



**OR Tambo International Airport
(ORTIA) Cargo Terminal Re-
configuration**

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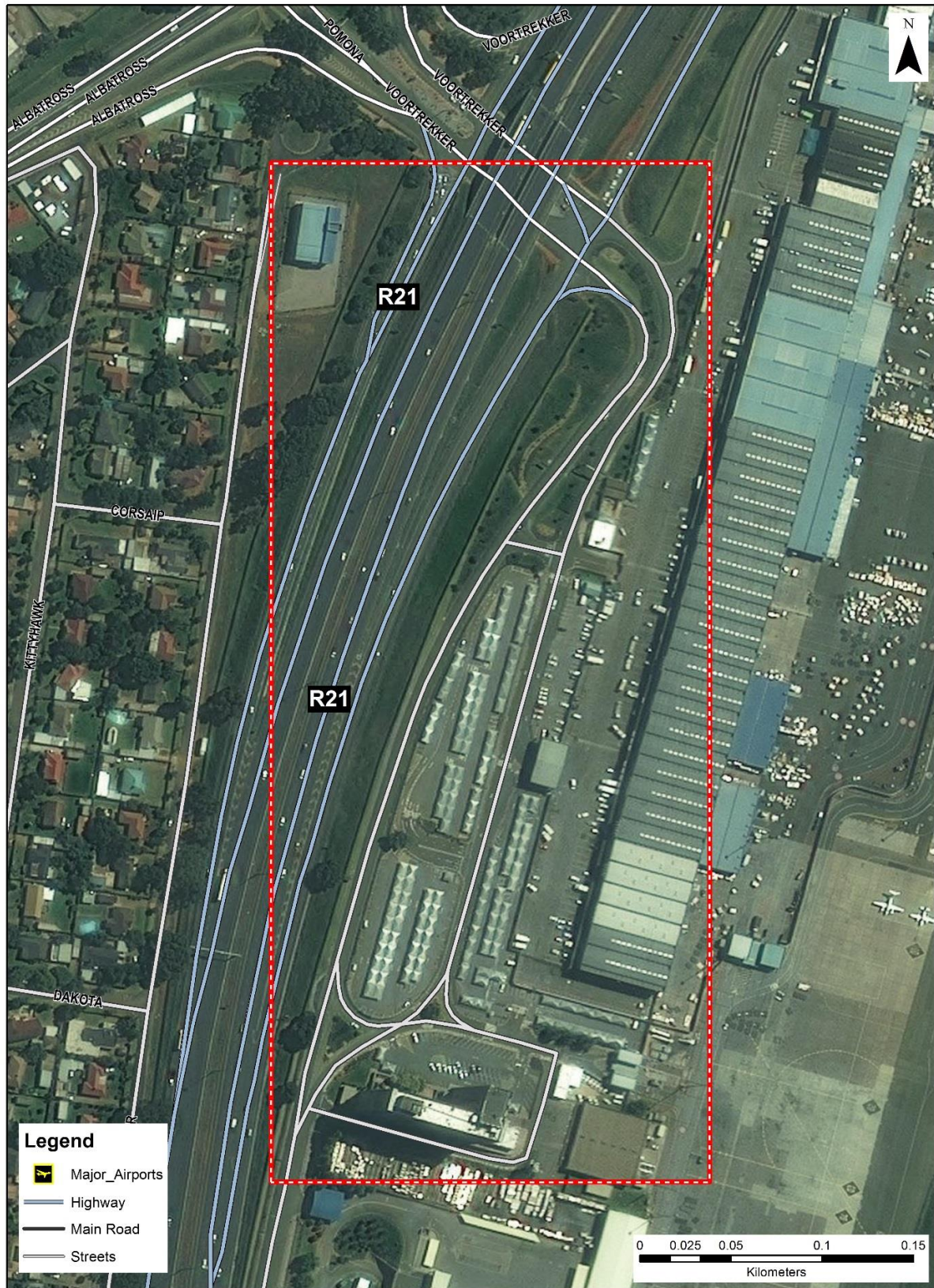
1 Introduction

██████████ was appointed by ██████████ to carry out a traffic assessment to identify how to improve access to the OR Tambo International Airport (ORTIA) Cargo terminal. The site is located on Voortrekker Road, near the R21 / Voortrekker Road interchange. The location of the site is shown in Figure 1 below.

Currently the positioning of the site access, access road and site layout in combination causes traffic congestion at the cargo facility access to back up towards Voortrekker Road and impacting on through traffic (non-cargo traffic). These factors present several operational challenges where various user groups, with different trip purposes and needs compete for road spaces resulting in vehicle conflict and unnecessary delays for both cargo and non-cargo traffic.

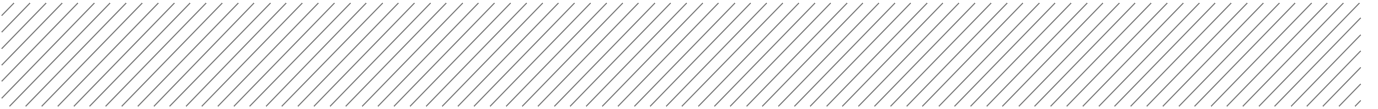
To improve the situation this study considered the following factors in better understanding the existing situation and in developing a solution:

- Lane capacity;
- Parking capacity;
- Access / gate capacity;
- Vehicle queueing;
- Relocation of the main gate;
- Trucks / heavy goods vehicles (HGV) parking/ holding facility;
- Traffic circulation;
- Vehicle weaving;
- Access configuration and geometry; and
- Conversations with the client to appreciate fully the needs and objectives to be addressed and achieved respectively.



STUDY AREA

Figure 1-1 Locality plan



The design philosophy adopted was aimed at:

- reconfiguring the cargo access;
- minimising vehicle conflict;
- identifying a road layout that supports optimum operational conditions for the cargo traffic; and
- separating cargo traffic from the general traffic.

To this end the study components included:

- A site visit to understand the existing situations;
- Initial scoping meeting with the client;
- Review of various alternative for new access gate location and local traffic circulation;
- Presentation of the access alternatives to the client;
- Conducting traffic count surveys;
- Traffic capacity analysis of the preferred concept road layout; and
- Preparation of a conceptual road layout drawing of the recommended solution demonstrating the proposed access strategy.

This document summarises the main findings, analytical results, and recommendations.

2 Site Observations

A site visit to the ORTIA Cargo terminal was carried out on Tuesday 27 October 2015, between 09:30 and 11:30. A follow-up site visit was also carried out on 28 October 2015, between 06:30 and 08:30. Details of the observations made are provided in the rest of this section.

2.1 Access

The site access is taken off the southbound carriageway off Voortrekker Road and comprise two inbound lanes and one outbound lane. One inbound lane is dedicated to permit holders and the other is dedicated for non-permit holders. The permit holder lane is controlled with a security guard allowing access on positive identification.

The photos below shows the lane configuration and access arrangement.



Figure 2-1-1: Access Site Observations

It was observed that the average service rate (processing time) for permit holders is approximately 8 seconds. Non-permit holders have to sign-in manually, and it takes approximately 50 seconds to process one non-permit holder vehicle. However, it was observed during the site visit that at least three non-permit holder vehicles were being processed simultaneously, resulting in an average service rate of approximately 17 seconds per vehicle. At the time of the site visit it was also observed that the split between permit and non-permit holder vehicles was more or less even (e.g. 50 / 50 split).

A snapshot of one of the service rate measurements for non-permit holders is provided in Figure 2-1 below. The concurrent processing of non-permit holders is illustrated in Figure 2-2.

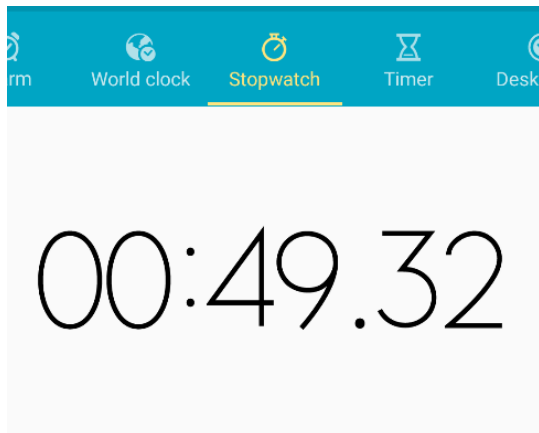


Figure 2-2 Non-permit holders service rate check



Figure 2-2 Concurrent processing of non-permit holder vehicles

2.2 Queuing

There were no excessive queuing observed during the site observations on two different days. However the security personnel did indicate that longer queues tend to develop during peak periods, mainly between 07h00 and 11h00.



2.3 Visitor parking

The visitor parking layout adjacent to the inbound lane to the cargo terminal appears confusing to those using it, with short spacing between the police station access and the main cargo facility access. Access (ingress and egress) to the visitor bays also appeared difficult as vehicles has to negotiate their way through a long vehicle queue.

2.4 Way-finding, signage and road markings

Way-finding, road signage and road markings is not clear enough (or a lack of appropriate signage) to warn drivers in advance about the appropriate lanes to be used to access the cargo terminal or which to use as through traffic or for parking purposes. This negatively impacts the optimal use of the road capacity around the cargo terminal and results in additional unnecessary traffic delays and congestion.

