Appendix A

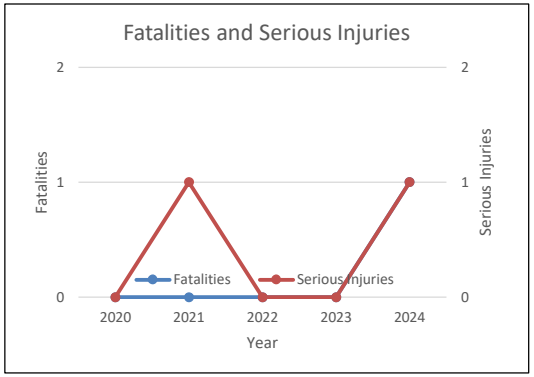
ODOT CAM Tool Output

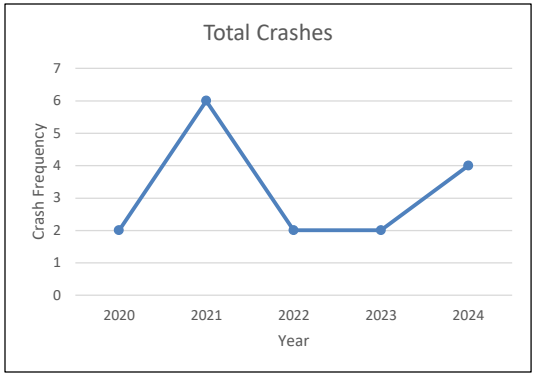
SR 21 and SR 212

Crash Summary Sheet

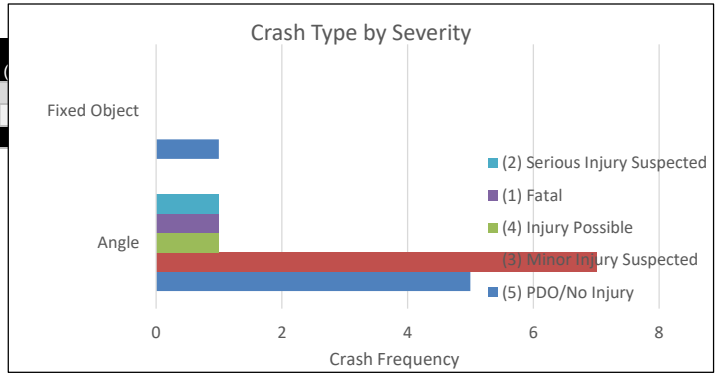
Crashes Per Year	3.20	Percent Injury	62.5%	EPDO	9.00

Year	Total Crashes	Fatalities	Serious Injuries
2020	2	0	0
2021	6	0	1
2022	2	0	0
2023	2	0	0
2024	4	1	1
Grand Total	16	1	2





Total Crashes Crash Type	Injury Level (1) Fatal	(2) Serious Inju	(3) Minor Injury
Angle	1	1	7
Fixed Object	0	0	0
Grand Total	1	1	7



SR 21 and SR 212
Crash Summary Sheet

Crashes Per Year	3.20	Percent Injury	62.5%	EPDO	9.00

Road Condition	Total Crashes	Fatalities	Serious Injuries
Dry	14	1	2
Wet	2	0	0
Grand Total	16	1	2

Hour of Day	Total Crashes
0	1
6	1
13	1
15	3
16	2
17	4
19	2
22	2
Grand Total	16

Month	Total Crashes
January	1
February	1
May	2
June	2
July	4
August	1
September	2
October	1
December	2
Grand Total	16

Weather	Total Crashes	Fatalities	Serious Injuries
Clear	10	1	2
Cloudy	4	0	0
Snow	1	0	0
Rain	1	0	0
Grand Total	16	1	2

Day in Week	Total Crashes
(1) Sunday	2
(2) Monday	1
(3) Tuesday	4
(4) Wednesday	2
(5) Thursday	1
(6) Friday	2
(7) Saturday	4
Grand Total	16

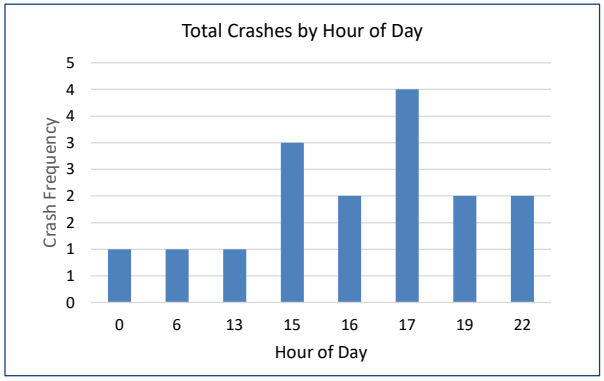
Crash Location	Total Crashes	Fatalities	Serious Injuries
Four-Way Intersection	14	1	2
Data Not Valid or Not Provided	2	0	0
Grand Total	16	1	2

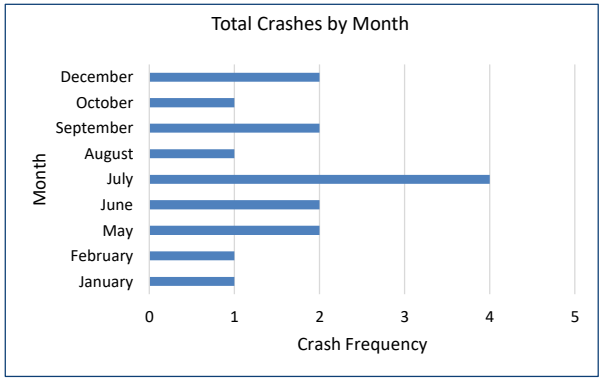
Roadway Contour	Total Crashes	Fatalities	Serious Injuries
Straight Level	15	1	2
Straight Grade	1	0	0
Grand Total	16	1	2

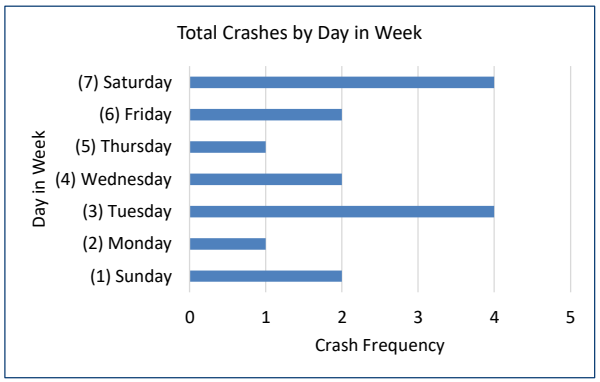
SR 21 and SR 212

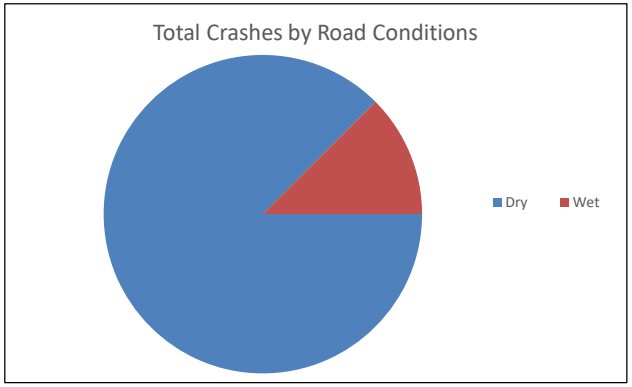
Crash Summary Sheet

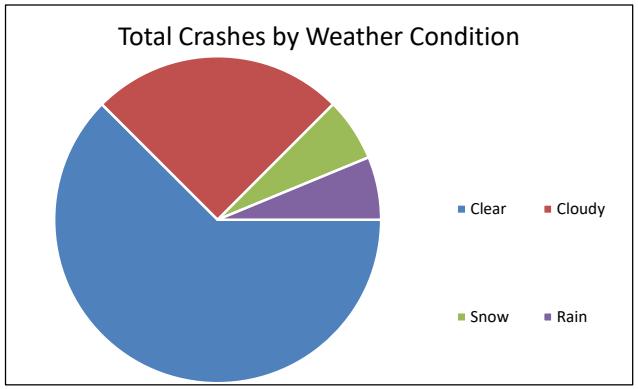
Crashes Per Year	3.20	Percent Injury	62.5%	EPDO	9.00

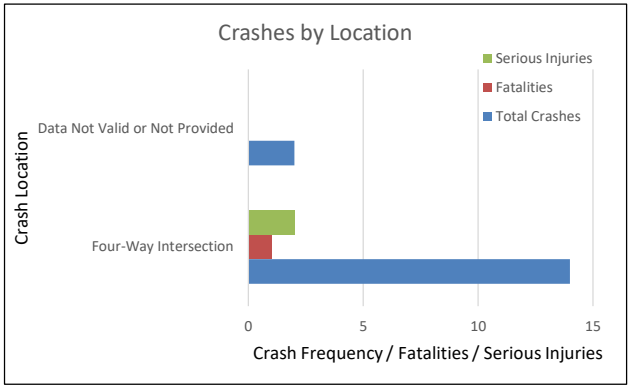


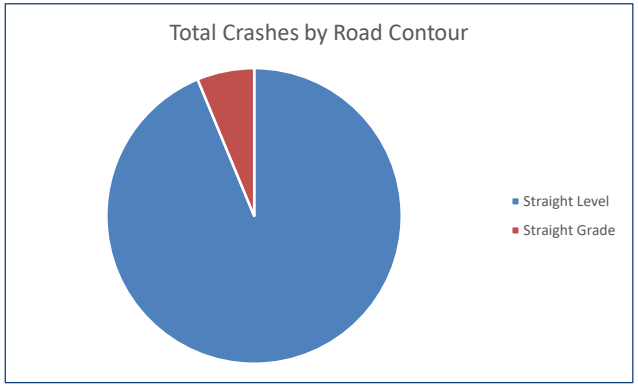












Appendix B

Study Area Crash Diagram

LEGEND

TYPES OF COLLISIONS

FIXED OBJECT

ANGLE

YEAR	LIGHT
2020	
2021	DL = DAYLIGHT
2022	NL = NIGHT LIGHTED
2023	NNL = NIGHT NOT-LIGHTED
2024	DW = DAWN

CONTRIBUTING FACTOR

FTC = FAILURE TO CONTROL
FTY = FAILURE TO YIELD

SEVERITY	ROAD
P = PROPERTY DAMAGE ONLY	D = DRY
I = INJURY	W = WET
F = FATALITY	S = SNOW
	I = ICE

DATE/HOUR/LIGHT/ROAD/
SEVERITY/CONTR FACTOR

HORIZONTAL SCALE IN FEET
0 20 40 80

STW Safety Studies 2025-5 Project
Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)

