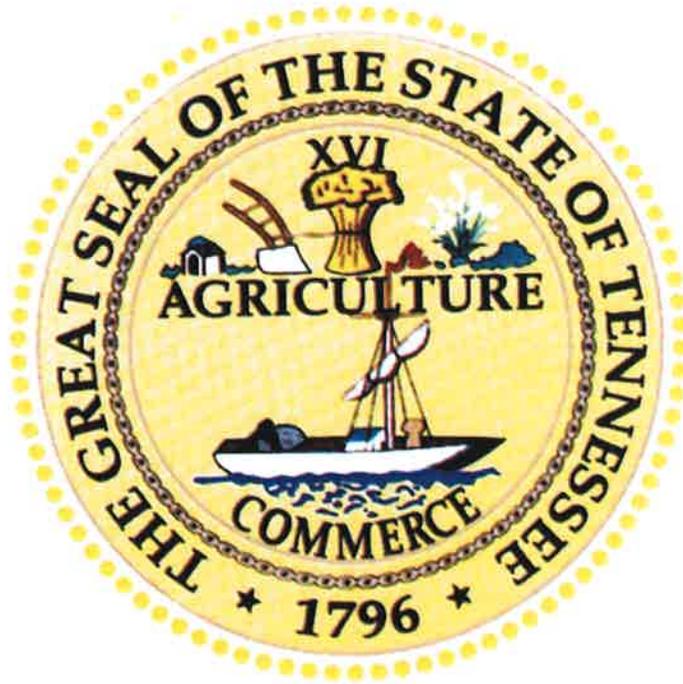


TECHNICAL STUDY

STATE ROUTE 386 AT FOREST RETREAT ROAD PROPOSED INTERCHNAGE HENDERSONVILLE, SUMNER COUNTY

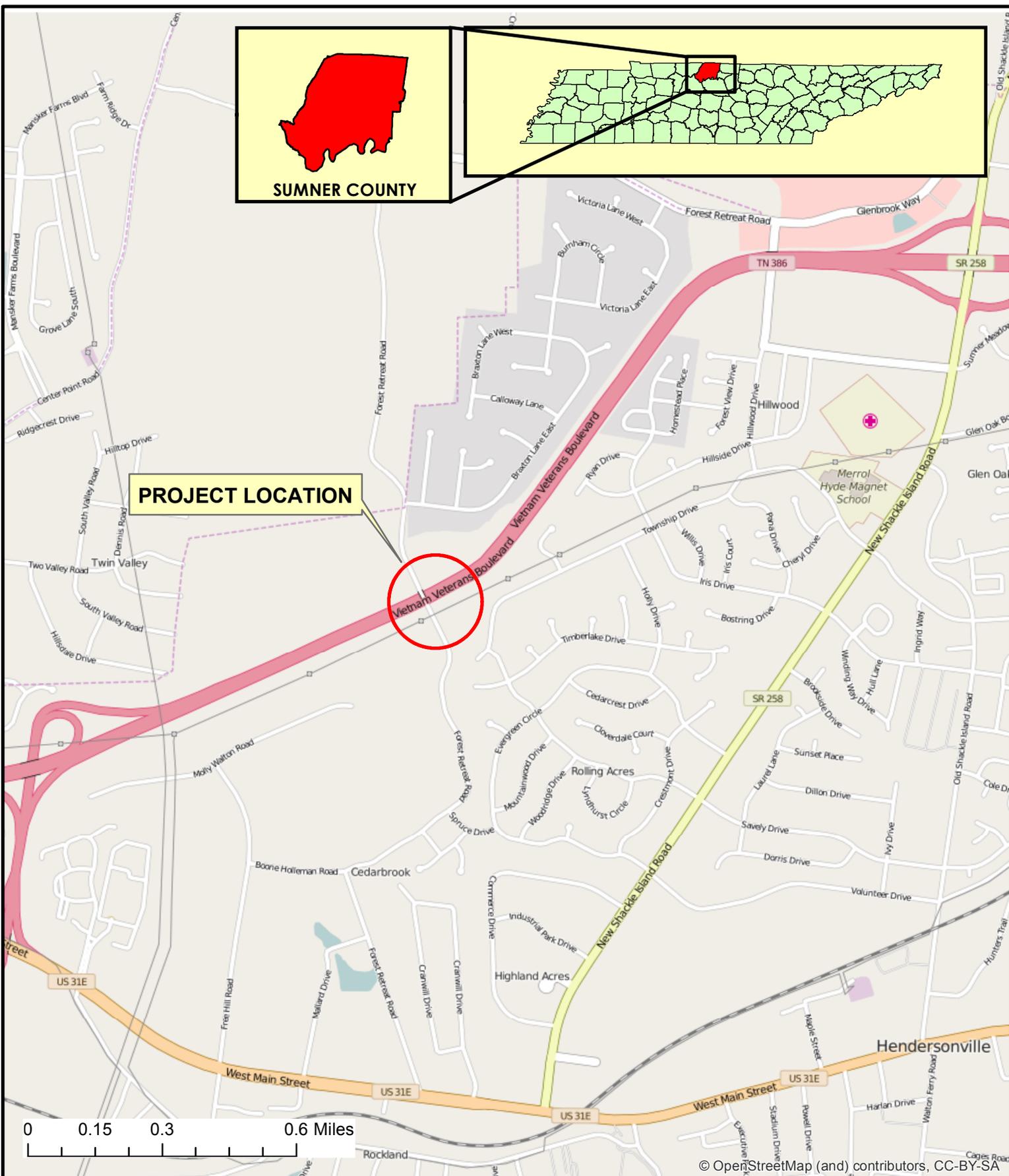
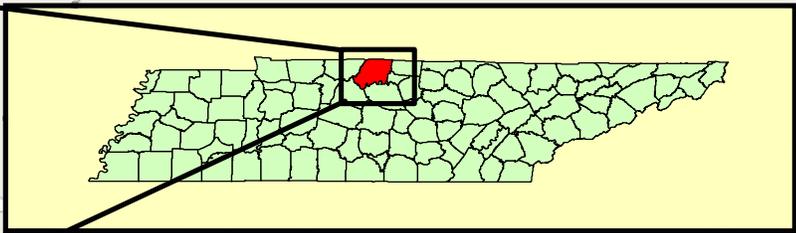


TENNESSEE DEPARTMENT OF TRANSPORTATION

***PREPARED BY
Strategic Transportation Investments Division***

Recommended by:	Signature	DATE
TRANSPORTATION DIRECTOR STRATEGIC TRANSPORTATION INVESTMENTS DIVISION		4-1-16

This document is covered by 23 USC § 409 and its production pursuant to fulfilling public planning requirements does not waive the provisions of § 409.

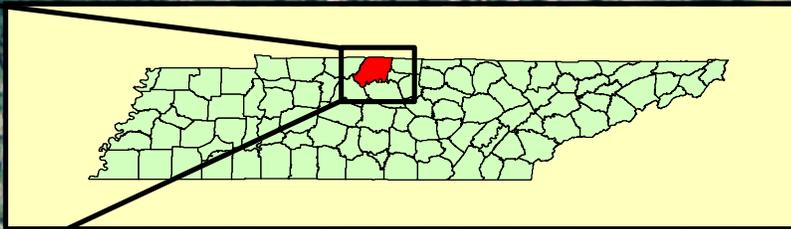


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**AREA MAP
TECHNICAL STUDY
PROPOSED INTERCHANGE
STATE ROUTE 386 AT FOREST RETREAT ROAD
SUMNER COUNTY**





PROJECT LOCATION



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



**LOCATION MAP
TECHNICAL STUDY
PROPOSED INTERCHANGE
STATE ROUTE 386 AT FOREST RETREAT ROAD
SUMNER COUNTY**



1.0 PROJECT DESCRIPTION AND BACKGROUND

1.1 EXPLANATION OF STUDY AREA

This report involves the operational analysis of the street network around the proposed interchange located at the intersection of Forest Retreat Road and State Route (SR) 386 (Vietnam Veterans Parkway). Intersections and segments in the study include:

- Forest Retreat Road at SR-386 Eastbound Ramp
- Forest Retreat Road at SR-386 Westbound Ramp
- SR-386 Eastbound Weave
- SR-386 Westbound Weave
- SR-386 Westbound Off-Ramp Diverge
- SR-386 Eastbound On-Ramp Merge

A Project Vicinity Map and a Location Map depicting the study area are provided.

The purpose of this report is to evaluate the traffic operations of the proposed interchange of Forest Retreat Road at SR-386.

1.2 EXISTING ROUTE DESCRIPTIONS

SR-386 (Vietnam Veterans Parkway) is a four-lane urban freeway that links the Cities of Gallatin and Hendersonville to Interstate 65. In the vicinity of the proposed interchange, SR-386 is a full controlled access facility with a posted speed limit of 65 MPH.

Forest Retreat Road is a two-lane urban major collector that bridges over SR-386. It has a posted speed limit of 30 MPH.

1.3 HISTORY

- In 1998, TDOT produced an Advance Planning Report (APR) which evaluated the feasibility of constructing an interchange at SR-386 and Forest Retreat Road. The study was initiated as a result of requests by Hendersonville City Officials, as well as the State Senator and State Representative from this area.
- Right-of-Way (ROW) funding was approved for fiscal year 2001-2002. ROW acquisition was completed in 2004.
- This project is in the Nashville Metropolitan Planning Organization's (MPO's) 2040 Regional Transportation Plan with a horizon year of 2020.

1.4 SUMMARY OF PROPOSED PROJECT

The 1998 APR proposed the construction of a traditional diamond type interchange on SR-386 at Forest Retreat Road. The typical section proposed for each of the four ramps consists of a sixteen (16) foot traffic lane, an eight (8) foot outside shoulder and a six (6) foot inside shoulder.

The west side ramps of the proposed interchange will be located only a short distance from the east side on and off ramps to the SR-6 connector. Due to this short distance from taper to taper points, it was proposed that auxiliary lanes on SR-386 in each direction of travel between these ramp terminals be constructed. It was also proposed that a continuous turn lane between ramp terminals be constructed on Forest Retreat Road in order to provide a storage area for left turning vehicles. The typical section to be used for this improvement consists of two (2) twelve (12) foot travel lanes, a twelve (12) foot continuous center turn lane and eight (8) foot shoulders.

The original interchange design has been altered since the publication of the APR. The westbound on-ramp is now designed as a loop ramp located in the northeast quadrant of the interchange.

2.0 TRAFFIC ANALYSIS

2.1 CAPACITY ANALYSIS METHODOLOGY AND ASSUMPTIONS

The daily traffic data used in this analysis was provided by the Special Projects Office in the Strategic Transportation Investments Division. The Average Annual Daily Traffic (AADT) and the Design Hour Volumes (DHV) for the AM and PM peak hour for the base year of 2021 and the design year of 2041 were provided for each of the major movements within the study limits. These traffic volumes are located in **Appendix A**.

Weave, merge and diverge, and intersection analyses were performed for the SR-386 ramp areas and terminals on the proposed Forest Retreat Road interchange for the 2021 and 2041 Build conditions using the Highway Capacity Manual (HCM 2010) methodology.

