nonstandard arrangements of them **Roadside Safety and Landscaping** Check The "clear zone width" generally available along both sides of the road, and comment on this aspect in the RSA report The "fixed roadside objects" that occur within the "clear zone width" and comment on the need to treat them in the interests of road safety The provision of guardrail along the road, consider whether it is really justified and identify locations where it is not justified and locations where it has not been provided where it is		Positioning adequate. No inconsistencies observed in view of few regional destinations. Route numbers are provided, but not consistently. See urban areas audit reports. Line markings vary from adequate to faded. A regular routine maintenance program is required, especially where intersection markings are abraded by sand. See Exhibit 17. No overtaking lines not of adequate length in some curves. See Exhibit 18. Not on main road. Merge areas at widened inter-sections should be painted to provide a recovery area. See Exhibit 19. See urban areas audit reports. See urban areas audit reports. Not observed. Not problematic on main route. See urban areas audit reports. Road studs should be considered for the route in view of mist conditions. In general the flat topography allows for generous recovery area. Recovery areas limited by rock cuttings. See Exhibit 20 Guard rails at culverts where no recovery is possible should be considered. See Exhibit 21.

warranted		
That the correct treatment has been applied to the ends of guardrail sections, including "soft" end treatments, end anchorage, and approach end flaring		Guard rails start with end wings. See exhibit 22. Proper end treatment must be reviewed along whole route.
For the adequacy of "bridge railing" systems on all bridges. Take particular note of inadequate railings that will not restrain an impacting vehicle—this is often the case with bridges		Concrete bridge balustrades observed as adequate.
The treatment of "approach guardrail" to bridges; record situations, where there is no "strong" anchorage of the approach guardrail to the bridge railing system and/or no proper transition of the rigidity of flexible or sem-irigid approach guardrail as it approaches and meets the rigid bridge railing		No connection between bridge and guard rails. See Exhibit 23.
The extent to which trees and other vegetation obstruct driver and pedestrian sight lines, which are essential for safe traffic operation		Mostly no vegetation on route, but problems exist at Swakopmund entrance. See Exhibit 24.
The existence of poles of various kinds along the road and comment on whether some or many can be removed, relocated to less hazardous positions, or (in the case of street lighting poles) made "frangible"		Only traffic signs poles on route.
The degree of hazard associated with large trees, boulders, etc. and whether these can be treated to improve roadside safety		Widening of rock cuts can be done to improve safety: shown in Exhibit 20.
General Traffic Management Items		
Check To see what, if any, special provisions have been made for motorcycles and comment on the need for the provision of such improvements as "paved shoulders," "segregated motorcycle lanes," or "separated motorcycle roadways" in accordance with any adopted warrants, guides, and practices		The extent of motorcycling does not warrant special measures.
The degree of safety afforded to pedestrians, particularly school children, and record instances where there is a need for special provisions to be made		See problem of hitch hikers / public transport under Exhibit 8.
The adequacy and credibility of existing speed limits and comment if they are not appropriate to the traffic situation and the nature of abutting development or are otherwise unrealistic in the view of most motorists		The 120km/h is realistic given the flat topography and gentle alignment of the road under normal conditions; however, the narrow roadway width makes this speed risky.
The effectiveness of speed limit signing: consider the need for more prominent signing of the start of "restricted" speed zones and for "reminder signs" within the speed zone, particularly near intersections where large numbers of vehicles enter the road in question from side roads		Speed restrictions not required due to good sight distances at intersections.
Substandard curves and low speed curved sections of the road; consider the need for "positive" advice to motorists about the safe travel speed and consider the need for "advisory curve speed" signing		No substandard curves.
The need at substandard curves, for other delineation improvements such as the provision of "guide post" delineation, the placement of "chevron alignment" signs, and the use of retro-reflective road studs		The use of road studs is recommended on the road, especially at curves.
The degree of safety afforded to all road users in town centers, particularly where highways pass through shopping centers or near schools, record the need for "traffic calming" techniques to improve safety in these sensitive locations		See urban areas audit reports.

The availability of overtaking opportunities along the route as a whole and comment on the need of specific "overtaking lanes" at regular intervals along two-lane undivided roads, particularly where traffic flows are high in hilly terrain		Trucks and buses traveling in convoy limits passing opportunities. Provision of passing lanes can be beneficial, but requires a separate study. See Exhibit 25
Consider the need for rest areas and other roadside stopping places, e.g., truck stops, scenic viewpoints, wayside picnic areas, etc., and note any current "unofficial" places where vehicles stop and the degree of hazard that this involves		Between Arandis and Swakopmund, there is no need for resting facilities. Swakopmund and Walvisbay, the destinations, are close by.
The existence of roadside stalls and other roadside business activities within the "right of way" of the road; comment on the relative safety of these and the possible need for formal parking arrangements and other regulatory controls		Such activities should be discouraged. The Martin Luther train facility is formalized. See Exhibit 26.
The safety of bus stop locations and provisions for buses to stand clear of traffic lanes; also the need for a street light at these locations for the security and safety of bus patrons		Bus and taxi stops should be located in the urban areas.
For any special problems and requirements that may be necessary to improve safety during "festive season" and holiday periods, when traffic demands are heavy and most drivers are relatively unfamiliar with the road		See the urban areas audit reports.
Culverts and bridges for structural integrity.		Failed and damaged culverts were noted. See Exhibit 27.
Pavement failures such as pot holes and edge breaks		Edge breaks were noted. See Exhibit 28

Annexure E 2
Statement

Road Safety Audit Report
Swakopmund to Arandis: Surfaced Road B2

The section of road was observed in November 2008 by Louis Roodt, Pr Eng.

A check list with supporting photos and comments are attached to this report.

The purpose of the Road Safety Audit was to highlight existing potential risk and safety performance of the road, which is used for commuting by employees of Rossing Uranium Mine. The mine provides bus services between Swakopmund, Walvisbay and Arandis to limit the exposure of employees to traffic hazards on a daily basis. The input of the Road Safety Audit will be used in the Environmental Impact Assessment undertaken to increase the production and lifespan of the mine.

The provision of such bus services contributes to a higher level of safety and reduced potential risks for the employees. The standard operating procedures for the drivers can be used to mitigate the hazards identified and highlighted. In particular, buses must not drive in platoons with short headways between them and trucks or other buses. Such platoons leads to dangerous overtaking by other drivers.

The increase in the number of buses to accommodate the increase in production will not cause significant increases in congestion, collision potential or risk exposure as such. The long term growth in background traffic, and seasonal peaks, must be monitored to adapt standard operating procedures such as traffic point duty, or local road improvements at intersections and bus stops which is not currently warranted.

The following aspects are highlighted:

1 The roadway is narrow considering the high heavy vehicle volumes on the road. A collision occurred during the site visit on the road B2 east of Arandis where two trucks driving in opposite directions sideswiped on a curve, leading to a head on collision with a third truck.
2 The general alignment is gentle and flat, leading to high operating speeds and driver expectation. Platooning of trucks and buses acts as moving obstructions, leading to dangerous passing. This can mitigated by providing passing opportunities and by advising drivers of slower vehicles to not platoon.
3 The flat topography also allows wide recovery areas next to the road. These are however not consistent as many culverts are not protected by guard rails and a number of narrow local rock cuts.
4 There is a need for road studs to assist driving at night and in mist.
5 Hazard markers should be used at all culverts, as the white concrete markers are inadequate and often not maintained.
6 Sand on the roadway at intersections is problematic as it can cause skidding and wearing of road markings. Continuous maintenance and cleaning are required.

7 There is a need for sign maintenance and correct usage as part of the continuous maintenance programme.

8 Damage to culverts was noted.

L D ROODT

Annexure E 3
Exhibits

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 1

General flat topography and smooth alignment parallel to railway line.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 2

Inadequate stopping sigh distance at junctions affected by the pipe line on the south side of B2. Also notice sand on the roadway affecting braking and road markings maintenance.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 3

Overtaking sight distance affected by horizontal and vertical alignment: in this case the road falls away over a vertical curve in the direction of travel, while the traffic from the opposite direction would not have adequate sight distance if travelling behind a heavy vehicle unless it moves into the opposing lane to see past the vehicle.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 4
Narrow cross section is compensated for by a wide recovery area, but is problematic in curves. See patching on inside of curve in second photo.

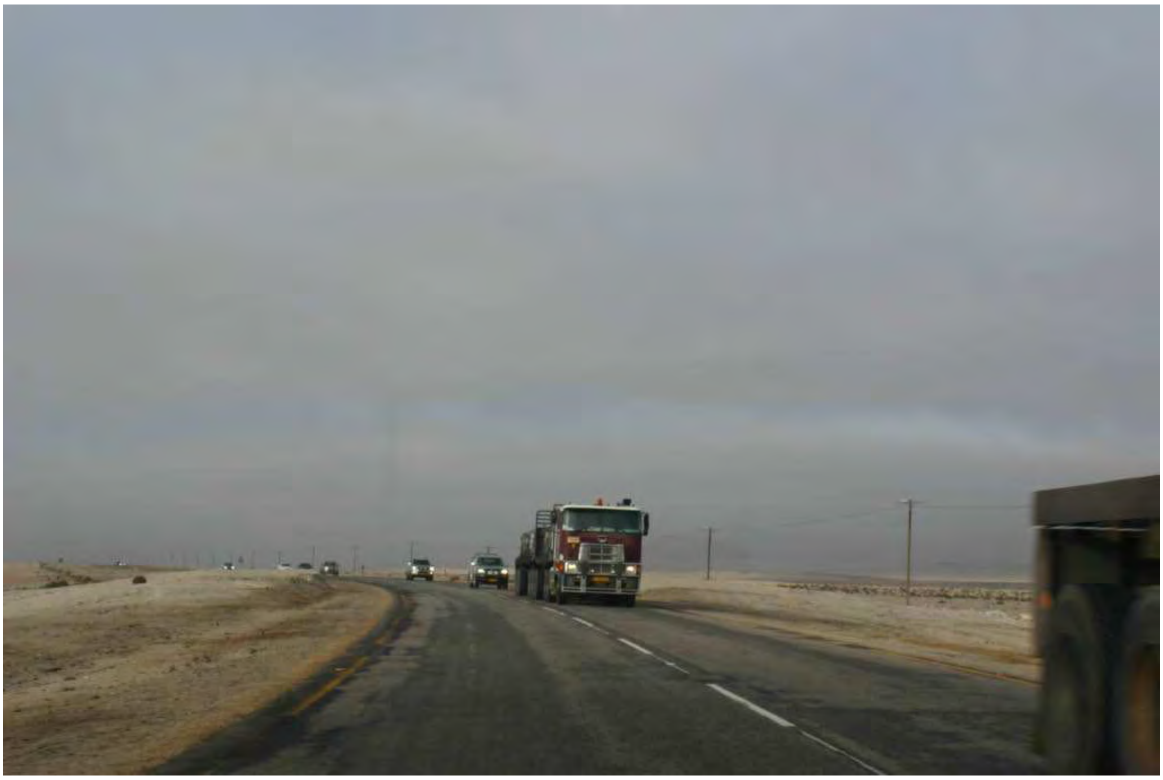


Exhibit 5: Intersections on the B2

Lack of auxiliary lanes at minor intersections or junctions leaves turning vehicles without any protection from high speed through vehicles. Where auxiliary lanes have been provided, the merges are not well defined. The practice of allowing through movement on both lanes in the widened area is less safe that having a dedicated protected right turn slot. The side approach must have adequate sight distance to the stop line.


Rossmund
Golf Course

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 6
Congestion caused by slow moving vehicles. Note illegal over taking.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 7
Inadequate shoulder widths and / or lack of kerbs at intersections cause sand to be transported on the roadway.

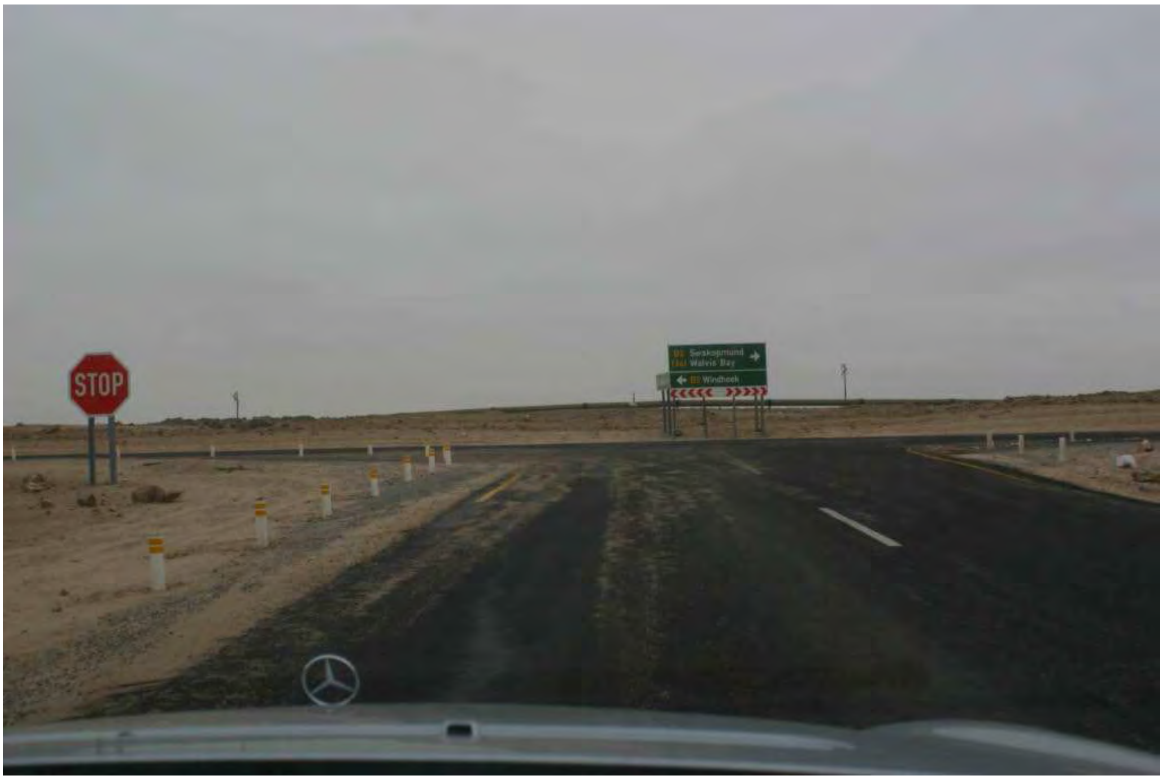


Exhibit 8
Hitch hikers at Nelson Mandela Drive, Swakopmund and Arandis T -junction. In the first case, the road was cordoned off. Facilities should be provided where it is safe for pedestrians and drivers.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 9
Old style road signs with blue background is not in conformance with the SADC Road and Traffic Signs Manual. These signs have no legal standing.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 10
Obstruction of signs by vegetation. This is primarily an urban problem.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 11
Legibility of signs: this information sign cannot be read from a moving vehicle.]

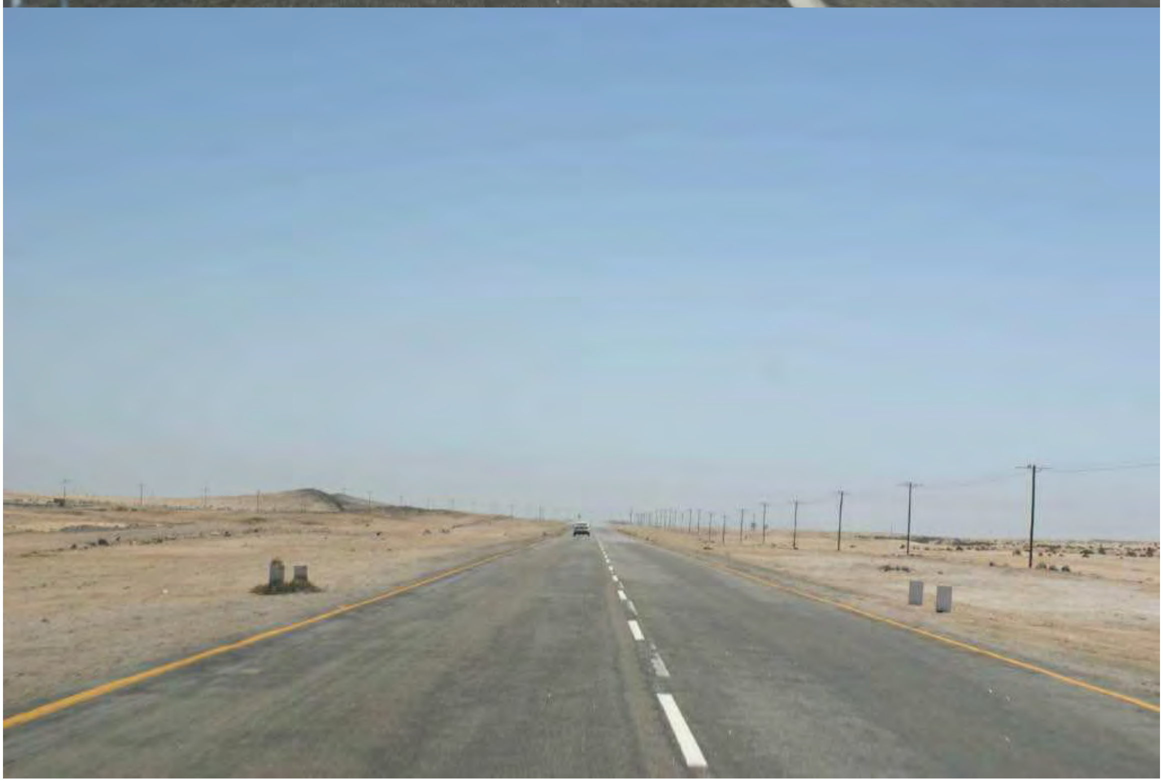
Exhibit 12
Too much information in the form of facilities signs on the B2.

Exhibit 13
Faded road traffic signs on the B2 and road approaching the B2.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 14
Missing signs on the B2: a yield sign lying next to the road and no stop of yield sign on the side road.

Exhibit 15
The use of hazard markers / delineators at culverts is recommended in favour of the concrete markers which are not as visible and often damaged during shoulder blading.



Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 16
The alternative road to Walvisbay via the "Salt" road is indicated on this direction sign. This may not be apparent to unfamiliar drivers, but known to local users.

Exhibit 17
Line marking is subject to fading and abrasion. The roadway must be cleaned regularly to prevent damage to markings, and to maintain friction for braking.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 18
No-Overtaking lines of inadequate length or on the wrong side to prevent unsafe overtaking.

Exhibit 19
The merge at the end of the auxiliary lane is marked on the edge of the roadway, leaving no recovery area. It is current practice to paint the merge some distance from the edge of the roadway to allow some encroachment of the merge limit without leaving the roadway.

Exhibit 20
Clear zones are affected by local narrow rock cuttings inhibit recovery and pose hazards.

Exhibit 21
Guard rails should be considered at culverts where recovery is not possible. Guard rails must be adequately marked with delineators and the start treatment must be curved down and flared.

Exhibit 22
Guard rail should not start with end wings.
Isolated guard rails used as barriers are not recommended.

Exhibit 23
Guard rails should tie in with bridge balustrades as an strong anchorage. Unconnected guard rails can deflect and guide the errand vehicle into the balustrade.

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 24
Sight lines affected by vegetation in Swakopmund at the junction on the B2.