2.5 Traffic movements on Voortrekker Road and its interaction with the Cargo access road

Turning left onto Voortrekker Road from the R21 towards the cargo area, a left turn to the perishable goods. There is 2 traffic lanes towards the cargo site. Accelerating forward, an overhead wayfinding sign can be observed directing foreign cargo and parking vehicles. Visitors parking is provided adjacent to the SAPS office in the one-way traffic lanes, causing deceleration of traffic prior the cargo access gate. Cargo traffic proceed forward to the access gate on the left-hand side with parking and through traffic keeping right. Causing some weaving of traffic. Traffic moving towards airside gate or terminals along with the vehicles that wants to enter the parking area, weaving back into the left lane after the cargo access gate. As the access gate is an entrance and exit, some weaving was observed as traffic heading out of the cargo terminal, wants to be in the right hand lane, due to the one way circulation.

The traffic splits at the intersection with the road to the terminals. This road is a dual carriage lane with two lanes, from the intersection towards the right the road functions as a one-way directing traffic away from the cargo area. Towards airside the traffic functions as a two way traffic lane.

Traffic lanes around the cargo area are very wide, and causes speeding towards and away from the area.

The circulation of the traffic at the cargo terminal is functioning at a high level of efficiency.

3 Site access – conceptual redesign

3.1 Existing vehicle movement situation

In the immediate vicinity of the site, there is a one-way circular flow of traffic, with two carriageway lanes on Voortrekker Road enveloping as shown in Figure 3-1. This results in through traffic being mixed with cargo traffic at the access gates resulting in additional vehicle delay.

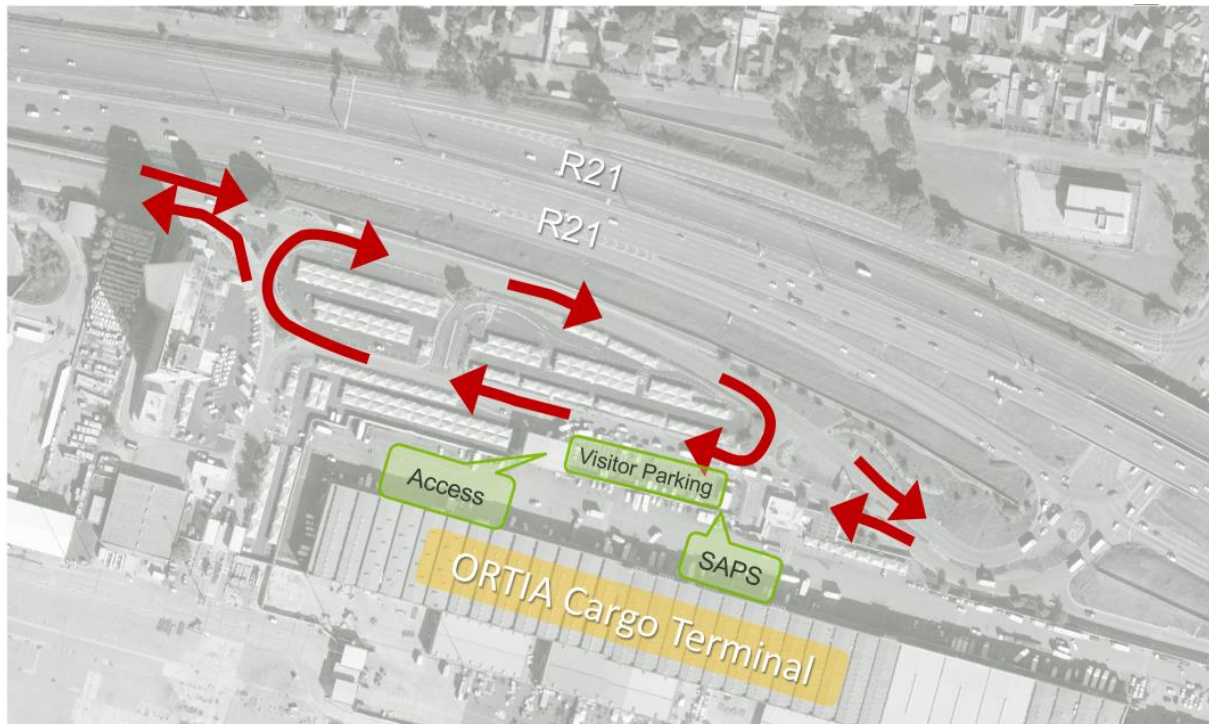


Figure 3-1 Circular vehicle movement around the ORTIA Cargo terminal

3.2 Option development and design considerations

In finding suitable access layout and road layout solutions several options (or possible solutions) were developed in the form of a number of drawings.

The options had to satisfy the following key design considerations:

- Separation of cargo traffic from the general traffic;
- Minimise delays at the access;
- Minimise queueing at the access and or Voortrekker Road;
- Rationalisation of visitor parking;
- Provision of waiting area for trucks within the site; and
- Optimise access to the tenant parking area.

Alternative cargo terminal access options developed were evaluated to ensure optimal access of the site and minimising vehicle conflict as far as possible. To this end the following activities were undertaken in the preparation of options and to ensure an optimal solution is found:

- A movement matrix was compiled to ensure that all movements were considered in the redirection of all traffic movements as shown by Table 1 below.

- Through / general traffic was diverted away from the Cargo terminal access, resulting in two-way traffic flow on the current northbound carriageway of Voortrekker Road.
- Providing a traffic circle to retain elements of the circular flow that are critical to the accessibility of the wider area (i.e. ensuring that all existing O-D pairs are still possible with the new access concept);
- Provision of additional access lanes to minimise delays and peak hour queuing;
- Separation of the cargo terminal inbound and outbound traffic in order to reduce vehicle conflict.
- Provision for 22m interlink vehicles – although not common for delivery and collection at the cargo area, the vehicles do utilise the facilities.

Table 1: Origin and Destination Matrix

Origin \ Destination	Perishable Cargo	Foreign Cargo	Parking	Office	Airside	SA Cargo/Passenger Terminal	Kempton/Voortrekker/R21
Perishable Cargo							
Foreign Cargo							
Parking							
Office							
Airside							
SA Cargo/Passenger Terminal							
Kempton/Voortrekker/R21							

3.3 Access strategy & local road network proposal

Following the development of several options and discussions with the client a preferred access and road layout concept was developed as shown in **Appendix A**. Two points of access to the cargo terminal is proposed – an inbound access and a separate outbound access. Additional road layout changes are proposed.

The proposal comprise the following characteristics:

- 4 inbound lanes to the cargo terminal, and additionally one lane dedicated to visitors and tenant parking / permit holders;
- The exit will be on the southern border of the terminal, and will comprise three outbound lanes;
- Future tenant / permit parking will have a full access on the southern border of the terminal;
- A truck waiting area will be provided inside the cargo terminal, near the site entrance;
- Through / general traffic will be diverted away from the cargo traffic, on approach to the entrance, and the current southbound carriageway of Voortrekker Road will be converted to a Cargo Terminal access road;

- The current northbound carriageway of Voortrekker Road will be converted into a two-lane bi-directional road;
- A roundabout will be provided on the reconfigured Voortrekker Road, just south of the cargo terminal. This is to ensure that all traffic using the area currently will be able to continue doing so in the future without lengthy additional journey distance or time;
- The existing SAPS facility will be relocated to a suitable location within the terminal. The exact location will be confirmed by [REDACTED] at a later stage; and
- Taxi layby facilities will be provided on Voortrekker Road.

3.4 Cargo Facilities Location

During our discussions with the client it was made clear that the location of the current kiosk facilities should be accommodated elsewhere, and provision for the electrical substation employee parking should be re-evaluated. The image below thus indicates the possible location of the kiosk and parking. This reference is made for future consideration of the Kiosk as well as the need to provide a parking



4 Traffic counts

To understand the current traffic movements around the site, manual classified traffic count surveys were undertaken to understand traffic flow patterns and to enable traffic capacity analysis. The classified counts were conducted at six locations, as indicated in Figure 4-1 below, on 24 November 2015, from 06h00 – 18h00.

