









UNITED
BY OUR
DIFFERENCE



PROPOSED SKYWALK AT GOD'S WINDOW,
BLYDE RIVER CANYON, THABA CHWEU
LOCAL MUNICIPALITY, MPUMALANGA
TRAFFIC IMPACT ASSESSMENT

August 2013

Quality Management

Issue/revision	Issue 1	Revision 1
Remarks	For Internal Review	For Issue
Date	23 August 2013	03 September 2013
Prepared by	Ms.N.Ciko Technologist	Ms.N.Ciko Technologist
Signature		
Checked by	Mr.T.Ueckermann Pr.Eng	Mr.T.Ueckermann Pr.Eng
Signature		
Authorised by	Mr. T. Ueckermann Pr.Eng	Mr. T. Ueckermann Pr.Eng
Signature		
Project number	16700.R	16700.R
Report number	16700	16700
File reference		

PROPOSED SKYWALK AT GOD'S WINDOW, BLYDE RIVER CANYON, THABA CHWEU LOCAL MUNICIPALITY, MPUMALANGA

TRAFFIC IMPACT ASSESSMENT

September 2013

Client

Strategic Environmental Focus (SEF)
PO BOX 74785
LYNNWOOD RIDGE
0040

Tel: +27 12 349 1307

Fax: +27 12 349 1229

www.sefsa.co.za

Consultant

WSP House
Bryanston Place, 199 Bryanston Drive
Bryanston
2191
South Africa

Tel: +27 12 349 1307

Fax: +27 12 349 1229

www.wspgroup.co.za

Registered Address

WSP Group Africa (Pty) Ltd
1999/008928/07
WSP House, Bryanston Place, 199 Bryanston Drive,
Bryanston, 2191, South Africa

WSP Contacts

Mr.Tobie Ueckermann & Ms.Nobuntu Ciko

Table of Contents

1. Introduction	8
1.1 Background and Purpose of the Study.....	8
1.2 Purpose of the Study.....	8
1.3 The Study Area	8
1.4 Extent of the Study.....	9
1.4.1 The size of the land in question.....	9
1.4.2 Preliminary summary of the different land uses that will be investigated	9
1.4.3 A preliminary indication of the total trip generation.....	9
1.4.4 An indication as to whether a TISm / comprehensive traffic study is required	9
1.4.5 Investigated Peak Periods.....	10
1.4.6 Horizon Years	10
1.5 Latent Rights.....	10
1.5.1 Proposed Cableway	10
1.5.2 Adventure Centre	11
1.5.3 Bourke's Luck Potholes.....	11
1.6 Scenarios Investigated.....	11
1.7 Assumptions.....	11
2. Selected Policy and Planning Issues	12
2.1 Introduction	12
2.2 Ehlanzeni District Municipality Comprehensive Integrated Transport Plan (April 2008)	12
2.3 Mpumalanga Economic Growth and Development Plan	12
2.4 Blyde River Canyon Tourism Development Strategy	13
2.4.1 Introduction	13
2.4.2 Benefits to the Provincial Economy	13
3. Existing Roadway Elements.....	14
3.1 Existing Road Network	14
3.2 Roadway Conditions	14
3.3 Roadway Restrictions.....	14
3.4 Non-Motorised Transport	14
3.5 Public Transport Facilities	14
4. Existing Public Transport.....	15
4.1 Minibus Taxi	15
4.2 Commuter Bus Operations.....	15
4.3 Rail Operations	15
4.4 Summary.....	16
5. Planned Changes to the Existing Road Network.....	16
6. Existing Traffic.....	17
6.1 Traffic Surveys	17
6.2 Peak Traffic Hours.....	17

6.3	2013 Background Traffic	17
6.4	Adjustment of Background Traffic	17
6.5	Traffic Conditions	18
6.6	Traffic Growth.....	19
7.	Trip Generation	20
7.1	Trip Generation of new and/or revised land uses.....	20
8.	Trip Distribution	22
8.1	Trip Distribution Percentages	22
9.	Capacity Analysis.....	23
9.1	Definitions	23
9.2	Modelling Software.....	24
9.3	Revised level of service method for vehicles in HCM 2010.....	24
9.4	2013 Background Traffic	26
9.4.1	R532 & R534 North	26
9.4.2	R532 & R534 South	27
9.4.3	God's Window Access off the R534	28
9.5	2016 Horizon Traffic.....	28
9.5.1	R532 & R534 North	28
9.5.2	R532 & R534 South	28
9.5.3	God's Window Access off the R534	29
9.6	2021 Horizon Traffic.....	29
9.6.1	R532 & R534 North	29
9.6.2	R532 & R534 South	29
9.6.3	God's Window Access off the R534	29
9.7	2016 Total Traffic	29
9.7.1	R532 & R534 North	29
9.7.2	R532 & R534 South	29
9.7.3	God's Window Access off the R534	30
9.8	2021 Total Traffic	30
9.8.1	R532 & R534 North	30
9.8.2	R532 & R534 South	30
9.8.3	God's Window Access off the R534	30
9.9	Summary.....	30
10.	Public Transport Assessment.....	31
11.	Parking.....	33
12.	Conclusions & Recommendations.....	34
13.	References.....	35

List of Figures

Figure 1.1: Regional Locality plan

Figure 1.2: Site Locality

Figure 7.1: Traffic Count Locations

Figure 7.2: 2013 Friday Peak Background Traffic

Figure 7.3: 2013 Saturday Peak Background Traffic

Figure 7.4: God's Window Visitor numbers (2009/2010)

