Preliminary Access Modification Report

Summit 18 Corridor

PID 77749

June 2010

BURGESS & NIPLE

Contents

INTRODUCTION

The "Planning Study including Strategic Plan" document for the Summit 18 Corridor identified preferred alternatives to improve traffic operations in the study area. Implementation of the preferred alternative, referred as the "Ultimate Build" concept from here on, will require major funding, the source for which has not yet been identified. As acknowledged in the Purpose and Need document, the primary bottleneck in the Study Corridor is the intersection of SR 18 and Crystal Lake Dr. This intersection fails in the current conditions and without improvements will be overwhelmed by additional traffic in the future. Traffic spillbacks from this intersection are the major contributing factor to the existing operational deficiencies in the Study Corridor. Therefore, fixing this intersection in the near term is critical to improving the overall traffic operations of the study corridor. The other problem areas in the corridor although important are not as critical in the near term. An Interim configuration, which assumes only the enhancements to the study corridor that are specifically targeted at improving the operations at this intersection, is therefore proposed until funding for the Ultimate Build concept becomes available. The intention is to use funding available from the "Highway Safety Program" to build the Interim improvements, addressing the immediate safety concerns. The Interim configuration also fits into the Ultimate Build configuration proposed for the study corridor.

1. INTERIM IMPROVEMENTS

The SR 18 & Montrose West Avenue/Crystal Lake Road Safety Study (see Appendix) identified two distinct crash patterns for the intersection of SR 18 & Montrose West Avenue/Crystal Lake Road.

The first observed pattern was the frequency of rear-end crashes. This is the most significant pattern of crashes at this intersection (39 of 79). Between 2002 and 2004, 8 of these crashes resulted in injury. The problem is especially distinct on the east and west approaches. Based upon the capacity analysis and field observations, congestion is the most significant factor contributing to the number of rear-end crashes at this location.

The second pattern identified was a high number of left-turn crashes. Based on field observations, one to two through vehicles frequently continue through the intersection after the onset of the red, often accelerating in the process. This situation creates a crash hazard with opposing left turning vehicles, which are waiting in the intersection for a gap in traffic. Also, with the volume of opposing through vehicles on each approach, there are very few acceptable gaps during the permissive phase during peak hours of traffic. These two situations indicate that the major contributing factor leading to left-turn crashes is congestion.

To address the identified crash patterns at the intersection, the following proposed Interim improvements were developed to relieve the bottleneck at the intersection of SR 18 and Crystal Lake Drive.

- Relocation of Montrose West Avenue to tie into Heritage Woods Drive.
- New Roundabout at the intersection of Heritage Woods Drive and Montrose West Avenue.
- Revised geometry for the intersection of SR 18 and Heritage Woods Drive to accommodate additional traffic due to Montrose West Avenue relocation. Included in the revised geometry are dual westbound left turn lanes on SR 18. The second left turn lane will be developed at the intersection with the SB I-77 exit ramp.
- Add one additional EB lane on SR 18 from just east of Scenic View Drive to the Ramp to I-77 SB, creating a two-lane entrance ramp to SB I-77. This eliminates the excessive lane changing that occurs east of the Crystal Lake Road intersection and allows the ramp traffic to travel through the Heritage Woods Drive and Crystal Lake Road intersections in two-lanes instead of queuing in the curb lane as it does today. The two-lane ramp tapers back to one lane prior to merging with I-77 SB.

These improvements, shown in Figures 1A and 1B, address the identified crash patterns in the following ways:

- Adding dual left turn lanes on the WB approach to the intersection of SR 18 and Montrose Avenue/Heritage Woods increases the capacity of the intersection and reduces the amount of left turn collisions at the intersection. This would most likely reduce the rate of rear-end, sideswipe, and angle crashes also.
- Due to the high number of left turns out of Crystal Lake Road and onto Montrose West Avenue conflicting with a high volume of East-West thru traffic it becomes beneficial to eliminate Montrose West Avenue and relocate it to Heritage Woods Drive. This relocation makes it possible to eliminate conflict points at the intersection and reduce the number of phases. This improvement makes it possible to reduce congestion and conflict points, reducing the number of left-turn crashes and congestion related crashes.
- S.R. 18 carries a high volume of East-West thru traffic thru the intersection of Crystal Lake Road/West Montrose Avenue. Additional thru lane capacity at the intersection reduces the congestion and will reduce the number of rear-end and congestion related crashes. In addition, a two-lane entrance ramp for I-77 SB reduces the congestion for the EB to SB movement.

2. OPERATIONAL ANALYSES

Traffic operational analysis was performed for the No-build and Interim conditions at the following intersections on the Summit-18 Corridor:

- SR 18 and South Hametown Road (Signalized)
- SR 18 and Scenic View Drive (Unsignalized)
- SR 18 and Heritage Woods Drive (Signalized)
- SR 18 and Crystal Lake Road (Signalized)
- SR 18 and Springside Drive (Signalized)

The freeway operational analysis on I-77 was performed for the section between its interchanges with Ghent Road and SR 21. Freeway operational analysis was performed for mainline, ramp merge, diverge and weaving areas. Because there are no freeway improvements proposed for the Interim condition, there is no difference between the No-Build and Interim freeway operations. Therefore, no separate analysis for the Interim configuration of the freeway system was performed. The existing freeway lane configuration is shown in Figure 6.

Results from HCS Analyses for the No-Build and Interim year conditions are tabulated in Table 1 and are detailed on Figures 2 and 3 for the No-Build condition and Figures 4 and 5 for the Interim condition. Detailed HCS reports for individual intersection and freeway segments are available in the Appendix. It can be inferred from the table that the individual intersection Levels of Service (LOS) for the Interim condition is better or similar to the No-Build condition. Specifically, LOS for the primary bottleneck in the corridor, the intersection of SR 18 and Crystal Lake Road, improves to C from F in the 2030 AM Peak Hour and to a D from F in the 2030 PM Peak Hour; LOS for the intersection of SR 18 and Heritage Woods Drive improves to a C from D in the 2030 PM Peak Hour. Operations at the other two intersections listed in the table, SR 18 and South Hametown Road, SR 18 and Scenic View Drive, and SR 18 and Springside Drive are similar between the No-Build and the Interim conditions. Specific insights into the above mentioned LOS deficiencies are given below.

- In the Interim condition, the intersection of SR 18 and South Hametown Road is expected to operate at LOS E without any improvements. As identified in the “Strategic Plan” document, operations at this intersection can be improved by widening SR 18 to accommodate a second westbound left turn lane and a third eastbound lane leaving the intersection. The third lane would allow the northbound right turn from South Hametown Road to SR 18 to operate as a free movement by providing a dedicated receiving lane for the turning traffic. This free movement would not require signalization.
- The intersection of SR 18 and Springside Drive is expected to operate at LOS F in the PM Peak Hour without any improvements. As identified in the “Strategic Plan” document, operations at this intersection can be improved with additional turn lanes on Springside Drive to accommodate higher turning volumes.

Table 1: Summary of HCS Analyses for No-Build and Interim Conditions

Summit 18 Corridor HCS Analyses Summary									
		2030 AM				2030 PM			
		No-Build		Interim		No-Build		Interim	
Intersection	Type	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
South Hametown Road	Signalized	79.5	E	79.5	E	40.7	D	40.7	D
Heritage Woods Road	Signalized	44.2	D	43.3	D	38.5	D	40.0	C
Crystal Lake Drive	Signalized	95.1	F	30.0	C	211.0	F	48.0	D
Springside Drive	Signalized	24.3	C	24.3	C	92.1	F	92.1	F
Scenic View Drive	Unsignalized	1367.0	F	1367.0	F	17.0	C	17.0	C
		2030 AM				2030 PM			
		No-Build		Interim		No-Build		Interim	
Freeway	Type	Density (pc/mi/lane)	LOS	Density (pc/mi/lane)	LOS	Density (pc/mi/lane)	LOS	Density (pc/mi/lane)	LOS
I-77 SB North of Ramp to SR 18 WB	Mainline	14.3	B	14.3	B	**26.0**	D	**26.0**	D
I-77 SB South of Ramp to SR 18 WB	Mainline	13.2	B	13.2	B	**23.3**	C	**23.3**	C
I-77 SB South of Ramp to SR 18 EB	Mainline	13.2	B	13.2	B	**25.6**	C	**25.6**	C
I-77 NB North of Ramp to SR 18 EB	Mainline	28.2	D	28.2	D	**17.6**	B	**17.6**	B
I-77 NB North of Ramp to SR 18 WB	Mainline	23.3	C	23.3	C	**11.6**	B	**11.6**	B
I-77 NB North of Ramp from SR 18 WB	Mainline	24.5	C	24.5	C	**13.3**	B	**13.3**	B
Ramp from I-77 SB to SR 18 WB	Diverge	16.9	B	16.9	B	**27.9**	C	**27.9**	C
Ramp from SR 18 WB to I-77 NB	Merge	26.3	C	26.3	C	**16.0**	B	**16.0**	B
I-77 SB and SR 18 Loops	Weaving	12.88	B	12.88	B	**27.92**	C	**27.92**	C
I-77 SB, SR 18 and SR 21	Weaving	22.88	C	22.88	C	**36.14**	E	**36.14**	E
I-77 NB, SR 21 and SR 18	Weaving	34.91	D	34.91	D	**18.51**	B	**18.51**	B
I-77 NB and SR 18 Loops	Weaving	37.17	E	37.17	E	**25.35**	C	**25.35**	C
SR 18 WB and I-77 Loops	Weaving	23.75	C	23.75	C	**46.85**	F	**46.85**	F
SR 18 EB and I-77 Loops	Weaving	15.47	B	15.47	B	**15.72**	B	**15.72**	B

- The intersection of SR 18 and Scenic View Drive is unsignalized in the current conditions. Signalization is not warranted at this intersection. Motorists currently have access to SR 18 westbound via the signalized intersection of S. Hametown Road.

All these changes will be incorporated into the Ultimate Build condition.

Operations for the freeway segments, also tabulated in Table 1 and shown in Figures 2-5, indicate that except for three weaving facilities in the study corridor, all the freeway segments perform at an acceptable level of service. The Ultimate Build configuration of the interchange will eliminate these weaving areas by incorporating a Southbound C-D system, "Early SR 18 Split" concept and the "Modified Cloverleaf" concept for the main interchange area as described later in this report.

Constrained Traffic Analyses

The intersection of SR 18 and Crystal Lake Road operates at LOS F in both the AM and PM peak for the No-Build condition. Since this intersection is immediately adjacent to the southbound I-77 ramps, it must be investigated for constrained analysis to determine if the Interim improvements are allowing more traffic to enter southbound I-77, which may cause a degradation to the operation on I-77. During the AM and PM peaks, the eastbound through movements have v/c ratios greater than 1.0 in the No-Build condition. In the Interim condition, the eastbound through movement operation has improved and the v/c ratios are less than 1.0. This means that the No-Build traffic is constrained and that the Interim improvements will allow more traffic to reach southbound I-77. The EB SR 18 to SB I-77 entrance ramp is an add lane to SB I-77 that creates a weaving section between SR 18 and SR 21. Examining the LOS results for the No-Build and Interim conditions, the weaving section operates at LOS C during the AM peak and LOS E during the PM peak. Because the mainline weaving section does not operate at LOS F during the No-Build condition, there is no degradation to the freeway caused by the constrained traffic being allowed to enter the freeway.

Turn Lane Storage Lengths

Turn lane storage lengths were calculated for all project intersections based on the procedure described in the ODOT Location and Design Manual, Section 401-7 to 401-12. These calculations are summarized in Table 2 and illustrated in Figures 1A and 1B. Most turn lanes in the project area satisfy the minimum required storage length. Due to the high through-lane volumes along SR 18, it was not possible for through-vehicle backups to avoid blocking access to certain turn lanes. The turn lane storage provided at each signalized intersection is described below.

Table 2: 2030 Storage Lane Length Calculations

Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Req'd Storage Length Type B	Req'd Storage Length Type C	Req'd Storage Leght (per lane)	Thru Vehicles per Cycle per Lane	Thru Lane Back of Queue	Turn Lane Decel and Storage Req'd	Turn Lane Decel and Storage Provided
State Route 18 & Scenic View Drive	WB	Left	1	2	50	2320	60	0.8	225	193	225	19.3	650	**650**	350
State Route 18 & Heritage Woods Road & Akron General	EB	Left	1	3	30	2270	120	1.0	225	193	225	25.2	825	**825**	600
	WB	Left	2	2	730	2220	120	24.3	225	968	484	37.0	1250	**1250**	1250
SR 18 & Crystal Lake Road	EB	Left	1	3	510	2290	120	17.0	225	743	743	25.4	825	**825**	350
	WB	Right	1	3	550	2610	120	18.3	225	793	793	29.0	975	**975**	450

SR 18 and Scenic View Drive – The westbound left turn lane at the SR 18 & Scenic View intersection provides adequate storage for the anticipated 2030 left turning vehicle demand. However, the length does not meet the calculated queue length for the WB thru-lanes. Because this approach is the free flowing movement of a two-way stop controlled intersection, the WB thru vehicles will not be required to stop and queuing will not be an issue.

SR 18 and Heritage Woods – The required storage length for the EB left turning traffic is 225 feet. To avoid being blocked by the EB thru vehicle queue, the required left turn lane length is 825 feet. While it is possible to provide this length, Section 401.6 of the L&D Manual, Vol. 1 states that a maximum storage length of 600' is recommended. Therefore, 600' has been provided for this movement.

The westbound left turn movement provides adequate storage for the anticipated 2030 left turning vehicle demand. In addition, there is sufficient length to avoid being blocked by the thru vehicle queue.

SR 18 and Crystal Lake Road – The EB left turn lane has a calculated storage length of 743 feet. However, this lane is back-to-back with the WB left turn lane at SR 18 and Heritage Woods. Because of this, only 350 feet can be provided for the EB left turn at Crystal Lake. As a double check to the calculated storage length, *SimTraffic* was used to check the 95th percentile queue length under the proposed signal operation. Output files for the analysis are in the Appendix. *SimTraffic* shows that in 2030, the 95th percentile queue for the EB left turn will be 314 feet. Based on this, the 350 feet of **storage length provided will be sufficient.**

The storage length available for the westbound right turn at the intersection of SR 18 and Crystal Lake is 450 feet. 793 feet are required to meet the requirements for turn lane storage. At this location, the proximity of the SB I-77 to WB SR 18 ramp intersection prevents the storage length from being any longer. *SimTraffic* was used to check the required storage under the proposed signal operation. Output files for the analysis are in the Appendix. *SimTraffic* shows that in 2030, the 95th percentile queue for the WB right turn will be 203 feet. Based on this, the 450 feet of **storage length provided will be sufficient.**

3. ULTIMATE BUILD IMPROVEMENTS

The "Planning Study including Strategic Plan" document for the Summit 18 Corridor identified preferred alternatives to improve traffic operations in the interchange area. Implementation of the preferred alternative, referred as the "Ultimate Build" concept, will require major funding, the source for which has not yet been identified. The Ultimate Build concept is described below.

PREFERRED MAINLINE CONCEPTS

Early SR 18 Split – The early SR 18 split is the preferred northbound I-77 mainline concept because it effectively removes the existing weave movement between northbound SR 21 to northbound I-77 traffic and northbound I-77 traffic exiting at SR 18. This concept offers a unique opportunity to eliminate a mainline weave without braiding any ramps. A no-build concept for the northbound mainline would degrade the operation of I-77 between SR 21 and SR 18 over time as a result of the influx of traffic on SR 21 generated by the rapidly developing region to the south.

The purpose of this improvement is to eliminate the northbound weave between the SR-21 entrance and SR-18 exit ramps. Although safety was not identified as an issue in this area, the elimination of the existing weave will result in a 100% reduction in crashes resulting from that conflict point.

Southbound C-D System - The construction of a southbound C-D system between SR 18 and SR 21 is the preferred mainline concept to eliminate the existing southbound weave condition. The southbound C-D system is preferred to a no-build concept because the elimination of the southbound mainline weave is necessitated by operational deficiencies of the weave (2030 PM Peak Hour LOS E). In addition to its compatibility with the Modified Cloverleaf interchange concept, the construction of the southbound C-D system is preferred to other alternatives because it more economical and has less substantial right-of-way impacts.

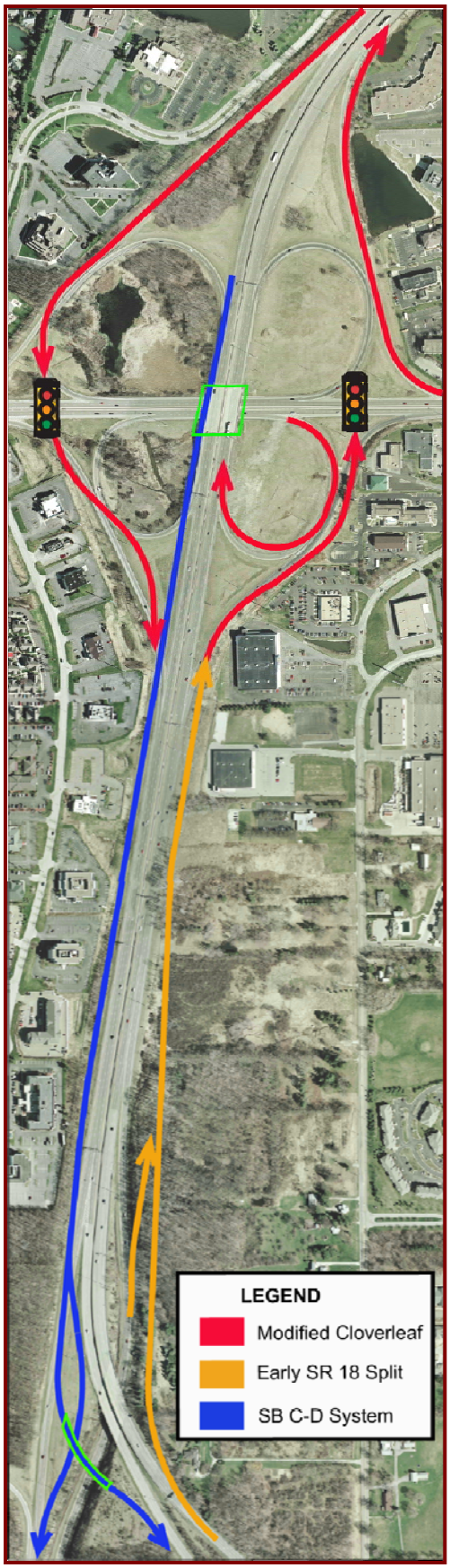
The purpose of this improvement is to eliminate the southbound weave between the SR 18 entrance and SR 21 exit ramps. Although safety was not identified as an issue for this area, the Southbound C-D System will reduce the number of vehicles performing conflicting movements as only SR-18 traffic entering SR-21 will have to switch lanes within the ramp system.

PREFERRED INTERCHANGE CONCEPT

Modified Cloverleaf

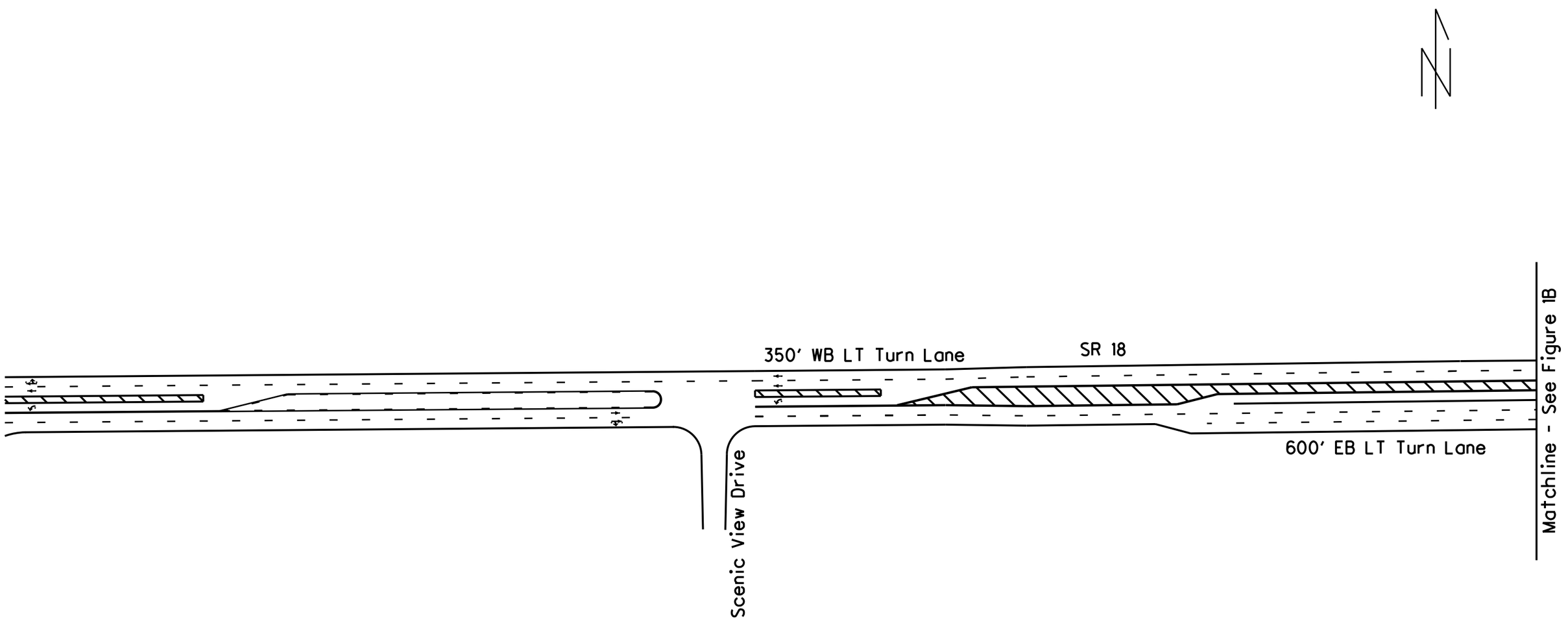
The Modified Cloverleaf is the preferred interchange concept at I-77 and SR 18 because it is advantageous compared to the no-build and other intersection reconfiguration concepts. The Modified Cloverleaf removes the existing weave conditions on SR 18 and eliminates undesirable loop exit ramps on the mainline, both undesirable aspects of the existing full cloverleaf interchange that would be preserved by a no-build concept. The Modified Cloverleaf operates more efficiently than either a Tight Diamond or Offset SPUI, in addition to more being more cost effective because it maximizes the reuse of existing ramp alignments and does not require any additional structures.

The purpose of this improvement is to address congestion and safety issues within the existing interchange along with upgrading its geometric deficiencies. Congestion issues associated with existing cloverleaf configuration (2030 PM Peak Hour LOS F along SR 18 between westbound loop ramps) will be addressed when the weave movements are eliminated through the removal of the exit loop ramps. Safety issues within the interchange (eastbound to southbound entrance ramp, northbound to westbound exit ramp, and SR 18 through the interchange) will be mitigated by the removal of exit loop ramps and signalization of the exit ramps at SR-18. Geometrically deficient shoulder widths on the existing ramps will be upgraded to current design standards as part of the Modified Cloverleaf reconfiguration.



5. CONCLUSIONS AND RECOMMENDATIONS

As shown in this study, an Interim solution of relocating Montrose West Avenue will address the major safety and congestion issues on the SR 18 corridor and at the Montrose West/Crystal Lake intersection specifically. The revised geometry at the intersections is capable of accommodating projected future traffic volumes at acceptable levels of service in the near term. The Interim condition will be a cost effective method to handle immediate safety concerns in the study corridor until further funding to construct the Ultimate Build configuration becomes available.



COLUMBUS, OHIO JUNE 2010

FIGURE 1A
INTERIM CONDITION
SR 18 LANE CONFIGURATION

SUMMIT 18 CORRIDOR STUSY

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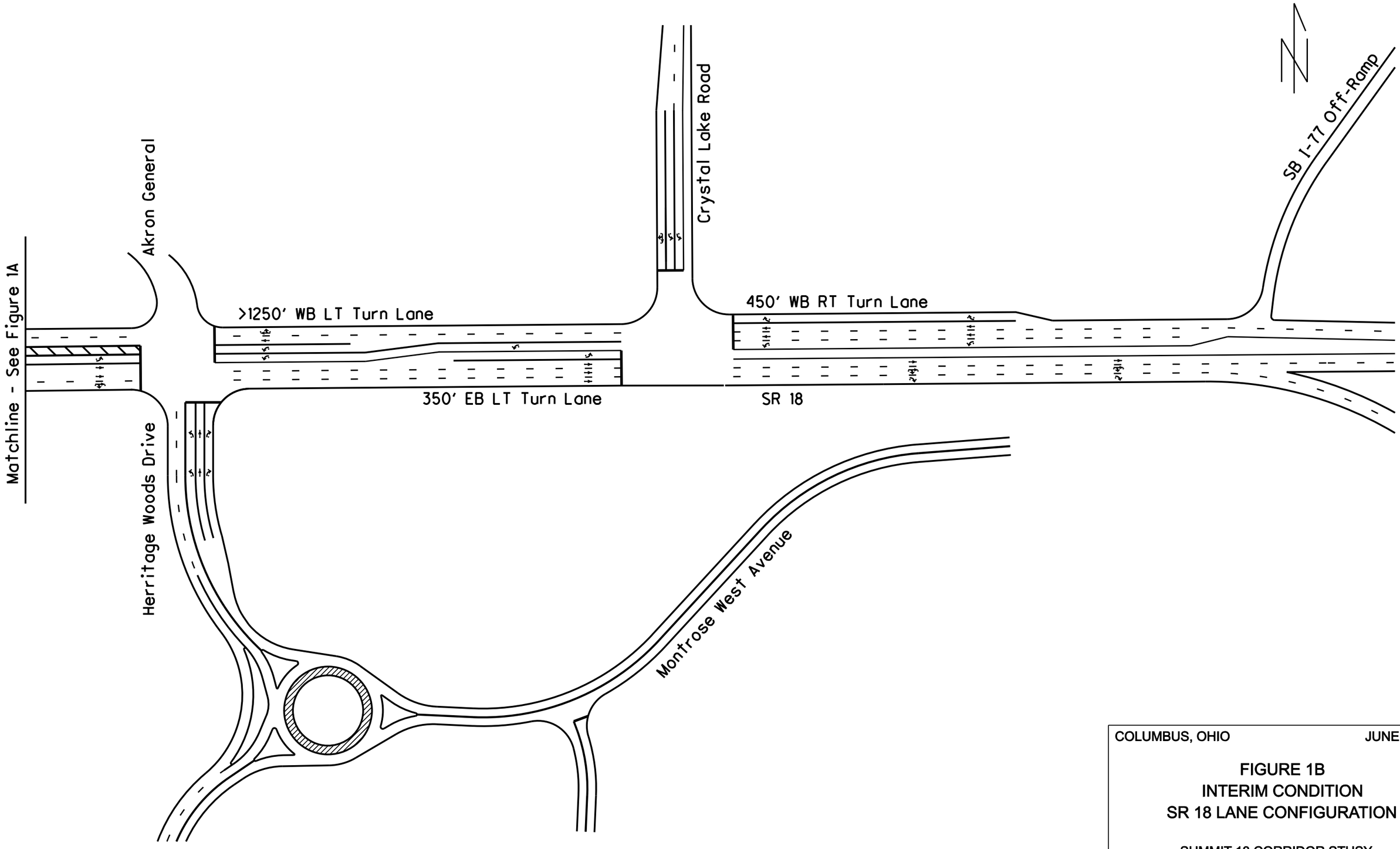
NOT TO SCALE



NOT TO SCALE

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FIGURE 1B
INTERIM CONDITION
SR 18 LANE CONFIGURATION

SUMMIT 18 CORRIDOR STUSY

BURGESS & NIPLE

State Route 18 2030 No Build
AM Peak LOS

Summit 18 Corridor Study

Level of Service	Signalized Level of Service	Unsignalized Level of Service
A, B & C	AM (Overall from HCS)	AM (Side Street LOS From HCS)
D		
E	xx.x [x.xx] X	
F	Movement Delay / Movement V/C Ratio / Movement LOS / Lane Group	

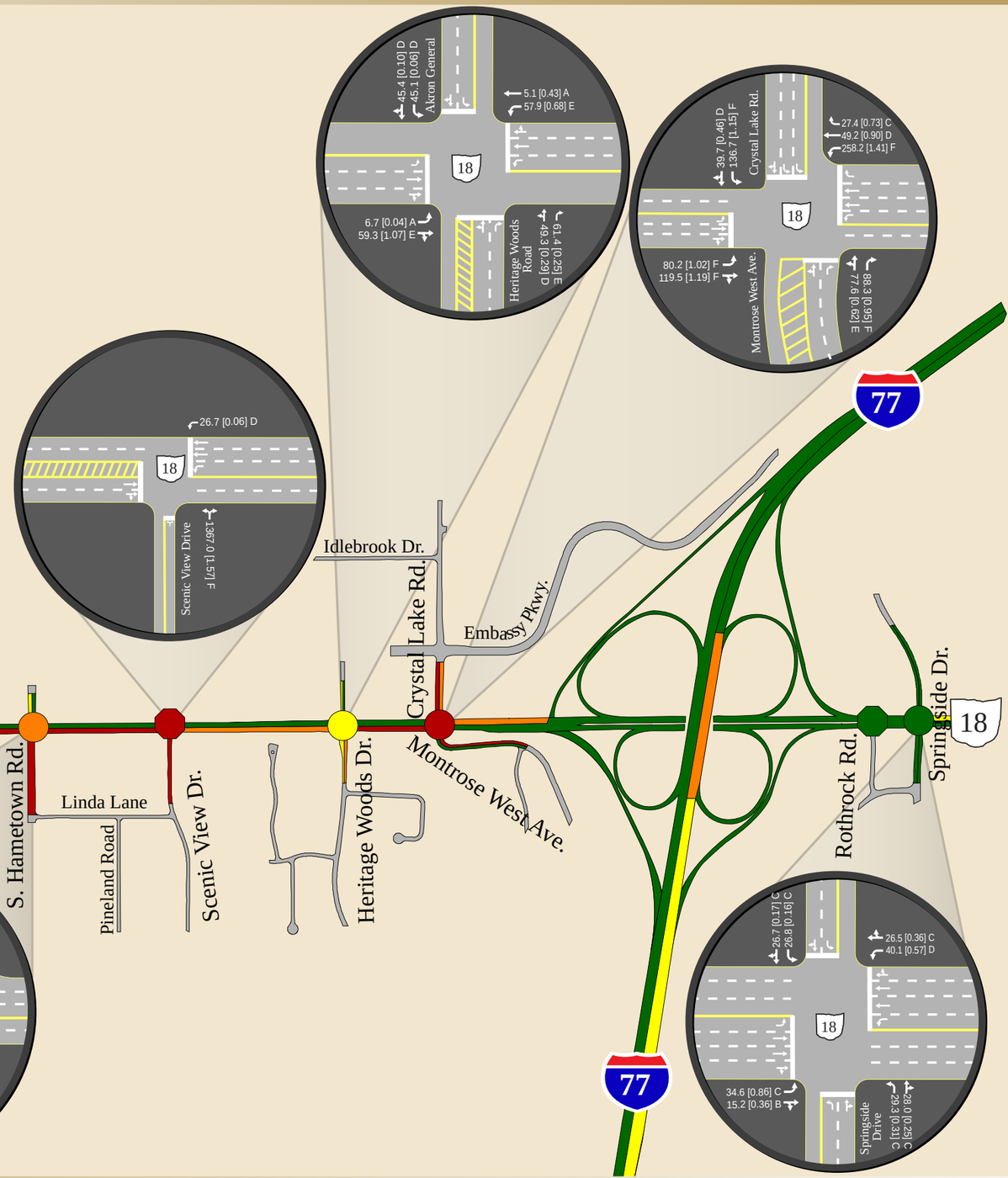

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Figure 2

Summit 18 Corridor Study

State Route 18 2030 No Build
PM Peak LOS

Level of Service	Signalized Level of Service	Unsignalized Level of Service
A, B & C	AM (Overall from HCS)	AM (Side Street LOS From HCS)
D		
E	xx.x [x.xx] X	
F	Movement Delay / Movement V/C Ratio / Movement LOS / Lane Group	

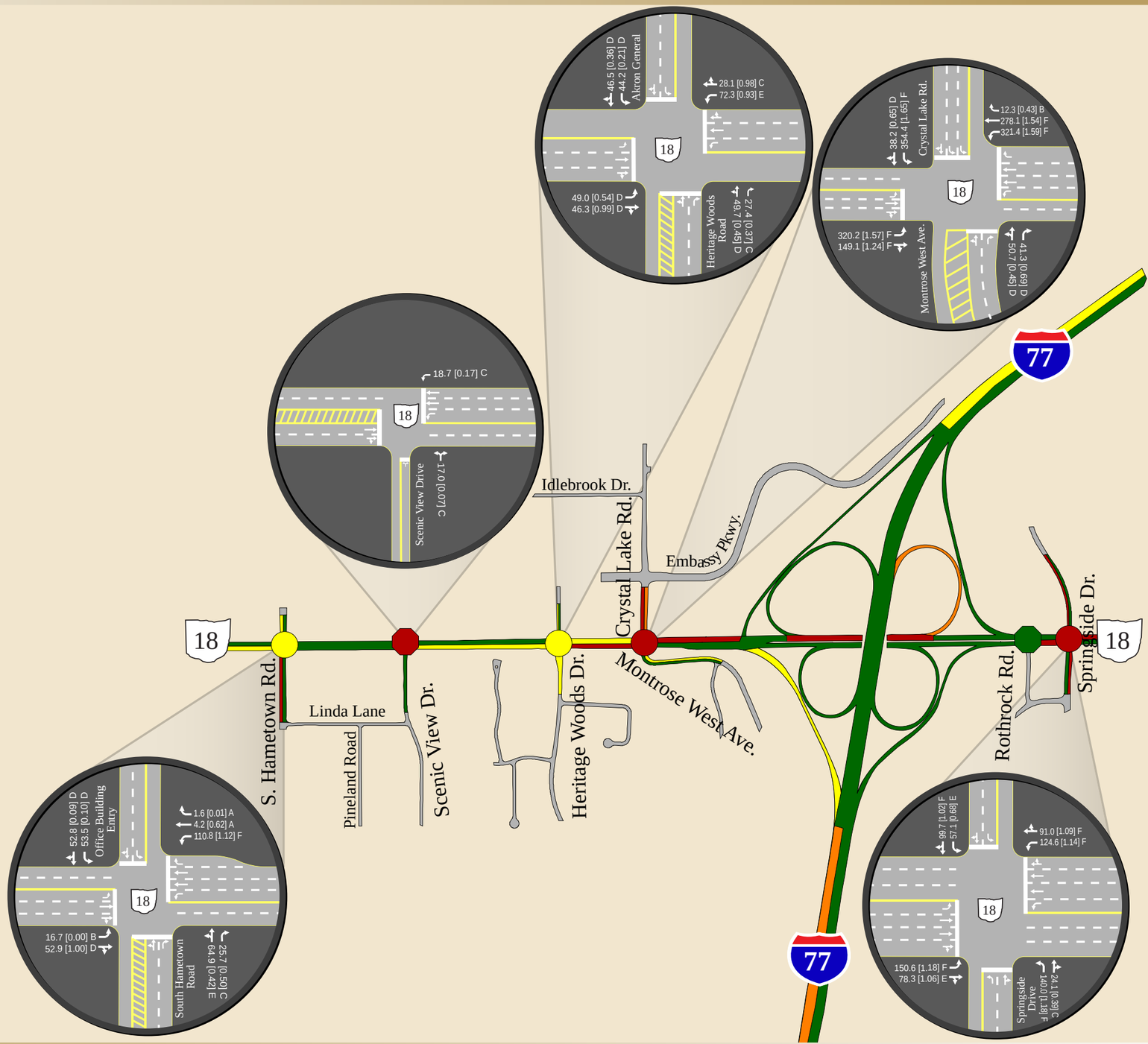

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Figure 3

Summit 18 Corridor Study

State Route 18 2030 West Montrose Relocation
AM Peak LOS

Level of Service	Signalized Level of Service	Unsignalized Level of Service
A, B & C	AM (Overall from HCS)	AM (Side Street LOS From HCS)
D		
E	xx.x [x.xx] X — Movement Delay / Movement V/C Ratio / Movement LOS / Lane Group	
F		

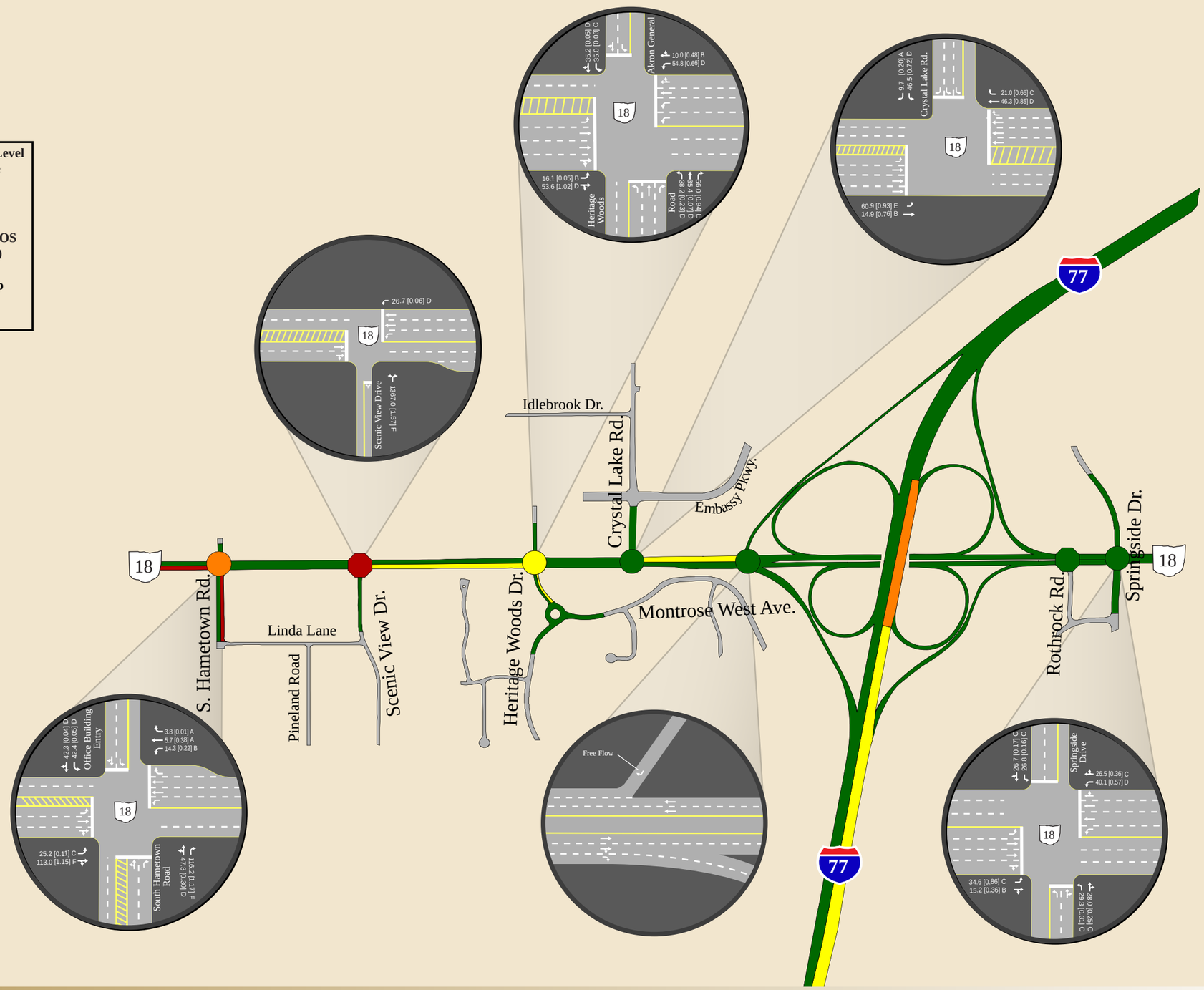

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Figure 4

State Route 18 2030 West Montrose Relocation
PM Peak LOS

Summit 18 Corridor Study

Level of Service	Signalized Level of Service	Unsignalized Level of Service
A, B & C	AM (Overall from HCS)	AM (Side Street LOS From HCS)
D		
E	xx.x [x.xx] X	
F	Movement Delay / Movement V/C Ratio / Movement LOS / Lane Group	