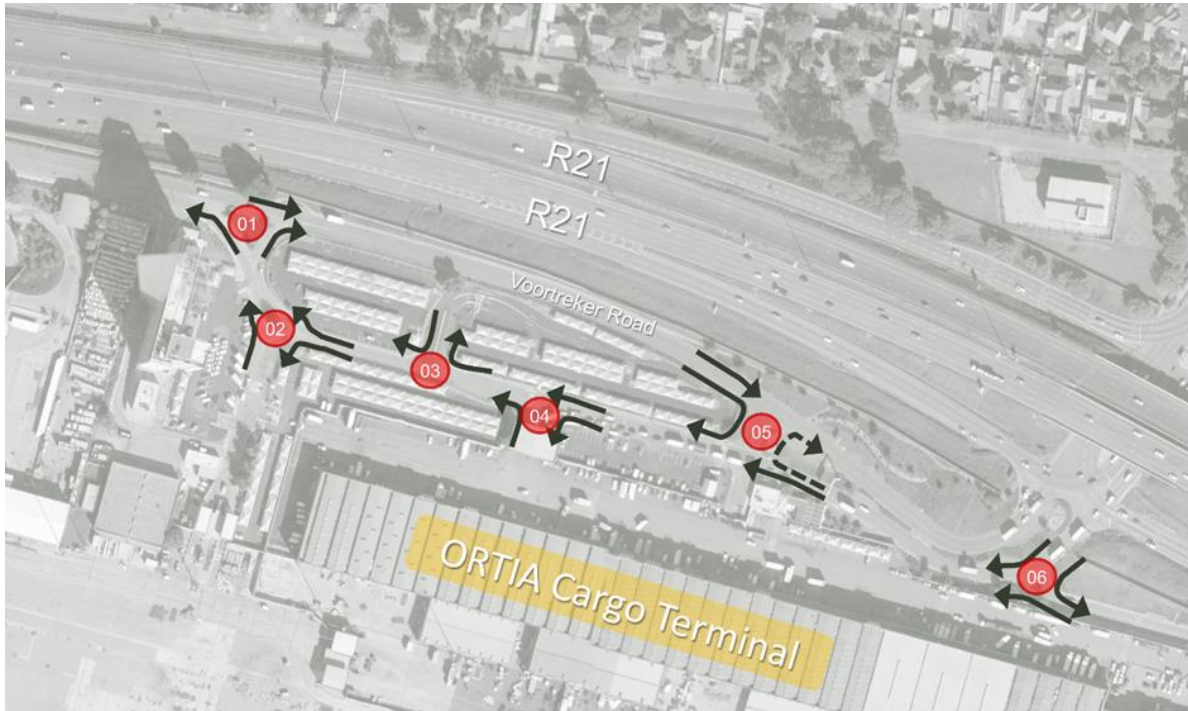


Figure 4-1: Survey points

The survey data was analysed and the daily flow profile is summarised in Figure 4-2.

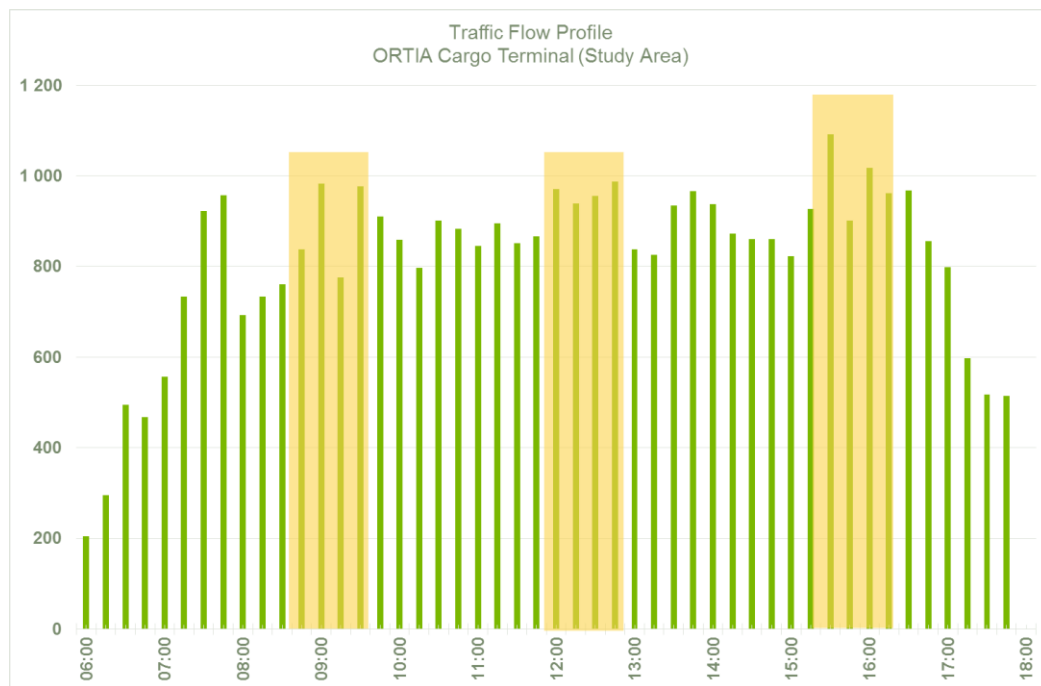


Figure 4-2 Flow profile

From the survey data analysis, it was determined that the morning peak (AM) hour occurred between 09h00 and 10h00 and the afternoon peak (PM) hour from 15h15 to 16h15.

The baseline AM and PM peak hour volumes are attached hereto as Appendix B Flow diagrams.

The arrival / departure profile at the site access, during the peak hours were also assessed. The AM peak hour departure / arrival peak distribution is shown in Figure 4-3 below:

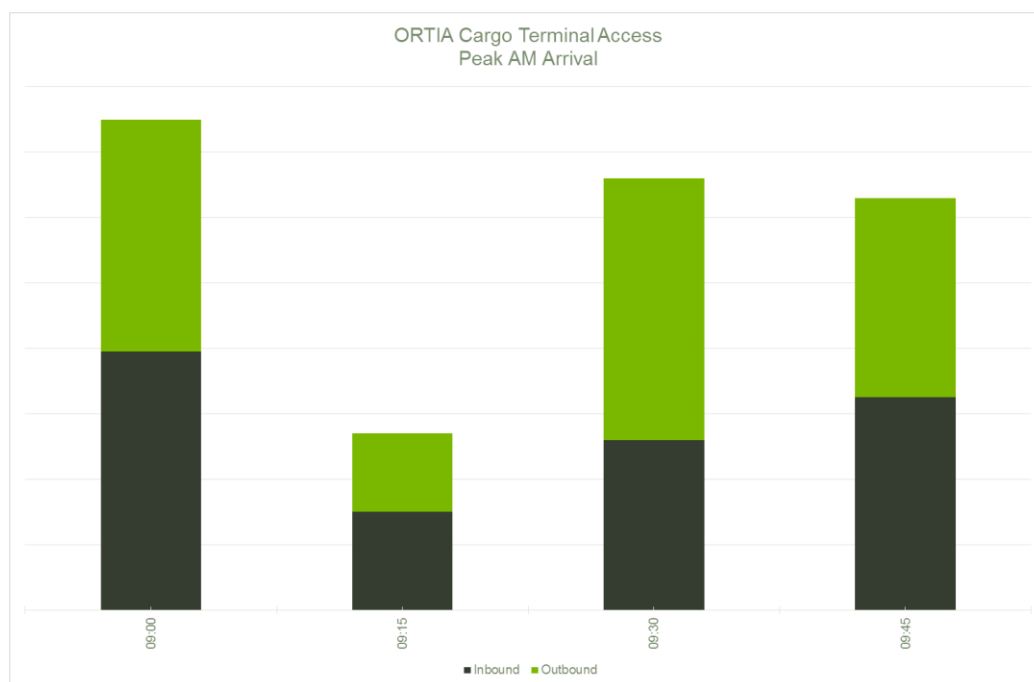



Figure 4-3 Peak AM Inbound and Outbound traffic, comparison



From the analysis, it was determined that the cargo terminal currently generates 293 inbound and 236 outbound vehicle trips during the AM peak hour (529 vph in both directions). In the PM peak hour, the cargo terminal generates 226 and 300 vehicles per an hour, for the inbound and outbound vehicles respectively (526 vph in both directions).

Due to the irregular arrival profile, during the peak hour, a Peak Hour Factor (PHF) was calculated at 0.72. The normal peak hour factor is between 0.95 and 1 in locations with relatively uniform peak hour arrival rates. The lower PHF, as is the case at the cargo terminal access, result in higher flow rates being modelled to account for the (occasionally) higher rate of traffic arriving at the access. This implies the modelling methodology is robust.

4.1 Redistribution of traffic

With the proposed site access reconfiguration, traffic patterns on the local road network will change. An assessment was made on the likely traffic redistribution. The third and fourth figures in Appendix B show the expected traffic assignment on the local road network as a consequence. The re-distributed traffic was used in the capacity analysis of intersections and accesses as part of the proposed road / access layout.

5 Intersection Capacity Analysis

Intersection capacity analyses were carried out on key intersections that may be affected by the proposed cargo terminal access re-configuration as shown by **Appendix A**. The capacity analysis process and results are discussed further in the remainder of this section.

5.1 LOS criteria

For purposes of defining the Level of Service (LOS), average vehicle delay was used as a performance measure. Level of service (LOS) is a qualitative measure used to relate the quality of traffic flow. LOS is used to analyse roads by categorizing traffic flow and assigning quality levels of traffic based on performance measured by the average total vehicle delay of all movements through an intersection.