Figure 7.5: Adjusted 2013 Friday Peak Background Traffic

Figure 7.6: Adjusted 2013 Saturday Peak Background Traffic

Figure 7.7: 2016 Friday Peak Horizon Traffic

Figure 7.8: 2016 Saturday Peak Horizon Traffic

Figure 7.9: 2021 Friday Peak Horizon Traffic

Figure 7.10: 2021 Saturday Peak Horizon Traffic

Figure 8.1: Existing Modal Split at God's Window

Figure 9.1: Estimated Vehicle Distribution

Figure 9.2: 2016 Development Trips

Figure 9.3: 2021 Development Trips

Figure 9.4: 2016 Friday Peak Total Traffic

Figure 9.5: 2016 Saturday Peak Total Traffic

Figure 9.6: 2021 Friday Peak Total Traffic

Figure 9.7: 2021 Saturday Peak Total Traffic

Figure 10.4.1: Existing Geometry of R532 & R534 North

Figure 10.4.2: Existing Geometry of R532 & R534 south

Figure 10.4.3: Existing Geometry of God's Windo access off the R534

Figure 11.1: Reserved on-street parking for buses and public transport vehicles

List of Tables

Table 5.1: Available Facilities at Graskop Taxi Rank

Table 8.1: Peak Hour Vehicle Estimates

Table 10.1: Method used for level of service at Approach and Intersection Level of Service

Table 10.2: Delay & v/c (HCM 2010) definitions for based on delay and v/c ratio

Appendices

Appendix A: Traffic Survey Data

Appendix B: Detailed Summary of 2009/2010 God's Window Visitor numbers

Appendix C: Summary of SIDRA analysis results

1. Introduction

1.1 Background and Purpose of the Study

The Industrial Development Corporation (IDC) appointed Aecom to prepare a feasibility study for the development of a new visitor attraction at God's Window which is located in the Blyde River Canyon National Park in Mpumalanga. The study was completed in April 2013.

The proposed Skywalk concept will include a cantilevered glass walkway that will protrude from the Canyon's edge, together with a main building which will house a cafeteria and a gift shop. The Skywalk will form part of a larger redevelopment of God's Window which will include the improvement of the existing walkways, viewpoints and car park.

1.2 Purpose of the Study

WSP Group Africa (Pty) Ltd was appointed by Strategic Environmental Focus (SEF) in July 2013 to undertake a Transport Impact Assessment (TIA) for the proposed Skywalk at God's Window in the Blyde River Canyon, near Graskop in the Mpumalanga province.

The TIA has been prepared as part of the Environmental Impact Assessment (EIA) being prepared by Strategic Environmental Focus (SEF) for the proposed development. The EIA is undertaken on behalf of the IDC.

The TIA covers, among others, the following:

- The impact of the proposed changes and additions to the existing God's window tourist attraction on the existing road and transportation infrastructure and
- The mitigation measures required to accommodate the proposed changes to the God's window and associated land-uses within acceptable norms.

1.3 The Study Area

God's Window is located on the ridge of the Blyde River Canyon within the Thaba Chweu Local Municipality, which is part of the Ehlanzeni District Municipality, in Mpumalanga. God's Window is situated approximately 9.2km north of the town of Graskop. Its regional and local locality is shown in **Figures 1.1** and **1.2**. It is located east of Johannesburg and Pretoria near the Kruger National Park.

The Blyde River Canyon National Park is a 'unique natural environment, with dramatic views across the world's deepest canyon and dramatic rock formations. Views from God's Window extend down to the lowveld, across to the distant Kruger National Park', Aecom, 2013.

2. Introduction

2.1 Extent of the Study

2.1.1 The size of the land in question

The site of God's Window sits on land owned by a collection of local communities. Whilst it does not have a clearly defined boundary, it is estimated that the main area of the God's Window site (parking area, ablution facility and area up to the ridge) is around 25 000m² in extent.

The area between the existing parking area and the ridge is considered as a 'disturbed area' due to prior environmental degradation. There is an additional area of some 50 000m² (forested zone) that leads up to the highest viewpoint.

2.1.2 Preliminary summary of the different land uses that will be investigated

The vision for the Skywalk at God's Window is to create a cantilevered glass walkway that protrudes 12m from the ridge of the canyon, offering 360° panoramic views and a sheer drop below. The redevelopment of the wider site would significantly enhance the existing observation areas and guest services and create a new visitor building containing a shop for food and beverages.

The initial designs depicts an improved car parking and service area, a new visitor centre and improved retail area for local craftspeople that currently trade from stalls at Gods Window.

2.1.3 A preliminary indication of the total trip generation

The total trip generation for the 2016 and 2021 Horizon year was estimated based on the on-site attendance for Gods Window (Aecom report) together with vehicle occupancy data obtained through new/additional surveys conducted on the 2 and 3 August 2013.

The preliminary trip generation estimates show the following peaks:

- 106 peak hour traffic (vehicles) in 2016 and
- 114 peak hour traffic (vehicles) in 2021.

2.1.4 An indication as to whether a TISm / comprehensive traffic study is required

According to the Manual for Traffic Impact Studies (Department of Transport, 1995), when a proposed development or change in land use will generate more than 150 development trips in the peak hour, a Traffic Impact Assessment report needs to be prepared.

Thus, in light of the estimated vehicle trips, there is no requirement to prepare a full Traffic Impact Study. However, due to the impact this development will have on the Mpumalanga Province, a comprehensive Traffic Impact Study has been prepared.

2.1.5 Investigated Peak Periods

As previously stated Gods Window is a tourist attraction/recreational area and thus the peak periods which have been investigated are those corresponding to the daily peaks (based on the new traffic surveys) of this particular land use.

The applicable peak periods are the following:

- Friday peak – 16:15 to 17:15 and
- Saturday peak – 13:00 to 14:00

2.1.6 Horizon Years

The 2016 and 2021 horizon years have been investigated as part of this TIS. These horizon years have been selected to coincide with the visitor estimates as included in the Aecom's Feasibility Study. Thus the traffic impacts which have been assessed as part of this TIS will speak to the effects of the increase in tourist numbers for the 2016 and 2021 scenario.