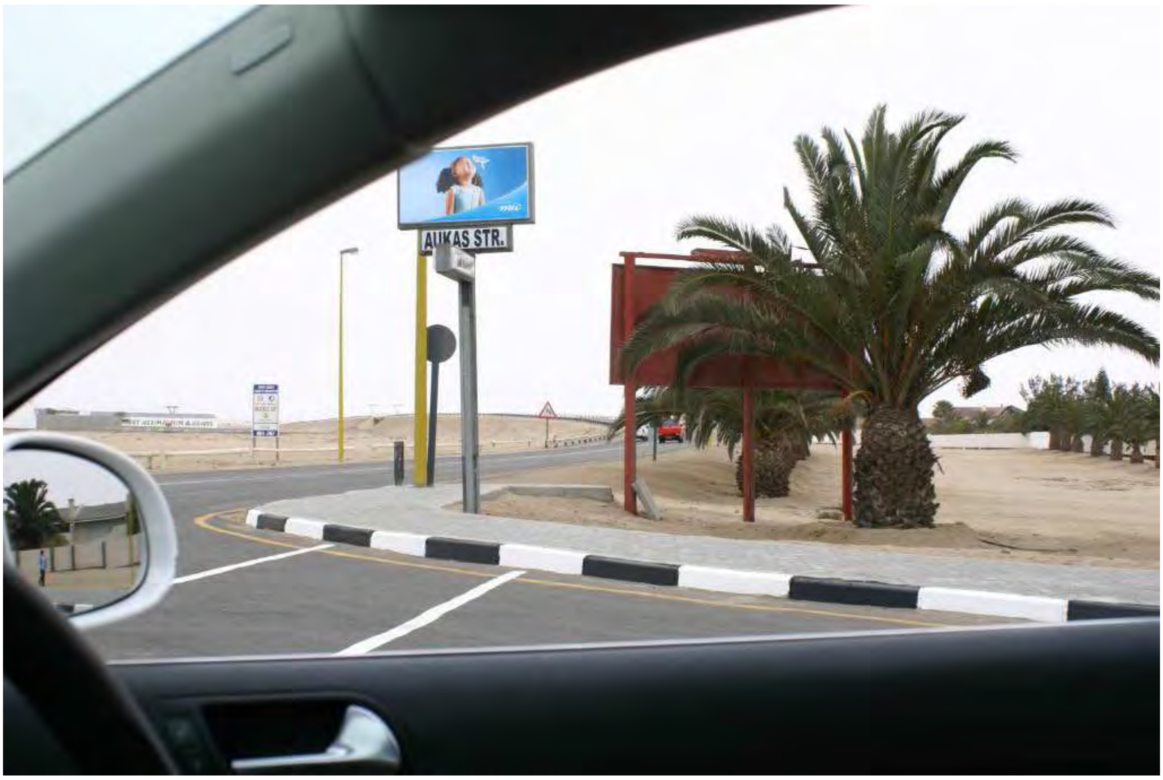
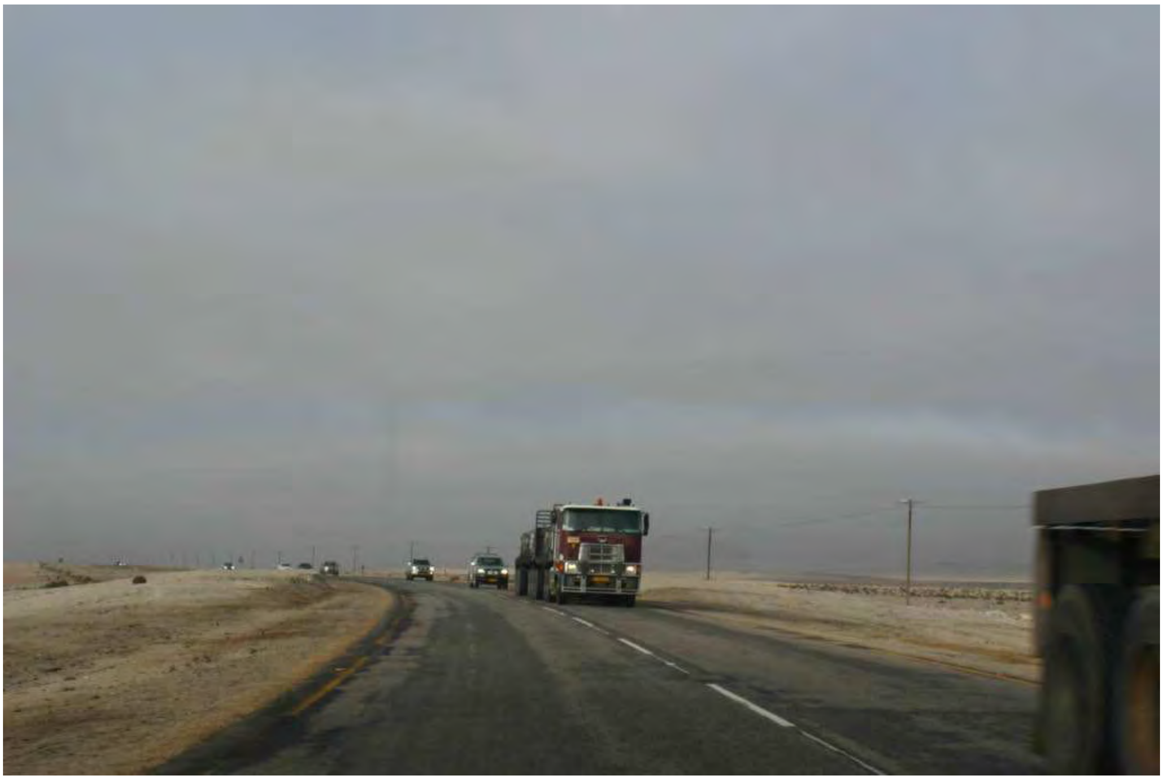


Exhibit 25
Passing opportunities are dictated by heavy vehicle speeds and platooning.
Provision of passing opportunities improves safety and reduces frustration.



Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 26
Formal access to the Martin Luther Train tourism facility off the B2

Road Safety Audit Report: Swakopmund to Arandis: Surfaced road B2

Exhibit 27

General issues: Edge breaks are hazardous for vehicles leaving the road as tyres can get cut or loss of control can occur in trying to re-enter the road.

Exhibit 28
Damage to culverts. Damaged or failed culverts can cause subsidence of the road, leading to loss of control of vehicles.

ANNEXURE F

REPORT B:
ROUTE B2 FROM SWAKOPMUND TO WALVIS BAY

Annexure F1
Route B2 from Swakopmund to Walvis Bay

ROAD SAFETY AUDIT — STAGE 5
AUDIT OF EXISTING ROADS

Walvisbay to Swakopmund: Surfaced road B2
November 2008

Checklist		Comment
Vertical and Horizontal Alignment		
General alignment standard		Speed limit 120km/h
– Check for consistency throughout the route, note any location where alignment standard changes abruptly and is not as expected by drivers		Generally smooth alignment parallel to sea in flat topography. No unexpected changes. See Exhibit 1
Substandard curves		
– Identify any curve with a speed value of more than 10 kilometers (km)/hour (h) below the 85th percentile approach speed; note any evidence of vehicles running off the roadway		No substandard curves on main road identified. Entry into Swakopmund on a curve serves as speed reduction measure. See Exhibit 2
Inadequate sight distance		
– Check and record any location with inadequate stopping sight distance – Check and record any location with inadequate overtaking sight distance at which "no passing lines" have been marked		No inadequate stopping sight distances were identified. Overtaking sight distance affected by horizontal alignment. See Exhibit 3.
Cross-Section		
Note any location where the cross-section standard changes abruptly along the route, or is otherwise inconsistent with driver expectations		Cross section width of approximately 7,4m with no shoulders is inadequate for 120 km/h main road with high percentage of heavy vehicles. See Exhibit 4.
Identify any locations where the capacity of the roadway is restricted		Capacity is restricted at intersections / junctions where no auxiliary lanes are provided. See Exhibit 5.
Note locations of regular traffic congestion		No locations of regular congestion: slow moving heavy vehicles cause moving congestion. See Exhibit 4.
Note any absence of provisions protecting "turning vehicles" at intersections		See Exhibit 5.
Note any locations with inadequate shoulder width; check that the correct type of kerb has been used and note any location where speeds are greater than 50 km/h and "barrier kerb" has been used.		No shoulder provided. See Exhibit 5 No kerbs at intersections. Sand on road due to absence of shoulder or kerbs.
Check that the cross-section provides adequately for "vulnerable road users"		See Exhibit 6 for problem holiday pedestrian traffic.

– Pedestrians—have paved footpaths, adequate refuge width on median and islands, and proper ramps up and down kerbs, where there is regular pedestrian traffic		Rural road not catering for pedestrians, except at crossings near settlements and holiday facilities. See Exhibit 7 of dangerous crossings.
– Bicyclists—segregated areas (e.g., paved shoulders) where numbers are significant		Rural road not catering for bicyclist.
– Motorcyclists—segregated lanes (paved shoulders), separate roadways, where warranted by demand		Not warranted.
Lack of access control—Identify any location where the cross section does not allow the development of appropriate access control		Developments next to main road restricted to designed access points.
Intersections Sight distances – Check that the sight distances are appropriate for speed limits – Approach (stopping) sight distance – Entering sight distance – Safe intersection sight distance		Sight distances are generally adequate due to flat topography, right angled intersections and lack of vegetation. Mist is problematic as sight distance is generally impeded.
General Layout Features Check That the general layout of the intersection caters safely for all road users (pedestrian, bicycles, motorcycles)		Intersections outside Walvisbay have no significant pedestrian, bicycle and motorcycle users. Roundabouts in Walvisbay are based on outdated designs, see Exhibit 8 for comment.
That the layout is logical for various traffic movements, that it correctly favors the major traffic movement		Intersections at right angles and generally favors main road.
For any lack of auxiliary (turning) lanes		See Exhibit 9. Turning lanes at intersection roads not consistently provided.
For any discontinuity of "through" traffic lanes.		See Exhibit 9. Widening at intersections for right turning vehicles allows for through movement in both lanes.
For any instance where "through" vehicles have to change lanes to continue on through an intersection.		No such occurrences
For the occurrence of "trap" lanes, i.e., where a "through" lane is suddenly marked, or aligned, as a lane for traffic turning off a roadway		See Exhibit 9 for comment on intersection layouts. No significant pedestrian movement.
Any location where the length and width of the "left turn" merge is substandard and instances where pedestrian movements across the continuous traffic flow movement are not properly catered for		See Exhibit 8 for issues with roundabout design.
For operational problems at roundabouts, e.g., inadequate deflection (and speed reduction) of traffic at entry point, high vehicle speeds within the roundabout, inadequate width of entry or circulating roadway, etc.		See Exhibit 8 for issues of poor island and channelization features.

For situations where channelization islands are too small to be easily seen by drivers, or for pedestrian refuge or for protecting traffic signs, signals, and other road furniture That barrier kerbs are not used where traffic speeds are likely to be greater than 50 km/h		See Exhibit 10.
Traffic Signal Installations		Not applicable on Route B2 outside Walvisbay. See Exhibit 11 for comment on traffic signals in the Walvisbay urban area.
Street Lighting		Not applicable on route in general, but provided at start of urban area of Walvisbay. Street lights are found at intersections along the route at accesses to settlements, thus defining the intersections. Street lighting can be better used to define the gateway to the town of Swakopmund. See Exhibits 2 and 9.
Traffic Signing		
General aspects Check For cases of unauthorized traffic signs and use of nonstandard signs (color and shape)		No old blue background warning signs were observed. Signs must conform to SADC Road Traffic Signs Manual.
The location and spacing of signs and note locations where there are too many signs, or the signs are too close together.		Too many tourism signs at the roundabouts in Walvisbay. See Exhibit 12.
That traffic signs are clearly visible and are prominently displayed to the intended road users		No obstruction of signs due to vegetation was observed in Walvisbay areas.
For instances where the legibility of the information on traffic signs is inadequate, bearing in mind the speed of vehicles and the amount of information displayed		Road traffic signs are legible. Inadequate legibility on information signs was observed. See Exhibit 12.
For instances where signs contain too much information to be capable of being read by drivers traveling at normal operating speed		See Exhibit 12.
The effectiveness of traffic signs by observing them at night and identifying any lack of reflectorization.		On the main route, most signs are effective at night. Some faded signs were observed in Walvisbay.
The type of signposts used and record situations where sign posts constitute a fixed roadside hazard or where the use of frangible signposts should be considered		See Exhibit 13 for hazardous sign supports.
For cases where there is a lack of clearance to traffic signs		Not observed on the main route.
For situations where traffic signs themselves are obstructing essential "lines of sight" for drivers and pedestrians		Not observed on this section of B2.
Regulatory and Warning Signs Check That the appropriate regulatory signs are provided where		General provisions of regulatory

necessary □ That warning signs have been used only where they are warranted **Guide and Direction Signs** Check □ That guide and direction signing has been done on a systematic route or regional strategy, that it is logical and meets needs of unfamiliar drivers. □ That all important intersections are provided with – Advance direction signs – Intersection direction signs – Reassurance (distance) signs □ That these signs are correctly positioned to allow the required action to be taken by the intended drivers □ For instances where there are inconsistencies in destination names on consecutive signs, e.g., on "advance direction signs" followed by "intersection direction signs," followed by "reassurance direction signs" □ For any lack of providing "road names" on direction signs, particularly in urban areas, and "route numbers" □ For instances of poor legibility and poor arrangement of information on signs **Pavement Marking** Check □ The general adequacy and visibility of pavement marking, both at night and in wet weather **Checklist Comment** □ That the correct type of line marking has been used in the various situations, e.g., "continuity lines" at merge and diverge sections, "barrier lines" where overtaking is to be prohibited, etc. □ For any discontinuities in "through traffic lane" marking and the existence of any "trap" lanes □ For any deficiency in the delineation of merge and diverge areas, including situations where through traffic may inadvertently lead into auxiliary and turn lanes □ For locations where there is a lack of "hazard marking" at approach ends of islands and medians, etc. □ For locations where auxiliary "turn lanes" have been designated with appropriate pavement arrows and locations where the wrong type of arrow has been used □ For locations where pavement arrows and other markings are confusing to drivers, particularly where "old incorrect" markings have not been properly removed		signs are adequate, some missing signs were observed. See Exhibit 14. SADC route signs not consistently used. The "salt" road alternative to Walvisbay is not clearly signed, but as this route is known to local drivers, this is not a serious problem. Advance and intersection direction signage are adequate, reassurance signs may be less serious in view of the few regional destinations. Positioning adequate. No inconsistencies observed in view of few regional destinations. Route numbers are provided, but not consistently. See urban areas audit reports. Line markings vary from adequate to faded. A regular routine maintenance program is required, especially where intersection markings are abraded by sand. Yellow edge markings are required at ends of tapers. See Exhibit 5. A short left lane at T junction merges with right and through lane. See Exhibit 15. See Exhibit 10 for misuse of sharp curve chevron for hazard marker. Not observed Not observed.

That the positioning of "stop" lines and "holding" lines are appropriate The effectiveness of road markings at night and in wet weather, consider the need for retro-reflective pavement markers or road studs to supplement line and hazard makings; identify inadequate provision of these devices and in the use of nonstandard arrangements of them		Road studs should be considered for the route in view of mist conditions. Yellow edge lines should be provided continuously and regularly swept to keep sand off the road.
Roadside Safety and Landscaping Check The "clear zone width" generally available along both sides of the road, and comment on this aspect in the RSA report		In general the flat topography allows for generous recovery area.
The "fixed roadside objects" that occur within the "clear zone width" and comment on the need to treat them in the interests of road safety		
The provision of guardrail along the road, consider whether it is really justified and identify locations where it is not justified and locations where it has not been provided where it is warranted		Guard rails at the sea edge are provided, but not consistently See Exhibit 16.
That the correct treatment has been applied to the ends of guardrail sections, including "soft" end treatments, end anchorage, and approach end flaring		Guard rails start with end wings. See exhibit 16. Proper end treatment must be reviewed along whole route.
For the adequacy of "bridge railing" systems on all bridges. Take particular note of inadequate railings that will not restrain an impacting vehicle—this is often the case with bridges		Concrete bridge balustrades observed as adequate.
The treatment of "approach guardrail" to bridges; record situations, where there is no "strong" anchorage of the approach guardrail to the bridge railing system and/or no proper transition of the rigidity of flexible or sem-irigid approach guardrail as it approaches and meets the rigid bridge railing		No connection between bridge and guard rails. See Exhibit 17.
The extent to which trees and other vegetation obstruct driver and pedestrian sight lines, which are essential for safe traffic operation		Mostly no vegetation on route. See Exhibit 18.
The existence of poles of various kinds along the road and comment on whether some or many can be removed, relocated to less hazardous positions, or (in the case of street lighting poles) made "frangible"		Post and cable barriers are used to control access. See Exhibit 19
The degree of hazard associated with large trees, boulders, etc. and whether these can be treated to improve roadside safety		No critical.
General Traffic Management Items Check To see what, if any, special provisions have been made for motorcycles and comment on the need for the provision of such improvements as "paved shoulders," "segregated motorcycle lanes," or "separated motorcycle roadways" in accordance with any adopted warrants, guides, and practices		The extent of motorcycling does not warrant special measures.
The degree of safety afforded to pedestrians, particularly school children, and record instances where there is a need for special provisions to be made		See problem of crossing pedestrians at entrance to Walvisbay under Exhibit 20.
The adequacy and credibility of existing speed limits and comment if they are not appropriate to the traffic situation and the nature of abutting development or are otherwise unrealistic in the view of most motorists.		The 120km/h is realistic given the flat topography and gentle alignment of the road under normal conditions; however, the narrow roadway width

		and high volume of heavy vehicles makes this speed risky where platooning and when mist occurs
The effectiveness of speed limit signing: consider the need for more prominent signing of the start of "restricted" speed zones and for "reminder signs" within the speed zone, particularly near intersections where large numbers of vehicles enter the road in question from side roads		Speed restrictions are required despite good sight distances at intersections, due to speed differentials. See Exhibit 5
Substandard curves and low speed curved sections of the road; consider the need for "positive" advice to motorists about the safe travel speed and consider the need for "advisory curve speed" signing		No substandard curves.
The need at substandard curves, for other delineation improvements such as the provision of "guide post" delineation, the placement of "chevron alignment" signs, and the use of retro-reflective road studs		The use of road studs is recommended on the road, especially at curves.
The degree of safety afforded to all road users in town centers, particularly where highways pass through shopping centers or near schools, record the need for "traffic calming" techniques to improve safety in these sensitive locations		Not part of the report.
The availability of overtaking opportunities along the route as a whole and comment on the need of specific "overtaking lanes" at regular intervals along two-lane undivided roads, particularly where traffic flows are high in hilly terrain		Trucks and buses traveling in convoy limit passing opportunities. Provision of passing lanes can be beneficial, but requires a separate study. See Exhibit 21
Consider the need for rest areas and other roadside stopping places, e.g., truck stops, scenic viewpoints, wayside picnic areas, etc., and note any current "unofficial" places where vehicles stop and the degree of hazard that this involves		Between Walvisbay and Swakopmund, there is no need for resting facilities. Swakopmund and Walvisbay, the destinations, are close by.
The existence of roadside stalls and other roadside business activities within the "right of way" of the road; comment on the relative safety of these and the possible need for formal parking arrangements and other regulatory controls.		Such activities should be discouraged. The location of recreational facilities on the east side of B2, where development has occurred on the west side, should be discouraged.
The safety of bus stop locations and provisions for buses to stand clear of traffic lanes; also the need for a street light at these locations for the security and safety of bus patrons		Bus and taxi stops should be located in the developments off B2.
For any special problems and requirements that may be necessary to improve safety during "festive season" and holiday periods, when traffic demands are heavy and most drivers are relatively unfamiliar with the road		See Exhibit 6 for discussion of recreational facilities on the other side of the main toad.
Culverts and bridges for structural integrity.		Not inspected.
Pavement failures such as pot holes and edge breaks		Edge breaks were noted.

Annexure F 2
Statement

Road Safety Audit Report B
Walvisbay to Swakopmund : Surfaced road B2

The section of road was observed in November 2008 by Louis Roodt, Pr Eng.

