PROTEA SOLAR POWER PLANT (RF) (Pty) Ltd

TRAFFIC IMPACT STUDY FOR THE TRANSPORT OF SOLAR ENERGY EQUIPMENT TO THE TOWN OF VRYBURG

32638.00C/TIS-REP-004 Rev 1

TRANSPORTATION REPORT

APRIL 2016

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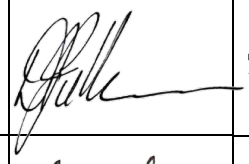
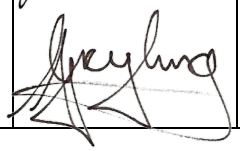
ISSUE & REVISION RECORD

QUALITY APPROVAL

	Capacity	Name	Signature	Date
By Author	Project Engineer	Dirk van der Merwe		7 April 2016
Approved by Design Centre Leader	Project Director	André Greyling		7 April 2016

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REVISION RECORD

Revision Number	Objective	Change	Date
0	Issue to Clients for comments	None	5 April 2016
1	Issue for inclusion in environmental application	Minor alterations and added detail to trip generation chapter	7 April 2016

TABLE OF CONTENT

1 INTRODUCTION

Sunsolar Energy (Pty) Ltd appointed BVi Consulting Engineers to undertake the Transportation Assessment for a proposed solar energy plant in the Vryburg area of the North-West Province. A locality plan is included as *Annexure A.*

The assessment has been conducted for the site which is located approximately 14km south of the town of Vryburg on National Route 18. It is focused on the following aspects of transporting the photo voltaic equipment from a primary port of delivery to the installation site:

- Location of the Site (Nearest numbered road indicated)
- Trip generation during construction and operation of the plant
- Probable Haulage Routes (National and Provincial Roads will be utilised)
- Site Access Route (from a National roadway)
- Affected Communities

Five other solar power plants are also being investigated for development in the immediate area. An ultimate scenario where all these plants are developed during the same period is addressed in the trip generation chapter.

The following documents/sources were used in compiling this report and reference will be made where necessary:

- Google earth images for locality plans and route layouts.
- Road Access Guidelines
- TRH 11: Guidelines for granting of exemption permits for the conveyance of abnormal loads and for other events on public roads
- Highway Capacity Manual 2010: HCM 2010
- TRH17: Geometric Design of Rural Roads

2 SITE LOCATION

The site is located in the North-West Province approximately 14km south of the town of Vryburg. The equipment will be delivered to site from two possible locations being Durban Harbour, 840km from site, or Cape Town Harbour, 1180km from site.

The site identified for this development is located off National Route 18 with an existing access to the farm, Hartsboom. ***Figure 2-1*** shows the locality of the site in relation to the town of Vryburg.

