INYANDA ENERGY PROJECTS (PTY) LTD

PROPOSED INYANDA ROODEPLAAT 140 MW WIND FARM

REPORT ON TURBINE TRANSPORT ROUTES AND TRAFFIC MANAGEMENT

REPORT FOR SUPPORTIVE INFORMATION TO THE EIA REPORT

Report No. : R1011-TR/01

March 2016

Prepared by:
Afri Coast Consulting Engineers
PO Box 5104, Walmer, 6065
South Africa
Afri Coast Building, Cnr Rose/Havelock Street,
Central, Port Elizabeth

Project Engineer : SP Schutte
Tel: +27 41 505 8000
Fax: +27 41 585 3437
Email: stephans@africoast.com
URL: www.africoast.com

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PROJECT NUMBER:	R1011
CLIENT:	Inyanda Energy Projects (Pty) Ltd
PROJECT NAME:	Proposed Roodeplaat Inyanda 140MW Wind Farm Development
DOCUMENT TITLE:	Report on Turbine Transport Routes and Traffic Management
DOCUMENT NUMBER:	Report No. : R1011-TR/01

Revision Record

Revision	Date	Description / File name	Prepared	Checked	Approved
	2016-02-22	R1011- Report on Transport Routes	LG	SS	BE

Prepared by:

Name : L Geyer (B.Tech) Date: _____

Designation : Civil Technologist Signature : _____

Reviewed by:

Name : S Schutte (B.Eng) Date: _____

Designation : Civil Engineer Signature : _____

Approved by:

Name : B Emslie (Pr Tech) Date: _____

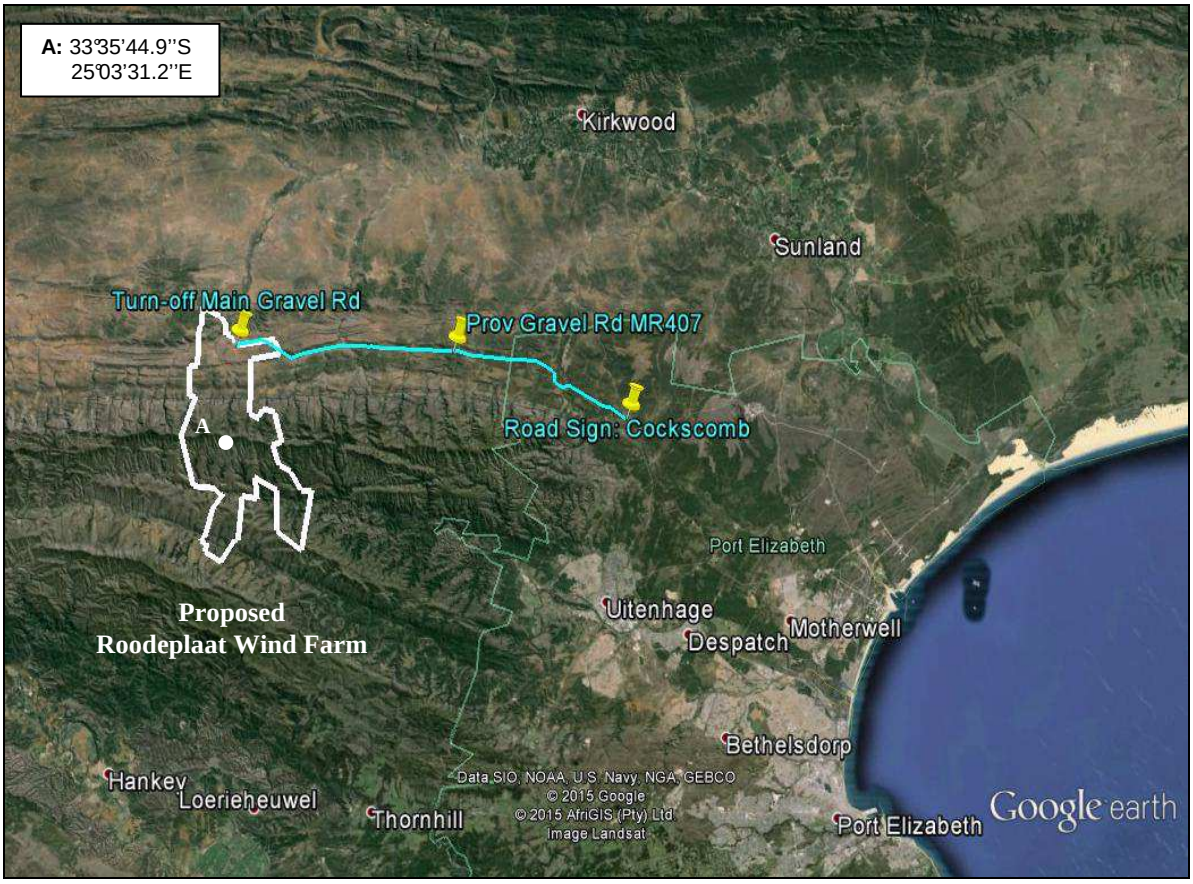
Designation : COO Signature : _____

CONTENTS..... PAGE No

ANNEXURES :

1 BACKGROUND

Inyanda Energy Projects (Pty) Ltd intends to develop a 140MW wind energy project, located within the Sundays River Valley Local Municipality, approximately 40km north west of Uitenhage, Eastern Cape (refer to **Map 1** below). The proposed Inyanda Roodeplaat Wind Farm will consist of a maximum of 55 turbines, depending on the selected turbine model and size of the turbines.



Map 1: *Locality map of the proposed 140MW wind farm development.*

1.1 Terms of Reference

Inyanda Energy Projects (Pty) Ltd appointed Afri Coast Consulting Engineers (Pty) Ltd to carry out several professional engineering services related to the development of the proposed wind farm. This Transport Route and Traffic Management Study and Report forms an integral part of the supportive documentation required for the Environmental Impact Assessments (EIA) and application to DEDEAT.

2 PURPOSE OF THIS REPORT

The purpose of this report is to identify transport routes, which will be practical, safe and economical to transport turbine components to the Wind Farm Site, while having the least impact on road traffic, the environment and surroundings. Constraints and required road improvements to accommodate the abnormal transport vehicles will be investigated through desktop studies, photo records and visual road assessments.

The transportation of the various Wind Turbine Generator (WTG) components to the development site is a critical aspect of the success of development. This aspect is an extremely expensive and time-consuming aspect of the development that can easily be overlooked. “Fatal flaws” during the transport route analysis, will have costly impacts on this development and possibly on the environment. Various alternative transport routes, any obstructions enroute as well as available types of transport trucks, should be considered and compared, in order to carefully select the safest and most economical transport route alternative.

The impact on public traffic enroute to the Wind Farm Development, as well as the management aspects of the construction traffic to and on site will be discussed, to highlight limitations, which need to be understood for proper logistics planning during the construction phase.

3 LIMITATIONS OF THIS REPORT

This report should be seen as a concept report. Aspects that limit the final recommendations of this report to date, are listed below. Once some or all of these aspects were addressed, this Transportation and Traffic Management Report should be updated with more accurate and final information.

- This report is based on a the Siemens SWT-3.6-130 turbine with applicable weights and dimensions of the turbine components;
- This report is based on the manoeuvrability of general abnormal transport vehicles (eg for turning radii and ability to climb step gradients etc.) – specific trucks available on site may have different capabilities;
- The specific Transport Operator company that will be appointed and the number of and availability of specific types of trucks and cranes or a combination of different truck and crane types, will determine the final transport cost and hence the success of the transportation operations, and financial impact on the development costs of this wind farm. See Section 5 on general Transport Trucks and Crane Types.
- Transport route alternatives were not analysed and compared on an economical basis (rand per kilometre travelled). This should be done once transport truck types and transport rates are available, in order to optimise the final recommended route, ensuring the most economical alternative.

4 WIND TOWER GENERATOR (WTG) COMPONENTS

Various wind turbine manufactures exist worldwide and each manufacturer has a variety of turbine models available on the market. The final selection of the type of turbine will ultimately determine the final transport requirements and limitations on the transport routes. Based on the current agreement in place with Siemens, this report is based on the Siemens SWT-3.6-130 turbine model.

The turbine supplier will be responsible to contract transport operators to convey the wind turbine components to site. Turbine components that must be transport to the site consist of:

- the foundation embedment assembly
- the tower units (in segments)
- the nacelle (gearbox and breaks unit)
- rotary hub unit
- the three rotor blades

The photos below describing the transportation mode, is a typical indication of the type of transport vehicles used in the transport of turbine components and is not necessarily based on the actual turbine weights and dimensions for the proposed turbine model.

4.1 Foundation Anchor Ring Assembly

Photo 1a and 1b: Siemens Foundation Anchor Ring Assembly

The Siemens foundation anchor ring assembly sets is brought to site in loose pieces of steel rings, bots and nuts (like a Mechano set), in standard shipping containers on a standard truck. This will have no impact on the general traffic and there will be no limitations on any transport routes to convey these containers.

It is important to note that these containers are generally shipped and transported separately to site - sometimes weeks before the rest of the WTG components. These containers will probably have to be temporary stored at a central holding area, and transported at later intervals (different dates), from the holding area to the various different turbine site locations, once the crane and working platforms were

prepared at each turbine site. This will imply that suitable plant (eg. a forklift) and a small flatbed truck will readily have to be available at the holding area, to load and transport these containers at intervals as and when required at a specific turbine site.

Similarly, a forklift or small crane will have to be available at the receiving turbine site, to assist with the off-loading of the container. The container will remain on site for a few days (serving as storage space for the assembly ring, components and tools) during the assembly process. This container will in the same way, has to be collected and transported off-site, on completion of the assembly ring installation.

4.2 Turbine Tower Sections

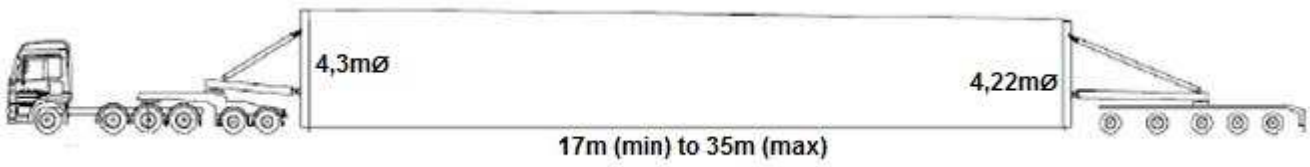
The turbine tower will consist of three (3) to five (5) steel tower sections, depending on the selected turbine hub-heights. Each section needs to be loaded and transport separately to site, due to the length and weight of these tower sections. Thus, three to five truck trips per each WTG will be required for the steel tower sections. The types of trucks required for the various tower sections may differ, depending on the dimensions of the specific unit, and the availability of truck types. See Section 5 on Transport Truck Types.

The figures below indicate the general dimensions and weights of the relevant Siemens tower sections.

4.2.1 Base Tower Section

The diameter of the bottom tower section is the largest, measuring 4,5m. With a mere 300mm bottom and top clearance, a minimum bridge height clearance of 5,1m is recommended for a safe turbine transport route. This implies that special turbine “clamp-type” trucks must be acquired for the safe transportation of the turbine tower sections. Should this not be possible, an alternative transport route will have to be selected with no bridge crossings enroute.

4.2.2 Mid Tower Section/s

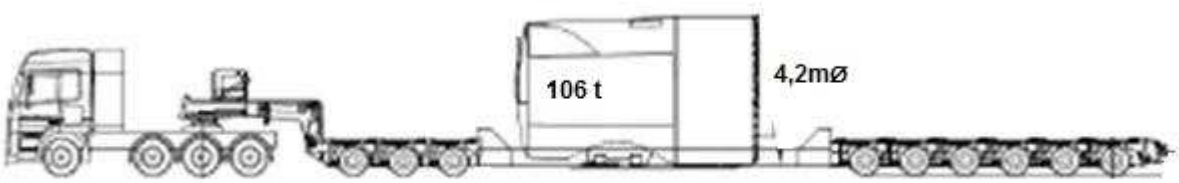


4.2.3 Top Tower Section

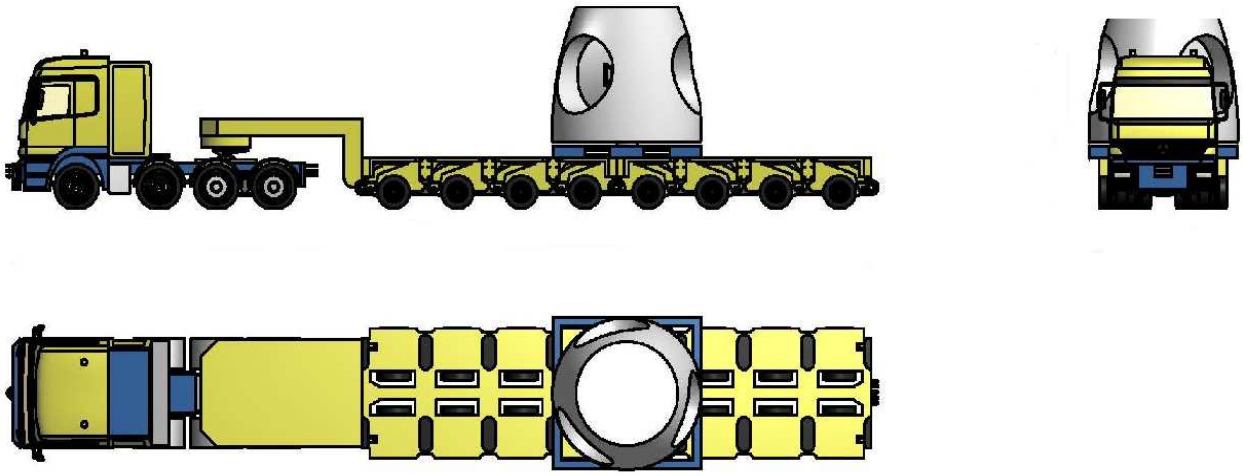
The top turbine tower section is the longest, measuring 36m. The transportation of this unit will impose limitations on the required horizontal clearances at all turning radii.

4.3 Nacelle Unit (turbine generator and brakes)

This is the heaviest and largest component of the WTG, weights 106 tons and is installed on top of the tower sections. This unit needs a minimum bridge soffit clearance of 5,1m height, and it will be transported separately, due to its heavy weight.



4.4 Turbine Hub and Rotary Units



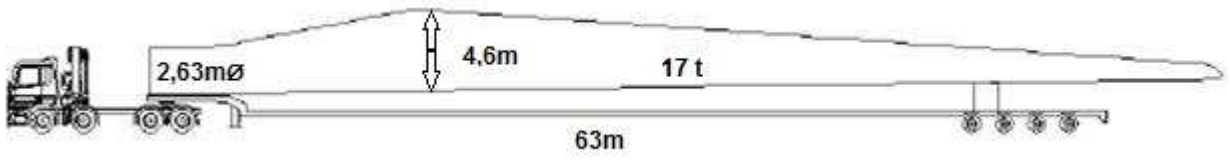
The turbine Hub unit and the Nose Cover unit are smaller units and are generally transported together. Often more than one Hub unit is transported together in order to optimise the available longer trucks and number of road trips for the trucks. The hub unit weighs 45 tons.

The Rotary Hub unit is installed to the front end on the Nacelle unit, on top of the tower sections and weighs 96 tons. This unit will be transported on its own due to its heavy weight.

4.5 WTG Blades

The blades are very sensitive components and should be handled and transported with utmost care. The blade tips should be carefully protected and supported in a special frame during shipping and transport. Each turbine consists of three (3) blades. Sets of three blades are calibrated and precisely balanced with another at the manufacturing plant, hence blades can not be swapped around between sets for another WTG. Should one blade be damaged during transport or erection, the entire set needs to be shipped

back to the manufacturing plant for re-calibration and balancing. Such an exercise will be very costly and time consuming, hence utmost care is required during the transportation process.



The turbine blades of the selected Siemens turbine measures 63m in length. This extreme abnormal length will impose major challenges enroute the transport roads. Special care should be taken during the planning of the transport routes, to ensure that selected roads have suitable turning radii and sufficient 'sweep' clearance is available around corners. This implies that bushes or trees may need trimming and that obstacles such as fences, road signage and electrical or telephone poles will temporarily or permanent, have to be relocated.

Blades can be lifted in air by cranes and installed one by one to the Rotary Hub unit on top of the tower sections, or all three blades can be assembled on ground level ('star-erection' type) to the Hub and lifted in the air at once and installed all three blades together, onto the Nacelle unit, on top of the tower sections. The latter installation process often saves installation time, but required larger ground lay-down areas, and hence vegetation clearance and earthworks.