The objectives of the traffic analysis were as follows:

- Forecast the projected build conditions;
- Determine intersection capacity;
- Identify traffic flow and queuing concerns;

Level of Service (LOS) is a qualitative measure that is used to gauge the operational performance of an intersection or roadway segment. There are six (6) levels ranging from 'A' to 'F' with 'F' being the worst. Each level represents a range of operating conditions. **Table 1** defines the traffic flow conditions and approximate driver comfort at each LOS for signalized and unsignalized intersections. The LOS is based on vehicular delay (seconds per vehicle) at an intersection or the vehicular density (passenger cars per mile per lane) in the area of influence along freeways and ramp junctions. **Table 2** defines the density range associated with levels of service for ramp junctions. **Table 3** defines the traffic flow conditions and approximate driver comfort at each LOS for freeway segments.

TABLE 1: LEVEL OF SERVICE INDEX FOR INTERSECTIONS

LOS	Traffic Flow Conditions	Signalized Intersection Delay (sec/veh)	Unsignalized Intersection Delay (sec/veh)
A	Progression is extremely favorable and most vehicles do not stop at all.	0-10	0-10
B	Good progression, some delay.	10-20	10-15
C	Fair progression, higher delay.	20-35	15-25
D	Unfavorable progression, congestion becomes apparent.	35-55	25-35
E	Poor progression, significant delay.	55-80	35-50
F	Poor progression, extreme delay.	>80	>50

TABLE 2: LEVEL OF SERVICE INDEX FOR FREEWAY RAMP JUNCTIONS

LOS	Traffic Flow Conditions	Density (pc/ln/ln)
A	Unrestricted operations.	0-10
B	Merging and diverging maneuvers noticeable to drivers.	10-20
C	Influence area speeds begin to decline.	20-28
D	Influence area turbulence becomes intrusive.	28-35
E	Turbulence felt by virtually all drivers.	>35
F	Ramp and freeway queues form.	Demand exceeds capacity

TABLE 3: LEVEL OF SERVICE INDEX FOR FREEWAY

LOS	Traffic Flow Conditions	Density (pc/mi/ln)
A	Motorists are able to travel at free-flow speeds and are almost completely unimpeded in their ability to maneuver within the traffic stream. The effects of incidents or point breakdowns are easily absorbed.	0-11
B	Free-flow speeds are maintained and the ability to maneuver within the traffic stream is only slightly restricted. The general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and point breakdowns are still easily absorbed.	11-18
C	Traffic flows at speeds near the free-flow speed. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes still require more care and vigilance on the part of the driver. Minor incidents may still be absorbed, but the local deterioration in service quality will be significant.	18-26
D	Speeds begin to decline with increasing flows, with density increasing more quickly. Freedom to maneuver within the traffic stream is seriously limited and drivers experience reduced physical and psychological comfort levels. Even minor incidents can be expected to create queuing because the stream has little space to absorb disruptions.	26-35
E	Freeway is operating at capacity. Operations are highly volatile because there are virtually no usable gaps within the traffic stream, leaving little room to maneuver. Any disruption to the traffic stream, such as vehicles entering from a ramp or a vehicle changing lanes, can establish a disruption wave that propagates throughout the upstream traffic flow.	35-45
F	Breakdown, or unstable flow.	>45

2.2 BUILD SCENARIO ANALYSES

A capacity, LOS, analysis and queue analysis were performed for AM and PM peak hour conditions for the Build condition using HCS2010 traffic analysis software. The LOS for the study intersections is shown in **Table 4**. As shown, the intersections along Forest Retreat Road operate at acceptable LOS in both the 2041 AM and PM peak conditions for the overall intersection LOS. **Table 5** shows the 95th percentile queue lengths for the critical moves at each intersection for the peak hour where the longest queue developed (i.e., the queue length listed may be the AM or PM peak queue length, whichever is longer).

The HCS2010 worksheets are provided in **Appendix B** of this report.

TABLE 4: BUILD CONDITION CAPACITY ANALYSIS SUMMARY

Location	Level of Service (Delay in sec/veh)			
	2021		2041	
	AM	PM	AM	PM
Forest Retreat Rd. @ SR-386 EB Ramps	B (13.0)	B (13.4)	D (34.9)	D (30.6)
Forest Retreat Rd. @ SR-386 WB Ramps	B (11.5)	A (9.8)	C (16.3)	B (11.7)

TABLE 5: BUILD CONDITION RAMP QUEUE SUMMARY

Location	2041 95 th Percentile Queue Length (ft)	Available Storage Length (ft) ¹
Forest Retreat Rd. @ SR-386 EB Ramps		
Eastbound Left	164'	>1500'
Southbound Left	2'	100'
Forest Retreat Rd. @ SR-386 WB Ramps		
Southbound Left	6'	100'
Westbound Left	27'	>1500'

A merge, diverge, and weave analysis was performed for the SR-386 ramp areas for the Build condition using Highway Capacity Manual (HCM) methodology. The LOS results are summarized in **Table 6**. As shown, the ramp movements for the peak direction in 2041 fail. This is due to the mainline of SR-386 being over capacity.

TABLE 6: BUILD CONDITION RAMP JUNCTION ANALYSIS SUMMARY

Ramp Junction	2021		2041	
	AM	PM	AM	PM
SR-386 EB Off-Ramp Weave	B	D	C	F
SR-386 EB On-Ramp Merge	B	E	C	F
SR-386 WB Off-Ramp Diverge	E	C	F	E
SR-386 WB On-Ramp Weave	D	C	F	D

3.0 RECOMMENDATIONS

3.1 Forest Retreat Road at SR-386 Eastbound Ramps

The proposed unsignalized intersection of Forest Retreat Road and the SR-386 eastbound ramps operates at an acceptable LOS for the AM and PM peak hours in both the 2021 base year and 2041 design year. The 2041 95th percentile queue length is well below the available storage for all critical approaches. The current design is adequate and needs no alteration.

3.2 Forest Retreat Road at SR-386 Westbound Ramps

The proposed unsignalized intersection of Forest Retreat Road and the SR-386 westbound ramps operates at an acceptable LOS for the AM and PM peak hours in both the 2021 base year and 2041 design year. The 2041 95th percentile queue length is well below the available storage for all critical approaches. The current design is adequate and needs no alteration.

3.2 SR-386 Ramp Junctions

The ramp junctions for the proposed SR-386 interchange at Forest Retreat Road operate at an acceptable LOS in the off peak direction (eastbound in the AM peak and westbound in the PM peak) in both the 2021 base year and 2041 design year. Ramp operations operate at an acceptable LOS in the peak direction (westbound in the AM peak and eastbound in the PM peak) for the 2021 base year. In the 2041 design year, traffic operations at the ramp junctions in the peak directions fail. This breakdown is due to the mainline of SR-386 being over capacity in the design year.

It is recommended that the mainline of SR-386 be widened to include an additional travel lane in each direction in order to provide an acceptable LOS for the facility.

Appendix A

Traffic Volumes

**TENNESSEE DEPARTMENT OF TRANSPORTATION
STRATEGIC TRANSPORTATION INVESTMENTS DIVISION**

PROJECT NO.: STP-NH-386(3) : 83076-1226-14 ROUTE: S.R. 386
 COUNTY: SUMNER CITY: HENDERSONVILLE
 PROJECT PIN NUMBER: 101452.00
 PROJECT DESCRIPTION: PROPOSED INTERCHANGE @ S.R. 386 & FOREST RETREAT ROAD.

[1] S.R. 386 AVERAGE TRAFFIC DATA.

[2] FOREST RETREAT ROAD AVERAGE TRAFFIC DATA.

DIVISION REQUESTING:

MAINTENANCE	<input type="checkbox"/>	PAVEMENT DESIGN	<input type="checkbox"/>
S.T.I.D.	<input checked="" type="checkbox"/>	STRUCTURES	<input type="checkbox"/>
PROG. DEVELOPMENT & ADM.	<input type="checkbox"/>	SURVEY & ROADWAY DESIGN	<input type="checkbox"/>
PUBLIC TRANS. & AERO.	<input type="checkbox"/>	TRAFFIC SIGNAL DESIGN	<input type="checkbox"/>
YEAR PROJECT PROGRAMMED FOR CONSTRUCTION:	_____	OTHER _____	<input type="checkbox"/>
PROJECTED LETTING DATE:	_____		

TRAFFIC ASSIGNMENT:

	BASE YEAR		DESIGN YEAR				DESIGN ROADWAY % TRUCKS		DESIGN AVERAGE DAILY LOADS		
	AADT	YEAR	AADT	DHV	%	YEAR	DIR.DIST.	DHV	AADT	FLEX	RIGID
[1]	66,720	2021	89,940	9,803	11	2041	53-47	3	4		
[2]	3,010	2021	5,750	750	13	2041	60-40	3	4		

REQUESTED BY: NAME GREG DYER DATE 1/8/16
 DIVISION S.T.I.D.
 ADDRESS 1000 J. K. POLK BUILDING
NASHVILLE TN 37243

REVIEWED BY: TONY ARMSTRONG *Tony Armstrong* DATE 1-19-16
 TRANSPORTATION MANAGER 1
 SUITE 1000, JAMES K. POLK BUILDING

APPROVED BY: MIKE PRESLEY *Mike Presley* DATE 1-19-16
 TRANSPORTATION MANAGER 2
 SUITE 1000, JAMES K. POLK BUILDING

COMMENTS:

FURNISH THE 2021-2041 AADT's AND DHV's FOR THIS PROPOSED INTERCHANGE.

THIS TRAFFIC IS BASED ON 2015 CYCLE COUNTS AND A 24-HOUR SPECIAL MACHINE COUNT. [JAN. 2016]. THE DESIGN YEAR TRAFFIC WAS TAKEN FROM THE NASHVILLE MPO COMPUTER ASSIGNMENT MODEL RE-CALIBRATED TO 2008 GROUND COUNTS. AADT's AND DHV's ARE INCLUDED.