2.2 Latent Rights

Proposed developments within the immediate vicinity of Gods Window are discussed in this section. As these developments are only planned and are not yet approved, their development traffic could not be considered.

2.2.1 Proposed Cableway

The Industrial Development Corporation (IDC) is promoting the development of a cableway which will link the Forever Resort Blyde Canyon, situated close to the Three Rondavels, across the Blyderivierspoort Reservoir to the Forever Resort Swadini in the lowveld. A feasibility study will evaluate the commercial viability of the proposal. This development has the potential to establish the Park as a strategic attraction and overnight stop on the Panorama Tour Route.

2.2.2 Adventure Centre

The proposed adventure centre will be located in the town of Graskop. It will provide a number of suspended walkways and will also include a cliff walk, a treetop walkway with a zip line, a big swing and children's play area along with observation deck and food and beverage offers.

2.2.3 Bourke's Luck Potholes

The proposed development includes for a five-star lodge and a restaurant. However the project has stalled, though initial consent was attained.

2.3 Scenarios Investigated

The following traffic scenarios have been investigated as part of this Traffic Impact Study:

- 2013 Background Traffic (Base Year);
- 2016 Horizon Traffic due to traffic growth; and
- 2016 Total Traffic (2016 Horizon Traffic and Development Traffic).

2.4 Assumptions

The trip generated by the proposed development/upgrade have been estimated based on the peak on-site attendance at God's Window estimated in the Aecom's Feasibility Report together with the vehicle occupancy estimates from our traffic surveys.

3. Selected Policy and Planning Issues

3.1 Introduction

The presence of adequate transport infrastructure is a pre-requisite of a developing tourism industry. It is also an important platform on which tourism plans and investment initiatives can be built. The non-availability and/or lack of public transport links inhibit the spread of tourists and residents within a particular destination and hamper growth in the tourism industry.

This section of the report has reviewed the current transportation policies and planning which supports tourism development in Mpumalanga.

3.2 Ehlanzeni District Municipality Comprehensive Integrated Transport Plan (April 2008)

A Comprehensive Integrated Transport Plan (CITP) was prepared for the Ehlanzeni District Municipality (EDM) in 2008. The EDM is one of three district municipalities which are located within the Mpumalanga Province (Nkangala and Gert Sibande being the other two), and also includes the provincial seat of government.

As previously stated, God's Window is located within the Thaba Chweu Local Municipality and only information relevant to this municipality has been discussed in the sections which follow.

From the CITP, the following modal split is evident:

- Walking – 43.3%;
- Private Vehicle – 16.3%;
- Bus – 9.0%;and
- Mini-bus taxi – 8.7%

The modal split indicated is typical of a rural area in comparison to an urban modal split. As seen, walking is the predominant mode of transport in the Municipality's area of jurisdiction.

3.3 Mpumalanga Economic Growth and Development Plan

The economic growth plan for the province focuses on job creation and the reduction of poverty. The plan has outlined key employment targets, which are, from the government's point of view, deemed achievable. As a result of these initiatives, Mpumalanga is envisioned to benefit from the creation of an extra 720 000 jobs by 2020. The development of successful tourist projects should assist in this, both directly and indirectly.

3.4 Blyde River Canyon Tourism Development Strategy

3.4.1 Introduction

The established vision for the Blyde River Canyon National Park is stated as follows:

“The Blyde River Canyon National Park, in partnership with local communities, will become recognised internationally as one of the world’s leading parks by protecting and promoting its unique landscapes, biodiversity and rich cultural assets.”

A strategy has been drafted to ensure that tourism development in the Blyde River Canyon National Park meets its desired aims. The strategy states that “The Park should act as a catalyst for tourism development in areas around the Park, particularly for the town of Graskop.”

Developing the Blyde River Canyon (BRC) National Park as a primary tourist attraction has long term tourism driven economic benefits for the Park’s immediate hinterland and other rural areas along the Gauteng-Kruger tour route. BRC National Park needs to be further developed to provide a suitable range of appropriate tourism products in order to optimise the full extent of the tourism opportunities that it can derive from its status as a national park.

3.4.2 Benefits to the Provincial Economy

The benefits to the development of the Blyde River Canyon National Park have been stated as follows:

- The Panorama Tour route may be extended by one day creating the potential for further development in other areas along the route;
- That it will catch and keep longer the flow of nearly half million tourists that travel past the Park on the Gauteng to Kruger tour route thus contributing significantly to the local surrounding economy;
- The Park will create considerable permanent and temporary jobs, business opportunities and opportunities for local people involved in the development of the Park; and
- The associated high service level of infrastructure necessary to support such tourism will have indirect, but significant benefits for local communities living in the area

The Skywalk concept is one that would bring the local area to international prominence. The development will significantly enhance the tourism product offer in the area, as well as creating an attraction with appeal to both domestic and international visitors. The proposed Blyde River Canyon cableway development, amongst other enhancement schemes, would further improve the perception of the area as a destination in its own rights.

4. Existing Roadway Elements

4.1 Existing Road Network

Access to the God's Window is gained via the main route to and from Graskop, the R532. The R534 off the R532 provides direct access to the God's Window tourist attraction.

The R534 can be classified as a Class 2 Rural Major Arterial which forms a spur loop. It is a single carriageway road which connects to the R532 at its northern and southern end. Deceleration and acceleration lanes are provided along the R532 to the north and south. There were no posted speed limit signs along the R534, but due to the class of the road, the speed limit can be assumed to be 100km/hr.

The R532 can be classified as a Class 2 Rural Major Arterial which runs in a north-south direction. It is a single carriageway road which leads to the small forestry town of Graskop. The observed speed limit along the R532 is 100 km/hr.

4.2 Roadway Conditions

The R532 and R534 which provide direct access to Gods Window are in a relatively good condition and are adequately maintained.

