WORLDWIDE HEAVY TRANSPORTATION AND LIFTING

ALE

SMARTER, SAFER, STRONGER

Noblesfontein Wind Energy Project

ROUTE SURVEY

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1. INTRODUCTION

1.1. EXECUTIVE SUMMARY

This Route Survey Report is concerned with the port operations and transport feasibility of the Noblesfontein Wind Energy Project, located on the Northern Cape of South Africa.

The survey investigates the respective routes (possible, feasible and cleared) from the port of arrival, Saldanha, to the proposed wind energy site. The site is located on the outskirts of three sisters in the Northern Cape and ± 680km in driving distance from the port of arrival being Saldana to the town of Noblesfontein.

It is the aim of this Route Survey Report to define and describe the constraints and pinch points, as well as equipment and possible solutions or alternatives that will be required to successfully complete the inland transportation of the wind turbine components.

In order to achieve this, ALE will survey and record route data, then apply and simulate the givens with conventional equipment, as well as investigate alternatives to conventional equipment, should the need arise to do so.

1.2. BACKGROUND INFORMATION ABOUT NOBLESFONTEIN:

Noblesfontein is a railroad station in the region of Northern Cape, the country of South Africa with an average elevation of 1,287 meter above sea level. The location is sparsely populated with 0 people per km2. The nearest town larger than 50,000 inhabitants takes about 4:31 hour by local transportation.

An estimated 1.59% of the children below 5 years old are underweight, with a mortality of 50 per 1,000 births.

Natural Hazards

Noblesfontein can have low impact (v or less) earthquakes (on average one every 50 years), with occurrences at <5 Richter. When an earthquake occurs, it may be felt indoors by many people, outdoors by a few people during the day. At night, some people may be awakened.

Nature

Noblesfontein has a semi-arid (0.2 - 0.5 p/pet) climate. The land area is not cultivated; most of the natural vegetation is still intact. The landscape is mostly covered with closed to open grassland. The climate is classified as a mid-latitude desert, with a warm temperate desert scrub bio zone. The soil in the area is high in calcisols, cambisols, luvisols (cl), soils dominated by calcium carbonate as powdery lime or concretions.

Location of Noblesfontein

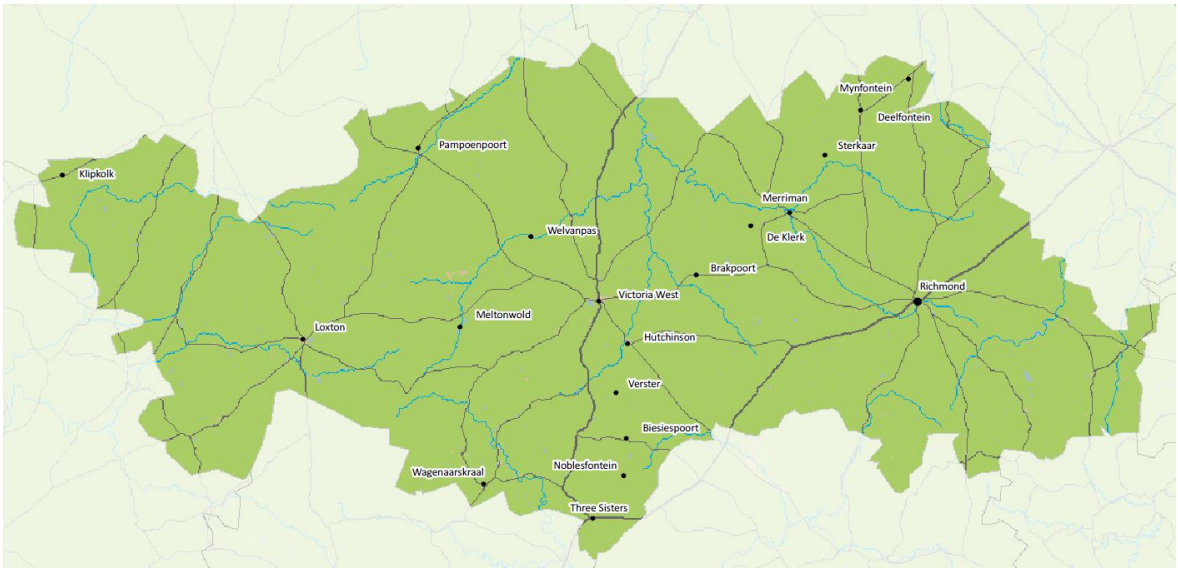


Figure 1: location of Noblesfontein within the Northern Cape.

1.3. BACKGROUND INFORMATION ON A SUITABLE PORT OF ARRIVAL:

1.3.1. The Port of Saldanha Bay

The Port of Saldanha Bay, South Africa's largest natural anchorage and port with the deepest water is 60 nautical miles northwest of Cape Town. Situated at Longitude 17º 58' E and Latitude 33º 02' S, Saldanha Bay is partly protected by a 3.1km long artificial breakwater.

Port Limitations:

The port of Saldanha Bay accepts vessels of up to 20.5m draught although the harbour master conditionally accepts vessels with a draught of 21.5m. The port entrance channel is dredged to a depth of -23m Chart Datum and -23.7m CD at the commencing of the entrance channel. The entrance channel has a minimum width of 400m. The turning basin seaward of the jetty has a diameter of 580m and a depth of -23.2m CD.

The draught at the multi purpose quays is 12m for berth 201 and 13.5m for berths 202 and 203. Pilotage is compulsory and tugs are required for ship working.

Marine Craft:

Saldanha Bay is served by a fleet of three tugs assisted by a fourth sent from Cape Town when required (vessels exceeding a draught of 19m require four tugs). The Saldanha based tugs are named Jutten, Marcus and Meeuw and are 1976-built Voith Schneider tractor tugs each with a bollard pull of 43 tonnes.

Pilotage service is compulsory and is provided by a diesel-powered pilot boat named Ivubu. The port has two launches named Sysie and Dikkop.

Port Volumes:

During the financial year 2008/09 ended 31 March 2009 the Port of Saldanha Bay handled a total of 452 ships with a total gross tonnage of 25,423,117-gt.

In 2008/09 cargo handled by the port totalled 50,282,909 tonnes, including oil. Of this total 49,632,380t was bulk cargo (33,958,761t exports; 13,966,243t imports; and 1,707,376t transhipped), and 650,529t break-bulk (603,115t exports and 47,414t imports). The port handled no containers during 2008.

Port Facilities:

Saldanha Bay is a common user port. The port has a 990m long jetty containing two iron ore berths linked to the shore along a 3.1km long causeway/breakwater. There is also an 874m long multipurpose quay for the handling of break-bulk cargo and a 365m tanker berth at the end of the ore jetty with a permitted draught of 21.25m alongside.

The iron ore jetty is 630m long with a permitted draught of 21.25m alongside. The multi purpose quays (berths 201-203) are a total of 874 long with a max draught permitted between 12m and 13.4m. Cargo handled at the multi purpose terminal includes various mineral exports, steel coils and pig iron. Imports include anthracite, coking coal and steel pellets.

Port control operates 24 hours a day. There are no bunkering facilities at Saldanha Bay. A full diving service is available for ship inspection and other services but ship repair is limited mainly to the fishing industry. Large ship repairs can however be carried out by services provided from Cape Town.

The port has a full chandelling and stevedore service available. Saldanha Bay has yachting marina facilities and a NSRI base for sea rescue.

1.3.2. Levels of storage within the port:

The 874m MPT quay of Saldanha can be used as a temporary storage area of Wind Turbine Generator (WTG) components. The area available is + 56.000m². Special arrangements must to be obtained from the port.

Picture 1: MPT and storage within the port.

1.3.3. Levels of storage outside the port:

ALE has identified a 45.000m² area fenced off outside the port. The area needs to be cleared and compacted and approval must be obtained from Transnet for the use of the area.

Picture 2: Temporarily lay down area outside the port.

1.3.4. Port Handling:

The WTG component will arrive on a geared vessel, i.e. a vessel with its own cranes to offload (pictured below).

Picture 3: Geared Vessel

The components will be received free Alongside Ship (FAS) onto suitable transport combinations for transport to the lay down area. The components will be offloaded // reloaded onto transporters with one, or a combination of, the mechanical handling machinery; mobile cranes, forklift trucks, truck mounted cranes, reach stackers, mobile gantry (pictured below).

Picture 4: Mobile gantry for port // laydown handling.

Picture 5: Reach stackers for port // laydown handling.

2. GENERAL SPECIFICATIONS OF WIND TURBINE COMPONENTS

2.1. SUMMARY

The request was to survey the routes for maximum sized loads for the V100 (1.8MW) model, with regards to dimensions and weight, using appropriate equipment combinations:

- ±3.811m height and 3.894m width clearance on all roads (geometric clearance);
- Swept area for blades on bends are usually between 49m to 49.120m blade;
- Nacelle loading of +79.8 tonnes excluding a suitable vehicle.

Picture 6: V112 (3MW) WTG.

3. SCOPE OF ROUTE SURVEY

3.1. ROUTES SURVEYED

1. Route1: Port of Saldanha on the OP599 ('Die Verbindings Pad') in the direction R27; Velddrif // Cape Town.
2. Bypass route: Port of Saldanha on the MR559 (Camp road) direction Langebaan; turn off on the OP538 Vredenburg road to the intersection with the R27; Velddrif // Cape Town.

3.2. DELIVERABLES PER ROUTE SURVEYED

1. All obstacles that could restrict WTG component dimensions and/or weight;
2. GPS coordinates of all obstacles;
3. Photographic record of all obstacles;
4. Best practice and procedures to be followed when transporting the WTG components;
5. Suggested solutions to overcome obstacles that could restrict WTG component dimensions and/or weight.

3.3. EXTENT OF ROUTE SURVEY PERFORMED:

1. All O/H power lines and telephone cables were recorded.
2. O/H power lines and telephone cables below 10m height were measured and recorded.
3. Any road furniture that could restrict WTG component dimensions was recorded.
4. All bridges were recorded.
5. All culverts that could restrict WTG component weight were recorded.
6. All hairpin turns that could restrict WTG component dimensions were recorded.
7. All road incline/decline angles that could restrict WTG component dimensions and/or weight were recorded.
8. Any road conditions that could deter transport combinations were recorded.

Refer to Appendix A for corresponding Route Findings

4. ROUTE DESCRIPTION

4.1. BASIC ROUTE DESCRIPTION:

Route 1:

- Exit the Saldanha Port main entrance on the OP599 ('Die Verbindings Pad')
- Turn right from OP599 ('Die Verbindings Pad') onto the OP599 ('Die Verbindings Pad') in the direction of the R27, Velddrif.

Bypass route:

- From the OP599 ('Die Verbindings Pad') road onto gravel bypass before the bridge 5953;
- Turn right from the gravel bypass onto the MR559 (Camp road) direction Langebaan.
- Turn left from the MR559 (Camp road) direction Langebaan onto the OP538 Vredenburg
- Turn right from the OP538 Vredenburg road onto the OP599 ('Die Verbindings Pad')

Route 1 and bypass route continued:

- Continue on the OP599 ('Die Verbindings Pad')
- Turn left from OP599 ('Die Verbindings Pad') onto the R27 direction Velddrif.
- Turn right form the R27 direction Velddrif onto the R45 Hopefield/Malmesbury road.
- R45 though Hopefield until N7 near Malmesbury
- Turn left on N7 towards Morreesburg
- Turn right on R311 to Riebeeck West, Riebeeck Kasteel
- Turn left on R46. Continue to R44
- Turn left on R44 – becomes R46
- Turn right to Wolseley, through Wolseley – becomes R43
- Continue on R43 to Worcester
- Turn left on the N1 to Worcester
- Through Worcester and continue on the N1 towards Beaufort West.
- Continue on the N1 thought Beaufort West to three Sisters
- Just after three sisters, turn left on dirt road (on private farm) to Noblesfontein.