CTY-RTE-SECTION

MODEL: Design PAPERSIZE: 34x22 (in.) DATE: 3/6/2026 TIME: 4:17:02 PM PLTDRV: OHDOT_PDF.pltcfg PENTBL: 122290_PenC.tbl USER: stephanie.otten@arcadis.com WORKSPACE: OHDOTCEv2_24.00 WORKSET: 122290 PRODUCT: OpenRoadsDesigner 24.00.02.25
pw:\\arcadis-us-pw.bentley.com:arcadis-us-01\Documents\01 Active Projects\30285409\v400_CAD\122290\100-Planning\Erie Avenue SW SR 21 and Dolphin Street SW SR 212\SR 21 and SR 212- Crash Diagram.dgn

DESIGN AGENCY
ARCADIS
1111 SUPERIOR AVENUE SUITE 1300
CLEVELAND, OHIO 44114
(216) 696-2604
www.arcadis.com

DESIGNER: XXX
REVIEWER: XXX MM-DD-YY
PROJECT ID: xxx
SHEET: P.01 TOTAL: 1

Appendix C

Traffic Forecast Modeling System Output

TFMS - Intersection Forecast Report

Forecast Summary



Project Id	Project Name
	TUS-21-1.47

Project Description
Intersection Safety Study at the intersection of SR 21 and SR 212 at the Stark/Tuscarawas County Line

Model Version	Script Date	Script Version
2025.1900	5/15/2025 10:30:27 AM	Initital

Username	Email Address
David.Hoffman	David.Hoffman@dot.ohio.gov

*Users of this data need to be aware that there are limitations to the forecasts generated by this product that make it suitable only for roadway design projects which are low risk.

Road Name	2030 AADT	2050 AADT	K%	DHV30	D%	T24%	TD%
SR21	6,650	8,850	11.3	1000	51	12.9	5.5
SR212	2,150	3,350	13.0	440	55	5.2	5.1
SR21	5,700	6,200	10.6	660	54	13.6	6.1
SR212	2,000	2,750	13.2	360	56	12.9	9.9

The values in parentheses have been overridden.

Pivot Count Date: 06/18/2025

TFMS - Intersection Forecast Report

Segment Information

Approach	Segment ID	LRS ID	BMP	Midpoint	EMP	Length	Latitude	Longitude
NB	2631	STUSSR00021**C	0.000	0.735	1.470	1.470	40.6354124786049	-81.5476866732396
EB	2632	STUSSR00212**C	0.000	0.2465	0.493	0.493	40.6455083635381	-81.5523288594815
SB	2633	SSTASR00021**C	0.000	1.528	3.056	3.056	40.6670938023861	-81.5455088574072
WB	2634	STUSSR00212**C	0.493	0.7795	1.066	0.573	40.646592120623	-81.5423039207608

Target Value Summary

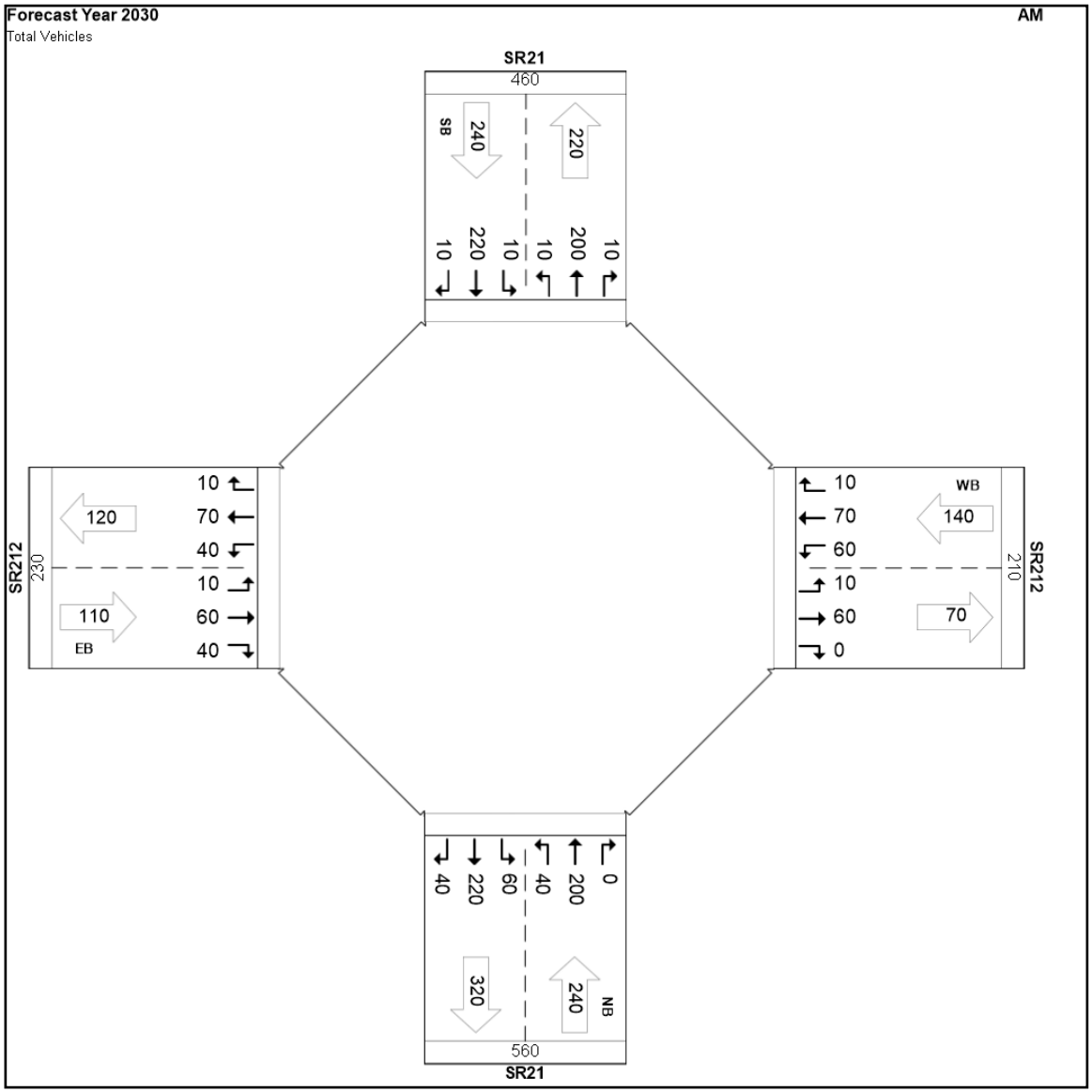
Approach	Adt Growth Rate	Adt Growth	2030 AADT	2050 AADT	2030 AM	2050 AM	2030 PM	2050 PM
NB	1.800	110.000	6,650	8,850	570	760	750	1,000
EB	3.100	58.000	* 2,150	3,350	220	330	280	430
SB	0.400	22.000	5,700	6,150	460	500	600	650
WB	2.100	38.000	2,000	2,750	200	280	260	360

The values in parentheses have been overridden.

* Warning: This volume is not within 10% of the target volume, growth rate or DHV factors may be incompatible between segments

