I-71 NB at SR 82 EB Interchange Operations Study

December 2015



Prepared for:

The Ohio Department of Transportation District 12 5500 Transportation Boulevard Garfield Heights, OH 44125

Prepared by:





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Samuel J. M.



I. Executive Summary

The Ohio Department of Transportation (ODOT) commissioned Hatch Mott MacDonald (HMM) to conduct an Interchange Operations Study at the Interstate 71 (I-71) / SR 82 interchange (CUY-71-2.57) located in the City of Strongsville, Cuyahoga County, Ohio. The City of Strongsville is looking for a long-term solution to reduce congestion and decrease crashes in the study area. Several short to medium term countermeasures have been implemented or studied with little improvement to congestion or crashes.

HMM evaluated the Build Condition for traffic operations, safety and to determine any impacts to the existing freeway network. The Build Condition includes widening the SR 82 EB to I-71 NB entrance ramp allowing an additional SR 82 EB lane to access I-71 NB. The proposed ramp widening will taper back to a single travel lane prior to merging with I-71. This improvement is proposed to specifically address the severe lane imbalance, congestion and rear end crashes on SR 82 EB. The proposed improvement may also have a positive impact on the overall congestion and crash problems in the study area by improving the efficiency of the adjacent I-71 SB and Howe Road signals.

Based on the analyses presented in this report, the Build condition does not degrade or otherwise negatively affect freeway operations on I-71. The Build condition is expected to improve the efficiency of the SR 82 coordinated signal system and thus reduce travel times, fuel consumption, emissions, and crashes. Improving the efficiency of the SR 82 signal system may also help mitigate queues that currently extend onto the I-71 SB mainline during periods of high traffic volumes. Therefore, the Build condition is recommended.













Hatch Mott MacDonald

I-71 NB at SR 82 EB Interchange Operations Study

II. Background

The Ohio Department of Transportation (ODOT) commissioned Hatch Mott MacDonald (HMM) to conduct an Interchange Operations Study (IOS) of the Interstate 71 (I-71) / SR 82 interchange (CUY-71-2.57) located in the City of Strongsville, Cuyahoga County, Ohio. This IOS expands upon the preparation of the *"I-71 at SR 82 Interchange Operation Analysis"* completed by HMM on April 15, 2013. The study follows IOS procedures and guidance as given by the ODOT Office of Roadway Engineering.

A formal safety study was also completed by ODOT District 12 in July of 2012. The study focused on approximately one mile of SR 82 centered at the SR 82/Howe intersection, including the I-71 / SR 82 interchange. The safety study focused on short and medium term countermeasures. Several of the short-term countermeasures from the study have already been implemented by the City of Strongsville. Recently implemented short-term improvements include:

- All noted non-functioning loop detectors were repaired.
- All noted non-functioning pedestrian crossings were repaired.
- Signal displays on Howe Road northbound revised to be OMUTCD compliant.
- Intersection dotted lines were re-positioned from the Howe Road northbound right turn lane to SR 82 and Southpark Center Road to SR 82.
- Additional left turn storage was provided along with a second left turn lane on SR 82 eastbound at Howe Road.
- A signal progression study was performed and timings were improved to reduce queuing onto I-71 southbound to the extent possible. As part of this study, weekend and holiday timing plans were also evaluated and optimized (PID 94550).

III. Purpose & Need

Congestion on SR 82 at the I-71 interchange and adjacent areas caused by high travel demand is pushing the limits of the existing transportation network. The congestion has also brought safety concerns as this area is high on ODOT's Highway Safety Program (HSP) Priority List (see Figure 5). The purpose of this study is to examine a long term countermeasure to improve safety by reducing congestion throughout the SR 82 corridor and the I-71 / SR 82 interchange study area.

IV. Study Area

The study area consists of I-71 from the SR 303 interchange to the I-80 (Ohio Turnpike) interchange and SR 82 from Howe Road through the I-71 interchange. See Figure 3 & Figure 4.



Figure 3 - Study Area







Figure 4 - I-71/SR 82 Interchange with Signal Spacing



V. Existing Conditions

a. Road Geometry & Access Locations

The existing I-71 / SR 82 interchange is a full-access, partial cloverleaf interchange. SR 82 is the major east-west roadway through the area and is heavily commerical from US 42 to I-71 with large retail centers on both the north and south sides of the roadway including Southpark Mall. Areas further to the south of SR 82 are largely residential. US 42 is a major north-south arterial located about one mile west of I-71 which is also heavily commercial.

Table 1 - Functional Classification within Study Area

	Functional Class	Legal Speed Limit
I-71	Urban Interstate	60
SR 82	Urban Principal Arterial	35

Current ADT on SR 82 in the project area is approximately 45,000 vehicles per day. Signalized intersections along with distances between each are shown on Figure 4. SR 82 traffic signals are part of a coordinated, closed loop system.

b. Physical Conditions – Terrain

The terrain is relatively flat is this area. I-71 passes under SR 82.

c. Crash Data

Based on the Formal Safety Study completed in July of 2012, an analysis of traffic crashes from 2008 - 2010 reveal that 289 crashes occurred on the SR 82 corridor from MP 2.7 to 3.7 with about 25% of all crashes resulting in an injury. Rear end crashes account for over 70% of all crashes. Crash frequency is highest during the weekday PM peak hours (4:00 - 7:00 PM), on Saturdays, and during the months of November and December. The high crash frequency periods directly correlate with the highest traffic volume periods.

Figure 5 on the following page shows the number of ODOT Highway Safety Program safety priority locations that are within the project area.





Figure 5 – 2014 ODOT HSP Priority Rankings

Green = Urban Intersection Safety Priority Location and Rank Blue = Urban Non-Freeway Safety Priority Location and Rank Red = Urban Freeway Safety Priority Location and Rank

* SR 82 / Howe Rd - Urban Intersection, HSP Priority Ranking #12 (2012), #99 (2013)

** SR 82 3.26-3.36 - Urban Non-Freeway Segment, HSP Priority Ranking #27 (2012), #32 (2013)



d. Demographics

Per 2013 Census data, The City of Strongsville has a total population of approximately 45,000 people while Cuyahoga County has approximately 1.26 million people. Refer to Appendix A for more detailed information.

e. Land Use

The land use along SR 82 and US 42 is largely commercial. The land use adjacent to these commercial areas is mostly single family residential. See Figure 6 for land use data retrieved from the Cuyahoga County GIS.



Figure 6 - Land Use Map

VI. Analysis Years

The current year traffic used for analysis is considered 2015 while the design year is established as 2035. Traffic analysis within this IOS uses 2035 design year volumes provided by ODOT's Office of Statewide Planning & Research. The No Build condition is defined as the existing geometry and lane use with revised traffic signal timing and coordination. The Build condition is defined as the proposed improvement as presented in Figure 7. This includes widening the SR 82 EB to I-71 NB loop ramp to two lanes allowing an additional SR 82 EB lane to access I-71 NB by converting the outside through lane to a decision lane.



VII. Alternatives Considered

The following alternatives have been considered as part of this or prior studies:

- 1. No Build The No Build condition is defined as the existing geometry and lane use.
- 2. Short-Term Several short term improvements have been implemented, are in the process of being implemented, or have been previously studied. They are as follows:
 - a. Pavement marking changes based on the formal safety study from July of 2012, several pavement marking changes have occurred on SR 82 between I-71 and the Southpark Mall entrances to improve turn lane use and efficiency (ex: the SR 82 EB left turn storage capacity at Howe Road was increased by providing a dual turning lane and extending the existing turning lane based on updated traffic count information).
 - b. Signal timing / coordination optimization ODOT completed a signal optimization study and implemented optimized timings for the SR 82 closed loop system which runs from US 42 through the I-71 interchange intersections. In addition, the City of Strongsville is sponsoring a city-wide traffic signal coordination and upgrade project which will include central monitoring and adaptive signal control.
- 3. Ramp Metering Ramp metering was dismissed as a viable option at this interchange because the congestion and crash problem is more prevalent on SR 82 as well as the I-71 SB to SR 82 WB exit ramp and ramp storage would likely degrade operations of SR 82. In addition, metering is typically applied on a corridor wide basis and at this time there is no ramp metering in this area. Ramp metering was tried at this interchange in the past for the SR 82 WB to I-71 NB entrance ramp. The ramp metering signal was removed not long after installation.
- 4. SR 82 / Howe Road Intersection Reconstruction Parsons Brinckerhoff, through ODOT District 12, evaluated alternative intersection designs at the SR 82 / Howe Road intersection such as a roundabout, continuous flow intersection (CFI), and median U-turns in a safety study dated November 2014. The close proximity of the I-71 interchange, physical site constraints, major disruption of traffic, and high construction / ROW costs prohibited these options as being viable at this time.
- 5. New I-71 Interchange Several studies have been conducted in the past to explore the feasibility of constructing a new interchange on I-71 between SR 303 and SR 82. Based on a teleconference on March 2, 2015 between HMM, District 12, and the Office of Roadway Engineering, ODOT has dismissed this alternative due to high costs, ROW needs, and a lack of support by local municipalities and ODOT.
- 6. Additional I-71 SB Exit Ramp As part of the SR 82 interchange, an additional I-71 SB exit ramp tying directly into Howe Road south of SR 82 is being explored in conjunction with this study.
- 7. Build The Build condition studied in this report will represent the following proposed conditions:
 - a. Widen the SR 82 EB to I-71 NB entrance loop ramp to accommodate two receiving lanes.
 - b. Modify SR 82 EB lane configuration by making the outside through lane a decision lane.
 - c. Optimize signal timings and coordination parameters.



One of the major identified issues associated with congestion and crashes in the project area is lane imbalance. This is particularly prevalent in the curb lane on SR 82 eastbound and for the northbound right turn movement of Howe Road at SR 82. Both conditions are directly related to the existing access to I-71 NB. Currently, the same SR 82 EB lane is the only lane that accesses both I-71 NB and SB. With only one lane for the heavy SR 82 EB to I-71 NB movement (over 1600 AM peak and 1100 PM peak vehicles), extended queues form in the curb lanes on SR 82 EB and Howe Road NB while the other lanes are under-utilized. During peak periods, the SR 82 EB curb lane queue lengths extend approximately three quarters of a mile to the western mall entrance and Howe Road NB curb lane queue lengths extend over 1000 feet in order to get into the lane that eventually accesses I-71 NB.

The Build condition specifically addresses this lane imbalance with the intent to distribute SR 82 EB traffic across two lanes to access I-71 NB.

Build Condition Design Standards

The proposed Build condition improvements meet ODOT design standards pertaining to roadway geometrics and interchange elements.

Build Condition Limits of L/A ROW

All proposed work for the Build condition is within existing ROW limits.



Figure 7 - Build Condition



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I-71 NB at SR 82 EB Interchange Operations Study

December 2015

VIII. Traffic Volumes

ODOT's Office of Statewide Planning & Research provided certified traffic forecasts on June 19, 2013. Certified traffic was provided for AM/PM peaks, ADT's, and truck factors for 2015 (current year) and 2035 (design year) No Build and Build conditions. See Appendix B for certified traffic.

IX. Traffic Analyses

Level of Service

Per the Highway Capacity Manual, a Level of Service (LOS) C is desired for the interstate/freeway system and interchange components of the Build condition. The Northeast Ohio Areawide Coordinating Agency (NOACA) accepts LOS D or better within their Metropolitan Planning Organization (MPO) boundaries. Full capacity reports are available in Appendix C.

Intersections

Traffic analysis was completed for the I-71 intersections with SR 82 during the AM and PM peak hours under the No Build and Build conditions. The intersections were analyzed to determine LOS given existing conditions (No Build) and to appropriately size the intersection given proposed conditions (Build). Analyses followed ODOT balancing procedures where the worst east-west approach was balanced within three seconds of the worst north-south approach where possible. Per ODOT procedures, HMM utilized *Highway Capacity Software (HCS) 2010* to analyze the I-71 NB intersection while *Synchro 8* was used for the I-71 SB intersection due to limitations of HCS given the geometrics and signal phasing of the intersection. The change in delay at the I-71 SB intersection was due to a change in lane utilization in the Build Condition.

In addition, the signal was analyzed in *Synchro 8* to measure coordination parameters and the interaction between other signals within the SR 82 closed loop system. Synchro results are shown for the SR 82/I-71 NB intersection as well as the two upstream intersections on SR 82. Note that the volumes are the same in the No Build and Build conditions.

	AM No Build vs Build				PM No Build vs Build						
п	Location	2035 N	lo Build	2035	Build			2035 N	lo Build	2035	Build
U	LOCATION	LOS	Delay	LOS	Delay	ID	LOCATION	LOS	Delay	LOS	Delay
13	SR 82 & I-71 NB	С	20.0	с	20.0	13	SR 82 & I-71 NB	С	22.0	с	22.0
	EB Approach	В	13.0	В	13.0		EB Approach	С	28.0	С	28.0
	WB Approach	С	21.8	С	21.8		WB Approach	В	12.7	В	12.7
	NB Approach	С	23.7	С	23.7		NB Approach	С	31.3	С	31.3
14	SR 82 & I-71 SB ¹	F	85.2	С	33.1	14	SR 82 & I-71 SB ¹	F	104.2	D	49.0
	EB Approach	F	111.6	С	33.3		EB Approach	F	145.7	D	45.9
	WB Approach	С	29.8	С	32.2		WB Approach	D	54.9	D	52.1
	NB Approach	E	60.1	С	32.0		NB Approach	F	145.1	D	46.2
	SB Approach	F	110.0	С	34.6		SB Approach	E	70.3	D	51.8

Figure 8 – Intersection LOS Summary

¹ SR 82 & I-71 SB analysis completed in Synchro. Unable to analyze in HCS due to limitations of software





	AM No Build vs Build				PM No Build vs Build						
10	l a cation	2035 N	lo Build	2035	Build	10	l a anti-m	2035 N	lo Build	2035 Build	
ID	Location	LOS	Delay	LOS	Delay	טו	Location	LOS	Delay	LOS	Delay
13	SR 82 & I-71 NB	В	17.9	В	16.4	13	SR 82 & I-71 NB	В	16.5	с	20.5
	EB Approach	А	4.7	А	7.6		EB Approach	А	7.2	В	15.5
	WB Approach	В	11.1	В	13.5		WB Approach	А	9.6	В	10.4
	NB Approach	E	61.8	E	66.9		NB Approach	E	63.7	E	74.4
14	SR 82 & I-71 SB	E	57.7	с	24.9	14	SR 82 & I-71 SB	F	105.5	D	50.5
	EB Approach	F	80.2	А	8.0		EB Approach	F	137.4	А	8.8
	WB Approach	С	28.3	С	32.3		WB Approach	D	54.3	D	54.1
	NB Approach	E	58.8	E	58.8		NB Approach	F	139.7	F	139.7
	SB Approach	D	43.9	D	42.8		SB Approach	F	91.0	E	65.6
	SR 82 & Howe	F	125.4	D	38.2		SR 82 & Howe	F	130.4	F	99.3
	EB Approach	F	221.4	D	35.2		EB Approach	F	204.8	F	100.6
	WB Approach	С	34.4	С	28.6		WB Approach	F	117.5	F	117.2
	NB Approach	F	174.2	E	62.1		NB Approach	D	53.5	D	53.5
	SB Approach	D	51.9	D	51.9		SB Approach	E	69.1	E	69.2

Figure 9 – SR 82 Coordinated System LOS Summary

Delay was reduced more in the Build condition for the intersections upstream of the SR 82/I-71 NB intersection. This is a direct effect of the expected lane balancing on SR 82 EB given the Build condition.



Freeway Section Analysis

HMM analyzed freeway segments on I-71 NB following ODOT methodology using *HCS 2010*. Segments were analyzed between interchanges and within interchanges between merge and diverge points. A summary is below. Note that no changes to the I-71 Mainline are proposed for the Build condition. Certified traffic volumes for each I-71 analysis point remained the same between the No Build and Build conditions.

- In the AM, the NB section of I-71 from SR 82 to I-80 is LOS E for the No Build & Build conditions.
- In the AM, the NB section of I-71 at I-80 is LOS E for No Build & Build conditions.
- The proposed Build condition does not degrade freeway segment operations.

AM No Build vs Build						
ID	I-71 Northbound	Lanac	2035	No Build	203	5 Build
U	Segment	Lanes	LOS	Density	LOS	Density
2	@ SR 303	3	С	20.1	С	20.1
4	SR 303 to SR 82	3	С	21.8	С	21.8
6	@ SR 82 EB	3	С	19.5	С	19.5
8	@ SR 82 WB	3	D	30.5	D	30.5
10	SR 82 to I-80	3	E	41.8	Ε	41.8
12	@ I-80	3	E	36.9	Ε	36.9

Figure 10 – Freeway Segment LOS Summary

PM No Build vs Build								
	I-71 Northbound	Lanos	2035 N		203	5 Build		
U	Segment	Lanes	LOS	Density	LOS	Density		
2	@ SR 303	3	В	11.2	В	11.2		
4	SR 303 to SR 82	3	В	13.1	В	13.1		
6	@ SR 82 EB	3	Α	10.2	Α	10.2		
8	@ SR 82 WB	3	В	16.8	В	16.8		
10	SR 82 to I-80	3	С	19.0	С	19.0		
12	@ -80	3	В	16.9	В	16.9		



Merge / Diverge Analysis

HMM analyzed the LOS at merge and diverge points along I-71 NB within the project area following ODOT methodology using *HCS 2010*. Note that although the SR 82 EB to I-71 NB entrance ramp is widened in the Build condition, the forecasted traffic volume at the merge point after the ramp has been reduced back to a single lane remains the same. All other merge and diverge analysis points also remain the same between the No Build and Build conditions.

- In the AM, the SR 82 WB entrance ramp to I-71 NB operates with a merge LOS E for the No Build and Build conditions.
- The proposed Build condition does not degrade freeway operations for merge and diverge points.

AM No Build vs Build						
		2035	No Build	2035 Build		
ID	I-7 I IND	LOS	Density	LOS	Density	
	@ SR 303					
1	Merge 1	С	22.0	С	22.0	
3	Merge 2	С	21.5	С	21.5	
	@ SR 82					
5	Diverge	С	24.7	С	24.7	
7	Merge 1	D	32.8	D	32.8	
9	Merge 2	E	36.5	Ε	36.5	
	@ I-80					
11	Diverge	D	34.6	D	34.6	

Figure 11 – Merge/Diverge LOS Summary

PM No Build vs Build						
2035 N		No Build	203	5 Build		
U	1-71 NB	LOS	Density	LOS	Density	
	@ SR 303					
1	Merge 1	В	12.4	В	12.4	
3	Merge 2	В	13.7	В	13.7	
	@ SR 82					
5	Diverge	В	16.4	В	16.4	
7	Merge 1	С	20.3	С	20.3	
9	Merge 2	С	20.2	С	20.2	
	@ I-80					
11	Diverge	С	21.3	С	21.3	



Constrained Analysis

Constrained analysis is not required as the Build condition does not cause freeway degradation as defined in the ODOT IMS Traffic Academy Manual.

X. Cost Estimate

The cost estimate for the Build condition, completed by EMH&T as part of PID 99435, is approximately \$857,000. A breakdown by group is provided below. A detailed cost estimate is provided in Appendix D.

Group	Cost
Roadway	\$ 205,000
Erosion Control	\$ 45,500
Drainage	\$ 35,500
Pavement	\$ 359,500
Lighting	\$ 24,500
Traffic Control	\$ 36,000
Maintenance of Traffic	\$ 86,000
Incidentals	\$ 41,500
Subtotal	\$ 833,500
Inflation (2016)	2.8 %
Total	\$ 857,000

Table 2 - Build Condition Cost Estimate

This improvement is funded by a 90% federal share through the ODOT Highway Safety Improvement Program and a 10% local match by the City of Strongsville.



VIII. Environmental Overview

Environmental Documentation was completed by ODOT District 12 with an Environmental Document Approval date of 8/14/2015. All proposed work will be in the public right of way. The only utility impacted by the Build condition is an electrical service cable owned by ODOT.

IX. Conclusion and Recommendations

The I-71 / SR 82 interchange is heavily congested due to traffic demand from commercial areas adjacent to the interchange as well as the large residential population surrounding the commercial areas. Travel delays are high due to the congestion and a number of closely spaced signalized intersections. In addition, crash frequency is high within the study area as many locations fall under ODOT's Highway Safety Program Priority List and have for several consecutive years.

The Build Condition reduces queues on SR 82 EB by distributing traffic desiring to access I-71 NB over two lanes as opposed to one lane. By improving the lane utilization to a more balanced condition, the Build condition will allow the SR 82 coordinated signal system to operate more efficiently. Improving the existing lane imbalance on SR 82 EB is also expected to help reduce crashes. Specifically, rear end crashes are expected to decrease as a result of the reduced queue lengths in the SR 82 EB curb lane.

The Build Condition does not degrade freeway operations. All intersections, freeway segments, merge and diverge locations operate with equal or improved LOS between the No Build and Build conditions. The Build Condition is expected to improve traffic operations along the SR 82 corridor and at the I-71 / SR 82 interchange. The presented Build condition provides an adequate traffic solution and is recommended to be carried forward.