5. ROUTE SURVEY

5.1. OVERVIEW OF ROUTES SURVEYED

5.1.1. Map of route(s) surveyed; (Google Earth image)

Picture 6: Route Overview: Saldanha Bay to Noblesfontein Wind Energy Project.

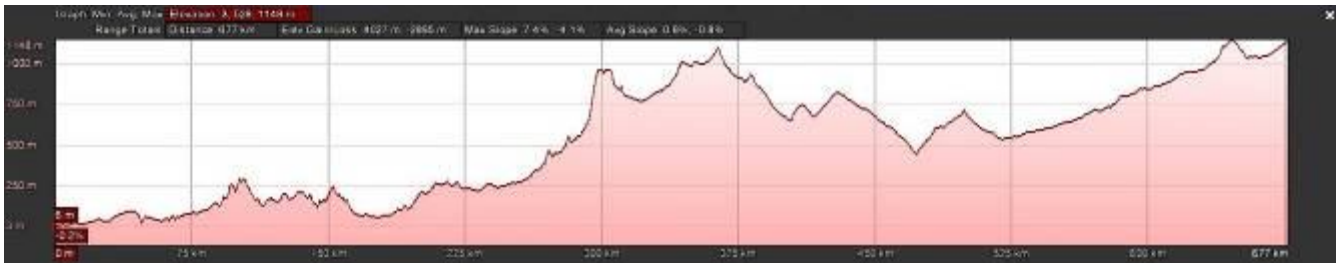
5.1.2. Elevation Profile:

Graph 1: Elevation Profile of the route from Saldanha to Noblesfontein Wind Energy Project.

5.2. ROUTE 1: PORT OF SALDANHA ON THE OP599 ('DIE VERBINDINGS PAD') TO NOBLESFONTEIN WIND ENERGY PROJECT.

5.2.1. Map of Route:

5.2.2. Elevation Profile:



Graph 2: Elevation Profile of the route 1 from Port of Saldanha to the conjunction with the bypass route.

5.2.3. Picture of Route:

Port of Saldanha Multi Purpose Terminal (SMPT).

Overview of the Port of Saldanha Multi Purpose Terminal (SMPT)

NOTES:

No O/H obstructions recorded

km Reading: 0.0km

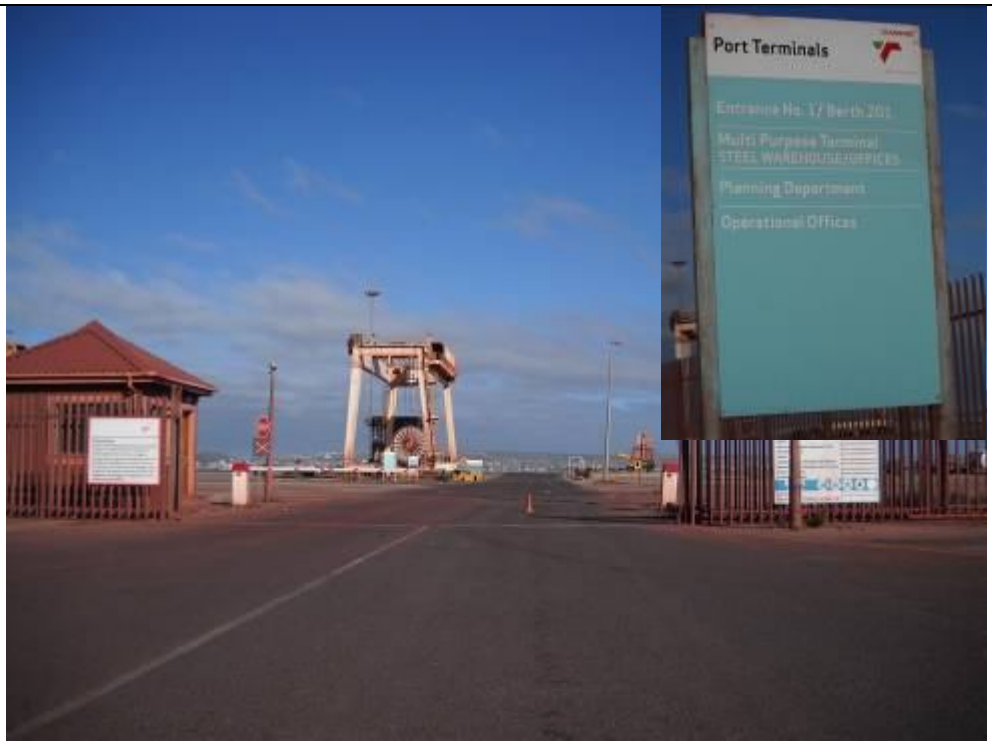
Port of Saldanha Multi Purpose Terminal (SMPT) Entrance No. 3

NOTES:

No O/H obstructions recorded

km Reading: 0.3km

Port of Saldanha Multi Purpose Terminal (SMPT) Entrance No. 2



NOTES:

No O/H obstructions recorded

km Reading: 0.6km

Port of Saldanha Multi Purpose Terminal (SMPT) Entrance No. 1

	NOTES: No O/H obstructions recorded km Reading: 0.8km
Exit the Multi Purpose Terminal (SMPT) onto the OP599 (‘Die Verbindings Pad’)	
	NOTES: km Reading: 0.9km
L/H Turn on the OP599 (‘Die Verbindings Pad’)	

NOTES:

No O/H obstructions recorded

km Reading: 0.9km

R/H Turn on the OP599 (‘Die Verbindings Pad’)

NOTES:

No O/H obstructions recorded

km Reading: 2.5 – 2.8km

Construction in progress. Further investigation is required to establish the completion date and the end result of the entrance.

Temporary access bypass on the OP599 (‘Die Verbindings Pad’)

NOTES:

No O/H obstructions recorded

km Reading: 2.5 – 2.8km

Construction work in progress on the road OP599 (‘Die Verbindings Pad’)

NOTES:

Height clearance of 5.4m available.

Suitable bypass route recorded and route has been identified as has been elaborated as a alternative//bypass section.

Width of bridge: 13m

km Reading: 3.4km

Bridge 5994 over the OP599 (‘Die Verbindings Pad’)

NOTES:

High voltage O/H power lines recorded with a height clearance of > 8m

km Reading: 3.8km

High voltage O/H power lines on the OP599 (‘Die Verbindings Pad’)

NOTES:

Height clearance of 5.2m available.

km Reading: 5km

Bridge no. 5974 over the OP599 (‘Die Verbindings Pad’)

NOTES:

High voltage O/H power lines recorded with a height clearance of > 8m.

km Reading: 5.2km

High and low voltage O/H power lines on the OP599 (‘Die Verbindings Pad’)

NOTES:

Remove all street furniture to increase inside and outside turning radius.

km Reading: 5.6km

R/H Turn from the OP599 (‘Die Verbindings Pad’) onto the R27 direction Velddrif / Cape Town

NOTES:

Load bearing capacity: 21.7kN/m^2

Width of bridge: 12m

km Reading: 8.8km

Bridge 5370 over railway on the R27 direction Velddrif / Cape Town

NOTES:

High voltage O/H power lines recorded with a height clearance of > 8m.

km Reading: 9.9km

High voltage O/H power lines on the R27 direction Velddrif / Cape Town

5.3. ROUTE SURVEY; BYPASS ROUTE//ALTERNATIVE ROUTE.

5.3.1. Map of Route:

5.3.1. Elevation Profile:

Graph 3: Elevation Profile of the bypass route from Port of Saldanha to the conjunction with route 1.

5.3.2. *Picture of Route:*

Overview on Option A and B.

NOTES:

No O/H obstructions recorded

km Reading: 0.0km

L/H Turn from the OP599 ('Die Verbindings Pad') road onto gravel bypass

NOTES:

No O/H obstructions recorded.

km Reading: 0.3km

R/H Turn from the gravel bypass onto the MR559 (Camp Road) direction Langebaan.

NOTES:

Load bearing capacity: 21.7kN/m^2

km Reading: 0.5km

Bridge 5994 over the OP599 ('Die Verbindings Pad')

NOTES:

No O/H obstructions recorded.

Construction in progress. Stop go system in place (single lane only) Could prohibit abnormal transport combinations from passing through. Further investigation is required to establish the completion date.

km Reading: 3.6km

Construction work in progress on the MR559 (Camp Road) direction Langebaan.

NOTES:

Construction in progress. Stop go system in place (single lane only) Could prohibit abnormal transport combinations from passing through. Further investigation is required to establish the completion date.

km Reading: 3.8km

L/H Turn from the MR559 (Camp Road) on to the OP538 Vredenburg Road.

NOTES:

High voltage O/H power lines at 6.2km which has been recorded > 8m.

Construction in progress. Stop go system in place (single lane only) Could prohibit abnormal transport combinations from passing through. Further investigation is required to establish the completion date.

km Reading: 7.2km

R/H Turn from the OP538 Vredenburg Road onto the R27; Veldrif / Cape Town

NOTES:

km Reading: 7.2km

L/H Turn from where the OP538 Vredenburg Road meets the R27; Velddrif/ Cape Town

NOTES:

High voltage O/H power lines recorded with a height clearance of > 8m.

Note: Position of O/H power lines used as the meeting point between route 1 and the bypass route.

km Reading: 7.2km

High voltage O/H power lines on the R27 direction Velddrif / Cape Town

NOTES:

No O/H obstructions recorded

Remove all street furniture to increase inside and outside turning radius.

km Reading: 8km

L/H Turn from the OP599 (‘Die Verbindings Pad’) onto the R27 direction Velddrif

NOTES:

No O/H obstructions recorded

Remove all street furniture to increase inside and outside turning radius.

km Reading:14.8km

R/H Turn from the R27 direction Velddrif onto the R45 Hopefield/Malmesbury

NOTES:

Construction in progress. Stop go system in place (single lane only) Could prohibit abnormal transport combinations from passing through. Further investigation is required to establish the completion date.

Remove all street furniture to increase inside and outside turning radius.

km Reading: 14.9 - 19km

Construction work in progress on the R45 Hopefield/Malmesbury.

NOTES:

Low voltage O/H power lines recorded with a height clearance of > 8m.

km Reading: 15.6km

Low voltage O/H power lines on the R45 Hopefield/Malmesbury.

NOTES:

Substation on left hand side of the R45

High voltage O/H power lines recorded with a height clearance of 6.4m

km Reading: 23.9km

High voltage O/H power lines on the R45 Hopefield/Malmesbury

NOTES:

Substation on left hand side of the R45

High voltage O/H power lines recorded of 6.4m height clearance.

Alternative bypass sectional route can be constructed on the left hand side to increase the laden height to 7.6m

km Reading: 23.9km

NOTES:

Low voltage O/H power lines recorded with a height clearance of
< 8m.

km Reading: 42.8km

Low voltage O/H power lines on the R45 Hopefield/Malmesbury.

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 43.1km

Bridge no. 4745 over the Sout River on the R45

NOTES:

OK

Road width: 12.5m

Km Reading: 79.2km

Well maintained tar road on the R45

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Tracking to be simulated.

Km Reading: 109km

L/H Turn from the R45 onto the N7

NOTES:

Bridge width: 12.5m

Km Reading: 135km

Culvert under well maintained tar road on the R45

NOTES:

Overview

Remove all street furniture to increase inside and outside turning radius.