The LOS criteria that was used in this study is taken from the Highway Capacity Manual (HCM2000) (TRB, 2000). Table 2 below indicates the LOS criteria for priority controlled intersections:

Table 2: Level of Service Criteria for priority controlled intersection (HCM 2000)

Level of Service	Average Delay (sec/veh)	General Descriptions
	Priority Control	
A	≤ 10	Free Flow , No delays
B	10 - 15	Stable Flow (slight delays)
C	15 – 25	Stable Flow (acceptable delays)
D	25 – 35	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	35 – 50	Unstable Flow (intolerable delay, demand equals capacity of the intersection / approach)
F	>50	Forced Flow (demand in excess of capacity, intersection or road section prone to bottleneck and traffic jams)

*HCM 2000, exhibit 17.2 (TRB, 2000)

5.2 Intersection Layouts

The intersection changes that was analysed are indicated in the Figures 5-1 and 5-2 below.

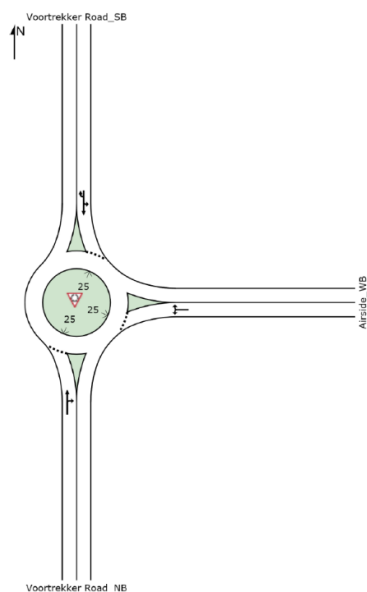


Figure 5-1 Voortrekker Road roundabout (New)

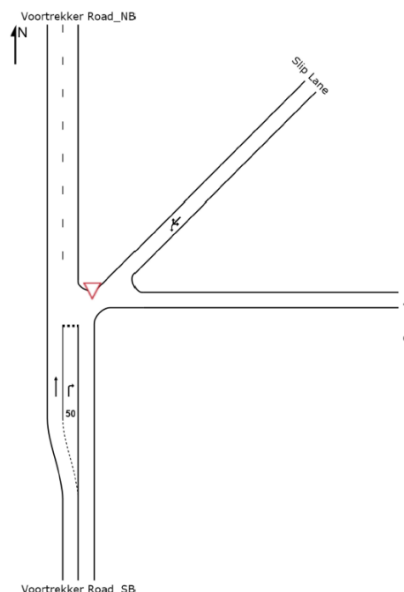


Figure 5-2 Mid-block access to Cargo terminal (Reconfigured)

5.3 Intersection capacity analysis results – 2015 (new road network)

A summary of the analysis results is provided in Table 3 below, detailed capacity analysis results are included in **Appendix B**.

Table 5-3: Capacity analysis results - 2015 volumes, on new conceptual road network

Intersection	Approach	AM			PM		
		(v/c)	Delay (sec)	LOS	(v/c)	Delay (sec)	LOS
01_Voortrekker Roundabout	Voortrekker Rd - NB	0.361	6.5	A	0.487	5.5	A
	Airside Access - WB	0.316	8.7	A	0.348	5.9	A
	Voortrekker Rd - SB	0.171	7.2	A	0.159	8	A
	Overall	0.361	7.5	A	0.487	6.2	A
5a_Voortrekker Mid-block Link	Voortrekker Rd - NB	0.272	1.7	A	0.476	0.7	A
	Voortrekker Rd - SB	0.144	4.8	A	0.099	4.8	A
	Overall	0.272	2.6	A	0.476	1.4	A
5b_Cargo Inbound & Mid-block Link	Voortrekker Rd (Cargo Access) - SB	0.05	0	A	0.045	0	A
	Mid-block Link - EB	0.173	4.1	A	0.113	4	A
	Overall	0.173	1.9	A	0.113	1.6	A

The analysis results demonstrate that all intersections assessed will operate well, with minimal delays on all. LOS A implies free flow conditions with no delays experienced.

5.4 Intersection capacity analysis results – 2015 (new road network) with multilevel parking facility

A summary of the analysis results is provided in Table 3 below, detailed capacity analysis results are included in **Appendix B**.

Table 5-4: Capacity analysis results - 2015 volumes with multilevel parking facility, on new conceptual road network

Intersection	Approach	AM			PM		
		(v/c)	Delay (sec)	LOS	(v/c)	Delay (sec)	LOS
02_Parking Exit	Airside Road_WB	0.228	0.0	A	0.260	0.0	A
	Parking Exit_SB	0.140	9.8	A	0.736	15.9	C
	Airside Road_EB	0.051	0.0	A	0.055	0.0	A
	Overall	0.228	2.0	A	0.487	8.5	B

6 Access Analysis

This section summarises the capacity analysis results of the proposed access reconfiguration as well as supporting queue analysis which helped define the number of inbound and outbound lanes / gates.

6.1 Access capacity analysis

Vehicle access analysis was undertaken at the cargo terminal exit. The analysis was done to determine the outbound delays effect on the general traffic.

The same capacity analysis was done as with intersection capacity analysis, where the capacity indicates the level of service according to the amount of traffic throughput. From the analysis the results were as follows:

Table 6-1: Access Analysis of the Cargo Outbound traffic (redirected 2015 background traffic in the AM)

Intersection	Approach	AM				
		(v/c)	Delay (sec)	LOS	90% back of vehicles	Queue Distance (m)
07_Cargo Outbound	Building Parkade - NB	0.035	8.2	A	0.1	0.8
	Airside - WB	0.021	0.1	A	0.0	0.0
	Cargo_Outbound - SB	0.395	7.8	A	1.8	18.5
	Airside - EB	0.040	2.8	A	0.2	1.2
	Overall	0.395	6.1	A	1.8	18.5

Table 5-2: Access Analysis of the Cargo Outbound traffic (redirected 2015 background traffic in the PM)

Intersection	Approach	PM				
		(v/c)	Delay (sec)	LOS	90% back of vehicles	Queue Distance (m)
07_Cargo Outbound	Building Parkade - NB	0.045	8.0	A	0.2	1.1
	Airside - WB	0.004	0.8	A	0.0	0.0
	Cargo_Outbound - SB	0.493	8.5	A	2.9	31.0
	Airside - EB	0.040	0.7	A	0.2	1.3
	Overall	0.493	7.0	A	2.9	31.0

As table 4 and 5 indicate that the level of service for each “intersection” at the outbound gate will not be severely influenced as the 90% back of vehicles are maximum 3 vehicles, and the layout indicates 3 outbound lanes that will saturated the probability of the line.

6.2 Queuing analysis

Vehicle queuing analysis was undertaken at the cargo terminal access to determine the number of entrance or exit lanes and the stacking space required on Voortrekker Road inbound.

Typically an access with a proximity reader and a boom-gate has capacity to process approximately 450 vph (about 8 seconds per vehicle). For this assessment and based on observations as discussed earlier, the following assumptions were made associated with the technical parameters of the queue model:

- Permit holders have a service rate of 8 seconds and non-permit holders have an average service rate of 20 seconds per vehicle (allowing for 60 seconds per vehicle, with 3 concurrent processing for non-permit holders or alternatively electronic access control with similar service rate)
- Despite the proportion of permit holders estimated at 50% during site visit, it is assumed in this analysis that permit holder account for 33% of all vehicles accessing the cargo terminal, with 67% being non-permit holders. This is considered to be a more conservative approach as it would result in a higher weighted average service rate that would be otherwise if the observed proportion is applied – therefore the access proposal is more robust;
- The weighted average service rate for the access was estimated at 17 seconds per vehicles. This result in a service rate of approximately 212 vehicles per an hour, per lane;
- From the traffic counts that was carried out, it is expected that a maximum of 293 inbound vehicle trips will be generated during the AM peak (the worst case scenario).
- A peak hour factor (PHF) of 0.72 was applied.
- By applying the PHF above, the effective demand that is analysed is 407 inbound vehicles (293/0.72), almost 40% higher than the observed demand (again supporting robust modelling and analysis practices).
- An average truck length of 16m is used. This is based on the observation that about 85% of the traffic entering the cargo terminal are light and light delivery vehicles, about 9m in length at the most. The remaining 15% are heavy vehicles, about 22m in length at the most. The weighted average truck length would therefore be around 11m. It is therefore deemed that the assumed average truck length (of 16m) would be satisfactory for purpose of estimating stacking space requirements for the site access.

Table 7 summarises the queueing analysis results.

Table 6-3: Queueing analysis results – cargo terminal (2015)

Description	Values
Peak Hour Inbound Traffic Volume	293
Peak Hour Factor	0.72
Average arrival rate (vehicle/ hour)	407
Average service rate (seconds / vehicle)	17
Average service rate (service / hour)	212
Traffic Intensity	1.92
Number of channels (gates)	4
90 th percentile queue length (<n vehicles)	4
Average number of vehicles in the system	2.1
Average Delay (seconds)	26.2

The results above show that four inbound lanes are required at the cargo access. Where a queuing space of at least 52m is required to accommodate up to 4 vehicles per lane waiting to enter the site.

Appendix A shows that these requirements are reflected and or accommodated as part of the recommended access proposal.

7 Design Standards

The following design standards and guidelines were used in the reconfiguration of the access roads in the vicinity of the ORTIA Cargo Terminal:

- Urban Transport Guidelines (UTG 5) - Geometric Design of Urban Collector Roads and
- Roundabouts: An Informational Guide from the U.S. Department of Transportation.

