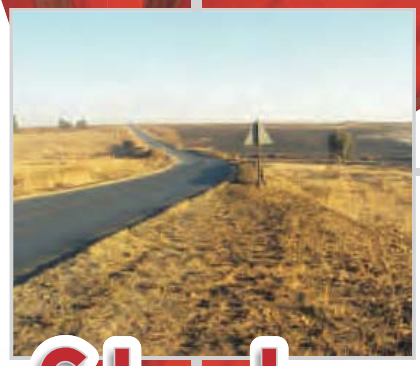

Traffic Impact Study

Brakfontein Thermal Coal Mine

September 2012

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T42_2012 (J01930)

TRAFFIC IMPACT STUDY

Brakfontein Thermal Coal Mine

Draft Report

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TITLE OF REPORT: Traffic Impact Study – Brakfontein Thermal Coal Mine	
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BUSINESS UNIT: Transportation

DEPARTMENT: Traffic

OFFICE: Pretoria

DESCRIPTION OF REPORT:

This report forms part of the Environmental Impact Assessment (EIA) being undertaken for the proposed Brakfontein Thermal Coal Mine and discusses the expected traffic impact of the proposed mine on the surrounding road network and includes an assessment of three haulage route alternatives.

PROJECT TEAM:

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LIST OF ABBREVIATIONS

TIS:	Traffic Impact Study
EIA:	Environmental Impact Assessment
ROM:	Run-of-Mine
LOS:	Level-of-Service
LV:	Light Vehicle
HV:	Heavy Vehicle
ADLT:	Average Daily Light (Vehicle) Traffic
ADTT:	Average Daily Truck Traffic (Heavy Vehicle Traffic)
ADT:	Average Daily Traffic
PCE:	Passenger Car Equivalent

1 INTRODUCTION

1.1 Background

It is proposed to establish the Brakfontein Thermal Coal Mine on Portions 6, 8, 9, 10, 20, 26, 30 and the Remaining Extent of the Farm Brakfontein 264 IR, located approximately 16km south-east of Delmas within the western margins of the Witbank coalfields of Mpumalanga – see **Figure 1**. The proposed colliery would supply 50mm crushed and screened run-of-mine (ROM) coal to the Kangala Colliery (a Universal Coal operation located approximately 20km west of the proposed Brakfontein mine – see **Figure 1**) where both C-grade steam coal (for export purposes) and D-grade coal for Eskom is produced [1]. In support of the Mining Right Application submitted by Universal Coal to the Department of Mineral Resources, an Environmental Impact Assessment (EIA) is currently being undertaken by Digby Wells Environmental. As part of the EIA, a Traffic Impact Study (TIS) is required to determine the expected traffic impact of the proposed mine on the surrounding road network and to assess three haulage route options, depicted in **Figure 1**, between the proposed Brakfontein Mine and Kangala. BKS (Pty) Ltd. was since appointed by Universal Coal Plc to undertake this aspect of the assessment.

1.2 Focus of Study

The study focuses on the following aspects:

- The quantification of the expected traffic impact of the proposed mine on the immediate surrounding road network;

- The preliminary assessment of the condition of the three haulage routes to determine which is the most preferable and the effect of the additional heavy vehicle traffic expected to be generated by the proposed mine on the selected route;

- The evaluation of the proposed accesses to Brakfontein and Kangala to safely and efficiently accommodate development traffic, public transport and pedestrians; and

- The identification of practical and feasible mitigation measures to maintain acceptable traffic flow operations on the road network within the study area.

2 METHODOLOGY

To determine the expected traffic impact of the proposed Brakfontein Coal Mine, the following methodology was pursued:

- A site investigation was undertaken to evaluate the layout of the immediate surrounding road network, as well as to observe present traffic flow operations and to visually assess the pavement conditions of the three haulage route alternatives between Brakfontein and Kangala.

- Classified manual traffic counts were performed at critical intersections within the study area during the weekday morning and afternoon peak periods on Tuesday the 14h of August 2012 to determine existing peak hour traffic volumes.

- Seven-day, classified electronic surveys were undertaken on critical links within the study area so as to ascertain existing traffic flow patterns.

- The expected peak hour trip generation of the proposed Brakfontein Thermal Coal Mine was determined with cognisance of the proposed operations and the estimated run-of-mine (ROM) coal tonnage to be transported from Brakfontein to Kangala. The trips were assigned to the road network and combined with the counted peak hour traffic volumes.

- Operational capacity analyses, using the **Highway Capacity Software** [2], were performed at each intersection to establish the expected peak hour operating conditions for the following scenarios:
  - 2012 status quo i.e. without development and
  - 2012 with the development of the proposed Brakfontein Coal Mine.

- With cognisance of the expected heavy vehicle traffic to be generated by the proposed mine and the existing condition of the three haulage routes between Brakfontein and Kangala, the effect the additional heavy vehicle traffic is expected to have on the selected route alternative route was assessed.

- The accesses to Brakfontein and Kangala were assessed to ensure that sufficient capacity is provided to safely accommodate the expected development traffic.

3 HAULAGE ROUTE ALTERNATIVES BETWEEN BRAKFONTEIN AND KANGALA

3.1 Background

As identified in the **Final Scoping Report** [1] for the Brakfontein Mine, the Colliery is to supply 50mm crushed and screened run-of-mine (ROM) coal to the Kangala Coal Mine where it will be washed and processed. Universal Coal Plc identified three possible haulage routes between the two mines, as follows (see **Figure 1**):

3.1.1 Route 1 – The Green Route:

Route 1 comprises a length of 24km between Brakfontein (Access 1) and Kangala and includes the following roads:

- Road D2543 (paved, 1.2km);
- Road D1274 (gravel, 3.6km);
- The R50 (paved, 3.7km);
- Road D1334 (gravel, 12.3km); and
- Road D1223 (gravel, 3.2 km).

3.1.2 Route 2 – The Pink Route:

Route 2 totals a distance of 27.4km, including:

- Road D2543 (paved, 1.2km);
- Road D1274 (gravel, 3.6km);
- The R50 (paved, 18.7km); and
- The R42 (paved, 3.9km).

3.1.3 Route 3 – The Blue Route:

Route 3 measures 23.2km and includes the following roads:

- Road D2543 (paved, 3.9km);
- Road D1147 (paved, 5.3km);
- The R50 (paved, 10.1km); and
- The R42 (paved, 3.9km).

To determine the preferred route alternative, a site investigation was undertaken and the basic characteristics of each route were assessed.

3.2 Pavement Condition Assessment

A visual pavement condition assessment was undertaken fir each of the three routes. For ease of reference, the assessment area was divided into 5 sections – refer to **Figure 2.** It should be noted that gravel roads were not included in the analysis owing to the maintenance actions that would be required during the rainy season. The following was observed – refer to the photographs attached as **Appendix A**:

3.2.1 Section 1: From the R42/D1223 to the R42/R50 (3.9km)

The surface of the road is in a fair condition. Light bleeding in the wheel paths is visible, though the surface seal is adequate. Selective edge braking occurs where the gravel shoulder has deteriorated on the curves. The gravel shoulder, therefore, needs backfilling of up to 50mm. Maintenance on this road is of the minimum, yet little deformation was detected and the road appears to be structurally sound.

3.2.2 Section 2: From the R42/R50 to the R50/D1147 (10.1km)

In selective areas of both lanes, a high level of bleeding occurs in the wheel paths. In addition, deformation was observed in some areas as a result of moisture entering the crocodile and transverse cracks which are visible on the road surface. Though the amount of potholes is limited, existing repaired patches show evidence of deterioration and deformation. The riding quality in particular sections is bumpy owing to the deformation of the base layer, but overall is considered to be fair. At the intersection of the R50 with Road D1147, the turning actions of heavy vehicles have caused the surface to deteriorate in such way that the base layer of the pavement is clearly visible and exposed. The ingress of water into the base layer has consequently resulted in potholes. It can, therefore, be concluded that despite some effort to maintain Section 2, it has unfortunately not been of a standard to prevent any further deterioration of the surface and base layer.

3.2.3 Section 3: From R50/D1147 to D1147/D2543 (5.3km)

As in Section 2, deformation can be observed in some areas as a result of moisture entering the crocodile and transverse cracks. Similarly, existing repaired patches show some deterioration and deformation. Cracks in these patches are highly visible and the ingress of moisture has resulted in the pumping and deterioration of the surface and base layer. Despite this, the number of potholes is limited. At the intersection of Road D1147 with Road D2543, the turning actions of heavy vehicles have caused the surface to become slightly polished. In comparison to Section 1 and Section 2, however, Section 3 is characterised by fewer defects and its condition can be classified as fair.

3.2.4 Section 4: From D1147/D2543 to D2543/D1274 (5.1km)

In particular areas of both lanes, bleeding occurs in the wheel paths. In addition, selective deformation is noticeable, as a result of moisture entering the crocodile and transverse cracks. Existing repaired patches also show deterioration and deformation. Cracks in these patches are highly visible and the ingress of moisture has resulted in the pumping and deterioration of the surface and base layers. Potholes are limited, but are large in some areas. The turning actions of heavy vehicles at the intersection of Road D2543 with Road D1274 have caused the surface to become slightly polished, but no serious potholes or deformation occurs. The surface seal is, however, stripped and the previous seal layer is clearly visible.

3.2.5 Section 5: From R50/D1147 to R50/D1274 (8.6km)

The condition of Section 5 is much the same as Section 2 – refer to **Section 3.2.2** and the photographs in **Appendix A**.

3.2.6 Conclusions

From this visual pavement condition assessment, it was found that:

- Section 2 (the R50), Section 4 (Road D2543) and Section 5 (the R50) require urgent attention with regards to rehabilitation; and that
- A good maintenance programme must be established for Section 1 (the R42) and Section 3 (Road D1147) to prevent these sections from failing.

3.3 Analysis of Haulage Route Alternatives

With cognisance of the information collated above, the viability of each route alternative was considered, as follows:

3.3.1 Route 1 - The Green Route

Eighty percent i.e. 19.1km of Route 1 constitutes gravel roads. The frequency these roads are to be utilised would necessitate that they be upgraded to paved surfaces, but at an estimated cost of approximately R 7,000,000 per kilometre of road to be paved (7m wide), would present a significant expense for Universal Coal. This route is therefore not considered a feasible haulage route between Brakfontein and Kangala.

3.3.2 Route 2 - The Pink Route

Similarly, Route 2 includes a portion of gravel road (D1274) and would require road upgrading, at the expense of Universal Coal, to sustain the expected heavy vehicle traffic to be generated by the mine. In addition, this route is longer than the other route alternatives and provides no significant benefits to substantiate the additional distance to be travelled.

