

**Remainder and Portion 1 of the Farm
Sims No. 462, Kuruman**

MIXED LAND USE DEVELOPMENT

TRAFFIC IMPACT STUDY

NOVEMBER 2015



**KMA
Consulting
Engineers**

Project: 6987

PO Box 25054, Langenhoven Park, 9330, 12 AG Visser Street,
Langenhoven Park, Bloemfontein
Tel & Fax: 051 446 2647, Cell: 083 381 5884, E-mail:
kma@telkomsa.net

REPORT SHEET

Property Description:	<i>Remainder and Portion 1 of the Farm Sims No. 462, Kuruman</i>
Municipal Area:	<i>Gamagara Local Municipality</i>
Application:	<i>Rezoning and subdivision</i>
Type of Report:	<i>Traffic Impact Study</i>
Project Number:	<i>6987</i>
Compiled By:	<i>Koot Marais Pr Eng</i>
Declaration	<i>I, Koot Marais, author of this traffic impact study, hereby certify that I am a professional traffic engineer (registration No 920023) and that I have the required experience and training in the field of traffic and transportation engineering as required by the Engineering Council of South Africa (ECSA), to compile this traffic impact study and I take full responsibility for the content, including all calculations, conclusions and recommendations made herein.</i>
Signed:	 920023
Date:	<i>November 2015</i>

PREPARED BY:



P.O. Box 25054, Langenhoven
 Park, 9330
 12 AG Visser St Langenhoven Park
 Bloemfontein, 9301
 T (051) 446 2647
 F (051) 446 2647
 M 083 381 5884
 kma@telkomsa.net

TABLE OF CONTENTS

TABLE OF CONTENTS	3
1 INTRODUCTION	5
1.1 Aim of the Study	5
1.2 Background	5
1.3 Study Area	5
1.4 Proposed Development	6
1.5 Scope of Analysis	8
1.5.1 Period for Analysis	8
1.5.2 Warrants for a Traffic Impact Study	8
1.5.3 Extent of Analysis	8
1.5.4 Assessment Years	9
1.6 Available Information	10
1.6.1 Traffic Counts	10
1.6.1 Latent Rights	10
2 BACKGROUND INFORMATION	12
2.1 Existing Road Network	12
2.2 Existing Land Use	14
2.3 Road Planning	14
3 TRIP GENERATION	15
3.1 Trip Generation Rates	15
3.1.1 Single Dwelling Units 210	15
3.1.2 Town Houses Multi Level 232	15
3.1.3 Public Primary School 520	15
3.1.4 Places of Public Worship 560 and 561	15
3.1.5 Pre-School (Day Care Centre) 565	15
3.1.6 Shopping Centre 820	15
3.1 Trips Generated	16
4 TRIP DISTRIBUTION	17
5 TRIP ASSIGNMENT	23
6 CAPACITY ANALYSIS	33
6.1 Intersection A: R380 / Hendrik van Eck Street Intersection	34
6.2 Intersection B: Ian Fleming Street / Hendrik van Eck Street Intersection	37
6.3 Intersection C: Access 1 on R380	39
6.4 Intersection D: Access 2 on R380	41

6.5	Intersection E: Access on Extension of Hendrik van Eck Street Intersection	43
6.6	Intersection F: Sishen Mine / Extension of Hendrik van Eck Street Intersection	45
6.7	Summary	48
7	OTHER ASPECTS	53
7.1	Trip Generation during Construction	53
7.2	Public Transport Operations	53
7.3	Pedestrian Activities	53
7.4	Road Condition	55
8.	CONCLUSIONS AND RECOMMENDATIONS	56
9.	REFERENCES	57

1 INTRODUCTION

1.1 Aim of the Study

The aim of this study was to determine the traffic impact of a proposed rezoning and subdivision of the **Remainder and Portion 1 of the Farm Sims No. 462, Kuruman**, located in Kathu.

1.2 Background

It is the intention to make provision for a new mixed use area with residential development as the main land use. Macroplan Town and Regional Planners appointed KMA Consulting Engineers to undertake a Traffic Impact Study in support of this planned development.

The developer is: **Gamagara Municipality** 

This document reports on the expected traffic impact of the development.

1.3 Study Area

The site is located to the west of the existing Kathu area on both sides of the R380.



Figure 1.1: Location Plan

The development will in principle consist of the following:

No	SIMS	Land Use	Erf Size	Erven	Extent	
	Zoning		Total Size		Number	Units
1	Residential 1	Single Home	351362.0	534	534	Units
2	Residential 2	Group Housing	339390.0	686	1018	Units
3	Residential 3	Flats	39391.0	4	1970	Units
4	Business 1	Commercial	62141.0	6	24000	m ² GLA
5	Open Space 1	Park	309867.0	31		
6	Institutional 2	Worship	22623.0	6	1800	Seats
7	Institutional 1	Education - School	68449.0	1	960	Pupils
		Education - Crèche		1	50	Pupils
8	Authority 2	Municipal Use	9585.0	4		
9	Transport 1	Public Street	486212.0	1		
	TOTAL		1689020.0			

Notes:

- The extent of development was as far as possible based on the Gamagara Scheme Regulations
- The size of shops (commercial) was determined based on the practical size considering parking requirements.
- It was assumed that churches will have 300 seats per church. This is however not significant trip generators.
- Education sizes were based on the CSIR standards.
- Municipal Use and Streets are not considered to be trip generators.

1.5 Scope of Analysis

1.5.1 Period for Analysis

Based on the type of proposed development both the morning and afternoon peak hours were investigated.

1.5.2 Warrants for a Traffic Impact Study

The development is expected to generate more than 150 peak hour trips and according to the “Manual for Traffic Impact Studies”¹, a Traffic Impact Study is warranted.

1.5.3 Extent of Analysis


All intersections where the increase in the critical lane volumes is expected to exceed 75, within 1.5 km of the development, should be analysed. Given the location of the development, the following intersections were investigated.



Figure 1.3: Intersections Analysed

- a) **Intersection A:** R380 / Hendrik van Eck Street Intersection
- b) **Intersection B:** Ian Fleming Street / Hendrik van Eck Street Intersection
- c) **Intersection C:** Access 1 on R380
- d) **Intersection D:** Access 2 on R380
- e) **Intersection E:** Access on Extension of Hendrik van Eck Street
- f) **Intersection F:** Sishen Mine / Extension of Hendrik van Eck Street Intersection

1.5.4 Assessment Years

As the development can potentially generate more than 2000 trips, both the base year and 10 years after the base year have been analysed. The phasing of the development is not known and as a worst case scenario full development in year one was assumed. 

Although a 3% per annum growth rate is normally assumed, traffic in the Kathu area has grown at a higher rate in recent times. This growth can mostly be attributed to major developments in the area and as these are included as latent rights (See Section 1.6.2) assumption of a high traffic growth in addition to the latent rights might result in an overestimation. As a result, a 3% per annum growth rate was assumed.

1.6 Available Information

1.6.1 Traffic Counts

Traffic counts were undertaken during the period 8 to 10 November 2015.

1.6.1 Latent Rights

The following developments, which are expected to be implemented, but are not yet fully developed, were taken into consideration as latent rights. The details of these developments were obtained from the relevant professional teams and/or reports on the planned developments. It was however in some instances necessary to determine the trip generation and trip distribution of the relevant areas.



Figure 1.3 Possible Latent Rights

a) Rooisand Estate

It was assumed that this development was mostly completed at the time of the traffic counting and no additional trip generation was assumed.

b) Bestwood Estate

The development will consist of the following:

- **Phase 1** will consist of 1 600 single residential units and 1 600 flats. It was assumed that half of the development has been completed.

- **Phase 2** will include 2 000 single residential units, a primary and secondary school, as well as commercial development. This portion was still vacant at the time of traffic counting. The expected trip generation of this phase was included in the analysis.
- **Phase 3** is a long-term development of approximately 5 000 housing units as well as industrial development. As this is a long term project, of which the actual implementation is uncertain, the possible trip generation was not considered.

c) Kathu Supplier Park

This development will consist of industrial, warehousing, a logistics centre, etc. The development was not yet implemented at the time of the study. The expected trip generation of this development was included in the analysis.

d) Dingleton Re-settlement Project

Approximately 700 families from Dingleton were resettled in the Kathu area. It was assumed that this project was more or less completed at the time of traffic counting. It is also not expected that this development will have a significant impact on the development under consideration

e) Uitkoms: Portion 1 of the Farm Sims No. 463

This development was planned at the time of this study and will consist of 163 single residential units and 64 group housing units. The development was not yet approved and due to its location will not have a noticeable impact in the study area of the development under consideration.

2 BACKGROUND INFORMATION

2.1 Existing Road Network

The most important roads in the area are the following:

a) R380

This provincial road links the N14 with Deben on a regional basis, but on a more local level serves as an access road to the southern and western portion of the Kathu area. The road is a two-lane undivided road



Photo 1: R380 as seen towards the northwest

b) Hendrik van Eck Street

This road is a four-lane divided road becoming a two-lane road to the west of the R380. The road links Kathu with the R380 and the mining areas to the west of the town.



Photo 2: Extension of Hendrik van Eck Street

c) Ian Fleming Street

This north-south road connects the industrial area with the CBD.



Photo 3: Ian Fleming Street

2.2 Existing Land Use


The area to be developed is currently vacant. Squatters settled in the area to the west of the site, although it is not certain whether these activities extend onto the site under consideration. 



Photo 4: Development site as seen from the R380

2.3 Road Planning

There is no known road planning that will directly affect the development other than the new roads that will be developed as part of this development.

3 TRIP GENERATION

3.1 Trip Generation Rates

Relevant trip generation rate descriptions as per the TMH 17⁸ are as follows:

3.1.1 Single Dwelling Units 210

Single dwelling units are detached houses on individual erven. The units usually have individual accesses to streets.

3.1.2 Town Houses Multi Level 232

Dwelling units provided in clusters in multi-level complexes. Individual townhouses can be provided on different levels. Individual townhouse could consist of one storey or could be multi-storeyed.

3.1.3 Public Primary School 520

Public primary schools typically serve students for the first half of their school education

3.1.4 Places of Public Worship 560 and 561

560: Places of public worship which normally operate on weekends (e.g. Saturdays or Sundays).

561: Places of public worship which normally operate during the week (e.g. Friday).

(Trip generation rates are very similar during the weekday peak hours.)

3.1.5 Pre-School (Day Care Centre) 565

A facility where care is provided for pre-school age children. The facilities include classrooms.

3.1.6 Shopping Centre 820

A shopping centre is an integrated (mixed-use) group of commercial establishments that operate as a unit. May include small components of other land uses, such as restaurants, hardware and paint shops, etc.

3.1 Trips Generated

The planned development could generate the following trips for the different options.

Table 3.1: Potential trip generation of development

No	Land Use	No	Unit	Reduction Factors					AM PEAK								PM PEAK								Trip Factors	
				Pm	Pv	Pv	Pt	Pc	TGR	TGR	Split		AM	AM	In	Out	TGR	TGR	Split		PM	PM	In	Out	Fact A	Fact B
				Mixed	Low	V Low	Transp		Reduc	In	Out	Reduc		Reduc			Reduc			Reduc						
Residential																										
210	Single Dwelling		unit	10%	40%	70%	15%		1.00		25%	75%					1.00		75%	25%						
210	Single Dwelling	534	unit	10%	40%			0.46	1.00	0.54	25%	75%	534	288	72	216	1.00	0.54	75%	25%	534	288	216	72		
220	Apartment & Flats		unit	15%	30%	50%	15%		0.65		25%	75%					0.65		70%	30%						
220	Apartment & Flats	1,970	unit	15%	30%			0.405	0.65	0.39	25%	75%	1281	762	190	571	0.65	0.39	70%	30%	1281	762	533	229		
232	Townhouses (multi level)		unit	15%	30%	50%	15%		0.75		25%	75%					0.75		70%	30%						
232	Townhouses (multi level)	1,018	unit	15%	30%			0.405	0.75	0.45	25%	75%	764	454	114	341	0.75	0.45	70%	30%	764	454	318	136		
Institutional																										
520	Public Primary School		Student	30%	50%	80%	15%		0.85		50%	50%					0.30		50%	50%						
520	Public Primary School	960	Student	30%	50%			0.65	0.85	0.30	50%	50%	816	286	143	143	0.30	0.11	50%	50%	288	101	50	50		
560	Places of Worship (weekday)		Seat	10%	50%	80%	15%		0.05		55%	45%					0.05		50%	50%						
560	Places of Worship (weekday)	1,800	Seat	10%	50%			0.55	0.05	0.02	55%	45%	90	41	22	18	0.05	0.02	50%	50%	90	41	20	20		
565	Pre-School		Student	5%	50%	80%	15%		1.00		50%	50%					0.80		50%	50%						
565	Pre-School	50	Student	5%	50%			0.525	1.00	0.48	50%	50%	50	24	12	12	0.80	0.38	50%	50%	40	19	10	10		
Retail																										
820	Shopping Centre North of R380		100m ²	10%	30%	60%	15%		0.60		65%	35%					3.40		50%	50%					6	3500
820	Shopping Centre North of R380	2,400	100m ²	10%	30%			0.37	2.74	1.72	65%	35%	66	41	27	14	15.50	9.77	50%	50%	372	234	117	117		
	Pass-by																13%		50%	50%		30	15	15		
	Diverted																29%		50%	50%		68	34	34		
820	Shopping Area South of R380		100m ²	10%	30%	60%	15%		0.60		65%	35%					3.40		50%	50%					6	3500
820	Shopping Area South of R380	21,600	100m ²	10%	30%			0.37	1.10	0.69	65%	35%	238	150	97	52	6.24	3.93	50%	50%	1349	850	425	425		
	Pass-by																13%		50%	50%		110	55	55		
	Diverted																29%		50%	50%		246	123	123		
	Total												3838	2046	677	1368					4717	2749	1690	1059		

In the above table reductions were made based on the assumption that the development will be a mixed land use development and low vehicle ownership was assumed. Assumption of a very low vehicle ownership could be an underestimation of the situation.

4 TRIP DISTRIBUTION

The following figures show the expected trip distribution. Trip distribution was based on the analogue method with consideration of graphical distributions.