Appendix A

2013 Census Data



OH - Strongsville city

Population

Total Population	1,280,122
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Housing Status

(in housing units unless noted)	
Total	621,763
Occupied	545,056
Owner-occupied	331,876
Population in owner-occupied	804,136
(number of individuals)	
Renter-occupied	213,180
Population in renter-occupied	446,735
(number of individuals)	
Households with individuals under 18	154,582
Vacant	76,707
Vacant: for rent	32,522
Vacant: for sale	9,679

Population by Sex/Age

Male	607,362
Female	672,760
Under 18	290,262
18 & over	989,860
20 - 24	78,335
25 - 34	157,986
35 - 49	254,121
50 - 64	266,049
65 & over	198,541

Population by Ethnicity

Hispanic or Latino	61,270
Non Hispanic or Latino	1,218,852

Population by Race

White	814,103
African American	380,198
Asian	32,883
American Indian and Alaska Native	2,578
Native Hawaiian and Pacific Islander	285
Other	23,339
Identified by two or more	26,73

Population

Total Population	44,750

Housing Status

g	
(in housing units unless noted)	
Total	18,476
Occupied	17,659
Owner-occupied	14,270
Population in owner-occupied	37,978
(number of individuals)	
Renter-occupied	3,389
Population in renter-occupied	6,468
(number of individuals)	
Households with individuals under 18	5,571
Vacant	817
Vacant: for rent	316
Vacant: for sale	205

Population by Sex/Age

Male	21,766
Female	22,984
Under 18	10,405
18 & over	34,345
20 - 24	1,951
25 - 34	4,014
35 - 49	9,567
50 - 64	10,686
65 & over	7,189

Population by Ethnicity

Hispanic or Latino	912
Non Hispanic or Latino	43,838

Population by Race

White	41,185
African American	845
Asian	1,833
American Indian and Alaska Native	42
Native Hawaiian and Pacific Islander	14
Other	190
Identified by two or more	641

Population Total Population 172,332

Housing Status

(in housing units unless noted)	
Total	69,181
Occupied	65,143
Owner-occupied	52,536
Population in owner-occupied	143,720
(number of individuals)	
Renter-occupied	12,607
Population in renter-occupied	27,414
(number of individuals)	
Households with individuals under 18	22,966
Vacant	4,038
Vacant: for rent	1,400
Vacant: for sale	880

Population by Sex/Age

Male	84,941
Female	87,391
Under 18	43,741
18 & over	128,591
20 - 24	7,801
25 - 34	17,926
35 - 49	39,633
50 - 64	36,696
65 & over	22,601

Population by Ethnicity

Hispanic or Latino	2,747
Non Hispanic or Latino	169,585

Population by Race

White	165,642
African American	2,027
Asian	1,660
American Indian and Alaska Native	247
Native Hawaiian and Pacific Islander	18
Other	652
Identified by two or more	2,086

OH - Brunswick city

Population

Total Population	34,255

Housing Status

(in housing units unless noted)	
Total	13,600
Occupied	12,967
Owner-occupied	10,190
Population in owner-occupied	27,816
(number of individuals)	
Renter-occupied	2,777
Population in renter-occupied	6,239
(number of individuals)	
Households with individuals under 18	4,695
Vacant	633
Vacant: for rent	322
Vacant: for sale	135

Population by Sex/Age

Male	16,830
Female	17,425
Under 18	8,644
18 & over	25,611
20 - 24	1,738
25 - 34	3,983
35 - 49	8,040
50 - 64	6,949
65 & over	4,079

Population by Ethnicity

Hispanic or Latino	790
Non Hispanic or Latino	33,465

Population by Race

White	32,706
African American	422
Asian	420
American Indian and Alaska Native	51
Native Hawaiian and Pacific Islander	6
Other	204
Identified by two or more	44

Appendix B

Certified Traffic



INTER-OFFICE COMMUNICATION

TO: Brian Blayney, P.E., Traffic Planning Engineer, District 12

FROM: Becky Salak, Transportation Planner, Office of Statewide Planning and Research

- SUBJECT: CUY-71-2.57, No PID Revised
- **DATE:** June 19, 2013

The attached plates have been revised, and replace the plates sent with the June 14, 2013 IOC.

In reply to a request received May 24, 2013, plates are attached showing 2015/2035 ADT, A.M. DHV, and P.M. DHV turning movement forecasts for the no build and build scenarios. K & D factors can be calculated as needed. Truck factors are shown on a separate plate.

If you have any questions, please contact me at (614) 644-8195.

c: M. Byram, OSPR – G. Giaimo, OSPR – File



Hu 1070/1090-J I 380 / 390-J 000000000000000000000000000000000000	—Drake Rd	303 303 303 303 303 303 303 303 303 303
340		CUY-71-2.57 NO PID
2/49		2015/2035 ADT NO BUILD
111 111 111 111 111 111 111 111 111 11		OHIO DEPARTMENT OF TRANSPORTATION
		OFFICE OF STATEWIDE PLANNING & RESEARCH
		JUNE 19, 2013 NOT TO SCALE





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2013	CUY-71-2.57 NO PID
m m	2015/2035 P.M. DHV NO BUILD
	OHIO DEPARTMENT OF TRANSPORTATION
	OFFICE OF STATEWIDE PLANNING & RESEARCH
	JUNE 19, 2013 NOT TO SCALE



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0 0	CUY-71-2.57 NO PID
<u>7/44</u>	2015/2035 ADT BUILD
4640	OHIO DEPARTMENT OF TRANSPORTATION
	OFFICE OF STATEWIDE PLANNING & RESEARCH
	JUNE 19, 2013 NOT TO SCALE





$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c}$	0171/06EL 30.3 30.3 30.3 30.3
20122	CUY-71-2.57 NO PID
m M Q	2015/2035 P.M. DHV BUILD
	OHIO DEPARTMENT OF TRANSPORTATION
	OFFICE OF STATEWIDE PLANNING & RESEARCH
	JUNE 19, 2013 NOT TO SCALE



Appendix C

Capacity Analysis



Intersections

2035 AM



HCS 2010 Signalized Intersection Results Summary

1474167 **General Information** Intersection Information Agency Hatch Mott MacDonald Duration, h 0.25 SJT Analyst Analysis Date Oct 20, 2015 Area Type Other PHF 0.92 Jurisdiction Strongsville Time Period AM Intersection SR 82 @ I-71 NB Analysis Year 2035 Analysis Period 1>7:00 13 SR82 & I-71 NB 2035 AM.xus File Name **Project Description** I-71 / SR 82 IMS **Demand Information** EB WB NB SB т Approach Movement L Т R L Т R L Т R L R Demand (v), veh/h 730 2040 290 0 120 Signal Information Cycle, s 80.0 **Reference Phase** 2 517 Offset, s 0 **Reference** Point End 0.0 0.0 Green 40.0 29.0 0.0 0.0 Uncoordinated Yes Simult. Gap E/W On Yellow 4.0 0.0 0.0 0.0 0.0 4.0 Force Mode Fixed Simult. Gap N/S 0.0 On Red 1.5 1.5 0.0 0.0 0.0 **Timer Results** EBL EBT WBL WBT NBL NBT SBL SBT **Assigned Phase** 2 6 8 Case Number 8.0 8.0 10.0 Phase Duration, s 45.5 45.5 34.5 Change Period, (Y+Rc), s 5.5 5.5 5.5 Max Allow Headway (MAH), s 3.0 3.0 3.3 Queue Clearance Time (g_s) , s 13.7 33.6 14.6 Green Extension Time (ge), s 11.7 4.7 0.9 1.00 Phase Call Probability 1.00 1.00 0.21 0.00 Max Out Probability 0.80 WB NB SB **Movement Group Results** EΒ Approach Movement L Т R L Т R L Т R L т R **Assigned Movement** 2 6 3 8 18 Adjusted Flow Rate (v), veh/h 793 2217 158 158 Adjusted Saturation Flow Rate (s), veh/h/ln 1740 1740 1756 1675 11.7 Queue Service Time (q_s) , s 31.6 5.1 5.1 Cycle Queue Clearance Time (q_c) , s 11.7 31.6 5.1 5.1 Green Ratio (g/C) 0.50 0.50 0.36 0.36 Capacity (c), veh/h 1756 2512 631 631 Volume-to-Capacity Ratio (X) 0.452 0.883 0.250 0.250 Available Capacity (ca), veh/h 1756 2512 631 631 Back of Queue (Q), veh/ln (50th percentile) 4.1 11.5 1.9 1.9 Queue Storage Ratio (RQ) (50th percentile) 0.00 0.00 0.20 0.20 Uniform Delay (d_1), s/veh 12.9 17.9 17.9 17.9 Incremental Delay (d2), s/veh 0.1 3.9 0.1 0.1 Initial Queue Delay (d3), s/veh 0.0 0.0 0.0 0.0 Control Delay (d), s/veh 13.0 21.8 18.0 18.0 Level of Service (LOS) В С В В 13.0 21.8 С 23.7 С 0.0 Approach Delay, s/veh / LOS В Intersection Delay, s/veh / LOS 20.0 С **Multimodal Results** EB WB NB SB Pedestrian LOS Score / LOS Bicycle LOS Score / LOS

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AM

	-	\mathbf{r}	1	-	1	~			
Lane Group	EBT	EBR	WBL	WBT	NBR2	SWR	ø1	ø4	
Lane Configurations	***	1	ሻ	***	11	111			
Volume (vph)	2050	280	100	1130	370	960			
Turn Type	NA	Perm	Prot	NA	pt+ov	custom			
Protected Phases	6		5	2	4 5	14	1	4	
Permitted Phases	6	6		2		14			
Detector Phase	6	6	5	2	45	14			
Switch Phase									
Minimum Initial (s)	25.0	25.0	10.0	25.0			1.0	7.0	
Minimum Split (s)	32.0	32.0	17.0	32.0			20.0	20.0	
Total Split (s)	111.0	111.0	25.0	105.0			31.0	14.0	
Total Split (%)	74.0%	74.0%	16.7%	70.0%			21%	9%	
Yellow Time (s)	5.0	5.0	5.0	5.0			5.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0			2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					
Total Lost Time (s)	7.0	7.0	7.0	7.0					
Lead/Lag	Lead	Lead	Lag	Lag			Lead		
Lead-Lag Optimize?	Yes	Yes							
Recall Mode	None	None	None	None			None	Max	
Act Effct Green (s)	104.0	104.0	18.0	98.0	33.0	38.0			
Actuated g/C Ratio	0.69	0.69	0.12	0.65	0.22	0.25			
v/c Ratio	1.22	0.27	1.03	0.40	0.68	1.09			
Control Delay	126.6	1.3	133.5	12.6	60.1	110.0			
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0			
Total Delay	126.6	1.3	133.5	12.6	60.1	110.0			
LOS	F	А	F	В	E	F			
Approach Delay	111.6			29.8					
Approach LOS	F			С					
Intersection Summary									
Cycle Length: 150									
Actuated Cycle Length: 150									
Natural Cycle: 150									
Control Type: Actuated-Unco	ordinated								
Maximum v/c Ratio: 1.22									

Splits and Phases: 2: I-71 SB Ramp & SR 82 Royalton Rd + -

Intersection Signal Delay: 85.2 Intersection Capacity Utilization Err%

Analysis Period (min) 15

ø1	← ø2		↓ Ø4
31 s	105 s		14 s
∞ ∎ø6		€ Pø5	
111 s		25 s	

Intersection LOS: F

ICU Level of Service H

AM No Build |

12/11/2015

Timings 2: I-71 SB Ramp & SR 82 Royalton Rd

	-	\mathbf{r}	1	-	1	~		
Lane Group	EBT	EBR	WBL	WBT	NBR2	SWR	ø1	ø4
Lane Configurations	***	1	ሻ	***	11	111		
Volume (vph)	2050	280	100	1130	370	960		
Turn Type	NA	Perm	Prot	NA	pt+ov	custom		
Protected Phases	6		5	2	45	14	1	4
Permitted Phases	6	6		2		14		
Detector Phase	6	6	5	2	45	14		
Switch Phase								
Minimum Initial (s)	25.0	25.0	10.0	25.0			1.0	7.0
Minimum Split (s)	32.0	32.0	17.0	32.0			20.0	20.0
Total Split (s)	78.0	78.0	45.0	53.0			70.0	27.0
Total Split (%)	52.0%	52.0%	30.0%	35.3%			47%	18%
Yellow Time (s)	5.0	5.0	5.0	5.0			5.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0			2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0				
Total Lost Time (s)	7.0	7.0	7.0	7.0				
Lead/Lag	Lead	Lead	Lag	Lag			Lead	
Lead-Lag Optimize?	Yes	Yes						
Recall Mode	None	None	None	None			None	Max
Act Effct Green (s)	71.1	71.1	22.1	65.5	50.1	54.8		
Actuated g/C Ratio	0.53	0.53	0.16	0.49	0.37	0.41		
v/c Ratio	0.93	0.33	0.75	0.54	0.40	0.68		
Control Delay	37.2	2.8	70.1	25.9	32.0	34.6		
Queue Delay	0.3	0.0	0.0	0.0	0.0	0.0		
Total Delay	37.5	2.8	70.1	25.9	32.0	34.6		
LOS	D	А	E	С	С	С		
Approach Delay	33.3			32.2				
Approach LOS	С			С				
Intersection Summary								
Cycle Length: 150								
Actuated Cycle Length: 134.	.3							
Natural Cycle: 90								
Control Type: Actuated-Unc	oordinated							
Maximum v/c Ratio: 0.93								
Intersection Signal Delay: 33	3.1			lr	ntersectio	on LOS: C		
Intersection Capacity Utilization	tion Err%			10	CU Level	of Service	H	
Analysis Period (min) 15								

Splits and Phases: 2: I-71 SB Ramp & SR 82 Royalton Rd

↓ ø1	← ø2	≁ rø4
70 s	53 s	27 s
₩ ø6	€ ¢5	
78 s	45 s	
Intersections

2035 PM



HCS 2010 Signalized Intersection Results Summary

1474167 **General Information** Intersection Information Agency Hatch Mott MacDonald Duration, h 0.25 SJT Analyst Analysis Date Oct 20, 2015 Area Type Other PHF 0.92 Jurisdiction Strongsville Time Period PM Intersection SR 82 @ I-71 NB Analysis Year 2035 Analysis Period 1>7:00 13 SR82 & I-71 NB 2035 PM.xus File Name **Project Description** I-71 / SR 82 IMS **Demand Information** EB WB NB SB т Approach Movement L Т R L Т R L Т R L R Demand (v), veh/h 1690 1600 330 0 190 Signal Information Cycle, s 80.0 **Reference Phase** 2 517 Offset, s 0 **Reference** Point End 0.0 0.0 Green 44.0 25.0 0.0 0.0 Uncoordinated Yes Simult. Gap E/W On Yellow 4.0 0.0 0.0 0.0 0.0 4.0 Force Mode Fixed Simult. Gap N/S 0.0 On Red 1.5 1.5 0.0 0.0 0.0 **Timer Results** EBL EBT WBL WBT NBL NBT SBL SBT **Assigned Phase** 2 6 8 Case Number 8.0 8.0 10.0 Phase Duration, s 49.5 49.5 30.5 Change Period, (Y+Rc), s 5.5 5.5 5.5 Max Allow Headway (MAH), s 3.0 3.0 3.3 Queue Clearance Time (g_s) , s 41.5 21.1 20.0 Green Extension Time (ge), s 2.2 13.7 0.7 1.00 Phase Call Probability 1.00 1.00 1.00 0.41 Max Out Probability 0.43 WB NB SB **Movement Group Results** EΒ Approach Movement L Т R L Т R L Т R L т R **Assigned Movement** 2 6 3 8 18 Adjusted Flow Rate (v), veh/h 1837 1739 179 179 Adjusted Saturation Flow Rate (s), veh/h/ln 1740 1740 1756 1675 6.3 Queue Service Time (q_s) , s 39.5 19.1 6.3 Cycle Queue Clearance Time (q_c) , s 39.5 19.1 6.3 6.3 Green Ratio (g/C) 0.55 0.55 0.31 0.31 Capacity (c), veh/h 1932 2764 544 544 Volume-to-Capacity Ratio (X) 0.951 0.629 0.330 0.330 Available Capacity (ca), veh/h 1932 2764 544 544 Back of Queue (Q), veh/ln (50th percentile) 16.2 6.2 2.5 2.5 Queue Storage Ratio (RQ) (50th percentile) 0.00 0.00 0.25 0.25 12.4 Uniform Delay (d_1), s/veh 17.0 21.1 21.1 Incremental Delay (d2), s/veh 11.0 0.4 0.1 0.1 Initial Queue Delay (d3), s/veh 0.0 0.0 0.0 0.0 Control Delay (d), s/veh 28.0 12.7 21.2 21.2 Level of Service (LOS) С В С С 28.0 С 12.7 31.3 С 0.0 Approach Delay, s/veh / LOS в Intersection Delay, s/veh / LOS 22.0 С **Multimodal Results** EB WB NB SB Pedestrian LOS Score / LOS Bicycle LOS Score / LOS

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PM

Timings 2: I-71 SB Ramp & SR 82 Royalton Rd

	-	\mathbf{r}	4	-	1	~			
Lane Group	EBT	EBR	WBL	WBT	NBR2	SWR	ø1	ø4	
Lane Configurations	***	1	ሻ	***	11	111			
Volume (vph)	2030	450	100	1400	840	1850			
Turn Type	NA	Perm	Prot	NA	pt+ov	custom			
Protected Phases	6		5	2	45	14	1	4	
Permitted Phases	6	6		2		14			
Detector Phase	6	6	5	2	45	14			
Switch Phase									
Minimum Initial (s)	25.0	25.0	10.0	25.0			1.0	7.0	
Minimum Split (s)	32.0	32.0	17.0	32.0			20.0	20.0	
Total Split (s)	101.5	101.5	25.0	66.0			60.0	23.5	
Total Split (%)	67.7%	67.7%	16.7%	44.0%			40%	16%	
Yellow Time (s)	5.0	5.0	5.0	5.0			5.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0			2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					
Total Lost Time (s)	7.0	7.0	7.0	7.0					
Lead/Lag	Lead	Lead	Lag	Lag			Lead		
Lead-Lag Optimize?	Yes	Yes							
Recall Mode	None	None	None	None			None	Max	
Act Effct Green (s)	94.5	94.5	18.0	59.5	42.5	76.5			
Actuated g/C Ratio	0.63	0.63	0.12	0.40	0.28	0.51			
v/c Ratio	1.33	0.44	1.03	0.82	1.19	1.05			
Control Delay	177.5	2.6	133.5	44.5	145.1	70.3			
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0			
Total Delay	177.5	2.6	133.5	44.5	145.1	70.3			
LOS	F	А	F	D	F	E			
Approach Delay	145.7			54.9					
Approach LOS	F			D					
Intersection Summary									
Cycle Length: 150									
Actuated Cycle Length: 150									
Natural Cycle: 150									
Control Type: Actuated-Unco	pordinated								
Maximum v/c Ratio: 1.33									
Intersection Signal Delay: 10)4.2			lr	ntersectio	on LOS: F			
Intersection Capacity Utilizat	ion Err%			IC	CU Level	of Service	Η		
Analysis Period (min) 15									

Splits and Phases: 2: I-71 SB Ramp & SR 82 Royalton Rd

↓ ø1	← ø2		↓ Ø4
60 s	66 s		23.5 s
₩ ø6		€rø5	
101.5 s		25 s	

12/11/2015

Timings 2: I-71 SB Ramp & SR 82 Royalton Rd

	-	\rightarrow	-	-	1	~			
Lane Group	EBT	EBR	WBL	WBT	NBR2	SWR	ø1	ø4	
Lane Configurations	^	1	۲	^	11	111			
Volume (vph)	2030	450	100	1400	840	1850			
Turn Type	NA	Perm	Prot	NA	pt+ov	custom			
Protected Phases	6		5	2	4 5	14	1	4	
Permitted Phases	6	6		2		14			
Detector Phase	6	6	5	2	45	14			
Switch Phase									
Minimum Initial (s)	25.0	25.0	10.0	25.0			1.0	7.0	
Minimum Split (s)	32.0	32.0	17.0	32.0			20.0	20.0	
Total Split (s)	82.0	82.0	40.0	62.0			60.0	28.0	
Total Split (%)	54.7%	54.7%	26.7%	41.3%			40%	19%	
Yellow Time (s)	5.0	5.0	5.0	5.0			5.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0			2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					
Total Lost Time (s)	7.0	7.0	7.0	7.0					
Lead/Lag	Lead	Lead	Lag	Lag			Lead		
Lead-Lag Optimize?	Yes	Yes							
Recall Mode	None	None	None	None			None	Max	
Act Effct Green (s)	75.0	75.0	33.0	55.0	62.0	81.0			
Actuated g/C Ratio	0.50	0.50	0.22	0.37	0.41	0.54			
v/c Ratio	0.97	0.49	0.56	0.88	0.82	0.99			
Control Delay	49.1	3.3	58.6	51.2	46.2	51.8			
Queue Delay	6.3	0.0	0.0	0.0	0.0	0.0			
Total Delay	55.4	3.3	58.6	51.2	46.2	51.8			
LOS	E	А	E	D	D	D			
Approach Delay	45.9			52.1					
Approach LOS	D			D					
Intersection Summary									
Cycle Length: 150									
Actuated Cycle Length: 150									
Natural Cycle: 90									
Control Type: Actuated-Unco	ordinated								
Maximum v/c Ratio: 0.99									
Intersection Signal Delay: 49.	.0			Ir	ntersectio	on LOS: D			
Intersection Capacity Utilizati	on Err%			[(CU Level	of Service	H		
Analysis Period (min) 15									