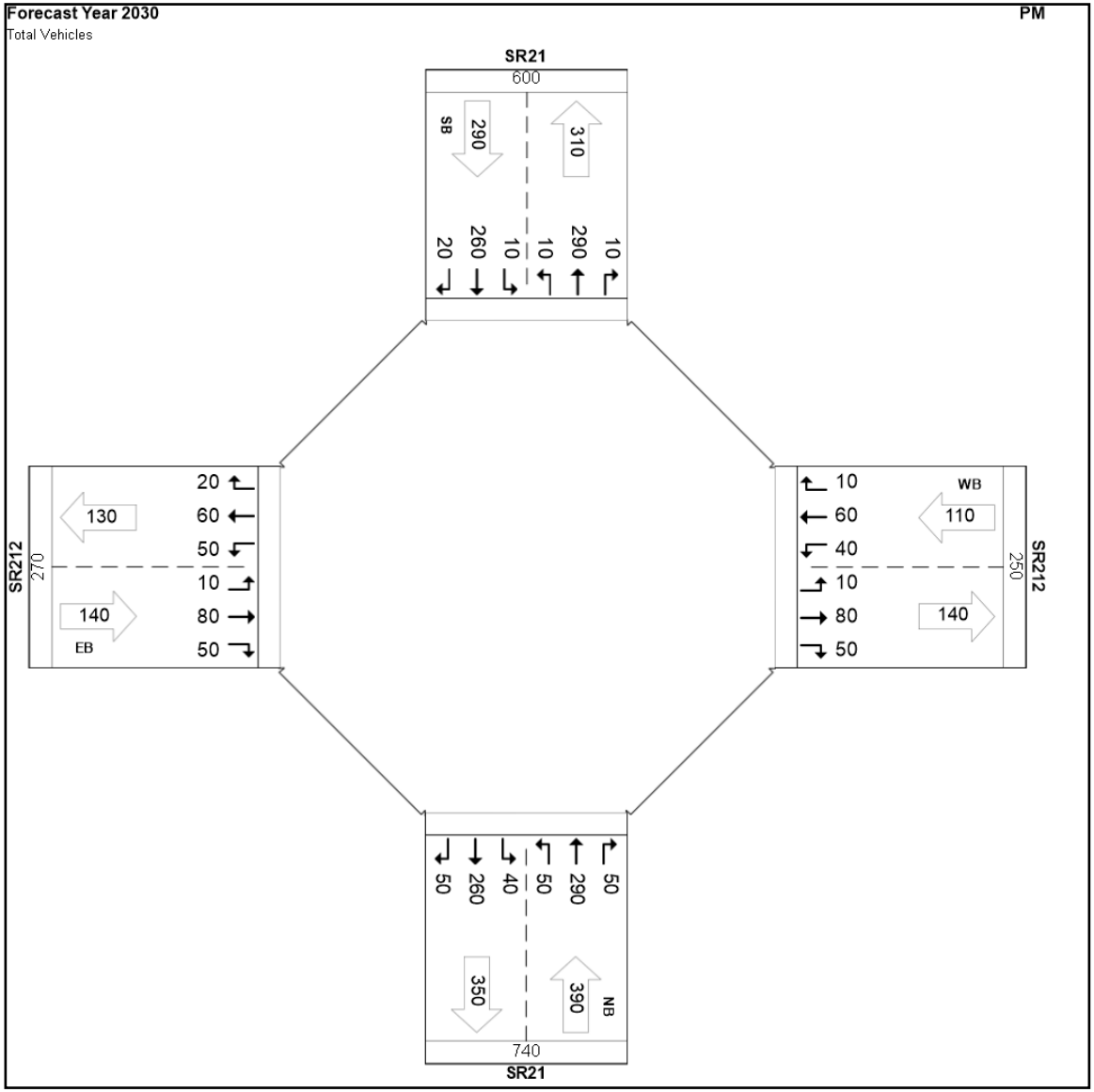
TFMS - Intersection Forecast Report

Opening Year AM



TFMS - Intersection Forecast Report

Opening Year PM



TFMS - Intersection Forecast Report

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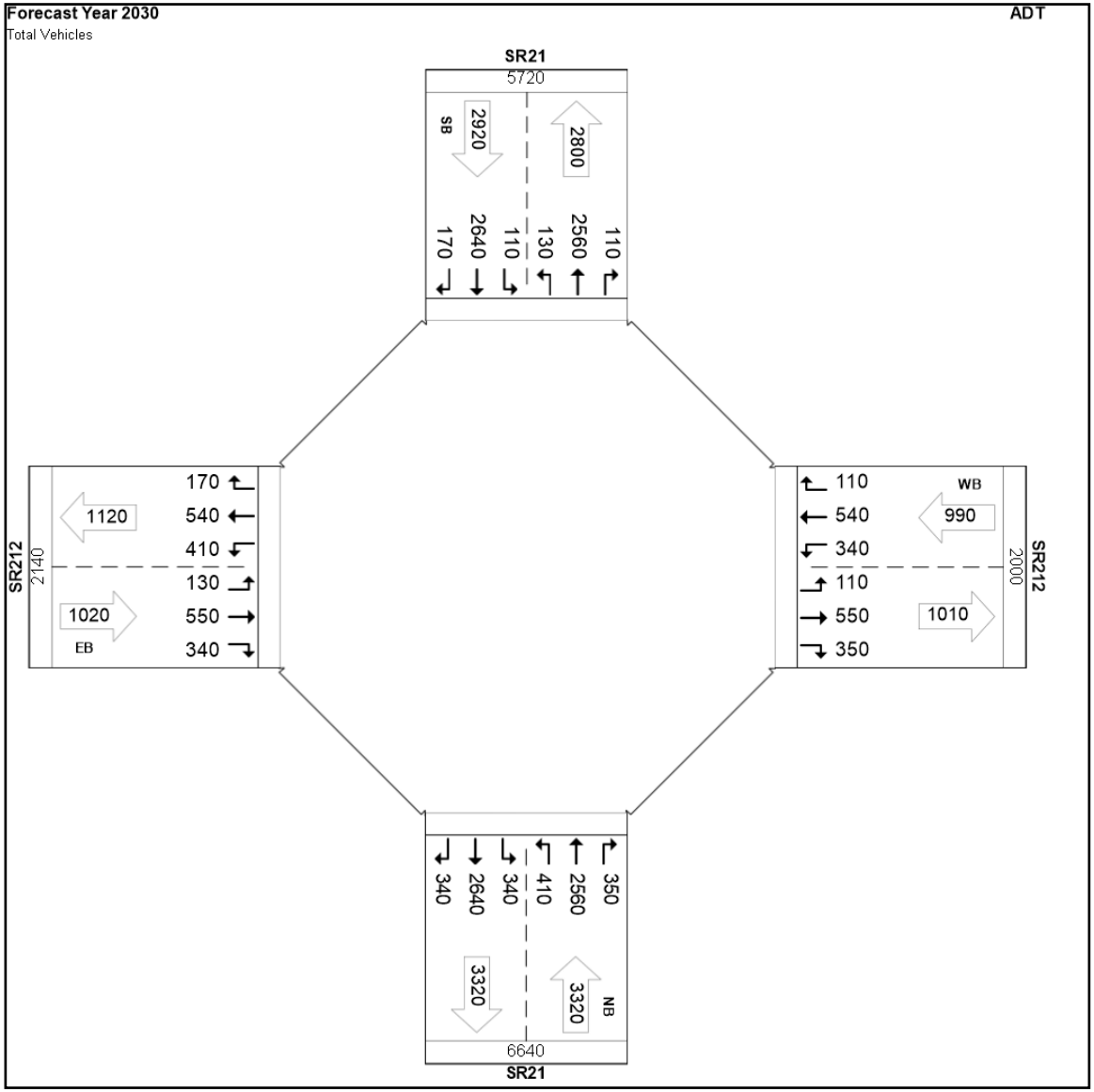
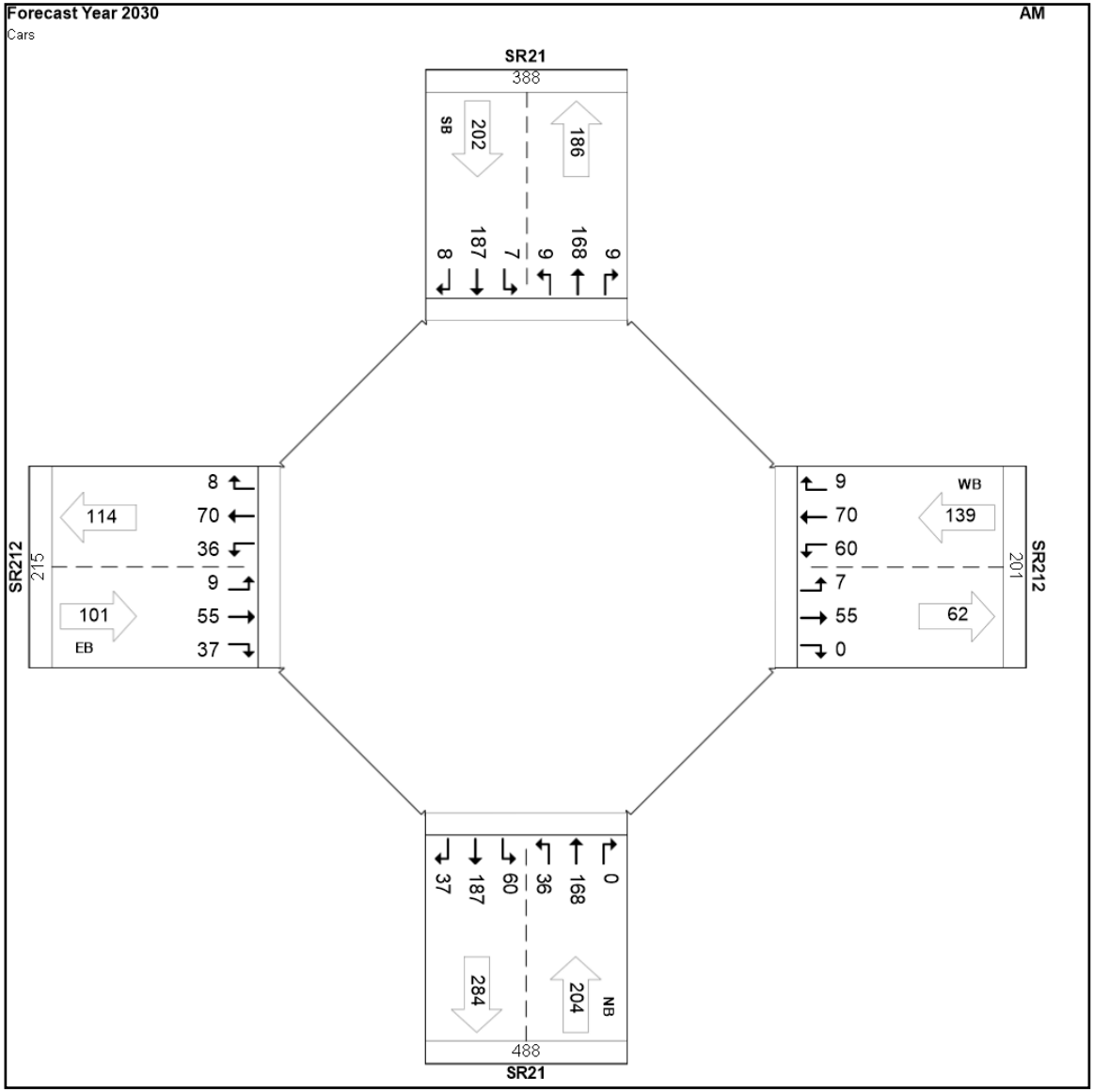