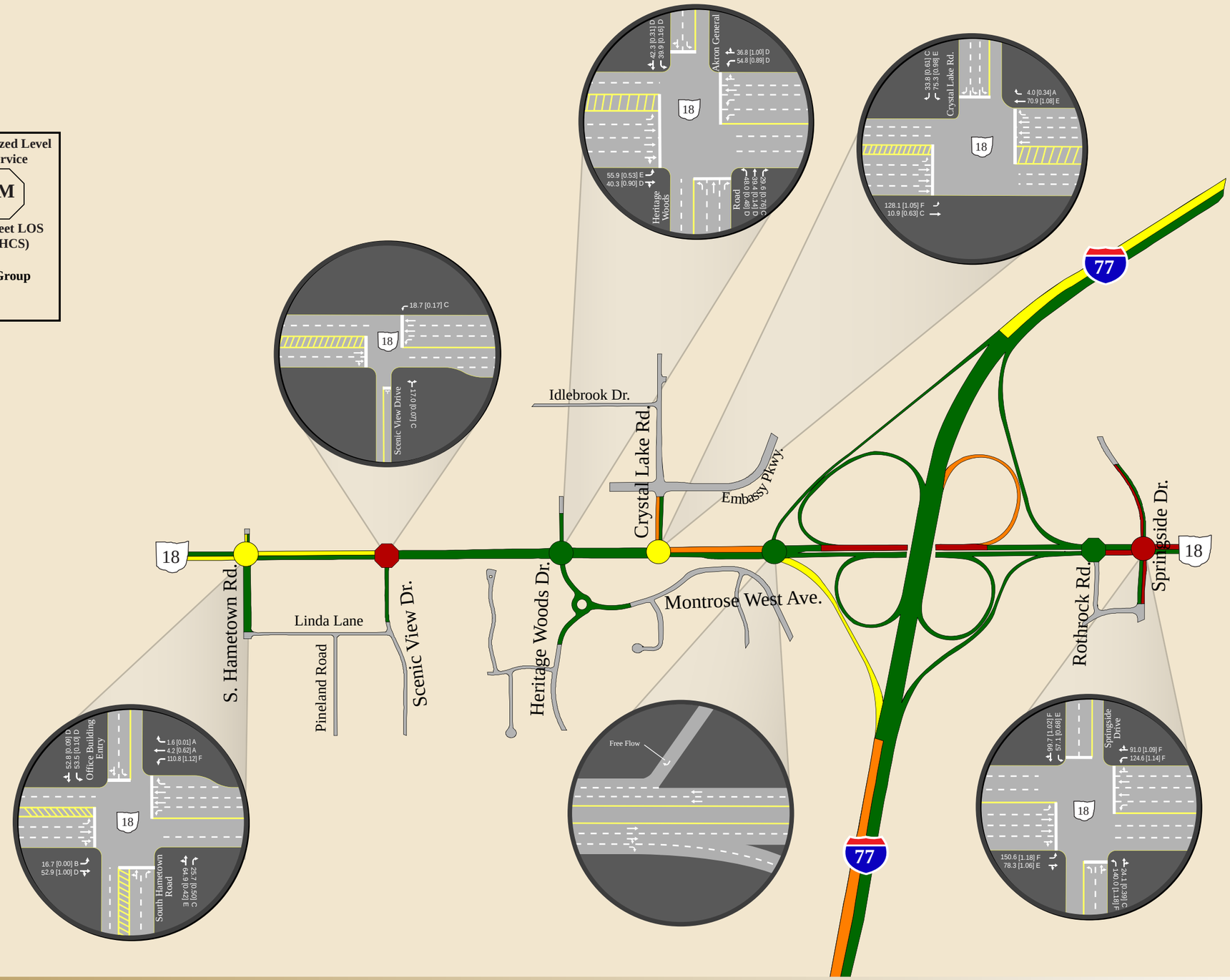

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Figure 5

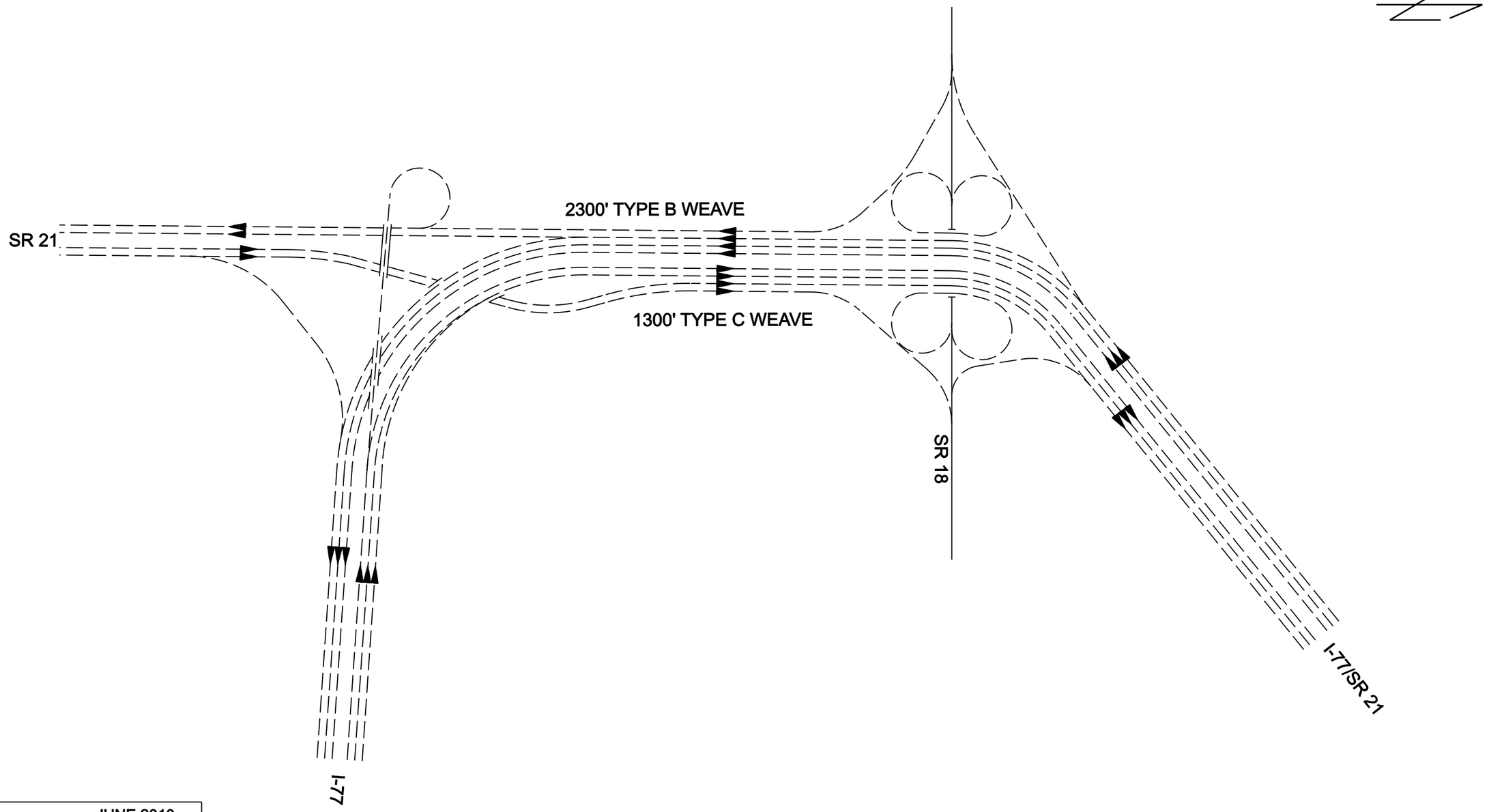

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FIGURE 6
EXISTING I-77/SR 18/SR 21
INTERCHANGE CONFIGURATION

SUMMIT 18 CORRIDOR STUSY

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NOT TO SCALE

APPENDIX

HCS ANALYSES

2030 Peak Hour

No-Build Intersections

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 11/3/2009
Period: AM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and S Hametown Rd
Area Type: All other areas
Jurisd:
Year : 2030 No-Build
N/S St: S. Hametown Rd

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	1	0	1	1	1	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Volume	20	1330	40	130	900	10	60	0	910	10	0	10
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		P			NB Left	P		
Thru		P			Thru	P		
Right		P			Right	P		
Peds					Peds			
WB Left	P	P			SB Left	P		
Thru	P	P			Thru	P		
Right	P	P			Right	P		
Peds					Peds			
NB Right	P				EB Right			
SB Right					WB Right			
Green	40.5	45.5	0.0		20.0	0.0		
Yellow	4.0	4.0			4.0			
All Red	0.0	1.0			1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	203	535	0.11	0.38	25.2	C		
TR	1326	3498	1.15	0.38	113.0	F	111.8	F
Westbound								
L	659	1770	0.22	0.76	14.3	B		
T	2634	3512	0.38	0.75	5.7	A	6.7	A
R	1187	1583	0.01	0.75	3.8	A		
Northbound								
LT	223	1339	0.30	0.17	47.3	D	111.9	F
R	864	1583	1.17	0.55	116.2	F		
Southbound								
L	222	1329	0.05	0.17	42.4	D		
TR	264	1583	0.04	0.17	42.3	D	42.3	D

Intersection Delay = 79.5 (sec/veh) Intersection LOS = E

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/3/2009
Analysis Time Period: AM Peak Hour
Intersection: SR 18 and S Hametown Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030 No-Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: S. Hametown Rd

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	20	1330	40	130	900	10	60	0	910	10	0	10
% Heavy Veh	2	3	2	2	3	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	6	369	11	36	250	3	17	0	253	3	0	3
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900	1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	1	2	0	1	2	1	0	1	1	1	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	22	1522		144	1000	11		67	1011	11	11	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000			1.000		1.000	0.000	
Prop RTs		0.029			0.000	1.000		0.000	1.000		1.000	
Peds Bikes	0			0			0			0		
Buses	0	0		0	0	0		0	0	0	0	
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3	3		3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date:
Period: AM Peak
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and Heritage Woods Rd
Area Type: All other areas
Jurisd:
Year : 2030
N/S St: Heritage Woods

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	0	0	1	1	1	1	0
LGConfig	L	TR		L	TR			LT	R	L	TR	
Volume	10	2230	40	110	1000	40	30	30	300	10	10	10
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left		P			NB Left	P			
Thru		P			Thru	P			
Right		P			Right	P			
Peds					Peds				
WB Left	P	P			SB Left	P			
Thru	P	P			Thru	P			
Right	P	P			Right	P			
Peds					Peds				
NB Right	P				EB Right				
SB Right					WB Right				
Green	8.0	80.9				17.1			
Yellow	4.0	4.0				4.0			
All Red	0.0	1.0				1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	306	454	0.04	0.67	6.7	A		
TR	2362	3503	1.07	0.67	59.3	E	59.0	E
Westbound								
L	179	1752	0.68	0.78	57.9	E		
TR	2703	3492	0.43	0.77	5.1	A	10.1	B
Northbound								
LT	225	1578	0.29	0.14	49.3	D	59.4	E
R	397	1583	0.84	0.25	61.4	E		
Southbound								
L	190	1330	0.06	0.14	45.1	D		
TR	246	1723	0.09	0.14	45.4	D	45.3	D

Intersection Delay = 44.2 (sec/veh) Intersection LOS = D

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed:
Analysis Time Period: AM Peak
Intersection: SR 18 and Heritage Woods Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Heritage Woods

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	10	2230	40	110	1000	40	30	30	300	10	10	10
% Heavy Veh	3	3	3	3	3	3	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	3	619	11	31	278	11	8	8	83	3	3	3
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900			1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes		1	2	0		1	2	0	0	1	1	0		1	1	0
LGConfig	L		TR		L		TR			LT	R		L		TR	
Lane Width	12.0	12.0			12.0	12.0				12.0	12.0		12.0	12.0		
RTOR Vol			0				0			0					0	
Adj Flow	11	2522			122	1155				66	333		11	22		
%InSharedLn																
Prop LTs	1.000	0.000			1.000	0.000				0.500			1.000	0.000		
Prop RTs		0.017				0.038				0.000	1.000			0.500		
Peds Bikes		0				0				0				0		
Buses	0	0			0	0				0	0		0	0		
%InProtPhase					0.0											

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3			3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 4/26/2006
Period: AM Peak
Project ID: Summit 18 Corridor Study
E/W St: SR 18

Inter.: Crystal Lake Road and SR 18
Area Type: All other areas
Jurisd:
Year : 2030

N/S St: Crystal Lake Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	1	0	1	1	2	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Volume	490	2030	20	170	950	550	40	20	260	550	20	160
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P	P	P		NB Left	P		
Thru		P	P		Thru	P		
Right		P	P		Right	P		
Peds					Peds			
WB Left	P		P		SB Left	P		
Thru			P		Thru	P	P	
Right			P		Right	P	P	
Peds					Peds			
NB Right	P				EB Right			
SB Right					WB Right	P		
Green	8.0	20.3	40.0			18.6	10.0	
Yellow	4.0	4.0	4.0			4.0	4.0	
All Red	0.0	1.0	1.0			0.0	1.0	

Cycle Length: 119.9 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	534	1752	1.02	0.64	80.2	F		
TR	1910	3507	1.19	0.54	119.5	F	111.9	F
Westbound								
L	134	1752	1.41	0.38	258.2	F		
T	1172	3512	0.90	0.33	49.2	D	63.3	E
R	832	1568	0.73	0.53	27.4	C		
Northbound								
LT	106	1271	0.62	0.08	77.6	E	86.3	F
R	304	1583	0.95	0.19	88.3	F		
Southbound								
L	533	3437	1.15	0.16	136.7	F		
TR	439	1614	0.46	0.27	39.7	D	112.8	F

Intersection Delay = 95.1 (sec/veh) Intersection LOS = F

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 4/26/2006
Analysis Time Period: AM Peak
Intersection: Crystal Lake Road and SR 18
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030
Project ID: Summit 18 Corridor Study
E/W St: SR 18 N/S St: Crystal Lake Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	490	2030	20	170	950	550	40	20	260	550	20	160
% Heavy Veh	3	3	3	3	3	3	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	136	564	6	47	264	153	11	6	72	153	6	44
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900	1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	1	2	0	1	2	1	0	1	1	2	1	0
LGConfig	L		TR	L	T	R		LT	R	L	TR	
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	544	2278		189	1056	611		66	289	611	200	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000			0.667			0.000	
Prop RTs		0.010			0.000	1.000		0.000	1.000		0.890	
Peds	Bikes	0			0			0			0	
Buses	0	0		0	0	0		0	0	0	0	
%InProtPhase	0.0			0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3	3		3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 4/26/2006
Period: AM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: Springside Drive and SR 18
Area Type: All other areas
Jurisd: ODOT
Year : 2030 No-Build
N/S St: Springside Drive

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	360	840	70	100	570	60	130	60	80	60	20	70
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	P	P			NB Left	P			
Thru	P	P			Thru	P			
Right	P	P			Right	P			
Peds					Peds				
WB Left		P			SB Left	P			
Thru		P			Thru	P			
Right		P			Right	P			
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	16.0	46.7				43.3			
Yellow	4.0	4.0				4.0			
All Red	0.0	1.0				1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	465	1770	0.86	0.56	34.6	C		
TR	2788	5015	0.36	0.56	15.2	B	20.7	C
Westbound								
L	196	504	0.57	0.39	40.1	D		
TR	1946	5001	0.36	0.39	26.5	C	28.4	C
Northbound								
L	465	1290	0.31	0.36	29.3	C		
TR	614	1703	0.25	0.36	28.0	C	28.6	C
Southbound								
L	419	1161	0.16	0.36	26.8	C		
TR	594	1645	0.17	0.36	26.7	C	26.8	C

Intersection Delay = 24.3 (sec/veh) Intersection LOS = C

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 4/26/2006
Analysis Time Period: AM Peak Hour
Intersection: Springside Drive and SR 18
Area Type: All other areas
Jurisdiction: ODOT
Analysis Year: 2030 No-Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Springside Drive

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	360	840	70	100	570	60	130	60	80	60	20	70
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	100	233	19	28	158	17	36	17	22	17	6	19
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900		1900	1900		1900	1900	
ParkExist												
NumPark												
No. Lanes	1	3	0	1	3	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	400	1011		111	700		144	156		67	100	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs		0.077			0.096			0.571			0.780	
Peds Bikes	0			0			0			0		
Buses	0	0		0	0		0	0		0	0	
%InProtPhase	0.0											

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Arriv. Type	3	3		3	3		3	3		3	3	
Unit Ext.	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/4/2009
Analysis Time Period: AM Peak
Intersection: SR 18 and Scenic View Dr
Jurisdiction:
Units: U. S. Customary
Analysis Year: 2030
Project ID: Summit 18 Corridor Study PID 77749
East/West Street: SR 18
North/South Street: Scenic View Dr
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		2240	10	10	1030	
Peak-Hour Factor, PHF		0.90	0.90	0.90	0.90	
Hourly Flow Rate, HFR		2488	11	11	1144	
Percent Heavy Vehicles		--	--	3	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	1	2	
Configuration		T	TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	10		40			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	11		44			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L		LR				
v (vph)		11		55				
C(m) (vph)		177		35				
v/c		0.06		1.57				
95% queue length		0.20		15.37				
Control Delay		26.7		1367				
LOS		D		F				
Approach Delay				1367				
Approach LOS				F				

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 11/3/2009
Period: PM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and S Hametown Rd
Area Type: All other areas
Jurisd:
Year : 2030 No-Build
N/S St: S. Hametown Rd

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	1	0	1	1	1	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Volume	0	1340	130	660	1650	10	40	0	320	10	0	10
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left		P			NB Left	P			
Thru		P			Thru	P			
Right		P			Right	P			
Peds					Peds				
WB Left	P	P			SB Left	P			
Thru	P	P			Thru	P			
Right	P	P			Right	P			
Peds					Peds				
NB Right	P				EB Right				
SB Right					WB Right				
Green	40.0	56.7	0.0			9.3	0.0		
Yellow	4.0	4.0				4.0			
All Red	0.0	1.0				1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	109	231	0.00	0.47	16.7	B		
TR	1639	3469	1.00	0.47	52.9	D	52.9	D
Westbound								
L	652	1770	1.12	0.85	110.8	F		
T	2947	3512	0.62	0.84	4.2	A	34.5	C
R	1328	1583	0.01	0.84	1.6	A		
Northbound								
LT	104	1339	0.42	0.08	64.9	E	30.0	C
R	716	1583	0.50	0.45	25.7	C		
Southbound								
L	105	1357	0.10	0.08	53.5	D		
TR	123	1583	0.09	0.08	52.8	D	53.2	D

Intersection Delay = 40.7 (sec/veh) Intersection LOS = D

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/3/2009
Analysis Time Period: PM Peak Hour
Intersection: SR 18 and S Hametown Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030 No-Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: S. Hametown Rd

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	1340	130	660	1650	10	40	0	320	10	0	10
% Heavy Veh	2	3	2	2	3	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	0	372	36	183	458	3	11	0	89	3	0	3
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900	1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	1	2	0	1	2	1	0	1	1	1	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	0	1633		733	1833	11		44	356	11	11	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000			1.000		1.000	0.000	
Prop RTs		0.088			0.000	1.000		0.000	1.000		1.000	
Peds Bikes	0			0			0			0		
Buses	0	0		0	0	0		0	0	0	0	
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3	3		3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date:
Period: PM Peak
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: Heritage Woods and SR 18
Area Type: All other areas
Jurisd: ODOT
Year : 2030
N/S St: Heritage Woods

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	0	0	1	1	1	1	0
LGConfig	L	TR		L	TR			LT	R	L	TR	
Volume	30	1620	30	310	2270	10	50	50	210	40	50	50
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left		P			NB Left	P			
Thru		P			Thru	P			
Right		P			Right	P			
Peds					Peds				
WB Left	P	P			SB Left	P			
Thru	P	P			Thru	P			
Right	P	P			Right	P			
Peds					Peds				
NB Right	P				EB Right				
SB Right					WB Right				
Green	21.0	63.5				21.5			
Yellow	4.0	4.0				4.0			
All Red	0.0	1.0				1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	61	116	0.54	0.53	49.0	D		
TR	1854	3503	0.99	0.53	46.3	D	46.3	D
Westbound								
L	369	1752	0.93	0.75	72.3	E		
TR	2589	3510	0.98	0.74	28.1	C	33.4	C
Northbound								
LT	250	1393	0.45	0.18	49.7	D	34.6	C
R	627	1583	0.37	0.40	27.4	C		
Southbound								
L	212	1185	0.21	0.18	44.2	D		
TR	309	1723	0.36	0.18	46.5	D	45.9	D

Intersection Delay = 38.5 (sec/veh) Intersection LOS = D

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed:
Analysis Time Period: PM Peak
Intersection: Heritage Woods and SR 18
Area Type: All other areas
Jurisdiction: ODOT
Analysis Year: 2030
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Heritage Woods

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	30	1620	30	310	2270	10	50	50	210	40	50	50
% Heavy Veh	3	3	3	3	3	3	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	8	450	8	86	631	3	14	14	58	11	14	14
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900			1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	1	2	0	1	2	0	0	1	1	1	1	0
LGConfig	L	TR		L	TR			LT	R	L	TR	
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	33	1833		344	2533			112	233	44	112	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000			0.500		1.000	0.000	
Prop RTs		0.018			0.004			0.000	1.000		0.500	
Peds Bikes	0			0			0			0		
Buses	0	0		0	0			0	0	0	0	
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3			3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 4/26/2006
Period: PM Peak
Project ID: Summit 18 Corridor Study
E/W St: SR 18

Inter.: Crystal Lake Road and SR 18
Area Type: All other areas
Jurisd:
Year : 2030

N/S St: Crystal Lake Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	1	0	1	1	2	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Volume	190	1640	40	360	2250	390	60	20	330	680	60	280
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	P		P		NB	Left		P		
	Thru			P			Thru		P		
	Right			P			Right		P		
	Peds						Peds				
WB	Left	P	P	P		SB	Left	P			
	Thru		P	P			Thru	P	P		
	Right		P	P			Right	P	P		
	Peds						Peds				
NB	Right	P	P			EB	Right				
SB	Right					WB	Right	P			
Green		8.0	1.0	51.5				16.0	22.5		
Yellow		4.0	3.0	4.0				4.0	4.0		
All Red		0.0	0.0	1.0				0.0	1.0		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	134	1752	1.57	0.47	320.2	F		
TR	1502	3500	1.24	0.43	149.1	F	166.5	F
Westbound								
L	252	1752	1.59	0.58	321.4	F		
T	1624	3512	1.54	0.46	278.1	F	248.8	F
R	1000	1568	0.43	0.64	12.3	B		
Northbound								
LT	196	1047	0.45	0.19	50.7	D	43.2	D
R	534	1583	0.69	0.34	41.3	D		
Southbound								
L	458	3437	1.65	0.13	354.4	F		
TR	578	1633	0.65	0.35	38.2	D	249.0	F

Intersection Delay = 211.0 (sec/veh) Intersection LOS = F

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 4/26/2006
Analysis Time Period: PM Peak
Intersection: Crystal Lake Road and SR 18
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030
Project ID: Summit 18 Corridor Study
E/W St: SR 18 N/S St: Crystal Lake Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	190	1640	40	360	2250	390	60	20	330	680	60	280
% Heavy Veh	3	3	3	3	3	3	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	53	456	11	100	625	108	17	6	92	189	17	78
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900	1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	1	2	0	1	2	1	0	1	1	2	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	211	1866		400	2500	433		89	367	756	378	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000			0.753			0.000	
Prop RTs		0.024			0.000	1.000		0.000	1.000		0.823	
Peds	Bikes	0			0			0			0	
Buses	0	0		0	0	0		0	0	0	0	
%InProtPhase	0.0			0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3	3		3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 4/26/2006
Period: PM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: Springside Drive and SR 18
Area Type: All other areas
Jurisd: ODOT
Year : 2030
N/S St: Springside Drive

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	270	1410	170	260	1590	60	410	100	160	150	70	270
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P	P			NB Left	P	P	
Thru		P			Thru	P	P	
Right		P			Right	P	P	
Peds					Peds			
WB Left	P	P			SB Left		P	
Thru		P			Thru		P	
Right		P			Right		P	
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	13.0	40.0				22.0	27.0	
Yellow	4.0	4.0				4.0	4.0	
All Red	0.0	1.0				0.0	1.0	

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	254	1770	1.18	0.48	150.6	F		
TR	1664	4992	1.06	0.33	78.3	E	88.9	F
Westbound								
L	254	1770	1.14	0.48	124.6	F		
TR	1682	5046	1.09	0.33	91.0	F	95.6	F
Northbound								
L	387	1770	1.18	0.45	140.0	F		
TR	747	1691	0.39	0.44	24.1	C	95.0	F
Southbound								
L	244	1086	0.68	0.22	57.1	E		
TR	369	1641	1.02	0.22	99.7	F	86.7	F

Intersection Delay = 92.1 (sec/veh) Intersection LOS = F

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 4/26/2006
Analysis Time Period: PM Peak Hour
Intersection: Springside Drive and SR 18
Area Type: All other areas
Jurisdiction: ODOT
Analysis Year: 2030
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Springside Drive

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	270	1410	170	260	1590	60	410	100	160	150	70	270
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	75	392	47	72	442	17	114	28	44	42	19	75
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900		1900	1900		1900	1900	
ParkExist												
NumPark												
No. Lanes	1	3	0	1	3	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol		0			0			0			0	
Adj Flow	300	1756		289	1834		456	289		167	378	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs	0.108			0.037			0.616			0.794		
Peds Bikes	0			0			0			0		
Buses	0	0		0	0		0	0		0	0	
%InProtPhase	0.0			0.0			0.0					

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Arriv. Type	3	3		3	3		3	3		3	3	
Unit Ext.	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/4/2009
Analysis Time Period: PM Peak
Intersection: SR 18 and Scenic View Dr
Jurisdiction:
Units: U. S. Customary
Analysis Year: 2030
Project ID: Summit 18 Corridor Study PID 77749
East/West Street: SR 18
North/South Street: Scenic View Dr
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1660	10	50	2320	
Peak-Hour Factor, PHF		0.90	0.90	0.90	0.90	
Hourly Flow Rate, HFR		1844	11	55	2577	
Percent Heavy Vehicles		--	--	3	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	1	2	
Configuration		T	TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0		20			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	0		22			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L		LR				
v (vph)		55		22				
C(m) (vph)		318		323				
v/c		0.17		0.07				
95% queue length		0.62		0.22				
Control Delay		18.7		17.0				
LOS		C		C				
Approach Delay				17.0				
Approach LOS				C				

2030 Peak Hour

Interim Condition Intersections

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 11/3/2009
Period: AM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and S Hametown Rd
Area Type: All other areas
Jurisd:
Year : 2030 Build
N/S St: S. Hametown Rd

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	1	0	1	1	1	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Volume	20	1330	40	130	900	10	60	0	910	10	0	10
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		P			NB Left	P		
Thru		P			Thru	P		
Right		P			Right	P		
Peds					Peds			
WB Left	P	P			SB Left	P		
Thru	P	P			Thru	P		
Right	P	P			Right	P		
Peds					Peds			
NB Right	P				EB Right			
SB Right					WB Right			
Green	40.5	45.5	0.0			20.0	0.0	
Yellow	4.0	4.0				4.0		
All Red	0.0	1.0				1.0		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	203	535	0.11	0.38	25.2	C		
TR	1326	3498	1.15	0.38	113.0	F	111.8	F
Westbound								
L	659	1770	0.22	0.76	14.3	B		
T	2634	3512	0.38	0.75	5.7	A	6.7	A
R	1187	1583	0.01	0.75	3.8	A		
Northbound								
LT	223	1339	0.30	0.17	47.3	D	111.9	F
R	864	1583	1.17	0.55	116.2	F		
Southbound								
L	222	1329	0.05	0.17	42.4	D		
TR	264	1583	0.04	0.17	42.3	D	42.3	D

Intersection Delay = 79.5 (sec/veh) Intersection LOS = E

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/3/2009
Analysis Time Period: AM Peak Hour
Intersection: SR 18 and S Hametown Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030 Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: S. Hametown Rd

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	20	1330	40	130	900	10	60	0	910	10	0	10
% Heavy Veh	2	3	2	2	3	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	6	369	11	36	250	3	17	0	253	3	0	3
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900	1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	1	2	0	1	2	1	0	1	1	1	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	22	1522		144	1000	11		67	1011	11	11	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000			1.000		1.000	0.000	
Prop RTs		0.029			0.000	1.000		0.000	1.000		1.000	
Peds Bikes	0			0			0			0		
Buses	0	0		0	0	0		0	0	0	0	
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3	3		3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 11/3/2009
Period: AM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and Heritage Woods Rd
Area Type: All other areas
Jurisd:
Year : 2030 Build
N/S St: Heritage Woods

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	2	2	0	1	1	1	1	1	0
LGConfig	L	TR		L	TR		L	T	R	L	TR	
Volume	10	2210	60	300	960	40	70	30	580	10	10	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		P			NB Left	P		
Thru		P			Thru	P		
Right		P			Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru	P	P			Thru	P		
Right	P	P			Right	P		
Peds					Peds			
NB Right	P				EB Right			
SB Right					WB Right			
Green	17.7	59.3	0.0		29.0	0.0		
Yellow	4.0	4.0			4.0			
All Red	0.0	1.0			1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	237	479	0.05	0.49	16.1	B		
TR	2474	5006	1.02	0.49	53.6	D	53.5	D
Westbound								
L	507	3437	0.66	0.15	54.8	D		
TR	2336	3460	0.48	0.68	10.0+	B	20.4	C
Northbound								
L	334	1384	0.23	0.24	38.2	D		
T	450	1863	0.07	0.24	35.4	D	53.3	D
R	682	1583	0.94	0.43	56.0	E		
Southbound								
L	331	1370	0.03	0.24	35.0-	C		
TR	416	1723	0.05	0.24	35.2	D	35.1	D

Intersection Delay = 43.3 (sec/veh) Intersection LOS = D

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/3/2009
Analysis Time Period: AM Peak Hour
Intersection: SR 18 and Heritage Woods Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030 Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Heritage Woods

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	10	2210	60	300	960	40	70	30	580	10	10	10
% Heavy Veh	2	3	2	2	4	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	3	614	17	83	267	11	19	8	161	3	3	3
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900		1900	1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	1	3	0	2	2	0	1	1	1	1	1	0
LGConfig	L	TR		L	TR		L	T	R	L	TR	
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	11	2523		333	1111		78	33	644	11	22	
%InSharedLn												
Prop LTs	1.000	0.000			0.000		1.000	0.000		1.000	0.000	
Prop RTs		0.027			0.040			0.000	1.000		0.500	
Peds Bikes	0			0			0			0		
Buses	0	0		0	0		0	0	0	0	0	
%InProtPhase												

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3		3	3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 11/3/2009
Period: AM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and Crystal Lake Rd
Area Type: All other areas
Jurisd:
Year : 2030 Build
N/S St: Crystal Lake Rd

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	0	3	1	0	0	0	2	0	1
LGConfig	L	T			T	R				L		R
Volume	510	2290			1120	550				550		180
Lane Width	12.0	12.0			12.0	12.0				12.0		12.0
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left			
Thru	P	P			Thru			
Right					Right			
Peds					Peds			
WB Left					SB Left	P		
Thru		P			Thru			
Right		P			Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right	P				WB Right	P		
Green	41.3	35.0	0.0		29.7	0.0		
Yellow	4.0	4.0			4.0			
All Red	0.0	1.0			1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	609	1770	0.93	0.34	60.9	E		
T	3363	5025	0.76	0.67	14.9	B	23.3	C
Westbound								
T	1466	5025	0.85	0.29	46.3	D	38.0	D
R	919	1583	0.66	0.58	21.0	C		
Northbound								
Southbound								
L	851	3437	0.72	0.25	46.5	D		
							37.4	D
R	1003	1583	0.20	0.63	9.7	A		

Intersection Delay = 30.0 (sec/veh) Intersection LOS = C

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/3/2009
Analysis Time Period: AM Peak Hour
Intersection: SR 18 and Crystal Lake Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030 Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Crystal Lake Rd

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	510	2290			1120	550				550		180
% Heavy Veh	2	3			3	2				2		2
PHF	0.90	0.90			0.90	0.90				0.90		0.90
PK 15 Vol	142	636			311	153				153		50
Hi Ln Vol												
% Grade		0			0						0	
Ideal Sat	1900	1900			1900	1900				1900		1900
ParkExist												
NumPark												
No. Lanes	1	3	0	0	3	1	0	0	0	2	0	1
LGConfig	L	T			T	R				L		R
Lane Width	12.0	12.0			12.0	12.0				12.0		12.0
RTOR Vol						0						0
Adj Flow	567	2544			1244	611				611		200
%InSharedLn												
Prop LTs		0.000			0.000							
Prop RTs	0.000			0.000		1.000						1.000
Peds Bikes				0			0			0		
Buses	0	0			0	0				0		0
%InProtPhase												

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0			0.0	0.0				0.0		0.0
Arriv. Type	3	3			3	3				3		3
Unit Ext.	3.0	3.0			3.0	3.0				3.0		3.0
I Factor		1.000			1.000						1.000	
Lost Time	2.0	2.0			2.0	2.0				2.0		2.0
Ext of g	2.0	2.0			2.0	2.0				2.0		2.0
Ped Min g					3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 4/26/2006
Period: AM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: Springside Drive and SR 18
Area Type: All other areas
Jurisd: ODOT
Year : 2030
N/S St: Springside Drive

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	360	840	70	100	570	60	130	60	80	60	20	70
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P	P			NB Left	P		
Thru	P	P			Thru	P		
Right	P	P			Right	P		
Peds					Peds			
WB Left		P			SB Left	P		
Thru		P			Thru	P		
Right		P			Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	16.0	46.7				43.3		
Yellow	4.0	4.0				4.0		
All Red	0.0	1.0				1.0		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	465	1770	0.86	0.56	34.6	C		
TR	2788	5015	0.36	0.56	15.2	B	20.7	C
Westbound								
L	196	504	0.57	0.39	40.1	D		
TR	1946	5001	0.36	0.39	26.5	C	28.4	C
Northbound								
L	465	1290	0.31	0.36	29.3	C		
TR	614	1703	0.25	0.36	28.0	C	28.6	C
Southbound								
L	419	1161	0.16	0.36	26.8	C		
TR	594	1645	0.17	0.36	26.7	C	26.8	C

Intersection Delay = 24.3 (sec/veh) Intersection LOS = C

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 4/26/2006
Analysis Time Period: AM Peak Hour
Intersection: Springside Drive and SR 18
Area Type: All other areas
Jurisdiction: ODOT
Analysis Year: 2030
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Springside Drive

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	360	840	70	100	570	60	130	60	80	60	20	70
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	100	233	19	28	158	17	36	17	22	17	6	19
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900		1900	1900		1900	1900	
ParkExist												
NumPark												
No. Lanes	1	3	0	1	3	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol		0			0			0			0	
Adj Flow	400	1011		111	700		144	156		67	100	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs	0.077			0.096			0.571			0.780		
Peds Bikes	0			0			0			0		
Buses	0	0		0	0		0	0		0	0	
%InProtPhase	0.0											

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Arriv. Type	3	3		3	3		3	3		3	3	
Unit Ext.	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/4/2009
Analysis Time Period: AM Peak
Intersection: SR 18 and Scenic View Dr
Jurisdiction:
Units: U. S. Customary
Analysis Year: 2030
Project ID: Summit 18 Corridor Study PID 77749
East/West Street: SR 18
North/South Street: Scenic View Dr
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		2240	10	10	1030	
Peak-Hour Factor, PHF		0.90	0.90	0.90	0.90	
Hourly Flow Rate, HFR		2488	11	11	1144	
Percent Heavy Vehicles		--	--	3	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	1	2	
Configuration		T	TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	10		40			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	11		44			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L		LR				
v (vph)		11		55				
C(m) (vph)		177		35				
v/c		0.06		1.57				
95% queue length		0.20		15.37				
Control Delay		26.7		1367				
LOS		D		F				
Approach Delay				1367				
Approach LOS				F				

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 11/3/2009
Period: PM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and S Hametown Rd
Area Type: All other areas
Jurisd:
Year : 2030 Build
N/S St: S. Hametown Rd

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	1	0	1	1	1	1	0
LGConfig	L	TR		L	T	R		LT	R	L	TR	
Volume	0	1340	130	660	1650	10	40	0	320	10	0	10
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		P			NB Left	P		
Thru		P			Thru	P		
Right		P			Right	P		
Peds					Peds			
WB Left	P	P			SB Left	P		
Thru	P	P			Thru	P		
Right	P	P			Right	P		
Peds					Peds			
NB Right	P				EB Right			
SB Right					WB Right			
Green	40.0	56.7	0.0		9.3	0.0		
Yellow	4.0	4.0			4.0			
All Red	0.0	1.0			1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	109	231	0.00	0.47	16.7	B		
TR	1639	3469	1.00	0.47	52.9	D	52.9	D
Westbound								
L	652	1770	1.12	0.85	110.8	F		
T	2947	3512	0.62	0.84	4.2	A	34.5	C
R	1328	1583	0.01	0.84	1.6	A		
Northbound								
LT	104	1339	0.42	0.08	64.9	E	30.0	C
R	716	1583	0.50	0.45	25.7	C		
Southbound								
L	105	1357	0.10	0.08	53.5	D		
TR	123	1583	0.09	0.08	52.8	D	53.2	D