Splits and Phases: 2: I-71 SB Ramp & SR 82 Royalton Rd

↓ ø1	← ø2	≁ 1ø4
60 s	62 s	28 s
₩ ø6	€ ¶ø5	
82 s	40 s	

SR 82 Corridor



No Build

2035 AM



1	0	23	3/2	20	1	5
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Lane Coup EBT WBT NBL Lane Configurations 11 114 114 Volume (vph) 730 2040 290 Turn Type NA NA Prot Protected Phases 2 6 8 Permitted Phases Detector Phase 2 6 8 Switch Phase 2 6 8 5 Minimum Initial (s) 32.0 32.0 10.0 5 Minimum Split (s) 53.0 38.0 20.0 7 Total Split (s) 102.0 48.0 7 104 Vellow Time (s) 3.6 3.6 3.0 30 All-Red Time (s) 2.2 2.2 3.0 1.0 1.1 Total Split (s) 1.4 -2.0 -1.4 1.1 1.1 1.1 Lead-Lag Lead/Lag Lead-Lag 1.1 61.8 1.1 1.1 61.8 1.1 1.1 61.8 1.1 1.1 61.8		-	←	1	
Lane Configurations $\uparrow \uparrow $	Lane Group	EBT	WBT	NBL	
Volume (vph) 730 2040 290 Turn Type NA NA Prot Protected Phases 2 6 8 Detector Phase 2 6 8 Switch Phase 2 6 8 Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 102.0 102.0 48.0 Total Split (s) 102.0 102.0 48.0 Total Split (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Split (s) 0.4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max C-Max None Act Lead Crag Optimize? Recall Mode 0.73 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay	Lane Configurations	* *	***	ħΜ	
Turn Type NA NA Prot Protected Phases 2 6 8 Detector Phase 2 6 8 Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 102.0 102.0 48.0 Total Split (s) 36.8 6 3.0 All-Red Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Split (s) -1.4 -2.0 -1.4 Total Cost Time (s) 4.4 3.8 4.6 Lead-Lag Detector (s) 109.7 31.9 Actuated yC Ratio 0.73 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 1	Volume (vph)	730	2040	290	
Protected Phases 2 6 8 Permitted Phases 0 8 9 Switch Phase 2 6 8 Switch Phase 0 10.0 10.0 Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 102.0 102.0 48.0 Total Split (s) 68.0% 68.0% 32.0% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead-Lag Detected g/C Ratio 0.73 0.21 V/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 0.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 <td>Turn Type</td> <td>NA</td> <td>NA</td> <td>Prot</td> <td></td>	Turn Type	NA	NA	Prot	
Permitted Phases 2 6 8 Switch Phase 2 0 8 Minimum Initial (s) 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 102.0 102.0 48.0 Total Split (s) 68.0% 32.0% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max C-Max None Actasted g/C Ratio 0.73 0.73 0.21 V/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach LOS A B E Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Gycle Length: 150 Gycle Length: 150 <	Protected Phases	2	6	8	
Detector Phase 2 6 8 Switch Phase Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 102.0 48.0 Total Split (s) 102.0 102.0 48.0 Total Split (%) 68.0% 68.0% 32.0% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Split (%) 68.0% 4.4 3.8 4.6 Lead-Lag Deminize? Recall Mode C-Max C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.21 v/c Ratio 0.0 Total Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E E Approach LOS A B<	Permitted Phases				
Switch Phase Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 102.0 48.0 Total Split (s) 68.0% 32.0% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead-Lag Optimize? Recall Mode C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.73 0.21 v/c Ratio Control Delay 4.7 11.1 61.8 0.0 Queue Delay 0.0 0.0 0.0 10.1 10.1 Cotrol Delay 4.7 11.1 61.8 18 10.1 11.1 61.8 10.2 11.1 61.8 10.2 10.2 11.1 61.8 10.2 11.1 61.8 10.2 11.1 61.8 10.2 11.1 61.8	Detector Phase	2	6	8	
Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (%) 68.0% 68.0% 32.0% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.0 -1.4 Total Lost Time (s) 1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag	Switch Phase				
Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 102.0 102.0 48.0 Total Split (%) 68.0% 68.0% 32.0% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead-Lag	Minimum Initial (s)	32.0	32.0	10.0	
Total Split (s) 102.0 102.0 48.0 Total Split (%) 68.0% 68.0% 32.0% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 0.0 100.0	Minimum Split (s)	53.0	38.0	20.0	
Total Split (%) 68.0% 68.0% 32.0% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary Cycle Length: 150 Greferenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection LOS: B	Total Split (s)	102.0	102.0	48.0	
Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead-Lag Optimize? Recall Mode C-Max C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.73 0.21 v/c Ratio V/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary Cycle Length: 150 Green Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection LOS: B Intersection Signal Delay: 17.9 Intersection LOS: B Intersection Capacity Utilization 58.6% Intersection Capacity Utilization 58.6% ICU	Total Split (%)	68.0%	68.0%	32.0%	
All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead/Lag Lead/Lag Recall Mode C-Max C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 LOS A B E Intersection Summary Cycle Length: 150 Cycle Length: 150 Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection Signal Delay: 17.9 Intersection LOS: B	Yellow Time (s)	3.6	3.6	3.0	
Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary Cycle Length: 150 Cotrol Type: Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	All-Red Time (s)	2.2	2.2	3.0	
Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 0.0 <td>Lost Time Adjust (s)</td> <td>-1.4</td> <td>-2.0</td> <td>-1.4</td> <td></td>	Lost Time Adjust (s)	-1.4	-2.0	-1.4	
Lead/Lag Lead-Lag Optimize? Recall Mode C-Max C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 LOS A B E Approach LOS A B E Intersection Summary Cycle Length: 150 Coffset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection Signal Delay: 17.9 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Total Lost Time (s)	4.4	3.8	4.6	
Lead-Lag Optimize? Recall Mode C-Max C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary Cycle Length: 150 Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection Signal Delay: 17.9 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases:	Lead/Lag				
Recall Mode C-Max C-Max None Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary E E E Cycle Length: 150 Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection Signal Delay: 17.9 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Servi	Lead-Lag Optimize?				
Act Effct Green (s) 109.1 109.7 31.9 Actuated g/C Ratio 0.73 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary Vycle Length: 150 Actuated Cycle Length: 150 Actuated Cycle Length: 150 Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection Signal Delay: 17.9 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Recall Mode	C-Max	C-Max	None	
Actuated g/C Ratio 0.73 0.73 0.21 v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 LOS A B E Approach LOS A B E Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection Signal Delay: 17.9 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Act Effct Green (s)	109.1	109.7	31.9	
v/c Ratio 0.31 0.61 0.81 Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary Cycle Length: 150 Cycle Length: 150 Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Actuated g/C Ratio	0.73	0.73	0.21	
Control Delay 4.7 11.1 61.8 Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary Cycle Length: 150 Cycle Length: 150 Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: 8 Intersection LOS: 8 Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	v/c Ratio	0.31	0.61	0.81	
Queue Delay 0.0 0.0 0.0 Total Delay 4.7 11.1 61.8 LOS A B E Approach Delay 4.7 11.1 61.8 Approach Delay 4.7 11.1 61.8 Approach Delay 4.7 11.1 61.8 Approach LOS A B E Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection LOS: B Intersection Signal Delay: 17.9 Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Control Delay	4.7	11.1	61.8	
Total Delay4.711.161.8LOSABEApproach Delay4.711.161.8Approach LOSABEIntersection SummaryCycle Length: 150Cycle Length: 150Actuated Cycle Length: 150Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of YellowNatural Cycle: 75Control Type: Actuated-CoordinatedMaximum v/c Ratio: 0.81Intersection LOS: BIntersection Capacity Utilization 58.6%ICU Level of Service BAnalysis Period (min) 15Splits and Phases: 1: I-71 NB Off Ramp	Queue Delay	0.0	0.0	0.0	
LOSABEApproach Delay4.711.161.8Approach LOSABEIntersection SummaryCycle Length: 150Actuated Cycle Length: 150Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of YellowNatural Cycle: 75Control Type: Actuated-CoordinatedMaximum v/c Ratio: 0.81Intersection Signal Delay: 17.9Intersection LOS: BIntersection Capacity Utilization 58.6%Coll Level of Service BAnalysis Period (min) 15	Total Delay	4.7	11.1	61.8	
Approach Delay4.711.161.8Approach LOSABEIntersection SummaryCycle Length: 150Actuated Cycle Length: 150Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of YellowNatural Cycle: 75Control Type: Actuated-CoordinatedMaximum v/c Ratio: 0.81Intersection Signal Delay: 17.9Intersection LOS: BIntersection Capacity Utilization 58.6%ICU Level of Service BAnalysis Period (min) 15	LOS	А	В	E	
Approach LOSABEIntersection SummaryCycle Length: 150Cycle Length: 150Actuated Cycle Length: 150Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of YellowNatural Cycle: 75Control Type: Actuated-CoordinatedMaximum v/c Ratio: 0.81Intersection Signal Delay: 17.9Intersection Capacity Utilization 58.6%IcU Level of Service BAnalysis Period (min) 15	Approach Delay	4.7	11.1	61.8	
Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15	Approach LOS	А	В	E	
Cycle Length: 150 Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection LOS: B Intersection Capacity Utilization 58.6% Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Intersection Summary				
Actuated Cycle Length: 150 Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection LOS: B Intersection Capacity Utilization 58.6% Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Cycle Length: 150				
Offset: 42 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection Capacity Utilization 58.6% Analysis Period (min) 15	Actuated Cycle Longth: 15	٥			
Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection Capacity Utilization 58.6% Analysis Period (min) 15	Offsot: 12 (28%) Deforence	u od to phase	ר 2∙EBT מ	nd 6.\M/RT	Start of Vollow
Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection Capacity Utilization 58.6% Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Natural Cyclo: 75		Z.LDI a		
Maximum v/c Ratio: 0.81 Intersection Signal Delay: 17.9 Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Control Type: Actuated Co	ordinated			
Intersection Signal Delay: 17.9 Intersection LOS: B Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Maximum v/c Datio: 0.91	orumateu			
Intersection Capacity Utilization 58.6% ICU Level of Service B Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Intersection Signal Delay:	17.0			Intersection LOS: P
Analysis Period (min) 15 Splits and Phases: 1: I-71 NB Off Ramp	Intersection Signal Delay.	17.7 ation 58.6%	4		Intersection EOS. B
Splits and Phases: 1: I-71 NB Off Ramp	Analysis Deriod (min) 15	.alion 30.0%	J		ICO LEVELOI SELVICE D
Splits and Phases: 1: I-71 NB Off Ramp	Analysis Fellou (IIIII) 15				
	Splits and Phases: 1: 1-7	1 NB Off R	amp		
			<u> </u>		

→ø2 (R)		
102 s		
← ø6 (R)	I	↑ ø8
102 s		48 s

	-	\rightarrow	-	-	1	~			
Lane Group	EBT	EBR	WBL	WBT	NBR2	SWR	ø1	ø4	
Lane Configurations	***	1	5	***	11	111			
Volume (vph)	2050	280	100	1130	370	960			
Turn Type	NA	custom	Prot	NA	pt+ov	custom			
Protected Phases	6	7	5	2	45	14	1	4	
Permitted Phases	6	67		2		14			
Detector Phase	6	7	5	2	45	14			
Switch Phase									
Minimum Initial (s)	25.0	4.0	10.0	25.0			1.0	7.0	
Minimum Split (s)	32.0	10.6	17.0	32.0			20.0	20.0	
Total Split (s)	110.0	20.0	20.0	80.0			50.0	20.0	
Total Split (%)	73.3%	13.3%	13.3%	53.3%			33%	13%	
Yellow Time (s)	3.6	3.6	3.6	3.6			3.6	3.0	
All-Red Time (s)	3.0	3.0	3.0	3.0			3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					
Total Lost Time (s)	6.6	6.6	6.6	6.6					
Lead/Lag	Lead		Lag	Lag			Lead		
Lead-Lag Optimize?									
Recall Mode	None	None	None	C-Max			None	Max	
Act Effct Green (s)	103.4	123.4	13.4	75.9	34.0	60.9			
Actuated g/C Ratio	0.69	0.82	0.09	0.51	0.23	0.41			
v/c Ratio	1.14	0.27	0.85	0.58	0.67	0.80			
Control Delay	91.9	2.9	96.8	22.0	58.8	43.9			
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0			
Total Delay	91.9	2.9	96.8	22.2	58.8	43.9			
LOS	F	А	F	С	E	D			
Approach Delay	80.2			28.3					
Approach LOS	F			С					
Intersection Summary									
Cycle Length: 150									
Actuated Cycle Length: 150	1								
Offset: 148 (99%), Reference	ced to phas	se 2:WBT	, Start of	Yellow					
Natural Cycle: 150									
Control Type: Actuated-Coo	ordinated								
Maximum v/c Ratio: 1.14									
Intersection Signal Delay: 5	7.7			lr	ntersectio	n LOS: E			
Intersection Capacity Utiliza	tion Err%			10	CU Level	of Service	Η		
Analysis Period (min) 15									

Splits and Phases: 2: I-71 SB Ramp & SR 82 Royalton Rd

ø1	← ø2 (R)		4 Ø4
50 s	80 s		20 s
₩ ø6		€ Ø5	→ ø7
110 s		20 s	20 s

Timings 3: Howe Road & SR 82 Royalton Rd

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Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	ኘኘ	*††	ካካ	<u></u>	1	۲	र्स	77	ኘ	†	1	
Volume (vph)	30	1400	420	1620	50	120	30	890	40	10	10	
Turn Type	Prot	NA	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	pm+ov	
Protected Phases	5	2	1	6	4	8	8	1	4	4	5	
Permitted Phases					6			8			4	
Detector Phase	5	2	1	6	4	8	8	1	4	4	5	
Switch Phase												
Minimum Initial (s)	4.0	27.0	10.0	27.0	10.0	10.0	10.0	10.0	10.0	10.0	4.0	
Minimum Split (s)	8.0	40.6	16.0	46.6	41.6	20.0	20.0	16.0	41.6	41.6	8.0	
Total Split (s)	19.0	73.0	30.0	84.0	17.0	30.0	30.0	30.0	17.0	17.0	19.0	
Total Split (%)	12.7%	48.7%	20.0%	56.0%	11.3%	20.0%	20.0%	20.0%	11.3%	11.3%	12.7%	
Yellow Time (s)	3.5	3.6	3.0	3.6	3.6	3.6	3.6	3.0	3.6	3.6	3.5	
All-Red Time (s)	0.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.5	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	
Total Lost Time (s)	2.0	4.6	4.0	4.6	4.6	5.0	5.0	4.4	5.0	5.0	2.4	
Lead/Lag	Lag	Lag	Lead	Lead				Lead			Lag	
Lead-Lag Optimize?												
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None	None	
Act Effct Green (s)	15.1	68.4	35.5	92.7	105.6	15.9	15.9	56.0	11.6	11.6	30.8	
Actuated g/C Ratio	0.10	0.46	0.24	0.62	0.70	0.11	0.11	0.37	0.08	0.08	0.21	
v/c Ratio	0.11	1.42	0.64	0.86	0.05	0.55	0.55	1.33	0.18	0.18	0.05	
Control Delay	53.2	225.0	58.8	28.8	1.0	74.6	74.2	194.9	66.6	68.0	0.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	53.2	225.0	58.8	28.8	1.0	74.6	74.2	194.9	66.6	68.0	0.2	
LOS	D	F	E	С	А	E	E	F	E	E	А	
Approach Delay		221.4		34.4			174.2			51.9		
Approach LOS		F		С			F			D		
Intersection Summary												
Cycle Length: 150												
Actuated Cycle Length: 150												
Offset: 0 (0%), Referenced to	phase 2	:EBT and	6:WBT, 5	Start of Y	ellow							
Natural Cycle: 150												
Control Type: Actuated-Coor	dinated											
Maximum v/c Ratio: 1.42												
Intersection Signal Delay: 12	5.4			li	ntersectio	n LOS: F						
Intersection Capacity Utilizati	ion 79.5%)		l	CU Level	of Service	e D					
Analysis Period (min) 15												

Splits and Phases: 3: Howe Road & SR 82 Royalton Rd



No Build

2035 PM



1	0	2	3/	2	0	1	5
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Lane Group EBT WBT NBL Lane Configurations ↑↑ ↑↑ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↓↓ ↑↓ ↓↓ ↑↓ ↓↓		-	←	1	
Lane Configurations Image of the temperature of the temperature of temperate of temperature of temperature of temperater of tempera	Lane Group	EBT	WBT	NBL	
Volume (vph) 1690 1600 330 Turn Type NA NA Prot Protected Phases 2 6 8 Detector Phase 2 6 8 Switch Phase 32.0 10.0 Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 107.0 107.0 43.0 Total Split (%) 71.3% 28.7% Yellow Time (s) Yellow Time (s) 3.6 3.0 All-Red Time (s) 4.4 Lost Time Adjust (s) 1.4 -2.0 -1.4 Total Lost Time (s) 4.4 Lead-Lag Optimize? Recall Mode C-Max None Actifict Green (s) 108.0 108.6 33.0 Actuated g/C Ratio	Lane Configurations	^	***	ħΜ	
Turn Type NA NA Prot Protected Phases 2 6 8 Permitted Phases 2 6 8 Switch Phase 2 6 8 Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 107.0 107.0 43.0 Total Split (s) 107.0 107.0 43.0 Total Split (s) 3.6 3.6 3.0 All-Red Time (s) 3.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag	Volume (vph)	1690	1600	330	
Protected Phases 2 6 8 Permitted Phases 2 6 8 Detector Phase 2 6 8 Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 107.0 43.0 107.0 Total Split (s) 71.3% 28.7% Yellow Time (s) 3.6 3.6 Lost Time Adjust (s) -1.4 -2.0 -1.4 -1.4 -1.4 Total Lost Time (s) 4.4 3.8 4.6 -2.6 -2.4 Lead-Lag Optimize? Recall Mode C-Max C-Max None -4.14 Act Lead Id (ag C Ratio 0.72 0.22 -0.2 -0.2 -0.2 Vic Ratio 0.73 0.47 0.84	Turn Type	NA	NA	Prot	
Permitted Phases 2 6 8 Switch Phase 6 8 6 8 Switch Phase 7	Protected Phases	2	6	8	
Detector Phase 2 6 8 Switch Phase	Permitted Phases				
Switch Phase Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 107.0 107.0 43.0 Total Split (s) 71.3% 71.3% 28.7% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) 1.4 4 2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead/Lag Lead/Lag Recall Mode C-Max C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 V/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Intersection Summary Cycle Length: 150 Intersection Summary Cycle Length: 150 Control Type: Actuated-Coordinated Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Control Type: Actuated Oper (min) 15	Detector Phase	2	6	8	
Minimum Initial (s) 32.0 32.0 10.0 Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 107.0 107.0 43.0 Total Split (s) 71.3% 28.7% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max Recall Mode C-Max None Act Effct Green (s) 108.6 Actuated g/C Ratio 0.72 0.22 Queue Delay 0.0 0.0 0.0 Queue Delay 0.0 0.0 0.0 Ibersection Summary 7.2 9.6 63.7 Cycle Length: 150 A A E Altreade Cycle Length: 150 A A E	Switch Phase				
Minimum Split (s) 53.0 38.0 20.0 Total Split (s) 107.0 17.0 43.0 Total Split (s) 71.3% 78.7% Yellow Time (s) 3.6 3.0 All-Red Time (s) 2.2 2.2 Lost Time Adjust (s) -1.4 Total Split (s) -1.4 Total Split (s) -1.4 Total Cost Time (s) 4.4 Lead/Lag Lead/Lag Lead-Lag Optimize? Recall Mode C-Max None Act Left Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach LOS A A E Intersection Summary Cycle Length: 150 Cycle Length: 150 Ortset Type: Actuated Coordinated Hard G:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated<	Minimum Initial (s)	32.0	32.0	10.0	
Total Split (s) 107.0 107.0 43.0 Total Split (%) 71.3% 71.3% 28.7% Yellow Time (s) 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead-Lag Optimize? Recall Mode C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total LOS A A E Approach LOS A A E Intersection Summary Cycle Length: 150 Gastrade Start of Yellow Natural Cycle Length: 150 Greet of phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection Signal Delay: 16.5 Intersection LOS: B	Minimum Split (s)	53.0	38.0	20.0	
Total Split (%) 71.3% 71.3% 28.7% Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) 1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 108.1 108.6 63.7 LOS A A E Intersection Sumary 2.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 10.1 10.1 10.1 10.1 10.1 10.1 LOS A A E 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1	Total Split (s)	107.0	107.0	43.0	
Yellow Time (s) 3.6 3.6 3.0 All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead/Lag Lead/Lag Optimize? Recall Mode C-Max C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach LOS A A E Intersection Summary 7.2 9.6 63.7 Cycle Length: 150 A A E Intersection Summary 7.2 9.6 63.7 Cycle Length: 150 A A E Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle	Total Split (%)	71.3%	71.3%	28.7%	
All-Red Time (s) 2.2 2.2 3.0 Lost Time Adjust (s) -1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead-Lag Optimize? Recall Mode C-Max None Recall Mode C-Max C-Max None None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach LOS A A E Intersection Summary Cycle Length: 150 Green Centrol Delay 7.2 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection LOS: B Intersection LOS: B Intersection Signal Delay: 16.5 Intersection LOS: B <td< td=""><td>Yellow Time (s)</td><td>3.6</td><td>3.6</td><td>3.0</td><td></td></td<>	Yellow Time (s)	3.6	3.6	3.0	
Lost Time Adjust (s) 1.4 -2.0 -1.4 Total Lost Time (s) 4.4 3.8 4.6 Lead/Lag Lead/Lag Optimize? Recall Mode C-Max C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Ontrol Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach LOS A A E Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Actuated Cycle Length: 150 Actuated Cycle Length: 150 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	All-Red Time (s)	2.2	2.2	3.0	
Total Lost Time (s) 4.4 3.8 4.6 Lead-Lag Optimize? Recall Mode C-Max C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach LOS A A E Approach LOS A A E Approach LOS A A E Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Actuated Cycle Length: 150 Actuated Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection LOS: B Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15 ICU Level of Service C	Lost Time Adjust (s)	-1.4	-2.0	-1.4	
Lead/Lag Lead-Lag Optimize? Recall Mode C-Max C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 Approach LOS A A E Approach LOS A A E Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Total Lost Time (s)	4.4	3.8	4.6	
Lead-Lag Optimize? Recall Mode C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Intersection Summary 7.2 9.6 63.7 Cycle Length: 150 A A E Actuated Cycle Length: 150 A A E Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of	Lead/Lag				
Recall Mode C-Max C-Max None Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 Approach LOS A A E Intersection Summary 7.2 9.6 63.7 Cycle Length: 150 A A E Intersection Summary 7.2 9.6 63.7 Cycle Length: 150 A A E Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84<	Lead-Lag Optimize?				
Act Effct Green (s) 108.0 108.6 33.0 Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach LOS A A E Intersection Summary Cycle Length: 150 Greeneed to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Recall Mode	C-Max	C-Max	None	
Actuated g/C Ratio 0.72 0.72 0.22 v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach LOS A A E Intersection Summary Cycle Length: 150 Gffset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15 Intersection Capacity Utilization 69.6%	Act Effct Green (s)	108.0	108.6	33.0	
v/c Ratio 0.73 0.47 0.84 Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 Approach Delay 7.2 9.6 63.7 Approach LOS A A E Intersection Summary Cycle Length: 150 A A Cycle Length: 150 Actuated Cycle Length: 150 Actuated Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection Signal Delay: 16.5 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15 State of Service C	Actuated g/C Ratio	0.72	0.72	0.22	
Control Delay 7.2 9.6 63.7 Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 Approach Delay 7.2 9.6 63.7 Approach LOS A A E Intersection Summary 7.2 9.6 63.7 Cycle Length: 150 A A Actuated Cycle Length: 150 Actuated Cycle Length: 150 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection Signal Delay: 16.5 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	v/c Ratio	0.73	0.47	0.84	
Queue Delay 0.0 0.0 0.0 Total Delay 7.2 9.6 63.7 LOS A A E Approach Delay 7.2 9.6 63.7 Approach Delay 7.2 9.6 63.7 Approach LOS A A E Intersection Summary Cycle Length: 150 E Cycle Length: 150 Actuated Cycle Length: 150 Gffset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection Signal Delay: 16.5 Intersection LOS: B Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C	Control Delay	7.2	9.6	63.7	
Total Delay7.29.663.7LOSAAEApproach Delay7.29.663.7Approach LOSAAEIntersection SummaryCycle Length: 150Cycle Length: 150Actuated Cycle Length: 150Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of YellowNatural Cycle: 75Control Type: Actuated-CoordinatedMaximum v/c Ratio: 0.84Intersection LOS: BIntersection Capacity Utilization 69.6%ICU Level of Service CAnalysis Period (min) 15Intersection Capacity Utilization Capacity Utilization 69.6%	Queue Delay	0.0	0.0	0.0	
LOSAAEApproach Delay7.29.663.7Approach LOSAAEIntersection SummaryCycle Length: 150Actuated Cycle Length: 150Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of YellowNatural Cycle: 75Control Type: Actuated-CoordinatedMaximum v/c Ratio: 0.84Intersection LOS: BIntersection Signal Delay: 16.5Intersection LOS: BIntersection Capacity Utilization 69.6%ICU Level of Service CAnalysis Period (min) 15Intersection Capacity Utilization 69.6%	Total Delay	7.2	9.6	63.7	
Approach Delay 7.2 9.6 63.7 Approach LOS A A E Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15 Start of Service C	LOS	A	А	E	
Approach LOS A A E Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection LOS: B Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15 Intersection Capacity Utilization 69.6%	Approach Delay	7.2	9.6	63.7	
Intersection Summary Cycle Length: 150 Actuated Cycle Length: 150 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Approach LOS	А	A	E	
Cycle Length: 150 Actuated Cycle Length: 150 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Intersection Summary				
Actuated Cycle Length: 150 Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Cycle Length: 150				
Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Actuated Cycle Length: 15	50			
Natural Cycle: 75 Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Offset: 136 (91%), Referen	nced to phas	se 2:EBT	and 6:WB	BT, Start of Yellow
Control Type: Actuated-Coordinated Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Natural Cycle: 75				
Maximum v/c Ratio: 0.84 Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15 Intersection LOS: B	Control Type: Actuated-Co	pordinated			
Intersection Signal Delay: 16.5 Intersection LOS: B Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15 ICU Level of Service C	Maximum v/c Ratio: 0.84				
Intersection Capacity Utilization 69.6% ICU Level of Service C Analysis Period (min) 15	Intersection Signal Delay:	16.5			Intersection LOS: B
Analysis Period (min) 15	Intersection Capacity Utiliz	zation 69.6%	ò		ICU Level of Service C
	Analysis Period (min) 15				
Splits and Phases: 1: I-71 NB Off Ramp	Splits and Phases: 1: I-	71 NB Off R	amp		
→ a2 (P)	→a2 (P)				_

