TRAFFIC AND ROADS IMPACT STUDY FOR PROPOSED EXTENSION OF THE WALVIS BAY CONTAINER TERMINAL

FINAL REPORT

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1. INTRODUCTION

1.1 Background and Objectives

The Namibian Ports Authority (Namport) is assessing the possibility of a new container terminal on reclaimed land adjacent to the existing berths in the Port of Walvis Bay. Delta Marine Consultants and CSIR have been appointed by Namport as the environmental assessment practitioner to undertake the necessary studies in terms of the Environmental Management Act (Act 7 of 2007) so that the impact of the proposed activities can be considered carefully before any decisions are made.

In order to address the traffic and roads issues identified in the Draft Scoping Report, CSIR appointed SSI Engineers and Environmental Consultants (Pty) Ltd to undertake a specialist study to assess the impacts that the construction and operation of the extended container terminal may have on traffic conditions, road infrastructure and the safety of other road users. The specialist study must also propose measures and procedures to ensure that negative impacts are limited and positive aspects are enhanced, as well as proposing monitoring requirements.

1.2 Study Methodology

A spreadsheet-based model was developed to determine the number of road vehicles that would be added to existing traffic flows as a result of the proposed project. This enabled the effect of the project on the capacity of the road network to be assessed. A conventional four-step process was used, namely trip generation (calculating the number of trips generated by the project), trip distribution (connecting each trip with an origin and destination), modal split (allocating each trip to a particular mode of transport or vehicle type) and trip assignment (assigning each vehicle trip to a particular route). The assessment focused on the daily and peak hour traffic associated with the project during construction and operations.

In order to assess impacts on traffic conditions, vehicle traffic flow was compared to the existing road and intersection capacity as determined by the Highway Capacity Manual (Transportation Research Board, 2000). The assessment of whether traffic signals are required at any intersections was determined using the warrants for signal installation contained in the SADC Road Traffic Signs Manual (1997).

The assessment of the traffic impact on the road structure (pavement) focussed on heavy vehicles since private motor cars and light delivery vehicles have a negligible effect on road pavement life.

2. IDENTIFICATION OF SOURCES OF IMPACT FROM THE PROPOSED PROJECT

2.1 Construction

During the envisaged construction period for the container terminal development, traffic impacts will occur as a result of the transportation of personnel, construction materials and equipment to the site.

Approximately 550 workers will be working at the construction site during the peak construction period, with 500 being labourers and 50 being supervisors and managers. It is assumed that buses or minibus vehicles will be used to transport labourers to the site from their residential areas and that supervisors and managers will use cars to travel to the site from wherever they are staying.

Materials required for construction of the quay walls and container handling area will consist of cement and aggregate for the production of concrete, and rock will be used for the revetments. The consultants conducting the preparatory survey for the container terminal development have indicated that about 400 truck trips per day will be used to transport rock to the construction site for a period of 5 months and about 40 truck trips per day will be used to transport cement and aggregate to the site for making concrete over a continuous period of 12 months.

(Source: email from N Endo, Padeco, July 01, 2009 to E Gelderblom, Namport and Construction Schedule in JICA Interim Report, August 2009)

2.2 Operations

Traffic Impacts during the operational phase will result from the transportation of personnel to and from the container terminal, as well as the import and export of containers.

The JICA Study Team estimated the number of staff which will be required for the new container terminal operation at different stages of its development, as shown in Table 2.1

Table 2.1 Number of Staff Necessary for Container Terminal Operations

Department	Stage 1 2013 – 14	Stage 2 2015 – 17	Stage 3 2018 – 2025
Management	4	8	8
Administration	80	108	136
Operations	119	157	194
Total	203	273	338

Source: JICA Interim Report, August 2009. Table 4.4.3

The container terminal will operate for 24 hours per day, 7 days a week and the above staff will therefore be divided into 3 shifts per day. At the shift change times, one-third of the above staff will enter the port gates and one-third will exit. On the assumption that the management and administration staff will use private transport (average 2 persons per car) and the operations staff will use minibus transport (average 10 persons per minibus), the number of road vehicles conveying staff in and out of the port gates at the shift change times will be as shown in Table 2.2.

Table 2.2 Number of Vehicles Conveying Staff at Shift Changes

Vehicle	Direction	Stage 1 2013 – 14	Stage 2 2015 – 17	Stage 3 2018 – 2025
Cars	In	14	19	24
	Out	14	19	24
Minibuses	In	4	5	7
	Out	4	5	7
Total	In + Out	36	48	62

Assumptions: 2 persons per car and 10 persons per minibus

The shift change times are assumed to occur at 06:00, 14:00 and 22:00. The arrival of new staff for a shift is assumed to take place during 30 minutes prior to the shift change and the departing staff are assumed to leave within 30 minutes after the shift change.

The number of truck trips per day that will in the future convey containers in and out through the port gates has been calculated from the modal split forecasts of shipped and landed containers by road and rail (JICA Interim Report, August 2009). It has been assumed that the terminal will operate for 365 days per year and trucks will access the port every day to load and unload containers. On the assumption that there will be an approximately equal number of 20 foot and 40 foot containers to be transported by road, an average load of 1.5 TEU per truck has been used to calculate the trucks per day in and out of the port, as shown in Table 2.3.

Table 2.3 Forecast of Road Container Trucks through Port Gates

	Containers (TEU)		Trucks per Day		Total Trucks per Day
	Shipped	Landed	In	Out	
2009	46674	61545	85	112	197
2010	47044	61737	86	113	199
2013	55591	87543	102	160	261
2015	61971	94334	113	172	285
2020	77458	112347	141	205	347
2025	93233	132294	170	242	412
Increase 2009 – 2025			85	130	215

Source: Container Forecasts by Road from JICA Report : Table 3.5.1

3. SCENARIOS CONSIDERED IN THE IMPACT ASSESSMENT

The assessment of impacts associated with road traffic and the transportation of personnel and materials related to the construction and operation of the container terminal is based on the worst-case traffic scenario in which:

1) Peak-period traffic volumes are assessed against the capacity of the existing road infrastructure assuming that no new roads are constructed in Walvis Bay. The assessment will determine whether any road upgrades are required to mitigate the impacts of the traffic generated by the project.

2) The construction of Phase 2 of the container terminal will overlap with the operation of Phase 1, and the construction of Phase 3 of the container terminal will overlap with the operation of Phase 2, resulting in a cumulative traffic impact from the transportation of personnel, construction materials and containers. It is assumed that Phase 1 will be commissioned for operation early in 2013, Phase 2 will be constructed in 2013/14 for commissioning in 2015 and Phase 3 will be constructed in 2017/18 for commissioning in 2019 or 2020.

3) The route to be used for transporting rock by truck from the quarry south of Walvis Bay to the harbour will be via 18th Road, 5th Street and 3rd Street. This is also the route currently used by container trucks. Although Namport has proposed an alternative route for trucks to the new container terminal via Union Street and 5th Road (red route in Figure 3.1) we consider that this route is not suitable, due to houses and schools alongside this route. For the purpose of this TIA we have assumed that the route for construction traffic and container traffic will be via the port entrance in 3rd Street East (blue route in Figure 3.1).