3.3.3 Route 3 - The Blue Route

Route 3 is not only the shortest of the haulage route alternatives, but it is also the only one to comprise only paved road sections. It should also be noted that the mine's weighbridge is to take access from Road D2543 – see the Conceptual Mine Plan in **Appendix B**. To prevent overloading, all Brakfontein's haulage trucks will be required to pass through this point on route to Kangala. From the left out exit, Route 3, therefore, presents the most convenient of the route alternatives to Kangala. Given that this route is approximately 4km shorter than Route 2, does not include gravel roads and is in no worse pavement condition, Route 3 is similarly considered the favourable route for the empty haulage trucks travelling from Kangala to Brakfontein.

3.3.4 Conclusions

It is concluded that Route 3 is the preferred haulage route alternative between Brakfontein and Kangala and should therefore function as the designated transport route between the two mines.

4 TRAFFIC OPERATIONS: 2012 STATUS QUO

4.1 Study Area

The study area was based on the current road network, the preferable haulage route alternative between Brakfontein and Kangala i.e. Route 3, present traffic and pavement conditions and a preliminary evaluation of the proposed mine's trip generation, distribution and assignment. The following intersections were consequently considered significant for the purposes of this study and therefore included in the analysis (see **Figure 3**):

- The intersection of the R42 with D1223 (2-way stop);
- The intersection of the R42 with the R50 (1-way stop);
- The intersection of the R50 with D1147 (1-way stop); and
- The intersection of D1147 with D2543 (1-way stop).

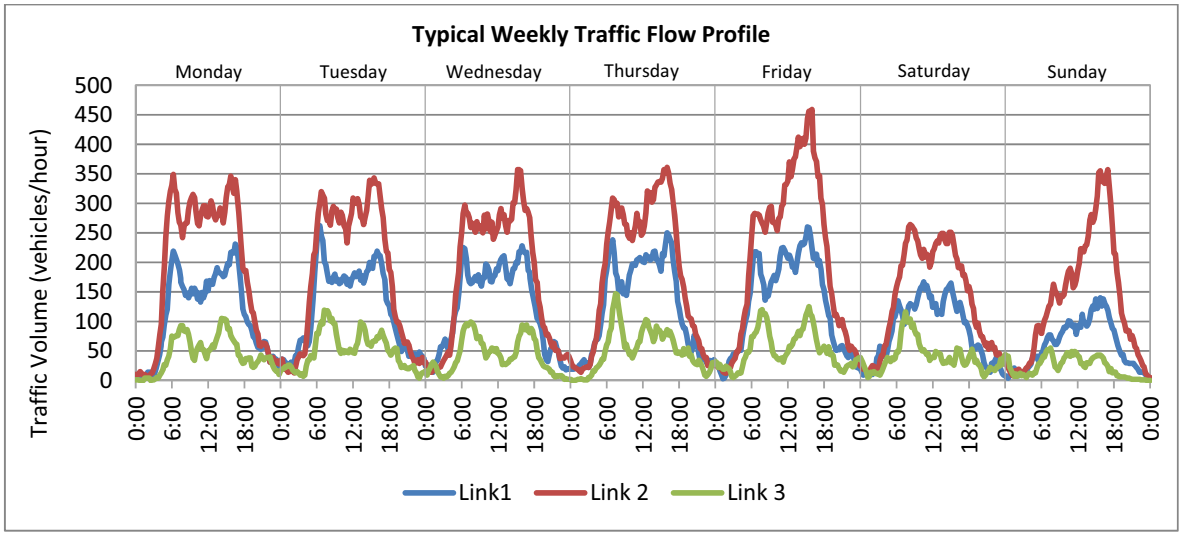
4.2 Existing Peak Hour Traffic Volumes

The existing traffic volumes at each of the intersections within the study area were surveyed during the weekday morning peak period (06h00 – 09h00) and the weekday afternoon peak period (15h00 – 18h00) on Tuesday the 14th of August, 2012. The traffic surveys were classified to differentiate between light and heavy vehicles. The traffic volumes in the peak hours are presented in **Figure 4**.

4.3 Traffic Flow Characteristics

In addition to the manual traffic counts performed at each intersection, classified electronic surveys were undertaken at three positions within the study area (see **Figure 3**) over a period of seven days (14 August to 21 August 2012) to determine the traffic characteristics of the study area over a typical week, as summarised below – refer also to the data summary for each site in **Appendix C**:

4.3.1 Traffic Flow Profile for a Typical Week



As indicated in the graph above:

- Link 2 i.e. the R50, a significant route to/from Delmas, carries the highest traffic volumes of the three links surveyed;

- Link 3 (Road D2543) carries substantially lower volumes than Link 2 and Link 1;
- Traffic volumes on all links are lower on the weekend.

4.3.2 Average Daily Traffic

The Average Daily Traffic on each link was determined to be as follows (see **Table 1**) and indicates that:

- Link 2 (the R50) carries substantially higher traffic volumes than Link 1 and Link 3;
- Heavy vehicles volumes on Link 1 (the R42), however, are almost equal to those on Link 2 (though the number of light vehicles is significantly less);
- The D2543 is characterised by low traffic volumes, but carries the highest percentage of heavy vehicle traffic which may be attributed to the fact that it is a coal route [4]. The R42, also a coal route, is similarly characterised by a substantial percentage of heavy vehicles.

Table 1: Average Daily Traffic Volumes per Link

Link	ADLT	ADTT	ADT
Link 1 (R42)	1,555	1,054 (40%)	2,609
Link 2 (R50)	3,106	1,015 (25%)	4,121
Link 3 (D2543)	439	590 (57%)	1,028

4.4 Operational Analysis

The existing operating conditions at each of the identified intersections (see **Section 4.1** and **Figure 3**) were analysed using their existing layouts, as depicted in **Figure 5**, and the surveyed traffic volumes in **Figure 4**.

The **Highway Capacity Software** [2] was used to determine the current V/C ratios and levels of service (LOS) with regard to the delay experienced at each intersection. The software evaluates and measures an intersections capacity in accordance with the **Highway Capacity Manual** [3]. The output of the analysis is given as levels-of-service (LOS) which are based on the average delay experienced and range from A, very good with minimum delay, to F, very bad with unacceptable delays. The V/C ratios depict the volume of vehicles in relation to the available road capacity, where figures greater than 0.95 indicate insufficient capacity to accommodate vehicles, resulting in excessive queues and delay. It should be noted that the results determined using the **Highway Capacity Software** [2] only reflect the critical/conflicting movements.

The results of the operational analysis for the base year conditions are presented in **Appendix D** and indicate that the network presently operates at good levels of service (LOS B or better) with minimal delay, with ample spare capacity. This was similarly observed on the site visit to the study area.

5 TRAFFIC AND PAVEMENT IMPACT EVALUATION: 2012 WITH DEVELOPMENT

5.1 Trip Generation, Distribution and Assignment

To determine the expected trip generation of the proposed Brakfontein Thermal Coal Mine, the following information was obtained from Universal Coal:

- 1,44 million tonnes of run-of-mine coal is to be transported from Brakfontein to Kangala per annum;
- The coal is to be transported using 40 tonne trucks; and
- The mine will operate on a 3 shift (8 hours per shift), 7-day week basis;

With cognisance of the above, the Brakfontein Coal Mine is expected to generate 200 (truck) trips per day i.e. 10 (truck) trips per hour.

The total expected peak hour vehicle trips were consequently distributed between Brakfontein and Kangala, and assigned onto the designated haulage route (Route 3) between the two mines. The expected mine traffic is depicted in **Figure 6** and it is clear that low peak hour traffic volumes will be added to the road network.

5.2 Operational Analysis

The expected development traffic depicted in **Figure 6** was added to the background traffic volumes for the base year so as to ascertain the impact of the proposed mine on the surrounding road network. The total expected traffic volumes for the base year (including the expected mine traffic) are shown in **Figure 7**.

Operational analyses were undertaken to verify whether the surrounding road network has sufficient capacity to accommodate the additional development traffic in the base year. It should be noted that for the purposes of the operational analysis, the heavy vehicle volumes expected to be generated by the Brakfontein mine were converted to a Passenger Car Equivalent (PCE) volume. In so doing, a Passenger Car Equivalent factor of 2.5 (as specified in the **Highway Capacity Manual** [3]) was utilised.

The results of the operational analysis are included in **Appendix D** and indicate that the proposed Brakfontein Thermal Coal Mine will have a negligible traffic impact on the surrounding road network. Existing traffic operating conditions will therefore be unchanged with the development of the mine.

5.3 Pavement Impact

To determine the expected pavement impact of the proposed Brakfontein Mine, the expected heavy vehicle traffic the mine is expected to add to each link per day was compared to the existing average daily heavy vehicle traffic volumes (ADTT), as indicated in **Table 2**:

Table 2: Comparison of Average Daily Truck Traffic (ADTT)

Link	Existing Heavy Vehicle (HV) Traffic Volumes			Heavy Vehicle Traffic Volumes (Brakfontein)		
	ADTT (Direction 1)	ADTT (Direction 2)	ADTT (Total)	ADTT (Direction 1)	ADTT (Direction 2)	ADTT (Total)
Link 1 (R42)	540	513	1,053	100	100	200
Link 2 (R50)	457	558	1,015	100	100	200
Link 3 (D2543)	292	298	590	100	100	200

For Link 1: Direction 1 is northbound; for Link 2 and Link 3: Direction 1 is eastbound; Direction 2 reflects the opposite direction.

With cognisance of the above, the Brakfontein haulage trucks are expected to constitute the following proportion of the ADTT on each link:

Table 3: Proportion of Brakfontein ADTT of the Total ADTT

Link	Total Expected ADTT	Proportion Brakfontein ADTT
Link 1 (R42)	1,253	16%
Link 2 (R50)	1,215	17%
Link 3 (D2543)	790	25%

Considering the existing heavy vehicle traffic volumes, it is therefore expected that the additional heavy vehicle traffic that will be added to the road network will be between 16% and 25%. With cognisance of the existing pavement conditions (as identified in **Section 3.2.6**), it must be reiterated that the road authority needs to give attention to the road sections that require rehabilitation and should ensure that a good maintenance programme is established to prevent pavement failure.

6 ACCESS ARRANGEMENTS TO BRAKFONTEIN MINE

6.1 Brakfontein Access

Considering the individual portions of land, four accesses are proposed to the Brakfontein Thermal Coal Mine – see the Conceptual Mine Plan in **Appendix B**. For the purposes of the traffic investigation, the required access arrangements were determined to ensure adequate capacity is provided to satisfactorily accommodate the expected mine traffic. Sight distances on either side of each access were additionally assessed.