TFMS - Intersection Forecast Report

Opening Year Cars AM



TFMS - Intersection Forecast Report

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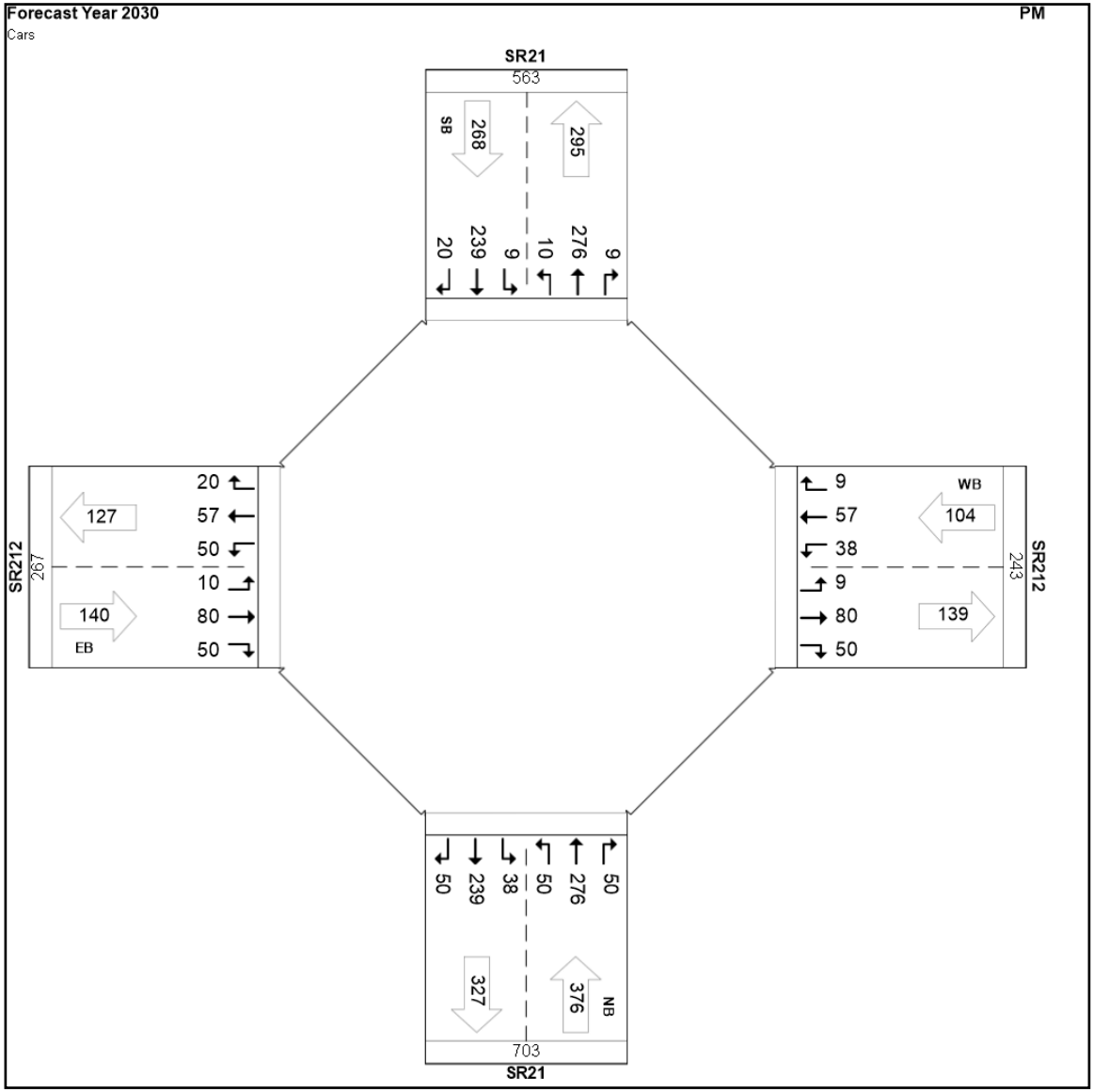
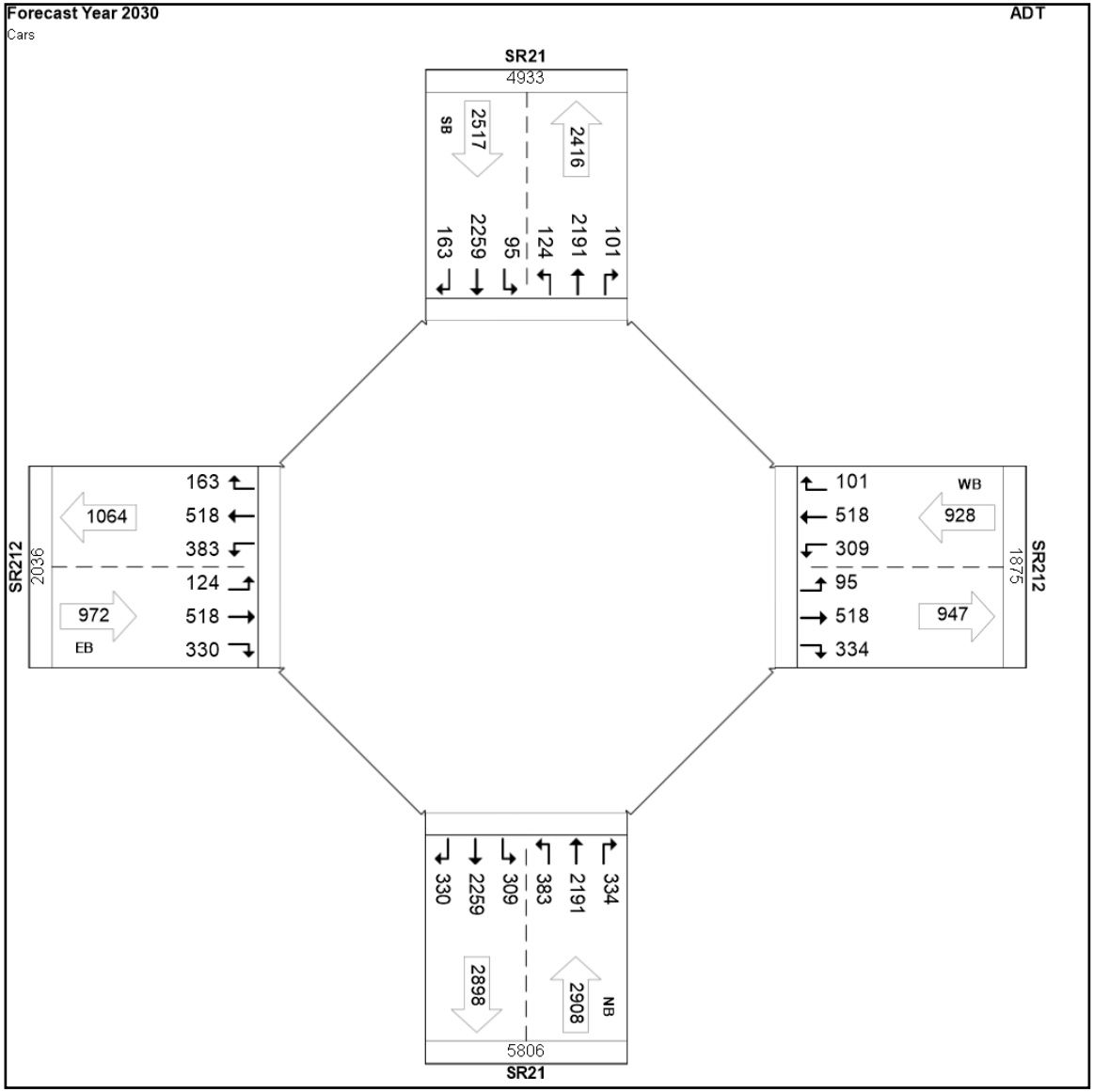
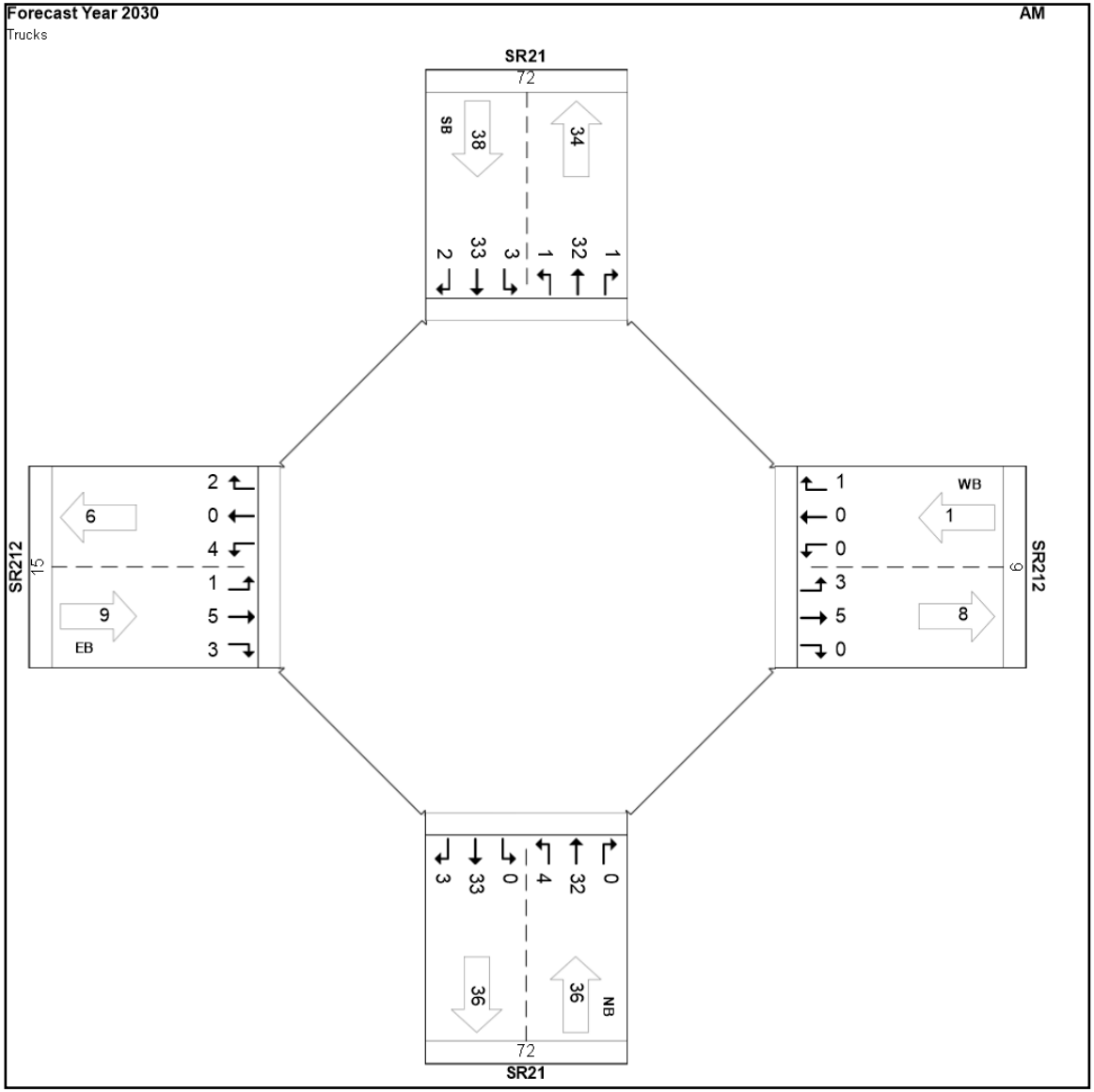