The scenario was modelled to evaluate the appropriateness of a roundabout and the preliminary capacity. The modelling for the single lane roundabout design indicated that the level of service from the south on Voortrekker road will decrease to a Level of Service (LOS) F. By adding a bypass lane the LOS improves significantly from an F to a B. The new layout concept was further developed on those results.

The constraints that had to be considered are the fence line, indicated in red in Figure 1, and the limited available road reserve. The client required that the parking area should be optimised to allow about 400 parking bays. It is therefore not possible to move the roadway towards the side of the parking area. The available space between the parking area and the fence had to be used as efficiently as possible.

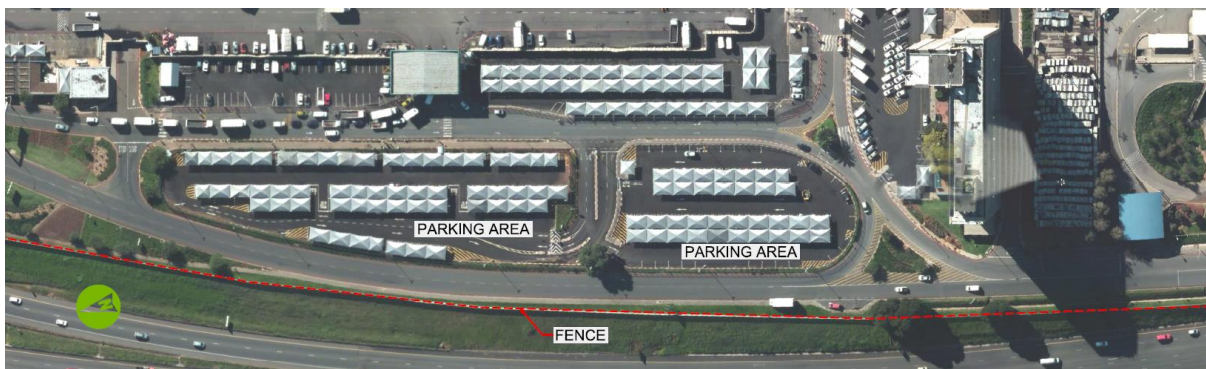


Figure 7-1: Current Layout

The design speed for the concept design is based on Table 2.2 *Design speeds for collector roads from the UTG 5*. It is recommended that for a central area street, with close intersection spacing with traffic signal control and pedestrian activity the design speed should be 50 km/h – 60 km/h. For this concept design, a design speed of 60 km/h was adopted.

For the roundabout design a 35 km/h design speed was applied as recommended in *Roundabouts: An Informational Guide* as maximum entry design speed for an urban single lane roundabout.

According to the *Roundabouts: An Informational Guide* a roundabout is optimally located when the centerlines of all approaching legs pass through the center of the inscribed circle or if not possible a slight offset to the right is acceptable. This layout usually allows for the geometry to be optimally designed. For this design the roundabout was placed that the centerlines for the approaching legs from the eastern and from the southern side pass through the center of the circle, and the centreline of the leg approaching from the northern side has a slight offset to the right, complying with the standards.

A slight realignment of the approaches was required in order to meet the above requirements. The horizontal alignments of the approaches were adjusted by adding the following horizontal curves:

- Southern side of the roundabout – adding horizontal curve with radius of 150 m.
- Eastern side of the roundabout – adding horizontal curve with radius of 250 m.
- Northern side of the roundabout – adding horizontal curve with radius of 430 m.

The design vehicle plays an important role in the design of a roundabout. In section 6.2 *Queuing analysis* it states that 85% of traffic entering the light and light delivery vehicles, about 9m in length at the most. The 12.5 m rigid truck was chosen as the design vehicle. Section 6.2 states that the maximum length of the heavy vehicles entering the cargo terminal are 22m. Although the maximum length traversing the area will be 22 m, it was found that the 18.5 m semi-trailer has the more critical tracking path.

AutoTurn, a movement tracking software, was used to determine the required lane width of a 12.5 m rigid truck around the roundabout with an inscribed radius of 21.0 m. To provide the extra width required for an 18.5 m semi-trailer that occasionally pass through the roundabout, an apron of 3.0 m is provided.

The geometric elements of the roundabout are listed below and indicated in Figure 2.

7.1.1 Single lane roundabout:

Inscribed diameter: 42.0 m
 Inscribed radius: 21.0 m
 Radius of central island: 15.0 m
 Lane width of roundabout: 6.0 m

7.1.2 Apron:

Inner radius of apron: 12.0 m
 Width of apron: 3.0 m

Width of physical barrier between roundabout and bypass lane: 0.8 m

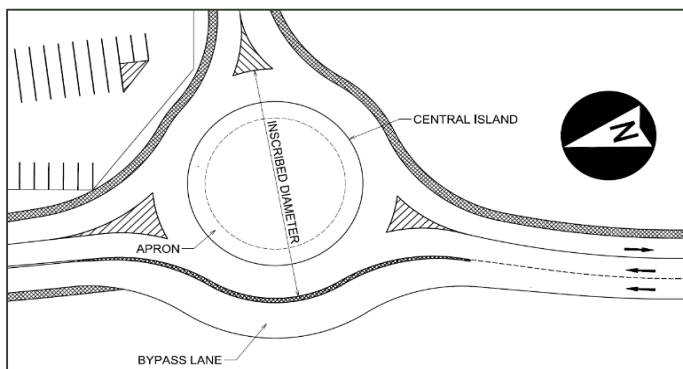


Figure 7-2: Roundabout Apron

7.1.3 Bypass lane:

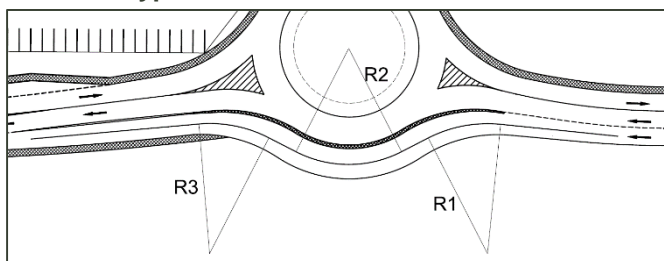


Figure 7-3: Roundabout Bypass Lane

The lane width of the bypass lane is: 6.5 m. The horizontal alignment of the bypass lane consists of a left curve, a right curve and another left curve. The radius of the horizontal curves respectively are indicated in Figure 3 and listed below:

- R1: 28 m
- R2: 25 m
- R3: 28 m

The concept design was checked in AutoTurn, to assure that the sweeping paths of the design vehicle was acceptable. Figure 4 and Figure 5 display the entrance and exit of the Cargo Terminal, whereas Figure 6 to Figure 8 display the design vehicle as it traverses the roundabout.