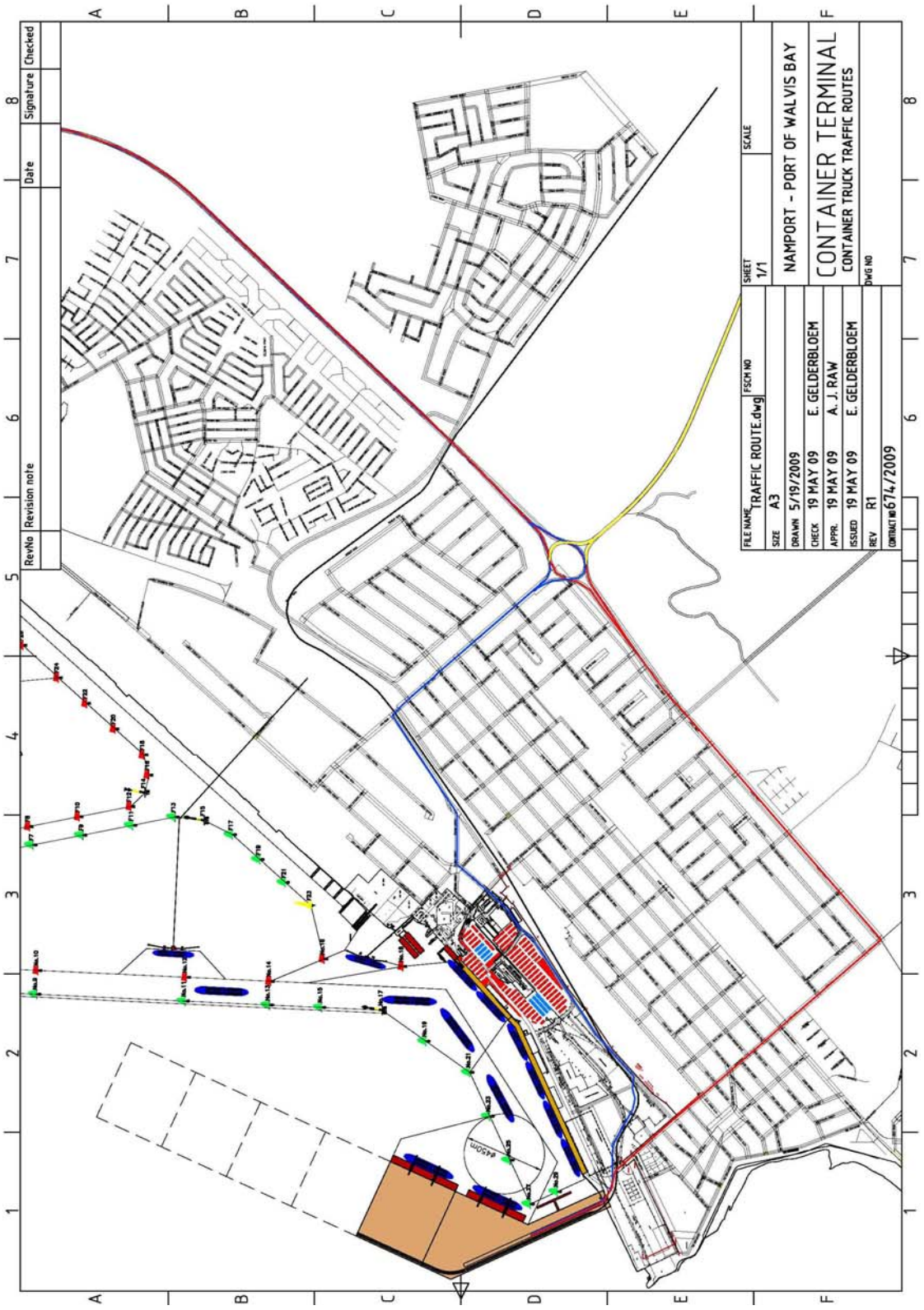

Figure 3.1 Existing (blue) and alternative (red) container routes being considered by Namport

4. IMPACT ASSESSMENT AND MITIGATION

4.1 Impact on traffic conditions

Construction

Traffic counts were conducted at the key intersections on the route that will be used by the vehicles conveying construction materials (rock, cement, concrete aggregate) from the quarries situated south of Walvis Bay (off road C14) to the harbour. These intersections are the traffic circle where the C14 meets the B2 at the entrance to Walvis Bay and the four-way stop street near the two entrances to the harbour, where Third Street intersects with Thirteenth Road. The current traffic flows at these intersections are shown in Figure 4.1 for 2009. Figure 4.1a shows the 12-hour traffic (06:00 – 18:00) and Figure 4.1b shows the peak hour traffic (16:30 – 17:30). The traffic counts from which these figures were derived are contained in Annexures 8.1 and 8.2.

Impact on road sections

The existing peak hour traffic plus the generated peak hour traffic during Phase 1 construction (2010/11) is shown in Figure 4.2b and during Phase 2 construction (2013/14) is shown in Figure 4.3b, which also includes the traffic generated by Phase 1 operation.

Peak hour traffic generated during the construction phases, when added to the current traffic volumes, will not exceed the vehicle-carrying capacity of the road sections, which have a capacity of approximately 1 500 vehicles per hour per lane per direction (Highway Capacity Manual). The road that will experience the highest traffic increase is Third Street east of 13th Road, which will increase from 421 vph westbound in the 2009 peak hour to 460 vph in 2013/14 during Phase 2 construction and to 480 vph in 2017/18 during Phase 3 construction. However, this will only increase the volume/capacity ratio from 0,28 in 2009 to 0,32 in 2018. The **significance** of this **negative impact** is therefore **low**.

Impact on intersections

Apart from the road sections, the intersections usually act as bottlenecks in the network and can also experience capacity problems. The critical intersection is the Third Street/13th Road 4-way stop, which will experience an increase in peak hour traffic through the intersection from 984 vph in 2009 to 1179 vph in 2013/14 during the Phase 2 construction period and to 1213 vph in 2017/18 during Phase 3 construction. This is a 23% increase in the peak hour traffic volume and will result in increased delays for all traffic passing through this 4-way stop.

The traffic through the traffic circle at the B2/C14 intersection will increase from 1033 vph in 2009 to 1138 vph in 2017/18, which is a 10% increase in the peak hour traffic volume from 2009 to 2018.

The **significance** of the **negative impacts** is therefore **medium** at the Third Street/13th Road 4-way stop and **low** at the B2/C14 traffic circle.

It should be noted that the additional traffic from container terminal operation in 2025 is in fact less than the additional traffic generated during each construction phase. The daily container terminal truck trips in 2025 is 412 vpd, whereas the daily construction truck trips in 2017/18 is 880 vpd (in + out).