4.3 Roadway Restrictions

The only observed roadway restriction are the posted speed limit signs and the prohibition on littering along the R534.

4.4 Non-Motorised Transport

Due to the class of the access roads to God's Window, the R532 and R534, facilities for non-motorised transport and disabled and vulnerable users are not provided along the roads.

4.5 Public Transport Facilities

Public transport stops are not provided along the R532 and R534. Parking for buses is provided outside the entrance to God's Window

5. Existing Public Transport

5.1 Minibus Taxi

The following relevant information pertaining to minibus taxis was obtained from the Ehlanzeni District Municipality's CITP:

- Name of Taxi Association – Graskop Local and Long Distance Taxi Association;
- Number of Vehicles – 80 vehicles;
- Number of Members – 93 members;
- Number of Operating Licences – 61 licences

The nearest taxi rank facility to God's Window is located in the town of Graskop. **Table 5.1** shows the facilities available at the Graskop Taxi Rank.

Table 5.1: Available Facilities at Graskop Taxi Rank

Name	Area (m ²) or bays	Status	Amenities	Paving	Off-Street
Graskop	950	Formal	O, A	Y	N

E= Electricity, T = telephone, O = office, A = Ablutions

Minibus taxi trips can be taken from Graskop to the nearby towns of Lydenburg, Sabie and Matibidi and even as far away as Gauteng. Minibus taxi and MB Shuttles trips to God's Window were observed during the traffic surveys at God's Window.

5.2 Commuter Bus Operations

There are currently no subsidised/unsubsidized commuter bus services within the Thaba Chweu Local Municipality.

The only buses which were observed serving the God's Window were the tourist buses/coaches.

5.3 Rail Operations

The railway line from Nelspruit to the town of Graskop was completed in 1913 and the first train arrived in Graskop in May 1914. The railway line is situated about 14.5km from Pilgrim's Rest and 32km from Sabie. However, the railway system does not currently serve commuters with this study area.

5.4 Summary

From the above, it is evident that the minibus taxi is currently the only form of public transport that is available to transport passengers to/from Graskop in the Thaba Chweu Local Municipality.

6. Planned Changes to the Existing Road Network

From the team's consultations with officials from the Thaba Chweu Local Municipality, it was confirmed that there are no planned changes or improvements to the existing road network.

7. Existing Traffic

7.1 Traffic Surveys

New intersection traffic count surveys were undertaken on 2nd (Friday) & 3rd (Saturday) August 2013 from 06:00 to 18:00 by Messrs Traffic Support Services (TSS) at the following intersections:

- R532 & R534 North;
- R532 & R534 South; and
- God's Window Access off the R534.

These surveys were supplemented by vehicle occupancy surveys together with number plate surveys of vehicles (in and out movements) visiting the God's Window tourist attraction.

The location of the intersections is as indicated in **Figure 7.1**.

A copy of the traffic survey data is included in **Appendix A**.

7.2 Peak Traffic Hours

The 'common' peak hours were determined from the traffic counts as follows:

- Friday peak – 16:15 to 17:15 and
- Saturday peak – 13:00 to 14:00

7.3 2013 Background Traffic

The traffic counts were used to determine the background traffic volumes in the vicinity of God's Window tourist attraction. The results of the Friday and Saturday peak hour background traffic counts are shown in **Figures 7.2 to 7.3**.

7.4 Adjustment of Background Traffic

Seasonal factors are parameters used to adjust base counts which to account for travel behaviour fluctuations by day of the week and month of the year.

Visitor volumes to Gods Window vary throughout the year, as shown by the historic visitor volumes in **Figure 7.4**. The detail summary of the March 2009 to February 2010 of God’s Window visitor numbers is included in **Appendix B**.

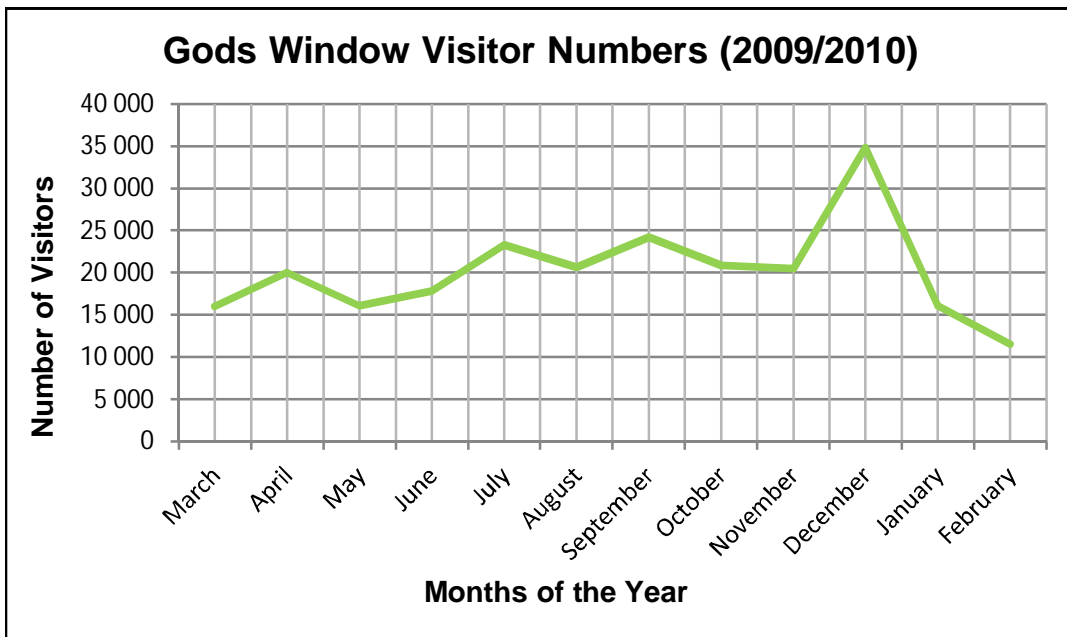


Figure 7.4: God’s Window visitor numbers (2009/2010)

From **Figure 7.4** the following is noted:

- Approximately 20 000 people visited God’s Window during the April holiday period and the month of August; and
- Approximately 35 000 people visited God’s Window during the December holiday period.