TFMS - Intersection Forecast Report

Opening Year Cars ADT



Opening Year Trucks AM



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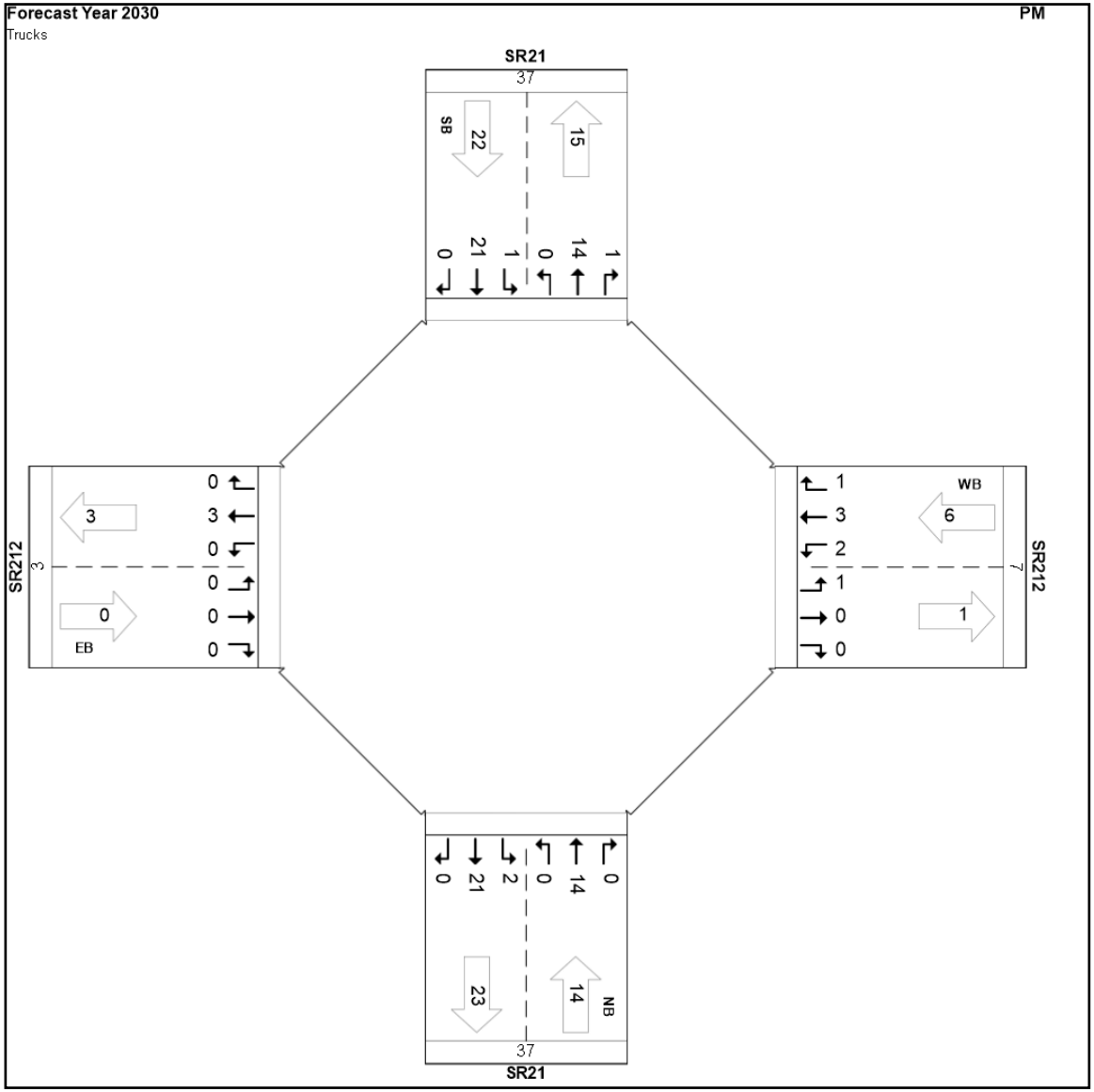

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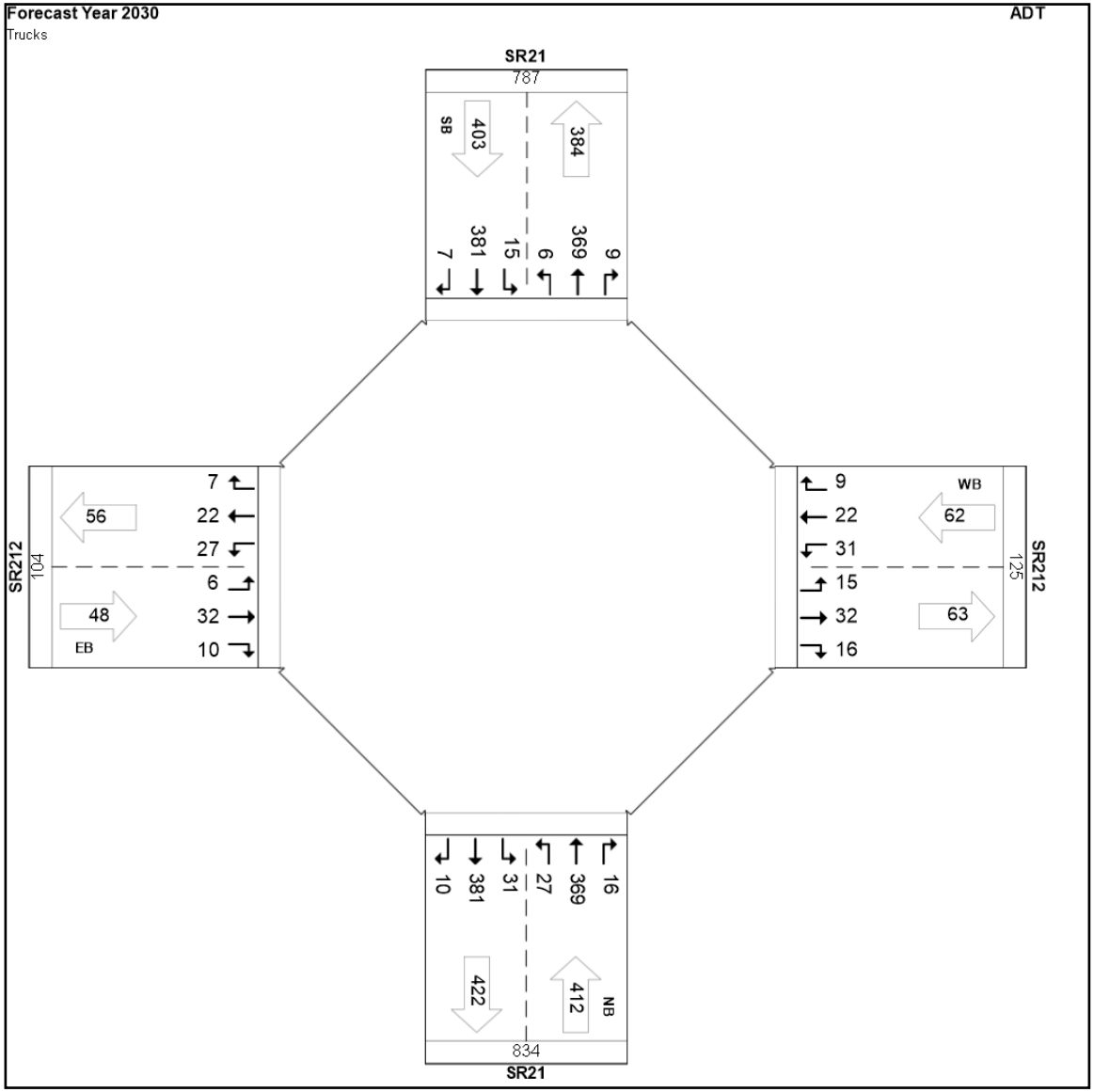
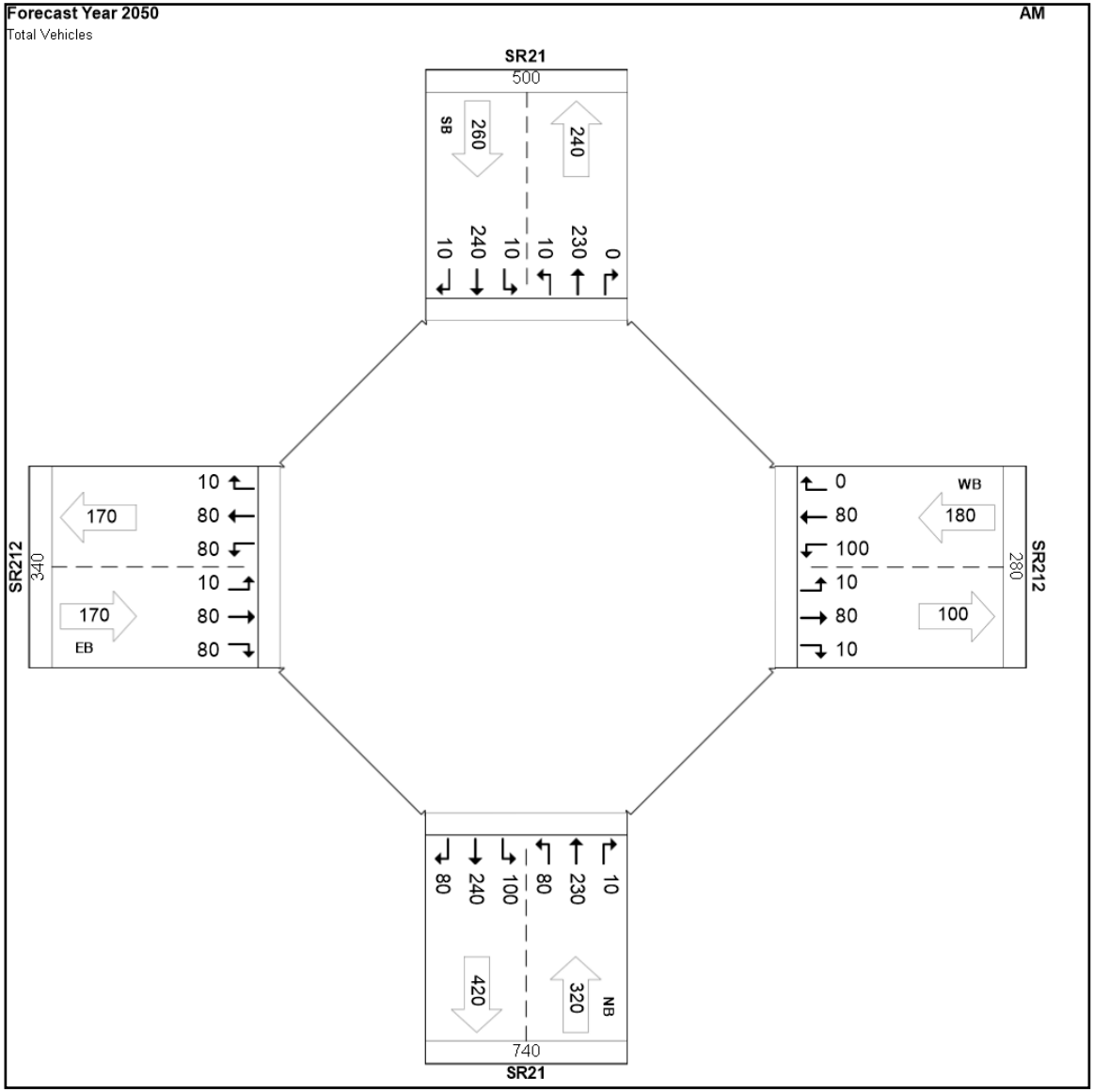