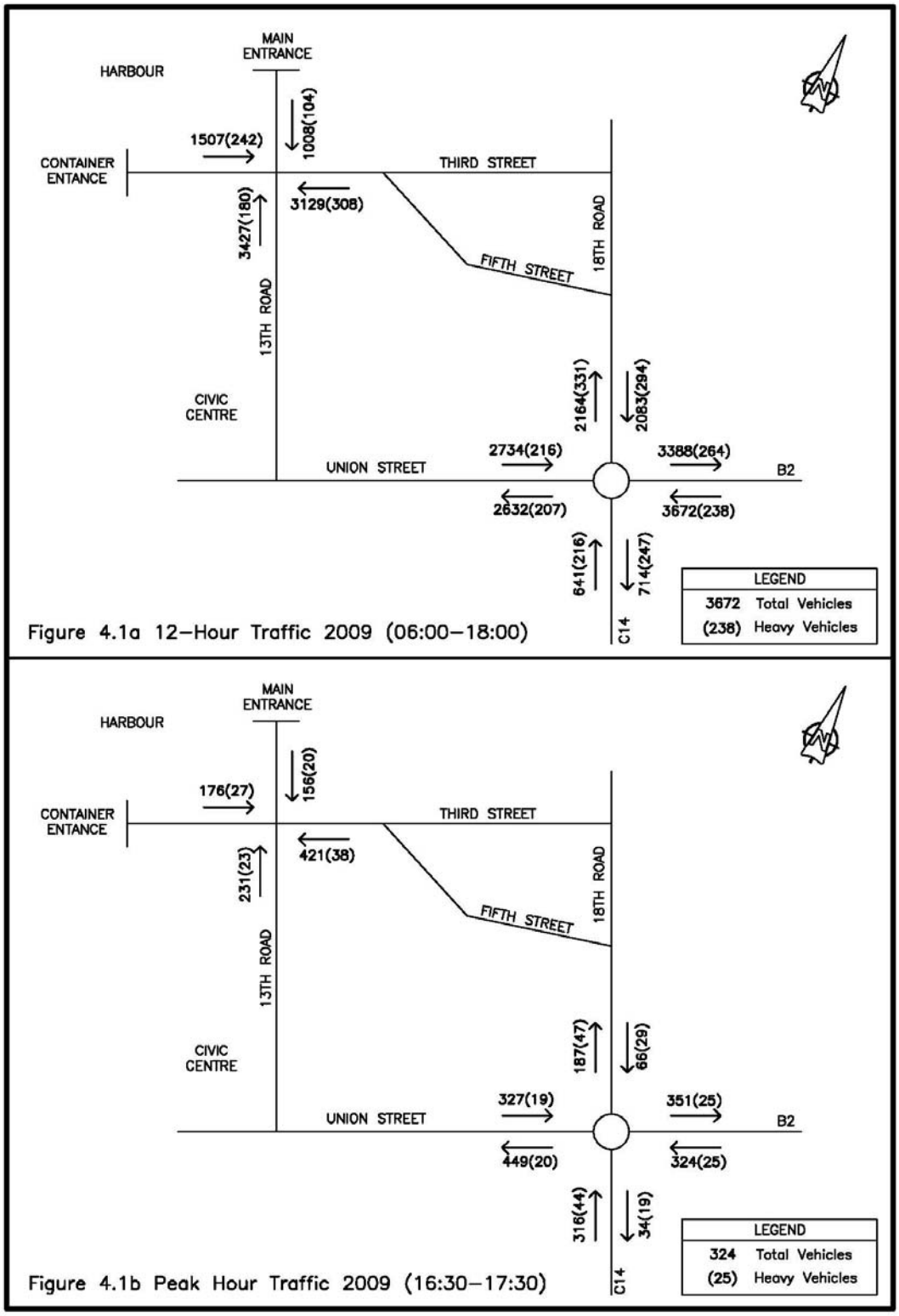

Figure 4.1 Existing daily and peak hour traffic on the road system (2009)

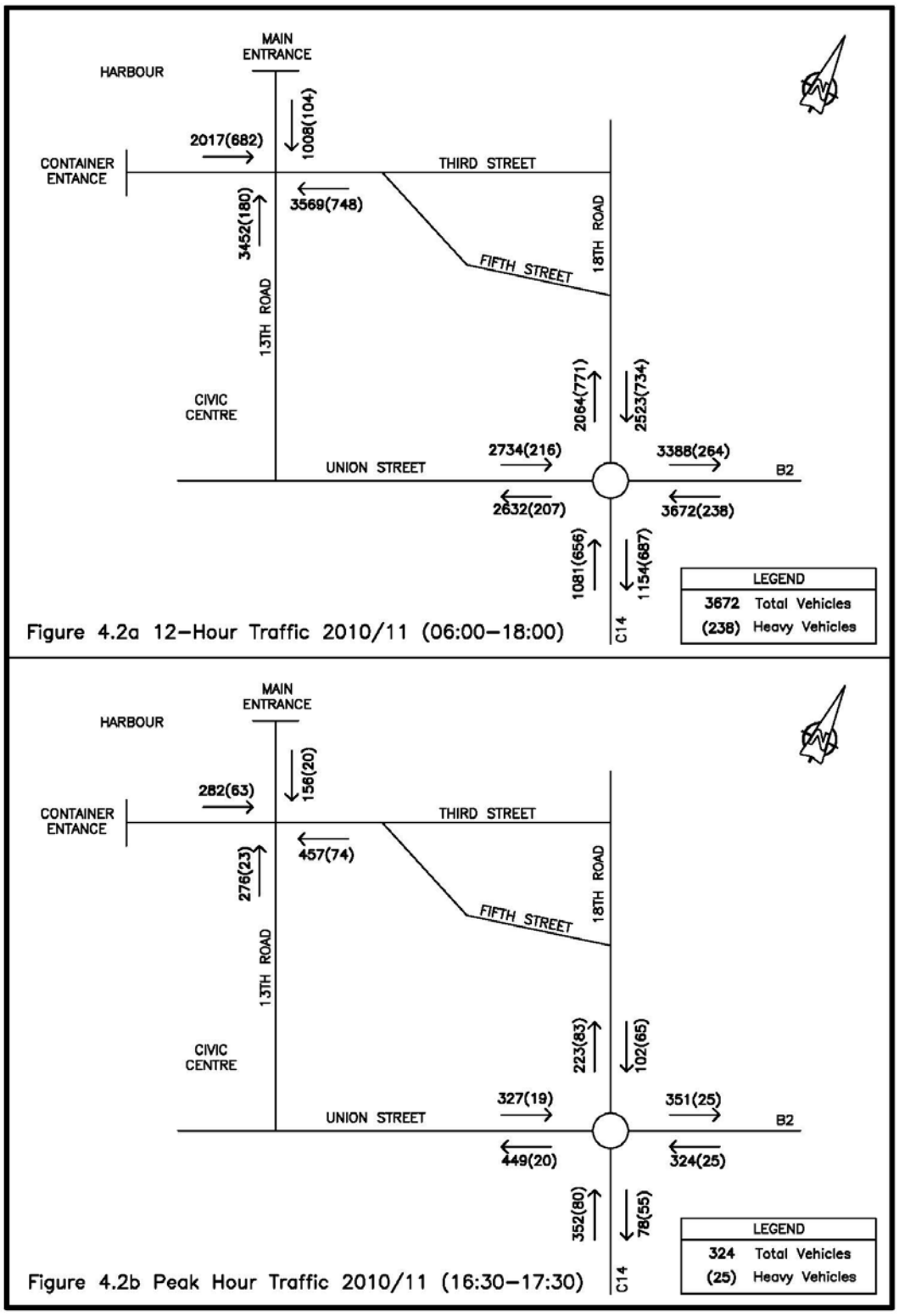

Figure 4.2 Traffic during construction of Phase 1 (2010/11)