Therefore the base traffic counts were adjusted by a factor of 1.75 to make allowances for the lower traffic volumes experienced in the month of August to December.

The adjusted background traffic counts are shown in **Figures 7.5 and 7.6**.

7.5 Traffic Conditions

The roads in the immediate vicinity of Gods Window carry low levels of traffic and thus traffic congestion is not currently a problem.

However, during peak times (weekends, school and public holidays), traffic congestion occurs as visitors try to find parking within the Gods Window site. When parking is not sufficient they end up finding parking at the nearby viewpoints and along the roads near the access.

7.6 Traffic Growth

The future tourist market for the Mpumalanga province has been projected to grow at an annual growth rate of 2.2%.

An annual growth rate of 2.0% was applied to the adjusted 2013 background traffic volumes to estimate the 2016 and 2021 horizon traffic.

The estimated 2016 and 2021 horizon traffic for the Friday and Saturday peak hours is shown in **Figures 7.7 to 7.10**.

8. Trip Generation

8.1 Trip Generation of new and/or revised land uses

The feasibility study prepared by Aecom, on behalf of the Industrial Development Corporation, provided estimates of attendance for the proposed Skywalk at God's Window. These estimates were produced through a 'market penetration rate analysis which measures the propensity of available market segments to visit the viewpoint'.

The estimate of peak on-site visitor attendance at the improved God's Window tourist attraction (with the proposed Skywalk):

- Skywalk's Maximum Hourly Capacity – 215 guests per hour;
- Peak on-site attendance for God's Window – 453 people in 2016
- Peak on-site attendance for God's Window – 487 people in 2021

The estimate of existing modal split at God's window is based on the assessment of the vehicle occupancy surveys done on the 3rd August 2013. The 3rd of August was a clearer day than the 2nd of August and this resulted in a higher number of visitors to the site (visibility to the Lowveld area is essential to experience the full splendour of God's Window and the nearby Wonderview.)

The estimated modal split for visitors is shown in **Figure 8.1**.

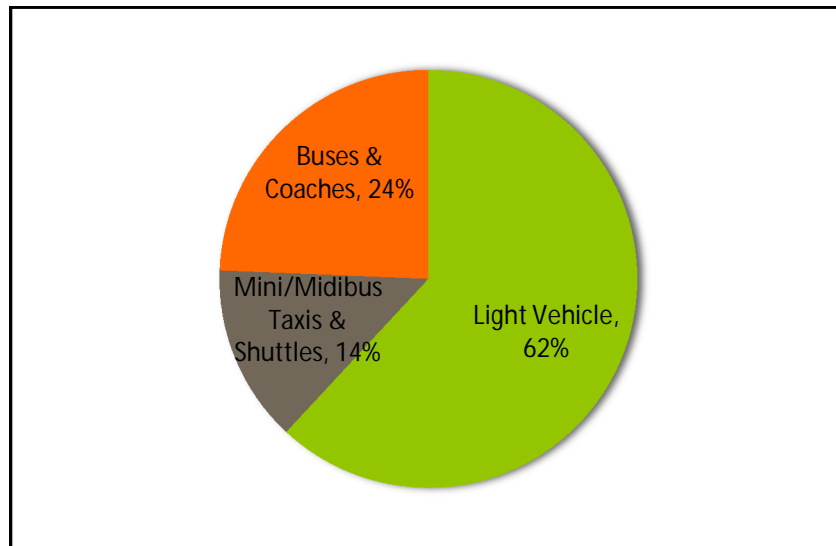


Figure 8.1: Existing Modal Split at God's Window

The above modal split estimate was used as the basis for the calculation of the peak hour traffic volumes that will be generated in 2016 and 2021.

The following are the estimates of vehicle occupancies, based on the traffic surveys, for the various modes:

- Light Vehicle – 2.87 persons/vehicle;
- Minibus Taxis – 10 persons/vehicle; and
- Buses – 53.1 persons/vehicle

The trip generation estimates are provided in **Table 8.1**.

Table 8.1: Peak Hour Vehicle Estimates

Vehicle Type	2016	2021
	Peak Hour Volumes	
Light Vehicle	98	105
Mini/Midibus Taxi	6	7
Buses	2	2
Total	106	114

Thus in 106 and 114 vehicles can be expected in 2016 and 2021 respectively.

9. Trip Distribution

9.1 Trip Distribution Percentages

It was estimated that the development traffic will distribute on to the surrounding public road network as follows:

- 65 % to/from the South (Graskop) via the R532 and
- 35% to/from North via the R532.

The estimated distributions are shown in **Figure 9.1**.

The generated trips were assigned to the external road network based on the trip distribution percentages. The development trips for 2016 and 2021 are shown in **Figures 9.2 and 9.3**.

The development trips were added to the 2016 Horizon Traffic and the 2021 Horizon Traffic to determine the 2016 Total Traffic in **Figure 9.4** and 2021 Total Traffic in **Figure 9.7**.

10. Capacity Analysis

The following intersections were assessed in terms of current and future traffic operations and capacity:

- R532 & R534 North;
- R532 & R534 South; and
- God's Window access off the R534.

10.1 Definitions

The following definitions from the Highway Capacity Manual (TRB, 2001) are used in this chapter.

