

TECHNICAL MEMORANDUM

Project: Allstone Quarries – Chester
Date: July 6, 2023
From: Roger Dickinson, PE
Subject: Traffic Impact Assessment

The purpose of this traffic impact assessment (TIA) is to examine the potential impacts of proposed operational and physical modifications to Allstone's quarries located in the Town of Chester, Vermont on future traffic congestion and safety conditions.

Project Description

Allstone produces dimensional stone which is used in building construction and various hardscape features (stone walls, patios, walkways, etc.). Products include thin stone, flagstone and wall stone. Allstone's Chester facilities include:

- The North Quarry located on VT Route 103 N just north of Bridge 51 over the Green Mountain Railroad and the Williams River (± 0.9 miles north of the VT Route 103 N / VT Route 10 intersection).
- The South Quarry located at 3645 VT Route 103 N. Access to this quarry is located ± 0.3 miles north of the VT Route 103 N / VT Route 10 intersection.
- The Chandler Road Quarry located at 137 Chandler Road (TH #22). Chandler Rd intersects with VT Route 10 approximately 1 mile east of VT Route 103 N.
- A small retail store located at 3643 VT Route 103 N. Access to the retail store is shared with that to the South Quarry.

Allstone's existing operations include quarrying stone at the North and South Quarries. The quarried stone is then transported to the Chandler Road Quarry where it is processed into dimensional stone and prepared for shipment. A large majority of the dimensional stone is then shipped directly to customers. The remainder is transported to the retail store or stored on-site.

The proposed modifications to the existing operations include:

- Reclaiming the North Quarry and transforming that location into a storage yard for product, equipment and materials. Access to the North Quarry will be relocated to

the south and the driveway approach regraded to eliminate the sharp turn required at the existing access.

- Constructing a new stone processing facility at the South Quarry to replace the existing facilities located at the Chandler Road Quarry.
- Converting the existing stone processing buildings at the Chandler Road Quarry to provide additional storage and reducing operations at this location to pre-existing levels.

The proposed transitional time period to complete the above modifications is 12-18 months from receipt of needed permits.

Trip Generation

The existing truck trip generation of the North and South Quarries is presently limited to 40 loaded truck trips per day, combined from both quarries.¹ Forty (40) loaded truck trips per day generates a total of 80 total truck trips per day entering and exiting the two quarries. Estimating an 8-hour day with a peaking factor of 2 to account for hourly variations, the resulting peak hour trip generation rate for the North and South Quarries, combined, equals 20 truck trips per hour.

The Chandler Road Quarry and the small retail store do not appear to have existing trip generation allocations; either for trucks or other vehicles. However, since all of the existing stone processing occurs at the Chandler Road Quarry, its existing truck trip generation would also be 40 loaded trucks / 80 total truck trips per day.

The proposed modifications will result in more efficient operations, which in turn will reduce future volumes of truck traffic on Routes 10 and 103 traveling between the three quarries. The proposed truck trip generation at each location is detailed in Table 1.

Table 1 – Proposed Truck Trip Generation

Location	12-18 Month Transition Period		Post-Transition	
	Avg. Day	Peak Hour	Avg. Day	Peak Hour
North Quarry	30	7	20	5
South Quarry	60	15	40	10
Chandler Rd Quarry	80	20	10	3
Total	170	42	70	18

¹ Act 250 Land Use Permit 2S0775-1, May 17, 2005, Condition #7

Traffic Congestion

With existing operations transporting stone quarried at the North and South Quarries to the Chandler Road Quarry for processing, the location most affected by the resulting truck traffic and by the proposed modifications is the intersection of VT Routes 10 and 103.

Peak hour traffic volumes at that intersection and on its approaches were obtained from traffic counts performed by the Vermont Agency of Transportation (VTrans). Two different counts provide the needed volumes for analytical purposes. The first is an automatic recorder count which was performed on Route 103 north of the intersection² from July 7-12, 2021. The annual average daily traffic volume (AADT) estimated from this count equaled 5,773 vehicles per day (vpd). The peak hour volume observed during this count was 642 vehicles per hour (vph). That peak hour volume occurred on a Friday between 1-2 pm. A tabulation of this count is included in Appendix A.

Per VTrans' guidelines, the estimated design hour volume (DHV) on a summer/winter recreational state highway having a AADT of 5,800 vpd is 890 vph. The DHV is defined as being the 30th highest hourly volume occurring annually, and is used to design roadways and intersections, and to assess traffic congestion conditions.