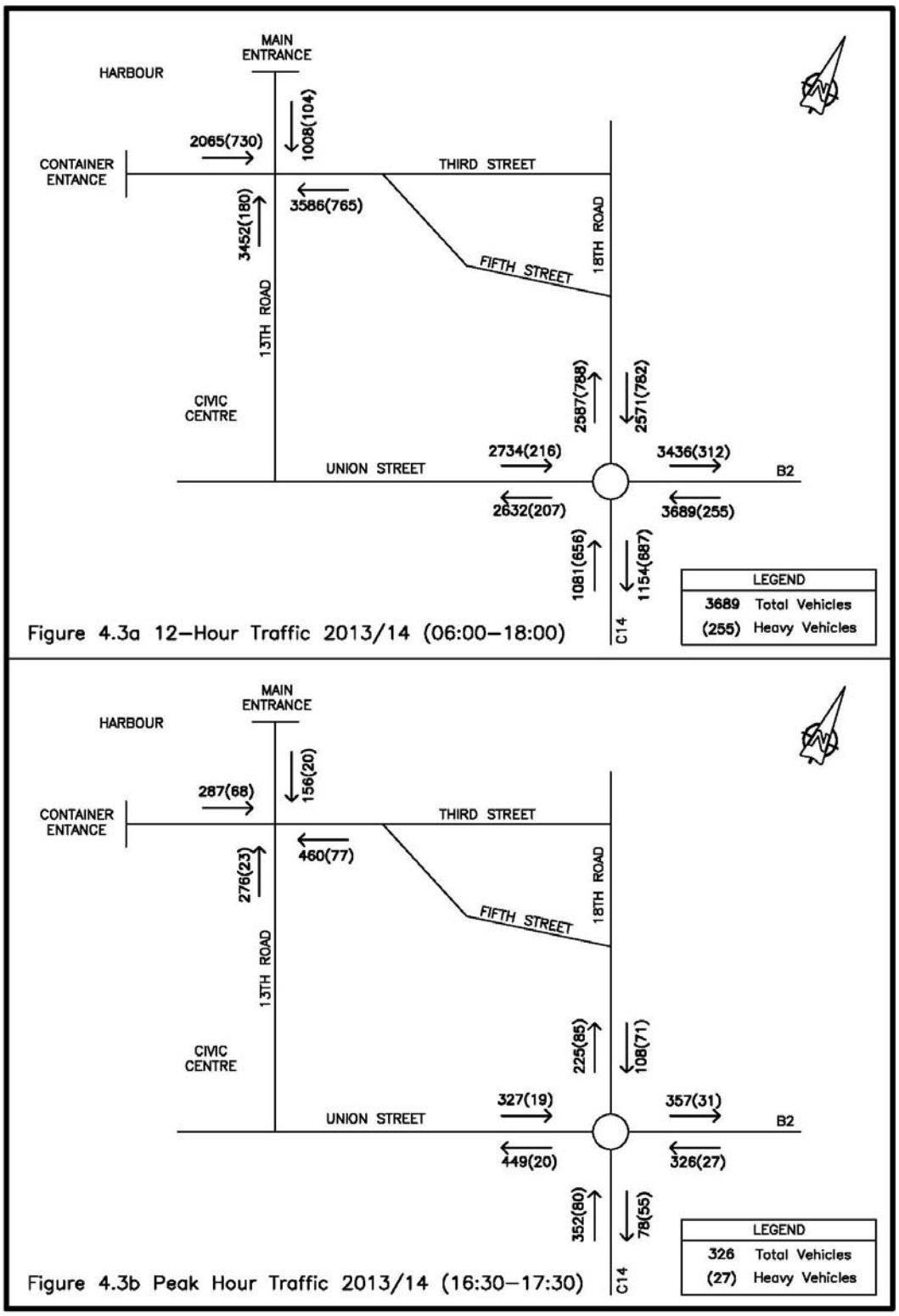

Figure 4.3 Traffic during Phase 1 operation and Phase 2 construction (2013/14)