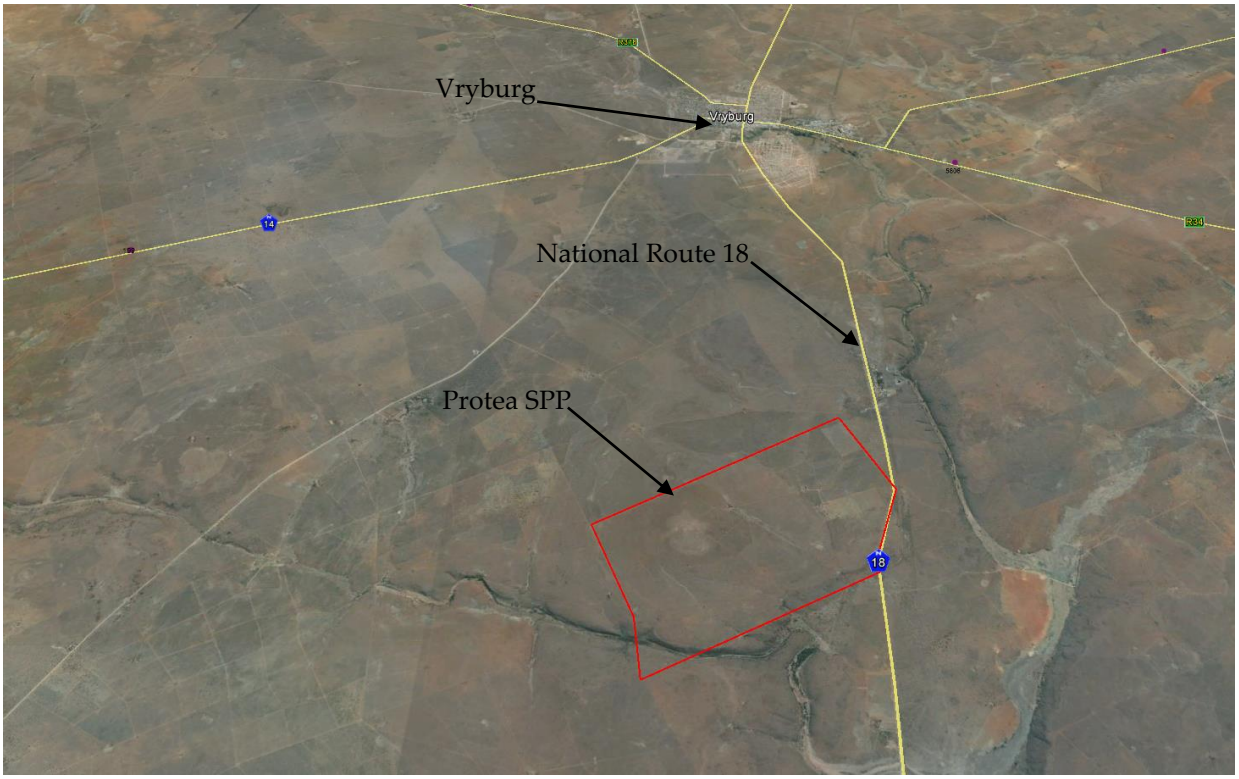


Figure 2-1 Vryburg-Protea Solar Power Plant locality

The construction stage of the plant is expected to take place over a period of 9 to 12 months during which local traffic will be affected minimally. The expected traffic and trip generation figures are dealt with in the following chapter.

The plant itself is expected to generate up to 115MW AC power and will stretch over 203 hectares of the remaining extent of the Farm Hartsboom 734, HN Registration Division, Province of the North-West, measuring 2035.9834 (two thousand and thirty deed seven comma nine eight three four) hectares, Title Deed No.: 258/2000.

None of the new services that will be installed will be crossing any National Road Reserves as an existing 132kv electrical transmission line is located on the farm. However, as the main access to the proposed facility is on a National Route, a wayleave application to the South African National Roads Agency SOC Ltd. (SANRAL SOC Ltd) will be needed. The access itself will also need to be formalised to a standard specified by the agency. An example of this standard is provided in *Annexure B.*

3 RECOMMENDED HAULAGE ROUTE

As mentioned in the chapter above the photo voltaic equipment and all its components will be transported to the Hartsboom farm over a distance of 840km or 1180km from either Durban or Cape Town harbours. Both of these routes are indicated in ***Figure 3-1*** below.