Adjusting for background traffic growth from 2021 to 2030 (a five-year projection from the estimated project completion in 2025) will increase the future 2030 DHV to 926 vph, a 4.1% increase.³

The most recent turning movement count at the intersection of Routes 10 and 103 was performed by VTrans on August 10, 2015. The observed peak hours from this count are included in Appendix B. The above 2030 DHV was used to factor the highest observed peak hour volumes (4:00 – 5:00 pm) from that turning movement count to an estimated design hour condition.

Future traffic delays and levels of service for No-Build and Build DHV traffic conditions were then determined by performing intersection capacity analyses using the analytical methodology prescribed in the Highway Capacity Manual.⁴ The results of these analyses include levels of service (LOS), average delays (seconds/vehicle) and volume/capacity ratios (V/C), all of which are summarized in Table 2. Detailed results are included in Appendix C.

² VTrans ATR Count Station Y495

³ *Continuous Traffic Counter Report (The Redbook)*, Vermont Agency of Transportation, June 2023

⁴ *Highway Capacity Manual*, Transportation Research Board, 6th Edition

**Table 2 – VT Routes 10 & 103
PM Peak Hour (DHV) Levels of Service**

Approach & Lane Group	LOS	Avg. Delay	V/C Ratio	LOS	Avg. Delay	V/C Ratio
	2030 No-Build			2030 Build		
VT 103 SB LT	A	8.6	0.17	A	8.6	0.16
VT 10 WB LT	D	29.2	0.39	D	27.7	0.37
VT 10 WB RT	B	11.1	0.25	B	11.0	0.24

The above results are typical of a two-way stop-controlled (TWSC) intersection where traffic from the minor street approach (Route 10) experiences greater delays due to having to yield to Route 103 traffic, which experiences little or no delay. VTrans' level of service policy at TWSC intersections is to maintain a minimum of LOS D on the side streets having ≥ 150 vph for a multi-lane approach.⁵ LOS D is defined at unsignalized intersections by average delays of 25-35 seconds per vehicle. Future levels of service at the intersection of Routes 10 and 103 will conform to that standard.

The above results also show that the reduced truck volumes resulting from this Project will create a small decrease in the average delays experienced by left-turns from Route 10 onto Route 103. Future levels of service will remain the same for all movements.

An additional intersection capacity analysis was also performed at the access to the South Quarry onto VT Route 103 using the projected 2030 DHV volumes on VT 103 and future peak hour volumes entering and exiting the South Quarry. That analysis indicates that traffic exiting the South Quarry will experience LOS B.

Traffic Safety

Available sight distances along VT Route 103 at the North and South Quarries exceed the recommended 555 ft for oncoming traffic traveling at the 50 mph speed limit. Having 555 ft of sight distance also satisfies the safe stopping distance for vehicles traveling at 55-60 mph.

Chandler Road is a relatively narrow gravel roadway having a posted speed limit of 30 mph. Relocating the existing stone processing facilities from the Chandler Road Quarry to the South Quarry will reduce truck traffic and improve future traffic safety conditions on Chandler Road.

The 2018-2022 five-year crash history on roadways in the vicinity of all three quarries was also examined using VTrans' online Public Crash Data Query Tool. The North and South Quarries each had one crash on Route 103 in their immediate vicinity over that five-year period. Neither crash resulted in injuries. The crash near the North Quarry was a head-on collision and the one near the South Quarry was a same direction sideswipe. Both were likely caused by operator error. There was also one crash at the Route 10 /

⁵ Highway Design "Level of Service" Policy, Vermont Agency of Transportation, May 31, 2007

Chandler Road intersection which involved property damage only. There were no crashes on Chandler Road during this five-year period.

Unfortunately, there was a fatal collision at #498 VT Route 10 during the early afternoon on Saturday, June 19, 2021. This crash was a left-turn and thru angle broadside collision.

None of the above crashes involved trucks or pedestrians.

Conclusions

In conclusion, it is our opinion that the proposed modifications in the operation of Allstone's Chester quarries and related facilities will improve future traffic congestion and safety conditions on the roadways in the immediate vicinity of those facilities.