Tracking to be simulated.

Km Reading: 136.2km

R/H Turn from N7 onto the R311

NOTES:

Load bearing capacity to be confirmed.

Road width: 12.56m

Km Reading: 140.2km

General Large size culvert on road R311

NOTES:

High voltage O/H power and Telecom lines recorded with a height clearance of < 8m.

Wire to be lifted/ propped.

Km Reading: 143.2km

O/H Power Lines in the town of Riebeeck Kasteel on the R311

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Tracking to be simulated.

Km Reading: 167.8km

L/H Turn from the R311 onto the R46

	NOTES: Load bearing capacity to be confirmed. Road width: 12.5m Km Reading: 175.8km
Bridge 4546A over stream on road R46	
	NOTES: Load bearing capacity to be confirmed. Road width: 11.5m Km Reading: 177.6km
Road over Railway line on the R46	

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Km Reading: 177.6km

L/H Turn from the R46 onto the R45

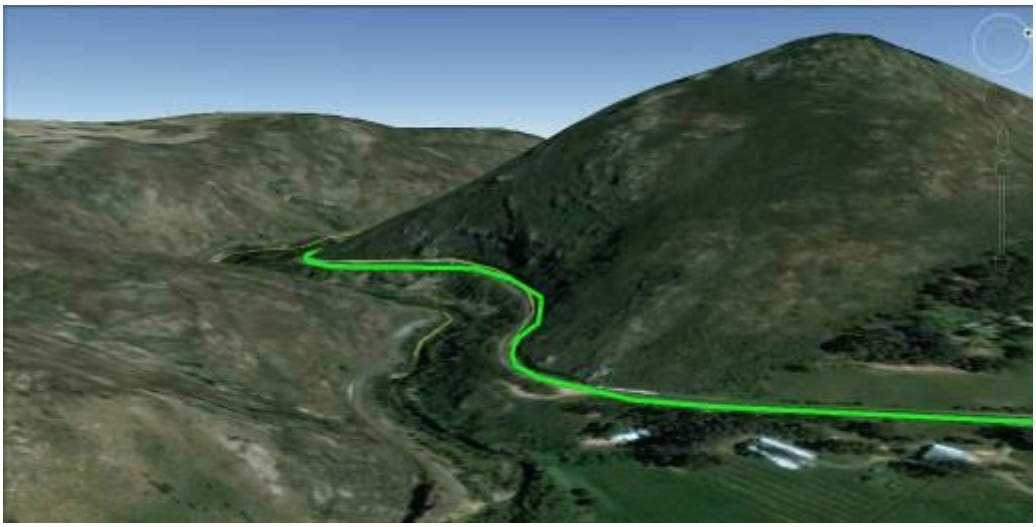
NOTES:

Load bearing capacity to be confirmed.

Road width: 12.5m

Km Reading: 197.8km

Bridge 4084 over river on the R45



NOTES:

Tracking to be simulated

Sharp corners on pass.

Sharp corners at the Nuwekloofpas on the R46 direction Tulbagh.

NOTES:

Roadwork's are in progress on route R45.

Km Reading: 195.4km

Road Conditions on the R45

NOTES:

Remove all street furniture to increase outside turning radius.

Tracking to be simulated at intersection.

Road width: 4.2m

Km Reading: 206.9km

R/H Turn from the R46 onto the R46

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Km Reading: 207.2km

R/H Turn from the R45 onto the R303

NOTES:

Load bearing capacity to be confirmed.

Road width: 12.5m

Km Reading: 216km

Bridge 5225 over river on the R303

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Km Reading: 225km

R/H Turn from the R303 onto the R43

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Tracking to be simulated.

Km Reading: 231.9km

L/H Turn from the R43 onto the R46

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 248.1km

Bridge 3071 over river on the R46

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Km Reading: 248.1km

L/H Turn from the R46 onto the N1

NOTES:

O/H Bridge over the N1 recorded with a height clearance of 5.81m.

Km Reading:252.2km

Use off ramp 108 on the N1 to avoid the overhead bridge in Worcester

NOTES:

High voltage O/H power lines recorded with a height clearance of 9.95m.

km Reading:248.1km

O/H power Lines on the N1

NOTES:

O/H Bridge over the N1 recorded with a height clearance of 5.3m

No bypass route recorded.

Km Reading: 252.2km

Bridge no. 5009 over the N1.

NOTES:

Km Reading: 256.1km

Bridge over railway on the N1.

NOTES:

Road width restriction between mountains.

Km Reading: 262km

On the N1 direction De Doorns

NOTES:

O/H Bridge over the N1 recorded with a height clearance of 5.4m

No bypass route recorded.

Km Reading: 275km

Bridge over the N1.

NOTES:

O/H pedestrian bridge over the N1 recorded with a height clearance of 6.1m.

No bypass route recorded.

Km Reading: 276.2km

Overhead pedestrian bridge on the N1 in De Doorns

NOTES:

Load bearing capacity to be confirmed.

Sharp hairpin corners recorded on pass

7.4% Incline on tar road. Traction to be calculated.

Tracking to be simulated

Km Reading: 285.7km

Hex river pass on the N1 in the direction of Touws River

NOTES:

Km Reading: 298.7m

Road conditions on top of the Hex river pass on the N1 direction Touws River

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 315.5km

Bridge over the Donkies River on the N1.

NOTES:

O/H Power and Telephone Lines recorded with a height clearance of <8m.

Km Reading:317.3 km

O/H Power and Telephone Lines in the town of Touws River

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 321.3km

Bridge 5076 over Touws River on the N1.

NOTES:

Load bearing capacity to be confirmed.

Km Reading:328.1 km

Bridge 5077 over Simonsleegte River on the N1.

NOTES:

Construction in progress. Stop go system in place (single lane only) Could prohibit abnormal transport combinations from passing through. Further investigation is required to establish the completion date.

km Reading: 348.1km

Construction work in progress on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 362.1km

Bridge 5079 over the Monument River on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading 368.1km

Bridge 5050 over the Baviaans River on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading:372.9km

Bridge 5081 over the Boelhouer River on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading;
379.1km

Bridge 4082 over the Doornfontein river on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 396.1km

Bridge 4083 over the Wilgerhout river in the direction of Lainsburg on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading:397.6km

Bridge 4083 over the Buffels river in the direction of Lainsburg on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 398.5km

Bridge 5000 over river in the direction of Beaufort West on the N1

NOTES:

Construction in progress. Stop go system in place (single lane only) Could prohibit abnormal transport combinations from passing through. Further investigation is required to establish the completion date.

km Reading: 398.6km

Construction work in progress on the N1direction Beaufort West.

NOTES:

Construction in progress. Stop go system in place (single lane only) Could prohibit abnormal transport combinations from passing through. Further investigation is required to establish the completion date.

km Reading: 440.1km

Construction work in progress on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 442.7km

Bridge 5001 over Railway in the direction of Beaufort West on the N1

NOTES:

O/H Power Lines recorded with a height clearance of >8m

Load bearing capacity to be confirmed.

Km Reading: 480km

O/H Power Lines in the Small town of Leeu Gamka direction of Beaufort West on the N1

NOTES:

O/H Power Lines recorded with a height clearance of >8m.

Km Reading: 492.7km

O/H power Lines in the direction of Beaufort West on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 520.8km

Bridge 4918 over the Leeu River in the direction of Beaufort West on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading:581.6km

Bridge over the Railway in the direction of Beaufort West on the N1

NOTES:

O/H Power Lines recorded with a height clearance of >8m.

Wire to be lifted/ propped

Km Reading: 582km

O/H power Lines in the town of Beaufort West on the N1

NOTES:

O/H Power Lines recorded with a height clearance of <8m.

Wire to be lifted/ propped

Main road of Beaufort West on the N1

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Tracking to be simulated.

Enter roundabout and take the 3rd exit in the direction of Johannesburg on the N1.

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 595.2km

General Overhead bill boards in the direction of Johannesburg on the N1.

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Km Reading: 599.1Km

Bridge B1917 over the Kuilspoort river in the direction of Johannesburg on the N1

NOTES:

Remove all street furniture to increase inside and outside turning radius.

Tracking to be simulated.

Km Reading: 615.4km

Bridge B1919 over the Platdoorns river in the direction of Johannesburg on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 655.4km

Bridge B1920 over Courland river in the direction of Johannesburg on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 667.6km

Bridge B1921 over Krom river in the direction of Johannesburg on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 667.6km

Bridge over the Karee river in the direction of Johannesburg on the N1

NOTES:

Load bearing capacity to be confirmed.

Km Reading: 680km

L/H Turn from the N1 onto a gravel section (Private Farm) to Noblesfontein

NOTES:

Location of the Noblesfontein Wind Energy Project

5.4. ROUTE 1 PINCH POINTS:

5.4.1. Hairpin Turns and Steep Inclines/Declines

Hairpin turns have been recorded on both route 1 and the bypass route. The turns will pose a restriction to the blade in its current condition. Works, such as removal of road furniture and backfilling, levelling/compacting of inside corners, are required to remove the restriction.

Various hairpin turns and steep inclines/declines have been recorded on the Nuwekloof and the Hexrivier pass.

The Nuwekloof pass is just before Tulbagh is approximately 190km from the Port of Saldanha which has Inclines of 2.5 – 3.5% recorded en route. The pass also has some sharp corners from where the longer items such as the blades and the longer tower sections may interferer with the mountains.

The Hexrivie pass is approximate 322.4km from the port of Saldanha which has inclined of up to 7.4%. The steep inclined could however be navigated with the addition tractors. The hairpin corner on the Hexrivie pass will affect the longer pieces such as the blades and the longer tower sections.

Tracking drawings simulating the sweeping patch of the blade should be constructed for all hairpin turns to establish the exact amount of works required.

5.4.2. Load Bearing Capacity

The route from Port of Saldanha to the wind energy site has been cleared for a minimum load-rating of 21.7kN/m^2. All bridges and culverts recorded en-route appeared to be in good condition and suited for abnormal transport. It is therefore not expected to cause any restrictions to WTG component weights.

Refer to TRH11 Load-Rating Calculation

5.4.3. O/H Obstructions

Various overhead bridges were recorded on route 1 limiting the route to a laden height of 5.1m. A bypass route has been identified to accommodate the transport combinations with a laden height in excess of 5.1m.

The overhead bridge just outside of the port of Saldanha has a height restriction of 5.1m. A suitable bypass section has been identified.

The overhead bridge just out side of Worcester has a height limitation of 5.4m with no bypass route recorded therefore it is expected to cause restrictions to component dimensions.

The overhead bridge recorded within the De Doorns valley just outside of Worcester has a height limitation of 5.4m. No bypass route recorded and is expected to cause restrictions to component dimensions.

The overhead pedestrian bridge recorded within the De Doorns valley just outside of Worcester has a height limitation of 6m. No bypass route recorded and is expected to cause restrictions to component dimensions.

Various overhead power lines and telephone cables will have to be propped or raised to accommodate the specified WTG components on conventional equipment.

Various High voltage power lines originating from a substation and overhead bridges have been recorded en route. Required clearance between laden height and high voltage power lines//overhead bridges to be checked/confirmed. The use of specialized equipment might be required to reduce the laden height of the tower sections.

5.4.4. Road Condition

Road works that could prohibit abnormal transport combinations from passing through has been recorded at the entrance/exit of the Port of Saldanha, on the bypass route, and on the R45 direction Hopefield/Malmesbury.