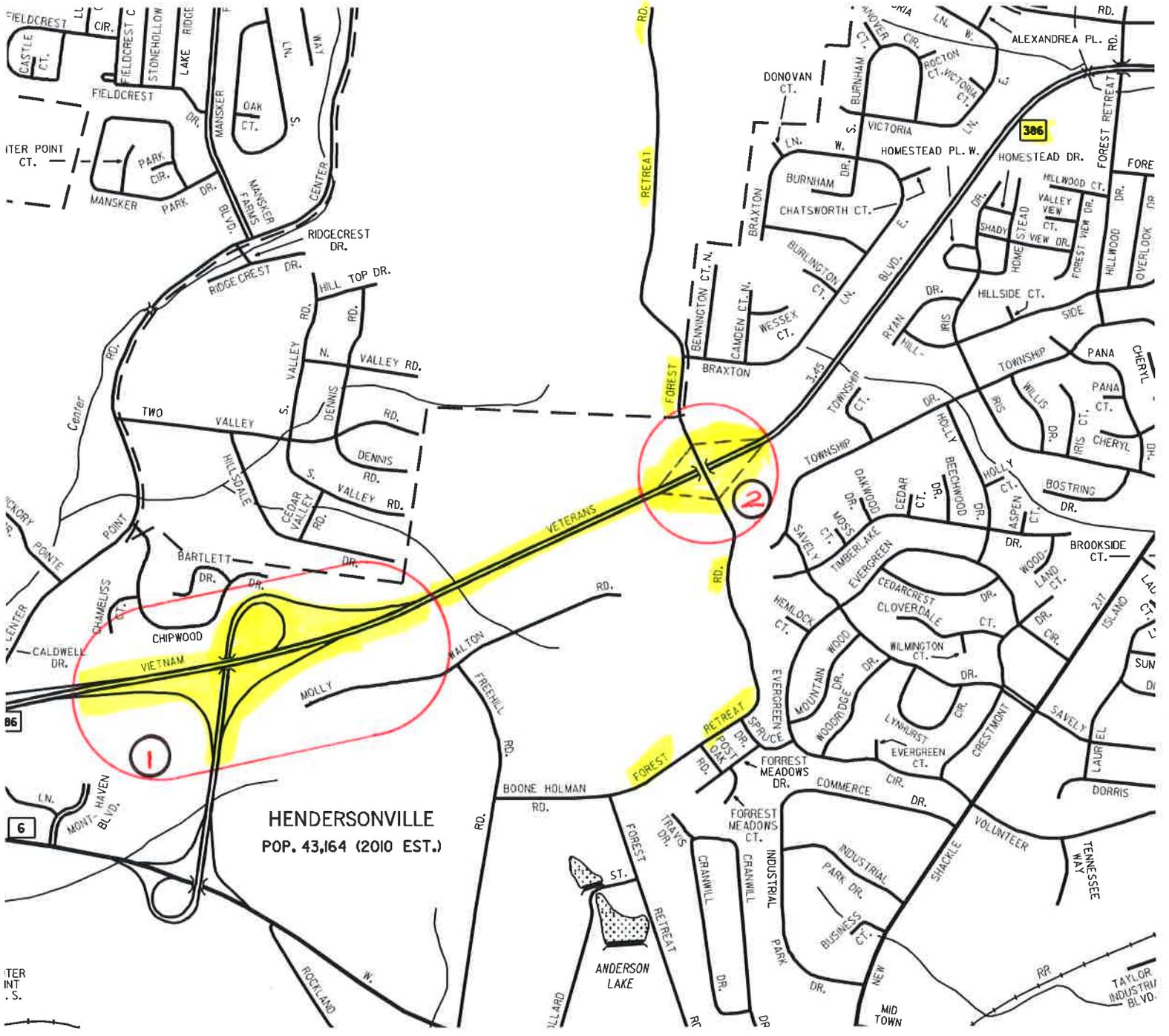
DHV'S ARE NOT REQUIRED FOR SIDE ROADS LESS THAN 1000 AADT.

NOTE: FOR BRIDGE REPLACEMENT PROJECTS, ADLs ARE NOT REQUIRED FOR ADTs OF 1000 OR LESS AND PERCENTAGE OF TRUCKS OF 7% OR LESS.

SEE ATTACHMENTS FOR TURNING MOVEMENTS AND/OR OTHER DETAILS.

(REV. 2/27/14)

Tx00229918



HENDERSONVILLE
POP. 43,164 (2010 EST.)

SUMNER COUNTY

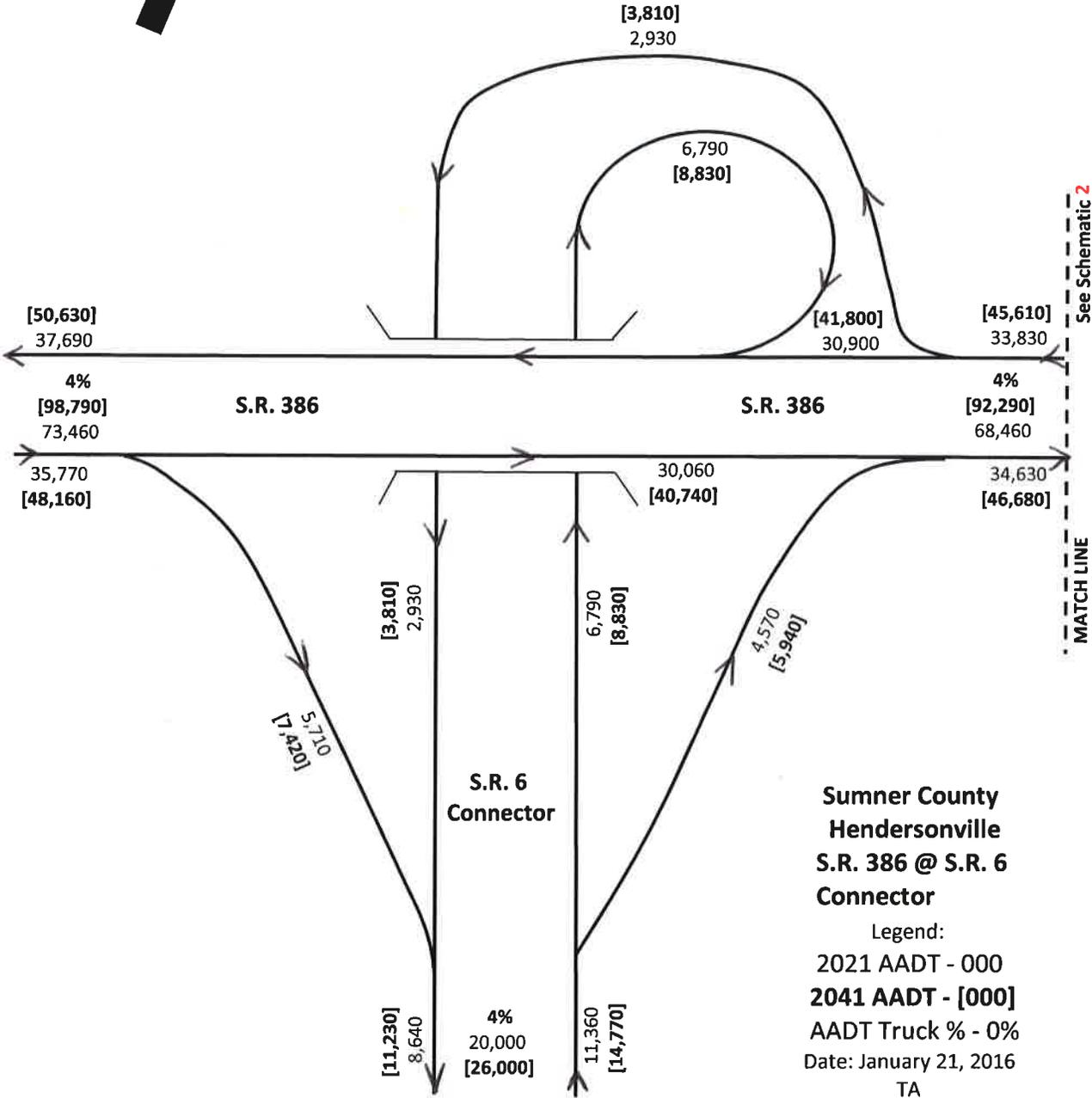
INTER
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TAYLOR
INDUSTRIAL
BLVD.



AADT

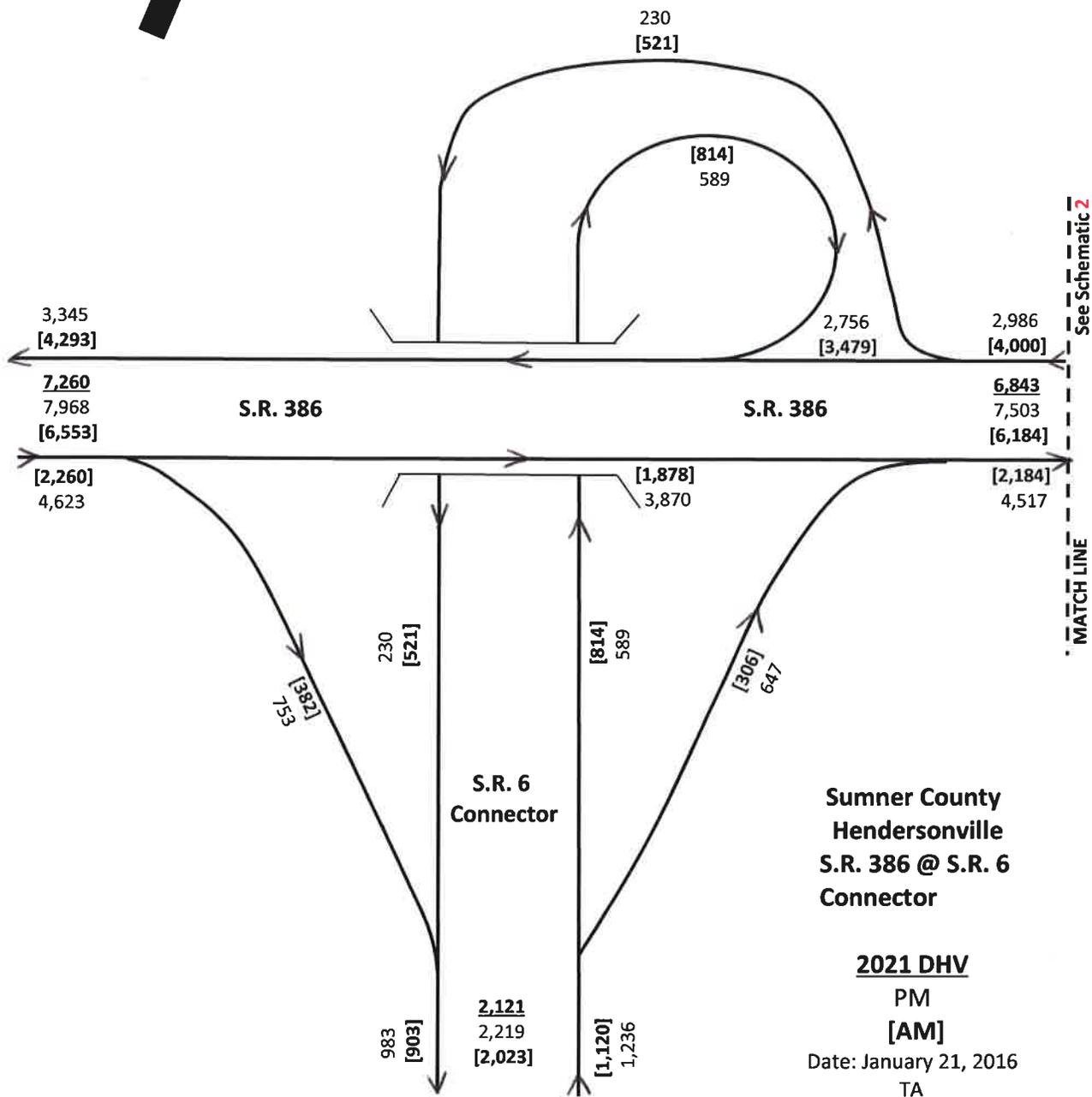
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2021 DHV