Capacity	The maximum hourly rate at which vehicles can reasonably be expected to traverse a lane or roadway during a given period under prevailing traffic control conditions
Volume	The hourly rate of vehicle arrivals at an intersection.
Volume to Capacity Ratio	The ratio of volume to capacity (V/C) also referred to as the saturation flow rate
Level of Service	Level of service is defined in terms of delay. Delay is a measure of driver discomfort, frustration, fuel consumption and lost travel time. The levels of service for signalised and non-signalised intersections as defined in the Highway Capacity Manual (HCM) are tabulated in Table 10.2

10.2 Modelling Software

The software SIDRA Intersection v.5 was used in analysing the operation and capacity of the intersections under investigation. SIDRA is an advanced micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive-cycle models coupled with an iterative approximation method to provide estimates of capacity and performance statistics i.e. delay, queue length, stop rate, etc. (Akcel& Associates, 2006)

The SIDRA intersection software is for use as an aid for the design and evaluation of the following intersection types:

- Signalised intersections (fixed-time, pre-timed and actuated),
- Signalised pedestrian crossings,
- Single point interchanges (signalised)
- Roundabouts
- Two-way stop control,
- All-way stop control, and
- Give-way (yield) sign control

Although SIDRA is a single intersection analysis package, it can perform traffic signal analysis as an isolated intersection (default) or as a co-ordinates intersection by specifying platooned arrival data. The flexibility of SIDRA allows its application to many other situations, including uninterrupted traffic flow conditions.

10.3 Revised level of service method for vehicles in HCM 2010

In SIDRA Intersection v5.1, Level of Service (LOS) results are given for all major road lanes and movements except any continuous lanes. Usually LOS A or B will result due to zero delay (or geometric delay only for turning vehicles). However, LOS results are not given for major road approaches in line with the Highway Capacity Manual (HCM) 2010, unlike in earlier versions of SIDRA Intersection.

The method used for vehicle level of service at Approach and Intersection level is summarised in **Table 10.1**.

Table 10.1: Method used for level of service at Approach and Intersection level

LOS Method	Site Type	Approach LOS	Intersection LOS
Delay (HCM 2000) Delay & v/c (HCM 2010) Delay (RTA NSW)	Two-Way Sign Control (Stop or Give-Way / Yield)	Average approach delay for Minor Road approaches N/A for Major Road approaches	N/A
	Others	Average approach delay	Average intersection delay

Degree of Saturation (SIDRA Method) ICU Method	All Site Types	Highest (worst movement / lane) degree of saturation for the approach	Highest (worst movement / lane) degree of saturation for the intersection
---	----------------	---	---

A revised LOS method for vehicles was introduced in HCM 2010 (TRB 2010). It offers an important variation on the Delay (HCM 2000) method in using both the average control delay and the v/c (demand volume / capacity) ratio, or degree of saturation for LOS determination.

It uses delay thresholds which are the same as in the Delay (HCM 2000) method, but assigns LOS F when v/c > 1.0 (oversaturated conditions) irrespective of delay, as seen in **Table 10.2**.

Table 10.2: Delay & v/c (HCM 2010) definitions for LOS based on delay and v/c ratio

Level of Service for $v/c \leq 1.0$	Average delay per vehicle in seconds (d)			Level of Service for $v/c > 1.0$
	Signals	"SIDRA Roundabout LOS" option	Sign Control (HCM 2010 default for roundabouts)	All Intersection Types
A	$d \leq 10$	$d \leq 10$	$d \leq 10$	F
B	$10 < d \leq 20$	$10 < d \leq 20$	$10 < d \leq 15$	F
C	$20 < d \leq 35$	$20 < d \leq 35$	$15 < d \leq 25$	F
D	$35 < d \leq 55$	$35 < d \leq 50$	$25 < d \leq 35$	F
E	$55 < d \leq 80$	$50 < d \leq 70$	$35 < d \leq 50$	F
F	$80 < d$	$70 < d$	$50 < d$	F

Note: v/c (demand volume / capacity) ratio, or degree of saturation: v/c > 1.0 represents oversaturated conditions.

This method replaces the Delay (HCM) & Degree of Saturation method which was available in earlier versions of SIDRA Intersection. In applying the Delay & v/c (HCM 2010) method:

- the v/c ratio (degree of saturation) is taken into account together with the average delay value in determining LOS for lanes and movements, but
- only the average delay value is considered in determining LOS for approaches and the intersection (special considerations apply to LOS for approaches and the intersection as a whole in the case of two-way sign control).

A summary of the analysis results is discussed hereafter. Detailed analysis results are provided in **Appendix C**.

10.4 2013 Background Traffic

10.4.1 R532 & R534 North

The intersection geometry of R532 & R534 North is shown in **Figure 10.4.1**.

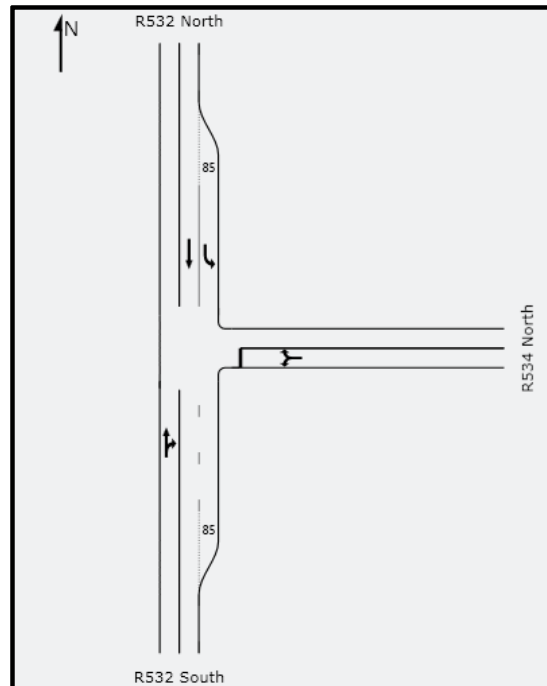


Figure 10.4.1: Existing Geometry R532 & R534 North

The analysis results show that R534 North operates at LOS B during both the Friday and Saturday peak hour with maximum movement average delays of 12.7 and 11.4 seconds during the Friday and Saturday peak hours respectively.