It is important to note that due to the limited ground space available at the Roodeplaat Wind Farm site, as well as the steep gradients (hilly topography), it will not be possible at most of the turbine sites, to assemble all three blades in a 'star-erection' profile on ground level. In addition, it is further strongly recommended that no blade laydown embankments should be constructed at any of the turbine sites, due to the steep gradients. This will considerably limit the disturbed footprint areas, to be impacted during the construction and installation processes.

The logistics of the blade transport to the various turbine sites, will thus have to be carefully planned in order to transport the blades only from the "Site Laydown Area", directly to the specific turbine platforms, when the installation team is on-site, and ready to commence with the blade erection process. This will imply that the blades should be lifted directly from the transport trucks into the air for installation, without the need to temporary place the blades down on the ground. The selected crane supplier / operator should be informed upfront about the blade erection limitations on site and installation recommendations.

5 ALTERNATIVE TRANSPORT TRUCK AND CRANE TYPES

Due to the limited number of various alternative trucks and crane types available in South Africa, it is essential to workshop the final transport recommendations and time frames, in detail with the appointed Transport Operator company. The hourly or daily rental costs for various trucks and crane types, as well as the kilometre travel cost, which Transport Operators will charge, should be compared. A detailed logistic plan should be tabled by the Transport Operator, to suit the Developer's construction programme.

5.1 Abnormal Transport Trucks

The following photos show various truck and crane types that can be used for the transportation and erection of the various WTG components.

Photo 2: Tower Section transported on Lowbed Truck (routes with No height restrictions).

Photo 3 : Tower Sections transported with trucks equipped with the Schnable Connection to reduce the total load height. Height clearances required can be as low as 4,8m at the extreme.

Photo 4 : WTG Blades transported with special "Centre Beam" Abnormal Long Trucks. Note special support frame for blade tips.

Photo 5 : Two WTG Blades transported simultaneously on one truck to reduce number of truck trips required. Special truck and support framework are required

Photo 6 : Transportation of the heavy weight Nacelle Unit on special Lowbed Truck. Note limited ground clearance and clearance to overhead electrical cables are critical.

Photo 7 : Rotary Hub transported on special Lowbed. Note the limited ground clearance available.

Photo 8 : Three (3) Rotary Hub nose units transported together. These smaller components are often transported with the Rotary Hub on a single truck.

More information on various truck alternatives will be available at the detail design stage, after consultation with the appointed Transport Operator.

5.2 Crane Transport and Erection

Various cranes will be needed for the safe loading and off-loading, handling and turbine erection and installation processes. These cranes are very large components and must also be transported to site, together with very heavy counter-weights. Mobile (self-driven) and fixed crane type are available. The transportation of cranes to site will generally not require special height clearances and large turning radii, as most cranes will be transported to site in sections, and will only be assembled on-site.

5.2.1 Cranes at Ngqura Harbour docking Quay

The shipping vessels importing the turbine components will be equipped with on-board cranes to do all the safe off-loading of WTG components to the abnormal transport vehicles, parked adjacent to the shipping vessels.

Photo 9 : Turbine shipping vessels equipped with on-board cranes

5.2.2 Cranes at Loading Area and Assistant Cranes

The imported turbine components will be transported from the Ngqura Harbour to the nearby Coega Turbine Laydown area (See Google Map 1 and Photo x, Section 6.3.1 below), or the centralised laydown area, to be developed on the Wind Farm site (see Google Image 32 and Photos 22 and 23, Annexure 5). Topsoil removal and stockpiling for later site rehabilitation will be required, as well as *minor earthworks to level the site for safe crane operations*.

Mobile (self-driven) cranes will be required at these turbine laydown areas for ease of movement in and around these areas. These will be smaller cranes, or a primary large crane and smaller assistant crane/s will be required to ensure safe handling and storage of turbine components.

Photo 10 : Mobile cranes parked at a typical centralised wind turbine component laydown storage site.

Large open space hard surfaces will be required to safely manoeuvre the abnormal trucks and mobile cranes in and around the turbine laydown areas, as well as to place the various turbine components level and close to another, during the temporary storage period.

Photo 11 : Small mobile cranes will be required at the turbine off-loading sites, assisting with the safe handling of turbine components.

Photo 12 : View of typical turbine blade laydown area – note large open (hard surface) spaces required to safely manoeuvre the abnormal trucks and mobile cranes in and around the turbine laydown area.

5.2.3 Main Fixed Lattice Boom Cranes

Large primary cranes will have to be transported to each turbine platform site for the erection of the turbine tower sections, the blades, the nacelle and the rotary hub units. The expected turbine hub-heights will be in excess of 100m. Hence, the reach of the primary crane to erect the blades and nacelle may extend up to a height of approximately 150m. This will necessitate the provision and erection of a fixed lattice boom primary crane.

Large assistant mobile cranes will be required to handle, to counter-weight the turbine components and to assist with the installation thereof.

Photo 13 & 14 : Typical Mobile (self-driven) and Primary Fixed (lattice boom type) cranes which will have to be available at each Turbine Platform area, during the turbine erection process.

The large lattice boom crane/s and counter-weights etc. will be transported to the wind farm site in several parts, on a number of abnormal transport trucks. The various parts of the main crane and lattice boom which will have to be assembled on site, at each turbine platform. After completion of a turbine erection, the primary crane and lattice boom will have to be partly dismantled, in order to safety travel to the next turbine platform area. The steep gradients between the various turbine sites, will complicate the partly erected transportation of the primary crane. It may therefore be necessary to fully dismantle the primary crane and lattice boom, for safe transportation.

Suitable temporary space for the assembly and dismantling of the long lattice boom of the Primary crane must be made available on site (at each turbine platform), of sufficient width for the assistant crane to manoeuvre safely alongside the lattice boom, for the assembly thereof. This open hard surface strip, may require only topsoil removal and compaction, or it may require considerable earthworks especially where steep gradients exist. Care must be exercised during the detail design stage to ensure minimal impact on the environment.

Photo 15 : Aerial view of typical turbine platform, showing the temporary space required for the assembly and dismantling of the long lattice boom of the Primary crane

6 TRANSPORT ROUTE ANALYSIS

6.1 General Transport Road Requirements

Turbine manufacturers often impose transport their own road requirements for each WTG unit. Different requirements may be set by different manufacturers/turbines. The requirements in terms of minimum road surface widths, maximum lateral slopes, maximum longitudinal slopes, minimum horizontal turning radii and required sweep clearances, will in detail be determined and assessed at the Detail Design stage.

6.2 Abnormal Load Mass Requirements

The National Road Traffic Act (Act 93 of 1996) and the National Road Traffic Regulations, 2000 prescribe certain limitations on vehicle dimensions and axle and vehicle masses which any vehicle using a public road, must comply with. 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. 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 and is allowed to travel on public roads under an exemption permit issued in terms of Section 81 of the National Road Traffic Act (TRH 11).

The Road Traffic Act, 1996 (Act No. 93 of 1996) and the Road Traffic Regulations made in terms of this Act, determine the permissible maximum mass limits of vehicles used on public roads in South Africa. The relevant regulations are Regulations No. 234 to 243. It is important to note that all these regulations are simultaneously applicable and that the one which prescribes the lowest mass for a particular vehicle is the applicable regulation/s.

These regulations are available from the Department of Transport or via the internet and are listed below:

http://www.polity.org.za/polity/govdocs/regulations/1999/roadregs06.html

Regulation 234 : Permissible maximum axle mass load of vehicle;
Regulation 235 : Permissible maximum axle unit mass load of vehicle;
Regulation 236 : Permissible maximum vehicle mass;
Regulation 237 : Permissible maximum combination mass;
Regulation 238 : Load on tyres;
Regulation 239 : Gross vehicle mass, gross axle mass load, gross axle unit mass load, gross combination mass, power to mass ratio and axle mass load of driving axle to total mass ratio not to be exceeded;
Regulation 240 : Mass load carrying capacity of road;
Regulation 241 : Mass load carrying capacity of bridges;
Regulation 242 : Distribution of axle mass load and wheel mass load on vehicle fitted with pneumatic tyres;
Regulation 243 : Axle mass load of vehicles fitted with tyres other than pneumatic tyres.

6.3 Transport Route Alternatives

Afri Coast conducted a desktop study to identify the possible transport routes from the Ngqura Harbour to the Roodeplaat Wind Farm site. The desktop study was followed-up by on-site investigations, with the proposed routes driven. Roadway characteristics were investigated and documented to identify the areas of concern. Each intersection along every transport route was visually reviewed to determine the improvements, if any, which would be required for the safe and practical transportation of all turbine components.

6.3.1 Ngqura Harbour

The Ngqura Harbour at the Coega Industrial Development Zone (IDZ), north of Port Elizabeth is the preferred harbour to import all the WTG components. Several previous wind turbine components have in the past successfully been imported and transported from this harbour. Applicable import permits from Customs will have to be arranged with the harbour authorities.

This harbour can accommodate the docking and handling of turbine components, with sufficient space available for abnormal truck movements. The docking of ships will typically takes place at the “Finger Quay” from where WTG components can safely be off loaded. Ships transporting WTG components will be equipped with on-board cranes, hence no additional mobile cranes at the quay are necessary.

Turbine components can be transported directly from the ship to the Roodeplaat Wind Farm site. However, this will implies that either the ship will be have to be docked for a few days (at considerable ‘docking time’ fees), until all off-loading has been completed, or that a number of transport truck will have to be available simultaneously, to assist with fast off-loading and transporting. Both options will be costly and may not be practical to arrange.

There is a ***temporary turbine storage yard*** arranged by the Coega IDZ, next to the “Finger Quay”, where mobile cranes are available to assist with the fast handling of all imported turbine components. This will ensure that ships can be off-loaded within a matter of hours, depending on the availability of trucks, in order for the ships to depart from the Ngqura Harbour as soon as possible. This will minimise expensive docking fees. Storage fees are payable to the Coega IDZ for the period while turbine components are temporary stored at their Storage Yard - – see Google Map 1 below.

Google Map 1 : Arial view of the Ngqura Harbour and the N2 National Freeway crossing Neptune Road, as entrance road to the harbour.

Photo 16 : Arial view of the Ngqura Harbour and the Coega Turbine Laydown Area

It is recommended to transport all turbine components as soon as possible from the Ngqura Harbour to the ***Combined Laydown Area on-site,*** at the entrance of the Roodeplaat Wind Farm Development. (This will however require that a suitable mobile crane will have to be available at this on-site Combined Laydown Area, from the day when the first turbine component will arrive on site, until the last day that all turbine components will be loaded and transported to the specific wind turbine platform. The daily cost of the crane rentals is very expensive. Hence, thorough logistic and construction planning, in order to minimise the duration of the crane requirement at the Combined Laydown Area, will save considerable cost to the Developer.)

This harbour is directly linked via Neptune Road (a wide 3 lane road) to the N2 National Freeway without any obstructions from the harbour – see photos in Annexure 2. However, the abnormal trucks will have to exit the harbour through security boom control gates. Larger gates are also available on the side on the security boom gates, should some of the turbine components be too large for the boom control gates.

The Transportation Routes discussed below, have been divided into a "**First Stage**" and a "**Second Stage**". The First stage covers the road assessment of various transport routes from the Ngqura Harbour to the start of the provincial gravel Main Road (MR407). Two alternatives have been identified for the "First Stage" transport route : Route Option A and Route Option B, which is further discussed in Sections 6.3.2 and 6.3.3 here below.

The provincial gravel Main Road (MR407) is the only possible access road towards the Roodeplaat Wind Farm Development from the R75 Provincial Road. The MR407 will be assessed separately as the "**Second Stage**" of the Transport Route. Refer to **Annexure 1** for the combined layout of all the proposed Transport Routes.

The transport of the turbine components on the development site (during the Construction and Turbine Erection satges), will be discussed as part of the **Traffic Management proposal in Section 8**.

6.3.2 First Stage - Transport Route Option A

The proposed transport route (Option A) runs from the Ngqura Harbour onto the N2 National Road, southwards to the R75 off-ramp, then heading northwards on the R75 to the start of the provincial gravel Main Road MR407 (Second Stage Route). Refer to Google Map 2 below for a depiction of the proposed route Option A.

Google Map 2 : Layout of Proposed Transport Route Option A

The N2 National Road is a two-lane dual carriageway freeway, which is in a good condition. Seven (7) road bridges are crossing over the N2 freeway enroute to the R75 off-ramp. The bridge soffit height clearances are generally acceptable.

The R75 is a two-lane dual carriageway Main Road, which transforms into a single-lane two-way road approximately 1km after the Daniel Pienaar Road bridge (R334) near Uitenhage. Three (3) road bridges are crossing the R75 main road, all with soffit height clearances of more than 5.5m.

Transport Route Option A (via the N2 National Route and the R75 Provincial Road) has the following advantages:

a) These roads are all surfaced roads and in a good condition, hence no upgrading work is foreseen;

b) Turning radii and road gradients are generally acceptable to transport abnormal loads;

c) The majority of these roads are dual carriageways, hence ease for other traffic to by-pass and no traffic “Stop-and-Go” sections will be required;

d) The transport travel time on the N2 will be relatively short due to the absence of controlled traffic intersections (traffic lights and stop signs).

6.3.2.1 Route Specific Problems Identified

Transport Route Option A (via the N2 National Route and the R75 Provincial Road) has the following dis-advantageous :

a) This route option is physically the longest route (though still relatively short) - approximately 62km from the Ngqura Harbour to the start of the MR407 – hence slightly higher travel cost;

b) The non-avoidable bridge at the Settlers (M4) North Freeway intersection has a low soffit clearance height of only 5.06m. (Refer to Google Images 7 & 8, Annexure 2);

c) The N2 off-ramp onto the R75 : Sufficient space for turning manoeuvres with very large abnormal transport vehicles at this intersection, especially for turbine blades is not available. It is not possible to widen this intersection to accommodate all turbine component transport. ***Hence, it is recommended that the turbine blades be transported via another route.*** Route Option A is however suitable for the transportation of the tower sections, nacelle and other smaller (shorter) components.

   However, this N2/R75 intersection is also a very busy intersection with heavily congested traffic, especially during peak traffic hours. Traffic police escorts will be required to assist and control the traffic, which may include temporary stoppage of traffic while the abnormal trucks are turning. (Refer to Photo 2, Annexure 2).

d) There are also a number of other busy intersections situated on the R75 towards the MR407, where it will be necessary for traffic control measures. All these intersections will only require a 'straight across' movement, and no other problems are foreseen at these intersections apart from traffic congestions;

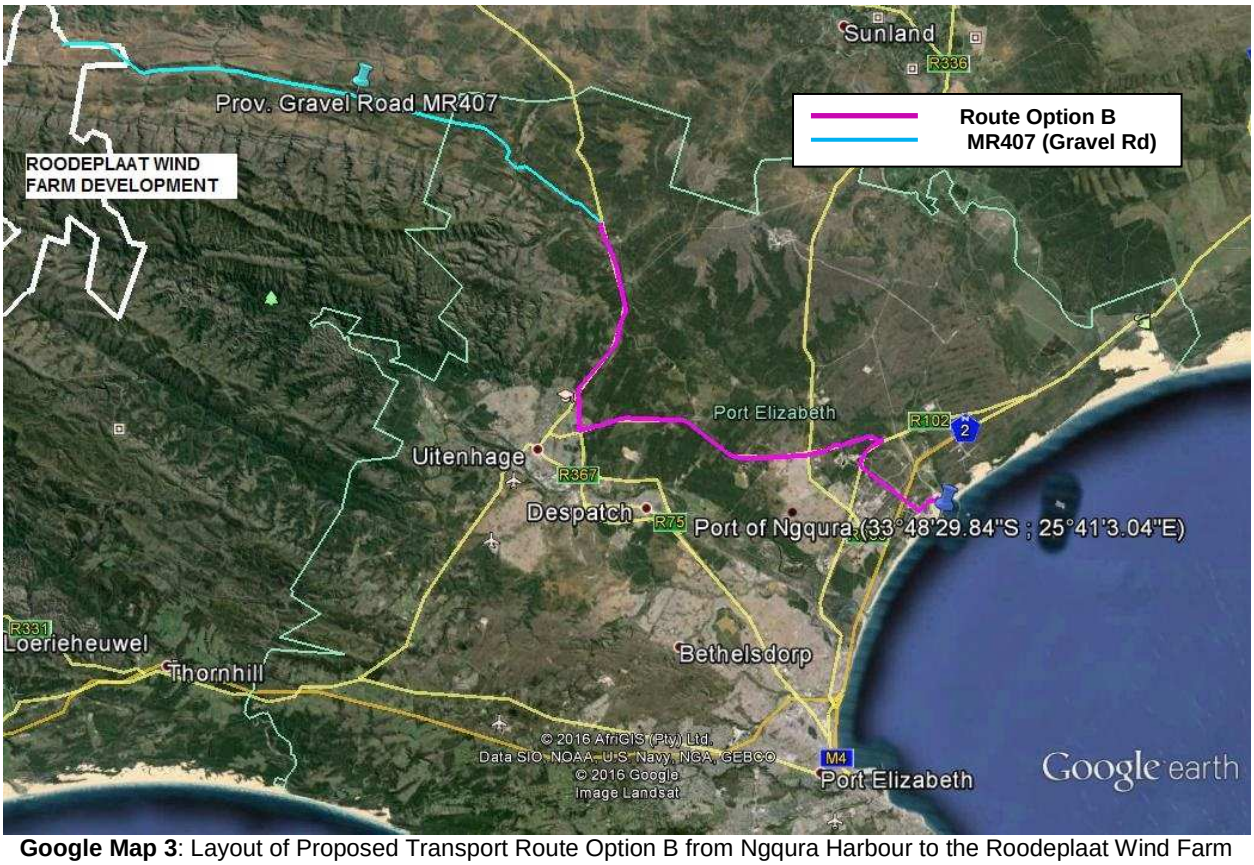
e) A section of the R75 dual carriageway passes through residential township areas (such as Algoa Park, New Brighton, Zwide, Kwadesi and Masibulel), where riots occasionally takes place and the main road may be closed-off by burning tyres etc. Traffic police escorts will be required to assist and control the traffic, the public / pedestrians as well as local residents. (Refer to Image 2B and 3B, Annexure 3)

f) Some relatively steep grades exist along the R75 Main Road, but with no major problems foreseen.