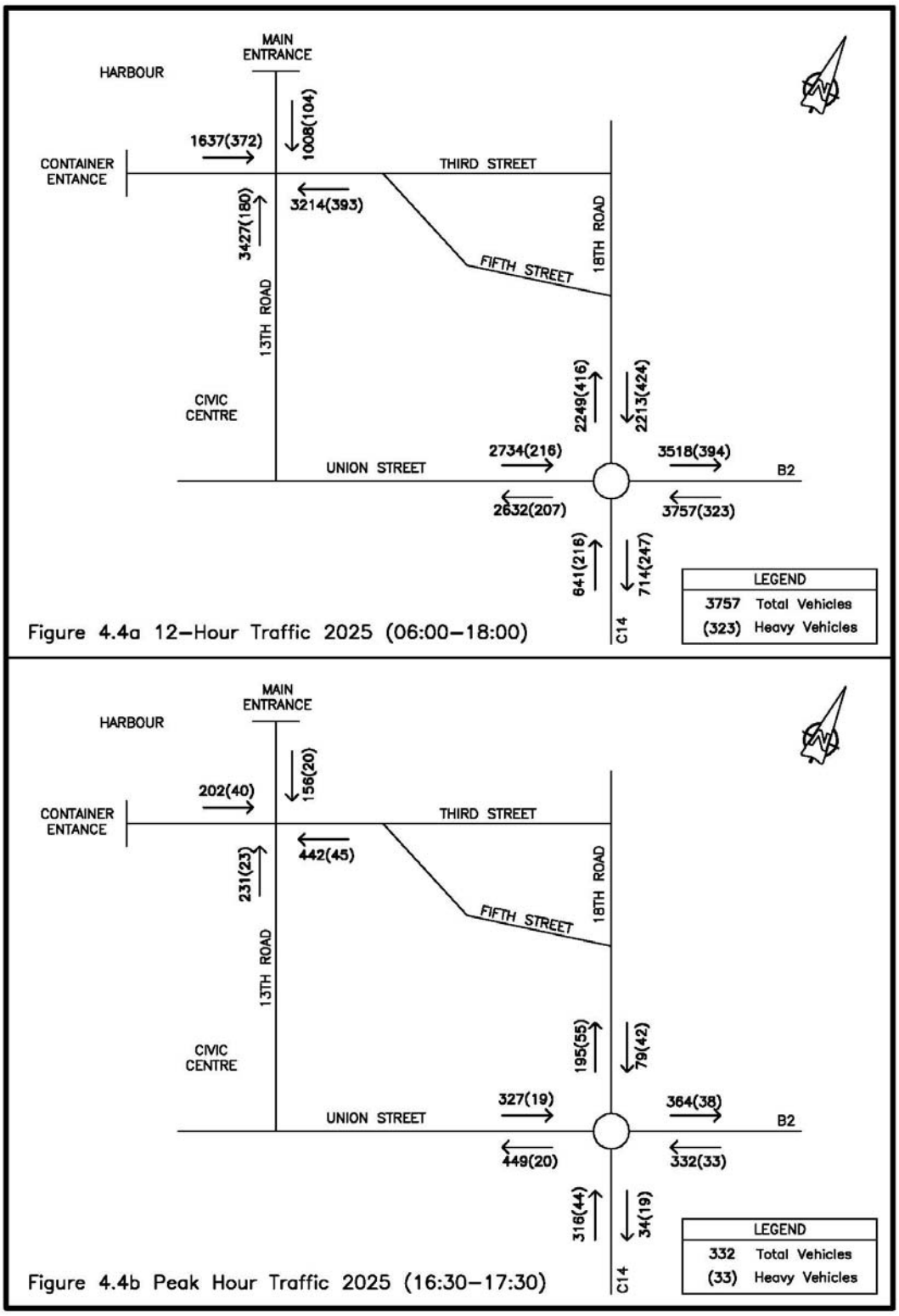

Figure 4.4 Traffic during ultimate operation of new container terminal (2025)

Operation

The container terminal will operate 24 hours per day, 7 days a week and will employ about 360 persons in three shifts at full operation (2025). The shift having the most significant impact on other road traffic will be the 06:00 – 14:00 shift, when 120 departing workers from the shift ending at 06:00 coincide with day staff arriving for the other port operations. The number of vehicles used by the departing container terminal staff is estimated to be 32 (24 cars and 8 minibuses), which will increase the current morning peak hour traffic volume at the Third Street/13th Road intersection by 4%. The **significance** of this **negative** impact is therefore **low**. The afternoon shift change at the container terminal at 14:00 will have no impact on the afternoon peak hour traffic (16:30 – 17:30).

The number of container trucks passing through the Third Street/13th Road intersection will increase from 197 per day in 2009 to 412 per day in 2025, as shown in Table 2.3 previously. The net increase will be 85 trucks per day into the port and 130 trucks per day out of the port. Assuming an even distribution throughout the 12 hours when the container gate is open (06:00 – 18:00) this means 7 trucks per hour in and 11 trucks per hour out.

These volumes are small and will not cause a noticeable impact on the peak hour traffic level of service at the intersections. The **significance** of the **negative impact** for the container terminal operation in 2025 is therefore assessed to be **low**.

Mitigation

The following mitigation measures to limit the impact of additional traffic generated during the *construction phase* should be considered:

- The use of public transport (buses and minibus taxis) by staff working in the port should be encouraged. This will reduce the volume of private cars on the roads.

- The installation of traffic signals at the Third Street/13th Road 4-way stop control will reduce the number of vehicle stops and the overall travel delay for all vehicles passing through this intersection. It will also reduce fuel consumption, exhaust emissions and noise from stop-start engine cycles. Traffic signals are warranted for the increased traffic during the Phase 1 construction period which commences in the mid-2010 based on the morning and afternoon peak period traffic volumes (SADC Road Traffic Signs Manual, 1997)

- An alternative to the installation of traffic signals at the Third Street/Thirteenth Road intersection is to impose a ban on construction trucks using this intersection during the morning and afternoon peak traffic periods, which are 07:00 – 08:30 and 16:00 – 17:30.

The same mitigation measures proposed above for the construction phase to limit the impact of additional road traffic generated are recommended for the *operational phase*. Furthermore, it is recommended that a greater proportion of containers destined for the hinterland should be transported by rail rather than by road. As noted in the JICA report, this will require significant expenditure to upgrade the existing railway infrastructure.

4.2 Impact on road infrastructure

The impact of the construction and operational traffic on the road pavement infrastructure has been assessed by comparing the cumulative daily volume of trucks on the roads from 2009 to 2025 with and without the project. Light vehicles have a very small impact on the structural capacity of the road pavement compared to heavy vehicles and therefore only the forecast truck volumes have been considered in this part of the impact study.

Without the project, the truck traffic on the main container route from Walvis Bay to Swakopmund (via Third Street, 18th Road and Road B2) is assumed to increase at the same rate as the "container cargo demand forecast without-the-project", which is summarised in Table 3.4.6 of the JICA Interim Report. This table shows that the total imports, exports and transit cargo (excluding transhipments) will increase from 119,919 TEU in 2009 to 219,204 TEU in 2025 for the medium growth scenario. This is an increase of 83% over the period of 16 years which is equivalent to an average annual compounded traffic growth rate of 3,85% per annum. This growth rate has been applied to the current 2009 daily truck traffic counts on each road section of the container route to determine the total cumulative number of trucks that would use this route from 01 January 2010 to 31 December 2025 "without-the-project". The highest directional flow on each road section has been used for the assessment.

The trucks during the construction periods for Phase 1 and Phase 2 will consist of 400 round trips per day conveying rock from the quarry for a period of 5 months and 40 round trips per day conveying cement and concrete aggregates for a period of 12 months. The same length of time and daily truck trips for conveying these construction materials is assumed to apply to each phase, as the size of the container terminal being constructed in phases 1 and 2 is the same. For Phase 3 the size of the container terminal is equivalent to the sizes of Phases 1 and 2 together, which means that the cumulative truck trips for Phase 3 will be twice that for Phases 1 and 2 together.

The total volume of trucks that will use the affected roads cumulatively from 01 January 2010 to 31 December 2025 "without-the-project" and "with-the-project during the construction and operation of the container terminal is shown in Table 4.1.

Table 4.1 Cumulative truck traffic volume from 01 January 2010 to 31 December 2025 without-the-project and additional truck volumes during construction and operation of the terminal

Road	2009 Trucks/day	Cumulative trucks without the project	Phase 1+2+3 Construction	% Increase	New terminal additional trucks	% Increase
3rd/5th Street	308	2 424 251	297 600	12,2	213 890	8,8
18th Road	331	2 605 283	297 600	11,4	213 890	8,2
B2	264	2 077 930	0	0	399 310	19,2
C14	247	1 944 124	297 600	15,4	0	0

Note: The additional truck trips which will be generated by the new container terminal after it is commissioned in 2013 were obtained from Table 2.3 by subtracting the truck trips per day in 2010, i.e. without-the-project and then calculating the cumulative additional trucks from 2013 to 2025 for the critical road lane (highest flow direction).

The **significance** of the **negative impact** of the construction traffic and additional container trucks on the structural capacity of the road infrastructure is assessed to be **low**, except on the B2 where it is assessed to be **medium**.

Mitigation

Overloading of vehicles should be avoided to limit the impact on the structural capacity of roads. This should be monitored by weighing vehicles before they leave the Port.

Truck drivers should be encouraged to use the alternative route to the B2 between Walvis Bay and Swakopmund. This route C34 behind the dune field has been resurfaced recently with a salt wearing coarse and is in good condition.