A check list with supporting photos and comments are attached to this report.

The following aspects are highlighted:

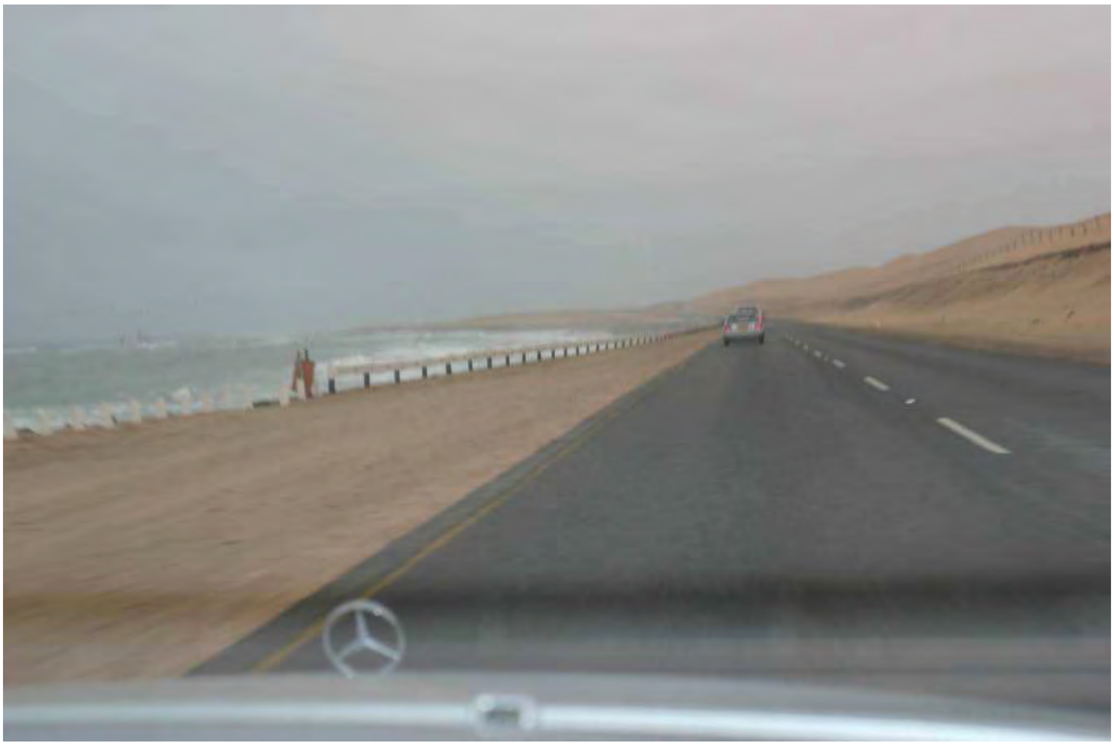
1 The roadway is narrow considering the high heavy vehicle volumes on the road. Widening is being undertaken to limit off tracking of the rear wheels of long combination to erode the road edges and shoulders and to limit encroachment of sand onto the roadway.
2 The general alignment is gentle and flat, leading to high operating speeds and driver expectation. Platoons of trucks and buses act as moving obstructions, leading to dangerous passing. This can mitigated by providing passing opportunities and by advising drivers of slower vehicles to not platoon.
3 The flat topography also allows wide recovery areas next to the road.
4 There is a need for road studs to assist driving at night and in mist.
5 Sand on the roadway at intersections is problematic as it can cause skidding and wearing of road markings. Continuous maintenance is required.
6 There is a need for sign maintenance and correct usage as part of the continuous maintenance programme.
7 Developments on the east side of the road should be discouraged as crossing movements by vehicles and pedestrians are hazardous.
8 Accesses to developments along the road must be to high geometric standard with adequate auxiliary lanes and lighting to mark these danger points clearly.

Signed:

L D ROODT

Annexure F 3
Exhibits

Exhibit 1
General flat topography and smooth alignment parallel to the shore line.



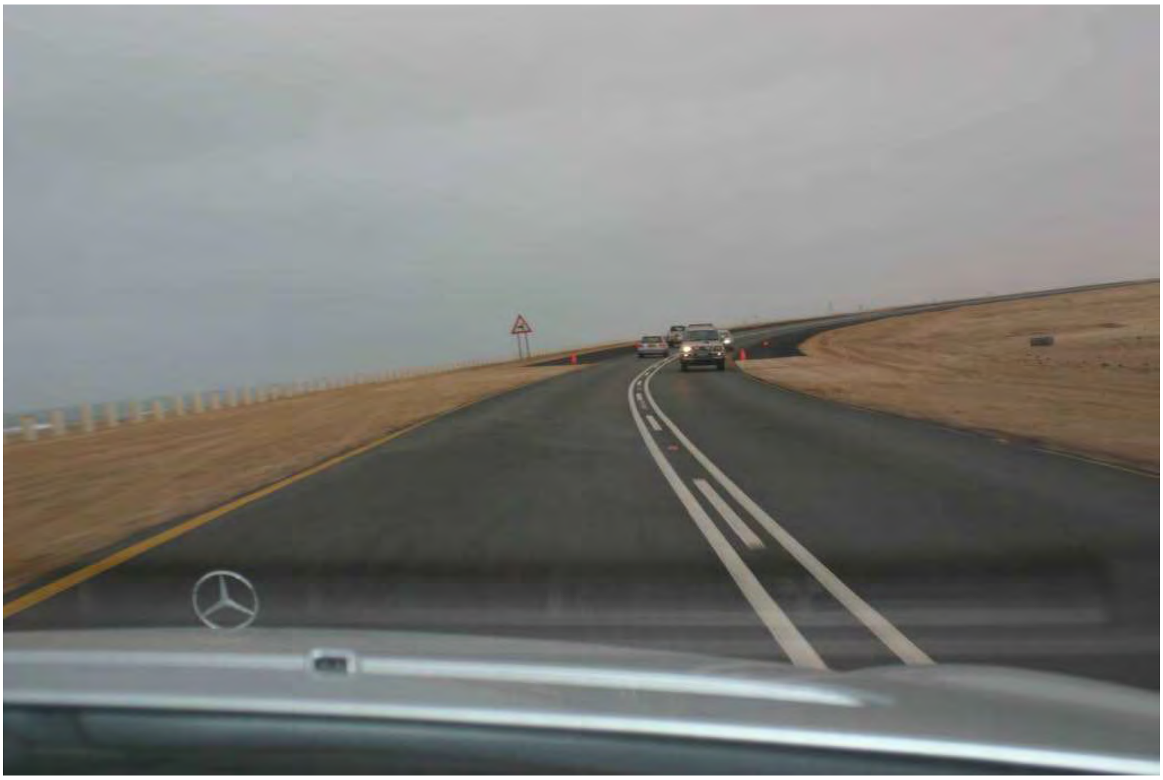
Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 2

Entry into Swakopmund on curve serves as speed reduction measure.

Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 3
Overtaking sight distance affected by horizontal alignment: the traffic from the opposite direction would not have adequate sight distance if travelling behind a heavy vehicle unless it moves into the opposing lane to see past the vehicle.



Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 4

Narrow cross section is compensated for by a wide recovery area, but is inadequate for 120 km/h with high volumes of heavy vehicle traffic.

High volumes of slow moving heavy vehicles cause delays and congestion.

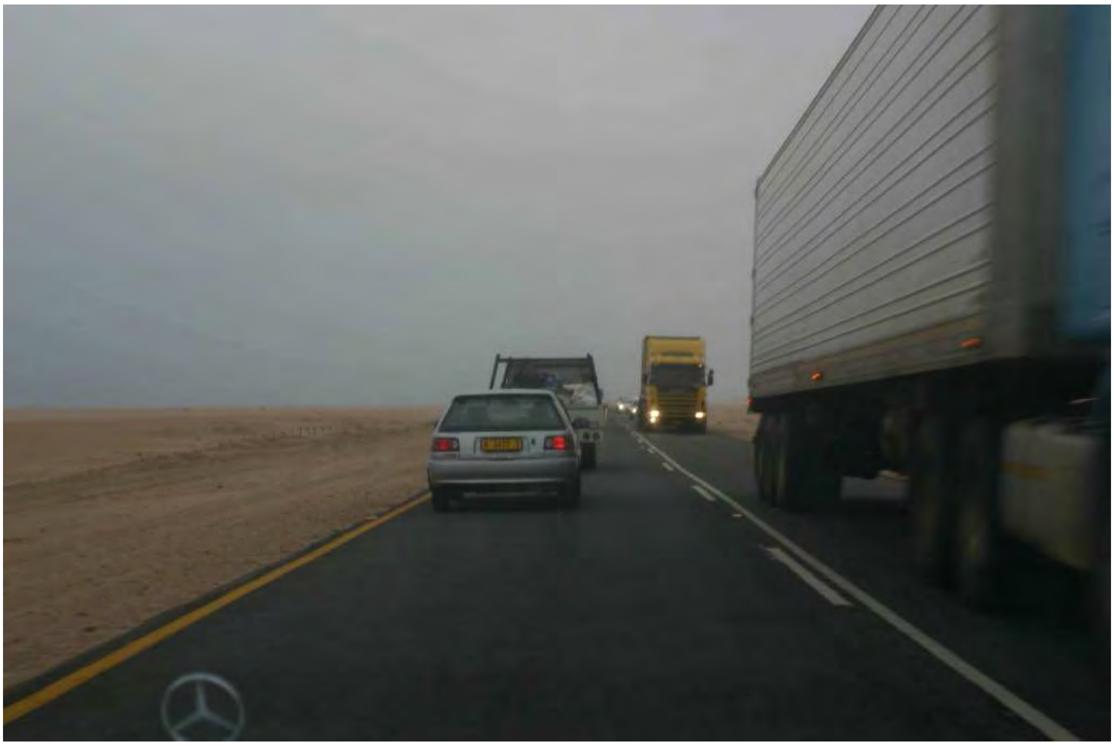
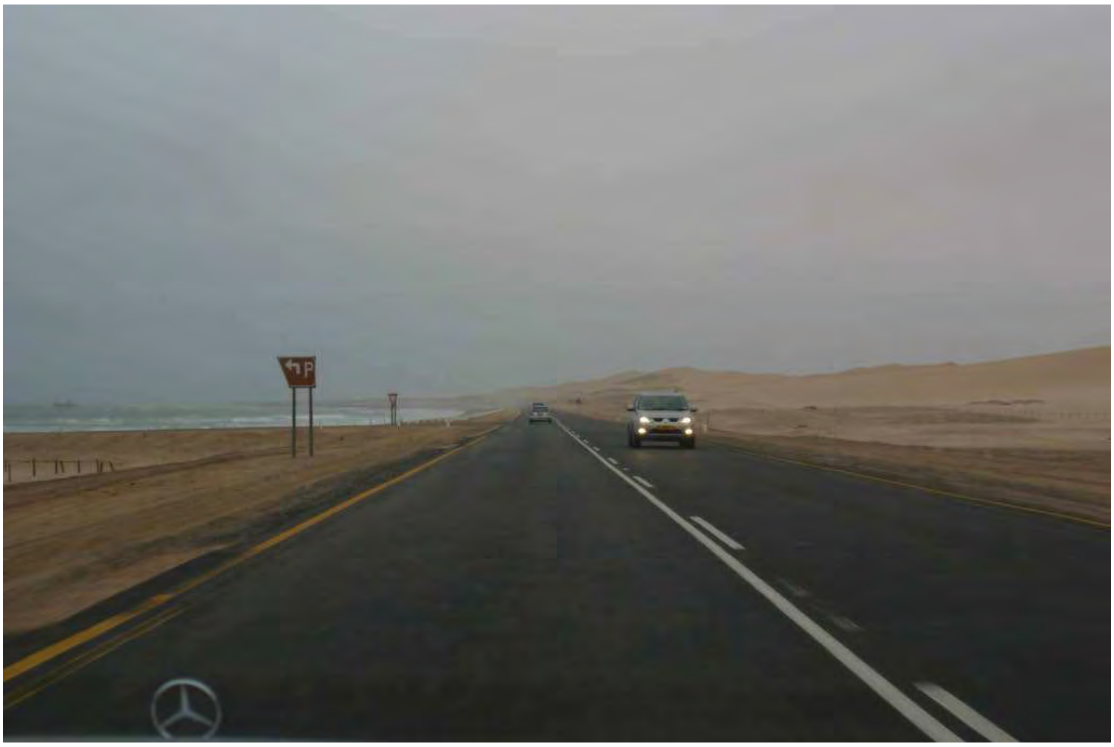


Exhibit 5: Intersections on the B2
Lack of auxiliary lanes at minor intersections or junctions leaves turning vehicles without any protection from high speed through vehicles and reduces capacity.
Lack of shoulders and kerbs at intersections lead to sand on the roadway.



Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 6

Holiday pedestrian traffic cross route B2 just on the other side of this vertical curve, as recreational facilities were provided on the inland side of the road, while the residential development is on die seaward side of the road. A temporary warning sign for children crossing will soon lose its credibility due to constant display.

Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 7
Pedestrians cross route B2 on the outskirts of Walvisbay. The road is in fill. The area is also used as pick up point for hitch hikers to Swakopmund.

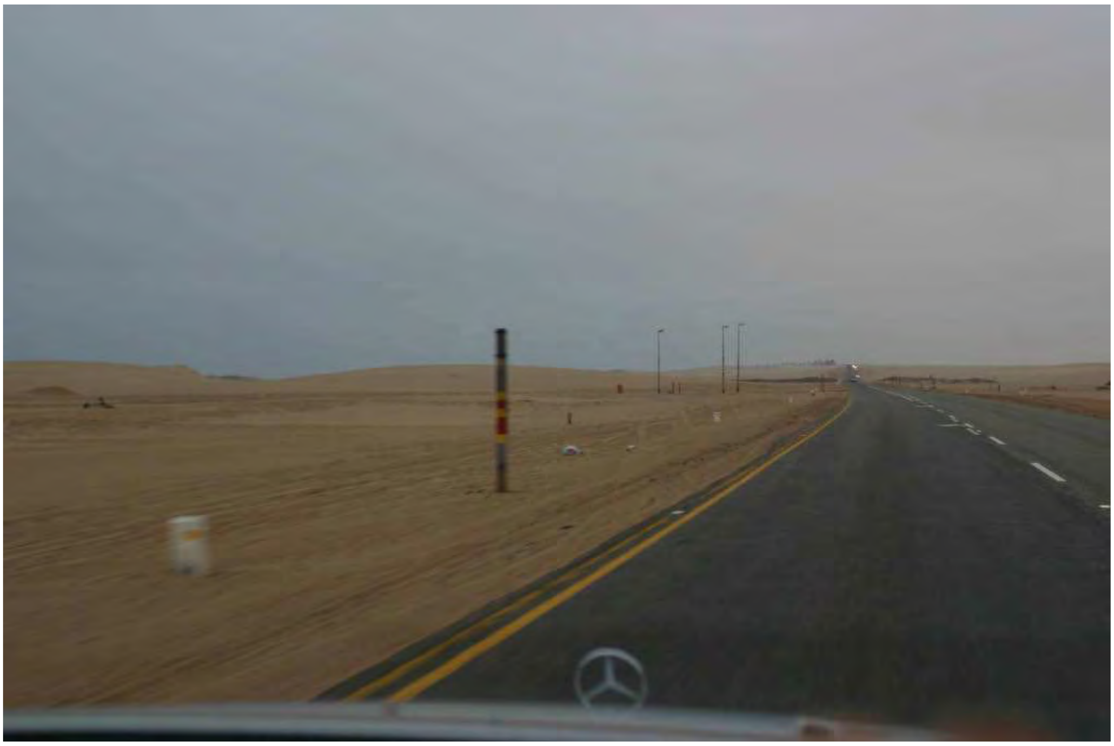
Exhibit 8

Roundabouts or traffic circles in Walvisbay do not conform to modern design principles. The basic assumption is that vehicles accept gaps in the circulating flow, not merging at will. The entry design in Walvisbay is more of a slip road leading to high speed and acute angles so that traffic cannot be observed from the right.
Note the sand on the roadway.

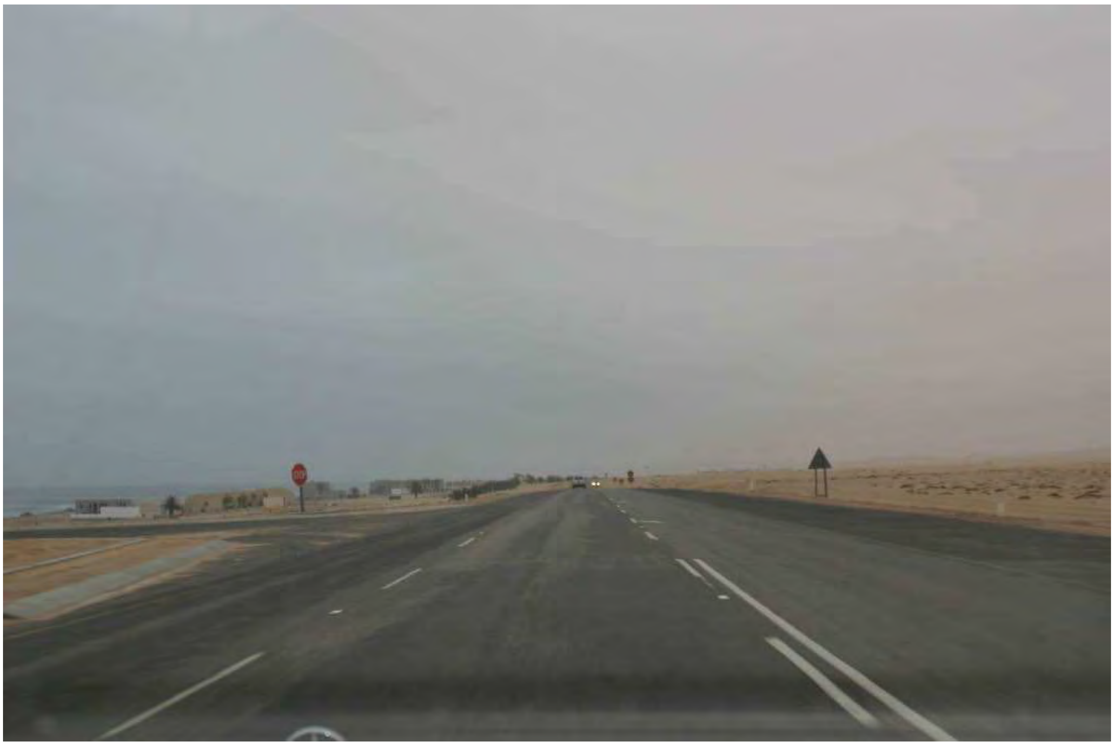
The acute entry angle requires a yield sign that must be placed so far on the splitter island that it may be seen to apply to the circulating traffic.