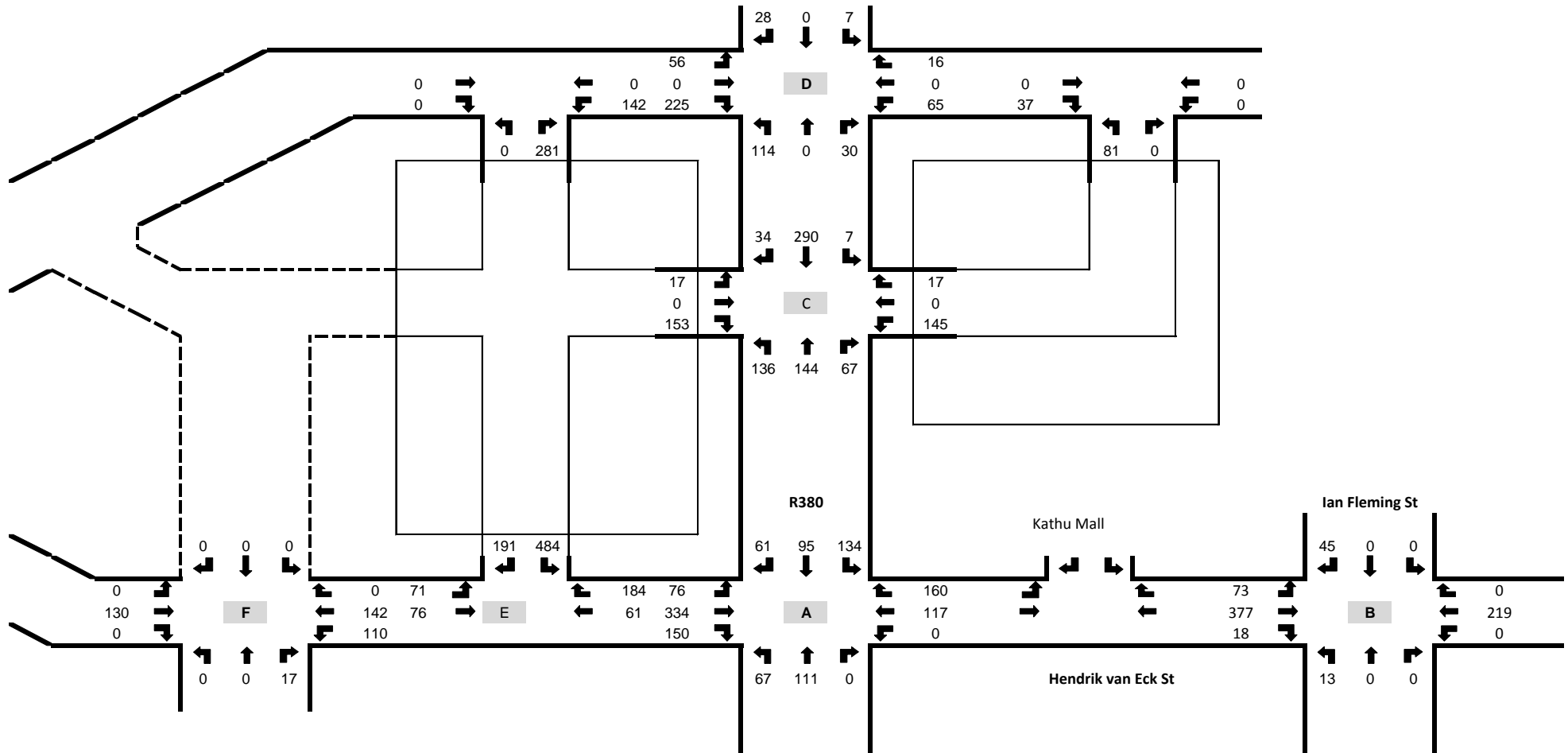


Figure 4.1a AM Peak Trip Distribution

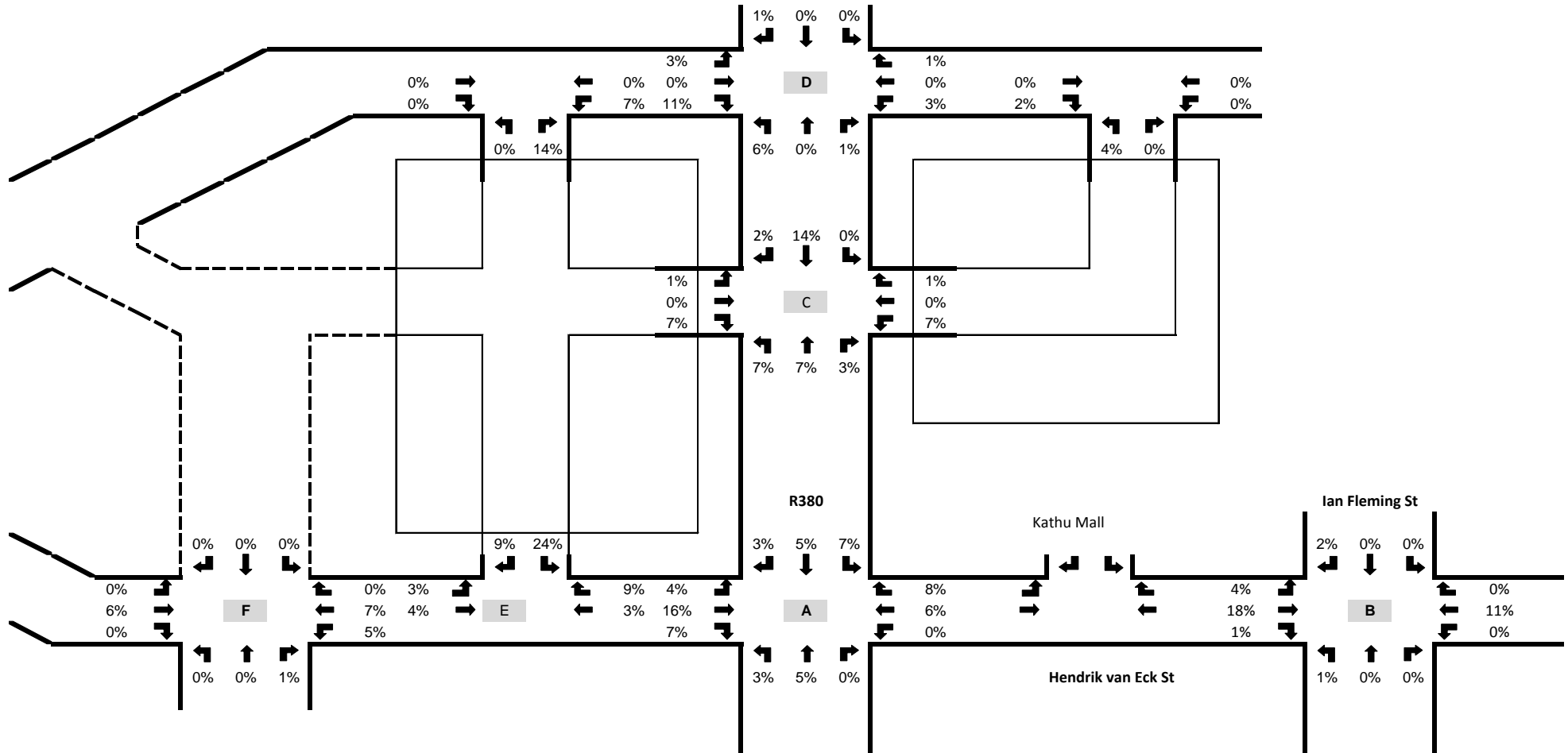


Figure 4.1b AM Peak Trip Distribution

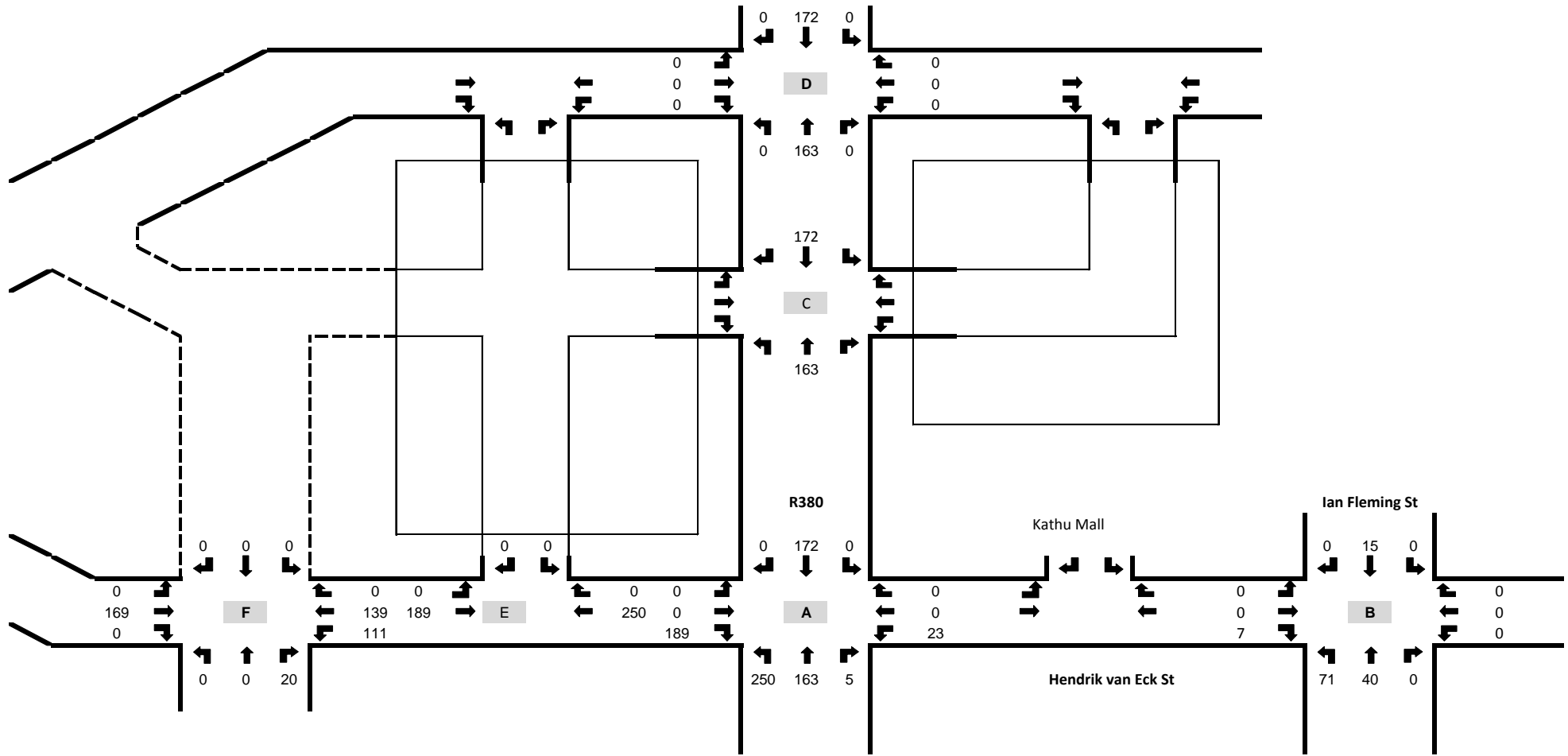
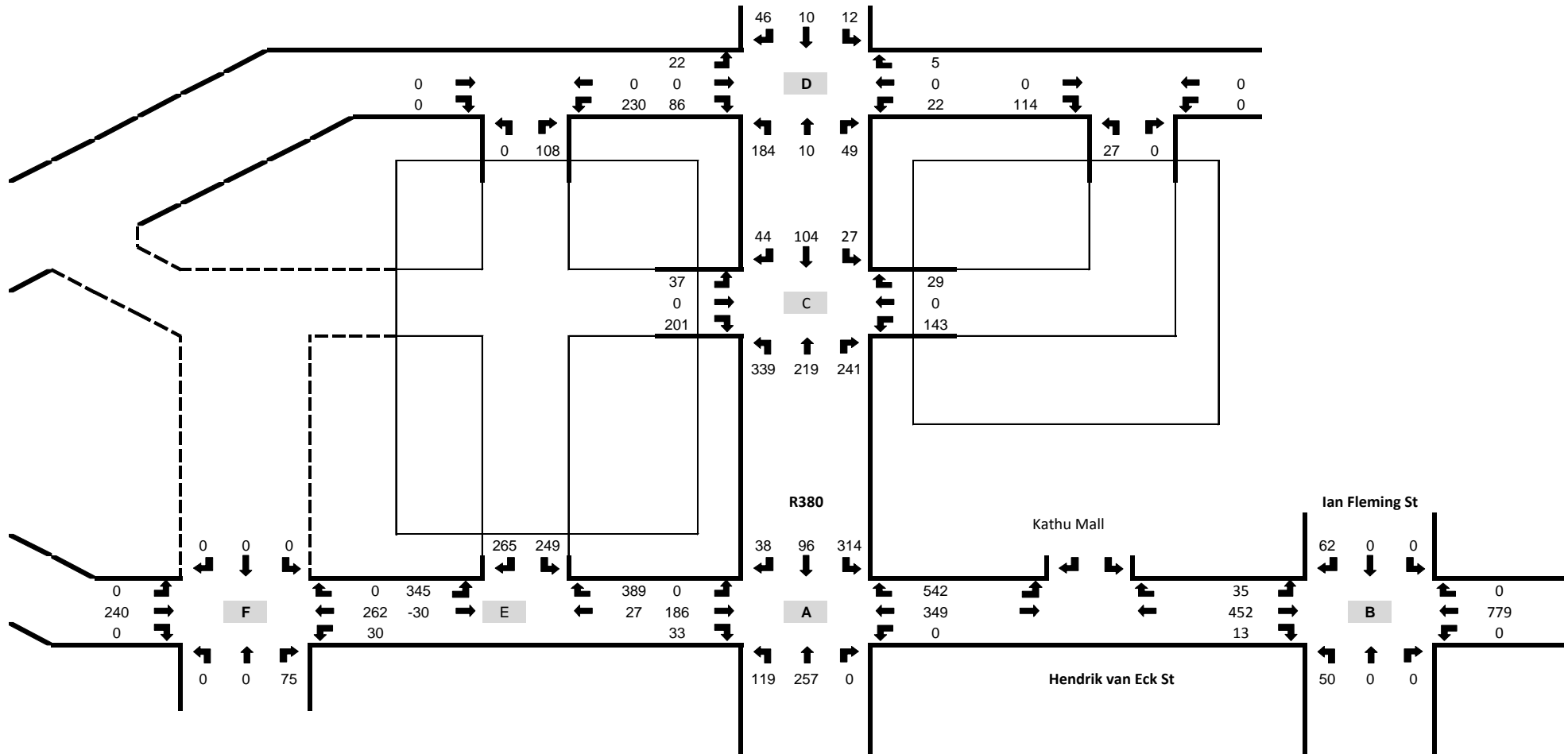