→ø2 (R)	
107 s	
≠— ø6 (R)	▲ ø8
107 s	43 s

	-	\mathbf{r}	1	-	1	~			
Lane Group	EBT	EBR	WBL	WBT	NBR2	SWR	ø1	ø4	
Lane Configurations	***	1	5	***	11	111			
Volume (vph)	2030	450	100	1400	840	1850			
Turn Type	NA	Perm	Prot	NA	pt+ov	custom			
Protected Phases	6		5	2	4 5	14	1	4	
Permitted Phases	6	6		2		14			
Detector Phase	6	6	5	2	45	14			
Switch Phase									
Minimum Initial (s)	25.0	25.0	10.0	25.0			1.0	7.0	
Minimum Split (s)	32.0	32.0	17.0	32.0			20.0	20.0	
Total Split (s)	101.0	101.0	23.0	62.0			62.0	26.0	
Total Split (%)	67.3%	67.3%	15.3%	41.3%			41%	17%	
Yellow Time (s)	3.6	3.6	3.6	3.6			3.6	3.0	
All-Red Time (s)	3.0	3.0	3.0	3.0			3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					
Total Lost Time (s)	6.6	6.6	6.6	6.6					
Lead/Lag	Lead	Lead	Lag	Lag			Lead		
Lead-Lag Optimize?									
Recall Mode	None	None	None	C-Max			None	Max	
Act Effct Green (s)	94.4	94.4	16.4	55.4	43.0	81.4			
Actuated g/C Ratio	0.63	0.63	0.11	0.37	0.29	0.54			
v/c Ratio	1.33	0.44	1.14	0.88	1.18	0.98			
Control Delay	167.8	0.3	154.2	40.9	139.7	50.4			
Queue Delay	0.0	0.0	0.0	0.0	0.0	40.6			
Total Delay	167.8	0.3	154.2	40.9	139.7	91.0			
LOS	F	А	F	D	F	F			
Approach Delay	137.4			54.3					
Approach LOS	F			D					
Intersection Summary									
Cycle Length: 150									
Actuated Cycle Length: 150	0								
Offset: 86 (57%), Reference	ed to phase	2:WBT,	Start of Y	ellow					
Natural Cycle: 150									
Control Type: Actuated-Coo	ordinated								
Maximum v/c Ratio: 1.33									
Intersection Signal Delay: 1	105.5			Ir	itersectio	n LOS: F			
Intersection Capacity Utiliza	ation Err%			IC	CU Level	of Service	H		
Analysis Period (min) 15									

Splits and Phases: 2: I-71 SB Ramp & SR 82 Royalton Rd

ø1			ø4
62 s	62 s		26 s
₩ ø6		€ Ø5	
101 s		23 s	

Timings 3: Howe Road & SR 82 Royalton Rd

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Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	ኘኘ	^	ሻሻ	<u>†</u> †	1	۲	†	11	ኘኘ	1	1	
Volume (vph)	190	1640	930	1930	390	170	100	630	210	150	270	
Turn Type	Prot	NA	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	pm+ov	
Protected Phases	5	2	1	6	4	8	8	1	4	4	5	
Permitted Phases					6			8			4	
Detector Phase	5	2	1	6	4	8	8	1	4	4	5	
Switch Phase												
Minimum Initial (s)	7.0	27.0	10.0	27.0	10.0	10.0	10.0	10.0	10.0	10.0	7.0	
Minimum Split (s)	13.0	40.6	16.0	46.6	41.6	20.0	20.0	16.0	41.6	41.6	13.0	
Total Split (s)	16.0	64.0	39.0	87.0	23.0	24.0	24.0	39.0	23.0	23.0	16.0	
Total Split (%)	10.7%	42.7%	26.0%	58.0%	15.3%	16.0%	16.0%	26.0%	15.3%	15.3%	10.7%	
Yellow Time (s)	3.0	3.6	3.0	3.6	3.6	3.6	3.6	3.0	3.6	3.6	3.0	
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	
Total Lost Time (s)	4.0	4.6	4.0	4.6	4.6	5.0	5.0	4.4	5.0	5.0	4.4	
Lead/Lag	Lag	Lag	Lead	Lead				Lead			Lag	
Lead-Lag Optimize?												
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None	None	
Act Effct Green (s)	12.0	59.4	35.8	83.2	101.3	18.5	18.5	58.9	17.7	17.7	34.3	
Actuated g/C Ratio	0.08	0.40	0.24	0.55	0.68	0.12	0.12	0.39	0.12	0.12	0.23	
v/c Ratio	0.79	1.41	1.42	1.03	0.49	0.84	0.49	0.63	0.64	0.82	0.86	
Control Delay	71.7	218.2	232.2	56.7	4.7	94.5	69.1	40.1	70.9	92.0	57.1	
Queue Delay	0.0	0.0	0.0	26.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	
Total Delay	71.7	218.2	232.2	83.3	4.7	94.5	69.1	40.1	70.9	92.0	57.3	
LOS	E	F	F	F	А	F	E	D	E	F	E	
Approach Delay		204.8		117.5			53.5			69.1		
Approach LOS		F		F			D			E		
Intersection Summary												
Cycle Length: 150												
Actuated Cycle Length: 150												
Offset: 28 (19%), Referenced	d to phase	e 2:EBT a	nd 6:WB	T, Start of	f Yellow							
Natural Cycle: 145												
Control Type: Actuated-Coor	dinated											
Maximum v/c Ratio: 1.42												
Intersection Signal Delay: 13	0.4			li	ntersectio	n LOS: F						
Intersection Capacity Utilizati	on 93.2%)		l	CU Level	of Service	e F					
Analysis Period (min) 15												
Splits and Phases: 3: How	e Road &	SR 82 R	oyalton F	?d								

Build

2035 AM



Timings 1: I-71 NB Off Ramp

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Lane Group	EBT	EBR	WBT	NBL2	NBL	
Lane Configurations	≜t ⊾	1	*††	5	M	
Traffic Volume (vph)	730	1690	940	290	0	
Future Volume (vph)	730	1690	940	290	0	
Turn Type	NA	Free	NA	Prot	Perm	
Protected Phases	2		6	8		
Permitted Phases		Free			8	
Detector Phase	2		6	8	8	
Switch Phase						
Minimum Initial (s)	32.0		32.0	10.0	10.0	
Minimum Split (s)	53.0		38.0	20.0	20.0	
Total Split (s)	102.0		102.0	48.0	48.0	
Total Split (%)	68.0%		68.0%	32.0%	32.0%	
Yellow Time (s)	3.6		3.6	3.0	3.0	
All-Red Time (s)	2.2		2.2	3.0	3.0	
Lost Time Adjust (s)	-1.4		-2.0	-1.4	0.0	
Total Lost Time (s)	4.4		3.8	4.6	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Max		C-Max	None	None	
Act Effct Green (s)	107.2	150.0	107.8	33.8	32.4	
Actuated g/C Ratio	0.71	1.00	0.72	0.23	0.22	
v/c Ratio	0.75	0.65	1.03dr	0.82	0.77	
Control Delay	8.7	5.7	13.5	72.1	61.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	8.7	5.7	13.5	72.1	61.2	
LOS	А	А	В	E	E	
Approach Delay	7.6		13.5		66.9	
Approach LOS	А		В		E	
Intersection Summary						
Cycle Length: 150						
Actuated Cycle Length: 150)					
Offset: 95 (63%), Reference	ed to phase	2:EBT a	nd 6:WB	Γ, Start of	Yellow	
Natural Cycle: 75						
Control Type: Actuated-Coc	ordinated					
Maximum v/c Ratio: 0.82						
Intersection Signal Delay: 1	6.4			Ir	ntersection	n LOS: B
Intersection Capacity Utiliza	ation 62.9%			10	CU Level	of Service B
Analysis Period (min) 15						
dr Defacto Right Lane. R	ecode with	1 though	lane as a	a right lan	e.	
5		5		5		
Splits and Phases: 1: I-7	1 NB Off Ra	Imp				

→ø2 (R)	₹ ø8
102 s	48 s
ملے ه6 (R)	
102 s	

12/10/201	5
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	-	\rightarrow	-	-	1	*			
Lane Group	EBT	EBR	WBL	WBT	NBR2	SWR	ø1	ø4	
Lane Configurations	***	1	5	***	11	111			
Traffic Volume (vph)	2050	280	100	1130	370	960			
Future Volume (vph)	2050	280	100	1130	370	960			
Turn Type	NA	custom	Prot	NA	pt+ov	custom			
Protected Phases	6	7	5	2	45	14	1	4	
Permitted Phases	6	67		2		14			
Detector Phase	6	7	5	2	45	14			
Switch Phase									
Minimum Initial (s)	25.0	4.0	10.0	25.0			1.0	7.0	
Minimum Split (s)	32.0	10.6	17.0	32.0			20.0	20.0	
Total Split (s)	110.0	20.0	20.0	80.0			50.0	20.0	
Total Split (%)	73.3%	13.3%	13.3%	53.3%			33%	13%	
Yellow Time (s)	3.6	3.6	3.6	3.6			3.6	3.0	
All-Red Time (s)	3.0	3.0	3.0	3.0			3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					
Total Lost Time (s)	6.6	6.6	6.6	6.6					
Lead/Lag	Lead		Lag	Lag			Lead		
Lead-Lag Optimize?			Ū	Ŭ					
Recall Mode	None	None	None	C-Max			None	Мах	
Act Effct Green (s)	103.4	123.4	13.4	78.9	34.0	57.9			
Actuated g/C Ratio	0.69	0.82	0.09	0.53	0.23	0.39			
v/c Ratio	0.73	0.27	0.85	0.55	0.67	0.74			
Control Delay	8.8	1.7	100.2	26.1	58.8	42.6			
Queue Delay	0.2	0.0	0.0	0.0	0.0	0.2			
Total Delay	9.0	1.7	100.2	26.1	58.8	42.8			
LOS	А	А	F	С	E	D			
Approach Delay	8.0			32.3					
Approach LOS	А			С					
Intersection Summary									
Cyclo Longth: 150									_
Actuated Cycle Longth: 150									
Actuated Cycle Length. 150	nd to nhas	0.2-W/RT	Start of	Vollow					
Natural Cyclo: 00	eu lo prias			TCIIUW					
Control Type: Actuated Coor	dinatod								
Maximum v/c Patio 0.85									
Intersection Signal Dolay: 24	0			In	ntorsactio	n I OS· C			
Intersection Canacity Utilizati	.7 ion Err%			 (of Service	л Н		
Analysis Period (min) 15				IC IC			/ 1 1		
marysis r choù (min) 13									

Splits and Phases: 2: I-71 SB Ramp & SR 82 Royalton Rd

≁ ø1	← ø2 (R)		↓ Ø4
50 s	80 s		20 s
₩ ø6		€ ø5	→ ø7
110 s		20 s	20 s

Timings 3: Howe Road & SR 82 Royalton Rd

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Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	ሻሻ	^	ሻሻ	<u></u>	1	۲	با	11	ሻሻ	1	1	
Traffic Volume (vph)	30	1400	420	1620	50	120	30	890	40	10	10	
Future Volume (vph)	30	1400	420	1620	50	120	30	890	40	10	10	
Turn Type	Prot	NA	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	pm+ov	
Protected Phases	5	2	1	6	4	8	8	1	4	4	5	
Permitted Phases					6			8			4	
Detector Phase	5	2	1	6	4	8	8	1	4	4	5	
Switch Phase												
Minimum Initial (s)	4.0	27.0	10.0	27.0	10.0	10.0	10.0	10.0	10.0	10.0	4.0	
Minimum Split (s)	8.0	40.6	16.0	46.6	41.6	20.0	20.0	16.0	41.6	41.6	8.0	
Total Split (s)	19.0	73.0	30.0	84.0	17.0	30.0	30.0	30.0	17.0	17.0	19.0	
Total Split (%)	12.7%	48.7%	20.0%	56.0%	11.3%	20.0%	20.0%	20.0%	11.3%	11.3%	12.7%	
Yellow Time (s)	3.5	3.6	3.0	3.6	3.6	3.6	3.6	3.0	3.6	3.6	3.5	
All-Red Time (s)	0.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.5	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	
Total Lost Time (s)	2.0	4.6	4.0	4.6	4.6	5.0	5.0	4.4	5.0	5.0	2.4	
Lead/Lag	Lag	Lag	Lead	Lead				Lead			Lag	
Lead-Lag Optimize?												
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None	None	
Act Effct Green (s)	15.1	68.5	35.4	92.7	105.6	15.9	15.9	55.9	11.6	11.6	30.8	
Actuated g/C Ratio	0.10	0.46	0.24	0.62	0.70	0.11	0.11	0.37	0.08	0.08	0.21	
v/c Ratio	0.11	0.83	0.64	0.86	0.06	0.55	0.55	0.92	0.18	0.18	0.05	
Control Delay	55.1	34.7	50.5	23.5	0.9	74.6	74.2	59.5	66.6	68.0	0.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	55.1	34.7	50.5	23.5	0.9	74.6	74.2	59.5	66.6	68.0	0.2	
LOS	E	С	D	С	А	E	E	E	E	E	А	
Approach Delay		35.2		28.6			62.1			51.9		
Approach LOS		D		С			E			D		
Intersection Summary												
Cycle Length: 150												
Actuated Cycle Length: 150												
Offset: 114 (76%), Reference	ed to phas	e 2:EBT	and 6:WE	3T, Start	of Yellow							
Natural Cycle: 150				·								
Control Type: Actuated-Coord	dinated											
Maximum v/c Ratio: 0.92												
Intersection Signal Delay: 38.	.2			li	ntersectio	n LOS: D						
Intersection Capacity Utilization	on 79.5%)		l	CU Level	of Service	e D					
Analysis Period (min) 15												

Splits and Phases: 3: Howe Road & SR 82 Royalton Rd



Build

2035 PM



Timings 1: I-71 NB Off Ramp

	-	\mathbf{r}	-	-	٦	
Lane Group	EBT	EBR	WBT	NBL2	NBL	
Lane Configurations	4 1,	1	**t	5	M	
Traffic Volume (vph)	1690	1180	1180	330	0	
Future Volume (vph)	1690	1180	1180	330	0	
Turn Type	NA	Free	NA	Prot	Perm	
Protected Phases	2		6	8		
Permitted Phases		Free			8	
Detector Phase	2		6	8	8	
Switch Phase						
Minimum Initial (s)	32.0		32.0	10.0	10.0	
Minimum Split (s)	53.0		38.0	20.0	20.0	
Total Split (s)	107.0		107.0	43.0	43.0	
Total Split (%)	71.3%		71.3%	28.7%	28.7%	
Yellow Time (s)	3.6		3.6	3.0	3.0	
All-Red Time (s)	2.2		2.2	3.0	3.0	
Lost Time Adjust (s)	-1.4		-2.0	-1.4	0.0	
Total Lost Time (s)	4.4		3.8	4.6	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Max		C-Max	None	None	
Act Effct Green (s)	107.0	150.0	107.6	34.0	32.6	
Actuated g/C Ratio	0.71	1.00	0.72	0.23	0.22	
v/c Ratio	0.92	0.67	0.50	0.87	0.83	
Control Delay	18.0	9.5	10.4	78.0	70.4	
Queue Delay	0.2	0.0	0.0	0.0	0.0	
Total Delay	18.2	9.5	10.4	78.0	70.4	
LOS	В	А	В	E	E	
Approach Delay	15.5		10.4		74.4	
Approach LOS	В		В		E	
Intersection Summary						
Cycle Length: 150						
Actuated Cycle Length: 150	0					
Offset: 127 (85%), Referen	ced to phas	e 2:EBT	and 6:WE	BT, Start o	of Yellow	
Natural Cycle: 90						
Control Type: Actuated-Co	ordinated					
Maximum v/c Ratio: 0.92						
Intersection Signal Delay: 2	20.5			Ir	ntersection	LOS: C
Intersection Capacity Utiliza	ation 82.9%			10	CU Level o	of Service E
Analysis Period (min) 15						
Splits and Phases: 1: I-7	1 NB Off Ra	amp				

→ø2 (R)	√ ø8
107 s	43 s
←	
ø6 (R)	
107 s	

12/10/2015

	-	\rightarrow	-	-	1	~			
Lane Group	EBT	EBR	WBL	WBT	NBR2	SWR	ø1	ø4	
Lane Configurations	***	1	5	***	11	111			
Traffic Volume (vph)	2030	450	100	1400	840	1850			
Future Volume (vph)	2030	450	100	1400	840	1850			
Turn Type	NA	Perm	Prot	NA	pt+ov	custom			
Protected Phases	6		5	2	4 5	14	1	4	
Permitted Phases	6	6		2		14			
Detector Phase	6	6	5	2	45	14			
Switch Phase									
Minimum Initial (s)	25.0	25.0	10.0	25.0			1.0	7.0	
Minimum Split (s)	32.0	32.0	17.0	32.0			20.0	20.0	
Total Split (s)	101.0	101.0	23.0	62.0			62.0	26.0	
Total Split (%)	67.3%	67.3%	15.3%	41.3%			41%	17%	
Yellow Time (s)	3.6	3.6	3.6	3.6			3.6	3.0	
All-Red Time (s)	3.0	3.0	3.0	3.0			3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					
Total Lost Time (s)	6.6	6.6	6.6	6.6					
Lead/Lag	Lead	Lead	Lag	Lag			Lead		
Lead-Lag Optimize?									
Recall Mode	None	None	None	C-Max			None	Max	
Act Effct Green (s)	94.4	94.4	16.4	55.8	43.0	81.0			
Actuated g/C Ratio	0.63	0.63	0.11	0.37	0.29	0.54			
v/c Ratio	0.77	0.44	1.14	0.87	1.18	0.87			
Control Delay	9.8	0.3	153.8	40.8	139.7	35.7			
Queue Delay	0.8	0.0	0.0	0.0	0.0	29.9			
Total Delay	10.6	0.3	153.8	40.8	139.7	65.6			
LOS	В	A	F	D	F	E			
Approach Delay	8.8			54.1					
Approach LOS	A			D					
Intersection Summary									
Cycle Length: 150									
Actuated Cycle Length: 150									
Offset: 74 (49%), Reference	ed to phase	e 2:WBT,	Start of Y	ellow					
Natural Cycle: 90									
Control Type: Actuated-Coo	ordinated								
Maximum v/c Ratio: 1.18									
Intersection Signal Delay: 5	0.5			lr	ntersectio	n LOS: D			
Intersection Capacity Utiliza	ition Err%			[(CU Level	of Service	H		
Analysis Period (min) 15									

