DEPARTMENT WATER & SANITATION

TRAFFIC IMPACT STUDY R1

(MARCH 2023)

CASTEEL DAM SAFETY REHABILITATION NEAR ACORNHOEK

PREPARED BY:

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Hamatino Consulting Engineers	**TITLE OF REPORT:** **TRAFFIC IMPACT STUDY: CASTEEL DAM SAFETY REHABILITATION NEAR ACORNHOEK**
Report File Name:	P02_23/TIA/Casteel Dam
Client:	Department Water & Sanitation

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DESCRIPTION OF REVISIONS	REVISION	DATE

EXECUTIVE SUMMARY

ABSTRACT

Client (Department of Water Affairs) is desirous to rehabilitate the Casteel Dam near Acornhoek, Bushbuck Ridge in the near future.

A number of construction vehicles will utilize existing access intersections to and from the R40 road which sorts under the jurisdiction of SANRAL during construction of the dam wall.

Construction vehicles will be mostly tipper trucks, importing material from the borrow to the dam wall and public transportation transporting workers to and from the site.

The existing access from the R40 towards the Casteel Dam will be maintained and upgraded. This access will be utilized after completion of the construction project as an access for maintenance purposes.

RECOMMENDATIONS

Based on the conclusions that have been derived from this study (refer section 9), the following are recommended:

- That both the existing R40 / Casteel Dam access intersection as well as the R40 / D3950 intersection be utilised for access to the construction site;

- That the existing R40 / Casteel Dam access intersection be slightly re-aligned in order to allow for better manoeuvrability to and from the R40 as is currently the case;

- That a safe drop off and loading area be provided at the construction site for daily commuters on public transport;

- That additional safety precautions be implemented for the duration of the construction period.

- It is advised that temporarily construction signage be provided in accordance with the South African Road Traffic Signs Manual Vol 2, Chapter 13 at the R40 / Casteel Dam access

intersection located to the north of the dam and the speed reduced to 60km/h at the locality of the access intersection.

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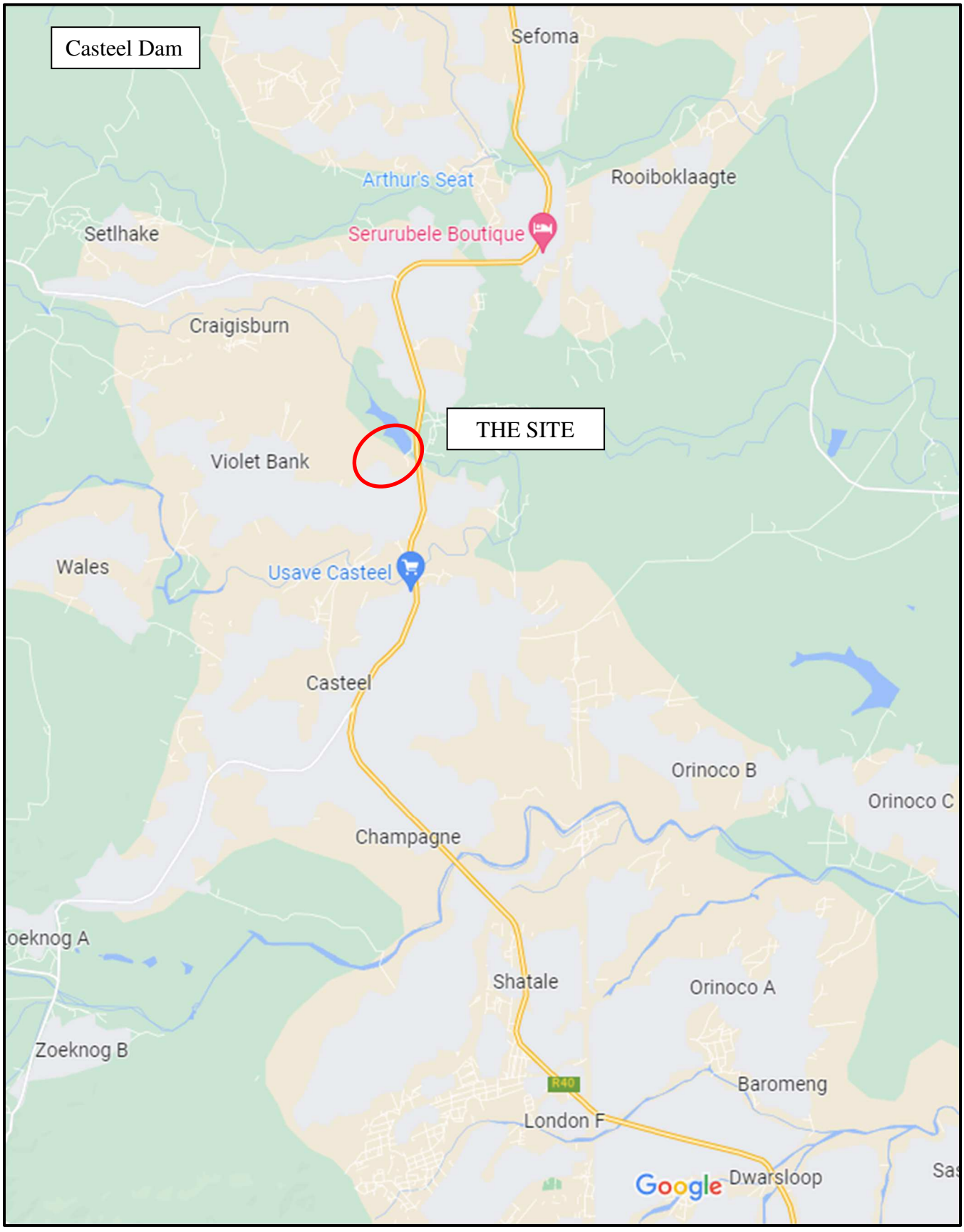


1. INTRODUCTION

1.1 BACKGROUND

Client (Department of Water Affairs) is desirous to rehabilitate the Casteel Dam near Acornhoek, Bushbuck Ridge in the near future.

A number of construction vehicles will utilize existing access intersections to and from the R40 road which sorts under the jurisdiction of SANRAL during construction of the dam wall.

Construction vehicles will be mostly tipper trucks, importing material from the borrow to the dam wall and public transportation transporting workers to and from the site.

The following has been deemed to be applicable to this project, following a discussion meeting with the DWS:

- Predicted traffic volumes for heavy construction vehicles:
    - $6m^3$ trucks would be used to transport the construction material from quarry to Casteel Dam.
    - The material volumes include:
        - 28 $000m^3$ of gravel
        - $5000m^3$ of concrete
        - $2500m^3$ of Rockfill
- It is predicted that a minimum of 150 and maximum 200 workers will be coming to site on a daily basis by means of public transportation;

- Construction material will be sourced from a licensed quarry (probably near Agen Court). The construction trucks would therefore approach Casteel Dam from the South.

The existing access from the R40 towards the Casteel Dam will be maintained and upgraded. This access will be utilized after completion of the construction project as an access for maintenance purposes.

1.2 PURPOSE OF THIS STUDY

The primarily purpose of this study is to ensure that the access and external road infrastructure to the development is appropriate, safe and will be able to accommodate the anticipated traffic demand in a safe and efficient manner.

The study is done in order to ensure that an acceptable level of service is maintained at all times. In the event that un-acceptable intersection levels of service are expected, mitigation measures are proposed accordingly.

A further decisive purpose of this report is to ascertain that the proposed access localities are safe.

1.3 STUDY AREA

The study area is limited to an analysis of the following intersections:

- R40 / Road D3950 Intersection;
- R40 / Casteel Dam Access.

1.4 TRAFFIC NOMENCLATURE

Traffic nomenclature used in this report includes the following:

Vph : Vehicles per hour
Pcu : Passenger car unit
Kph : Kilometres per hour
V/C : Volume to capacity ratio
LOS : Level of service

According to the Highway Capacity Manual, the LOS is defined according to the following table:

TABLE 1: LEVEL OF SERVICE

LEVEL-OF-SERVICE CRITERIA FOR PRIORITY INTERSECTIONS & ROUNDABOUTS

Level of Service	Average Control Delay (S/veh)
A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

LOS CRITERIA FOR SIGNALIZED INTERSECTIONS

LOS	Control Delay per Vehicle (s/veh)
A	0-10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

Table 1 indicates the levels of services as A to F, of which A is the best and F is the worst level of service.

An explanation of the respective levels of services is as follows:
Level of Service A: Free flowing traffic with a volume to capacity ratio between 0 to 0.1

Level of Service B: Low stable flow with a volume to capacity ratio between 0.1 to 0.3

Level of Service C: High stable flow with a volume to capacity ratio between 0.3 to 0.7

Level of Service D: Approaching unstable flow with a volume to capacity ratio between 0.7 to 1.0

Level of Service E: Unstable flow with a volume to capacity ratio of 1.0

Level of Service F: Forced flow

Intersections or lanes with a Level of Service E or F should be upgraded as soon as possible.

2. METHODOLOGY

The methodology undertaken in conducting this study was as follow:

- Discussion of the project with the Client;

- Study of background information & other reports compiled to date;

- Conduct weekday morning (06h00 to 09h00am) and afternoon (15h00 to 18h00) peak hour traffic counts in order to determine the existing background traffic volumes. Traffic counts has been conducted as follow:

    - Traffic surveys have been undertaking by means of a CCTV camera recording of each intersection as well as a pneumatic tube counter;
    - The recorded videos have been manual counted in office on the sample sheets provided from this office at 15 min intervals (06:00am – 09:00am and 15:00pm – 18:00pm one weekday only);
    - 3 leg intersections consist of 6 movements through the intersection;
    - 4 leg intersections consist of 12 movements through the intersection;
    - Volumes are classified into light vehicles (LV) and heavy vehicles (HV)
    - Light vehicles are passenger cars, light delivery vehicles, bakkies, kombis and motorcycles;
    - Heavy vehicles all others.

- Perform speed measurements of vehicles travelling along the R40 Road;

- Base year (2022) capacity analysis;

- Build a traffix model representing the adjacent road network of the study area;

- Access intersection locality and safety;

- Trip generation & distribution of the project will be calculated using information as discussed / provided by client (construction vehicles & public transportation);

- Trip assignment on the road network located within the study area;

- Intersection capacity analysis with construction vehicles added;
- Intersection safety in terms of sight distances;
- Intersection upgrading layout (schematic);
- Construction temporarily road signage;
- Public transportation will be discussed;

3. TRAFFIC STATUS QUO

3.1 EXISTING PEAK HOUR TRAFFIC VOLUMES

Traffic surveys were conducted on Thursday 09 and Friday 10 March 2023 as well as Thursday 16 February and Friday 17 February (D3950 Intersection) during the following times:

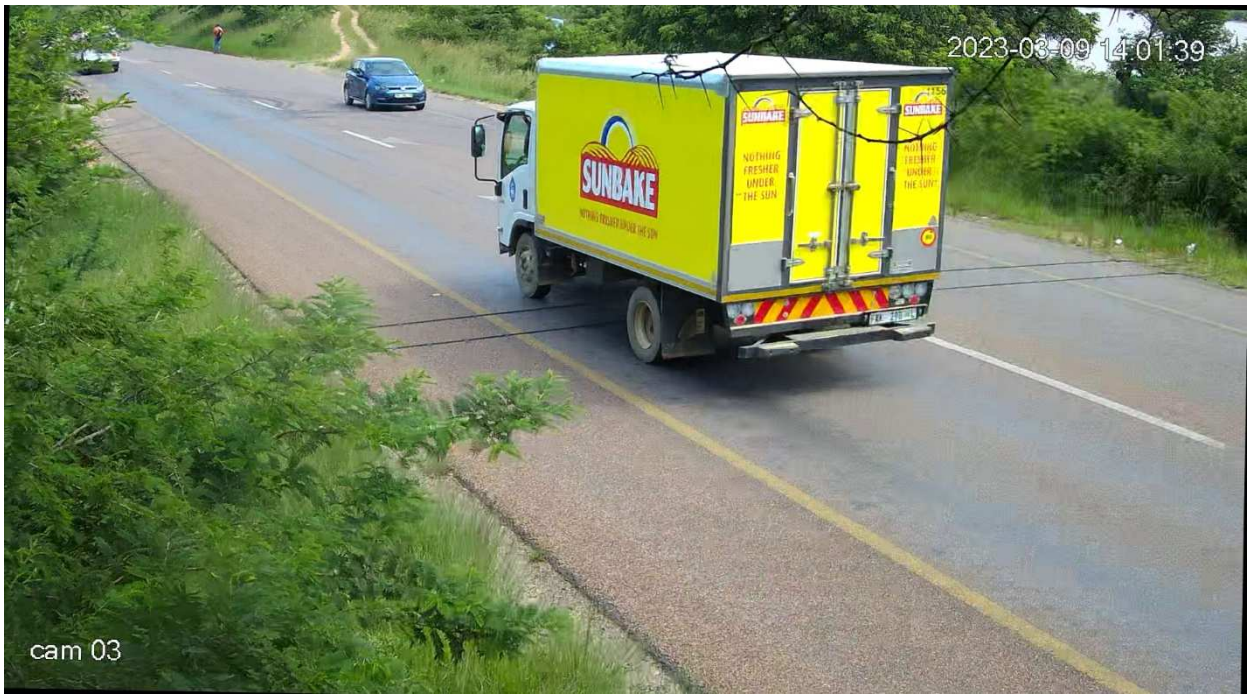
- Morning: 06h00 to 09h00 am: Friday 10 March 2023 & 17 February;
- Weekday Afternoon: 15:00 to 18:00pm Thursday 09 March 2023 & 16 Feb.
- Friday Afternoon: 15:00 – 18:00 pm: Friday 11 March 2023 & 17 February

The weather was mostly sunny and warm, especially Thursday 09 March 2023. The weather was however not of abnormal nature and didn't affect traffic flow. Normal Traffic flow phenomena were observed during the both counting days.

The weather during both counting days is depicted in figure 1 below.