10.4.2 R532 & R534 South

The intersection geometry of R532 & R534 South is shown in **Figure 10.4.2**.

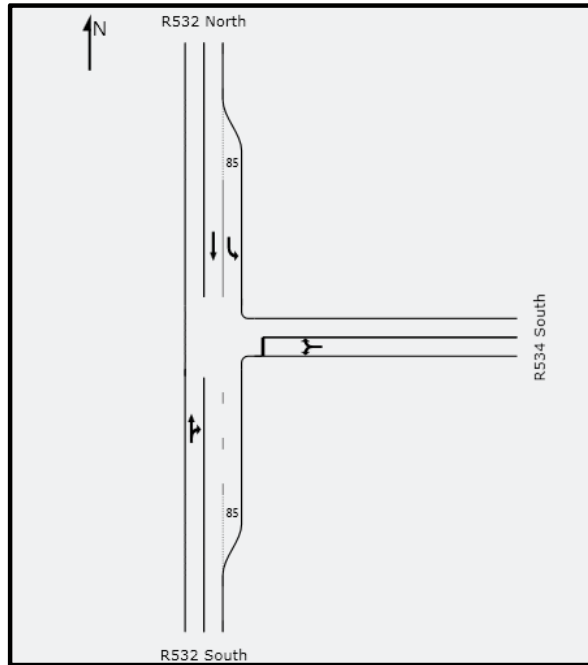


Figure 10.4.2: Existing Geometry of R532 & R534 South

The analysis results show that R534 South operates at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 12.0 and 12.3 seconds during the Friday and Saturday peak hours respectively.

10.4.3 God's Window Access off the R534

The intersection geometry of God's Window off the R534 is shown in **Figure 10.4.3**.

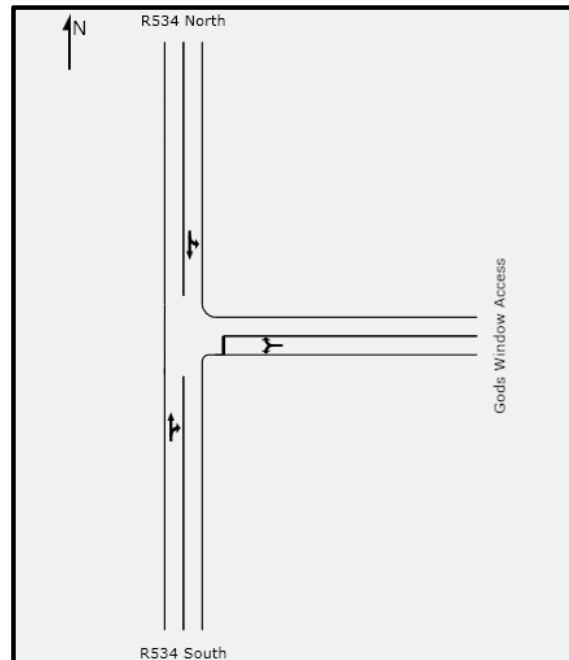


Figure 10.4.3: Existing Geometry of God's Window access off the R534

The analysis results show that the Gods Window Access operates at LOS B during both the Friday and Saturday peak hour with maximum average delays of 11.2 and 11.4 during the Friday and Saturday peak hours respectively.

10.5 2016 Horizon Traffic

10.5.1 R532 & R534 North

The analysis results show that R534 North operates satisfactorily at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 13.0 and 12.4 seconds during the Friday and Saturday peak hour respectively.

10.5.2 R532 & R534 South

The analysis results show that R534 South operates satisfactorily at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 12.1 and 12.4 seconds during the Friday and Saturday peak hour respectively.

10.5.3 God's Window Access off the R534

The analysis results show that the Gods Window access operates well at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 11.2 and 11.4 seconds during the Friday and Saturday peak hour respectively.

10.6 2021 Horizon Traffic

10.6.1 R532 & R534 North

The analysis results show that R534 North operates at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 13.2 and 12.6 seconds during the Friday and Saturday peak hours respectively.

10.6.2 R532 & R534 South

The analysis results show that R534 South operates at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 12.2 and 12.7 seconds during the Friday and Saturday peak hours respectively.

10.6.3 God's Window Access off the R534

The analysis results show that the Gods Window access operates well at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 11.2 and 11.5 seconds during the Friday and Saturday peak hour respectively.

10.7 2016 Total Traffic

10.7.1 R532 & R534 North

The analysis results show that R534 North operates satisfactorily at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 13.1 and 12.5 seconds during the Friday and Saturday peak hour respectively.

10.7.2 R532 & R534 South

The analysis results show that R534 South operates satisfactorily at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 12.1 and 12.7 seconds during the Friday and Saturday peak hour respectively.

10.7.3 God's Window Access off the R534

The analysis results show that the Gods Window access operates well at LOS B during both the Friday and Saturday peak hours with average delays of 11.5 and 12.0 seconds during the Friday and Saturday peak hour respectively.

10.8 2021 Total Traffic

10.8.1 R532 & R534 North

The analysis results show that R534 North operates at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 13.4 and 12.8 seconds during the Friday and Saturday peak hours respectively.

10.8.2 R532 & R534 South

The analysis results show that R534 South operates at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 12.2 and 13.0 seconds during the Friday and Saturday peak hours respectively.

10.8.3 God's Window Access off the R534

The analysis results show that the Gods Window access operates well at LOS B during both the Friday and Saturday peak hours with maximum movement average delays of 11.5 and 12.2 seconds during the Friday and Saturday peak hour respectively.

10.9 Summary

The analysis results show that the intersections on the immediate road network will continue to operate satisfactorily for all the assessed traffic scenarios.