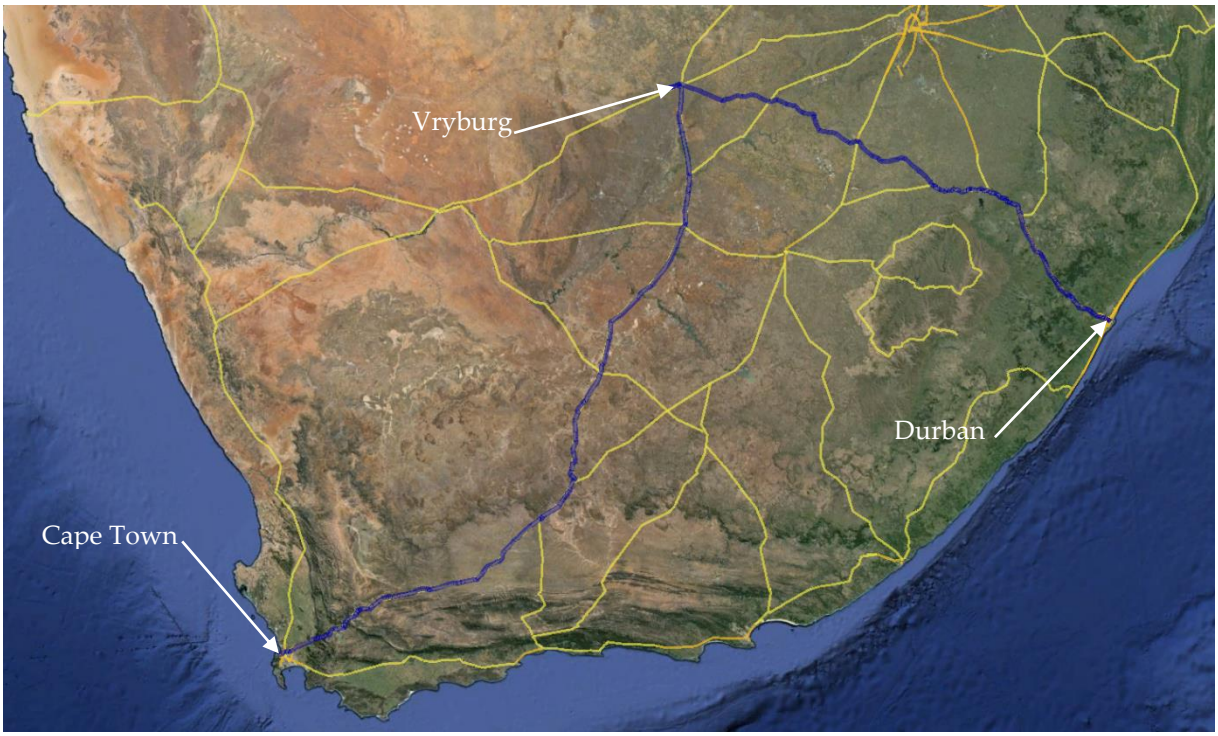


Figure 3-1 Transportation Routes

3.1 Alternative 1 – Durban to Vryburg (840km)

The route overview is shown in ***Figure 3-1*** and is briefly described below:

- Durban Harbour via the N3 towards Harrismith Interchange.
- Take N5 from Harrismith Interchange towards Bethlehem.
- Travel through Bethlehem and take R76 northwest towards Kroonstad.
- Turn onto the N1 south and turn right onto the R34 for approximately 13km.
- Turn right onto the R713 for approximately 48km and turn right onto the R30.
- Travel towards Bothaville and turn left onto the R504 north of the town.
- Travel west on the R504 past Wolmaranstad to Schweizer-Reneke.
- Take R34 towards Vryburg.
- Exit the town of Vryburg to the south via the N18 for 14km to the farm access.

3.2 Alternative 2 – Cape Town to Vryburg (1180km)

The route overview is also shown in ***Figure 3-1*** and is briefly described below:

- Cape Town harbour via the N1 towards and through the towns of:
  - Paarl
  - Worcester
  - Laingsburg
  - Beaufort West
  - Three Sisters
- At Three Sisters turn left onto the N12 north towards and through the towns of:
  - Victoria West
  - Britstown
  - Strydenburg
  - Hopetown
  - Kimberley
  - Warrenton
- At Warrenton turn left onto the N18 north towards and through the towns of:
  - Jan Kempdorp
- The farm access is located approximately 14km outside the town of Vryburg on the N18.

3.3 Route Clearance

The vehicles used to transport the photo voltaic equipment are standard container trucks and not oversize vehicles. As this route is travelled by the same type of vehicle throughout, no obstacles (e.g. Low overhead services, cattle grids, narrow bridges etc.) are expected.

