Appendix F:
2012 Traffic Analysis

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Zavoral Mine & Reclamation Project EIS
2012 Traffic Analysis

TH 95 and TH9 7 Intersection Analysis

AECOM completed a level of service (LOS) analysis for the intersection at TH 95 and TH 97. Traffic counts were collected during the morning and evening rush hour on Tuesday June 12, 2012. These times were chosen to reflect typical AM and PM peak hour traffic conditions. Tiller was not conducting a haul event from Franconia, Minnesota and/or Osceola, Wisconsin during the June traffic counts.

A LOS analysis was completed for three scenarios at the TH 97 and TH 95 intersection:

1) Existing AM and PM peak hour traffic

2) The No-build alternate with a haul event from Franconia, Minnesota and/or Osceola, Wisconsin occurring at maximum hourly haul rates.

3) The Proposed Site in operation at hourly haul rates that ranged from 56 to 62 trips per hour which is equivalent to 560 trips per day (10 hour day) to 744 trips per day (12 hour day). These truck trip rates cover the range of proposed operations under Alternatives 1, 3, and 3A.

<u>Existing AM and PM peak hour traffic</u>

The LOS analysis for existing conditions showed that the LOS is Level A or B during the two peak traffic times under most turning conditions. The LOS drops to Level C for two afternoon turning movements, eastbound (left turn) and Eastbound Approach, as shown below.

Existing Conditions – Unsignalized Intersection Level of Service

Intersection	Delay & Level of Service (LOS/Delay in seconds per vehicle)			
	Northbound (left turn)	Eastbound (left turn)	Eastbound (right turn)	Eastbound Approach
TH 97 & TH 95 AM Peak	A / 8.4	B / 12.0	A / 9.6	B / 11.6
TH 97 & TH 95 PM Peak	A / 8.0	C / 16.5	A / 9.0	C / 15.9

<u>No-build alternative with a haul event from Franconia, Minnesota and/or Osceola, Wisconsin occurring at maximum hourly haul rates</u>

The LOS analysis for the No-build Alternative showed that the LOS is Level A or B during the two peak traffic times under most turning conditions. The LOS drops to Level C for two afternoon turning movements, eastbound (left turn) and Eastbound Approach, as shown below.

Alternative 2 No Build Haul Conditions – Unsignalized Intersection Level of Service

Intersection	Delay & Level of Service (LOS/Delay in seconds per vehicle)			
	Northbound (left turn)	Eastbound (left turn)	Eastbound (right turn)	Eastbound Approach
TH 97 & TH 95 AM Peak	A / 8.6	B / 13.5	A / 9.6	B / 13.1
TH 97 & TH 95 PM Peak	A / 8.1	C / 21.8	A / 9.0	C / 20.8

Proposed Project alternatives in operation at maximum hourly haul rates

The LOS analysis for proposed conditions showed that the LOS is Level A, B or C during peak traffic periods under most turning conditions. The LOS drops to Level D for two afternoon turning movements as shown below.

Alternatives 1 and 3- Unsignalized Intersection Level of Service

Intersection	Delay & Level of Service (LOS/Delay in seconds per vehicle)				
	Northbound (left turn)	Westbound (thru)	Eastbound (left turn)	Eastbound (right turn)	Eastbound Approach
TH 97 & TH 95 AM Peak	A / 8.5	C / 16.9	C / 15.5	A / 9.6	B / 14.7
TH 97 & TH 95 PM Peak	A / 8.0	C/ 18.6	D / 32.0	A / 9.0	D / 30.2

The results of the LOS analysis for the intersection of TH 97 and TH 95 did not change in comparison to Alternatives 1 and 3 as shown below.

Subalternative 3A - Unsignalized Intersection level of service

Intersection	Delay and Level of Service (LOS/Delay in seconds per vehicle)				
	Northbound (left turn)	Westbound (thru)	Eastbound (left turn)	Eastbound (right turn)	Eastbound Approach
TH 97 and TH 95 AM Peak	A / 8.5	C / 17.0	C / 15.8	A / 9.6	C / 15.1
TH 97 and TH 95 PM Peak	A / 8.0	C / 18.8	D / 34.1	A / 9.0	D / 32.2

Scandia Elementary Driveway

An intersection turning movement analysis was completed for buses and cars at the Scandia Elementary school driveway. The traffic counts were based on peak hour Automated Traffic Recorder (ATR) data provided by MnDOT, bus data, and maximum truck traffic rates. The specific ATR data used represented the time when school peak traffic hours occurred in the morning and afternoon.

The LOS analysis showed the morning peak had a level of A and the afternoon peak had a Level of B. This indicates that sufficient gaps are present in traffic to allow buses and cars to access TH 97. Also, the LOS for the intersection at Scandia Elementary School for Subalternative 3A did not change when compared to the other build alternatives.

Intersection Analysis Summary

The LOS analysis showed that the TH 95 and TH 97 intersection has sufficient gaps under all scenarios and all traffic patterns.

During the morning rush hour the LOS for all scenarios is Level C or better for all turning movements for all scenarios. During the evening rush hour the LOS is at Level C or better for all turning movements for

all three scenarios except evening rush hour for the eastbound approach and eastbound left turn. According to Section 5.3, Figure 5.2 of the Mn/DOT Traffic Impact Study Guidance these levels are considered to be acceptable for this type of intersection.

The LOS analysis for the Scandia Elementary driveway has sufficient gaps under all alternative traffic scenarios and traffic patterns.

Intersection Potential Mitigation Measures

A requirement to reduce truck traffic levels during the time period from approximately 4:00 PM to 6:00 PM on weekdays is a potential mitigation measure that the City may require through the CUP process to reduce traffic congestion at the TH 97 and TH 95 intersection.

The city's ordinance already prohibits mining operations from occurring on weekends or holidays. Additionally, truck traffic could be restricted on Friday afternoons when tourist traffic is most likely to be present in the area.

Copies of the Intersection Capacity Analyses are included in Attachment A.

TH 97 Corridor Analysis

The alternatives for the TH 97 corridor vary in the range of "daily haul volumes" based on the planned duration of mining or the No Build (not a defined number of years for mining). The truck volume analyzed was the Maximum Daily Capacity (and Maximum Hourly Capacity).

The morning and evening peak hour traffic volumes were analyzed (based on ATR data from MnDOT) for the roadway segment on TH 97 from Lofton to TH 95 using Highway Capacity Analysis software. For both the morning and evening conditions, the segment is LOS C. Use of peak hourly traffic data plus maximum truck traffic obviates the need to run multiple analyses for lower traffic volumes. The corridor summary for the AM and PM peak hours is shown in Attachment B.

Sight Distance Analysis

AECOM completed an analysis for the following sight distances.

1. Sight Corners

   MnDOT has a requirement that no obstructions be placed in the sight corners of the intersection. The sight corners for the proposed new driveway have found no obstructions. The Sight Corner Exhibit is contained in Attachment C.

2. Enabling a Stopped Vehicle to Cross a Major Highway

   At an intersection with stopped control, the operator of the stopped vehicle must have sufficient visibility to cross the mainline road without interfering with oncoming vehicles. The MnDOT sight distance required for this is defined as D=1.47V (J + T), where D =minimum sight distance, V = design speed of the mainline highway, J=perception/reaction time (use 2.0 sec.), and T=time required to traverse the highway (110ft @ 10mph) =7.5 sec.

   Therefore, D = 1.47(55)(2+7.5) = 768 Ft.

Based on a review of topographic maps with a contour interval of 1 foot of TH95, the existing sight distance is approximately 1,400 feet in both the north and south directions. This exceeds the MnDOT requirement of 768 feet for stopping sight distance.

3. Turning Left onto a Major Highway

   At an intersection with stopped control, the operator of the stopped vehicle must have sufficient visibility to turn left onto the mainline road. Figure 5-2.02F of the MnDOT Road design Manual shows that 780 ft of sight distance is needed for the vehicles coming from the south. As noted above, the northbound sight distance is approximately 1400'.

   The MnDOT Figure 5-2.02F is included in Attachment C.

4. Signal Control

   This is not a signalized intersection, so this section does not apply.

5. Effects of Skew

   This is not a skewed intersection, so this section does not apply.

6. Effect of Grades

   Adjustments to the intersection only need to occur when grades exceed 3%. The grade of Highway 95 is roughly 2%, so no adjustments are necessary.

Based on the above analysis, the existing sight distance at the TH 95 and TH 97 intersection meet the MnDOT standards for the proposed Project modification to a four way intersection.

TH 97 and TH 95 Road Conditions

As part of the proposed project, Tiller Corporation has stated that truck hall traffic currently using TH 95 from Franconia and Wisconsin would be offset by truck traffic from the Zavoral Site. Thus, truck traffic and its associated impact on TH 95 would decrease. Tiller Corporation has also stated that under the proposed scenarios, the maximum truck traffic on TH 97 would not increase. Therefore, impacts on TH 97 would not change.

MnDOT completes an annual evaluation of TH 97 and TH 95 as part of their road inspection program. As shown on the figures in Attachment D, in 2011 TH 97 was rated as having very good pavement quality, good ride quality, very good surface rating and an expected lifespan of 4 to 11 years.