Intersection Delay = 40.7 (sec/veh) Intersection LOS = D

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/3/2009
Analysis Time Period: PM Peak Hour
Intersection: SR 18 and S Hametown Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030 Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: S. Hametown Rd

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	1340	130	660	1650	10	40	0	320	10	0	10
% Heavy Veh	2	3	2	2	3	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	0	372	36	183	458	3	11	0	89	3	0	3
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900	1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes		1	2	0		1	2	1		0	1	1		1	1	0
LGConfig	L		TR		L		T	R			LT	R	L		TR	
Lane Width	12.0	12.0			12.0	12.0	12.0			12.0	12.0		12.0	12.0		
RTOR Vol			0				0				0				0	
Adj Flow	0	1633			733	1833	11			44	356		11	11		
%InSharedLn																
Prop LTs	1.000	0.000			1.000	0.000				1.000			1.000	0.000		
Prop RTs		0.088				0.000	1.000			0.000	1.000			1.000		
Peds Bikes		0				0				0				0		
Buses	0	0			0	0	0			0	0		0	0		
%InProtPhase					0.0											

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3	3		3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 11/3/2009
Period: PM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and Heritage Woods Rd
Area Type: All other areas
Jurisd:
Year : 2030 Build
N/S St: Heritage Woods

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	2	2	0	1	1	1	1	1	0
LGConfig	L	TR		L	TR		L	T	R	L	TR	
Volume	30	1580	70	730	2210	10	110	50	560	40	50	50
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		P			NB Left	P		
Thru		P			Thru	P		
Right		P			Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru	P	P			Thru	P		
Right	P	P			Right	P		
Peds					Peds			
NB Right	P				EB Right			
SB Right					WB Right			
Green	31.9	48.9				25.2	0.0	
Yellow	4.0	4.0				4.0		
All Red	0.0	1.0				1.0		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	62	152	0.53	0.41	55.9	E		
TR	2035	4995	0.90	0.41	40.3	D	40.5	D
Westbound								
L	914	3437	0.89	0.27	54.8	D		
TR	2456	3476	1.00	0.71	36.8	D	41.3	D
Northbound								
L	254	1210	0.48	0.21	48.0	D		
T	391	1863	0.14	0.21	39.4	D	33.1	C
R	819	1583	0.76	0.52	29.6	C		
Southbound								
L	282	1342	0.16	0.21	39.9	D		
TR	362	1723	0.31	0.21	42.3	D	41.6	D

Intersection Delay = 40.0 (sec/veh) Intersection LOS = D

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/3/2009
Analysis Time Period: PM Peak Hour
Intersection: SR 18 and Heritage Woods Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030 Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Heritage Woods

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	30	1580	70	730	2210	10	110	50	560	40	50	50
% Heavy Veh	2	3	2	2	4	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	8	439	19	203	614	3	31	14	156	11	14	14
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900		1900	1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	1	3	0	2	2	0	1	1	1	1	1	0
LGConfig	L	TR		L	TR		L	T	R	L	TR	
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	33	1834		811	2467		122	56	622	44	112	
%InSharedLn												
Prop LTs	1.000	0.000			0.000		1.000	0.000		1.000	0.000	
Prop RTs		0.043			0.004			0.000	1.000		0.500	
Peds Bikes	0			0			0			0		
Buses	0	0		0	0		0	0	0	0	0	
%InProtPhase												

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Arriv. Type	3	3		3	3		3	3	3	3	3	
Unit Ext.	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 11/3/2009
Period: PM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: SR 18 and Crystal Lake Rd
Area Type: All other areas
Jurisd:
Year : 2030 Build
N/S St: Crystal Lake Rd

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	0	3	1	0	0	0	2	0	1
LGConfig	L	T			T	R				L		R
Volume	210	1970			2610	390				680		340
Lane Width	12.0	12.0			12.0	12.0				12.0		12.0
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left			
Thru	P	P			Thru			
Right					Right			
Peds					Peds			
WB Left					SB Left	P		
Thru		P			Thru			
Right		P			Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right	P				WB Right	P		
Green	15.0	64.2	0.0		26.8	0.0		
Yellow	4.0	4.0			4.0			
All Red	0.0	1.0			1.0			

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	221	1770	1.05	0.13	128.1	F		
T	3484	5025	0.63	0.69	10.9	B	22.1	C
Westbound								
T	2688	5025	1.08	0.53	70.9	E	62.3	E
R	1266	1583	0.34	0.80	4.0	A		
Northbound								
Southbound								
L	768	3437	0.98	0.22	75.3	E		
							61.5	E
R	617	1583	0.61	0.39	33.8	C		

Intersection Delay = 48.0 (sec/veh) Intersection LOS = D

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/3/2009
Analysis Time Period: PM Peak Hour
Intersection: SR 18 and Crystal Lake Rd
Area Type: All other areas
Jurisdiction:
Analysis Year: 2030 Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Crystal Lake Rd

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	210	1970			2610	390				680		340
% Heavy Veh	2	3			3	2				2		2
PHF	0.90	0.90			0.90	0.90				0.90		0.90
PK 15 Vol	58	547			725	108				189		94
Hi Ln Vol												
% Grade		0			0						0	
Ideal Sat	1900	1900			1900	1900				1900		1900
ParkExist												
NumPark												
No. Lanes	1	3	0	0	3	1	0	0	0	2	0	1
LGConfig	L	T			T	R				L		R
Lane Width	12.0	12.0			12.0	12.0				12.0		12.0
RTOR Vol						0						0
Adj Flow	233	2189			2900	433				756		378
%InSharedLn												
Prop LTs		0.000			0.000							
Prop RTs	0.000			0.000		1.000						1.000
Peds Bikes				0			0			0		
Buses	0	0			0	0				0		0
%InProtPhase												

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0			0.0	0.0				0.0		0.0
Arriv. Type	3	3			3	3				3		3
Unit Ext.	3.0	3.0			3.0	3.0				3.0		3.0
I Factor		1.000			1.000						1.000	
Lost Time	2.0	2.0			2.0	2.0				2.0		2.0
Ext of g	2.0	2.0			2.0	2.0				2.0		2.0
Ped Min g					3.2			3.2			3.2	

HCS+: Signalized Intersections Release 5.4

Analyst: RA
Agency: Burgess & Niple Inc
Date: 4/26/2006
Period: PM Peak Hour
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18

Inter.: Springside Drive and SR 18
Area Type: All other areas
Jurisd: ODOT
Year : 2030 Build
N/S St: Springside Drive

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	270	1410	170	260	1590	60	410	100	160	150	70	270
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P	P			NB Left	P	P	
Thru		P			Thru	P	P	
Right		P			Right	P	P	
Peds					Peds			
WB Left	P	P			SB Left		P	
Thru		P			Thru		P	
Right		P			Right		P	
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	13.0	40.0				22.0	27.0	
Yellow	4.0	4.0				4.0	4.0	
All Red	0.0	1.0				0.0	1.0	

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	254	1770	1.18	0.48	150.6	F		
TR	1664	4992	1.06	0.33	78.3	E	88.9	F
Westbound								
L	254	1770	1.14	0.48	124.6	F		
TR	1682	5046	1.09	0.33	91.0	F	95.6	F
Northbound								
L	387	1770	1.18	0.45	140.0	F		
TR	747	1691	0.39	0.44	24.1	C	95.0	F
Southbound								
L	244	1086	0.68	0.22	57.1	E		
TR	369	1641	1.02	0.22	99.7	F	86.7	F

Intersection Delay = 92.1 (sec/veh) Intersection LOS = F

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 4/26/2006
Analysis Time Period: PM Peak Hour
Intersection: Springside Drive and SR 18
Area Type: All other areas
Jurisdiction: ODOT
Analysis Year: 2030 Build
Project ID: Summit 18 Corridor Study PID 77749
E/W St: SR 18 N/S St: Springside Drive

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	270	1410	170	260	1590	60	410	100	160	150	70	270
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	75	392	47	72	442	17	114	28	44	42	19	75
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900		1900	1900		1900	1900	
ParkExist												
NumPark												
No. Lanes	1	3	0	1	3	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0
Adj Flow	300	1756		289	1834		456	289		167	378	
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs	0.108			0.037			0.616			0.794		
Peds Bikes	0			0			0			0		
Buses	0	0		0	0		0	0		0	0	
%InProtPhase	0.0			0.0			0.0					

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Arriv. Type	3	3		3	3		3	3		3	3	
Unit Ext.	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ext of g	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ped Min g		3.2			3.2			3.2			3.2	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: RA
Agency/Co.: Burgess & Niple Inc
Date Performed: 11/4/2009
Analysis Time Period: PM Peak
Intersection: SR 18 and Scenic View Dr
Jurisdiction:
Units: U. S. Customary
Analysis Year: 2030
Project ID: Summit 18 Corridor Study PID 77749
East/West Street: SR 18
North/South Street: Scenic View Dr
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1660	10	50	2320	
Peak-Hour Factor, PHF		0.90	0.90	0.90	0.90	
Hourly Flow Rate, HFR		1844	11	55	2577	
Percent Heavy Vehicles		--	--	3	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0	1	2	
Configuration		T	TR	L	T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0		20			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	0		22			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L		LR				
v (vph)		55		22				
C(m) (vph)		318		323				
v/c		0.17		0.07				
95% queue length		0.62		0.22				
Control Delay		18.7		17.0				
LOS		C		C				
Approach Delay				17.0				
Approach LOS				C				

2030 AM Peak Hour

Freeway Segments

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	I-77 SB
From/To:	Ghent Rd Onramp to SR 18 Exit
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	2620	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	728	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	999	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	999	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	3	
Density, D	14.3	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	I-77 SB
From/To:	South of Exit to SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	2430	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	675	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	927	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	927	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	3	
Density, D	13.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	I-77 SB
From/To:	
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	2430	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	675	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	927	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	927	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	3	
Density, D	13.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	I-77 NB
From/To:	North of Ramp to SR 18 EB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	4940	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1372	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1885	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1885	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	66.8	mi/h
Number of lanes, N	3	
Density, D	28.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	I-77 NB
From/To:	North of Ramp to SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	4240	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1178	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1617	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1617	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	69.3	mi/h
Number of lanes, N	3	
Density, D	23.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	I-77 NB
From/To:	North of Ramp from SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	4430	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1231	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1690	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1690	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	68.9	mi/h
Number of lanes, N	3	
Density, D	24.5	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date performed:	11/8/2009
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-77 SB
Junction:	Exit to SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2620	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	190	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	180	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1650	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2620	190	180	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	728	53	50	v
Trucks and buses	6	7	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, f_{HV}	0.971	0.966	0.980	
Driver population factor, f_P	1.00	1.00	1.00	
Flow rate, v_p	2998	218	204	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.675 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2095 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2998	7200	No
$v_{FO} = v_F - v_R$	2780	7200	No
v_R	218	2000	No
v_3 or v_{av34}	903 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12}/2	No	

If yes, v_{12A} = 2095 (Equation 25-18)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2095	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 16.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.448

Space mean speed in ramp influence area, S_R = 57.5 mph

Space mean speed in outer lanes, S_0 = 76.8 mph

Space mean speed for all vehicles, S = 62.2 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date performed:	11/9/2009
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-77 NB
Junction:	SR 18 WB to I-77 NB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4240	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	190	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1080	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4240	190	1080	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1178	53	300	v
Trucks and buses	6	3	12	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.971	0.985	0.943	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4852	214	1272	pcph

Estimation of V12 Merge Areas

L_{EQ} = 734.32 (Equation 25-2 or 25-3)

P_{FM} = 0.591 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2870 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5066	7200	No
v_3 or v_{av34}	1982 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34}	> 2700 pc/h?		No
Is v_3 or v_{av34}	> 1.5 v_{12} /2		No
If yes, v_{12A} = 2870		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2870	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 26.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.371	
Space mean speed in ramp influence area,	S_R = 59.6	mph
Space mean speed in outer lanes,	S_0 = 64.7	mph
Space mean speed for all vehicles,	S = 61.5	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/8/2009
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	I-77 SB
Weaving Location:	Loop Ramps at SR 18
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	65	mph
Weaving number of lanes, N	4	
Weaving segment length, L	725	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.50	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	2250	0	180	180	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	625	0	50	50	v
Trucks and buses	6	0	8	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	0.962	0.980	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2575	0	208	204	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.63	0.23
Weaving and non-weaving speeds, Si	48.77	59.78
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	0.81
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	57.98	mph
Weaving segment density, D	12.88	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	7575	pc/h
Capacity as a 15-minute flow rate, c	7354	pc/h
Capacity as a full-hour volume, ch	6619	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	412	2800	a
Average flow rate (pcphpl)	746	2350	b
Volume ratio, VR	0.14	0.35	c
Weaving ratio, R	0.50	N/A	d
Weaving length (ft)	725	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RMK
Agency/Co.:	Burgess & Niple, Inc.
Date Performed:	6/28/2010
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	I-77 SB
Weaving Location:	EB SR 18 amd SR 21
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	4	
Weaving segment length, L	2300	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	B	
Volume ratio, VR	0.62	
Weaving ratio, R	0.45	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V o1	V o2	V w1	V w2	
Volume, V	1320	210	1330	1110	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	367	58	369	308	v
Trucks and buses	6	7	7	6	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.966	0.966	0.971	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1510	241	1529	1270	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.66	0.84
Weaving and non-weaving speeds, Si	51.15	47.57
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	2.74
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.50
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.71	mph
Weaving segment density, D	22.88	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	6532	pc/h
Capacity as a 15-minute flow rate, c	6342	pc/h
Capacity as a full-hour volume, ch	5708	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2799	4000	a
Average flow rate (pcphpl)	1137	2400	b
Volume ratio, VR	0.62	0.80	c
Weaving ratio, R	0.45	N/A	d
Weaving length (ft)	2300	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/8/2009
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	I-77 NB
Weaving Location:	SR 21 and I-77 NB Merge
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	4	
Weaving segment length, L	1300	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	C	
Volume ratio, VR	0.49	
Weaving ratio, R	0.06	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	2380	430	2560	160	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	661	119	711	44	v
Trucks and buses	6	3	6	2	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.985	0.971	0.990	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2723	484	2929	179	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.30	6.00
c (Exhibit 24-6)	0.80	1.10
d (Exhibit 24-6)	0.60	0.60
Weaving intensity factor, Wi	0.98	0.99
Weaving and non-weaving speeds, Si	45.24	45.22
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	2.56
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.00
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	45.23	mph
Weaving segment density, D	34.91	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	7027	pc/h
Capacity as a 15-minute flow rate, c	6822	pc/h
Capacity as a full-hour volume, ch	6140	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	3108	3500	a
Average flow rate (pcphpl)	1578	2400	b
Volume ratio, VR	0.49	0.50	c
Weaving ratio, R	0.06	0.40	d
Weaving length (ft)	1300	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/8/2009
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	I-77 NB
Weaving Location:	Loop Ramps at SR 18
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	65	mph
Weaving number of lanes, N	4	
Weaving segment length, L	725	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.28	
Weaving ratio, R	0.25	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	3860	0	1080	380	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1072	0	300	106	v
Trucks and buses	6	0	12	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	0.943	0.980	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4417	0	1272	430	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.63	0.92
Weaving and non-weaving speeds, Si	35.94	43.60
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.39
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	41.16	mph
Weaving segment density, D	37.17	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	6673	pc/h
Capacity as a 15-minute flow rate, c	6479	pc/h
Capacity as a full-hour volume, ch	5831	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1702	2800	a
Average flow rate (pcphpl)	1529	2350	b
Volume ratio, VR	0.28	0.35	c
Weaving ratio, R	0.25	N/A	d
Weaving length (ft)	725	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 18 WB
Weaving Location:	SR 18 WB at I-77 Loop Ramps
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	45	mph
Weaving number of lanes, N	3	
Weaving segment length, L	1000	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.77	
Weaving ratio, R	0.14	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	400	0	1080	180	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	111	0	300	50	v
Trucks and buses	3	0	12	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.985	1.000	0.943	0.980	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	451	0	1272	204	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.58	0.49
Weaving and non-weaving speeds, Si	24.79	38.51
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	2.11
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	27.04	mph
Weaving segment density, D	23.75	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	4180	pc/h
Capacity as a 15-minute flow rate, c	4118	pc/h
Capacity as a full-hour volume, ch	3706	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1476	2800	a
Average flow rate (pcphpl)	642		b
Volume ratio, VR	0.77	0.45	c
Weaving ratio, R	0.14	N/A	d
Weaving length (ft)	1000	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 18 EB
Weaving Location:	SR 18 EB at I-77 Loop Ramps
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	45	mph
Weaving number of lanes, N	3	
Weaving segment length, L	600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.37	
Weaving ratio, R	0.33	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	980	0	380	180	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	272	0	106	50	v
Trucks and buses	3	0	4	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.985	1.000	0.980	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1105	0	430	208	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.86	0.39
Weaving and non-weaving speeds, Si	33.85	40.10
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.19
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	37.56	mph
Weaving segment density, D	15.47	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	4192	pc/h
Capacity as a 15-minute flow rate, c	4130	pc/h
Capacity as a full-hour volume, ch	3717	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	638	2800	a
Average flow rate (pcphpl)	581		b
Volume ratio, VR	0.37	0.45	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	600	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2030 PM Peak Hour

Freeway Segments

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	I-77 SB
From/To:	North of Ramp to SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	4600	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1278	v
Trucks and buses	8	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.962	
Driver population factor, fp	1.00	
Flow rate, vp	1772	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1772	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	68.2	mi/h
Number of lanes, N	3	
Density, D	26.0+	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	I-77 SB
From/To:	South of Exit to SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	4190	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1164	v
Trucks and buses	8	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.962	
Driver population factor, fp	1.00	
Flow rate, vp	1614	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1614	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	69.4	mi/h
Number of lanes, N	3	
Density, D	23.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	I-77 SB
From/To:	South of Exit to SR 18 EB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	4540	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1261	v
Trucks and buses	8	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.962	
Driver population factor, fp	1.00	
Flow rate, vp	1749	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1749	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	68.4	mi/h
Number of lanes, N	3	
Density, D	25.6	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	I-77 NB
From/To:	North of Ramp to SR 18 EB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	3190	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	886	v
Trucks and buses	8	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.962	
Driver population factor, fp	1.00	
Flow rate, vp	1229	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1229	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	3	
Density, D	17.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	I-77 NB
From/To:	North of Ramp to SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	2100	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	583	v
Trucks and buses	8	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.962	
Driver population factor, fp	1.00	
Flow rate, vp	809	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	809	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	3	
Density, D	11.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency or Company:	Burgess & Niple Inc
Date Performed:	11/6/2009
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	I-77 NB
From/To:	North of Ramp from SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Flow Inputs and Adjustments

Volume, V	2410	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	669	v
Trucks and buses	8	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.962	
Driver population factor, fp	1.00	
Flow rate, vp	928	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	928	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	3	
Density, D	13.3	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date performed:	11/8/2009
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-77 SB
Junction:	Exit to SR 18 WB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4600	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	410	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	650	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1650	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4600	410	650	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1278	114	181	v
Trucks and buses	6	2	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5264	460	737	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.607 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3377 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5264	7200	No
$v_{FO} = v_F - v_R$	4804	7200	No
v_R	460	2000	No
v_3 or v_{av34}	1887 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 3377 (Equation 25-18)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3377	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 27.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.469

Space mean speed in ramp influence area, S_R = 56.9 mph

Space mean speed in outer lanes, S_0 = 73.3 mph

Space mean speed for all vehicles, S = 61.8 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date performed:	11/9/2009
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-77 NB
Junction:	SR 18 WB to I-77 NB
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2100	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	310	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1280	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2100	310	1280	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	583	86	356	v
Trucks and buses	6	2	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2403	348	1472	pcph

Estimation of V12 Merge Areas

L_{EQ} = 238.91 (Equation 25-2 or 25-3)

P_{FM} = 0.591 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 1421 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2751	7200	No
$v_{3 \text{ or } av34}$	982 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34}$ > 2700 pc/h?		No	
Is $v_{3 \text{ or } av34}$ > 1.5 v_{12} /2		No	
If yes, v_{12A} = 1421		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1421	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 16.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.309	
Space mean speed in ramp influence area,	S_R = 61.4	mph
Space mean speed in outer lanes,	S_0 = 68.3	mph
Space mean speed for all vehicles,	S = 63.7	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/8/2009
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	I-77 SB
Weaving Location:	Loop Ramps at SR 18
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	4	
Weaving segment length, L	725	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.20	
Weaving ratio, R	0.32	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	3890	0	650	300	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1081	0	181	83	v
Trucks and buses	6	0	4	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	0.980	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4451	0	736	346	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.27	0.62
Weaving and non-weaving speeds, Si	41.39	52.04
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.07
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.55	mph
Weaving segment density, D	27.92	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	7484	pc/h
Capacity as a 15-minute flow rate, c	7266	pc/h
Capacity as a full-hour volume, ch	6539	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1082	2800	a
Average flow rate (pcphpl)	1383	2400	b
Volume ratio, VR	0.20	0.35	c
Weaving ratio, R	0.32	N/A	d
Weaving length (ft)	725	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RMK
Agency/Co.:	Burgess & Niple, Inc.
Date Performed:	6/28/2010
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	I-77 SB
Weaving Location:	EB SR 18 amd SR 21
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	4	
Weaving segment length, L	2300	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	B	
Volume ratio, VR	0.57	
Weaving ratio, R	0.26	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V o1	V o2	V w1	V w2	
Volume, V	2090	460	2450	870	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	581	128	681	242	v
Trucks and buses	6	7	6	7	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.966	0.971	0.966	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2391	528	2803	1000	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.81	1.03
Weaving and non-weaving speeds, Si	48.15	44.52
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	2.60
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.50
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.50	mph
Weaving segment density, D	36.14	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	7067	pc/h
Capacity as a 15-minute flow rate, c	6861	pc/h
Capacity as a full-hour volume, ch	6175	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	3803	4000	a
Average flow rate (pcphpl)	1680	2400	b
Volume ratio, VR	0.57	0.80	c
Weaving ratio, R	0.26	N/A	d
Weaving length (ft)	2300	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/8/2009
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	I-77 NB
Weaving Location:	SR 21 and I-77 NB Merge
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	4	
Weaving segment length, L	1300	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	C	
Volume ratio, VR	0.34	
Weaving ratio, R	0.12	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V o1	V o2	V w1	V w2	
Volume, V	2060	430	1130	160	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	572	119	314	44	v
Trucks and buses	6	2	0	2	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	1.000	0.990	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2357	482	1255	179	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.30	6.00
c (Exhibit 24-6)	0.80	1.10
d (Exhibit 24-6)	0.60	0.60
Weaving intensity factor, Wi	0.56	0.33
Weaving and non-weaving speeds, Si	53.51	60.12
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	2.40
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.00
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	57.73	mph
Weaving segment density, D	18.51	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	8371	pc/h
Capacity as a 15-minute flow rate, c	8127	pc/h
Capacity as a full-hour volume, ch	7314	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1434	3500	a
Average flow rate (pcphpl)	1068	2400	b
Volume ratio, VR	0.34	0.50	c
Weaving ratio, R	0.12	0.40	d
Weaving length (ft)	1300	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS+: Freeway Weaving Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple, Inc
Date Performed:	11/8/2009
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	I-77 NB
Weaving Location:	Loop Ramps at SR 18
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	65	mph
Weaving number of lanes, N	4	
Weaving segment length, L	725	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.44	
Weaving ratio, R	0.13	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	1910	0	1280	190	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	531	0	356	53	v
Trucks and buses	6	0	7	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	0.966	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2185	0	1471	219	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	3.15	0.46
Weaving and non-weaving speeds, Si	28.25	52.57
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.74
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	38.22	mph
Weaving segment density, D	25.35	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	6208	pc/h
Capacity as a 15-minute flow rate, c	6027	pc/h
Capacity as a full-hour volume, ch	5424	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1690	2800	a
Average flow rate (pcphpl)	968	2350	b
Volume ratio, VR	0.44	0.35	c
Weaving ratio, R	0.13	N/A	d
Weaving length (ft)	725	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 18 WB
Weaving Location:	SR 18 WB at I-77 Loop Ramps
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	45	mph
Weaving number of lanes, N	3	
Weaving segment length, L	1050	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.60	
Weaving ratio, R	0.33	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	1310	0	1280	650	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	364	0	356	181	v
Trucks and buses	3	0	7	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.985	1.000	0.966	0.980	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1477	0	1471	736	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	3.73	0.74
Weaving and non-weaving speeds, Si	22.39	35.17
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.95
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	26.21	mph
Weaving segment density, D	46.85	pc/mi/ln
Level of service, LOS	F	
Capacity of base condition, cb	4210	pc/h
Capacity as a 15-minute flow rate, c	4148	pc/h
Capacity as a full-hour volume, ch	3733	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2207	2800	a
Average flow rate (pcphpl)	1228		b
Volume ratio, VR	0.60	0.45	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	1050	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	RA
Agency/Co.:	Burgess & Niple Inc
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 18 EB
Weaving Location:	SR 18 EB at I-77 Loop Ramps
Jurisdiction:	
Analysis Year:	2030
Description:	Summit 18 Corridor Study PID 77749

Inputs

Freeway free-flow speed, SFF	45	mph
Weaving number of lanes, N	3	
Weaving segment length, L	600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.30	
Weaving ratio, R	0.39	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V o1	V o2	V w1	V w2	
Volume, V	1130	0	300	190	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	314	0	83	53	v
Trucks and buses	3	0	3	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.985	1.000	0.985	0.980	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1274	0	338	215	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.81	0.35
Weaving and non-weaving speeds, Si	34.36	40.99
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.06
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	38.73	mph
Weaving segment density, D	15.72	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	4401	pc/h
Capacity as a 15-minute flow rate, c	4336	pc/h
Capacity as a full-hour volume, ch	3902	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	553	2800	a
Average flow rate (pcphpl)	609		b
Volume ratio, VR	0.30	0.45	c
Weaving ratio, R	0.39	N/A	d
Weaving length (ft)	600	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

INTER-OFFICE COMMUNICATION

TO: Joe DeFuria, District 4

FROM: Peggy Siddle, Transportation Planner, Office of Technical Services

SUBJECT: SUM-18-Corridor Study, PID 77749

DATE: September 23, 2008

In reply to a request received on August 5, 2008, the Office of Technical Services (OTS) has provided year 2010 and 2030 A.M. DHV and P.M. DHV turning movements plates for the SUM-18-Corridor Study. These plates reflect the traffic generated by the Heritage Woods development.

Additionally, 2 plates for the Build Relocation are provided for your use.

Please use the design designations that were provided to you on February 10, 2006 for the SUM-18-Corridor Study (PID 77749).

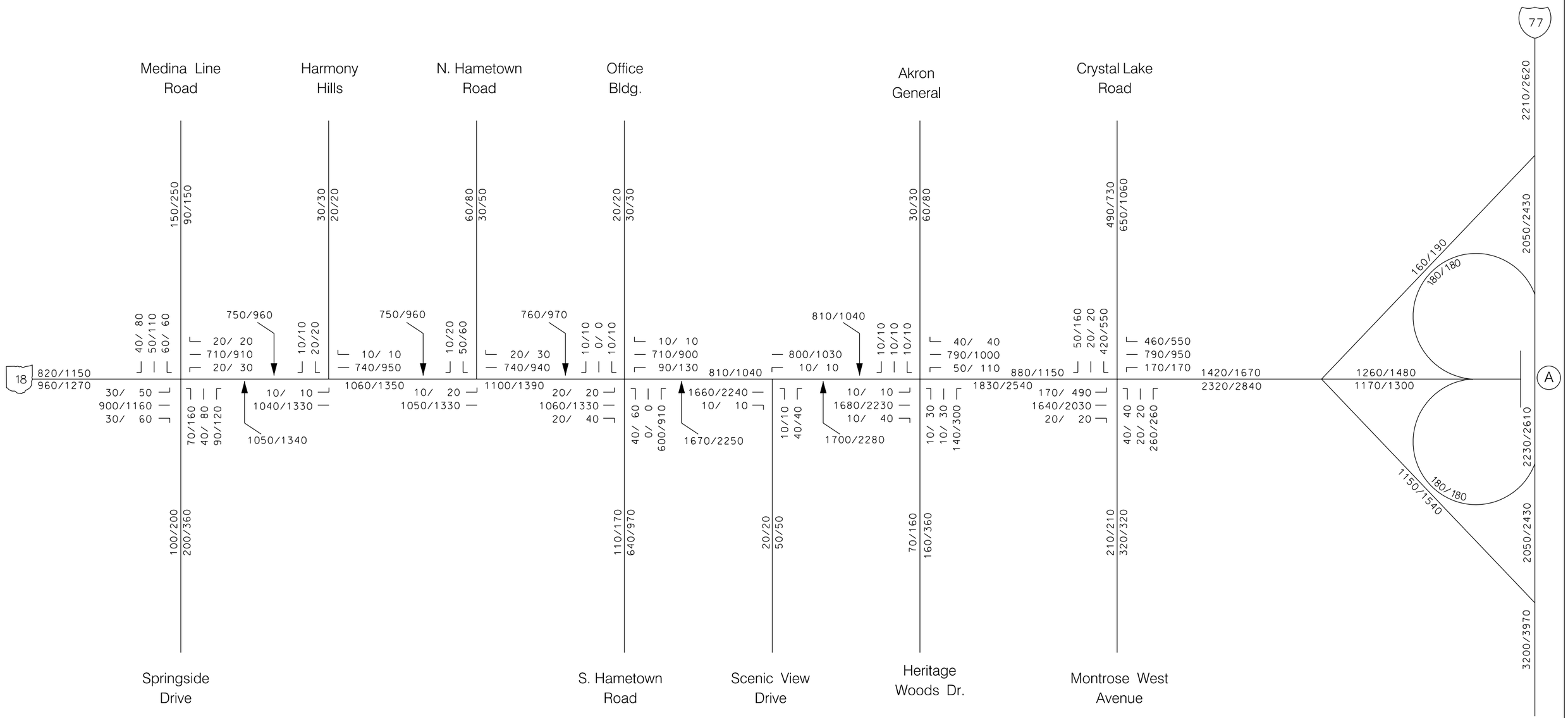
If you have any questions, please contact me at (614) 752-5734.

PS:ps

c: L. Oesterling, OTS – File

SUM–18–Corridor Study
PID 77749
PLATE 1 OF 4

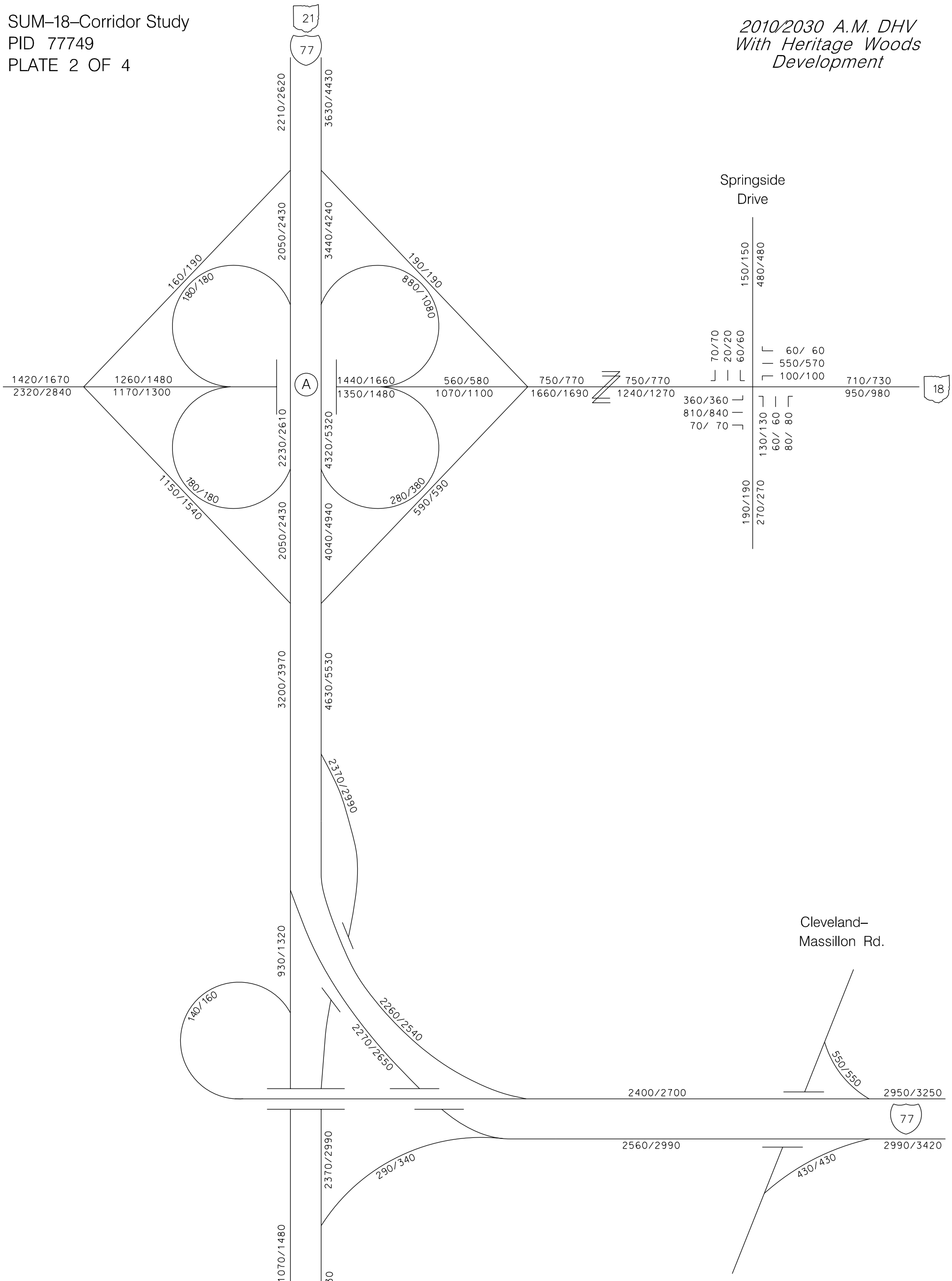
2010/2030 A.M. DHV
With Heritage Woods
Development



SUM–18–Corridor Study PID 77749	
2010/2030 A.M./P.M. DHV	
OHIO DEPARTMENT OF TRANSPORTATION	
OFFICE OF TECHNICAL SERVICES	
SEPTEMBER 23, 2008	NOT TO SCALE

SUM–18–Corridor Study
PID 77749
PLATE 2 OF 4

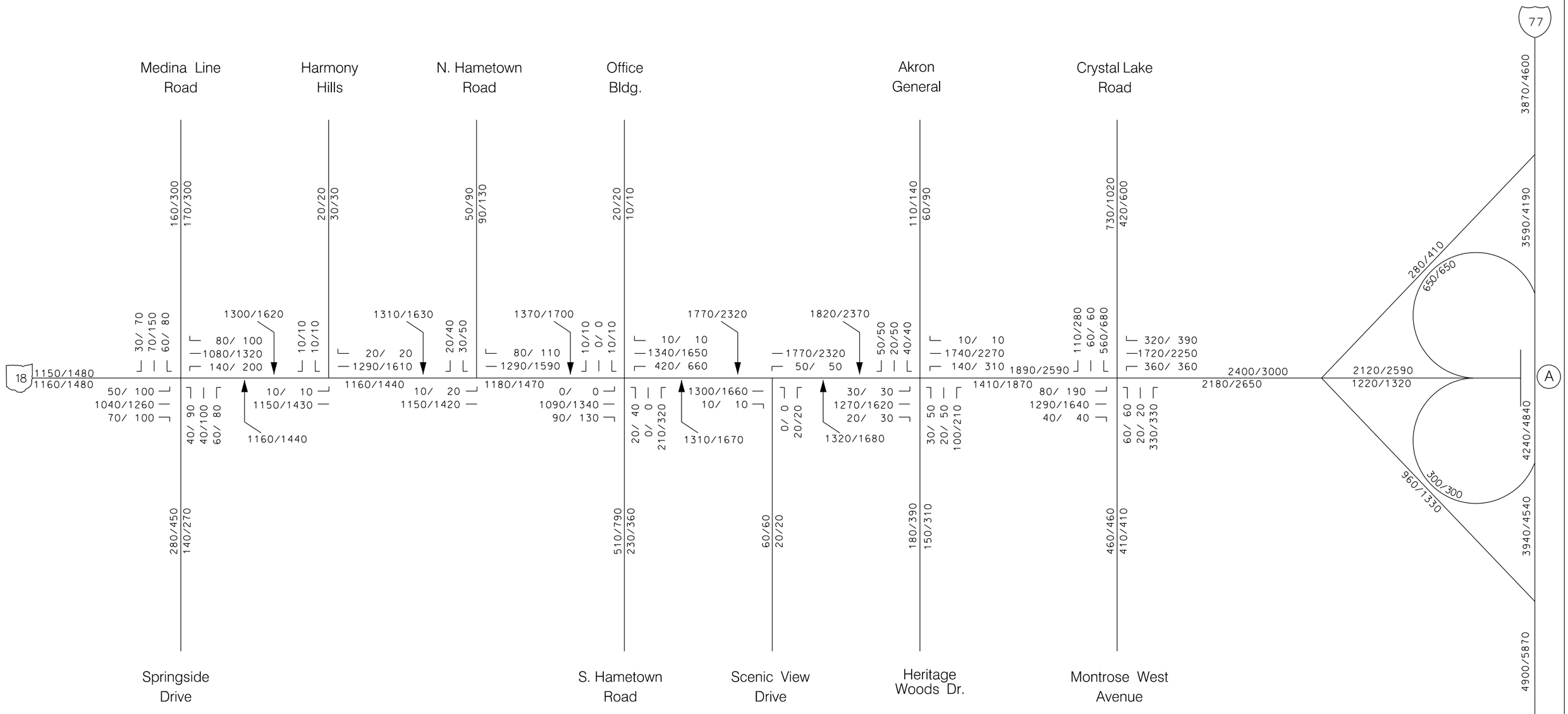
2010/2030 A.M. DHV
With Heritage Woods
Development



SUM–18–Corridor Study PID 77749	
2010/2030 A.M./P.M. DHV	
OHIO DEPARTMENT OF TRANSPORTATION	
OFFICE OF TECHNICAL SERVICES	
SEPTEMBER 23, 2008	NOT TO SCALE