Splits and Phases: 2: I-71 SB Ramp & SR 82 Royalton Rd

✓ ø1			≁ 1ø4
62 s	62 s		26 s
₩ ø6		€ ø5	
101 s		23 s	

Timings 3: Howe Road & SR 82 Royalton Rd

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Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	ሻሻ	*††	ካካ		1	1	•	77	ሻሻ	•	1	
Traffic Volume (vph)	190	1640	930	1930	390	170	100	630	210	150	270	
Future Volume (vph)	190	1640	930	1930	390	170	100	630	210	150	270	
Turn Type	Prot	NA	Prot	NA	pm+ov	Split	NA	pm+ov	Split	NA	pm+ov	
Protected Phases	5	2	1	6	4	8	8	1	4	4	5	
Permitted Phases					6			8			4	
Detector Phase	5	2	1	6	4	8	8	1	4	4	5	
Switch Phase												
Minimum Initial (s)	7.0	27.0	10.0	27.0	10.0	10.0	10.0	10.0	10.0	10.0	7.0	
Minimum Split (s)	13.0	40.6	16.0	46.6	41.6	20.0	20.0	16.0	41.6	41.6	13.0	
Total Split (s)	16.0	64.0	39.0	87.0	23.0	24.0	24.0	39.0	23.0	23.0	16.0	
Total Split (%)	10.7%	42.7%	26.0%	58.0%	15.3%	16.0%	16.0%	26.0%	15.3%	15.3%	10.7%	
Yellow Time (s)	3.0	3.6	3.0	3.6	3.6	3.6	3.6	3.0	3.6	3.6	3.0	
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	
Total Lost Time (s)	4.0	4.6	4.0	4.6	4.6	5.0	5.0	4.4	5.0	5.0	4.4	
Lead/Lag	Lag	Lag	Lead	Lead				Lead			Lag	
Lead-Lag Optimize?												
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None	None	
Act Effct Green (s)	12.0	59.4	35.8	83.2	101.3	18.5	18.5	58.9	17.7	17.7	34.3	
Actuated g/C Ratio	0.08	0.40	0.24	0.55	0.68	0.12	0.12	0.39	0.12	0.12	0.23	
v/c Ratio	0.79	1.15	1.42	1.03	0.49	0.84	0.49	0.63	0.64	0.82	0.86	
Control Delay	70.7	103.6	233.8	55.3	5.5	94.5	69.1	40.1	71.0	92.0	57.1	
Queue Delay	0.0	0.0	0.0	26.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	
Total Delay	70.7	103.6	233.8	81.9	5.5	94.5	69.1	40.1	71.0	92.0	57.4	
LOS	E	F	F	F	А	F	E	D	E	F	E	
Approach Delay		100.6		117.4			53.5			69.2		
Approach LOS		F		F			D			E		
Intersection Summary												
Cycle Length: 150												
Actuated Cycle Length: 150												
Offset: 6 (4%), Referenced to	phase 2	:EBT and	6:WBT, 3	Start of Y	ellow							
Natural Cycle: 145												
Control Type: Actuated-Coord	dinated											
Maximum v/c Ratio: 1.42												
Intersection Signal Delay: 99.	3			li	ntersectio	n LOS: F						
Intersection Capacity Utilization	on 93.2%)		l	CU Level	of Service	e F					
Analysis Period (min) 15												

Splits and Phases: 3: Howe Road & SR 82 Royalton Rd

√ ø1	→ø2 (R)		≪ ø4	▲ ø8
39 s	64 s		23 s	24 s
▲		4		
ø6 (R)		ø5		
87 s		16 s		

Freeway Segments

2035 AM



BASIC FREEWAY SEGMENTS WORKSHEET							
General Information			Site Information				
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott MacDonald 5/27/2015 AM		Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB @ SR 30 2035	13		
Project Description I-71 / SF	R 82 IMS						
Oper.(LOS)			es.(N)	🗌 Plai	nning Data		
Flow Inputs							
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	3620	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length	0.94 4 0 Level mi			
			Up/Down %				
Calculate Flow Adjustme	nts						
f _p E _T	1.00 1.5		E_R $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	1.2 0.980			
Speed Inputs			Calc Speed Adj and FFS				
Lane Width		ft					
Rt-Side Lat. Clearance		ft	f _{rw}		mph		
Number of Lanes, N	3		fic		mph		
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph		
FFS (measured)	65.0	mph	FFS	65.0	mph		
Base free-flow Speed, BFFS		mph					
I OS and Performance M	201100		Design (N)				
$\frac{Operational (LOS)}{v_p} = (V \text{ or DDHV}) / (PHF x N x) f_p)$ S D = v_p / S LOS	(f _{HV} x 1 6 2 0	1309 pc/h/ln 15.0 mph 20.1 pc/mi/ln C	Design (N) Design LOS v _p = (V or DDHV) / (PHF x N > f _p) S D = v _p / S Required Number of Lanes, N	(f _{HV} x	pc/h/ln mph pc/mi/ln		
Glossary			Factor Location				
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - Sp D - De FFS - F BFFS -	beed ensity ree-flow speed Base free-flow speed e	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11 [,]	-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11		

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Page 1 of 1

BASIC FREEWAY SEGMENTS WORKSHEET							
Conoral Information			Site Information				
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott MacDonald 5/27/2015 AM		Site Information Highway/Direction of Travel NB From/To SR 303 Jurisdiction Analysis Year 2035		3 to SR 82		
Project Description I-71 / SF	R 82 IMS						
Oper.(LOS)			es.(N)	Plann	ing Data		
Flow Inputs							
Volume, V AADT Peak-Hr Prop. of AADT, K	3920	veh/h veh/day	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R	0.94 4 0			
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	mi			
Calculate Flow Adjustme	nts						
f _p	1.00		E _R	1.2			
Ε _T	1.5		$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980			
Speed Inputs			Calc Speed Adj and FFS				
Lane Width		ft					
Rt-Side Lat. Clearance		ft	f _{LW}		mph		
Number of Lanes, N	3		f _{LC}		mph		
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph		
FFS (measured)	65.0	mph	FFS	65.0	mph		
Base free-flow Speed, BFFS		mph					
LOS and Performance Me	easures		Design (N)				
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S LOS	c f _{HV} x 1418 65.0 21.8 C	pc/h/ln mph pc/mi/ln	<u>Design (N)</u> Design LOS v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S Required Number of Lanes, N	f _{HV} x	pc/h/ln mph pc/mi/ln		
Glossary			Factor Location				
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - Speed D - Density FFS - Free-flow BFFS - Base fro ur volume	v speed ee-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11- f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11-	f 13 f 2, 11-3	_{LW} - Exhibit 11-8 _{LC} - Exhibit 11-9 IRD - Page 11-11		

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BASIC FREEWAY SEGMENTS WORKSHEET							
General Information			Site Information				
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott MacDonald 5/27/2015 AM		Highway/Direction of Travel NB From/To @ SF Jurisdiction Analysis Year 2035		EB		
Project Description I-71 / SF	R 82 IMS						
✓ Oper.(LOS)			Des.(N)	Plan	ning Data		
Flow Inputs							
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	3510	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length	0.94 4 O Level mi			
Coloulata Elour Adjustma	nto		Op/Down 70				
f _p E _T	1.00 1.5		E_{R} $f_{HV} = 1/[1+P_{T}(E_{T} - 1) + P_{R}(E_{R} - 1)]$	1.2 0.980			
Speed Inputs			Calc Speed Adj and FFS				
Lane Width Rt-Side Lat. Clearance Number of Lanes, N Total Ramp Density, TRD FFS (measured) Base free-flow Speed, BFFS	3 65.0	ft ft ramps/mi mph mph	f _{⊥w} f _{LC} TRD Adjustment FFS	65.0	mph mph mph mph		
LOS and Performance M	easures		Design (N)				
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N > f _p) S D = v _p / S LOS	^{k f} _{HV} x 1270 65.0 19.5 C	pc/h/ln mph pc/mi/ln	$\frac{\text{Design (N)}}{\text{Design LOS}}$ $v_p = (V \text{ or DDHV}) / (PHF x N x)$ $f_p)$ S $D = v_p / S$ Required Number of Lanes, N	(f _{HV} x	pc/h/ln mph pc/mi/ln		
Glossary			Factor Location				
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - Speed D - Density FFS - Free-flow BFFS - Base fl ur volume	w speed ree-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11-	-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11		

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BASIC FREEWAY SEGMENTS WORKSHEET							
General Information			Site Information				
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott MacDonald 5/27/2015 AM		Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB @ SR 82 1 2035	WB		
Project Description I-71 / SF	R 82 IMS						
Oper.(LOS)			Des.(N)	🗌 Planr	ning Data		
Flow Inputs							
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	5200	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length Up/Down %	0.94 4 O Level mi			
Calculate Flow Adjustme	nts						
f _ρ E _T	1.00 1.5		E _R f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	1.2 0.980			
Speed Inputs			Calc Speed Adj and FFS				
Lane Width Rt-Side Lat, Clearance		ft ft	f.w		mph		
Number of Lanes, N	3		fuc		mph		
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph		
FFS (measured)	65.0	mph	FFS	65.0	mph		
Base free-flow Speed, BFFS		mph			ľ		
LOS and Performance M	easures		Design (N)				
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S LOS	^{k f} _{HV} x 1881 61.7 30.5 D	pc/h/ln mph pc/mi/ln	Design (N) Design LOS $v_p = (V \text{ or DDHV}) / (PHF x N > f_p)$ S D = v_p / S Required Number of Lanes, N	(f _{HV} x	pc/h/ln mph pc/mi/ln		
Glossary			Factor Location				
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - Speed D - Density FFS - Free-flo BFFS - Base ur volume	ow speed free-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11-	-13 i -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11		

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BASIC FREEWAY SEGMENTS WORKSHEET							
General Information			Site Information				
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott MacDonald 5/27/2015 AM		Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB SR 82 to I-8 2035	0		
Project Description I-71 / SF	R 82 IMS						
✓ Oper.(LOS)			Des.(N)	🗌 Plannir	ng Data		
Flow Inputs							
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	6300	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length Up/Down %	0.94 3 O Level mi			
Calculate Flow Adjustme	nts						
f _p E _T	1.00 1.5		E _R f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	1.2 0.985			
Speed Inputs			Calc Speed Adj and FFS				
Lane Width Rt-Side Lat. Clearance		ft ft	f _{LW}		mph		
Number of Lanes, N	3		f _{LC}		mph		
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph		
FFS (measured)	65.0	mph	FFS	65.0	mph		
Base free-flow Speed, BFFS		mph					
LOS and Performance Me	easures		Design (N)				
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S LOS	^{c f} _{HV} x 2268 54.3 41.8 E	pc/h/ln mph pc/mi/ln	<u>Design (N)</u> Design LOS v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S Required Number of Lanes, N	α f _{HV} x	pc/h/ln mph pc/mi/ln		
Glossary			Factor Location				
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design hou	S - Speed D - Density FFS - Free-flov BFFS - Base fr ur volume	v speed ee-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11- f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11-	f _L , -13 f _L TF 2, 11-3	_W - Exhibit 11-8 _C - Exhibit 11-9 RD - Page 11-11		

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	BASIC	FREEWAY SE	GMENTS WORKSHEET		
Conoral Information			Site Information		
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott N 5/27/2015 AM	lacDonald	Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB @ I-80 2035	
Project Description I-71 / SF	R 82 IMS				
Oper.(LOS)			Des.(N)	🗌 Pla	inning Data
Flow Inputs					
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	5900	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length Up/Down %	0.94 3 0 Level mi	
Calculate Flow Adjustme	onte				
f _p E _T	1.00 1.5		E _R f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	1.2 0.985	
Speed Inputs			Calc Speed Adj and FFS		
Lane Width Rt-Side Lat. Clearance Number of Lanes, N Total Ramp Density, TRD FFS (measured) Base free-flow Speed, BFFS	3 65.0	ft ft ramps/mi mph mph	f _{∟w} f _{LC} TRD Adjustment FFS	65.0	mph mph mph mph
LOS and Performance M	easures		Design (N)		
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S LOS	x f _{HV} x 2124 57.6 36.9 E	pc/h/ln mph pc/mi/ln	Design (N) Design LOS $v_p = (V \text{ or DDHV}) / (PHF x N)$ $f_p)$ S D = v_p / S Required Number of Lanes, N	(f _{HV} x	pc/h/ln mph pc/mi/ln
Glossary			Factor Location		
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - Speed D - Density FFS - Free-flo BFFS - Base ur volume	ow speed free-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11-	-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11

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Freeway Segment

2035 PM



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	BASIC	FREEWAY SE	GMENTS WORKSHEET		
General Information			Site Information		
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott 5/27/2015 PM	MacDonald	Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB @ SR 30 2035	03
Project Description I-71 / S	R 82 IMS				
✓ Oper.(LOS)			Des.(N)	🗌 Pla	nning Data
Flow Inputs					
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	2010	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length Up/Down %	0.94 4 0 Level mi	
Calculate Flow Adjustme	ents				
f _p E _T	1.00 1.5		E_R $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	1.2 0.980	
Speed Inputs			Calc Speed Adj and FFS		
Lane Width Rt-Side Lat. Clearance Number of Lanes, N Total Ramp Density, TRD FFS (measured) Base free-flow Speed, BFFS	3 65.0	ft ft ramps/mi mph mph	f _{LW} f _{LC} TRD Adjustment FFS	65.0	mph mph mph mph
LOS and Performance M	easures		Design (N)		
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N f _p) S D = v _p / S LOS	x f _{HV} x 727 65.0 11.2 B	pc/h/ln mph pc/mi/ln	<u>Design (N)</u> Design LOS v _p = (V or DDHV) / (PHF x N f f _p) S D = v _p / S Required Number of Lanes, N	x f _{HV} x	pc/h/ln mph pc/mi/ln
Glossary			Factor Location		
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - Speed D - Density FFS - Free-f BFFS - Base pur volume	low speed e free-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11	-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11

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General Information			Site Information			
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott MacDonald 5/27/2015 PM		Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB SR 303 to SR 82 2035		
Project Description I-71 / SI	R 82 IMS					
Oper.(LOS)			Des.(N)	Pla	nning Data	
Flow Inputs						
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	2350	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length Up/Down %	0.94 4 0 Level mi		
Calculate Flow Adiustme	ents					
f _p E _T	1.00 1.5		E_R $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	1.2 0.980		
Speed Inputs			Calc Speed Adj and FFS			
Lane Width		ft				
Rt-Side Lat. Clearance		ft	f _{LW}		mph	
Number of Lanes, N	3		f _{LC}		mph	
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph	
FFS (measured)	65.0	mph	FFS	65.0	mph	
Base free-flow Speed, BFFS		mph				
LOS and Performance M	easures		Design (N)			
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N : f _p) S D = v _p / S LOS	x f _{HV} x 850 65.0 13.1 B	pc/h/ln mph pc/mi/ln	Design (N) Design LOS $v_p = (V \text{ or DDHV}) / (PHF x N x)$ $f_p)$ S D = v_p / S Required Number of Lanes, N	< f _{HV} x	pc/h/ln mph pc/mi/ln	
Glossary			Factor Location			
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - Speed D - Density FFS - Free-flo BFFS - Base pur volume	ow speed free-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11-	-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11	

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	BASI	C FREEWAY SE	GMENTS WORKSHEET		
General Information			Site Information		
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott MacDonald 5/27/2015 PM		Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB @ SR 82 1 2035	ЕВ
Project Description I-71 / S	R 82 IMS				
✓ Oper.(LOS))		Des.(N)	🗌 Planı	ning Data
Flow Inputs					
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	1830	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length Up/Down %	0.94 4 O Level mi	
Calculate Flow Adjustme	ents				
f _p E _T	1.00 1.5		E_R $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	1.2 0.980	
Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f _{LW}		mph
Number of Lanes, N	3		f _{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	65.0	mph	FFS	65.0	mph
Base free-flow Speed, BFFS		mph			
LOS and Performance N	leasures		Design (N)		
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N f _p) S D = v _p / S LOS	x f _{HV} x 662 65.0 10.2 A	pc/h/ln mph pc/mi/ln	Design (N) Design LOS $v_p = (V \text{ or DDHV}) / (PHF x N x)$ $f_p)$ S D = v_p / S Required Number of Lanes, N	k f _{HV} x I	pc/h/ln mph pc/mi/ln
Glossary			Factor Location		
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design he	S - Speed D - Densit FFS - Free- BFFS - Bas our volume	y flow speed e free-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11	-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11

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		BASIC F	REEWAY SE	GMENTS WORKSHEET		
General Information				Site Information		
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott MacDonald 5/27/2015 PM		cDonald	Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB @ SR 82 2035	? WB
Project Description I-71 / SF	R 82 IM	S				
Oper.(LOS)				Des.(N)	🗌 Plar	nning Data
Flow Inputs						
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	3010		veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length Up/Down %	0.94 4 0 Level mi	
Calculate Flow Adjustme	nts					
f _ρ E _T	1.00 1.5			E _R f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	1.2 0.980	
Speed Inputs				Calc Speed Adj and FFS		
Lane Width Rt-Side Lat. Clearance Number of Lanes, N Total Ramp Density, TRD	3		ft ft ramps/mi	f _{∟w} f _{LC} TRD Adjustment		mph mph mph
FFS (measured) Base free-flow Speed, BFFS	65.0		mph mph	FFS	65.0	mph
LOS and Performance Mo	easure	S		Design (N)		
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S LOS	(f _{HV} x	1089 65.0 16.8 B	pc/h/ln mph pc/mi/ln	Design (N) Design LOS $v_p = (V \text{ or DDHV}) / (PHF x N x)$ $f_p)$ S D = v_p / S Required Number of Lanes, N	(f _{HV} x	pc/h/ln mph pc/mi/ln
Glossary				Factor Location		
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - S D - E FFS - BFFS ur volur	Speed Density Free-flow - Base fre	speed ee-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11-	-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11

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Conoral Information			Site Information			
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch 5/27/2 PM	Mott MacDonald 2015	Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB SR 82 to I 2035	-80	
Project Description I-71 / SF	R 82 IMS	S				
Oper.(LOS)			Des.(N)	Plan	ning Data	
Flow Inputs						
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	3440	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length Up/Down %	0.94 3 0 Level mi		
Calculate Flow Adjustme	ents					
f _p E _T	1.00 1.5		E_R $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	1.2 0.985		
Speed Inputs			Calc Speed Adj and FFS			
Lane Width Rt-Side Lat. Clearance Number of Lanes, N Total Ramp Density, TRD FFS (measured) Base free-flow Speed, BFFS	3 65.0	ft ft ramps/mi mph mph	f _{Lw} f _{LC} TRD Adjustment FFS	65.0	mph mph mph mph	
LOS and Performance M	easure	s	Design (N)			
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S LOS	k f _{HV} x	1238 pc/h/ln 65.0 mph 19.0 pc/mi/ln C	<u>Design (N)</u> Design LOS v _p = (V or DDHV) / (PHF x N x f _p) S D = v _p / S Required Number of Lanes, N	< f _{HV} x	pc/h/ln mph pc/mi/ln	
Glossary			Factor Location			
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design ho	S - S D - D FFS - BFFS ur volun	Speed Density Free-flow speed - Base free-flow speed ne	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11-	-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11	

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	BASIC	C FREEWAY SE	GMENTS WORKSHEET		
General Information			Site Information		
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatch Mott 1 5/27/2015 PM	MacDonald	Highway/Direction of Travel From/To Jurisdiction Analysis Year	NB @ I-80 2035	
Project Description I-71 / S	SR 82 IMS				
✓ Oper.(LOS)			Des.(N)	🗌 Pla	anning Data
Flow Inputs					
Volume, V AADT Peak-Hr Prop. of AADT, K Peak-Hr Direction Prop, D DDHV = AADT x K x D	3060	veh/h veh/day veh/h	Peak-Hour Factor, PHF %Trucks and Buses, P _T %RVs, P _R General Terrain: Grade % Length	0.94 3 0 Level mi	
Calculate Flow Adjustm	onte		Op/Down //		
f _p E _T	1.00 1.5		E_R $f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	1.2 0.985	
Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f _{LW}		mph
Number of Lanes, N	3		f _{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	65.0	mph	FFS	65.0	mph
Base free-flow Speed, BFFS	i	mph			
LOS and Performance M	leasures		Design (N)		
<u>Operational (LOS)</u> v _p = (V or DDHV) / (PHF x N f _p) S D = v _p / S LOS	x f _{HV} x 1101 65.0 16.9 B	pc/h/ln mph pc/mi/ln	$\frac{\text{Design (N)}}{\text{Design LOS}}$ $v_p = (V \text{ or DDHV}) / (PHF x N)$ $f_p)$ S $D = v_p / S$ Required Number of Lanes, N	x f _{HV} x	pc/h/ln mph pc/mi/ln
Glossary			Factor Location		
N - Number of lanes V - Hourly volume v _p - Flow rate LOS - Level of service DDHV - Directional design h	S - Speed D - Density FFS - Free-f BFFS - Base our volume	low speed e free-flow speed	E _R - Exhibits 11-10, 11-12 E _T - Exhibits 11-10, 11-11, 11 f _p - Page 11-18 LOS, S, FFS, v _p - Exhibits 11	I-13 -2, 11-3	f _{LW} - Exhibit 11-8 f _{LC} - Exhibit 11-9 TRD - Page 11-11