FIGURE 1: R40 / D3950 INTERSECTION – SUNNY 16/02/2023 AT 16:00 PM

FIGURE 2: R40 / CASTEEL DAM ACCESS INTERSECTION –SUNNY 09/03/2023 AT 14:02 PM



The following information was deduced from the traffic counts:

TABLE 2: THREE DAY TRAFFIC COUNT

DATE & TIME	NORTHBOUND		SOUTHBOUND		TOTAL	Hourly
	LV	HV	LV	HV		
09/03/2023 12:00 - 12:14	45	7	25	3	80	
09/03/2023 12:15 - 12:29	40	3	26	9	78	
09/03/2023 12:30 - 12:44	39	2	18	0	59	
09/03/2023 12:45 - 12:59	40	2	34	1	77	294
09/03/2023 13:00 - 13:14	46	1	26	1	74	288
09/03/2023 13:15 - 13:29	26	4	26	1	57	267
09/03/2023 13:30 - 13:44	35	4	28	3	70	278
09/03/2023 13:45 - 13:59	47	3	27	0	77	278
09/03/2023 14:00 - 14:14	39	2	33	2	76	280
09/03/2023 14:15 - 14:29	44	2	41	2	89	312
09/03/2023 14:30 - 14:44	42	4	30	2	78	320
09/03/2023 14:45 - 14:59	31	7	43	1	82	325
09/03/2023 15:00 - 15:14	46	3	41	4	94	343
09/03/2023 15:15 - 15:29	54	4	42	5	105	359
09/03/2023 15:30 - 15:44	44	6	42	3	95	376
09/03/2023 15:45 - 15:59	51	4	47	3	105	399

DATE & TIME	NORTHBOUND		SOUTHBOUND		TOTAL	Hourly
	LV	HV	LV	HV		
09/03/2023 16:00 - 16:14	48	1	38	2	89	394
09/03/2023 16:15 - 16:29	40	5	48	1	94	383
09/03/2023 16:30 - 16:44	47	4	30	4	85	373
09/03/2023 16:45 - 16:59	43	2	44	1	90	358
09/03/2023 17:00 - 17:14	52	1	42	5	100	369
09/03/2023 17:15 - 17:29	37	4	41	1	83	358
09/03/2023 17:30 - 17:44	50	4	39	3	96	369
09/03/2023 17:45 - 17:59	40	2	33	1	76	355
09/03/2023 18:00 - 18:14	43	10	35	3	91	346
09/03/2023 18:15 - 18:29	49	15	27	8	99	362
09/03/2023 18:30 - 18:44	40	6	31	2	79	345
09/03/2023 18:45 - 18:59	37	0	21	2	60	329
09/03/2023 19:00 - 19:14	28	0	27	4	59	297
09/03/2023 19:15 - 19:29	46	3	26	13	88	286
09/03/2023 19:30 - 19:44	19	0	20	3	42	249
09/03/2023 19:45 - 19:59	20	1	13	0	34	223
09/03/2023 20:00 - 20:14	19	0	18	0	37	201
09/03/2023 20:15 - 20:29	10	0	17	0	27	140
09/03/2023 20:30 - 20:44	13	0	11	0	24	122
09/03/2023 20:45 - 20:59	17	0	6	0	23	111
09/03/2023 21:00 - 21:14	10	0	10	0	20	94
09/03/2023 21:15 - 21:29	9	1	7	1	18	85
09/03/2023 21:30 - 21:44	7	0	5	1	13	74
09/03/2023 21:45 - 21:59	7	0	4	0	11	62
09/03/2023 22:00 - 22:14	8	0	9	1	18	60
09/03/2023 22:15 - 22:29	4	0	8	0	12	54
09/03/2023 22:30 - 22:44	1	2	6	1	10	51
09/03/2023 22:45 - 22:59	7	0	1	0	8	48
09/03/2023 23:00 - 23:14	1	0	4	0	5	35
09/03/2023 23:15 - 23:29	3	1	3	0	7	30
09/03/2023 23:30 - 23:44	3	1	1	0	5	25
09/03/2023 23:45 - 23:59	1	0	7	0	8	25
10/03/2023 00:00 - 00:14	2	0	2	0	4	24
10/03/2023 00:15 - 00:29	2	0	5	0	7	24
10/03/2023 00:30 - 00:44	1	0	1	0	2	21
10/03/2023 00:45 - 00:59	0	0	2	0	2	15
10/03/2023 01:00 - 01:14	2	0	2	0	4	15
10/03/2023 01:15 - 01:29	3	0	2	0	5	13
10/03/2023 01:30 - 01:44	1	0	1	0	2	13
10/03/2023 01:45 - 01:59	0	0	1	0	1	12
10/03/2023 02:00 - 02:14	0	0	3	0	3	11
10/03/2023 02:15 - 02:29	2	1	1	0	4	10
10/03/2023 02:30 - 02:44	2	0	0	0	2	10

DATE & TIME	NORTHBOUND		SOUTHBOUND		TOTAL	Hourly
	LV	HV	LV	HV		
10/03/2023 02:45 - 02:59	0	0	1	1	2	11
10/03/2023 03:00 - 03:14	4	0	2	0	6	14
10/03/2023 03:15 - 03:29	5	2	4	0	11	21
10/03/2023 03:30 - 03:44	2	0	2	0	4	23
10/03/2023 03:45 - 03:59	4	0	0	0	4	25
10/03/2023 04:00 - 04:14	1	0	3	1	5	24
10/03/2023 04:15 - 04:29	3	1	3	0	7	20
10/03/2023 04:30 - 04:44	6	2	3	14	25	41
10/03/2023 04:45 - 04:59	5	0	6	2	13	50
10/03/2023 05:00 - 05:14	6	2	5	3	16	61
10/03/2023 05:15 - 05:29	9	6	9	8	32	86
10/03/2023 05:30 - 05:44	10	2	17	4	33	94
10/03/2023 05:45 - 05:59	23	5	16	11	55	136
10/03/2023 06:00 - 06:14	11	1	23	1	36	156
10/03/2023 06:15 - 06:29	25	1	30	5	61	185
10/03/2023 06:30 - 06:44	30	2	32	3	67	219
10/03/2023 06:45 - 06:59	41	4	39	3	87	251
10/03/2023 07:00 - 07:14	61	4	60	5	130	345
10/03/2023 07:15 - 07:29	61	3	67	0	131	415
10/03/2023 07:30 - 07:44	41	7	52	0	100	448
10/03/2023 07:45 - 07:59	53	6	39	1	99	460
10/03/2023 08:00 - 08:14	29	3	44	1	77	407
10/03/2023 08:15 - 08:29	27	7	29	2	65	341
10/03/2023 08:30 - 08:44	37	4	42	3	86	327
10/03/2023 08:45 - 08:59	32	4	44	7	87	315
10/03/2023 09:00 - 09:14	27	4	32	3	66	304
10/03/2023 09:15 - 09:29	30	4	27	2	63	302
10/03/2023 09:30 - 09:44	43	1	45	2	91	307
10/03/2023 09:45 - 09:59	38	1	43	2	84	304
10/03/2023 10:00 - 10:14	28	1	44	7	80	318
10/03/2023 10:15 - 10:29	37	5	49	5	96	351
10/03/2023 10:30 - 10:44	33	1	61	7	102	362
10/03/2023 10:45 - 10:59	40	8	54	6	108	386
10/03/2023 11:00 - 11:14	38	4	48	5	95	401
10/03/2023 11:15 - 11:29	39	5	50	2	96	401
10/03/2023 11:30 - 11:44	32	7	52	9	100	399
10/03/2023 11:45 - 11:59	44	10	57	9	120	411
10/03/2023 12:00 - 12:14	49	4	45	6	104	420
10/03/2023 12:15 - 12:29	41	2	47	1	91	415
10/03/2023 12:30 - 12:44	40	3	48	8	99	414
10/03/2023 12:45 - 12:59	41	5	35	3	84	378
10/03/2023 13:00 - 13:14	45	6	44	8	103	377
10/03/2023 13:15 - 13:29	41	3	51	5	100	386

DATE & TIME	NORTHBOUND		SOUTHBOUND		TOTAL	Hourly
	LV	HV	LV	HV		
10/03/2023 13:30 - 13:44	46	11	45	3	105	392
10/03/2023 13:45 - 13:59	61	12	41	5	119	427
10/03/2023 14:00 - 14:14	67	8	50	9	134	458
10/03/2023 14:15 - 14:29	58	6	62	9	135	493
10/03/2023 14:30 - 14:44	72	7	45	2	126	514
10/03/2023 14:45 - 14:59	73	8	49	6	136	531
10/03/2023 15:00 - 15:14	60	4	55	13	132	529
10/03/2023 15:15 - 15:29	45	6	60	6	117	511
10/03/2023 15:30 - 15:44	54	7	44	5	110	495
10/03/2023 15:45 - 15:59	50	6	70	6	132	491
10/03/2023 16:00 - 16:14	52	5	61	2	120	479
10/03/2023 16:15 - 16:29	44	4	64	4	116	478
10/03/2023 16:30 - 16:44	56	9	43	5	113	481
10/03/2023 16:45 - 16:59	61	7	53	5	126	475
10/03/2023 17:00 - 17:14	55	3	43	4	105	460
10/03/2023 17:15 - 17:29	65	7	48	3	123	467
10/03/2023 17:30 - 17:44	53	8	55	3	119	473
10/03/2023 17:45 - 17:59	50	6	46	7	109	456
10/03/2023 18:00 - 18:14	56	5	46	2	109	460
10/03/2023 18:15 - 18:29	68	5	48	3	124	461
10/03/2023 18:30 - 18:44	43	1	45	3	92	434
10/03/2023 18:45 - 18:59	54	1	39	2	96	421
10/03/2023 19:00 - 19:14	43	0	45	2	90	402
10/03/2023 19:15 - 19:29	48	2	30	3	83	361
10/03/2023 19:30 - 19:44	37	0	32	0	69	338
10/03/2023 19:45 - 19:59	23	2	33	1	59	301
10/03/2023 20:00 - 20:14	21	1	33	1	56	267
10/03/2023 20:15 - 20:29	12	2	18	1	33	217
10/03/2023 20:30 - 20:44	17	1	18	2	38	186
10/03/2023 20:45 - 20:59	21	0	18	1	40	167
10/03/2023 21:00 - 21:14	15	2	15	1	33	144
10/03/2023 21:15 - 21:29	17	0	15	3	35	146
10/03/2023 21:30 - 21:44	16	0	24	2	42	150
10/03/2023 21:45 - 21:59	12	0	13	0	25	135
10/03/2023 22:00 - 22:14	14	1	8	0	23	125
10/03/2023 22:15 - 22:29	16	0	7	1	24	114
10/03/2023 22:30 - 22:44	6	0	12	0	18	90
10/03/2023 22:45 - 22:59	12	0	9	0	21	86
10/03/2023 23:00 - 23:14	8	1	8	3	20	83
10/03/2023 23:15 - 23:29	4	0	11	0	15	74
10/03/2023 23:30 - 23:44	3	0	4	0	7	63
10/03/2023 23:45 - 23:59	9	1	11	0	21	63
11/03/2023 00:00 - 00:14	0	0	7	0	7	50

DATE & TIME	NORTHBOUND		SOUTHBOUND		TOTAL	Hourly
	LV	HV	LV	HV		
11/03/2023 00:15 - 00:29	1	0	8	0	9	44
11/03/2023 00:30 - 00:44	4	0	6	0	10	47
11/03/2023 00:45 - 00:59	2	0	7	0	9	35
11/03/2023 01:00 - 01:14	5	0	5	0	10	38
11/03/2023 01:15 - 01:29	3	0	3	0	6	35
11/03/2023 01:30 - 01:44	3	0	8	0	11	36
11/03/2023 01:45 - 01:59	0	0	4	1	5	32
11/03/2023 02:00 - 02:14	4	0	4	0	8	30
11/03/2023 02:15 - 02:29	1	0	3	0	4	28
11/03/2023 02:30 - 02:44	2	1	4	0	7	24
11/03/2023 02:45 - 02:59	1	0	0	0	1	20
11/03/2023 03:00 - 03:14	2	0	6	1	9	21
11/03/2023 03:15 - 03:29	4	0	3	2	9	26
11/03/2023 03:30 - 03:44	5	3	4	0	12	31
11/03/2023 03:45 - 03:59	5	0	2	0	7	37
11/03/2023 04:00 - 04:14	0	0	6	1	7	35
11/03/2023 04:15 - 04:29	7	0	12	0	19	45
11/03/2023 04:30 - 04:44	3	0	11	2	16	49
11/03/2023 04:45 - 04:59	4	0	7	0	11	53
11/03/2023 05:00 - 05:14	10	6	4	2	22	68
11/03/2023 05:15 - 05:29	13	1	20	2	36	85
11/03/2023 05:30 - 05:44	11	3	24	8	46	115
11/03/2023 05:45 - 05:59	26	11	28	8	73	177
11/03/2023 06:00 - 06:14	33	3	19	2	57	212
11/03/2023 06:15 - 06:29	22	0	33	7	62	238
11/03/2023 06:30 - 06:44	20	2	27	3	52	244
11/03/2023 06:45 - 06:59	20	0	28	2	50	221
11/03/2023 07:00 - 07:14	29	1	35	3	68	232
11/03/2023 07:15 - 07:29	37	5	35	11	88	258
11/03/2023 07:30 - 07:44	29	0	31	6	66	272
11/03/2023 07:45 - 07:59	36	1	37	4	78	300
11/03/2023 08:00 - 08:14	22	1	43	9	75	307
11/03/2023 08:15 - 08:29	33	2	40	6	81	300
11/03/2023 08:30 - 08:44	31	2	41	7	81	315
11/03/2023 08:45 - 08:59	42	2	35	6	85	322
11/03/2023 09:00 - 09:14	33	1	35	4	73	320
11/03/2023 09:15 - 09:29	29	5	41	10	85	324
11/03/2023 09:30 - 09:44	38	5	31	17	91	334
11/03/2023 09:45 - 09:59	34	1	38	11	84	333
11/03/2023 10:00 - 10:14	37	2	36	5	80	340
11/03/2023 10:15 - 10:29	29	1	45	5	80	335
11/03/2023 10:30 - 10:44	29	8	56	9	102	346
11/03/2023 10:45 - 10:59	47	4	43	9	103	365

DATE & TIME	NORTHBOUND		SOUTHBOUND		TOTAL	Hourly
	LV	HV	LV	HV		
11/03/2023 11:00 - 11:14	26	0	37	10	73	358
11/03/2023 11:15 - 11:29	43	4	45	4	96	374
11/03/2023 11:30 - 11:44	42	1	39	10	92	364
11/03/2023 11:45 - 11:59	31	11	40	8	90	351
11/03/2023 12:00 - 12:14	42	4	47	2	95	373
11/03/2023 12:15 - 12:29	35	8	39	8	90	367
11/03/2023 12:30 - 12:44	26	4	36	3	69	344
11/03/2023 12:45 - 12:59	48	6	43	5	102	356
11/03/2023 13:00 - 13:14	41	4	39	4	88	349
11/03/2023 13:15 - 13:29	42	4	49	2	97	356

TABLE 3: PEAK HOUR TRAFFIC COUNTS

Intersection	2023 Count	Peak hour	Peak hour Factor
AM TRAFFIC			
R40 / Casteel Dam	460	07:00 – 08:00	0.88
WEEKDAY PM TRAFFIC			
R40 / Casteel Dam	399	15:00 – 16:00	0.95
FRIDAY PM TRAFFIC			
R40 / Casteel Dam	531	14:00 – 15:00	0.98
SATURDAY PEAK TRAFFIC			
R40 / Casteel Dam	374	10:30 – 11:30	0.91

The observed traffic volumes are shown in Appendix A to this report.