Annexure 2 contains several maps and photos depicting and discussing the Transport Route Option A in more detail. Specific localised problems identified, are also highlighted and discussed in more detail in this Annexure.

6.3.3 First Stage - Route Option B

An alternative transport route (Option B) was identified, running from the Ngqura Harbour, northwards onto Neptune Road and the R367, turning westwards onto Daniel Pienaar Road (R334) towards the R75 on-ramp and then northwards on the R75 towards the provincial gravel Main Road MR407. Refer to the Google Map 3 below for a depiction of the proposed Route Option B.



Google Map 3: Layout of Proposed Transport Route Option B from Ngqura Harbour to the Roodeplaat Wind Farm

This transport route was identified specifically to avoid all bridges and to opt for the shortest route distance (45km). Thus, there are no height restrictions along this transport route.

Neptune Road is a three-lane one-way main road with low traffic volumes. This road crosses under the N2 with a soffit clearance of more than 6m, hence no problems are foreseen along this road.

The other roads to the MR407 are all single lane, two-way roads. The transport travel time on this route will be relatively quick due to the absence of controlled traffic intersections (traffic lights) and no traffic congestions expected, due to low traffic volumes. There are a number of turning radii at intersections which will impose some minor problems and needs attention (minor road upgrade work and road furniture), as well as a few noticeable horizontal and vertical curves along this route, which are further discussed in Section 6.3.3.1 here below.

6.3.3.1 Route Specific Problems Identified

Transport Route Option B (via Neptune Road, R367, R334 and R75) has the following dis-advantages:

a) **Neptune Road / R367 T-junction intersection**: this is a large open intersection with low traffic volumes. Adequate right turning radius will be available at this intersection for large abnormal trucks. However, it may be necessary to temporary widen this intersection depending on specific truck types available at that stage. This may entail a combination of widening the inside and outside curves, which will include minor site clearance and earthworks. Roadside furniture (eg. signposts, traffic control signs and poles etc.) may have to be temporary removed / permanently relocated, to accommodate the sweep path of the transport vehicles. (Refer to Google Images 22a) and b), as well as Photos 4 and 5, Annexure 3).

b) **R367 / Daniel Pienaar Street (R334) T-junction intersection**: this is a large open intersection with low traffic volumes. Adequate left turning radius will be available at this intersection for large abnormal trucks. However, it may be necessary to temporary widen this intersection depending on specific truck types available at that stage. This may entail a combination of widening the inside and outside curves, which will include minor site clearance and earthworks. Roadside furniture (eg. signposts, traffic control signs and poles etc.) may have to be temporary removed / permanently relocated, to accommodate the sweep path of the transport vehicles.

c) A traffic island with raised barrier kerbs is situated within the transport vehicle movement. Some kerbs of the traffic island, where previously removed (not yet re-installed) for previous large abnormal trucks, which safely turned at this intersection for other wind farm developments. (Refer to Google Images 23a) and b), as well as Photos 6 and 7, Annexure 3).

d) **Road condition between the R367 / R334** (Daniel Pienaar Road) T-junction intersection and the R334/R335 four-way intersection: The road condition is not desirable at the time of the assessment, but can be travelled safely with a little inconvenience. Large areas exist where rough pothole plugging, major crocodile cracking and severe surface and pavement failures are visible. The road requires rehabilitation in its current condition, to accommodate the high number of heavy abnormal transport vehicles expected. This is however a secondary road with low traffic volumes, therefore it is not envisaged that any rehabilitation work on this road section, will be undertaken by the Department of Roads in the near future. (Refer to Photos 8 to 13, Annexure 3).

   The repair work on this Section of the R334 is not yet critical (eg. not a “No-Go” option). However, if these road defects will be left untreated, it is expected that sections of this road will totally break up under the heavy abnormal loads expected for this Development. Due to no height limitations along Route Option B, it is recommended that high raised trucks be selected for the Transportation Stage, but it will still require carefull driving through the poor road sections. The condition of this surfaced road section should be monitored, re-inspected and reported to the Department as soon as the commencement date of the transportation of turbine components, is known. It may be necessary to allow for some surface road repair work by the Developer, should no rehabilitation work will soon be undertaken by the Department on this section of the R334.

e) There are a few noticeable horizontal curves along this section of the route, which will require vegetation trimming and possibly tree and bush cutting, to clear the blade sweep area. Some vertical gradients are relatively steep, but no major problems are foreseen.

f) **On-ramp onto the R75 from Daniel Pienaar Road** (R334): this is a large open intersection, but high traffic volumes will be experienced during peak hours. Adequate space for large abnormal trucks, for a safe right turning radius, is currently not available at this on-ramp. However, it is evident from kerbs, which were previously removed (and not yet installed), that large abnormal trucks (from other wind farm developments) can be accommodated at this intersection.

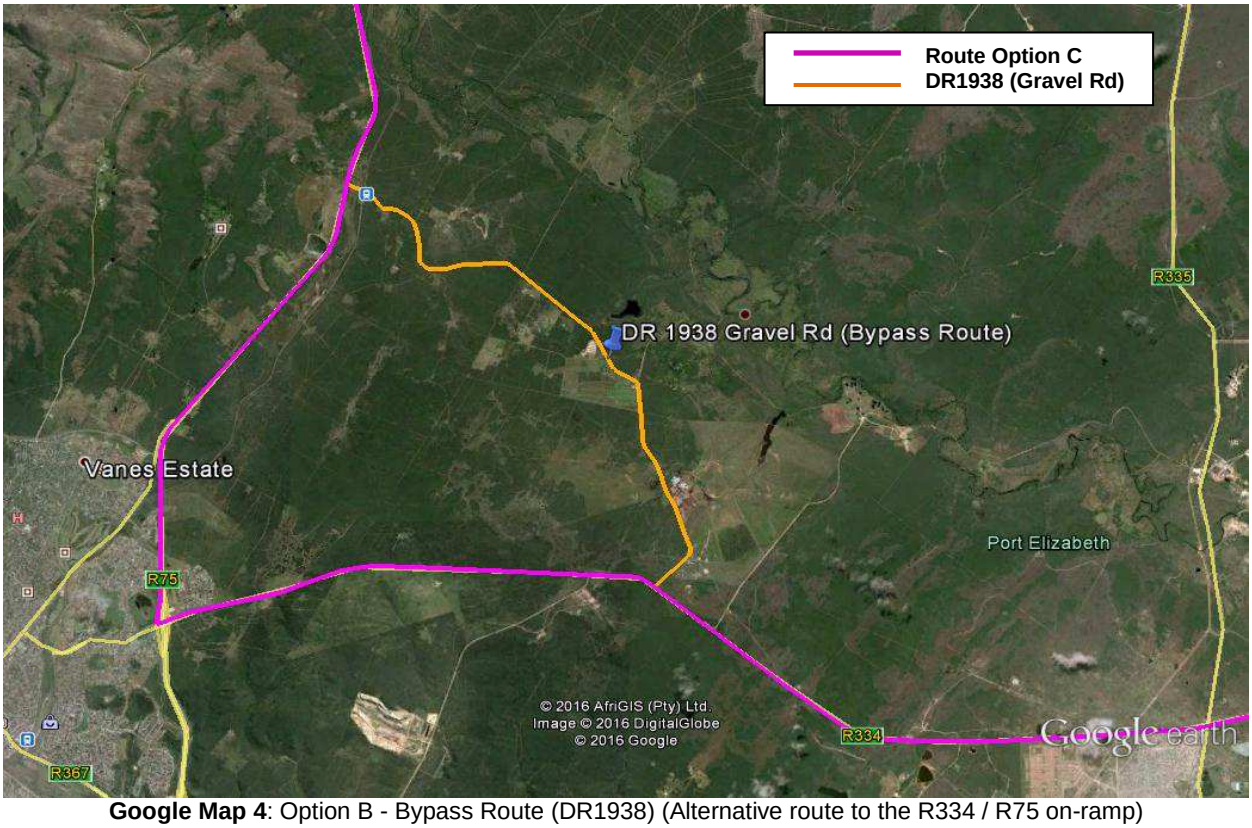
g) It is possible to temporary widen this road intersection, by removing the high-mast street light pole and additional inside kerbs. Minor earthworks may also be required. Other roadside furniture (eg. signposts, traffic control signs, etc.) will have to be temporary removed / permanently relocated to accommodate the sweep path of the transport vehicles. (Refer to Google Image 26 and Photo 14, Annexure 3).

   Annexure 3 contains several maps and photos of Transport Route Option B. Specific localised problems, are also highlighted and discussed in more detail in this Annexure.

6.3.3.2 Gravel By-pass Road (DR1938)

The gravel bypass route was identified as an alternative to Route Option B, to avoid the difficult right turn movement from the R334 (Daniel Pienaar Road) to the R75. This gravel road starts on the R334, at approximately 7km before the R75 on-ramp. (Refer to the Google Map 4 below). Turning northwards on this gravel road and continue towards the R75, turning right and continue northwards on the R75 towards the provincial gravel Main Road MR407. This gravel by-pass road is approximately 9,5km long and will by-pass the surfaced road sections of the R334 and R75 of a total distance of approximately 15km.

Refer to the Google Map 4 below for a layout of the proposed By-Pass Gravel Road.



Google Map 4: Option B - Bypass Route (DR1938) (Alternative route to the R334 / R75 on-ramp)

Gravel road (DR1938) is 5 to 6m wide and was in a relative good condition at the time of the assessment. However, this gravel road has a number of minor localised problem areas. The entrance (at the R334) and exit (at the R75) T-junction intersections will need to be widened, to accommodate appropriate safe turning movements of the large abnormal truck. This will entail minor earthworks and temporary or permanent replacement of roadside furniture, including the necessity to move electrical posts and fences.

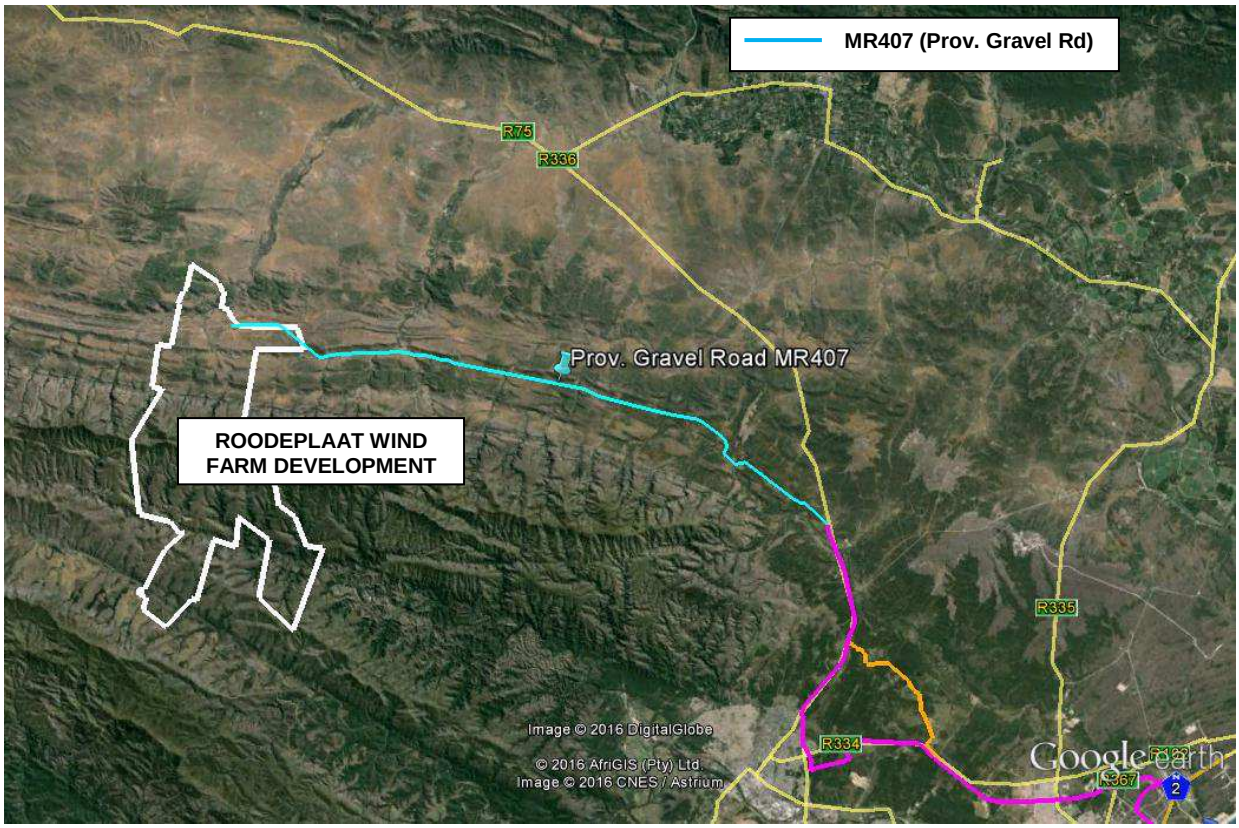
Vertical and horizontal curves along this gravel road may need to be reshaped, to suit appropriate sagging or crest curves for save ground clearance and sweep areas. This road will have to be maintained regularly (eg. by wet grading) by the Developer, during the Transport stage.

Based on the discussion in this section, it is recommended that Transport Route Option B with the Gravel by-pass road option, be selected as the preferred turbine transport route alternative.

Annexure 4 contains several maps and photos depicting and discussing the Gravel By-Pass Road in more detail. Specific localised problems identified are highlighted and discussed in more detail in this Annexure.

6.3.4 Second Stage – Gravel Main Road (MR407)

The "Second Stage" of the transport route starts at the R75 / MR407 intersection. This provincial gravel Main Road MR407 is the only route to the development site and is approximately 39km long with a width of 5m to 6m. A turbine component laydown area will be developed within the proposed development site. Refer to Google Map 5 below for a depiction of this proposed route and refer to Annexure 5 for representative photos.



Google Map 5: Layout of the Gravel Main Road (MR407)

6.3.4.1 Route Specific Problems Identified

A few of the important problem areas identified enroute this gravel road, are as follow:

- A couple of concrete drifts with notable steep vertical gradients exist. These road sections needs to be surveyed to verify the gradients. It should be confirmed with the Transport Operator (to be appointed), to ensure that suitable abnormal transport trucks will be made available to carry the expected heavy loads up the steep slopes. It may be necessary to designed and possibly re-aligned or respace sections this gravel access road to accommodate available transportation vehicles.

- A few noticeable sharp horizontal curves were observed. These road sections need to be surveyed, and designed to suite available transport truck movements. It may be necessary to re-aligned short sections of this gravel access road to accommodate transportation vehicles. It is expected that minor vegetation clearance and bush cutting, removal of farm fencing and minor earthworks may be required at a few sharp horizontal curves, to accommodate the sweep of the blade transportation.