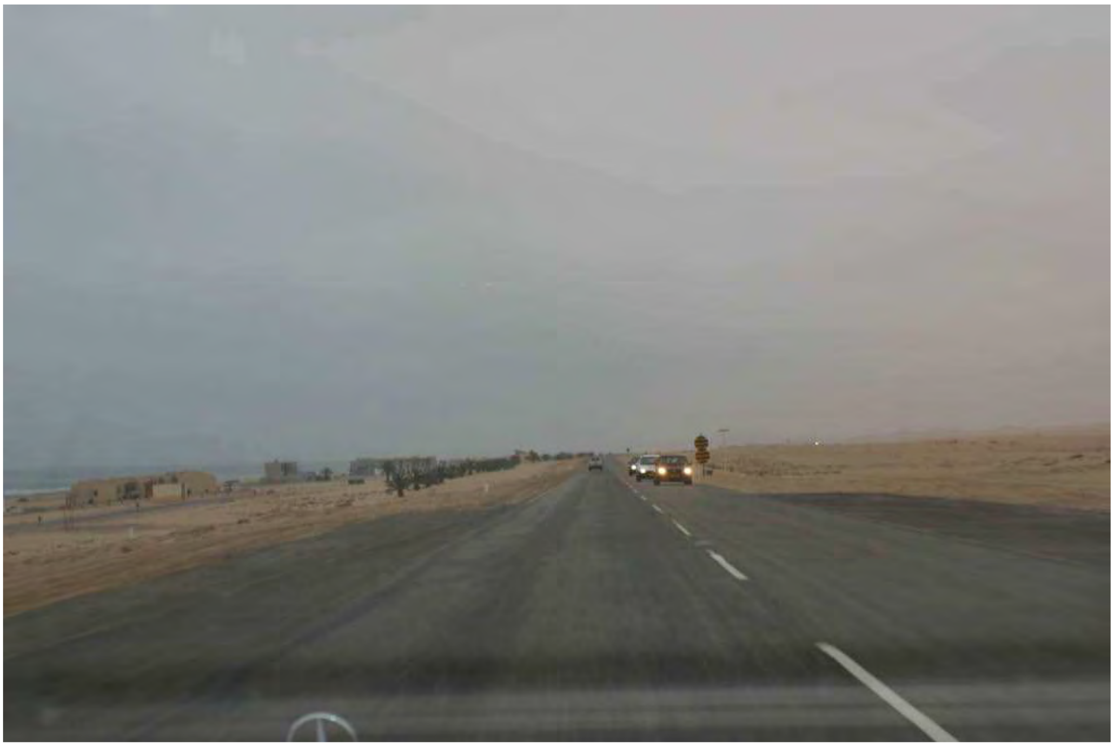
Exhibit 9
Intersections and junctions onto route B2 are mainly at right angles. The provision of auxiliary lanes (turning or deceleration lanes) are not consistent. Turning vehicles obstruct through vehicles.

This photo shows a poorly defined intersection, where future development will take place.



The next photos show intersections or junctions at Langstrand, with varying lengths of auxiliary lanes and tapers to end the auxiliary lanes.
Road markings are not to SADC RTSM guidelines in the case of the new junction It is important for safe operations to complete road markings as soon as possible after construction, as drivers must be able to interpret the junction. Note the lack of yellow edge lines in the second junction and sudden merge at the end of the acceleration lane. As safe area should be painted out so that late mergers do not drive on the gravel shoulder, but on a painted island.





Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 10
Small islands and medians are difficult to see. Signs to enhance visibility do not always solve the problem as there is inadequate clearance to vehicles and the run over signs must be constantly maintained.
Note that the chevron used with the keep left arrow is for a sharp curve. A hazard marker would be more appropriate.
The lighting poles in the median are very vulnerable.
Note how sand collects in the paved central area before the start of the median.

Small islands must be made visible with signs, which then have inadequate lateral clearance.
Note that the chevron signs used again are sharp curve chevrons.

Exhibit 11
Traffic signal installations in Walvisbay are in reasonable conformance with The SADC RTSM. Signal heads should be upgraded with backing boards.

Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 12
Too much information in the form of facilities signs on the B2 into Walvisbay.
Legibility of signs: the information signs cannot be read from a moving vehicle.
Note sand on roadway.
The height of the signs does not conform to requirements of the SADC RTSM in terms of clearance. For pedestrians


DIAMOND FACTORY SHOP
NAMIB NAUKLUFT PARK
DUNE 7
PELICAN TOURS


LAGOON CHALETS & CARAVAN PARK
CATAMARAN CHARTERS
MOLA MOLA
KUISEB DELTA QUAD ADVENTURES
PELICAN TOURS
Business Centre
Industrial Centre

Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 13

Hazardous sign support observed in Walvisbay.

Exhibit 14
Missing signs on the B2: post still standing

Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 15
Short left through lane to bypass right turning vehicle. A dangerous condition arises when the vehicle in the right hand lane goes straight and adequate merging length is not available..

Exhibit 16
Guard rails are provided at the sections where the road is close to the beach, but not in a consistent way.
End wings are not acceptable end treatments.

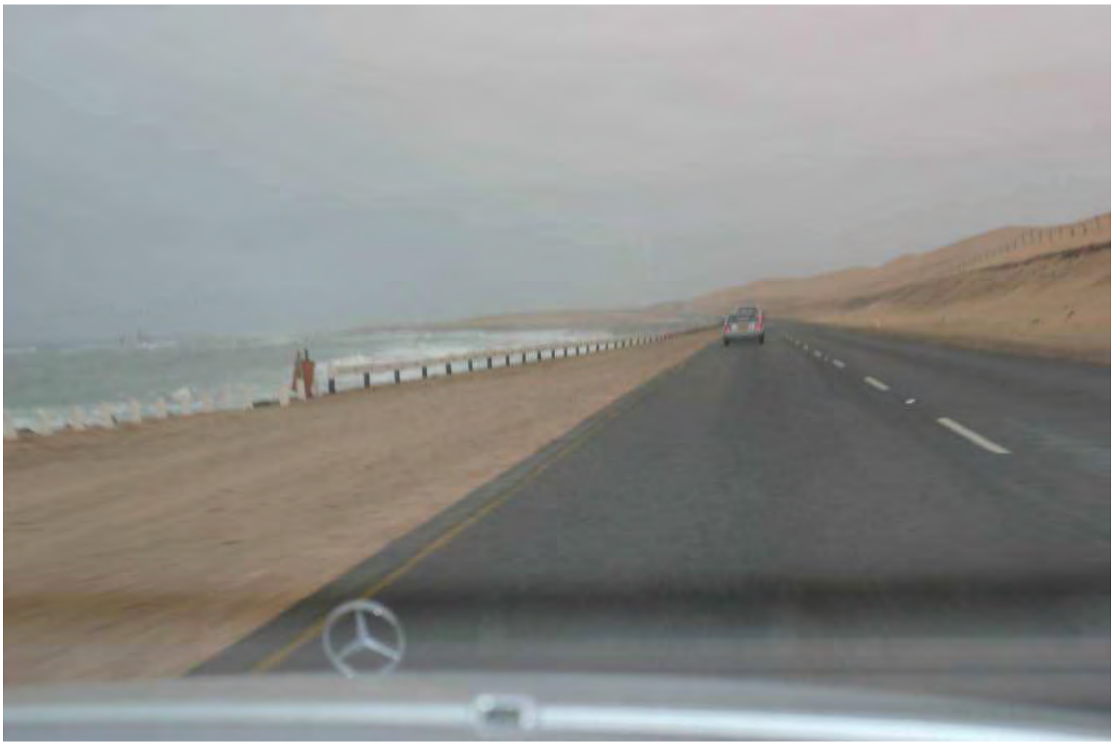
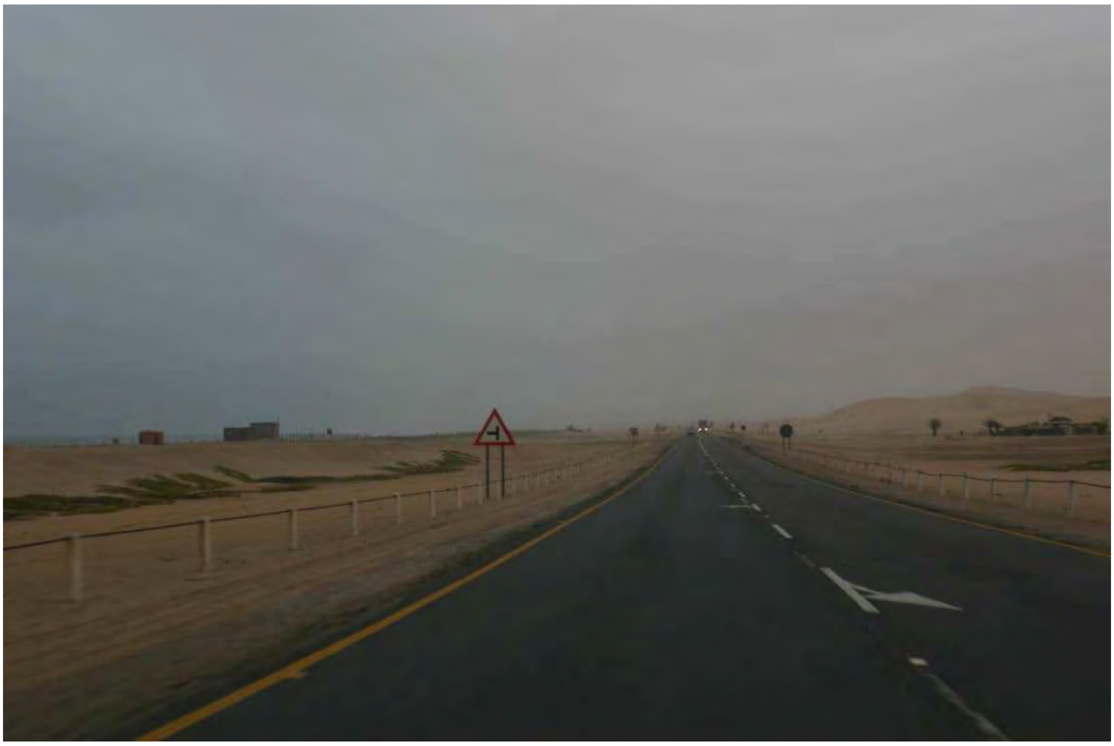


Exhibit 17
Guard rails should be connected to the bridge abutments to provide strong anchorage.

Exhibit 18
The dry and harsh climate along the route contributes to little vegetation to obscure signs.

Exhibit 19
Post and cable barriers are provided to control access to route B2.



Road Safety Audit Report: Swakopmund to Walvisbay: Surfaced road B2

Exhibit 20
Pedestrian crossing on the outskirts of Walvisbay.

Exhibit 21
Passing opportunities can be restricted when there are curves in the road or heavy truck volumes on the road. Mist also inhibits sight distance required for passing.
Note how a driver passes with disregard for the road markings.
The provision of regular passing lanes will give driver the choice to wait for safe passing opportunities.

ANNEXURE G

REPORT C:
ARANDIS TOWN

Annexure G 1
Route Arandis Town

ROAD SAFETY AUDIT — STAGE 5 AUDIT OF EXISTING ROADS Arandis: Surfaced roads Access, bus route and bus stop November 2008		
Checklist		**Comment**
Vertical and Horizontal Alignment		
General alignment standard		Speed limits: Access road 100km/h Urban roads 60km/h
– Check for consistency throughout the route, note any location where alignment standard changes abruptly and is not as expected by drivers		No speed limit sign where urban area starts. Pedestrians walk between training college and Arandis.
Substandard curves – Identify any curve with a speed value of more than 10 kilometers (km)/hour (h) below the 85th percentile approach speed; note any evidence of vehicles running off the roadway		No substandard curves on access road identified.
Inadequate sight distance		
– Check and record any location with inadequate stopping sight distance – Check and record any location with inadequate overtaking sight distance at which "no passing lines" have been marked		Adequate stopping sight distance along access road. Overtaking not allowed on curve on road over rail bridge.
Cross-Section		
Note any location where the cross-section standard changes abruptly along the route, or is otherwise inconsistent with driver expectations		Cross section width is adequate for 100 km/h access road
Identify any locations where the capacity of the roadway is restricted Note locations of regular traffic congestion Note any absence of provisions protecting "turning vehicles" at intersections		Capacity is restricted at circle, but there is low demand due to low car ownership. No locations of regular congestion. No right turn lane at link between B2 and mine/ Arandis road, but low demand does not necessitate this.
Note any locations with inadequate shoulder width; check that the correct type of kerb has been used and note any location where speeds are greater than 50 km/h and "barrier kerb" has been used. Check that the cross-section provides adequately for "vulnerable road users"		No kerbed sections on access road. Kerbs at bus stops at circle. Local roads kerbed intermittently due to low rainfall. Kerbs provided near storm water inlets. Inadequate sidewalks for pedestrians on local bus routes and road towards the circle. No medians on local roads.
– Pedestrians—have paved footpaths, adequate refuge width on median and islands, and proper		Pedestrian facilities such as ramps are not provided. Paved foot path on east

ramps up and down kerbs, where there is regular pedestrian traffic – Bicyclists—segregated areas (e.g., paved shoulders) where numbers are significant Lack of access control—Identify any location where the cross section does not allow the development of appropriate access control		side of road between circle and bus terminus. Bicycles not an important mode of transport. Access to training college outside Arandis defined .
Intersections Sight distances – Check that the sight distances are appropriate for speed limits – Approach (stopping) sight distance – Entering sight distance – Safe intersection sight distance		Sight distance at T junction of link road from B2 with Arandis / Mine road is adequate due to flat topography and lack of obstructions. See Exhibit 1.
General Layout Features Check That the general layout of the intersection caters safely for all road users (pedestrian, bicycles, motorcycles) That the layout is logical for various traffic movements, that it correctly favors the major traffic movement For operational problems at roundabouts, e.g., inadequate deflection (and speed reduction) of traffic at entry point, high vehicle speeds within the roundabout, inadequate width of entry or circulating roadway, etc. For situations where channelization islands are too small to be easily seen by drivers, or for pedestrian refuge or for protecting traffic signs, signals, and other road furniture		The traffic circle at the entrance to Arandis provides a good gateway, but the design and signing is inadequate. This will be discussed under Exhibit 2. Splitter island are too small and not signed. See Exhibit 2.
Traffic Signal Installations		No traffic signal installations are warranted. The traffic circle as gateway also provides passive control.
Street Lighting Check That street lighting is provided on arterial roads and highways in cities, towns, and other "built-up" areas, particularly where there are pedestrians and parking along the road That where lighting is installed, it is of an appropriate standard, consistent with the needs of the location, pedestrians, and other factors Locations where the street lighting poles constitute a hazard to traffic, e.g., on small islands, noses of medians, on the outside of sharp curves, etc. That the arrangement of street lights enhances "route guidance" rather than confuse the driver's ability to "see the direction of the route ahead"		Street lighting is provided to most of the main routes, particularly from the bus stops at the circle at the entrance to Arandis, along the bus route to the terminus, where high mast lighting is provided. The standard of lighting was not assessed. Some light poles are on the verge of the road with no kerbs to guide traffic. Others are on small islands of landscaping. No such problems observed.
Traffic Signing **General aspects** Check For cases of unauthorized traffic signs and use of nonstandard signs (color and shape)		Most of the traffic signs are outdated (old blue background) as shown in Exhibits 1 and 2.

☐ The location and spacing of signs and note locations where there are too many signs, or the signs are too close together		Location of signs appropriate when provided.
☐ That traffic signs are clearly visible and are prominently displayed to the intended road users.		Inadequate traffic signs at traffic circle: chevrons and direction signs should be provided.
☐ For instances where the legibility of the information on traffic signs is inadequate, bearing in mind the speed of vehicles and the amount of information displayed		Standard signs are used.
☐ For instances where signs contain too much information to be capable of being read by drivers traveling at normal operating speed		Standard signs are used.
☐ The effectiveness of traffic signs by observing them at night and identifying any lack of reflectorization		Many signs are outdated and lack reflectorization.
☐ The type of signposts used and record situations where sign posts constitute a fixed roadside hazard or where the use of frangible signposts should be considered		Normal posts are used in urban area.
☐ For cases where there is a lack of clearance to traffic signs		Signs on small island do not provide enough clearance.
☐ For situations where traffic signs themselves are obstructing essential "lines of sight" for drivers and pedestrians		Not observed.
Regulatory and Warning Signs Check		
☐ That the appropriate regulatory signs are provided where necessary		Yield signs at circle outdated: See Exhibit 2
☐ That warning signs have been used only where they are warranted		Culverts on the access road are not indicated with Hazard makers W401 signs.
Guide and Direction Signs Check		
☐ That guide and direction signing has been done on a systematic route or regional strategy, that it is logical and meets needs of unfamiliar drivers		No direction signage is provided, except at the T junction of the link between the Arandis / mine road and route B2. Mostly local traffic.
☐ That all important intersections are provided with – Advance direction signs – Intersection direction signs – Reassurance (distance) signs		The short length of the link road between Arandis / mine road does not allow for all these signs.
☐ That these signs are correctly positioned to allow the required action to be taken by the intended drivers		The T junction of the link road to the Arandis / mine road should have intersection direction signs.
☐ For instances where there are inconsistencies in destination names on consecutive signs, e.g., on "advance direction signs" followed by "intersection direction signs," followed by "reassurance direction signs"		
☐ For any lack of providing "road names" on direction signs, particularly in urban areas, and "route numbers"		The need for street names is a local issue. There are only two destinations: Arandis and the mine.
☐ For instances of poor legibility and poor arrangement of information on signs		
Pavement Marking Check		
☐ The general adequacy and visibility of pavement marking, both at night and in wet weather		Pavement markings at circle show double markings. In general, markings are faded. The inside yellow line on the fill on the road over rail bridge is worn due to

		vehicles off-tracking and sand on the lower side of the super-elevation.
Checklist Comment		
That the correct type of line marking has been used in the various situations, e.g., "continuity lines" at merge and diverge sections, "barrier lines" where overtaking is to be prohibited, etc.		Barrier line on fill of road over rail bridge.
For locations where pavement arrows and other markings are confusing to drivers, particularly where "old incorrect" markings have not been properly removed		See Exhibit 2.
That the positioning of "stop" lines and "holding" lines are appropriate		Stop lines should be 300mm wide in urban areas.
Roadside Safety and Landscaping Check		
The "clear zone width" generally available along both sides of the road, and comment on this aspect in the RSA report		Clear zones are generally provided, except at culvert head walls.
The "fixed roadside objects" that occur within the "clear zone width" and comment on the need to treat them in the interests of road safety		On the access road, few fixed roadside object are found. In the urban area, there may be a need to revise the location of trees, lamp posts and islands in conjunction with kerbs,
The provision of guardrail along the road, consider whether it is really justified and identify locations where it is not justified and locations where it has not been provided where it is warranted		Guard rails are provided in the fill of the road over rail bridge.
That the correct treatment has been applied to the ends of guardrail sections, including "soft" end treatments, end anchorage, and approach end flaring		End treatment is by means of wings, which is not acceptable on the approach end.
For the adequacy of "bridge railing" systems on all bridges. Take particular note of inadequate railings that will not restrain an impacting vehicle—this is often the case with bridges		W shaped guard rails are provided.
The treatment of "approach guardrail" to bridges; record situations, where there is no "strong" anchorage of the approach guardrail to the bridge railing system and/or no proper transition of the rigidity of flexible or semirigid approach guardrail as it approaches and meets the rigid bridge railing		Guard rails bolted to concrete of bridge balustrade.
The extent to which trees and other vegetation obstruct driver and pedestrian sight lines, which are essential for safe traffic operation		No obstruction observed.
The existence of poles of various kinds along the road and comment on whether some or many can be removed, relocated to less hazardous positions, or (in the case of street lighting poles) made "frangible"		Lamp posts at the circle are set back and behind kerbs.
The degree of hazard associated with large trees, boulders, etc. and whether these can be treated to improve roadside safety		Large trees occur along the bus route between the circle and terminus. This is a low speed area.