3.2 VEHICLE SPEEDS ALONG R40 AT THE ACCESS INTERSECTION LOCALITY

A speed profile of the vehicles travelling both north and southbound along the R40 at the Casteel Dam access intersection has been measured from 12:00 Thursday 09 March 2023 until 13:30 Saturday 11 March 2023.

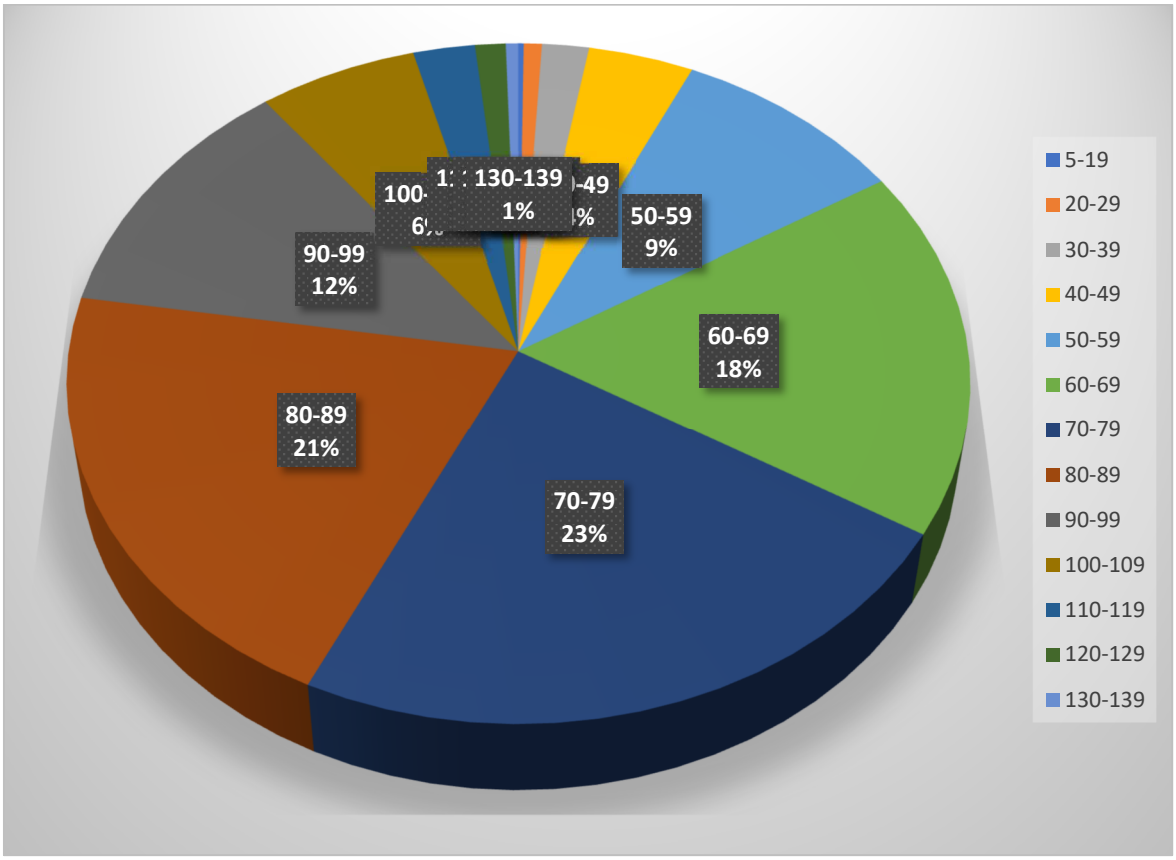
A sample size of 11 901 vehicles has been measured and is applicable to this analysis.

Speed - Km/h														
Date/Time	5-19	20 29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110 - 119	120 - 129	130-139	140-149
09/03/2023 11:00 - 11:59	2	7	13	21	20	21	17	11	4	0	0	0	0	0
09/03/2023 12:00 - 12:59	0	7	11	21	40	67	66	51	21	9	1	0	0	0
09/03/2023 13:00 - 13:59	0	1	1	13	30	59	63	53	26	17	6	8	1	0
09/03/2023 14:00 - 14:59	0	2	6	18	27	58	71	69	39	20	7	7	1	0
09/03/2023 15:00 - 15:59	1	3	7	28	34	73	109	81	33	21	6	3	0	0
09/03/2023 16:00 - 16:59	1	3	9	16	43	69	92	60	36	15	10	2	2	0
09/03/2023 17:00 - 17:59	1	1	5	15	32	71	85	81	38	17	5	2	1	1
09/03/2023 18:00 - 18:59	2	3	7	19	31	82	78	65	29	8	3	1	0	1
09/03/2023 19:00 - 19:59	0	2	0	15	28	58	61	34	16	6	0	2	1	0
09/03/2023 20:00 - 20:59	0	0	2	2	10	22	25	21	16	4	7	1	1	0
09/03/2023 21:00 - 21:59	0	0	1	2	2	9	20	12	11	2	1	1	1	0
09/03/2023 22:00 - 22:59	0	0	2	2	8	7	7	8	8	3	1	2	0	0
09/03/2023 23:00 - 23:59	0	0	0	2	3	2	4	6	5	2	1	0	0	0
10/03/2023 00:00 - 00:59	0	0	1	2	1	5	2	2	2	0	0	0	0	0
10/03/2023 01:00 - 01:59	0	0	0	0	0	0	1	3	5	2	0	0	0	1
10/03/2023 02:00 - 02:59	0	0	0	0	1	1	0	5	3	1	0	0	0	0
10/03/2023 03:00 - 03:59	0	0	1	0	0	2	2	8	5	5	0	1	0	1
10/03/2023 04:00 - 04:59	0	0	1	8	8	8	8	4	5	4	2	2	0	0
10/03/2023 05:00 - 05:59	0	2	2	9	16	21	25	24	15	13	3	4	1	0
10/03/2023 06:00 - 06:59	0	3	1	8	22	28	52	61	38	20	11	7	0	0
10/03/2023 07:00 - 07:59	2	1	5	14	30	54	92	125	76	34	10	8	6	3
10/03/2023 08:00 - 08:59	1	3	2	10	22	44	75	67	48	27	7	6	3	0
10/03/2023 09:00 - 09:59	1	2	12	9	22	45	66	69	39	24	10	2	2	0
10/03/2023 10:00 - 10:59	0	2	4	14	28	61	97	96	46	25	6	7	0	0
10/03/2023 11:00 - 11:59	1	5	2	19	47	81	107	70	30	30	11	4	2	0
10/03/2023	0	0	3	11	24	65	109	76	57	16	10	5	2	0

Speed - Km/h														
Date/Time	5-19	20 29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110 - 119	120 - 129	130-139	140-149
12:00 - 12:59														
10/03/2023 13:00 - 13:59	2	2	9	17	31	87	94	102	51	19	5	5	3	0
10/03/2023 14:00 - 14:59	0	4	14	15	47	101	140	99	66	29	11	3	2	0
10/03/2023 15:00 - 15:59	2	6	5	7	33	73	134	109	63	38	12	5	2	2
10/03/2023 16:00 - 16:59	0	3	6	16	42	68	103	116	62	33	21	1	3	0
10/03/2023 17:00 - 17:59	1	0	9	13	56	67	92	102	67	27	12	7	2	1
10/03/2023 18:00 - 18:59	0	4	16	14	21	86	114	94	46	11	9	3	3	0
10/03/2023 19:00 - 19:59	0	1	3	8	41	83	73	52	23	9	3	4	1	0
10/03/2023 20:00 - 20:59	0	1	0	8	21	38	33	27	19	9	6	4	0	1
10/03/2023 21:00 - 21:59	2	2	0	1	18	25	35	23	15	10	2	1	0	1
10/03/2023 22:00 - 22:59	0	0	1	2	7	17	19	17	11	5	4	1	1	1
10/03/2023 23:00 - 23:59	0	2	0	2	5	6	14	9	11	9	3	1	1	0
11/03/2023 00:00 - 00:59	0	0	2	0	2	4	6	9	7	2	2	0	1	0
11/03/2023 01:00 - 01:59	0	0	0	1	2	6	9	4	7	1	2	0	0	0
11/03/2023 02:00 - 02:59	0	0	0	0	2	2	3	6	1	4	2	0	0	0
11/03/2023 03:00 - 03:59	0	0	3	4	3	4	4	8	4	4	3	0	0	0
11/03/2023 04:00 - 04:59	0	1	2	1	8	13	8	5	4	6	4	0	1	0
11/03/2023 05:00 - 05:59	0	0	2	15	19	38	33	30	23	11	4	2	0	0
11/03/2023 06:00 - 06:59	0	1	5	11	22	24	44	42	30	20	14	1	2	4
11/03/2023 07:00 - 07:59	1	3	10	15	21	46	52	57	38	36	11	5	4	1
11/03/2023 08:00 - 08:59	0	3	8	10	32	48	60	78	41	24	11	5	1	1
11/03/2023 09:00 - 09:59	2	1	6	11	30	45	70	64	55	33	10	4	1	1
11/03/2023 10:00 - 10:59	2	0	7	16	33	67	87	65	43	29	8	7	1	0
11/03/2023 11:00 - 11:59	0	1	10	16	28	60	91	82	39	16	3	3	1	0
11/03/2023 12:00 - 12:59	1	2	3	11	32	54	99	67	44	23	9	4	4	2
11/03/2023 13:00 - 13:59	1	1	2	4	19	29	49	34	26	15	2	3	0	0

Speed - Km/h														
Date/Time	5-19	20 29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110 - 119	120 - 129	130-139	140-149
Totals / Speed Category	26	85	221	496	1104	2104	2800	2463	1447	748	291	144	58	22

FIGURE 3: SPEED CATEGORIES – PIE CHART



It is evident from the above that the majority of vehicles were traveling at a speed of between 70 – 79 km/h and that 62% of vehicles were travelling at a speed between 60 – 90 km/h.

The following has been deduced:

- Average speed; 72 km/h
- 85th Percentile Speed (design speed): 91 km/h

4. ANALYSIS: EXISTING SCENARIO 2023

4.1 AM AND PM: PEAK ANALYSIS

The Traffix for Windows as well as Sidra Intersection 5.0 software package was used to determine the existing levels of service, V/C ratios and the total delay experienced at the analysed intersections.
Analysis performed is based on the method dictated in the Highway Capacity Manual.

It is evident from table 4 below that all of the analysed intersections are currently (2023) prior to construction (development) operating at an acceptable level of service.

No intersections need therefore to be upgraded in order to accommodate the existing 2023 background traffic demand.

TABLE 4: PEAK HOUR EXISTING LEVELS OF SERVICE (2023)

INTER-SECTION	LEVELS OF SERVICE AND DELAY (s)												
	Northbound			Southbound			Eastbound			Westbound			Int
	L	S	R	L	S	R	L	S	R	L	S	R	LOS
WEEKDAY AM													
R40 / D3950	A	A	A	A	A	A	B	A	B	n/a	n/a	n/a	B
	0	0	0	0	0	8.1	10.1	0	14.4	n/a	n/a	n/a	12.3
R40 / Access	A	A	A	A	A	A	A	A	A	A	A	B	B
	0	0	7.9	0	0	0	0	0	0	0	0	11.8	11.8
WEEKDAY PM													
R40 / D3950	A	A	A	A	A	A	B	A	C	n/a	n/a	n/a	B
	0	0	0	0	0	8.3	10.6	0	15.1	n/a	n/a	n/a	13
R40 / Access	A	A	A	A	A	A	A	A	A	A	A	B	B
	0	0	7.9	0	0	0	0	0	0	0	0	11.5	11.5

5. TRIP GENERATION & TRIP DISTRIBUTION

The Department of Water Affairs is desirous to rehabilitate the Casteel Dam near Acornhoek, Bushbuck Ridge in the near future.

The trip generation for construction purposes will be mostly tipper trucks, importing material from the borrow to the dam wall and public transportation, transporting workers to and from the site.

The following has been deemed to be applicable to this project, following a discussion meeting with the DWS:

Predicted traffic volumes for heavy construction vehicles:

- 6m^3 trucks would be used to transport the construction material from quarry to Casteel Dam.
- The material volumes include:
    - 28 000m^3 of gravel
    - 5000m^3 of concrete
    - 2500m^3 of Rockfill
- It is predicted that a minimum of 150 and maximum 200 workers will be coming to site on a daily basis by means of public transportation;

5.1 IMPORTATION OF MATERIAL FROM QUARRY TO CONSTRUCTION SITE

The exact locality of the quarry from where fill material for the dam wall will be sourced was still not finalised at the time of this report.

It was however indicated by DWS that the material will most probably source from Agin Court, which is located to the south of the construction site.

Although the project is expected to be 24 months (2-year project), the importation of filling material activity of the project plan was assumed to be 3 months for the purposes of this study.

The following assumptions have been maid in order to determine the delivery truck volume per hour:

5.2 DEVELOPMENT TRIP GENERATION, DISTRIBUTION AND ASSIGNMENT TO THE ROAD NETWORK

5.2.1 ASSUMPTIONS

- Importation of fill material: 4 months;
- Days work per month: 22;
- Hours per day: 8 hours / day;
- 6 m^3 trucks at uniform arrivals.
- Importation of Concrete: 5000m^3 in three months;
- Importation of Rockfill: 2500 m^3 in two months.
- The activities of importation of fill, Concrete and rockfill will all overlap and coincide for a short period, but will result in a worst-case peak hour trip generation for that period.

5.2.3 TRIP GENERATION

Following the above, the anticipated trip generation has been determined and tabled in table 5 below for ease of reference.