SUM–18–Corridor Study
PID 77749
PLATE 3 OF 4

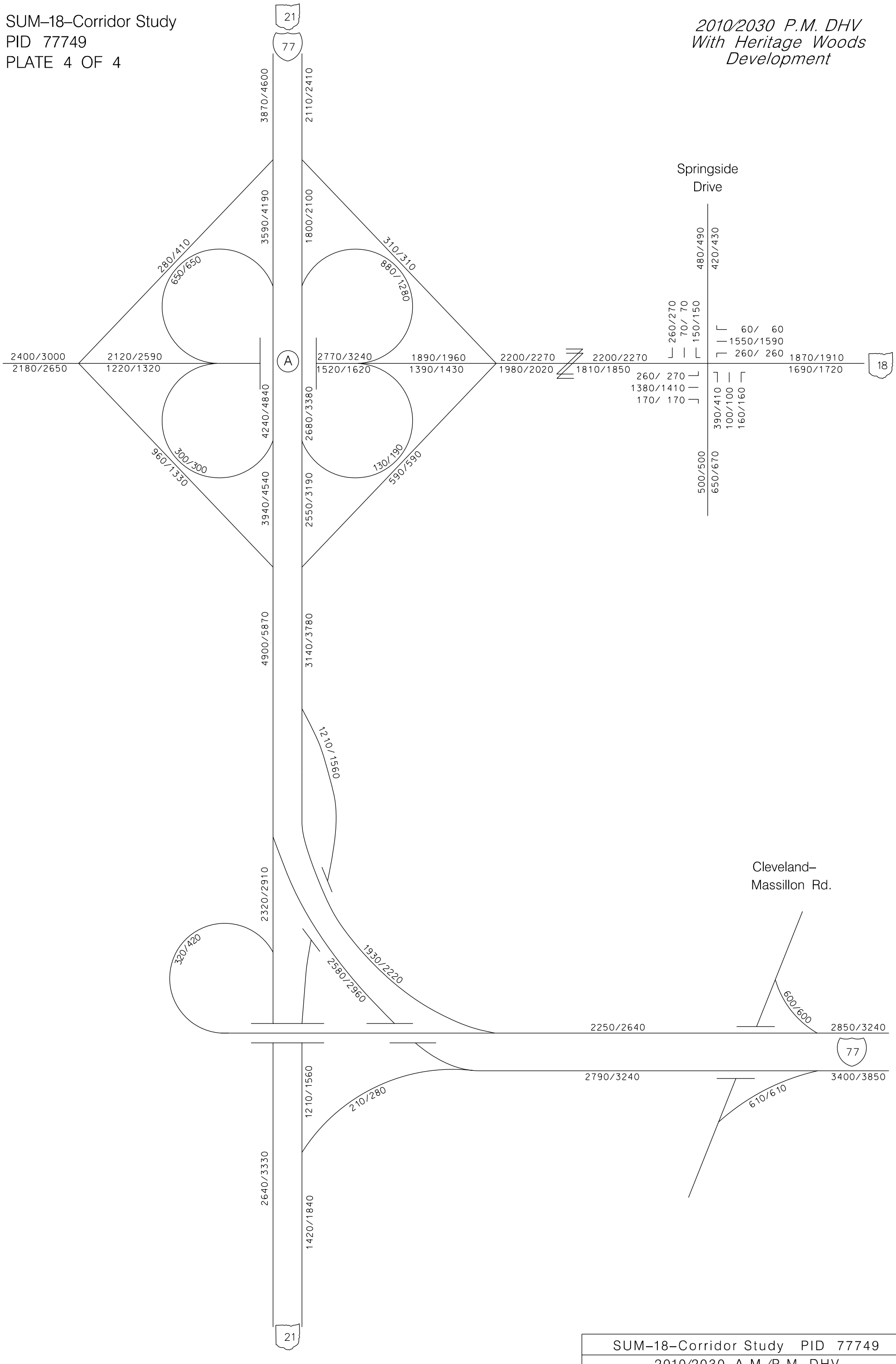
2010/2030 P.M. DHV
With Heritage Woods
Development



SUM–18–Corridor Study PID 77749	
2010/2030 A.M./P.M. DHV	
OHIO DEPARTMENT OF TRANSPORTATION	
OFFICE OF TECHNICAL SERVICES	
SEPTEMBER 23, 2008	NOT TO SCALE

SUM–18–Corridor Study
PID 77749
PLATE 4 OF 4

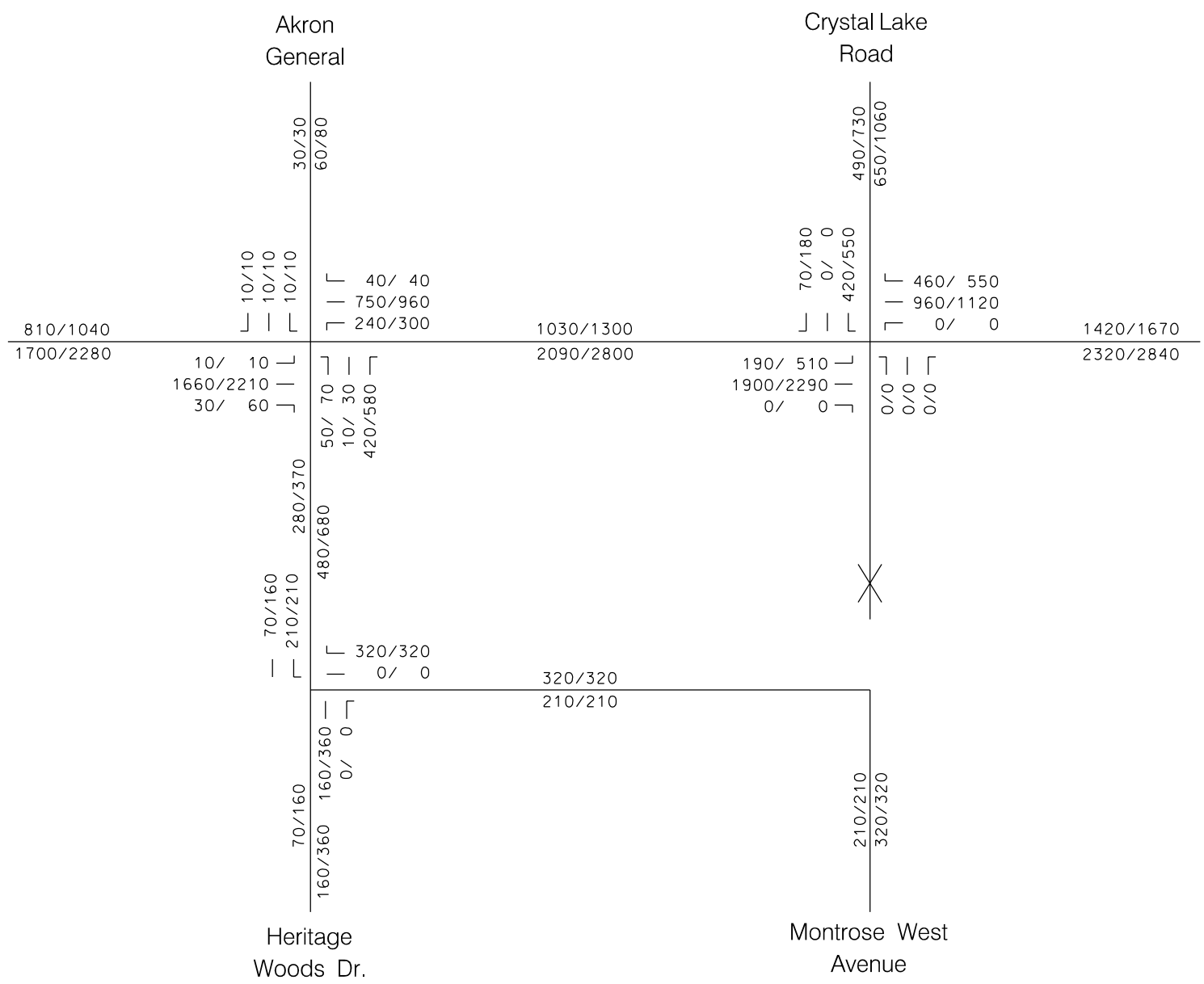
2010/2030 P.M. DHV With Heritage Woods Development



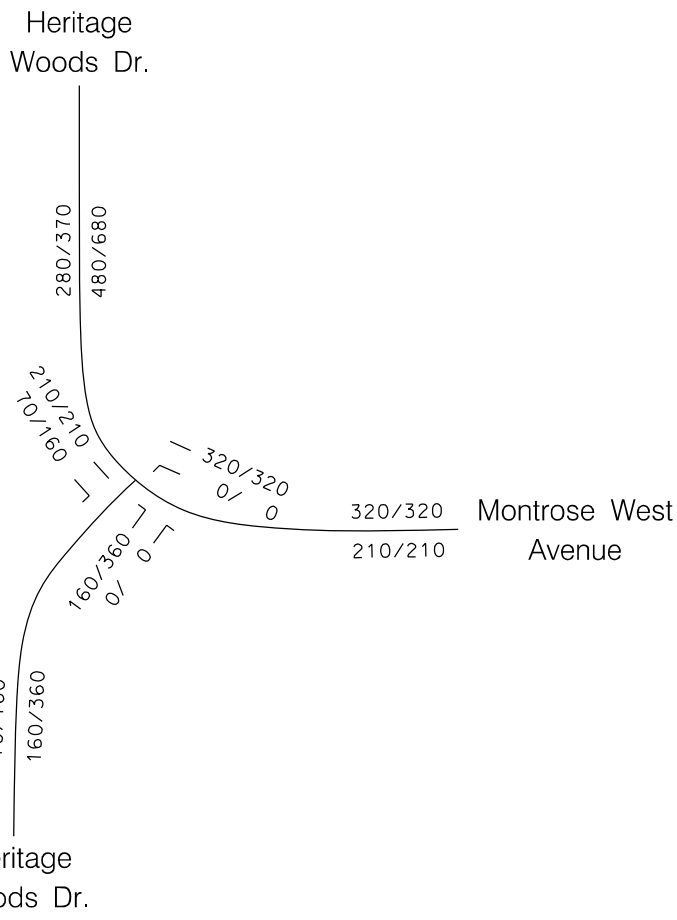
SUM–18–Corridor Study PID 77749	
2010/2030 A.M./P.M. DHV	
OHIO DEPARTMENT OF TRANSPORTATION	
OFFICE OF TECHNICAL SERVICES	
SEPTEMBER 23, 2008	NOT TO SCALE

RELOCATE MONTROSE WEST
TO HERITAGE WOODS
PLATE 1 OF 2

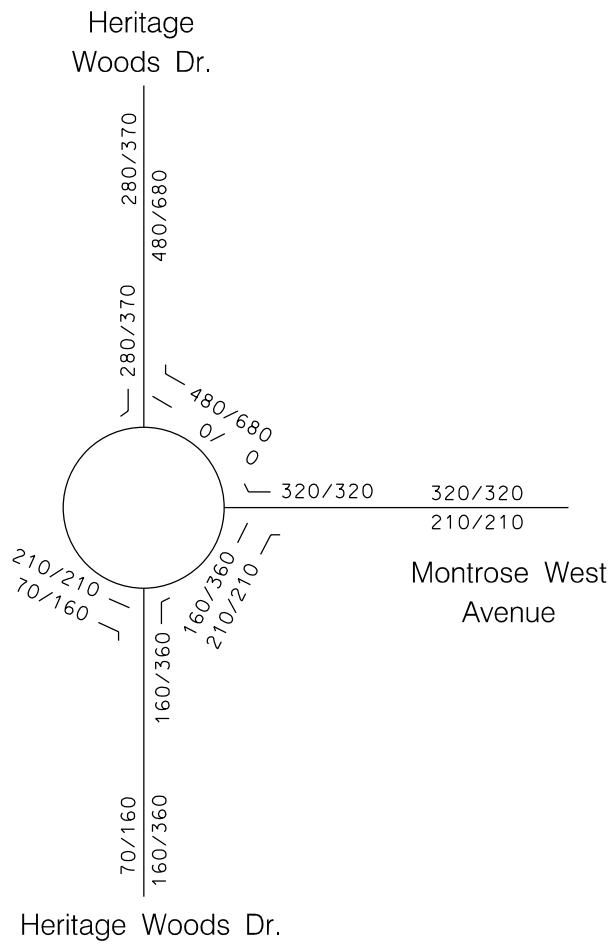
2010/2030 A.M. DHV
With Heritage Woods
Development and
Relocation of Montrose West



Option 1 Intersection Configuration



Option 2 Intersection Configuration

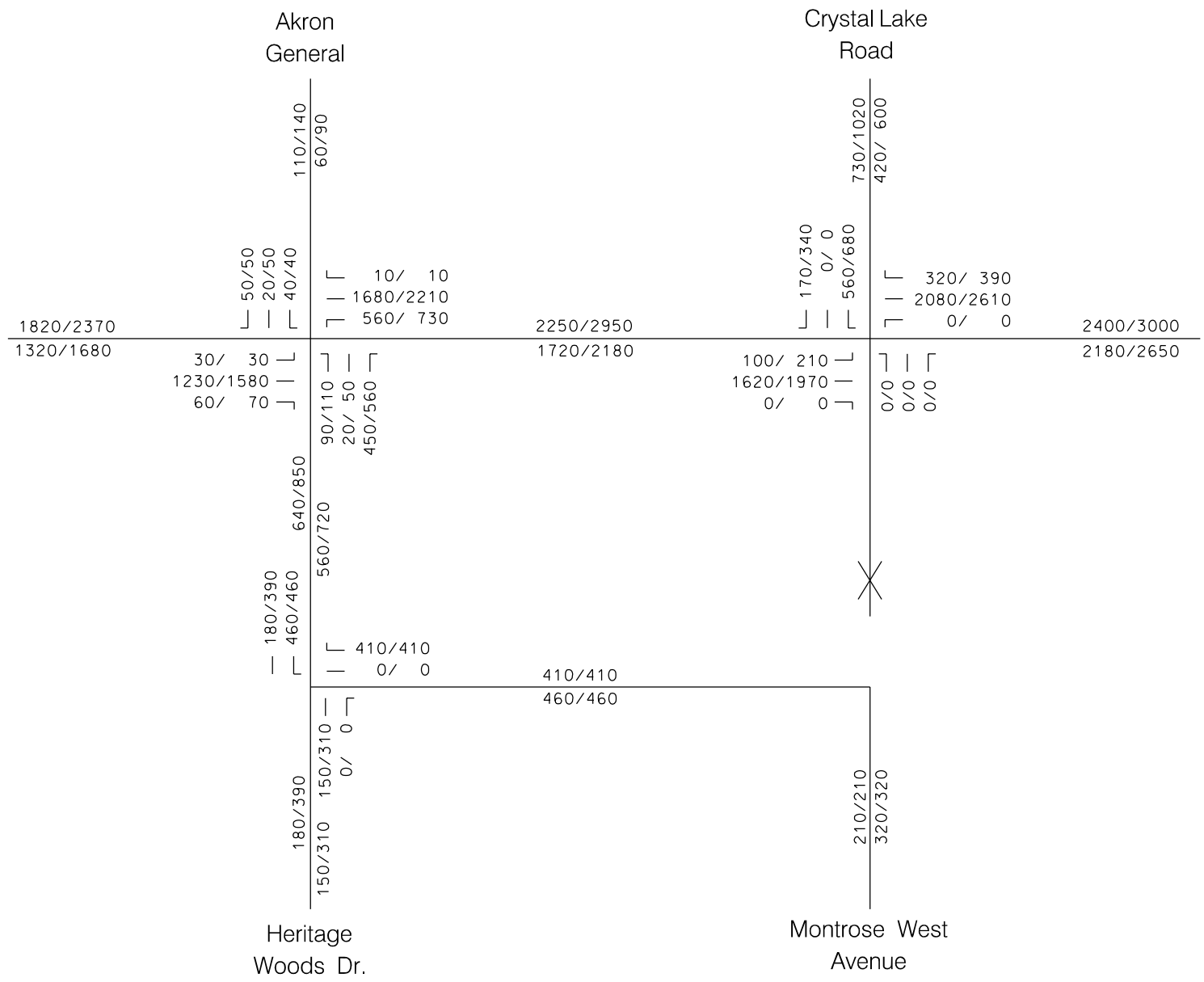


Option 3 Intersection Configuration

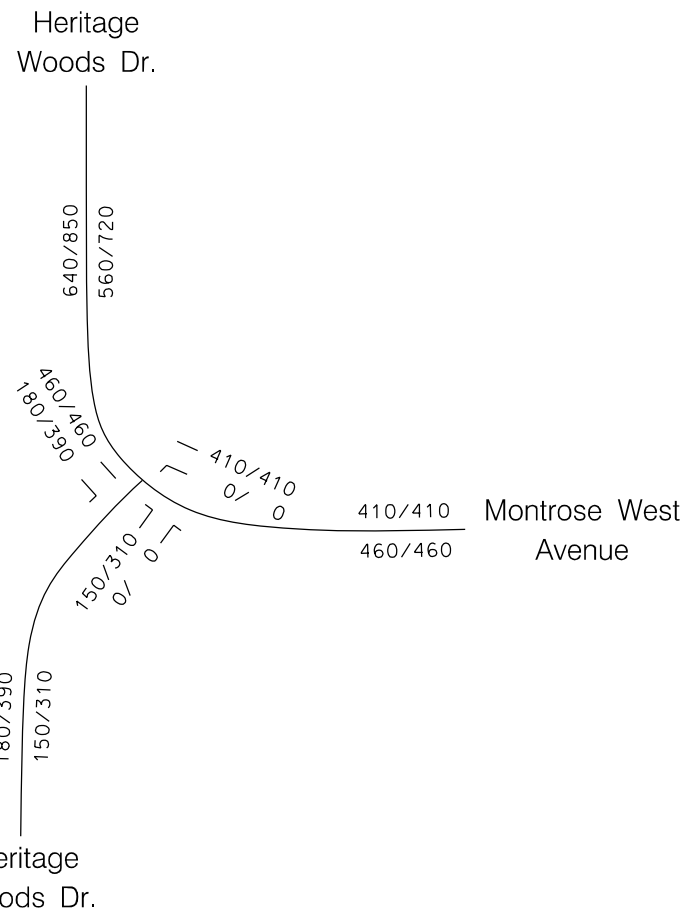
RELOCATE MONTROSE WEST	
2010/2030 A.M./P.M. DHV	
OHIO DEPARTMENT OF TRANSPORTATION	
OFFICE OF TECHNICAL SERVICES	
SEPTEMBER 23, 2008	NOT TO SCALE

RELOCATE MONTROSE WEST
TO HERITAGE WOODS
PLATE 2 OF 2

2010/2030 P.M. DHV
With Heritage Woods
Development and
Relocation of Montrose West



Option 1 Intersection Configuration



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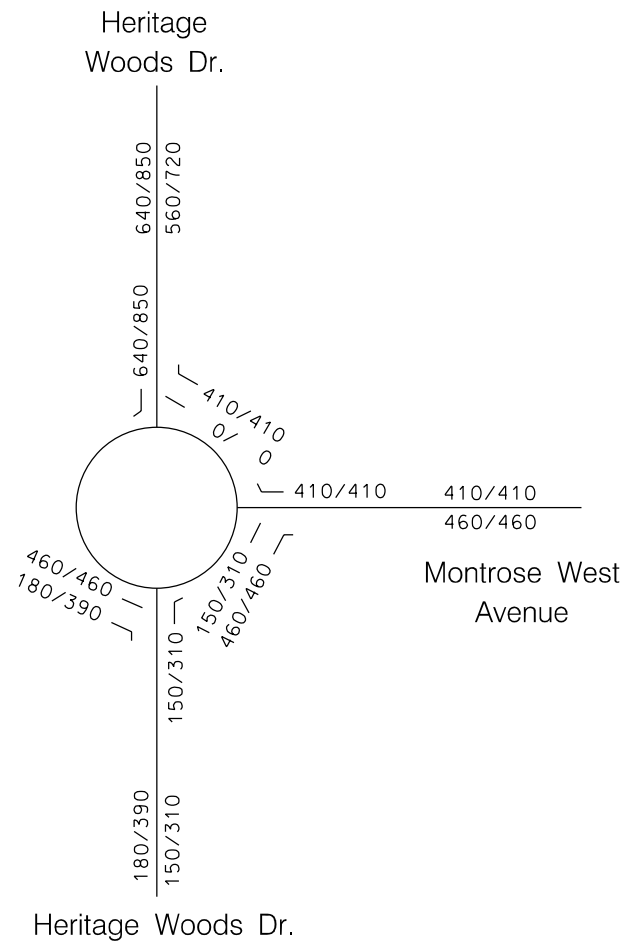


Option 3 Intersection Configuration

RELOCATE MONTROSE WEST	
2010/2030 A.M./P.M. DHV	
OHIO DEPARTMENT OF TRANSPORTATION	
OFFICE OF TECHNICAL SERVICES	
SEPTEMBER 23, 2008	NOT TO SCALE

INTER-OFFICE COMMUNICATION

TO: Joe Defuria, District 4

FROM: Leigh A. Oesterling, Transportation Planner, Office of Technical Services

SUBJECT: SUM-18-Corridor Study, PID 77749

DATE: February 10, 2006

In reply to a request dated January 20, 2006, attached is a set of plates showing 2010 and 2030 AM DHVs and PM DHVs, and the requested turning movement volumes for the subject project.

Please use the following design designations and truck factors:

	IR 77 north of SR 18	IR 77 north of SR 21	IR 77 south of SR 21	IR 77 south of Cleveland-Massillon Rd	SR 18 east of IR 77	SR 18 east of Springside Dr
2010 ADT:	55640	78060	50780	64280	41460	32940
2030 ADT:	69200	95680	58460	71960	41460	32940
K:	0.11	0.10	0.10	0.10	0.10	0.11
D:	0.64	0.61	0.55	0.55	0.52	0.52
T24:	0.11	0.11	0.10	0.09	0.03	0.03
TD A.M.:	0.06	0.06	0.06	0.05	0.02	0.02
TD P.M.:	0.06	0.06	0.06	0.05	0.02	0.02

	SR 18 west of IR 77	SR 18 west of Crystal Lake	SR 18 west of Heritage	SR 18 west of N. Hametown	SR 18 west of Medina Line	SR 21 south of IR 77
2010 ADT:	50670	36440	34560	27110	25300	35360
2030 ADT:	59780	46200	42900	33560	32330	46840
K:	0.09	0.09	0.09	0.09	0.09	0.11
D:	0.53	0.58	0.58	0.53	0.50	0.65
T24:	0.05	0.05	0.06	0.08	0.09	0.10
TD A.M.:	0.03	0.03	0.04	0.05	0.05	0.06
TD P.M.:	0.03	0.03	0.04	0.05	0.05	0.06

IR 77 & SR 18 RAMPS

	SB-WB	SB-EB	NB-EB	NB-WB	EB-SB	EB-NB	WB-NB	WB-SB
TD A.M.:	0.07	0.08	0.03	0.12	0.07	0.04	0.03	0.04
TD P.M.:	0.02	0.04	0.02	0.07	0.07	0.03	0.02	0.04

IR 77 & SR 21 RAMPS

	77 SB to 21 SB	77 NB to 21 SB	21 NB to 77 SB	21 NB to 77 NB
TD A.M.:	0.03	0.02	0.03	0.06
TD P.M.:	0.03	0.02	0.02	0.06

IR 77 & CLEVELAND-MASSILLON RD RAMPS

	77 NB to Clev-Mass Rd	Cleve-Mass Rd to 77SB
TD A.M.:	0.04	0.03
TD P.M.:	0.03	0.02

	All other locations
TD A.M.:	0.02
TD P.M.:	0.02

If you have any questions, please contact me at (614) 752-5747.

LAO:lo

c: J. McQuirt, OTS–P. Siddle, OTS–B. Schafer, D-4–File

Intersection: 25: Crystal Lake & , Interval #1

Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	T	R	L	LR
Maximum Queue (ft)	284	326	116	140	442	428	412	150	311	345
Average Queue (ft)	227	87	86	111	263	304	330	123	224	263
95th Queue (ft)	291	251	125	136	401	427	432	206	305	350
Link Distance (ft)		608	608	608	1344	1344	1344		2638	2638
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	260							125		
Storage Blk Time (%)	8						26	8		
Queuing Penalty (veh)	62						139	28		

Intersection: 25: Crystal Lake & , Interval #2

Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	T	R	L	LR
Maximum Queue (ft)	284	355	98	165	784	1147	1243	150	396	454
Average Queue (ft)	282	221	77	106	478	616	698	111	225	289
95th Queue (ft)	287	453	100	150	836	1172	1355	212	362	434
Link Distance (ft)		608	608	608	1344	1344	1344		2638	2638
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	260							125		
Storage Blk Time (%)	28						44	13		
Queuing Penalty (veh)	239						270	54		

Intersection: 25: Crystal Lake & , Interval #3

Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	T	R	L	LR
Maximum Queue (ft)	284	417	124	138	999	1370	1359	150	456	448
Average Queue (ft)	259	202	94	105	823	1140	1339	90	325	353
95th Queue (ft)	297	442	123	146	1055	1541	1384	171	524	500
Link Distance (ft)		608	608	608	1344	1344	1344		2638	2638
Upstream Blk Time (%)						5	22			
Queuing Penalty (veh)						0	0			
Storage Bay Dist (ft)	260							125		
Storage Blk Time (%)	15						50	5		
Queuing Penalty (veh)	110						263	18		

Intersection: 25: Crystal Lake & , Interval #4

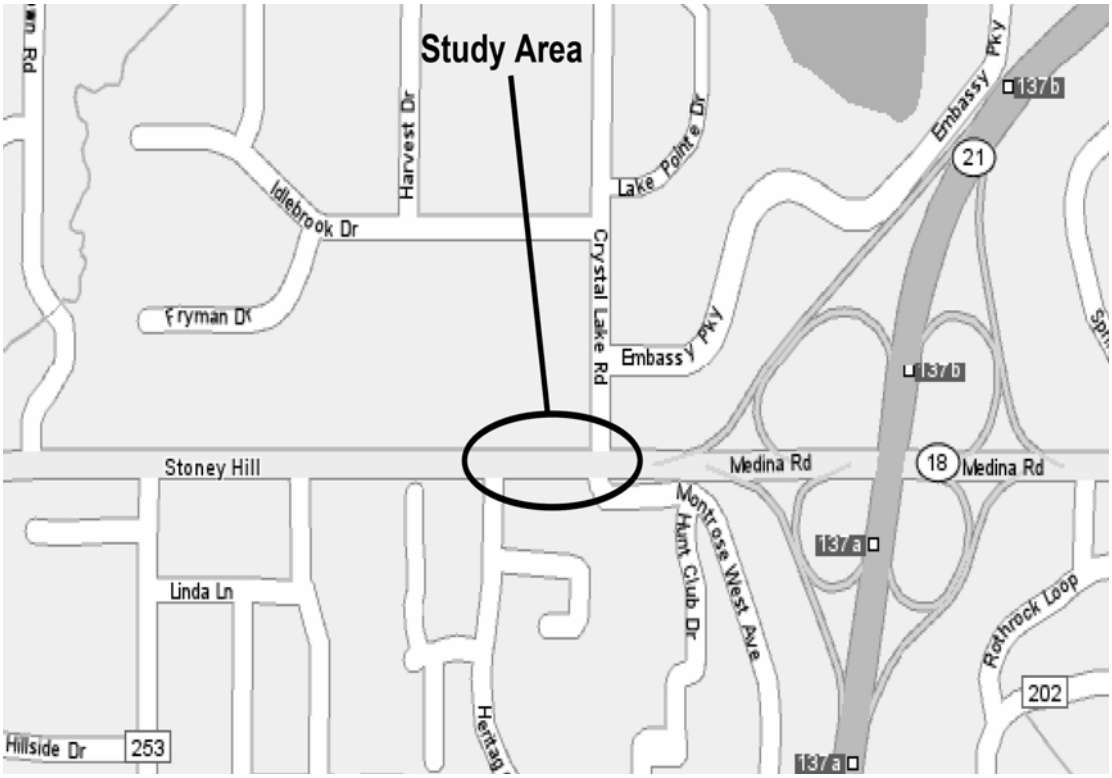
Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	T	R	L	LR
Maximum Queue (ft)	284	356	332	119	801	1330	1357	150	350	384
Average Queue (ft)	280	299	155	110	698	843	1071	149	241	289
95th Queue (ft)	288	467	335	125	857	1191	1388	151	377	396
Link Distance (ft)		608	608	608	1344	1344	1344		2638	2638
Upstream Blk Time (%)						0	1			
Queuing Penalty (veh)						0	0			
Storage Bay Dist (ft)	260							125		
Storage Blk Time (%)	26						48	16		
Queuing Penalty (veh)	193						253	59		

Intersection: 25: Crystal Lake & , All Intervals

Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	T	R	L	LR
Maximum Queue (ft)	284	417	332	165	999	1370	1359	150	456	454
Average Queue (ft)	262	202	103	108	565	726	860	118	254	299
95th Queue (ft)	314	442	209	142	991	1364	1589	203	414	434
Link Distance (ft)		608	608	608	1344	1344	1344		2638	2638
Upstream Blk Time (%)						1	6			
Queuing Penalty (veh)						0	0			
Storage Bay Dist (ft)	260							125		
Storage Blk Time (%)	19						42	11		
Queuing Penalty (veh)	151						231	40		

S.R. 18 & MONTROSE WEST AVE. / CRYSTAL LAKE ROAD
SUM 18 at Crystal Lake #1207 HSP Intersection for 2005
SUM 18, 1.69 to 2.05, #1417 HSP Non-Freeway Section for 2005
SUM 18 2.00 to 4.00, #93 Hot Spot Section for 2005

SAFETY STUDY



Prepared for:
ODOT District 4
April, 2007

BURGESS & NIPLE
50 South Main Street
Suit 600
Akron, Ohio 44308

Table of Contents

List of Figures

List of Tables

1.0 Executive Summary

The Montrose West Ave. / Crystal Lake Rd. and S.R. 18 intersection is located in Summit County, in Copley and Bath Townships. Montrose West Ave. / Crystal Lake Road has a north-south orientation and is classified as a 2-lane urban local road. S.R. 18 is oriented east-west and is classified as a 5-lane urban principal arterial. The intersection is signalized with protected / permissive left-turn phasing for S.R. 18 with the northbound and southbound phases being split. The northbound approach consists of a right turn lane and a thru-left lane. The southbound approach consists of a thru-right lane and two left turn lanes. The westbound approach consists of two thru lanes a right turn lane and a left turn lane. The eastbound approach consists of two thru lanes and a left turn lane. The intersection is surrounded by a mixed commercial, business, and residential area and is within close proximity to the S.R. 18 / IR 77 interchange. The northeast corner is developed with an office building. The northwest corner is developed with a large wellness center. Although the southern corners are undeveloped, Montrose West Avenue is developed with retail business in close proximity to the intersection. The intersection has an AADT of 49,846 vehicles, and has experienced 79 crashes in the three year analysis, for a crash rate of 1.45

The crash analysis revealed two distinct crash patterns at this intersection.
The first observed pattern was the frequency of rear-end crashes. Rear-end crashes are typical at signalized intersections. This is the most significant pattern of crashes at this intersection (39 of 79). Between 2002 and 2004, 8 of these crashes resulted in injury. The problem is especially distinct on the east and west approaches. Based upon the capacity analysis and field observations, congestion is the most significant factor contributing to the number of rear-end accidents at this location. Countermeasures identified to address the rear end accident problem are to relocate Montrose West Avenue to Heritage Woods, and add capacity to Heritage Woods through additional turn lanes as well as adding capacity to S.R. 18 by adding additional thru lanes.

The second pattern identified was a high number of left-turn crashes. Based on field observations, one to two through vehicles frequently continue through the intersection after the onset of the red, often accelerating in the process. This situation creates a crash hazard with opposing left turning vehicles, which are waiting in the intersection for a gap in traffic. Also, with the volume of opposing through vehicles on each approach, there are very few acceptable gaps during the permissive phase during peak hours of traffic. These two situations indicate that the major contributing factor leading to left-turn crashes is congestion. The countermeasures identified to address this problem are to relocate Montrose West Avenue to Heritage Woods, and add capacity to Heritage Woods through additional turn lanes as well as adding capacity to S.R. 18 by adding additional thru lanes and dual left turn lanes onto Crystal Lake Road and Heritage Woods Drive.

The medium-term recommended improvements are:

- Relocate Montrose West Avenue to Heritage Woods, and add capacity to Heritage Woods through additional turn lanes, as well as adding capacity to S.R. 18 by adding additional thru lanes and dual left turn lanes onto Crystal Lake Road and Heritage Woods Drive.

2.0 Purpose and Background

The Montrose West Ave. / Crystal Lake Rd. and S.R. 18 intersection has an AADT of 49,846 vehicles, and has experienced 79 crashes in the three year analysis, for a crash rate of 1.45. The purpose of this study is to analyze crash patterns and determine appropriate countermeasures to enhance the safety of this intersection in relation to the overall S.R. 18 corridor.

The intersection is located in Summit County, in Copley and Bath Townships. Montrose West Ave. / Crystal Lake Road has a north-south orientation and is classified as a 2-lane urban local road. S.R. 18 is oriented east-west and is classified as a 5-lane urban principal arterial. The intersection is signalized with protected / permissive left-turn phasing for S.R. 18 with the northbound and southbound phases being split. The northbound approach consists of a right turn lane and a thru-left lane. The southbound approach consists of a thru-right lane and two left turn lanes. The westbound approach consists of two thru lanes a right turn lane and a left turn lane. The eastbound approach consists of two thru lanes and a left turn lane.

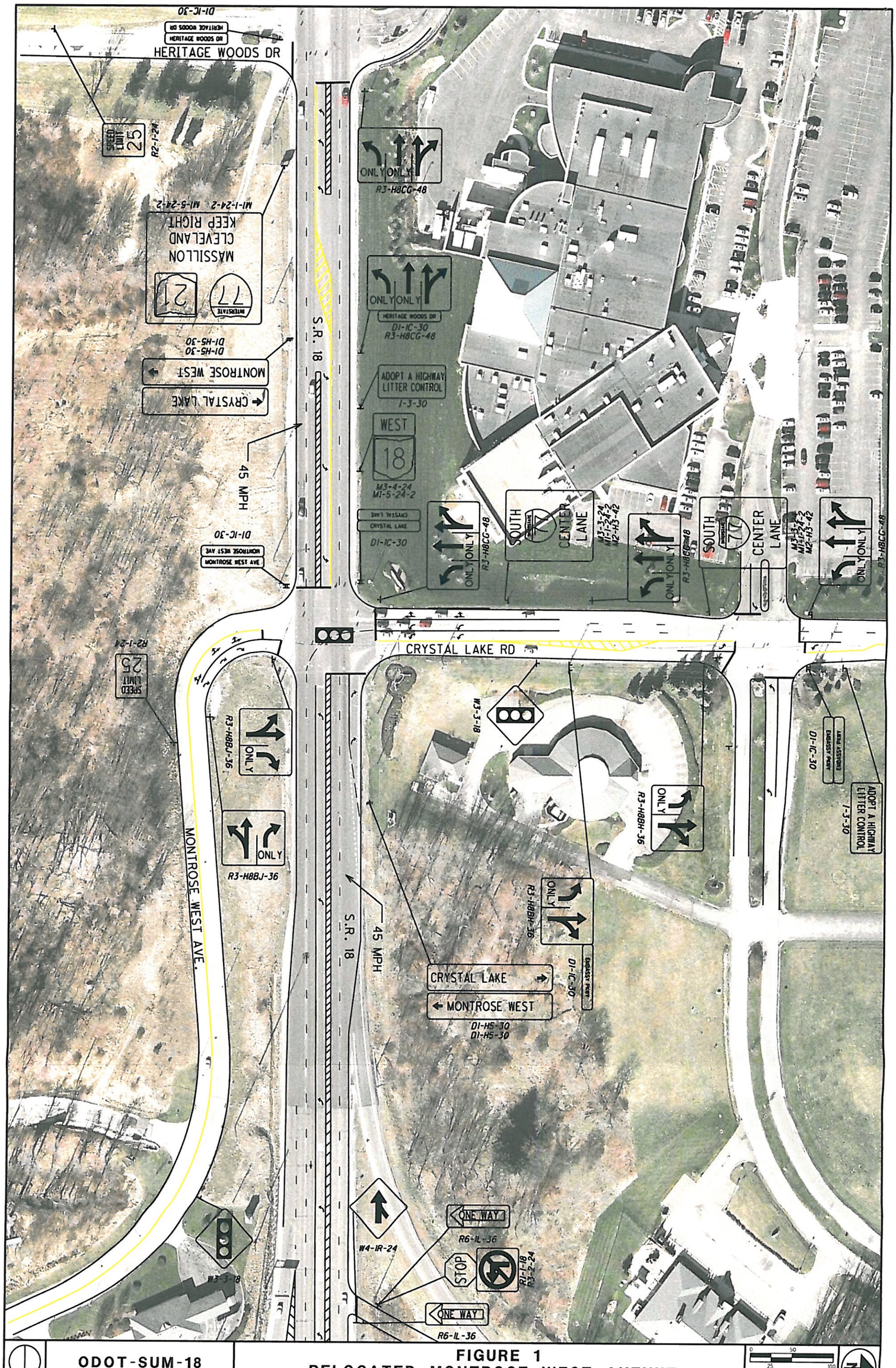
3.0 Existing Conditions

The intersection of Montrose West Ave. / Crystal Lake Rd. and S.R. 18 is in Summit County, in the Townships of Copley and Bath. Montrose West Ave. / Crystal Lake Rd. has a north-south orientation and is classified as a 2-lane urban local road. S.R. 18 is oriented east-west and is classified as a 5-lane urban principal arterial. The intersection is signalized with protected / permissive left-turn phasing for S.R. 18 with the northbound and southbound phases being split. The northbound approach consists of a right turn lane and a thru-left lane. The southbound approach consists of a thru-right lane and two left turn lanes. The westbound approach consist of two thru lanes, a right turn lane and a left turn lane. The eastbound approach consists of two thru lanes, and a left turn lane. The intersection is located in mixed commercial, business, and residential area and is located in close proximity to the S.R. 18 / IR 77 interchange. The northeast corner is developed with an office building. The northwest corner is developed with a large wellness centre. The southwest and southeast corners are undeveloped, however; Montrose West Ave. is developed with retail business in close proximity to the intersection. The intersection has an AADT of 49,846 vehicles, and has experienced 58 crashes in the three year analysis, for a crash rate of 1.45.