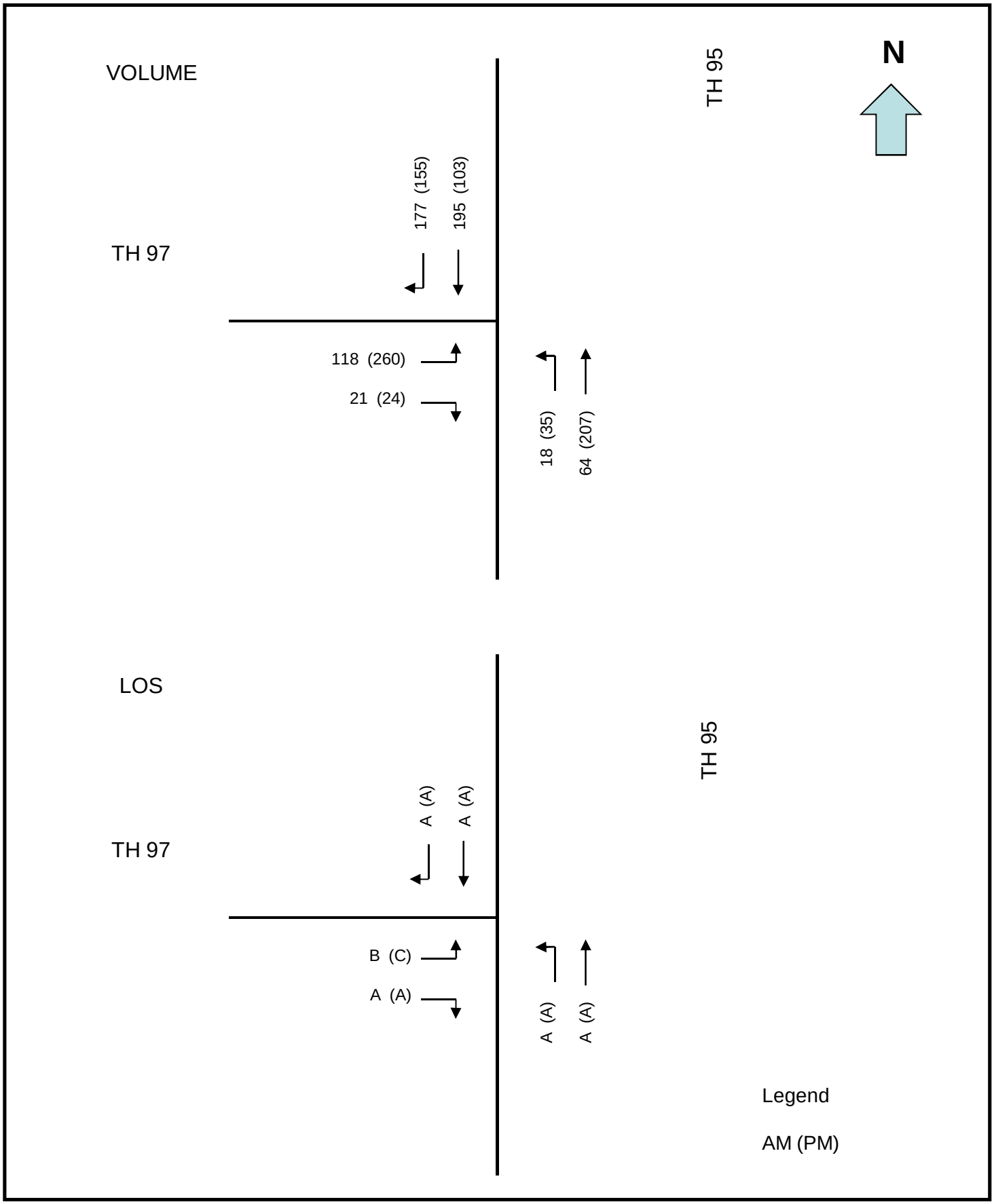
Additional Mitigation Measures

The City of Scandia ordinances would prohibit operation of the proposed Zavoral Site on weekends or holidays. In order to minimize potential impacts to tourism, the prohibition could be extended to Friday afternoons to avoid conflicts with recreational travelers using TH 97 and TH 95.

Attachment A

Intersection Capacity Analysis

- TH97 and TH95
- TH97 and Scandia Elementary School Driveway



Zavoral EIS Update

Figure 1

TH 95 & TH 97 Existing AM and PM Peak

AECOM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Mark Smith*	Intersection	*TH 95 and TH 97*
Agency/Co.	*AECOM*	Jurisdiction	
Date Performed	*6/12/2012*	Analysis Year	*2012*
Analysis Time Period	*AM Peak*		

Project Description *Existing*

East/West Street: *TH 97* North/South Street: *TH 95*

Intersection Orientation: *North-South* Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*18*	*64*			*195*	*177*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*1.00*	*1.00*	*0.88*	
Hourly Flow Rate, HFR (veh/h)	*20*	*72*	*0*	*0*	*221*	*186*
Percent Heavy Vehicles	*18*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*118*		*21*			
Peak-Hour Factor, PHF	*0.88*	*1.00*	*0.88*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*134*	*0*	*23*	*0*	*0*	*0*
Percent Heavy Vehicles	*20*	*0*	*10*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*					*L*		*R*
v (veh/h)	*20*					*134*		*23*
C (m) (veh/h)	*1070*					*649*		*799*
v/c	*0.02*					*0.21*		*0.03*
95% queue length	*0.06*					*0.78*		*0.09*
Control Delay (s/veh)	*8.4*					*12.0*		*9.6*
LOS	*A*					*B*		*A*
Approach Delay (s/veh)	--	--				*11.6*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Mark Smith*	Intersection	*TH 95 and TH 97*
Agency/Co.	*AECOM*	Jurisdiction	
Date Performed	*6/12/2012*	Analysis Year	*2012*
Analysis Time Period	*PM Peak*		

Project Description *Existing*

East/West Street: *TH 97* North/South Street: *TH 95*

Intersection Orientation: *North-South* Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*35*	*207*			*103*	*155*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*1.00*	*1.00*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*39*	*235*	*0*	*0*	*117*	*176*
Percent Heavy Vehicles	*9*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*260*		*24*			
Peak-Hour Factor, PHF	*0.88*	*1.00*	*0.88*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*295*	*0*	*27*	*0*	*0*	*0*
Percent Heavy Vehicles	*5*	*0*	*8*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*					*L*		*R*
v (veh/h)	*39*					*295*		*27*
C (m) (veh/h)	*1230*					*607*		*919*
v/c	*0.03*					*0.49*		*0.03*
95% queue length	*0.10*					*2.79*		*0.09*
Control Delay (s/veh)	*8.0*					*16.5*		*9.0*
LOS	*A*					*C*		*A*
Approach Delay (s/veh)	--	--				*15.9*		
Approach LOS	--	--				*C*		

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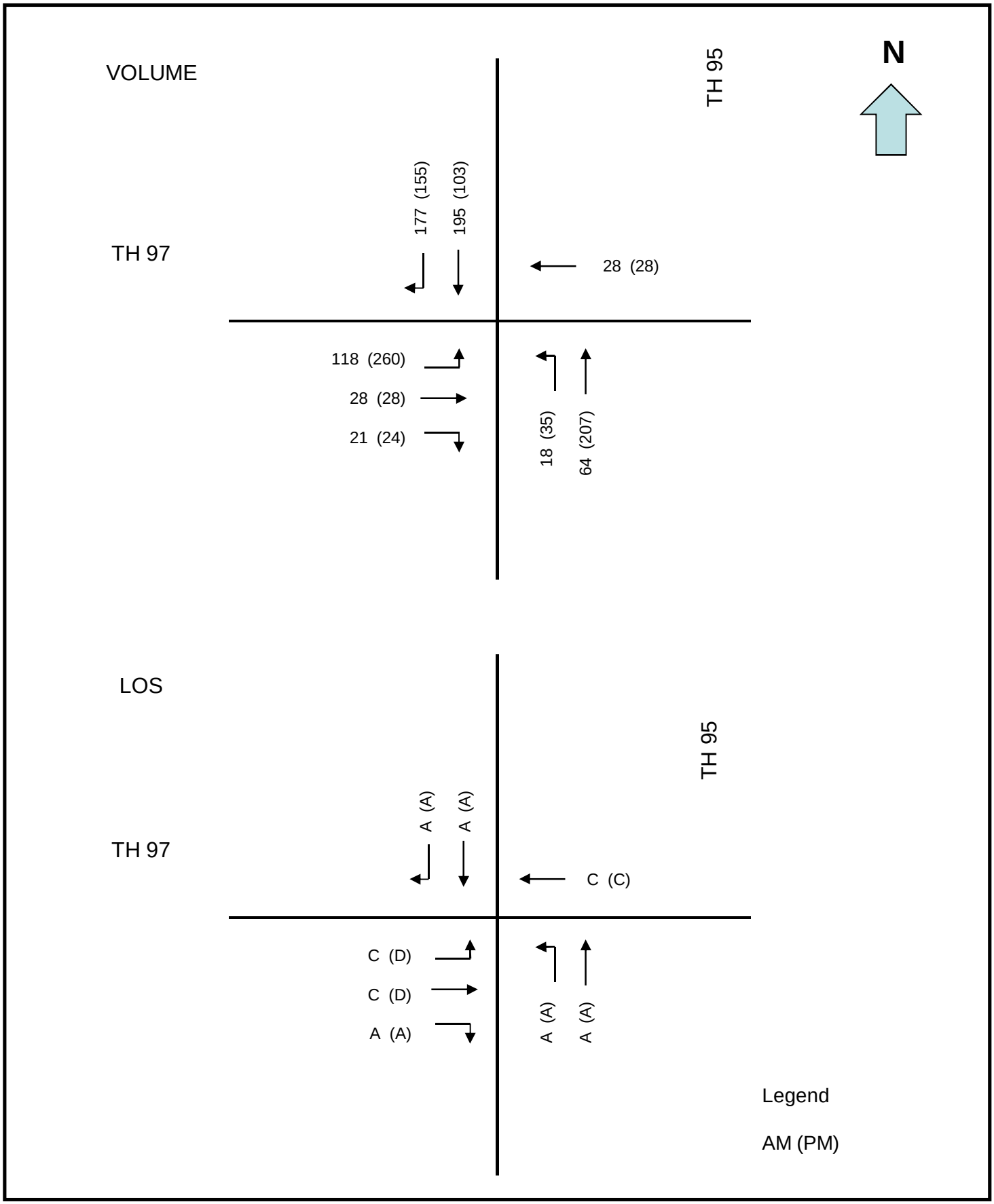

Zavoral EIS Update

Figure 2

TH 95 & TH 97 Alternative 1 - Trucks added to EBT and WBT AM and PM Peak

AECOM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Mark Smith*	Intersection	*TH 95 and TH 97*
Agency/Co.	*AECOM*	Jurisdiction	
Date Performed	*6/12/2012*	Analysis Year	*2012*
Analysis Time Period	*AM Peak*		