4 TRIP GENERATION

4.1 General

To estimate the number of trips that will be generated during the construction period a few assumptions were made:

- The solar plant will generate 115MW
- Each photo voltaic module is a 300W unit.
- 220 of these units can fit into a container.

The following traffic load figures are expected during the construction period:

- From the above information it is calculated that the development will generate 1740 truck[1] trips over a 9 to 12 month period.
- Between seven (7) and nine (9) standard containers will therefore be delivered to site every working day during the construction period. It should be noted that these are not Abnormal Load Vehicles and do not require the associated permits or approvals.
- It is expected that a maximum of five (5) trucks will deliver raw materials to site daily for the construction of the photo voltaic foundations. These trucks will most probably originate from Vryburg or Kimberley.

A total of fourteen (14) trips is therefore expected to be generated as a result of this development. It must be noted that these trips will be daily trips and not necessarily peak hour trips. As mentioned, there is a possibility that six power plants, including Protea, could be developed over the same period or at the very least, overlap. This will increase the daily trips generated to eighty four (84). Additionally, the local traffic during construction generated by commuting staff is estimated as follows:

- Approximately 300 staff will be transported to site, most probably from Vryburg on a daily basis. It is expected that minibus transport will be used for this.
- This translates to approximately 45 light vehicles travelling to and from site daily. 15 light delivery vehicles and 30 minibus vehicle.

These trips are expected to be peak hour trips. This will increase to 270 generated trips in the event that six power plants are developed simultaneously.

The following traffic figures are expected during the operational period:

- Average of 6 light vehicles per day with a maximum of 15 vehicles per day.
- Four mini-bus trips per day for permanent staff transport.

[1] None of these trips will necessitate the application for abnormal load permits as set out in the TRH 11.

4.2 Expected Impact on Long Distance Route

The *HCM 2010 Chapter 15: Two lane Highways* was consulted as the greatest portion of the route to be travelled by the delivery trucks are rural two lane highways of Class I, II or III. The trips generated by this development were evaluated in relation to the quantum of trips needed to change the Level of Service (LOS) on a portion of the rural highway and the ultimate capacity of two lane highways.

When considering the sections of the routes that are multilane facilities like the N3 from Durban, the projected number of daily trips expected, must be compared to a current Average Annual Daily Traffic (AADT) of approximately 40 000vpd. Again the trips generated by the delivery of equipment to site is insignificant when compared to the AADT. Further detail is provided in the trip generation summary below.

4.3 Expected Impact on Local Traffic

The ultimate accepted capacity of a two lane highway is 3200 vehicles per hour. From historic traffic count data it was observed that the roadways around Vryburg have an abundance of spare capacity, (specifically along the N14, R34 and N18) as the current AADT along these roadways are between 1600vpd and 2000vpd. This therefore indicates that the estimated additional traffic generated by the construction staff travelling to and from site, can be accommodated on the existing roadways. Further detail is provided in the trip generation summary below.

4.4 Trip Generation Summary

A summary of the additional trips generated by the development of this solar power plant is provided in the tables below.

Table 3-1: Trip Summary Generated Trips

Route Description	Delivery trips (None Peak)	Construction Vehicle Trips (None Peak)	Cumulative trips for six SPP's
Durban to Vryburg via R34	9 vpd	5 vpd	84 vpd
Cape Town to Vryburg via N18	9vpd	5 vpd	84 vpd
Commuter traffic	-	-	270 vpd

Note; The cumulative column is provided on the assumption that all deliveries will take place from the same port of origin

It is assumed that the portion of average daily traffic that occur during the design hour (30th highest volume) is no more than 10% *(K=10). TRH17: Geometric Design of Rural Roads* provides service volumes for LOS B to be retained, which translates to 4900vpd as an estimated maximum AADT. The tables below is a summary of all the expected trips generated by the development of the solar power plant along with the background traffic on each of the major routes into Vryburg. These volumes are for the immediate surrounding road network.