Road works has been recorded at the entrance//exit of the Port of Saldanha, on the bypass route, and on the R45 direction Hopefield/Malmesbury.

Further roadwork's has been recorded just after the town of Worcester until just after the town Beaufort Wes. Stop go system in place (single lane only) could prohibit abnormal transport combinations from passing through.

Liaison with port authorities and local government as well as civil contractors are required to establish the completion dates and possible cooperation to allow the abnormal transport combinations to pass through.

For the purpose of the route survey, the assumption was made that the road works would be completed at the time of transporting the WTG components.

5.5. ROUTE CONCLUSION:

The biggest obstruction on the route is the road works currently in progress and the overhead bridges with no bypass recorded, should the road works be completed the route will be rendered suitable for the transport of WTG components as long as it is within the allowable dimensions specified within the report.

6. LEGAL REQUIREMENT FOR ABNORMAL LOADS

6.1. INTRODUCTION

6.1.1. Background information:

The National Road Traffic Act (Act 93 of 1996) (herein referred to as the NRTA) and the National Road Traffic Regulations, 2000 (herein after referred to as the NRTR), prescribe certain limitations on vehicle dimensions and axle and vehicle masses with which a vehicle using a public road must comply. However, certain vehicles and loads cannot be moved on public roads without exceeding the limitations in terms of the dimensions and/or mass as prescribed in the NRTR. Where such a vehicle or load cannot be dismantled without disproportionate effort, expense or risk of damage into units that can travel or be transported legally, it is classified as an abnormal load. Provision for such abnormal vehicles and loads is made in Section 811 of the NRTA, which reads as follows:

‘‘Vehicle and load may be exempted from provisions of Act

81. (1) The Minister may, after the applicant has paid the fees or charges referred to in section 7(3) and subject to such conditions as he or she may determine, authorise in writing, either generally or specifically, the operation on a public road of a vehicle which, due to such vehicle’s original design cannot comply with this Act.
(2) The MEC may, after the applicant has paid the fees or charges referred to in section 7(3) and subject to such conditions as he or she may determine, authorise in writing, either generally or specifically, the conveyance in a safe manner on a public road of passengers or any load otherwise than in accordance with this Act.
(3) An MEC shall determine the fees or charges payable for a vehicle or load that does not comply with this Act.’’

When the movement of an abnormal load is considered to be in the economic and/or social interest of the country, an exemption permit may be issued to allow a vehicle(s) transporting such an abnormal load to operate on a public road for a limited period.

Exemption permits are issued by provincial permit offices in terms of guidelines developed by the Abnormal Loads Technical Committee (ALTC).

Abnormal vehicles, whether in terms of dimensions and/or mass, operate outside the criteria used for the geometrical and structural design of road infrastructure. An abnormal vehicle operating on the road therefore creates additional risks in terms of damage to the road infrastructure and the safety of other road users. Road authorities have to assess these risks, put measures in place to minimize the identified risks and ensure that they are properly managed.

The fundamental principles guiding this process are:

- An exemption permit for an abnormal load will only be considered for an indivisible load, abnormal in dimension and/or mass, where there is no possibility of transporting the load in a legal manner;
- The damage to the road infrastructure by an abnormal vehicle has to be recovered from the carrier;

- The risks to other road users must be reduced to a level equivalent to a situation without the presence of the abnormal vehicle on the road; and
- The conditions imposed must take into account the economic and/or social interest of the country and public at large.
- The purpose of the exemption permit system is not to undermine or circumvent the NRTA and the NRTR.
- This document contains recommendations that are generally applicable, but the issuing authority can deviate from these recommendations and/or impose additional requirements when taking the circumstances applicable to each application into account.

6.1.2. Types of Abnormalities

A vehicle or a vehicle with its load that is considered to be indivisible can be abnormal either in terms of dimension or mass or both.

6.1.3. Dimension Abnormality

A vehicle/combination is dimensionally abnormal when any of the following dimensions exceeds the legal limitations:

- Length
- Width
- Height
- Overhangs
- Load projections
- Wheelbase

6.1.4. Mass Abnormality

When the allowable mass of the vehicle/combination or one or more axle groups exceeds the legal limitations, a mass abnormality exists. This is discussed in Section 3.

6.1.5. Load and Vehicle Configurations

A number of typical abnormal load/vehicle configurations are illustrated in the following Figure 1.1 to Figure 1.4.

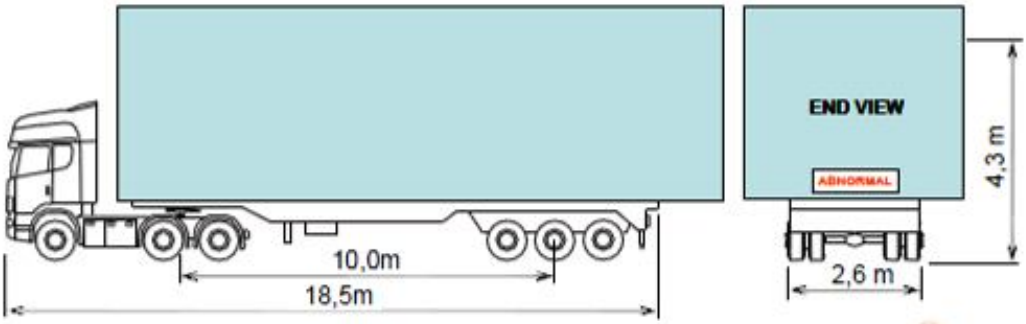


Figure 1.1: Abnormal Load on a Legal Combination

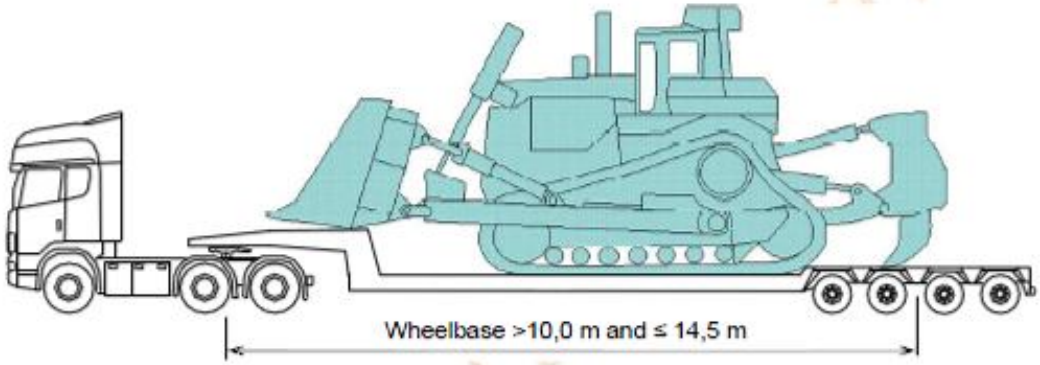


Figure 1.2: Abnormal Load on a Long Wheelbase Trailer

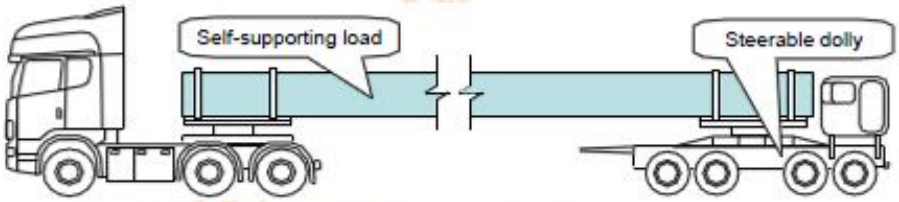


Figure 1.3: Self-Supporting Load on a Steerable Dolly

Figure 1.4: Heavy Loads on Multi-axle or Modular Trailers

6.1.6. Multiple Indivisible Items in One Abnormal Load

In some cases authorities may allow the transportation of more than one indivisible item that is abnormal in one dimension as long as an additional abnormality in another dimension is not created and the total mass is within legal limits. In this manner, the number of abnormal vehicles (or abnormal load trips) on the road is reduced and therefore also the risk to other road users.

vehicles (or abnormal load trips) on the road is reduced and therefore also the risk to other road users.

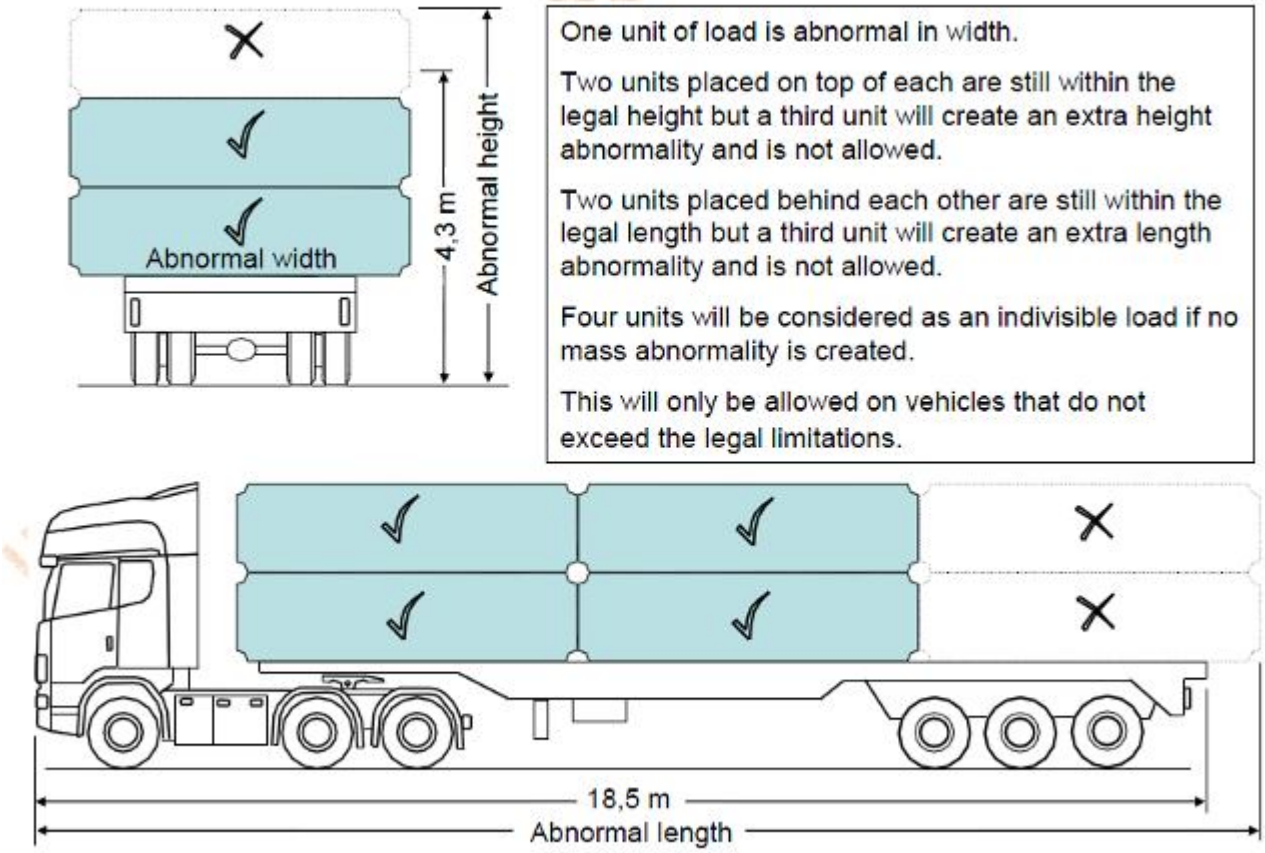


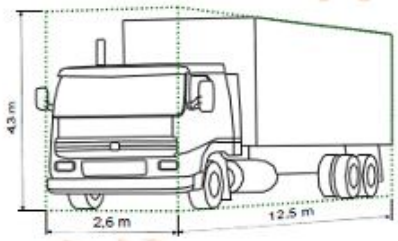
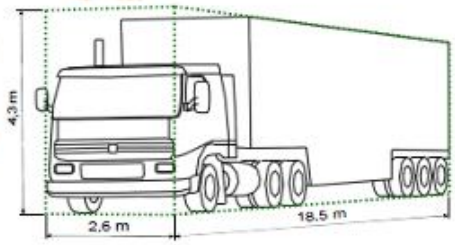
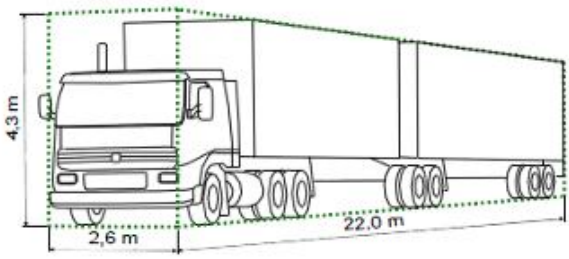
Figure 1.8: Multiple Indivisible Items in One Abnormal Load.