Project Description *Option 1 - 4 Leg (Trucks added to EBT and WBT)*

East/West Street: *TH 97* North/South Street: *TH 95*

Intersection Orientation: *North-South* Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*18*	*64*			*195*	*177*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*1.00*	*1.00*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*20*	*72*	*0*	*0*	*221*	*201*
Percent Heavy Vehicles	*18*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*118*	*28*	*21*		*28*	
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.88*	*1.00*	*0.88*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*134*	*31*	*23*	*0*	*31*	*0*
Percent Heavy Vehicles	*20*	*100*	*10*	*0*	*100*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*		*T*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*			*T*		*LT*		*R*
v (veh/h)	*20*			*31*		*165*		*23*
C (m) (veh/h)	*1056*			*334*		*509*		*799*
v/c	*0.02*			*0.09*		*0.32*		*0.03*
95% queue length	*0.06*			*0.31*		*1.43*		*0.09*
Control Delay (s/veh)	*8.5*			*16.9*		*15.5*		*9.6*
LOS	*A*			*C*		*C*		*A*
Approach Delay (s/veh)	--	--	*16.9*			*14.7*		
Approach LOS	--	--	*C*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Mark Smith*	Intersection	*TH 95 and TH 97*
Agency/Co.	*AECOM*	Jurisdiction	
Date Performed	*6/12/2012*	Analysis Year	*2012*
Analysis Time Period	*PM Peak*		

Project Description *Option 1 - 4 Leg (Trucks added to EBT and WBT)*

East/West Street: *TH 97* North/South Street: *TH 95*

Intersection Orientation: *North-South* Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*35*	*207*			*103*	*155*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*1.00*	*1.00*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*39*	*235*	*0*	*0*	*117*	*176*
Percent Heavy Vehicles	*9*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*260*	*28*	*24*		*28*	
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.88*	*1.00*	*0.88*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*295*	*31*	*27*	*0*	*31*	*0*
Percent Heavy Vehicles	*5*	*100*	*8*	*0*	*100*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*		*T*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*			*T*		*LT*		*R*
v (veh/h)	*39*			*31*		*326*		*27*
C (m) (veh/h)	*1230*			*295*		*456*		*919*
v/c	*0.03*			*0.11*		*0.71*		*0.03*
95% queue length	*0.10*			*0.35*		*6.81*		*0.09*
Control Delay (s/veh)	*8.0*			*18.6*		*32.0*		*9.0*
LOS	*A*			*C*		*D*		*A*
Approach Delay (s/veh)	--	--	*18.6*			*30.2*		
Approach LOS	--	--	*C*			*D*		

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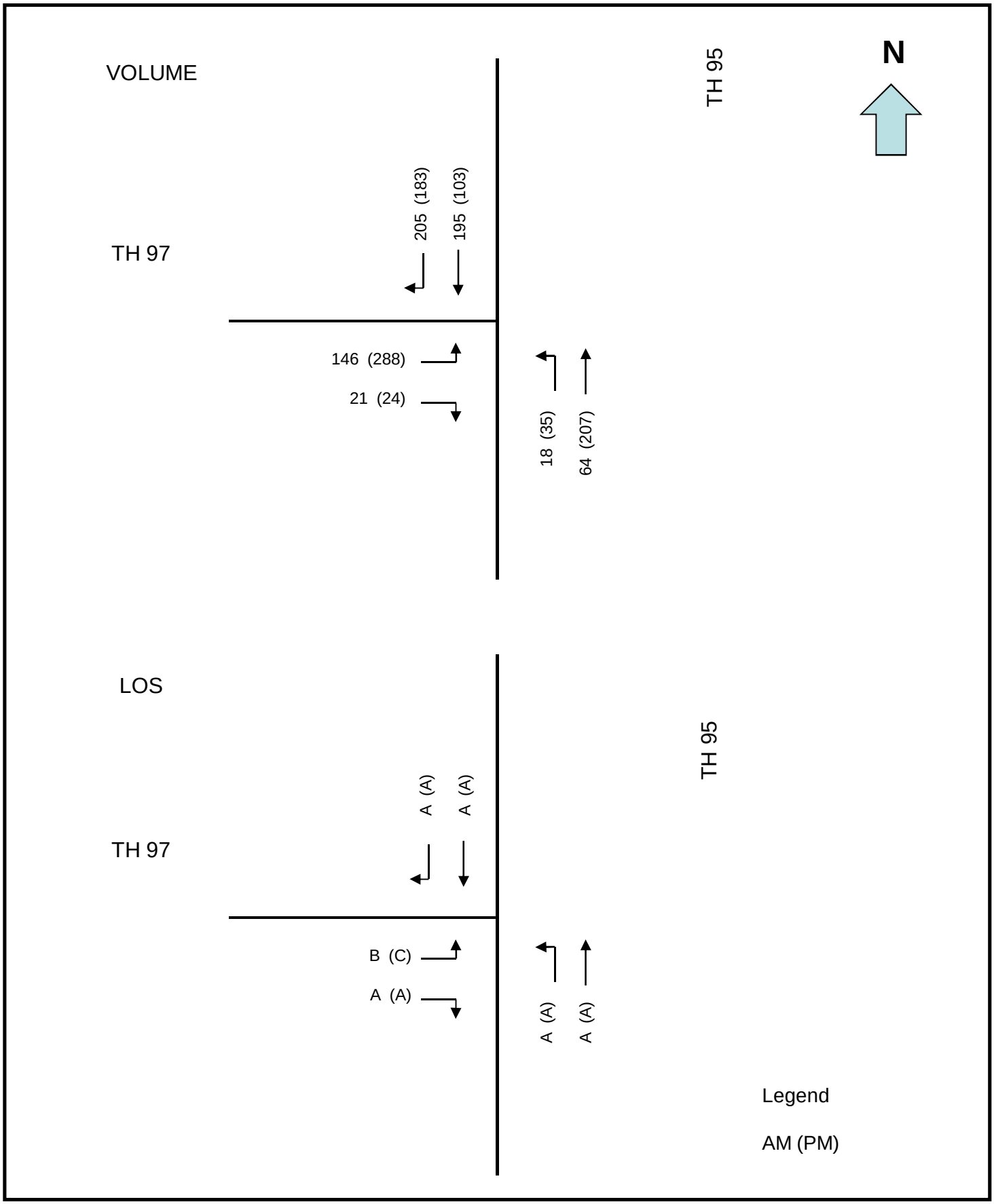

Zavoral EIS Update

Figure 3

TH 95 & TH 97 Alternative 2 - Trucks added to EBL and SBR AM and PM Peak

AECOM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Mark Smith*	Intersection	*TH 95 and TH 97*
Agency/Co.	*AECOM*	Jurisdiction	
Date Performed	*6/12/2012*	Analysis Year	*2012*
Analysis Time Period	*AM Peak*		

Project Description *Option 2 - 3 Leg (Trucks added to EBL and SBR)*

East/West Street: *TH 97* North/South Street: *TH 95*

Intersection Orientation: *North-South* Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*18*	*64*			*195*	*205*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*1.00*	*1.00*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*20*	*72*	*0*	*0*	*221*	*232*
Percent Heavy Vehicles	*18*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*146*		*21*			
Peak-Hour Factor, PHF	*0.88*	*1.00*	*0.88*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*165*	*0*	*23*	*0*	*0*	*0*
Percent Heavy Vehicles	*36*	*0*	*10*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*					*L*		*R*
v (veh/h)	*20*					*165*		*23*
C (m) (veh/h)	*1028*					*586*		*799*
v/c	*0.02*					*0.28*		*0.03*
95% queue length	*0.06*					*1.17*		*0.09*
Control Delay (s/veh)	*8.6*					*13.5*		*9.6*
LOS	*A*					*B*		*A*
Approach Delay (s/veh)	--	--				*13.1*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Mark Smith*	Intersection	*TH 95 and TH 97*
Agency/Co.	*AECOM*	Jurisdiction	
Date Performed	*6/12/2012*	Analysis Year	*2012*
Analysis Time Period	*PM Peak*		

Project Description *Option 2 - 3 Leg (Trucks added to EBL and SBR)*

East/West Street: *TH 97* North/South Street: *TH 95*

Intersection Orientation: *North-South* Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*35*	*207*			*103*	*183*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*1.00*	*1.00*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*39*	*235*	*0*	*0*	*117*	*207*
Percent Heavy Vehicles	*9*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*288*		*24*			
Peak-Hour Factor, PHF	*0.88*	*1.00*	*0.88*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*327*	*0*	*27*	*0*	*0*	*0*
Percent Heavy Vehicles	*15*	*0*	*8*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*					*L*		*R*
v (veh/h)	*39*					*327*		*27*
C (m) (veh/h)	*1197*					*540*		*919*
v/c	*0.03*					*0.61*		*0.03*
95% queue length	*0.10*					*4.42*		*0.09*
Control Delay (s/veh)	*8.1*					*21.8*		*9.0*
LOS	*A*					*C*		*A*
Approach Delay (s/veh)	--	--				*20.8*		
Approach LOS	--	--				*C*		