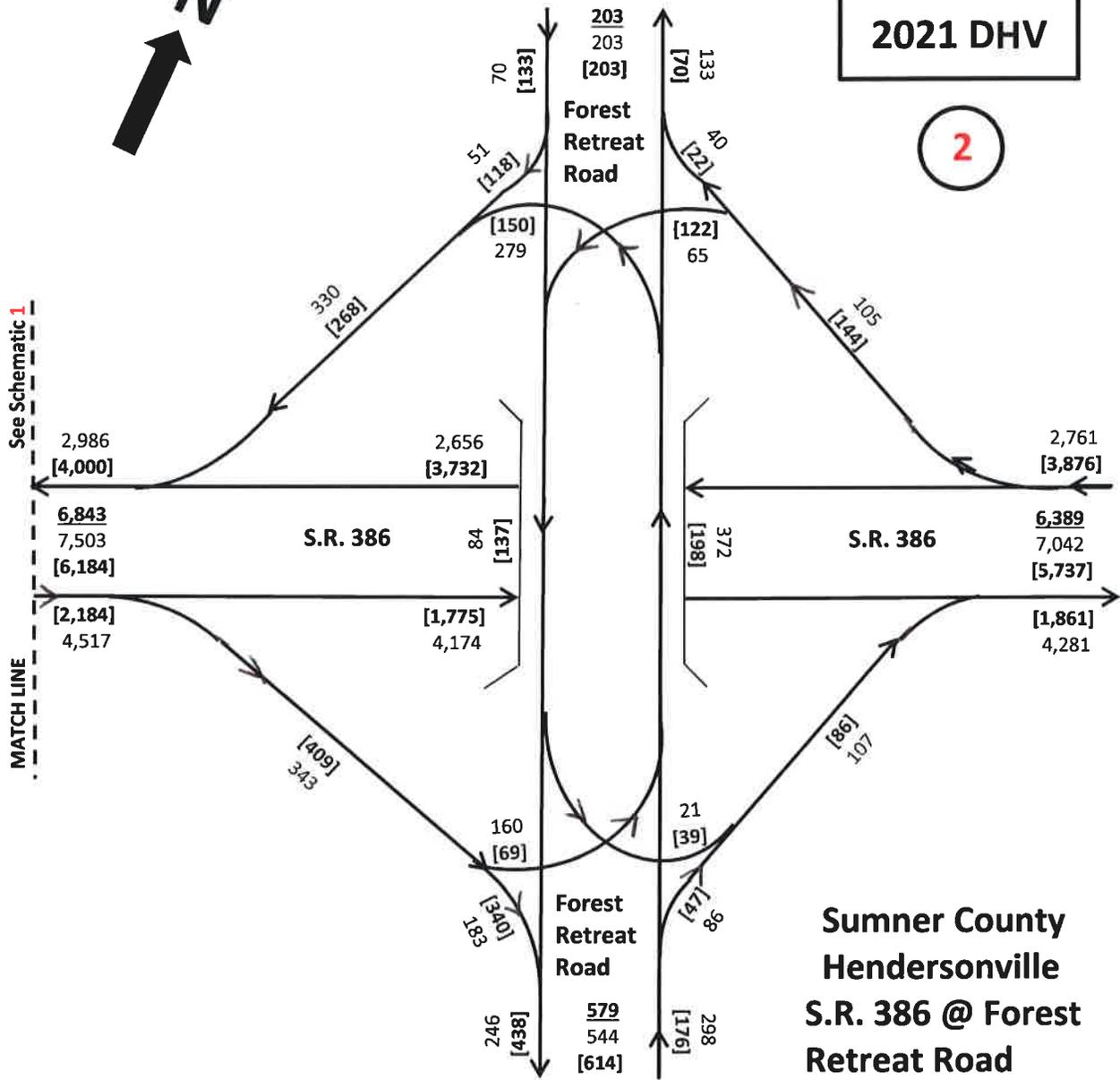
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2021 DHV

2



**Sumner County
Hendersonville
S.R. 386 @ Forest
Retreat Road**

2021 DHV

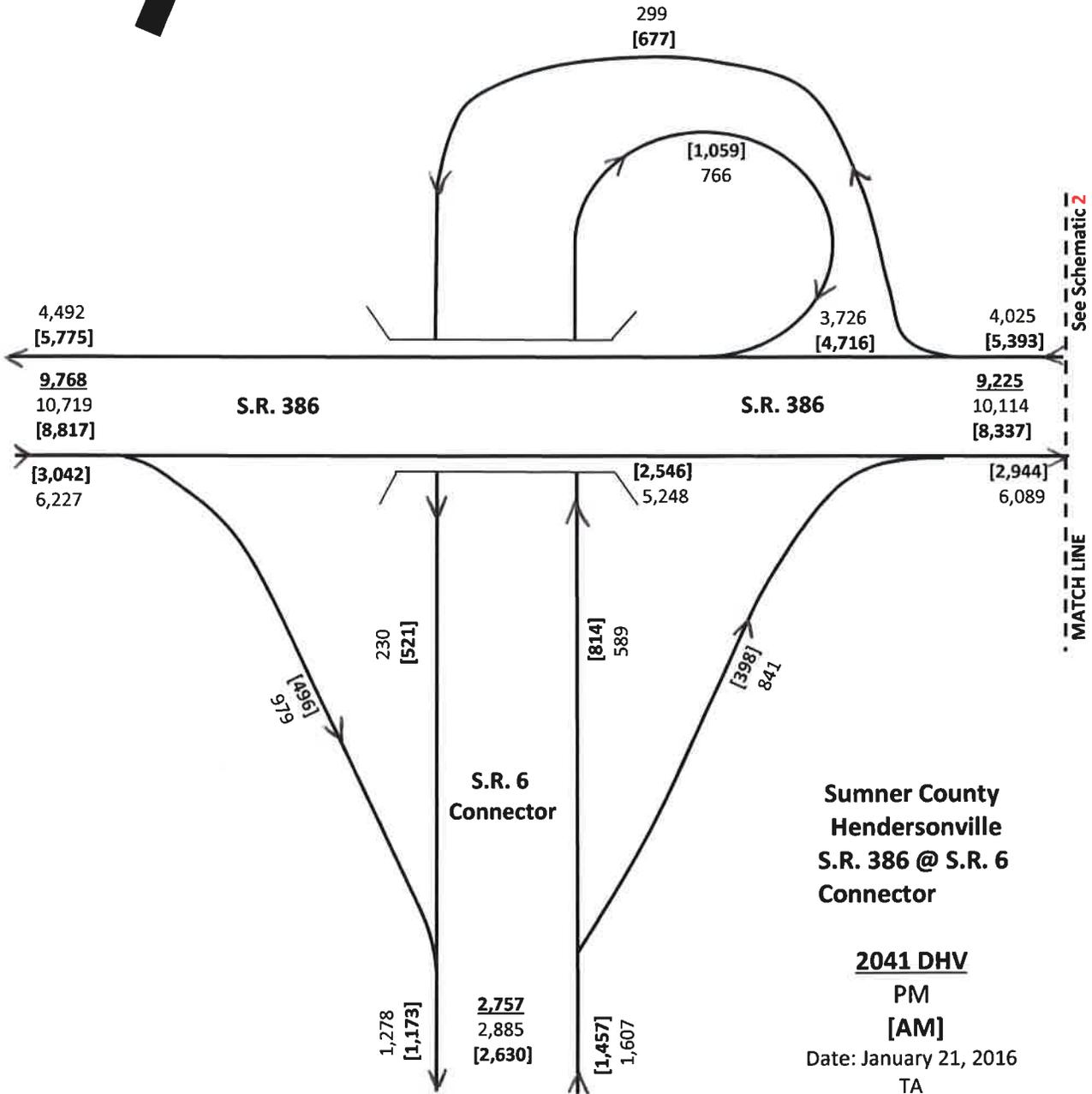
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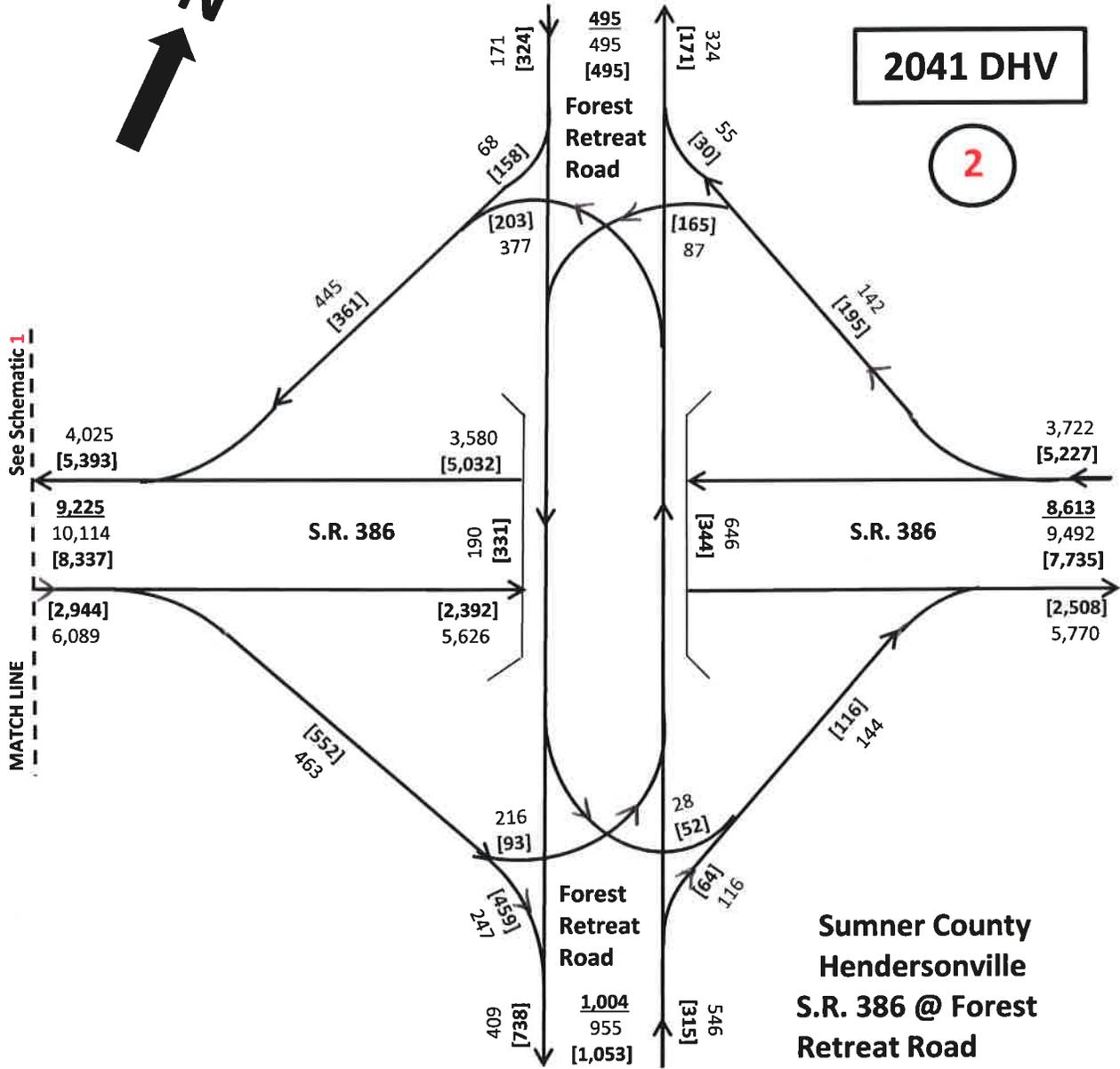
[AM]

Date: January 21, 2016

2041 DHV

1





2041 DHV

PM

[AM]

Date: January 21, 2016

TA

Appendix B

Capacity Analysis Worksheets

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	GKD			Intersection	Forest Retreat @ SR-386 EB		
Agency/Co.	TDOT			Jurisdiction	Sumner County		
Date Performed	2/17/2016			Analysis Year	2021		
Analysis Time Period	AM Peak						
Project Description							
East/West Street: SR-386 EB Off Ramp				North/South Street: Forest Retreat Rd.			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		129	47	39	98		
Peak-Hour Factor, PHF	1.00	0.94	0.94	0.94	0.94	1.00	
Hourly Flow Rate, HFR (veh/h)	0	137	50	41	104	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			0			0	
Lanes	0	1	0	1	1	0	
Configuration			TR	L	T		
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)	69	0	340				
Peak-Hour Factor, PHF	0.94	0.94	0.94	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	73	0	361	0	0	0	
Percent Heavy Vehicles	4	4	4	0	0	0	
Percent Grade (%)	0			0			
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	1	0	0	0	0	
Configuration		LTR					
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		L					LTR
v (veh/h)		41					434
C (m) (veh/h)		1375					881
v/c		0.03					0.49
95% queue length		0.09					2.77
Control Delay (s/veh)		7.7					13.0
LOS		A					B
Approach Delay (s/veh)	--	--					13.0
Approach LOS	--	--					B