- The surface of this gravel road is currently in good condition and the Developer will be responsible for maintaining the road during the transportation of turbine components to site. It is recommended that regular wet grading and wetting for dust suppression, may be required from time to time.

7 SURVEY AND DESIGN WORK REQUIRED

No survey information is available for any of the proposed Transport roads (both surfaced of gravel roads) to Wind Farm Development site. Therefor no detail design and accurate confirmations could be done, to verify specific problems, either in terms of steep gradients or limitations for horizontal turning movements.

It will be costly, and not recommendable or practical, to re-construct any vertical gradients of surfaced roads to suit the capabilities of specific transport trucks. It may however be necessary and practical to re-construct and re-align short sections of the gravel access roads to the Wind Farm development, to flatten specific short sections, where steep vertical gradients exist.

Several horizontal turning movements at intersections are currently obstructed with fencing, vegetation, kerbing, guardrails, road signages or poles, as discussed above. It is necessary to perform detail "turning movement" designs at each intersection, to ensure that safe horizontal movements, including the expected blade sweep path, is indeed possible and safe at every intersection, and to indicate the extent of sweep areas, to be cleared from any obstacles. This should be done once the specific truck types to be available, were confirmed.

It is critical to ensure that suitable transport trucks will be selected and made available for the transportation of all turbine components. Hence, it is recommended that all "hot spot" problem sections enroute the surfaced and gravel roads, as well as all intersections with limited turning radii (as discussed in above Sections), be surveyed and designed, to confirm the vertical gradients and any obstacles in the designed sweep path of the expected transport truck movements.

The survey results and designed transport vehicle movements must be discussed with the Transport Operator, to verify and confirm that safe and un-obstructed abnormal movements are possible. It is strongly recommended that a "dry-run" with the largest abnormal transport truck must be performed, prior to the transportation of any turbine components.

8 TRAFFIC MANAGEMENT ASPECTS

No traffic counts were done as part of the Traffic Management Study. This section will briefly discuss the expected traffic congestions and traffic impacts enroute, from the Ngqura Harbour to the Wind Farm Development site, as well as the expected on-site traffic management aspects.

8.1 Expected Traffic Volumes

It is necessary to gain an understanding of the expected additional traffic volumes that will be generated due to this Wind Farm Development. The majority of additional traffic flow will be generated during the Construction Stage and the Turbine Erection Stage. The number of expected additional traffic volumes during the Operation Stage is very low and negligible.

The Construction and Turbine Erection Stages will interlink and it is expected that the duration of both stages will be approximately 24 months. However, the majority of inconvenience, which will be caused to the general public and traffic flow interruptions, will be limited to the abnormal transportation of turbine components.

Based on a worst case scenario, the following additional traffic volumes will be generated : :

Table 1 : Expected Traffic Volumes and Impacts for the Inyanda Roodeplaat Wind Farm Development

No	Description of Transport	Development Stage	Vehicle Types	Estimated No off vehicle trips		Expected trip frequency	No off Transport days	Expected Impact to Public Traffic
				per WTG	Total for WF (1)			
1	Turbine Foundation Assembly	Construction Stage	Std Container trucks	1	48	8 / day	6	No / Minimal impact.
2	Turbine Tower Sections	Transport Stage	Special Abnormal Vehicles	5	240	5 / day	48	Selected Transport Route : Road and Intersection Upgrades, and Road closure - section of R75
3	Turbine Blades	Transport Stage	Special Abnormal Vehicles	3	144	3 / day	48	
4	Turbine Nacelle, Hub and Rotor	Transport Stage	Special Abnormal Vehicles	3	144	3 / day	48	
5	Turbine Tools & Installation Material	Transport Stage	Std Container trucks	1	48	8 / day	6	No / Minimal impact.
6	Mobile Cranes	Transport Stage	Self-driven or Low-bed	---	4	4 / day	1	No / Minimal impact.
7	Main "Lattice Boom" - type cranes	Transport Stage	Large Delivery Trucks	---	8 to 12	6 / day	2	No / Minimal impact.
8	Earthmoving Plant (Roads & Platforms)	Construction Stage	Standard Tipper trucks	220	10 560	20 / day	528	Mainly from Borrow Pit to Site and on Site - no impact on Public Roads outside Development Footprint
9	Concrete Mixing Trucks (Foundations)	Construction Stage	Ready Mixed Concrete Trucks	75	3 600	15 / day	240	Mainly from Concrete Batching Plant (near WF) to Site, crossing MR407. Minimal Impact.
10	Deliveries of Aggregate, Cement etc.	Construction Stage	Large Tipper Trucks	25	1 200	5 / day	240	No / Minimal impact.
11	Deliveries of Bricks & Building Material	Construction Stage	Large Delivery Trucks	---	10	2 / day	5	No / Minimal impact.
12	Deliveries of Electrical Cables and Material	Construction Stage	Large Delivery Trucks	1	48	1 / day	48	No / Minimal impact.

(1) Based on 48 Wind Turbine Generators

8.2 N2 and R75 Dual-carriage way roads

Based on discussions in Section 6.3.2 above, the N2 and R75 roads are not recommended as the preferred transport routes to the Wind Farm site. Although these roads are wide open dual carriage way freeways, the average daily traffic volumes, especially during morning and afternoon peak periods, are extremely high. Major traffic congestions, especially at the N2 / R75 off-ramp right-turn movement, is expected, as normal traffic flow will have to be temporary stopped for every abnormal truck turning movement.

Therefore, in addition to the road condition limitations as discussed above (eg. soffit height clearances and limited blade sweep area at localise points), and due to high traffic volumes along the N2 and R75, it is not recommended to opt for these roads as the preferred transport route.

8.3 Provincial Main Roads

The provincial main roads selected as part of the recommended Transport Route Option B, are the R367 (R102) and the R334 surfaced roads. These roads are single lane, two-way roads with narrow surfaced shoulders. The average daily traffic volumes on these roads are very low and little or no traffic congestions are expected along these transport routes.

No negative traffic impact or inconveniences are foreseen along this section of the transport route.

Traffic police escort vehicles are however still recommended to control the normal traffic flow, especially at the following intersections :

- at the right- turn movement at the T-intersection from Neptune Road to the R367;
- at the sharp left-turn from the R367 to the R334, where the on-coming lane will also be used;
- at the R334 and R335 crossing intersection, where the cross-flow traffic has right of way.

Based on the discussions in Section 6.3.3 above, it is not recommended to opt for the right-turn movement from the R334 off-ramp to the R75. Apart from possible road infrastructure obstacles, high traffic volumes will be experienced during peak hours on this road. Major traffic congestions are expected should the normal flow of traffic be stopped for every right-turn movement of every abnormal vehicle. This section of the R75 is in the northern part of Uitenhage and carries high traffic volumes to the industrial areas of Uitenhage (eg. VWSA) and to the northern residential areas. (Refer to Google Image 25, Annexure 3). It is therefore recommended to avoid this intersection.

8.4 Gravel By-Pass Road (DR1938)

The provincial road is a gravel district road, which carries very low traffic volumes. This road is approximately 9,5km long and can be used to by-pass the traffic congested R334 / R75 intersection, as well as town of Uitenhage with related traffic flow on that section of the R75 freeway. At the point where this gravel by-pass road intersects with the surfaced R75 north of Uitenhage, the R75 has already tapered down to a single lane two-way road.

No negative traffic impact or inconveniences are foreseen along this section of the gravel transport route.

8.5 R75 Provincial Road

The section of the R75, from the DR1938 gravel road to the MR407 gravel road is approximately 7,2km long. This road is a narrow single lane two-way surfaced road with no or narrow gravel shoulder and has a poor surface condition. This road section crosses the narrow Coega River Bridge – see photo below.

This road section carries medium high average daily traffic volumes during morning and afternoon peaks (estimated in the range of 200 vehicles per hour), with a large percentage of vehicle being trucks. The allowable speed limit on this road section is 120km/h, which is unsafe for the current condition of the road.

Photo 16 : View of the narrow Coega River Bridge – full road closure of this section of the R75 will be required

The width of most of the large turbine components will occupy more than the available width of a single lane of this road. It is therefore not foreseen that it will be possible for on-coming traffic, to safely cross this river bridge on the R75, while the large abnormal turbine components are in transit.

Based on above and the relative short section of the R75 which will form part of the Transport Route option, it is strongly recommended that this section of the R75 (from before the DR1938 gravel road intersection, up to the MR407 gravel road), should be closed-off for normal traffic, for the short period while the abnormal vehicles will travel on this road section.

It will therefore be practical to travel with a few abnormal transport vehicles in a convoy, from the harbour to the end of the DR1938 gravel road and temporary park the abnormal vehicles before the intersection with the R75, while the road closures be prepared. It should not take longer than 15 minutes for a convoy of abnormal trucks to travel this 7,2km. Traffic police escort vehicles will be required to control the road closures and normal traffic flow on this section of the R75.

The impact and inconvenienced which will be caused to normal road users will be minimal. It is further recommended that the transportation of abnormal vehicles and related road closures, be scheduled outside of the morning and afternoon peak periods.

8.6 Gravel Main Road MR407

The provincial road is a gravel main road running from the R75 towards Steytlerville, which carries very low traffic volumes – mainly local farmers. This road is approximately 40km long up to the entrance of the Wind Farm Development. This road is in a good condition and is wide enough for other road users (including trucks) to safely over-take or by-pass any abnormal turbine transport vehicles.

At some horizontal bends, sight distances are limited due to small radii or overgrown vegetation, which should be addressed during the preparation and maintenance of the Transport Routes.

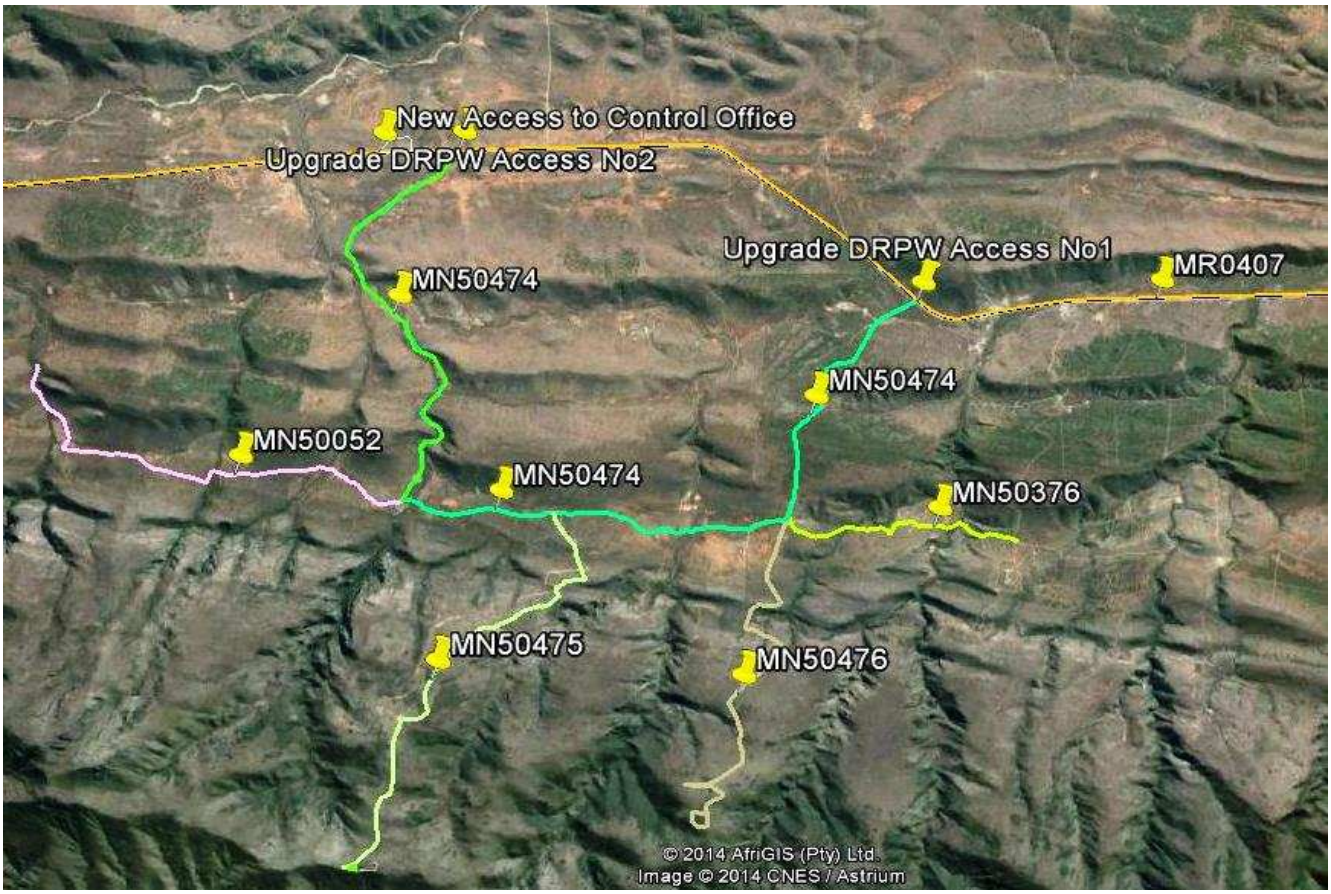
No negative traffic impact or inconveniences are foreseen along this section of the gravel transport route.

8.7 Transport on the Wind Farm

It is recommended that all turbine components be transported from the harbour to the "Combined Site Laydown Area" near the "Access No2" - entrance to the wind farm site. (Refer also to Google Image 31 and Photos 23 and 24, Annexure 5). Turbine components can then be transported to the various turbine platform areas as and when required, via the provincial Minor Road MN50474 running southwards to the turbine sites.

The provincial Minor Road MN50474 makes a loop-road through the bottom parts of the wind farm site, serving as the primary access road to the wind farm, and joining the provincial Main Road again at the "Access No1" intersection. Two other provincial Minor Roads MN50475 and MN50476 are running further southwards from this loop road, serving as the secondary access roads to the wind farm, to the first turbine positions (from where new internal roads will be constructed to link to the various other turbine sites). See Google Map 6 below.

These provincial Minor Roads are currently narrow gravel roads, which will all have to be upgraded to 6m wide roads, to accommodate the safe transport of the turbine components. If will however not be possible and safe to accommodate counter-direction traffic flow on these roads, while the abnormal transport vehicles are travelling on these roads to the turbine sites.



Google Map 6: Layout of the Minor Provincial Roads on the Wind Farm Development site

In order to avoid traffic congestions on the site roads, it is recommended that a counter-clockwise traffic flow pattern be adhered to on site. This will imply that each abnormal vehicle will enter the Wind Farm site at “Access No2” and will exit the Wind Farm at “Access No.1”.

A new east-west site link-road will also be constructed, to create a second loop road, to assist with single direction traffic flow on site, and avoid that the abnormal transport vehicles will have to travel in opposite directions on the same access roads. This may however not be possible along all internal roads in between all various turbine sites. It will therefore be important to properly plan all the site logistics, traffic flow movements and timing of transport deliveries to the various turbine sites, very thoroughly.

9 RECOMMENDATIONS

The following recommendations are made:

- The recommended transport route to the development site from the Ngqura Harbour, is the Transport Route Option B, including the Gravel By-pass road. There is however a number of intersections that will require minor modification (demolish kerbs, minor earthworks etc.) and temporary removal or permanent relocation of roadside furniture (signposts and traffic signs, electrical poles etc.).

- The condition of the R334 between the R367 / R334 intersection and the R335 / R334 intersection is undesirable and will require urgent surface and pavement rehabilitation. Due to no height limitations along Route Option B, it is recommended that high raised trucks be selected for the Transportation Stage, but it will still require careful driving through the poor road sections along this road;

- It may be necessary to allow for some surface road repair work by the Developer on the poor road section of the R334, should no rehabilitation work will soon be undertaken by the Department.

- On-site detail surveys and transport movement designs should be performed on road sections (gravel and surfaced), which were identified as problem areas, such as steep longitudinal profiles or problem intersections, to confirm road modification required to ensure safe transportation of turbine components.

- Gravel roads with steep longitudinal slopes that cannot be avoided, should be designed and re-constructed to suit acceptable road conditions.

- Surfaced roads with steep longitudinal slopes that cannot be avoided or realigned should be indicated to the Transport Operator companies. In such instances, the exact weights of the various WTG components should carefully be considered. It may be necessary to use 8x8 trucks transporting specific heavy weight components along steep slopes.

- It is recommended that the transportation of abnormal vehicles and related road closures, be scheduled outside of the morning and afternoon peak periods.