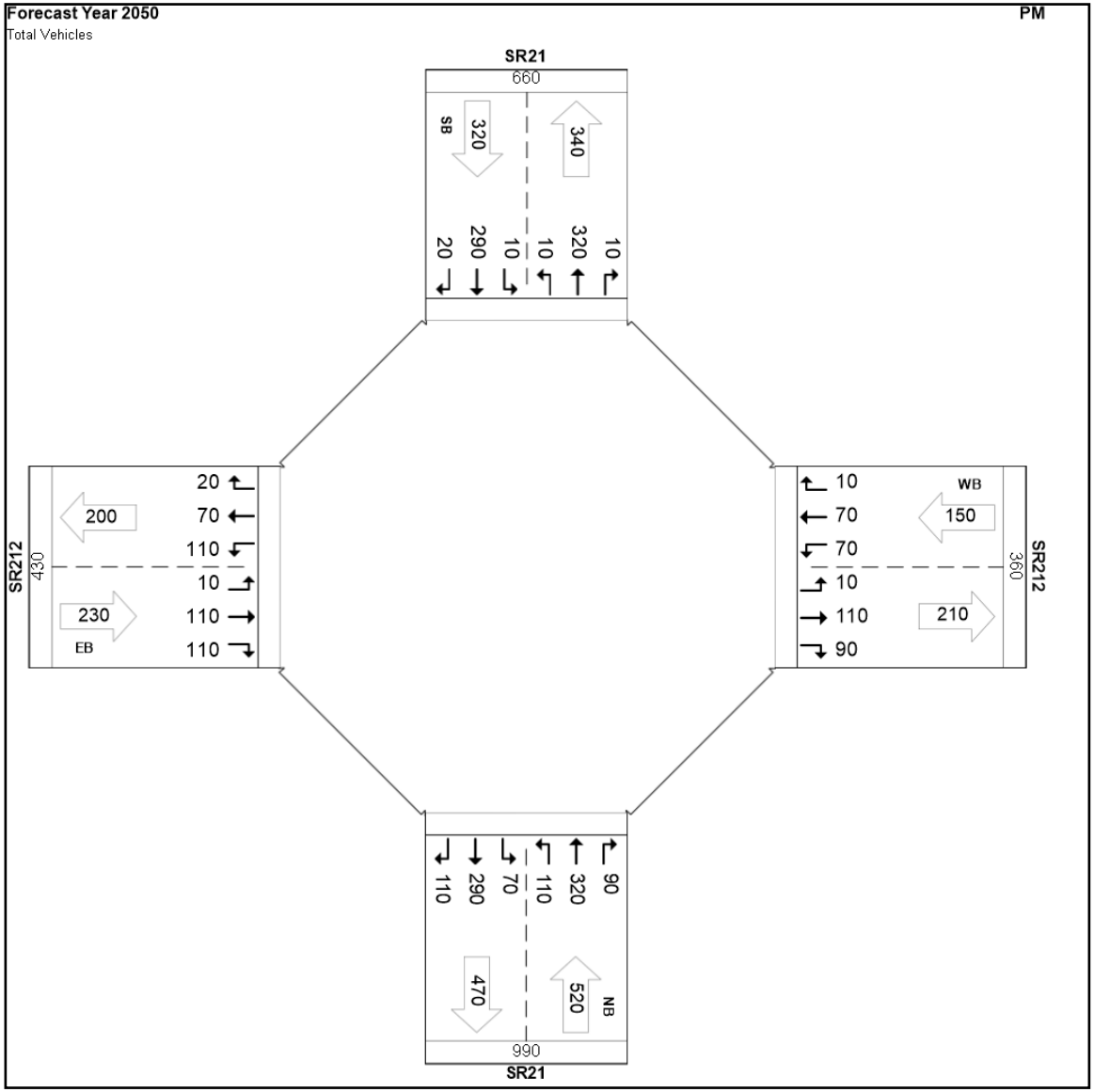
TFMS - Intersection Forecast Report

Design Year AM



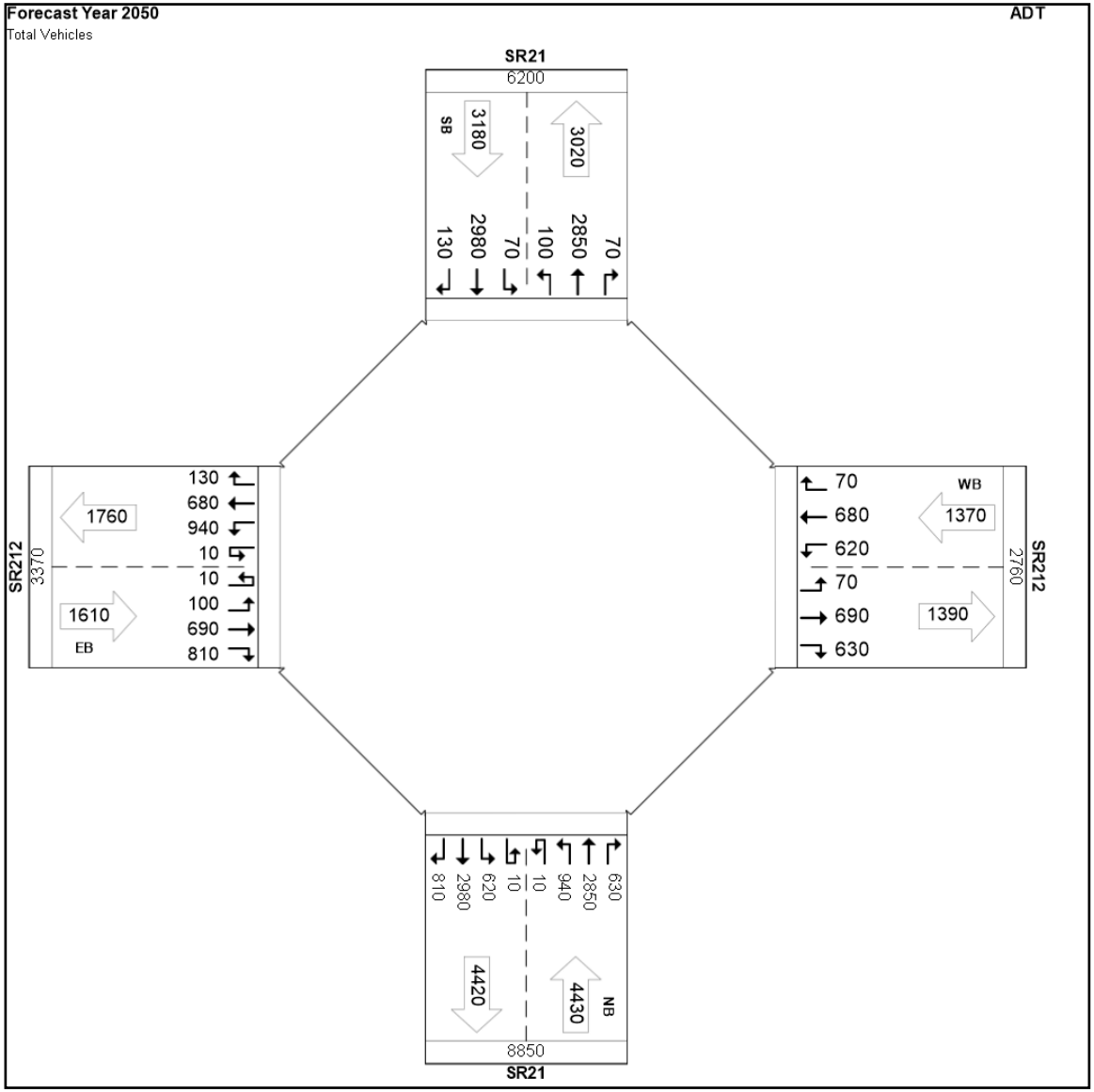
TFMS - Intersection Forecast Report

Design Year PM



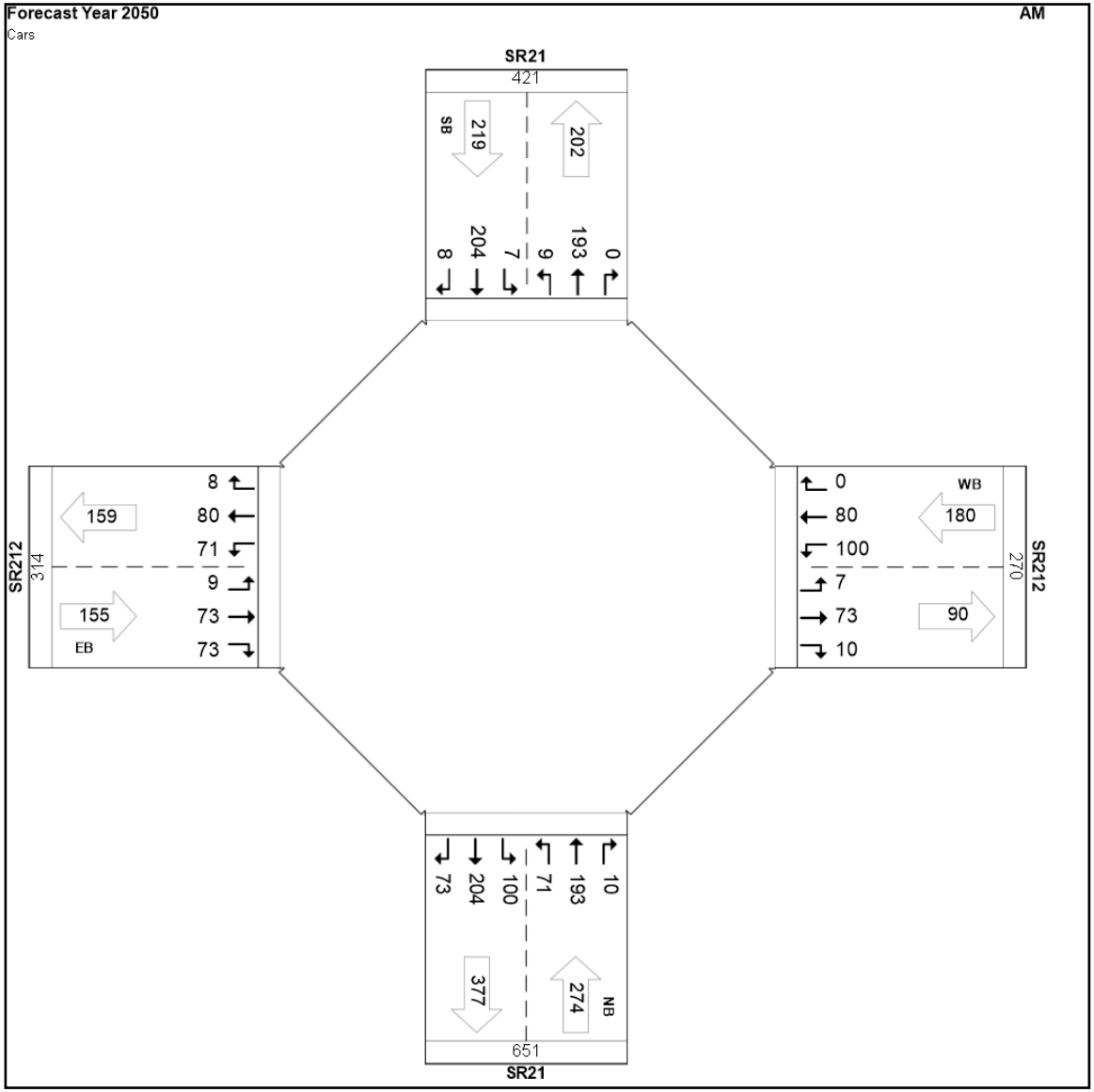