Table 3-2: Trip Summary with delivery from Durban

Destinations	On N14	On N18	On R34
Current ADT on Route (vpd)	1860	1700	1600
Delivery & Construction Trips (vpd)	42	14	28
Commuter Trips (vpd)	135	45	90
Pass-by trips (vpd) (Delivery & construction trips)	0	0	84
Total Expected Trips	**2037**	**1759**	**1802**

Table 3-3: Trip Summary with delivery from Cape Town

Destinations	On N14	On N18	On R34
Current ADT on Route (vpd)	1860	1700	1600
Delivery & Construction Trips (vpd)	42	14	28
Commuter Trips (vpd)	135	45	90
Pass-by trips (vpd) (Delivery & construction trips)	0	84	0
Total Expected Trips	**2037**	**1843**	**1718**

The projected trips per day for the scenario that includes six solar developments, are deemed to be of no consequence to the LOS of the travelled route from Durban to Vryburg or Cape Town to Vryburg as it does not exceed the maximum AADT of 4900vpd.

5 SITE ACCESS ROUTE

Access to the site will be via a partially existing gravel track. This gravel road will need upgrading and extension and will need to be suitably maintained. Re-gravelling may be necessary as a maintenance measure, from time to time, throughout the operational life of the plant. This access road is approximately 2km in length.

A formal application for the access point on the N18 will need to be lodged with SANRAL SOC Ltd. The formalisation of the access point to the standard provided in *Annexure B* will in all probability be a requirement set as part of wayleave approval.

6 EFFECTED COMMUNITIES

It is expected that the community of Vryburg will participate in the construction phase of this development.

From a traffic point of view, the total daily construction traffic is deemed to be very low and will not significantly impact these communities.

7 SUMMARY AND CONCLUSION

The following conclusions are made:

- The impact of the construction traffic on the general traffic and the surrounding communities along the haulage route is considered to be low.

- All the components will be transported by truck from Durban or Cape Town to the site using the routes as defined. Both these routes are of acceptable standard and should not impede travel from a riding quality perspective.

- No abnormal loads will be transported to the site.

- The access to the site is off National Route 18 which will trigger the involvement of SANRAL and their approval.

- Adequate traffic accommodation signage must be erected and maintained on either side of the access on National Route 18 throughout the construction period.

The development of a solar farm on Farm Hartsboom 734 in the North-West Province is therefore supported from a traffic engineering perspective.

ANNEXURE A

Locality Plan

DATE	INITIAL	No./CODE	REVISION DESCRIPTION
01/04/2016	B.V.W	A/D	DRAWING COMPLETED

CLIENT

ENGINEERING PROCUREMENT MANAGEMENT
Western Cape — Cape Town — (021) 527-7000 — cpt@bvivec.co.za
Registration no. 1998/000157/07

PROJECT: SOLAR ENERGY FARMS NEAR VRYBURG

DRAWING TITLE: PROTEA SOLAR FARM

APPROVED BY BVi

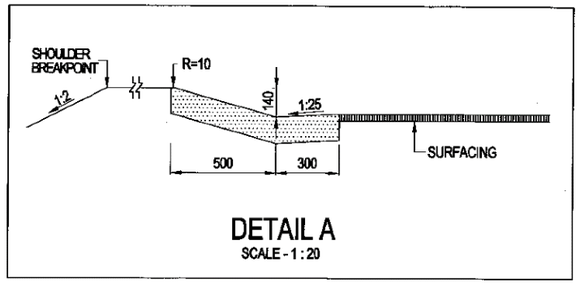
ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	1:100 000	DRAWN	BVW
DESIGNED	BVW	CHECKED	DVDM