- It is strongly recommended that the section of the R75 (from the DR1938 gravel road to the MR407 gravel road), should be closed-off for normal traffic, for the short period while the abnormal vehicle will travel on this road section. Traffic police escort will be required to control the road closures.

10 CONCLUSION

The purpose of this assessment is to determine the probable transport routes and potential road modification activities required for the safe transportation of the major wind turbine components during the construction of the Roodeplaat Wind Farm Project.

Route Option B (with the Gravel By-Pass road) will be the most practical and economical route to transport turbine components to site. No major No-Go problems are foreseen.

A number of intersections have been identified, which will require minor widening and modification. A detailed assessment will be conducted at all identified problem areas, when all applicable further / final information (surveys, turbine component sizes, weights, available abnormal truck types etc.) is obtained.

A “dry” trail run should be carried out after all road modifications were addressed, before the commencement of the turbine components transportation.

ANNEXURE 1

General Layout of the Combined Transportation Routes

General Layout of the Combined Transportation Routes

ANNEXURE 2

Photo Album : First Stage - Route Option A

Google Image 1: Continue from the Ngqura Harbour onto Neptune Road. Take the N2 on-ramp to the left and continue in a southern direction towards Port Elizabeth.

Photo 1 : Entrance / Exit to the Ngqura Harbour

Google Image 2: "Street View" of Neptune Road with the N2 on-ramp to the left.

Google Image 3: Continue southwards on the N2, crossing the R335 Bridge. (See image below)

Google Image 4: "Street View" N2 National Freeway crossing the R335 Bridge.

Google Image 5: Continue southwards on the N2 National Freeway crossing John Tallent Road Bridge.
(See image below)

Google Image 6: "Street View" N2 National Freeway crossing the John Tallent Road Bridge.

Google Image 7: Continue westward crossing the Settler Way (M4) Bridge and Kempston Road Bridge.
The Settlers Way (M4) Bridge is unavoidable and has a clearance of only 5.05m, which is the lowest bridge clearance soffit along this Transport Route.
(Refer to images below)

Google Image 8: "Street View" of the N2 National Freeway crossing the Settlers Way (M4) Bridge.
This non-avoidable bridge has a soffit clearance height limitation of only 5.05m. This will have an influence on the type of transport trucks, which should be made available.

Google Image 9: "Street View" N2 National Freeway crossing the Kempston Road Bridge.

Google Image 10 : "Street View" N2 National Freeway crossing Cradle Road Bridge. This bridge has a soffit height clearance of 5,18m. No transport problems are foreseen.

Google Image 11: Continue onto the R75 intersection / N2 off-ramp. Turn right onto the R75 (Commercial Road) and continue northwards towards Uitenhage. (See image below).

Photo 2: View of the N2 with the off-ramp to the R75. Sufficient space for right turning manoeuvres by transport vehicles, especially for turbine blades may not be available. It is not possible to widen the intersection to accommodate turbine component transportation. This is also a very busy intersection with heavily congested traffic.
Traffic police escorts will be required to assist and control the traffic, which may include temporary traffic stoppages while turning right onto the R75 ramp.

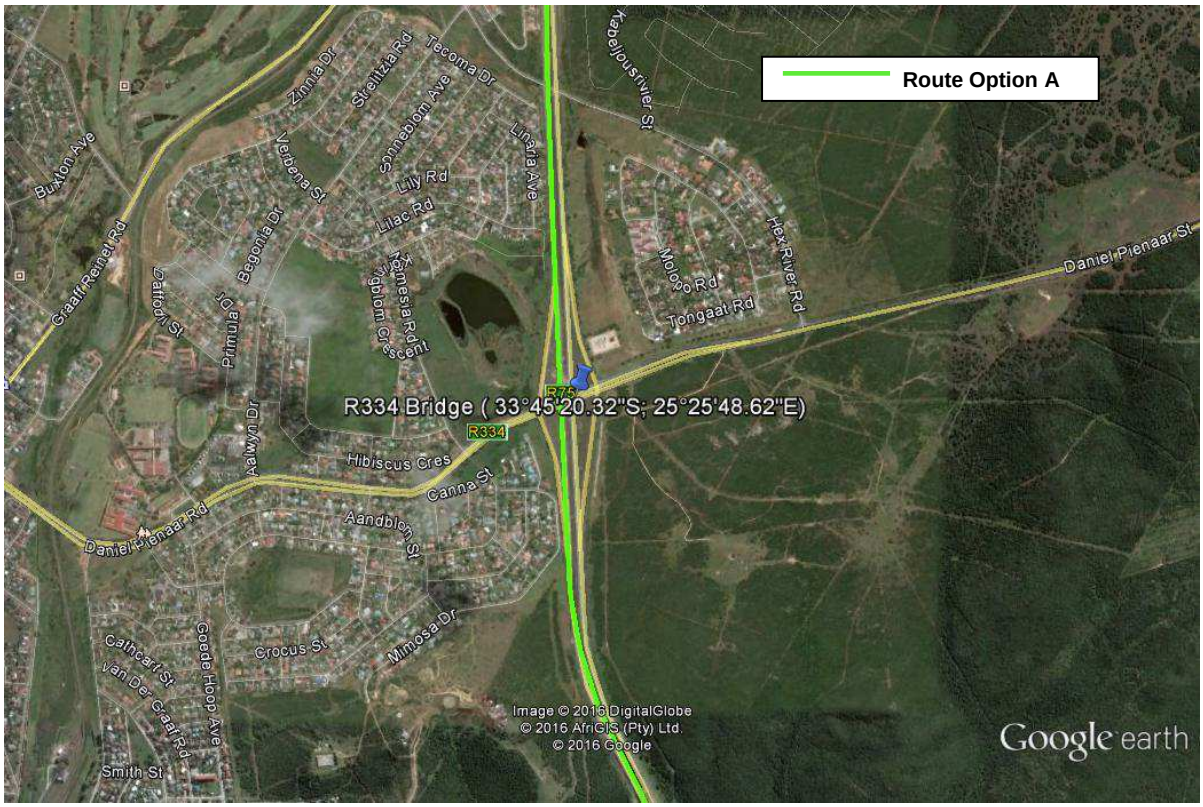
Google Image 12: A number of busy intersections are situated on the R75 towards the MR407. The route pass the townships of Algoa Park, New Brighton, Zwide, Kwadesi,and Masibulel.
Traffic police escorts will be required to assist and control the traffic.

Google Image 13: A number of busy intersections are situated on the R75 towards the MR407. The route pass the townships of Algoa Park, New Brighton, Zwide, Kwadesi,and Masibulel.
Traffic police escorts will be required to assist and control the traffic.

Google Image 14: Continue onto the R75 in a northwestern direction. This route passes Despatch, which is situated, to the north. No obstructions were noted.

Google Image 15: Continue northwards on the R75 crossing the Botha Road Bridge. The bridge has a clearance of more than 5.5m. (See image below).

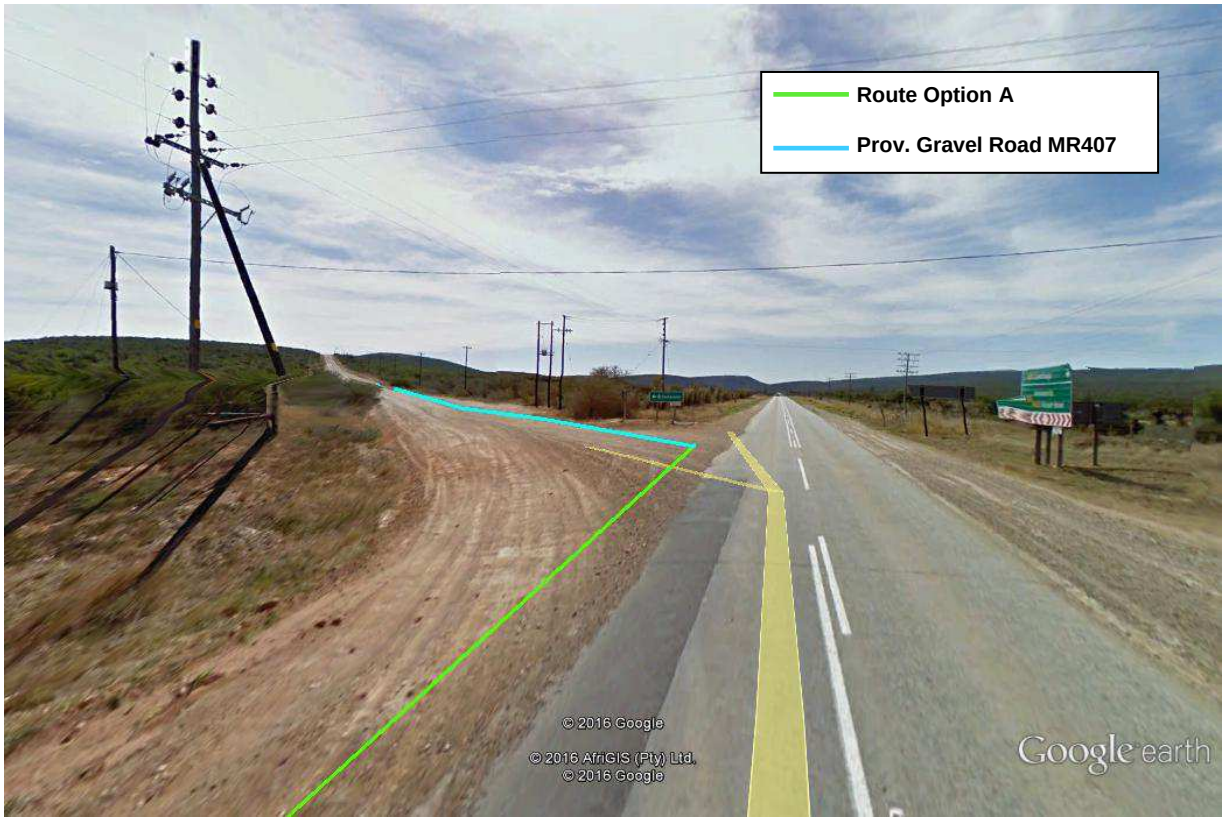
Google Image 16: "Street View" R75 crossing Botha Road Bridge.



Google Image 17: Continue northwards on the R75 crossing the R334 Bridge. The bridge has a clearance of more than 5.5m. Approximately 1km after the bridge the road converge into a single lane two direction road. (See image below)

Google Image 18: "Street View" R75 crossing the R334 Bridge. Sufficient soffit clearance for more than 5,5m is available. No problems are foreseen.

Google Image 19: Continue up to the MR407 T-junction intersection. Turn left onto the MR407 gravel road. (See image below and refer to Annexure 5 for representative photos of road MR407)



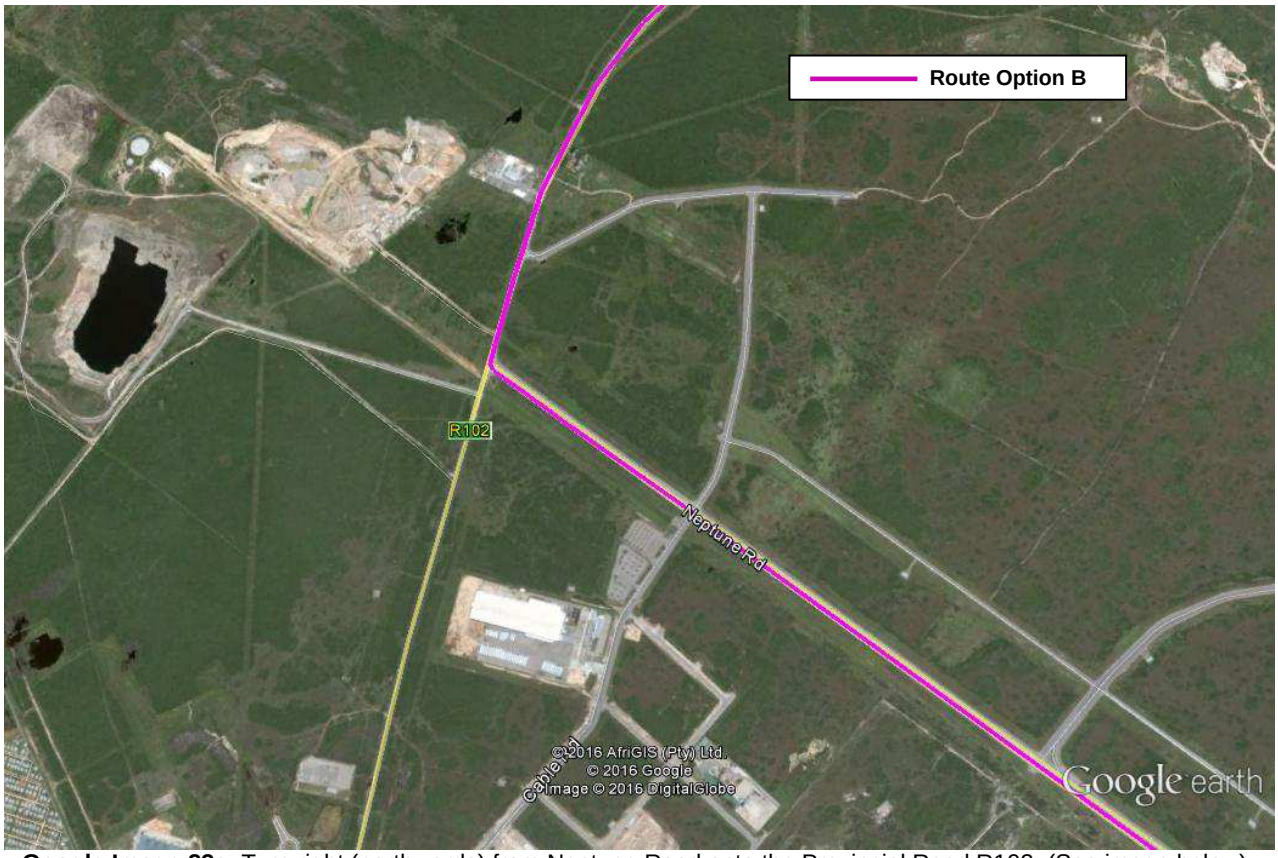
Google Image 20: "Street View" R75 / MR407 T-junction intersection.

ANNEXURE 3

Photo Album : First Stage - Route Option B

Google Image 21: From the Ngqura Harbour, continue straight with Neptune Road into the Coega IDZ area. The N2 freeway bridge that cross Neptune Road will have to be passed, however this bridge has a clearance of approx. 6,5m and is not a concern. (See image below)

Photo 3: Northern view of the three-lane one-way Neptune road crossing the N2 Bridge. Bridge soffit clearance in excess of 6m is available.

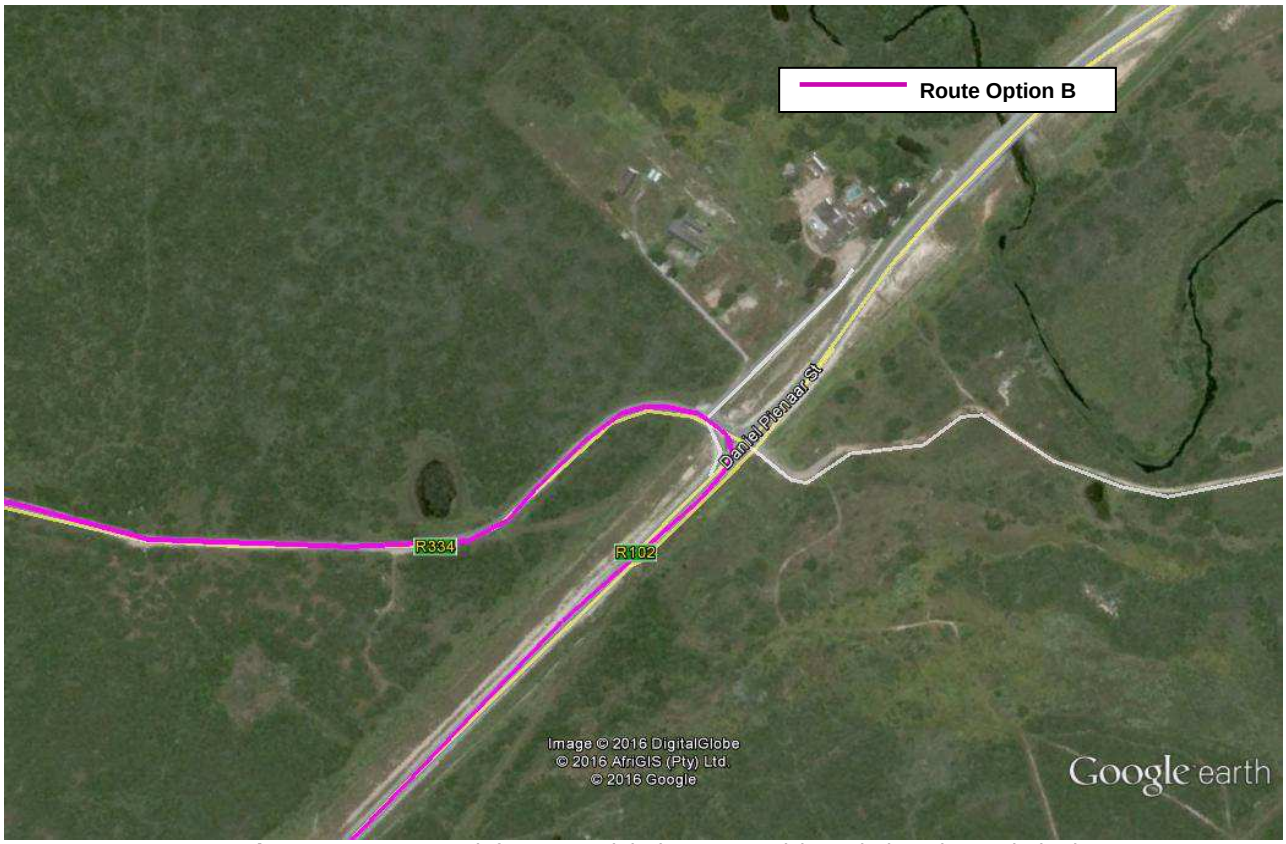


Google Image 22a: Turn right (northwards) from Neptune Road onto the Provincial Road R102. (See image below).