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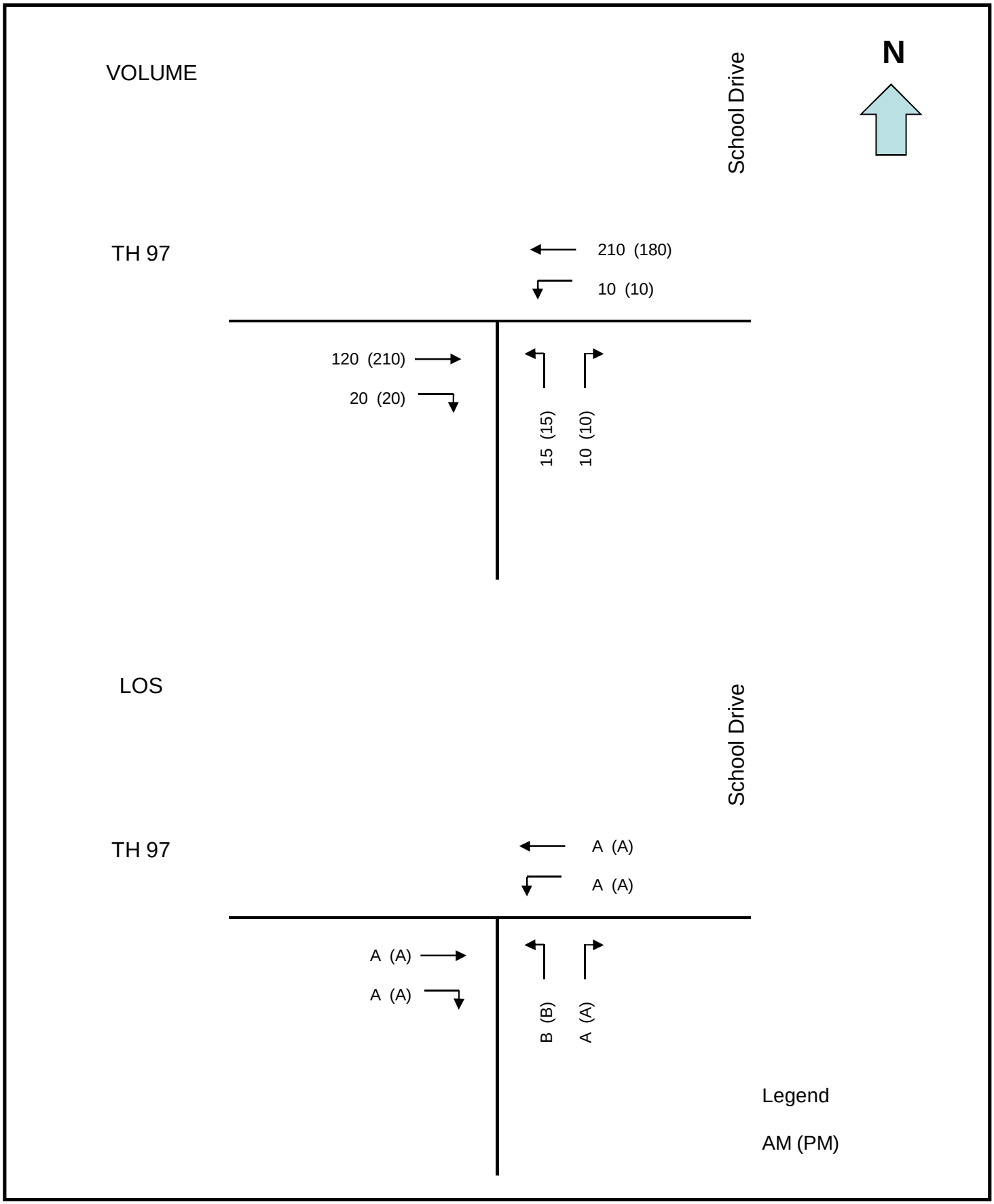

Zavoral EIS Update

Figure 4

TH 97 & School Drive - Existing AM and PM Peak

AECOM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMC*	Intersection	*TH 97 & School*
Agency/Co.		Jurisdiction	
Date Performed	*9/19/2011*	Analysis Year	*2010*
Analysis Time Period	*AM School 9-10*		

Project Description

East/West Street: *TH 97*	North/South Street: *School Drive*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*120*	*20*	*10*	*210*	
Peak-Hour Factor, PHF	*1.00*	*0.90*	*0.90*	*0.90*	*0.90*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*133*	*22*	*11*	*233*	*0*
Percent Heavy Vehicles	*0*	--	--	*6*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*		*10*			
Peak-Hour Factor, PHF	*0.90*	*1.00*	*0.90*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*11*	*0*	*0*	*0*
Percent Heavy Vehicles	*6*	*0*	*6*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*11*	*16*		*11*			
C (m) (veh/h)		*1401*	*603*		*906*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.02*	*0.08*		*0.04*			
Control Delay (s/veh)		*7.6*	*11.1*		*9.0*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*10.3*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMC*	Intersection	*TH 97 & School*
Agency/Co.		Jurisdiction	
Date Performed	*9/19/2011*	Analysis Year	*2010*
Analysis Time Period	*PM School 3-4*		

Project Description

East/West Street: *TH 97* North/South Street: *School Drive*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*210*	*20*	*10*	*180*	
Peak-Hour Factor, PHF	*1.00*	*0.90*	*0.90*	*0.90*	*0.90*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*233*	*22*	*11*	*200*	*0*
Percent Heavy Vehicles	*0*	--	--	*6*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*		*10*			
Peak-Hour Factor, PHF	*0.90*	*1.00*	*0.90*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*11*	*0*	*0*	*0*
Percent Heavy Vehicles	*6*	*0*	*6*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*11*	*16*		*11*			
C (m) (veh/h)		*1287*	*551*		*796*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.03*	*0.09*		*0.04*			
Control Delay (s/veh)		*7.8*	*11.7*		*9.6*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*10.9*					
Approach LOS	--	--	*B*					

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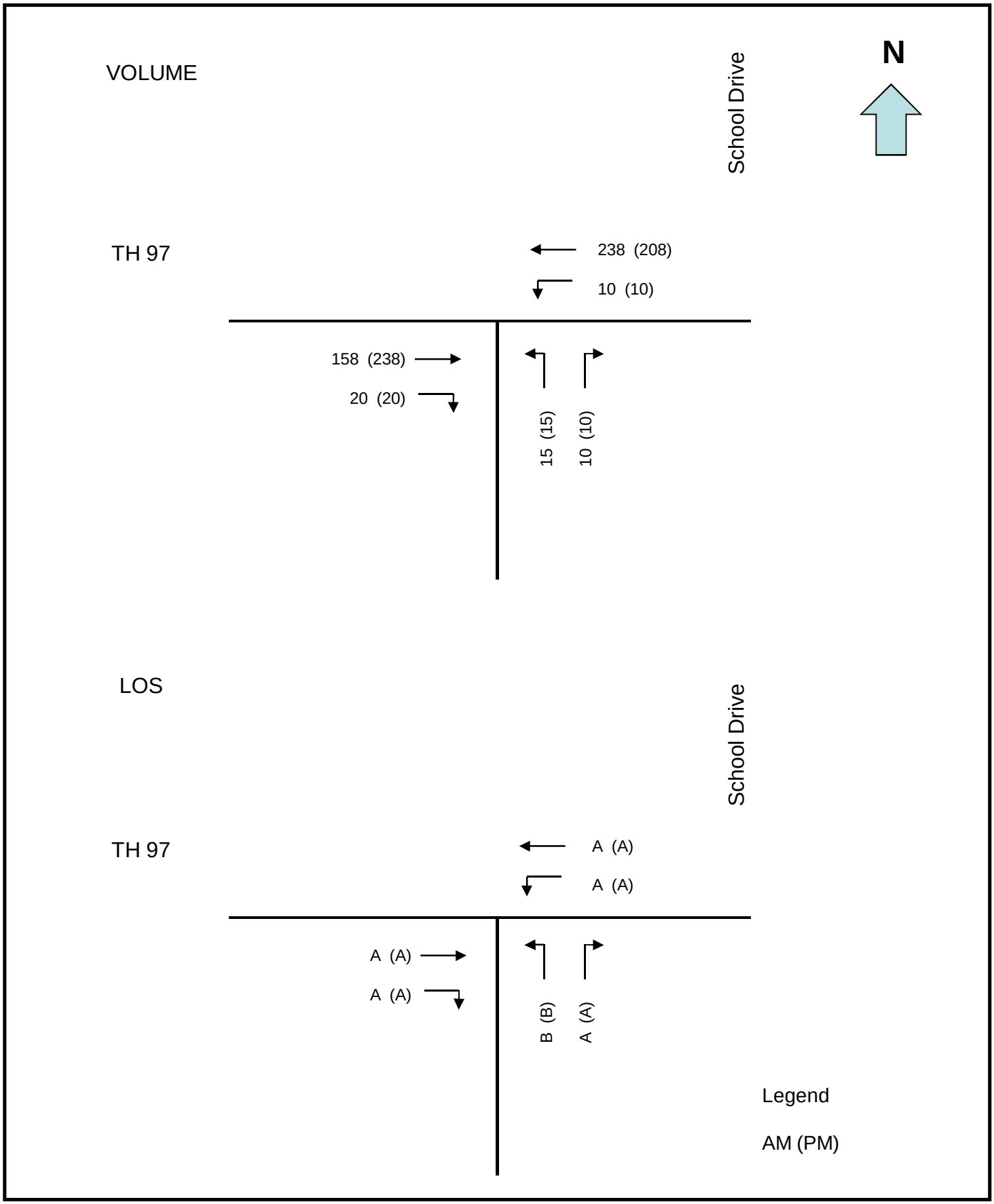

Zavoral EIS Update

Figure 5

TH 97 & School Drive - Trucks added to EBT and WBT AM and PM Peak

AECOM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMC*	Intersection	*TH 97 & School*
Agency/Co.		Jurisdiction	
Date Performed	*9/19/2011*	Analysis Year	*2010*
Analysis Time Period	*AM School 9-10*		

Project Description

East/West Street: *TH 97*	North/South Street: *School Drive*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*158*	*20*	*10*	*238*	
Peak-Hour Factor, PHF	*1.00*	*0.90*	*0.90*	*0.90*	*0.90*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*175*	*22*	*11*	*264*	*0*
Percent Heavy Vehicles	*0*	--	--	*6*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*		*10*			
Peak-Hour Factor, PHF	*0.90*	*1.00*	*0.90*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*11*	*0*	*0*	*0*
Percent Heavy Vehicles	*6*	*0*	*6*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*11*	*16*		*11*			
C (m) (veh/h)		*1352*	*547*		*858*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.02*	*0.09*		*0.04*			
Control Delay (s/veh)		*7.7*	*11.8*		*9.3*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*10.7*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMC*	Intersection	*TH 97 & School*
Agency/Co.		Jurisdiction	
Date Performed	*9/19/2011*	Analysis Year	*2010*
Analysis Time Period	*PM School 3-4*		

Project Description

East/West Street: *TH 97*	North/South Street: *School Drive*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*238*	*20*	*10*	*208*	
Peak-Hour Factor, PHF	*1.00*	*0.90*	*0.90*	*0.90*	*0.90*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*264*	*22*	*11*	*231*	*0*
Percent Heavy Vehicles	*0*	--	--	*6*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*		*10*			
Peak-Hour Factor, PHF	*0.90*	*1.00*	*0.90*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*11*	*0*	*0*	*0*
Percent Heavy Vehicles	*6*	*0*	*6*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*11*	*16*		*11*			
C (m) (veh/h)		*1253*	*507*		*765*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.03*	*0.10*		*0.04*			
Control Delay (s/veh)		*7.9*	*12.3*		*9.8*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*11.3*					
Approach LOS	--	--	*B*					