6.1.1 Required Access Arrangements

As shown in **Figure 4** and **Figure 6**, the existing traffic volumes are low, as is the expected trip generation of the proposed Brakfontein Mine. No capacity constraints are therefore foreseen at the accesses. To confirm this, a conservative approach was followed in assuming that all the Brakfontein Mine traffic will be focused at a single access i.e. Access 1 (instead of all four accesses). A two way stop controlled access will provide ample spare capacity as a LOS A is expected to prevail. Considering this result, the following is concluded (see **Figure 8**):

- Access 1 should operate as a 2-way stop (free flow on Road D2543) with single lanes on all approaches (no ride widening will be required on Road D2543);
- Access 2 should operate as a 2-way stop (free flow on Road D1274) with single lanes on all approaches;
- Access 3 should function as a 1-way stop (free flow on Road D2543) with single lanes on all approaches (no ride widening will be required on Road D2543); and
- Access 4 should function as a left-in only access for haulage trucks travelling from Access 2 to the weighbridge facility.

If the accesses are to be controlled, it is recommended that at least 40m of storage space be provided from the road reserve to the access control point.

It is additionally recommended that the section of Road D1274 between Road D2543 and Access 2 be upgraded to a paved road to adequately sustain the heavy vehicle traffic.

6.1.2 Sight Distance

The sight distance at each access is sufficient and is depicted in **Appendix E**. From a traffic safety perspective, no lane widening will be required at any of the accesses to the Brakfontein Mine.

6.2 Kangala Access

The Kangala Mine is served by only a single access on the R42, opposite the D1223. All the Brakfontein traffic will therefore be consolidated at this access. To determine the required layout of this access, consideration was given to the following:

- The expected volume of mine traffic to utilise the access;
- Existing traffic volumes on the road network – as shown in **Section 4.3**, traffic volumes on the R42 are substantially higher than on the D2543; and
- The speed of vehicles – the speed limit on the R42 is 120km/hr.

With cognisance of the above, it is therefore recommended that at the access to Kangala, the following be provided – see **Figure 8**:

- An exclusive right turning lane on the westbound approach; and
- The access to Kangala (at least 50m from the R42) be upgraded to a paved road and that a left turn slip lane be provided for trucks exiting this site.

It is further recommended that the speed limit on the R42 in the vicinity of the access be reduced to 100km/hr.

7 BRAKFONTEIN MINE: WEIGHBRIDGE FACILITY

A weighbridge is proposed off Road D2543, downstream of Access 1 (see **Appendix B**) to monitor the loading of the haulage trucks that are to travel from Brakfontein to Kangala and to prevent the overloading of these vehicles. To control access to this facility, it is recommended that it be entered from Access 1 and exited via a left-out only access further downstream. In addition, a feedback loop should be provided for overloaded heavy vehicles.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

It is concluded that:

- It is proposed to establish the Brakfontein Thermal Coal Mine on Portions 6, 8, 9, 10, 20, 26, 30 and the Remaining Extent of the Farm Brakfontein 264 IR, located approximately 16km south-east of Delmas within the western margins of the Witbank coalfields of Mpumalanga

- The proposed mine is to supply 1.44 million tonnes of crushed run-of-mine coal per annum to the Kangala Colliery, where it will be washed and processed.

- Route 3 (R42, R50, D1147, D2543) i.e. the blue route is the preferred route alternative between Brakfontein and Kangala.

- The proposed mine is expected to generate 200 truck trips per day i.e. 10 truck trips per hour and will have a negligible traffic impact on the surrounding road network.

- The proposed mine is expected to contribute a proportion of no more than 25% to the total heavy vehicle traffic volume on Route 3 and will therefore not have a substantial pavement impact on this route.

- Sufficient sight distance is provided at the proposed accesses to the Brakfontein Mine.

- A weighbridge facility will be constructed as part of the Brakfontein Mine to ensure that haulage trucks travelling to Kangala are not overloaded.

8.2 Recommendations

It is recommended that:

1. With regards to existing pavement conditions, the road authority should ensure that:

    - Section 2 (the R50), Section 4 (Road D2543) and Section 5 (the R50) receive urgent attention with regards to pavement rehabilitation; and that
    - A good maintenance programme be established for Section 1 (the R42) and Section 3 (Road D1147) to prevent pavement failure.

2. The developer of the proposed Brakfontein Mine be responsible for the following:

    - The construction of the four accesses, as follows:
        - A two-way stop (Access 1) on Road D2543 (located approximately 1.1km west of Road D1274) with single lanes on all approaches;
        - A two-way stop (Access 2) on Road D1274 (located approximately 850m south of Road D2543) with single lanes on all approaches;
        - A one-way stop (Access 3) on Road D2543 (located approximately 1.2km east of Road D1274) with single lanes on all approaches; and

- A left-in only access (Access 4) for haulage trucks travelling from Access 2 to the weighbridge facility (located approximately 80m south of Road D2543).

- If the accesses to the Brakfontein Mine are to be controlled, at least 40m of storage space be provided from the road reserve to the access control point.

- Upgrading of the section of Road D1274 between Road D2543 and Access 2 to a paved road to adequately sustain heavy vehicle traffic.

- Upgrading of the access to Kangala, as follows:
  - The construction of an exclusive right turning lane on the westbound approach and a left turn slip lane on the southbound approach for trucks exiting this site; and
  - The upgrading of the access to Kangala (at least 50m from the R42) to a paved road.

- The construction of the weighbridge facility on Road D2543 to be entered via Access 1 and exited via a left-out only exit further downstream and including a feedback loop for overloaded haulage trucks.