6.2. DIMENSIONAL LIMITATIONS

6.2.1. Background

Loads with abnormal dimensions can cause obstruction and danger to other road users. Permits will only be considered for abnormally dimensioned loads that are considered to be indivisible. Table 2.1 summarizes the legal limits for different vehicle types.

Table 2.1: Maximum Overall Legal Dimensions (GVM/GCM exceeds 12 t)

Vehicle Type	Overall Length (m)	Overall Width (m)	Overall Height (m)	Example
Single vehicle (Rigid)	12.5	2.6	4.3	
Articulated vehicle	18.5	2.6	4.3	
Other combinations of vehicles	22.0	2.6	4.3	

6.2.2. Length

6.2.2.1. Legally Permissible

Regulation 221 sets the legal limits for the permissible maximum length of road vehicles as shown in Table 2.2.

Table 2.2: Maximum Overall Legal Length (including load projections)

Vehicle Type	Overall Length (m)	Comments
Single vehicle	12.5	Excluding a semi-trailer
Articulated vehicle	18.5	Truck-tractor & semi-trailer
Other combinations of vehicles	22.0	Interlinks, multiple trailers.

6.2.2.2. Allowable under Permit

Table 2.3 Maximum Overall Length per Vehicle Type (including load projections)

Vehicle Type	Overall Length (m)	Comments
Rigid vehicles	20	Including mobile cranes
Foundation diggers	23	
Articulated vehicles	26	Truck-tractor & semi-trailer
Combinations of vehicles	28	Truck, dolly & semi-trailer

Where abnormally long vehicles could have difficulty in travelling around the sharp curves on some roads, particularly in mountain passes, in urban areas, on freeway ramps, over certain roads with short vertical curves and some bridges, it is necessary to limit further the allowable overall length of the abnormal vehicle.
For the transportation of long loads of up to 20, 0 m in length, vehicles of a conventional type without steerable rear axles, or vehicles incorporating non-steerable dollies or extendible trailers may be used. In the case of non-steerable axle units, the longitudinal distance between the extreme axle centres of any axle unit may not exceed 4, 2 m.
For the transportation of loads from 20, 0 m to 25, 0 m in length or for wheelbases exceeding 14,5 m, steerable rear axles or steerable dollies must be used.
For loads longer than 25, 0 m all rear axle units must be fully steerable. Alternatively, a steerable dolly (fully steerable axles in all conditions, both static and dynamic) with a turntable capable of 180 degree rotation may be used. With this type of vehicle, a rear projection of the load is not desirable and loads should be supported near the end.
Abnormally long loads should be transported by vehicles specifically designed for the conveyance of such loads. Exceptions may be made at the discretion of the MEC in small centres where such vehicles are not available. On the other hand, an abnormally long vehicle may not be used to transport a load which does not require a vehicle of such length.

6.2.3. Width

6.2.3.1. Legally Permissible

Regulation 223 stipulates that goods vehicles with a gross vehicle mass of 12 000 kg or more may operate on a public road with an overall width of not more than 2, 6 m. All other vehicles shall not exceed 2, 5 m in width.
Regulation 230 stipulates that the overall width of certain agricultural and road construction machines shall not exceed 4,5 m and 3,5 m respectively if operated on a public road.

6.2.3.2. Allowable under Permit

Limits depend on factors such as topography, road width, traffic volumes and obstructions. Special provision must be made in terms of markings and escorting (see Chapter 4: Marking and Escorting) if the vehicle width exceeds 3,5 m.

6.2.4. Height

6.2.4.1. Legally Permissible

Regulation 224 sets a limit of 4, 3 m on the overall height of a road vehicle, together with its load, measured from ground level.

6.2.4.2. Allowable under Permit

The principal factors limiting the permissible height of abnormal loads are the clearances under any overhead bridges or overhead lines on the route, and the stability of the vehicle and the load. It is the responsibility of the carrier to identify a suitable route and to substantiate the suitability of the route with the application.

Table 2.4: Actions Required when Transporting High Loads

Height	Action
> 4,3 m	The clearance of every overhead obstruction must be established by the carrier before the vehicle passes under it. (Note that the clearance under a transmission line is not simply the clearance between the conductor and the ground, but that a safety factor should be allowed for, depending on the voltage).
> 4,7 m	A vehicle shall be provided to drive ahead of the abnormal vehicle. A gauge of non-conducting material shall be fitted to the top of this vehicle. The height of the gauge shall be 100 mm higher than the highest point of the abnormal vehicle or load. It is also required of the carrier to give a written confirmation that he knows the particular route and has recently gone through it and should any structural damage occur he will then be held responsible for any financial implications that have resulted.
> 5,5 m	Permission must be obtained from Telkom prior to applying for a permit, unless a lower limit is specified by Telkom for a specific area or route.
> 5,8 m	Permission must be obtained from Eskom prior to applying for a permit, unless a lower limit is specified by Eskom for a specific area or route.

6.2.5. Overhangs

The front and rear overhangs of a vehicle are illustrated in Figure 2.1.

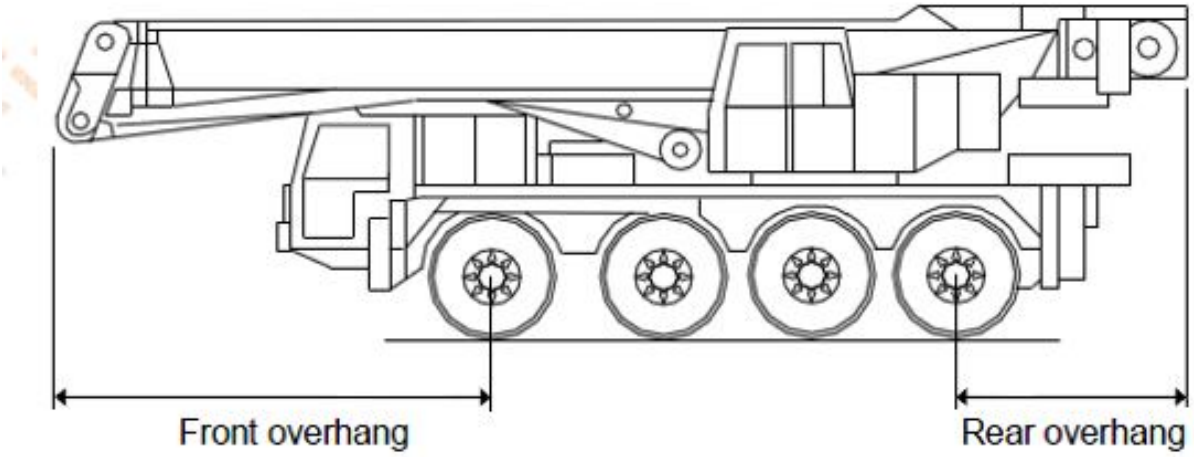


Figure 2.1: Front and Rear Overhangs

6.2.5.1. Front Overhang

6.2.5.1.1. Legally Permissible

Regulation 226 limits the front overhang of a vehicle as follows:

i) For vehicles where the distance from the front end of the vehicle to the backrest of the driver's seat at seat-level is less than 1,7 m, to the lesser of – 60 per cent of the wheelbase, or 6,2 m less half the wheelbase.

ii) Where this distance is more than 1, 7 m, to the lesser of – 60 per cent of the wheelbase, or 5, 8 m less half the wheelbase.

iii) To 1, 8 m for a semi-trailer.

6.2.5.1.2. Allowable under Permit

Load carrying abnormal vehicles must comply with the requirements of Regulation 226. For non-load carrying vehicles, refer to section 2.5.3.

6.2.5.2. Rear Overhang

6.2.5.2.1. Legally Permissible

Regulation 226 limits the rear overhang of goods vehicles, measured from the rearmost axle, to 60 per cent of the wheelbase.

6.3. MASS LIMITATIONS

6.3.1. Background

The permissible maximum vehicle or combination mass of a road vehicle or combination of road vehicles that is allowed to operate either legally or under permit on a public road is limited by:

- The capacity of the vehicles as rated by the manufacturer;
- The load which may be carried by the tyres;
- The damaging effect on road pavements;
- The structural capacity of bridges and culverts;
- The power of the prime mover(s);
- The load imposed on the driving axles; and
- The load imposed on the steering axles.

In this section the legal limits permitted by the NRTR are presented, as well as the corresponding limits allowable under permit. In both cases, the lowest allowable mass determines the permissible maximum masses which may be carried legally or under permit respectively.

6.3.2. Mass load Carrying Capacity of Bridges and Culverts

The load carrying capacity of bridges and culverts requires that the load intensity of a vehicle be limited. The load carrying capacity of a bridge or culvert is determined by the design and present condition of the structure. The load intensity of a vehicle is determined by the loads on axles and axle units and the spacing of those axles and axle units. It is therefore necessary to limit the load that is carried by a group of axles or axle units.

Table 3.1: Limitations on the Maximum Allowable Mass (in kg) of Multi Axle Groups imposed by Bridges and Culverts

Distance between extreme axles (m)	Effective width (m)													Tracking required
	3,5	3,6	3,7	3,8	3,9	4,0	4,1	4,2	4,3	4,4	4,5	4,6	4,7	
1,2	30070	30920	31780	32640	33500	34360	35220	36080	36940	37800	38660	39510	40370	30950
1,5	31590	32490	33390	34300	35200	36100	37000	37910	38810	39710	40610	41520	42420	33700
1,8	33110	34060	35000	35950	36890	37840	38790	39730	40680	41620	42570	43520	44460	36300
2,1	34630	35620	36610	37600	38590	39580	40570	41560	42550	43540	44530	45520	46510	38750
2,4	36160	37190	38220	39250	40290	41320	42350	43380	44420	45450	46490	47520	48550	41300
2,7	37680	38750	39830	40910	41980	43060	44140	45210	46290	47370	48440	49520	50600	43100
3,0	39200	40320	41440	42560	43680	44800	45920	47040	48160	49280	50400	51520	52640	45100
3,3	40720	41890	43050	44210	45380	46540	47700	48870	50030	51190	52360	53520	54680	46900
3,6	42250	43450	44660	45870	47070	48280	49490	50690	51900	53110	54320	55520	56730	48550
3,9	43770	45020	46270	47520	48770	50020	51270	52520	53770	55020	56270	57520	58770	50050
4,2	45290	46580	47880	49170	50470	51760	53050	54350	55640	56940	58230	59520	60820	51800
4,5	46810	48150	49490	50830	52160	53500	54840	56180	57510	58850	60190	61530	62860	52600
4,8	48340	49720	51100	52480	53860	55240	56620	58000	59380	60760	62150	63530	64910	53600
5,1	49860	51280	52710	54130	55560	56980	58400	59830	61250	62680	64100	65530	66950	54500
5,4	51380	52850	54320	55780	57250	58720	60190	61660	63120	64590	66060	67530	69000	55200
5,7	52900	54410	55930	57440	58950	60460	61970	63480	64990	66510	68020	69530	71040	55800
6,0	54430	55980	57540	59090	60650	62200	63760	65310	66870	68420	69980	71530	73090	56200

i) Values are based on the formula: **Allowable Mass (kg) = EW x (6,850 + 0,00145 x distance between extreme axles)**
where EW, the effective width, and the distance between extreme axles are in mm (values are rounded to the nearest 10 kg).
ii) **Interpolation is permitted but not extrapolation.**
iii) Where loads exceed the maximum unrestricted values given in the last column, vehicles will be subject to special tracking requirements and structures will be temporarily closed to other road users. This applies to all values to the right of the heavy stepped line in the table.