The AM peak hour volumes are larger eastbound than westbound due to the large morning commute traffic from the residents of Copley and Bath townships and well

as Medina County. The AM peak hour volumes for the intersection in the eastbound direction are 83 left turning vehicles, 1506 thru vehicles and 17 right turning vehicles. In the westbound direction there are 100 left turning vehicles, 739 thru vehicles, and 414 right turning vehicles. The northbound direction consists of 23 left turning vehicles, 13 thru vehicles, and 257 right turning vehicles. The southbound direction consists of 349 left turning vehicles, 15 thru vehicles and 15 right turning vehicles.

The PM peak hour volumes are larger westbound than eastbound due to the large evening commute home for the residents of Copley and Bath townships as well as Medina County. The traffic in the eastbound direction consists of 57 left turning vehicles, 1222 thru vehicles and 46 right turning vehicles. In the westbound direction there are 368 left turning vehicles, 1529 thru vehicles, and 302 right turning vehicles. The northbound direction consists of 58 left turning vehicles, 23 thru vehicles, and 317 right turning vehicles. The southbound direction consists of 529 left turning vehicles, 75 thru vehicles and 74 right turning vehicles.


HERITAGE WOODS DR
D1-IC-30
SPEED LIMIT 25
R2-1-24
MI-1-24-2 MI-5-24-2
MASSILLON
CLEVELAND
KEEP RIGHT
77
21
INTERSTATE
D1-H5-30
MONTROSE WEST
CRYSTAL LAKE
S.R. 18
45 MPH
D1-IC-30
MONTROSE WEST AVE
R3-H8CG-48
ONLY
ONLY
HERITAGE WOODS DR
D1-IC-30
R3-H8CG-48
ADOPT A HIGHWAY
LITTER CONTROL
I-3-30
WEST
18
M3-4-24
M1-5-24-2
CRYSTAL LAKE
D1-IC-30
SOUTH
CENTER
LANE
M3-3-24
M1-1-24-2
M2-H3-42
R3-H8CG-48
CRYSTAL LAKE RD
R2-1-24
SPEED LIMIT 25
MONTROSE WEST AVE.
R3-H8BJ-36
ONLY
R3-H8BJ-36
S.R. 18
45 MPH
M3-3-18
R3-H8BH-36
ONLY
D1-IC-30
EMBASSY PKWY
ADOPT A HIGHWAY
LITTER CONTROL
I-3-30
CRYSTAL LAKE
MONTROSE WEST
D1-H5-30
D1-H5-30
W4-IR-24
ONE WAY
R6-IL-36
STOP
R1-1-18
R3-2-24
ONE WAY
R6-IL-36
M3-3-18
ODOT-SUM-18
FIGURE 1
RELOCATED MONTROSE WEST AVENUE
0 50
25 100
HORIZONTAL
SCALE IN FEET
N

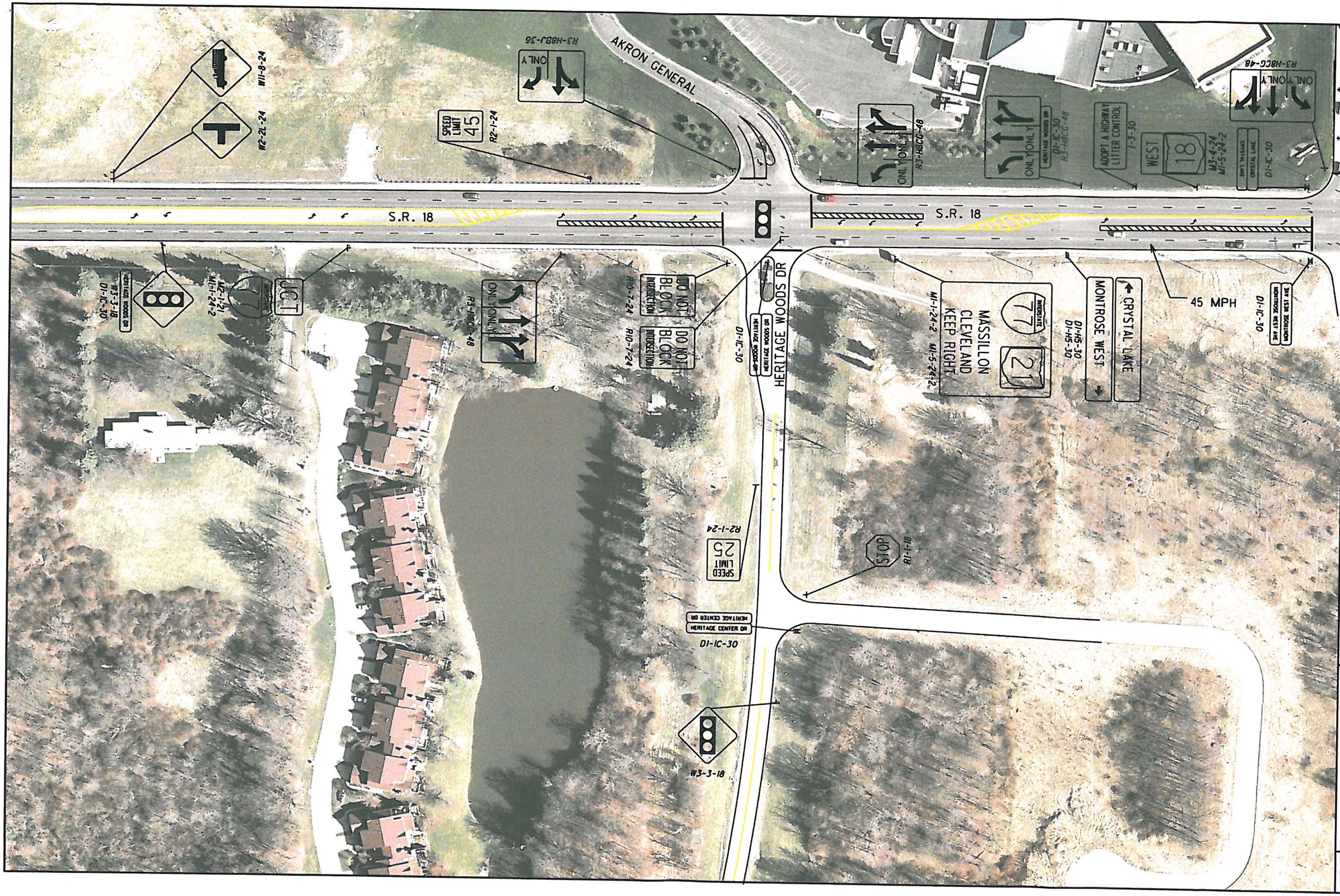


FIGURE 2
HERITAGE WOODS DRIVE EX. CONDITIONS

ODOT-SUM-18

Figure 3 – Peak Hour Turning Movement Volumes

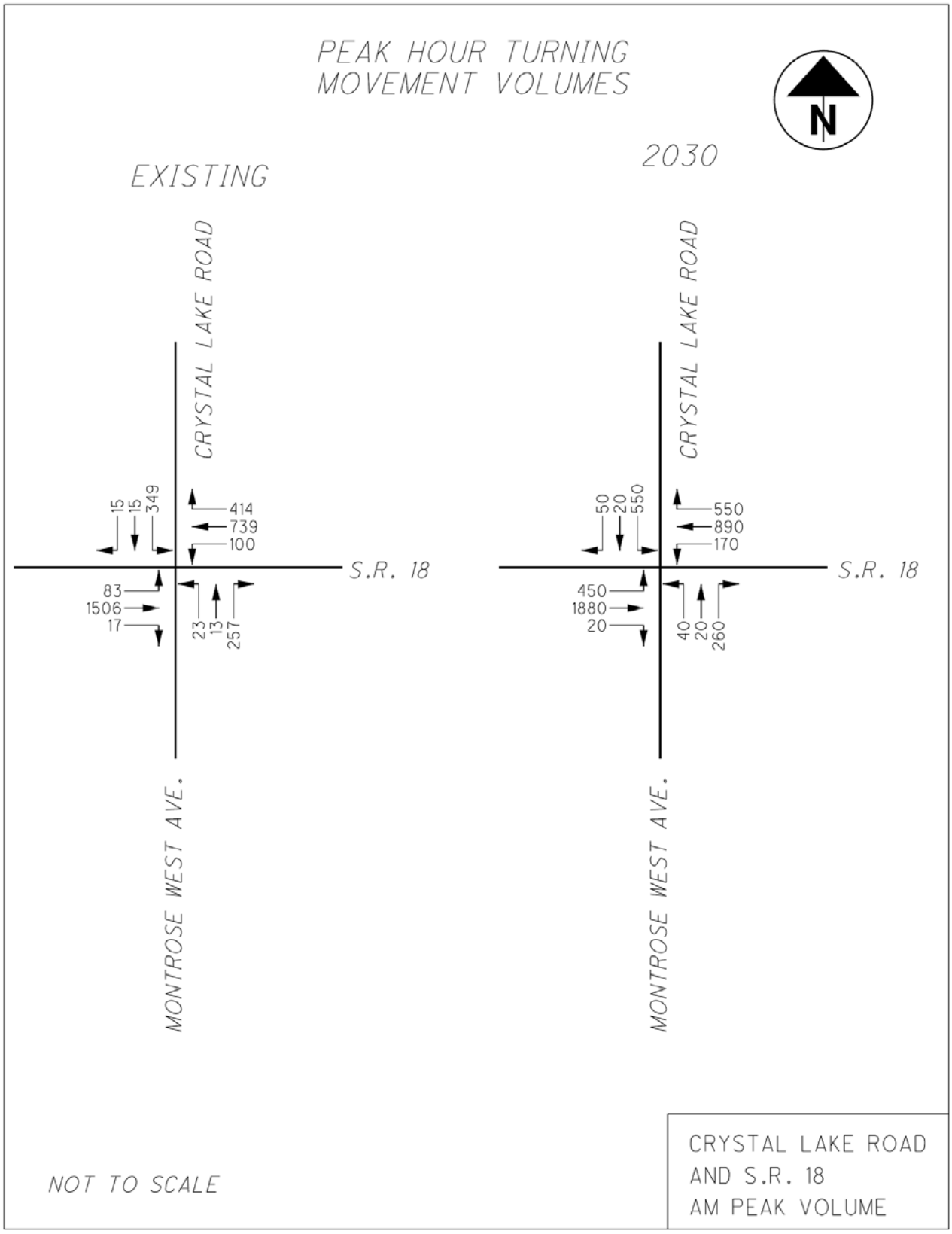


Figure 4 – Peak Hour Turning Movement Volumes

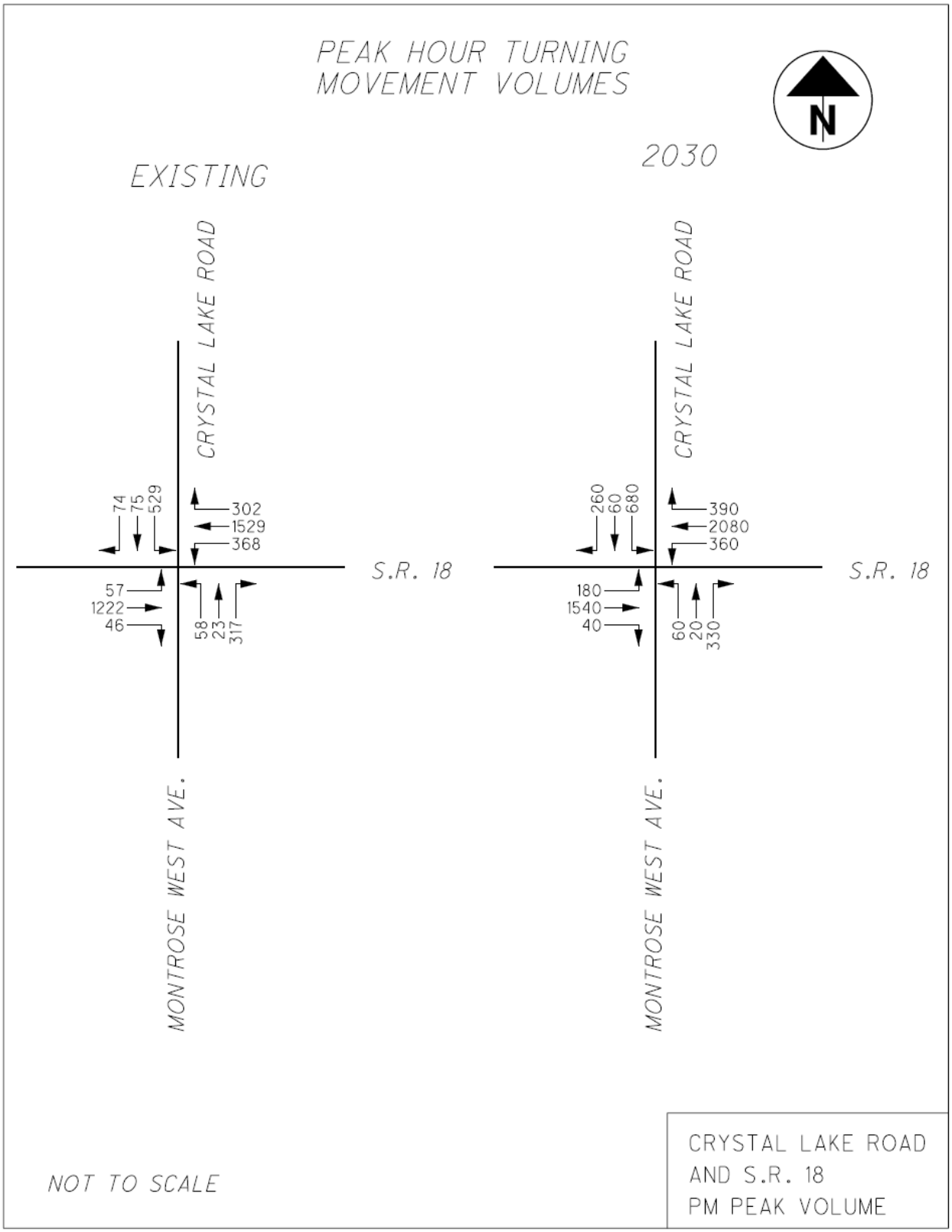


Figure 5 – Peak Hour Turning Movement Volumes

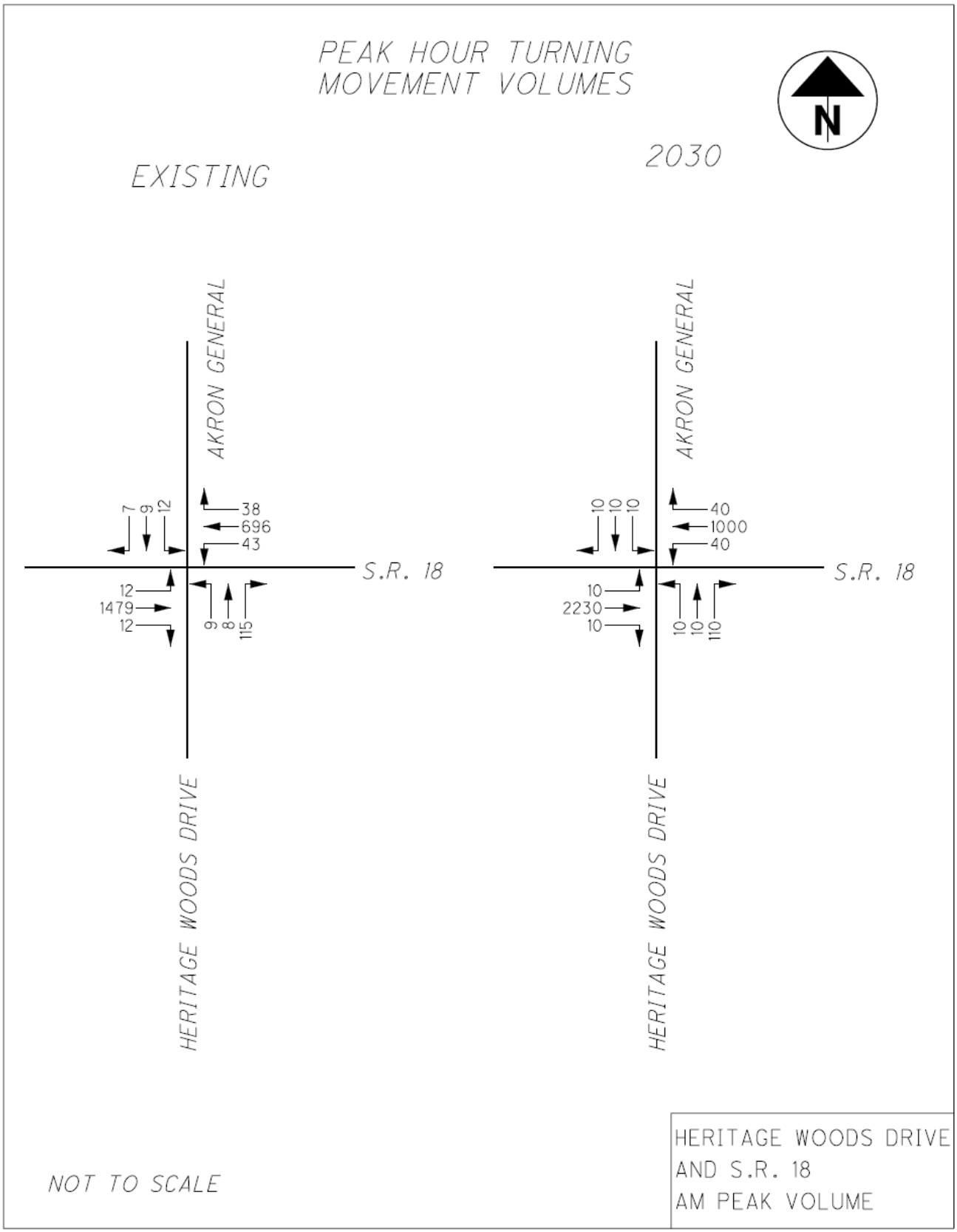
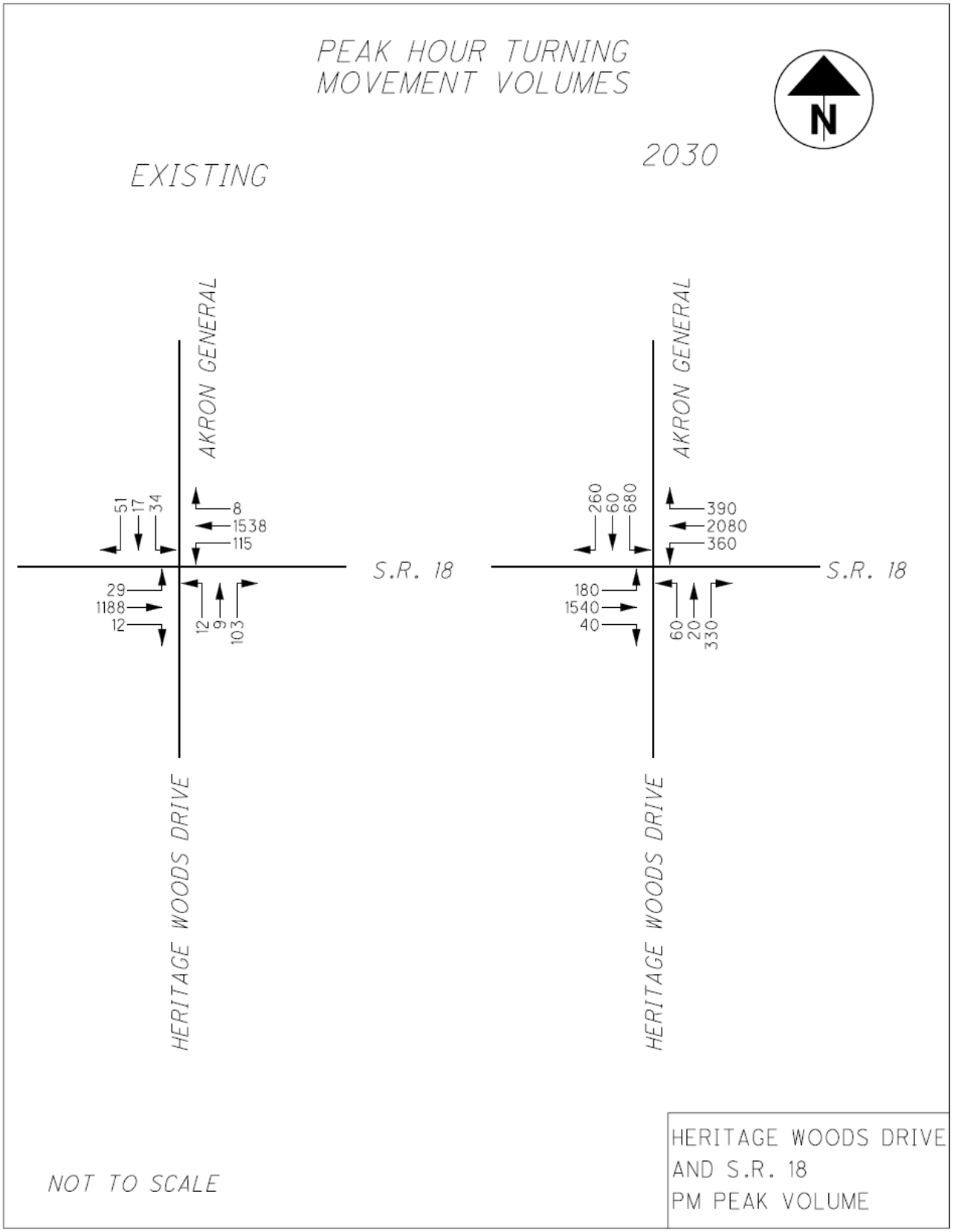


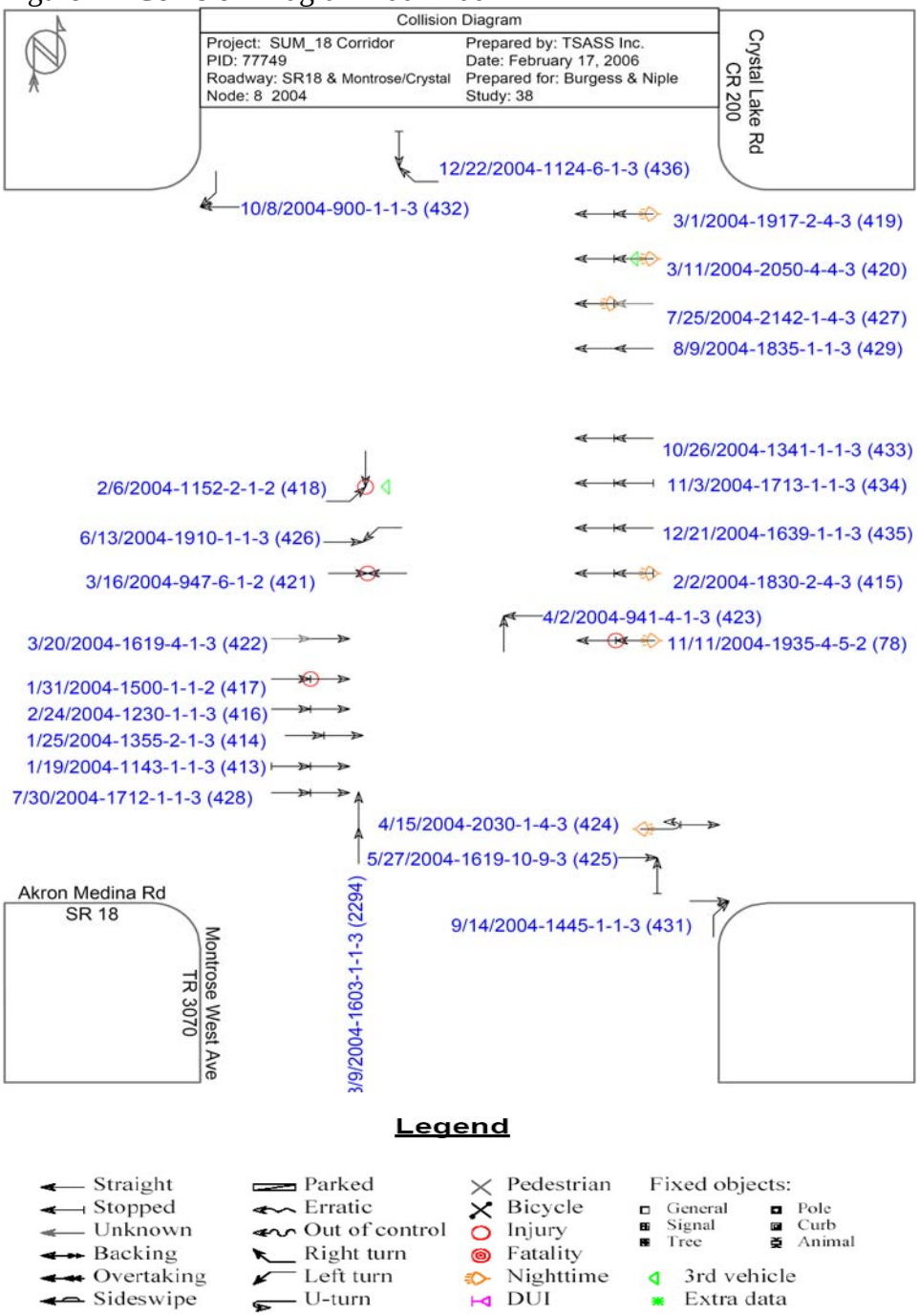
Figure 6 – Peak Hour Turning Movement Volumes

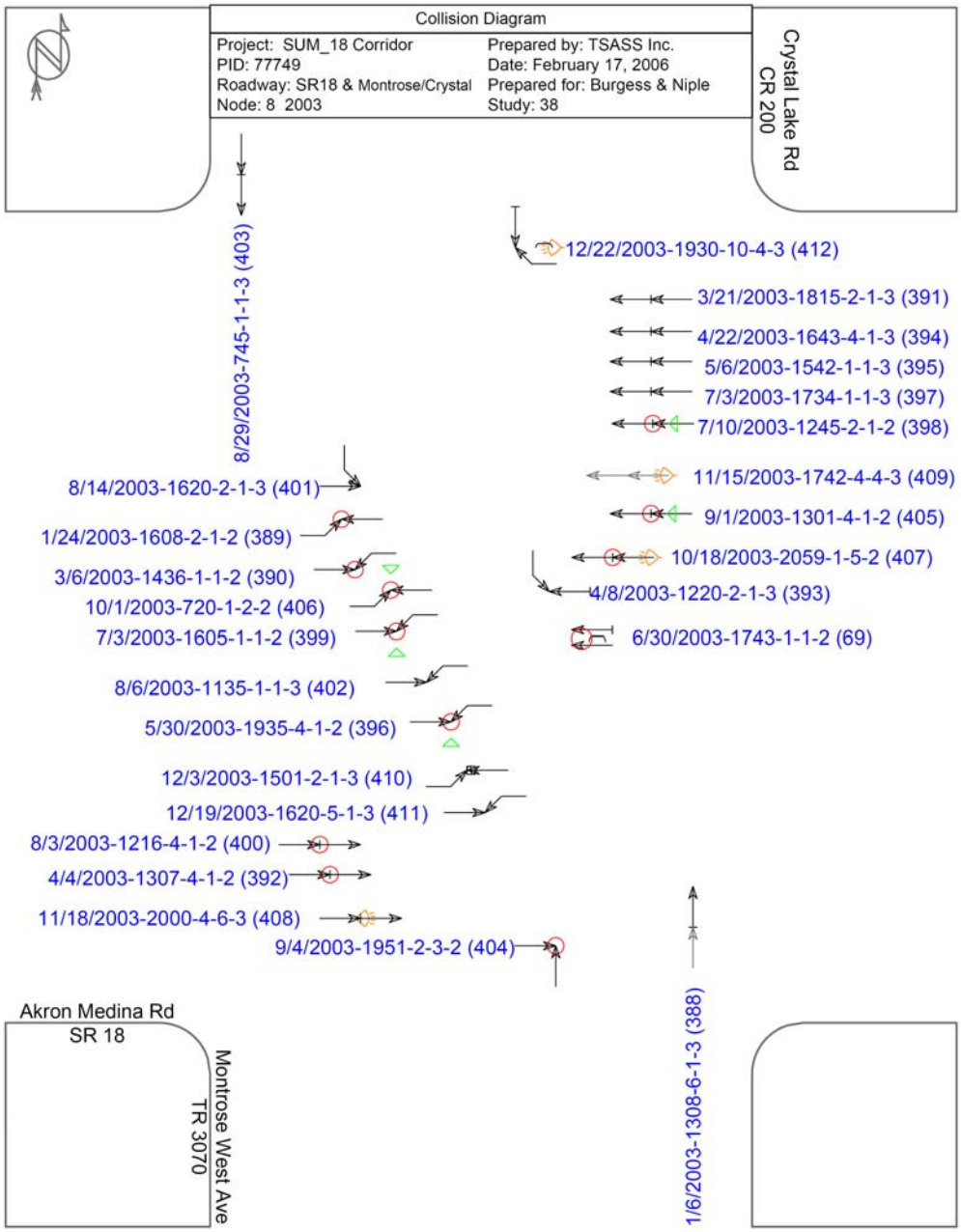


4.0 Crash Data

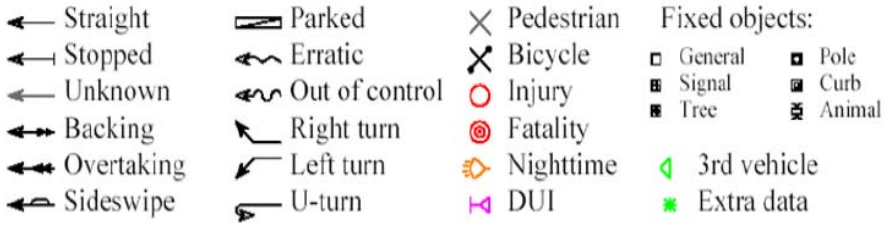
This section of the report includes crash data and summaries used in the crash analysis. The data is presented as Figure 7. Crash data analyzed was from 2002, 2003, and 2004.

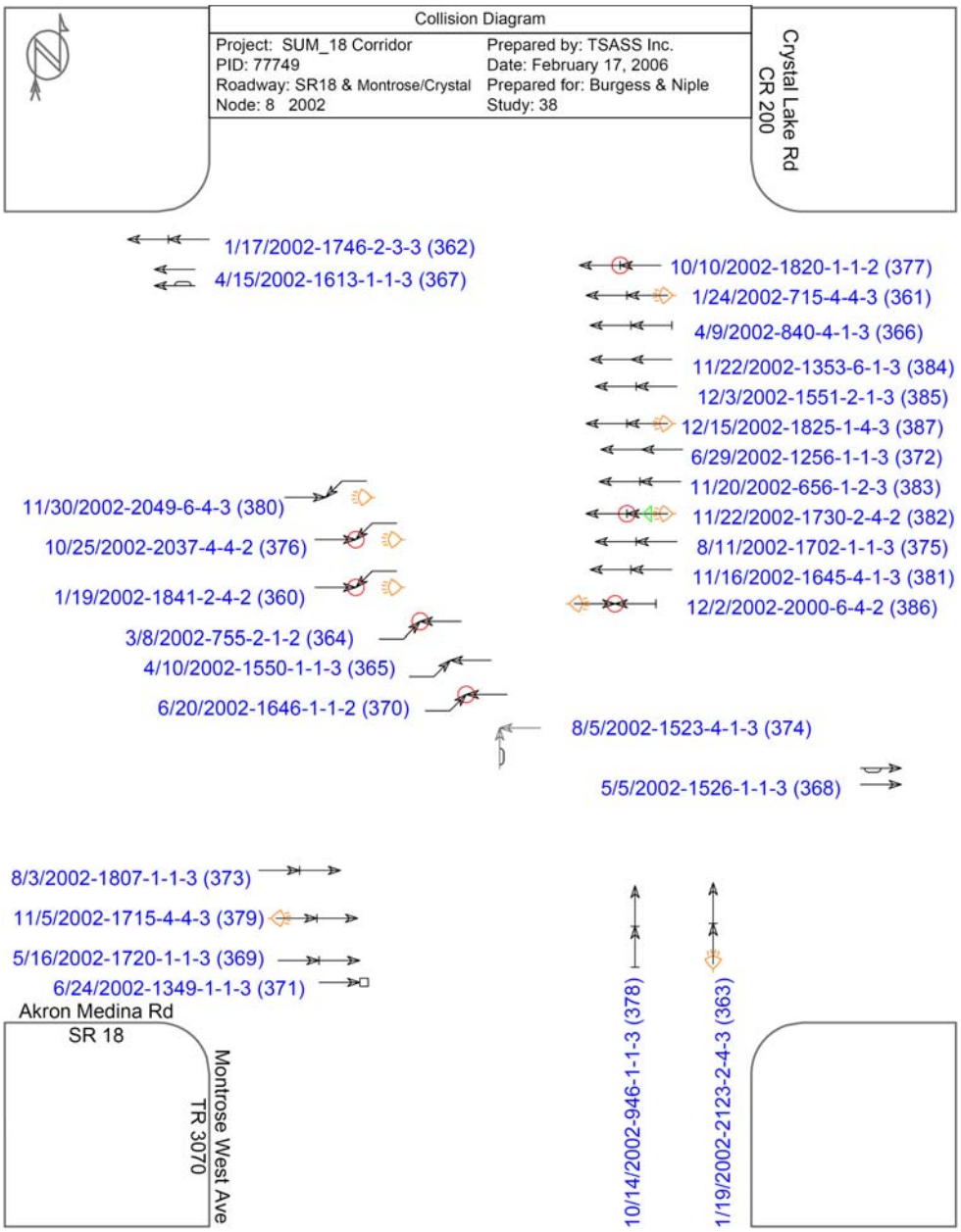
Figure 7 – Collision Diagram 2002-2004




Collision Diagram
Project: SUM_18 Corridor
PID: 77749
Roadway: SR18 & Montrose/Crystal
Node: 8 2003
Prepared by: TSASS Inc.
Date: February 17, 2006
Prepared for: Burgess & Niple
Study: 38
Crystal Lake Rd
CR 200
8/29/2003-745-1-1-3 (403)
12/22/2003-1930-10-4-3 (412)
3/21/2003-1815-2-1-3 (391)
4/22/2003-1643-4-1-3 (394)
5/6/2003-1542-1-1-3 (395)
7/3/2003-1734-1-1-3 (397)
7/10/2003-1245-2-1-2 (398)
11/15/2003-1742-4-4-3 (409)
9/1/2003-1301-4-1-2 (405)
10/18/2003-2059-1-5-2 (407)
4/8/2003-1220-2-1-3 (393)
6/30/2003-1743-1-1-2 (69)
8/14/2003-1620-2-1-3 (401)
1/24/2003-1608-2-1-2 (389)
3/6/2003-1436-1-1-2 (390)
10/1/2003-720-1-2-2 (406)
7/3/2003-1605-1-1-2 (399)
8/6/2003-1135-1-1-3 (402)
5/30/2003-1935-4-1-2 (396)
12/3/2003-1501-2-1-3 (410)
12/19/2003-1620-5-1-3 (411)
8/3/2003-1216-4-1-2 (400)
4/4/2003-1307-4-1-2 (392)
11/18/2003-2000-4-6-3 (408)
9/4/2003-1951-2-3-2 (404)
1/6/2003-1308-6-1-3 (388)
Akron Medina Rd
SR 18
Montrose West Ave
TR 3070

Legend


Straight
Stopped
Unknown
Backing
Overtaking
Sideswipe
Parked
Erratic
Out of control
Right turn
Left turn
U-turn
Pedestrian
Bicycle
Injury
Fatality
Nighttime
DUI
Fixed objects:
General
Signal
Tree
Pole
Curb
Animal
3rd vehicle
Extra data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Crystal Lake Rd
CR 200
1/17/2002-1746-2-3-3 (362)
4/15/2002-1613-1-1-3 (367)
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11/5/2002-1715-4-4-3 (379)
5/16/2002-1720-1-1-3 (369)
6/24/2002-1349-1-1-3 (371)
Akron Medina Rd
SR 18
Montrose West Ave
TR 3070
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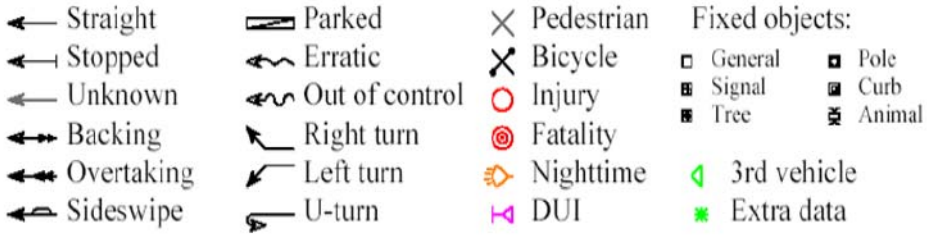
1/19/2002-2123-2-4-3 (363)

Legend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Stopped
Unknown
Backing
Overtaking
Sideswipe
Parked
Erratic
Out of control
Right turn
Left turn
U-turn
Pedestrian
Bicycle
Injury
Fatality
Nighttime
DUI
Fixed objects:
General
Signal
Tree
Pole
Curb
Animal
3rd vehicle
Extra data

TRAFFIC ACCIDENT ANALYSIS
SUM-18 Corridor Study

County SUM | Main Roadway SR 18 | Begin SLM 1.550 | End SLM 0.000

Intersecting Roadway Crystal Lake Ave/ Montrose West Ave

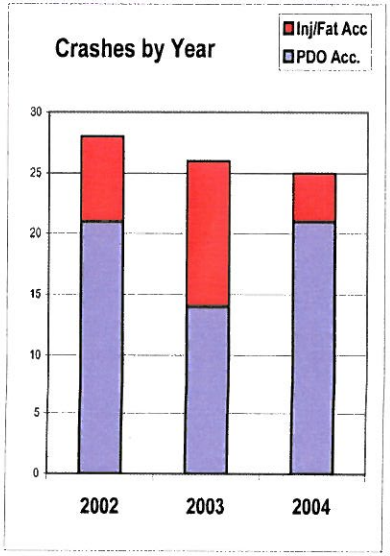
Crash Data last Updated: 2/9/2006

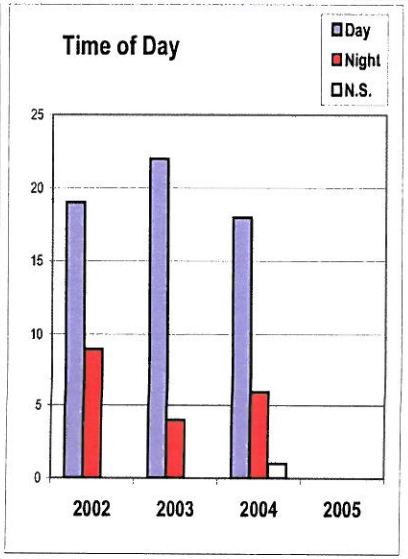
Prepared by TSASS-KM | Date 4/12/2007 | Prepared for: Burgess & Niple