3. It is further recommended that the proposed Brakfontein Mine be approved from a traffic engineering point of view.

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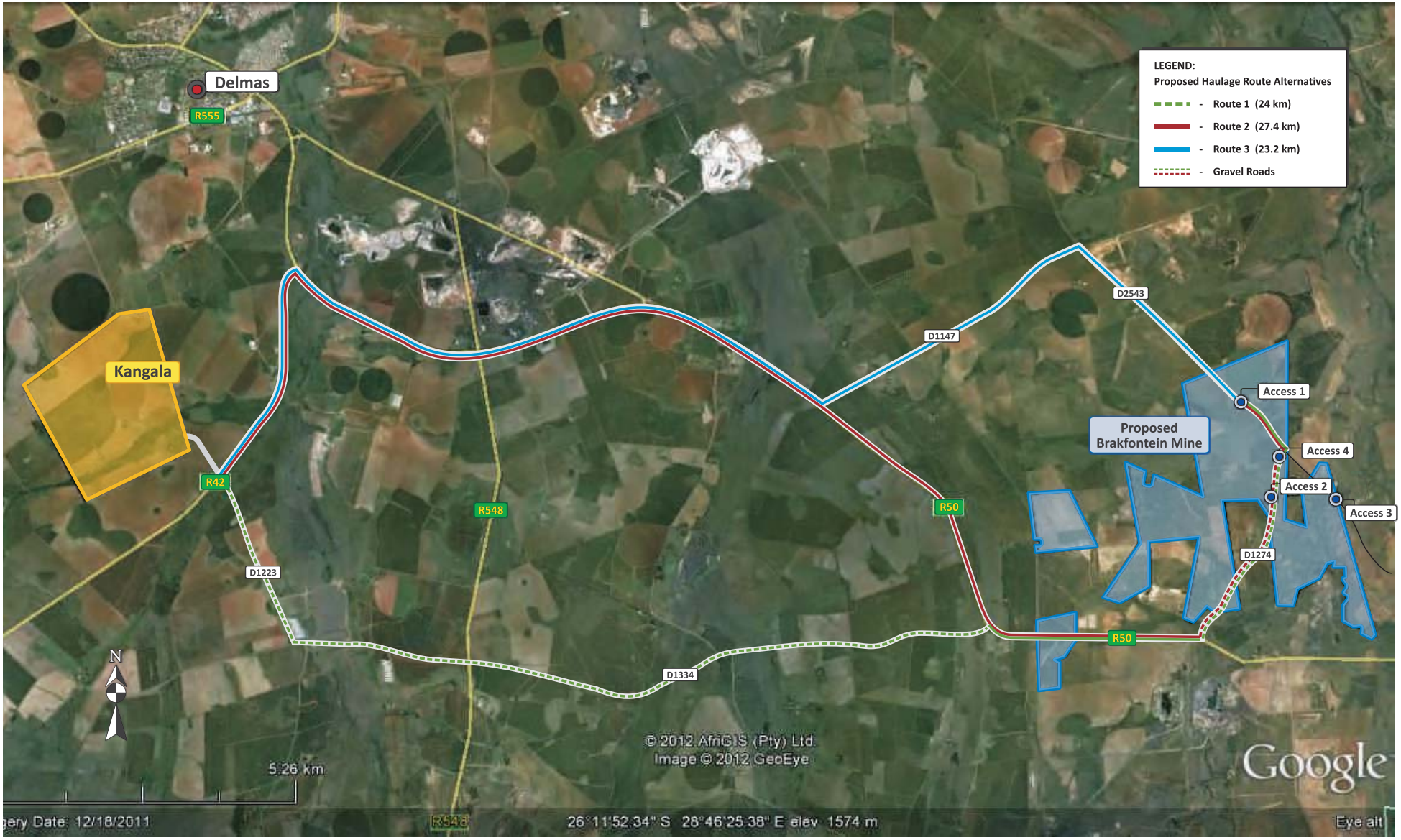
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Proposed Haulage Route Alternatives
- Route 1 (24 km)
- Route 2 (27.4 km)
- Route 3 (23.2 km)
- Gravel Roads
Delmas
R555
Kangala
R42
D1223
R548
D1147
D2543
R50
Proposed Brakfontein Mine
Access 1
Access 4
Access 2
Access 3
D1274
R50
D1334
N
5.26 km
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Google
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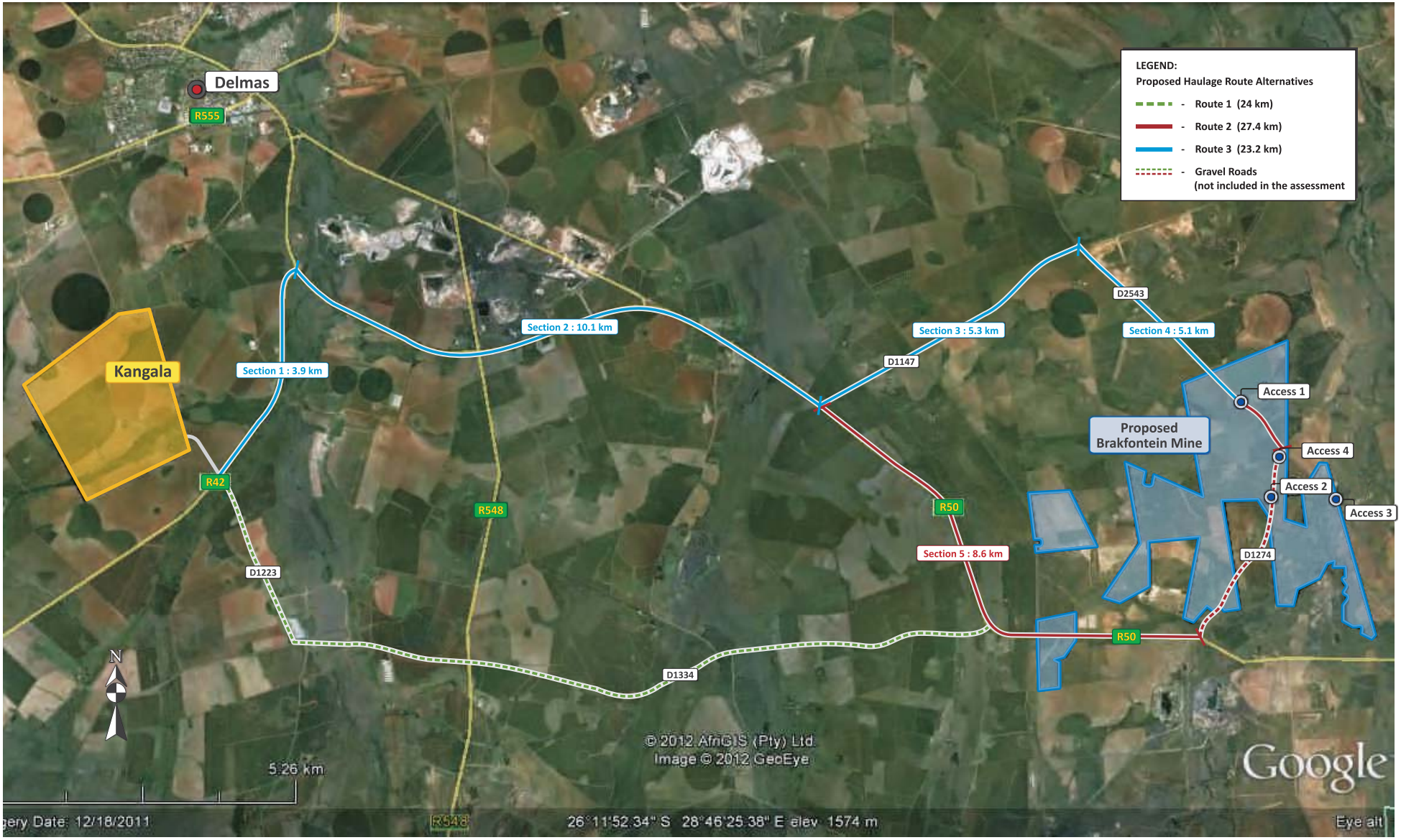