7. PROPOSED TRANSPORT COMBINATIONS TO COMPLY WITH THE LEGAL REQUIREMENTS WITHIN SOUTH AFRICA

ALE has investigated several types of transport combinations for the givens dimensions and weight of the WTG components from Saldanha to the wind energy site.

The requirements for the recommended equipment combinations are to:

- Operate inside the dimensional constraints of the route;
- Carry the required loads while complying with the allowable ground bearing pressures (GBP) of the roads and bridges;
- Supply sufficient traction and power to negotiate the inclines and declines of the routes;
- Do the above safely, reliably, and inside the given time constraints.

7.1. PROPOSED TRANSPORT COMBINATIONS;

Based on the V100 (1.8MW) machine, we proposed to use the following transport combinations:

- Tower Sections: Extendable & steerable, semi-lowloader trailers
- Blades: Extendable & steerable, platform blade carrier trailers
- Nacelle: 7 Axle-line, 2 file Cometto conventional hydraulic multi-axle trailer

7.2. LOAD RATING TABLE FOR THE TRASPORT OF THE 79.8T NACELLE:

Pitch of Axles-Lines (m)	1.90	Number of Axles-Lines	7
Pitch of Files (m)	2.55	Number of Files	2
Effective Length (m)	11.40	Weight of Transport Skids (Te)	0
Effective Width (m)	4.28	Weight of Loadspreading (Te)	0
Effective Area (m²)	48.74	Weight of Turntables (Te)	0
Weight per Axle-File (Te)	1.70	Gooseneck (2 File Only) = 1 / Draw Bar = 2	1
Weight of Gooseneck on Transporter (Te)	4.00		
Total Weight of Transporter (Te)	27.80		
Weight of Load (Te)	79.80		
Weight of Auxiliary Equipment (Te)	0.00		
Weight Transferred by Gooseneck (Te)	22.00		
Total Combination Weight on Transporter (Te)	85.60		
Calculated Load Rating (kN/m²)	17.23	Weight of Load (Te)	79.8
Calculated Load (Te)	102.00	Required Load Rating (kN/m²)	21.7
Weight / Axle-Line (Te)	12.23		
Weight / Axle-File (Te)	6.11		
Weight / Duel Set of Tyres (Te)	3.06		
Weight / Tyre (Te)	1.53		

Table 1: TRH11 Load-Rating Calculation for the 79.8t Nacelle.

8. CONCLUSION:

The two biggest obstruction on both route 1 and the bypass route is the road works currently in progress and the high voltage power lines originating from a substation on left hand side of the R45. Liaison with port authorities and local government as well as civil contractors are required to establish the completion dates and possible cooperation to allow the abnormal transport combinations to pass through. Required clearance between laden height and high voltage power lines to be checked/confirmed.

The remaining obstacles are the various overhead power lines and telephone cables which will have to be propped or raised and the hairpin turns which requires works such as removal of road furniture and backfilling, levelling/compacting of inside corners to accommodate the specified WTG components.

Should the above listed obstructions be addresses, both route 1 and the bypass route will be well suited for the transport of the WTG components.

9. DRAWINGS:

PROJECT DRAWINGS AND REFERENCE DOCUMENTS

DRAWING NUMBER	DESCRIPTION
DRW-12-058-01-*	Tracking Simulation: 49.12m x 10.2t Blade on a 4 Axle-line Triple Extendable Semi-lowloader.

** Always refer to the latest revision of drawing / document.*

Reference Documents:

DRAWING NOTES:

-ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

-ALL WEIGHTS ARE IN t (METRIC TONNES) UNLESS OTHERWISE STATED.

-ALL DETAILS ARE PROVISIONAL AND ARE SUBJECT TO CONFIRMATION.

TECHNICAL NOTES:

Left hand turn from the route 1 onto the gravel alternative/bypass section;

Rev.	Date	Drawn	Check	Description	QF19 (Issue 5)

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Client: Vestas

Project Title: Hopefiled Wind Energy Project

Drawing Title: Tracking Simulation
49.12m x 8.9t Blade on a 4 Axle-line Triple Extendable Semi-lowloader

Date	Drawn	Checked	Scale (A1)	Sheet
20-03-12	JB		See Views	1 of 1

Project No.	Drawing No.	Rev.
12-031	DRW-12-031-01	A

File Location: \\server\ALE DATA\Customers\Vestas\8. Hopefield\Engineering\Drawings\ALE\Tracking Drawings\MDL-11-266-03-A.dwg

10. CONVENTIONAL AND SPECIALIZED EQUIPMENT DETAILS

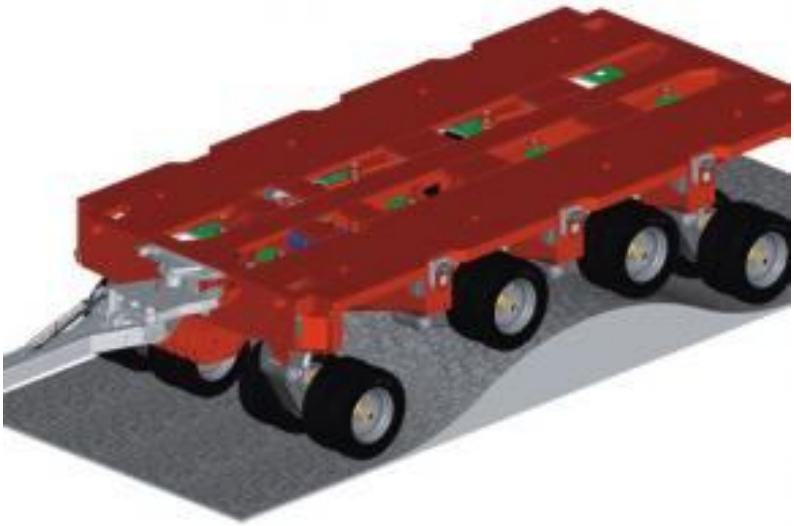
10.1. CONVENTIONAL HYDRAULIC MULTI-AXLE TRAILERS

These trailers can be combined in different combinations for different loads and applications. The trailers are fully steerable to negotiate hairpin turns. The industry leaders for these units are Scheuerle, Goldhofer and Nicolas. A description of the units is included below.

The units can be combined to create the widest range of transport combinations. They can be combined lengthwise and crosswise and can also be supplemented with various goosenecks and loading decks for customised, economical transport combinations. As a result, the units have nearly limitless possibilities for solving the most complicated transport requirements.

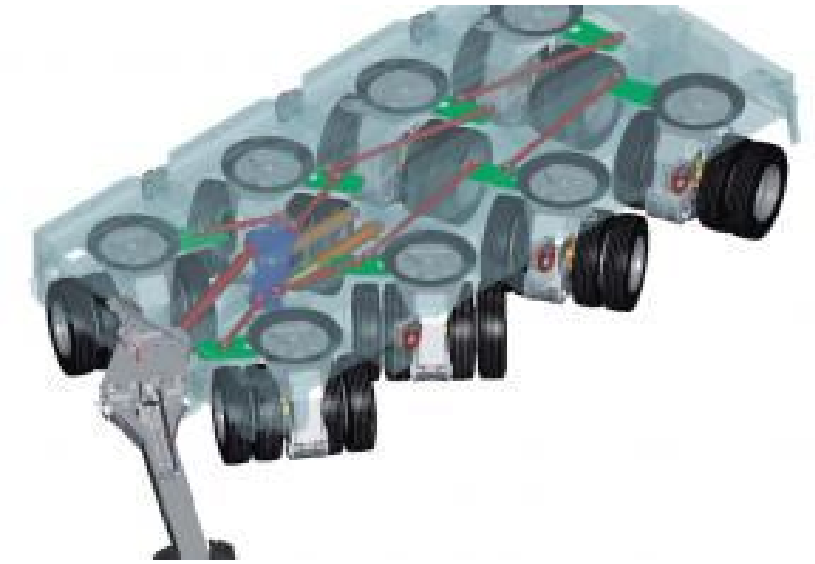
Hydraulic suspension:

The hydraulic suspension of the individual axles can be connected into different hydraulic circuits in order to ensure stability and equal axle loadings. This guarantees optimal lengthwise and crosswise levelling on uneven terrain and also regulates extreme cross falls.



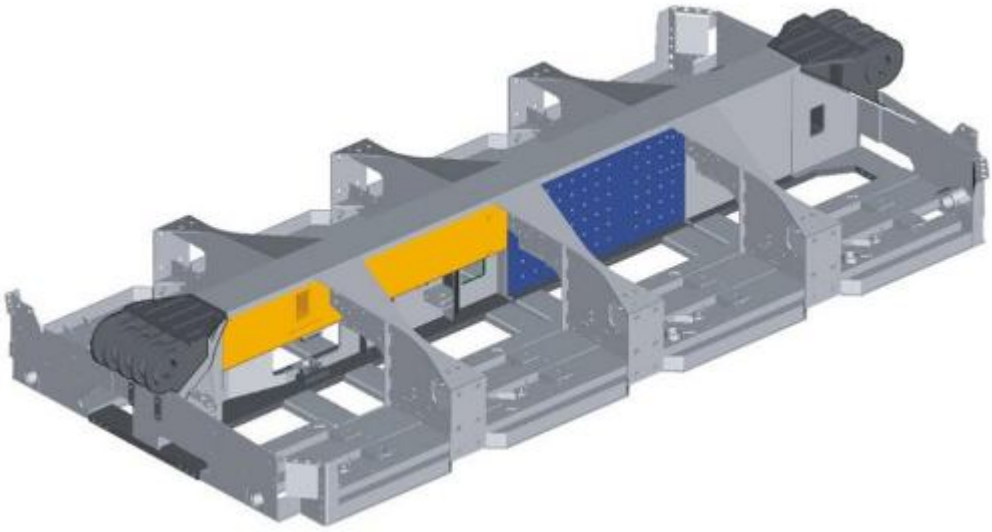
Steering:

A hydro-mechanical all-wheel force steering system in 2-circuit design guarantees that the full functionality of the steering is maintained even in case of a failure of one of the steering circuits. The steering angle ranges from 45° to 60° and can be quickly adjusted with steering rods that are easily accessible from above to suit the various combinations.