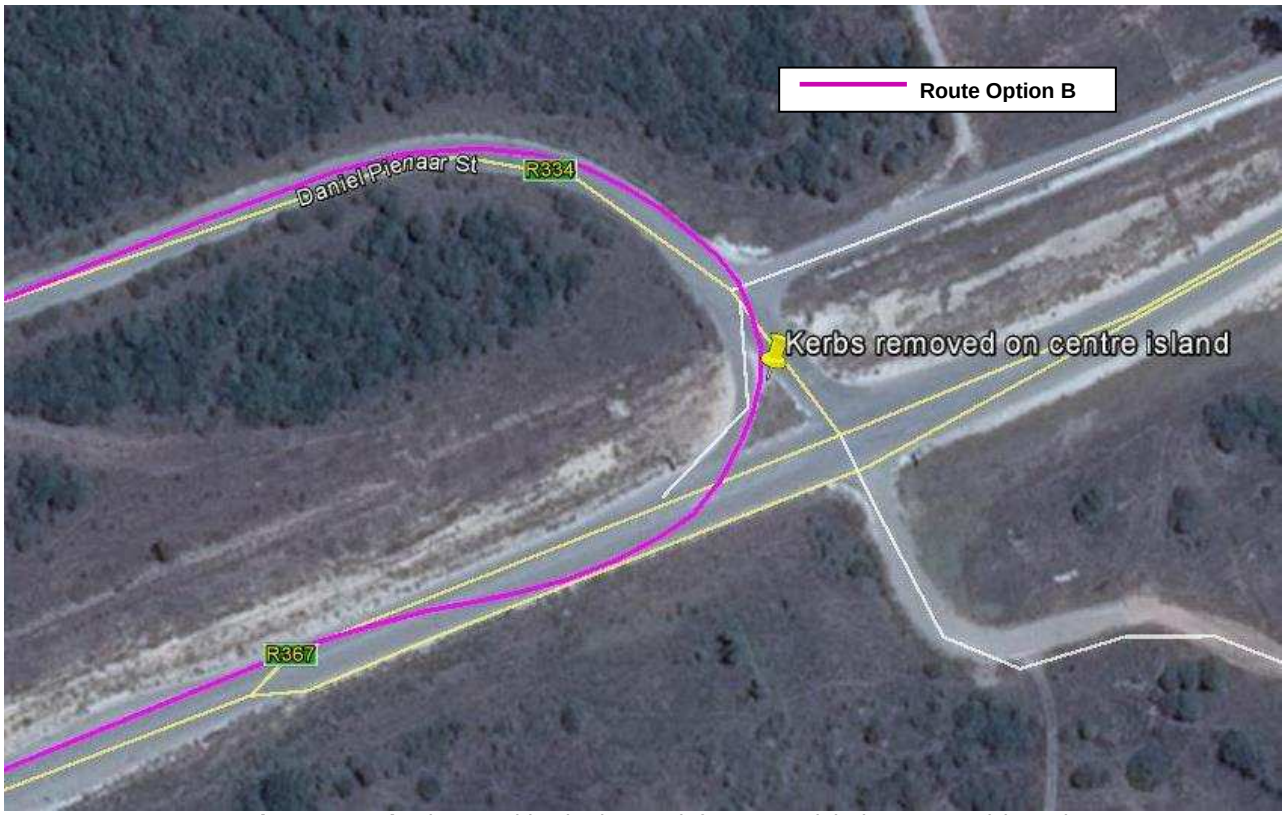
Google Image 22b: (Zoomed-in View). Turn right (northwards) from Neptune Road onto the Provincial Road R102. Note large open space available for turning movement. (See image below).

Photo 4 (above) and 5 (below): View of the right turn movement at the R367 (R102) T-junction intersection. The R367 is a wide single lane two-way road with surfaced shoulders.

Adequate turning radii may not be available at this intersection however it is possible to temporary widen this intersection. This may entail a combination of widening the inside and outside curves, which will include minor earthworks. Roadside furniture (signposts, traffic control signs, light poles etc.) may have to be temporary removed / permanently relocated to accommodate the sweep path of the transport vehicles.

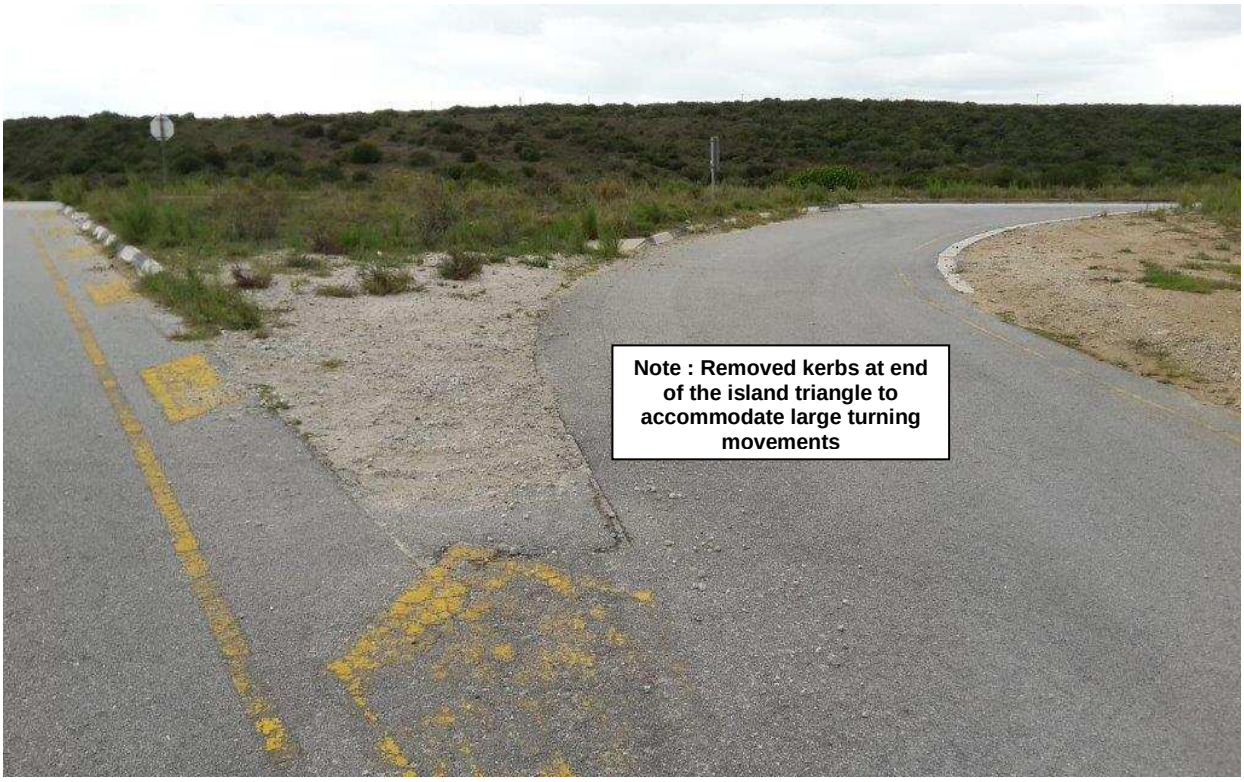


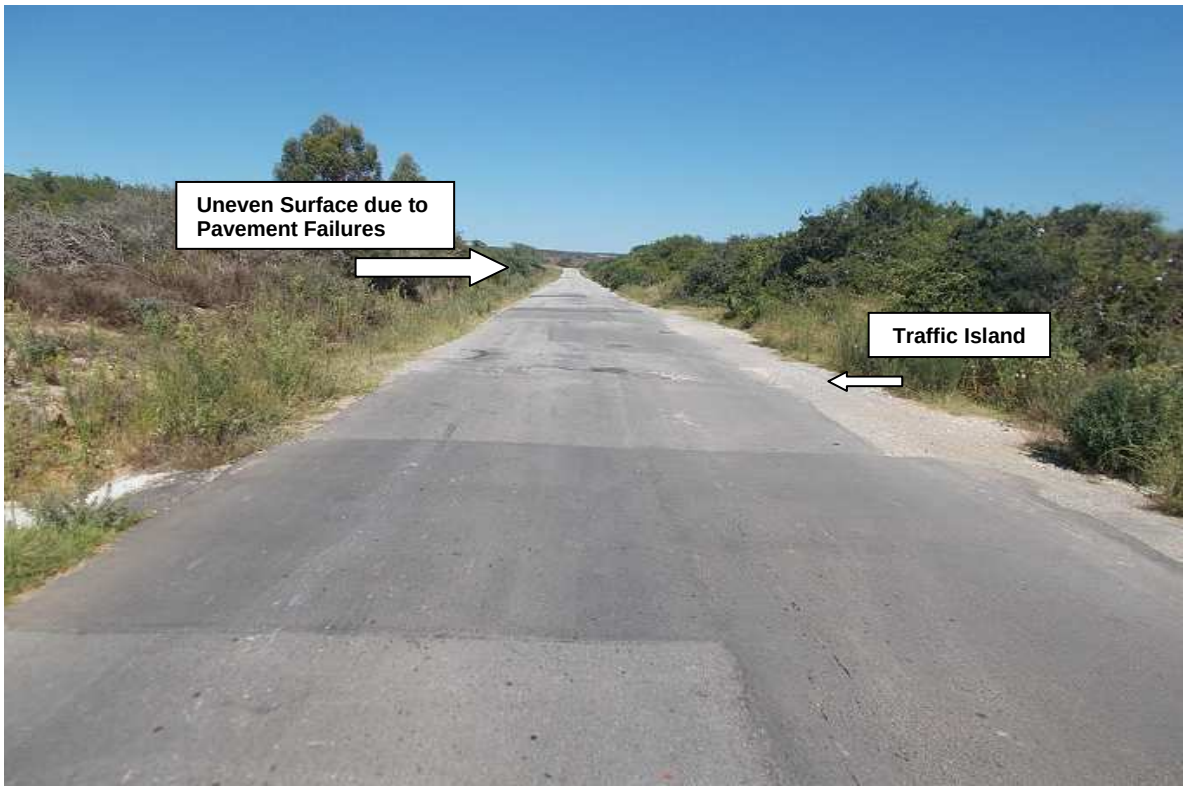
Google Image 23a : Turn left onto Daniel Pienaar Road (R334). (See image below)



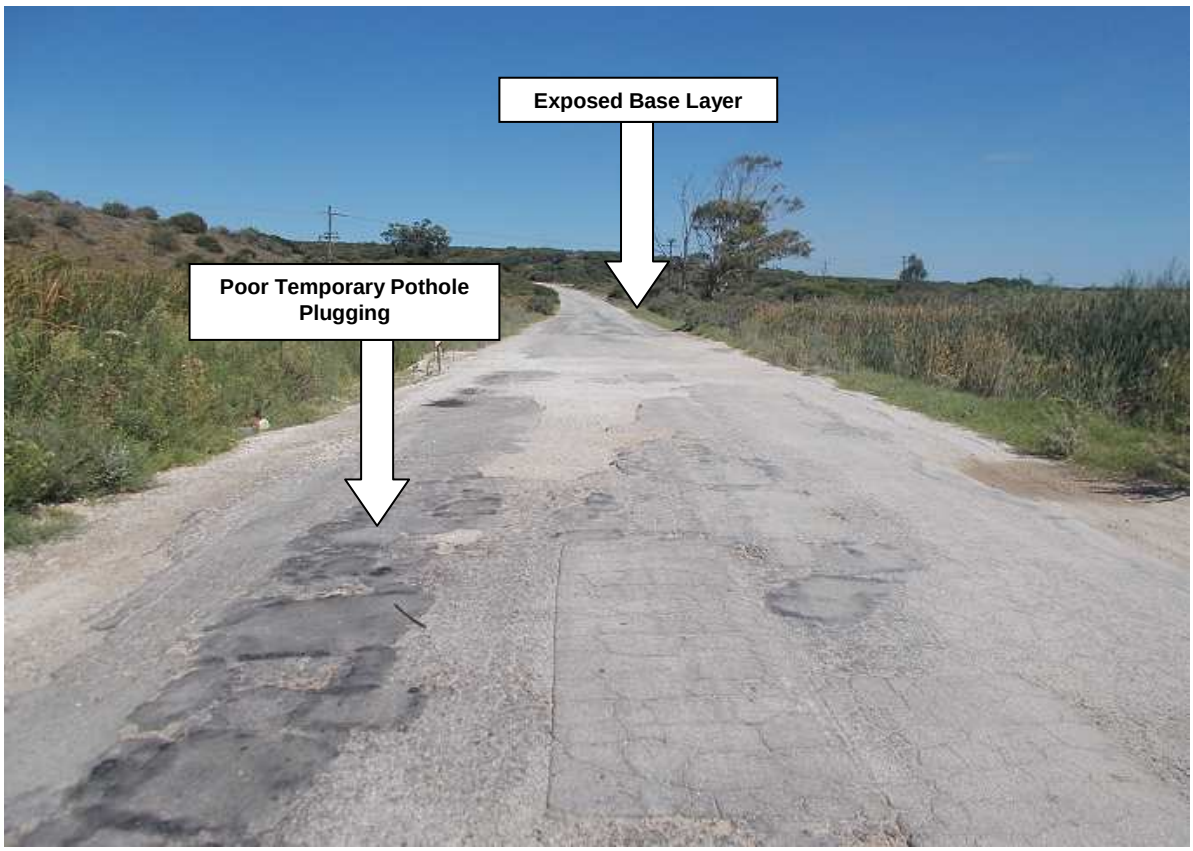
Google Image 23b : (Zoomed-in view). Turn left onto Daniel Pienaar Road (R334).
A large area is available for the turning movement. Centre island kerbs were previously removed.
Possibly additional minor earthworks will still be required. (See image below)

Photos 6 (above) and 7 (below) : View of the intersection and slip road at the R367 / R334 (Daniel Pienaar Road). A traffic island with raised barrier kerbs is situated within the transport vehicle movement. Some of the kerbs of this island have previously been removed (not yet replaced) to make provision of large abnormal turbing movements. This may be sufficient or minor additional modifications and minor earthworks and vegetation clearance may still be required. Roadside furniture (eg. signposts and poles) may have to be temporary removed / permanently be relocated to accommodate the sweep path of the transport vehicles.





Photos 8 (above) and 9 (below): The condition of Daniel Pienaar Road (R334) between the R367 (R102) and the R335 intersection is poor / not desirable with a large extent of rough pothole plugging and pavement failures are present. The road section will require minor rehabilitation to safely accommodate transport vehicles.



Photos 10 (above) and 11 (below): The condition of Daniel Pienaar Road (R334) between the R367 (R102) and the R335 intersection is poor / not desirable with a large extent of crocodile cracking, potholes and pavement failures are present. The road section will require minor rehabilitation to safely accommodate transport vehicles.