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Proposed Haulage Route Alternatives
- Route 1 (24 km)
- Route 2 (27.4 km)
- Route 3 (23.2 km)
- Gravel Roads
(not included in the assessment
Delmas
R555
Kangala
Section 1 : 3.9 km
Section 2 : 10.1 km
Section 3 : 5.3 km
Section 4 : 5.1 km
Section 5 : 8.6 km
D2543
D1147
Access 1
Access 2
Access 3
Access 4
Proposed
Brakfontein Mine
R42
R548
R50
D1223
D1274
D1334
N
5.26 km
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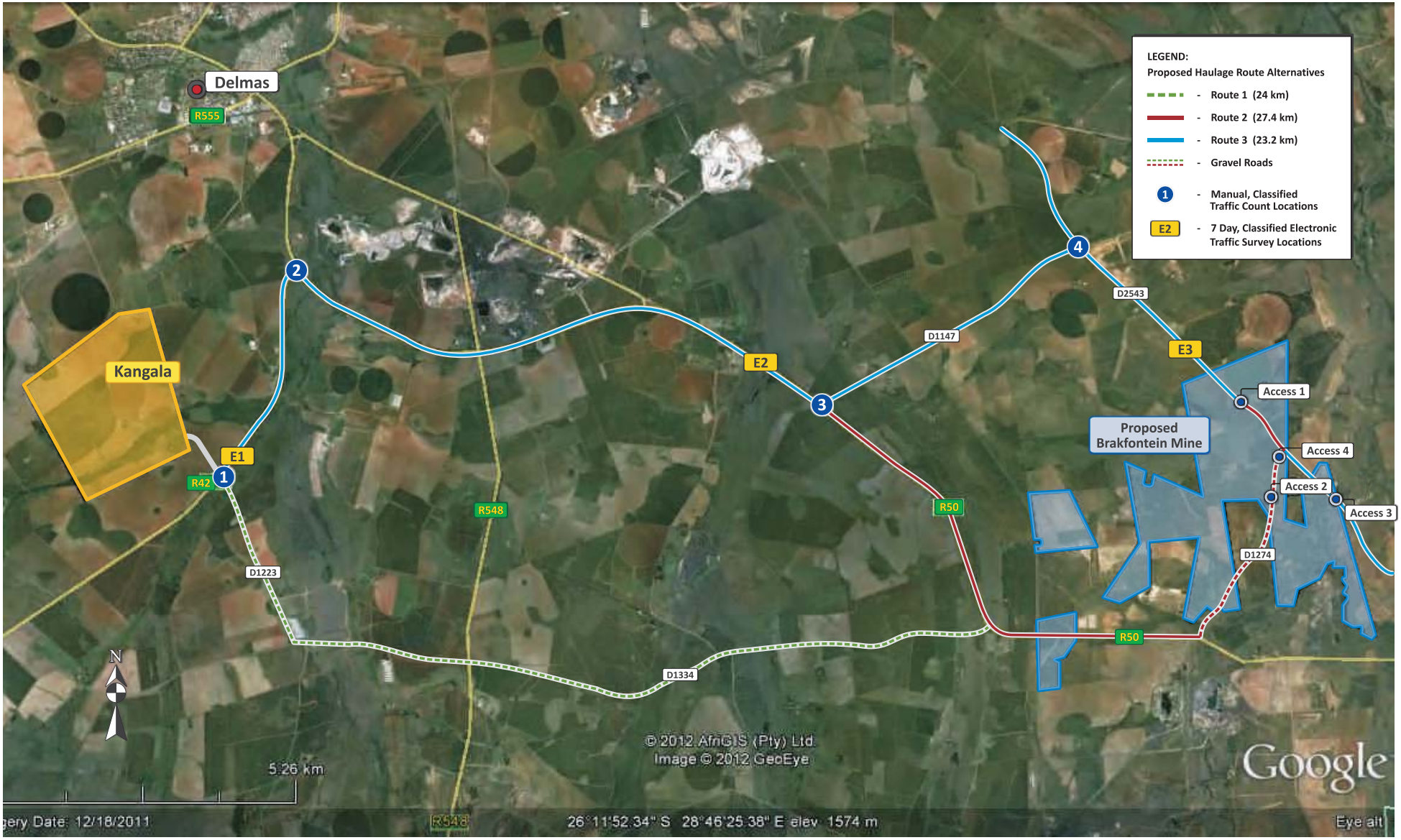
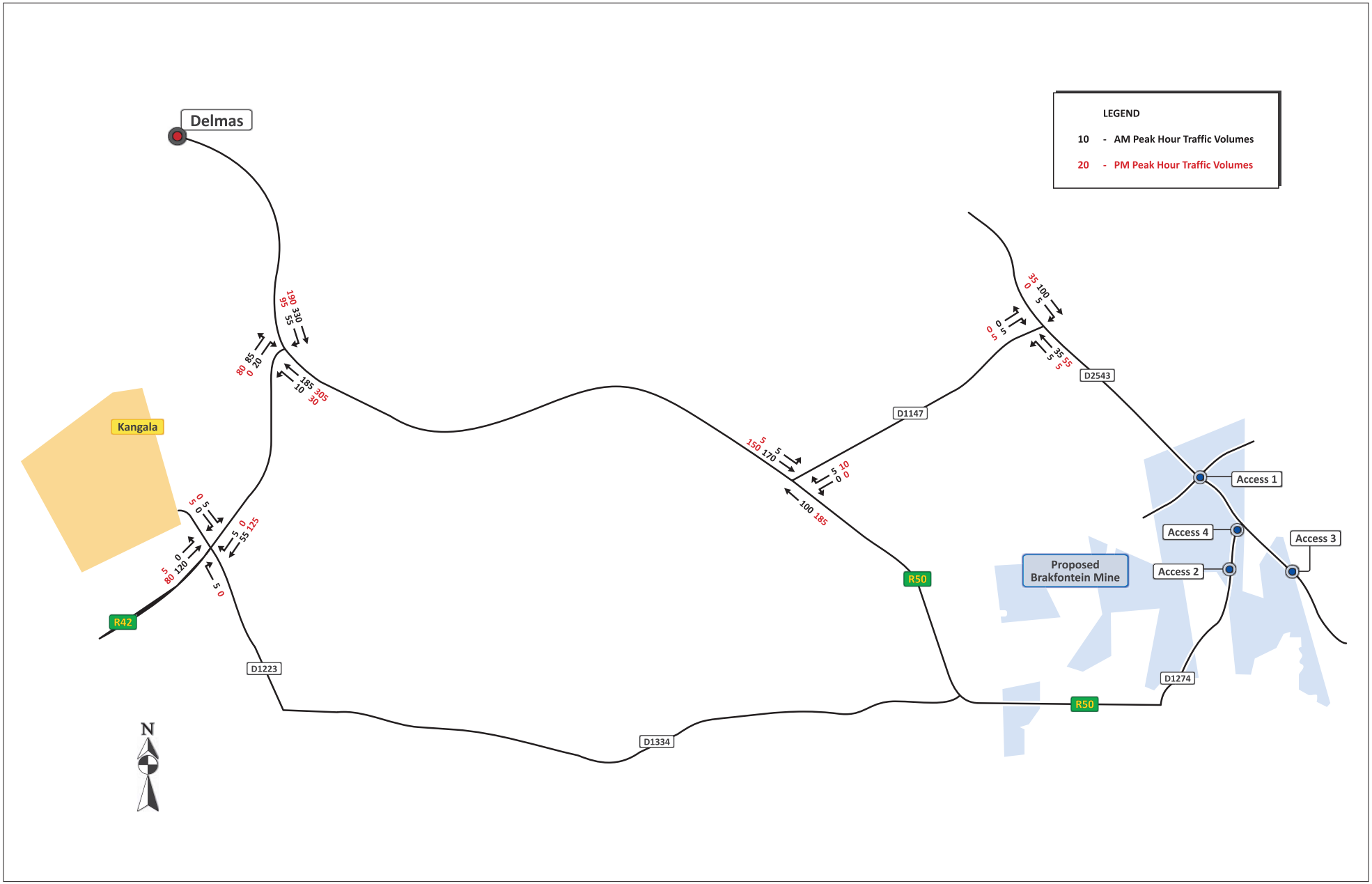
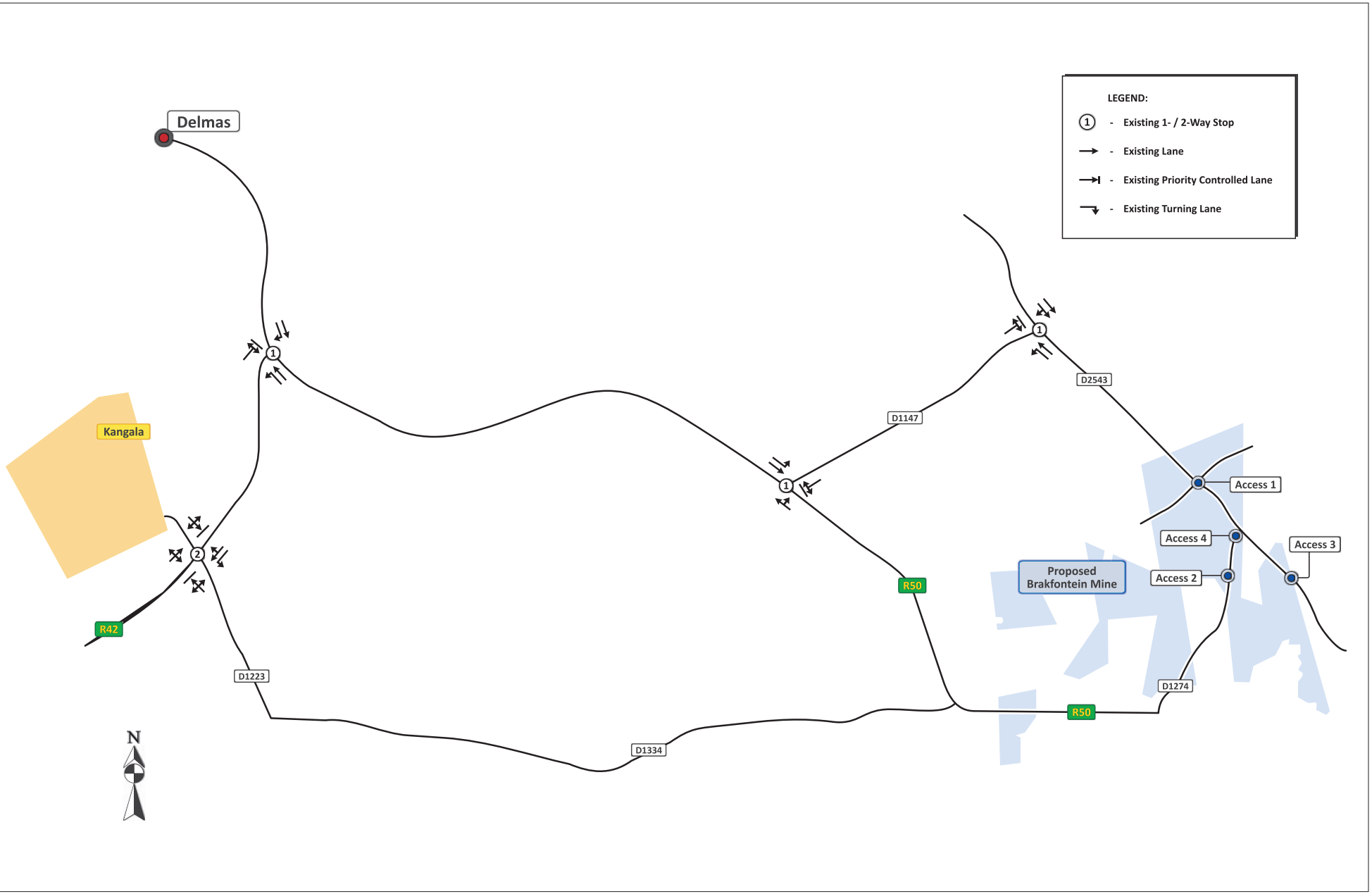
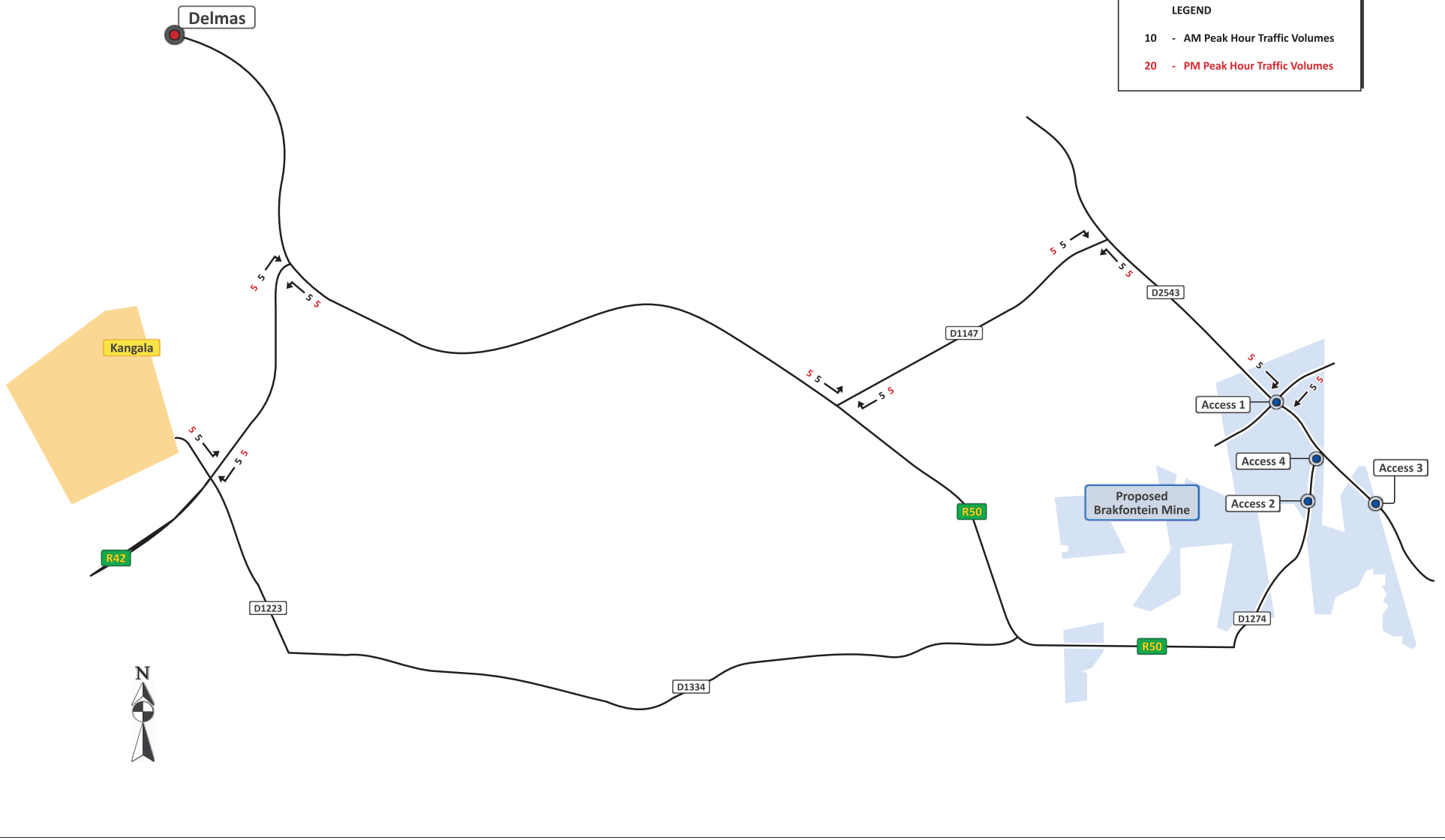
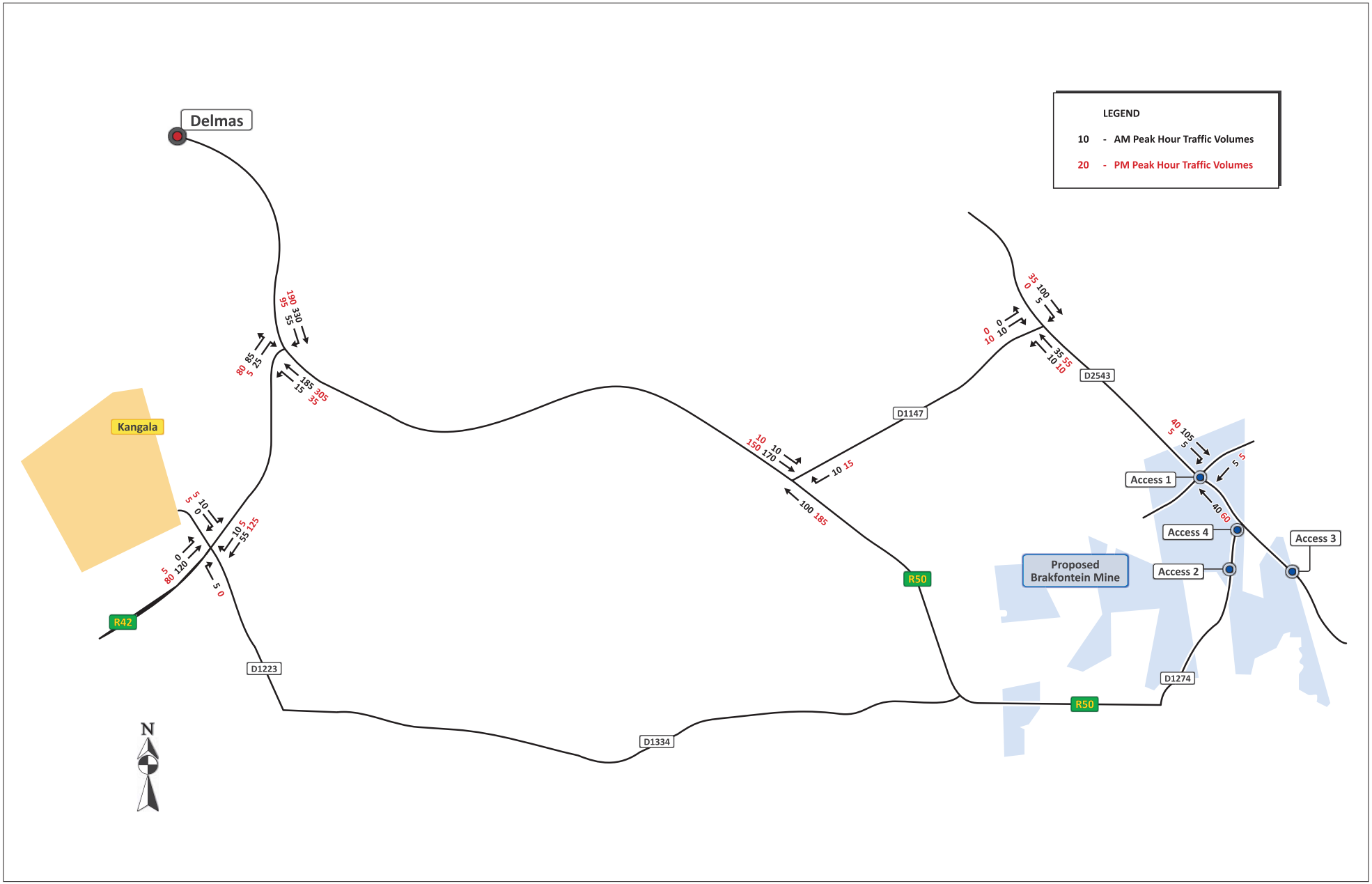
Google
26°11'52.34" S 28°46'25.38" E elev 1574 m