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	GKD			Intersection	Forest Retreat @ SR-386 EB		
Agency/Co.	TDOT			Jurisdiction	Sumner County		
Date Performed	2/17/2016			Analysis Year	2021		
Analysis Time Period	PM Peak						
Project Description							
East/West Street: SR-386 EB Off Ramp				North/South Street: Forest Retreat Rd.			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		212	86	21	63		
Peak-Hour Factor, PHF	1.00	0.94	0.94	0.94	0.94	1.00	
Hourly Flow Rate, HFR (veh/h)	0	225	91	22	67	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			0			0	
Lanes	0	1	0	1	1	0	
Configuration			TR	L	T		
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)	160	0	183				
Peak-Hour Factor, PHF	0.94	0.94	0.94	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	170	0	194	0	0	0	
Percent Heavy Vehicles	4	4	4	0	0	0	
Percent Grade (%)	0			0			
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	1	0	0	0	0	
Configuration		LTR					
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		L					LTR
v (veh/h)		22					364
C (m) (veh/h)		1233					789
v/c		0.02					0.46
95% queue length		0.05					2.46
Control Delay (s/veh)		8.0					13.4
LOS		A					B
Approach Delay (s/veh)	--	--					13.4
Approach LOS	--	--					B

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	GKD			Intersection	Forest Retreat @ SR-386 EB		
Agency/Co.	TDOT			Jurisdiction	Sumner County		
Date Performed	2/17/2016			Analysis Year	2041		
Analysis Time Period	AM Peak						
Project Description							
East/West Street: SR-386 EB Off Ramp				North/South Street: Forest Retreat Rd.			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		251	64	52	279		
Peak-Hour Factor, PHF	1.00	0.94	0.94	0.94	0.94	1.00	
Hourly Flow Rate, HFR (veh/h)	0	267	68	55	296	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			0			0	
Lanes	0	1	0	1	1	0	
Configuration			TR	L	T		
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)	93	0	459				
Peak-Hour Factor, PHF	0.94	0.94	0.94	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	98	0	488	0	0	0	
Percent Heavy Vehicles	4	4	4	0	0	0	
Percent Grade (%)	0			0			
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	1	0	0	0	0	
Configuration		LTR					
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		L					LTR
v (veh/h)		55					586
C (m) (veh/h)		1213					676
v/c		0.05					0.87
95% queue length		0.14					10.23
Control Delay (s/veh)		8.1					34.9
LOS		A					D
Approach Delay (s/veh)	--	--					34.9
Approach LOS	--	--					D

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	GKD			Intersection	Forest Retreat @ SR-386 EB		
Agency/Co.	TDOT			Jurisdiction	Sumner County		
Date Performed	2/17/2016			Analysis Year	2041		
Analysis Time Period	PM Peak						
Project Description							
East/West Street: SR-386 EB Off Ramp				North/South Street: Forest Retreat Rd.			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		430	116	28	162		
Peak-Hour Factor, PHF	1.00	0.94	0.94	0.94	0.94	1.00	
Hourly Flow Rate, HFR (veh/h)	0	457	123	29	172	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			0			0	
Lanes	0	1	0	1	1	0	
Configuration			TR	L	T		
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)	216	0	247				
Peak-Hour Factor, PHF	0.94	0.94	0.94	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	229	0	262	0	0	0	
Percent Heavy Vehicles	4	4	4	0	0	0	
Percent Grade (%)	0			0			
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	1	0	0	0	0	
Configuration		LTR					
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		L					LTR
v (veh/h)		29					491
C (m) (veh/h)		984					611
v/c		0.03					0.80
95% queue length		0.09					8.00
Control Delay (s/veh)		8.8					30.6
LOS		A					D
Approach Delay (s/veh)	--	--					30.6
Approach LOS	--	--					D