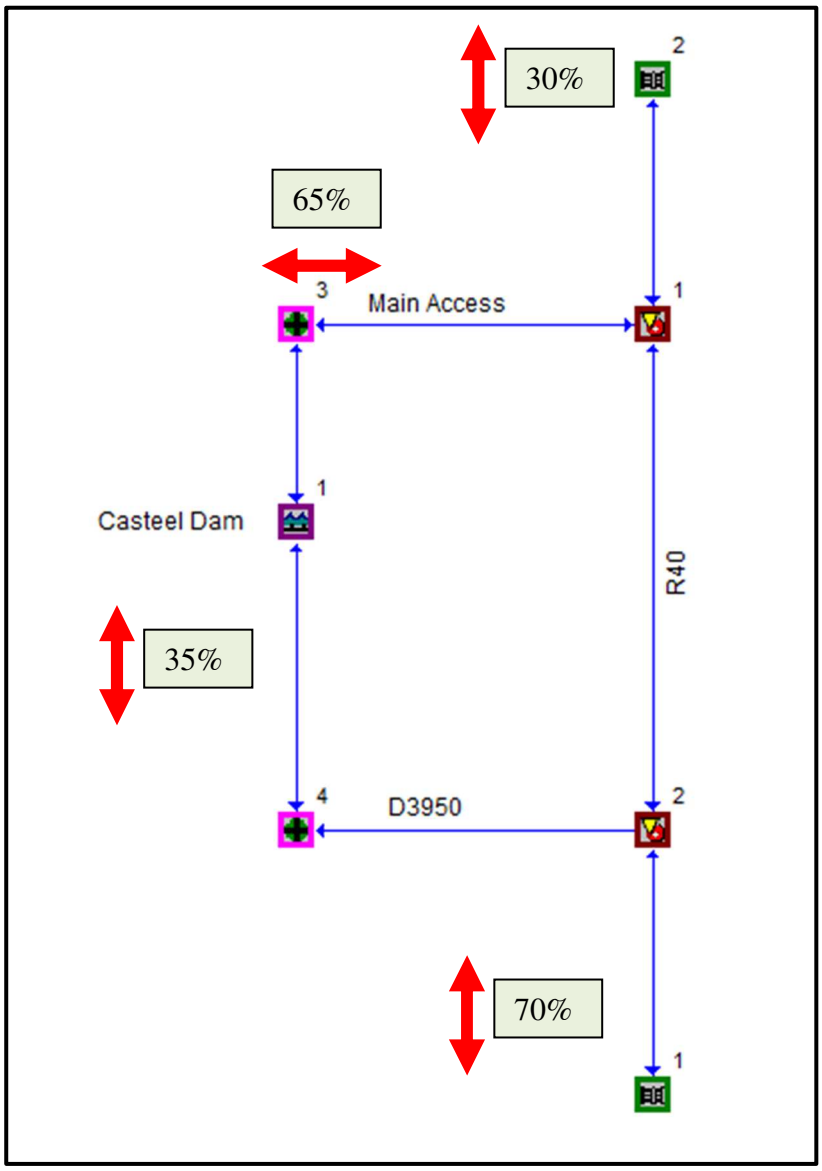
TABLE 5: DEVELOPMENT TRIP GENERATION

Activity	Volume / No	Truck Volume (m^3)	Duration of Activity (Months)	Work Days / Month	Work Hours / Day	Directional Split (peak hour)		Trucks / Busses		Midi Busses	
						IN	OUT	IN	OUT	IN	OUT
Tipper Trucks (Fill)	28000	6	4	22	8	7	7	7	7		
Concrete Trucks	5000	5	3	22	8	2	2	2	2		
Tipper Trucks (Rock Fill)	2500	6	2	22	8	2	2	2	2		
Workers	200	10/midi bus				20	20			20	20
Total						**31**	**31**	**11**	**11**	**20**	**20**

5.1.2 TRIP DISTRIBUTION

The trip distribution was deduced from the existing traffic counts. The development trips are expected to distribute in accordance with figure 4 below.

FIGURE 4: TRAFFIX ROAD NETWORK & TRIP DISTRIBUTION



The anticipated trip generation and distribution as per this section was added to the existing background traffic (as per section 3) and analysed as such. The aforesaid analysis is included in sections 6 & 7 of this report.

6. BASE YEAR ANALYSIS WITH DEVELOPMENT (2023)

The trips that are expected to be generated by the construction activities (refer paragraph 5.1.1) was assigned to the existing background traffic and distributed in accordance with paragraph 5.1.2 and analysed as such. A peak hour factor of 0.85 has been used in the analysis.

It is evident from tables 6 (quarry located to the south) and 7 (quarry located to the north) below that all of the analysed intersections are expected to be operating at acceptable levels of service with the addition of construction traffic

TABLE 6: PEAK HOUR LEVELS OF SERVICE (QUARRY LOCATED TO THE SOUTH OF SITE)

INTER-SECTION	LEVELS OF SERVICE AND DELAY (s)												
	Northbound			Southbound			Eastbound			Westbound			Int
	L	S	R	L	S	R	L	S	R	L	S	R	LOS
WEEKDAY AM													
R40 / D3950	A	A	A	A	A	A	B	A	C	n/a	n/a	n/a	B
	0	0	0	0	0	8.3	14.4	0	15.6	n/a	n/a	n/a	13.3
R40 / Access	A	A	A	A	A	A	A	A	A	B	A	B	B
	0	0	8.0	0	0	8.1	0	0	0	12.9	0	13.2	13.2
WEEKDAY PM													
R40 / D3950	A	A	A	A	A	A	B	A	C	n/a	n/a	n/a	B
	0	0	0	0	0	8.5	10.9	0	16.4	n/a	n/a	n/a	14.1
R40 / Access	A	A	A	A	A	A	A	A	A	B	A	B	B
	0	0	8.1	0	0	8.3	0	0	0	14.1	0	12.6	14.1

Due thereto that the exact locality of the quarry hasn't been finalised yet, an analysis scenario in the event of quarry located to the north of the construction site is tabled in table 7 below.

TABLE 7: PEAK HOUR LEVELS OF SERVICE (QUARRY LOCATED TO THE NORTH OF SITE)

INTER-SECTION	LEVELS OF SERVICE AND DELAY (s)												
	Northbound			Southbound			Eastbound			Westbound			Int
	L	S	R	L	S	R	L	S	R	L	S	R	LOS
WEEKDAY AM													
R40 / D3950	A	A	A	A	A	A	B	A	C	n/a	n/a	n/a	B
	0	0	0	0	0	8.3	10.4	0	15.1	n/a	n/a	n/a	12.9
R40 / Access	A	A	A	A	A	A	A	A	A	B	A	B	B
	0	0	8.0	0	0	8.1	0	0	0	11.3	0	13.8	13.8
WEEKDAY PM													
R40 / D3950	A	A	A	A	A	A	B	A	C	n/a	n/a	n/a	B
	0	0	0	0	0	8.5	10.8	0	15.8	n/a	n/a	n/a	13.6
R40 / Access	A	A	A	A	A	A	A	A	A	B	A	B	B
	0	0	8.1	0	0	8.3	0	0	0	12.1	0	13.0	13.0

7. ACCESS INTERSECTIONS

7.1 ACCESS TO THE CONSTRUCTION SITE

Access to the construction site will be provided at two localities:

- Existing Casteel Dam Access;
- Existing R40 / D3950 intersection

7.1.1 Existing Casteel Dam Access (24°41'19.43"S 31° 1'40.07"E)

An existing access to the Casteel Dam is located along the R40 at a locality as described above and depicted in figure 5 further below.

It is the intention that this access will be used by construction vehicles to and from the construction site.
It is anticipated that most of the construction vehicles will use this entrance and some of the public transport vehicles (taxis) as well.

The existing access which will be slightly re-aligned in order to allow for better manoeuvrability to and from the R40 as is currently the case.

The access will remain after completion of the construction and be used for maintenance purposes.

The access as discussed above is depicted in figure 5 below.

FIGURE 5: CATEEL DAM ACCESS

7.1.2 Existing R40 / D3950 Intersection (24°42'12.96"S 31° 1'37.10"E)

The above mentioned intersection is located to the south of the Casteel Dam.
Road D3950 currently provides access to the rural residential villages located to the west of the R40 such as Casteel and Whales.
Although there is currently no existing road which links D3950 with the Casteel Dam, a short link road of less than 300m could be constructed. This route from the R40 via D3950, internal township road and ultimately newly constructed portion will provide an alternative access to the construction site.

Due to the proximity of the rural townships mentioned above, it is anticipated that a number of local workers may reside in these villages and will therefore approach the construction site via this route.

It is anticipated that the majority of transportation vehicles will approach the construction site via this access.

7.2 ACCESS INTERSECTION SIGHT DISTANCE (CASTEEL DAM ACCESS)

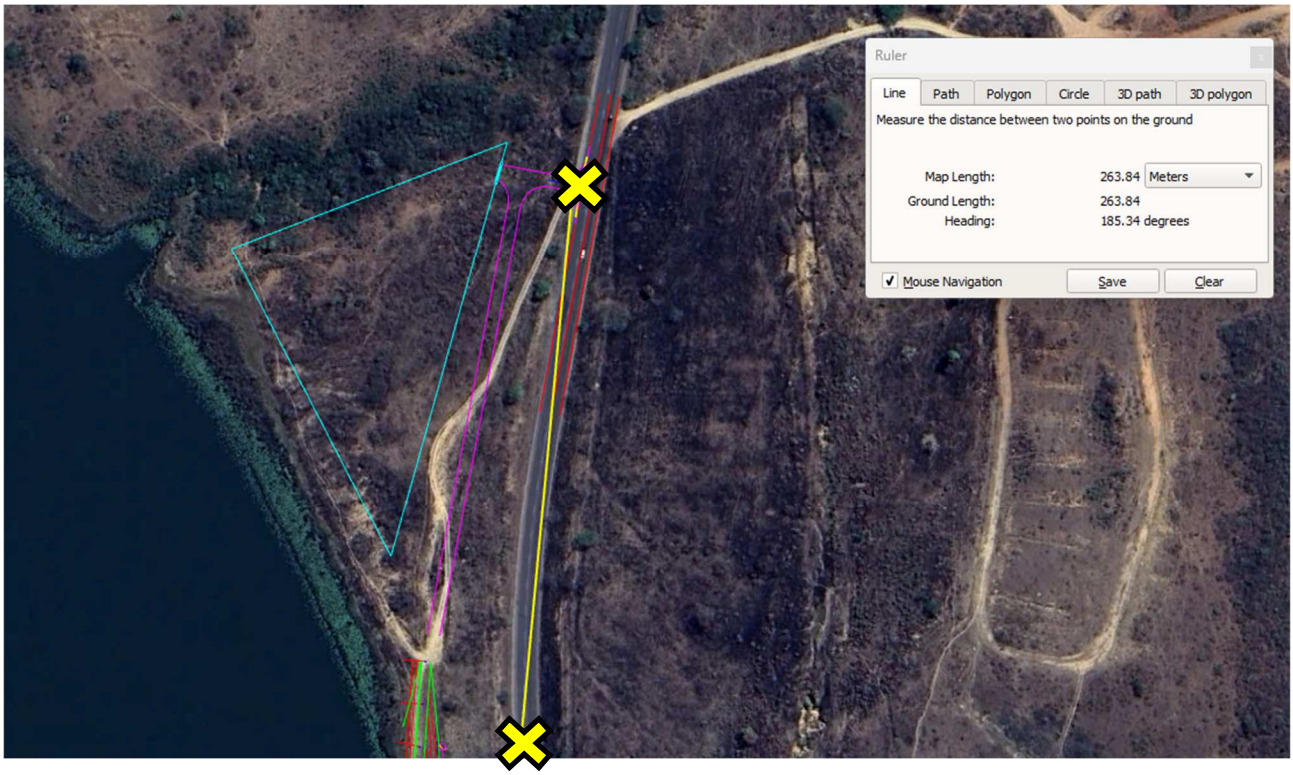
7.2.1: AVAILABLE SIGHT DISTANCE

Sight distance towards the north (left shoulder) along the R40 as well as towards the south (over right shoulder) is as follow:

North: 275m (Vertical Curve)

South: 263m (Horizontal Curve)

FIGURE 6: R40 SIGHT TOWARDS SOUTH



REQUIRED SIGHT DISTANCE

The following elements have an influence on the sight distance calculation and consequently need to be considered prior to the sight distance calculation:

Vehicular speeds along R40;

Grade of Access;

R40 cross section (width and number of lanes).

The above elements are discussed below as bulleted above.

VEHICULAR SPEED ALONG R40 (REFER SECTION 3.2)

A 85th percentile speed of 91 km/h has been found to be applicable from a sample size of 11 901 vehicles.
A conservative speed of 100 km/h has been utilised for sight distance calculations

GRADIENT OF ACCECSS ROAD

The access gradient is less than 4% and will therefore not have any impact on the site distance calculation.

ROAD CROSS SECTIONS AT THE ACCESS INTERSECTION

R40 is a two-lane single carriageway road of approximately 10.0m wide (at the access locality). The development access is a full access with standard gap size requirements.

GAP ACCEPTANCE SIGHT DISTANCE (SHOULDER SIGHT DISTANCE)

Having taking cognisance of the discussion above, the relevant shoulder and stopping sight distances are discussed in the remainder if this section.

The shoulder sight distance (as described by the Committee of State Road Authorities) or the Gap acceptance sight distance is the sight distance required by drivers entering an intersection to enable them to establish that it is safe to do so and then carry out the manoeuvres necessary either to join or to cross the opposing traffic stream.

Sight distance values are based on the ability of the driver of a vehicle to see an approaching vehicle along the main road. Shoulder sight distances are measured from an eye height of 1.05m to an object height of 1.05m (passenger car). The eye height from trucks is 1.8m

Since the volume of heavy vehicles that will make use of this entrance is unsubstantial, the sight distance requirements of a light vehicle will be applicable to this sight distance calculation.

Sight distance calculations are based on speeds as discussed above.