Figure 7-4 Entrance Sweep Path



Figure 7-5 Exit Sweep Path

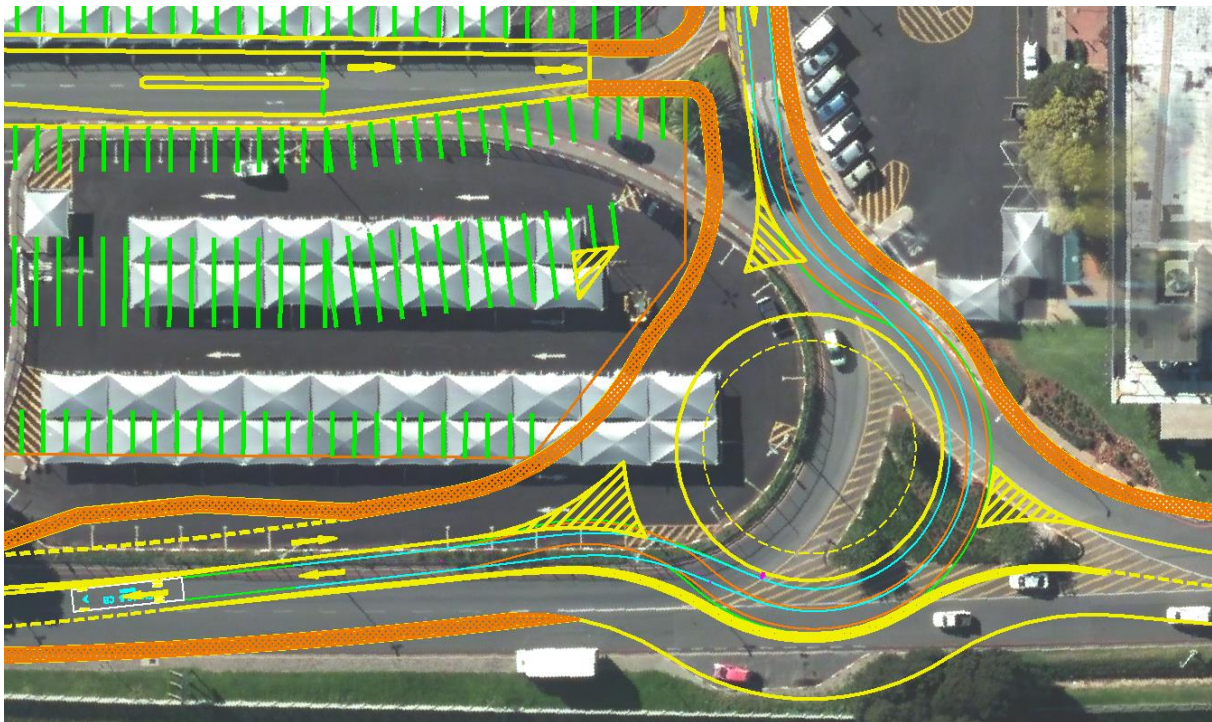


Figure 7-6 Roundabout Sweep Path

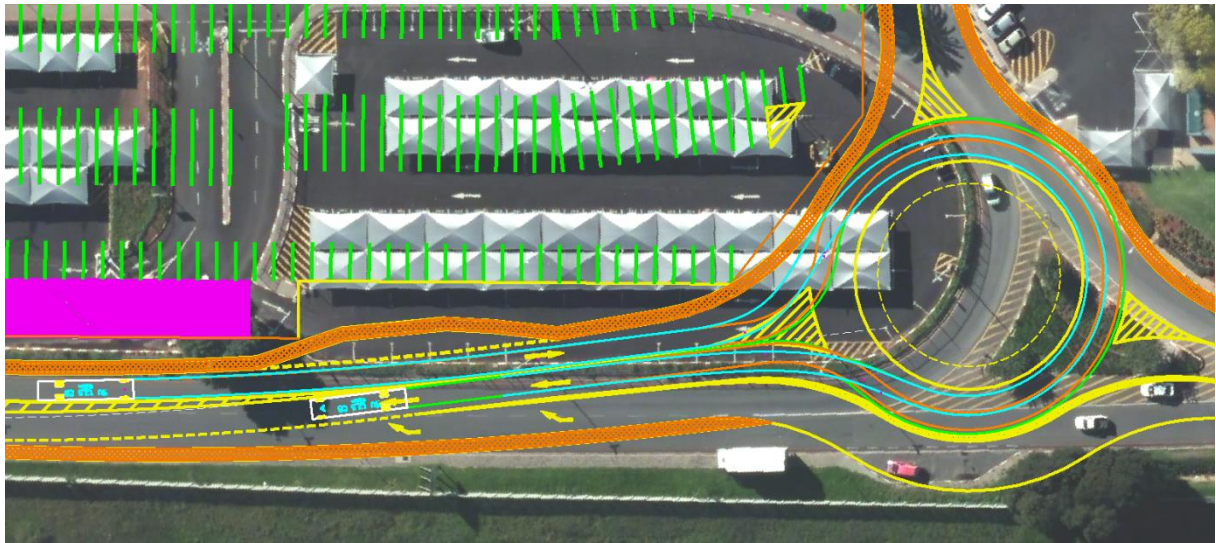


Figure 7-7 U-turn movement at Roundabout Sweep Path

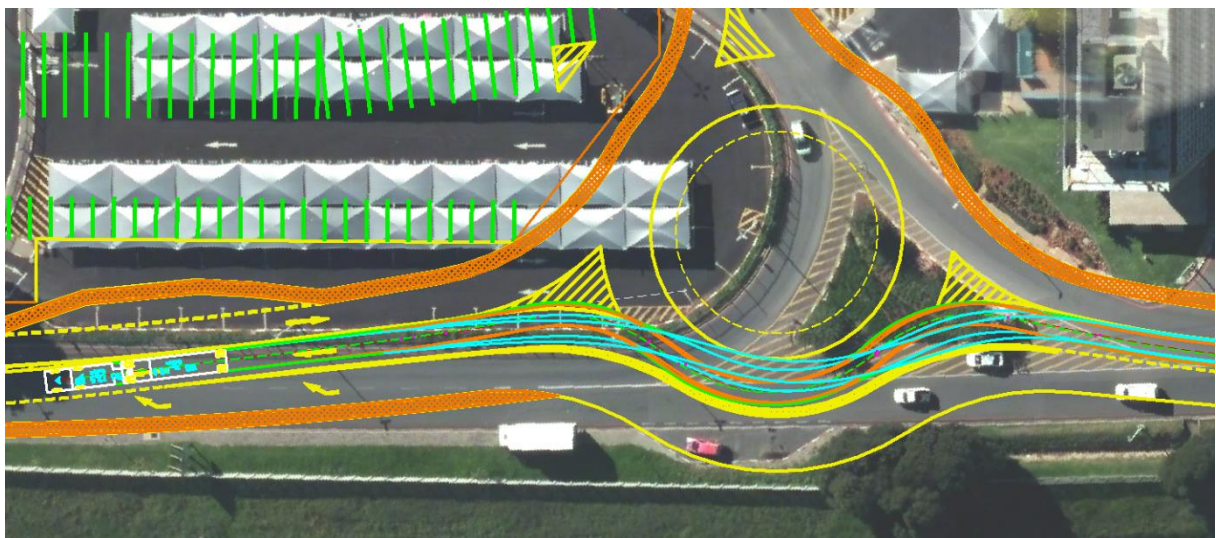


Figure 7-8 Bypass movement at Roundabout Sweep Path

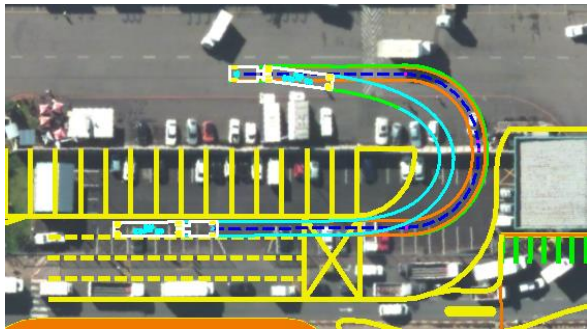


Figure 7-9 Semi-Trailer Sweep Path



Figure 7-10 Semi-Trailer Sweep Path

Figure 7-9 to Figure 7-11 show that the 18.5 m semi-trailers can pass through the entrance and exit and are accommodated by means of the apron at the roundabout.

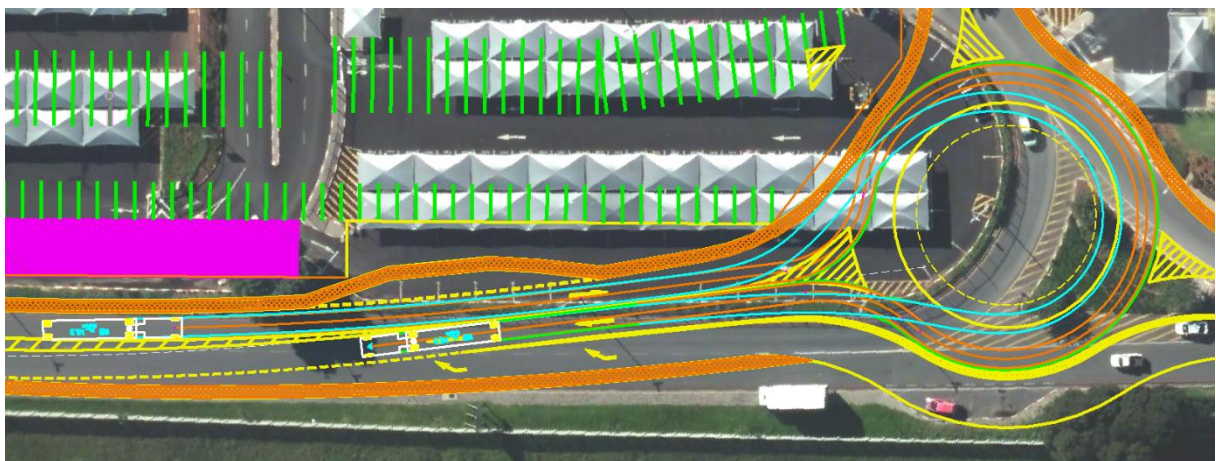


Figure 7-11 Semi Trailer, U-turn movement at Roundabout Sweep Path

The lane width of the design varies from 3.7 m to 6 m, as it ties the new concept design into the existing road. The lane width for the new concept design was based on the UTG 5 guidelines. The UTG 5 recommends a 3.7 m lane width for a two-lane collector road. These lane widths were widened to tie in with the existing lane widths of 6 m.

The lane width was also flared out at the roundabout for the following reasons. The capacity of the roundabout would be affected by narrower approaches as it will decrease the speed of the heavy vehicles entering the roundabout and thus the operating speed of the roundabout. The flaring is also required to accommodate the sweeping path of the design vehicle as it enters and exits the roundabout.

7.1.4 Entrance and Exit Gates of the Cargo Terminal

The lanes at the access gate are 3.7 m wide, allowing for 1.2 m between the heavy vehicles. It should be noted that after the heavy vehicles have entered the entrance gate, a maximum of 2 heavy vehicles will be able to turn into the cargo terminal area at any given time

At the exit gate of the cargo terminal area, two 4 m wide lanes were designed to provide sufficient space for the heavy vehicles turning onto the road. Though at any given time only one truck will be able to turn right into the eastern approach of the roundabout. Besides the sweeping paths of the heavy vehicles that need to be accommodated, there is also a safety aspect that should be considered. If two trucks would exit at the same time, the truck on the eastern side wouldn't be able to see oncoming traffic. It should be regulated by the exit gate that only one truck is allowed through and that the next truck can only exit if the previous truck has turned onto the road.