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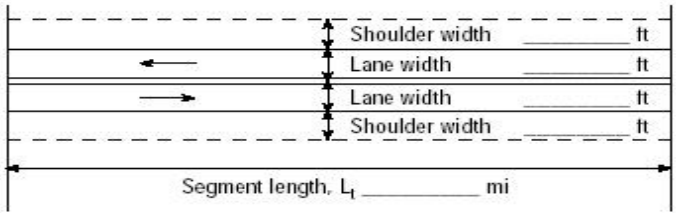
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*AMC*	Highway / Direction of Travel	
Agency or Company	*AECOM*	From/To	
Date Performed	*7/2/2012*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2012*

Project Description: *Subalt 3A ATR 386 - PK Hours*

Input Data



☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *20%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *8*/mi

Analysis direction vol., V_d *320*veh/h

Opposing direction vol., V_o *145*veh/h

Shoulder width ft *6.0*

Lane Width ft *12.0*

Segment Length mi *0.0*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.3*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.965*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*370*	*171*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*55.0 mi/h*
Total demand flow rate, both directions, v		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*0.0 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*2.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.1 mi/h*	Free-flow speed, FFS ($FSS=BFFS-f_{LS}-f_A$)	*53.0 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*47.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*366*	*166*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*35.4*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*31.4*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*57.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.22*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1700*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*90.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*363.6*
Effective width, Wv (Eq. 15-29) ft	*24.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*3.47*
Bicycle level of service (Exhibit 15-4)	*C*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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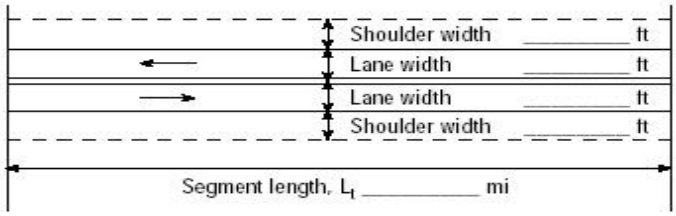
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*AMC*	Highway / Direction of Travel	
Agency or Company	*AECOM*	From/To	
Date Performed	*7/2/2012*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2012*

Project Description: *Subalternative 3A ATR 386 - PK Hp ´B*

Input Data



☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *20%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *8*/mi

Analysis direction vol., V_d *320*veh/h

Opposing direction vol., V_o *145*veh/h

Shoulder width ft *6.0*

Lane Width ft *12.0*

Segment Length mi *0.0*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.3*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.965*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*370*	*171*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*55.0 mi/h*
Total demand flow rate, both directions, v		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*0.0 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*2.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.1 mi/h*	Free-flow speed, FFS ($FSS=BFFS-f_{LS}-f_A$)	*53.0 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*47.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*366*	*166*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*35.4*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*31.4*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*57.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.22*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1700*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*90.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*363.6*
Effective width, Wv (Eq. 15-29) ft	*24.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*3.47*
Bicycle level of service (Exhibit 15-4)	*C*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMC*	Intersection	*TH 95 and TH 97*
Agency/Co.	*AECOM*	Jurisdiction	
Date Performed	*7/2/2012*	Analysis Year	*2012*
Analysis Time Period	*AM Peak*		

Project Description *Subalternative 3A*

East/West Street: *TH 97* North/South Street: *TH 95*

Intersection Orientation: *North-South* Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*18*	*64*			*195*	*177*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*1.00*	*1.00*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*20*	*72*	*0*	*0*	*221*	*201*
Percent Heavy Vehicles	*18*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*118*	*31*	*21*		*31*	
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.88*	*1.00*	*0.88*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*134*	*35*	*23*	*0*	*35*	*0*
Percent Heavy Vehicles	*20*	*100*	*10*	*0*	*100*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*		*T*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*			*T*		*LT*		*R*
v (veh/h)	*20*			*35*		*169*		*23*
C (m) (veh/h)	*1056*			*334*		*502*		*799*
v/c	*0.02*			*0.10*		*0.34*		*0.03*
95% queue length	*0.06*			*0.35*		*1.51*		*0.09*
Control Delay (s/veh)	*8.5*			*17.0*		*15.8*		*9.6*
LOS	*A*			*C*		*C*		*A*
Approach Delay (s/veh)	--	--	*17.0*			*15.1*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMC*	Intersection	*TH 95 and TH 97*
Agency/Co.	*AECOM*	Jurisdiction	
Date Performed	*7/2/2012*	Analysis Year	*2012*
Analysis Time Period	*PM Peak*		

Project Description *Subalternative 3A*

East/West Street: *TH 97* North/South Street: *TH 95*

Intersection Orientation: *North-South* Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*35*	*207*			*103*	*155*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*1.00*	*1.00*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*39*	*235*	*0*	*0*	*117*	*176*
Percent Heavy Vehicles	*9*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*260*	*31*	*24*		*31*	
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.88*	*1.00*	*0.88*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*295*	*35*	*27*	*0*	*35*	*0*
Percent Heavy Vehicles	*5*	*100*	*8*	*0*	*100*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*		*T*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*			*T*		*LT*		*R*
v (veh/h)	*39*			*35*		*330*		*27*
C (m) (veh/h)	*1230*			*295*		*450*		*919*
v/c	*0.03*			*0.12*		*0.73*		*0.03*
95% queue length	*0.10*			*0.40*		*7.35*		*0.09*
Control Delay (s/veh)	*8.0*			*18.8*		*34.1*		*9.0*
LOS	*A*			*C*		*D*		*A*
Approach Delay (s/veh)	--	--	*18.8*			*32.2*		
Approach LOS	--	--	*C*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMC*	Intersection	*TH 97 & School*
Agency/Co.		Jurisdiction	
Date Performed		Analysis Year	*2010*
Analysis Time Period	*AM School 9-10*		

Project Description *Subalternative 3A*

East/West Street: *TH 97*	North/South Street: *School Drive*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*161*	*20*	*10*	*241*	
Peak-Hour Factor, PHF	*1.00*	*0.90*	*0.90*	*0.90*	*0.90*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*178*	*22*	*11*	*267*	*0*
Percent Heavy Vehicles	*0*	--	--	*6*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*		*10*			
Peak-Hour Factor, PHF	*0.90*	*1.00*	*0.90*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*11*	*0*	*0*	*0*
Percent Heavy Vehicles	*6*	*0*	*6*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*11*	*16*		*11*			
C (m) (veh/h)		*1349*	*543*		*855*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.02*	*0.09*		*0.04*			
Control Delay (s/veh)		*7.7*	*11.8*		*9.3*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*10.8*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*AMC*	Intersection	*TH 97 & School*
Agency/Co.		Jurisdiction	
Date Performed	*7/2/2012*	Analysis Year	*2010*
Analysis Time Period	*PM School 3-4*		

Project Description *Subalternative 3A*

East/West Street: *TH 97* | North/South Street: *School Drive*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*241*	*20*	*10*		
Peak-Hour Factor, PHF	*1.00*	*0.90*	*0.90*	*0.90*	*0.90*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*267*	*22*	*11*	*231*	*0*
Percent Heavy Vehicles	*0*	--	--	*6*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*		*10*			
Peak-Hour Factor, PHF	*0.90*	*1.00*	*0.90*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*11*	*0*	*0*	*0*
Percent Heavy Vehicles	*6*	*0*	*6*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*11*	*16*		*11*			
C (m) (veh/h)		*1250*	*505*		*762*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.03*	*0.10*		*0.04*			
Control Delay (s/veh)		*7.9*	*12.4*		*9.8*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*11.3*					
Approach LOS	--	--	*B*					

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Attachment B

Corridor Capacity Analysis

Two Lane Highway Capacity Analysis

- TH 97 Existing Conditions (AM & PM)

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Mark Smith
Agency/Co.	AECOM
Date Performed	6/13/2012
Analysis Time Period	AM Peak
Highway	
From/To	
Jurisdiction	
Analysis Year	2012
Description	ATR 386 - PK Hours

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	6.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 315 veh/h
Opposing direction volume, Vo 140 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.7	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.960	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	365	pc/h	166	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	2.0	mi/h
Free-flow speed, FFSd	53.0	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h
Average travel speed, ATSd	47.8	mi/h
Percent Free Flow Speed, PFFS	90.3	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	360	pc/h	160	pc/h

Base percent time-spent-following,(note-4) BPTSFd	34.9	%
Adjustment for no-passing zones, fnp	31.1	
Percent time-spent-following, PTSFd	56.4	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.21	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	2473	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.0	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	47.8	mi/h
Percent time-spent-following, PTSFd (from above)	56.4	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	-	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	358.0
Effective width of outside lane, We	24.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	3.47
Bicycle LOS	C

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Mark Smith
Agency/Co.	AECOM
Date Performed	6/13/2012
Analysis Time Period	PM Peak
Highway	
From/To	
Jurisdiction	
Analysis Year	2012
Description	ATR 386 - PK Hours

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	6.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 390 veh/h
Opposing direction volume, Vo 225 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	451	pc/h	262	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	2.0	mi/h
Free-flow speed, FFSd	53.0	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h
Average travel speed, ATSd	46.1	mi/h
Percent Free Flow Speed, PFFS	87.1	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.0	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	1.000	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	443 pc/h	257 pc/h

Base percent time-spent-following,(note-4) BPTSFd	42.4	%
Adjustment for no-passing zones, fnp	30.7	
Percent time-spent-following, PTSFd	61.8	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.27	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	2687	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.0	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	46.1	mi/h
Percent time-spent-following, PTSFd (from above)	61.8	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	-	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	443.2
Effective width of outside lane, We	24.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	3.57
Bicycle LOS	D

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Two Lane Highway Capacity Analysis

- TH 97 Maximum Haul Conditions (AM & PM)