TFMS - Intersection Forecast Report

Design Year ADT



TFMS - Intersection Forecast Report

Design Year Cars AM



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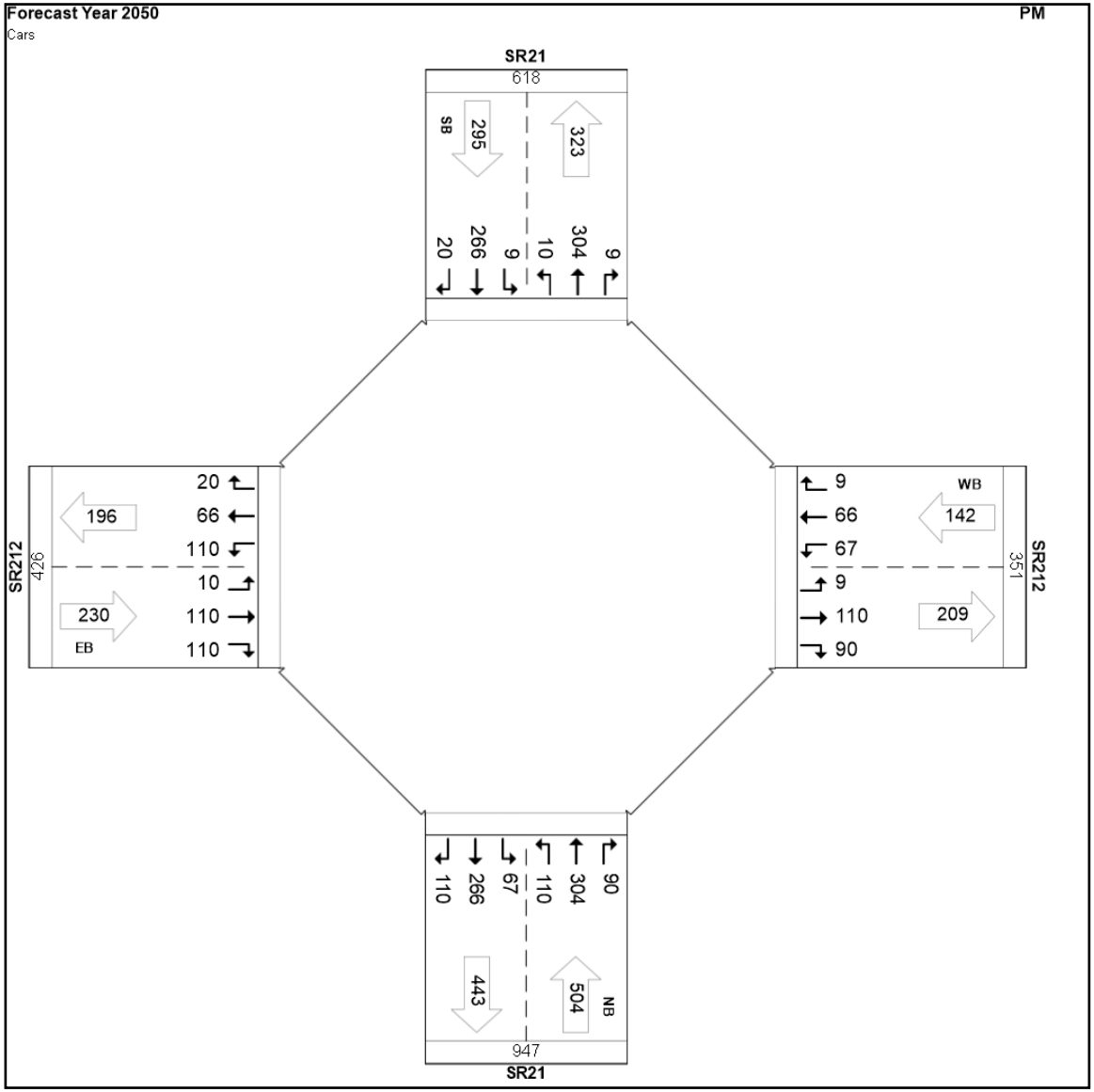