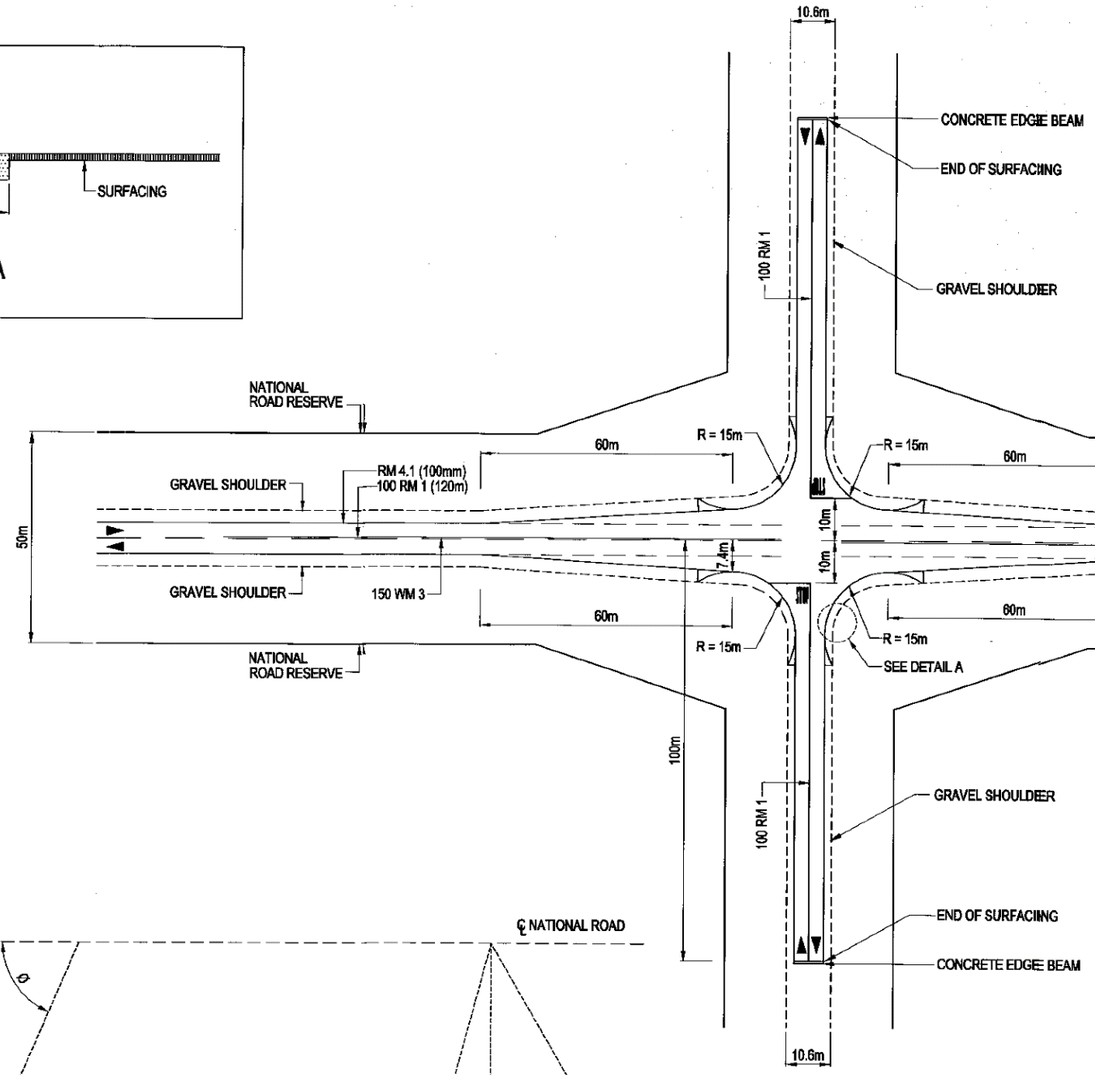
PLAN NUMBER	REVISION NO.	DATE SAVED
PROTEA	A	01 April 2016