There is an additional 3 m wide lane, exclusively for light vehicles, to ensure that the exit procedure for light vehicles doesn't hold up the heavy vehicles exiting the cargo terminal.

The movements from the airside of the cargo area via the oversize gate to the proposed exit gate was also considered and is shown in Figures 12 and 13

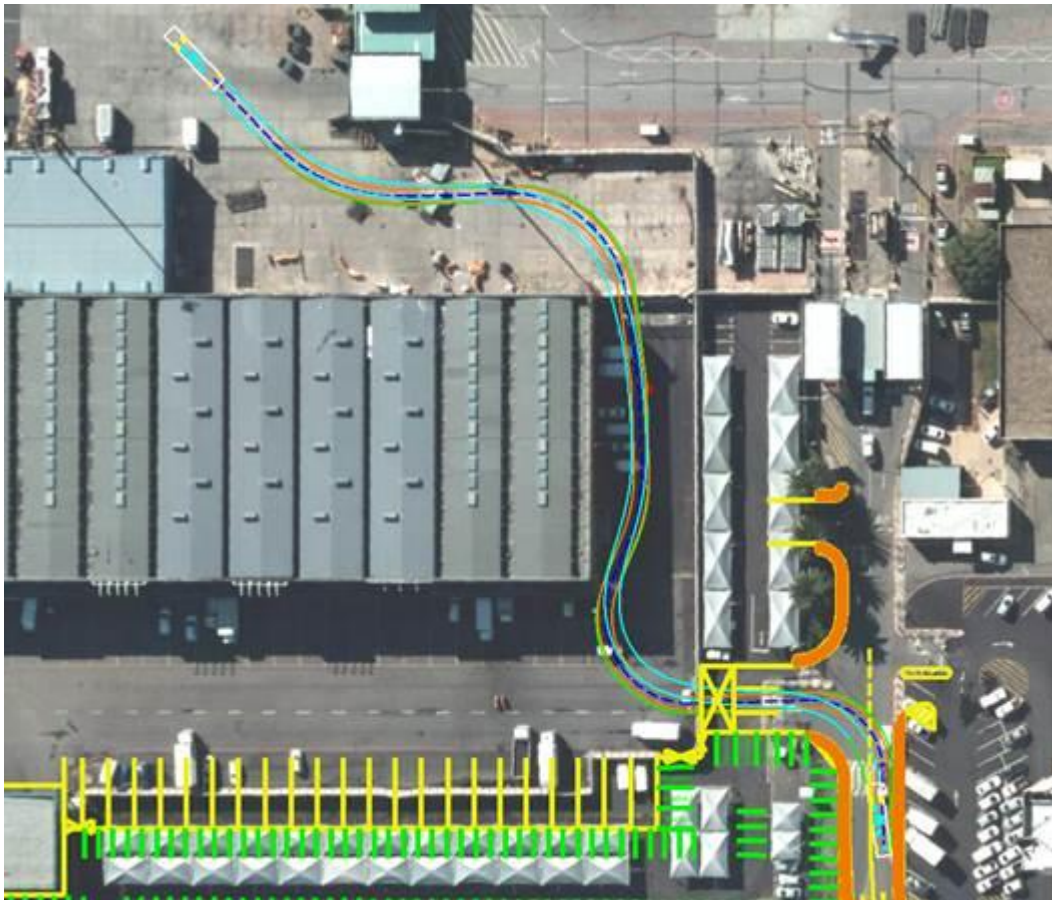


Figure 7-12 Rigid truck (12.5m), Exit from oversize airside access

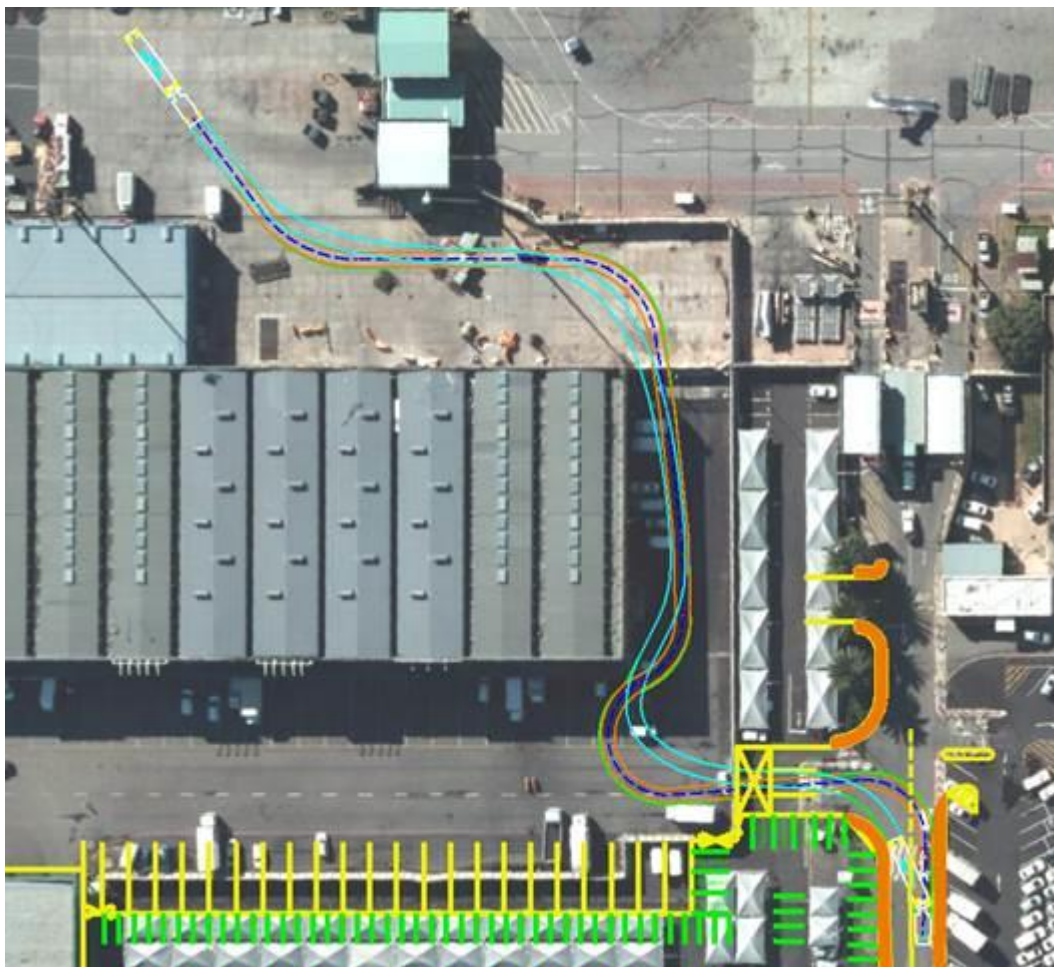


Figure 7-13 Semi Trailer, Exit from oversized airside access

7.1.5 Exit of the Parking Area

The distance between the exit of the parking and the roundabout, displayed in figure 14, is less than the required sight distance. Assuming a running speed of 35 km/h the required sight distance is 37.5m. The sight distance at that junction is only 26 m. It isn't possible to move the exit of the parking



Figure 7-124: Sight distance

area closer to the exit of the cargo terminal exit gate, due to the space constraint. The proposed position of the parking areas exit, was accepted as reasonable, due to the fact that low speeds are expected, as it leads to other parking areas and can almost be seen as part of the parking facilities. Additionally it is not considered a through road. Low traffic volumes are expected towards the airside, east bound and the use of a speedbump is proposed as a safety and traffic calming measure which will provided vehicles exiting the parking area with a sufficient gap to perform a right turn movement.

7.1.6 Tapered sections

Tapered sections have been designed in accordance with the taper rates for active and passive tapers as stated in the *Urban Transport Guidelines* (UTG 5). The specifications of the tapers are listed in the table below. Figure 15 indicates the positions of the tapers.