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Freeway Merges / Diverges

2035 AM


			RAMPS AN	ID RAMP JUN	ICTIONS WO	RKSHEET						
General	Informa	tion		Site Inf	ormation							
Analyst		SJT		F	Freeway/Dir of Trav	/el	I-71 N	3				
Agency or (Company	Hatch	n Mott MacDonale	L b	Junction		SR 303	3 EB				
Date Perfor	med	5/27/	2015		Jurisdiction		0005					
Analysis Tir	me Period			ŀ	Analysis Year		2035					
Project Des	scription I-	1/ SK 02 1115										
	\di Ramn		Freeway Numb	eroflanes N	3					Downstre	am Adi Ramp	
opsileam A	nuj manip		Demo Number		3					Downouro	amp	
Ves	On		Ramp Number	bi Lanes, N	1					🗹 Yes	🗹 On	
			Acceleration La	ne Length, L _A	750							
V No			Deceleration La	ne Length L _D						No	Off	
INO NO			Freeway Volum	e, V _F	2640					. =	1500 ft	
L =	ft		Ramp Volume,	V _R	980					∽down [—]	1500 11	
-up	i.		Freeway Free-F	low Speed, SEE	65.0							
V _u =	veh/h		Ramp Free-Flov	w Speed, S _{FD}	40.0					v _D =	300 veh/h	
Convers	sion to n	c/h Under F	Rase Condit	ions								
		V		Tarraia	0/ Truels	0/ Du		f	f		Evf vf	
(pt	u/11)	(Veh/hr)	РПГ	Terrain	%11UCK	70 FLV		'HV	'p	v = v/i i ii	∧ ' _{HV} ∧ ' _p	
Freeway		2640	0.94	Level	4	0	(0.980	1.00		2865	
Ramp		980	0.94	Level	6	0	(0.971	1.00		1074	
UpStream Deurs Chron		200	0.04	Laval	F	0 0.976 1.00 327					207	
DownStrea		300	0.94 Marga Arazs	Levei	5	0 0.976 1.00 327						
Estimati	ion of v	•	Merge Areas			Diverge Areas						
		Z	(P)									
. –		V ₁₂ - V _F	('FM /	7)		$V_{12} = V_R + (V_F - V_R)P_{FD}$						
EQ -				() (Tubibit 12.6)		L _{EQ} = (Equation 13-12 or 13-13) P = using Equation (Exhibit 13.7)						
'FM - V -		0.399 US	ng Equation (EXHIBIT 13-0)		$V_{12} = pc/h$						
v ₁₂ – V or V		1/15 pc/	ll h (Equation 1)	(14 - 12 + 17)		$v_{12} - v_{12} - v$						
	> 2 700 -	1150 pc/	n (Equation 13	5-14 01 13-17)		v ₃ 01 v _{av34}	> 0.70	pc	In (Equation 13-14	+ or 13-17)		
	_{v34} ~ 2,700 p		I No			Is V_3 or $V_{av34} > 2,700$ pc/h? Yes No						
Is V ₃ or V _{av}	_{v34} > 1.5 * V	12 ^{/2} Yes	No			Is V ₃ or V _{av34}	₁ > 1.5	* V ₁₂ /2	Yes No			
lf Yes,V _{12a}	=	1715 pc/	h (Equation 13	3-16, 13-18, or		If Yes,V _{12a} =		pc 19)	h (Equation 1	3-16, 13-1	8, or 13-	
Capacit	v Checks	<u>10-10)</u>				Capacity	Chec	:ks				
		Actual	0	Capacity	LOS F?			Actual	Car	pacity	LOS F?	
				· ·		V _F			Exhibit 13-8	;		
V	FO	3939	Exhibit 13-8		No	$V_{FO} = V_F$	- V _R		Exhibit 13-8	;		
			1 1			V _P			Exhibit 13-1	0		
Flow En	terina M	erae Influe	nce Area			Flow Ente	erina	Diverae	Influence Are			
		Actual	Max	Desirable	Violation?			Actual	Max Desi	rable	Violation?	
V _R	R12	2789	Exhibit 13-8	4600:All	No	V ₁₂			Exhibit 13-8			
Level of	Service	Determina	tion (if not F	9		Level of S	Servio	ce Detern	nination (if n	ot F)	•	
[D _R = 5.475 +	- 0.00734 v _R + 0			D _R =	= 4.252 + 0	.0086 V ₁₂ - 0.0	09 L _D				
D _R =	22.0 (pc/mi/	n)				D _R = (p	c/mi/l	n)				
105 =	C (Exhibit 1)	, 3-2)				10S= (F	xhibit	, 13-2)				
Speed D	Determin	ation				Speed De	term	ination				
$M_{o} =$		13_11)					xhibit 1	3-12)				
s с –	5.527 (LAD	vhibit 12 44)				S _R = m	ph (Exh	, nibit 13-12)				
ο _R -	57.5 mpn (E	xnidit 13-11)				S_0 = mph (Exhibit 13-12)						
S ₀ =	62.7 mph (E	xhibit 13-11)				S = mph (Exhibit 13.13)						
S =	58.9 mph (E	xhibit 13-13)				3- m	µi (⊏xi	101(13-13)			10/00/07	
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			RAMPS AN	D RAMP JUN	CTIONS WO	RKSHEET							
Genera	l Informa	tion		Site Info	ormation								
Analyst Agency or Date Perfo	Company rmed	SJT Hatch 5/27/	n Mott MacDonal 2015	Fi J Ju Ju	reeway/Dir of Trav unction urisdiction	vel l	-71 NB SR 303 V	VB					
Analysis Ti Project Do	me Period			A	nalysis Year		2035						
	scription 1-	/ 1 / SR 02 1113											
lingtroom	Adi Dama		Eroowov Numb	ar of Lanca N	2					Downstre	am Adi Pamp		
Opstream	Auj Kamp		Demo Number		3					Downstre			
🗹 Yes	🗹 On		Acceleration La	ne Length, L _A	750					Yes	On		
🗌 No	Off		Deceleration La	ne Length L _D						🗹 No	Off		
			Freeway Volum	e, V _F	3620	, L _{down} = ft							
L _{up} =	1500 f	t	Ramp Volume,	V _R	300								
× -			Freeway Free-F	low Speed, S _{FF}	65.0					V _D =	veh/h		
v _u =	980 Ve	n/n	Ramp Free-Flov	v Speed, S _{FR}	50.0								
Conver	sion to p	c/h Under E	Base Condit	ions									
(p	ic/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f	HV	f _p	v = V/PHF	⁼ x f _{HV} x f _p		
Freeway		3620	0.94	Level	4	0	0.9	80	1.00		3928		
Ramp		300	0.94	Level	5	0	0.9	76	1.00	ļ	327		
UpStream David Otra		980	0.94	Level	6	0	0.9	71	1.00		1074		
DownStre	am		Merce Areas					I	Diverge Areas				
Estimat	tion of v	0	Merge Areas			Diverge Areas							
		V = V.	(P)			Estimation of v_{12}							
L 50 =		•12 •⊦ (Equatio	\'FM/ \n 13-6 or 13-'	7)		$V_{12} = V_R + (V_F - V_R)P_{FD}$ (Equation 13-12 or 13-13)							
PEN =		0.599 usi	ng Equation (Fxhibit 13-6)		P_{EQ} = (Equation 13-12 of 13-13) P_{ED} = using Equation (Exhibit 13-7)							
$V_{12} =$		2351 pc/	ng _qaaaon , h			$V_{12} = pc/h$							
V ₃ or V _{av34}	Ļ	1577 pc/	h (Equation 13	3-14 or 13-17)		V ₃ or V _{av34}		pc	/h (Equation 13-1	4 or 13-17)			
Is V ₃ or V ₄	_{av34} > 2,700	pc/h? Yes	✓ No			Is V ₃ or V _{av34}	> 2,700 p	oc/h?	Yes No				
Is V ₃ or V ₂	_{av34} > 1.5 * V	12/2 Ves	No			Is V ₃ or V _{av34}	> 1.5 * V	12/2	Yes No				
lf Yes,V _{12a}	=	2351 pc/ 13-19)	h (Equation 13	3-16, 13-18, or		If Yes,V _{12a} =		pc 19)	/h (Equation 1	3-16, 13-1	8, or 13-		
Capacit	ty Check	s				Capacity (Checks	s					
		Actual	(apacity	LOS F?			Actual	Ca	pacity	LOS F?		
						V _F			Exhibit 13-8	3			
V	/ _{FO}	4255	Exhibit 13-8		No	$V_{FO} = V_F$ -	V _R		Exhibit 13-8	3			
						V _R			Exhibit 13-1	0			
Flow Er	ntering M	lerge Influe	nce Area			Flow Ente	ring D	iverge l	Influence Ar	ea			
		Actual	Max	Desirable	Violation?		A	ctual	Max Des	irable	Violation?		
V	R12	2678	Exhibit 13-8	4600:All	No	V ₁₂			Exhibit 13-8				
Level o	f Service	Determinat	tion (if not F)		Level of S	ervice	Detern	nination (if n	ot F)			
	D _R = 5.475 ·	+ 0.00734 v _R + (0.0078 V ₁₂ - 0.00	627 L _A			D _R = 4	.252 + 0	.0086 V ₁₂ - 0.0	009 L _D			
D _R =	21.5 (pc/mi/	'ln)				D _R = (po	:/mi/ln)						
LOS =	C (Exhibit 1	3-2)				LOS = (Ex	khibit 1	3-2)					
Speed I	Determin	ation				Speed Det	ermin	ation					
M _S =	0.303 (Exibi	it 13-11)				D _s = (Ex	hibit 13-1	12)					
S _R =	58.0 mph (E	Exhibit 13-11)				S _R = mp	h (Exhibi	t 13-12)					
S ₀ =	61.1 mph (E	Exhibit 13-11)				S ₀ = mph (Exhibit 13-12)							
S =	 59.1 mph (E	, Exhibit 13-13)				S = mp	h (Exhibi	t 13-13)					
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		RAN	IPS AND RAI		S WORKS	SHEET	Г			
General Inform	ation		Site Inf	ormation		-				
Analyst Agency or Company Date Performed	SJT Hatch 5/27/2	n Mott MacDonal 2015	d .	Freeway/Dir of Trav Junction Jurisdiction	el	I-71 NB SR 82				
Analysis Time Period	AM			Analysis Year		2035				
Project Description I	-71 / SR 82 IMS									
		Cara and a bloom b		2					Downstroor	n Adi Domn
Upstream Adj Ra	imp	Freeway Numb	er of Lanes, N	3					Downstream	n Auj Rahip
□ Yes [On	Ramp Number Acceleration La	of Lanes, N ine Length, L _A	1					Ves 🗹	On
✓ No	Off	Deceleration La Freeway Volum	ane Length L _D ie. V⊏	460 3920					No	Off
L _{up} = 1	ft	Ramp Volume,	V _R	410					L _{down} =	1800 ft
V _u = v	reh/h	Freeway Free-R Ramp Free-Flo	-low Speed, S _{FF} w Speed, S _{FR}	65.0 50.0					V _D =	1690 veh/h
Conversion to	oc/h Under E	ase Condit	ions							
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv		f _{HV}	f _p	v = V/PHF >	c f _{HV} x f _p
Freeway	3920	0.94	Level	4	0 0.980 1.00 4254 0 0.980 1.00 445					54
Ramp	410	0.94	Level	4	0 0.980 1.00 445					
DownStream	1690	0.94	ا مربوا	4	0 0.980 1.00 1834					
2000000	1000	Merge Areas	20101		, v	0.		Diverge Areas	10	
Estimation of v	12				Estimatio	n of v	12	•		
$L_{EQ} = P_{FM} = V_{12} = V_{3} \text{ or } V_{av34}$ Is V ₃ or V _{av34} > 2,700 Is V ₃ or V _{av34} > 1.5 * V_{12a} =		$\begin{array}{l} L_{EQ} = \\ P_{FD} = \\ V_{12} = \\ V_3 \mbox{ or } V_{av34} \\ Is \ V_3 \ or \ V_{av34} \\ Is \ V_3 \ or \ V_{av34} \\ Is \ V_3 \ or \ V_{av34} \\ If \ Yes, V_{12a} = \end{array}$	↓ > 2,700 ↓ > 1.5 *	V ₁₂ = (Ec 0.63 285 139 0 pc/h? □ V ₁₂ /2 □ pc/	= V_R + (V_F - V_R . quation 13-12 o 13 using Equatio 7 pc/h (Equatio 7 pc/h (Equatio Yes	1 ⁰² FD r 13-13) on (Exhibit 13 n 13-14 or 1 -16, 13-18, c	-7) 3-17) pr 13-19)			
Capacity Check	(S	1			Capacity	Chec	ks			
	Actual		Capacity	LOS F?	V		Actual	Ca	pacity 7050	LOS F?
V _{FO}		Exhibit 13-8			$V_{FO} = V_F$	- V _R	4254 3809	Exhibit 13-8	7050	No
							440	Exhibit 13-10	2100	INO
Flow Entering I		nce Area	Desirable	Violation?	FIOW Ente	ering i	Actual	Max Desirab	ea	Violation?
Vara	Actual	Exhibit 13-8	Desilable	VIOIAUOITE	Via		2857	Fyhibit 13-8	4400-AII	No
l evel of Service	V _{R12} Exhibit 13-6						e Detern	nination (if no	of F)	NO
$D_R = 5.475 +$ $D_R = (pc/mi/ln)$ LOS = (Exhibit 2	0.00734 v _R + () 13-2)	0.0078 V ₁₂ - ().00627 L _A		D _R = 24 LOS = C	D _R = I.7 (pc/r (Exhib	4.252 + 0 mi/ln) it 13-2)	0.0086 V ₁₂ - 0.0	09 L _D	
Speed Determin	nation				Speed De	termi	nation	0)		
$M_S =$ (Exibit 13 $S_R =$ mph (Exh $S_0 =$ mph (Exh	S = (Exibit 13-11) R ⁼ mph (Exhibit 13-11) J ⁼ mph (Exhibit 13-11) make (Exhibit 13-12)						(Exhibit 13-1) (Exhibit 1) (Exhibit 1)	∠) 3-12) 3-12) 2-12)		
S = mph (Exh	idit 13-13)				0 ⁻ 01	.5 mpn		5-13)		

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			RAMPS AN	D RAMP JUN	ICTIONS WO	RKSHEET							
Genera	l Informa	ntion		Site Infe	ormation								
Analyst Agency or Date Perfo	Company	SJT Hatch 5/27/2	n Mott MacDonald 2015	F J J J	Freeway/Dir of Trav lunction lurisdiction	el	I-71 NE SR 82	3 EB					
Analysis I	ime Period			P	Analysis Year		2035						
Project De	scription i-	/ 1 / SR 02 11115											
Inputs	A di Dama		Fraguery Numb	ar of Longo N						Downstro	am Adi Dama		
Opstream	Аај катр		Freeway Numbe	er of Laries, in	3					Downsue	ani Auj Kanip		
🗌 Yes	🗌 On		Ramp Number of Acceleration La	of Lanes, N ne Length, L _A	1 600					✓ Yes	🗹 On		
No.			Deceleration La	ne Length L _D						🗌 No	Off		
			Freeway Volum	e, V _F	3510					L _{down} =	1400 ft		
L _{up} =	ft		Ramp Volume,	V _R	1690 65 0					down			
V _u =	veh/h		Ramp Free-Flov	iow Speed, S _{FF}	65.0 40.0					V _D =	1100 veh/h		
Conver	sion to n	c/h Under F	Base Condit	ions	10.0								
(F	oc/h)	V (Veb/br)	PHF	Terrain	%Truck	%Rv		f _{HV}	f _p	v = V/PHF	= x f _{HV} x f _p		
Freeway		3510	0.94	Level	4	0),980	1.00		3809		
Ramp		1690	0.94	Level	4	0).980	1.00		1834		
UpStream													
DownStre	am	1100	0.94	Level	1	0 0.995 1.00 1176							
Fatima	tion of		Merge Areas			Diverge Areas							
Estima	tion of v ₁	12	(5)			Estimation of v ₁₂							
		V ₁₂ = V _F	(P _{FM})			$V_{12} = V_R + (V_F - V_R)P_{FD}$							
L _{EQ} =		(Equatio	on 13-6 or 13-	() 5 11 10 0)		L_{EQ} = (Equation 13-12 or 13-13)							
Г _{FM} -		0.594 USI	ng Equation (Exhibit 13-6)		P _{FD} =		us	ing Equation (Exhibit 13-7)			
v ₁₂ – V. or V		2264 pc/	li h (Equation 1)	2 14 or 12 17		$v_{12} - v_{12} - v$		pc	//I /h /Equation 12.1	1 or 12 17)			
ls V. or V	1 	1545 pc/		5-14 01 13-17)		v ₃ 01 v _{av34}	> 2 70	μι 10 pc/b2 🗔		4 01 13-17)			
$\log V$ or V	av34 ~ 2,700		✓ NO			$15 V_3 O V_{av34}$	> 1 5		Yes No				
If Yes,V ₁₂	av34 ~ 1.5 v	2264 pc/	No h (Equation 13)	3-16, 13-18, or		If Yes, V_{122} =	- 1.5	v ₁₂ /2	Yes IINo h (Equation 1	3-16, 13-1	8, or 13-		
Canaci	ty Chock	13-19) s				Canacity	Chor	19) • k e					
Capacit	ly Oneen	Actual		anacity	LOS F?			Actual	Ca	nacity	LOS F2		
		7.0000	1 T			Vr		7101000	Exhibit 13-	3			
۱ N		5643	Exhibit 13-8		No	$V_{EO} = V_E$	- V _P		Exhibit 13-8	3			
	10					V _R			Exhibit 13-1	0			
Flow E	nterina M	lerae Influe	nce Area			Flow Ente	erina	Diverae	Influence Ar	ea			
		Actual	Max	Desirable	Violation?			Actual	Max Des	irable	Violation?		
V	R12	4098	Exhibit 13-8	4600:All	No	V ₁₂			Exhibit 13-8				
Level o	f Service	Determinat	tion (if not F)		Level of S	Servi	ce Detern	nination (if n	ot F)			
	D _R = 5.475	+ 0.00734 v _R + (0.0078 V ₁₂ - 0.00	627 L _A			D _R =	= 4.252 + 0	.0086 V ₁₂ - 0.0	009 L _D			
D _R =	32.8 (pc/mi/	′ln)				D _R = (p	c/mi/l	n)					
LOS =	D (Exhibit 1	3-2)				LOS = (E	xhibit	13-2)					
Speed	Determin	ation				Speed De	term	ination					
M _S =	0.508 (Exib	it 13-11)				D _s = (E	xhibit 1	3-12)					
S _R =	53.3 mph (E	Exhibit 13-11)				S₀= mi	on (Exh ob (⊑v⊦	nibit 13-12)					
S ₀ =	61.2 mph (E	Exhibit 13-11)				S = m	oh (Exh	nibit 13-13)					
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			RAMPS AN	D RAMP JUN	ICTIONS WO	RKSHEET							
Genera	l Informa	tion		Site Info	ormation								
Analyst Agency or Date Perfo	Company rmed	SJT Hatc 5/27/	h Mott MacDonald /2015	F J J	Freeway/Dir of Trav lunction lurisdiction	el l	-71 NB SR 82 WB						
Analysis Ti	ime Period	AM		A	Analysis Year		2035						
Project Des	scription I-	(1 / SR 82 IMS											
Unstream	Adi Ramp		Freeway Numbe	er of Lanes N	3					Downstre	am Adi Ramp		
openean	aj ramp		Ramp Number of	of Lanes. N	1								
🗹 Yes	🗹 On		Acceleration La	ne Length, L _A	600					∐ Yes	l On		
No	□ Off		Deceleration La	ne Length L _D						🗹 No	Off		
			Freeway Volum	e, V _F	5200					= mob	ft		
L _{up} =	1400 fi	t	Ramp Volume,	V _R	1100					donn			
V -	1000	- - / -	Freeway Free-F	low Speed, S _{FF}	65.0					V _D =	veh/h		
v _u –	1090 Ve		Ramp Free-Flov	v Speed, S _{FR}	50.0								
Conver	sion to p	<u>c/h Under L</u>	Base Conditi	ons	1	1	1						
(p	ic/h)	v (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _H	/	f _p	v = V/PHF	⁻ x f _{HV} x f _p		
Freeway		5200	0.94	Level	4	0	0.980)	1.00		5643		
Ramp		1100	0.94	Level	1	0	0.995	5	1.00		1176		
DownStream	am	1690	0.94	Level	4	0	0.980)	1.00		1834		
Downource	um		Merge Areas			Diverge Areas							
Estimat	tion of v ₁	2				Estimation of v ₁₂							
		V ₁₂ = V _F	(P _{FM})					V ₁₂ = \	/ _R + (V _F - V _R)F	FD			
L _{EQ} =		(Equation	on 13-6 or 13-7	7)		L _{EQ} = (Equation 13-12 or 13-13)							
P _{FM} =		0.594 us	ing Equation (Exhibit 13-6)		P _{FD} = using Equation (Exhibit 13-7)							
$v_{12} = V_{12}$		3354 pc/	'h /h /Equation 12	(14 - 12 + 17)		V ₁₂ = pc/h V ₂ or V _{20/34} pc/h (Equation 13-14 or 13-17)							
v ₃ 0r v _{av34} Is V ₂ or V	ا مر > 2 700 ا	2209 pc/		-14 01 13-17)		v ₃ 01 v _{av34} Is V. or V	> 2 700 pc	/h2		or 13-17)			
Is V ₂ or V	$\sim > 1.5 * V$					Is Valor V	> 1.5 * V.	//2 □ \					
lf Yes,V _{12a}	=	3354 pc/ 13-19)	h (Equation 13	8-16, 13-18, or		lf Yes,V _{12a} =	1.0 112	pc/ 19)	h (Equation 13	-16, 13-1	8, or 13-		
Capacit	ty Check	Ś				Capacity (Checks						
		Actual	C	apacity	LOS F?			Actual	Сар	acity	LOS F?		
						V _F			Exhibit 13-8				
V V	FO	6819	Exhibit 13-8		No	$V_{FO} = V_F$	- V _R		Exhibit 13-8				
							<u> </u>		Exhibit 13-10)			
Flow Er	ntering M	Actual	nce Area	Desirable	Violation?	Flow Ente	ring Div	verge Ir	May Desir	ahla	Violation?		
V	P12	4530	Exhibit 13-8	4600:All	No	V ₁₂	7.00		Exhibit 13-8	abie	Violation		
Level of	f Service	Determina	tion (if not F)		Level of S	ervice L	Determ	ination (if no	ot F)	<u> </u>		
	D _R = 5.475 ·	+ 0.00734 v _R +	0.0078 V ₁₂ - 0.00	627 L _A			D _R = 4.2	252 + 0.	0086 V ₁₂ - 0.0	09 L _D			
D _R =	36.5 (pc/mi/	ln)				D _R = (po	c/mi/ln)						
LOS =	E (Exhibit 1	3-2)				LOS = (E:	xhibit 13-	2)					
Speed I	Determin	ation				Speed De	termina	tion					
M _S =	0.623 (Exibi	t 13-11)				D _s = (Ex	hibit 13-12	!)					
S _R =	50.7 mph (E	xhibit 13-11)				S _R = mp	h (Exhibit '	13-12)					
S ₀ =	. 、 58.6 mph (E	xhibit 13-11)				S ₀ = mp	h (Exhibit '	13-12)					
S =	53.1 mph (E	xhibit 13-13)				S = mp	h (Exhibit '	13-13)					
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AM | 11