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	GKD			Intersection	Forest Retreat @ SR-386 WB		
Agency/Co.	TDOT			Jurisdiction	Sumner County		
Date Performed	2/17/2016			Analysis Year	2021		
Analysis Time Period	AM Peak						
Project Description							
East/West Street: SR-386 WB Ramps				North/South Street: Forest Retreat Rd.			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		48	150	118	15		
Peak-Hour Factor, PHF	1.00	0.94	0.94	0.94	0.94	1.00	
Hourly Flow Rate, HFR (veh/h)	0	51	159	125	15	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			1				0
Lanes	0	1	1	1	1		0
Configuration		T	R	L	T		
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				122		22	
Peak-Hour Factor, PHF	0.94	0.94	0.94	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	122	0	22	
Percent Heavy Vehicles	4	4	4	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			1				1
Lanes	0	0	0	1	0		1
Configuration				L			R
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		L	L		R		
v (veh/h)		125	122		22		
C (m) (veh/h)		1542	632		1011		
v/c		0.08	0.19		0.02		
95% queue length		0.26	0.71		0.07		
Control Delay (s/veh)		7.5	12.1		8.6		
LOS		A	B		A		
Approach Delay (s/veh)	--	--	11.5				
Approach LOS	--	--	B				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	GKD			Intersection	Forest Retreat @ SR-386 WB		
Agency/Co.	TDOT			Jurisdiction	Sumner County		
Date Performed	2/17/2016			Analysis Year	2021		
Analysis Time Period	PM Peak						
Project Description							
East/West Street: SR-386 WB Ramps				North/South Street: Forest Retreat Rd.			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		93	279	51	19		
Peak-Hour Factor, PHF	1.00	0.94	0.94	0.94	0.94	1.00	
Hourly Flow Rate, HFR (veh/h)	0	98	296	54	20	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			1				0
Lanes	0	1	1	1	1		0
Configuration		T	R	L	T		
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				65		40	
Peak-Hour Factor, PHF	0.94	0.94	0.94	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	65	0	40	
Percent Heavy Vehicles	4	4	4	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			1				1
Lanes	0	0	0	1	0		1
Configuration				L			R
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		L	L		R		
v (veh/h)		54	65		40		
C (m) (veh/h)		1483	737		953		
v/c		0.04	0.09		0.04		
95% queue length		0.11	0.29		0.13		
Control Delay (s/veh)		7.5	10.4		8.9		
LOS		A	B		A		
Approach Delay (s/veh)	--	--	9.8				
Approach LOS	--	--	A				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	GKD			Intersection	Forest Retreat @ SR-386 WB		
Agency/Co.	TDOT			Jurisdiction	Sumner County		
Date Performed	2/17/2016			Analysis Year	2041		
Analysis Time Period	AM Peak						
Project Description							
East/West Street: SR-386 WB Ramps				North/South Street: Forest Retreat Rd.			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		141	203	158	166		
Peak-Hour Factor, PHF	1.00	0.94	0.94	0.94	0.94	1.00	
Hourly Flow Rate, HFR (veh/h)	0	150	215	168	176	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			1				0
Lanes	0	1	1	1	1		0
Configuration		T	R	L	T		
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				165		30	
Peak-Hour Factor, PHF	0.94	0.94	0.94	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	165	0	30	
Percent Heavy Vehicles	4	4	4	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			1				1
Lanes	0	0	0	1	0		1
Configuration				L			R
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		L	L		R		
v (veh/h)		168	165		30		
C (m) (veh/h)		1419	448		891		
v/c		0.12	0.37		0.03		
95% queue length		0.40	1.67		0.10		
Control Delay (s/veh)		7.9	17.6		9.2		
LOS		A	C		A		
Approach Delay (s/veh)	--	--	16.3				
Approach LOS	--	--	C				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	GKD			Intersection	Forest Retreat @ SR-386 WB		
Agency/Co.	TDOT			Jurisdiction	Sumner County		
Date Performed	2/17/2016			Analysis Year	2041		
Analysis Time Period	PM Peak						
Project Description							
East/West Street: SR-386 WB Ramps				North/South Street: Forest Retreat Rd.			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		269	377	68	103		
Peak-Hour Factor, PHF	1.00	0.94	0.94	0.94	0.94	1.00	
Hourly Flow Rate, HFR (veh/h)	0	286	401	72	109	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			1				0
Lanes	0	1	1	1	1		0
Configuration		T	R	L	T		
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				87		55	
Peak-Hour Factor, PHF	0.94	0.94	0.94	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	87	0	55	
Percent Heavy Vehicles	4	4	4	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			1				1
Lanes	0	0	0	1	0		1
Configuration				L			R
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		L	L		R		
v (veh/h)		72	87		55		
C (m) (veh/h)		1265	557		748		
v/c		0.06	0.16		0.07		
95% queue length		0.18	0.55		0.24		
Control Delay (s/veh)		8.0	12.7		10.2		
LOS		A	B		B		
Approach Delay (s/veh)	--	--	11.7				
Approach LOS	--	--	B				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst	GKD	Freeway/Dir of Travel	SR-386 EB						
Agency or Company	TDOT	Junction	Forest Retreat Rd						
Date Performed	2/8/2016	Jurisdiction	Sumner County						
Analysis Time Period	AM	Analysis Year	2021						
Project Description									
Inputs									
Upstream Adj Ramp	Freeway Number of Lanes, N		2		Downstream Adj Ramp				
<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On	Ramp Number of Lanes, N		1		<input type="checkbox"/> Yes <input type="checkbox"/> On				
<input type="checkbox"/> No <input type="checkbox"/> Off	Acceleration Lane Length, L _A		800		<input checked="" type="checkbox"/> No <input type="checkbox"/> Off				
L _{up} = 4800 ft	Deceleration Lane Length L _D				L _{down} = ft				
V _u = 306 veh/h	Freeway Volume, V _F		1861		V _D = veh/h				
	Ramp Volume, V _R		86						
	Freeway Free-Flow Speed, S _{FF}		70.0						
	Ramp Free-Flow Speed, S _{FR}		35.0						
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p	
Freeway	1861	0.94	Rolling	4	0	0.980	1.00	2019	
Ramp	86	0.94	Level	4	0	0.980	1.00	93	
UpStream	306	0.94	Level	4	0	0.980	1.00	332	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v ₁₂					Estimation of v ₁₂				
$V_{12} = V_F (P_{FM})$ (Equation 13-6 or 13-7)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ (Equation 13-12 or 13-13)				
P _{FM} = 1.000 using Equation (Exhibit 13-6)					P _{FD} = using Equation (Exhibit 13-7)				
V ₁₂ = 2019 pc/h					V ₁₂ = pc/h				
V ₃ or V _{av34} = 0 pc/h (Equation 13-14 or 13-17)					V ₃ or V _{av34} = pc/h (Equation 13-14 or 13-17)				
Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No				
If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}	2112	Exhibit 13-8		No	V _F		Exhibit 13-8		
					V _{FO} = V _F - V _R		Exhibit 13-8		
					V _R		Exhibit 13-10		
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?
V _{R12}	2112	Exhibit 13-8		No	V ₁₂		Exhibit 13-8		
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$					$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$				
D _R = 16.9 (pc/mi/ln)					D _R = (pc/mi/ln)				
LOS = B (Exhibit 13-2)					LOS = (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S = 0.297 (Exhibit 13-11)					D _S = (Exhibit 13-12)				
S _R = 61.7 mph (Exhibit 13-11)					S _R = mph (Exhibit 13-12)				
S ₀ = N/A mph (Exhibit 13-11)					S ₀ = mph (Exhibit 13-12)				
S = 61.7 mph (Exhibit 13-13)					S = mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst	GKD	Freeway/Dir of Travel	SR-386 EB						
Agency or Company	TDOT	Junction	Forest Retreat Rd						
Date Performed	2/8/2016	Jurisdiction	Sumner County						
Analysis Time Period	PM	Analysis Year	2021						
Project Description									
Inputs									
Upstream Adj Ramp	Freeway Number of Lanes, N	2	Downstream Adj Ramp						
<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On	Ramp Number of Lanes, N	1	<input type="checkbox"/> Yes <input type="checkbox"/> On						
<input type="checkbox"/> No <input type="checkbox"/> Off	Acceleration Lane Length, L _A	800	<input checked="" type="checkbox"/> No <input type="checkbox"/> Off						
L _{up} = 4800 ft	Deceleration Lane Length L _D		L _{down} = ft						
V _u = 647 veh/h	Freeway Volume, V _F	4281	V _D = veh/h						
	Ramp Volume, V _R	107							
	Freeway Free-Flow Speed, S _{FF}	70.0							
	Ramp Free-Flow Speed, S _{FR}	35.0							
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p	
Freeway	4281	0.94	Rolling	4	0	0.980	1.00	4645	
Ramp	107	0.94	Level	4	0	0.980	1.00	116	
UpStream	647	0.94	Level	4	0	0.980	1.00	702	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
$V_{12} = V_F (P_{FM})$ (Equation 13-6 or 13-7)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ (Equation 13-12 or 13-13)				
P _{FM} = 1.000 using Equation (Exhibit 13-6)					P _{FD} = using Equation (Exhibit 13-7)				
V ₁₂ = 4645 pc/h					V ₁₂ = pc/h				
V ₃ or V _{av34} = 0 pc/h (Equation 13-14 or 13-17)					V ₃ or V _{av34} = pc/h (Equation 13-14 or 13-17)				
Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No				
If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}	4761	Exhibit 13-8		No	V _F		Exhibit 13-8		
					V _{FO} = V _F - V _R		Exhibit 13-8		
					V _R		Exhibit 13-10		
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?
V _{R12}	4761	Exhibit 13-8		4600:All	Yes	V ₁₂	Exhibit 13-8		
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$					$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$				
D _R = 37.5 (pc/mi/ln)					D _R = (pc/mi/ln)				
LOS = E (Exhibit 13-2)					LOS = (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _s = 0.721 (Exhibit 13-11)					D _s = (Exhibit 13-12)				
S _R = 49.8 mph (Exhibit 13-11)					S _R = mph (Exhibit 13-12)				
S ₀ = N/A mph (Exhibit 13-11)					S ₀ = mph (Exhibit 13-12)				
S = 49.8 mph (Exhibit 13-13)					S = mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst	GKD	Freeway/Dir of Travel	SR-386 EB						
Agency or Company	TDOT	Junction	Forest Retreat Rd						
Date Performed	2/8/2016	Jurisdiction	Sumner County						
Analysis Time Period	AM	Analysis Year	2041						
Project Description									
Inputs									
Upstream Adj Ramp	Freeway Number of Lanes, N	2	Downstream Adj Ramp						
<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On	Ramp Number of Lanes, N	1	<input type="checkbox"/> Yes <input type="checkbox"/> On						
<input type="checkbox"/> No <input type="checkbox"/> Off	Acceleration Lane Length, L _A	800	<input checked="" type="checkbox"/> No <input type="checkbox"/> Off						
L _{up} = 4800 ft	Deceleration Lane Length L _D		L _{down} = ft						
V _u = 398 veh/h	Freeway Volume, V _F	2508	V _D = veh/h						
	Ramp Volume, V _R	116							
	Freeway Free-Flow Speed, S _{FF}	70.0							
	Ramp Free-Flow Speed, S _{FR}	35.0							
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p	
Freeway	2508	0.94	Rolling	4	0	0.980	1.00	2721	
Ramp	116	0.94	Level	4	0	0.980	1.00	126	
UpStream	398	0.94	Level	4	0	0.980	1.00	432	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v ₁₂					Estimation of v ₁₂				
$V_{12} = V_F (P_{FM})$ (Equation 13-6 or 13-7)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ (Equation 13-12 or 13-13)				
P _{FM} = 1.000 using Equation (Exhibit 13-6)					P _{FD} = using Equation (Exhibit 13-7)				
V ₁₂ = 2721 pc/h					V ₁₂ = pc/h				
V ₃ or V _{av34} = 0 pc/h (Equation 13-14 or 13-17)					V ₃ or V _{av34} = pc/h (Equation 13-14 or 13-17)				
Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No				
If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity	LOS F?			Actual	Capacity	LOS F?	
V _{FO}	2847	Exhibit 13-8	No		V _F		Exhibit 13-8		
					V _{FO} = V _F - V _R		Exhibit 13-8		
					V _R		Exhibit 13-10		
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable	Violation?			Actual	Max Desirable	Violation?	
V _{R12}	2847	Exhibit 13-8	4600:All	No	V ₁₂		Exhibit 13-8		
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$					$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$				
D _R = 22.6 (pc/mi/ln)					D _R = (pc/mi/ln)				
LOS = C (Exhibit 13-2)					LOS = (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S = 0.332 (Exhibit 13-11)					D _S = (Exhibit 13-12)				
S _R = 60.7 mph (Exhibit 13-11)					S _R = mph (Exhibit 13-12)				
S ₀ = N/A mph (Exhibit 13-11)					S ₀ = mph (Exhibit 13-12)				
S = 60.7 mph (Exhibit 13-13)					S = mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst	GKD	Freeway/Dir of Travel	SR-386 EB						
Agency or Company	TDOT	Junction	Forest Retreat Rd						
Date Performed	2/8/2016	Jurisdiction	Sumner County						
Analysis Time Period	PM	Analysis Year	2041						
Project Description									
Inputs									
Upstream Adj Ramp	Freeway Number of Lanes, N	2	Downstream Adj Ramp						
<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On	Ramp Number of Lanes, N	1	<input type="checkbox"/> Yes <input type="checkbox"/> On						
<input type="checkbox"/> No <input type="checkbox"/> Off	Acceleration Lane Length, L _A	800	<input checked="" type="checkbox"/> No <input type="checkbox"/> Off						
L _{up} = 4800 ft	Deceleration Lane Length L _D		L _{down} = ft						
V _u = 841 veh/h	Freeway Volume, V _F	5770	V _D = veh/h						
	Ramp Volume, V _R	144							
	Freeway Free-Flow Speed, S _{FF}	70.0							
	Ramp Free-Flow Speed, S _{FR}	35.0							
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p	
Freeway	5770	0.94	Rolling	4	0	0.980	1.00	6261	
Ramp	144	0.94	Level	4	0	0.980	1.00	156	
UpStream	841	0.94	Level	4	0	0.980	1.00	913	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v ₁₂					Estimation of v ₁₂				
$V_{12} = V_F (P_{FM})$ (Equation 13-6 or 13-7)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ (Equation 13-12 or 13-13)				
P _{FM} = 1.000 using Equation (Exhibit 13-6)					P _{FD} = using Equation (Exhibit 13-7)				
V ₁₂ = 6261 pc/h					V ₁₂ = pc/h				
V ₃ or V _{av34} = 0 pc/h (Equation 13-14 or 13-17)					V ₃ or V _{av34} = pc/h (Equation 13-14 or 13-17)				
Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No				
If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity	LOS F?			Actual	Capacity	LOS F?	
V _{FO}	6417	Exhibit 13-8	Yes		V _F		Exhibit 13-8		
					V _{FO} = V _F - V _R		Exhibit 13-8		
					V _R		Exhibit 13-10		
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable	Violation?			Actual	Max Desirable	Violation?	
V _{R12}	6417	Exhibit 13-8	4600:All	Yes	V ₁₂		Exhibit 13-8		
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$					$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$				
D _R = 50.4 (pc/mi/ln)					D _R = (pc/mi/ln)				
LOS = F (Exhibit 13-2)					LOS = (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S = 2.652 (Exhibit 13-11)					D _S = (Exhibit 13-12)				
S _R = -4.3 mph (Exhibit 13-11)					S _R = mph (Exhibit 13-12)				
S ₀ = N/A mph (Exhibit 13-11)					S ₀ = mph (Exhibit 13-12)				
S = -4.3 mph (Exhibit 13-13)					S = mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst	GKD	Freeway/Dir of Travel	SR-386 WB						
Agency or Company	TDOT	Junction	Forest Retreat Rd.						
Date Performed	2/8/2016	Jurisdiction	Sumner County						
Analysis Time Period	AM	Analysis Year	2021						
Project Description									
Inputs									
Upstream Adj Ramp	Freeway Number of Lanes, N = 2				Downstream Adj Ramp				
<input type="checkbox"/> Yes <input type="checkbox"/> On	Ramp Number of Lanes, N = 1				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On				
<input checked="" type="checkbox"/> No <input type="checkbox"/> Off	Acceleration Lane Length, L _A				<input type="checkbox"/> No <input checked="" type="checkbox"/> Off				
L _{up} = ft	Deceleration Lane Length L _D = 580				L _{down} = 4800 ft				
V _u = veh/h	Freeway Volume, V _F = 3876				V _D = 521 veh/h				
	Ramp Volume, V _R = 144								
	Freeway Free-Flow Speed, S _{FF} = 70.0								
	Ramp Free-Flow Speed, S _{FR} = 35.0								
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p	
Freeway	3876	0.94	Rolling	4	0	0.943	1.00	4371	
Ramp	144	0.94	Level	4	0	0.980	1.00	156	
UpStream									
DownStream	521	0.94	Level	4	0	0.980	1.00	565	
Merge Areas					Diverge Areas				
Estimation of v ₁₂					Estimation of v ₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = (Equation 13-6 or 13-7) P _{FM} = using Equation (Exhibit 13-6) V ₁₂ = pc/h V ₃ or V _{av34} pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 1.000 using Equation (Exhibit 13-7) V ₁₂ = 4371 pc/h V ₃ or V _{av34} 0 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}		Exhibit 13-8			V _F	4371	Exhibit 13-8	4800	No
					V _{FO} = V _F - V _R	4215	Exhibit 13-8	4800	No
					V _R	156	Exhibit 13-10	2000	No
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?
V _{R12}		Exhibit 13-8			V ₁₂	4371	Exhibit 13-8	4400:All	No
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ D _R = (pc/mi/ln) LOS = (Exhibit 13-2)					$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ D _R = 36.6 (pc/mi/ln) LOS = E (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S =	(Exhibit 13-11)				D _S =	0.442 (Exhibit 13-12)			
S _R =	mph (Exhibit 13-11)				S _R =	57.6 mph (Exhibit 13-12)			
S ₀ =	mph (Exhibit 13-11)				S ₀ =	N/A mph (Exhibit 13-12)			
S =	mph (Exhibit 13-13)				S =	57.6 mph (Exhibit 13-13)			