11. Public Transport Assessment

“Tourist travel has predictable patterns and needs, and often occurs in areas that have unique environmental and social features that are particularly sensitive to degradation by excessive automobile traffic. Tourist Travel Management can preserve the amenities that attract visitors to an area”, (TDM Encyclopaedia, 2011)

Thus encouraging environmentally sustainable travel to holiday/recreational areas is crucial to maintaining the attractiveness of a recreational site.

38% of travel to Gods Window is made by mass transit vehicles (24% tourist and school buses with 14% being minibus taxis and shuttles). Thus, it is important to ensure that facilities for mass transit vehicles are maintained and improved at God’s Window.

Reserved on-street parking for mass transit vehicles is currently provided adjacent to the God’s Window access as shown in **Figure 11.1**. During off-peak seasons, buses are allowed to park within the parking area of God’s Window.



Figure 11.1: Reserved On-Street Parking for Buses & Public Transport Vehicles

The following can increase the use of mass transport vehicles to God’s Window:

- Make it affordable, convenient and enjoyable to Visit God’s Window without having to use a private vehicle;
- Provide detailed information on available travel choices to God’s Window at Graskop;
- Provide benefits to visitors who arrive without a car, e.g. priority access for buses;
- Create functional and attractive pedestrian and cycling facilities;
- Formalise bus parking area outside God’s Window, by means of demarcation of bays; provide bus shelters, etc.

-
- Provide signage for buses on the approaches to Gods Window; and
 - Provide signage for alternative parking (spill over parking) when the existing parking is fully utilised.

12. Parking

The existing parking at God's Window is a combination of angled and parallel parking which is used by light vehicles, minibus taxis and tourist buses.

The parking fee paid at the entrance is not linked to the parking duration. The number plate survey of vehicle entry and exits from God's Window, showed that on average vehicles parked for a period of 48 min at the parking area.

According to Parking Management Strategies, (Todd Litman, 2011), the following are just some strategies that can be used to better manage parking at Gods Window:

- Encourage the use of alternative modes and reduce motor vehicle use;
- Provide information to visitors about minibus taxi services and ridesharing;
- Develop a contingency-based overflow parking plan that indicates where is available parking nearby if on-site facilities are full (e.g. during holidays, weekends and school holidays) and how spillover impacts will be addressed;
- Improve enforcement, marketing and mobility management programs which encourage the use of alternative modes.

The use of some of these strategies can assist in managing parking demand at Gods Window. When parking is better managed, the cost of building expensive parking areas and its associated environment impacts is reduced.

13. Conclusions & Recommendations

The following conclusions can be made:

- A Transport Impact Assessment was prepared to assess the impact of the proposed changes to the existing God's Window tourist attraction, in Mpumalanga, on the existing road and transportation infrastructure;
- It is estimated that proposed changes in land use at the God's Window access will result in 106 and 114 peak hour traffic in 2016 and 2021 respectively;
- The surrounding intersections, R532 & R534 North, R532 & R534 South, and the God's Window access have been assessed in terms of current and future traffic operations;
- The assessment results show that the intersections are currently operating at satisfactory levels of service for the 2013 Background Traffic Scenario;
- The assessment results show that the intersections will continue to operate at satisfactory levels during the 2016 Horizon and 2016 Total Traffic scenario;
- The assessment results show that the intersections will continue to operate at satisfactory levels during the 2021 Horizon and 2021 Total Traffic scenario;
- No intersection upgrades are proposed to the immediate surrounding road network.

It is recommended that the Transport Impact Assessment is approved from a traffic engineering point of view, with a proviso that the following is accommodated:

- Make it affordable, convenient and enjoyable to Visit God's Window without having to use a private vehicle;
- Provide detailed information on available travel choices to God's Window at Graskop;
- Provide benefits to visitors who arrive without a car, e.g. priority access for buses;
- Create functional and attractive pedestrian and cycling facilities;
- Formalise bus parking area outside God's Window, painting of bays; provide bus shelters
- Provide signage for buses on the approaches to Gods Window;
- Provide signage for alternative parking (spill over parking) when the existing parking is fully utilised.

14. References

The following references have been used in the compilation of this report:

Aecom, 2013. *Feasibility Study Report for the proposed Skywalk at God's Window*. Aecom, April.

DoEAT, *Blyde River Canyon National Park – Tourism Development Strategy*, undated. Department of Environmental Affairs and Tourism.

Mpumalanga Province's Tourism Industry Statistics, 2007/2008.

Mpumalanga Tourism Fact Sheet 2007/2008, Mpumalanga Tourism and Parks Agency.

Campbell Scott et al.2009. *Skywalk Complex and Skylift at Gods Window – Blyde River Canyon Nature Reserve*, December.

Hazyview Areal Cable Trails (Pty) Ltd T/A Skyway Trails. Undated. *Feasibility Study for the Development of a Skywalk complex and Skylift at God's Window*

Victoria Transport Policy Institute, 2011 *Tourist Transport Management, Improving Leisure Travel Choices*, TDM Encyclopaedia. Updated 18 February 2011.

Todd Litman, 2011. *Parking Management Strategies, Evaluation and Planning*. Victoria Transport Policy Institute, 2011

Figures

Appendices

Appendix A: Traffic Survey Data

Appendix B: Detailed Summary of 2009/2010 God's
Window Visitor Numbers

Appendix C: Summary of SIDRA Analysis Results

2013 Background Traffic

2016 Horizon Traffic

2021 Horizon Traffic

2016 Total Traffic

2021 Total Traffic

WSP Group Africa (Pty) Ltd
WSP House
Bryanston Place, 199 Bryanston Drive
Bryanston
2191
South Africa
Tel: +27 12 349 1307
Fax: +27 12 349 1229
www.wspgroup.co.za

UNITED
BY OUR
DIFFERENCE