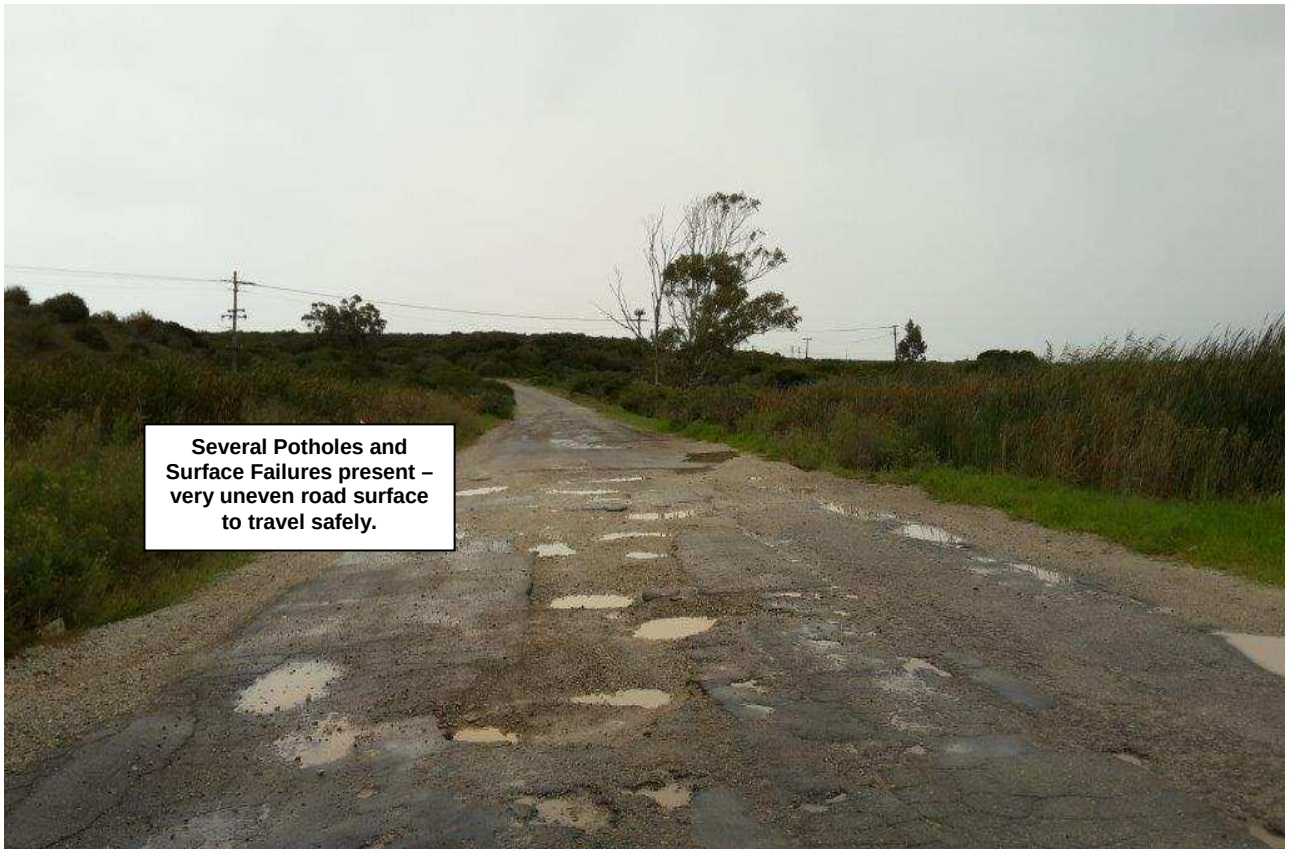
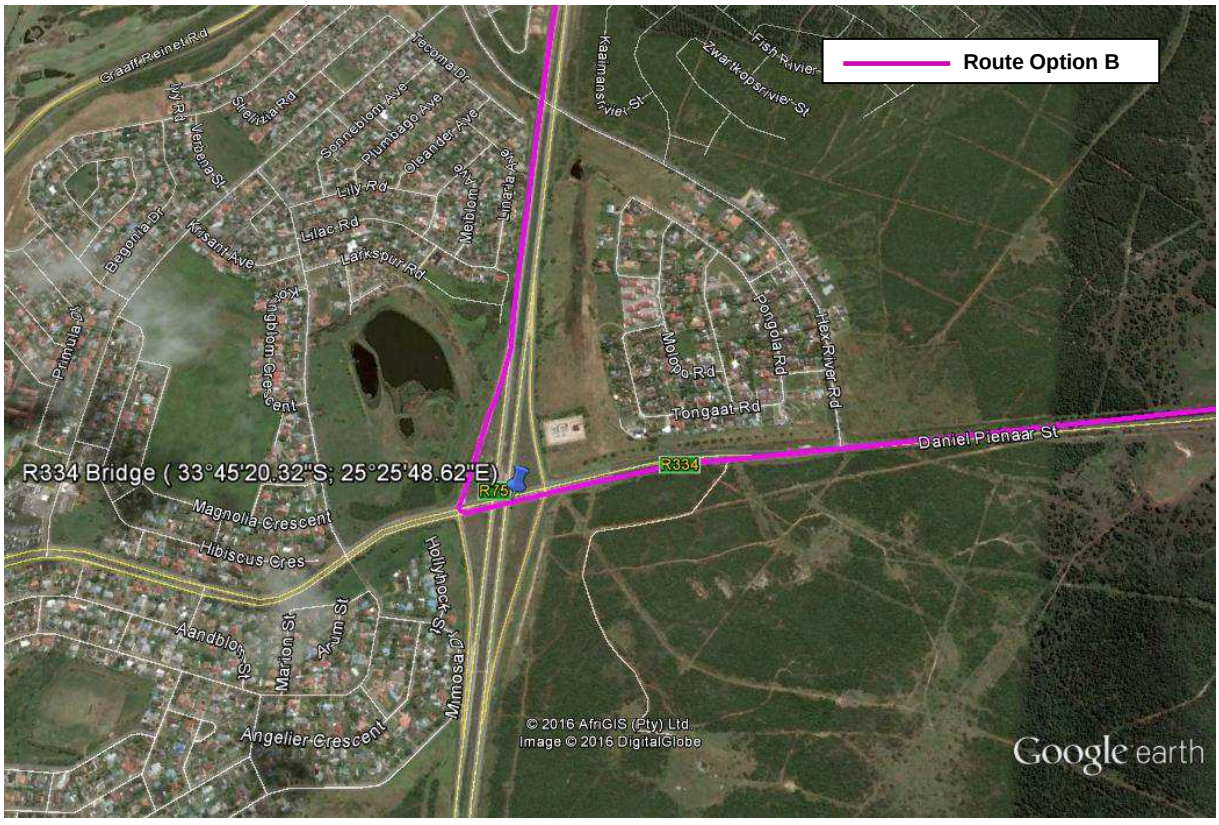


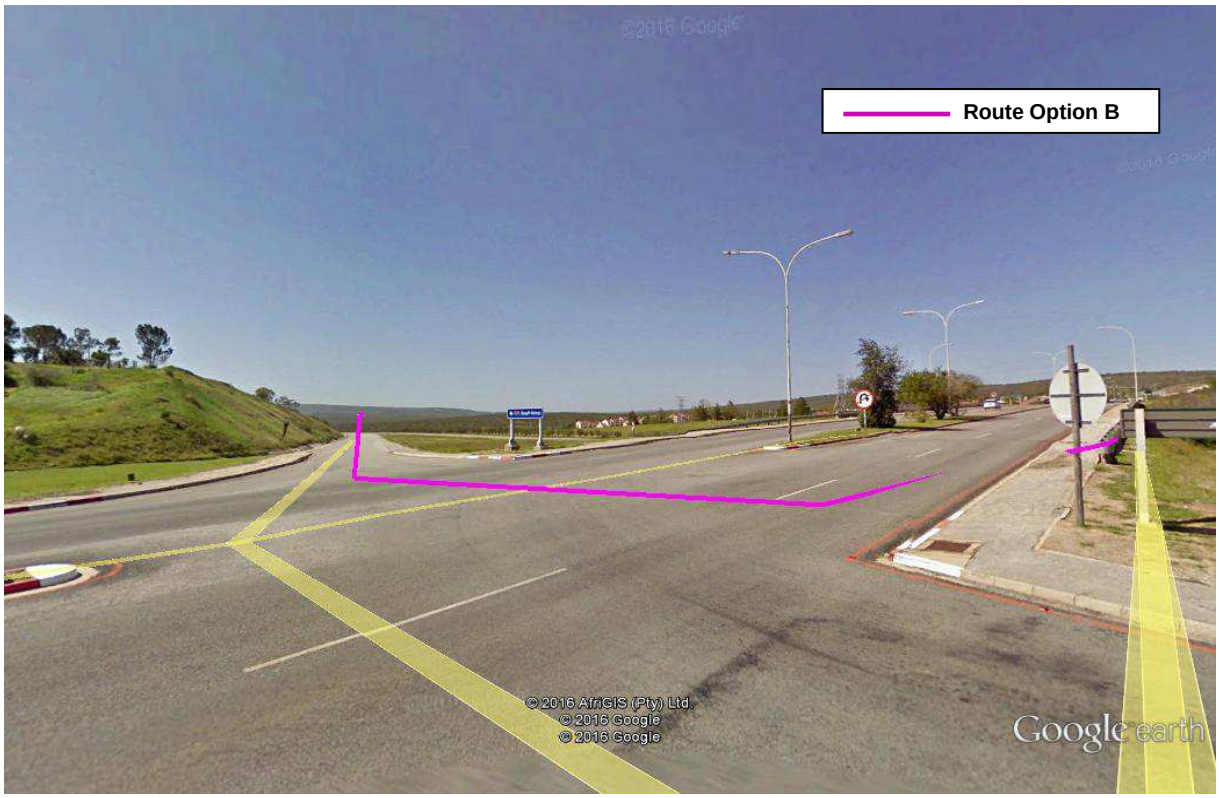
Photo 12: Noticeable crest and sagging vertical curves are present on the Daniel Pienaar Road (R334) between the R367 and R335 intersections. These sections will need to be surveyed to confirm at Detail Design stage that this will not pose transport problems.

Google Image 24: Continue on Daniel Pienaar Road (R334) and cross the four-way intersection with R335. (See image below). This is a busy road intersection with stop sign control. There is no road widening or street furniture that needs to be addressed, however traffic police escort will be required to assist and control the on-coming cross traffic.

Photo 13 : Western view of the R334 / R335 four-way intersection.
Continue straight across this intersection.



Google Image 25: Turn right onto the R75 on-ramp and continue north towards the MR407 intersection.
(See image below)



Google Image 26: "Street View" Turn right onto the R75 on-ramp from the Daniel Pienaar Road (R334)

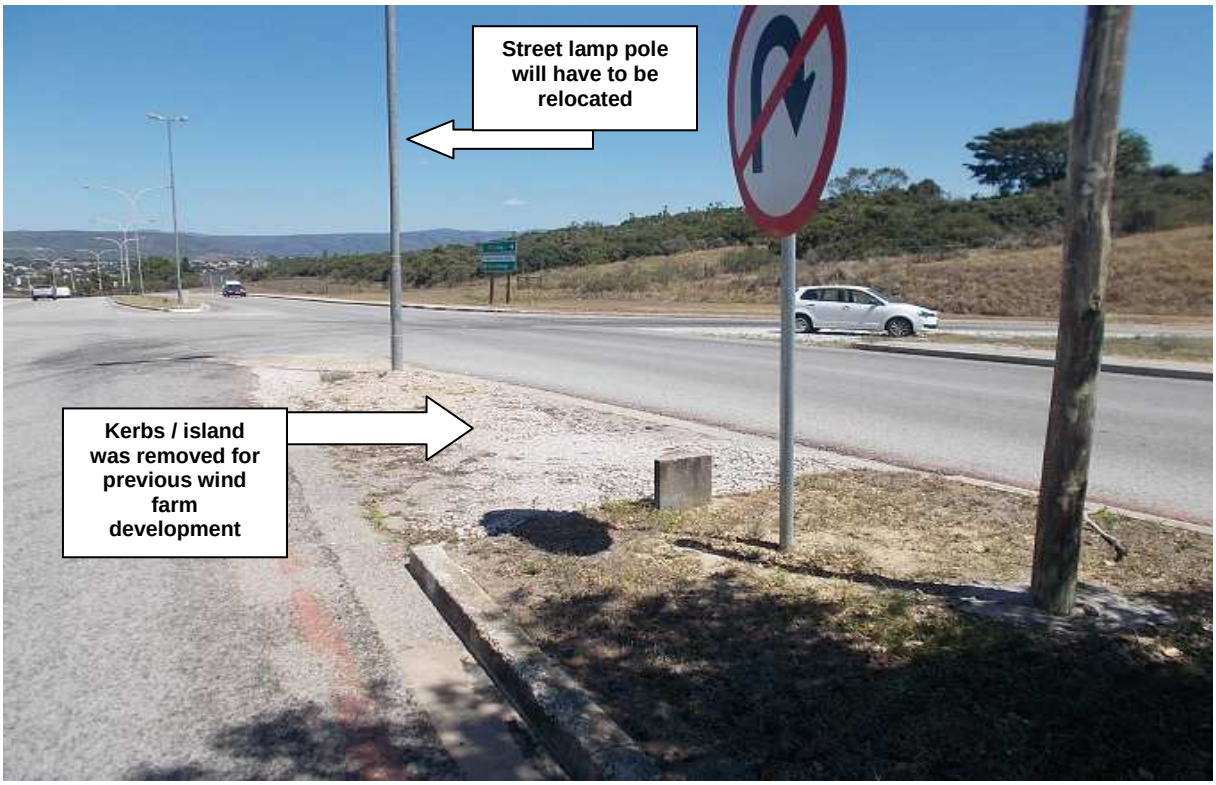
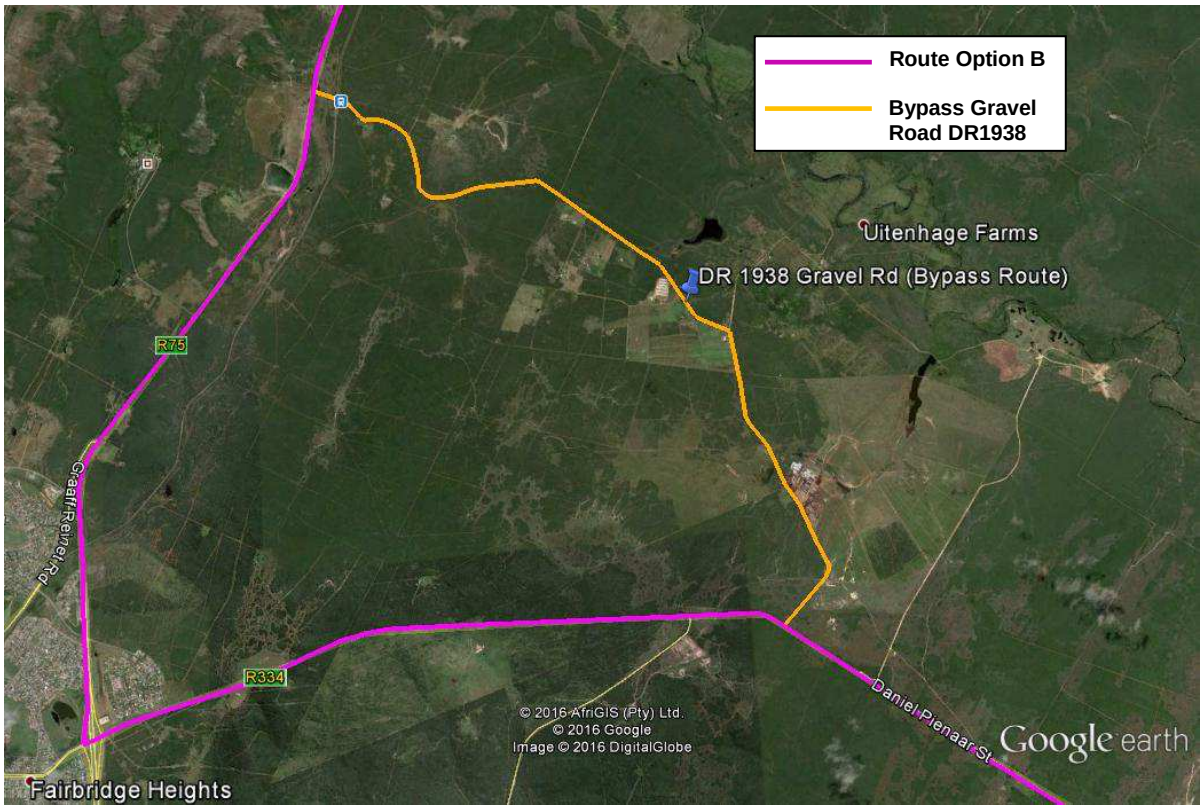


Photo 14: Adequate turning radii may not be available at this R75 on-ramp. However it is possible to temporary widen the road through removing additional the inside kerbs. Minor earthworks may be required. Roadside furniture (signposts, traffic control signs etc.) including the street lights will have to be temporary removed / permanently relocated to accommodate the sweep path of the transport vehicles.