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst	GKD	Freeway/Dir of Travel	SR-386 WB						
Agency or Company	TDOT	Junction	Forest Retreat Rd.						
Date Performed	2/8/2016	Jurisdiction	Sumner County						
Analysis Time Period	PM	Analysis Year	2021						
Project Description									
Inputs									
Upstream Adj Ramp	Freeway Number of Lanes, N				2	Downstream Adj Ramp			
<input type="checkbox"/> Yes <input type="checkbox"/> On	Ramp Number of Lanes, N				1	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On			
<input checked="" type="checkbox"/> No <input type="checkbox"/> Off	Acceleration Lane Length, L _A					<input type="checkbox"/> No <input checked="" type="checkbox"/> Off			
L _{up} = ft	Deceleration Lane Length L _D				580	L _{down} = 4800 ft			
V _u = veh/h	Freeway Volume, V _F				2761	V _D = 230 veh/h			
	Ramp Volume, V _R				105				
	Freeway Free-Flow Speed, S _{FF}				70.0				
	Ramp Free-Flow Speed, S _{FR}				35.0				
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p	
Freeway	2761	0.94	Rolling	4	0	0.943	1.00	3113	
Ramp	105	0.94	Level	4	0	0.980	1.00	114	
UpStream									
DownStream	230	0.94	Level	4	0	0.980	1.00	250	
Merge Areas					Diverge Areas				
Estimation of v ₁₂					Estimation of v ₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = (Equation 13-6 or 13-7) P _{FM} = using Equation (Exhibit 13-6) V ₁₂ = pc/h V ₃ or V _{av34} pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 1.000 using Equation (Exhibit 13-7) V ₁₂ = 3113 pc/h V ₃ or V _{av34} 0 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}		Exhibit 13-8			V _F	3113	Exhibit 13-8	4800	No
					V _{FO} = V _F - V _R	2999	Exhibit 13-8	4800	No
					V _R	114	Exhibit 13-10	2000	No
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable	Violation?			Actual	Max Desirable	Violation?	
V _{R12}		Exhibit 13-8			V ₁₂	3113	Exhibit 13-8	4400:All	No
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ D _R = (pc/mi/ln) LOS = (Exhibit 13-2)					$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ D _R = 25.8 (pc/mi/ln) LOS = C (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S =	(Exhibit 13-11)				D _S =	0.438 (Exhibit 13-12)			
S _R =	mph (Exhibit 13-11)				S _R =	57.7 mph (Exhibit 13-12)			
S ₀ =	mph (Exhibit 13-11)				S ₀ =	N/A mph (Exhibit 13-12)			
S =	mph (Exhibit 13-13)				S =	57.7 mph (Exhibit 13-13)			

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst	GKD	Freeway/Dir of Travel	SR-386 WB						
Agency or Company	TDOT	Junction	Forest Retreat Rd.						
Date Performed	2/8/2016	Jurisdiction	Sumner County						
Analysis Time Period	AM	Analysis Year	2041						
Project Description									
Inputs									
Upstream Adj Ramp	Freeway Number of Lanes, N = 2				Downstream Adj Ramp				
<input type="checkbox"/> Yes <input type="checkbox"/> On	Ramp Number of Lanes, N = 1				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On				
<input checked="" type="checkbox"/> No <input type="checkbox"/> Off	Acceleration Lane Length, L _A				<input type="checkbox"/> No <input checked="" type="checkbox"/> Off				
L _{up} = ft	Deceleration Lane Length L _D = 580				L _{down} = 4800 ft				
V _u = veh/h	Freeway Volume, V _F = 5227				V _D = 677 veh/h				
	Ramp Volume, V _R = 195								
	Freeway Free-Flow Speed, S _{FF} = 70.0								
	Ramp Free-Flow Speed, S _{FR} = 35.0								
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p	
Freeway	5227	0.94	Rolling	4	0	0.943	1.00	5894	
Ramp	195	0.94	Level	4	0	0.980	1.00	212	
UpStream									
DownStream	677	0.94	Level	4	0	0.980	1.00	735	
Merge Areas					Diverge Areas				
Estimation of v ₁₂					Estimation of v ₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = (Equation 13-6 or 13-7) P _{FM} = using Equation (Exhibit 13-6) V ₁₂ = pc/h V ₃ or V _{av34} pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 1.000 using Equation (Exhibit 13-7) V ₁₂ = 5894 pc/h V ₃ or V _{av34} 0 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}		Exhibit 13-8			V _F	5894	Exhibit 13-8	4800	Yes
					V _{FO} = V _F - V _R	5682	Exhibit 13-8	4800	Yes
					V _R	212	Exhibit 13-10	2000	No
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?
V _{R12}		Exhibit 13-8			V ₁₂	5894	Exhibit 13-8	4400:All	Yes
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ D _R = (pc/mi/ln) LOS = (Exhibit 13-2)					$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ D _R = 49.7 (pc/mi/ln) LOS = F (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S = (Exhibit 13-11)					D _S = 0.447 (Exhibit 13-12)				
S _R = mph (Exhibit 13-11)					S _R = 57.5 mph (Exhibit 13-12)				
S ₀ = mph (Exhibit 13-11)					S ₀ = N/A mph (Exhibit 13-12)				
S = mph (Exhibit 13-13)					S = 57.5 mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET										
General Information					Site Information					
Analyst	GKD	Freeway/Dir of Travel	SR-386 WB							
Agency or Company	TDOT	Junction	Forest Retreat Rd.							
Date Performed	2/8/2016	Jurisdiction	Sumner County							
Analysis Time Period	PM	Analysis Year	2041							
Project Description										
Inputs										
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off	Freeway Number of Lanes, N	2	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off	Ramp Number of Lanes, N	1	$L_{down} =$	4800 ft	$V_D =$	299 veh/h	
$L_{up} =$	ft	Acceleration Lane Length, L_A		Deceleration Lane Length L_D	580					
$V_u =$	veh/h	Freeway Volume, V_F		Freeway Free-Flow Speed, S_{FF}	70.0					
		Ramp Volume, V_R		Ramp Free-Flow Speed, S_{FR}	35.0					
Conversion to pc/h Under Base Conditions										
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$		
Freeway	3722	0.94	Rolling	4	0	0.943	1.00	4197		
Ramp	142	0.94	Level	4	0	0.980	1.00	154		
UpStream										
DownStream	299	0.94	Level	4	0	0.980	1.00	324		
Merge Areas					Diverge Areas					
Estimation of v_{12}					Estimation of v_{12}					
$L_{EQ} =$	$V_{12} = V_F (P_{FM})$ (Equation 13-6 or 13-7)	$P_{FM} =$	using Equation (Exhibit 13-6)		$L_{EQ} =$	$V_{12} = V_R + (V_F - V_R)P_{FD}$ (Equation 13-12 or 13-13)	$P_{FD} =$	1.000 using Equation (Exhibit 13-7)		
$V_{12} =$	pc/h	V_3 or V_{av34}	pc/h (Equation 13-14 or 13-17)		$V_{12} =$	4197 pc/h	V_3 or V_{av34}	0 pc/h (Equation 13-14 or 13-17)		
Is V_3 or $V_{av34} > 2,700$ pc/h?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Is V_3 or $V_{av34} > 1.5 * V_{12}/2$	<input type="checkbox"/> Yes <input type="checkbox"/> No		Is V_3 or $V_{av34} > 2,700$ pc/h?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Is V_3 or $V_{av34} > 1.5 * V_{12}/2$	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
If Yes, $V_{12a} =$	pc/h (Equation 13-16, 13-18, or 13-19)	If Yes, $V_{12a} =$	pc/h (Equation 13-16, 13-18, or 13-19)							
Capacity Checks					Capacity Checks					
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?	
V_{FO}		Exhibit 13-8			V_F	4197	Exhibit 13-8		4800	No
					$V_{FO} = V_F - V_R$	4043	Exhibit 13-8		4800	No
					V_R	154	Exhibit 13-10		2000	No
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area					
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?	
V_{R12}		Exhibit 13-8			V_{12}	4197	Exhibit 13-8		4400:All	No
Level of Service Determination (if not F)					Level of Service Determination (if not F)					
$D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$					$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$					
$D_R =$	(pc/mi/ln)				$D_R =$	35.1 (pc/mi/ln)				
LOS =	(Exhibit 13-2)				LOS =	E (Exhibit 13-2)				
Speed Determination					Speed Determination					
$M_S =$	(Exhibit 13-11)				$D_S =$	0.442 (Exhibit 13-12)				
$S_R =$	mph (Exhibit 13-11)				$S_R =$	57.6 mph (Exhibit 13-12)				
$S_0 =$	mph (Exhibit 13-11)				$S_0 =$	N/A mph (Exhibit 13-12)				
$S =$	mph (Exhibit 13-13)				$S =$	57.6 mph (Exhibit 13-13)				

FREEWAY WEAVING WORKSHEET									
General Information					Site Information				
Analyst	GKD				Freeway/Dir of Travel	SR-386 EB			
Agency/Company	TDOT				Weaving Segment Location	Forest Retreat Aux Lane			
Date Performed	2/8/2016				Analysis Year	2021			
Analysis Time Period	AM								
Project Description									
Inputs									
Weaving configuration	One-Sided				Segment type	Freeway			
Weaving number of lanes, N	3				Freeway minimum speed, S _{MIN}	15			
Weaving segment length, L _S	1700ft				Freeway maximum capacity, C _{IFL}	2400			
Freeway free-flow speed, FFS	70 mph				Terrain type	Rolling			
Conversions to pc/h Under Base Conditions									
	V (veh/h)	PHF	Truck (%)	RV (%)	E _T	E _R	f _{HV}	f _p	v (pc/h)
V _{FF}	1878	0.94	4	0	2.5	2.0	0.943	1.00	2118
V _{RF}	306	0.94	4	0	2.5	2.0	0.943	1.00	345
V _{FR}	409	0.94	4	0	2.5	2.0	0.943	1.00	461
V _{RR}	0	0.94	4	0	2.5	2.0	0.943	1.00	0
V _{NW}	2118							V =	2924
V _W	806								
VR	0.276								
Configuration Characteristics									
Minimum maneuver lanes, N _{WL}	2 lc				Minimum weaving lane changes, LC _{MIN}	806 lc/h			
Interchange density, ID	1.0 int/mi				Weaving lane changes, LC _W	1035 lc/h			
Minimum RF lane changes, LC _{RF}	1 lc/pc				Non-weaving lane changes, LC _{NW}	780 lc/h			
Minimum FR lane changes, LC _{FR}	1 lc/pc				Total lane changes, LC _{ALL}	1815 lc/h			
Minimum RR lane changes, LC _{RR}	lc/pc				Non-weaving vehicle index, I _{NW}	360			
Weaving Segment Speed, Density, Level of Service, and Capacity									
Weaving segment flow rate, v	2759 veh/h				Weaving intensity factor, W	0.238			
Weaving segment capacity, c _w	6008 veh/h				Weaving segment speed, S	59.5 mph			
Weaving segment v/c ratio	0.459				Average weaving speed, S _w	59.4 mph			
Weaving segment density, D	16.4 pc/mi/ln				Average non-weaving speed, S _{NW}	59.5 mph			
Level of Service, LOS	B				Maximum weaving length, L _{MAX}	5324 ft			
Notes									
a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".									
b. For volumes that exceed the weaving segment capacity, the level of service is "F".									