General Traffic Management Items Check		
The degree of safety afforded to pedestrians, particularly school children, and record instances where there is a need for special provisions to be made		A pedestrian crossing over the access road is provided at the training college.
The adequacy and credibility of existing speed limits and comment if they are not appropriate to the traffic situation and the nature of abutting development or are otherwise unrealistic in the view of most motorists		A speed limit should be provided at the training college and approach to the circle (gateway to urban area).
The degree of safety afforded to all road users in town centers, particularly where highways pass through shopping centers or near schools, record the need for "traffic calming" techniques to improve safety in these sensitive locations		The area around the bus terminus should be reviewed for more pedestrian orientated traffic calming if required. The kerbed island to guide the buses and provide platforms for boarding separates vehicle and pedestrians. See Exhibit 3.
The availability of overtaking opportunities along the route as a whole and comment on the need of specific "overtaking lanes" at regular intervals along two-lane undivided roads, particularly where traffic flows are high in hilly terrain		Not required in view of short length of access road to Arandis.
The existence of roadside stalls and other roadside business activities within the "right of way" of the road; comment on the relative safety of these and the possible need for formal parking arrangements and other regulatory controls		Roadside stalls should not be allowed on the access route. Parking at the training college should be on the same side as the facilities.
The safety of bus stop locations and provisions for buses to stand clear of traffic lanes; also the need for a street light at these locations for the security and safety of bus patrons		The bus stops on either side of the access road at the traffic circle are well defined and street lighting provided.
For any special problems and requirements that may be necessary to improve safety during "festive season" and holiday periods, when traffic demands are heavy and most drivers are relatively unfamiliar with the road		The local municipality should act on such problems, not identified during the inspections.

Annexure G 2
Statement

Road Safety Audit Report C
Arandis:
Access road from surfaced road B2, bus route and bus stop.

The Arandis area was observed in November 2008 by Louis Roodt, Pr Eng.

A check list with supporting photos and comments are attached to this report.

The following aspects are highlighted:

1 The access road follows a high speed alignment over the road over rail bridge, passed the training college to the traffic circle which is a good gateway to define the start of the urban area. There is a need to reduce speed passed the training college and on the approach to the traffic circle.
2 The culverts between the training college and the circle are not marked with hazard markers.
3 The signage of the traffic circle is outdated and inadequate: chevrons and directional signs should be provided to the SADC Road traffic signs manual. The islands are too small for signs and visibility.
4 The bus route to the terminus is for low speed, but lacks continuous kerbs and guidance past lamp posts and trees.
5 Pedestrian facilities are provided on one side of this route, but must be reviewed for continuity and ease of use.
6 The bus terminus in provided with island to separate passengers and vehicles, but can be refined with signage and pedestrian crossings.
7 Pavement markings are faded and worn around the traffic circle and on the curve on the fill at the road over rail bridge due to sand and vehicles running on the inside of the curve.
8 The guard rail terminals in the approach direction should be flared and turned down: end wings are not acceptable.
9 All signs must conform to the SADC RTSM in terms of colour and placement.

Signed:

L D ROODT

Annexure G 3
Exhibits

Exhibit 1
General flat topography and few obstructions at T junction of link road between route B2 and the Arandis / mine road.
Note the outdated sign or wrong use of a construction sign in the form of the Junction chevron. This sign colours should be red and white.
Note no direction signage. Arandis is to the left, the Rossing Mine to the right.

Exhibit 2
The traffic circle at the entrance of Arandis provides a gateway to the urban area. The splitter islands are not to any standard and too small to accommodate signs of be properly visible. The geometry of the traffic circle should be reviewed to adapt to modern roundabout standards for deflection and circulation.
The signs leading to and on the traffic circle are inadequate. Chevrons and direction signs should be provided on the central island in line with the approach.
Pavement markings are doubled and faded.
The dividing line between the opposing flows should be a barrier line for a longer length from the splitter island.
Note the outdated colour of the yield sign: the use of the blue background has been stopped in 1996.
Note the faded one way sign on the small splitter island that will have inadequate clearance to large vehicles. The standard signage does not indicate the use of this sign.

Exhibit 2 continued.

Note the outdated circle warning sign with blue background.

The circle is not legible form this approach due to no signs on the central island to guide drivers.
Pedestrian sidewalks are in poor condition. Bus stops are located to the left at the entrance to Arandis and pedestrians walk along the edge of the traffic circle to get to the bus stops.

Exhibit 3

The bus terminus has kerbed islands to separate passengers from vehicles.
The construction activities flow over into the roadway, have no warning signs and loose bricks constitute trip hazards.
Islands should be demarcated by means of hazard markers: even if the area is provided with high mast lighting, drivers turning into the area may not see the raised island and damage their vehicles.
The islands should be linked to the sidewalks by means of pedestrian crossings.

ANNEXURE H

REPORT D:
RÖSSING URANIUM MINE

Annexure D 1
Route Rössing Uranium Mine

– Pedestrians—have paved footpaths, adequate refuge width on median and islands, and proper ramps up and down kerbs, where there is regular pedestrian traffic		The provision of sidewalks and facilities such as ramps for pedestrians to bus stops is not consistent. This should be reviewed in a systematic manner. See Exhibit 6 and 7.
– Bicyclists—segregated areas (e.g., paved shoulders) where numbers are significant		Bicycles not allowed on the mine site.
Intersections		
□ Sight distances – Check that the sight distances are appropriate for speed limits – Approach (stopping) sight distance – Entering sight distance – Safe intersection sight distance		Sight distance at intersection with of junctions to the mine road is generally adequate due to flat topography and lack of obstructions.
General Layout Features Check		
□ That the general layout of the intersection caters safely for all road users (pedestrian, bicycles, motorcycles) □ That the layout is logical for various traffic movements, that it correctly favors the major traffic movement		Most of the intersections are adequate. The intersection at the mine offices is not well defined and the large paved area can lead to conflict: this area should be reviewed to eliminate the small islands, possibly by means of a roundabout. See Exhibit 8.
□ For operational problems at roundabouts, e.g., inadequate deflection (and speed reduction) of traffic at entry point, high vehicle speeds within the roundabout, inadequate width of entry or circulating roadway, etc.		No roundabouts occur on the mine.
□ For situations where channelization islands are too small to be easily seen by drivers, or for pedestrian refuge or for protecting traffic signs, signals, and other road furniture		Splitter island are too small and not signed. See Exhibit 8.
Traffic Signal Installations		No traffic signal installations are warranted.
Street Lighting Check		
□ That street lighting is provided on arterial roads and highways in cities, towns, and other "built-up" areas, particularly where there are pedestrians and parking along the road		Street lighting should be provided at the bus stops and at the entrance to the mine. See Exhibit 5.
□ That where lighting is installed, it is of an appropriate standard, consistent with the needs of the location, pedestrians, and other factors		The standard of lighting was not assessed.
□ Locations where the street lighting poles constitute a hazard to traffic, e.g., on small islands, noses of medians, on the outside of sharp curves, etc.		No such problems observed.
Traffic Signing		
General aspects Check		

For cases of unauthorized traffic signs and use of nonstandard signs (color and shape)		Most of the traffic signs are outdated (old blue background) as shown in Exhibits 1,2 and 6.
The location and spacing of signs and note locations where there are too many signs, or the signs are too close together		Location of signs appropriate when provided.
That traffic signs are clearly visible and are prominently displayed to the intended road users.		Standard signs should be used.
For instances where the legibility of the information on traffic signs is inadequate, wrt the speed of vehicles and the amount of information displayed		Standard signs should be used.
For instances where signs contain too much information to be capable of being read by drivers traveling at normal operating speed		None observed.
The effectiveness of traffic signs by observing them at night and identifying any lack of reflectorization		Many signs are outdated and lack reflectorization. See Exhibit 9.
The type of signposts used and record situations where sign posts constitute a fixed roadside hazard or where the use of frangible signposts should be considered		Normal posts are used in mine area which is similar to urban area.
For cases where there is a lack of clearance to traffic signs		Signs on small island do not provide enough clearance. See Exhibit 8.
For situations where traffic signs themselves are obstructing essential "lines of sight" for drivers and pedestrians		Not observed.
Regulatory and Warning Signs Check		
That the appropriate regulatory signs are provided where necessary		Adequate.
That warning signs have been used only where they are warranted		No unnecessary signs observed.
Guide and Direction Signs Check		
That guide and direction signing has been done on a systematic route or regional strategy, that it is logical and meets needs of unfamiliar drivers.		No direction signage is provided on the mine. The mine is a controlled environment. Visitors are met by employees and do not drive alone.
That all important intersections are provided with – Advance direction signs – Intersection direction signs – Reassurance (distance) signs		The T junction at the link road from B2 is provided with “Welcome to Arandis” sign, but lacks formal direction signs to Arandis and the mine. See Exhibit 1.
That these signs are correctly positioned to allow the required action to be taken by the intended drivers		A direction sign at the T junction should be opposite the stop line.
Pavement Marking Check		
The general adequacy and visibility of pavement marking, both at night and in wet weather		The road markings on the access road is general adequate but some markings in the mine area are faded and scoured by dirt.
Checklist Comment		
That the correct type of line marking has been used in the various situations, e.g., "continuity lines" at merge and diverge sections, "barrier lines" where		Barrier lines are provided at the rock cuttings where sight distance is inadequate. See Exhibit 9.

overtaking is to be prohibited, etc. For locations where pavement arrows and other markings are confusing to drivers, particularly where "old incorrect" markings have not been properly removed		Not applicable.
That the positioning of "stop" lines and "holding" lines are appropriate		The large area at the mine offices has holding lines at the island. It is suggested that the area be redesigned to be clearer. See Exhibit 8.
Roadside Safety and Landscaping Check The "clear zone width" generally available along both sides of the road, and comment on this aspect in the RSA report		Clear zones are generally provided, but manholes occur in the clear zone. See Exhibit 7.
The "fixed roadside objects" that occur within the "clear zone width" and comment on the need to treat them in the interests of road safety		On the access road, few fixed roadside object are found. On the access road, cut faces are with in the clear zone width. See Exhibit 10.
The provision of guardrail along the road, consider whether it is really justified and identify locations where it is not justified and locations where it has not been provided where it is warranted		Guard rails are provided at rail over road bridge, and between the cuttings and railway line on a curve. Hazard markers at the start are faded. See Exhibits 9 and 10.
That the correct treatment has been applied to the ends of guardrail sections, including "soft" end treatments, end anchorage, and approach end flaring		Some starts are by means of wings,
For the adequacy of "bridge railing" systems on all bridges. Take particular note of inadequate railings that will not restrain an impacting vehicle—this is often the case with bridges		No bridges.
The treatment of "approach guardrail" to bridges; record situations, where there is no "strong" anchorage of the approach guardrail to the bridge railing system and/or no proper transition of the rigidity of flexible or semirigid approach guardrail as it approaches and meets the rigid bridge railing		No bridges.
The extent to which trees and other vegetation obstruct driver and pedestrian sight lines, which are essential for safe traffic operation		No obstruction observed.
The existence of poles of various kinds along the road and comment on whether some or many can be removed, relocated to less hazardous positions.		No comment.
The degree of hazard associated with large trees, boulders, etc. and whether these can be treated to improve roadside safety		Large trees occur along the access route e.g. at the entrance to the mine, which is a low speed area. The pipe barriers at the rail crossing is not of a standard design. See Exhibit 3.
General Traffic Management Items Check		
The degree of safety afforded to pedestrians, particularly school children, and record instances where there is a need for special provisions to be made		Pedestrian crossings need to be formalized at the bus stop at the entrance to the mine. See Exhibit 5.
The adequacy and credibility of existing speed		No comment.

limits and comment if they are not appropriate to the traffic situation and the nature of abutting development or are otherwise unrealistic in the view of most motorists		
The degree of safety afforded to all road users in town centers, particularly where highways pass through shopping centers or near schools, record the need for "traffic calming" techniques to improve safety in these sensitive locations		The Rio Tinto arches define the mine access road. Hazard markers on the one side are installed wrong. See Exhibit 11. The approach to the mine entrance gate is not clear: a road from the right is signed by not visible. See Exhibit 12.
The availability of overtaking opportunities along the route as a whole and comment on the need of specific "overtaking lanes" at regular intervals along two-lane undivided roads, particularly where traffic flows are high in hilly terrain		The low traffic volume and gentle alignment of the access road allows sufficient passing opportunities.
The existence of roadside stalls and other roadside business activities within the "right of way" of the road; comment on the relative safety of these and the possible need for formal parking arrangements and other regulatory controls		Roadside stalls should not be allowed on the access route.
The safety of bus stop locations and provisions for buses to stand clear of traffic lanes; also the need for a street light at these locations for the security and safety of bus patrons		The bus stops on the access road at are well defined and street lighting may be provided.
For any special problems and requirements that may be necessary to improve safety during "festive season" and holiday periods, when traffic demands are heavy and most drivers are relatively unfamiliar with the road		Not applicable.
Management of Construction Signage		
Check if temporary signs are in accordance with appropriate guidelines such as SADC RTSM Vol 2 Chapter 13. Check if construction signs are credible.		The temporary signs observed were not functional and did not appear to relate to actual construction taking place. See Exhibit 13

ROAD SAFETY AUDIT — STAGE 5 AUDIT OF EXISTING ROADS Rossing Mine: Surfaced roads Access and bus routes November 2008		
Checklist		**Comment**
Vertical and Horizontal Alignment General alignment standard – Check for consistency throughout the route, note any location where alignment standard changes abruptly and is not as expected by drivers		Speed limits: External access road 100km/h, as no speed limit is displayed. See Exhibit 1. Mine roads 60km/h. The mine main access route travels through various environments and facilities. Change in driver environment is warned, such as at the mine entrance. See Exhibit 2
Substandard curves – Identify any curve with a speed value of more than 10 kilometers (km)/hour (h) below the 85th percentile approach speed; note any evidence of vehicles running off the roadway		The curve at the railway crossing just inside the mine is substandard: adequate warnings should be erected to compensate. This layout should be revised in long term planning. See Exhibit 3.
Inadequate sight distance – Check and record any location with inadequate stopping sight distance – Check and record any location with inadequate overtaking sight distance at which "no passing lines" have been marked		Adequate stopping sight distances occur along most of the access road. Overtaking is not allowed on curves through rock cuttings. See Exhibit 4
Cross-Section Note any location where the cross-section standard changes abruptly along the route, or is otherwise inconsistent with driver expectations Identify any locations where the capacity of the roadway is restricted Note locations of regular traffic congestion Note any absence of provisions protecting "turning vehicles" at intersections		Cross section width is adequate for low volumes on the access road. Yellow edge markings are provided. Capacity is not of concern due to low volume of traffic to the mine. No locations of regular congestion. Protection of right turns is not of concern due to low volumes of traffic on the mine.
Note any locations with inadequate shoulder width; check that the correct type of kerb has been used and note any location where speeds are greater than 50 km/h and "barrier kerb" has been used. Check that the cross-section provides adequately for "vulnerable road users"		No kerbed sections on external access road. Kerbs are provided at bus stops and parking areas. See Exhibits 5 and 6.

Annexure D 2
Statement

Road Safety Audit Report D
Rossing Mine: Surfaced roads: Access road and internal circulation.

The sections of road were observed in November 2008
by Louis Roodt, Pr Eng.

A check list with supporting photos and comments are attached to this report.

The following aspects are highlighted:

1 The access road, from the Rio Tinto arch to the main gate, is a low volume public road parallel to the railway line. Speeds are generally high, but commensurate with the alignment and traffic. The risks on this road are related to high speed crashes, either single vehicle or head on collisions, on the narrow cross section, especially where sight and recovery area is impeded by rock cuttings.

2 The main gate risks are related to the movement of vehicles and pedestrians. The area was under construction in 2008 and 2009 in order to separate movements and improve security control

3 The internal roads are private and subject to mine driving regulations, such as compulsory stops and reverse parking. The main spine road is fairly uncomplicated in alignment, but traverses public transport stops, plant and offices. Road traffic signs must comply with the appropriate manual (the Southern African Development Community's Road Traffic Signs Manual with respect to size, placement and visibility.

4 Risk management is best achieved by reducing traffic volume and exposure; the latter measured in distance travelled, and operational procedures. Traffic volumes are effectively reduced by the public transport (bus) system as no private vehicles are allowed in the mine perimeter. Exposure is reduced by planning trips to the minimum. Operational procedures discipline employees to behave in a predictable manner and react in emergencies.

5 Specific measures were identified to improve safety or reduce risk, such as upgrading road traffic signs, making fixed hazards visible and removing those hazards that can be removed.

6 Contractors must ensure that temporary signs are correctly displayed, only when working to ensure credibility.

Signed:

L D ROODT

Annexure D 3
Exhibits

Road Safety Audit Report:
Rossing mine: Surfaced access road and internal route

Exhibit 1

General flat topography and there are few obstructions at the T junction of the link road between route B2 and the Arandis / mine road.
No speed limit signs occur on the access road to the mine: the general speed limit of 100 km/h in rural areas thus applies.
Note the outdated sign or wrong use of a construction sign as the Junction chevron. This sign colours should be red and white.
Note that no formal direction signage is provided. Arandis is to the left, the Rossing Mine to the right.

Road Safety Audit Report: Rossing mine:
Surfaced access road and internal route

Exhibit 2

Speed limit 60 km/h in mine environment.
Speed limit sign outdated and should not be combined with warning sign.
Warning sign stop ahead is a temporary sign. This should be replaced with a control gate sign on a separate post.
The road markings should be repainted after patching.

Road Safety Audit Report:
Rossing mine: Surfaced access road and internal route

Exhibit 3

The mine road curves to the left over the railway line: direction from the mine towards the entrance gate. The curve is substandard compared to the rest of the alignment.
Sharp curve warning signs are required on the approach of the curve.
The sharp curve chevron is outdated.
The barriers on the left are not of an approved road side barrier design. Vehicles hitting the blunt ends can sustain severe damage.

Road Safety Audit Report: Rossing mine:
Surfaced access road and internal route

Exhibit 4

Barrier lines provided where adequate passing sight distance cannot be provided.
Clearance width to the cutting is inadequate.

Exhibit 5
The bus terminus has kerbed islands to separate passengers from vehicles.
The construction activities must not flow over into the roadway. Construction should have adequate warning signs.
Islands should be demarcated by means of hazard markers as drivers turning into the area may not see the raised island and damage their vehicles.
The area should be provided with high mast lighting to define the entrance better.
The islands should be linked to the sidewalks by means of pedestrian crossings.

Road Safety Audit Report:

Road Safety Audit Report: Rossing mine:
Surfaced access road and internal route

Exhibit 6

Kerbs are provided at the bus stop inside the mine.
The “see through” effect of the continuous left hand lane may lead to confusion as to where the “Keep left sign” directs traffic. The island is not clear.
The sharp curve to the right on the island is outdated and not credible: the roads merge ahead.
Sharp curve chevrons can be provided on the outside of the lanes that merge to direct traffic.
It is suggested that the left lane of the main road be painted out to clarify the required movements.
Facilities for pedestrians such as side walks and crossings are not clearly demarcated.

Exhibit 6 continued

It is suggested that the section of lane that is not to be used be painted out. The broken dividing line may be interpreted as allowing passing.
Facilities for pedestrians such as side walks and crossings are not clearly demarcated.

Exhibit 7

This pedestrian crossing seems to be in disuse.
No defined side walks are provided.
Note the manholes on the left, which is both trip hazards for pedestrians and collision hazards for vehicles, as they occur in the clear width of the road. These namholes should be marked with hazard markers.

Exhibit 8

The intersection at the mine offices is not well defined and the large paved area can lead to conflict: this area should be reviewed to eliminate the small islands, possibly by means of a roundabout.
Note the difficulty to see the sign posts on the small islands.

Exhibit 8 continued.

Note the difficulty to see the sign posts on the small islands.
The splitter islands are not conspicuous.

Road Safety Audit Report Rossing mine:
Surfaced access road and internal route

Exhibit 9

Hazard marker sign is faded and lacks reflectorization.
Height restriction sign on the bridge is outdated and faded.

Road Safety Audit Report Rossing mine:
Surfaced access road and internal route

Exhibit 10

A barrier line is provided where sight distance is inadequate due to cutting on the left.
The safe clear width is not sufficient due to the cut face.
Guard rail is provided between the road and the railway line on the curve.

Road Safety Audit Report Rossing mine:
Surfaced access road and internal route

Exhibit 11.