Frame:

The box-shaped spine beam with its stable crossbeams offers a high degree of frame rigidity and thus an optimal loading possibility. Air and hydraulic oil tanks as well as the steering system are integrated in the bogie frame and thereby protected against corrosion and damage. A reinforced loading deck allows extreme point loads. The optimised bolt-plate coupling guarantees the problem-free assembly of longitudinal combinations.



10.2. CONVENTIONAL SEMI-LOWLOADER TRAILERS

The semi-low loader trailers are used to carry very long loads, and/or loads that are too heavy for normal trucking solutions, but do not require the use of conventional hydraulic multi-axle trailers. The trailers are extendable and steerable. The steering system is developed to access difficult locations with low axle loadings of approximately 10t / axle-line and a deck height of approximately 1100m. The trailers usually have an air suspension which can be lowered/ raised by approximately 90mm.

Picture 8: Broshuis 6 axle-line extendable semi-lowloader trailer

10.3. SPECIALIZED WIND TOWER ADAPTORS

Wind tower adapters are designed for wind tower segments with an approximate diameter of up to 5000mm x 90t. The adapter can either be mounted directly on the platform or be used as a free-turning device with supporting tip frame and swivelling bolster. Best operating comfort easy and quick handling with connected mounting platforms. The wind tower adaptors are used to negotiate hairpin turns and to reduce the laden height offered by conventional equipment. Some of the tower adaptors has the added advantage of height adjustment to avoid obstacles on the insides of corners.

Picture: Scheuerle wind tower adapter

Picture: Nicolas wind tower adapter

Picture: Goldhofer wind tower adapter

6.2.5.2.2. Allowable under Permit

The rear overhang of a load carrying abnormal vehicle, measured from the rearmost axle, may not exceed 2 m or 70 per cent of the wheelbase, whichever is the greater, subject to the restriction on load projection stipulated in section 2.6. For non-load carrying vehicles, refer to section 2.5.3.

6.2.5.2.3. Front and Rear Overhangs Allowable under Permit for Non-load Carrying Vehicles

In the case of non-load carrying vehicles, such as mobile cranes and foundation diggers, the actual front or rear overhang shall not exceed the values given in Table 2.5. The overhang is measured from the centre of the foremost or rearmost axle to the furthest point of the overhang section of the vehicle.

Table 2.5: Allowable Front/Rear Overhang under Permit for Non-load Carrying Vehicles.

Wheelbase (m)	3 m	4 m	5 m	6 m or more
Allowable front or rear overhang*	3.9	4.6	5.2	6.0

* From the centre of the front or rear axle to the furthest point of the overhang section of the vehicle.

11. APPENDICES

11.1. APPENDIX ‘A’ – ROUTE FINDINGS

ALE SMARTER, SAFER, STRONGER	Project No.: 12-058	Page 1 of 1	ALE Heavylift South Africa (Pty) Ltd			
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NO.:	TITLE	DESCRIPTION	RESTRICTION	MEASUREMEN	km READING	PHOTO NO.
Option A: Port of Saldanha to the R27; Velddrif/ Cape town turn off						
1	MPT entrance no. 3	MPT exit onto road OP599 ('Die Verbindings Pad')			0	2110-2111
2	MPT entrance no. 2	MPT exit onto road OP599 ('Die Verbindings Pad')			0.1	2112-2113
3	MPT entrance no. 1	MPT exit onto road OP599 ('Die Verbindings Pad')			0.2	2114-2115
4	L/H Turn	From road OP599 ('Die Verbindings Pad') to OP599 ('Die Verbindings Pad')	Obstructions on I/S / O/S radius		0.8	2116-2118
5	R/H Turn	From road OP599 ('Die Verbindings Pad') to OP599 ('Die Verbindings Pad')	Obstructions on I/S / O/S radius		0.9	2119-2120
6	Road condition	Road works commencing on road OP599 ('Die Verbindings Pad')	Access		2.5 - 2.8	2121-2124
7	**Saldanha Harbour Entrance**				2.7	2125
8	O/H bridge	Bridge 5994 over road OP599 ('Die Verbindings Pad')	Height	5.72m	3.4	2126-2127
9	O/H power line	High Voltage Power Lines	Height	10.9 - 12.13	3.8	2128
10	O/H power line	High Voltage Power Lines	Height	9.57 - 10.8	4.6	2129
11	O/H bridge	Bridge no. 5974 over road OP599 ('Die Verbindings Pad')	Height	5.17 - 5.2	5	2130
12	O/H power line	Low Voltage Power Lines	Height	8.9	5.2	2131
13	O/H power line	High Voltage Power Lines	Height	9.5	5.2	2132
14	R/H Turn	From road OP599 ('Die Verbindings Pad') to R27			5.6	2134
15	O/H power line	High Voltage Power Lines	Height	13.5	7.3	
16	Bridge	Bridge no. 5370 over railway.	Load-rating		7.9	
17	O/H power line	High Voltage Power Lines	Height	> 8m	9.9	2135-2137
Option B: Port of Saldanha to Camp road and then back on to the R27; Velddrif/ Cape Town road.						
18	L/H Turn	From the OP599 ('Die Verbindings Pad') road onto gravel bypass	Obstructions on I/S / O/S radius		0	2138
19	Culvert	On the gravel bypass	Load-rating		0	2139
20	R/H Turn	From the gravel bypass onto the MR559 (Camp road) direction Langebaan.	Obstructions on I/S / O/S radius		0.3	
21	Bridge	Bridge no. 5974 over road OP599 ('Die Verbindings Pad')	Load-rating		0.5	
22	O/H power line	High Voltage	Height	10.27-10.38	0.5	2144
23	Road condition	Road works on length of MR559 (Camp road) direction Langebaan.	Access		3.6	2145
24	L/H Turn	From the MR559 (Camp road) direction Langebaan onto the OP538 Vredenburg road	Obstructions on I/S / O/S radius		3.8	2146-2149
25	O/H power line	High Voltage	Height	>10m	6.2	
26	R/H Turn	From the OP538 Vredenburg road onto the R27; Velddrif/ Cape Town road.	Obstructions on I/S / O/S radius		7.2	2150
Route on Option A and B: meet at the intersection of road OP538 Vredenburg and R27; Velddrif/ Cape Town.						
27	O/H power line	High Voltage	Height	>10m	7.2	
28	L/H Turn	From the port of Saldana road onto the R27 direction Velddrif	Obstructions on I/S / O/S radius		7.2	2154
29	O/H power line	High Voltage	Height	8.17-8.36	13.8	2157
30	Bridge	Bridge no: 5106 over Railway	Load-rating		14.6	2158
31	L/H Turn	From the R27 direction Velddrif onto the R45 Hopefield/Malmesbury			14.8	2159-2162
32	Road condition	Road works from R45 turn off. Single lane	Access		14.9 - 19	2163
33	O/H power line	Low Voltage	Height	<7m	15.6	
34	O/H tele cable		Height	< 7m	16.6	
35	Bridge	Unknown Bridge over the Railway	Load-rating		18.3	
36	O/H power line	Low Voltage	Height	8.06	19.4	2164
37	O/H power line/tele cable	Low Voltage	Height	7.2	21.4	2165
38	O/H tele cable		Height	7.06	22.3	
39	O/H tele cable		Height	5.9	23.2	
40	O/H tele cable		Height	7	26.7	
41	O/H power line	High Voltage	Height	6.4 - 7.6	31.1	2167-71
42	O/H power line	High Voltage	Height	>10	31.1	2172
43	O/H power line	High Voltage	Height	>10	31.2	2178
44	O/H power line	High Voltage	Height	>10	31.3	2173
45	O/H tele cable		Height	7.7	34	
46	O/H power line	High Voltage	Height	8.8	34.4	
47	O/H tele cable		Height	7.6	36.46	
48	O/H power line	High Voltage	Height	7.95	37.1	2175
49	O/H power line	High Voltage	Height	7.9	37.5	2176
50	O/H power line	High Voltage	Height	6.8	37.9	2177
51	O/H power line	High Voltage	Height	8.5	38.7	2178
52	O/H power line	High Voltage	Height	8.69	38.7	2179
53	O/H power line	High Voltage	Height	8.6	42.1	2180
54	O/H tele cable		Height	7.48	42.6	
55	O/H tele cable		Height	7.16	42.8	

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56	O/H power line	High Voltage	Height	8.43	42.8	2181
57	Bridge	Bridge no. 4745 over the Sout River on the R45	Load-rating		43.1	2182
58	Bridge	Bridge no. 4746 over Railway on the R45	Load-rating		43.7	
59	O/H power line	High Voltage	Height	> 8m	68.7 - 72.9	
60	O/H power line	High Voltage	Height	> 8m	73.6	2171
61	O/H power line	Low Voltage	Height	< 8m	76.8	2172
62	O/H power line	High Voltage	Height	< 8m	78.8	2173
63	Road condition	Ok	Access		79.2	2174 - 2177
64	Bridge	Bridge no. 5044 over River on the R45	Load-rating	12.5	80.2	2178 - 2179
65	O/H power line	Low Voltage	Height	< 8m	86.2	
66	O/H power line	Low Voltage	Height	< 8m	90.2	2181 - 2182
67	O/H power line	Low Voltage	Height	< 8m	93.5	2183
68	Road condition	Potholes, road works etc.	Access	12	95.8	2184 - 2185
69	Bridge	Bridge no. 5045 over railway.	Load-rating	12.5	101.9	2186
70	O/H power line	High Voltage	Height	> 8m	103.5 - 169.8	2187
71	L/H Turn	From R45 to N7	Obstructions on I/S / O/S radius		109	2188
72	O/H power line	High Voltage	Height	> 8m	111.5	2189
73	Culvert	Culvert B2422 over stream on the N7	Load-rating	11.3	117.6	
74	Culvert	Culvert B2423 over stream on the N7	Load-rating	11.3	121.1	2190
75	O/H power line	High Voltage	Height	< 8m	126.9	
76	O/H power line	Low Voltage	Height	< 8m	127.5	
77	O/H power line	High Voltage	Height	< 8m	127.82 - 131.2	
78	Culvert	Culvert 4972 over stream on the N7	Load-rating	11	135.8	
79	O/H power line	High Voltage	Height	> 8m	135.8	2193 - 2195
80	R/H Turn	From N7 to R311	Obstructions on I/S / O/S radius		136.2	2196 - 2197
81	O/H power line	High Voltage	Height	> 8m	136.7	2189
82	Culvert	Unknown Culvert over stream on the R311	Load-rating	11	140.2	
83	O/H power line	High Voltage	Height	> 8m	141	
84	O/H power line	High Voltage	Height	> 8m	142.2	
85	O/H power line	High Voltage	Height	> 8m	143.3	
86	Road condition	Potholes, road works etc.	Access	12.5	144.2	
87	Culvert	Unknown Culvert over stream on the R311	Load-rating	12.5	145.4	
88	O/H power line	High Voltage	Height	< 8m	147.3 - 158.9	
89	O/H power line	Series of 1x3 Medium in the town of Riebeek West	Height	< 8m	160.7 - 165.2	
90	O/H power line	High Voltage	Height	> 8m	166.8	
91	L/H Turn	From R311 to R46	Obstructions on I/S / O/S radius		167.8	
92	Bridge	Bridge no. 4546A over stream.	Load-rating	12.5	175.8	
93	Bridge	Bridge no. 2177 over railway	Load-rating	12.5	177.1	
94	R/H Turn	From R46 to R46	Obstructions on I/S / O/S radius		177.6	
95	O/H power line	High Voltage	Height	< 8m	251 - 193.6	
96	Bridge	Bridge no. 4084 over the Klein Berg River on the R46 (Nuwekloofpas)	Load-rating	12.5	197.8	
97	Sharp turn	On the Nuwekloofpas	Radius, Obstructions on I/S / O/S radius		202.6	
98	R/H Turn	From R46 to R46	Obstructions on I/S / O/S radius		206.9	
99	R/H Turn	From R46 to R303	Obstructions on I/S / O/S radius		207.2	
100	Bridge	Bridge no. 5225 over the River on the R303	Load-rating	12.5	216	
101	Bridge	Bridge no. 5226 over the Dwars River on the R303	Load-rating	12.5	224.1	
102	R/H Turn	From R303 to R43	Obstructions on I/S / O/S radius		225	
103	O/H power line	High Voltage	Height	> 8m	226.2 - 229	
104	L/H Turn	From R43 on R46	Obstructions on I/S / O/S radius		231.9	
105	O/H power line	High Voltage	Height	< 8m	237.2	
106	Bridge	Bridge no. 3915 over the railway on the R46	Load-rating	12.5	239.2	
107	O/H power line	High Voltage	Height	< 8m	240	
108	Bridge	Bridge no. 3073 over the river on the R46	Load-rating	12.5	240.5	
109	Bridge	Bridge no. 3072A over the river on the R46	Load-rating	12.5	241.2	
110	Bridge	Bridge no. 3071 over the river on the R46	Load-rating	12.5	248.1	
	L/H Turn	From the R46 onto the N1	Obstructions on I/S / O/S radius		248.1	
1	Bridge	Bridge over the N1	Load-rating		252.2	
111	O/H power line	High Voltage	Height	9.95	248.1	384
112	O/H power line	Low Voltage	Height	<8	248.3	
113	O/H power line	Low Voltage	Height	<8	349	385
114	Bridge	Bridge no 5009 over the N1	Load-rating		252.2	386
115	O/H power line	High Voltage	Height	6.1	254.3	
116	O/H power line	High Voltage	Height	9.95	254.5	
117	Bridge	Bridge over railway on the N1	Load-rating		256.1	387
118	Road condition	Road restriction	Access		262	388