REQUIRED GAP ACCEPTANCE SIGHT DISTANCE CALCULATION

The TMH 16 Vol. 2 (South African Traffic Impact and Site Impact Assessment Standards & Requirements Manual) prescribes a sight distance that will be equal to a gap size of 7.5s (for

passenger cars) for right turn and 6.5s for left turn. Due to construction activities, the gap size requirements for trucks have been adopted (8.5s left and 9.5s for right turn manoeuvres)

The sight distance calculation is therefore as follow:

The following attributes are applicable to R40:

Gradient : < 4%;

Gap size adjustment due to gradient not applicable;

Speed : 100 km/h

Required sight towards the north along R40 (right turn): (100 km/h / 3.6) x (9.5) = 264m

Required sight towards the south (right turn): (100 km/h / 3.6 x (8.5) = 236m

The above sight distance calculations are compared with prescribed norms and are tabled in table 8 below for ease of reference.

TABLE: 8 SUMMARY OF SIGHT DISTANCE CALCULATIONS (100 km/h)

INTERSECTION	REFERENCE	SIGHT DISTANCE TOWARDS	REQUIRED (m)	AVAILABLE	RESULT
R40 / Access	TMH 16	Towards north (right turn)	264	275	OK
		Towards south (left turn)	236	263	OK

Following all of the above, sight distances at the existing access locality are acceptable.

2.2: STOPPING SIGHT DISTANCE

The stopping sight distance is defined as the required distance along the main road to bring a vehicle safely to a standstill if required. Stopping sight distance is measured from an eye height of 1.05m to an object height of 0.15m (eye height of 1.8m for trucks). Stopping sight distance is expresses as:

$$S = 0.694v + v^2/254f+-G$$

The required stopping sight distance is calculated to be 205m. The required stopping sight distance is available on site at the access intersections locality.

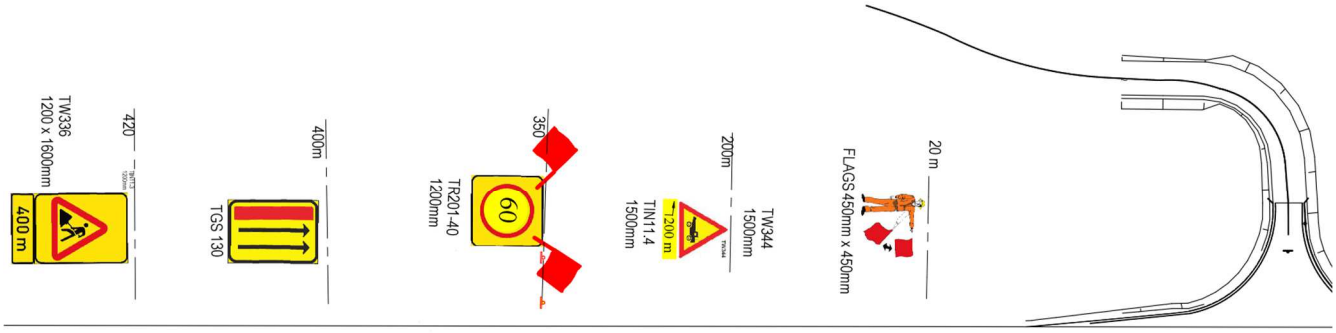
7.3 ACCESS INTERSECTION SAFETY (CASTEEL DAM ACCESS)

Irrespective the fact that sight distances are in order for speeds of up to 100km/h, the speed of some construction vehicles may be slow to enter / exit the R40 at the access intersection which may impose a safety hazard.

It is advised that additional safety precautions be implemented for the duration of the construction period.

It is advised that temporarily construction signage be provided in accordance with the South African Road Traffic Signs Manual Vol 2, Chapter 13.

FIGURE 7: TYPICAL CONSTRUCTION SIGNS



The above depicted scenario is applicable to both sides of the access intersection.

8. PUBLIC TRANSPORTATION

Public transport is this area is mainly provided by means of mini-bus taxis and private transportation companies.

It is foreseen that a vast number of workers at the construction site will be dependent on public transportation.

A safe drop off and loading area shall be provided at the construction site for daily commuters.

9. CONCLUSIONS & RECOMMENDATIONS

9.1 CONCLUSIONS

It has been found that:

- All of the analysed intersections are currently (2023) prior to construction activities operating at an acceptable level of service.

- No intersections need therefore to be upgraded in order to accommodate the existing 2023 background traffic;

- The following has been deduced from a survey of 11 901 vehicles passing the site:
  - Average speed; 72 km/h
  - 85th Percentile Speed (design speed): 91 km/h

- The trip generation of the construction (development) is expected to be as follow:
  - 62 AM trips (31 in; 31 out);
  - 62 PM trips (31 in; 31 out).

- No intersection upgrading is required in terms of intersection capacity to accommodate the construction (development) traffic demand;

- The above is applicable for a locality of the quarry to the north of the site as well as a locality of the quarry to the south of the site (refer tables 6 and 7);

- Two routes toward the site construction site will be provided:
  - R40 / Existing Casteel Dam Access Intersection;
  - R40 / D3950 intersection.

- Sight distances at the existing access locality are acceptable;

9.2 RECOMMENDATIONS

Based on the conclusions that have been derived from this study, the following are recommended:

- That both the existing R40 / Casteel Dam access intersection as well as the R40 / D3950 intersection be utilised for access to the construction site;

- That the existing R40 / Casteel Dam access intersection be slightly re-aligned in order to allow for better manoeuvrability to and from the R40 as is currently the case;

- That a safe drop off and loading area be provided at the construction site for daily commuters on public transport;

- That additional safety precautions be implemented for the duration of the construction period;

- It is advised that temporarily construction signage be provided in accordance with the South African Road Traffic Signs Manual Vol 2, Chapter 13 at the R40 / Casteel Dam access intersection located to the north of the dam and the speed reduced to 60km/h at the locality of the access intersection.

REFERENCES

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2. Committee of State Road Authorities, 1988, **TRH 17 Geometric design of Rural Roads,** National Department of Transport, Pretoria.

3. Committee of Transportation Officials, 2012, **South African Trip Data Manual,** TMH17, National Roads Agency Limited, Pretoria.

4. Dowling Associates Inc, 1997, **Traffic for Windows Version 8.0**

5. National Department of Transport, 1995, **Manual for Traffic Impact Studies,** Research Report PR 93/635, BKS (Pty) Ltd, Pretoria.

6. South African National Roads Agency Limited, 2002, **Geometric Design Guidelines,** Version 1.0, CSIR, Pretoria.

7. Transportation Research Board, **Highway Capacity Manual,** Washington D.C.

ANNEXURE A: TRAFFIC VOLUMES

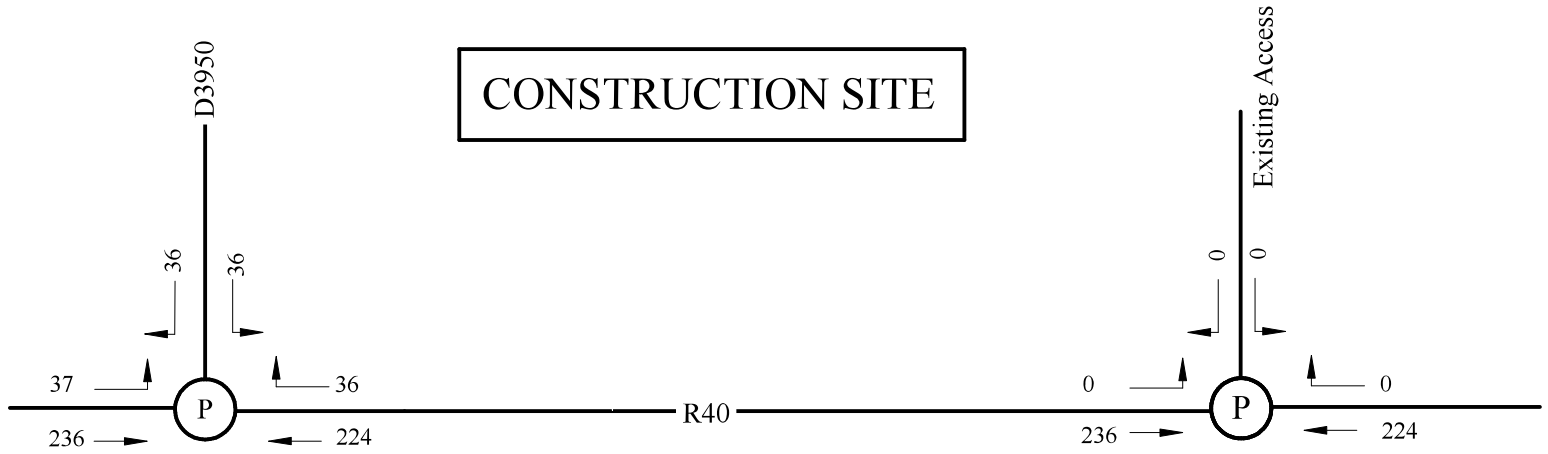
ANNEXURE B: ANALYSIS

P: PRIORITY CONTROL

R: ROUNDABOUT

S: SIGNAL

A: 4 WAY STOP



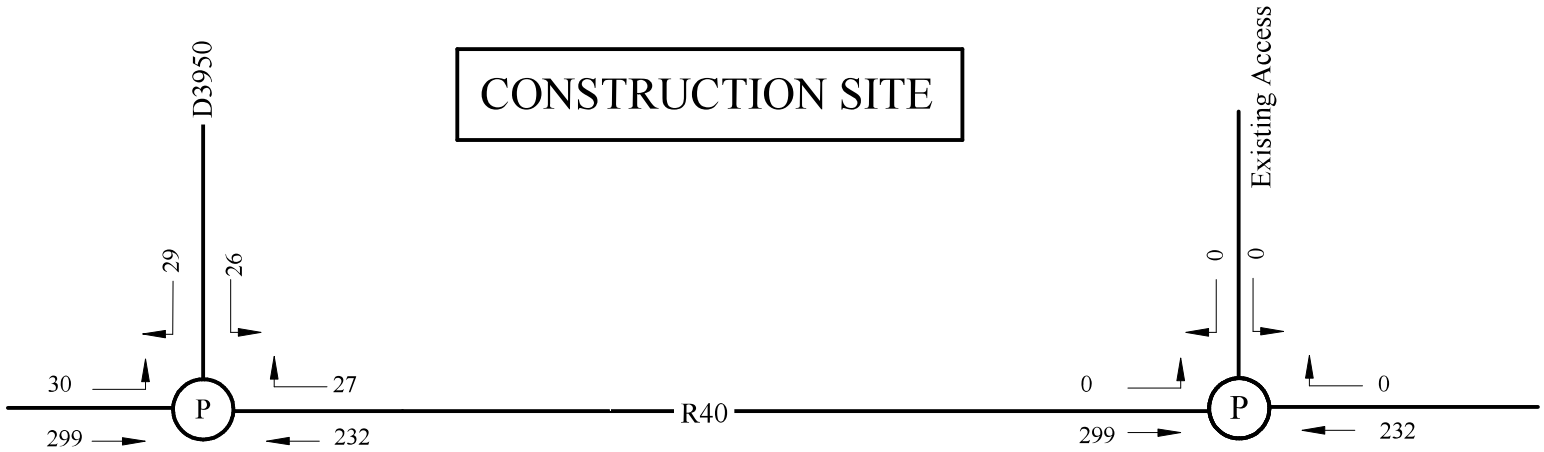
HAMATINO CONSULTING ENGINEERS	CASTEEL DAM REHABILITATION	WEEKDAY AM 2023 BACKGROUND TRAFFIC VOLUMES

P: PRIORITY CONTROL

R: ROUNDABOUT

S: SIGNAL

A: 4 WAY STOP



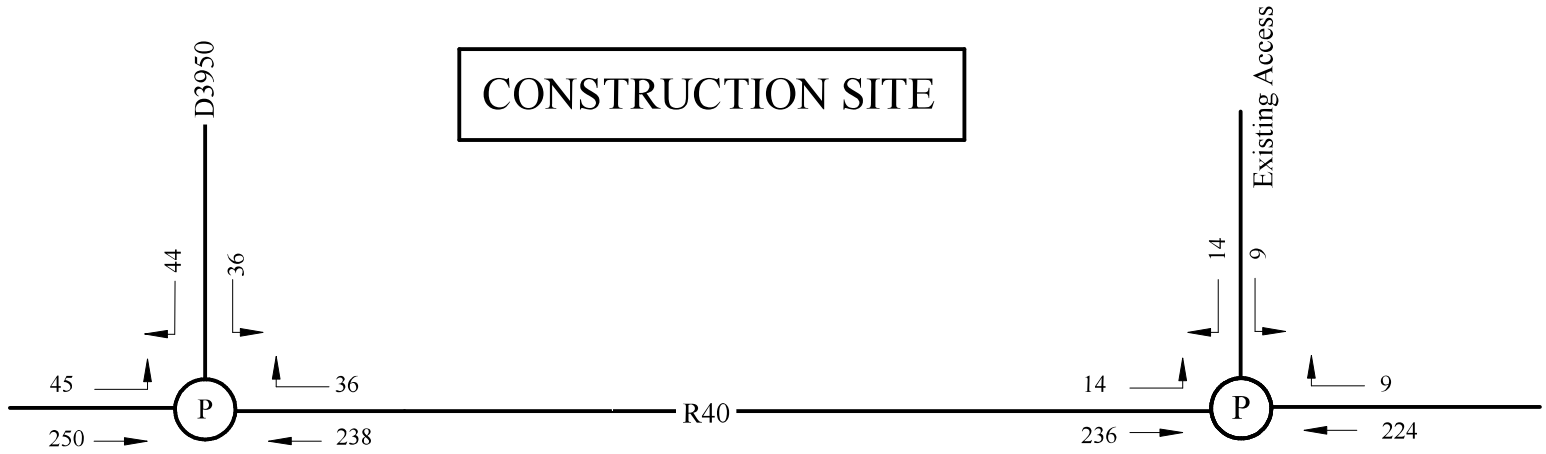
HAMATINO CONSULTING ENGINEERS	CASTEEL DAM REHABILITATION	FRIDAY PM 2023 BACKGROUND TRAFFIC VOLUMES

P: PRIORITY CONTROL

R: ROUNDABOUT

S: SIGNAL

A: 4 WAY STOP



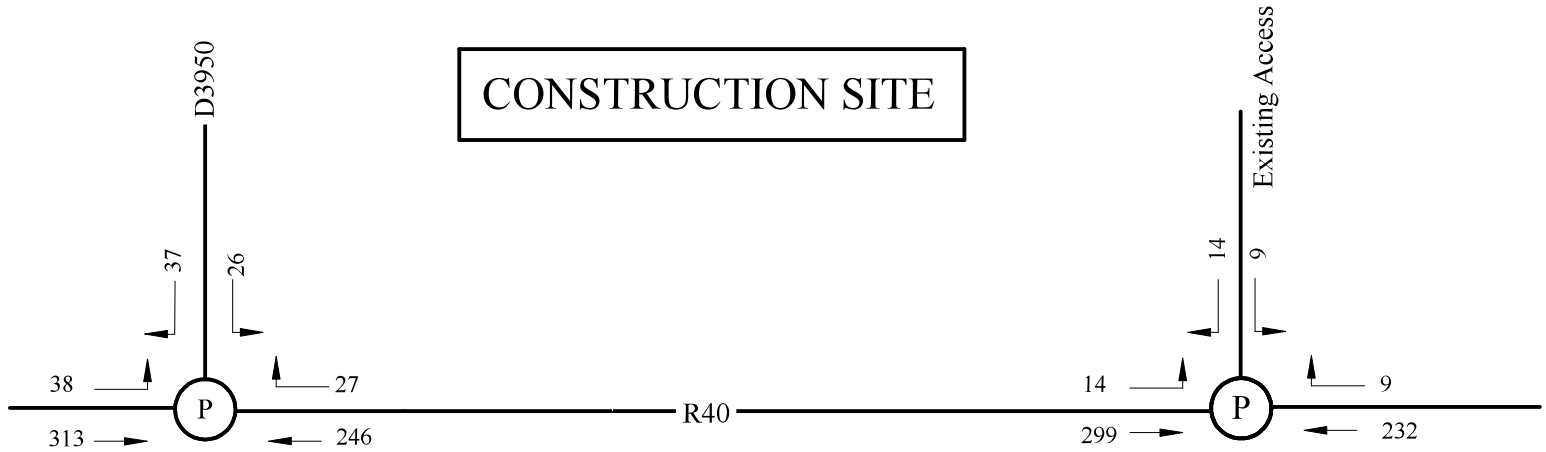
HAMATINO CONSULTING ENGINEERS	CASTEEL DAM REHABILITATION	WEEKDAY AM WITH CONSTRUCTION TRAFFIC VOL.