Appendix A

Automatic Traffic Recorder Count VT 103 Station Y495

Volume By Hour By Week for 7/7/2021 - 7/12/2021
Criteria: Location ID = Y495

District : 2 Location ID : Y495 County : WINDSOR SF Group : 5
 Located On : VT ROUTE 103 Functional Class : Other Principal Arterial Area Type : Rural

YEAR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		
AADT										5900			6100	6411	6533	5671	5597	5603	4746	5773		
Start Time	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Avg Volume Graph															Pct. of Total
12:00 AM	17	15	20	11	7	16																0.2%
1:00 AM	33	30	27	7	10	24																0.4%
2:00 AM	38	43	42	22	13	39																0.5%
3:00 AM	122	108	107	56	30	118																1.5%
4:00 AM	294	306	263	76	56	280																3.5%
5:00 AM	459	426	353	171	143	356																5.3%
6:00 AM	393	380	385	269	231	375																5.6%
7:00 AM	334	360	410	368	354	364																6.0%
8:00 AM	382	345	443	446	428	367																6.6%
9:00 AM	390	407	445	480	507	429																7.3%
10:00 AM	399	484	462	490	481	407																7.5%
11:00 AM	417	481	528	424	477	444																7.6%
12:00 PM	436	438	583	387	498	390																7.5%
1:00 PM	528	517	642	405	455	458																8.3%
2:00 PM	516	535	566	415	434	458																8.0%
3:00 PM	370	471	594	364	396	388																7.1%
4:00 PM	302	309	440	262	268	251																5.0%
5:00 PM	185	224	276	210	260	167																3.6%
6:00 PM	145	194	347	189	190	132																3.3%
7:00 PM	113	128	202	137	106	86																2.1%
8:00 PM	58	74	130	88	76	50																1.3%
9:00 PM	49	55	78	59	38	43																0.9%
10:00 PM	29	30	29	28	16	34																0.5%
11:00 PM	15	14	16	18	8	19																0.2%
Total	6024	6374	7388	5382	5482	5695																
AM Pk Hr	5:00 AM	10:00 AM	11:00 AM	10:00 AM	9:00 AM	11:00 AM																
AM Peak	459	484	528	490	507	444																485
PM Pk Hr	1:00 PM	2:00 PM	1:00 PM	2:00 PM	12:00 PM	1:00 PM																
PM Peak	528	535	642	415	498	458																513
Peak %	8.76%	8.39%	8.69%	9.10%	9.25%	8.04%																8.71%