The rail service should be improved to encourage a larger proportion of containers destined for the hinterland to be conveyed by rail rather than by road vehicle.

4.3 Impact on traffic safety

Construction

As a result of the increase in traffic generated by the construction activities there is a potential for increased accident rates. It is estimated that there will be about 6 million additional vehicle kilometres travelled on the road network by vehicles conveying staff and construction materials during the construction periods for Phases 1, 2 and 3 added together.

The estimation of the number of casualties and fatalities associated with the construction traffic is based on accident statistics produced by the Central Statistics Service of the South African Department of Transport which indicates 100 casualties and 7 fatalities per 100 million kilometres travelled in South Africa. In the absence of accident statistics for Walvis Bay, we have assumed a similar accident rate for Namibia as in South Africa. Using this ratio it is estimated that the construction traffic is likely to cause 6 casualties and a 40% chance of one fatality during the three construction periods altogether. The **significance** of the **negative impact** on road safety during the construction phases is therefore assessed to be **low**.

Operation

Assuming an average travel distance of 500 km per container truck trip (one-way), it is estimated that there will be an additional 12 million vehicle kilometres per year travelled on the road network when the container terminal becomes operational in 2013. This is likely to cause an additional 12 casualties per year and one fatality per year at the start of the operational phase and increase at about 10% per annum as the additional container truck traffic volume will increase at this rate. The **significance** of the **negative impact** of new container operations traffic on road safety is therefore assessed to be **medium**. As the container volumes increase annually, the accident rate will also increase proportionately.

Mitigation

Properly trained drivers and well maintained vehicles should be used during the construction and operational phases of the development.

A greater proportion of containers should be carried by rail in the operational phase. However, this requires upgrading of the railway infrastructure, as identified in the JICA Interim Report.

Traffic officers should conduct random inspections of vehicles entering and leaving the Port to check that they are in a safe and roadworthy condition.

4.4 Cumulative impacts from other developments

Other construction activities that may take place during the same time as the extensions to the container terminal and may cause a cumulative effect on traffic conditions, are the proposed coal-fired power station and associated infrastructure being investigated by NamPower for possible location on either the northern or eastern side of Walvis Bay. The Environmental and Socio-Economic Impact Assessment for this project was published on the NamPower website in June 2009.

The cumulative traffic impact of the proposed power station has not yet been assessed and will depend on the choice of site and the size of the power station (200 – 800 MW). If the peak construction period of the power station overlaps with the peak construction period of the new container terminal in the Port, the negative impacts on the affected roads (mainly B2 and C14) are likely to be significant.

5. MONITORING RECOMMENDATIONS

The actions which we consider to be necessary to ensure that the proposed mitigation measures are monitored are set out in Table 5.1 with regard to what needs to be done, by whom, to what standard and how often.

Table 5.1 Monitoring of Recommended Mitigation Actions

No.	Mitigation Recommendation	Monitoring Responsibility	Action Required	Monitoring Method	Frequency
1.	Provision of reliable passenger transport service during construction and operation to encourage high use of buses by workers	Namport	Namport must check that the staff bus service is provided as per agreement, with the operator	Appointed inspectors must record buses arrival and departure times at designated pick-up points and count passengers on buses	Once a week on a randomly selected day each week
2.	An alternative to the installation of traffic signals at the Third Street/ Thirteenth Road intersection is to ban construction trucks from using this intersection during peak traffic periods (07:00 – 08:30 and 16:00 – 17:30)	WBM Traffic Department	Traffic signs on the approaches to the Third Street/ Thirteenth Road intersection indicating that no construction trucks are allowed on these roads during the specified time periods	Traffic law enforcement during specified time periods	Daily
3.	A greater proportion of containers to be transported by rail instead of road	TransNamib and Namport	TransNamib to investigate using more wagons for conveying containers	Namportt to record supply of wagons by TransNamib and delivery time between origin and destination of selected container trains	Monitor trains on a daily basis and discuss progress with TransNamib on a monthly basis
4.	Heavy vehicle safety and overloading checks during construction and operation	WBM Traffic Department	Traffic enforcement officials to weigh and inspect selected vehicles entering and leaving the Port	WBM to organize use of vehicle weighing equipment at Port gateway	All heavy vehicles passing over weight detector. Selected vehicles to undergo safety inspection daily.

6. SUMMARY OF IMPACTS AND MITIGATION

This section summarises the impacts and mitigation measures as identified in Section 4. These impacts are assessed according to the following categories:

- **Nature of impact** - explains the type of effect that a proposed activity will have on the environment and includes "what will be affected and how?"
- **Extent** - indicates whether the impact will be local and limited to the immediate area of *development* (the site) limited to within 5 km of the development *(local)*; or whether the impact may be realised *regionally*, *nationally* or even *internationally*.
- **Duration** - indicates the lifetime of the impact, as being *short term* (0 - 5 years*), medium term* (5 - 15 years*), long term* (>15 years but where the impacts will cease after the operation of the site), or *permanent*.
- **Intensity** - indicates whether the impact is destructive or innocuous and is described as *low* (where no environmental functions and processes are affected), *medium* (where the environment continues to function but in a modified manner) or *high* (where the environmental functions and processes are altered such that they temporarily or permanently cease).
- **Probability** - indicates the likelihood of the impact occurring and is described as *improbable* (low likelihood), *probable* (distinct possibility), *highly probable* (most likely) or *definite* (impact will occur regardless of prevention measures).
- **Significance** – indicates the potential impact and is described as *low* (where the impact will not have an influence on the decision or be required to be significantly accommodated in the project design), *medium* (where it could have an influence on the environment which will require modification of the project design or alternative mitigation) or *high* (where it could have a "no-go" implication for the project regardless of any possible mitigation).
- **Status of impact** – indicates whether the impact will be positive (a benefit), negative (a cost) or neutral.
- **Degree of confidence** – indicates the degree of confidence in the predictions, based on the availability of information and specialist knowledge, and is described as *low*, *medium* or *high*.

The assessment of the traffic impacts is summarised in Table 6.1. The significance is shown with and without the possible mitigation measure as identified in Section 4. The mitigation measures which are recommended are as follows:

1. The provision of a reliable transport service by the contracted bus operator to convey workers to and from the Port during construction and operation must be monitored by Namport, to ensure that the service is punctual. This will mitigate the need for workers to seek to use other modes of transport like cars and taxis, which are less efficient in the use of road space per passenger carried, resulting in greater peak hour traffic congestion.

2. The impact of construction trucks on peak hour traffic congestion at the Third Street/Thirteenth Road intersection must be mitigated either by the installation of traffic signal control or by imposing a ban on construction trucks using this intersection during peak traffic periods (07:00 – 08:30 and 16:00 – 17:30).

3. If a greater proportion of containers destined for the hinterland can be transported by rail rather than by road, it will mitigate the accelerated degradation of the road pavement structure and the increased number of road accidents that will result from increased heavy vehicle traffic. This can be achieved in the short term by TransNamib supplying more locomotives and wagons for containers, and in the longer term by upgrading the capacity of the railway line.