FREEWAY WEAVING WORKSHEET									
General Information					Site Information				
Analyst					Freeway/Dir of Travel				
Agency/Company					SR-386 EB				
Date Performed					Weaving Segment Location				
Analysis Time Period					Analysis Year				
TDOT					Forest Retreat Aux Lane				
2/8/2016					2021				
PM									
Project Description									
Inputs									
Weaving configuration					Segment type				
Weaving number of lanes, N					Freeway				
Weaving segment length, L _s					Freeway minimum speed, S _{MIN}				
Freeway free-flow speed, FFS					Freeway maximum capacity, C _{IFL}				
One-Sided					Terrain type				
3					Rolling				
1700ft					15				
70 mph					2400				
Conversions to pc/h Under Base Conditions									
	V (veh/h)	PHF	Truck (%)	RV (%)	E _T	E _R	f _{HV}	f _p	v (pc/h)
V _{FF}	3870	0.94	4	0	2.5	2.0	0.943	1.00	4364
V _{RF}	647	0.94	4	0	2.5	2.0	0.943	1.00	730
V _{FR}	343	0.94	4	0	2.5	2.0	0.943	1.00	387
V _{RR}	0	0.94	4	0	2.5	2.0	0.943	1.00	0
V _{NW}	4364							V =	5481
V _W	1117								
VR	0.204								
Configuration Characteristics									
Minimum maneuver lanes, N _{WL}					Minimum weaving lane changes, LC _{MIN}				
Interchange density, ID					Weaving lane changes, LC _W				
Minimum RF lane changes, LC _{RF}					Non-weaving lane changes, LC _{NW}				
Minimum FR lane changes, LC _{FR}					Total lane changes, LC _{ALL}				
Minimum RR lane changes, LC _{RR}					Non-weaving vehicle index, I _{NW}				
2 lc					1117 lc/h				
1.0 int/mi					1346 lc/h				
1 lc/pc					1243 lc/h				
1 lc/pc					2589 lc/h				
lc/pc					742				
Weaving Segment Speed, Density, Level of Service, and Capacity									
Weaving segment flow rate, v					Weaving intensity factor, W				
Weaving segment capacity, c _w					Weaving segment speed, S				
Weaving segment v/c ratio					Average weaving speed, S _w				
Weaving segment density, D					Average non-weaving speed, S _{NW}				
Level of Service, LOS					Maximum weaving length, L _{MAX}				
5171 veh/h					0.315				
6170 veh/h					53.9 mph				
0.838					56.8 mph				
33.9 pc/mi/ln					53.2 mph				
D					4575 ft				
Notes									
a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".									
b. For volumes that exceed the weaving segment capacity, the level of service is "F".									

FREEWAY WEAVING WORKSHEET									
General Information					Site Information				
Analyst					Freeway/Dir of Travel				
Agency/Company					SR-386 EB				
Date Performed					Weaving Segment Location				
Analysis Time Period					Analysis Year				
TDOT					Forest Retreat Aux Lane				
2/8/2016					2041				
PM									
Project Description									
Inputs									
Weaving configuration					Segment type				
Weaving number of lanes, N					Freeway				
Weaving segment length, L _s					Freeway minimum speed, S _{MIN}				
Freeway free-flow speed, FFS					Freeway maximum capacity, C _{IFL}				
One-Sided					Terrain type				
3					Rolling				
1700ft					15				
70 mph					2400				
Conversions to pc/h Under Base Conditions									
	V (veh/h)	PHF	Truck (%)	RV (%)	E _T	E _R	f _{HV}	f _p	v (pc/h)
V _{FF}	5248	0.94	4	0	2.5	2.0	0.943	1.00	5918
V _{RF}	841	0.94	4	0	2.5	2.0	0.943	1.00	948
V _{FR}	463	0.94	4	0	2.5	2.0	0.943	1.00	522
V _{RR}	0	0.94	4	0	2.5	2.0	0.943	1.00	0
V _{NW}	5918							V =	7388
V _W	1470								
VR	0.199								
Configuration Characteristics									
Minimum maneuver lanes, N _{WL}					Minimum weaving lane changes, LC _{MIN}				
Interchange density, ID					Weaving lane changes, LC _W				
Minimum RF lane changes, LC _{RF}					Non-weaving lane changes, LC _{NW}				
Minimum FR lane changes, LC _{FR}					Total lane changes, LC _{ALL}				
Minimum RR lane changes, LC _{RR}					Non-weaving vehicle index, I _{NW}				
2 lc					lc/h				
1.0 int/mi					lc/h				
1 lc/pc					lc/h				
1 lc/pc					lc/h				
lc/pc					lc/h				
Weaving Segment Speed, Density, Level of Service, and Capacity									
Weaving segment flow rate, v					Weaving intensity factor, W				
Weaving segment capacity, c _w					Weaving segment speed, S				
Weaving segment v/c ratio					Average weaving speed, S _w				
Weaving segment density, D					Average non-weaving speed, S _{NW}				
Level of Service, LOS					Maximum weaving length, L _{MAX}				
6971 veh/h					4526 ft				
6181 veh/h					mph				
1.128					mph				
pc/mi/ln					mph				
F									
Notes									
a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".									
b. For volumes that exceed the weaving segment capacity, the level of service is "F".									

FREEWAY WEAVING WORKSHEET									
General Information					Site Information				
Analyst	GKD				Freeway/Dir of Travel	SR-386 WB			
Agency/Company	TDOT				Weaving Segment Location	Forest Retreat Aux Lane			
Date Performed	2/8/2016				Analysis Year	2021			
Analysis Time Period	AM								
Project Description									
Inputs									
Weaving configuration	One-Sided			Segment type	Freeway				
Weaving number of lanes, N	3			Freeway minimum speed, S _{MIN}	15				
Weaving segment length, L _S	3070ft			Freeway maximum capacity, C _{IFL}	2400				
Freeway free-flow speed, FFS	70 mph			Terrain type	Rolling				
Conversions to pc/h Under Base Conditions									
	V (veh/h)	PHF	Truck (%)	RV (%)	E _T	E _R	f _{HV}	f _p	v (pc/h)
V _{FF}	4000	0.94	4	0	2.5	2.0	0.943	1.00	4511
V _{RF}	268	0.94	4	0	2.5	2.0	0.943	1.00	302
V _{FR}	521	0.94	4	0	2.5	2.0	0.943	1.00	588
V _{RR}	0	0.94	4	0	2.5	2.0	0.943	1.00	0
V _{NW}	4511							V =	5401
V _W	890								
VR	0.165								
Configuration Characteristics									
Minimum maneuver lanes, N _{WL}	2 lc			Minimum weaving lane changes, LC _{MIN}	890 lc/h				
Interchange density, ID	1.0 int/mi			Weaving lane changes, LC _W	1212 lc/h				
Minimum RF lane changes, LC _{RF}	1 lc/pc			Non-weaving lane changes, LC _{NW}	2104 lc/h				
Minimum FR lane changes, LC _{FR}	1 lc/pc			Total lane changes, LC _{ALL}	3316 lc/h				
Minimum RR lane changes, LC _{RR}	lc/pc			Non-weaving vehicle index, I _{NW}	1385				
Weaving Segment Speed, Density, Level of Service, and Capacity									
Weaving segment flow rate, v	5095 veh/h			Weaving intensity factor, W	0.240				
Weaving segment capacity, c _w	6552 veh/h			Weaving segment speed, S	55.6 mph				
Weaving segment v/c ratio	0.778			Average weaving speed, S _w	59.3 mph				
Weaving segment density, D	32.4 pc/mi/ln			Average non-weaving speed, S _{NW}	55.0 mph				
Level of Service, LOS	D			Maximum weaving length, L _{MAX}	4179 ft				
Notes									
a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".									
b. For volumes that exceed the weaving segment capacity, the level of service is "F".									

FREEWAY WEAVING WORKSHEET									
General Information					Site Information				
Analyst					Freeway/Dir of Travel				
Agency/Company					SR-386 WB				
Date Performed					Weaving Segment Location				
Analysis Time Period					Analysis Year				
Project Description									
Inputs									
Weaving configuration					Segment type				
Weaving number of lanes, N					Freeway				
Weaving segment length, L _s					Freeway minimum speed, S _{MIN}				
Freeway free-flow speed, FFS					Freeway maximum capacity, C _{IFL}				
					Terrain type				
Conversions to pc/h Under Base Conditions									
	V (veh/h)	PHF	Truck (%)	RV (%)	E _T	E _R	f _{HV}	f _p	v (pc/h)
V _{FF}	2986	0.94	4	0	2.5	2.0	0.943	1.00	3367
V _{RF}	330	0.94	4	0	2.5	2.0	0.943	1.00	372
V _{FR}	230	0.94	4	0	2.5	2.0	0.943	1.00	259
V _{RR}	0	0.94	4	0	2.5	2.0	0.943	1.00	0
V _{NW}	3367							V =	3998
V _W	631								
VR	0.158								
Configuration Characteristics									
Minimum maneuver lanes, N _{WL}					Minimum weaving lane changes, LC _{MIN}				
Interchange density, ID					Weaving lane changes, LC _W				
Minimum RF lane changes, LC _{RF}					Non-weaving lane changes, LC _{NW}				
Minimum FR lane changes, LC _{FR}					Total lane changes, LC _{ALL}				
Minimum RR lane changes, LC _{RR}					Non-weaving vehicle index, I _{NW}				
Weaving Segment Speed, Density, Level of Service, and Capacity									
Weaving segment flow rate, v					Weaving intensity factor, W				
Weaving segment capacity, c _w					Weaving segment speed, S				
Weaving segment v/c ratio					Average weaving speed, S _w				
Weaving segment density, D					Average non-weaving speed, S _{NW}				
Level of Service, LOS					Maximum weaving length, L _{MAX}				
Notes									
a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".									
b. For volumes that exceed the weaving segment capacity, the level of service is "F".									

FREEWAY WEAVING WORKSHEET									
General Information					Site Information				
Analyst					Freeway/Dir of Travel				
Agency/Company					SR-386 WB				
Date Performed					Weaving Segment Location				
Analysis Time Period					Analysis Year				
Project Description									
Inputs									
Weaving configuration					Segment type				
Weaving number of lanes, N					Freeway				
Weaving segment length, L _s					Freeway minimum speed, S _{MIN}				
Freeway free-flow speed, FFS					Freeway maximum capacity, C _{IFL}				
					Terrain type				
Conversions to pc/h Under Base Conditions									
	V (veh/h)	PHF	Truck (%)	RV (%)	E _T	E _R	f _{HV}	f _p	v (pc/h)
V _{FF}	3580	0.94	4	0	2.5	2.0	0.943	1.00	4037
V _{RF}	445	0.94	4	0	2.5	2.0	0.943	1.00	502
V _{FR}	299	0.94	4	0	2.5	2.0	0.943	1.00	337
V _{RR}	0	0.94	4	0	2.5	2.0	0.943	1.00	0
V _{NW}	4037							V =	4876
V _W	839								
VR	0.172								
Configuration Characteristics									
Minimum maneuver lanes, N _{WL}					Minimum weaving lane changes, LC _{MIN}				
Interchange density, ID					Weaving lane changes, LC _W				
Minimum RF lane changes, LC _{RF}					Non-weaving lane changes, LC _{NW}				
Minimum FR lane changes, LC _{FR}					Total lane changes, LC _{ALL}				
Minimum RR lane changes, LC _{RR}					Non-weaving vehicle index, I _{NW}				
Weaving Segment Speed, Density, Level of Service, and Capacity									
Weaving segment flow rate, v					Weaving intensity factor, W				
Weaving segment capacity, c _w					Weaving segment speed, S				
Weaving segment v/c ratio					Average weaving speed, S _w				
Weaving segment density, D					Average non-weaving speed, S _{NW}				
Level of Service, LOS					Maximum weaving length, L _{MAX}				
Notes									
a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".									
b. For volumes that exceed the weaving segment capacity, the level of service is "F".									