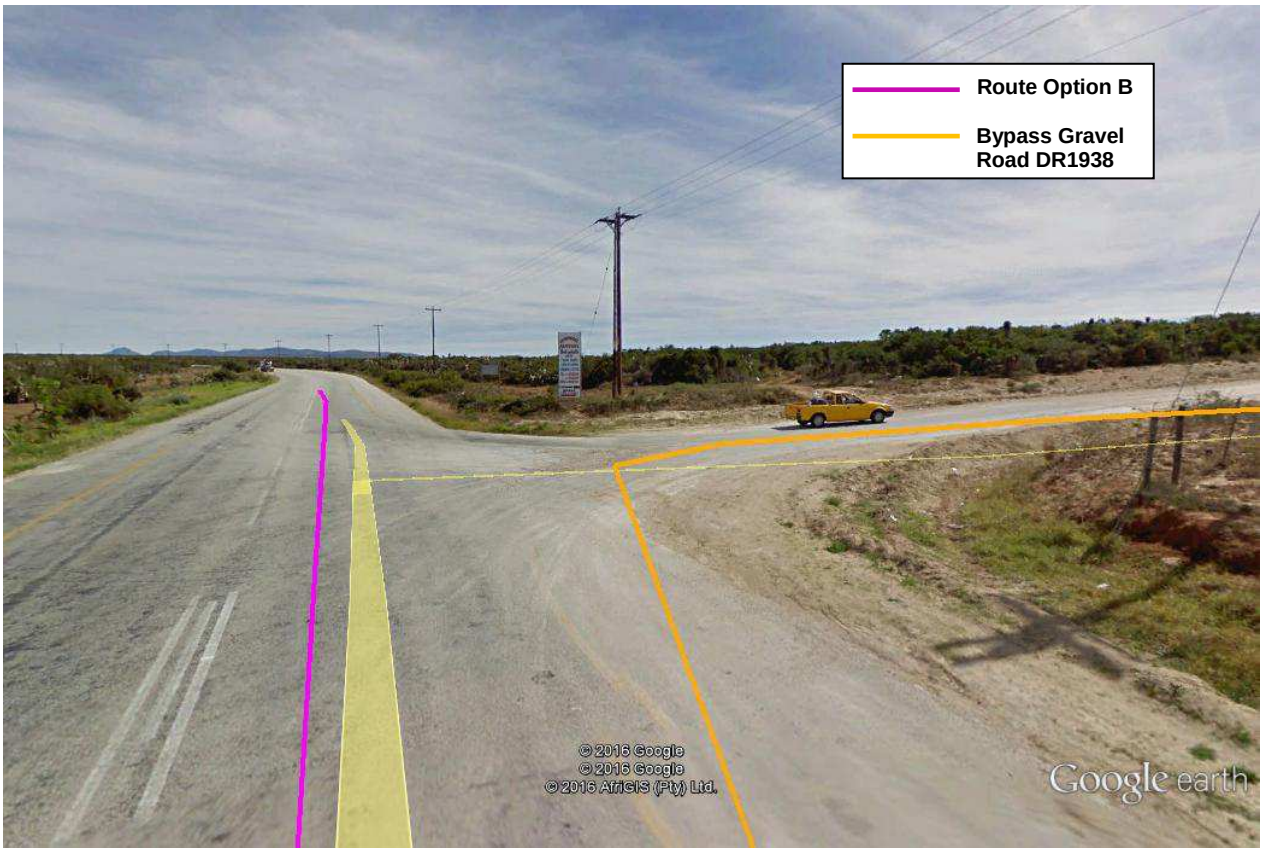
ANNEXURE 4

Photo Album: First Stage - Route Option B (Bypass Gravel Road DR1938)



Google Image 27: Arial view of the bypass gravel road in order to avoid the R75 on-ramp, which may not have appropriate sweeping area for transport vehicles.

Google Image 28: Ariel view of the DR 1938 / Daniel Pienaar Road (R334) T-junction intersection.
This intersection will require widening to accommodate transport vehicle movements which will include earthworks, temporary removal of road side furniture including electrical poles and boundary fences. (See image below).

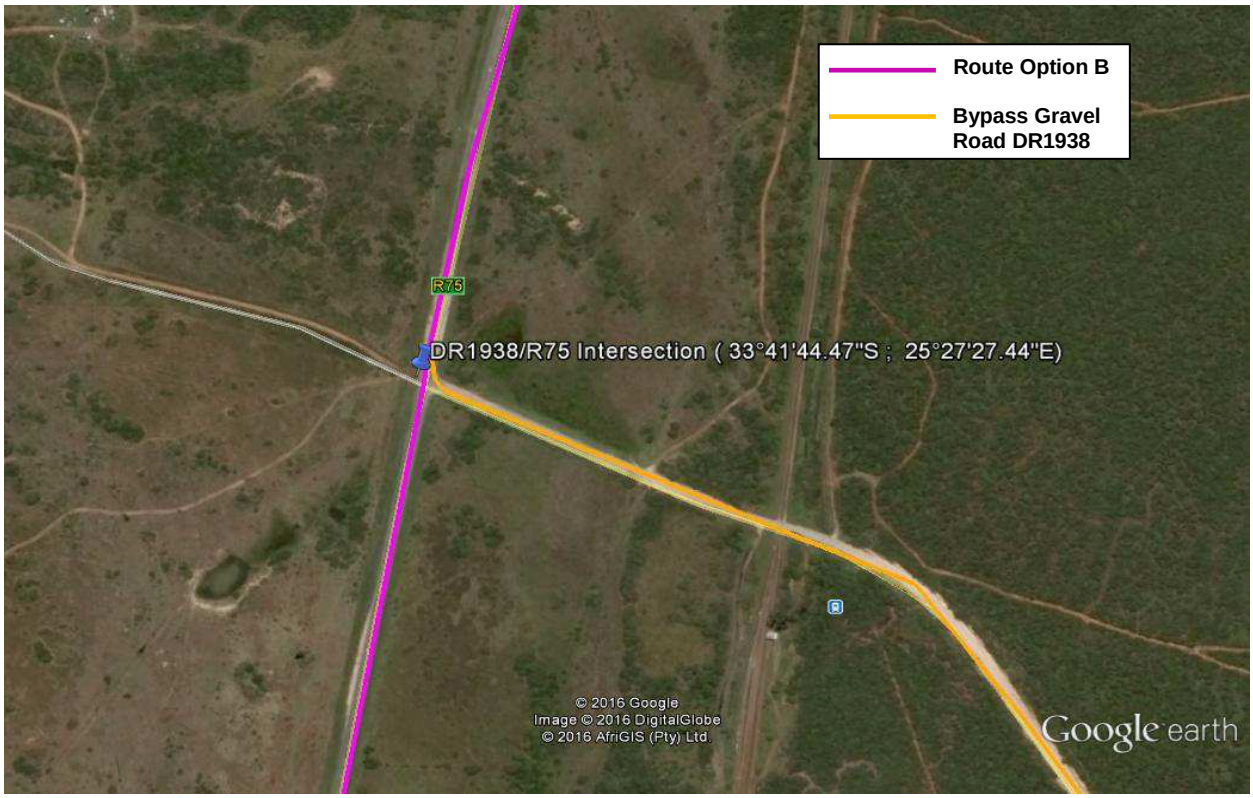


Google Image 29: "Street View" from the R334 turning right onto the gravel road DR1938

Photo 15: Typical section of the gravel road DR1938 that at the time of the assessment was in a good riding condition. The road is average 5 to 6m wide with some areas exceeding 7m.

Photo 16: Noticeple horizontal and vertical crest/sag curves are situated along this road. These areas will need to be surveyed and assessed at detail design stage.

Photo 17: A railway level crossing may need to be upgraded to accommodate transportation vehicles.



Google Image 30: Arial view of the DR1938 / R75 T-junction intersection. Turn right onto the R75 from the DR1938 and continue north to road MR407. This intersection will require widening to accommodate transport vehicle movements, which will include minor earthworks, temporary removal of road side furniture (sign posts), including the electrical pole and boundary fences. (See image below).

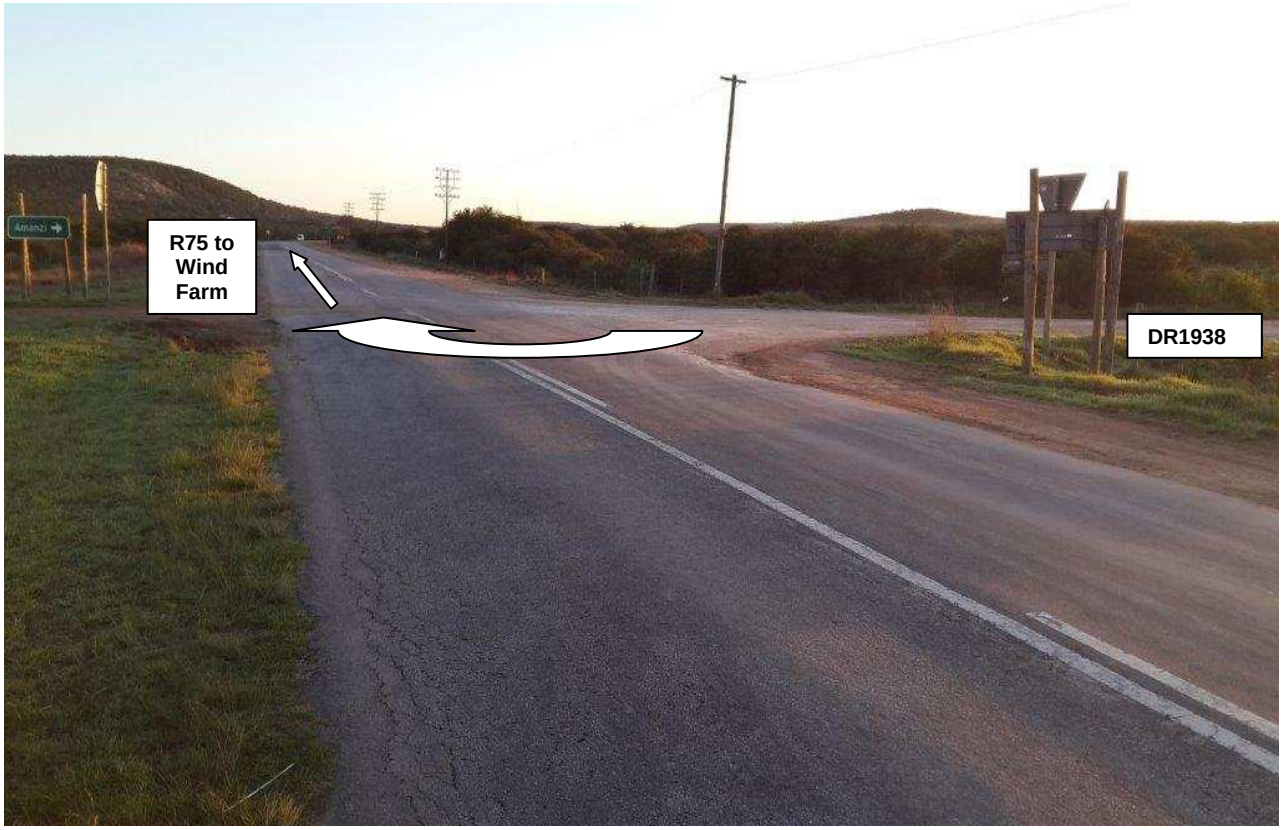


Photo 18 : View from the R75 towards the right turn movement, required from the DR1938 / R75 T-junction intersection, on to the R75 heading northwards.

ANNEXURE 5

Photo Album : Second Stage – Provincial Gravel Road (MR407)

Photo 19: Y-junction R75 / MR407 intersection.
No road widening or removal of any roadside furniture is envisaged.

Photo 20: The gravel road (at the time of the assessment) was in a reasonable condition.
Upgrading of the road to accommodate transport vehicles will not be required,
however regular maintenance(wet grading) will be required during the construction stage.

Photo 21: A number of noticeple horizontal and vertical curves (crests and sags) are located along this route. These areas will need to be surveyed an assessed during Detail Design stage which may require reshaping of the road.

Photo 22: A number of low-level concrete culvert crossing are located along this route. There are noticeable changes in vertical gradients at two of these crossings, which will need to be surveyed and assessed during the Detail Design stage. These sections may need re-alignment, but no upgrading of the culvert structures are required.

Google Image 31: Access Roads and locality of the proposed centralised "***Turbine Component Laydown Area***" at position : 33°31'54.76"S and 25°03'51.06"E. It is recommended that all turbine components be transported directly / as soon as possible, from the Ngqura Harbour, to this area for the temporary holding of WTG components. Mobile cranes will be required at this area for the safe handling, off-loading and loading.

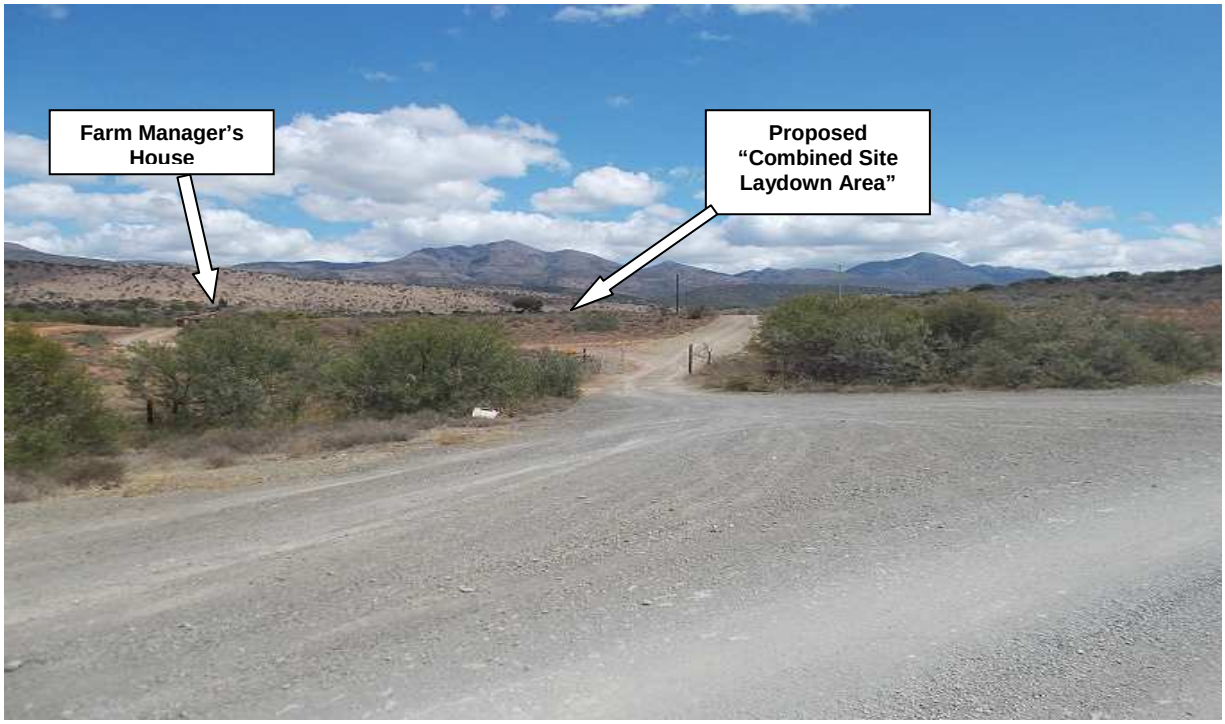


Photo 23: View of the entrance to the Roodeplaat Wind Farm Development site from the MR407 Provincial Road to Minor Road MN50474 and "Combined Laydown Area" in the background.
This intersection will be widened to accommodate the turning radii of transportation vehicles.
The work will entail minor earthworks and removal of bushed, boundary fences and the existing gate.

Photo 24: View of the proposed centralised "***Turbine Component Laydown Area***" from the Minor Road MN50474, near the entrance of the Roodeplaat Wind Farm. Topsoil removal and stockpiling for later site rehabilitation will be required, as well as minor earthworks to level the site for safe crane operations.