Figure 4.1c AM Latent Rights



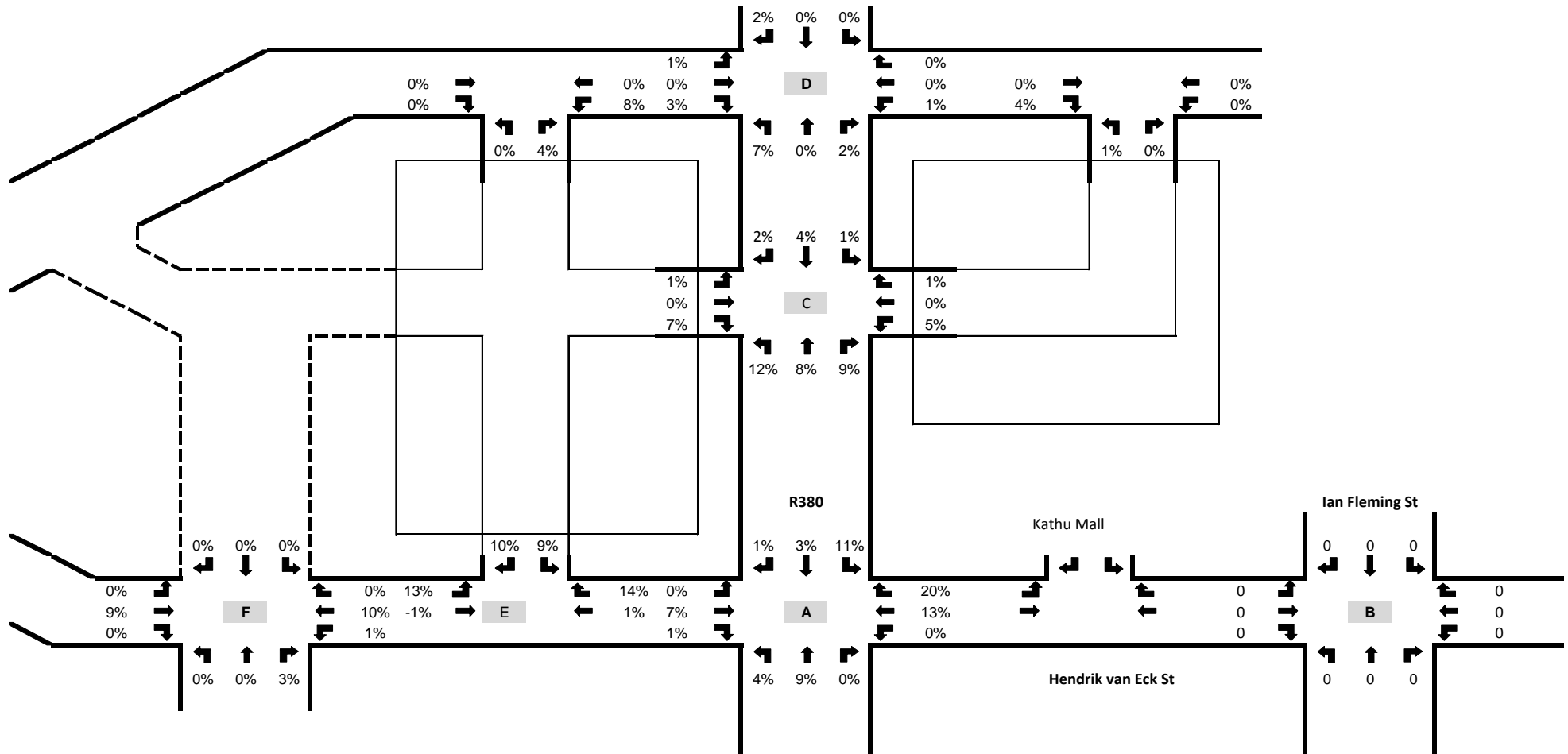


Figure 4.2b PM Peak Trip Distribution

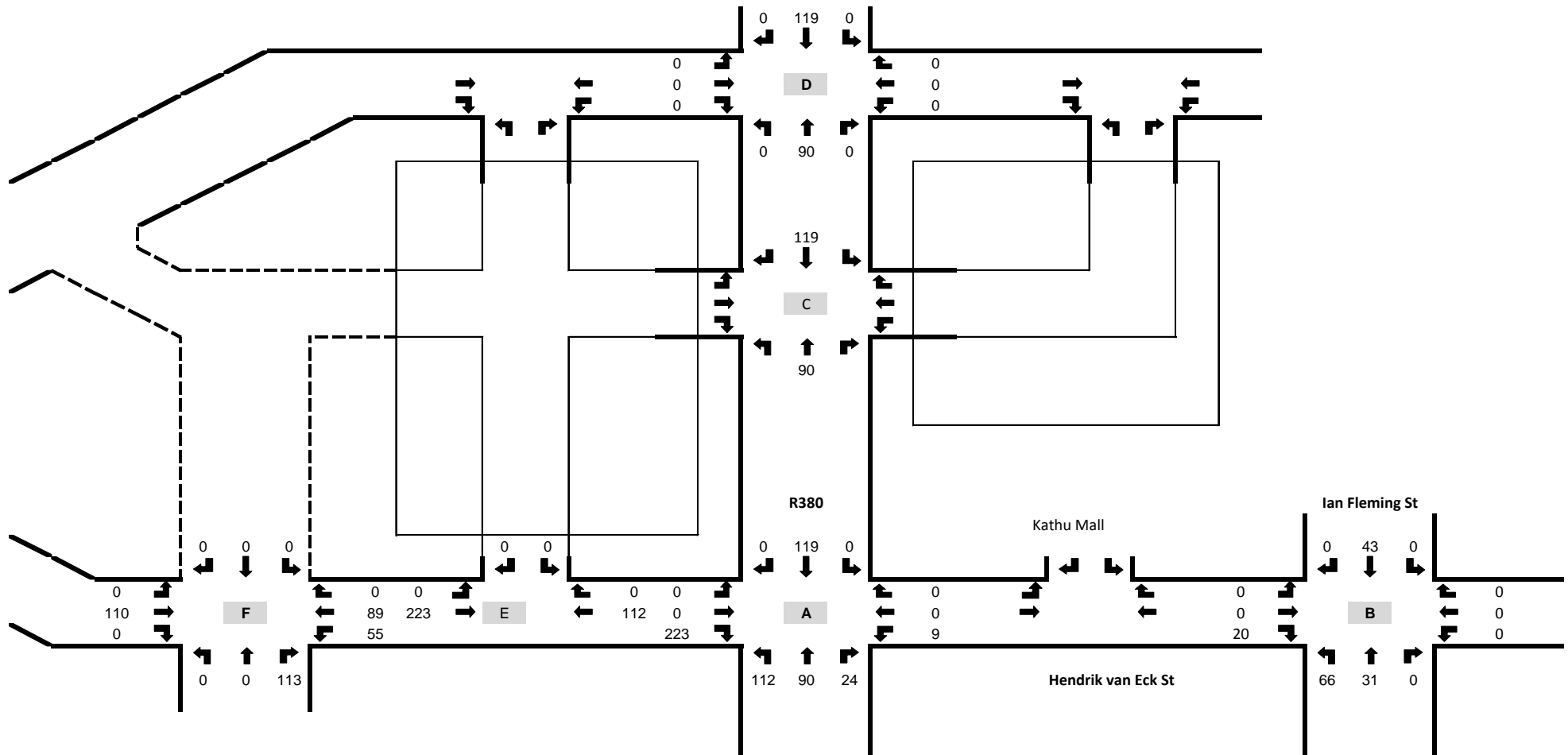


Figure 4.2c PM Latent Rights

5 TRIP ASSIGNMENT

The generated trips have been assigned to the background traffic volumes. The following figures show the traffic volumes for the different scenarios.

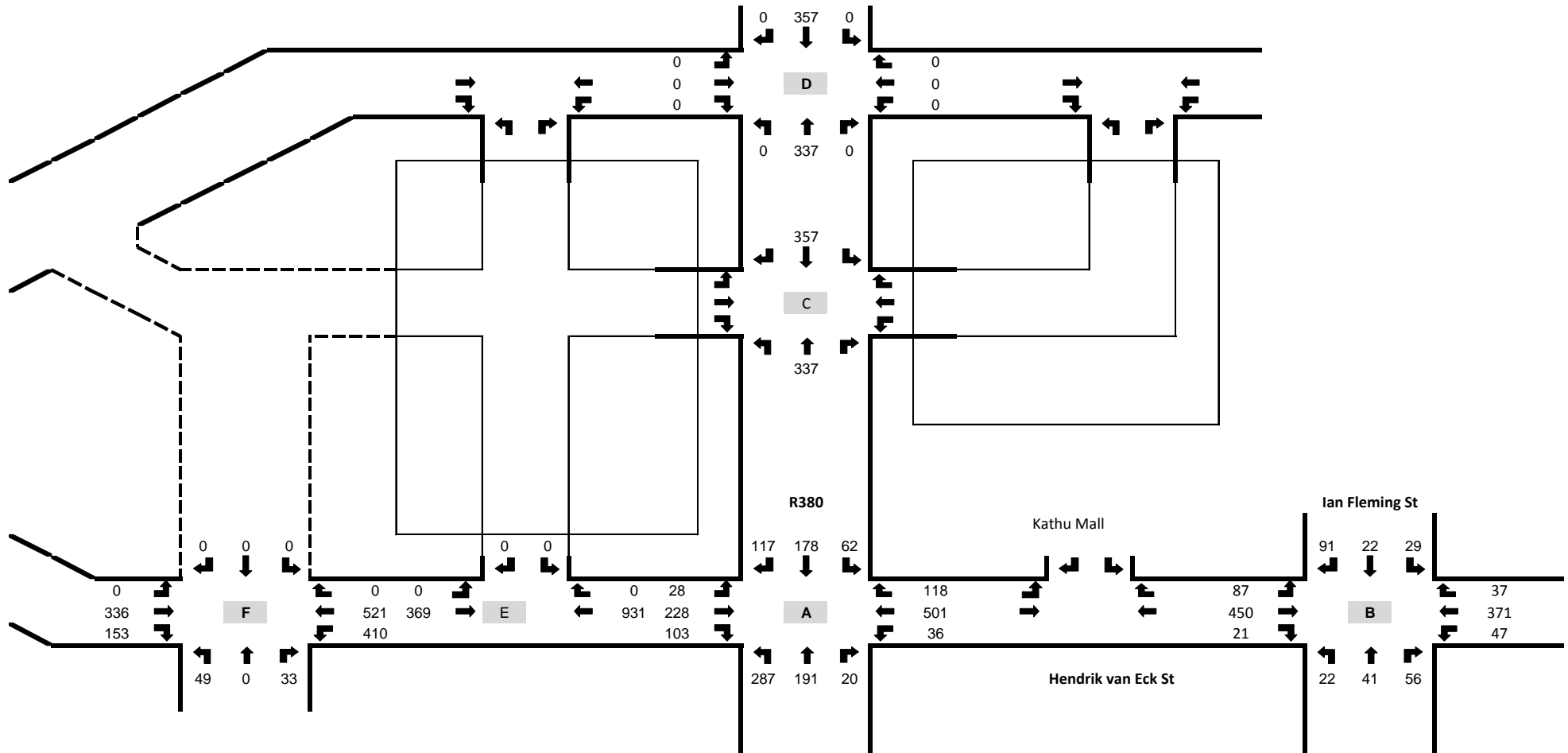


Figure 5.1a: 2015 AM Peak Volumes

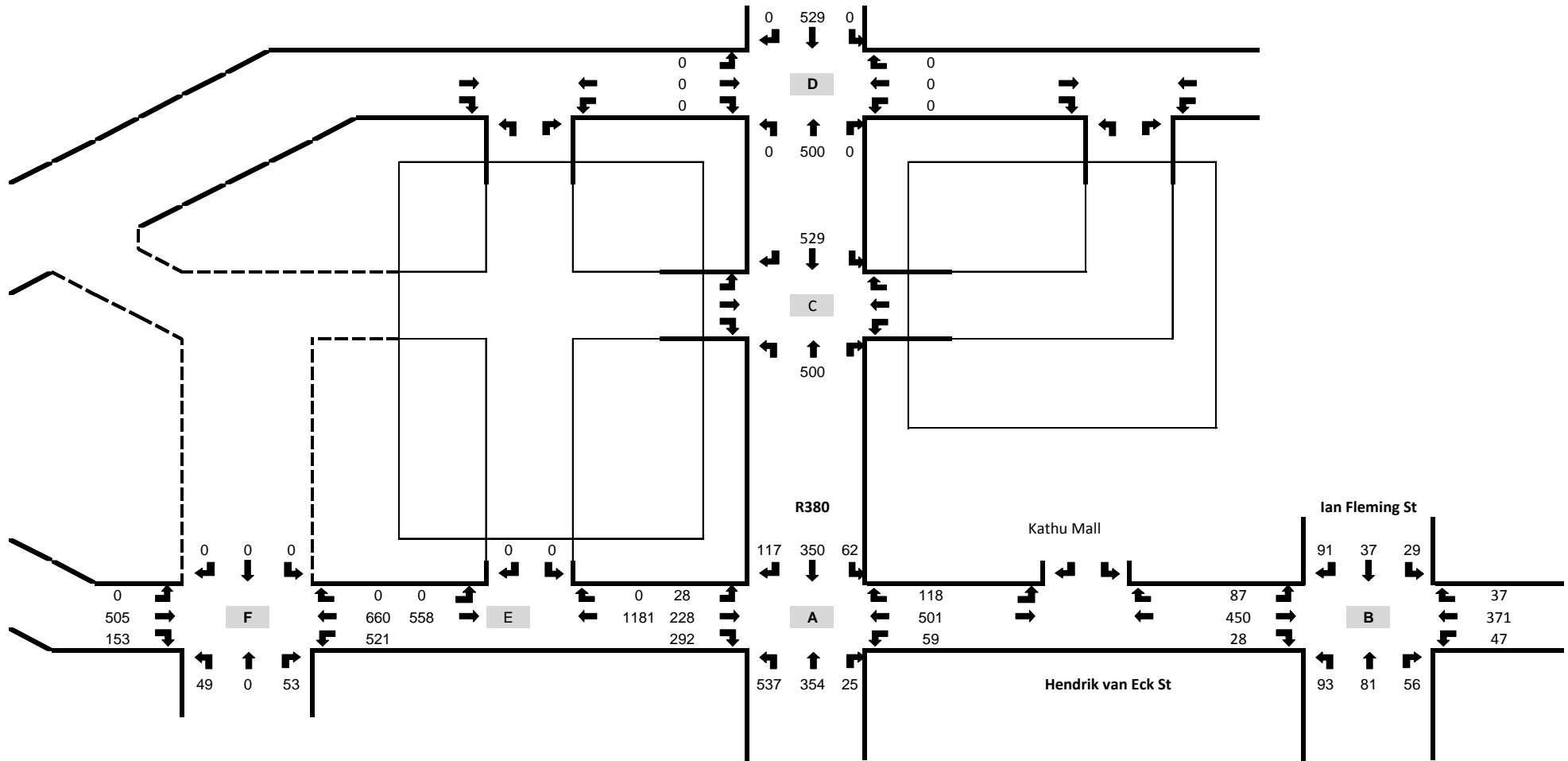


Figure 5.1b: 2015 AM Background Peak (including latent rights)