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Mark Smith
Agency/Co.	AECOM
Date Performed	6/13/2012
Analysis Time Period	AM Peak
Highway	
From/To	
Jurisdiction	
Analysis Year	2012
Description	ATR 386 - PK Hours

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	6.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 345 veh/h
Opposing direction volume, Vo 170 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	399	pc/h	199	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	2.0	mi/h
Free-flow speed, FFSd	53.0	mi/h
Adjustment for no-passing zones, fnp	1.4	mi/h
Average travel speed, ATSd	47.0	mi/h
Percent Free Flow Speed, PFFS	88.7	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	394	pc/h	194	pc/h
Base percent time-spent-following,(note-4) BPTSFd	37.5	%		
Adjustment for no-passing zones, fnp	32.7			
Percent time-spent-following, PTSFd	59.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.23	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	2547	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.0	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	47.0	mi/h
Percent time-spent-following, PTSFd (from above)	59.4	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	-	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	392.0
Effective width of outside lane, We	24.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	3.51
Bicycle LOS	D

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Mark Smith
Agency/Co.	AECOM
Date Performed	6/13/2012
Analysis Time Period	PM Peak
Highway	
From/To	
Jurisdiction	
Analysis Year	2012
Description	ATR 386 - PK Hours

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	6.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 420 veh/h
Opposing direction volume, Vo 255 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.2		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.988		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	483	pc/h	297	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	2.0	mi/h
Free-flow speed, FFSd	53.0	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h
Average travel speed, ATSd	45.6	mi/h
Percent Free Flow Speed, PFFS	86.1	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	477	pc/h	292	pc/h
Base percent time-spent-following,(note-4) BPTSFd	46.8	%		
Adjustment for no-passing zones, fnp	28.5			
Percent time-spent-following, PTSFd	64.5	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.28	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	2745	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.0	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	45.6	mi/h
Percent time-spent-following, PTSFd (from above)	64.5	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	-	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

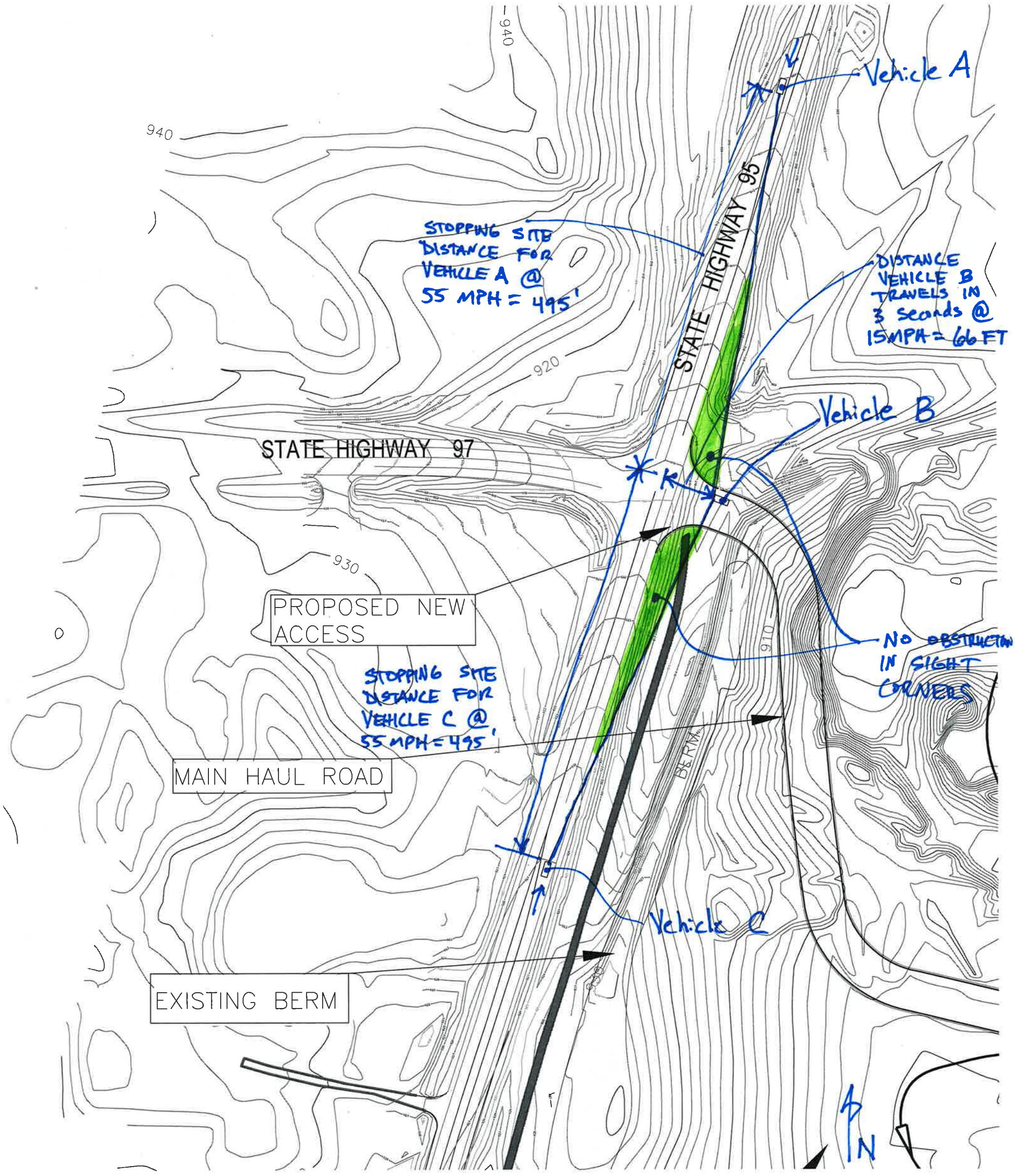
Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	477.3
Effective width of outside lane, We	24.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	3.61
Bicycle LOS	D

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Attachment C

Sight Distance Exhibits

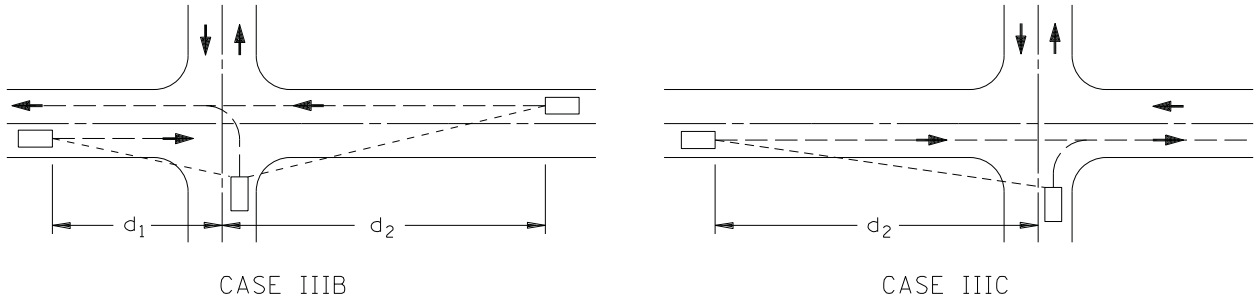


SIGHT CORNERS EXHIBIT

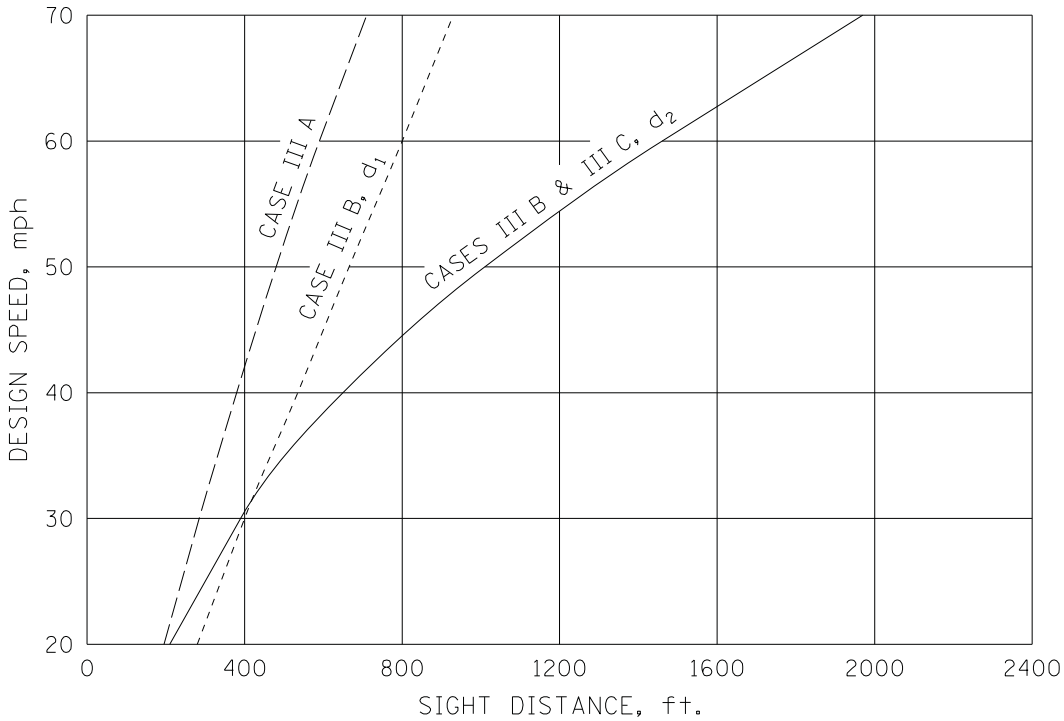
WRW 09/20/12

operation of the left-turn maneuver outlined in Case IIIB, see Figures 5-2.02F and G to obtain required sight distances.

In designing for case IIIB or IIIC, figure 5-2.02G is used. The figure is based on a passenger car design vehicle. The intersection sight distance needed for trucks is considerably bigger than that for P. The required sight distances (d) may be computed using the formula $d = 1.47V(J+t_a)$. The time (t_a) required to accelerate and traverse the intersection (distance = S) may be obtained from figure 5-2.02D. Corrections for grades greater than $\pm$ 3% must be made using the truck acceleration charts shown in Chapter 3. Designers should use the curvilinear distance of S when applying cases IIIB and IIIC.