4. The Walvis Bay Municipality traffic enforcement officials should make arrangements for the weighing and safety inspection of heavy vehicles entering and leaving the Port. This will curb the overloading of vehicles and ensure that all vehicles are in a roadworthy condition, which will help reduce accidents caused by overloaded and/or unsafe vehicles.

Table 6.1 Summarised traffic impact assessment for container terminal extension

Nature of the impact	Extent	Duration	Intensity	Probability	Significance (without mitigation)	Significance (with mitigation)	Status	Degree of confidence
1. Reduction in road-based level of service due to increase in traffic volumes during construction	Local	Short term	Low	Highly probable	**Medium**	**Low**	Negative	High
2. Reduction in level of service due to increased number of heavy vehicles transporting containers during operation	Regional	Long term	Low	Highly probable	**Low**	**Low**	Negative	High
3. Accelerated degradation of road structure due to construction traffic	Local	Short term	Low	Highly probable	**Low**	**Low**	Negative	Medium
4. Accelerated degradation of road structure due to increase in container traffic	Regional	Long term	Medium	Highly probable	**Medium**	**Low**	Negative	Medium
5. Increased number of road accidents due to increased traffic during construction	Local	Short term	Low	Probable	**Low**	**Low**	Negative	Low
6. Increased number of road accidents due to increase in container traffic	Regional	Long term	Low	Probable	**Medium**	**Low**	Negative	Low

7. REFERENCES

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5. Transportation Research Board, 2000. Highway Capacity Manual. National Research Council, Washington DC.

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ANNEXURE 8.1: TRAFFIC COUNT AT WALVIS BAY TRAFFIC CIRCLE (B2/C14)

Walvisbay Traffic Circle: B2 - C14								
12 Hour Traffic Volume: 5 November 2008								
Approach	To				From			
	LV	HV	Total	% HV	LV	HV	Total	% HV
A	2425	207	2632	7.9%	518	216	734	29.4%
B	1833	331	2164	15.3%	1789	294	2083	14.1%
C	3124	264	3388	7.8%	3434	238	3672	6.5%
D	467	247	714	34.6%	425	216	641	33.7%

Walvisbay Traffic Circle: B2 - C14								
5 November 2008: Morning Peak 08:00-09:00								
Approach	To				From			
	LV	HV	Total	% HV	LV	HV	Total	% HV
A	283	22	305	7%	171	12	183	7%
B	179	19	198	10%	18	21	39	54%
C	146	21	167	13%	285	17	302	6%
D	9	12	21	57%	285	21	306	7%

Walvisbay Traffic Circle: B2 - C14								
5 November 2008: Midday Peak 13:00-14:00								
Approach	To				From			
	LV	HV	Total	% HV	LV	HV	Total	% HV
A	316	24	340	7%	290	15	305	5%
B	228	30	258	12%	66	18	84	21%
C	285	20	305	7%	285	20	305	7%
D	30	13	43	30%	218	35	253	14%

Walvisbay Traffic Circle: B2 - C14								
5 November 2008: Evening Peak 17:00-18:00								
Approach	To				From			
	LV	HV	Total	% HV	LV	HV	Total	% HV
A	429	20	449	4%	318	9	327	3%
B	140	47	187	25%	37	29	66	44%
C	326	25	351	7%	299	25	324	8%
D	15	19	34	56%	272	44	316	14%

Source: NamPower website. Proposed coal-fired power station in Walvis Bay. Traffic Impact Assessment – Final Report June 2009

Note: SSI is of the opinion that the 12 hour traffic volume on Approach A (from) should be 2734 and not 734 because the To and From totals over 12 hours should be approximately the same.

ANNEXURE 8.2.1: TRAFFIC COUNTS AT THIRD STREET/13TH ROAD INTERSECTION **Thursday 6 August 2009**

Approach	13th North				13th South				3rd East				3rd West				Total
Movement	L/T		R		L/T		R		L/T		R		L/T		R		
Vehicle	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	
7:00 - 7:30	13	0	0	0	66	1	138	2	68	7	1	2	29	3	32	1	363
7:30 - 8:00	24	0	2	1	104	4	162	2	109	9	0	6	17	5	22	3	470
8:00 - 8:30	40	4	3	2	78	5	116	1	115	14	10	5	18	8	9	3	431
8:30 - 9:00	37	0	2	1	48	6	74	4	97	12	1	6	39	15	16	4	362
Total	114	4	7	4	296	16	490	9	389	42	12	19	103	31	79	11	1626
7 - 8	37	0	2	1	170	5	300	4	177	16	1	8	46	8	54	4	833
Per road	40				479				202				112				833
8 - 9	77	4	5	3	126	11	190	5	212	26	11	11	57	23	25	7	793
Per road	89				332				260				112				793
7:30 - 8:30	64	4	5	3	182	9	278	3	224	23	10	11	35	13	31	6	901
Per road	76				472				268				85				901
15:30 - 16:00	53	3	6	1	66	5	63	7	112	12	2	5	32	17	18	0	402
16:00 - 16:30	33	7	3	0	61	3	78	10	162	16	1	5	50	16	37	2	484
16:30 - 17:00	48	15	2	0	30	5	83	11	167	8	1	4	26	10	34	3	447
17:00 - 17:30	84	5	2	0	26	3	69	4	208	26	2	0	24	14	49	9	525
Total	218	30	13	1	183	16	293	32	649	62	6	14	132	57	138	14	1858
15:30 - 16:30	86	10	9	1	127	8	141	17	274	28	3	10	82	33	55	2	886
Per road	106				293				315				172				886
16:30 - 17:30	132	20	4	0	56	8	152	15	375	34	3	4	50	24	83	12	972
Per road	156				231				416				169				972

Note: L/T = left/through movement
R = Right turn movement
L = Light vehicle (cars, bakkies, minibus)
H = Heavy vehicle (trucks, buses)

Source: WML Coast Consulting Engineers

ANNEXURE 8.2.2: TRAFFIC COUNTS AT THIRD STREET/13TH ROAD INTERSECTION **Tuesday 11 August 2009**

Approach	13th North				13th South				3rd East				3rd West				Total
Movement	L/T		R		L/T		R		L/T		R		L/T		R		
Vehicle	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	
7:00 - 7:30	7	0	1	0	73	5	129	3	60	11	0	2	30	4	18	4	347
7:30 - 8:00	34	6	2	0	93	5	144	7	92	13	0	6	21	4	16	3	446
8:00 - 8:30	39	9	4	0	83	4	122	6	123	5	2	1	34	10	23	0	465
8:30 - 9:00	29	4	1	1	42	5	90	7	113	16	2	6	32	8	24	3	383
Total	109	19	8	1	291	19	485	23	388	45	4	15	117	26	81	10	1641
7 - 8	41	6	3	0	166	10	273	10	152	24	0	8	51	8	34	7	793
Per road	50				459				184				100				793
8 - 9	68	13	5	1	125	9	212	13	236	21	4	7	66	18	47	3	848
Per road	87				359				268				134				848
7:30 - 8:30	73	15	6	0	176	9	266	13	215	18	2	7	55	14	39	3	911
Per road	94				464				242				111				911
15:30 - 16:00	41	7	3	0	69	7	70	1	118	15	10	3	47	7	4	2	404
16:00 - 16:30	35	4	8	0	42	3	83	3	128	13	9	10	74	18	5	1	436
16:30 - 17:00	49	7	6	0	47	7	64	5	181	7	4	4	66	13	0	0	460
17:00 - 17:30	80	1	2	0	17	0	55	0	217	3	4	1	81	14	2	0	477
Total	205	19	19	0	175	17	272	9	644	38	27	18	268	52	11	3	1777
15:30 - 16:30	76	11	11	0	111	10	153	4	246	28	19	13	121	25	9	3	840
Per road	98				278				306				158				840
16:30 - 17:30	129	8	8	0	64	7	119	5	398	10	8	5	147	27	2	0	937
Per road	145				195				421				176				937