P: PRIORITY CONTROL

R: ROUNDABOUT

S: SIGNAL

A: 4 WAY STOP



HAMATINO CONSULTING ENGINEERS	CASTEEL DAM REHABILITATION	FRIDAY PM 2023 WITH CONSTRUCTION TRAFFIC VOL

AM WITH CONSTRUCTION ACTIVITIES

Scenario Report

Scenario:	AM
Command:	Default Command
Volume:	AM
Geometry:	Default Geometry
Impact Fee:	Default Impact Fee
Trip Generation:	AM
Trip Distribution:	Default Trip Distribution
Paths:	Default Path
Routes:	Default Route
Configuration:	Default Configuration

Trip Generation Report

Forecast for AM

Zone #	Subzone	Amount	Units	Rate In	Rate Out	Trips In	Trips Out	Total Trips	% Of Total
1		100.00	mixed	0.31	0.31	31	31	62	100.0
	Zone 1 Subtotal		.....			31	31	62	100.0
TOTAL			.....			31	31	62	100.0

Trip Distribution Report

Percent Of Trips DEF

Zone	To Gates 1	2
1	70.0	30.0

Turning Movement Report

AM

Volume Type	Northbound Left	Thru	Right	Southbound Left	Thru	Right	Eastbound Left	Thru	Right	Westbound Left	Thru	Right	Total Volume
#1 R40 / Casteel Dam Access													
Base	0	236	4	5	224	0	0	0	0	3	0	7	479
Added	14	0	0	0	0	9	9	0	14	0	0	0	46
Total	14	236	4	5	224	9	9	0	14	3	0	7	525
#2 R40 / D3950													
Base	37	236	0	0	224	36	36	0	36	0	0	0	605
Added	8	14	0	0	14	0	0	0	8	0	0	0	44
Total	45	250	0	0	238	36	36	0	44	0	0	0	649

Link Volume Report
AM

Volume Type	NB Link In	NB Link Out	NB Link Total	SB Link In	SB Link Out	SB Link Total	EB Link In	EB Link Out	EB Link Total	WB Link In	WB Link Out	WB Link Total	Total Volume
#1 R40 / Casteel Dam Access													
Base	240	227	467	229	243	472	0	0	0	10	9	19	958
Added	14	14	28	9	9	18	23	23	46	0	0	0	92
Total	254	241	495	238	252	490	23	23	46	10	9	19	1050
#2 R40 / D3950													
Base	273	260	533	260	272	532	72	73	145	0	0	0	1210
Added	22	22	44	14	14	28	8	8	16	0	0	0	88
Total	295	282	577	274	286	560	80	81	161	0	0	0	1298

Intersection Volume Report
Base Volume Alternative

Node	Intersection	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
1	R40 / Casteel	0	236	4	5	224	0	0	0	0	3	0	7
2	R40 / D3950	37	236	0	0	224	36	36	0	36	0	0	0

Intersection Volume Report
Future Volume Alternative

Node	Intersection	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
1	R40 / Casteel	14	236	4	5	224	9	9	0	14	3	0	7
2	R40 / D3950	45	250	0	0	238	36	36	0	44	0	0	0

Impact Analysis Report
Level Of Service

Intersection	Base LOS	Base Del/Veh	Base V/C	Future LOS	Future Del/Veh	Future V/C	Change in
# 1 R40 / Casteel Dam Access	B	11.4	0.000	B	12.2	0.000	+ 0.845 D/V
# 2 R40 / D3950	B	11.7	0.000	B	12.2	0.000	+ 0.504 D/V

Level Of Service Computation Report
2000 HCM Unsignalized Method (Base Volume Alternative)

Intersection #1 R40 / Casteel Dam Access

Average Delay (sec/veh): 0.2 Worst Case Level Of Service: B[11.4]

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Uncontrolled				Uncontrolled				Stop Sign				Stop Sign			
Lefts:	Include				Include				Include				Include			
Lanes:	1	0	0	1 0	0	1	0	0 1	0	0	1!	0 0	0	0	1!	0 0
Volume Module:																
Base Vol:	0	236		4	5	224		0	0	0		0	3	0		7
Growth Adj:	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Initial Bse:	0	236		4	5	224		0	0	0		0	3	0		7
User Adj:	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
PHF Adj:	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
PHF Volume:	0	236		4	5	224		0	0	0		0	3	0		7
Reduct Vol:	0	0		0	0	0		0	0	0		0	0	0		0
FinalVolume:	0	236		4	5	224		0	0	0		0	3	0		7
Critical Gap Module:																
Critical Gp:	xxxxx	xxxx		4.3	xxxxx	xxxx	xxxxx		6.4	6.7		7.3	6.4	6.7		6.6
FollowUpTim:	xxxxx	xxxx		2.4	xxxxx	xxxx	xxxxx		3.5	4.2		3.7	3.5	4.2		3.7
Capacity Module:																
Cnflict Vol:	xxxx	xxxx		229	xxxx	xxxx	xxxxx		236	473		472	227	471		471
Potent Cap.:	xxxx	xxxx		1240	xxxx	xxxx	xxxxx		761	464		474	770	466		520
Move Cap.:	xxxx	xxxx		1240	xxxx	xxxx	xxxxx		761	463		471	770	464		519
Volume/Cap:	xxxx	xxxx		0.00	xxxx	xxxx	xxxx		0.00	0.00		0.00	0.00	0.00		0.01
Level Of Service Module:																
2Way95thQ:	xxxx	xxxx		0.0	xxxx	xxxx	xxxxx		xxxx	xxxx	xxxxx		xxxx	xxxx	xxxxx	
Control Del:	xxxxx	xxxx		7.9	xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx	
LOS by Move:	*	*		A	*	*	*		*	*	*		*	*	*	
Movement:	LT -	LTR -	RT		LT -	LTR -	RT		LT -	LTR -	RT		LT -	LTR -	RT	
Shared Cap.:	xxxx	xxxx		1	xxxx	xxxx	xxxxx		xxxx	0	xxxxx		xxxx	575	xxxxx	
SharedQueue:	xxxxx	xxxx		0.0	xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx		xxxxx	0.1	xxxxx	
Shrd ConDel:	xxxxx	xxxx		7.9	xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx		xxxxx	11.4	xxxxx	
Shared LOS:	*	*		A	*	*	*		*	*	*		*	B	*	
ApproachDel:	xxxxxx				xxxxxx				xxxxxx				11.4			
ApproachLOS:	*				*				*				B			

Note: Queue reported is the number of cars per lane.

Level Of Service Detailed Computation Report
2000 HCM Unsignalized Method
Base Volume Alternative

Intersection #1 R40 / Casteel Dam Access

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
HevVeh:	20%				20%				20%				20%			
Grade:	0%				0%				0%				0%			
Peds/Hour:	0				0				0				0			

Pedestrian Walk Speed: 1.20 meters/sec

LaneWidth:	3.66 meters	3.66 meters	3.66 meters	3.66 meters

Time Period: 0.25 hour

Level Of Service Computation Report
2000 HCM Unsignalized Method (Future Volume Alternative)

Intersection #1 R40 / Casteel Dam Access

Average Delay (sec/veh): 0.8 Worst Case Level Of Service: B[12.2]

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Uncontrolled				Uncontrolled				Stop Sign				Stop Sign			
Lefts:	Include				Include				Include				Include			
Lanes:	1	0	0	1 0	0	1	0	0 1	0	0	1!	0 0	0	0	1!	0 0
Volume Module:																
Base Vol:	0	236	4		5	224	0		0	0	0		3	0	7	
Growth Adj:	1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	
Initial Bse:	0	236	4		5	224	0		0	0	0		3	0	7	
Added Vol:	14	0	0		0	0	9		9	0	14		0	0	0	
PasserByVol:	0	0	0		0	0	0		0	0	0		0	0	0	
Initial Fut:	14	236	4		5	224	9		9	0	14		3	0	7	
User Adj:	1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	
PHF Adj:	1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	
PHF Volume:	14	236	4		5	224	9		9	0	14		3	0	7	
Reduct Vol:	0	0	0		0	0	0		0	0	0		0	0	0	
FinalVolume:	14	236	4		5	224	9		9	0	14		3	0	7	
Critical Gap Module:																
Critical Gp:	xxxxx	xxxx	4.3		xxxxx	xxxx	4.3		6.4	6.7	7.3		6.4	6.7	7.3	
FollowUpTim:	xxxxx	xxxx	2.4		xxxxx	xxxx	2.4		3.5	4.2	3.7		3.5	4.2	3.7	
Capacity Module:																
Cnflict Vol:	xxxx	xxxx	229		xxxx	xxxx	250		236	491	490		227	503	500	
Potent Cap.:	xxxx	xxxx	1240		xxxx	xxxx	1217		761	453	460		770	446	453	
Move Cap.:	xxxx	xxxx	1240		xxxx	xxxx	1217		761	448	455		770	441	444	
Volume/Cap:	xxxx	xxxx	0.00		xxxx	xxxx	0.01		0.01	0.00	0.03		0.00	0.00	0.02	
Level Of Service Module:																
2Way95thQ:	xxxx	xxxx	0.0		xxxx	xxxx	0.0		xxxx	xxxx	xxxxx		xxxx	xxxx	xxxxx	
Control Del:	xxxxx	xxxx	7.9		xxxxx	xxxx	8.0		xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx	
LOS by Move:	*	*	A		*	*	A		*	*	*		*	*	*	
Movement:	LT	-	LTR	- RT	LT	-	LTR	- RT	LT	-	LTR	- RT	LT	-	LTR	- RT
Shared Cap.:	xxxx	xxxx	1		xxxx	xxxx	xxxxx		xxxx	540	xxxxx		xxxx	509	xxxxx	
SharedQueue:	xxxxx	xxxx	0.0		xxxxx	xxxx	xxxxx		xxxxx	0.1	xxxxx		xxxxx	0.1	xxxxx	
Shrd ConDel:	xxxxx	xxxx	7.9		xxxxx	xxxx	xxxxx		xxxxx	12.0	xxxxx		xxxxx	12.2	xxxxx	
Shared LOS:	*	*	A		*	*	*		*	B	*		*	B	*	
ApproachDel:	xxxxxx				xxxxxx				12.0				12.2			
ApproachLOS:	*				*				B				B			

Note: Queue reported is the number of cars per lane.

Level Of Service Detailed Computation Report
2000 HCM Unsignalized Method
Future Volume Alternative

Intersection #1 R40 / Casteel Dam Access

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
HevVeh:	20%				20%				20%				20%			
Grade:	0%				0%				0%				0%			
Peds/Hour:	0				0				0				0			

Pedestrian Walk Speed: 1.20 meters/sec

LaneWidth:	3.66 meters	3.66 meters	3.66 meters	3.66 meters

Time Period: 0.25 hour

Level Of Service Computation Report
2000 HCM Unsignalized Method (Base Volume Alternative)

Intersection #2 R40 / D3950

Average Delay (sec/veh): 1.4 Worst Case Level Of Service: B[11.7]

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	- T	- R		L	- T	- R		L	- T	- R		L	- T	- R	
Control:	Uncontrolled				Uncontrolled				Stop Sign				Stop Sign			
Lefts:	Include				Include				Include				Include			
Lanes:	1	0 1	0	0	0	0 1	0	1	1	0 0	0	1	0	0 0	0	0
Volume Module:																
Base Vol:	37	236	0	0	224	36	36	0	36	0	0	0				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	37	236	0	0	224	36	36	0	36	0	0	0				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Volume:	37	236	0	0	224	36	36	0	36	0	0	0				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
FinalVolume:	37	236	0	0	224	36	36	0	36	0	0	0				
Critical Gap Module:																
Critical Gp:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	4.3	6.4	xxxx	6.6	xxxxx	xxxx	xxxxx				
FollowUpTim:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	2.4	3.5	xxxx	3.7	xxxxx	xxxx	xxxxx				
Capacity Module:																
Cnflict Vol:	xxxx	xxxx	xxxxx	xxxx	xxxx	273	236	xxxx	532	xxxx	xxxx	xxxxx				
Potent Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	1193	761	xxxx	478	xxxx	xxxx	xxxxx				
Move Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	1193	761	xxxx	467	xxxx	xxxx	xxxxx				
Volume/Cap:	xxxx	xxxx	xxxx	xxxx	xxxx	0.03	0.05	xxxx	0.08	xxxx	xxxx	xxxx				
Level Of Service Module:																
2Way95thQ:	xxxx	xxxx	xxxxx	xxxx	xxxx	0.1	0.1	xxxx	0.2	xxxx	xxxx	xxxxx				
Control Del:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	8.1	10.0	xxxx	13.3	xxxxx	xxxx	xxxxx				
LOS by Move:	*	*	*	*	*	A	A	*	B	*	*	*				
Movement:	LT - LTR - RT			LT - LTR - RT			LT - LTR - RT			LT - LTR - RT						
Shared Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx				
SharedQueue:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx				
Shrd ConDel:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx				
Shared LOS:	*	*	*	*	*	*	*	*	*	*	*	*				
ApproachDel:	xxxxxx			xxxxxx			11.7			xxxxxx						
ApproachLOS:	*			*			B			*						

Note: Queue reported is the number of cars per lane.