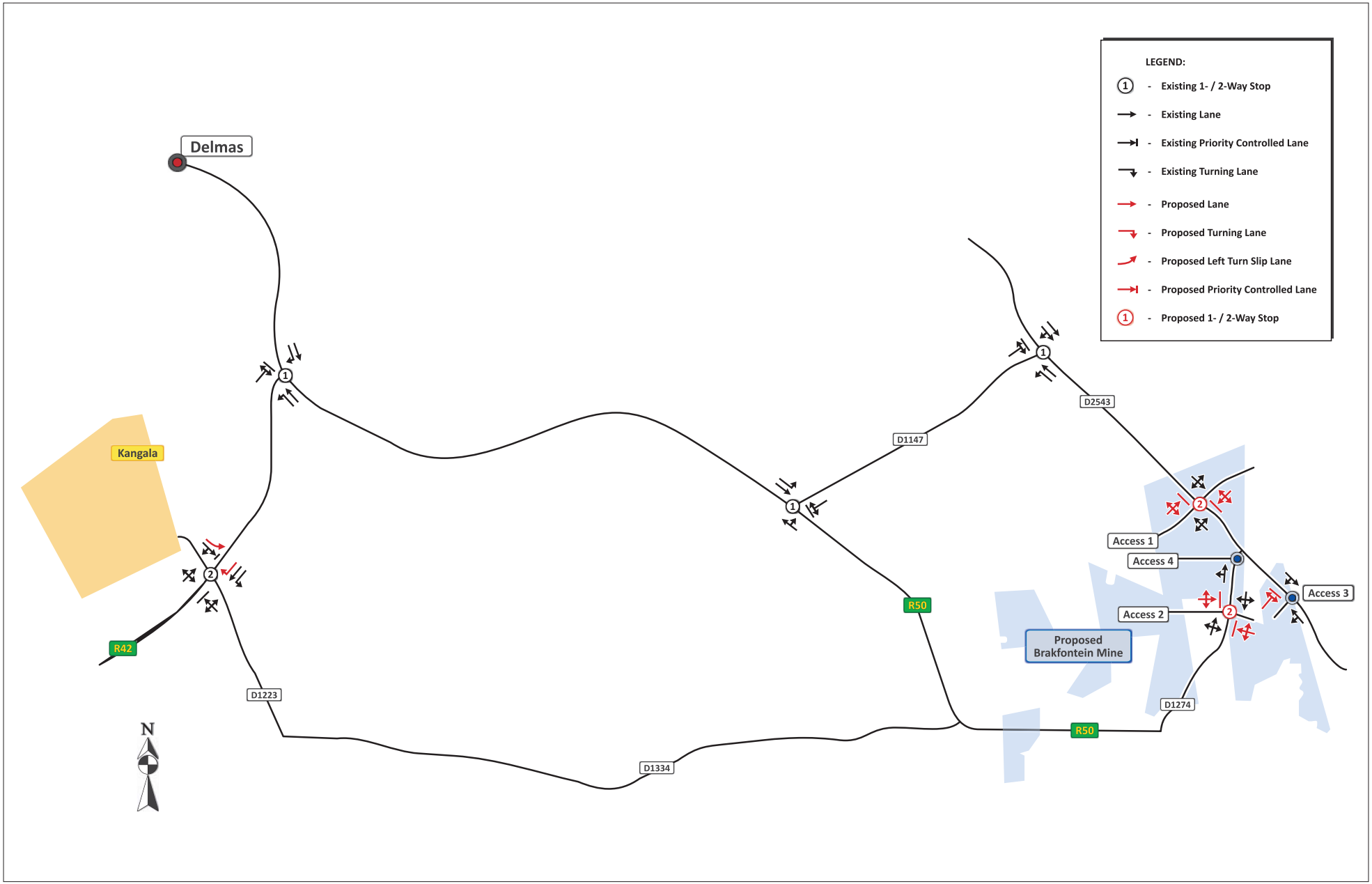

LEGEND:
Proposed Haulage Route Alternatives
- Route 1 (24 km)
- Route 2 (27.4 km)
- Route 3 (23.2 km)
- Gravel Roads
1 - Manual, Classified Traffic Count Locations
E2 - 7 Day, Classified Electronic Traffic Survey Locations
Delmas
R555
Kangala
E1
R42
1
2
3
4
E2
D1147
D2543
E3
Access 1
Proposed Brakfontein Mine
Access 4
Access 2
Access 3
D1274
R50
R548
D1223
D1334
N
5.26 km
© 2012 AfriGIS (Pty) Ltd
Image © 2012 GeoEye
Google
26°11'52.34" S 28°46'25.38" E elev 1574 m


LEGEND
10 - AM Peak Hour Traffic Volumes
20 - PM Peak Hour Traffic Volumes
Delmas
Kangala
R42
D1223
D1334
D1147
D2543
R50
Proposed Brakfontein Mine
Access 1
Access 2
Access 3
Access 4
D1274
N


LEGEND:
1 - Existing 1- / 2-Way Stop
- Existing Lane
- Existing Priority Controlled Lane
- Existing Turning Lane
Delmas
Kangala
R42
D1223
D1334
D1147
D2543
R50
Proposed Brakfontein Mine
Access 1
Access 2
Access 3
Access 4
D1274
N


LEGEND
10 - AM Peak Hour Traffic Volumes
20 - PM Peak Hour Traffic Volumes
Delmas
Kangala
R42
D1223
D1334
R50
D1147
D2543
Access 1
Access 2
Access 3
Access 4
Proposed Brakfontein Mine
D1274
N


LEGEND
10 - AM Peak Hour Traffic Volumes
20 - PM Peak Hour Traffic Volumes
Delmas
Kangala
R42
D1223
D1334
R50
D1147
D2543
Access 1
Access 2
Access 3
Access 4
Proposed Brakfontein Mine
D1274
N


LEGEND:
1 - Existing 1- / 2-Way Stop
- Existing Lane
- Existing Priority Controlled Lane
- Existing Turning Lane
- Proposed Lane
- Proposed Turning Lane
- Proposed Left Turn Slip Lane
- Proposed Priority Controlled Lane
1 - Proposed 1- / 2-Way Stop
Delmas
Kangala
R42
D1223
D1334
D1147
D2543
R50
R50
D1274
Access 1
Access 4
Access 2
Access 3
Proposed Brakfontein Mine
N

APPENDIX A

Observations: Visual Pavement Condition Assessment

SECTION 1:

SECTION 2:








SECTION 3:

SECTION 4













SECTION 5:











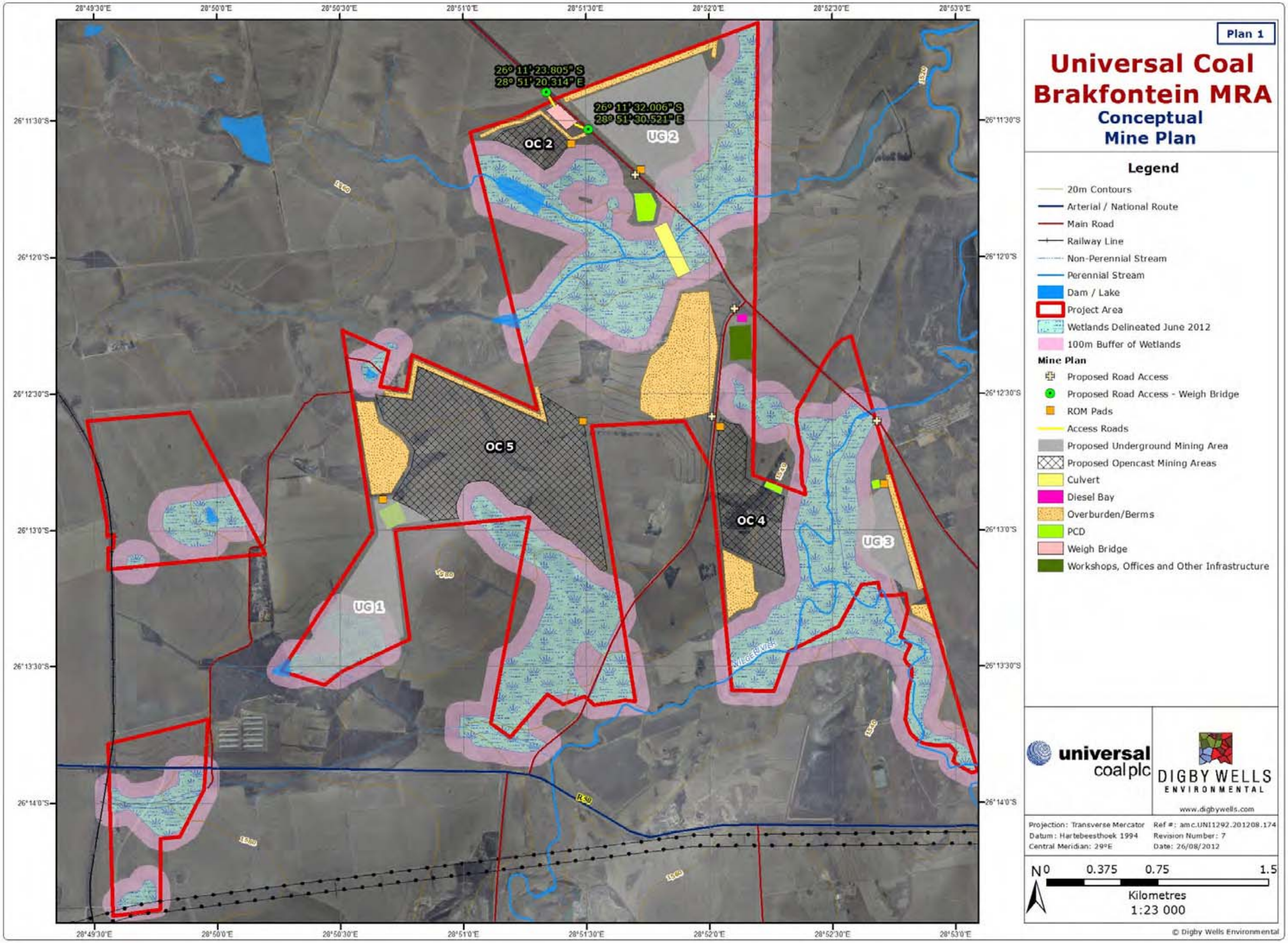


Brakfontein

Brakfontein

APPENDIX B

Conceptual Mine Plan



Plan 1
Universal Coal
Brakfontein MRA
Conceptual
Mine Plan
Legend
20m Contours
Arterial / National Route
Main Road
Railway Line
Non-Perennial Stream
Perennial Stream
Dam / Lake
Project Area
Wetlands Delineated June 2012
100m Buffer of Wetlands
Mine Plan
Proposed Road Access
Proposed Road Access - Weigh Bridge
ROM Pads
Access Roads
Proposed Underground Mining Area
Proposed Opencast Mining Areas
Culvert
Diesel Bay
Overburden/Berms
PCD
Weigh Bridge
Workshops, Offices and Other Infrastructure
universal coal plc
DIGBY WELLS ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 29°E
Ref #: amc.UNI1292.201208.174
Revision Number: 7
Date: 26/08/2012
N
0 0.375 0.75 1.5
Kilometres
1:23 000
© Digby Wells Environmental
26° 11' 23.805" S
28° 51' 20.314" E
26° 11' 32.006" S
28° 51' 30.521" E
OC 2
UG 2
OC 5
OC 4
UG 1
UG 3
R 50
28°49'30"E
28°50'0"E
28°50'30"E
28°51'0"E
28°51'30"E
28°52'0"E
28°52'30"E
28°53'0"E
26°11'30"S
26°12'0"S
26°12'30"S
26°13'0"S
26°13'30"S
26°14'0"S

APPENDIX C

Electronic Traffic Surveys: Data Summaries

Brakfontein 1

0858

STATION DETAIL

ROAD:	*R42*	**DIRECTION 1:**	NB To R50	**GPS COORDIANTES**	
LOCATION:	*Btwn R50 & Road*	**DIRECTION 2:**	SB To Road	S 26° 12' 17.9"	E 28° 41' 12.6"
REGION:	*Delmas*	**ROAD TYPE:**	*2 lanes*		
OWNER:	*BKS*	**SPEED LIMIT:**	*120 km/h*		

SURVEY DETAIL

TYPE OF SURVEY: ELECTRONIC **OPERATION:** Adhoc **SURVEY PERIOD:** 12/08/14 - 12/08/21 *(171 hours)*

DAILY INFO

Average daily traffic (ADT)			**2609**
Directional Split (Direction 1:2)			**50:49**
Average daily heavy vehicle traffic (ADTT)		40.4%	**1053**
Average weekday daily traffic (AWDT)			**2955**
Heavy vehicle split: % short, medium and long			**28:8:64**
Night traffic (18h00 - 06h00)	- All Vehicles	22%	**574**
	- Heavy Vehicles	27.8%	**293**
Vehicles exceeding speed limit		**10.9 %**	
Vehicles less than 2 s behind the vehicle ahead		**12.7 %**	

GROWTH

FLOWS

Highest volumes recorded

	Vehs/h	% Heavy	Date	Start Time
- On the Road	250	34.0	16/ 8/2012	16:00
- In One Lane	156	29.5	21/ 8/2012	7:00
- In Direction 1	156	29.5	21/ 8/2012	7:00
- In Direction 2	141	31.9	16/ 8/2012	16:00

30 th Highest volume recorded

	Vehs/h	% Heavy
- Both Directions	189	48.2
- In Direction 1	96	45.8
- In Direction 2	95	39.0

Peak Hour Information

	Start Time	Vehs/h	% Heavy	K-Factor	(Dir1:Dir2)
- Weekday AM	07:00	238	32.5	0.091	60:40
- Weekday PM	16:00	250	27.9	0.096	44:56
- Friday PM	15:15	260	40.6	0.084	44:55
- Saturday	10:30	167	46.0	0.082	52:47

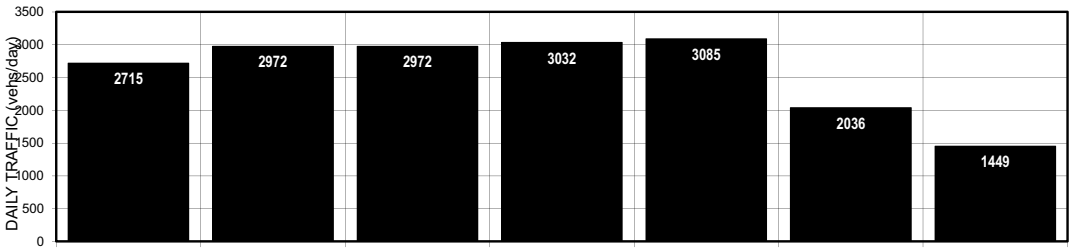
Peak Hour Factors

	AM Peak	PM Peak
- Both Directions	0.94	0.79
- In Direction 1	0.74	0.89
- In Direction 2	0.99	0.92

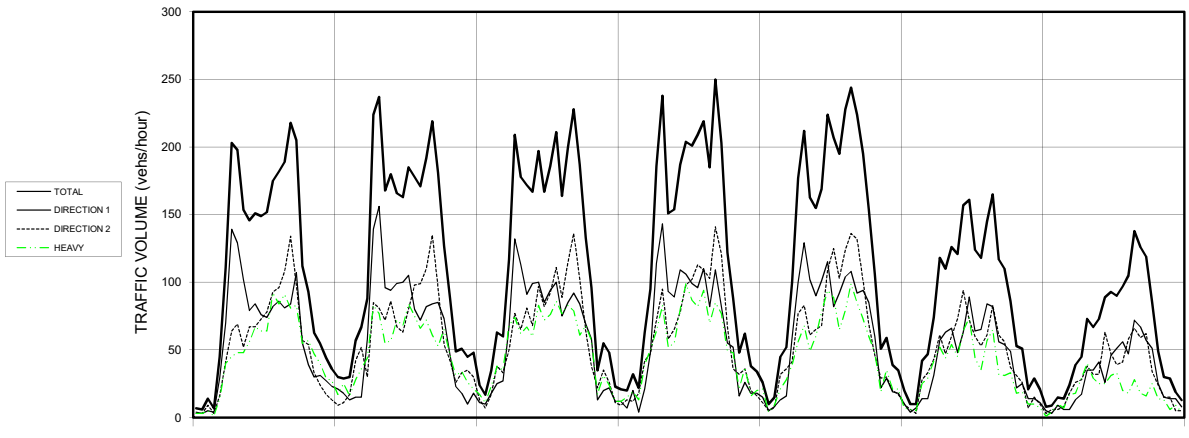
SPEED

	Direction 1	Direction 2	Both Dir
Arithmetic mean speed (km/h)	92.8	90.6	91.7
Arithmetic mean speed, light vehicles (km/h)	100.5	98.9	99.7
Arithmetic mean speed, heavy vehicles (km/h)	81.7	78.1	79.9
Harmonic mean speed (km/h)	----	----	84.8

TRAFFIC VARIATIONS



	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Day of Week ADT	2715	2972	2972	3032	3085	2036	1449
Expansion Factor	1.041	1.139	1.139	1.162	1.183	0.780	0.555



REMARKS:

TES

Brakfontein 2

0859

STATION DETAIL

ROAD:	*R50*	**DIRECTION 1:**	EB To D1147	**GPS COORDIANTES**	
LOCATION:	*Btwn D1147 & R548*	**DIRECTION 2:**	WB To R548	S 26° 11' 22.5"	E 28° 46' 46.0"
REGION:	*Delmas*	**ROAD TYPE:**	*2 lanes*		
OWNER:	*BKS*	**SPEED LIMIT:**	*120 km/h*		

SURVEY DETAIL

TYPE OF SURVEY: ELECTRONIC **OPERATION:** Adhoc **SURVEY PERIOD:** 12/08/14 - 12/08/21 *(170 hours)*

DAILY INFO

Average daily traffic (ADT)			**4120**
Directional Split (Direction 1:2)			**50:49**
Average daily heavy vehicle traffic (ADTT)		24.6%	**1015**
Average weekday daily traffic (AWDT)			**4446**
Heavy vehicle split: % short, medium and long			**49:9:42**
Night traffic (18h00 - 06h00)	- All Vehicles	20.2%	**832**
	- Heavy Vehicles	26.2%	**266**
Vehicles exceeding speed limit		**18.7 %**	
Vehicles less than 2 s behind the vehicle ahead		**16.9 %**	

GROWTH

FLOWS

Highest volumes recorded

	Vehs/h	% Heavy	Date	Start Time
- On the Road	459	15.3	17/ 8/2012	16:00
- In One Lane	259	21.2	17/ 8/2012	16:00
- In Direction 1	200	7.5	17/ 8/2012	16:00
- In Direction 2	259	21.2	17/ 8/2012	16:00

30 th Highest volume recorded

	Vehs/h	% Heavy
- Both Directions	291	13.1
- In Direction 1	149	17.5
- In Direction 2	149	33.6

Peak Hour Information

	Start Time	Vehs/h	% Heavy	K-Factor	(Dir1:Dir2)
- Weekday AM	07:00	309	21.0	0.075	62:38
- Weekday PM	16:00	361	29.4	0.088	37:63
- Friday PM	16:00	459	15.3	0.092	43:56
- Saturday	8:15	264	18.1	0.079	37:62

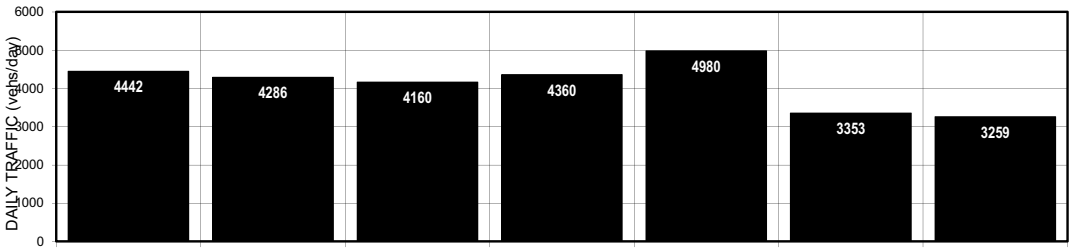
Peak Hour Factors

	AM Peak	PM Peak
- Both Directions	0.92	0.76
- In Direction 1	0.88	0.91
- In Direction 2	0.91	0.96