Rio Tinto arch: gateway to mine access road from the Arandis side.
The hazard markers on the right hand side are pointing in the wrong direction.
The no overtaking sign is outdated and faded.
The S curve ahead warning sign should be a sharp curve to the right sign.

Rio Tinto arch from the mine's side:
Hazard marker on the left hand side pointing the wrong direction

Road Safety Audit Report: Rossing mine:
Surfaced access road and internal route

Exhibit 12
Approach to the mine entrance: side road from right not clear.

Road Safety Audit Report: Rossing mine:
Surfaced access road and internal route

Exhibit 13

Temporary signs observed were not functional and did not appear to relate to actual construction taking place.

ANNEXURE I

REPORT E:
SWAKOPMUND URBAN AREA

Annexure E 1
Route Swakopmund Town

ROAD SAFETY AUDIT — STAGE 5
AUDIT OF EXISTING ROADS

Swakopmund : Urban Routes
November 2008
The urban routes were surveyed from the point of view of risk to the Rossing bus operations. It is only concerned with the road and traffic control that may increase risk for the bus operation or cause other drivers to perform actions that may pose risk to the bus, such as tourists stopping to observe facilities signs or trucks merging at lane drops. This RSA is thus not comprehensive.

Checklist		Comment
Vertical and Horizontal Alignment		
General alignment standard		Speed limit 60 km/h
– Check for consistency throughout the route, note any location where alignment standard changes abruptly and is not as expected by drivers		Generally smooth alignment in flat topography. See Exhibit 1.
• Substandard curves • Inadequate sight distance		Curve disappears over sharp crest curve. See Exhibit 2.
Cross-Section		
Note any location where the cross-section standard changes abruptly along the route, or is otherwise inconsistent with driver expectations		The entrance from Walvisbay changes from a rural cross section to an urban, with no defined gateway to the urban area. Flower pots on the median are considered dangerous hazards. See Exhibit 3.
Identify any locations where the capacity of the roadway is restricted		Capacity was not investigated.
Check that the cross-section provides adequately for "vulnerable road users"		
– Pedestrians—have paved footpaths, adequate refuge width on median and islands, and proper ramps up and down kerbs, where there is regular pedestrian traffic		No provision for pedestrians along Nelson Mandela Road is shown as an example: See Exhibit 4.
– Bicyclists—segregated areas (e.g., paved shoulders) where numbers are significant		Bicyclists are not significant road users.
– Motorcyclists—segregated lanes (paved shoulders), separate roadways, where warranted by demand		Motorcycling is not a significant mode of transport.
Lack of access control—Identify any location where the cross section does not allow the development of appropriate access control		Access control was not assessed.

Intersections Sight distances – Check that the sight distances are appropriate for speed limits – Approach (stopping) sight distance – Entering sight distance – Safe intersection sight distance		Sight distances are mostly adequate, except where affected by signs or trees.
General Layout Features Check		
That the general layout of the intersection caters safely for all road users (pedestrian, bicycles, motorcycles)		Pedestrian facilities are provided, but not in a consistent manner. See Exhibit 5.
That the layout is logical for various traffic movements, that it correctly favors the major traffic movement		One example was found of a right turn at a T-junction having priority over the through movement. See Exhibit 6.
For any lack of auxiliary (turning) lanes		Not investigated.
For any discontinuity of "through" traffic lanes and any instance where "through" vehicles have to change lanes to continue on through an intersection		This was observed. See Exhibit 7.
For the occurrence of "trap" lanes, i.e., where a "through" lane is suddenly marked, or aligned, as a lane for traffic turning off a roadway		Not observed.
Any location where the length and width of the "right turn" merge is substandard and instances where pedestrian movements across the continuous traffic flow movement are not properly catered for		Slip lanes often do not cater or pedestrian moments as drivers look to the right for gaps and do not observe pedestrians on the left. See Exhibit 8.
For operational problems at roundabouts, e.g., inadequate deflection (and speed reduction) of traffic at entry point, high vehicle speeds within the roundabout, inadequate width of entry or circulating roadway, etc.		The design of roundabouts is not consistent and in conformance with modern design wrt splitter island, deflection, signage and guidance. See Exhibit 9 for examples.
For situations where channelization islands are too small to be easily seen by drivers, or for pedestrian refuge or for protecting traffic signs, signals, and other road furniture		Many instances of small islands were observed. See Exhibit 10 for examples.
That barrier kerbs are not used where traffic speeds are likely to be greater than 50 km/h		Not observed.
Traffic Signal Installations		The traffic signals were not assessed.
Street Lighting Check		
That street lighting is provided on arterial roads and highways in cities, towns, and other "built-up" areas, particularly where there are pedestrians and parking along the road		Street lighting is provided on the important routes, except on Nelson Mandela Road between B2 and the railway crossing.
That where lighting is installed, it is of an appropriate standard, consistent with the needs of the location, pedestrians, and other factors		The adequacy of the street lights was not assessed.
Locations where the street lighting poles constitute a hazard to traffic, e.g., on small islands, noses of medians, on the outside of sharp curves, etc.		Street lighting poles are typically set back too far to be used for road signs.
For situations where street lighting poles could be eliminated by joint sharing of traffic signal pedestals and electric power poles		No assessed.

□ That the arrangement of street lights enhances "route guidance" rather than confuse the driver's ability to "see the direction of the route ahead" **Traffic Signing** **General aspects** Check		No problems observed.
□ For cases of unauthorized traffic signs and use of nonstandard signs (color and shape)		Signs are generally in conformance with the SADC RTSM.
□ The location and spacing of signs and note locations where there are too many signs, or the signs are too close together		See Exhibit 11.
□ That traffic signs are clearly visible and are prominently displayed to the intended road users		Mostly adequate.
□ For instances where the legibility of the information on traffic signs is inadequate, bearing in mind the speed of vehicles and the amount of information displayed		Legibility is only problematic on facilities signs. See Exhibit 12.
□ For instances where signs contain too much information to be capable of being read by drivers traveling at normal operating speed		See Exhibit 12.
□ The effectiveness of traffic signs by observing them at night and identifying any lack of reflectorization		Some signs are faded and should be replaced under a regular maintenance programme.
□ The type of signposts used and record situations where sign posts constitute a fixed roadside hazard or where the use of frangible signposts should be considered		Not critical under urban conditions.
□ For cases where there is a lack of clearance to traffic signs		See Exhibit 10 where small island cause lack of clearance.
□ For situations where traffic signs themselves are obstructing essential "lines of sight" for drivers and pedestrians **Regulatory and Warning Signs** Check		See Exhibit 13.
□ That the appropriate regulatory signs are provided where necessary		Sharp curve chevrons are used as hazard markers. See Exhibit 14.
□ That warning signs have been used only where they are warranted **Guide and Direction Signs** Check		Train crossing sign observed where no railway line is evident. See Exhibit 15. T-junction chevron signs needed. See Exhibits 6 and 16.
□ That guide and direction signing has been done on a systematic route or regional strategy, that it is logical and meets needs of unfamiliar drivers **Pavement Marking** Check		No anomalies were observed in the guide and direction signage.
□ The general adequacy and visibility of pavement marking, both at night and in wet weather		The visibility of pavement markings are affects by mist conditions and sand on the roads.

Checklist Comment		
That the correct type of line marking has been used in the various situations, e.g., "continuity lines" at merge and diverge sections, "barrier lines" where overtaking is to be prohibited, etc.		The stop lines in urban areas should be 300mm wide.
For any discontinuities in "through traffic lane" marking and the existence of any "trap" lanes		See Exhibit 7.
For any deficiency in the delineation of merge and diverge areas, including situations where through traffic may inadvertently lead into auxiliary and turn lanes		See Exhibit 7. The merge at the lane drop is short.
For locations where there is a lack of "hazard marking" at approach ends of islands and medians, etc.		Many instances were observed where the approach ends of median islands lacked hazards markers and or Keep left signs: some examples are shown in Exhibit 16.
For locations where auxiliary "turn lanes" have been designated with appropriate pavement arrows and locations where the wrong type of arrow has been used		Short turn lanes are provided with turning arrows, but only at stop line. A left turn is shown from the through lane while a slip lane is provided. See Exhibit 17.
For locations where pavement arrows and other markings are confusing to drivers, particularly where "old incorrect" markings have not been properly removed		Shoulder lane is not continuous and confusing. See Exhibit 18.
That the positioning of "stop" lines and "holding" lines are appropriate		No comment.
The effectiveness of road markings at night and in wet weather, consider the need for retro-reflective pavement markers or road studs to supplement line and hazard makings; identify inadequate provision of these devices and in the use of nonstandard arrangements of them		Urban area does not justify road studs. The existence of gravel surfaced road in the urban area leads to instances where no road marking can be provided. These routes should be upgraded in relation to the importance in the system. See Exhibit 19.
Roadside Safety and Landscaping Check		
The "clear zone width" generally available along both sides of the road, and comment on this aspect in the RSA report		Clear zones are more appropriate on rural roads.
The "fixed roadside objects" that occur within the "clear zone width" and comment on the need to treat them in the interests of road safety		Fixed objects next to urban roads should be kept to a minimum. See Exhibit 3 for flower pots on median that constitutes risk of secondary collisions.
The extent to which trees and other vegetation obstruct driver and pedestrian sight lines, which are essential for safe traffic operation		Trees and vegetation is limited to the main roads and can affect sight distance. See Exhibit 13.
General Traffic Management Items Check		
The degree of safety afforded to pedestrians, particularly school children, and record instances where there is a need for special provisions to be made		This aspect was not investigated on the bus routes, but in general, pedestrian facilities are not consistent. See Exhibit 5.
The adequacy and credibility of existing speed limits and comment if they are not appropriate to the traffic situation and the nature of abutting development or are otherwise unrealistic in the view of most motorists		Urban speed limit of 60 km/h is appropriate.

□ The degree of safety afforded to all road users in town centers, particularly where highways pass through shopping centers or near schools, record the need for "traffic calming" techniques to improve safety in these sensitive locations □ The safety of bus stop locations and provisions for buses to stand clear of traffic lanes; also the need for a street light at these locations for the security and safety of bus patrons □ For any special problems and requirements that may be necessary to improve safety during "festive season" and holiday periods, when traffic demands are heavy and most drivers are relatively unfamiliar with the road □ Particular problems to the area: list.		Trip hazards for pedestrians were observed. These hazards should be removed in the town centre. Traffic calming by means of speed humps was observed. See Exhibit 20. Bus stops on main routes are provided with street lighting. See Exhibit 21. The festive season was not observed, but Swakopmund is a well known holiday destination. The problem of sand on the road and signs are particular to coastal towns. See Exhibit 22. A drainage problem on the road parallel to the beach was noticed, also typical of the flat topography of coastal towns. See Exhibit 23. A section of kerb that does not align with the road was observed. See Exhibit 24.

Annexure E 2
Statement

Road Safety Audit Report E
Swakopmund : Urban Area

The urban area of Swakopmund was observed in November 2008 by Louis Roodt, Pr Eng.

A check list with supporting photos and comments are attached to this report.

The following aspects are highlighted:

1 **The urban routes were surveyed from the point of view of risk to the Rossing bus operations. It is only concerned with the road and traffic control that may increase risk for the bus operation or cause other drivers to perform actions that may pose risk to the bus, such as tourists stopping to observe facilities signs or trucks merging at lane drops. This RSA is thus not comprehensive.**
2 The general layout of streets is in a grid and flat, thus setting a typical urban environment.
3 Facilities signs need to be controlled as the proliferation of signs leads to crowding and clutter of space at intersections and requires time to read all the information.
4 The gateways to the town from Usakos and Walvisbay can be better defined to alert drivers to the change from rural to urban environment.
5 Sand on the road at intersections is problematic as it can cause skidding and wearing of road markings. Continuous maintenance is required.
6 There is a need for sign maintenance and correct usage as part of the continuous maintenance programme.
7 The upgrading of Nelson Mandela Road as link between the B2 and the Swakopmund road system is required to eliminate the gravel surface, improve road marking and safer operation.
8 The use of small islands must be discouraged.
9 The design of roundabouts should conform to modern design principles and provide for deflection to reduce speed, guidance and uniform signage.

Signed:

L dW Roodt

L D ROODT

Annexure E 3
Exhibits

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 1

General topography as seen from the entrance from Usakos is flat.
Routes are mainly straight and in a grid layout.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 2

Curve to the right disappears over the sharp vertical crest. The danger is reduced by the Stop control on the approach to the curve.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 3
Cross section:
The change in the cross section of the road from rural to urban on the approach from Walvisbay is not well defined.
A defined gateway will change driver perception of the driving environment.

Flower pots on the median is considered dangerous hazards for secondary collisions.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 4.

No pedestrian facilities are provided on this section of Nelson Mandela Road between the B2 and the railway line. This section of road links the industrial area next to the B2 with the residential area north of the railway line.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 5.

Pedestrian facilities at intersections not provided in a consistent manner. This increase the risk of pedestrians walking in the road or getting hidden behind objects such as bins.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 6.

The right turn from the T junction into the through road has priority. This is not an expected priority and unfamiliar drivers may brake unexpectantly.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 7.

Through lane stops and traffic is forced to merge to the right.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 8.

Exhibit 9.

The design of roundabouts is not consistent and in conformance with modern design wrt splitter island, deflection, signage and guidance. The following photos illustrate some of the problems observed.

No deflection, splitter islands or signs on the central island may lead an unfamiliar driver to drive into the raised island.

Exhibit 9 continued

Roundabout design elements: no deflection or signs on the central island.

Exhibit 10.

Small islands are difficult to see and drivers can collide into them or drive over them, thus affecting steering. Signs erected on small islands often do not have adequate clearance to the traffic flow paths.

Exhibit 10 continued.
Small islands.

Exhibit 11.

A high density of road traffic signs was observed on the road leading to Usakos. Multiple regulatory signs on a post should be avoided, as drivers may observe selectively. The no stopping sign is a duplication of the red pavement marking.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 12.

Too many facilities signs are provided. The legibility of some destinations is questionable. Swakopmund must revised its policy for providing for facilities signs to avoid such crowing at intersections, where the driver must also attend to traffic conflicts and guidance.

Exhibit 12 continued.
Facilities signs.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 13.

Signs obstruction sight distance.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 14.

Sharp curve chevrons are used as hazard markers.

Exhibit 15.

This train crossing warning sign was observed where not railway line was evident. Note the excessively wide lanes that will lead to overtaking.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 16.

Missing signs: T junction Chevron required at this major junction.

Road Safety Audit Report:
Swakopmund: Urban routes

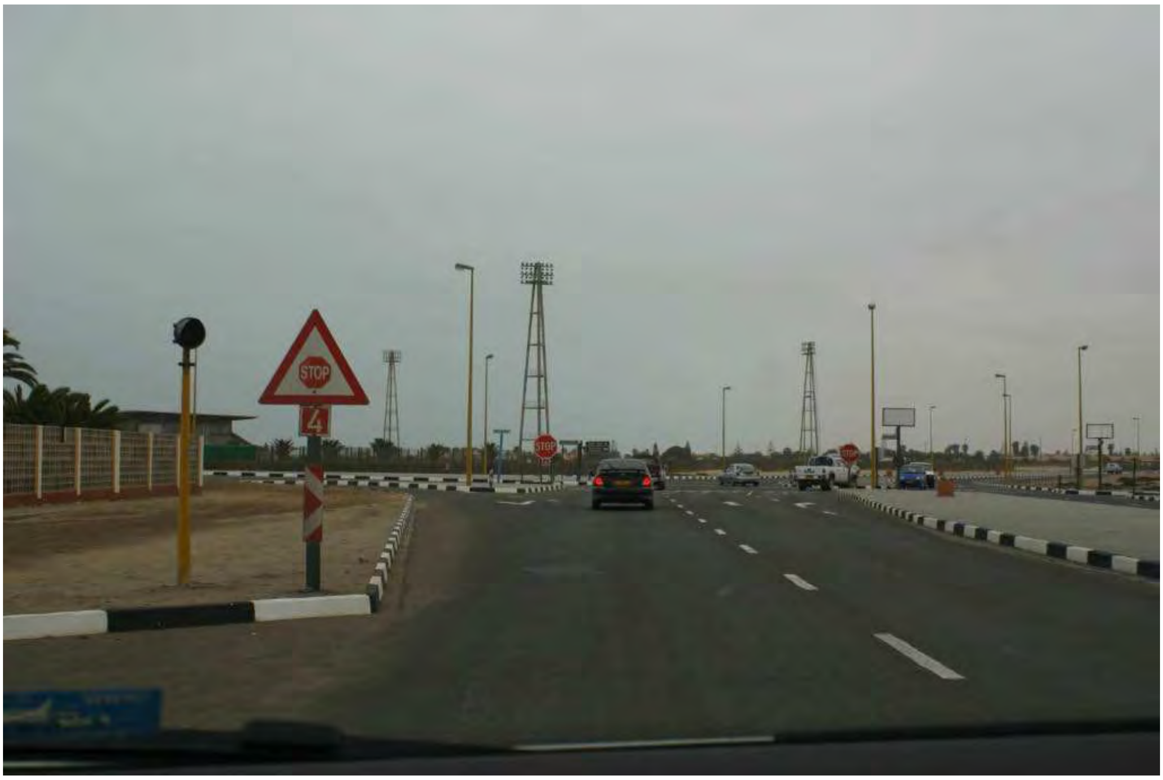
Exhibit 16.

Missing hazard markers and or Keep Left signs at approach ends of median islands or splitter islands.

Exhibit 16 continued

Exhibit 16 continued

Missing hazard markers on splitter islands: there should be markers pointing left and right.



Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 17.

Turning arrows at stop lines with short turn lane lengths give little guidance.
Note the through and left arrow at the stop line while a slip lane is provided.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 18.

Shoulder lane confusing.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 19.

Gravel surfaced roads has no road markings. On important routes such as Nelson Mandela Road, this increases risk for the users.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 20.

Trip hazards in the town centre.

Traffic calming: note vehicles bypassing to the left.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 21.

Bus stops with street lighting.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 22.

Sand on signs and road.

Road Safety Audit Report:
Swakopmund: Urban routes

Exhibit 23.

Drainage problems.