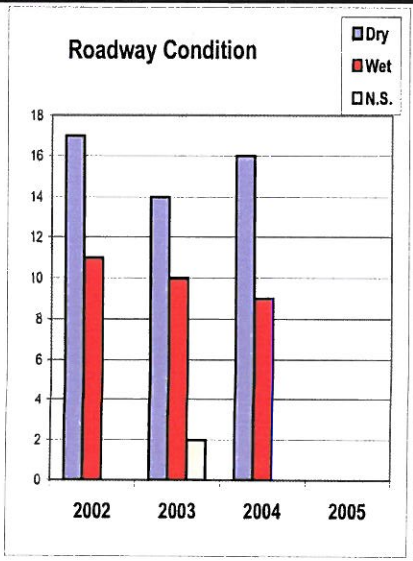
Estimated Percent of 2005 data = 79.32

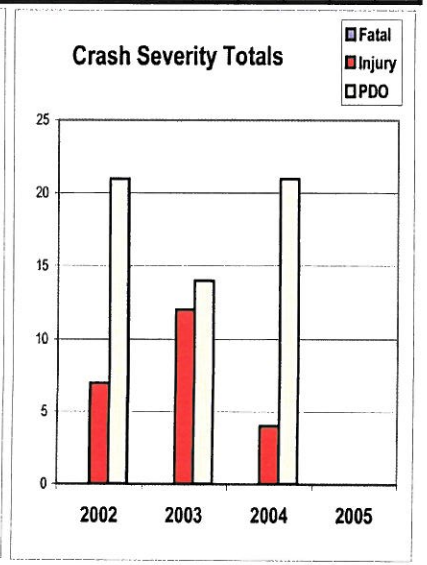
TSASS ID:	1176		
Site	Sect	Sub	Node
38	0	0	8

YEAR	LIGHTING CONDITION						ROADWAY CONDITION						CRASH TYPE																			
	Day		Night		N.S.		Dry		Wet		N.S.		L.T.		R.T.		Angle		Rear-end		Head On		S.S. Same		S.S. Oppos		F.O.		Backing		Other		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2002	16	3	5	4	0	0	14	3	7	4	0	0	2	4	0	0	1	0	13	2	0	0	4	0	0	0	1	0	0	0	0	1	21	7
2003	11	11	3	1	0	0	6	8	6	4	2	0	2	3	0	0	4	1	5	4	0	0	1	0	0	0	0	0	0	3	2	1	14	12
2004	15	3	5	1	1	0	14	2	7	2	0	0	1	0	0	0	5	0	13	2	0	1	1	0	0	0	0	0	0	1	1	0	21	4
Subtotal	**42**	**17**	**13**	**6**	**1**	**0**	**34**	**13**	**20**	**10**	**2**	**0**	**5**	**7**	**0**	**0**	**10**	**1**	**31**	**8**	**0**	**1**	**6**	**0**	**0**	**0**	**1**	**0**	**0**	**4**	**3**	**2**	**56**	**23**
Total	**59**		**19**		**1**		**47**		**30**		**2**		**12**		**0**		**11**		**39**		**1**		**6**		**0**		**1**		**4**		**5**		**79**	





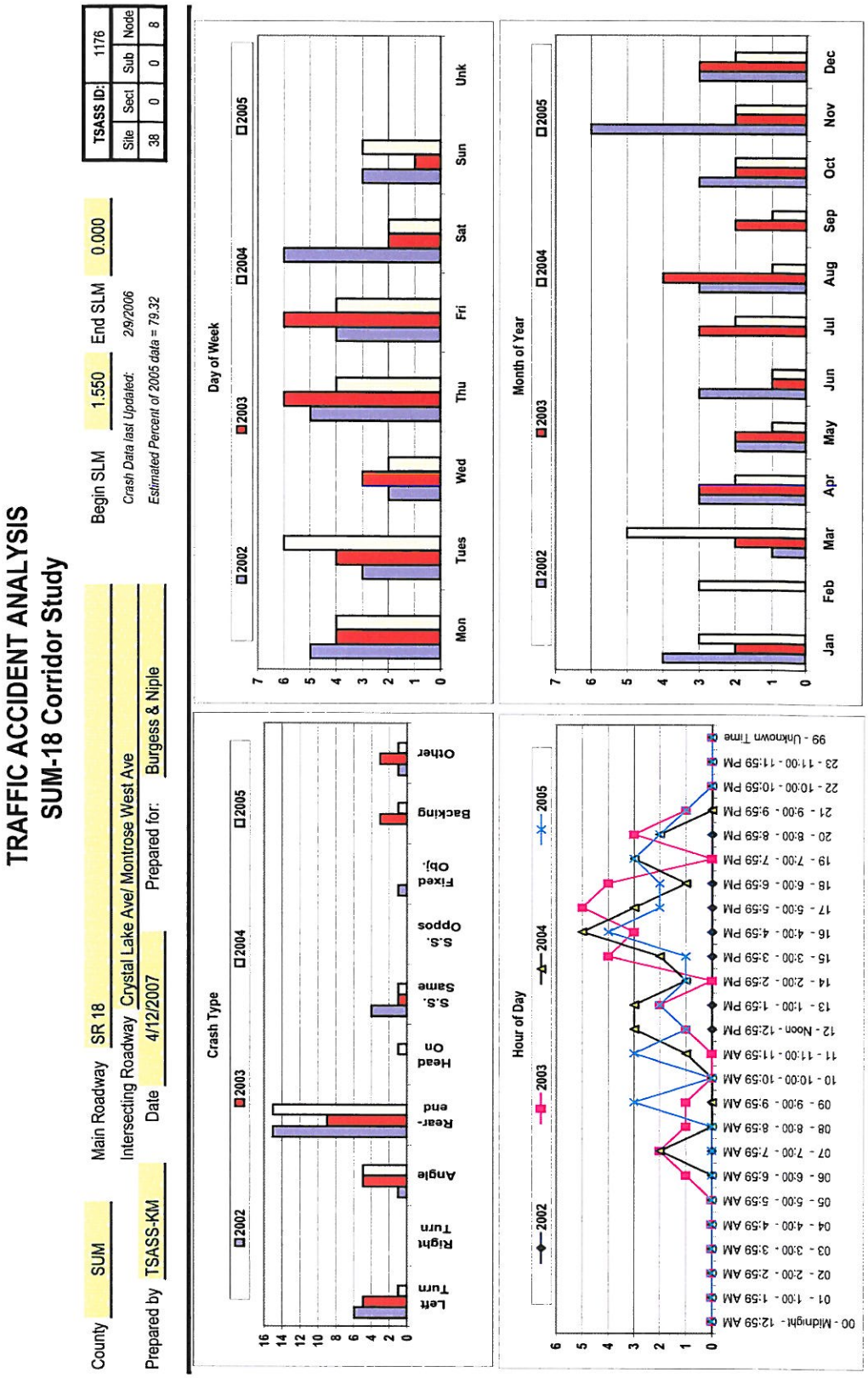




Source: Traffic Safety Analysis Systems & Services - Ohio Safety Information System - Data represents most current data available as of date of preparation. Subject to change due to late crash data submissions by police agencies and / or additional improved crash location information. The Ohio Safety Information System (OSIS) is a proprietary safety database containing Ohio traffic crash and related safety information. Available on line at: osis.tsass.com

Figure 8 – Crash Analysis Tables and Graphs (Crystal Lake Road)

Figure 9 – Crash Analysis Tables and Graphs (Crystal Lake Road)



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TRAFFIC ACCIDENT ANALYSIS
SUM-18 Corridor Study

County: SUM | Main Roadway: SR 18 | Intersecting Roadway: Heritage Woods Dr | Begin SLM: 1.410 | End SLM: 0.000

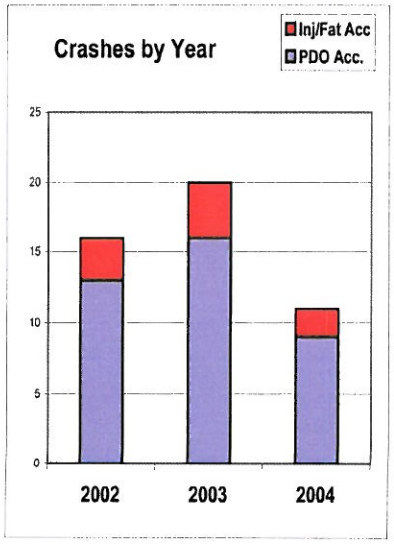
Prepared by: TSASS-KM | Date: 4/16/2006 | Prepared for: Burgess & Niple

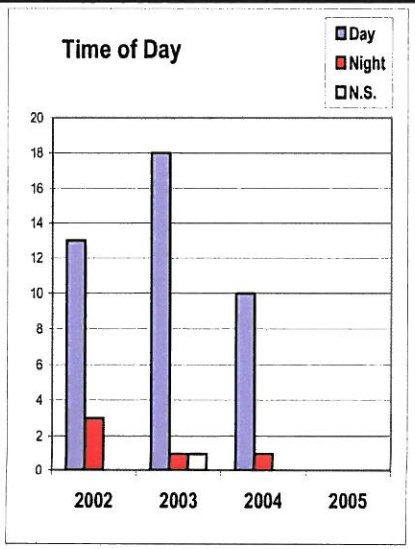
Crash Data last Updated: 2/9/2006

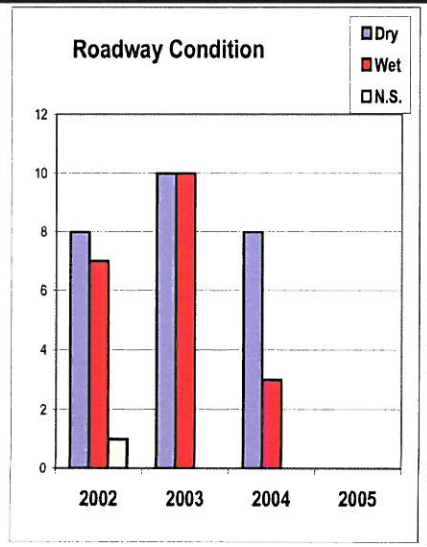
Estimated Percent of 2005 data = 79.32

TSASS ID:	1175		
Site	Sect	Sub	Node
38	0	0	7

YEAR	LIGHTING CONDITION						ROADWAY CONDITION						CRASH TYPE																			
	Day		Night		N.S.		Dry		Wet		N.S.		L.T.		R.T.		Angle		Rear-end		Head On		S.S. Same		S.S. Oppos		F.O.		Backing		Other		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2002	10	3	3	0	0	0	8	0	5	2	0	1	0	0	0	0	0	0	10	2	0	0	0	1	0	0	0	0	2	0	1	0	13	3
2003	14	4	1	0	1	0	7	3	9	1	0	0	0	0	0	0	0	0	12	3	0	1	3	0	0	0	0	0	0	0	1	0	16	4
2004	8	2	1	0	0	0	6	2	3	0	0	0	1	1	0	0	0	0	7	1	0	0	1	0	0	0	0	0	0	0	0	0	9	2
Subtotal	**32**	**9**	**5**	**0**	**1**	**0**	**21**	**5**	**17**	**3**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**29**	**6**	**0**	**1**	**4**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**0**	**38**	**9**
Total	**41**		**5**		**1**		**26**		**20**		**1**		**2**		**0**		**0**		**35**		**1**		**5**		**0**		**0**		**2**		**2**		**47**	







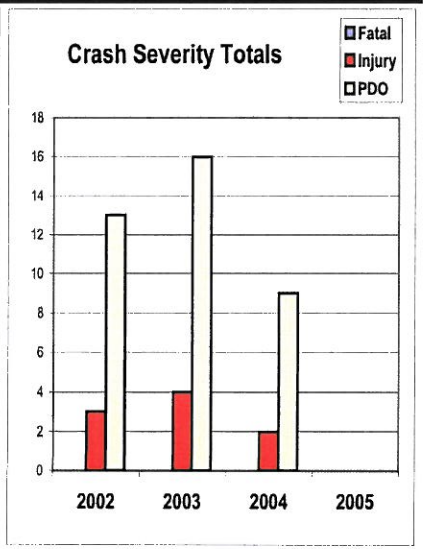


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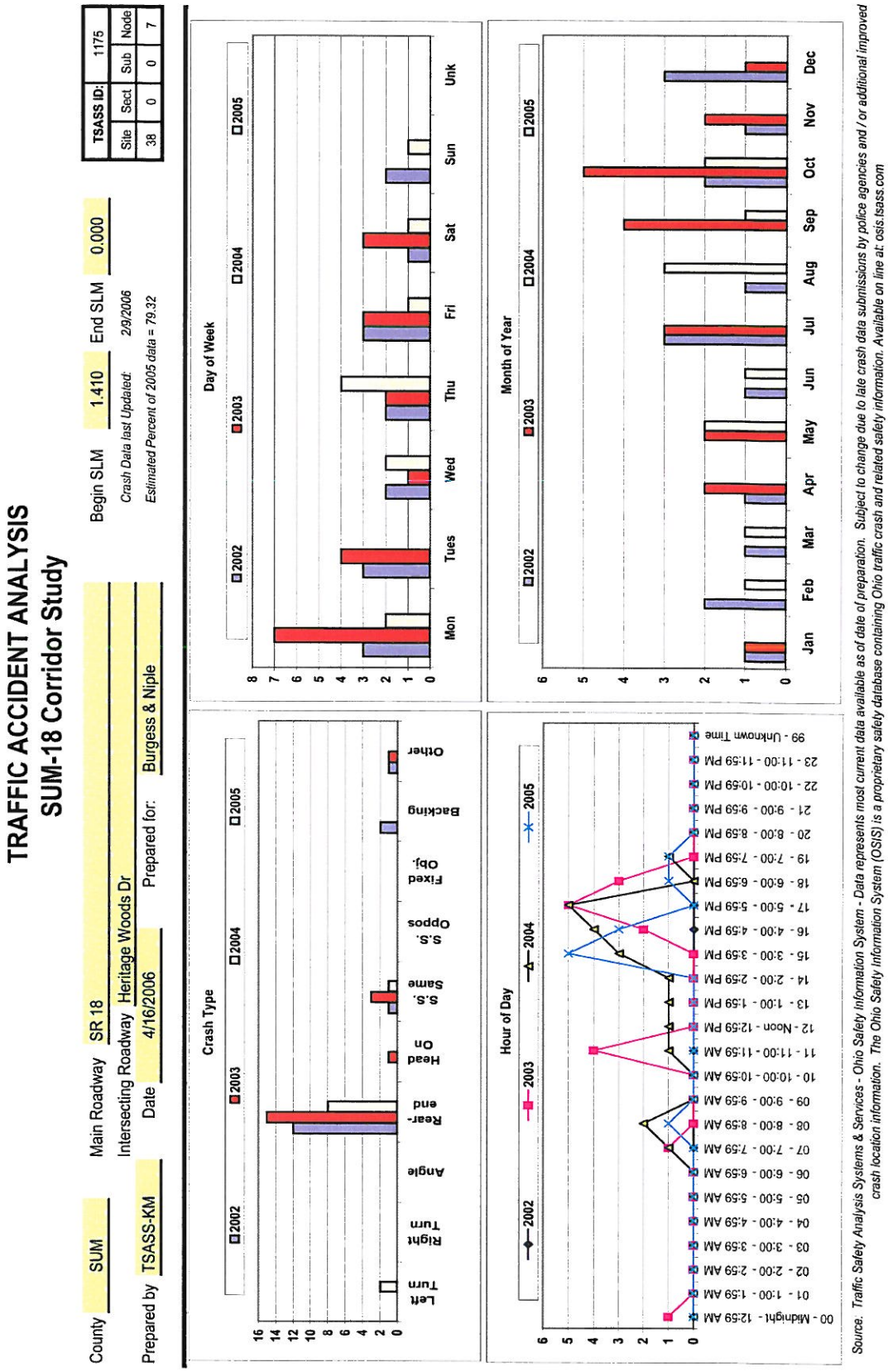
Figure 10 – Crash Analysis Tables and Graphs (Heritage Woods)

Figure 11 – Crash Analysis Tables and Graphs (Heritage Woods)



5.0 Crash Analysis

From 2002 to 2004, there were 79 crashes at the intersection – 56 property damage and 23 injury crashes. None of the crashes involved a fatality. The 2002-2004 crash rate at this intersection is 1.45 crashes per million entering vehicles. The data shows a peak in crashes between 6 a.m. and 8 a.m., and between 4 p.m. and 7 p.m. The predominant crash types at this location are left-turn and rear-end crashes, which together account for more than 64% of the crashes.

Table 1 compares crashes at the intersection with the statewide percentage for that type or condition of crash.

Table 1 - Crash Type compared with statewide averages for urban intersections

Condition	# of crashes 2002 – 2004	% of crashes 2002 – 2004	% of crashes statewide 2002-2004
Night-time	19	24.1	28.8
Wet pavement	30	38.0	28.4
Crash type			
Left-turn	12	15.2	12.0
Rear-end	39	49.4	26.2
Same-direction sideswipe	6	7.6	12.5
Angle	11	13.9	22.3

Source: Ohio Department of Public Safety Crash Data

Based on the collision diagrams, crash summaries, and Table 1, the following patterns and possible causes of these crashes are apparent:

Rear-End crashes: While rear-end accidents are typical of signalized intersections the percentage of rear-end crashes at this intersection is high relative to statewide averages for urban intersections and deserves consideration. This is the most significant pattern of crashes at this intersection (39 of 79). Between 2002 and 2004, 8 of these crashes resulted in injury. The problem is especially distinct on the east and west approaches. Potential causes for rear-end crashes are, are congestion, queued traffic, wet or slippery pavement, and poor geometry.

Based upon the capacity analysis and field observations, congestion is significant at this intersection, which contributes to the number of rear-end accidents. The percentage of crashes occurring on wet pavement is above the statewide average, however; skid testing in the area shows sufficient pavement friction thus discounting that condition as a significant crash contributor. The main contributing factor for wet pavement crashes in conjunction with congestion is following too closely.

There are no apparent geometry characteristics on the approaches that would lead to rear-end crashes, namely grades or structures that limit the sight distance, or conflict with the left turning vehicles related to horizontal and vertical sight distance.

Left-turn crashes: This is the second most significant (12 of 79) pattern of crashes at this intersection and is slightly above the state-wide average for left turn crashes. Between 2002 and 2004, over half (7 of 12) of these crashes resulted in injury. The problem is especially distinct on the eastbound and westbound approaches. Potential causes for left-turn crashes are, restricted sight distance, permitted left-turn phase, and excessive speeding on approaches.

There is a moderate volume of left turns at this intersection. During the PM peak hour, the westbound left turn volume is 368 vehicles. The left-turn volume for the southbound approach is 529 vehicles. Delay and vehicle queues experienced by these movements are also significant.

Currently all four approaches at the intersection have protected left-turn phasing and phasing on the east and west legs that allows for a protected / permitted eastbound and westbound left turn. Based on field observations, one to two through vehicles frequently continue through the intersection after the onset of the red, often accelerating in the process. This situation creates a crash hazard with opposing left turning vehicles, which are waiting in the intersection for a gap in traffic. Also, with the volume of opposing through vehicles on each approach, there are very few acceptable gaps during the permissive phase during peak hours of traffic.

Same-direction sideswipe crashes: The percentage of side-swipe crashes is below the statewide average for urban intersections. Side-swipe crashes can be discounted due to the low frequency of the crashes.

Night-time crashes: The number of crashes occurring at night is below the statewide average for urban intersections. This would indicate that the intersection lighting for this location seems to be adequate and would not require upgrades to lighting.

Based on the above crash patterns, potential countermeasures considered for this intersection include:

- Restrict or prohibit maneuvers by signing.
- Increase capacity (widen roadway).
- Add dual left turn lanes on EB and WB approaches
- Relocate Montrose West Ave. to Heritage Woods Drive intersection
- Improve signing and pavement markings.
- Retime signals (green times).
- Resurface the intersection to improve skid resistance.

6.0 Capacity Analysis

A capacity analysis was performed to quantify the congestion problem observed at the intersection during the existing morning and evening peak hours. The capacity analysis performed on the existing traffic conditions uses the current signal timings now operating. Detailed Capacity analysis including the future "2030" traffic with existing signal timings is included in the Appendix.

Peak hour traffic delay (Level of Service) was calculated using the *Highway Capacity Software*™. Level of Service (LOS) for a signalized intersection is defined by the *Highway Capacity Manual* as "a measure of driver discomfort, frustration, fuel consumption, and lost travel time," and is evaluated on the basis of control delay per vehicle, in seconds per vehicle. Control delay is the portion of the total delay attributed to traffic signal operation for signalized intersections, and includes initial deceleration delay, queue move-up, stopped delay, and final acceleration delay.

Table 2 - Level of Service at a signalized intersection

Level of Service	Controlled delay in seconds	Description
A	< 10	Most vehicles do not stop.
B	10 - 20	Good progression; more vehicles stop than at LOS A.
C	20 - 35	The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.
D	35 - 55	Many vehicles stop, and the proportion of vehicles not stopping declines. Occasionally, all vehicles on an approach will not clear the intersection during the green.
E	55 - 80	Considered the limit of acceptable delay. Frequently, all vehicles on an approach will not clear the intersection during the green.
F	> 80	Considered unacceptable to most drivers.

Table 3 - Level of Service

Heritage Woods 2006 Existing	Overall	EB		WB		NB		SB	
		TH-RT	LT	TH-RT	LT	RT	TH-LT	TH-RT	LT
AM Peak Hour	D	E	A	B	B	D	C	C	C

Heritage Woods 2006 Existing	Overall	EB		WB		NB		SB	
		TH-RT	LT	TH-RT	LT	RT	TH-LT	TH-RT	LT
PM Peak Hour	E	C	B	F	B	C	C	C	C

Crystal Lake Rd 2006 Existing	Overall	EB		WB			NB		SB	
		TH-RT	LT	LT	TH	RT	RT	TH-LT	TH-RT	LT
AM Peak Hour	F	F	C	C	C	B	D	D	D	E

Crystal Lake Rd 2006 Existing	Overall	EB		WB			NB		SB	
		TH-RT	LT	LT	RT	TH	RT	TH-LT	TH-RT	LT
PM Peak Hour	F	F	C	F	B	F	F	E	E	F

Heritage Woods 2030 Relocated	Overall	EB		WB		NB		SB	
		TH-RT	LT	TH-RT	LT	RT	TH-LT	TH-RT	LT
AM Peak Hour	C	C	A	A	D	C	D	D	D

Heritage Woods 2030 Relocated	Over all	EB		WB		NB		SB	
		TH-RT	LT	TH-RT	LT	RT	TH-LT	TH-RT	LT
PM Peak Hour	B	C	C	A	D	B	C	C	C

Crystal Lake Rd 2030 Relocated	Overall	EB		WB		SB	
		TH	LT	RT	TH	RT	LT
AM Peak Hour	C	C	C	B	C	A	C

Crystal Lake Rd 2030 Relocated	Overall	EB		WB		SB	
		TH	LT	RT	TH	RT	LT
PM Peak Hour	C	A	D	B	C	C	E

7.0 Identify and Evaluate Proposed Countermeasures

7.1 Evaluation of Countermeasures

Table 5 lists each countermeasure considered, whether the countermeasure is being proposed, and the reason for including or not including the countermeasure.

Table 4 - Potential Countermeasures and Evaluation

Countermeasure	Proposed Countermeasure?	Reason
"Do Nothing"	No	Congestion alone would warrant an improvement at this location and the accident rate for a signalized intersection of (1.45) is substantially higher than the state average of (0.32) These factors indicate that the "Do Nothing" option is not a viable option over the long-term.
Restrict or eliminate left turns by signing	No	Since this is the intersection of an east-west principal arterial with a north-south local road, restricting left turns would have a detrimental impact on traffic flow. No reasonable alternatives exist for the rerouting of left turns at the intersection.

Countermeasure	Proposed Countermeasure?	Reason
Add dual left turn lanes on the EB and WB approaches by widening the intersection.	Yes Medium-term	Adding dual left turn lanes on the EB and WB approaches increases the capacity of the intersection and reduces the amount of left turn collisions at the intersection. This would most likely reduce the rate of rear-end, sideswipe, and angle crashes also.
Improve signing and pavement markings	Yes Medium-Term	The existing pavement markings and signing throughout both intersections should be upgraded as part of the overall intersection reconstruction. This upgrade will provide the driver with a highly visible set of traffic control devices, reducing driver confusion and congestion thereby reducing congestion related crashes.
Retime signals (green times)	Yes Medium-Term	Although signal timing alone will not solve the congestion related crash problem at the intersection, new signal timing to reduce the number of phases, coupled with intersection widening and the relocation of West Montrose Ave. to Heritage Woods will increase the intersection LOS, reduce congestion and congestion-related crashes.
Improve roadway illumination	No	Night-time crashes are below the state average indicating that lighting conditions seem to be adequate for the intersection. This situation can be discounted as a significant crash indicator.

Countermeasure	Proposed Countermeasure?	Reason
Relocate Montrose West Ave. approach to Heritage Woods Drive.	Yes Medium-Term	Due to the high number of left turns out of Crystal Lake Road and onto Montrose West Avenue conflicting with a high volume of East-West thru traffic it becomes beneficial to eliminate Montrose West Avenue and relocate it to Heritage Woods Drive. This relocation makes it possible to eliminate conflict points at the intersection and reduce the number of phases. This improvement makes it possible to reduce congestion and conflict points, reducing the number of left-turn crashes and congestion related crashes.
Widen roadway to create additional East-West thru capacity.	Yes Medium-Term	S.R. 18 carries a high volume of East-West thru traffic thru the intersection of Crystal Lake Road/West Montrose Avenue. Additional thru lane capacity at the intersection reduces the congestion and will reduce the number of rear-end and congestion related accidents.
Resurface the intersection approaches to improve skid resistance	No	Skid testing in the area shows sufficient pavement friction thus discounting that condition as a significant crash contributor.

7.2 Proposed Countermeasures

Table 14 shows the recommended countermeasures with an estimated cost. These are grouped with respect to required implementation time.

Table 5 - Proposed Countermeasures and Cost

Proposed Countermeasure	Estimated Cost
Medium – term	
Relocate Montrose West Avenue to Heritage Woods, and add capacity to Heritage Woods through additional turn lanes as well as adding capacity to S.R. 18 by adding additional thru lanes and dual left turn lanes onto Crystal Lake Road and Heritage Woods Drive. This includes one total Right-of-Way take.	Roadway Improvements - $2,502,000 Drainage - $1,428,000 Right-of-Way - $2,477,000 Total - $6,407,000

Short-term

No recommendations

Long-term

No recommendations

RATE OF RETURN - ECONOMIC ANALYSIS WORKSHEET

TSASS ID:			1176
Site	Sect	Sub	Node
38	0	0	8

County: SUM | Main Roadway: SR 18 | Begin SLM: 1.55 | End SLM: -
Intersecting Roadway: Crystal Lake Ave/ Montrose West Ave
Prepared by: RWD | Date: 16-Apr-07

Year	TIME OF DAY						ROADWAY CONDITION						CRASH TYPE																	
	DAY		NITE		N. S.		DRY		WET		N. S.		L.T.		R.T.		Angle		Rear-end		Head On		S. S.		F.O.		Backing		Other		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2002	16	3	5	4	-	-	14	3	7	4	-	-	2	4	-	-	1	1	13	2	-	-	4	-	1	-	-	-	-		21	7
2003	11	11	3	1	-	-	6	8	6	4	2	-	2	3	-	-	6	2	5	7	-	-	1	-	-	-	-				14	12
2004	15	3	5	1	1	-	14	2	7	2	-	-	1	-	-	-	6	-	13	3	-	1	1	-	-	-	-			-	21	4
TOTAL	42	17	13	6	1	-	34	13	20	10	2	-	5	7	-	-	13	3	31	12	-	1	6	-	1	-	-	-	-	-	56	23
3 yr AVG.	14	6	4	2	0	-	11	4	7	3	1	-	2	2	-	-	4	1	10	4	-	0	2	-	0	-	-	-	-	-	19	8

RECOMMENDED IMPROVEMENTS

1. Relocate Montrose West Ave.
2. Reconstruct Crystal Lake Intersection
3. Resurface Urban > 2 Lane
4. Upgrade Pavement Marking - General
5.
6.
7.
8.

CRASH TYPE	PDO CRASHES							INJ. - FAT. CRASHES						
	R1	R2	R3	R4	RT	AVG PDO	EST. RED.	R1	R2	R3	R4	RT	AVG INJ-FAT	EST. RED.
Left Turn	-	0.27	0.42	0.10	0.62	1.67	1.03	0.08	0.27	0.46	0.10	0.67	2.33	1.57
Right Turn		0.27	0.42	0.10	0.62	-	-		0.27	0.46	0.10	0.65	-	-
Angle	0.15	0.27	0.42	0.10	0.68	4.33	2.93	0.08	0.27	0.46	0.10	0.67	1.00	0.67
Rearend	0.16	0.27	0.42	0.10	0.68	10.33	7.03		0.27	0.46	0.10	0.65	4.00	2.58
Head On		0.27	0.42	0.10	0.62	-	-		0.27	0.46	0.10	0.65	0.33	0.22
Side Swipe		0.27	0.42	0.10	0.62	2.00	1.24		0.27	0.46	0.10	0.65	-	-
Fixed Object		0.27	0.42	0.10	0.62	0.33	0.21		0.27	0.46	0.10	0.65	-	-
					-	-	-					-	-	-
					-	-	-					-	-	-
	ESTIMATED PDO CRASH REDUCTION						12.43	ESTIMATED INJ. - FAT. CRASH REDUCTION						5.04

ADT Factor

Project Service Life: 20 years
Present ADT (PADT): 49,723
Future ADT (FADT): 61,112

Average ADT = (PADT + FADT)/2 = (49,723.00 + 61,112.00) / 2 = 55,417.50
ADT Factor = Average ADT / PADT = 55,417.50 / 49,723.00 = 1.11

Average Annual Benefits

Annual PDO Benefits = Estimated PDO Crash Reduction * Avg PDO Cost	=	12.43	*	2,500	=	31,078
Annual INJ.-FAT. Benefits = Estimated INJ.-FAT. Crash Reduction * Avg INJ.-FAT. Cost	=	5.04	*	67,900	=	342,304
Total Benefits					=	373,382
Average Annual Benefits = Total Benefits * ADT Factor	=	1.11	*	373,382	=	416,143

Rate of Return

Project Cost	$	4,000,000.00
Maintenance and Energy Costs	$	1,000.00
Salvage Value	$	1,000.00

Rate of Return: 8%

Figure 12 - Medium-Term Rate of Return (Crystal Lake Road):

RATE OF RETURN - ECONOMIC ANALYSIS WORKSHEET

TSASS ID:			1175
Site	Sect	Sub	Node
38	0	0	7

County: SUM | Main Roadway: SR 18 | Begin SLM: 1.41 | End SLM: -
Intersecting Roadway: Heritage Woods Dr
Prepared by: RWD | Date: 16-Apr-07

Year	TIME OF DAY						ROADWAY CONDITION						CRASH TYPE																	
	DAY		NITE		N. S.		DRY		WET		N. S.		L.T.		R.T.		Angle		Rear-end		Head On		S. S.		F.O.		Backing		Other		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2002	10	3	3	-	-	-	8	-	5	2	-	1	1	-	-	-	-	-	12	2	-	-	-	1	-	-		-		-	13	3
2003	14	4	1	-	1	-	7	3	9	1	-	-	1	-	-	-	-	-	12	3	-	1	3	-	-	-	-	-		-	16	4
2004	8	2	1	-	-	-	6	2	3	-	-	-	1	1	-	-	-	-	7	1	-	-	1	-	-	-	-	-	-	-	9	2
TOTAL	32	9	5	-	1	-	21	5	17	3	-	1	3	1	-	-	-	-	31	6	-	1	4	1	-	-	-	-	-	-	38	9
3 yr AVG.	11	3	2	-	0	-	7	2	6	1	-	0	1	0	-	-	-	-	10	2	-	0	1	0	-	-	-	-	-	-	13	3

RECOMMENDED IMPROVEMENTS

1. (56) Resurface - Urban section > 2 lane
2. (22) Upgade existing signal - general
3. (1) Upgrade pavement markings
4.
5.
6.
7.
8.

CRASH TYPE	PDO CRASHES							INJ. - FAT. CRASHES						
	R1	R2	R3	R4	RT	AVG PDO	EST. RED.	R1	R2	R3	R4	RT	AVG INJ-FAT	EST. RED.
Left Turn	0.42	0.20	0.10		0.58	1.00	0.58	0.46	0.20	0.10		0.61	0.33	0.20
Right Turn	0.42	0.20	0.10		0.58	-	-	0.46	0.20	0.10		0.61	-	-
Angle	0.42	0.20	0.10		0.58	-	-	0.46	0.20	0.10		0.61	-	-
Rearend	0.42	0.20	0.10		0.58	10.33	6.02	0.46	0.20	0.10		0.61	2.00	1.22
Head On	0.42	0.20	0.10		0.58	-	-	0.46	0.20	0.10		0.61	0.33	0.20
Side Swipe	0.42	0.20	0.10		0.58	1.33	0.78	0.46	0.20	0.10		0.61	0.33	0.20
Fixed Object	0.42	0.20	0.10		0.58	-	-	0.46	0.20	0.10		0.61	-	-
					-	-	-					-	-	-
					-	-	-					-	-	-
	ESTIMATED PDO CRASH REDUCTION						7.38	ESTIMATED INJ. - FAT. CRASH REDUCTION						1.83

ADT Factor

Project Service Life: 20 years
Present ADT (PADT): 34,111
Future ADT (FADT): 43,223

Average ADT = (PADT + FADT)/2 = (34,111.00 + 43,223.00) / 2 = 38,667.00
ADT Factor = Average ADT / PADT = 38,667.00 / 34,111.00 = 1.13

Average Annual Benefits

Annual PDO Benefits = Estimated PDO Crash Reduction * Avg PDO Cost	=	7.38	*	2,500	=	18,443
Annual INJ.-FAT. Benefits = Estimated INJ.-FAT. Crash Reduction * Avg INJ.-FAT. Cost	=	1.83	*	67,900	=	124,501
Total Benefits					=	142,944
Average Annual Benefits = Total Benefits * ADT Factor	=	1.13	*	142,944	=	162,036

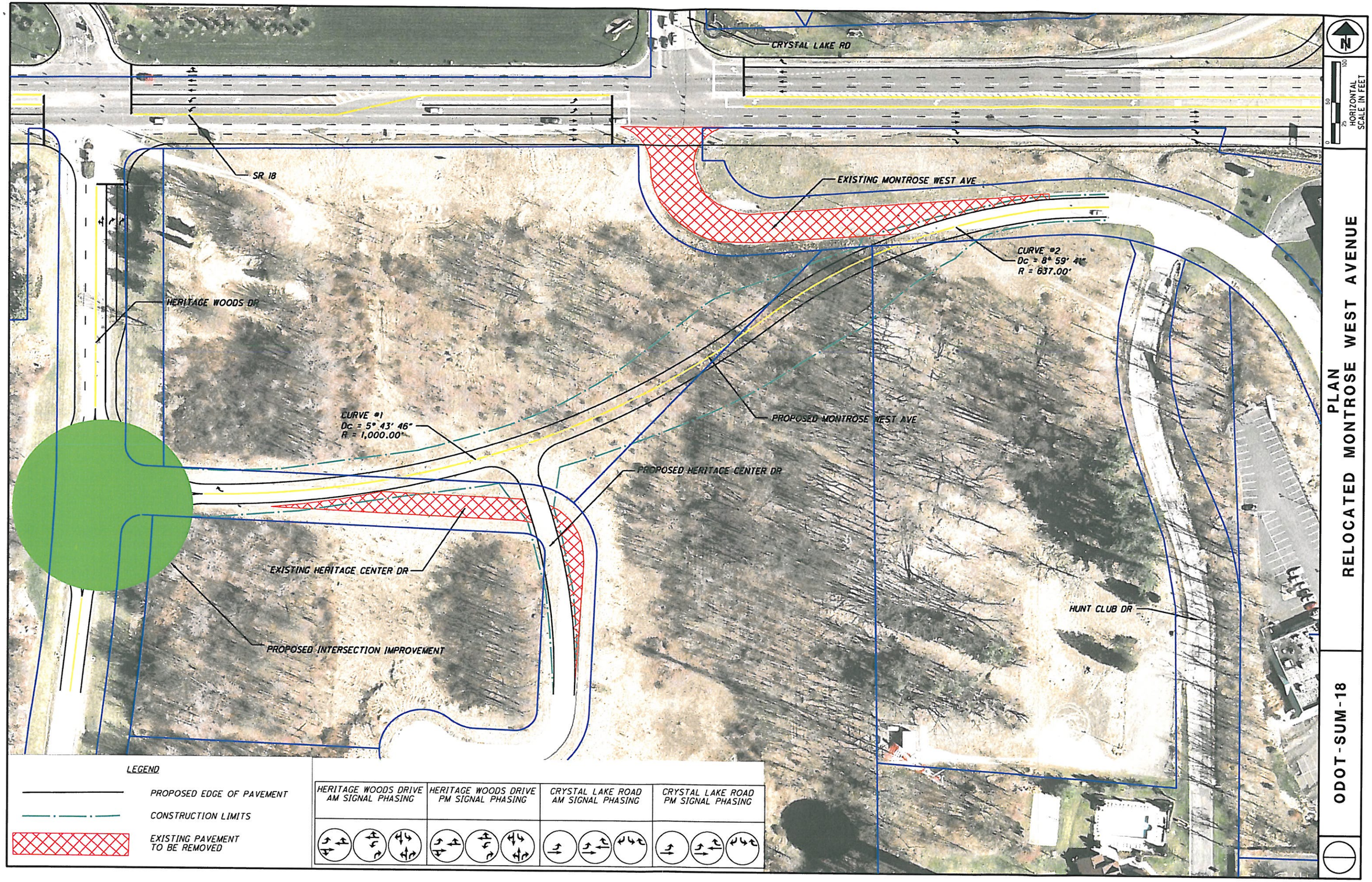
Rate of Return

Project Cost	$	2,407,000.00
Maintenance and Energy Costs	$	1,000.00
Salvage Value	$	1,000.00

Rate of Return: 3%

Figure 13 - Medium-Term Rate of Return (Heritage Woods Drive)

Figure-14 - Medium-Term Recommendation Diagram:



8.0 Conclusions:

The Montrose West Ave. / Crystal Lake Rd. and S.R. 18 intersection is located in Summit County, in Copley and Bath Townships. Montrose West Ave. / Crystal Lake Road has a north-south orientation and is classified as a 2-lane urban local road. S.R. 18 is oriented east-west and is classified as a 5-lane urban principal arterial. The intersection is signalized with protected / permissive left-turn phasing for S.R. 18 with the northbound and southbound phases being split. The south approaches consist of right turn lane and a thru-left lane. The north approach consists of a thru-right lane and two left turn lanes. The east approach consist of two thru lanes a right turn lane and a left turn lane. The west approach consists of two thru lanes and a left turn lane. The intersection is surrounded by a mixed commercial, business, and residential area and is within close proximity to the S.R. 18 / IR 77 interchange. The northeast corner is developed with an office building. The northwest corner is developed with a large wellness center. Although the southern corners are undeveloped, Montrose West Avenue is developed with retail business in close proximity to the intersection. The intersection has an AADT of 49,846 vehicles, and has experienced 79 crashes in the three year analysis, for a crash rate of 1.45

The crash analysis revealed two distinct crash patterns at this intersection. The first observed pattern was the frequency of rear-end crashes. Rear-end crashes are typical at signalized intersections. This is the most significant pattern of crashes at this intersection (39 of 79). Between 2002 and 2004, 8 of these crashes resulted in injury. The problem is especially distinct on the east and west approaches. Based upon the capacity analysis and field observations, congestion is the most significant factor contributing to the number of rear-end accidents at this location. Countermeasures identified to address the rear end accident problem are to relocate Montrose West Avenue to Heritage Woods, and add capacity to Heritage Woods through additional turn lanes as well as adding capacity to S.R. 18 by adding additional thru lanes.