119	O/H power line	High Voltage	Height	<8	263.1	
120	O/H power line	Low Voltage	Height	>8	264.1	389
121	O/H power line	Low Voltage	Height	9.97	264.7	
122	O/H power line	Low Voltage	Height	>8	266.1	
123	O/H power line	Low Voltage	Height	<8	266.8	
124	O/H power line	Low Voltage	Height	7.92	267.9	
125	O/H power line	Low Voltage	Height	7.9	268.7	
126	O/H power line	Low Voltage	Height	7.42	269.7	
127	O/H power line	Low Voltage	Height	>8	269.8	
128	O/H power line	Low Voltage	Height	8	270.6	
129	O/H tele cable	Low Voltage	Height	<8	271	
130	O/H power line	Low Voltage	Height	>8	271.2	
131	O/H power line	Medium	Height	8.61	271.8	
132	O/H power line	Medium	Height	>8	273.1	
133	O/H tele cable	High Voltage	Height	<8	274.1	
134	O/H bridge	On the N1	Height	5.4	275.3	390
135	O/H bridge	Pedestrian bridge on the N1	Height	6.1	276.2	391
136	Bridge	Bridge over railway on the N1	Load-rating		277.8	392
137	O/H power line	High Voltage	Height	>8	278.3	393
138	Bridge	Bridge 5628 over railway on the N1	Load-rating		279.5	394-395
139	O/H power line	High Voltage	Height	>8	280.2	
140	O/H power line	High Voltage	Height	>8	281.9	
141	O/H power line	High Voltage	Height	>8	283.6	
142	Hex river pass		Radius, Obstructions on I/S / O/S radius		285.7	
143	O/H power line	High Voltage	Height	>8	292.3	
144	O/H tele cable	Low Voltage	Height	7.2	296.5	
145	O/H power line	High Voltage	Height	>8	303.7	
146	O/H tele cable	High Voltage	Height	>8	305.7	
147	O/H power line	High Voltage	Height	>8	306.9	
148	O/H tele cable	Low Voltage	Height	>8	309	
149	O/H tele cable	Low Voltage	Height	>8	313.9	
150	O/H power line	High Voltage	Height	>8	314.9	
151	Bridge	Bridge over Donkies rivier on the N1	Load-rating		315.5	398
152	O/H tele cable	Low Voltage	Height	>8	316.8	399
153	O/H power line	High Voltage	Height	>8	316.8	400
154	Bridge	Bridge 5076 over Touws rivier on the N1	Load-rating		317.3	401
155	O/H power line	High Voltage	Height	8.63	318.4	402
156	Bridge	Bridge 5077 over Simonsleegte rivier on the N1	Load-rating		321.3	403
157	Bridge	Bridge 5078 over unknown rivier on the N1	Load-rating		328.1	404
158	O/H power line	High Voltage	Height	>8	329.9	
159	Road condition	Road works, Stop go system in place	Access		348.1	405
160	Bridge	Bridge 5079 over Monumeut rivier on the N1	Load-rating		362.1	406
161	Bridge	Bridge 5080 over Baviaan rivier on the N1	Load-rating		368.1	407
162	O/H power line	High Voltage	Height	>8	370.7	408-409
163	Bridge	Bridge 5081 over Boelhouer rivier on the N1	Load-rating		372.9	410
164	Bridge	Bridge 5082 over Doornfontein rivier on the N1	Load-rating		379.7	411 - 412
165	O/H power line	High Voltage	Height	>8	396.1	408 - 409
166	Bridge	Bridge 5083 over Wilgerhout rivier on the N1	Load-rating (limited to 10t)		396.1	412 - 414
167	Bridge	Bridge 5084 over Biffelsjag rivier on the N1	Load-rating		397.6	414 - 416
168	Bridge	Bridge 5000 over Stars rivier on the N1	Load-rating		398.5	417
169	Road condition	Road works, Stop go system in place	Access		398.6	418 - 421
170	O/H power line	High Voltage	Height	>8	408.1	
171	O/H power line	High Voltage	Height	>8	411.1	
172	O/H power line	High Voltage	Height	>8	420.1	
173	O/H tele cable	Low Voltage	Height	>8	429.7	
174	O/H power line	High Voltage	Height	>8	434.1	
175	Road condition	Road works, Stop go system in place	Access		440.1	421
176	Bridge	Bridge over railway rivier on the N1	Load-rating		442.7	417
177	Road condition	Road works, Stop go system in place	Access		448.5	
178	Bridge	Bridge 4998 over Dwykd rivier on the N1	Load-rating		466.7	422 - 424
179	Bridge	Bridge 5001 over Railway rivier on the N1	Load-rating		478.1	425
180	O/H power line	High Voltage	Height	>8	481.9	426
181	Bridge	Bridge 5324 over Unknown rivier on the N1	Load-rating		484.9	427
182	Bridge	Bridge 5323 over Unknown rivier on the N1	Load-rating		484.9	
183	O/H power line	High Voltage	Height	<8	492.7	
184	Road condition	Road works, Stop go system in place	Access		499.1	428
185	Bridge	Bridge over Unknown rivier on the N1	Load-rating		512.3	429
186	O/H power line	High Voltage	Height	<8	516.1	430

187	Bridge	Bridge over Unknown rivier on the N1	Load-rating		516.6	431
188	Culvert	On the N1	Load-rating		518.1	432 - 433
189	Bridge	Bridge 4918 over Leeu rivier on the N1	Load-rating		520.8	434 - 434
190	Culvert	On the N1	Load-rating		534.8	435
191	Culvert	On the N1	Load-rating		536.1	
192	O/H power line	High Voltage	Height	<8	540.9	436
193	Culvert	On the N1	Load-rating		540.9	437
194	Culvert	On the N1	Load-rating		542.5	438
195	Culvert	On the N1	Load-rating		547.5	439
196	Culvert	On the N1	Load-rating		548.1	
197	Culvert	On the N1	Load-rating		551.6	
198	O/H power line	High Voltage	Height	<8	556.2	436
199	Culvert	On the N1	Load-rating		560.6	
200	Culvert	On the N1	Load-rating		566.1	
201	Culvert	On the N1	Load-rating		572.1	
202	O/H power line	High Voltage	Height	<8	573.1	
203	O/H power line	High Voltage	Height	<8	578.2	442
204	Bridge	Bridge over Unknown rivier on the N1	Load-rating		681.6	443
205	Culvert	On the N1	Load-rating		586.1	
206	Road condition	Road works, Stop go system in place	Access		591.1	
207	Bridge	Bridge over Railway rivier on the N1	Load-rating		592	444
208	O/H power line	High Voltage	Height	>8	593.1	
209	Bridge	Bridge B1913 over Boaufeldvest rivier on the N1	Load-rating		593.1	445 - 457
210	Bridge	Bridge B1914 over Kuilspoort rivier on the N1	Load-rating		599.1	458
211	Bridge	Bridge B1914 over Kuilspoort rivier on the N1	Load-rating		599.1	
212	Bridge	Bridge S333 over Kuilspoort rivier on the N1	Load-rating		599.6	459
213	Bridge	Bridge B1918 over Platdoorns rivier on the N1	Load-rating		615.4	460 - 461
214	Bridge	Bridge S3334 over Platdoorns rivier on the N1	Load-rating		615.8	462
215	Bridge	Bridge B1919 over Platdoorns rivier on the N1	Load-rating		618.1	462
216	Bridge	Bridge B1920 over Platdoorns rivier on the N1	Load-rating		621	463
217	O/H power line	High Voltage	Height	>8	633.1	
218	Culvert	On the N1	Load-rating		642.9	
219	O/H power line	High Voltage	Height	>8	652.4	464
220	O/H power line	High Voltage	Height	>8	653.3	
221	Bridge	Bridge B1921 over Courland rivier on the N1	Load-rating		655.4	465
222	Bridge	Bridge B5431 over Salt rivier on the N1	Load-rating		656.3	466
223	O/H power line	High Voltage	Height	>8	658.1	
224	Culvert	On the N1	Load-rating		660.5	467
225	O/H power line	High Voltage	Height	>8	661	
226	O/H power line	High Voltage	Height	>8	663.6	
227	Bridge	Bridge B5433 over Krom rivier on the N1	Load-rating		667.6	
228	Bridge	Bridge S513 over Railway rivier on the N1	Load-rating		670.5	
229	Bridge	Bridge 5514 over Karee rivier on the N1	Load-rating		671.1	
230	L/H Turn	From the N1 onto gravel secetion			680	

Legend:

	Sharp turn	On the *	Radius, Obstructions on I/S / O/S radius		* km	Photo
	L/H Turn	From * to *	Obstructions on I/S / O/S radius		* km	
	R/H Turn	From * to *	Obstructions on I/S / O/S radius		* km	
	Steep incline	On the *		* %	* km	
	Steep decline	On the *		* %	* km	
	O/H power line	1x5 Small, Medium, Large	Height	< or > 8m	* km	
	O/H tele cable	1x1	Height	< or > 8m	* km	
	O/H bridge	On the *	Height	* m	* km	Photo
	O/H general	Billboard, Trees etc. on the *	Height	* m	* km	Photo
	Bridge	* Bridge no. * over the * on the *	Load-rating		* km	Photo
	Culvert	On the *	Load-rating		* km	Photo
	Road condition	Potholes, road works etc.	Access		* km	Photo
	Road width		Width	* m	* km	Photo
	Lay-by area	On L/H / R/H side of the *	Ground bearing capacity		* km	Photo