Level Of Service Detailed Computation Report
2000 HCM Unsignalized Method
Base Volume Alternative

Intersection #2 R40 / D3950

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	- T	- R		L	- T	- R		L	- T	- R		L	- T	- R	
HevVeh:	20%				20%				20%				20%			
Grade:	0%				0%				0%				0%			
Peds/Hour:	0				0				0				0			

Pedestrian Walk Speed: 1.20 meters/sec

LaneWidth:	3.66 meters	3.66 meters	3.66 meters	3.66 meters

Time Period: 0.25 hour

Level Of Service Computation Report
2000 HCM Unsignalized Method (Future Volume Alternative)

Intersection #2 R40 / D3950

Average Delay (sec/veh): 1.5 Worst Case Level Of Service: B[12.2]

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	- T	- R		L	- T	- R		L	- T	- R		L	- T	- R	
Control:	Uncontrolled				Uncontrolled				Stop Sign				Stop Sign			
Lefts:	Include				Include				Include				Include			
Lanes:	1	0 1	0	0	0	0 1	0	1	1	0 0	0	1	0	0 0	0	0
Volume Module:																
Base Vol:	37	236	0	0	224	36	36	0	36	0	0	0				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	37	236	0	0	224	36	36	0	36	0	0	0				
Added Vol:	8	14	0	0	14	0	0	0	8	0	0	0				
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0				
Initial Fut:	45	250	0	0	238	36	36	0	44	0	0	0				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Volume:	45	250	0	0	238	36	36	0	44	0	0	0				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
FinalVolume:	45	250	0	0	238	36	36	0	44	0	0	0				
Critical Gap Module:																
Critical Gp:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	4.3	6.4	xxxx	6.6	xxxxx	xxxx	xxxxx				
FollowUpTim:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	2.4	3.5	xxxx	3.7	xxxxx	xxxx	xxxxx				
Capacity Module:																
Cnflict Vol:	xxxx	xxxx	xxxxx	xxxx	xxxx	295	250	xxxx	560	xxxx	xxxx	xxxxx				
Potent Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	1170	747	xxxx	460	xxxx	xxxx	xxxxx				
Move Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	1170	747	xxxx	449	xxxx	xxxx	xxxxx				
Volume/Cap:	xxxx	xxxx	xxxx	xxxx	xxxx	0.03	0.05	xxxx	0.10	xxxx	xxxx	xxxx				
Level Of Service Module:																
2Way95thQ:	xxxx	xxxx	xxxxx	xxxx	xxxx	0.1	0.2	xxxx	0.3	xxxx	xxxx	xxxxx				
Control Del:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	8.2	10.1	xxxx	13.9	xxxxx	xxxx	xxxxx				
LOS by Move:	*	*	*	*	*	A	B	*	B	*	*	*				
Movement:	LT - LTR - RT			LT - LTR - RT			LT - LTR - RT			LT - LTR - RT						
Shared Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx				
SharedQueue:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx				
Shrd ConDel:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx				
Shared LOS:	*	*	*	*	*	*	*	*	*	*	*	*				
ApproachDel:	xxxxxx			xxxxxx			12.2			xxxxxx						
ApproachLOS:	*			*			B			*						

Note: Queue reported is the number of cars per lane.

Level Of Service Detailed Computation Report
2000 HCM Unsignalized Method
Future Volume Alternative

Intersection #2 R40 / D3950

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	- T	- R		L	- T	- R		L	- T	- R		L	- T	- R	
HevVeh:	20%				20%				20%				20%			
Grade:	0%				0%				0%				0%			
Peds/Hour:	0				0				0				0			

Pedestrian Walk Speed: 1.20 meters/sec

LaneWidth:	3.66 meters	3.66 meters	3.66 meters	3.66 meters

Time Period: 0.25 hour

Turning Movement By Zone Report
AM

Volume Type	Northbound Left	Thru	Right	Southbound Left	Thru	Right	Eastbound Left	Thru	Right	Westbound Left	Thru	Right	Total Volume
#1 R40 / Casteel Dam Access													
[Base(LOS=B,Del=0.2,V/C=0.000)][Future(LOS=B,Del=0.8,V/C=0.000)][+0.000 V/C]													
Base	0	236	4	5	224	0	0	0	0	3	0	7	479
Growth	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
InitBs	0	236	4	5	224	0	0	0	0	3	0	7	479
Zn 1	14	0	0	0	0	9	9	0	14	0	0	0	46
Added	14	0	0	0	0	9	9	0	14	0	0	0	46
PassBy	0	0	0	0	0	0	0	0	0	0	0	0	0
Future	14	236	4	5	224	9	9	0	14	3	0	7	525
UseAdj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total	14	236	4	5	224	9	9	0	14	3	0	7	525
#2 R40 / D3950													
[Base(LOS=B,Del=1.4,V/C=0.000)][Future(LOS=B,Del=1.5,V/C=0.000)][+0.000 V/C]													
Base	37	236	0	0	224	36	36	0	36	0	0	0	605
Growth	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
InitBs	37	236	0	0	224	36	36	0	36	0	0	0	605
Zn 1	8	14	0	0	14	0	0	0	8	0	0	0	44
Added	8	14	0	0	14	0	0	0	8	0	0	0	44
PassBy	0	0	0	0	0	0	0	0	0	0	0	0	0
Future	45	250	0	0	238	36	36	0	44	0	0	0	649
UseAdj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total	45	250	0	0	238	36	36	0	44	0	0	0	649

Project Trips Report
AM

Node	Intersection	Northbound L	T	R	Southbound L	T	R	Eastbound L	T	R	Westbound L	T	R
Zone #1:													
1	R40 / Casteel	14	0	0	0	0	9	9	0	14	0	0	0
2	R40 / D3950	8	14	0	0	14	0	0	0	8	0	0	0

Lane Geometry Report

Number of approach lanes: (L) (LT) (T) (RT) (R) (LTR)

Node	Intersection	NB	SB	EB	WB
1	R40 / Casteel Dam Access	100100	010010	000001	000001
2	R40 / D3950	101000	001010	100010	000000

Base Queue Report (cars)

Node	Intersection	Northbound L -- T -- R	Southbound L -- T -- R	Eastbound L -- T -- R	Westbound L -- T -- R
#1	[2Way95thQ]:	xxxx 0.0 0.0	xxxx xxxx xxxx	xxxx xxxx xxxx	0.1 0.1 0.1
#2	[2Way95thQ]:	xxxx xxxx xxxx	xxxx xxxx 0.1	0.1 xxxx 0.2	xxxx xxxx xxxx

Future Queue Report (cars)

Node	Intersection	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
#1	[2Way95thQ]:	xxxx	0.0	0.0	xxxx	xxxx	0.0	0.1	0.1	0.1	0.1	0.1	0.1
#2	[2Way95thQ]:	xxxx	xxxx	xxxx	xxxx	xxxx	0.1	0.2	xxxx	0.3	xxxx	xxxx	xxxx

PM WITH CONSTRUCTION ACTIVITIES

Scenario Report

Scenario:	PM
Command:	Default Command
Volume:	PM
Geometry:	Default Geometry
Impact Fee:	Default Impact Fee
Trip Generation:	PM
Trip Distribution:	Default Trip Distribution
Paths:	Default Path
Routes:	Default Route
Configuration:	Default Configuration

Trip Generation Report

Forecast for PM

Zone #	Subzone	Amount	Units	Rate In	Rate Out	Trips In	Trips Out	Total Trips	% Of Total
1		100.00	mixed	0.31	0.31	31	31	62	100.0
	Zone 1 Subtotal		.....			31	31	62	100.0
TOTAL			.....			31	31	62	100.0

Trip Distribution Report

Percent Of Trips DEF

Zone	To Gates 1	2
1	70.0	30.0

Turning Movement Report

PM

Volume Type	Northbound Left	Thru	Right	Southbound Left	Thru	Right	Eastbound Left	Thru	Right	Westbound Left	Thru	Right	Total Volume
#1 R40 / Casteel Dam Access													
Base	0	299	5	7	232	0	0	0	0	4	0	3	550
Added	14	0	0	0	0	9	9	0	14	0	0	0	46
Total	14	299	5	7	232	9	9	0	14	4	0	3	596
#2 R40 / D3950													
Base	30	299	0	0	232	27	26	0	29	0	0	0	643
Added	8	14	0	0	14	0	0	0	8	0	0	0	44
Total	38	313	0	0	246	27	26	0	37	0	0	0	687

Link Volume Report
PM

Volume Type	NB Link In	NB Link Out	NB Link Total	SB Link In	SB Link Out	SB Link Total	EB Link In	EB Link Out	EB Link Total	WB Link In	WB Link Out	WB Link Total	Total Volume
#1 R40 / Casteel Dam Access													
Base	304	236	540	239	302	541	0	0	0	7	12	19	1100
Added	14	14	28	9	9	18	23	23	46	0	0	0	92
Total	318	250	568	248	311	559	23	23	46	7	12	19	1192
#2 R40 / D3950													
Base	329	261	590	259	325	584	55	57	112	0	0	0	1286
Added	22	22	44	14	14	28	8	8	16	0	0	0	88
Total	351	283	634	273	339	612	63	65	128	0	0	0	1374

Intersection Volume Report
Base Volume Alternative

Node	Intersection	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
1	R40 / Casteel	0	299	5	7	232	0	0	0	0	4	0	3
2	R40 / D3950	30	299	0	0	232	27	26	0	29	0	0	0

Intersection Volume Report
Future Volume Alternative

Node	Intersection	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
1	R40 / Casteel	14	299	5	7	232	9	9	0	14	4	0	3
2	R40 / D3950	38	313	0	0	246	27	26	0	37	0	0	0

Impact Analysis Report
Level Of Service

Intersection	Base LOS	Base Del/Veh	Base V/C	Future LOS	Future Del/Veh	Future V/C	Change in
# 1 R40 / Casteel Dam Access	B	11.1	0.000	B	12.8	0.000	+ 1.741 D/V
# 2 R40 / D3950	B	12.2	0.000	B	12.8	0.000	+ 0.585 D/V

Level Of Service Computation Report
2000 HCM Unsignalized Method (Base Volume Alternative)

Intersection #1 R40 / Casteel Dam Access

Average Delay (sec/veh): 0.1 Worst Case Level Of Service: B[11.1]

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Uncontrolled				Uncontrolled				Stop Sign				Stop Sign			
Lefts:	Include				Include				Include				Include			
Lanes:	1	0	0	1 0	0	1	0	0 1	0	0	1!	0 0	0	0	1!	0 0
Volume Module:																
Base Vol:	0	299		5	7	232		0	0	0		0	4	0		3
Growth Adj:	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Initial Bse:	0	299		5	7	232		0	0	0		0	4	0		3
User Adj:	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
PHF Adj:	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
PHF Volume:	0	299		5	7	232		0	0	0		0	4	0		3
Reduct Vol:	0	0		0	0	0		0	0	0		0	0	0		0
FinalVolume:	0	299		5	7	232		0	0	0		0	4	0		3
Critical Gap Module:																
Critical Gp:	xxxxx	xxxx		4.3	xxxxx	xxxx	xxxxx		6.4	6.7		7.3	6.4	6.7		6.6
FollowUpTim:	xxxxx	xxxx		2.4	xxxxx	xxxx	xxxxx		3.5	4.2		3.7	3.5	4.2		3.7
Capacity Module:																
Cnflict Vol:	xxxx	xxxx		239	xxxx	xxxx	xxxxx		299	548		547	236	545		545
Potent Cap.:	xxxx	xxxx		1229	xxxx	xxxx	xxxxx		700	420		422	761	422		470
Move Cap.:	xxxx	xxxx		1229	xxxx	xxxx	xxxxx		700	418		418	761	420		469
Volume/Cap:	xxxx	xxxx		0.00	xxxx	xxxx	xxxx		0.00	0.00		0.00	0.01	0.00		0.01
Level Of Service Module:																
2Way95thQ:	xxxx	xxxx		0.0	xxxx	xxxx	xxxxx		xxxx	xxxx	xxxxx		xxxx	xxxx	xxxxx	
Control Del:	xxxxx	xxxx		7.9	xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx	
LOS by Move:	*	*		A	*	*	*		*	*	*		*	*	*	
Movement:	LT -	LTR -	RT		LT -	LTR -	RT		LT -	LTR -	RT		LT -	LTR -	RT	
Shared Cap.:	xxxx	xxxx		1	xxxx	xxxx	xxxxx		xxxx	0	xxxxx		xxxx	600	xxxxx	
SharedQueue:	xxxxx	xxxx		0.0	xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx		xxxxx	0.0	xxxxx	
Shrd ConDel:	xxxxx	xxxx		7.9	xxxxx	xxxx	xxxxx		xxxxx	xxxx	xxxxx		xxxxx	11.1	xxxxx	
Shared LOS:	*	*		A	*	*	*		*	*	*		*	B	*	
ApproachDel:	xxxxxx				xxxxxx				xxxxxx				11.1			
ApproachLOS:	*				*				*				B			

Note: Queue reported is the number of cars per lane.