The second pattern identified was a high number of left-turn crashes. Based on field observations, one to two through vehicles frequently continue through the intersection after the onset of the red, often accelerating in the process. This situation creates a crash hazard with opposing left turning vehicles, which are waiting in the intersection for a gap in traffic. Also, with the volume of opposing through vehicles on each approach, there are very few acceptable gaps during the permissive phase during peak hours of traffic. These two situations indicate that the major contributing factor leading to left-turn crashes is congestion. The countermeasures identified to address this problem are to relocate Montrose West Avenue to Heritage Woods, and add capacity to Heritage Woods through additional turn lanes as well as adding capacity to S.R. 18 by adding additional thru lanes and dual left turn lanes onto Crystal Lake Road and Heritage Woods Drive.

The short-term approaches to addressing the crash problem at this intersection are to coordinate Crystal Lake/Montrose West and Heritage Woods Drive for optimal performance to reduce the congestion at the intersection. However due to the close spacing of the two intersections, approximately 600 ft between them, and the congestion experienced at this location it is a common occurrence for the EB Crystal Lake Road intersection and the WB Heritage Woods intersection to experience very large Queue lengths and spill back past the adjacent intersections. Even with the optimal timings and coordination at these two intersections the congestion continues to be too heavy for the capacity available and the Intersections still operate at unacceptable Levels of Service. Due to this heavy congestion situation there is no viable

short-term solution that adequately addresses the crash problem without capacity improvements, therefore no short-term recommendation can be made at this time.

The rate of return for the short-term was not evaluated since as previously stated no short-term recommendation is available at this time. The rate of return for the medium-term countermeasure is positive at 8 percent for the Crystal Lake intersection and 3 percent for the Heritage Woods intersection for a combined rate of return of 11 percent total. This positive rate of return indicates a viable solution to address the crashes at the intersection. No long-term countermeasure is being recommended because of the extensive improvements that can be addressed in the medium term recommendation. Since the congestion at the location requires an extensive multifaceted group of improvements such as a road relocation and roadway widening to remedy the crash problem, there are no further improvements identified that are not already included as part of the medium term recommendation.

9.0 Recommendations:

The short-term recommended improvements are:

None Recommended

The medium-term recommended improvements are:

- Increase capacity (widen roadway).
- Add dual left turn lanes on EB and WB approaches
- Relocate Montrose West Ave. to Heritage Woods Intersection.
- Optimize Signal timings
- Upgrade pavement markings

The long-term recommended improvements are:

None Recommended.

10.0 Appendix:

PHOTOS

Crystal Lake southbound cross corner site distance facing east-photo 1**.**

Crystal Lake southbound cross corner site distance facing west- photo 2**.**

PHOTOS

Crystal Lake southbound approach at 200 feet- photo 3**.**

Crystal Lake southbound approach at 600 feet- photo 4**.**

PHOTOS

Crystal Lake southbound approach at 1000 feet- photo 5

S.R. 18 westbound cross corner site distance facing south- photo6.

PHOTOS

S.R. 18 westbound cross corner site distance facing north-photo 7.

S.R. 18 westbound approach at 200 feet- photo 8.

PHOTOS

S.R. 18 westbound approach at 600 feet- photo 9.

S.R. 18 westbound approach at 1000 feet- photo 10.

PHOTOS

Montrose West northbound cross corner site distance facing west- photo 11.

Montrose West northbound cross corner site distance facing east- photo 12

PHOTOS

Montrose West northbound approach at 200 feet- photo 13

Montrose West northbound approach at 600 feet- photo 14

PHOTOS

Montrose West northbound approach at 1000 feet- photo 15

S.R. 18 eastbound cross corner site distance facing north- photo 16

PHOTOS

S.R. 18 eastbound cross corner site distance facing north- photo 17

S.R. 18 eastbound approach at 200 feet- photo 18

PHOTOS

S.R. 18 eastbound approach at 600 feet- photo 19

Heritage Woods northbound cross corner site distance facing west- photo 20

PHOTOS

Heritage Woods northbound cross corner site distance facing east- photo 21

Heritage Woods northbound approach at 200 feet - photo 22

PHOTOS

Heritage Woods northbound approach at 600 feet - photo 23

Heritage Woods northbound approach at 1000 feet - photo 24

PHOTOS

S.R. 18 eastbound cross corner site distance facing north- photo 25

S.R. 18 eastbound cross corner site distance facing south- photo 26

PHOTOS

S.R. 18 eastbound approach at 200 feet - photo 27

S.R. 18 eastbound approach at 600 feet - photo 28

PHOTOS

S.R. 18 eastbound approach at 1000 feet - photo 29

Akron General Driveway southbound cross corner site distance facing east- photo 30

PHOTOS

Akron General Driveway southbound cross corner site distance facing west- photo 31

S.R. 18 westbound cross corner site distance facing south- photo32

PHOTOS

S.R. 18 westbound cross corner site distance facing south- photo33

S.R. 18 westbound approach at 200 feet - photo 34

PHOTOS

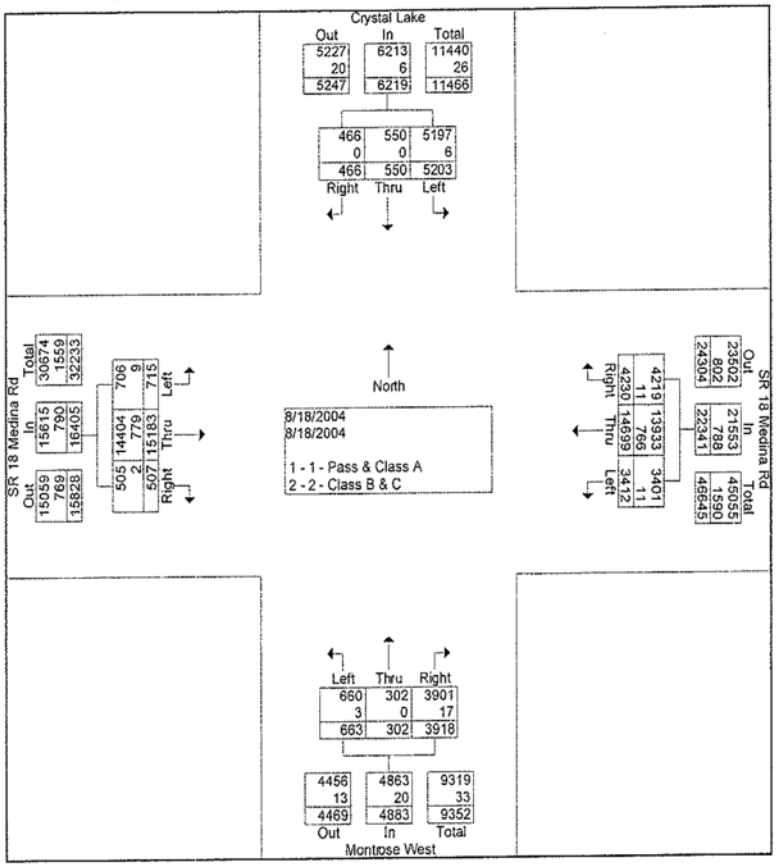
S.R. 18 westbound approach at 600 feet - photo 35

S.R. 18 westbound approach at 1000 feet - photo 36

Akron Metro. Area ısportation Study
806 Citicenter / .46 S. High St.
Akron, Ohio 44308
(330) 375-2436

SR 18 Medina Rd & Crystal Lake Rd
AM & PM Counters: DP & MA

File Name : SU 72 (2004)
Site Code : 00000000
Start Date : 08/18/2004
Page No :



24 Hour Expanded Count
Seasonally Adjusted
Intersection Volume = 49,849

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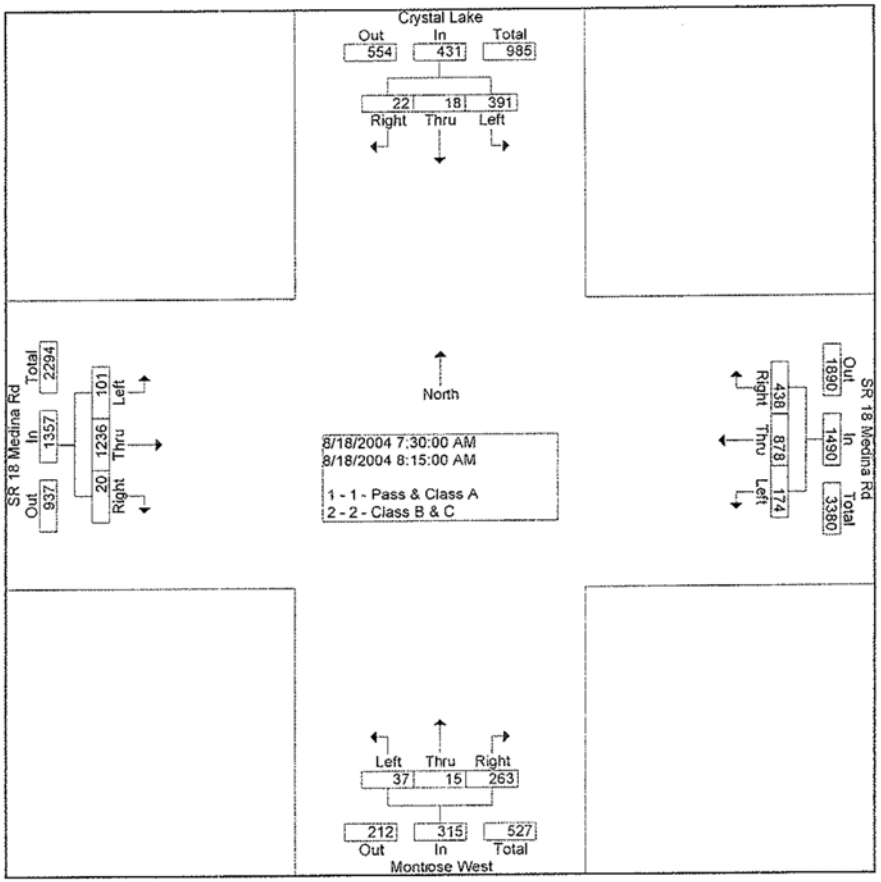
SR 18 Medina Rd & Crystal Lake Rd
AM & PM Counters: DP & MA

File Name : SU 72 (2004)
Site Code : 00000000
Start Date : 08/18/2004
Page No :



AM Peak Hour: 7:30 - 8:30
Intersection Volume = 3,593

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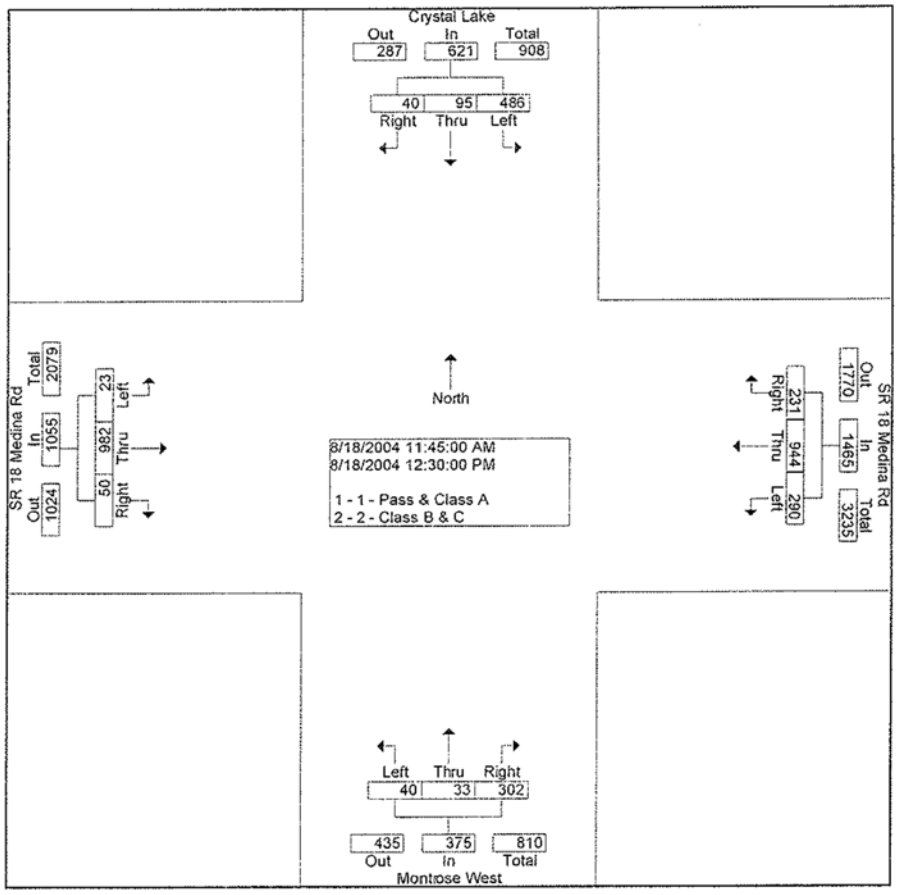
SR 18 Medina Rd & Crystal Lake Rd
AM & PM Counters: DP & MA

File Name : SU 72 (2004)
Site Code : 00000000
Start Date : 08/18/2004
Page No :



Midday Peak Hour: 11:45 - 12:45
Intersection Volume = 3,516

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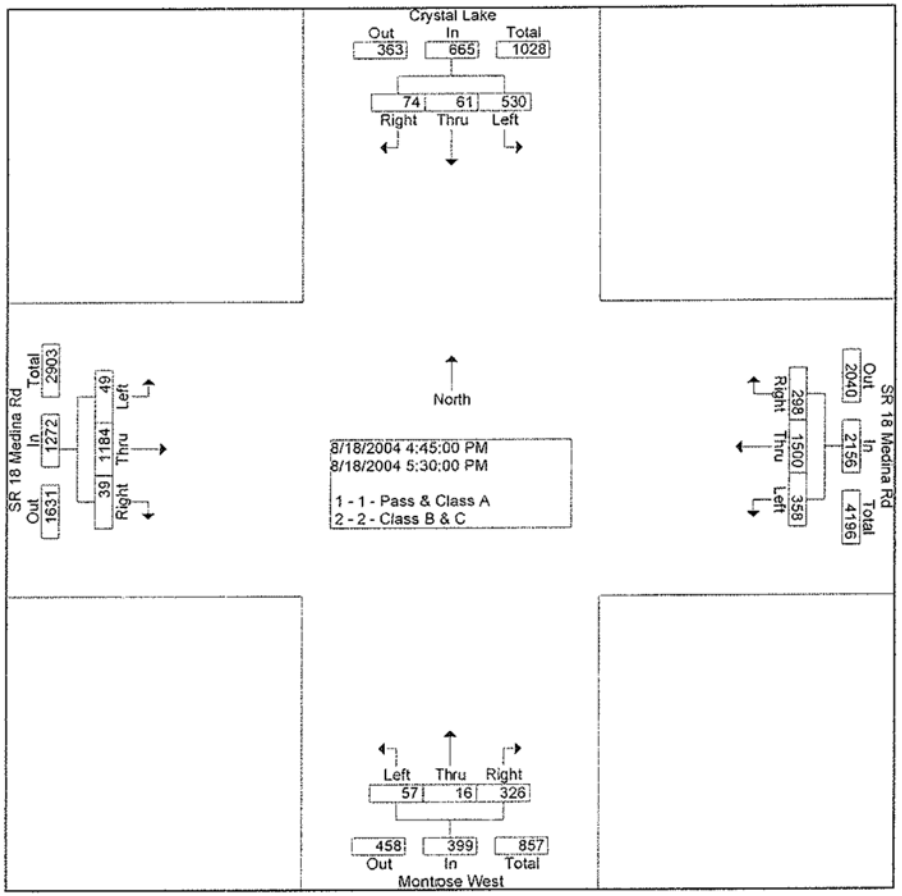
SR 18 Medina Rd & Crystal Lake Rd
AM & PM Counters: DP & MA

File Name : SU 72 (2004)
Site Code : 00000000
Start Date : 08/18/2004
Page No :



PM Peak Hour: 4:45 - 5:45
Intersection Volume = 4,492

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SR 18 Medina Rd & Crystal Lake Rd
AM & PM Counters: DP & MA

File Name : SU 72 (2004)
Site Code : 00000000
Start Date : 08/18/2004
Page No :

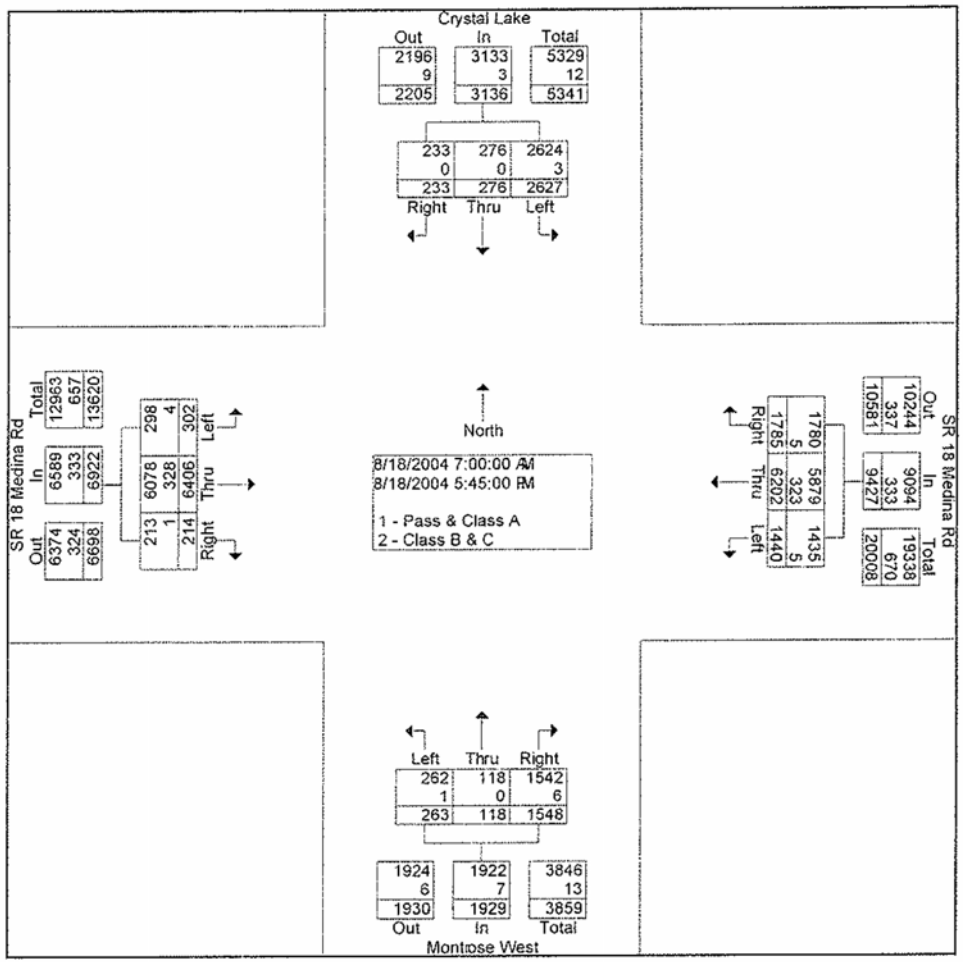
Weather: Sunny and warm

Groups Printed- 1 - Pass & Class A - 2 - Class B & C

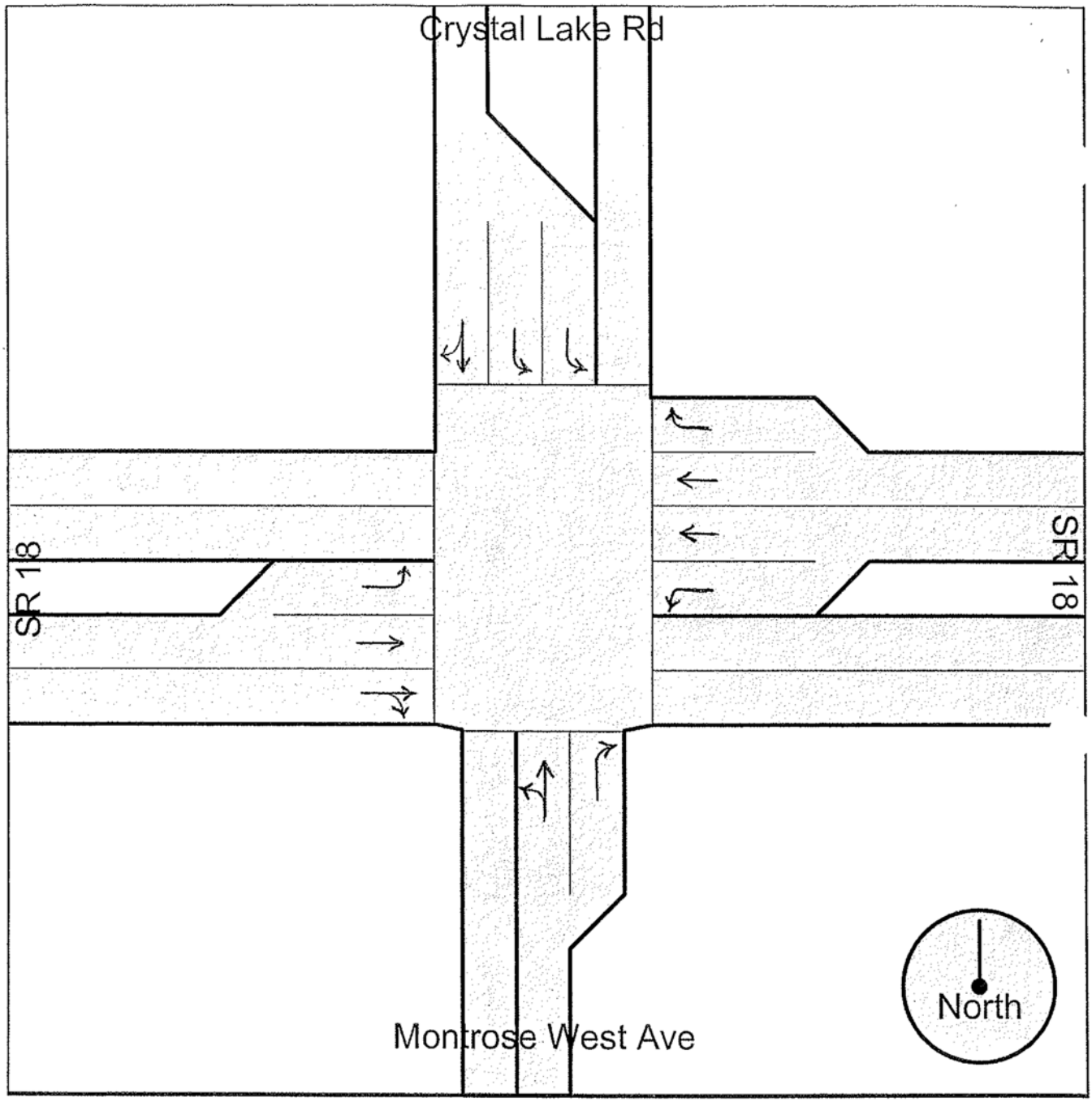
	Crystal Lake Southbound				SR 18 Medina Rd Westbound				Montrose West Northbound				SR 18 Medina Rd Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
07:00	57	3	3	63	12	195	68	275	2	2	43	47	8	214	5	227	612
07:15	78	4	2	84	17	223	80	320	4	1	61	66	8	272	5	285	755
07:30	124	3	6	133	29	204	107	340	10	3	79	92	34	302	5	341	906
07:45	90	5	4	99	42	229	159	430	7	7	74	88	33	296	2	331	948
Total	349	15	15	379	100	851	414	1365	23	13	257	293	83	1084	17	1184	3221
08:00	112	7	10	129	53	215	87	355	8	2	49	59	17	342	6	365	908
08:15	65	3	2	70	50	230	85	365	12	3	61	76	17	296	7	320	831
08:30	87	1	3	91	46	193	74	313	11	3	43	57	15	227	6	248	709
08:45	94	5	6	105	60	191	109	360	13	3	41	57	14	250	7	271	793
Total	358	16	21	395	209	829	355	1393	44	11	194	249	63	1115	26	1204	3241
				774				2758				542				2388	
*** BREAK ***																	
11:00	102	14	3	119	44	201	62	307	8	3	33	44	5	224	5	234	704
11:15	132	3	2	137	27	196	62	285	8	1	37	46	12	211	10	233	701
11:30	101	14	8	123	57	230	45	332	11	2	49	62	3	215	8	226	743
11:45	155	16	10	181	71	216	62	349	10	4	55	69	10	313	11	334	933
Total	490	47	23	560	199	843	231	1273	37	10	174	221	30	963	34	1027	3081
12:00	98	35	14	147	83	248	63	394	4	4	62	70	4	206	12	222	833
12:15	114	19	13	146	61	245	52	358	12	14	96	122	3	221	16	240	866
12:30	119	25	3	147	75	235	54	364	14	11	89	114	6	242	11	259	884
12:45	83	12	11	106	67	242	101	410	17	13	98	128	14	252	9	275	919
Total	414	91	41	546	286	970	270	1526	47	42	345	434	27	921	48	996	3502
				1106				2794				655				2023	
*** BREAK ***																	
16:00	125	9	17	151	74	284	64	422	4	8	59	71	13	222	13	248	892
16:15	134	10	18	162	61	317	38	416	12	3	63	78	7	291	13	311	967
16:30	108	3	11	122	50	268	42	360	26	6	72	104	13	367	8	388	974
16:45	120	10	13	143	93	368	69	530	12	2	67	81	9	285	9	303	1057
Total	487	32	59	578	278	1237	213	1728	54	19	261	334	42	1165	43	1250	3890
17:00	148	15	25	188	80	344	63	487	14	2	100	116	14	351	9	374	1165
17:15	163	15	17	195	91	383	80	554	14	5	72	91	15	263	10	288	1128
17:30	99	21	19	139	94	405	86	585	17	7	87	111	11	285	11	307	1142
17:45	119	24	13	156	103	340	73	516	13	9	58	80	17	259	16	292	1044
Total	529	75	74	678	368	1472	302	2142	58	23	317	398	57	1158	46	1261	4479
				1256				3870				732				2511	
Grand Total	2627	276	233	3136	1440	6202	1785	9427	263	118	1548	1929	302	6406	214	6922	21414

Appr	83.8	8.8	7.4		15.3	65.8	18.9		13.6	6.1	80.2		4.4	92.5	3.1			
Tota	12.3	1.3	1.1	14.6	6.7	29.0	8.3		1.2	0.6	7.2	9.0	1.4	29.9	1.0			

Data from all hours manually counted



Plot of all hours manually counted
7:00 - 9:00 AM and 4:00 - 6:00 PM


Crystal Lake Rd
SR 18
SR 18
Montrose West Ave
North

09/28/04
13:51:37

AMATS
806 CitiCenter; 146 S. High St.
Akron, Ohio 44308
(330) 375-2436

Page:

*** Basic Count Print (#302) ***

Site ID : Crystal Lake Rd SB (SU 72)
Info 1 :
Info 2 :
Data Starts : 00:00 on 08/18/
Data Ends : 23:45 on 08/18/
Adj. Factor : 1.000%

Lane #1 Info : SB
Lane Mode : Normal
Sensor Used : Axle

********** Lane 1 Basic Count Print **********

Date	Time	:00	:15	:30	:45	Total	
08/18/04	00:00	11	4	6	7	28	
	01:00	2	5	8	3	18	
	02:00	0	2	1	1	4	
	03:00	2	3	2	3	10	
	04:00	0	2	1	4	7	
	05:00	3	7	6	10	26	
	06:00	15	19	38	40	112	
	07:00	62	83	109	108	362	762
	08:00	120	85	95	100	400	
	09:00	97	114	113	113	437	
	10:00	115	102	119	104	440	
	11:00	144	120	160	158	582	1090
	12:00	136	128	130	114	508	
	13:00	112	112	96	128	448	
	14:00	114	102	123	110	449	
	15:00	103	86	84	132	405	
	16:00	162	161	142	149	614	1299
	17:00	230	177	137	141	685	
	18:00	143	115	98	86	442	
	19:00	91	63	59	55	268	
	20:00	69	48	54	27	198	
	21:00	38	25	35	38	136	
	22:00	28	20	8	8	64	
	23:00	13	7	11	19	50	

Daily Total : 6693
AM Total : 2426 (36.2%)
PM Total : 4267 (63.8%)
Peak AM Hour: 11:00= 582 (8.7%)
Peak PM Hour: 16:30= 698 (10.4%)

Average Period: 69.0
Average Hour : 278.9

Peak AM Factor: 0.909
Peak PM Factor: 0.759

	MECH.	MANUAL
7-9	762	774
11-1	1090	1106
4-6	1299	1256
	3151	3136

24 HR EXP FACTOR = $\frac{6693}{3151} = 2.12$

S.A.F. = 0.93

1.98

09/28/04
13:51:37

AMATS
806 CitiCenter; 146 S. High St.
Akron, Ohio 44308
(330) 375-2436

GRAND TOTALS

********** LANE 1 FINAL **********

Grand Total	6693	Average Period:	69.0
# Of Days	1.01	ADT	6624
AM Total	2426 (36.2%)	Average Hour	278.9
PM Total	4267 (63.8%)		
Peak AM Hour:	11:00= 582 (08/18/04)	Peak AM Factor:	0.909
Peak PM Hour:	16:30= 698 (08/18/04)	Peak PM Factor:	0.759

09/28/04
13:44:19

AMATS
806 CitiCenter; 146 S. High St.
Akron, Ohio 44308
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Page:

*** Basic Count Print (#302) ***

Site ID : SR 18 WB (SU 72)
Info 1 :
Info 2 :
Data Starts : 00:00 on 08/18/0
Data Ends : 23:45 on 08/18/0
Adj. Factor : 1.000%

Lane #1 Info : WB
Lane Mode : Normal
Sensor Used : Axle

********** Lane 1 Basic Count Print **********

Date	Time	:00	:15	:30	:45	Total	
08/18/04	00:00	57	39	51	36	183	
	01:00	27	34	25	33	119	
	02:00	23	34	20	22	99	
	03:00	9	22	15	12	58	
	04:00	23	23	43	56	145	
	05:00	50	84	87	85	306	
	06:00	132	176	212	253	773	
	07:00	284	340	371	430	1425	
	08:00	411	371	379	375	1536	2961
	09:00	281	330	300	311	1222	
	10:00	345	297	329	337	1308	
	11:00	323	309	370	344	1346	
	12:00	386	366	354	383	1489	2835
	13:00	407	439	408	394	1648	
	14:00	406	402	370	415	1593	
	15:00	443	443	435	439	1760	
	16:00	425	461	436	513	1835	
	17:00	474	553	523	475	2025	3860
	18:00	482	452	369	371	1674	
	19:00	347	326	310	285	1268	
	20:00	328	291	301	285	1205	
	21:00	288	256	232	184	960	
	22:00	165	130	146	106	547	
	23:00	120	77	68	71	336	

Daily Total : 24860
AM Total : 8520 (34.3%)
PM Total : 16340 (65.7%)
Peak AM Hour: 07:45= 1591 (6.4%)
Peak PM Hour: 16:45= 2063 (8.3%)

Average Period: 256.3
Average Hour : 1035.8

Peak AM Factor: 0.925
Peak PM Factor: 0.933

	MECH	MANUAL
7-9	2961	2758
11-1	2835	2799
4-6	3860	3870
	9656	9427

24 HR EXP FACTOR = $\frac{24860}{9656} = 2.57$

S.A.F. = 0.92

* 2.57

* USE THIS VALUE FOR EB SIDE ALSO. EB COUNT WAS HOSE DEVELOPED A HOLE.

09/28/04
13:44:19

AMATS
806 CitiCenter; 146 S. High St.
Akron, Ohio 44308
(330) 375-2436

GRAND TOTALS

********** LANE 1 FINAL **********

Grand Total	24860		Average Period: 256.3
# Of Days	1.01		ADT : 24604
AM Total	8520	(34.3%)	Average Hour : 1035.8
PM Total	16340	(65.7%)	
Peak AM Hour:	07:45=	1591 (08/18/04)	Peak AM Factor: 0.925
Peak PM Hour:	16:45=	2063 (08/18/04)	Peak PM Factor: 0.933

09/28/04 AMATS Page:
13:57:31 806 CitiCenter; 146 S. High St.
Akron, Ohio 44308
(330) 375-2436

*** Basic Count Print (#302) ***

Site ID : Montrose West NB (SU 72) Data Starts : 00:00 on 08/18/0
Info 1 : Data Ends : 23:45 on 08/18/0
Info 2 : Adj. Factor : 1.000%

Lane #1 Info : NB
Lane Mode : Normal Sensor Used : Axle

********** Lane 1 Basic Count Print **********

Date	Time	:00	:15	:30	:45	Total	
08/18/04	00:00	13	7	8	7	35	
	01:00	7	9	2	7	25	
	02:00	3	1	1	1	6	
	03:00	2	4	3	4	13	
	04:00	3	0	1	1	5	
	05:00	5	10	18	11	44	
	06:00	22	31	33	54	140	
	07:00	64	71	105	85	325	557
	08:00	58	63	60	51	232	
	09:00	48	54	58	37	197	
	10:00	60	45	60	36	201	
	11:00	42	39	57	82	220	631
	12:00	81	99	121	110	411	
	13:00	118	103	109	83	413	
	14:00	68	91	55	64	278	
	15:00	83	69	70	73	295	
	16:00	72	82	79	83	316	675
	17:00	94	94	98	73	359	
	18:00	99	64	97	95	355	
	19:00	116	94	104	78	392	
	20:00	92	79	66	84	321	
	21:00	87	64	50	53	254	
	22:00	55	31	32	32	150	
	23:00	27	21	25	16	89	

Daily Total : 5076 Average Period: 52.3
AM Total : 1443 (28.4%) Average Hour : 211.5
PM Total : 3633 (71.6%)
Peak AM Hour: 07:00= 325 (6.4%) Peak AM Factor: 0.774
Peak PM Hour: 12:30= 452 (8.9%) Peak PM Factor: 0.934

	MECH.	MANUAL
7-9	557	542
11-1	631	655
4-6	675	732
	1,863	1,929

24 HR. EXP FACTOR = $\frac{5076}{1863} = 2.72$

S.A.F. = 0.73

2.53

09/28/04 AMATS Page:
13:57:31 806 CitiCenter; 146 S. High St.
Akron, Ohio 44308
(330) 375-2436

GRAND TOTALS

********** LANE 1 FINAL **********

Grand Total	5076	Average Period	52.3
# Of Days	1.01	ADT	5024
AM Total	1443 (28.4%)	Average Hour	211.5
PM Total	3633 (71.6%)		
Peak AM Hour:	07:00= 325 (08/18/04)	Peak AM Factor:	0.774
Peak PM Hour:	12:30= 452 (08/18/04)	Peak PM Factor:	0.934

17077

07/13/04 Ohio Department of Transportation Page: 1

12:13:44 Office of Technical Services
Traffic Section - 2nd Floor North
Columbus, Ohio 43223
(614) 466-3727

*** Count Dump with 24hr Totals (#309) ***

****
** SR 18 E of C200 (Longstreth Lake Rd)
Site ID : 000000017077 Data Starts : 02:00 on 06/29/04
Info 1 : Data Ends : 01:00 on 06/30/04
Info 2 : Adj. Factor : 1.000%
****
**
Lane #1 Info : 13
Lane Mode : Normal Sensor Used : Axle
****
**

********** Lane 1 Count Dump with 24hr Totals **********

Date	Time	#1
Record Interval: 01:00		
06/29/04	02:00	1854
Tue	03:00	1725
	04:00	1897
	05:00	1908
	06:00	1907
	07:00	1375
	08:00	1243
	09:00	817
	10:00	494
	11:00	291
	12:00	175
	13:00	106
	14:00	45
	15:00	46
	16:00	47
	17:00	224
	18:00	867

Office of Technical Services
Traffic Section - 2nd Floor North
Columbus, Ohio 43223
(614) 466-3727

*** Count Dump with 24hr Totals (#309) ***

****
Site ID : 000000017077 Data Starts : 02:00 on 06/29/04
Info 1 : Data Ends : 01:00 on 06/30/04
Info 2 : Adj. Factor : 1.000%
****
Lane #1 Info : 13
Lane Mode : Normal Sensor Used : Axle
****

********** Lane 1 Count Dump with 24hr Totals **********

Date	Time	#1
Record Interval: 01:00		
06/29/04	02:00	1854
Tue	03:00	1725
	04:00	1897
	05:00	1908
	06:00	1907
	07:00	1375
	08:00	1243
	09:00	817
	10:00	494
	11:00	291
	12:00	175
	13:00	106
	14:00	45
	15:00	46
	16:00	47
	17:00	224
	18:00	867

17077

19:00	1601
20:00	1716
21:00	1593
22:00	1781
23:00	2009
Record Interval: 01:00	
06/30/04 00:00	2057
Wed 01:00	1827

24HR TOTAL	27605

Operational Analysis:

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Crystal Lake Road and SR 18
Agency or Co.		Area Type	CBD or Similar
Date Performed	4/26/2006	Jurisdiction	ODOT
Time Period	AM Peak - Existing Timing	Analysis Year	2006
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	1	0	1	1	2	1	0
Lane Group	L	TR		L	T	R		LT	R	L	TR	
Volume, V (vph)	83	1506	17	100	739	414	23	13	257	349	15	15
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	P	P	A	P	P	P	P	P	P	P	P
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3	3		3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000	1.000		1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0	0		0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	EW Perm	04	SB Only	NB Only	07	08
Timing	G = 5.0	G = 9.0	G = 56.0	G =	G = 21.0	G = 21.0	G =	G =
	Y = 4	Y = 6	Y = 6	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 140.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	92	1692		111	821	460		40	286	388	34	
Lane Group Capacity, c	275	1238		250	1573	969		244	458	464	233	
v/c Ratio, X	0.33	1.37		0.44	0.52	0.47		0.16	0.62	0.84	0.15	
Total Green Ratio, g/C	0.44	0.40		0.57	0.51	0.70		0.15	0.32	0.15	0.15	
Uniform Delay, d_1	23.7	42.0		28.3	23.1	9.4		51.8	40.3	57.8	51.7	
Progression Factor, PF	1.000	1.000		1.000	1.000	1.000		1.000	1.000	1.000	1.000	
Delay Calibration, k	0.11	0.50		0.11	0.50	0.50		0.50	0.50	0.50	0.50	
Incremental Delay, d_2	0.7	170.3		1.3	1.2	1.7		1.4	6.3	16.2	1.3	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay	24.4	212.3		29.6	24.4	11.1		53.3	46.6	74.1	53.0	
Lane Group LOS	C	F		C	C	B		D	D	E	D	
Approach Delay	202.6			20.4			47.4			72.4		
Approach LOS	F			C			D			E		
Intersection Delay	111.1			X_c = 1.00			Intersection LOS			F		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Crystal Lake Road and SR 18
Agency or Co.		Area Type	CBD or Similar
Date Performed	3/15/2006	Jurisdiction	ODOT
Time Period	PM Peak - Existing Timing	Analysis Year	2006
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	1	0	1	1	2	1	0
Lane Group	L	TR		L	T	R		LT	R	L	TR	
Volume, V (vph)	57	1222	46	368	1529	302	58	23	317	529	75	74
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	P	P	A	P	P	P	P	P	P	P	P
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3	3		3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000	1.000		1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0	0		0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	EW Perm	04	NB Only	SB Only	07	08
Timing	G = 10.0	G = 4.0	G = 56.0	G =	G = 21.0	G = 21.0	G =	G =
	Y = 4	Y = 6	Y = 6	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 140.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	63	1409		409	1699	336		90	352	588	165	
Lane Group Capacity, c	162	1234		250	1462	860		243	316	464	233	
v/c Ratio, X	0.39	1.14		1.64	1.16	0.39		0.37	1.11	1.27	0.71	
Total Green Ratio, g/C	0.47	0.40		0.57	0.47	0.62		0.15	0.22	0.15	0.15	
Uniform Delay, d_1	30.4	42.0		45.6	37.0	13.2		53.5	54.5	59.5	56.6	
Progression Factor, PF	1.000	1.000		1.000	1.000	1.000		1.000	1.000	1.000	1.000	
Delay Calibration, k	0.11	0.50		0.50	0.50	0.50		0.50	0.50	0.50	0.50	
Incremental Delay, d_2	1.5	74.0		303.7	80.9	1.3		4.3	84.9	136.5	16.6	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay	32.0	116.0		349.2	117.9	14.6		57.8	139.4	196.0	73.2	
Lane Group LOS	C	F		F	F	B		E	F	F	E	
Approach Delay	112.4			142.4			122.8			169.1		
Approach LOS	F			F			F			F		
Intersection Delay	136.0			X_c = 2.72			Intersection LOS			F		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Crystal Lake Road and SR 18
Agency or Co.		Area Type	CBD or Similar
Date Performed	4/26/2006	Jurisdiction	ODOT
Time Period	AM Peak - Existing Timing	Analysis Year	2030
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_l	1	2	0	1	2	1	0	1	1	2	1	0
Lane Group	L	TR		L	T	R		LT	R	L	TR	
Volume, V (vph)	450	1880	20	170	890	550	40	20	260	550	20	150
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	P	P	A	P	P	P	P	P	P	P	P
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3	3		3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000	1.000		1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0	0		0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	EW Perm	04	SB Only	NB Only	07	08
Timing	G = 5.0	G = 9.0	G = 56.0	G =	G = 21.0	G = 21.0	G =	G =
	Y = 4	Y = 6	Y = 6	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 140.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	500	2111		189	989	611		66	289	611	189	
Lane Group Capacity, c	221	1238		250	1573	969		243	458	464	218	
v/c Ratio, X	2.26	1.71		0.76	0.63	0.63		0.27	0.63	1.32	0.87	
Total Green Ratio, g/C	0.44	0.40		0.57	0.51	0.70		0.15	0.32	0.15	0.15	
Uniform Delay, d_1	48.0	42.0		41.7	25.0	11.3		52.7	40.4	59.5	58.1	
Progression Factor, PF	1.000	1.000		1.000	1.000	1.000		1.000	1.000	1.000	1.000	
Delay Calibration, k	0.50	0.50		0.31	0.50	0.50		0.50	0.50	0.50	0.50	
Incremental Delay, d_2	582.3	320.8		12.4	1.9	3.1		2.7	6.5	157.2	34.2	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay	630.3	362.8		54.1	26.9	14.4		55.5	46.9	216.7	92.4	
Lane Group LOS	F	F		D	C	B		E	D	F	F	
Approach Delay	414.0			25.5			48.5			187.3		
Approach LOS	F			C			D			F		
Intersection Delay	232.9			X_c = 1.61			Intersection LOS			F		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Crystal Lake Road and SR 18
Agency or Co.		Area Type	CBD or Similar
Date Performed	3/15/2006	Jurisdiction	ODOT
Time Period	PM Peak - Existing Timing	Analysis Year	2030
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	1	0	1	1	2	1	0
Lane Group	L	TR		L	T	R		LT	R	L	TR	
Volume, V (vph)	180	1540	40	360	2080	390	60	20	330	680	60	260
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	P	P	A	P	P	P	P	P	P	P	P
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3	3		3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000	1.000		1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0	0		0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	EW Perm	04	NB Only	SB Only	07	08
Timing	G = 10.0	G = 4.0	G = 56.0	G =	G = 21.0	G = 21.0	G =	G =
	Y = 4	Y = 6	Y = 6	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 140.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	200	1755		400	2311	433		89	367	756	356	
Lane Group Capacity, c	162	1236		250	1462	860		242	316	464	221	
v/c Ratio, X	1.23	1.42		1.60	1.58	0.50		0.37	1.16	1.63	1.61	
Total Green Ratio, g/C	0.47	0.40		0.57	0.47	0.62		0.15	0.22	0.15	0.15	
Uniform Delay, d_1	42.0	42.0		48.0	37.0	14.6		53.5	54.5	59.5	59.5	
Progression Factor, PF	1.000	1.000		1.000	1.000	1.000		1.000	1.000	1.000	1.000	
Delay Calibration, k	0.50	0.50		0.50	0.50	0.50		0.50	0.50	0.50	0.50	
Incremental Delay, d_2	147.4	193.8		288.0	264.6	2.1		4.3	101.9	292.9	294.9	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay	189.4	235.8		336.0	301.6	16.7		57.8	156.4	352.4	354.4	
Lane Group LOS	F	F		F	F	B		E	F	F	F	
Approach Delay	231.0			266.8			137.1			353.0		
Approach LOS	F			F			F			F		
Intersection Delay	261.8			X_c = 2.69			Intersection LOS			F		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Crystal Lake Road and SR 18 w/ W. Montrose relocation
Agency or Co.		Area Type	CBD or Similar
Date Performed	4/26/2006	Jurisdiction	ODOT
Time Period	AM Peak	Analysis Year	2030
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	2	3			3	1				2		1
Lane Group	L	T			T	R				L		R
Volume, V (vph)	470	2140			1060	550				550		170
% Heavy Vehicles, %HV	5	5			5	5				2		2
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90				0.90		0.90
Pretimed (P) or Actuated (A)	A	P			P	P				P		P
Start-up Lost Time, l_1	2.0	2.0			2.0	2.0				2.0		2.0
Extension of Effective Green, e	2.0	2.0			2.0	2.0				2.0		2.0
Arrival Type, AT	3	3			3	3				3		3
Unit Extension, UE	3.0	3.0			3.0	3.0				3.0		3.0
Filtering/Metering, I	1.000	1.000			1.000	1.000				1.000		1.000
Initial Unmet Demand, Q_b	0.0	0.0			0.0	0.0				0.0		0.0
Ped / Bike / RTOR Volumes	0	0		0	0	0				0	0	0
Lane Width	12.0	12.0			12.0	12.0				12.0		12.0
Parking / Grade / Parking	N	0	N	N	0	N				N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0			0	0				0		0
Min. Time for Pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	Thru & RT	03	04	SB Only	06	07	08
Timing	G = 18.0	G = 25.0	G =	G =	G = 21.0	G =	G =	G =
	Y = 4	Y = 6	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25					Cycle Length, C = 80.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	522	2378			1178	611				611		189
Lane Group Capacity, c	676	2606			1386	900				812		802
v/c Ratio, X	0.77	0.91			0.85	0.68				0.75		0.24
Total Green Ratio, g/C	0.22	0.59			0.31	0.65				0.26		0.56
Uniform Delay, d_1	29.1	14.7			25.7	8.8				27.1		8.8
Progression Factor, PF	1.000	1.000			1.000	1.000				1.000		1.000
Delay Calibration, k	0.32	0.50			0.50	0.50				0.50		0.50
Incremental Delay, d_2	5.5	6.2			6.7	4.1				6.4		0.7
Initial Queue Delay, d_3	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay	34.6	20.9			32.4	12.9				33.5		9.5
Lane Group LOS	C	C			C	B				C		A
Approach Delay	23.4			25.8						27.8		
Approach LOS	C			C						C		
Intersection Delay	24.8			X_c = 0.86			Intersection LOS			C		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	Burgess & Niple, KAM	Intersection	Crystal Lake Road and SR 18 w/ W. Montrose relocation
Agency or Co.	SUM-18	Area Type	All other areas
Date Performed	04/03/2006	Jurisdiction	
Time Period	PM Peak	Analysis Year	2030
		Project ID	

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	2	3			3	1				2		1
Lane Group	L	T			T	R				L		R
Volume, V (vph)	200	1870			2440	390				680		320
% Heavy Vehicles, %HV	5	5			5	5				2		2
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90				0.90		0.90
Pretimed (P) or Actuated (A)	A	P			P	P				A		A
Start-up Lost Time, l_1	2.0	2.0			2.0	2.0				2.0		2.0
Extension of Effective Green, e	2.0	4.0			4.0	4.0				4.0		2.0
Arrival Type, AT	2	5			3	3				4		4
Unit Extension, UE	3.0	3.0			3.0	3.0				3.0		3.0
Filtering/Metering, I	0.773	0.773			1.000	1.000				0.771		0.771
Initial Unmet Demand, Q_b	0.0	0.0			0.0	0.0				0.0		0.0
Ped / Bike / RTOR Volumes	0	0		0	0	0				0	0	0
Lane Width	12.0	12.0			12.0	12.0				12.0		12.0
Parking / Grade / Parking	N	0	N	N	0	N				N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0			0	0				0		0
Min. Time for Pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	Thru & RT	03	04	SB Only	06	07	08
Timing	G = 8.0	G = 48.0	G =	G =	G = 18.0	G =	G =	G =
	Y = 4	Y = 6	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	222	2078			2711	433				756		356
Lane Group Capacity, c	297	3396			2738	854				764		563
v/c Ratio, X	0.75	0.61			0.99	0.51				0.99		0.63
Total Green Ratio, g/C	0.09	0.69			0.56	0.56				0.22		0.36
Uniform Delay, d_1	40.0	7.5			19.8	12.4				34.9		24.1
Progression Factor, PF	1.000	0.161			1.000	1.000				1.000		0.939
Delay Calibration, k	0.30	0.50			0.50	0.50				0.49		0.21
Incremental Delay, d_2	7.9	0.6			15.0	2.1				25.9		1.8
Initial Queue Delay, d_3	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay	47.9	1.9			34.8	14.5				60.8		24.4
Lane Group LOS	D	A			C	B				E		C
Approach Delay	6.3			32.0						49.2		
Approach LOS	A			C						D		
Intersection Delay	25.9			X_c = 0.97			Intersection LOS			C		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Heritage Woods and SR 18
Agency or Co.		Area Type	CBD or Similar
Date Performed	4/26/2006	Jurisdiction	ODOT
Time Period	AM Peak - Existing Timing	Analysis Year	2006
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	0	0	1	1	1	1	0
Lane Group	L	TR		L	TR			LT	R	L	TR	
Volume, V (vph)	12	1479	12	43	696	38	9	8	115	12	9	7
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	P	P	A	P	P	P	P	P	P	P	P
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3			3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0			0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 9.0	G = 34.0	G =	G =	G = 11.0	G =	G =	G =
	Y = 4	Y = 6	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 70.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	13	1656		48	815			19	128	13	18	
Lane Group Capacity, c	414	1504		302	1495			227	224	196	246	
v/c Ratio, X	0.03	1.10		0.16	0.55			0.08	0.57	0.07	0.07	
Total Green Ratio, g/C	0.67	0.49		0.67	0.49			0.16	0.16	0.16	0.16	
Uniform Delay, d_1	4.7	18.0		12.3	12.6			25.2	27.3	25.1	25.2	
Progression Factor, PF	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Delay Calibration, k	0.11	0.50		0.11	0.50			0.50	0.50	0.50	0.50	
Incremental Delay, d_2	0.0	56.1		0.2	1.4			0.7	10.2	0.7	0.6	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Control Delay	4.8	74.1		12.5	14.0			25.9	37.5	25.8	25.7	
Lane Group LOS	A	E		B	B			C	D	C	C	
Approach Delay	73.5			13.9			36.0			25.8		
Approach LOS	E			B			D			C		
Intersection Delay	52.0			X_c = 0.88			Intersection LOS			D		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Heritage Woods and SR 18
Agency or Co.		Area Type	CBD or Similar
Date Performed	3/15/2006	Jurisdiction	ODOT
Time Period	PM Peak- Existing Timing	Analysis Year	2006
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	0	0	1	1	1	1	0
Lane Group	L	TR		L	TR			LT	R	L	TR	
Volume, V (vph)	29	1188	12	115	1538	8	12	9	103	34	17	51
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	P	P	A	P	P	P	P	P	P	P	P
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3			3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0			0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 9.0	G = 33.0	G =	G =	G = 12.0	G =	G =	G =
	Y = 4	Y = 6	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 70.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	32	1333		128	1718			23	114	38	76	
Lane Group Capacity, c	302	1460		302	1460			239	244	213	255	
v/c Ratio, X	0.11	0.91		0.42	1.18			0.10	0.47	0.18	0.30	
Total Green Ratio, g/C	0.66	0.47		0.66	0.47			0.17	0.17	0.17	0.17	
Uniform Delay, d_1	12.1	17.2		9.9	18.5			24.4	26.1	24.8	25.3	
Progression Factor, PF	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Delay Calibration, k	0.11	0.50		0.11	0.50			0.50	0.50	0.50	0.50	
Incremental Delay, d_2	0.2	10.3		1.0	87.0			0.8	6.3	1.8	3.0	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Control Delay	12.3	27.4		10.8	105.5			25.2	32.4	26.6	28.3	
Lane Group LOS	B	C		B	F			C	C	C	C	
Approach Delay	27.1			99.0			31.2			27.7		
Approach LOS	C			F			C			C		
Intersection Delay	65.6			X_c = 0.97			Intersection LOS			E		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Heritage Woods and SR 18
Agency or Co.		Area Type	CBD or Similar
Date Performed	4/26/2006	Jurisdiction	ODOT
Time Period	AM-Peak- Existing Timing	Analysis Year	2030
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	0	0	1	1	1	1	0
Lane Group	L	TR		L	TR			LT	R	L	TR	
Volume, V (vph)	10	2230	10	40	1000	40	10	10	110	10	10	10
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	P	P	A	P	P	P	P	P	P	P	P
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3			3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0			0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 9.0	G = 34.0	G =	G =	G = 11.0	G =	G =	G =
	Y = 4	Y = 6	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 70.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	11	2489		44	1155			22	122	11	22	
Lane Group Capacity, c	312	1505		302	1497			228	224	196	244	
v/c Ratio, X	0.04	1.65		0.15	0.77			0.10	0.54	0.06	0.09	
Total Green Ratio, g/C	0.67	0.49		0.67	0.49			0.16	0.16	0.16	0.16	
Uniform Delay, d_1	6.3	18.0		12.4	14.8			25.2	27.2	25.1	25.2	
Progression Factor, PF	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Delay Calibration, k	0.11	0.50		0.11	0.50			0.50	0.50	0.50	0.50	
Incremental Delay, d_2	0.0	297.2		0.2	3.9			0.8	9.2	0.5	0.7	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Control Delay	6.3	315.2		12.6	18.7			26.1	36.4	25.6	26.0	
Lane Group LOS	A	F		B	B			C	D	C	C	
Approach Delay	313.9			18.5			34.8			25.8		
Approach LOS	F			B			C			C		
Intersection Delay	209.7			X_c = 1.23			Intersection LOS			F		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Heritage Woods and SR 18
Agency or Co.		Area Type	CBD or Similar
Date Performed	3/15/2006	Jurisdiction	ODOT
Time Period	PM Peak - Existing Timing	Analysis Year	2030
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	0	0	1	1	1	1	0
Lane Group	L	TR		L	TR			LT	R	L	TR	
Volume, V (vph)	30	1620	10	120	2270	10	10	10	100	40	20	50
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	P	P	A	P	P	P	P	P	P	P	P
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3			3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0			0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 9.0	G = 33.0	G =	G =	G = 12.0	G =	G =	G =
	Y = 4	Y = 6	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 70.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	33	1811		133	2533			22	111	44	78	
Lane Group Capacity, c	302	1460		302	1461			244	244	214	256	
v/c Ratio, X	0.11	1.24		0.44	1.73			0.09	0.45	0.21	0.30	
Total Green Ratio, g/C	0.66	0.47		0.66	0.47			0.17	0.17	0.17	0.17	
Uniform Delay, d_1	12.1	18.5		13.0	18.5			24.4	26.1	24.9	25.4	
Progression Factor, PF	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Delay Calibration, k	0.11	0.50		0.11	0.50			0.50	0.50	0.50	0.50	
Incremental Delay, d_2	0.2	114.2		1.0	333.1			0.7	6.0	2.2	3.1	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Control Delay	12.3	132.7		14.0	351.6			25.1	32.1	27.1	28.4	
Lane Group LOS	B	F		B	F			C	C	C	C	
Approach Delay	130.6			334.7			30.9			27.9		
Approach LOS	F			F			C			C		
Intersection Delay	239.4			X_c = 1.32			Intersection LOS			F		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	B&N	Intersection	Heritage Woods and SR 18 w/ W. Montrose relocation
Agency or Co.		Area Type	CBD or Similar
Date Performed	4/26/2006	Jurisdiction	ODOT
Time Period	AM Peak	Analysis Year	2030
		Project ID	Sum-18-Corridor Study

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	3	0	2	3	0	0	1	2	1	1	0
Lane Group	L	TR		L	TR			LT	R	L	TR	
Volume, V (vph)	10	2210	30	230	960	40	50	10	390	10	10	10
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	P	P	P	A	P	P	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Arrival Type, AT	3	3		3	3			3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0			0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	06	07	08
Timing	G = 52.0	G = 10.0	G =	G =	G = 10.0	G =	G =	G =
	Y = 6	Y = 6	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25					Cycle Length, C = 90.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	11	2489		256	1111			67	433	11	22	
Lane Group Capacity, c	228	2558		334	3332			139	729	133	172	
v/c Ratio, X	0.05	0.97		0.77	0.33			0.48	0.59	0.08	0.13	
Total Green Ratio, g/C	0.58	0.58		0.11	0.76			0.11	0.29	0.11	0.11	
Uniform Delay, d_1	8.3	18.3		38.9	3.6			37.6	27.5	35.9	36.1	
Progression Factor, PF	1.000	1.000		1.000	1.000			1.000	1.000	1.000	1.000	
Delay Calibration, k	0.50	0.50		0.32	0.50			0.11	0.18	0.11	0.11	
Incremental Delay, d_2	0.4	12.5		10.2	0.3			2.6	1.3	0.3	0.3	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Control Delay	8.7	30.8		49.1	3.9			40.2	28.8	36.2	36.4	
Lane Group LOS	A	C		D	A			D	C	D	D	
Approach Delay	30.7			12.3			30.3			36.3		
Approach LOS	C			B			C			D		
Intersection Delay	25.0			X_c = 0.85			Intersection LOS			C		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	Burgess & Niple, KAM	Intersection	SR 18 & Heritage Woods Dr. w/ W. Montrose relocation
Agency or Co.	SUM-18	Area Type	All other areas
Date Performed	04/03/2006	Jurisdiction	
Time Period	PM Peak	Analysis Year	2030
		Project ID	

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	3	0	2	3	0	0	1	2	1	1	0
Lane Group	L	TR		L	TR			LT	R	L	TR	
Volume, V (vph)	30	1580	50	540	2210	10	70	10	450	40	20	50
% Heavy Vehicles, %HV	5	5	5	5	5	5	2	2	2	2	2	2
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	P	P	P	A	P	P	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	
Extension of Effective Green, e	2.0	4.0		2.0	4.0			4.0	2.0	4.0	4.0	
Arrival Type, AT	3	3		4	4			3	3	3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Filtering/Metering, I	1.000	1.000		0.375	0.375			1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0			12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0			0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

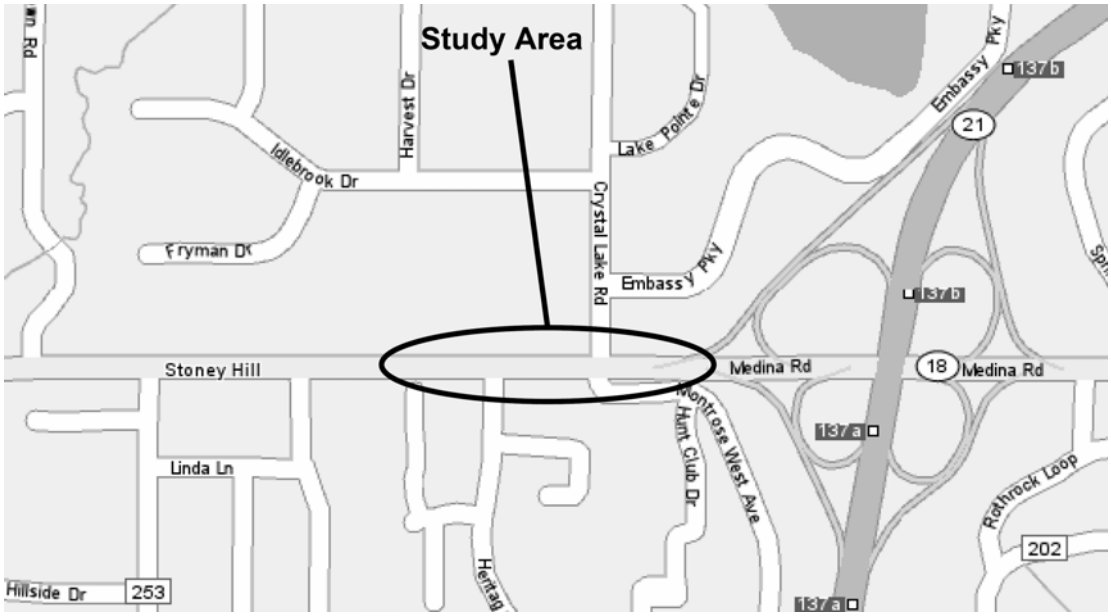
Phasing	EW Perm	WB Only	03	04	NS Perm	06	07	08
Timing	G = 39.0	G = 20.0	G =	G =	G = 13.0	G =	G =	G =
	Y = 6	Y = 6	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	33	1812		600	2467			89	500	44	78	
Lane Group Capacity, c	81	2235		742	3667			217	1215	217	277	
v/c Ratio, X	0.41	0.81		0.81	0.67			0.41	0.41	0.20	0.28	
Total Green Ratio, g/C	0.43	0.46		0.22	0.74			0.17	0.43	0.17	0.17	
Uniform Delay, d_1	17.5	21.2		33.2	5.9			33.5	17.6	32.3	32.8	
Progression Factor, PF	1.000	1.000		1.000	0.225			1.000	1.000	1.000	1.000	
Delay Calibration, k	0.50	0.50		0.35	0.50			0.11	0.11	0.11	0.11	
Incremental Delay, d_2	14.5	3.3		2.6	0.4			1.3	0.2	0.5	0.6	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Control Delay	32.0	24.5		35.8	1.7			34.8	17.8	32.8	33.3	
Lane Group LOS	C	C		D	A			C	B	C	C	
Approach Delay	24.6			8.4			20.4			33.2		
Approach LOS	C			A			C			C		
Intersection Delay	15.5			X_c = 0.73			Intersection LOS			B		

S.R. 18 & MONTROSE WEST AVE. / CRYSTAL LAKE ROAD
SUM 18 at Crystal Lake #1207 HSP Intersection for 2005
SUM 18, 1.69 to 2.05, #1417 HSP Non-Freeway Section for 2005
SUM 18 2.00 to 4.00, #93 Hot Spot Section for 2005

ADDENDUM



Prepared for:
ODOT District 4
April, 2007

BURGESS & NIPLE
50 South Main Street
Suit 600
Akron, Ohio 44308

Addendum:

To investigate to effects of a 2004 resurfacing project completed to reduce crashes in the project location and to include 2005 crash data, a more thorough query of crashes were analyzed. The crash frequencies were examined before and after the resurfacing project to identify what, if any, effects it had on crash frequencies. Before the resurfacing project, wet pavement related crashes accounted for 42 percent of all crashes, after the resurfacing, wet pavement related crashes dropped to 25.6 percent of the total crashes. The rear-end crashes, which are occurring mainly due to congestion, accounted for 64.8 percent of all crashes before the resurfacing and rose to 68.3 percent after the resurfacing. Although the wet pavement crashes were reduced to below the state wide average, the congestion related crashes, namely the rear-end crashes continue to be a safety problem and need to be addressed. The crash reduction factor that would be applied due to the resurfacing needed for the recommended improvement has been taken out of the Rate of Return analysis since the past resurfacing of this location provided a reduction of wet pavement crashes and no further reduction is anticipated with the proposed project.

Due to the results of this new query, updated to the most current 3-year period (2003-2005), the crash data contained in the original report differs from the crash data used during the following analysis. The crash data contained in the original report contains information available from 2002-2004 and analyzes the location as two separate intersection locations. Due to the very close proximity of the intersections and the availability of the 2003-2005 crash data, the study area was re-analyzed as a section of roadway. Though the crash data frequencies changed during this analysis the patterns remained the same. The crashes are still predominantly due to congestion and the inefficient operation of two intersections located in close proximity each other and to the S.R. 18 & I-77 interchange. Since the recommendations made remain prudent to solving the identified crash patterns, the recommendations have remained unchanged. The updated Crash Analysis has been included as part of this Addendum.

Crash Analysis

From 2003 to 2005, there were 170 crashes at the location – 116 property damage and 54 injury crashes. None of the crashes involved a fatality. The 2003-2005 crash rate at this 1-mile section is 4.28 crashes per million vehicle miles. The data shows a peak in crashes between 3 p.m. and 6 p.m. relating to the evening commute. The predominant crash types at this location are angle and rear-end crashes, which together account for 84.7% of the crashes. The 3 year average for wet pavement crashes is 34.1%, however, before the 2004 resurfacing wet pavement crashes were 42% and 25.6% after, so the effective rate studied was 25.6%. The 3 year average for rear-end accidents is 66.5%, however, they were 64.8% before the 2004 resurfacing and 68.3% after, leaving 68.3% as the effective rate studied.

Table 1 - Crash Type compared with statewide averages for urban intersections

Condition	# of crashes 2003 – 2005	% of crashes 2003 – 2005	% of crashes statewide 2003-2005
Night-time	40	23.5	28.6
Wet pavement	30	34.1	32.3
Crash type			
Rear-end	39	66.5	26.3
Same-direction sideswipe	6	11.8	6.9
Angle	11	18.2	24.7

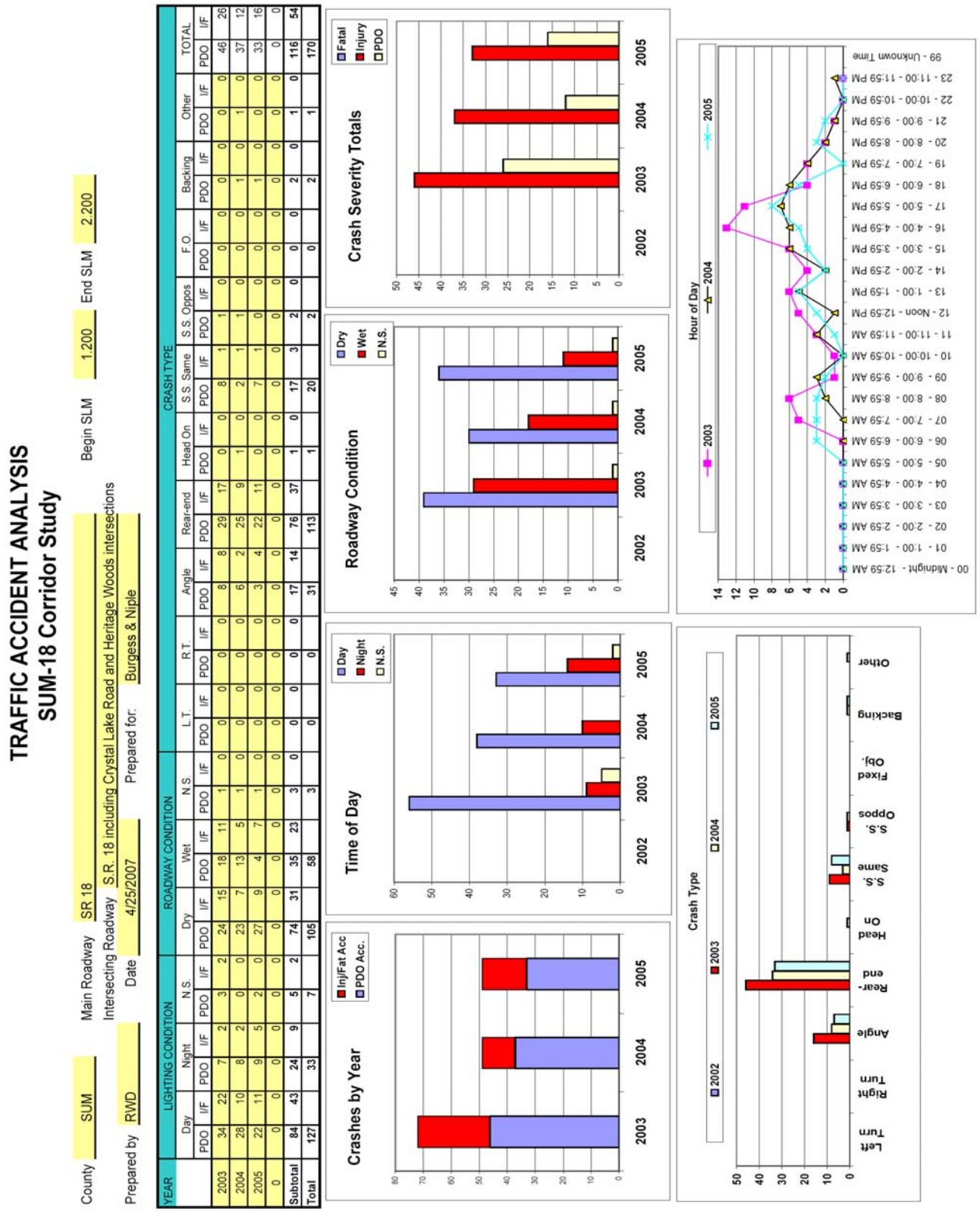
Source: Ohio Department of Public Safety Crash Data

Conclusions:

Though the crash data frequencies changed during this analysis the patterns remained the same. The crashes are still predominantly due to congestion and the inefficient operation of two intersections located in close proximity each other and to the S.R. 18 & I 77 interchange. Since the recommendations made remain prudent to solving the identified crash patterns, the recommendations have remained unchanged. The short-term approaches to addressing the crash problem at this intersection are to coordinate Crystal Lake/Montrose West and Heritage Woods Drive for optimal performance to reduce the congestion at the intersection. However due to the close spacing of the two intersections, approximately 600 ft between them, and the congestion experienced at this location it is a common occurrence for the EB Crystal Lake Road intersection and the WB Heritage Woods intersection to experience very large Queue lengths and spill back past the adjacent intersections. Even with the optimal timings and coordination at these two intersections the congestion continues to be too heavy for the capacity available and the Intersections still operate at unacceptable Levels of Service. Due to this heavy congestion situation there is no viable short-term solution that adequately addresses the crash problem without capacity improvements, therefore no short-term recommendation can be made at this time.

The rate of return for the short-term was not evaluated since as previously stated no short-term recommendation is available at this time. The rate of return for the medium-term countermeasure is positive at 12.32 percent. This positive rate of return indicates a viable solution to address the crashes at the intersection. Since the congestion at the location requires an extensive multifaceted group of improvements such as a road relocation and roadway widening to remedy the crash problem, there are no further improvements identified that are not already included as part of the medium term recommendation.

Figure 1 – Crash Analysis Tables and Graphs



TRAFFIC ACCIDENT ANALYSIS
SUM-18 Corridor Study

County SUM Main Roadway SR 18 Begin SLM 1.200 End SLM 2.200
Intersecting Roadway S.R. 18 including Crystal Lake Road and Heritage Woods intersections
Prepared by RWD Date 4/25/2007 Prepared for: Burgess & Niple

YEAR	LIGHTING CONDITION						ROADWAY CONDITION						CRASH TYPE																							
	Day		Night		N.S.		Dry		Wet		N.S.		L.T.		R.T.		Angle		Rear-end		Head On		S.S. Same		S.S. Oppos		F.O.		Backing		Other		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2003	34	22	7	2	3	2	24	15	18	11	1	0	0	0	0	0	8	8	29	17	0	0	8	1	1	0	0	0	0	0	0	0	46	26
2004	28	10	8	2	0	0	23	7	13	5	1	0	0	0	0	0	6	2	25	9	1	0	2	1	1	0	0	0	1	0	1	0	37	12
2005	22	11	9	5	2	0	27	9	4	7	1	0	0	0	0	0	3	4	22	11	0	0	7	1	0	0	0	0	1	0	0	0	33	16
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	84	43	24	9	5	2	74	31	35	23	3	0	0	0	0	0	17	14	76	37	1	0	17	3	2	0	0	0	2	0	1	0	116	54
Total	127		33		7		105		58		3		0		0		31		113		1		20		2		0		2		1		170	

RATE OF RETURN - ECONOMIC ANALYSIS WORKSHEET

Cells in Yellow Require User Input

Click to Clear Sample Information

Ohio Department of Transportation
Office of Systems Planning and Program Manage

5,000 Crash Record Analysis Limit

County	SUM	Main Roadway	SR 18	Begin SLM	1.20	End SLM	2.20
		Intersecting Roadway					
Prepared by	District 4 ODOT	Date	4/25/2007	Crash BDate	2003	Crash EDate	2005

Year	TIME OF DAY w/o CR200 S.Leg						ROADWAY CONDITION w/o CR200 S.Leg						All w/o CR200 S.Leg												Only		Only		Only	
	DAY		DAWN/DUSK		DARK		DRY		WET		SNOW / ICE		REAR END		ANGLE		SS PASS		SS MEET		BACKING		HEAD ON		OVERTURN		CR200 S.Leg		CR200 w/o S.Leg		TR3075	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	76	37	5	1	20	9	66	26	32	21	3	0	71	36	12	8	16	3	0	0	1	0	0	0	1	0	15	7	66	29	35	18
AVG.	25.3	12.3	1.7	0.3	6.7	3.0	22.0	8.7	10.7	7.0	1.0	0.0	23.7	12.0	4.0	2.7	5.3	1.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0	5.0	2.3	22.0	9.7	11.7	6.0

--The "TOTAL" and "AVERAGE" row formulas are set to only use 2003-2005 crash data. If the crash data is not for these three years, the formulas must be modified by the user to calculate the associated year data.

RECOMMENDED IMPROVEMENTS	Select Countermeasures
R1	Relocate CR200 South Leg
R2	23 Reconstruct existing signal - major
R3	25 Revise signal timing
R4	

CRASH TYPE	PDO CRASHES							INJ. - FAT. CRASHES						
	R1	R2	R3	R4	RT	AVG PDO	EST. RED.	R1	R2	R3	R4	RT	AVG INJ-FAT	EST. RED.
ANGLE					0	4.00	0.00					0	2.67	0.00
SS PASS					0	5.33	0.00					0	1.00	0.00
SS MEET					0	0.00	0.00					0	0.00	0.00
REAR END					0	23.67	0.00					0	12.00	0.00
BACKING					0	0.33	0.00					0	0.00	0.00
HEAD ON					0	0.00	0.00					0	0.00	0.00
OVERTURN					0	0.33	0.00					0	0.00	0.00
CR200 S.Leg	1				1	5.00	5.00	1				1	2.33	2.33
TR3075		0.2	0.15		0.32	11.67	3.73		0.2	0.15		0.32	6.00	1.92
NIGHT					0	6.67	0.00					0	3.00	0.00
WET					0	10.67	0.00					0	7.00	0.00
CR200 w/o S.Leg		0.27	0.15		0.38	22.00	8.35		0.27	0.15		0.38	9.67	3.67
ESTIMATED PDO CRASH REDUCTION =							17.08	ESTIMATED INJ. - FAT. CRASH REDUCTION =						7.92

ADT Factor

Project Service Life	20 years					
Present ADT (PADT)	36300 veh / day	Average ADT =	(PADT + FADT)/2 = (	36300 +	45997) =	41148.5
Future ADT (FADT)	45997 veh / day	ADT Factor =	Average ADT / PADT =	41148.5 /	36300 =	1.13

Average Annual Benefits

Select Facility Type Below: Rural State Highways

Annual PDO Benefits = Estimated PDO Crash Reduction * Avg PDO Cost	=	17.08	*	$ 8,501.00	=	$ 145,216.92
Annual INJ.-FAT. Benefits = Estimated INJ.-FAT. Crash Reduction * Avg INJ.-FAT. Cost	=	7.92	*	$ 79,341.00	=	$ 628,526.18
Total Benefits					=	$ 773,743.09
AverageAnnual Benefits = Total Benefits * ADT Factor	=	1.13	*	$ 773,743.09	=	**$ 877,090.02**

Rate of Return

Project Cost	$6,407,000
Maintenance and Energy Costs	$2,000
Salvage Value	$2,000

Rate of Return: **12.32%**

Figure 2 – Rate of Return Analysis