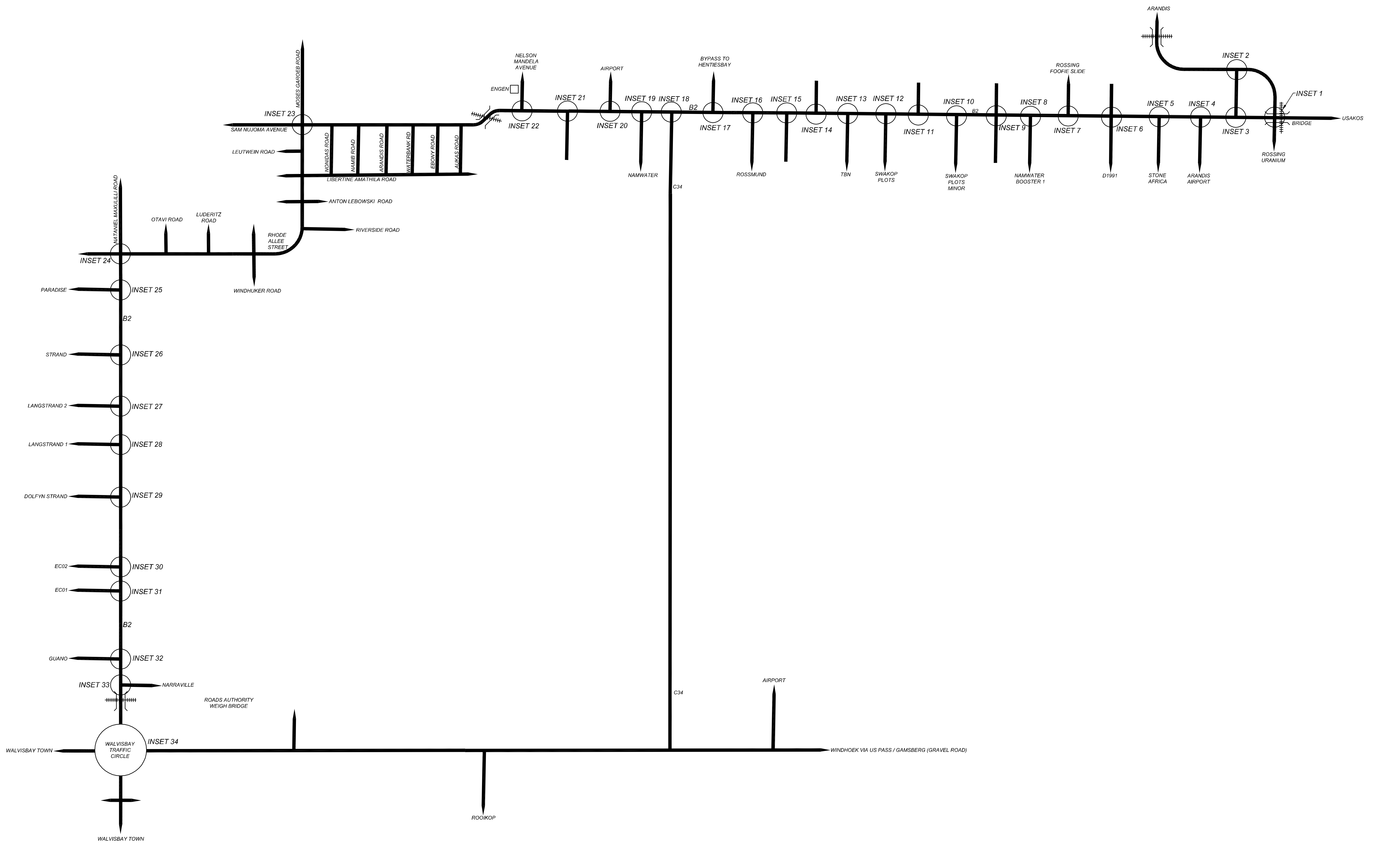
Exhibit 24.

Misaligned kerb.

ANNEXURE J

LIST OF PLANS

- W1141 – CP-01
- W1141 – CP-02
- W1141 – CP-03
- W1141 – CP-04
- W1141 – CP-05
- W1141 – CP-06
- W1141 – CP-07
- W1141 – CP-08
- W1141 – CP-09
- W1141 – CP-10



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A member of the Rio Tinto Group
WORKING FOR NAMIBIA

Notes:

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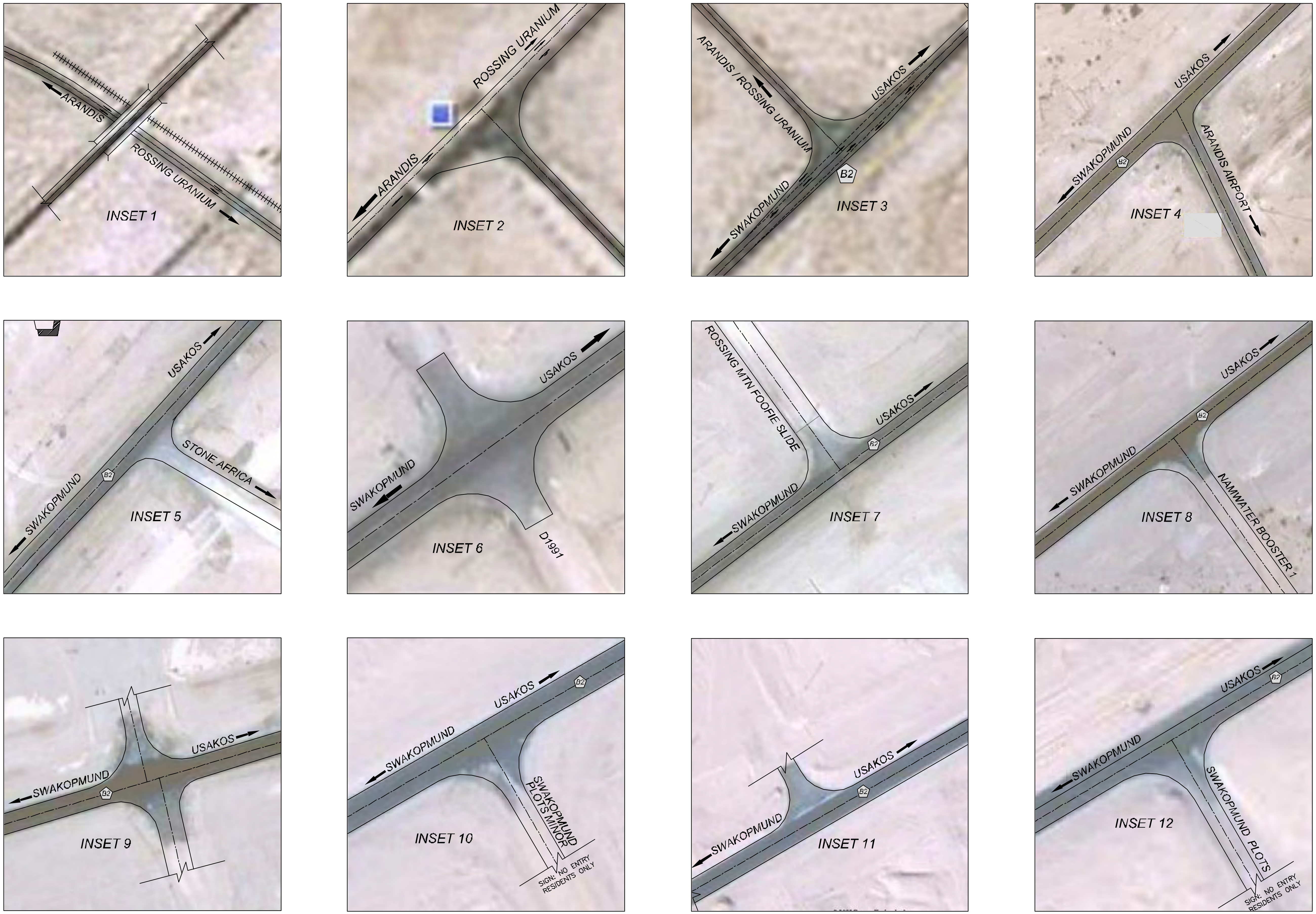
TRAFFIC IMPACT ASSESEMENT FOR RÖSSING URANIUM

DIAGRAMATIC ROAD LAYOUT FOR INTERSECTIONS REPORT

SCALE: NTS

W1141-CP-01



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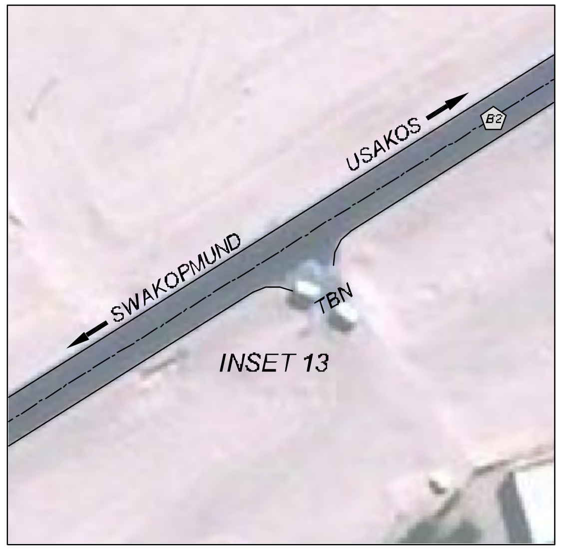
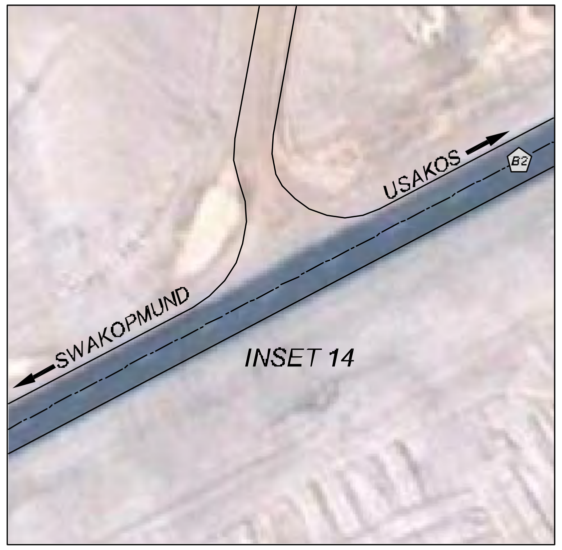
TRAFFIC IMPACT ASSESMENT FOR RÖSSING URANIUM

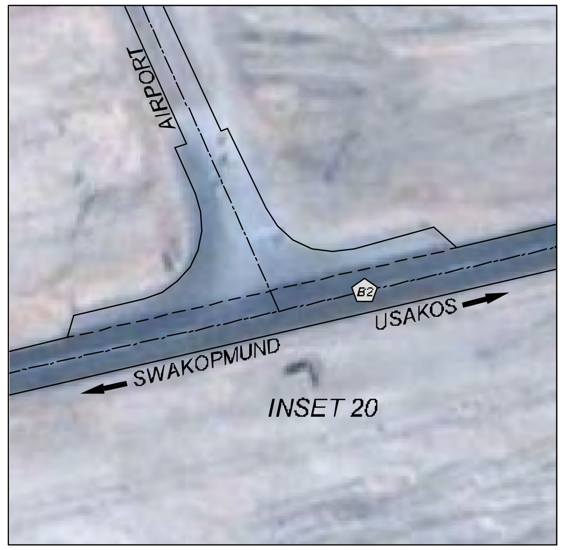
EXISTING INTERSECTIONS: USAKOS (B2) - SWAKOPMUND

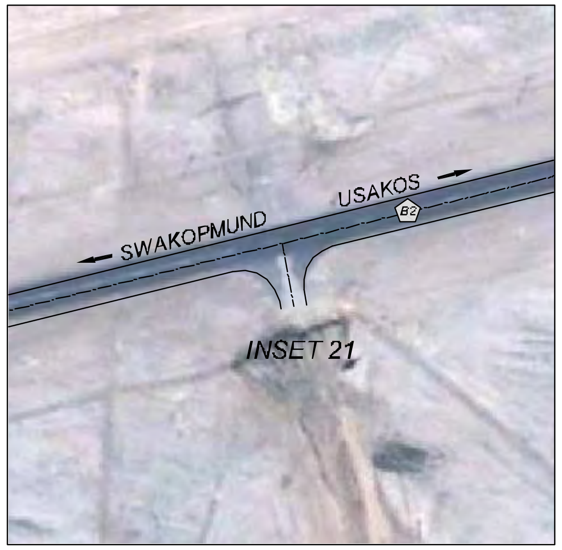
SCALE: NTS

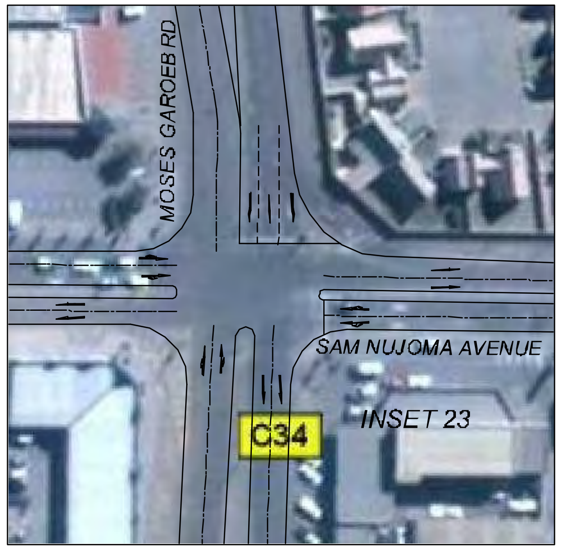
W1141-CP-02











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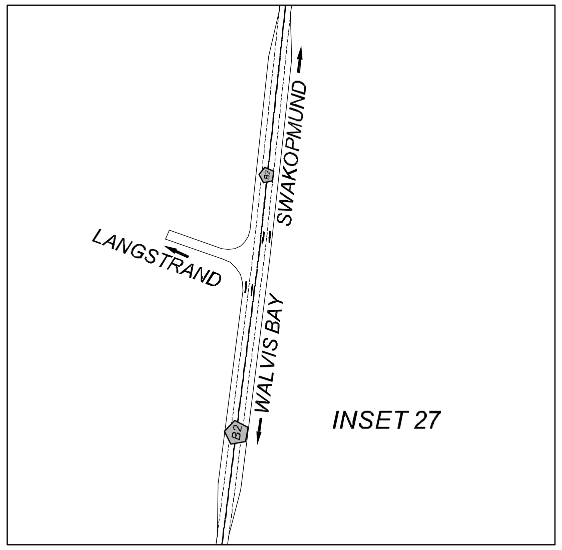
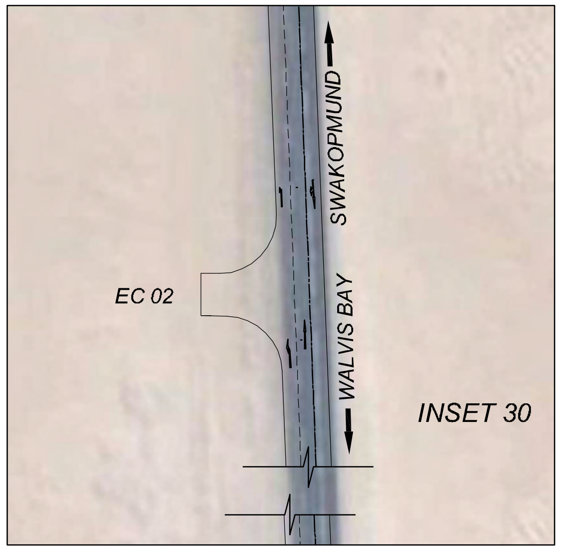
TRAFFIC IMPACT ASSESMENT FOR RÖSSING URANIUM

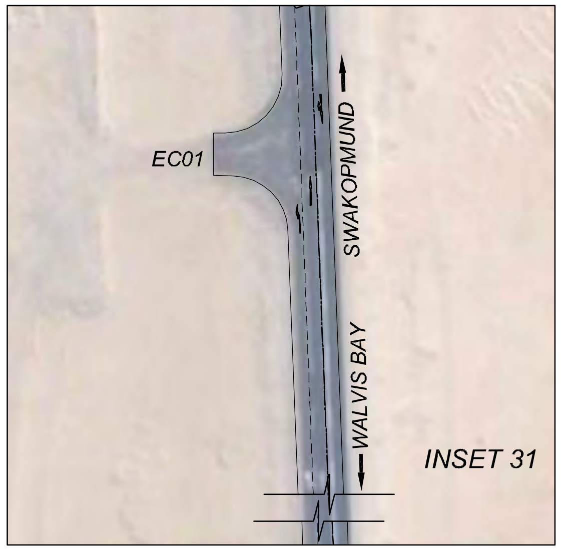
EXISTING INTERSECTIONS: USAKOS (B2) - SWAKOPMUND

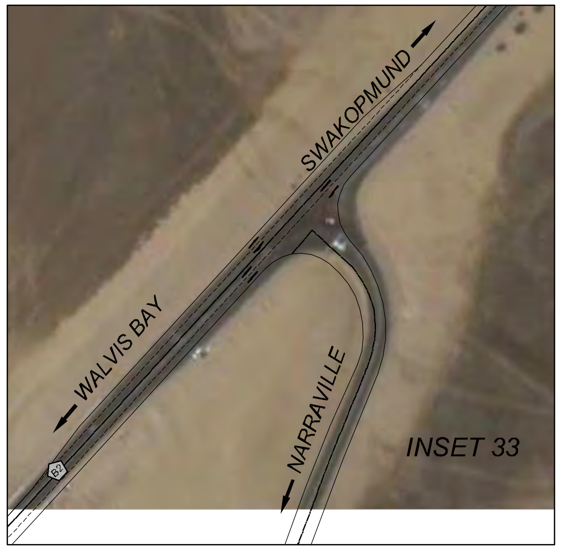
SCALE: NTS

W1141-CP-03









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Client:

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A member of the Rio Tinto Group
WORKING FOR NAMIBIA

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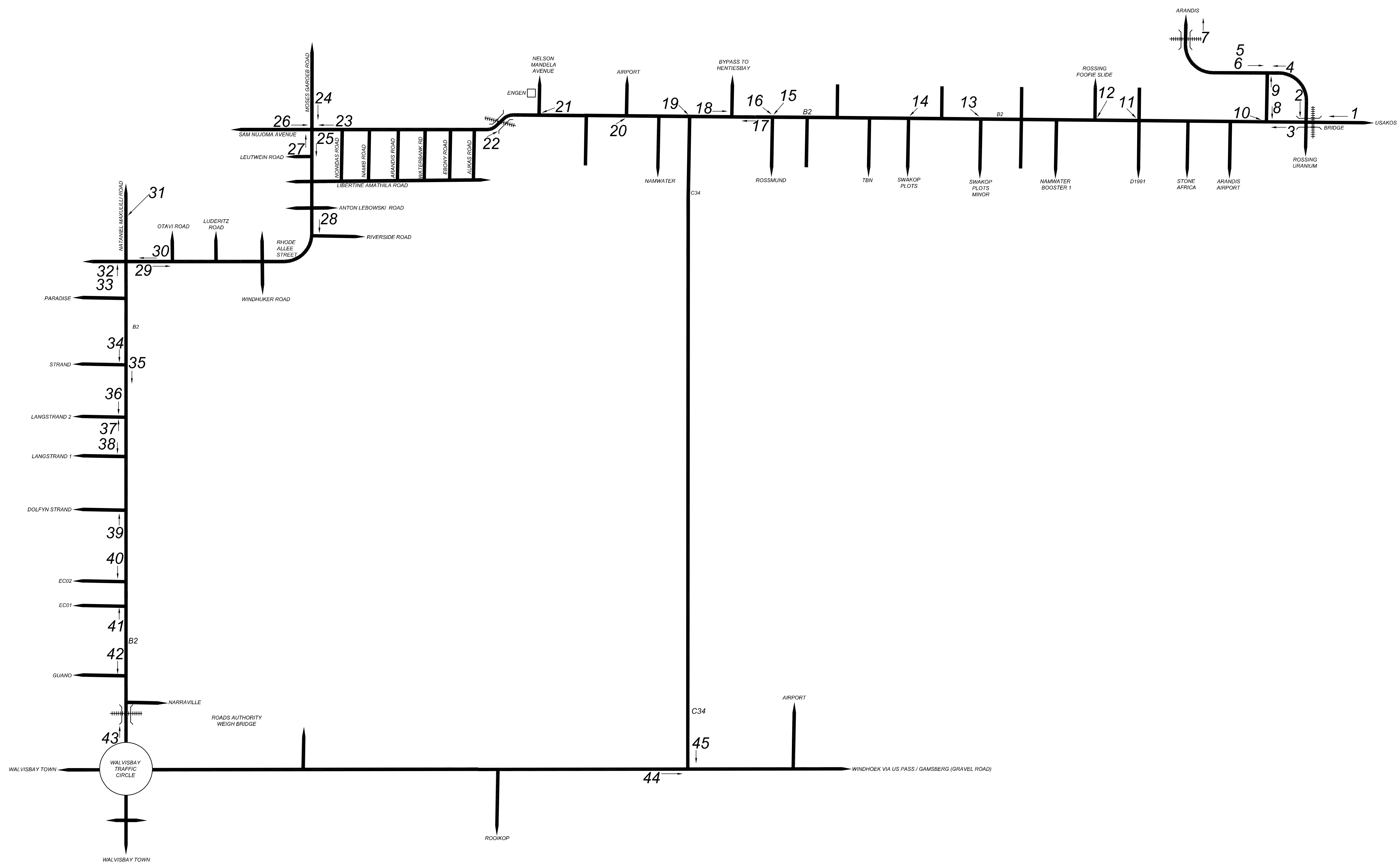
EXISTING INTERSECTIONS: USAKOS (B2) - SWAKOPMUND