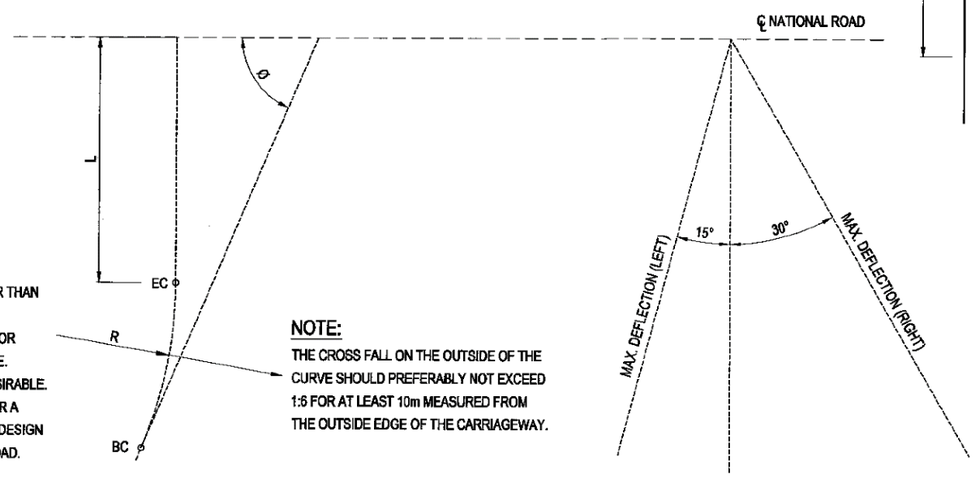
ANNEXURE B

Typical access Geometry



DETAIL A
SCALE - 1 : 20





NOTE
1. Ø = DEFLECTION ANGLE SMALLER THAN SAFE ANGLE.
2. L = STOPPING SIGHT DISTANCE FOR DESIGN SPEED FOR LAST CURVE. MINIMUM LENGTH OF 155m IS DESIRABLE.
3. R = CORRESPONDING RADIUS FOR A SPEED 15km/h LOWER THAN THE DESIGN SPEED FOR THE REST OF THE ROAD.

NOTE:
THE CROSS FALL ON THE OUTSIDE OF THE CURVE SHOULD PREFERABLY NOT EXCEED 1:6 FOR AT LEAST 10m MEASURED FROM THE OUTSIDE EDGE OF THE CARRIAGEWAY.

SAFE ANGLES AND STOPPING SIGHT DISTANCE AT T-JUNCTIONS
SCALE - N.T.S

ROAD MARKING LEGEND
RM 1 = NO OVERTAKING LINE
RM 4.1 = LEFT EDGE LINE
WM 3 = DIVIDING LINE

NOTE :
APPLICABLE AT INTERSECTIONS WHERE THE RIGHT TURNING VOLUME IS < 30 VEHICLES / DAY.

TABLE 1
SHOULDER SIGHT DISTANCE FOR STOP CONDITIONS

DESIGN SPEED (THROUGH ROAD) (km/h)	SIGHT DISTANCE (D) (m)
50	150
60	180
70	210
80	240
90	270
100	300
110	330
120	360

NOTE:
1. GRADIENT ON BOTH ROADS SHOULD NOT EXCEED 3%, ESPECIALLY ON THE JUNCTION LEG.
2. TABLE 1 CAN BE USED AS A BASIC GUIDELINE ON CONDITION THAT THE GRADIENTS ON BOTH THE JUNCTION AND PRIMARY ROADS DO NOT EXCEED 2%. THE SIGHT DISTANCE MUST BE MEASURED FROM AN EYE LEVEL OF 1,05m FROM A POINT 2m BEFORE THE STOP LINE ON THE JUNCTION ROAD TO AN OBJECT HEIGHT ON THE CENTRE LINE OF THE NATIONAL ROAD OF 1,30m.
3. THE DESIRABLE MINIMUM SIGHT DISTANCE IS 300m.
4. FOR DETAIL OF ROAD MARKINGS REFER TO THE SADC ROAD TRAFFIC SIGNS MANUAL.
5. THIS PLAN SERVES AS A GUIDE LINE AND WELL MOTIVATED DEVIATIONS MAY BE CONSIDERED.
6. WHERE APPLICABLE CROSS-SECTION DIMENSIONS MUST BE ADJUSTED ACCORDING TO THE APPROVED TYPICAL CROSS-SECTION BEING USED.

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