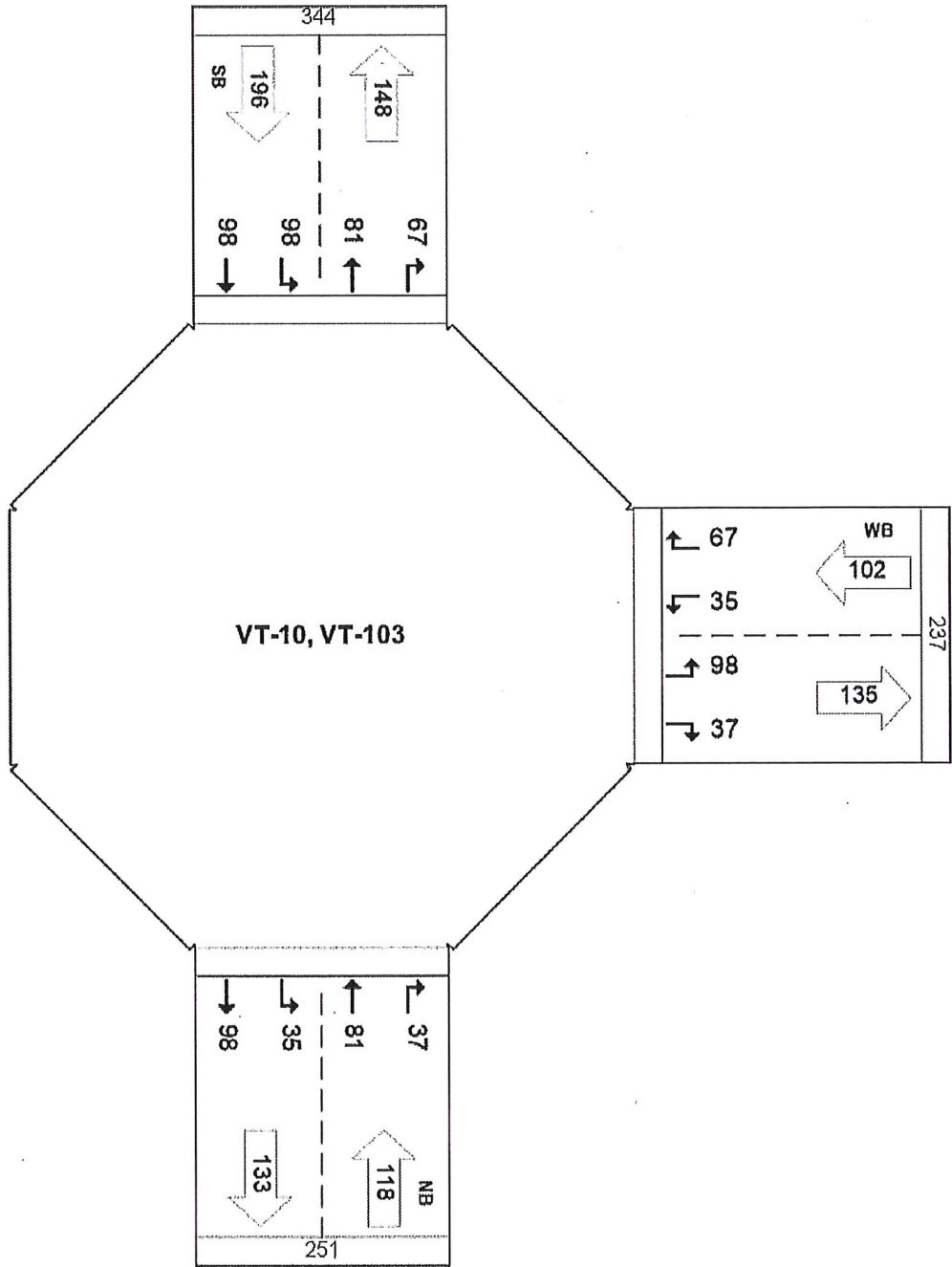
Appendix B

VT Route 10 & 103 Turning Movement Count Peak Hour Diagrams

ID 31407805
Car & Pedestrian & Truck

08/11/2015

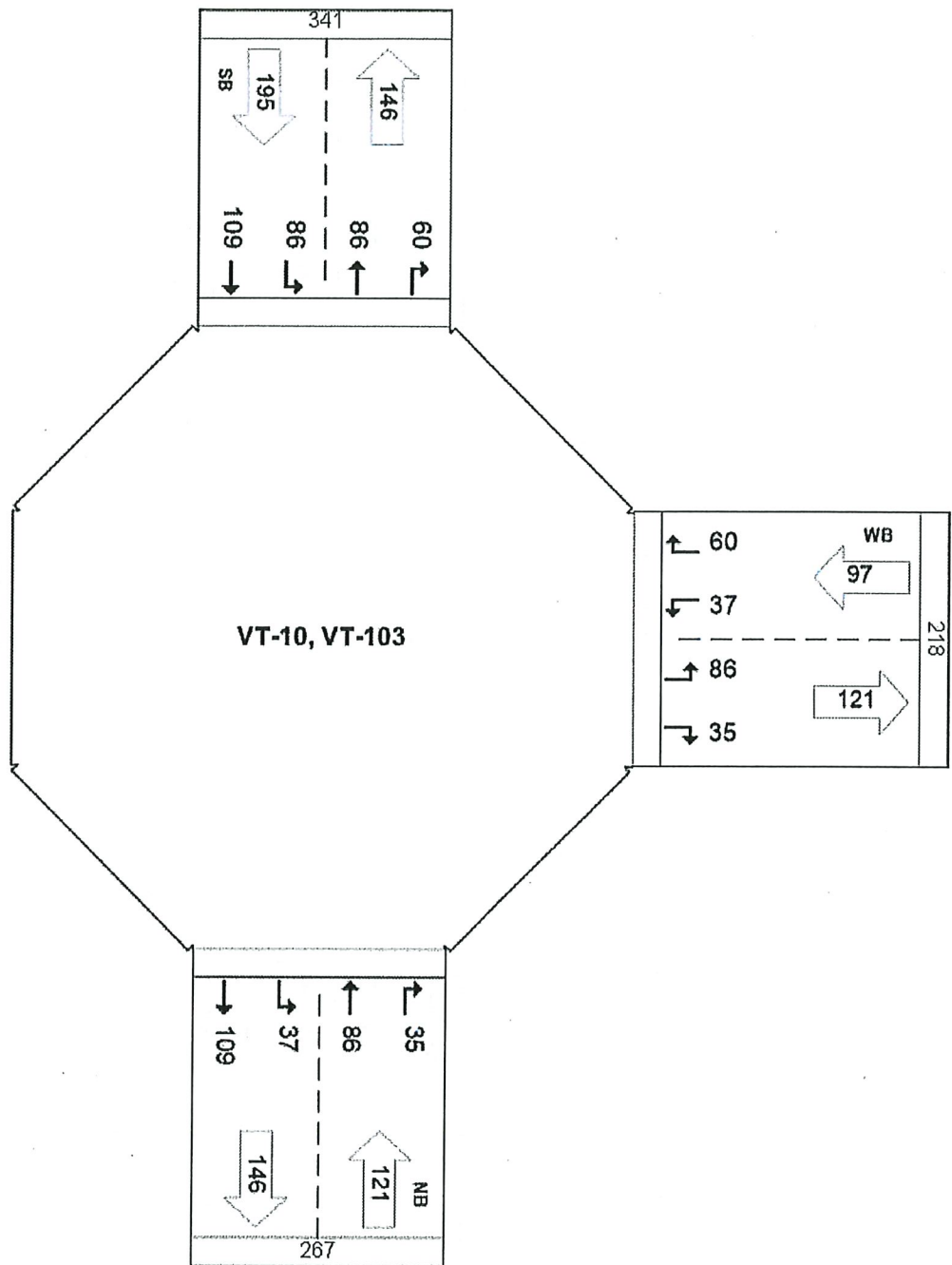
7:15 AM-8:15 AM



ID 31407805
Car & Pedestrian & Truck

08/11/2015

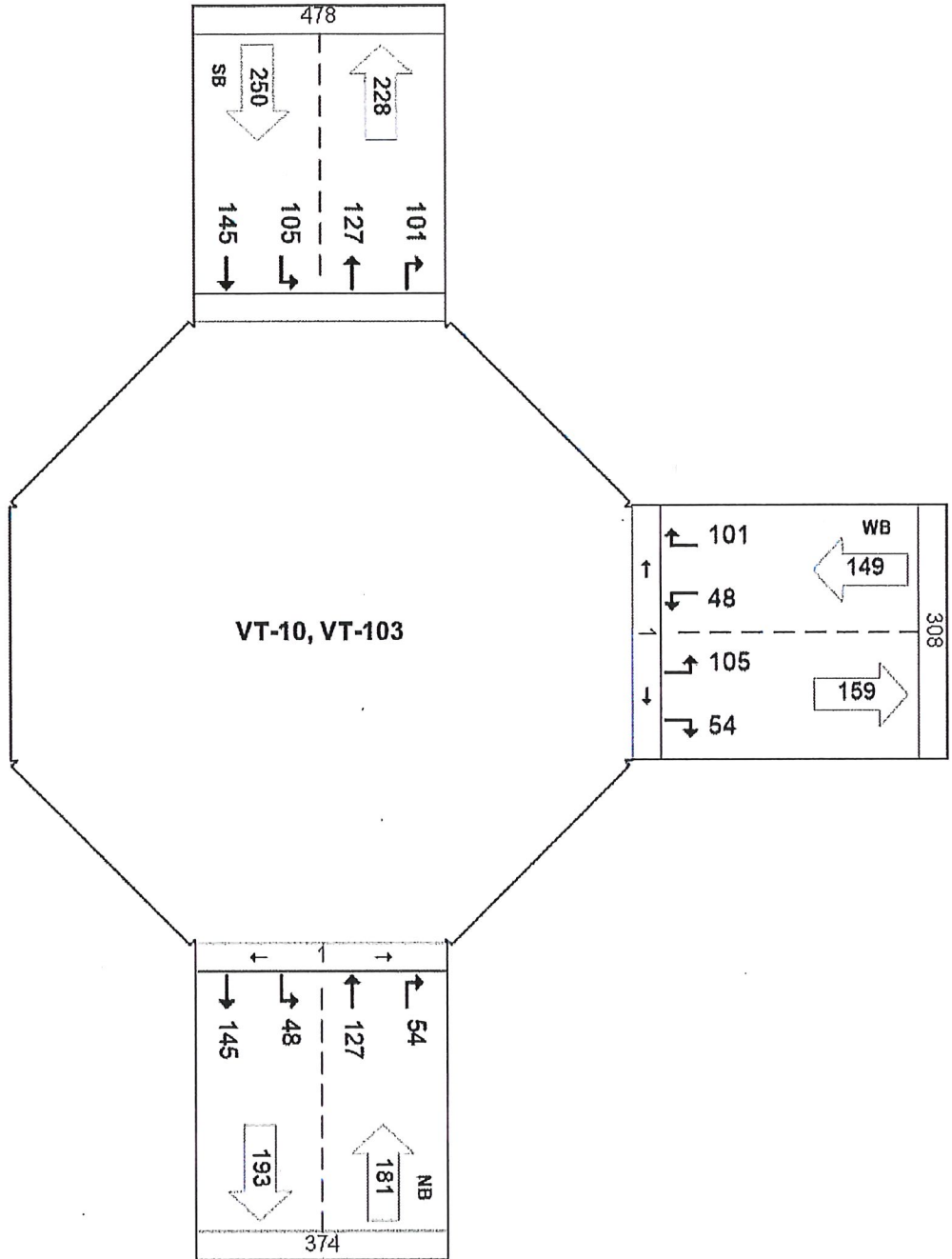
10:15 AM-11:15 AM



ID 31407805
Car & Pedestrian & Truck

08/10/2015

4:00 PM-5:00 PM



Appendix C

Intersection Capacity Analysis Reports

Intersection

Int Delay, s/veh	5.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↘	↗	↗	↘	↗
Traffic Vol, veh/h	93	196	246	105	204	281
Future Vol, veh/h	93	196	246	105	204	281
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	None
Storage Length	0	100	-	250	125	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	93	196	246	105	204	281

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	935	246	0	0	351	0
Stage 1	246	-	-	-	-	-
Stage 2	689	-	-	-	-	-
Critical Hdwy	6.45	6.25	-	-	4.15	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.345	-	-	2.245	-
Pot Cap-1 Maneuver	291	785	-	-	1191	-
Stage 1	788	-	-	-	-	-
Stage 2	493	-	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	241	785	-	-	1191	-