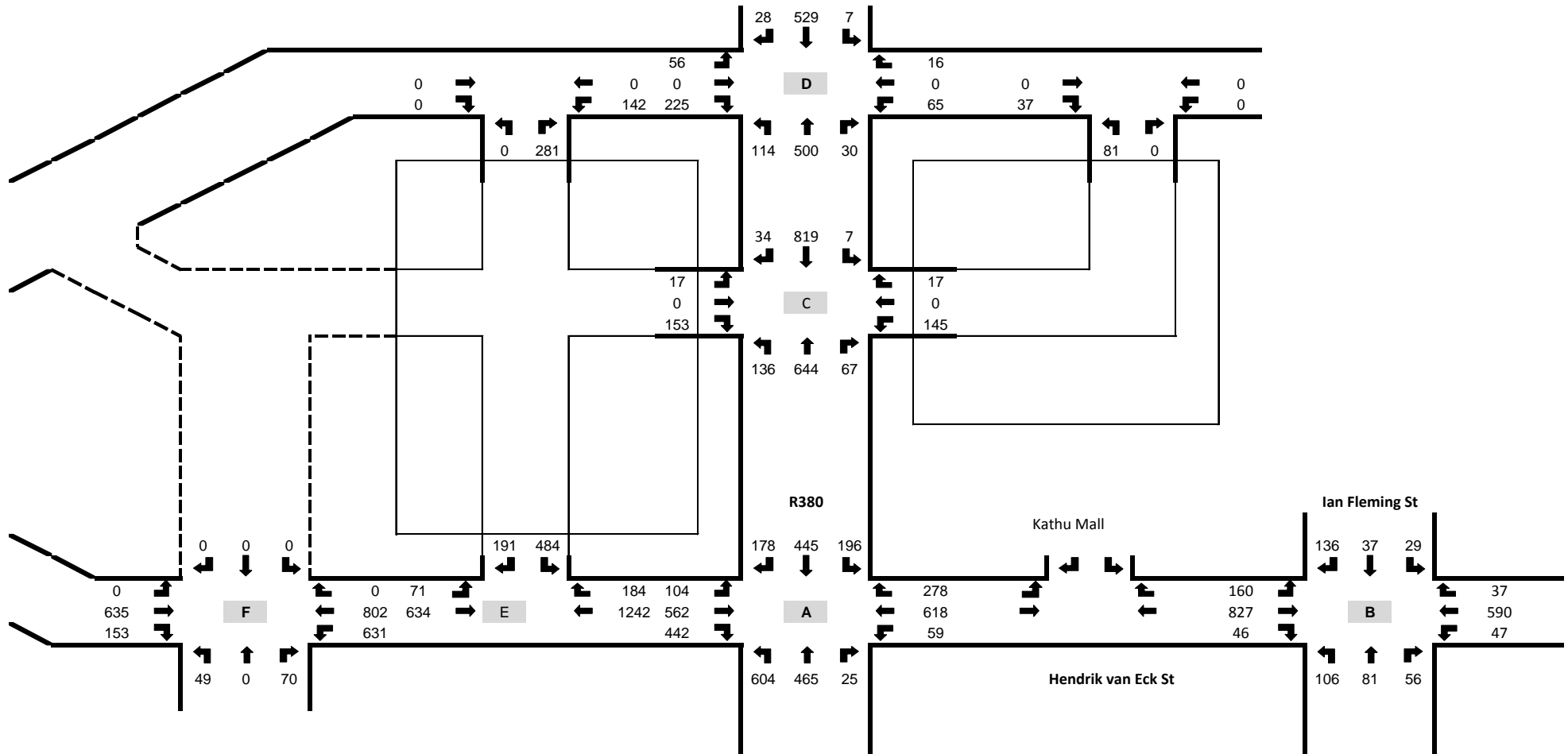


Figure 5.2: 2015 AM Background Peak with development

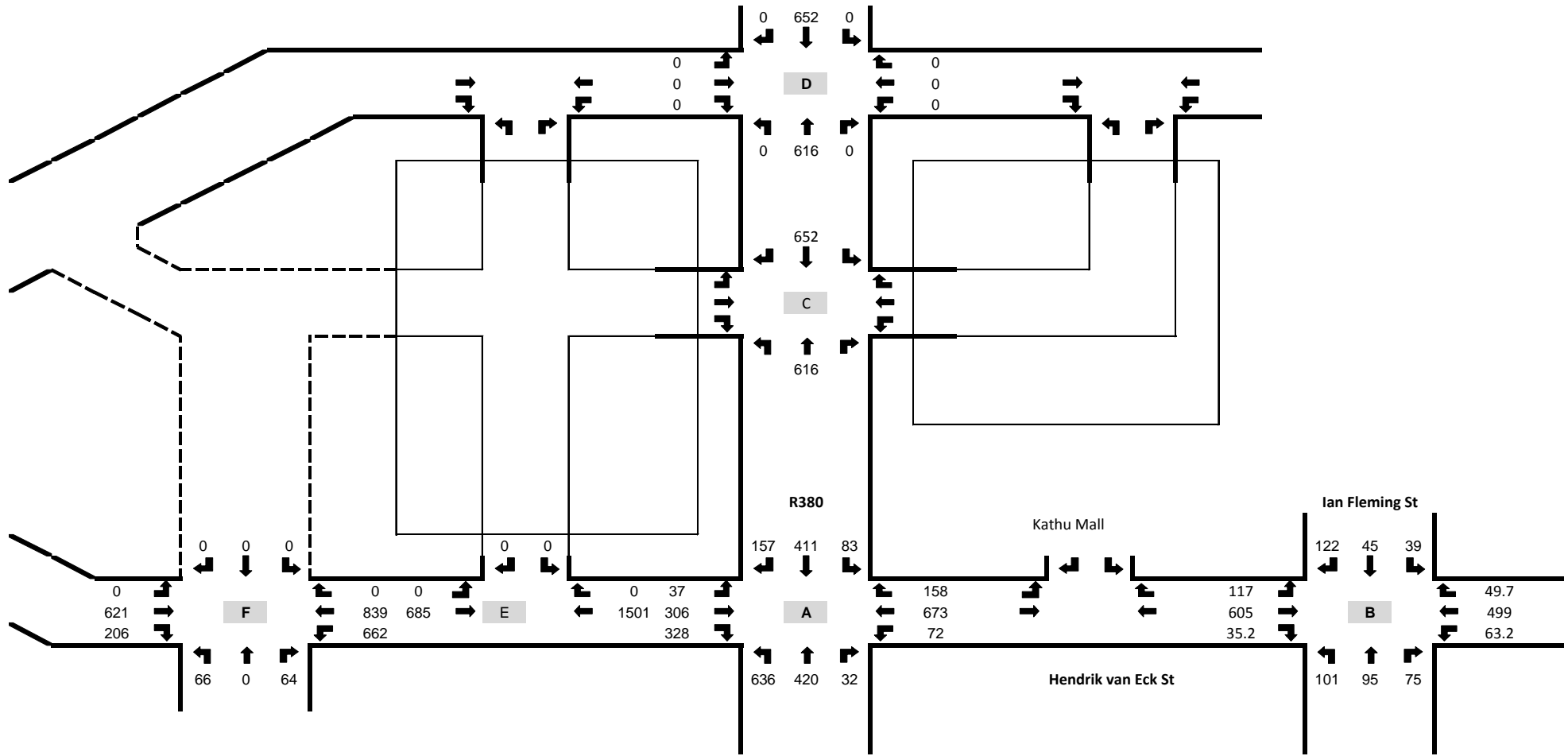


Figure 5.3: 2025 AM Background Peak (including latent rights)