		DAN				JEET							
General Inform	ation		Site Inf	ormation									
Analyst Agency or Company Date Performed	SJT Hatch 5/27/2	n Mott MacDonal 2015	d J	Freeway/Dir of Trav lunction lurisdiction	rel - ⁻ -1	71 NB 80							
Project Description			F	Analysis Year	20	135							
Inputs	-71738 02 1103												
Linstream Adi Pa	amp	Freeway Numb	er of Lanes N	3			l	Downstream	1 Adi Ramp				
opstream Auj Na	inp	Ramp Number	of Lanes N	1				_					
Yes	On	Acceleration La	ne Length, L _A	'				Yes	On				
V No	Off	Deceleration La	ine Length L _D	550				No	Off				
		Freeway Volum	e, V _F	6300			ı	-down =	ft				
L _{up} =	ft	Ramp Volume,	V _R	400				down					
		Freeway Free-F	low Speed, S _{FF}	65.0				V _D =	veh/h				
V _u = v	/eh/h	Ramp Free-Flo	w Speed, S _{FR}	50.0					-				
Conversion to	pc/h Under E	Base Condit	ions		i	í							
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	/ = V/PHF x	f _{HV} x f _p				
Freeway	6300	0.94	Level	3	0	0.985	1.00	680	13				
Ramp	400	0.94	Level	7	0	0.966	1.00	44	0				
DownStream		<u>├</u>											
		Merge Areas		-			Diverge Areas	15					
Estimation of v	12				Estimation	of v ₁₂							
L _{EQ} = P _{FM} = V10 =	V ₁₂ = V _F (Equation using Ect pc/h	(P _{FM}) on 13-6 or 13- quation (Exhit	7) it 13-6)		L _{EQ} = P _{FD} = V ₁₂ =	V ₁₂ : (Ec 0.57 406	= V _R + (V _F - V _R) quation 13-12 or 70 using Equatio 5 pc/h	P _{FD} 13-13) on (Exhibit 13-7	7)				
V_3^{12} or V_{av34}^{12} Is V_3 or $V_{av34} > 2,700$	pc/h (Ec	quation 13-14	or 13-17)		V ₃ or V _{av34} Is V ₃ or V _{av34} >	273 2,700 pc/h?	8 pc/h (Equation	1 13-14 or 1	3-17)				
Is V_3 or $V_{av34} > 1.5 *$ If Yes, $V_{12a} =$	V ₁₂ /2 pc/h (Ec 19)	No No quation 13-16,	13-18, or 13-		Is V ₃ or V _{av34} > If Yes,V _{12a} =	· 1.5 * V ₁₂ /2 410 19)	Yes	ו 13-16, 13-	18, or 13-				
Capacity Check	ks				Capacity C	hecks							
	Actual	(Capacity	LOS F?		Actual	Cap	bacity	LOS F?				
					V _F	6803	Exhibit 13-8	7050	No				
V _{FO}		Exhibit 13-8			$V_{FO} = V_F -$	V _R 6363	Exhibit 13-8	7050	No				
					V _R	440	Exhibit 13-10	2100	No				
Flow Entering I	Merge Influer	nce Area	Desirable	Vieletie - O	Flow Enter	ing Diverge	Influence Area	a	Vieletie - O				
Vala	Actual	Max Evhibit 13-8	Desirable	Violation?	Vie	Actual 4065	Max Desirable	3 4400-All	Violation?				
VR12	 o Dotorminat	tion (if not F	-)			rvice Detern	nination (if no	4400.All	INU				
D _R = 5.475 +	0.00734 v _R +	0.0078 V ₁₂ - ().00627 L _A		Lever or Se	D _R = 4.252 + 0).0086 V ₁₂ - 0.00)9 L _D					
D _R = (pc/mi/ln)				D _R = 34.6	(pc/mi/ln)							
LOS = (Exhibit '	, 13-2)				LOS = D (E	Exhibit 13-2)							
Speed Determi	nation				Speed Dete	ermination							
M _S = (Exibit 13	3-11)				D _s = 0.273 (Exhibit 13-12)								
S _R = mph (Exh	ibit 13-11)				S _R = 58.7	mph (Exhibit 1	3-12)						
S ₀ = mph (Exh	ibit 13-11)				S ₀ = 64.7	mph (Exhibit 1	3-12)						
S = mph (Exh	ibit 13-13)				S = 61.0	mph (Exhibit 1	3-13)						

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Freeway Merges / Diverges

2035 PM



		RAMPS AN	D RAMP JUN	CTIONS WO	RKSHEET							
General Inform	nation		Site Info	ormation								
Analyst	SJT		Fr	eeway/Dir of Trav	vel I	-71 NB						
Agency or Company	Hatc	h Mott MacDonald	Ju	Inction	c.	SR 303	EB					
Date Performed	5/27/	2015	JL	irisdiction	,	0.025						
Analysis Time Period			AI	nalysis Year	4	2035						
	1-71 / SR 82 IMS											
inputs		L										
Upstream Adj Ramp		Freeway Numbe	er of Lanes, N	3					Downstrea	am Adj Ramp		
		Ramp Number c	f Lanes, N	1					✓ Yes	✓ On		
res LC	'n	Acceleration Lar	ne Length, L _A	750								
		Deceleration La	ne Length L _D						No	Off		
I Mo □ C	Off	Freeway Volume	e. V _E	1520								
		Ramn Volume \	/_	190					L _{down} =	1500 ft		
L _{up} = ft			'R	430								
	L.	Freeway Free-F	ow Speed, S _{FF}	65.0					V _D =	340 veh/h		
v _u – ven/	n	Ramp Free-Flow	/ Speed, S _{FR}	40.0								
Conversion to	pc/h Under E	Base Conditi	ons									
(pc/h)	V () (ab /br)	PHF	Terrain	%Truck	%Rv		f _{HV}	f _n	v = V/PHF	x f _{HV} x f _n		
Frooway	(Ven/hr) 1520	0.04	Lovol	4	0		080	1 00		1640		
Ramp	100	0.94	Level	4	0		.900 071	1.00		537		
UnStream	430	0.34	Level	0	0	-	.571	1.00		557		
DownStream	340	0.94	Level	5	0	0	.976	1.00 371				
		Merge Areas			Diverge Areas							
Estimation of v	/12				Estimation of V ₁₂							
	12	(V =	$V_{p} + (V_{r} - V_{p})$	Per			
	$v_{12} = v_{F}$	(P _{FM})			$L_{EO} = (Equation 13-12 \text{ or } 13-13)$							
L _{EQ} =	(Equation	on 13-6 or 13-7)		-EQ P =		(L	ing Equation (Evhibit 13-7)			
P _{FM} =	0.599 us	ing Equation (=xhibit 13-6)		· FD V (0 =		nc	h				
V ₁₂ =	987 pc/h	1			Viar Via		pc	/h (Equation 13-1	1 or 13-17)			
V ₃ or V _{av34}	662 pc/h	(Equation 13-	14 or 13-17)			< 2 70) na/h2 🗔		4 01 13-17)			
Is V ₃ or V _{av34} > 2,70	0 pc/h? 🗌 Yes	✓ No			13 v ₃ 01 v _{av34}	- 2,700		Yes No				
Is V ₃ or V _{av34} > 1.5 *	V ₁₂ /2 Yes	🗹 No			Is V ₃ or V _{av34}	> 1.5 ^	V ₁₂ /2	Yes No	0 40 40 4			
If Yes,V _{12a} =	pc/h (Eo	quation 13-16,	13-18, or 13-19))	lf Yes,V _{12a} =		20 10)	h (Equation 1	3-16, 13-18	3, or 13-		
Capacity Chec	ks				Capacity (Chec	13) ks					
	Actual	0	anacity	LOS F2		1	Actual	Ca	nacity	LOS F2		
	, lotau	Ť	apaony	20011	Vr		7101001	Exhibit 13-	R	20011		
V-a	2186	Evhibit 13.8		No	$V_{-a} = V_{-a}$. V		Exhibit 13	8			
¥F0	2100			NO	VFO VF	۴R		Exhibit 10				
					V _R			Exhibit 13-	10			
Flow Entering	Merge Influe	nce Area	De sinch la) (in lation 2	Flow Ente	ring i	Diverge I	Influence Ar	ea)/islation 0		
	Actual	Max L		Violation?	N/		Actual	Max Des		Violation?		
V _{R12}	1524	Exhibit 13-8	4600:All	NO	V ₁₂	Ļ		Exhibit 13-8				
Level of Servic		Level of S	ervic	e Detern		10t F)						
D _R = 5.47	5 + 0.00734 v _R +	0.0078 V ₁₂ - 0.006			D _R =	4.252 + 0	.0086 V ₁₂ - 0.	009 L _D				
D _R = 12.4 (pc/r	ni/ln)				D _R = (po	c/mi/In	ı)					
LOS = B (Exhibit	13-2)				LOS = (E:	xhibit	13-2)					
Speed Determ	ination				Speed Det	termi	nation					
$M_0 = 0.270 / E_V$	ibit 13-11)				D _s = (Ex	hibit 13	3-12)					
- 500 ·					S _R = mp	h (Exhi	, bit 13-12)					
S _R = 58.6 mph	(Exnibit 13-11)				$S_0 = mph$ (Exhibit 13-12)							
S ₀ = 64.4 mph	(Exhibit 13-11)				S = mnb (Evhibit 13.13)							
S = 60.2 mph	(Exhibit 13-13)				s= mp	n (Exhi	dit 13-13)					
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			RAMPS AN	D RAMP JU	NCTIONS WO	RKSHEET					
General	Informat	ion		Site In	formation						
Analyst Agency or (Date Perfor	Company med	SJT Hatc 5/27	h Mott MacDonald /2015		Freeway/Dir of Trav Junction Jurisdiction	vel l	-71 NB SR 303	WB			
Analysis Tir	ne Period	PM			Analysis Year		2035				
Project Des	cription I-71	/ SR 82 IMS									
Inputs			1							1	
Jpstream A	dj Ramp		Freeway Numbe	r of Lanes, N	3					Downstre	am Adj Ramp
			Ramp Number o	f Lanes, N	1					Yes	On
Yes	i⊻ On		Acceleration Lar	ie Length, L _A	750						
	□ o#		Deceleration La	ne Length L _D						🗹 No	Off
			Freeway Volume	e, V _F	2010					. =	ft
=	1500 ft		Ramp Volume, V	/ _R	340					∽down	п
up			Freeway Free-F	ow Speed, S _{FF}	65.0					V -	voh/h
/ _u =	490 veh	/h	Ramp Free-Flow	Speed, S _{FR}	50.0						Ven/m
Convers	ion to pc	/h Under I	Base Conditi	ons							
(pc	:/h)	V (\/eh/hr)	PHF	Terrain	%Truck	%Rv		f _{HV}	fp	v = V/PH	F x f _{HV} x f _p
reeway		2010	0.94	Level	4	0	0	.980	1.00		2181
Ramp		340	0.94	Level	5	0	0	.976	1.00		371
UpStream		490	0.94	Level	6	0	0	.971	1.00		537
DownStrea	m										
otimot	ion of v		Merge Areas			Diverge Areas					
sumau	011 01 V ₁₂					Estimation of v ₁₂					
_		V ₁₂ = V _F	• (P _{FM})					V ₁₂ =	V _R + (V _F - V _R	P _{FD}	
EQ =		(Equation	on 13-6 or 13-7) Tubibit 12 C)		L _{EQ} =		(E	quation 13-12	2 or 13-13)	
FM = / =		0.599 US	ang Equation (i /b	EXMIDIL 13-0)		r _{FD} - V =		us		(EXNIDIT 13-7)	
' 12 /2 or V_224		876 pc/	(Fouation 13-	14 or 13-17)		V_{12}^{-}		pc	/// /h (Equation 13-)	14 or 13-17)	
s V ₂ or V ₂	> 2.700 pc	/h? 🗌 🗸 es				Is V ₂ or V ₂₁₂₄	> 2.70) pc/h? 🗔			
s V ₂ or V	~~> 1.5 * V ₄	$\sqrt{2}$ $\sqrt{2}$ Voc				Is Voor Voo	> 1.5 *	V/2			
Yes,V _{12a}	=	1305 pc/	/h (Equation 13	-16, 13-18, or		If Yes,V _{12a} =		•12'- pc	/h (Equation '	13-16, 13-1	8, or 13-
Capacit	v Checks	13-19)				Capacity (Chec	ks			
		Actual	С	apacity	LOS F?			Actual	C	apacity	LOS F?
			ŤŤ			V _F			Exhibit 13-	-8	
V	FO	2552	Exhibit 13-8		No	$V_{FO} = V_F$	V _R		Exhibit 13-	-8	
			1 1			V _R			Exhibit 13-	10	
low En	terina Me	erae Influe	nce Area		I	Flow Ente	rina	Diverae	Influence A	rea	
		Actual	Max [Desirable	Violation?		T	Actual	Max De	sirable	Violation?
V _R	12	1676	Exhibit 13-8	4600:All	No	V ₁₂			Exhibit 13-8		
evel of	Service I	Determina	tion (if not F			Level of S	ervic	e Detern	nination (if I	not F)	
I	D _R = 5.475 +	0.00734 v _R +	0.0078 V ₁₂ - 0.006	627 L _A			D _R =	4.252 + 0	.0086 V ₁₂ - 0.	.009 L _D	
_R =	13.7 (pc/mi/ln)				D _R = (po	c/mi/In	ı)			
OS =	B (Exhibit 13-	2)				LOS = (E:	xhibit	13-2)			
Speed D	Determina	tion				Speed Dea	termi	nation			
1 _s =	0.267 (Exibit	13-11)				D _s = (Ex	hibit 13	3-12)			
S_=	58.9 mnh (Ex	, hibit 13-11)				S _R = mp	h (Exhi	ibit 13-12)			
- K Sa=	63.6 mnh (Ev	hibit 13 11)				S ₀ = mp	h (Exhi	ibit 13-12)			
²∪- S=	60.4 mnh (Ex	hibit 13-13)				S = mp	h (Exhi	ibit 13-13)			
			Dighta Deconved			'	·	,		Generated:	10/26/2015 2:4:



		RAM	IPS AND RAI			SHEE	г							
General Inform	ation		Site Inf	formation			-							
Analyst Agency or Company Date Performed Analysis Time Period	SJT Hatc 5/27/ PM	h Mott MacDonal /2015	d .	Freeway/Dir of Trav Junction Jurisdiction Analysis Year	vel	I-71 NB SR 82 2035								
Project Description	I-71 / SR 82 IMS			Analysis Teal		2000								
Inputs														
Upstream Adj Ra	amp	Freeway Numb	er of Lanes, N	3					Downstrean	n Adj Ramp				
Yes [On	Ramp Number Acceleration La	of Lanes, N ne Length, L _A	1					Ves 🗸	On				
✓ No	Off	Deceleration La	ine Length L _D	460					No	Off				
L _{up} =	ft	Ramp Volume,	v _R	2350 520					L _{down} =	1800 ft				
V _u =	veh/h	Freeway Free-F	Flow Speed, S _{FF} w Speed, S _{FR}	65.0 50.0					V _D =	1180 veh/h				
Conversion to	pc/h Under l	Jase Condit	ions											
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv		f _{HV}	f _p	v = V/PHF x	f _{HV} x f _p				
Freeway	2350	0.94	Level	4	0	0.	.980	1.00	25	50				
Ramp	520	0.94	Level	4	0	0	.980	1.00	Downstream Adj Ramp \checkmark Yes \circlearrowright On \bigcirc No \bigcirc Off $L_{down} =$ 1800 ft $V_D =$ 1180 veh/r \lor V = V/PHF x f _{HV} x f _p 2550 564 1280 IPFD r 13-13) pn (Exhibit 13-7) 13-14 or 13-17) 16, 13-18, or 13-19) pacity LOS F? 7050 No 2100 No 2100 No 4400:All No					
UpStream						<u> </u>			2550 564 1280					
DownStream	1180	Level	4	0	0.	.980	1.00	12	80					
Estimation of v	40	werge Areas			Estimatio	nofy	40	Diverge Areas						
	<u>12</u>	(P)			Loumatio		12							
$L_{EQ} = P_{FM} = V_{12} = V_{3} \text{ or } V_{av34}$ Is V ₃ or V _{av34} > 2,700 Is V ₃ or V _{av34} > 1.5 * If Yes,V _{12a} =		L _{EQ} = P _{FD} = V ₁₂ = V ₃ or V _{av34} Is V ₃ or V _{av34} Is V ₃ or V _{av34} If Yes,V _{12a} =	₁ > 2,700 ₁ > 1.5 *	(Ec 0.67 1899 655 0 pc/h? □ V ₁₂ /2 □ pc/	quation 13-12 o 0 using Equation 5 pc/h pc/h (Equation Yes ☑ No Yes ☑ No 'h (Equation 13)	- 13-13) on (Exhibit 13- 13-14 or 13 -16, 13-18, c	7) 5-17) or 13-19)							
Capacity Chec	ks				Capacity	Chec	ks							
	Actual		Capacity	LOS F?	V _F		Actual 2550	Ca Exhibit 13-8	pacity 7050	LOS F? No				
V _{FO}		Exhibit 13-8			V _{FO} = V _F	- V _R	1986 564	Exhibit 13-8 Exhibit 13-10	7050	No				
Elow Entering	Nerge Influe	nce Area			Flow Ente	erina	Diverae	Influence Are	a					
	Actual	Max	Desirable	Violation?			Actual	Max Desirab	le	Violation?				
V _{R12}		Exhibit 13-8			V ₁₂		1895	Exhibit 13-8	4400:All	No				
Level of Servic		Level of S	Servic	e Detern	nination (if no	ot F)								
D _R = 5.475 + D _R = (pc/mi/ln LOS = (Exhibit	0.00734 v _R +)) 13-2)	0.0078 V ₁₂ - 0).00627 L _A		D _R = 16 LOS = B	D _R = 6.4 (pc/i (Exhib	4.252 + 0 mi/ln) it 13-2)	.0086 V ₁₂ - 0.0	09 L _D					
Speea Determi	nation				Speea De			2)						
M _S = (Exibit 1: S _R = mph (Exh S ₀ = mph (Exh S = mph (Exh		⊔ _s −	204 (⊟X 3.5 mph 1.3 mph	(Exhibit 13-1) (Exhibit 13) (Exhibit 13) (Exhibit 13)	∠, 3-12) 3-12) 3-13)									
	101(10-10)						\	,						

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			RAMPS AN	ID RAMP JU	NCTIONS WO	RKSHEET								
Genera	l Informa	tion		Site In	formation									
Analyst Agency or Date Perfo Analysis T	Company ormed ime Period	SJT Hatc 5/27/ PM	h Mott MacDonal 2015	d	Freeway/Dir of Trav Junction Jurisdiction Analysis Year	vel	I-71 NB SR 82 I 2035	B EB						
Project De	scription I-	71 / SR 82 IMS			·									
Inputs														
Upstream	Adj Ramp		Freeway Numb	er of Lanes, N	3					Downstre	am Adj Ramp			
—			Ramp Number	of Lanes, N	1					Ves.	√ On			
∐ Yes	l On		Acceleration La	ine Length, L _A	600									
			Deceleration La	ane Length L _D						🗌 No	Off			
INO INO			Freeway Volum	ne, V _F	1830						1400 ft			
L _{up} =	ft		Ramp Volume,	V _R	1180					-down	1400 11			
			Freeway Free-F	Flow Speed, S _{FF}	65.0					V _D =	430 veh/h			
V _u =	veh/h		Ramp Free-Flo	w Speed, S _{FR}	40.0									
Conver	rsion to p	c/h Under L	Base Condit	ions						-				
(r	oc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv		f _{HV}	f _p	v = V/PHF	^F x f _{HV} x f _p			
Freeway		1830	0.94	Level	4	0	0	.980	1.00		1986			
Ramp		1180	0.94	Level	4	0	0	.980	1.00		1280			
UpStream	1	400	0.04	Laural				005	4.00		400			
DownStre	am	430	0.94 Merge Areas	Levei	1	0	0	.995	1.00 460 Diverge Areas					
Estima	tion of v ₁	2	inorgo / irouo			Diverge Areas Estimation of v ₁₂								
			(P _{FM})			Estimation of v_{12} $V_{12} = V_{R} + (V_{F} - V_{R})P_{FD}$								
L _{EQ} =		(Equation	on 13-6 or 13-	7)		L _{EQ} = (Equation 13-12 or 13-13)								
P _{FM} =		0.594 us	ing Equation	(Exhibit 13-6)		P _{FD} =		us	ing Equation	(Exhibit 13-7)				
$V_{12} =$		1180 pc/	'n			V ₁₂ =		рс	/h					
v ₃ or v _{av3}	4	806 pc/r	(Equation 13	-14 or 13-17)		V ₃ or V _{av34}	> 2 70	pc	/h (Equation 13-	14 or 13-17)				
	av34 ~ 2,700	/2 Ves	I NO			$15 V_3 01 V_{av3}$	4 ~ 2,70		Yes No					
If Yes,V _{12a}	_{av34} ~ 1.5 v	12/2 Yes 1180 pc/ 13-19)	No (Equation 1)	3-16, 13-18, or		Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 Yes No If Yes,V _{12a} = pc/h (Equation 13-16, 13-18, or 13 19)					8, or 13-			
Capaci	ty Check	Ś				Capacity	Chec	ks						
		Actual	(Capacity	LOS F?			Actual	C	apacity	LOS F?			
						V _F			Exhibit 13-	-8				
	/ _{FO}	3266	Exhibit 13-8		No	$V_{FO} = V_F$	- V _R		Exhibit 13-	-8				
						V _R			Exhibit 13-	10				
Flow E	ntering M	Actual	nce Area	Docirable	Violation?	Flow Ent	ering	Diverge I	nfluence Al	rea	Violation?			
v	D12	2460	Exhibit 13-8	4600-All	No	V12	+	Actual	Exhibit 13-8		VIOIAUOIT			
Level o	f Service	Determina	tion (if not F	F)	110	Level of S	Servic	e Detern	nination (if i	not F)	1			
	D _R = 5.475	+ 0.00734 v _R +	0.0078 V ₁₂ - 0.00)627 L₄			D _R =	4.252 + 0	.0086 V ₁₂ - 0.	.009 L _D				
D _P =	20.3 (pc/mi/	ln)		D _P = (r	oc/mi/lr	1)	12	D						
105 =	C (Exhibit 1	, 3-2)				10S = (F	- xhibit	, 13-2)						
Speed	Determin	ation				Speed De	termi	ination						
M _e =	0 319 (Exibi	t 13-11)				$D_s = (E$	Exhibit 13	3-12)						
S _D =	57 7 mnh /F					S _R = m	ph (Exh	ibit 13-12)						
-к S_=	63.0 mph (E	-xhibit 13-11)				S ₀ = m	ph (Exhi	ibit 13-12)						
S =	59.1 mnh (F	-xhibit 13-13)				S = m	ph (Exh	ibit 13-13)						
	00.1 mpn (L							'			40/00/0045 0.40 5			