Mov Cap-2 Maneuver	241	-	-	-	-	-
Stage 1	788	-	-	-	-	-
Stage 2	409	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.9	0	3.6
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	241	785	1191
HCM Lane V/C Ratio	-	-	0.386	0.25	0.171
HCM Control Delay (s)	-	-	29.2	11.1	8.6
HCM Lane LOS	-	-	D	B	A
HCM 95th %tile Q(veh)	-	-	1.8	1	0.6

Intersection

Int Delay, s/veh	5.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	93	188	246	105	193	281
Future Vol, veh/h	93	188	246	105	193	281
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	None
Storage Length	0	100	-	250	125	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	93	188	246	105	193	281

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	913	246	0
Stage 1	246	-	-
Stage 2	667	-	-
Critical Hdwy	6.45	6.25	-
Critical Hdwy Stg 1	5.45	-	-
Critical Hdwy Stg 2	5.45	-	-
Follow-up Hdwy	3,545	3,345	-
Pot Cap-1 Maneuver	300	785	-
Stage 1	788	-	-
Stage 2	505	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	251	785	-
Mov Cap-2 Maneuver	251	-	-
Stage 1	788	-	-
Stage 2	423	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.5	0	3.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	251	785	1191	-
HCM Lane V/C Ratio	-	-	0.371	0.239	0.162	-
HCM Control Delay (s)	-	-	27.7	11	8.6	-
HCM Lane LOS	-	-	D	B	A	-
HCM 95th %tile Q(veh)	-	-	1.7	0.9	0.6	-

Intersection

Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	3	4	442	485	1
Future Vol, veh/h	2	3	4	442	485	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	2	3	4	442	485	1

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	936	486	486	0	0
Stage 1	486	-	-	-	-
Stage 2	450	-	-	-	-
Critical Hdwy	6.45	6.25	4.15	-	-
Critical Hdwy Stg 1	5.45	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-
Follow-up Hdwy	3.545	3.345	2.245	-	-
Pot Cap-1 Maneuver	291	575	1062	-	-
Stage 1	612	-	-	-	-
Stage 2	636	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	290	575	1062	-	-
Mov Cap-2 Maneuver	290	-	-	-	-
Stage 1	609	-	-	-	-
Stage 2	636	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.8	0.1	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1062	-	413	-	-
HCM Lane V/C Ratio	0.004	-	0.012	-	-
HCM Control Delay (s)	8.4	0	13.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-