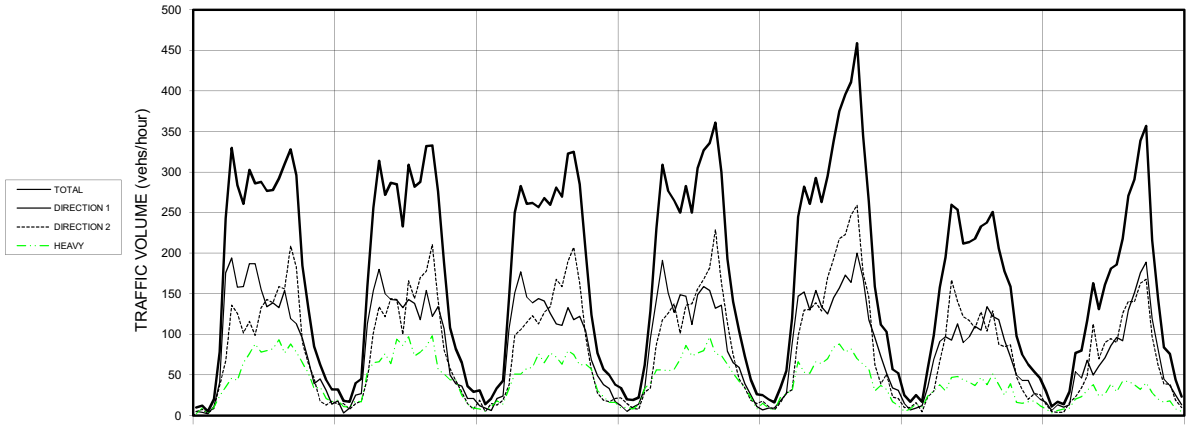
SPEED

	Direction 1	Direction 2	Both Dir
Arithmetic mean speed (km/h)	97.0	103.3	100.1
Arithmetic mean speed, light vehicles (km/h)	102.2	108.5	105.2
Arithmetic mean speed, heavy vehicles (km/h)	78.2	89.5	84.4
Harmonic mean speed (km/h)	----	----	93.5

TRAFFIC VARIATIONS



	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Day of Week ADT	4442	4286	4160	4360	4980	3353	3259
Expansion Factor	1.078	1.040	1.010	1.058	1.209	0.814	0.791



REMARKS:

TES

Brakfontein 3

0860

STATION DETAIL

ROAD:	*Goedgedacht Road*	**DIRECTION 1:**	EB To Kromdraai Dam
LOCATION:	*Btwn Kromdraai Dam & Vanggatfontein*	**DIRECTION 2:**	WB To Vanggatfontein
REGION:	*Delmas*	**ROAD TYPE:**	*2 lanes*
OWNER:	*BKS*	**SPEED LIMIT:**	*100 km/h*

GPS COORDIANTES	
S 26° 11' 21.2"	E 28° 51' 17.6"

SURVEY DETAIL

TYPE OF SURVEY: ELECTRONIC **OPERATION:** Adhoc **SURVEY PERIOD:** 12/08/14 - 12/08/21 *(169 hours)*

DAILY INFO

Average daily traffic (ADT)			**1028**
Directional Split (Direction 1:2)			**49:50**
Average daily heavy vehicle traffic (ADTT)		57.4%	**590**
Average weekday daily traffic (AWDT)			**1136**
Heavy vehicle split: % short, medium and long			**22:5:73**
Night traffic (18h00 - 06h00)	- All Vehicles	24.5%	**252**
	- Heavy Vehicles	28.2%	**166**
Vehicles exceeding speed limit		**26.1 %**	
Vehicles less than 2 s behind the vehicle ahead		**11.3 %**	

GROWTH

FLOWS

Highest volumes recorded

	Vehs/h	% Heavy	Date	Start Time
- On the Road	122	54.9	16/ 8/2012	8:00
- In One Lane	88	71.6	21/ 8/2012	8:00
- In Direction 1	88	71.6	21/ 8/2012	8:00
- In Direction 2	61	78.7	16/ 8/2012	12:00

30 th Highest volume recorded

	Vehs/h	% Heavy
- Both Directions	76	64.5
- In Direction 1	35	57.1
- In Direction 2	39	74.4

Peak Hour Information

	Start Time	Vehs/h	% Heavy	K-Factor	(Dir1:Dir2)
- Weekday AM	07:30	147	63.7	0.143	71:29
- Weekday PM	12:30	103	66.7	0.100	44:56
- Friday PM	15:30	125	61.3	0.102	46:53
- Saturday	7:30	116	61.4	0.122	60:39

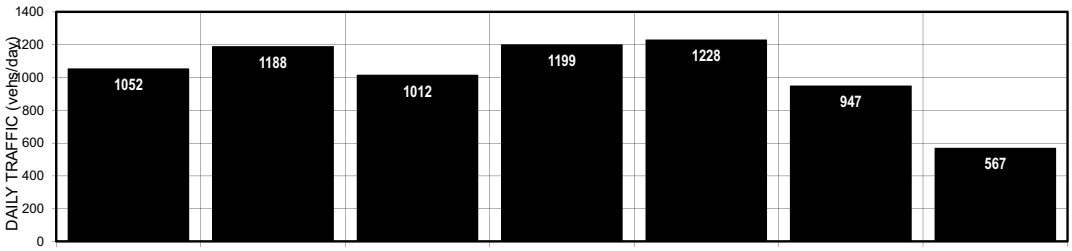
Peak Hour Factors

	AM Peak	PM Peak
- Both Directions	0.72	0.48
- In Direction 1	0.86	0.85
- In Direction 2	0.74	0.95

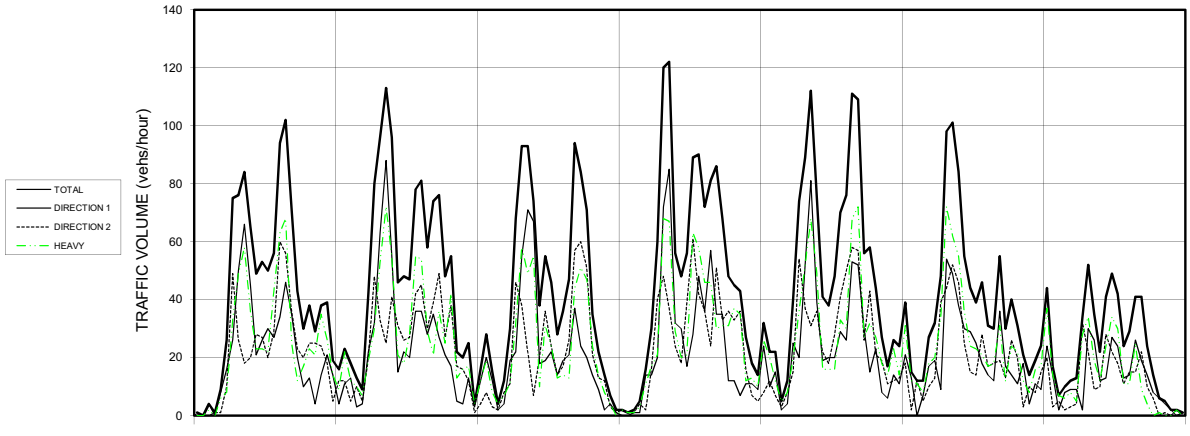
SPEED

	Direction 1	Direction 2	Both Dir
Arithmetic mean speed (km/h)	91.8	87.6	89.7
Arithmetic mean speed, light vehicles (km/h)	105.9	101.6	103.8
Arithmetic mean speed, heavy vehicles (km/h)	81.2	77.5	79.3
Harmonic mean speed (km/h)	----	----	81.8

TRAFFIC VARIATIONS



	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Day of Week ADT	1052	1188	1012	1199	1228	947	567
Expansion Factor	1.024	1.156	0.985	1.167	1.195	0.922	0.552



REMARKS:

TES

APPENDIX D

Operational Analysis Results

Intersection	Critical Movement / Approach	AM						PM					
		2012 (Status Quo)			2012 (With Brakfontein)			2012 (Status Quo)			2012 (With Brakfontein)		
		V/C	Delay (s)	LOS	V/C	Delay (s)	LOS	V/C	Delay (s)	LOS	V/C	Delay (s)	LOS
R42 / Kangala Access / D1223	Northbound (right)	<0.1	7.7	A	<0.1	7.7	A	<0.1	7.5	A	<0.1	7.5	A
	Westbound	<0.1	10.6	B	<0.1	11.3	B	<0.1	10.6	B	<0.1	11.2	B
	Southbound (right)	<0.1	8.1	A	<0.1	7.6	A	<0.1	7.7	A	<0.1	7.7	A
	Eastbound	<0.1	11.0	B	<0.1	10.4	B	<0.1	10.3	B	0.17	10.3	B
R42 / R50	Northbound	0.2	12.6	B	0.23	13.2	B	0.22	13.8	B	0.27	15.6	C
	Eastbound (right)	<0.1	8.2	A	<0.1	8.3	A	0.14	9.5	A	0.14	9.6	A
R50 / D1147	Westbound (right)	0	7.8	A	<0.1	7.8	A	<0.1	7.8	A	<0.1	7.9	A
	Southbound	<0.1	9.9	A	<0.1	10.2	B	<0.1	10.3	B	0.15	10.7	B
D1147 / D2543	Northbound	<0.1	9.3	A	<0.1	9.2	A	<0.1	9.7	A	<0.1	9.3	A
	Eastbound (right)	<0.1	8.1	A	<0.1	8.1	A	<0.1	7.9	A	<0.1	8.0	A
D2543 / Brakfontein Access 1	Northbound	-	-	-	<0.1	9.8	A	-	-	-	<0.1	9.5	A
	Westbound (right)	-	-	-	<0.1	7.5	A	-	-	-	<0.1	7.3	A
	Southbound	-	-	-	<0.1	10.2	B	-	-	-	<0.1	9.8	A
	Eastbound (right)	-	-	-	<0.1	7.3	A	-	-	-	<0.1	7.4	A

APPENDIX E

Sight Distance Assessment at Brakfontein Accesses

ACCESS 1:

	
Eastbound View	Westbound View

ACCESS 2:

	
Northbound View	Southbound View

ACCESS 3:

	
Westbound View	Eastbound View

ACCESS 4:

	
Southbound View	Northbound View