Note: L/T = left/through movement
R = Right turn movement
L = Light vehicle (cars, bakkies, minibus)
H = Heavy vehicle (trucks, buses)

Source: WML Coast Consulting Engineers

ANNEXURE 8.3: TRAFFIC COUNTS AT PORT ENTRANCE GATES

Vehicle Count – Main Gate Entrance

- Week: Tuesday 31 March to Monday 6 April 2009

Tuesday	Sedan	LDV	Truck	Total
05H00 to 07H00	20	30	7	57
07H00 to 08H00	28	43	10	81
08H00 to 09H00	22	40	18	80
09H00 to 10H00	12	21	14	47
10H00 to 11H00	13	41	12	66
11H00 to 12H00	27	38	15	80
12H00 to 13H00	13	32	4	49
13H00 to 14H00	23	20	9	52
14H00 to 15H00	6	15	11	32
15H00 to 16H00	8	27	14	49
16H00 to 17H00	6	9	2	17
17H00 to 18H00	9	6	1	16
18H00 to 22H00	12	22	10	44
	199	344	127	670

Wednesday	Sedan	LDV	Truck	Total
05H00 to 07H00	0	0	0	0
07H00 to 08H00	0	0	0	0
08H00 to 09H00	12	25	13	50
09H00 to 10H00	7	31	13	51
10H00 to 11H00	19	41	25	85
11H00 to 12H00	12	41	15	68
12H00 to 13H00	17	34	17	68
13H00 to 14H00	44	28	13	85
14H00 to 15H00	28	43	14	85
15H00 to 16H00	13	40	15	68
16H00 to 17H00	10	21	3	34
17H00 to 18H00	7	6	4	17
18H00 to 22H00	7	14	13	34
	176	324	145	645

Thursday	Sedan	LDV	Truck	Total
05H00 to 07H00	40	40	5	85
07H00 to 08H00	31	57	14	102
08H00 to 09H00	18	28	22	68
09H00 to 10H00	12	35	16	63
10H00 to 11H00	8	19	7	34
11H00 to 12H00	9	30	12	51
12H00 to 13H00	15	28	8	51
13H00 to 14H00	13	9	11	33
14H00 to 15H00	19	39	10	68
15H00 to 16H00	14	30	24	68
16H00 to 17H00	7	18	8	33
17H00 to 18H00	3	11	1	15
18H00 to 22H00	18	34	9	61
	207	378	147	732

Friday	Sedan	LDV	Truck	Total
05H00 to 07H00	40	40	25	105
07H00 to 08H00	15	10	26	51
08H00 to 09H00	14	40	23	77
09H00 to 10H00	9	25	18	52
10H00 to 11H00	19	38	19	76
11H00 to 12H00	23	49	23	95
12H00 to 13H00	18	41	9	68
13H00 to 14H00	25	32	11	68
14H00 to 15H00	3	37	11	51
15H00 to 16H00	21	44	20	85
16H00 to 17H00	13	25	13	51
17H00 to 18H00	13	15	6	34
18H00 to 22H00	12	26	13	51
	225	422	217	864

Saturday	Sedan	LDV	Truck	Total
05H00 to 07H00	17	21	13	51
07H00 to 08H00	7	13	14	34
08H00 to 09H00	2	7	7	16
09H00 to 10H00	2	6	9	17
10H00 to 11H00	18	27	6	51
11H00 to 12H00	9	17	8	34
12H00 to 13H00	10	21	3	34
13H00 to 14H00	14	16	4	34
14H00 to 15H00	5	7	5	17
15H00 to 16H00	2	4	1	7
16H00 to 17H00	3	8	0	11
17H00 to 18H00	4	8	0	12
18H00 to 22H00	30	48	7	85
	123	203	77	403

Sunday	Sedan	LDV	Truck	Total
05H00 to 07H00	9	14	11	34
07H00 to 08H00	5	4	8	17
08H00 to 09H00	4	10	3	17
09H00 to 10H00	6	9	2	17
10H00 to 11H00	0	0	0	0
11H00 to 12H00	0	0	0	0
12H00 to 13H00	12	13	9	34
13H00 to 14H00	3	9	5	17
14H00 to 15H00	6	7	0	13
15H00 to 16H00	1	0	1	2
16H00 to 17H00	5	3	0	8
17H00 to 18H00	0	0	0	0
18H00 to 22H00	8	14	0	22
	59	83	39	181

Monday	Sedan	LDV	Truck	Total
05H00 to 07H00	40	42	20	102
07H00 to 08H00	0	0	0	0
08H00 to 09H00	0	0	0	0
09H00 to 10H00	14	18	19	51
10H00 to 11H00	24	31	46	101
11H00 to 12H00	27	39	36	102
12H00 to 13H00	26	24	18	68
13H00 to 14H00	27	24	17	68
14H00 to 15H00	33	48	38	119
15H00 to 16H00	16	33	19	68
16H00 to 17H00	21	25	22	68
17H00 to 18H00	11	15	8	34
18H00 to 22H00	9	23	2	34
	248	322	245	815

Week Totals	Sedan	LDV	Truck	Total
	1237	2076	997	4310

Source: NamPort

Vehicle Count – Container Gate Entrance
- Week: Tuesday 31 March to Monday 6 April 2009

Tuesday	Total
07H00 to 08H00	4
08H00 to 09H00	22
09H00 to 10H00	13
10H00 to 11H00	13
11H00 to 12H00	4
12H00 to 13H00	0
13H00 to 14H00	5
14H00 to 15H00	3
15H00 to 16H00	6
16H00 to 17H00	11
17H00 to 18H00	0
18H00 to 22H00	0
	81

Wednesday	Total
08H00 to 09H00	7
09H00 to 10H00	7
10H00 to 11H00	7
11H00 to 12H00	7
12H00 to 13H00	7
13H00 to 14H00	6
14H00 to 15H00	6
15H00 to 16H00	6
16H00 to 17H00	6
17H00 to 18H00	6
	65

Thursday	Total
08H00 to 09H00	10
09H00 to 10H00	9
10H00 to 11H00	9
11H00 to 12H00	9
12H00 to 13H00	9
13H00 to 14H00	9
14H00 to 15H00	9
15H00 to 16H00	9
16H00 to 17H00	9
17H00 to 18H00	9
	91

Total
237

Source: NamPort