Table 6: Taper specifications

	Type	Design speed	Taper rate
TAPER 1	Turning lane taper	N/A	Between 1:2 and 1:10
TAPER 2	Active taper – painted line	35 km/h	1:20
TAPER 3	Passive taper – painted line	60 km/h	1:15
TAPER 4	Active taper – painted line	60 km/h	1:35

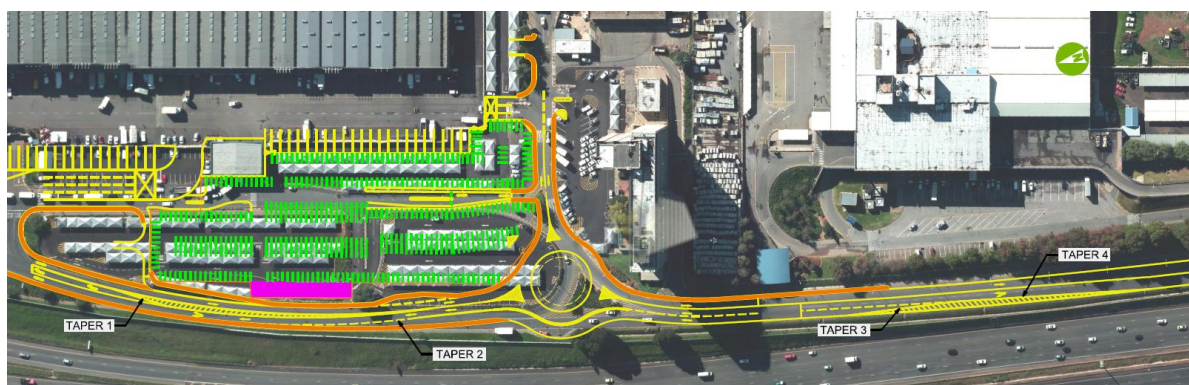


Figure 7-135: Active and Passive Tapers

7.1.7 Other notes:

Storm water drainage will need to be considered and designed in the preliminary design phase. The existing pavement will have to be evaluated. The pavement of the parking area has to be tested and analysed to determine whether it is appropriate to be used as roadway pavement or whether it should be removed and replaced.

8 Conclusions and Recommendations

[REDACTED] was appointed by [REDACTED] to carry out a traffic assessment to identify how to improve access to the OR Tambo International Airport (ORTIA) Cargo terminal.

Currently the positioning of the site access, access road and site layout in combination causes traffic congestion at the cargo facility access to back up towards Voortrekker Road and impacting on through traffic (non-cargo traffic). These factors present several operational challenges where various user groups, with different trip purposes and needs compete for road spaces resulting in vehicle conflict and unnecessary delays for both cargo and non-cargo traffic.

To improve the situation this study considered the following factors in better understanding the existing situation and in developing a solution:

- Lane capacity;
- Parking capacity;
- Access / gate capacity;
- Vehicle queueing;
- Relocation of the main gate;
- Trucks / heavy goods vehicles (HGV) parking/ holding facility;
- Traffic circulation;
- Vehicle weaving;
- Access configuration and geometry; and
- Conversations with the client to appreciate fully the needs and objectives to be addressed and achieved respectively.


The design philosophy was adopted aimed at:

- reconfiguring the cargo access;
- minimising vehicle conflict;
- identifying a road layout that supports optimum operational conditions for the cargo traffic; and
- separating cargo traffic from the general traffic.

In finding suitable access layout and road layout solutions several options (or possible solutions) were developed in the form of a number of drawings. The options had to satisfy the following key design considerations:

- Separation of cargo traffic from the general traffic;
- Minimise delays at the access;
- Minimise queueing at the access and or Voortrekker Road;
- Rationalisation of visitor parking;
- Provision of waiting area for trucks within the site; and
- Optimise access to the tenant parking area.

Following the development of several options and discussions with the client a preferred access and road layout concept was developed as shown in **Appendix A**. Two points of access to the cargo



terminal is proposed – an inbound access and a separate outbound access. In addition road layout changes are proposed.

The proposal comprise the following characteristics:

- 4 inbound lanes to the cargo terminal, and one lane dedicated to visitors and tenant parking / permit holders; dependant on an average service rate of 17 seconds at the cargo entrance.
- The stacking space required for the processing of cargo traffic is 52m from the entrance north of the access.
- The exit will be on the southern border of the terminal, and will comprise three outbound lanes; (may be a safety concern)
- Future tenant / permit parking with an entrance adjacent to the cargo entrance and an exit close to the airport building (Freight handlers' building) on the southern section of the parking area allocated;
- A truck waiting area will be provided inside the cargo terminal, near the site entrance;
- Through / general traffic will be diverted away from the cargo traffic, on approach to the entrance, and the current southbound carriageway of Voortrekker Road will be converted to a Cargo Terminal access road;
- The current northbound carriageway of Voortrekker Road will be converted into a two-lane bi-directional road;
- A roundabout will be provided on the reconfigured Voortrekker Road, just south of the cargo terminal. This is to ensure that all traffic using the area currently will be able to continue doing so in the future without lengthy additional journey distance or time;
- The existing SAPS facility will be relocated to a suitable location within the terminal. The exact location will be confirmed by [REDACTED] at a later stage but could be considered at the location of the existing access gate; and
- A Public Transport layby is be provided on Voortrekker Road.

The change in traffic circulation is expected to have a relatively low impact on the local road network and will have major traffic impact advantaged in the form of reduced traffic delay, reduced congestion and logistical time saving. Capacity analysis have demonstrated that the re-configured access arrangement and local road network will continue operating at acceptable levels of service with minimal delays.

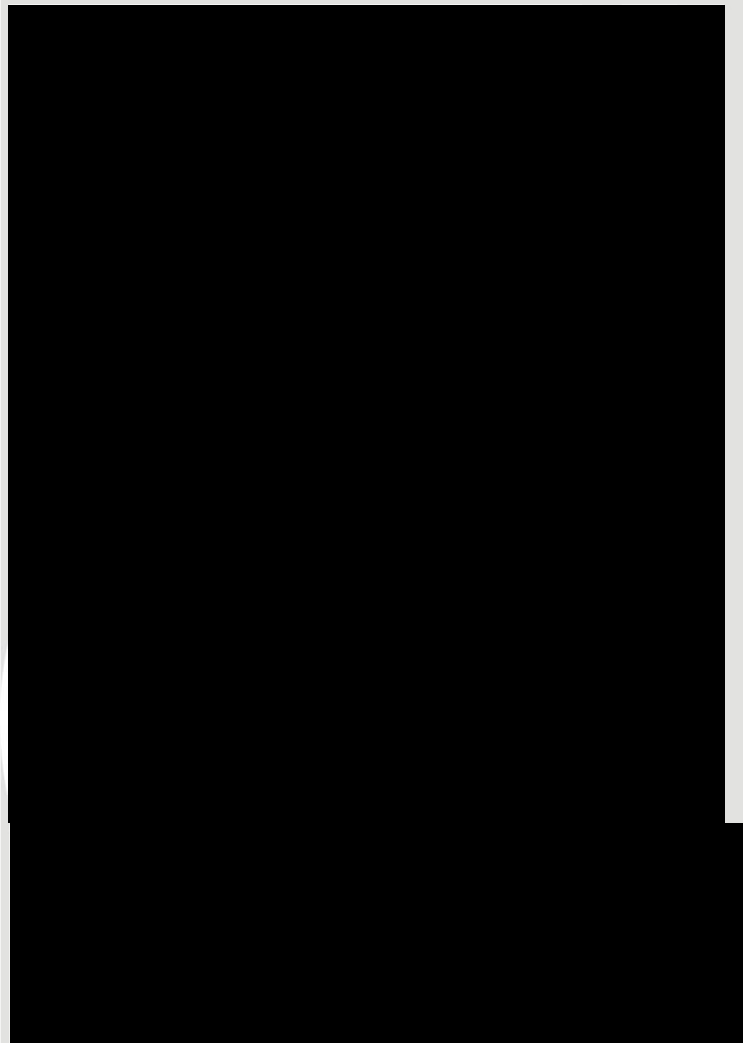
The change in access arrangements will result in additional traffic capacity at the cargo terminal entrance. The separation of general traffic from the cargo traffic will reduce vehicle conflict and improve the efficiency of the access. Separating the inbound and outbound traffic will also result in even further reduction in vehicle conflicts within the terminal.

The proposed re-configuration of the OR Tambo International Airport (ORTIA) Cargo Terminal is supported from traffic engineering and transport planning perspective and is recommended for implementation, subject to detailed design of proposals defined in Appendix A. The cost of effecting the changes will be the responsibility of the client [REDACTED]



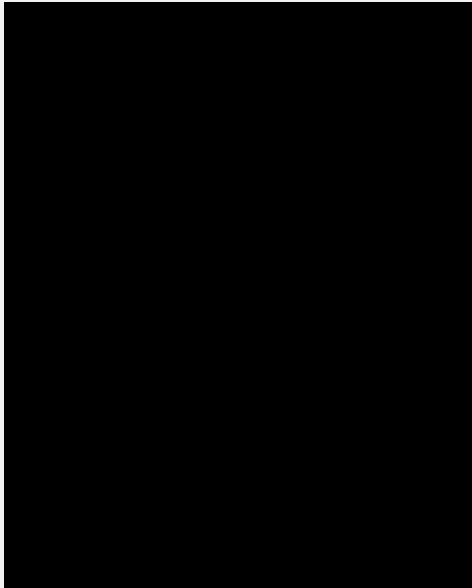
Appendix A

New Concept Layout



Appendix B

Flow diagrams and Capacity Analysis (Sidra) Results



offices are located in:

Angola, Australia, Botswana, Chile, China,
Ethiopia, Ghana, Hong Kong, Indonesia,
Lesotho, Libya, Malawi, Mozambique,
Namibia, New Zealand, Nigeria,
Philippines, Qatar, Singapore, South Africa,
Swaziland, Tanzania, Thailand, Uganda,
United Arab Emirates, Vietnam and Zimbabwe.