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			RAMPS AN	ID RAMP JUN	ICTIONS WOR	RKSHEET							
General I	Informat	tion		Site Inf	ormation								
Analyst		SJT		F	Freeway/Dir of Trave	el -	71 NB						
Agency or Co	ompany	Hatch	n Mott MacDonald	d J	Junction	S	R 82 WB						
Date Perform	ned	5/27/	2015		Jurisdiction	0	005						
Analysis Tim	ne Period			ŀ	Analysis Year	2	035						
Project Desc	cription I-7	1 / SR 82 IMS											
nputs			L										
Jpstream Ad	dj Ramp		Freeway Numbe	er of Lanes, N	3					Downstre	am Adj Ramp		
			Ramp Number	of Lanes, N	1					Ves	On		
Yes Yes	🗹 On		Acceleration La	ne Length, L _A	600								
_	_		Deceleration La	ne Length L _n						🗹 No	Off		
No No	🗌 Off		Freeway Volum	e V_	3010					_	_		
			Domp Volumo	ο, ν _F	420					L _{down} =	ft		
up =	1400 ft			v _R	430								
			Freeway Free-F	low Speed, S _{FF}	65.0					V _D =	veh/h		
/ _u =	1180 ve	h/h	Ramp Free-Flov	w Speed, S _{FR}	50.0								
Conversi	ion to po	:/h Under E	Base Condit	ions						8			
(nc/	/h)	V	PHF	Terrain	%Truck	%Rv	funz		f.,	v = V/PH	= x fuy x f		
(20)	,	(Veh/hr)			,01100k	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	· HV		-p		HV		
reeway		3010	0.94	Level	4	0	0.980		1.00		3266		
Ramp		430	0.94	Level	1	0	0.995		1.00		460		
JpStream		1180	0.94	Level	4	0	0.980		1.00		1280		
JownStream	n		Marga Araaa										
etimatio	on of v		Merge Areas			Estimation	ofv	DI	verge Areas				
Suman		2				Estimation of V ₁₂							
		v ₁₂ = v _F	(P _{FM})			$V_{12} = V_R + (V_F - V_R)P_{FD}$							
EQ =		(Equatio	on 13-6 or 13-7	7)		L _{EQ} = (Equation 13-12 or 13-13)							
° _{FM} =		0.594 usi	ing Equation (Exhibit 13-6)		P _{FD} =		usin	g Equation (Exhibit 13-7)			
' ₁₂ =		1941 pc/	h			V ₁₂ =		pc/h					
$'_3$ or V_{av34}		1325 pc/	h (Equation 13	3-14 or 13-17)		V ₃ or V _{av34}		pc/h	(Equation 13-1	4 or 13-17)			
Is V ₃ or V _{av3}	₃₄ > 2,700 p	c/h? 🗌 Yes 🛛	🖌 No			Is V ₃ or V _{av34} >	> 2,700 pc/h	? 🗌 Y	es 🗌 No				
Is V_3 or V_{av3}	₃₄ > 1.5 * V ₁	2/2 Ves	No			Is V_3 or V_{av34} >	• 1.5 * V ₁₂ /2	ΠY	es 🗌 No				
		1941 pc/	h (Equation 13	3-16. 13-18. or			12	pc/h	(Equation 1	3-16, 13-1	8, or 13-		
res,v _{12a} -	-	13-19)		, ,		n res,v _{12a} –		19)	· ·		-		
Capacity	Checks					Capacity C	hecks						
		Actual	0	Capacity	LOS F?		A	ctual	Са	pacity	LOS F?		
						V _F			Exhibit 13-8	3			
VF	0	3726	Exhibit 13-8		No	$V_{FO} = V_F$ -	V _R		Exhibit 13-	3			
	-					Vp	<u> </u>		Exhibit 13-1	10			
low Ent	toring M	orgo Influo	nco Aroa			Elow Entor	ina Dive	rao In	fluonco Ar	202			
		Actual	Max	Desirable	Violation?		Actua		Max Des	irable	Violation?		
Vn	10	2401	Exhibit 13-8	4600-All	No	Via	710100		Exhibit 13-8		Violation		
	Service	Dotormina	tion (if not F		110	Lovel of Sc	I Drvico Dr	tormi	nation (if n	of E)			
	- 5 475			/ 627 I			D = 4.26	2 + 0 0					
D	0.00734 V R + 0	_	D _R = 4.20	2 + 0.0	000 v ₁₂ - 0.0	JU9 LD							
_R = 2	20.2 (pc/mi/li	ו)				D _R = (pc	/mi/ln)						
OS = C	C (Exhibit 13	-2)				LOS = (Exhibit 13-2)							
Speed D	etermina	ation				Speed Det	erminati	on					
1 - ^	204 /	12 11)				$D_{\text{s}} = (F_{\text{ybibit}} 13, 12)$							
"s - 0	.304 (EXIDIT	13-11)				-s (∟∧i Sa= moh		-12)					
S _P = 5	58.0 mph (E	khibit 13-11)				B _R = mpn (Exhibit 13-12)							
κ •						s ₀ = mph (Exhibit 13-12)							
i ₀ = 6	2.0 mph (E	khibit 13-11)				0 ₀ - mpi		,					
₀ = 6 = 5	2.0 mph (E: 9.4 mph (E:	khibit 13-11) khibit 13-13)				S = mph	i (Exhibit 13	-13)					



PM | 11

		DAN				JEET						
General Inform	nation		Site Inf	ormation								
Analyst Agency or Company Date Performed	SJT Hatcl 5/27/	h Mott MacDonal /2015	d J	Freeway/Dir of Trav Junction Jurisdiction	vel l- l-i	71 NB 80						
Project Description	I-71 / SR 82 IMS		r	Andiysis Teal	20	000						
Inputs												
Linstroom Adi E	Pomp	Freeway Numb	eroflanes N	3				Downstream	1 Adi Ramp			
Opsilean Auj I	amp	Pamp Number	of Lanes N	1								
Yes	On	Acceleration La	ane Length, L _A	I				Yes	On			
	O "	Deceleration La	ane Length L _D	550				🗹 No	Off			
		Freeway Volum	ne, V _F	3440				. =	ft			
L _{up} =	ft	Ramp Volume,	V _R	380				⊂down	ii.			
up		Freeway Free-F	Flow Speed, S _{FF}	65.0				V -	voh/h			
V _u =	veh/h	Ramp Free-Flo	w Speed, S _{FR}	50.0				•D -	VEII/II			
Conversion to	pc/h Under E	Base Condit	ions					4				
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x	f _{HV} x f _p			
Freeway	3440	0.94	Level	3	0	0.985	1.00	371	4			
Ramp	380	0.94	Level	7	0	0.966	1.00	41	8			
UpStream	_							 				
DownStream		Marga Araga						<u>i</u>				
Estimation of	Via	werge Areas			Estimation	ofvio	Diverge Areas					
Louination of	<u>12</u>	(D)			Loumation	12						
L _{EQ} = P _{FM} = V ₁₂ = V ₃ or V _{av34} Is V ₃ or V _{av34} > 2,70 Is V ₃ or V _{av34} > 1.5 If Yes,V _{12a} =	(Equation using E pc/h pc/h (Eo 00 pc/h? ☐ Yes * V ₁₂ /2 ☐ Yes pc/h (Eo	quation 13-6 or 13- iquation (Exhit union 13-14 No No quation 13-16	7) bit 13-6) or 13-17) , 13-18, or 13-		$L_{EQ} = P_{FD} = V_{12} = V_{3} \text{ or } V_{av34} = V_{3} \text{ or } V_{$	 12 (E 0.6 25: 11/ 2,700 pc/h? □ > 1.5 * V₁₂/2 □ Do 	Equation 13-12 c 48 using Equati 54 pc/h 60 pc/h (Equation 1 Yes I No 2 Yes I No 5/h (Equation 13	" FD r 13-13) on (Exhibit 13-7 n 13-14 or 1 -16, 13-18, o	7) 3-17) rr 13-19)			
Canacity Cher	19) • k s				Canacity C	hocks			,			
	Actual		Capacity	LOS F?		Actua	L Ca	nacity	LOS F?			
	, lottur	1 1	supuony	20011	Vr	3714	Exhibit 13-8	7050	No			
VEO		Exhibit 13-8			$V_{EO} = V_E -$	Vp 3296	Exhibit 13-8	7050	No			
FU						418	Exhibit 13-1	2100	No			
Elow Entering	<u> </u>	nce Area			Elow Enter	rina Diverae		2.00				
	Actual	Max	Desirable	Violation?		Actual	Max Desirab	le	Violation?			
V _{R12}		Exhibit 13-8			V ₁₂	2554	Exhibit 13-8	4400:All	No			
Level of Servi	ce Determina	tion (if not F	=)		Level of Se	ervice Deter	mination (if n	ot F)				
D _R = 5.475 + D _R = (pc/mi/l LOS = (Exhibit	+ 0.00734 v _R + n) ∶13-2)	0.0078 V ₁₂ - 0	D.00627 L _A		D _R = 21.3 LOS = C (E	D _R = 4.252 + 8 (pc/mi/ln) Exhibit 13-2)	0.0086 V ₁₂ - 0.0	09 L _D				
Speed Determ	ination				Speed Determination							
M _S = (Exibit ´ S _R = mph (Ex	13-11) hibit 13-11)				$D_s = 0.271$ (Exhibit 13-12) $S_R = 58.8$ mph (Exhibit 13-12)							
S ₀ = mph (Ex S = mph (Ex	hibit 13-11) hibit 13-13)				S = 62.0) mph (Exhibit	13-13)					

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Appendix D

Cost Estimate



Estimate CUY-82-3.54

Estimated Cost:\$833,485.10 Contingency: 2.80%

Estimated Total: \$856,822.68

STAGE 3 ESTIMATE

Base Date: 09/17/15

Spec Year: 13

Unit System: E

Work Type: ASPHALT

Highway Type: 448 ON 304

Urban/Rural Type: URBAN CLASS

Season: SUMMER

County: CUYAHOGA

Midpoint of Latitude: 411845

Midpoint of Longitude: 0814835

District: 12

Federal/State Project Number: E150253/527095

Prepared by Dan Reinke Checked by Ed Kagel

Line # Item Number Description Supplemental Description	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	Extension
Group 0100: ROADWAY				
0001 201E11000 CLEARING AND GRUBBING	1.000	LS	\$10,000.00000	\$10,000.00
0002 202E23000 PAVEMENT REMOVED	3,891.000	SY	\$11.80248	\$45,923.45
0003 202E30000 WALK REMOVED	1,957.000	SF	\$1.65955	\$3,247.74
0004 202E30500 CONCRETE MEDIAN REMOVED	220.000	FT	\$10.88808	\$2,395.38
0005 202E30600 CONCRETE MEDIAN REMOVED	20.000	SY	\$29.88857	\$597.77
0006 202E32000 CURB REMOVED	493.000	FT	\$3.67812	\$1,813.31
0007 202E38000 GUARDRAIL REMOVED	170.000	FT	\$2.39120	\$406.50
0008 202E98100 REMOVAL MISC.:	1.000	EACH	\$3,000.00000	\$3,000.00
CATCH BASIN CASTING AND GRAT	E REMOVED A	AND STC	ORED	
0009 204E10000	6,310.000	SY	\$1.66745	\$10,521.61
SUBGRADE COMPACTION				
0010 204E45000	4.000	HOUR	\$195.58211	\$782.33
PROOF ROLLING	0.000.000		\$10,00050	\$40 F00 07
EXCAVATION	3,666.000	СY	\$12.69058	\$46,523.67
0012 203E20000 EMBANKMENT	36.000	CY	\$27.71233	\$997.64
0013 606E15050 GUARDRAIL, TYPE MGS	325.000	FT	\$16.18728	\$5,260.87
0014 606E26000 ANCHOB ASSEMBLY TYPE B	1.000	EACH	\$1,505.66298	\$1,505.66
0015 606E26550	1.000	EACH	\$774.62623	\$774.63
0016 606E60028 IMPACT ATTENUATOR, TYPE 2 (BID , 25MPH, 28"	2.000 IRECTIONAL)	EACH	\$17,132.13740	\$34,264.27
0017 608E10000 4" CONCRETE WALK	1,603.000	SF	\$5.69782	\$9,133.61
0018 608E52000 CURB RAMP	314.000	SF	\$13.54756	\$4,253.93
0019 622E10060 CONCRETE BARRIER, SINGLE SLO	240.000 PE. TYPE B	FT	\$61.27924	\$14,707.02
0020 622E24840 CONCRETE BARRIER END SECTIO	2.000 N, TYPE B	EACH	\$4,471.75630	\$8,943.51

Total for Group 0100:\$205,052.90

EMH&T Inc.

Group 0200: EROSION CONTROL

0021 601E21050 TIED CONCRETE BLOCK MAT, TYPE 1	2.000	SY	\$177.17301	\$354.35
0022 601E21060 TIED CONCRETE BLOCK MAT, TYPE 2	5.000	SY	\$150.00000	\$750.00
0023 659E00100 SOIL ANALYSIS TEST	2.000	EACH	\$64.93874	\$129.88
0024 659E00300 TOPSOIL	635.000	CY	\$21.19174	\$13,456.75
0025 659E10000 SEEDING AND MULCHING	5,104.000	SY	\$0.96420	\$4,921.28
0026 659E14000	255.000	SY	\$0.70310	\$179.29
8:35:30AM				
Friday, September 18, 2015				Page 2 of 5

stimate:	CUY-82-3.54				EMH&T Inc.
<u>Line #</u> Dese <u>Sup</u>	<u>Item Number</u> cription plemental Description	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	Extension
REP	AIR SEEDING AND MULCHING				
0027 Inte	659E15000 ER-SEEDING	255.000	SY	\$0.29026	\$74.02
0028 CON	659E20000 IMERCIAL FERTILIZER	1.150	TON	\$937.00000	\$1,077.55
0029 LIME	659E31000	1.050	ACRE	\$122.00000	\$128.10
0030 WAT	659E35000 ER	29.000	MGAL	\$1.08640	\$31.51
0031 MOV	659E40000 VING	11.000	MSF	\$1.84347	\$20.28
0032 DIT(670E00700 CH EROSION PROTECTION	952.000	SY	\$1.82739	\$1,739.68
0033 STO	832E15000 RM WATER POLLUTION PREVEN	1.000 ITION PLAN	LS	\$2,500.00000	\$2,500.00
0034 ERC	832E30000 SION CONTROL	20,394.000	EACH	\$1.00000	\$20,394.00

Total for Group 0200:\$45,756.69

Group 0300: DRAINAGE

0035 605E11110 6" SHALLOW PIPE UNDERDRAINS WIT	1,293.000 FT H FABRIC WRAP	\$11.09101	\$14,340.68
0036 605E13410 6" UNCLASSIFIED PIPE UNDERDRAINS	35.000 FT WITH FABRIC WF	\$20.00000 RAP	\$700.00
0037 605E14020 6" BASE PIPE UNDERDRAINS WITH FA	1,345.000 FT BRIC WRAP	\$13.48606	\$18,138.75
0038 611E00510 6" CONDUIT, TYPE F FOR UNDERDRAI	84.000 FT N OUTLETS	\$16.66513	\$1,399.87
0039 611E99710 PRECAST REINFORCED CONCRETE C	2.000 EACH UTLET	\$220.21585	\$440.43
0040 611E98651 CATCH BASIN FRAME AND GRATE, AS	1.000 EACH PER PLAN	\$600.00000	\$600.00

Total for Group 0300:\$35,619.73

Group 0400: PAVEMENT

0041 302E46000	1,542.000	CY	\$130.77235	\$201,650.96
ASPHALT CONCRETE BASE, PG64-22				
0042 304E20000	1,052.000	CY	\$49.67938	\$52,262.71
AGGREGATE BASE				
0043 407E14000	239.000	GAL	\$3.43646	\$821.31
TACK COAT FOR INTERMEDIATE COU	RSE			
0044 441E50101	249.000	CY	\$190.00000	\$47,310.00
ASPHALT CONCRETE SURFACE COUF	RSE, TYPE ⁻	1, (448), /	AS PER PLAN	
, (PG64-22)				
0045 441E50300	291.000	CY	\$168.35237	\$48,990.54
ASPHALT CONCRETE INTERMEDIATE	COURSE, T	YPE 2, (448)	
0046 609E12000	153.000	FT	\$28.47955	\$4,357.37
COMBINATION CURB AND GUTTER, T	YPE 2			
0047 609E16000	217.000	FT	\$14.30588	\$3,104.38
CURB, TYPE 2-B				
0048 609E72000	7.000	SY	\$135.36414	\$947.55
CONCRETE MEDIAN				

Total for Group 0400:\$359,444.82

Group 0700: LIGHTING

stimate:	CUY-82-3.54				EMH&T Inc.
<u>Line #</u> Des <u>Sup</u>	I <u>tem Number</u> cription plemental Description	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	Extension
0049 CON	625E00480 INECTION, UNFUSED PERMANEN	3.000 Г	EACH	\$89.07792	\$267.23
0050 NO.	625E23200 4 AWG 5000 VOLT DISTRIBUTION	2,037.000 CABLE	FT	\$2.64357	\$5,384.95
0051 CON	625E25500 NDUIT, 3", 725.04	639.000	FT	\$15.94876	\$10,191.26
0052 TRE	625E29000 NCH	639.000	FT	\$6.05661	\$3,870.17
0053 PUL	625E30700 L BOX, 725.08, 18"	4.000	EACH	\$630.73427	\$2,522.94
0054 PUL	625E31510 L BOX REMOVED	6.000	EACH	\$122.52870	\$735.17
0055 PLA	625E36000 STIC CAUTION TAPE	639.000	FT	\$0.32924	\$210.38
0056 LIGI	625E75500 HT POLE FOUNDATION REMOVED	1.000	EACH	\$323.99742	\$324.00
0057 DIS ⁻	625E75550 TRIBUTION CABLE REMOVED	1,047.000	FT	\$0.41313	\$432.55
0058 DIS(625E75800 CONNECT CIRCUIT	3.000	EACH	\$147.17833	\$441.53

Total for Group 0700:\$24,380.18

Group 1100: TRAFFIC CONTROL

0059 620E00500 DELINEATOR. POST MOUNTED	42.000	EACH	\$39.55324	\$1,661.24
0060 620E31200 REMOVAL OF DELINEATOR	45.000	EACH	\$2.43463	\$109.56
0061 621E00100 RPM , (WHITE/RED), (YELLOW/RED)	31.000	EACH	\$65.22324	\$2,021.92
0062 630E03100 GROUND MOUNTED SUPPORT, NO. 3	99.000 POST	FT	\$7.88772	\$780.88
0063 630E80100 SIGN, FLAT SHEET	49.000	SF	\$15.88906	\$778.56
0064 630E80400 SIGN, PERMANENT OVERLAY	29.000	SF	\$20.73823	\$601.41
0065 630E84900 REMOVAL OF GROUND MOUNTED SIG	3.000 N AND DIS	EACH POSAL	\$15.67638	\$47.03
0066 630E86002 REMOVAL OF GROUND MOUNTED POS	3.000 ST SUPPOI	EACH	\$19.11292 DISPOSAL	\$57.34
0067 646E10010 EDGE LINE, 6"	0.540	MILE	\$8,763.73031	\$4,732.41
0068 646E10110 LANE LINE, 6"	0.300	MILE	\$15,000.00000	\$4,500.00
0069 646E10300 CHANNELIZING LINE, 8"	1,441.000	FT	\$1.45592	\$2,097.98
0070 646E10500 CROSSWALK LINE	72.000	FT	\$5.45239	\$392.57
0071 646E10600 TRANSVERSE/DIAGONAL LINE , (WHITE)	59.000	FT	\$6.11262	\$360.64
0072 646E20300 LANE ARROW	10.000	EACH	\$140.00154	\$1,400.02
0073 646E20350 LANE REDUCTION ARROW	2.000	EACH	\$260.00000	\$520.00
0074 646E20504 DOTTED LINE, 6"	400.000	FT	\$8.00000	\$3,200.00
0075 646E50000	3.000	EACH	\$200.00000	\$600.00
8:35:30AM				

Friday, September 18, 2015

Estimate: CUY-82-3.54				EMH&T Inc.
Line # Item Number Description Supplemental Description	<u>Quantity</u>	<u>Units</u>	Unit Price	Extension
REMOVAL OF PAVEMENT MARKING				
0076 630E97700 SIGNING, MISC.:	2.000	EACH	\$6,000.00000	\$12,000.00
SOLAR POWERED RECTANGULAR F	RAPID FLASH	ING BEA	CON (RRFB) SIGN ASSEN Total for (^{IBLY} Group 1100:\$35,861.56
Group 2100: MAINTENANCE C	F TRAFF	С		
0077 614E11110 LAW ENFORCEMENT OFFICER WITH	50.000 H PATROL CA	HOUR R FOR A	\$61.36704 SSISTANCE	\$3,068.35
0078 614E12336 WORK ZONE IMPACT ATTENUATOR	4.000 (UNIDIRECTI	EACH	\$2,187.11571	\$8,748.46
0079 614E13300 BABRIER REFLECTOR, TYPE B	74.000	EACH	\$6.16128	\$455.93
0080 614E13350 OBJECT MARKER, ONE WAY	74.000	EACH	\$11.62547	\$860.28
0081 614E22100 WORK ZONE EDGE LINE, CLASS I. 6	1.830 42 PAINT	MILE	\$1,336.02782	\$2,444.93
0082 614E23200 WORK ZONE CHANNELIZING LINE, 0	780.000 CLASS I, 642 I	FT PAINT	\$0.61211	\$477.45
0083 614E25200 WORK ZONE TRANSVERSE/DIAGON	66.000 IAL LINE, CLA	FT SS I, 642	\$2.50000 2 PAINT	\$165.00
0084 615E10000 ROADS FOR MAINTAINING TRAFFIC	1.000	LS	\$2,200.00000	\$2,200.00
0085 615E20000 PAVEMENT FOR MAINTAINING TRAF	344.000 FIC, CLASS A	SY	\$59.61958	\$20,509.14
0086 622E41000 PORTABLE BARRIER, 32"	3,670.000	FT	\$12.33814	\$45,280.97
0087 622E41050 PORTABLE BARRIER, "Y" CONNECTO	1.000 DR	EACH	\$1,670.82777	\$1,670.83
			Total for (Group 2100:\$85,881.34

Group 2300: INCIDENTALS

0088 FIEL	619E16010 .D OFFICE, TYPE B	6.000	MNTH	\$1,197.97980	\$7,187.88
0089	623E10000		LS	\$5,300.00000	\$5,300.00
	STRUCTION LATOUT STAKES AND ST			* ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	#00.000.00
0090	624E10000	1.000	LS	\$20,000.00000	\$20,000.00
MOE	BILIZATION				
0091	614E11001	1.000	LS	\$9,000.00000	\$9,000.00
MAII	NTAINING TRAFFIC, AS PER PLAN				

Total for Group 2300:\$41,487.88