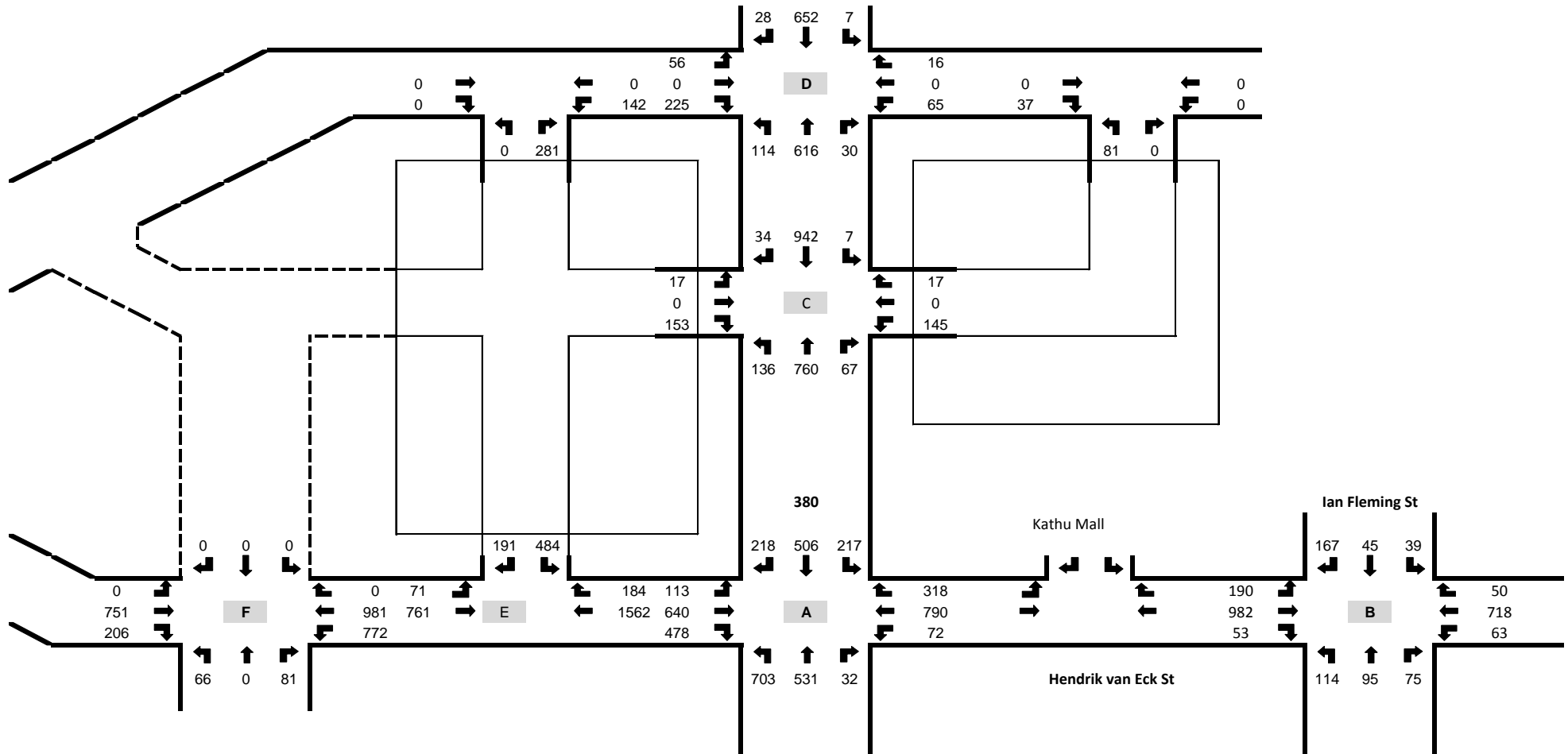


Figure 5.4: 2025 AM Background Peak with development

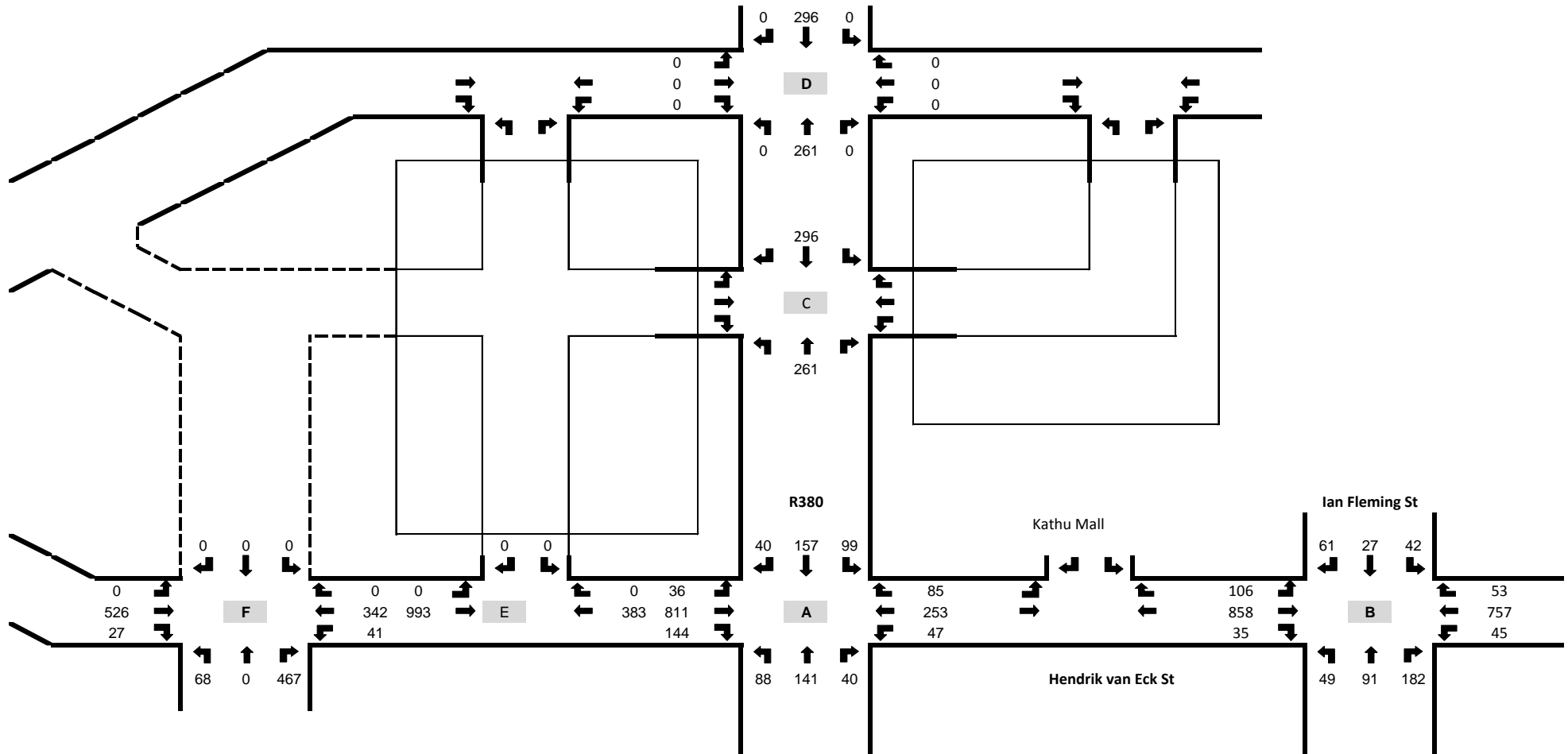


Figure 5.5a: 2015 PM Peak Volumes

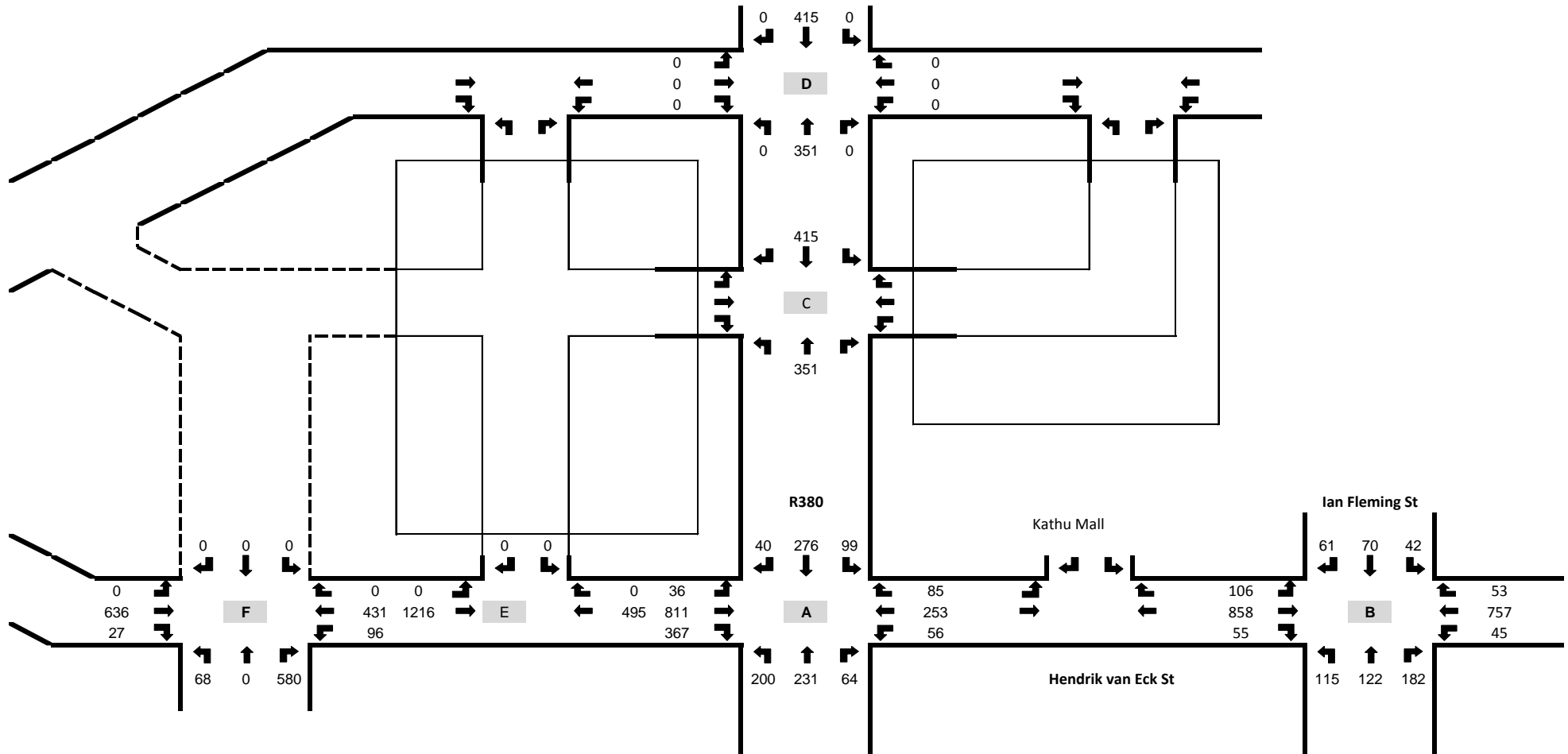


Figure 5.5b: 2015 PM Background Peak (including latent rights)

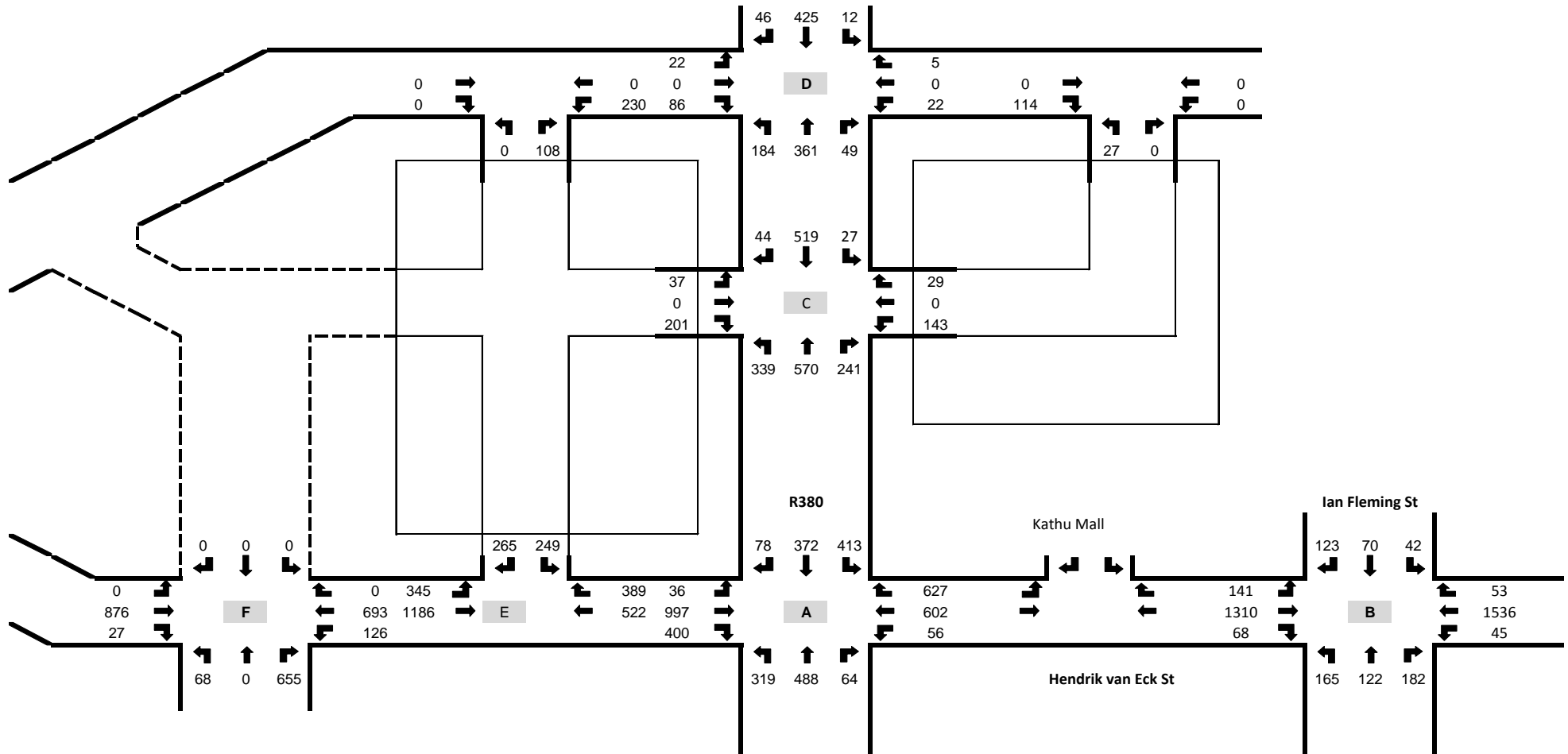


Figure 5.6: 2015 PM Background Peak with development

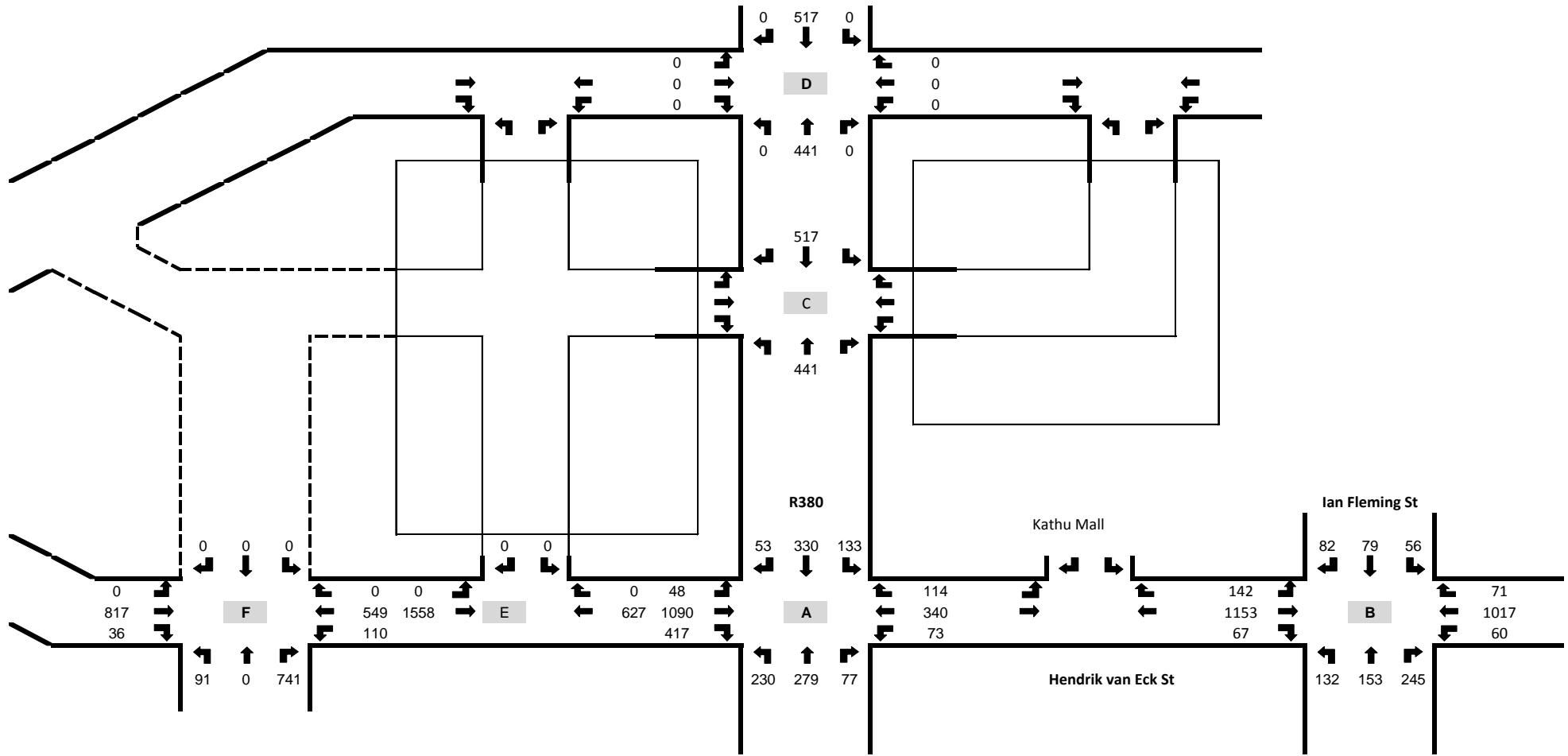


Figure 5.7: 2025 PM Background Peak (including latent rights)

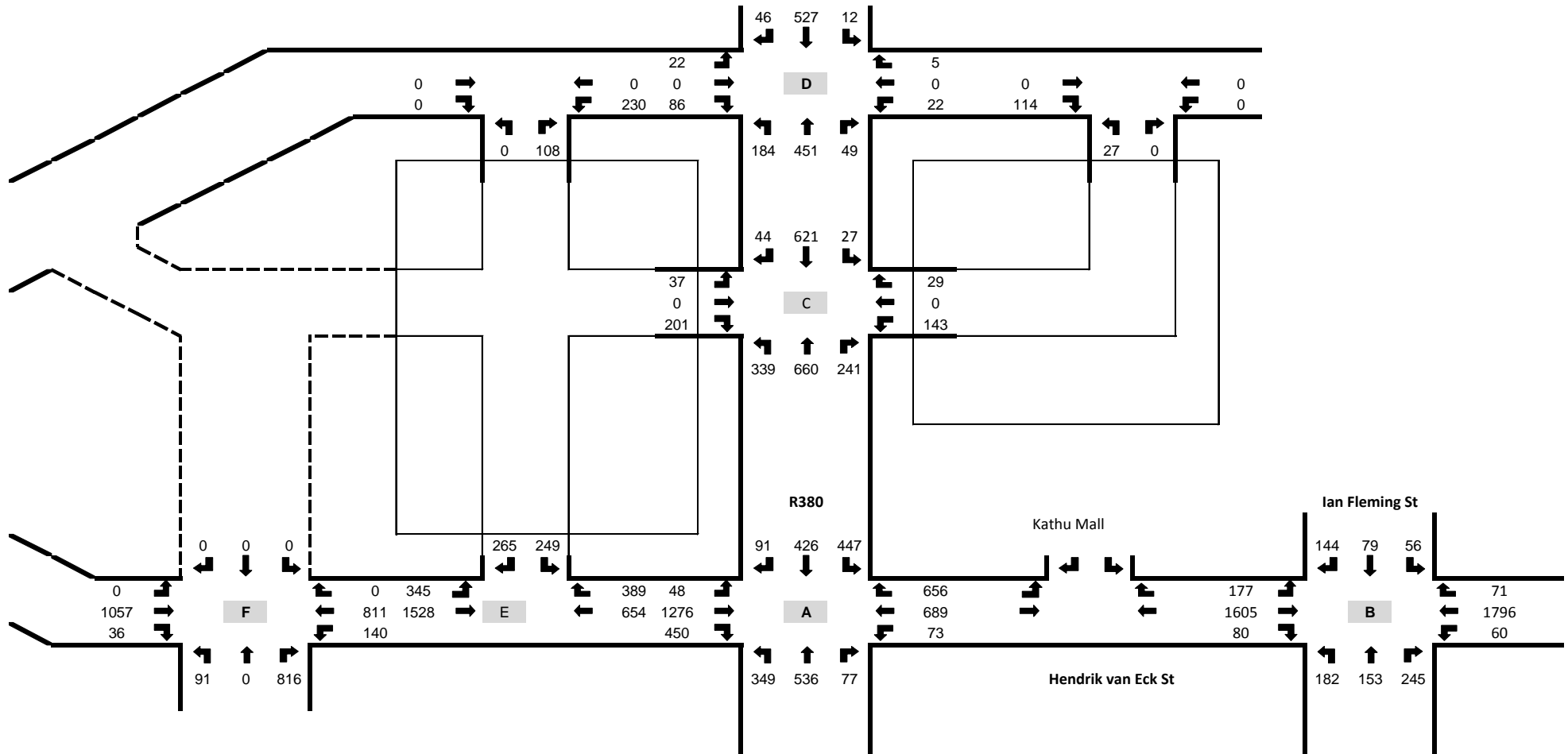


Figure 5.8: 2025 PM Background Peak with development

6 CAPACITY ANALYSIS

Capacity analyses were performed by means of the SIDRA program. The tables below show the Levels of Service of the different traffic movements. Levels of Service (LOS) give an indication of operational characteristics in a traffic stream and their perception by motorists and passengers. Levels of service A to D are usually assumed to be acceptable, with LOS E regarded as the maximum flow rate, or capacity of the facility.