SCALE: NTS

W1141-CP-04



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DIAGRAMATIC ROAD LAYOUT FOR PHOTOGRAPHIC REPORT

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Drawing Number:

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PHOTOGRAPHIC REPORT

SCALE : NTS

Drawing Number:

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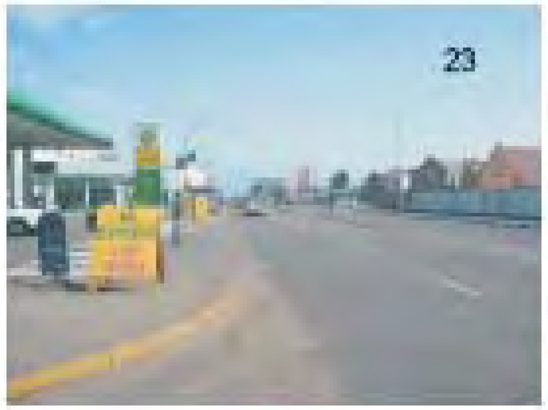

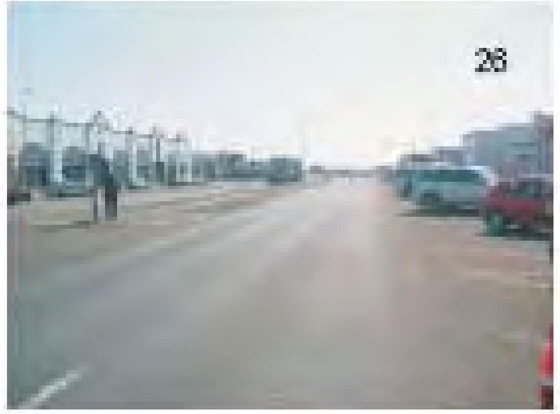

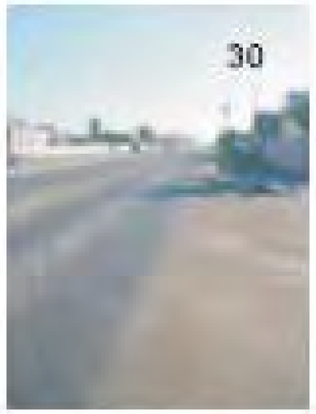

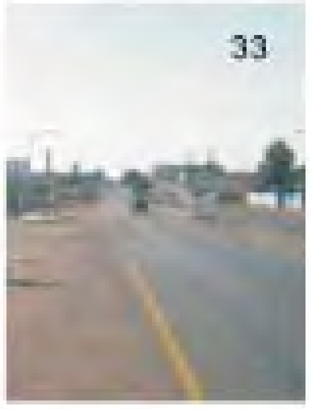

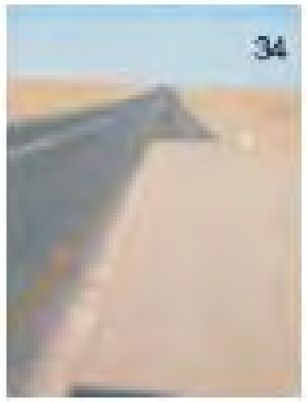

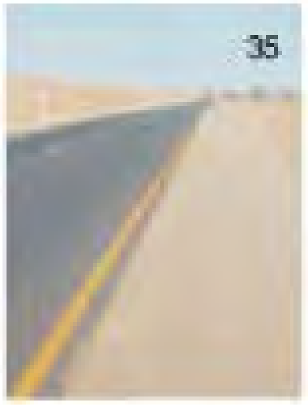

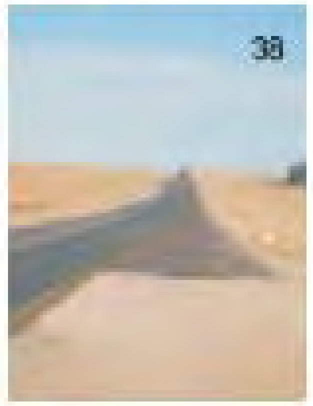

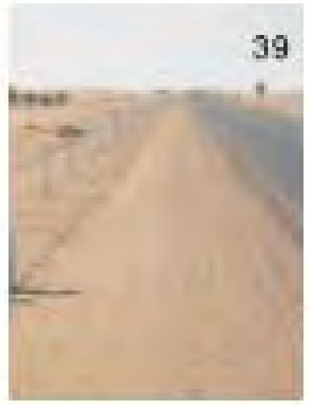

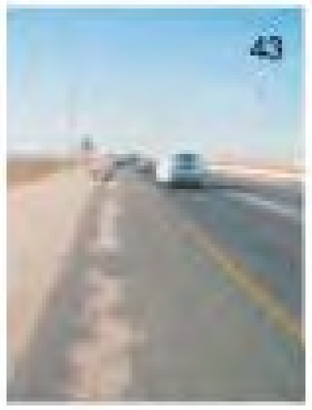

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PHOTOGRAPHIC REPORT

SCALE : NTS

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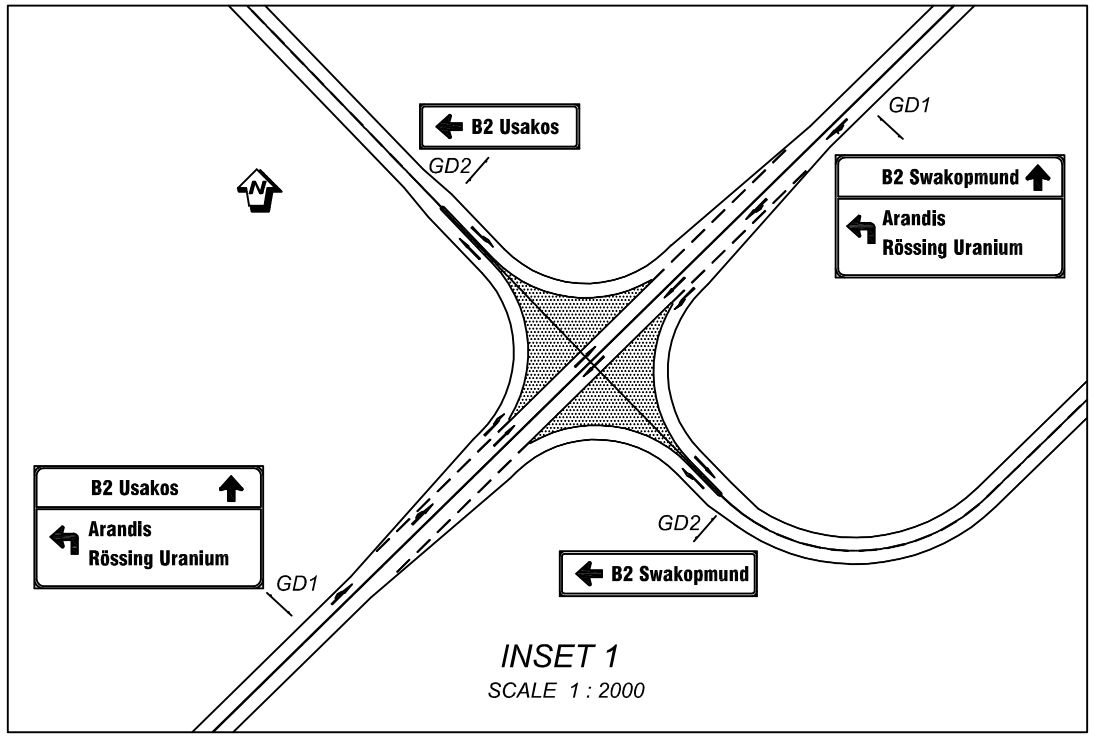

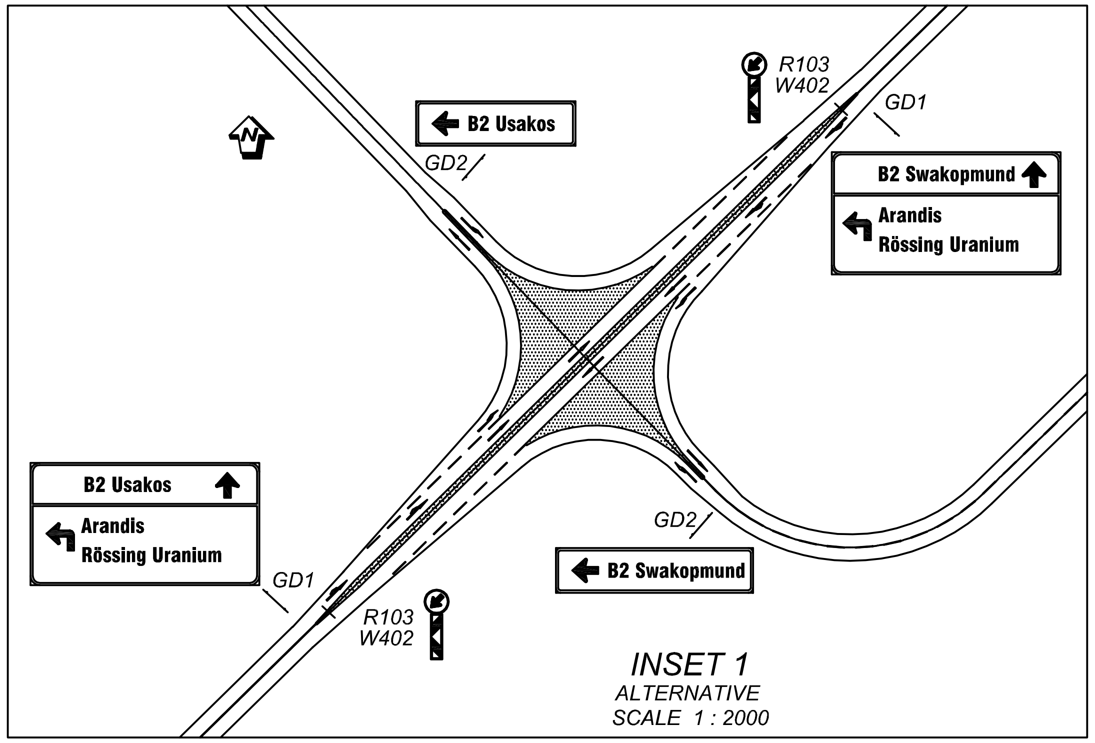

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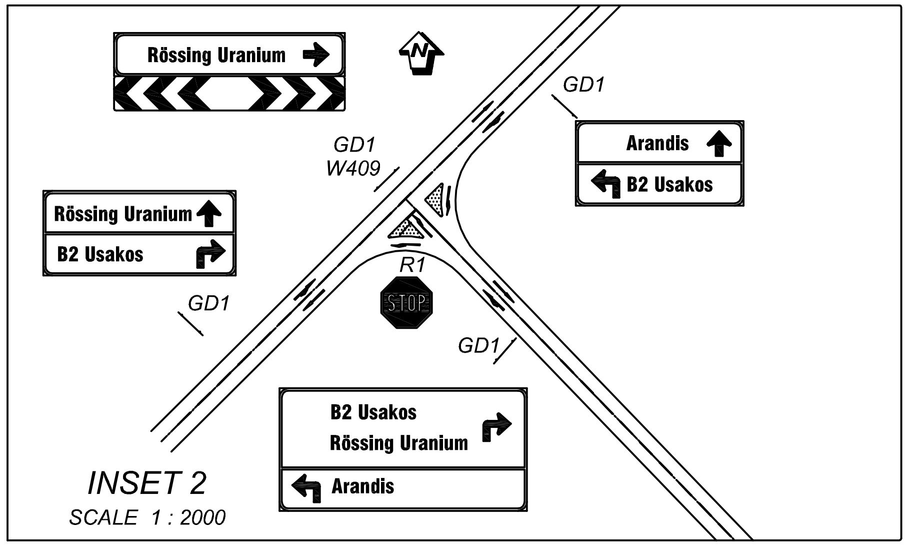
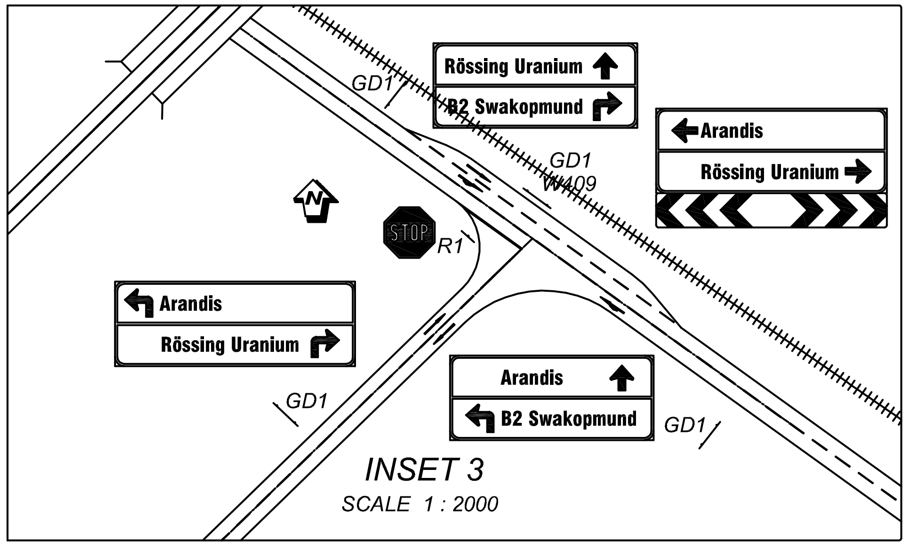
TRAFFIC IMPACT ASSESEMENT FOR RÖSSING URANIUM

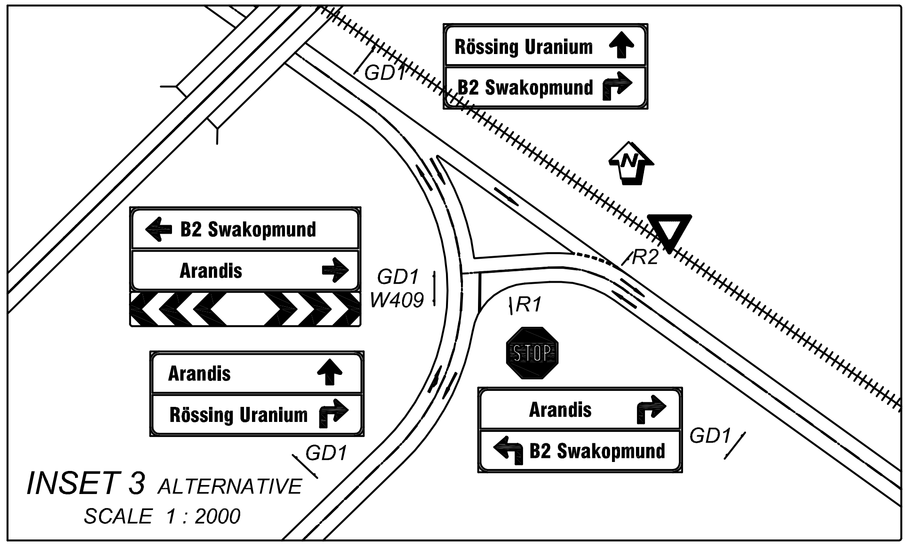
PROPOSED IMPROVEMENTS - B2 - ARANDIS

SCALE: AS SHOWN

W1141-CP-08







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Client:

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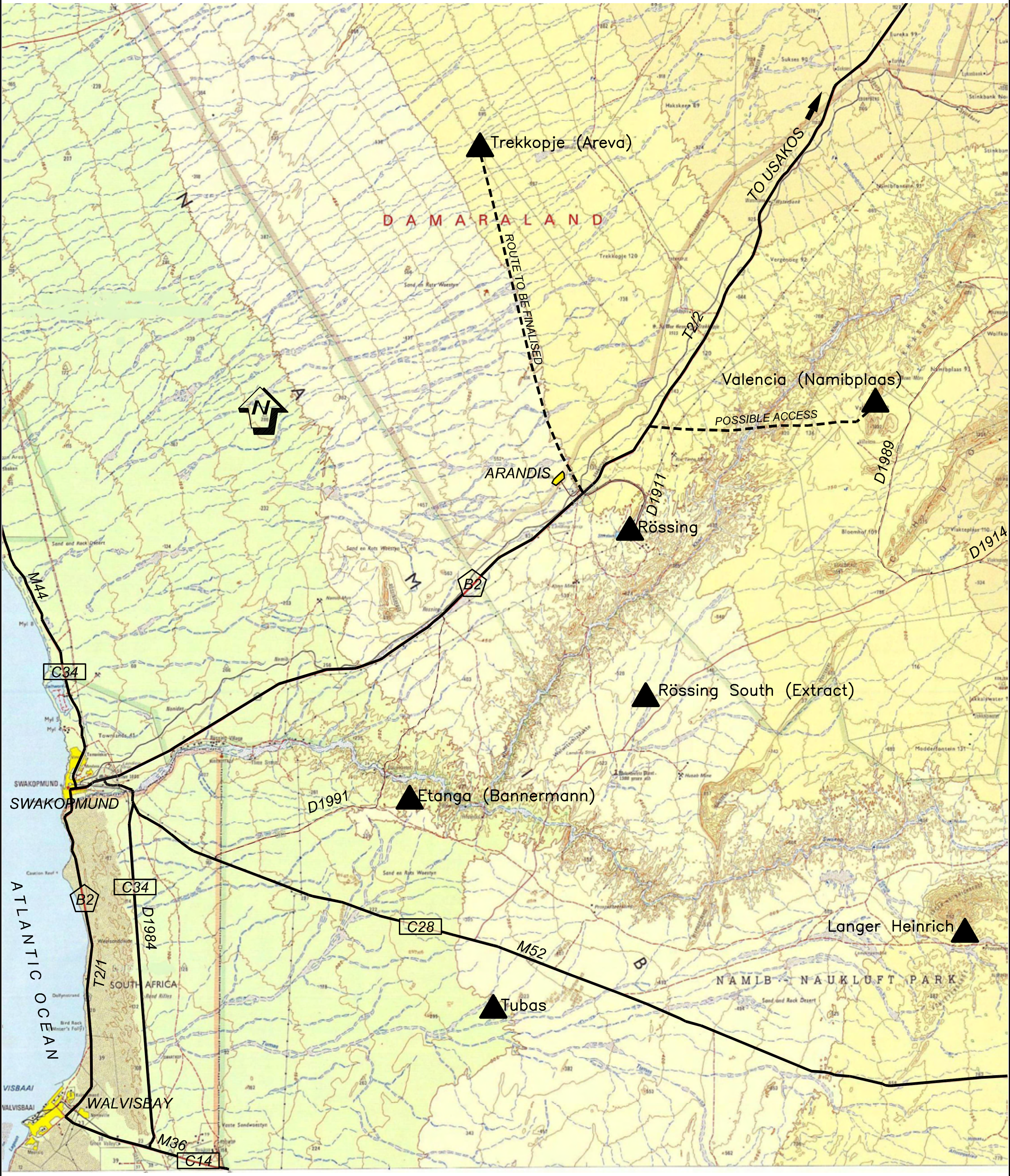
TRAFFIC IMPACT ASSESMENT FOR RÖSSING URANIUM

PROPOSED IMPROVEMENTS - B2 - ARANDIS

SCALE: AS SHOWN

W1141-CP-09



LEGEND

POTENSIAL PROBLEM INTERSECTION

MAJOR ROAD

Rössing URANIUM MINE

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TRAFFIC IMPACT ASSESMENT FOR RÖSSING URANIUM	
POTENSIAL PROBLEM INTERSECTIONS	
SCALE: NTS	W1141-CP-10