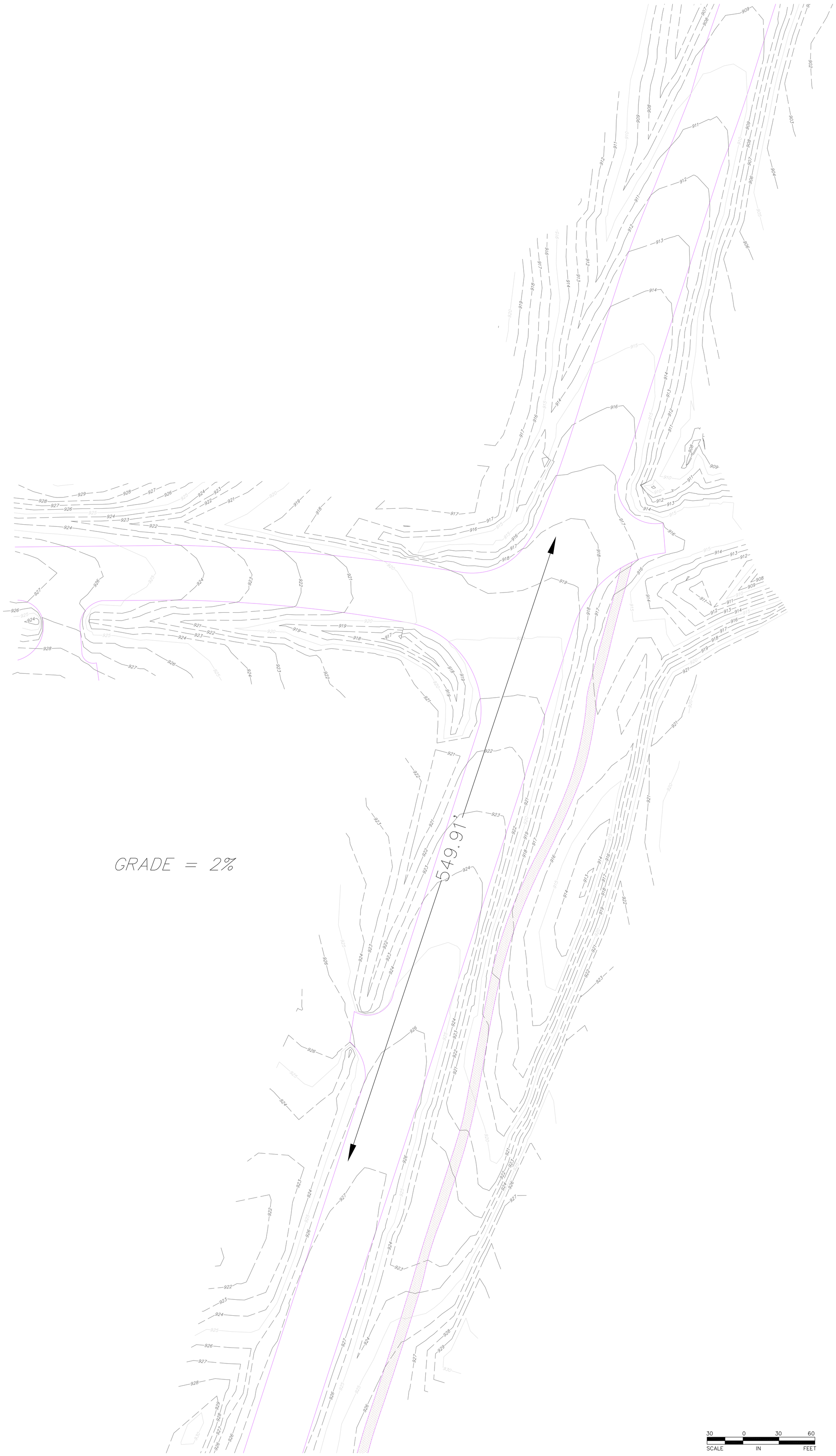


SIGHT DISTANCE AT INTERSECTIONS - Left and Right Turning Vehicles
Cases IIIB AND IIIC
Figure 5-2.02F



CASE IIIA - CROSSING MANEUVER.
CASE IIIB, d_1 - TURNING LEFT ONTO A MAJOR HIGHWAY ACROSS VEHICLE APPROACHING FROM LEFT.
CASE IIIB, d_2 - TURNING LEFT ONTO A MAJOR HIGHWAY AND ATTAINING AVERAGE RUNNING SPEED WITHOUT BEING OVERTAKEN BY VEHICLE APPROACHING FROM RIGHT WHICH REDUCES SPEED FROM DESIGN SPEED TO AVERAGE RUNNING SPEED.
CASE IIIC, d_2 - TURNING RIGHT ONTO A MAJOR HIGHWAY.

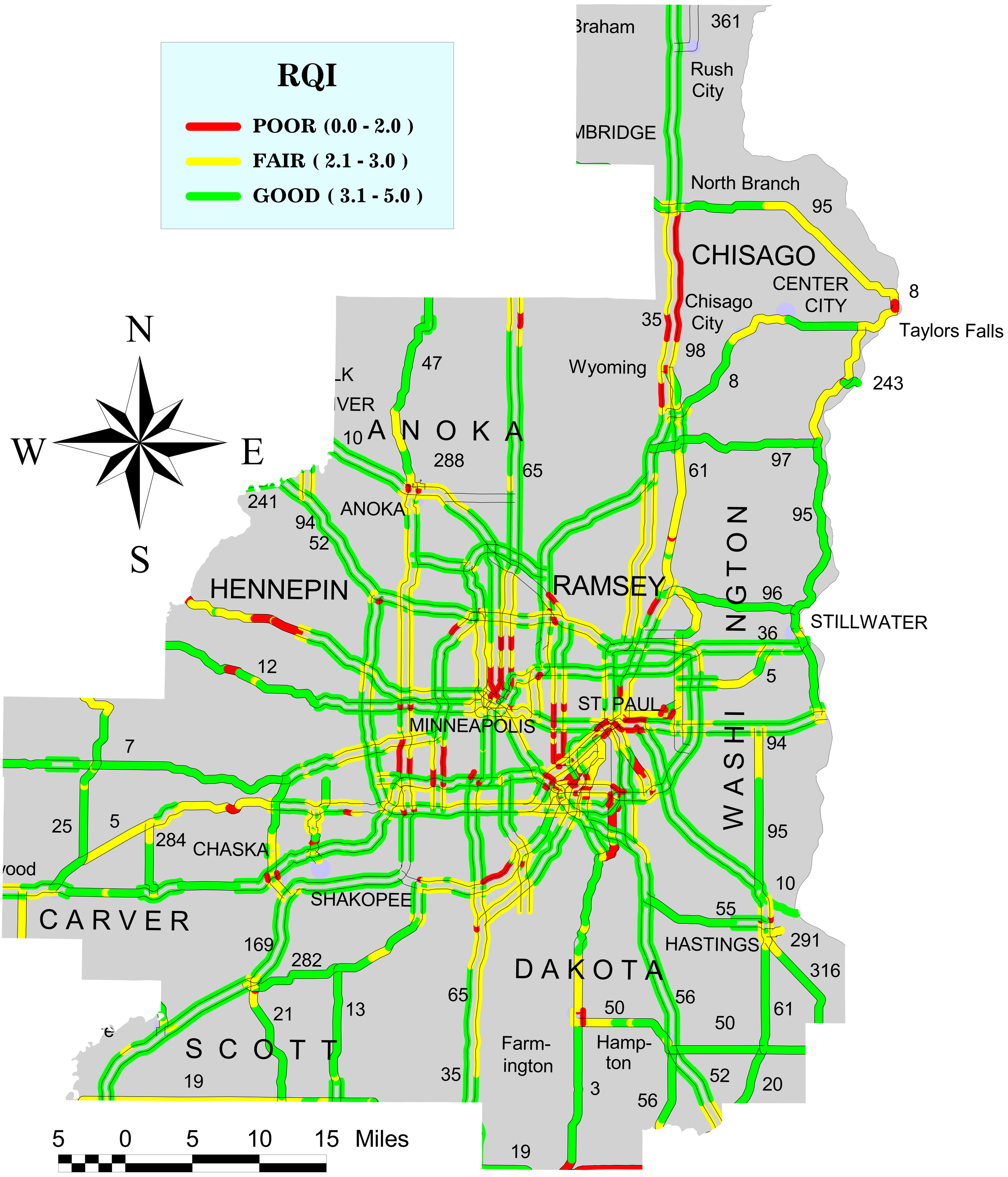
SAFE SIGHT DISTANCE ALONG MAJOR HIGHWAY FOR P TYPE DESIGN VEHICLES
Cases IIIA, IIIB, and IIIC
Figure 5-2.02G