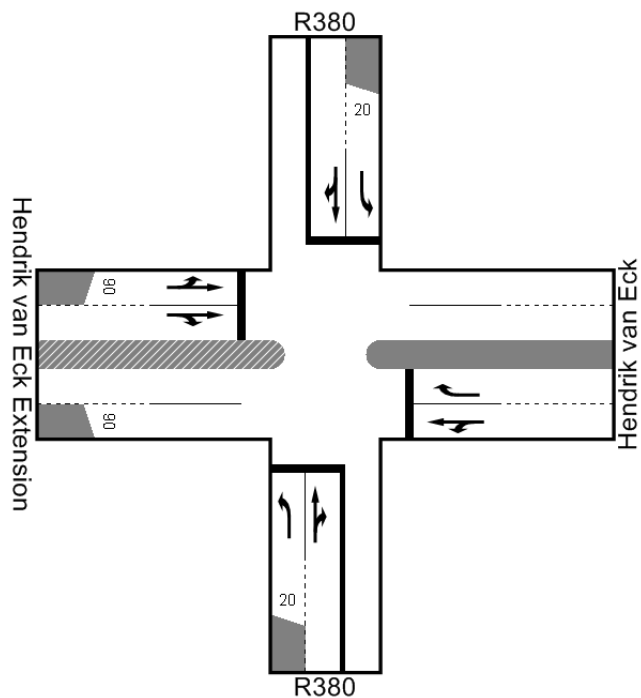


Figure 6.1: Intersections Analysed

- a) **Intersection A:** R380 / Hendrik van Eck Street Intersection
- b) **Intersection B:** Ian Fleming Street / Hendrik van Eck Street Intersection
- c) **Intersection C:** Access 1 on R380
- d) **Intersection D:** Access 2 on R380
- e) **Intersection E:** Access on Extension of Hendrik van Eck Street
- f) **Intersection F:** Sishen Mine / Extension of Hendrik van Eck Street Intersection

6.1 Intersection A: R380 / Hendrik van Eck Street Intersection

The current layout is as shown below:



Current Layout



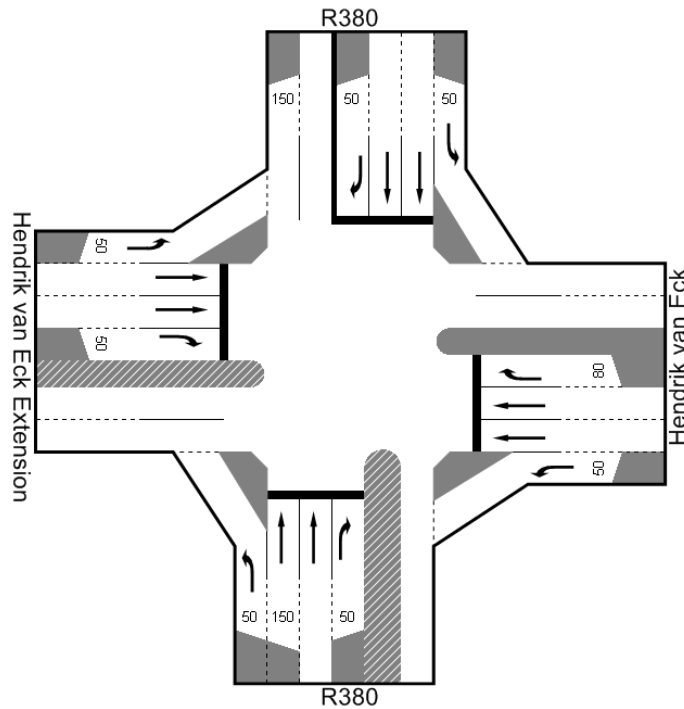
Photo 5: Intersection as seen from the west

Levels of service at this intersection will be as follows:

Intersection: R380 / Hendrik van Eck		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
1b	2015 AM Background Peak	C	E	F	D	C	D	C	D	E	C	C	F
5b	2015 PM Background Peak	C	C	C	C	C	D	B	C	C	C	F	F

The intersection is therefore expected to experience capacity problems with the latent rights; even before implementation of the development under consideration.

To ensure acceptable levels of service the intersection will have to be upgraded as follows:



Required Layout

Worst case levels of service will be as follows.

Intersection: R380 / Hendrik van Eck		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
4	2025 AM Peak with Development	A	C	D	B	B	C	C	C	D	A	B	D
8	2025 PM Peak with Development	C	D	D	B	B	D	A	D	D	A	B	C

Apart from the need to upgrade the intersection to ensure sufficient capacity, mention must also be made of the requirements of the South African Road Traffic Signs, Manual 3, namely:

5.3.3 Right-turn auxiliary lanes

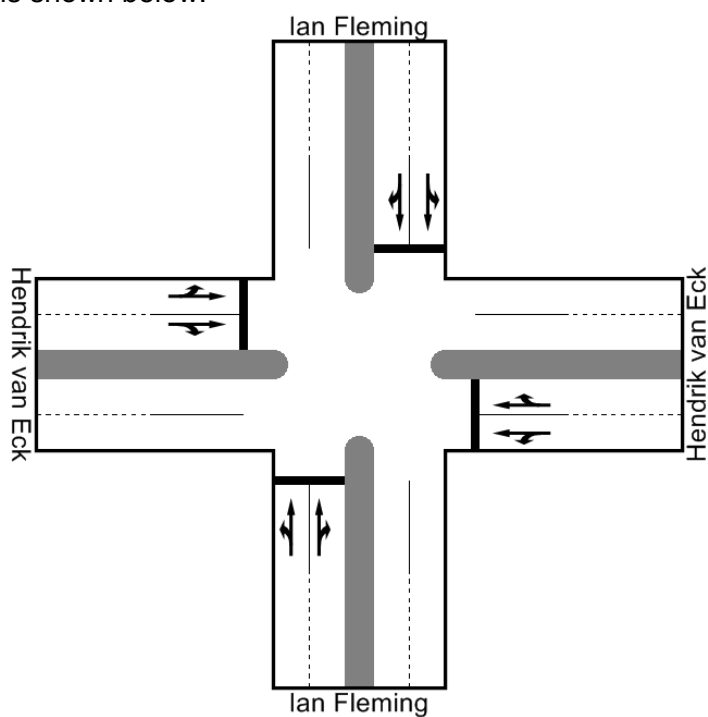
1. *The right-turn movement is of particular importance at signalised (and also other) junctions. Even one vehicle wanting to turn right at a junction, and having to wait because of limited gaps in the opposing flow, will impede other traffic and could create unsafe operating conditions. Exclusive right-turn lanes at a traffic signal will be warranted at most locations where signals are warranted.*
2. *Right-turn lanes not only contribute to improved capacity, but also have a significant safety benefit. In many cases, right turn lanes can be warranted based on their **safety** benefits alone, rather than the capacity improvements that can be achieved. Relatively few right-turn vehicles can cause severe disruptions that could lead to accidents, although sufficient capacity may be available at a junction.*

3. *The need for right-turn lanes to improve safety depends on the speed on a road as well as the probability of conflicts between the right-turn and other traffic travelling in the same direction. On high-speed roads, a right-turn lane will be justified, even if very low volumes of traffic turn right. On roads with low operating speeds, a higher degree of conflict can be accepted.*
4. *In general, right-turn lanes should be provided at all traffic signals, except where operating speeds are low (50 km/h or less) or where very few conflicts occur between right-turn and other traffic movements (either because of low volumes of right turners or low volumes of opposing traffic movements). A cost-benefit analysis can be undertaken in which the benefits accruing from the provision of a right-turn lane can be compared with the cost of providing such a lane.*

In summary, the intersection should preferably from the onset have been developed with turning lanes.

6.2 Intersection B: Ian Fleming Street / Hendrik van Eck Street Intersection

The current layout is shown below:



Current Layout



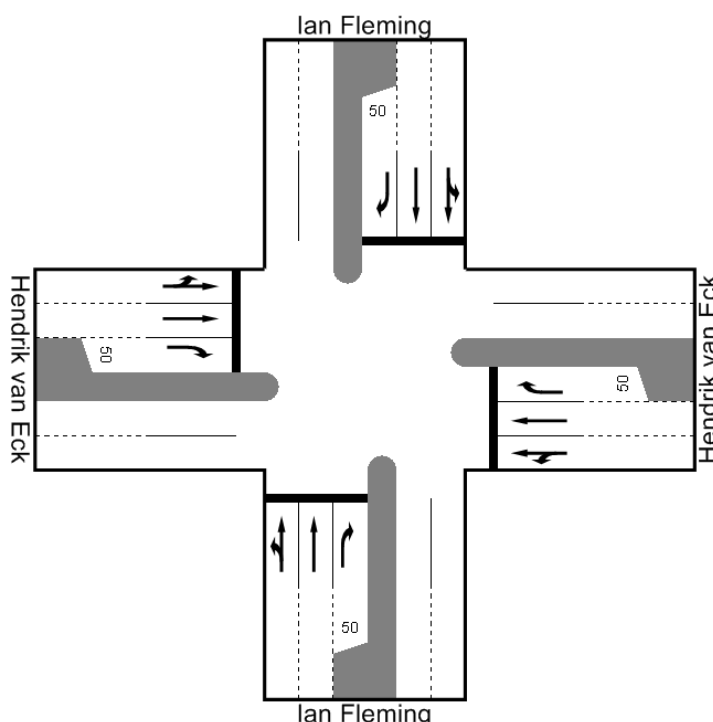
Photo 6: Intersection as seen from the south

Levels of service at this intersection will be as follows:

Intersection: Ian Fleming / Hendrik van Eck		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
1b	2015 AM Background Peak	B	B	C	C	C	C	B	B	B	C	C	C
2	2015 AM Peak with Development	C	C	D	B	B	C	C	C	D	B	B	C
5b	2015 PM Background Peak	C	C	C	C	C	D	C	C	C	C	C	D
6	2015 PM Peak with Development	C	C	D	F	F	F	C	C	D	F	F	F

The intersection should therefore continue to operate acceptably with the latent rights and the development under consideration during the morning peak, but capacity problems are expected during the afternoon peak, mainly due to the higher traffic volumes in this area as a result of the nearby Kathu Village Mall.

To ensure acceptable levels of service the intersection will have to be upgraded as follows:



Required Layout

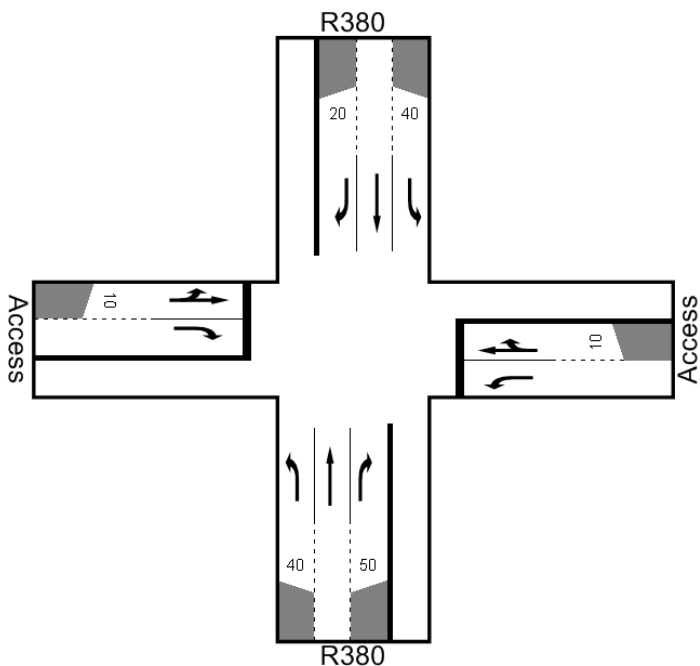
Worst case levels of service will be as follows.

Intersection: Ian Fleming / Hendrik van Eck		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
4	2025 AM Peak with Development	C	C	C	C	B	D	C	C	C	C	B	C
8	2025 PM Peak with Development	D	D	D	C	B	D	C	D	D	B	B	D

Apart from the increased capacity road safety will also improve with the provision of right turning lanes. During the site visit an accident in fact occurred that could be directly attributed to the lack of right turning lanes.

6.3 Intersection C: Access 1 on R380

The expected layout is shown below. As an intersection on a major road, the intersection should preferably be developed with turning lanes on the main road.



Expected Layout

Levels of service at this intersection will be as follows:

Intersection: Access 1 on R380		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
2	2015 AM Peak with Development	A	A	C	C	F	F	A	A	C	C	C	F
4	2025 AM Peak with Development	A	A	C	D	F	F	A	A	C	D	D	F
6	2015 PM Peak with Development	A	A	C	C	F	F	A	A	C	C	C	F
8	2025 PM Peak with Development	A	A	C	C	F	F	A	A	C	C	C	F

Side road traffic is expected to experience capacity problems with the implementation of a priority controlled access. With provision of proper turning lanes capacity problems are expected to be restricted to side road traffic, whilst traffic on the R380 will operate at acceptable levels of service. Although not ideal, this could be acceptable based on the principle contained in the Manual for Traffic Impact Studies, namely "It may, however be acceptable if individual movements are operating at LOS E or even F, if the traffic volumes affected are low"

It is not possible to implement all way stop control at this intersection due to the following principles as contained in the South African Road Traffic Signs Manual (SARTSM). The manual prescribes the conditions under which all-way stop control is allowable, namely:

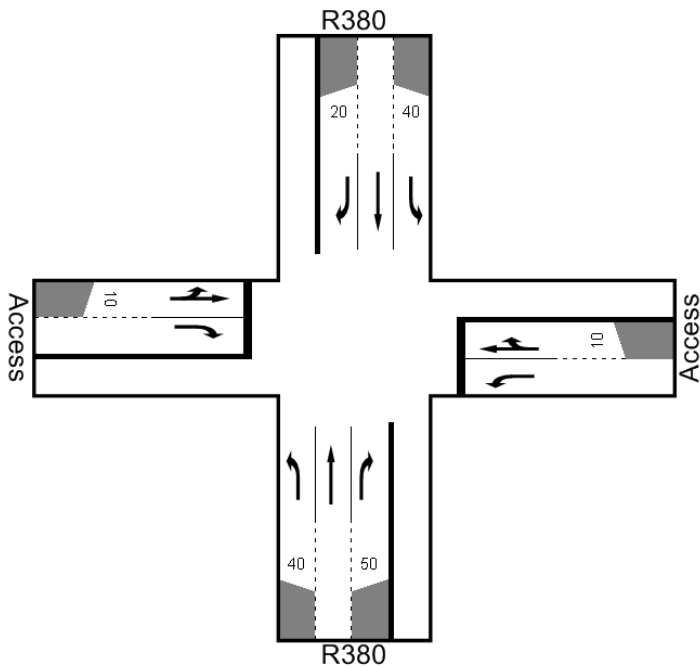
- a) *All-way stop control should not be implemented on a trunk road or major arterial road*
- b) *It should not be implemented on a public passenger transport route*
- c) *The traffic flow on one road should not exceed the traffic flow on the other road by more than 20% of the total traffic through the junction.*

- d) *It should not be implemented if any approach road to the junction has more than one lane for traffic.*

Although the intersection will not initially warrant signalisation, it is possible that installation of traffic lights could be warranted at some stage. It is therefore necessary to monitor the intersection at regular times to determine when signalisation is warranted. Initially, the intersection should however be implemented as a priority controlled intersection with auxiliary lanes.