Level Of Service Detailed Computation Report
2000 HCM Unsignalized Method
Base Volume Alternative

Intersection #1 R40 / Casteel Dam Access

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
HevVeh:	20%				20%				20%				20%			
Grade:	0%				0%				0%				0%			
Peds/Hour:	0				0				0				0			

Pedestrian Walk Speed: 1.20 meters/sec

LaneWidth:	3.66 meters	3.66 meters	3.66 meters	3.66 meters

Time Period: 0.25 hour

Level Of Service Computation Report
2000 HCM Unsignalized Method (Future Volume Alternative)

Intersection #1 R40 / Casteel Dam Access

Average Delay (sec/veh): 0.6 Worst Case Level Of Service: B[12.8]

Approach:	North Bound						South Bound						East Bound						West Bound					
Movement:	L	-	T	-	R		L	-	T	-	R		L	-	T	-	R		L	-	T	-	R	
Control:	Uncontrolled						Uncontrolled						Stop Sign						Stop Sign					
Lefts:	Include						Include						Include						Include					
Lanes:	1	0	0	1	0		0	1	0	0	1		0	0	1!	0	0		0	0	1!	0	0	
Volume Module:																								
Base Vol:	0	299		5	7	232		0		0	0		0		4	0		3						
Growth Adj:	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00		1.00		1.00	1.00		1.00						
Initial Bse:	0	299		5	7	232		0		0	0		0		4	0		3						
Added Vol:	14	0		0	0	0		9		9	0		14		0	0		0						
PasserByVol:	0	0		0	0	0		0		0	0		0		0	0		0						
Initial Fut:	14	299		5	7	232		9		9	0		14		4	0		3						
User Adj:	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00		1.00		1.00	1.00		1.00						
PHF Adj:	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00		1.00		1.00	1.00		1.00						
PHF Volume:	14	299		5	7	232		9		9	0		14		4	0		3						
Reduct Vol:	0	0		0	0	0		0		0	0		0		0	0		0						
FinalVolume:	14	299		5	7	232		9		9	0		14		4	0		3						
Critical Gap Module:																								
Critical Gp:	xxxxx	xxxx		4.3	xxxxx	xxxx		4.3		6.4	6.7		7.3		6.4	6.7		7.3						
FollowUpTim:	xxxxx	xxxx		2.4	xxxxx	xxxx		2.4		3.5	4.2		3.7		3.5	4.2		3.7						
Capacity Module:																								
Cnflict Vol:	xxxx	xxxx		239	xxxx	xxxx		313		299	566		565		236	577		574						
Potent Cap.:	xxxx	xxxx		1229	xxxx	xxxx		1152		700	410		410		761	404		404						
Move Cap.:	xxxx	xxxx		1229	xxxx	xxxx		1152		700	405		404		761	399		395						
Volume/Cap:	xxxx	xxxx		0.00	xxxx	xxxx		0.01		0.01	0.00		0.03		0.01	0.00		0.01						
Level Of Service Module:																								
2Way95thQ:	xxxx	xxxx		0.0	xxxx	xxxx		0.0		xxxx	xxxx		xxxxx		xxxx	xxxx		xxxxx						
Control Del:	xxxxx	xxxx		7.9	xxxxx	xxxx		8.1		xxxxx	xxxx		xxxxx		xxxxx	xxxx		xxxxx						
LOS by Move:	*	*		A	*	*		A		*	*		*		*	*		*						
Movement:	LT	-	LTR	-	RT		LT	-	LTR	-	RT		LT	-	LTR	-	RT		LT	-	LTR	-	RT	
Shared Cap.:	xxxx	xxxx		1	xxxx	xxxx		xxxxx		xxxx	484		xxxxx		xxxx	545		xxxxx						
SharedQueue:	xxxxx	xxxx		0.0	xxxxx	xxxx		xxxxx		xxxxx	0.1		xxxxx		xxxxx	0.0		xxxxx						
Shrd ConDel:	xxxxx	xxxx		7.9	xxxxx	xxxx		xxxxx		xxxxx	12.8		xxxxx		xxxxx	11.7		xxxxx						
Shared LOS:	*	*		A	*	*		*		*	B		*		*	B		*						
ApproachDel:	xxxxxx				xxxxxx					12.8					11.7									
ApproachLOS:	*				*					B					B									

Note: Queue reported is the number of cars per lane.

Level Of Service Detailed Computation Report
2000 HCM Unsignalized Method
Future Volume Alternative

Intersection #1 R40 / Casteel Dam Access

Approach:	North Bound					South Bound					East Bound					West Bound				
Movement:	L	-	T	-	R	L	-	T	-	R	L	-	T	-	R	L	-	T	-	R
HevVeh:	20%					20%					20%					20%				
Grade:	0%					0%					0%					0%				
Peds/Hour:	0					0					0					0				
Pedestrian Walk Speed: 1.20 meters/sec																				
LaneWidth:	3.66 meters					3.66 meters					3.66 meters					3.66 meters				

Time Period: 0.25 hour

Level Of Service Computation Report
2000 HCM Unsignalized Method (Base Volume Alternative)

Intersection #2 R40 / D3950

Average Delay (sec/veh): 1.0 Worst Case Level Of Service: B[12.2]

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
Control:	Uncontrolled				Uncontrolled				Stop Sign				Stop Sign			
Lefts:	Include				Include				Include				Include			
Lanes:	1	0	1	0 0	0	0	1	0 1	1	0	0	0 1	0	0	0	0 0
Volume Module:																
Base Vol:	30	299		0 0	232		27		26		0	29		0	0	0
Growth Adj:	1.00	1.00		1.00 1.00	1.00		1.00		1.00		1.00	1.00		1.00	1.00	1.00
Initial Bse:	30	299		0 0	232		27		26		0	29		0	0	0
User Adj:	1.00	1.00		1.00 1.00	1.00		1.00		1.00		1.00	1.00		1.00	1.00	1.00
PHF Adj:	1.00	1.00		1.00 1.00	1.00		1.00		1.00		1.00	1.00		1.00	1.00	1.00
PHF Volume:	30	299		0 0	232		27		26		0	29		0	0	0
Reduct Vol:	0	0		0 0	0		0		0		0	0		0	0	0
FinalVolume:	30	299		0 0	232		27		26		0	29		0	0	0
Critical Gap Module:																
Critical Gp:	xxxxx	xxxx		xxxxx xxxxx	xxxx		4.3		6.4		xxxx	6.6		xxxxx	xxxx	xxxxx
FollowUpTim:	xxxxx	xxxx		xxxxx xxxxx	xxxx		2.4		3.5		xxxx	3.7		xxxxx	xxxx	xxxxx
Capacity Module:																
Cnflict Vol:	xxxx	xxxx		xxxxx xxxx	xxxx		329		299		xxxx	585		xxxx	xxxx	xxxxx
Potent Cap.:	xxxx	xxxx		xxxxx xxxx	xxxx		1136		700		xxxx	445		xxxx	xxxx	xxxxx
Move Cap.:	xxxx	xxxx		xxxxx xxxx	xxxx		1136		700		xxxx	437		xxxx	xxxx	xxxxx
Volume/Cap:	xxxx	xxxx		xxxx xxxx	xxxx		0.02		0.04		xxxx	0.07		xxxx	xxxx	xxxx
Level Of Service Module:																
2Way95thQ:	xxxx	xxxx		xxxxx xxxx	xxxx		0.1		0.1		xxxx	0.2		xxxx	xxxx	xxxxx
Control Del:	xxxxx	xxxx		xxxxx xxxxx	xxxx		8.2		10.3		xxxx	13.8		xxxxx	xxxx	xxxxx
LOS by Move:	*	*		* *	*		A		B		*	B		*	*	*
Movement:	LT -	LTR -	RT	LT -	LTR -	RT	LT -	LTR -	RT	LT -	LTR -	RT	LT -	LTR -	RT	
Shared Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxx	xxxxx
SharedQueue:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxx	xxxxx
Shrd ConDel:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxx	xxxxx
Shared LOS:	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ApproachDel:	xxxxxx			xxxxxx			12.2			xxxxxx						
ApproachLOS:	*			*			B			*						

Note: Queue reported is the number of cars per lane.

Level Of Service Detailed Computation Report
2000 HCM Unsignalized Method
Base Volume Alternative

Intersection #2 R40 / D3950

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	-	T	- R	L	-	T	- R	L	-	T	- R	L	-	T	- R
HevVeh:	20%				20%				20%				20%			
Grade:	0%				0%				0%				0%			
Peds/Hour:	0				0				0				0			
Pedestrian Walk Speed: 1.20 meters/sec																
LaneWidth:	3.66 meters				3.66 meters				3.66 meters				3.66 meters			

Time Period: 0.25 hour

Level Of Service Computation Report
2000 HCM Unsignalized Method (Future Volume Alternative)

Intersection #2 R40 / D3950

Average Delay (sec/veh): 1.2 Worst Case Level Of Service: B[12.8]

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	- T	- R		L	- T	- R		L	- T	- R		L	- T	- R	
Control:	Uncontrolled				Uncontrolled				Stop Sign				Stop Sign			
Lefts:	Include				Include				Include				Include			
Lanes:	1	0 1	0	0	0	0 1	0	1	1	0 0	0	1	0	0 0	0	0
Volume Module:																
Base Vol:	30	299	0	0	232	27	26	0	29	0	0	0				
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
Initial Bse:	30	299	0	0	232	27	26	0	29	0	0	0				
Added Vol:	8	14	0	0	14	0	0	0	8	0	0	0				
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0				
Initial Fut:	38	313	0	0	246	27	26	0	37	0	0	0				
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
PHF Volume:	38	313	0	0	246	27	26	0	37	0	0	0				
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0				
FinalVolume:	38	313	0	0	246	27	26	0	37	0	0	0				
Critical Gap Module:																
Critical Gp:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	4.3	6.4	xxxx	6.6	xxxxx	xxxx	xxxxx				
FollowUpTim:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	2.4	3.5	xxxx	3.7	xxxxx	xxxx	xxxxx				
Capacity Module:																
Cnflict Vol:	xxxx	xxxx	xxxxx	xxxx	xxxx	351	313	xxxx	613	xxxx	xxxx	xxxxx				
Potent Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	1114	687	xxxx	428	xxxx	xxxx	xxxxx				
Move Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	1114	687	xxxx	420	xxxx	xxxx	xxxxx				
Volume/Cap:	xxxx	xxxx	xxxx	xxxx	xxxx	0.02	0.04	xxxx	0.09	xxxx	xxxx	xxxx				
Level Of Service Module:																
2Way95thQ:	xxxx	xxxx	xxxxx	xxxx	xxxx	0.1	0.1	xxxx	0.3	xxxx	xxxx	xxxxx				
Control Del:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	8.3	10.4	xxxx	14.4	xxxxx	xxxx	xxxxx				
LOS by Move:	*	*	*	*	*	A	B	*	B	*	*	*				
Movement:	LT - LTR - RT			LT - LTR - RT			LT - LTR - RT			LT - LTR - RT						
Shared Cap.:	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx	xxxx	xxxx	xxxxx				
SharedQueue:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx				
Shrd ConDel:	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx	xxxxx	xxxx	xxxxx				
Shared LOS:	*	*	*	*	*	*	*	*	*	*	*	*				
ApproachDel:	xxxxxx			xxxxxx			12.8			xxxxxx						
ApproachLOS:	*			*			B			*						

Note: Queue reported is the number of cars per lane.

Level Of Service Detailed Computation Report
2000 HCM Unsignalized Method
Future Volume Alternative

Intersection #2 R40 / D3950

Approach:	North Bound				South Bound				East Bound				West Bound			
Movement:	L	- T	- R		L	- T	- R		L	- T	- R		L	- T	- R	
HevVeh:	20%				20%				20%				20%			
Grade:	0%				0%				0%				0%			
Peds/Hour:	0				0				0				0			

Pedestrian Walk Speed: 1.20 meters/sec

LaneWidth:	3.66 meters	3.66 meters	3.66 meters	3.66 meters

Time Period: 0.25 hour

Turning Movement By Zone Report
PM

Volume	Northbound			Southbound			Eastbound			Westbound			Total
Type	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume
#1 R40 / Casteel Dam Access													
[Base(LOS=B,Del=0.1,V/C=0.000)][Future(LOS=B,Del=0.6,V/C=0.000)][+0.000 V/C]													
Base	0	299	5	7	232	0	0	0	0	4	0	3	550
Growth	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
InitBs	0	299	5	7	232	0	0	0	0	4	0	3	550
Zn 1	14	0	0	0	0	9	9	0	14	0	0	0	46
Added	14	0	0	0	0	9	9	0	14	0	0	0	46
PassBy	0	0	0	0	0	0	0	0	0	0	0	0	0
Future	14	299	5	7	232	9	9	0	14	4	0	3	596
UseAdj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total	14	299	5	7	232	9	9	0	14	4	0	3	596
#2 R40 / D3950													
[Base(LOS=B,Del=1.0,V/C=0.000)][Future(LOS=B,Del=1.2,V/C=0.000)][+0.000 V/C]													
Base	30	299	0	0	232	27	26	0	29	0	0	0	643
Growth	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
InitBs	30	299	0	0	232	27	26	0	29	0	0	0	643
Zn 1	8	14	0	0	14	0	0	0	8	0	0	0	44
Added	8	14	0	0	14	0	0	0	8	0	0	0	44
PassBy	0	0	0	0	0	0	0	0	0	0	0	0	0
Future	38	313	0	0	246	27	26	0	37	0	0	0	687
UseAdj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total	38	313	0	0	246	27	26	0	37	0	0	0	687

Project Trips Report
PM

Node	Intersection	Northbound L -- T -- R			Southbound L -- T -- R			Eastbound L -- T -- R			Westbound L -- T -- R		
Zone #1:													
1	R40 / Casteel	14	0	0	0	0	9	9	0	14	0	0	0
2	R40 / D3950	8	14	0	0	14	0	0	0	8	0	0	0

Lane Geometry Report

Number of approach lanes: (L) (LT) (T) (RT) (R) (LTR)

Node	Intersection	NB	SB	EB	WB
1	R40 / Casteel Dam Access	100100	010010	000001	000001
2	R40 / D3950	101000	001010	100010	000000

Base Queue Report (cars)

Node	Intersection	Northbound L -- T -- R	Southbound L -- T -- R	Eastbound L -- T -- R	Westbound L -- T -- R
#1	[2Way95thQ]:	xxxx 0.0 0.0	xxxx xxxx xxxx	xxxx xxxx xxxx	0.0 0.0 0.0
#2	[2Way95thQ]:	xxxx xxxx xxxx	xxxx xxxx 0.1	0.1 xxxx 0.2	xxxx xxxx xxxx

Future Queue Report (cars)

Node	Intersection	Northbound L -- T -- R	Southbound L -- T -- R	Eastbound L -- T -- R	Westbound L -- T -- R
#1	[2Way95thQ]:	xxxx 0.0 0.0	xxxx xxxx 0.0	0.1 0.1 0.1	0.0 0.0 0.0
#2	[2Way95thQ]:	xxxx xxxx xxxx	xxxx xxxx 0.1	0.1 xxxx 0.3	xxxx xxxx xxxx