549.91'
GRADE = 2%
30 0 30 60
SCALE IN FEET

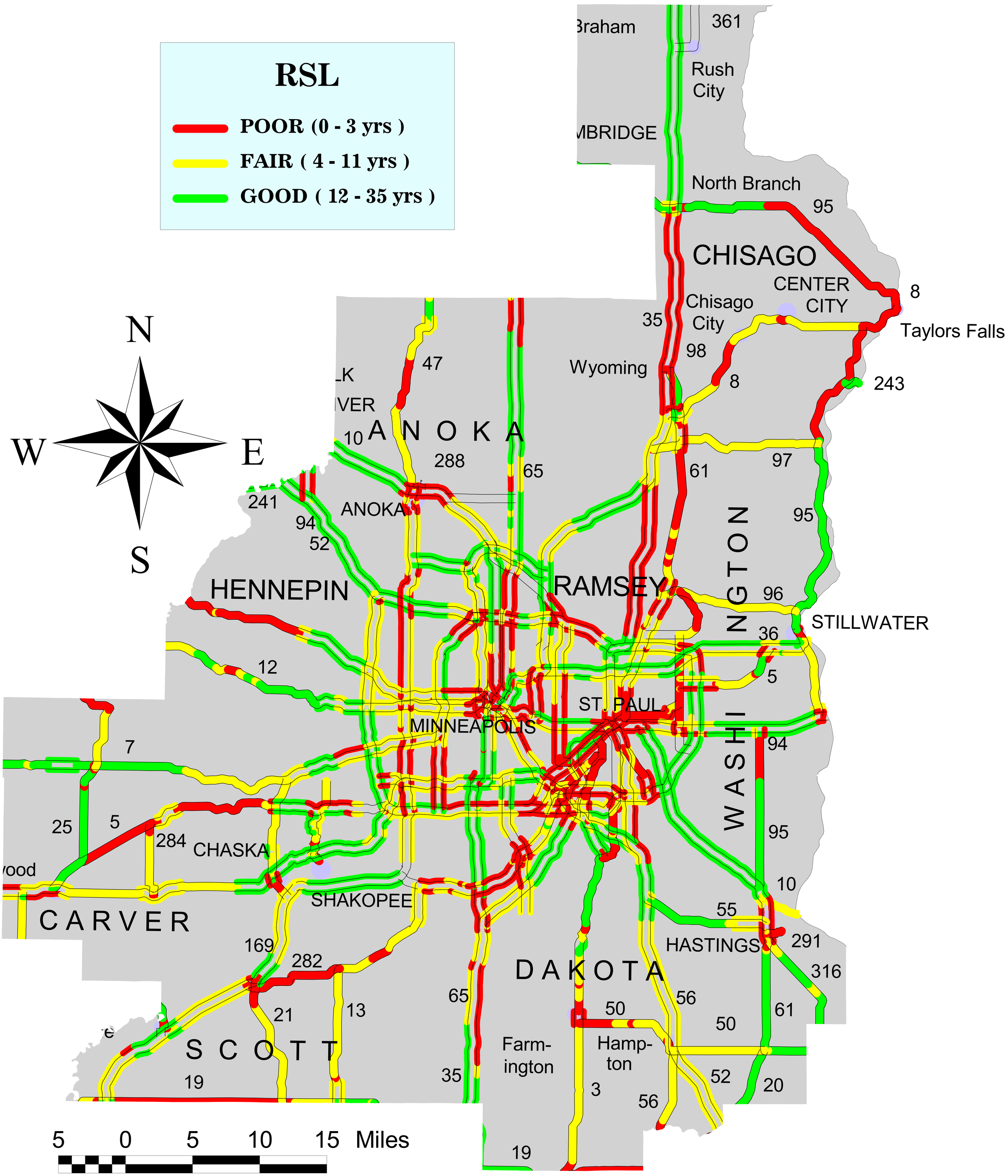
Attachment D

2011 Minnesota Department of Transportation Road Evaluation Maps

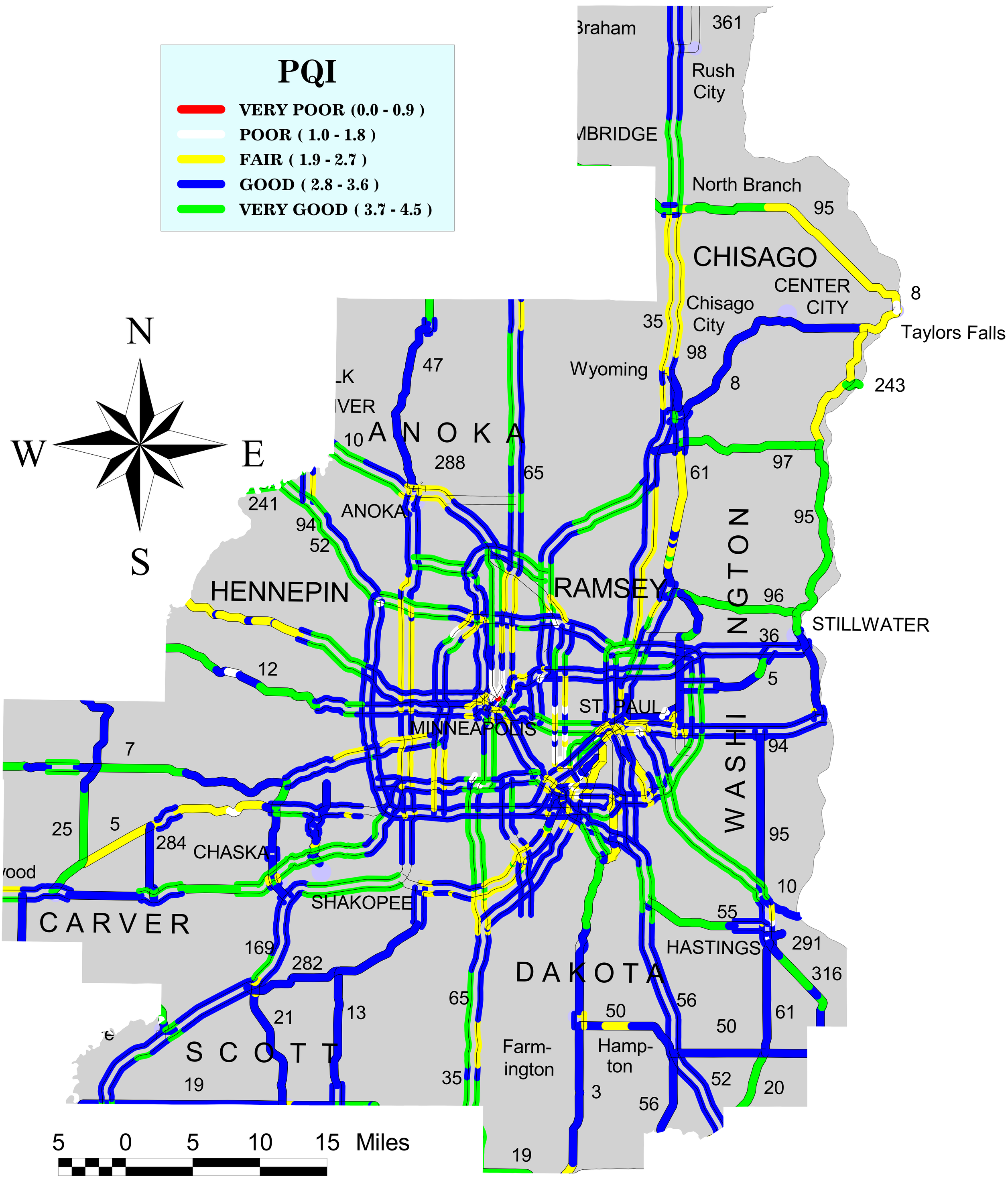
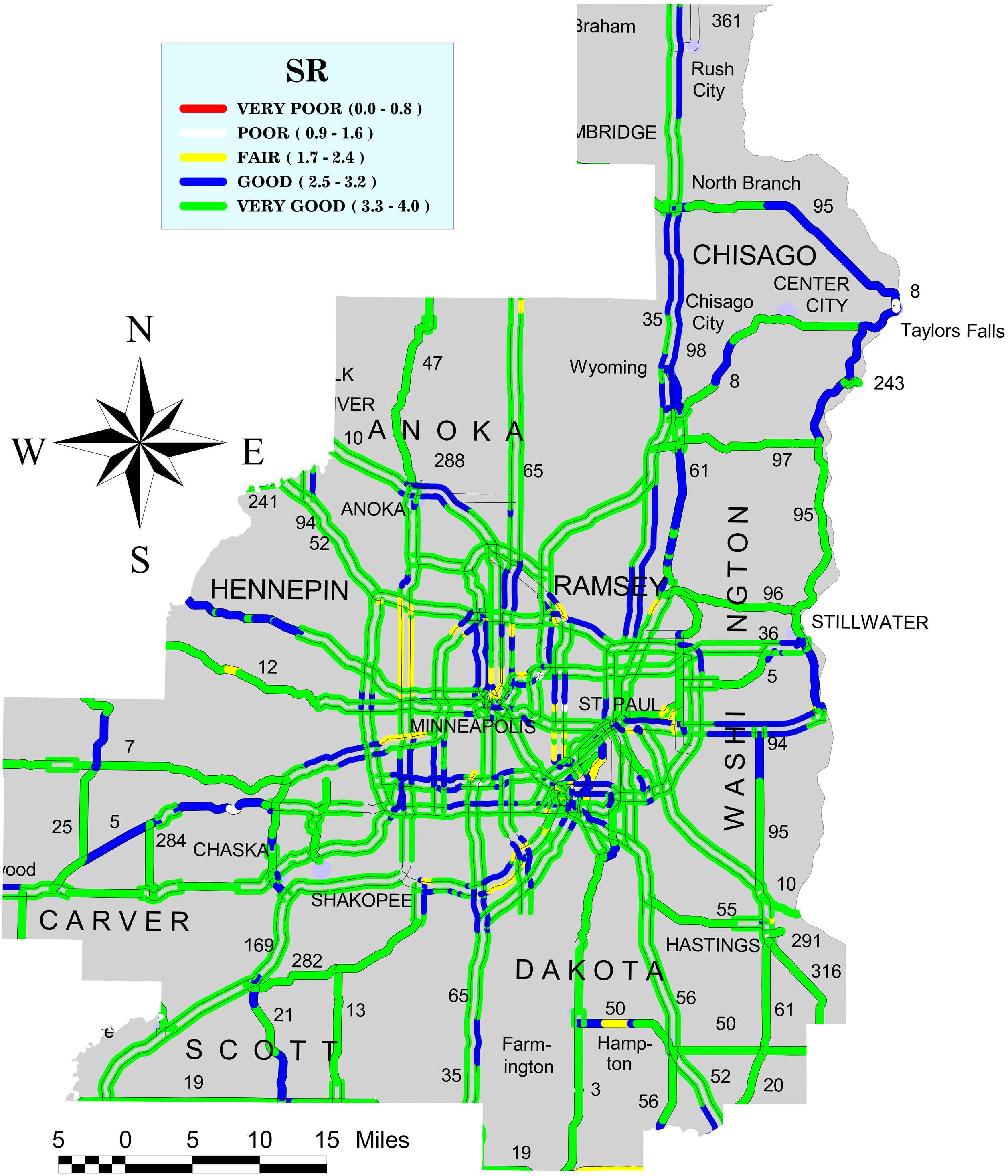
2011 METRO RQI



2011 METRO RSL



2011 METRO PQI



2011 METRO SR