6.4 Intersection D: Access 2 on R380

The expected and current layouts are shown below. As an intersection on a major road, the intersection should preferably be developed with turning lanes on the main road, with the result that the current layout is not acceptable for the purposes of providing access to the new development.



Expected Layout



Photo 7: Current intersection as seen from the south

The western approach is however at this stage closed as shown in the photo below. This road will have to be reopened when the development is implemented.



Photo 8: Western approach closed.

Levels of service at this intersection will be as follows:

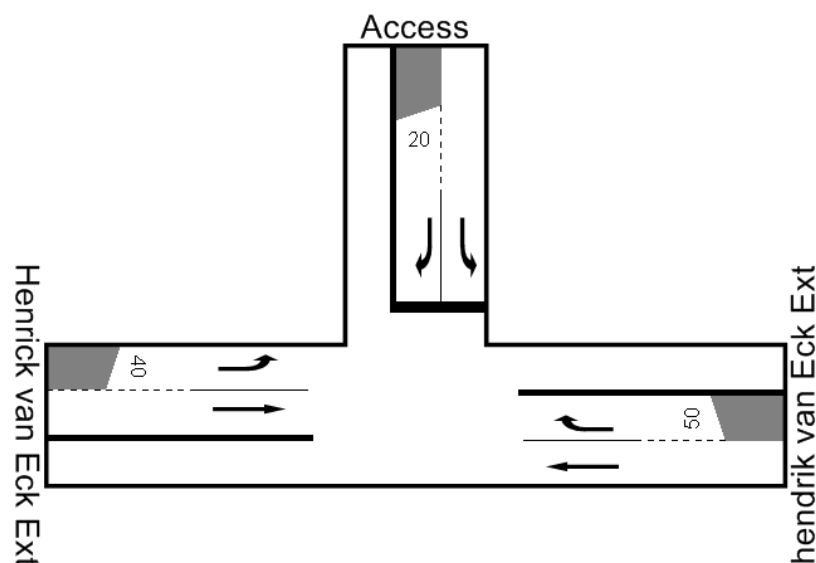
Intersection: Access 2 on R380		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
2	2015 AM Peak with Development	A	A	C	C	F	F	A	A	C	C	C	F
4	2025 AM Peak with Development	A	A	C	D	F	F	A	A	C	D	D	F
6	2015 PM Peak with Development	A	A	C	C	F	F	A	A	C	C	C	F
8	2025 PM Peak with Development	A	A	C	C	F	F	A	A	C	C	C	F

As in the case of Access 1, side road traffic is expected to experience capacity problems with the implementation of a priority controlled access. With provision of proper turning lanes capacity problems are expected to be restricted to side road traffic, whilst traffic on the R380 will operate at acceptable levels of service.

As discussed in the previous section a priority controlled intersection might be acceptable and should initially be implemented, although the installation of traffic lights could be warranted at some stage. It is therefore necessary to monitor the intersection at regular intervals to determine if and when signalisation is warranted.

6.5 Intersection E: Access on Extension of Hendrik van Eck Street Intersection

The expected layout is shown below. As an intersection on a major road, the intersection should preferably be developed with turning lanes on the main road.



Expected Layout

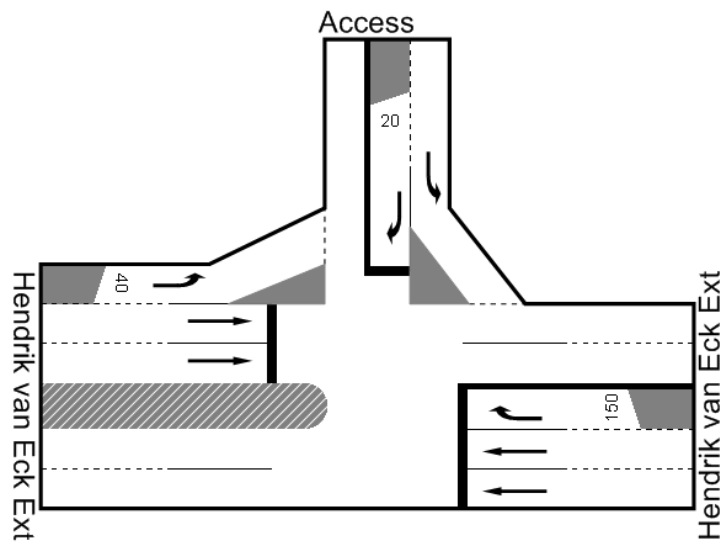
Levels of service at this intersection will be as follows:

Intersection: Access on Hendrik van Eck Ext		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
2	2015 AM Peak with Development	F		F		A	C				A	A	
4	2025 AM Peak with Development	F		F		A	C				A	A	
6	2015 PM Peak with Development	F		F		A	F				A	A	
8	2025 PM Peak with Development	F		F		A	F				A	A	

As in the case of Accesses 1 and 2 on the R380, all way stop control is not appropriate, whilst a priority controlled intersection is expected to experience capacity problems, although the implementation of a priority controlled access with auxiliary lanes could be acceptable for some time.

With higher traffic volumes and the establishment of significant shops in the area, it is however expected that signalisation of the intersection will sooner be warranted than in the case of the accesses on the R380. Given the expected traffic volumes it is also recommended that the section of the road between Intersection A and Intersection F (See Figure 6.1) be widened to a four lane undivided road.

If signalised, the following layout should be implemented.



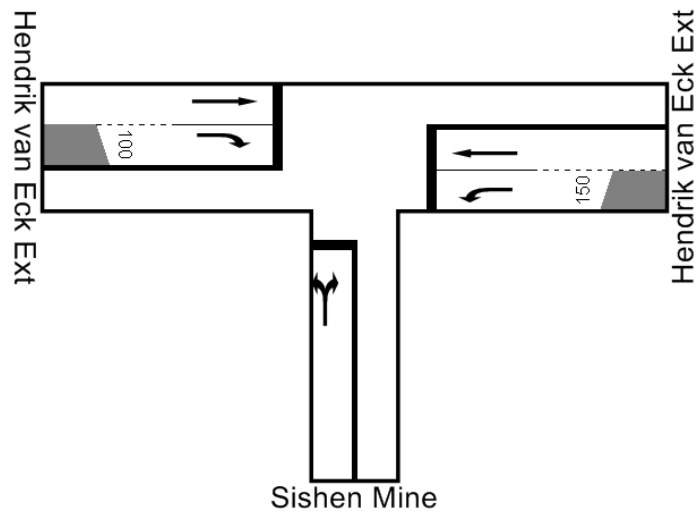
Possible Signalised Layout

Levels of service with this signalised layout will be as follows for the worst case scenarios:

Intersection: Access on Hendrik van Eck Ext		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
4	2025 AM Peak with Development	B		D		B	C				C	B	
8	2025 PM Peak with Development	C		D		A	D				A	C	

6.6 Intersection F: Sishen Mine / Extension of Hendrik van Eck Street Intersection

The current layout is shown below. It is assumed that the intersection will only become a four legged intersection once development to the west of the area under consideration takes place. A T-junction was thus assumed for the purposes of this study.



Current Layout



Photo 9: Intersection as seen from the east

Please note that the current third phase is not correct as eastbound traffic is not allowed to travel with right turning traffic and the settings can be improved as follows:

Phasing Summary

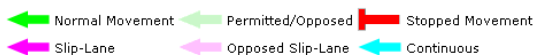
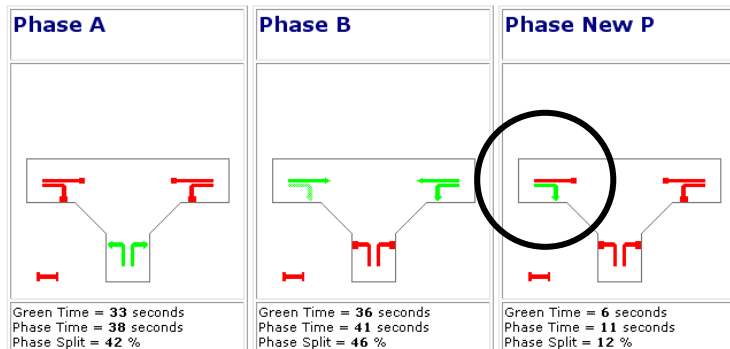
Intersection F

2025 PM Peak with Dev

C = 90 seconds

Cycle Time Option: User-specified cycle time

Phase times determined by the program.



Current Phasing

Phasing Summary

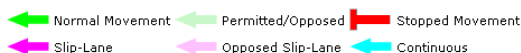
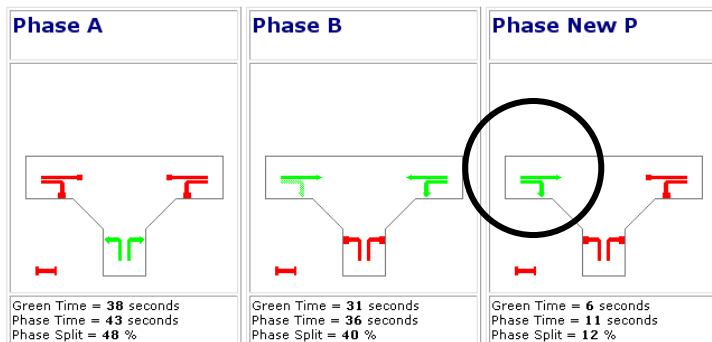
Intersection F

2025 PM Peak with Dev

C = 90 seconds

Cycle Time Option: User-specified cycle time

Phase times determined by the program.

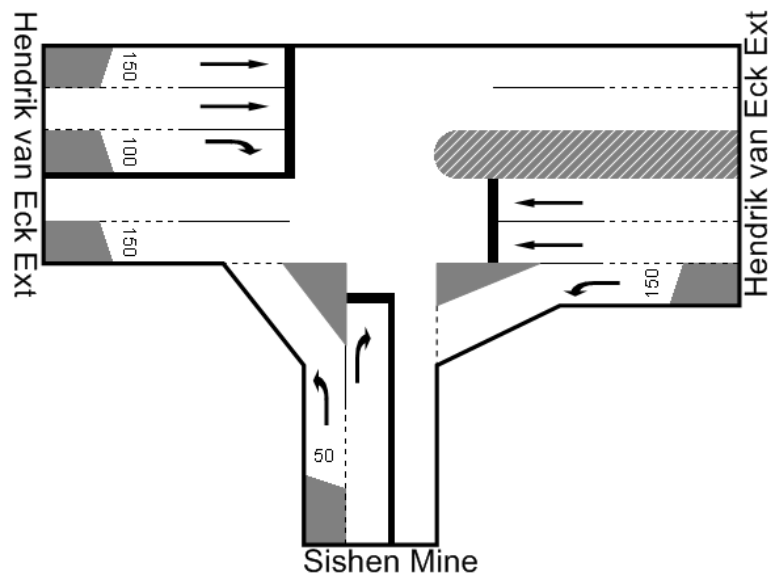


Improved Phasing

Levels of service will be as follows for the worst case scenarios (with the corrected phasing)

Intersection: Sishen Mine / Hendrik van Eck Ext		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
4	2025 AM Peak with Development				B	B		D		D		A	D
8	2025 PM Peak with Development				C	F		F		F		F	D

The analysis shows that even with the improved signal settings, the intersection is expected to experience capacity problems during the afternoon peak. To ensure longer term acceptable levels of service the intersection should be improved as follows.



Possible improved Layout

Levels of service with this layout will be as follows for the worst case scenario:

Intersection: Sishen Mine / Hendrik van Eck Ext		North			East			South			West		
		L	T	R	L	T	R	L	T	R	L	T	R
8	2025 PM Peak with Development				A	D		B		D		C	D

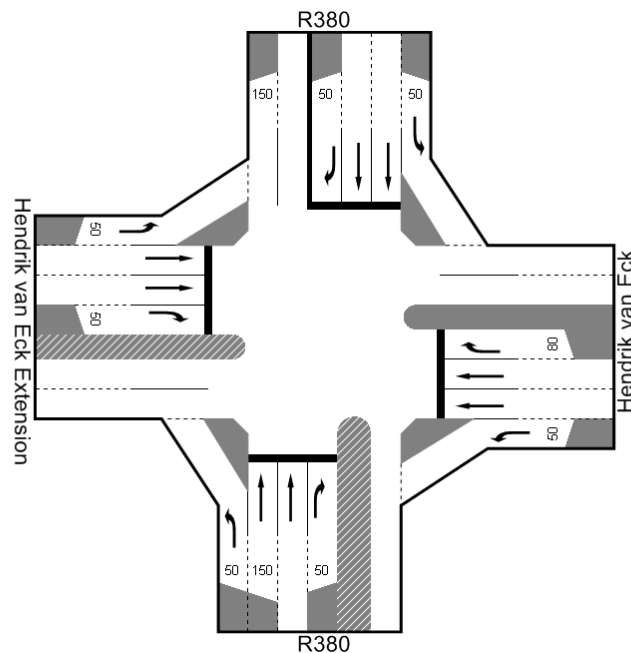
As mentioned before, the road section should be widened to a four lane road. The additional lanes can be terminated to the west of the intersection.

6.7 Summary

The findings of the Capacity Analysis can be summarised as follows.

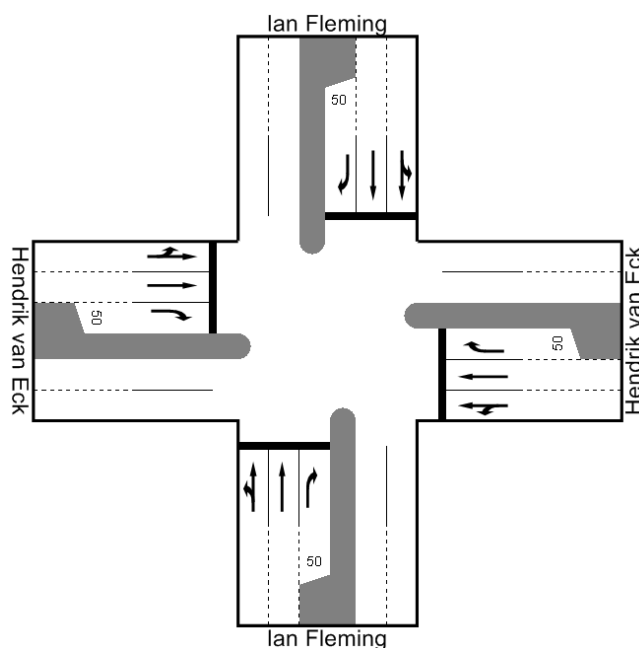
a) Intersection A: R380 / Hendrik van Eck Street Intersection

It is expected that the current intersection will not be able to accommodate the additional trips expected to be generated by the latent rights and will have to be upgraded with proper auxiliary lanes as recommended by the South African Road Traffic Signs Manual.



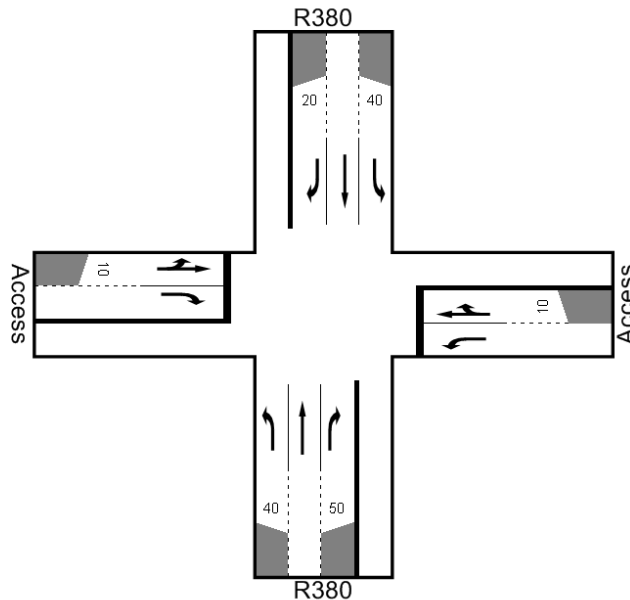
b) Intersection B: Ian Fleming Street / Hendrik van Eck Street Intersection

It is expected that the current intersection will not be able to accommodate the additional trips and will have to be upgraded with at least right turning lanes.



c) Intersection C: Access 1 on the R380

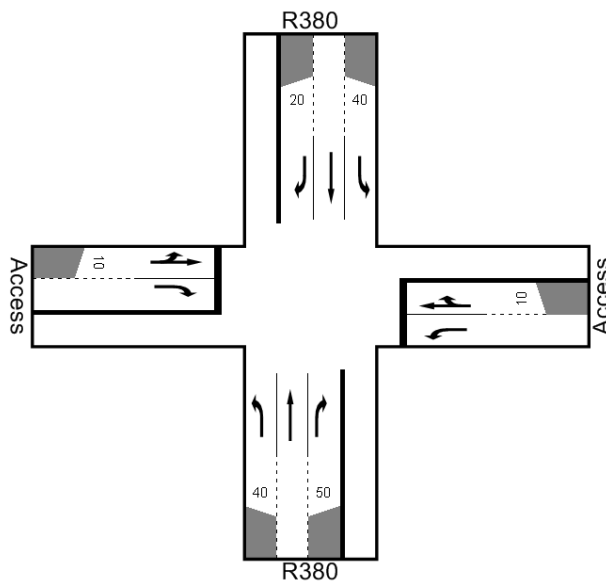
Although capacity problems can be expected with a priority controlled intersection, all-way stop control is not warranted according to the South African Road Traffic Signs Manual and the intersection will not initially warrant signalisation. At first, the intersection should be implemented as a priority controlled intersection with auxiliary lanes.



It is possible that installation of traffic lights could be warranted at some stage. It is therefore necessary to monitor the intersection at regular times to determine if and when signalisation is warranted.

d) Intersection D: Access 2 on the R380

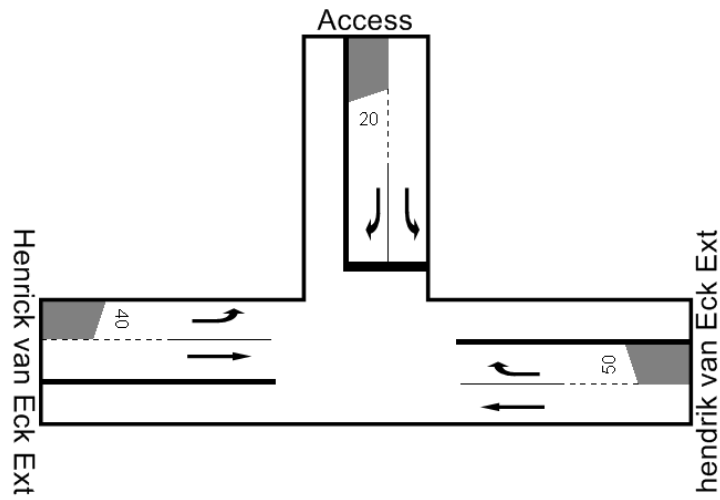
The current intersection will not suffice and the intersection should be upgraded as a priority controlled intersection with auxiliary lanes.



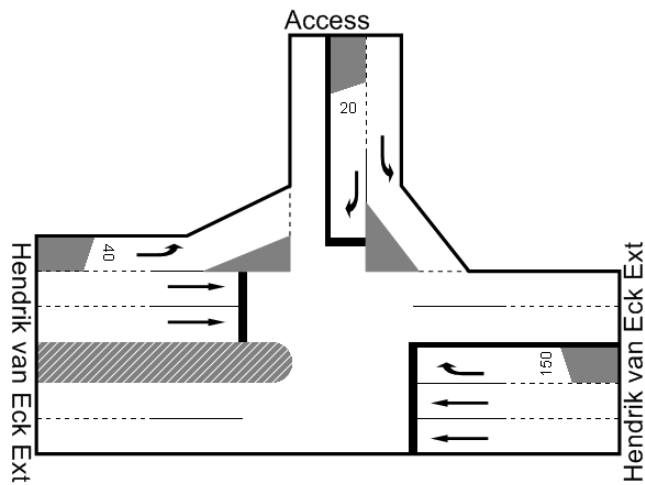
All-way stop control is not warranted according to the South African Road Traffic Signs Manual and the intersection will not initially warrant signalisation. It is possible that installation of traffic lights could be warranted at some stage. It is therefore necessary to monitor the intersection at regular times to determine when signalisation is warranted.

e) Intersection E: Access on Extension of Hendrik van Eck Street Intersection

As an intersection on a major road, the intersection should preferably be developed with turning lanes on the main road.



With relatively high traffic volumes and the establishment of significant shops in the area, it is expected that signalisation of the intersection will relatively soon be warranted. If signalised, the following layout should be implemented.



f) Intersection F: Sishen Mine / Extension of Hendrik van Eck Street Intersection

As a minimum the current incorrect phasing should be improved as follows:

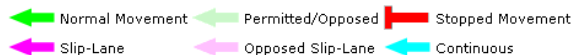
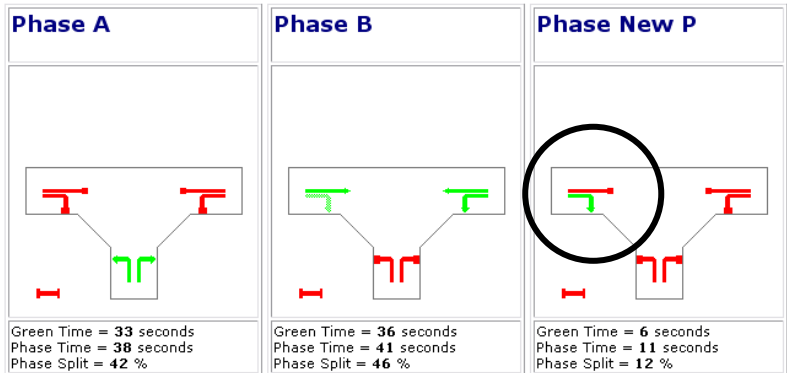


Phasing Summary

Intersection F

2025 PM Peak with Dev

C = 90 seconds
 Cycle Time Option: **User-specified cycle time**
 Phase times determined by the program.



Current Phasing

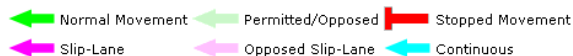
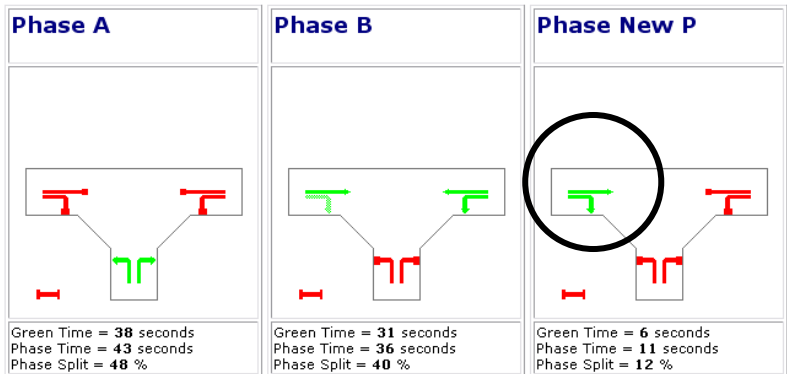


Phasing Summary

Intersection F

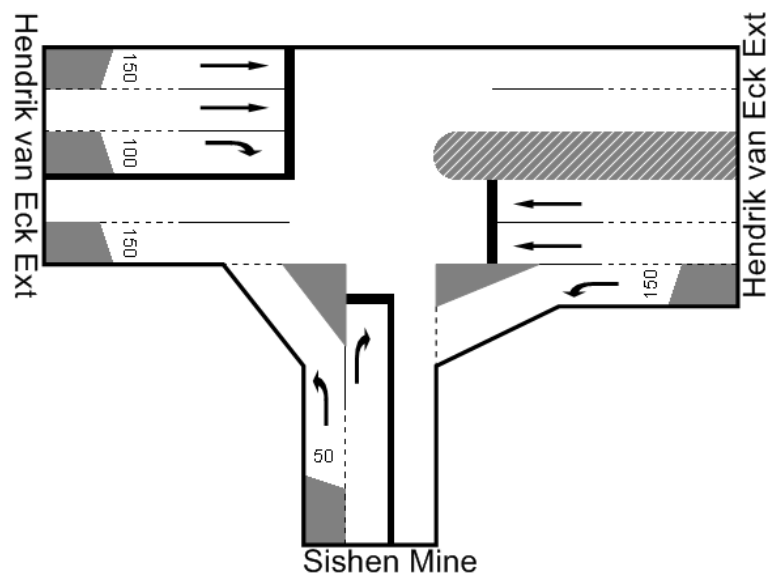
2025 PM Peak with Dev

C = 90 seconds
 Cycle Time Option: **User-specified cycle time**
 Phase times determined by the program.



Improved Phasing

Even with the improved signal settings, the intersection is expected to experience capacity problems during the afternoon peak. To ensure longer term acceptable levels of service the intersection should be improved as follows.



g) Other

The section of the Extension of Hendrik van Eck Street between the intersection with the R380 and the Sishen Mine Road should be widened to a four lane road

7 OTHER ASPECTS

7.1 Trip Generation during Construction

Detail regarding planned construction was not available but considering the expected significant trip generation as discussed in Chapter 3, it is believed that the worst case scenario will be when the development is fully implemented as analysed in Chapter 6.

During construction heavy vehicle volumes will be relatively higher than during the operational stages. As the development site is located in an area served by main roads such as the R380, and is mostly surrounded by vacant land, it is not expected that any community will be significantly affected by heavy vehicle operations during construction.

There will obviously be periods when there will be combination of construction - and operational trips. A significant portion of trip generation will however be by apartments / flats and shops, which will not necessarily be developed at the early stages of the project, with the result that no combination of trips is expected to exceed the full trip generation as analysed.

7.2 Public Transport Operations

In assuming a low vehicle ownership it is assumed that significant public transport operations can be expected, although a very low vehicle ownership was not assumed, which would have implied that resident would mostly be dependent on public transport.

To ensure effective public transport operations, provision should preferably be made for public transport lay-bys in the final street layout in such positions that people do not walk more than 500m to reach public transport. Provision should be made for more public transport bays at schools, shops and possibly at apartments/flats.

7.3 Pedestrian Activities

During traffic counting limited pedestrian activity was observed. With existing work opportunities some distance away from the area, no significant home - work pedestrian movement is expected. Most pedestrian activity is expected to be internal movements.

A concern is that a school will only be located to the west of the R380 with the result that some pedestrian movement across the mentioned road can be expected. Mid block pedestrian crossings are not recommended due to the inherent road safety concerns with these facilities. Pedestrian crossing should be facilitated at the intersections, especially once the intersections are signalised. As a result, it might be prudent to construct fencing that will prevent pedestrian crossing at other locations along the main roads and thus channelize movement at the intersections.

Some pedestrian movement between the area and the Kathu Village Mall can be expected and this should also be accommodated at the signalised intersections.

Although the main roads have gravel shoulders, the shoulders are not pedestrian friendly; as shown below.



Photo 10: Gravel road shoulders

The fact that the main roads in the area have a relatively rural character rather than a street character encourages speeding, thus increases the hazardousness of pedestrian activities.

With possible upgrading of the roads, provision should preferably be made for proper sidewalks to facilitate pedestrians as well as street lighting. This should enhance the establishment of a more urban environment, which should also reduce speeding.

7.4 Road Condition

The relevant road surfaces are in a reasonable condition, but the lack of sidewalks with kerbs and formal lay-bys result in vehicles such as taxis stopping at various positions along the roads, resulting in significant edge breaking, as shown in the photo below.



Photo 11: Significant edge break along the R380

With the development under consideration, heavy vehicle volumes ratios are not expected to change, except during construction. Repair of the road edges and shoulders is essential in the shorter term to prevent further edge break, but also to decrease the road safety implications of a significant edge drop and reduced lane widths. In the longer term proper sidewalks with kerbs should preferably be constructed.



Photo 12: Proper sidewalks along Hendrik van Eck Street

8. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be made from the study:

- a) The development is of significant size and can potentially generate 2046 trips during the morning peak and 2749 trips during the afternoon peak.
- b) The development will have an impact on all of the analysed intersections and with normal traffic growth, the expected trip generation of latent rights as well as the additional trip generation, some improvements are required to the relevant intersections.

Based on the conclusions it is recommended that the development be approved from a traffic point of view.

9. REFERENCES

1. **Manual for Traffic Impact Studies**, Department of Transport, Pretoria, 1995
2. **South African Trip Generation Rates**, Department of Transport, Pretoria, 1995
3. **ITE Trip Generation Rates, 6th Edition**, Institute of Transportation Engineers, Washington, 1998
4. **Transportation and Land Development**, Institute of Transportation Engineers, Washington, 1988
5. **UTG 1, Guidelines for the Geometric Design of Urban Arterial Roads**, CSIR, Pretoria, 1986
6. **National Guidelines for Road Management in South Africa**, COTO
7. **Spacing of Accesses on Major Arterials**, Department of Transport, Pretoria, 1993
8. **TMH 17 Volume 1**, The South African National Roads Agency Limited, Pretoria, 2012
9. **UTG 5: Geometric Design of Urban Collector Roads**, CUTA, Pretoria, 1988
10. **UTG 7: Geometric Design of Urban Local Residential Streets**, CUTA, Pretoria, 1986