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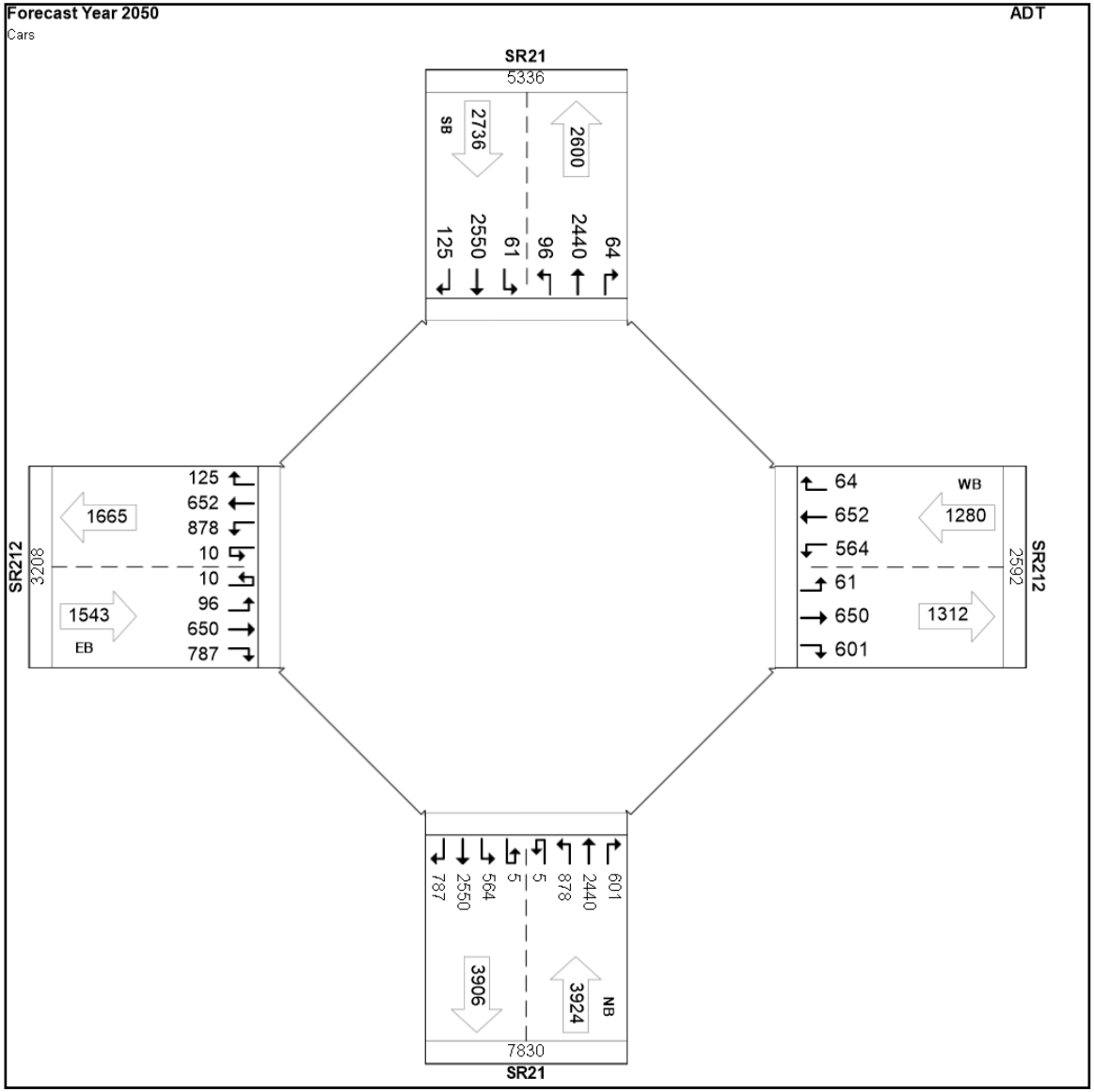

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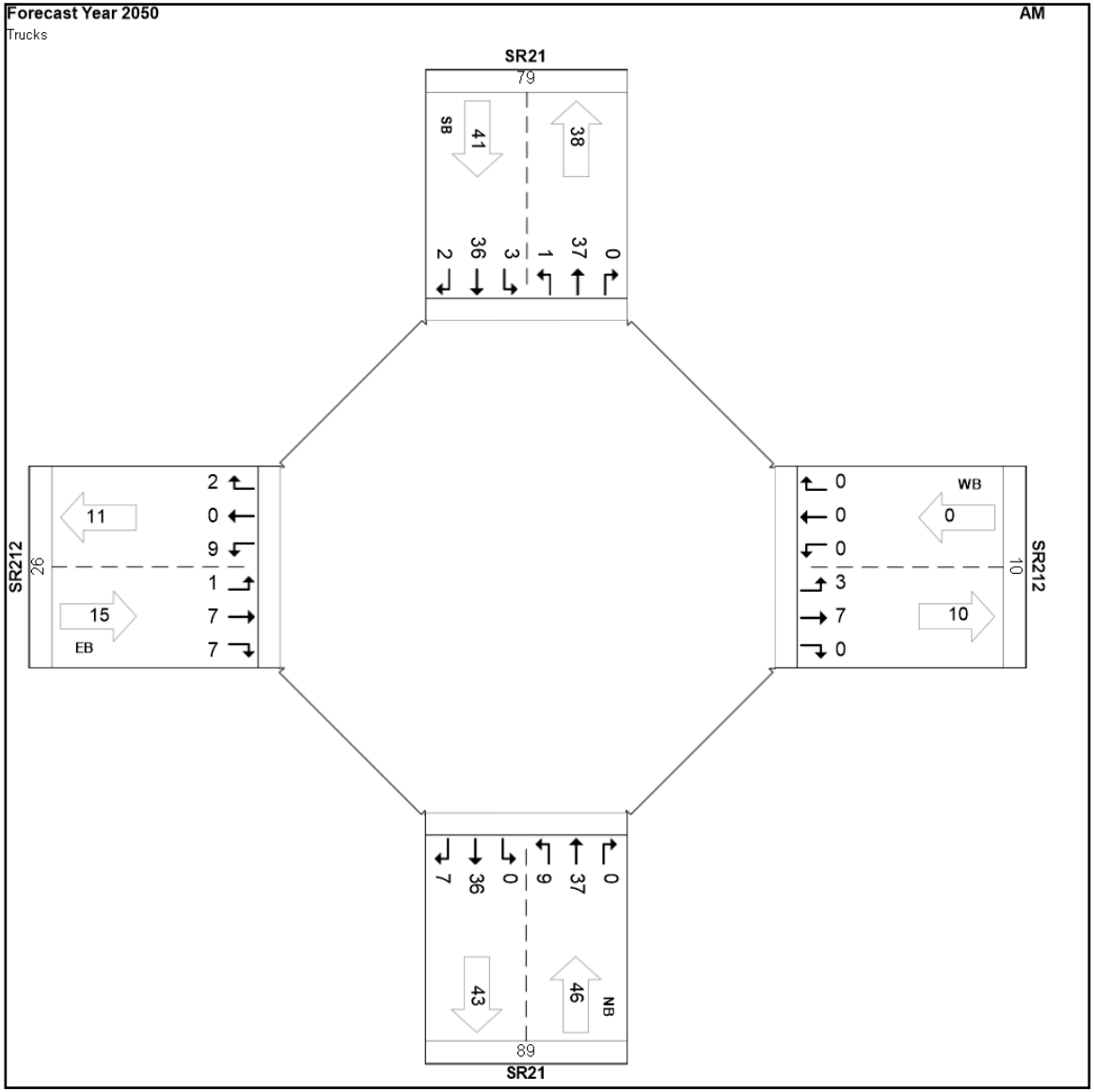

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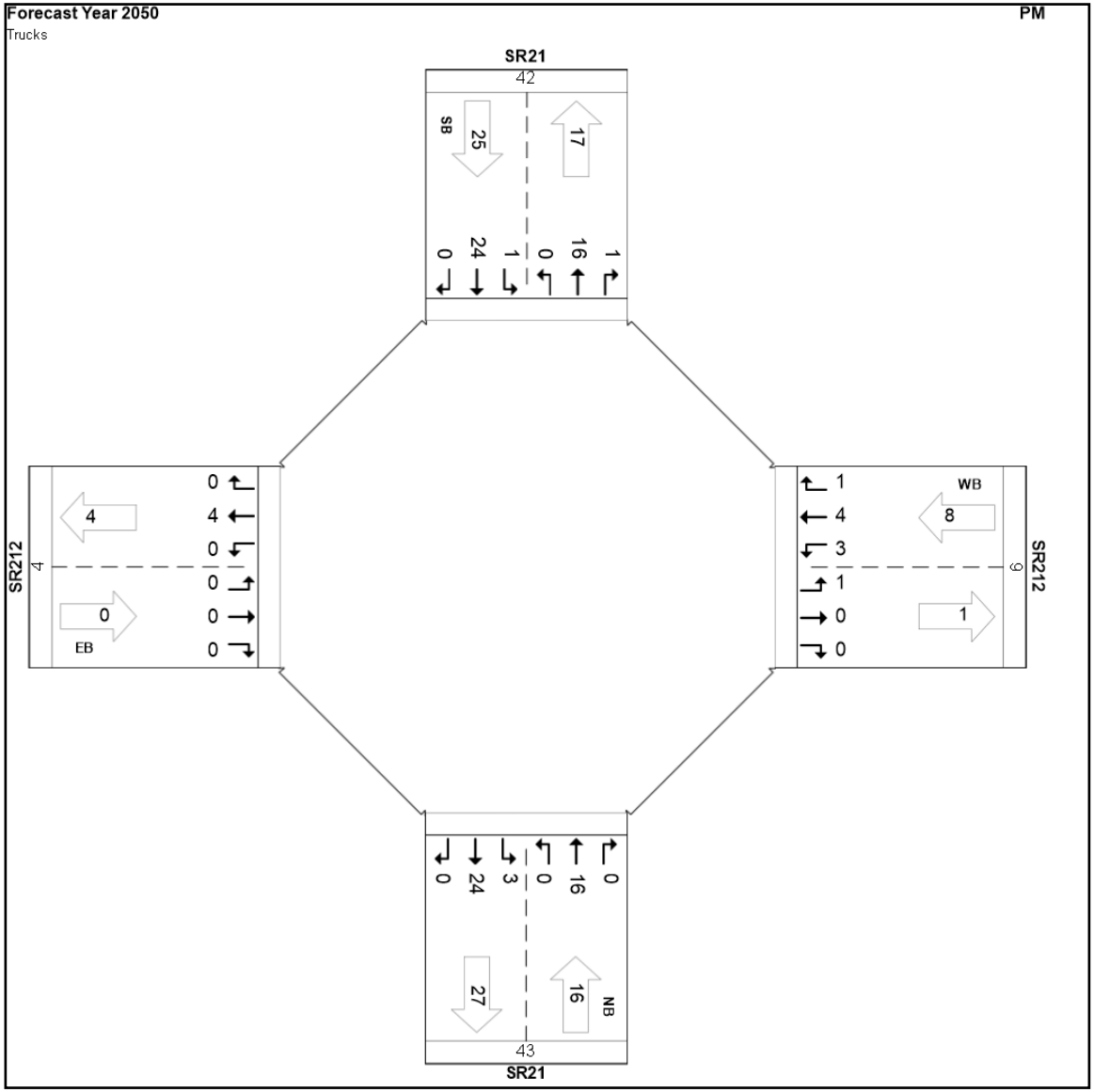

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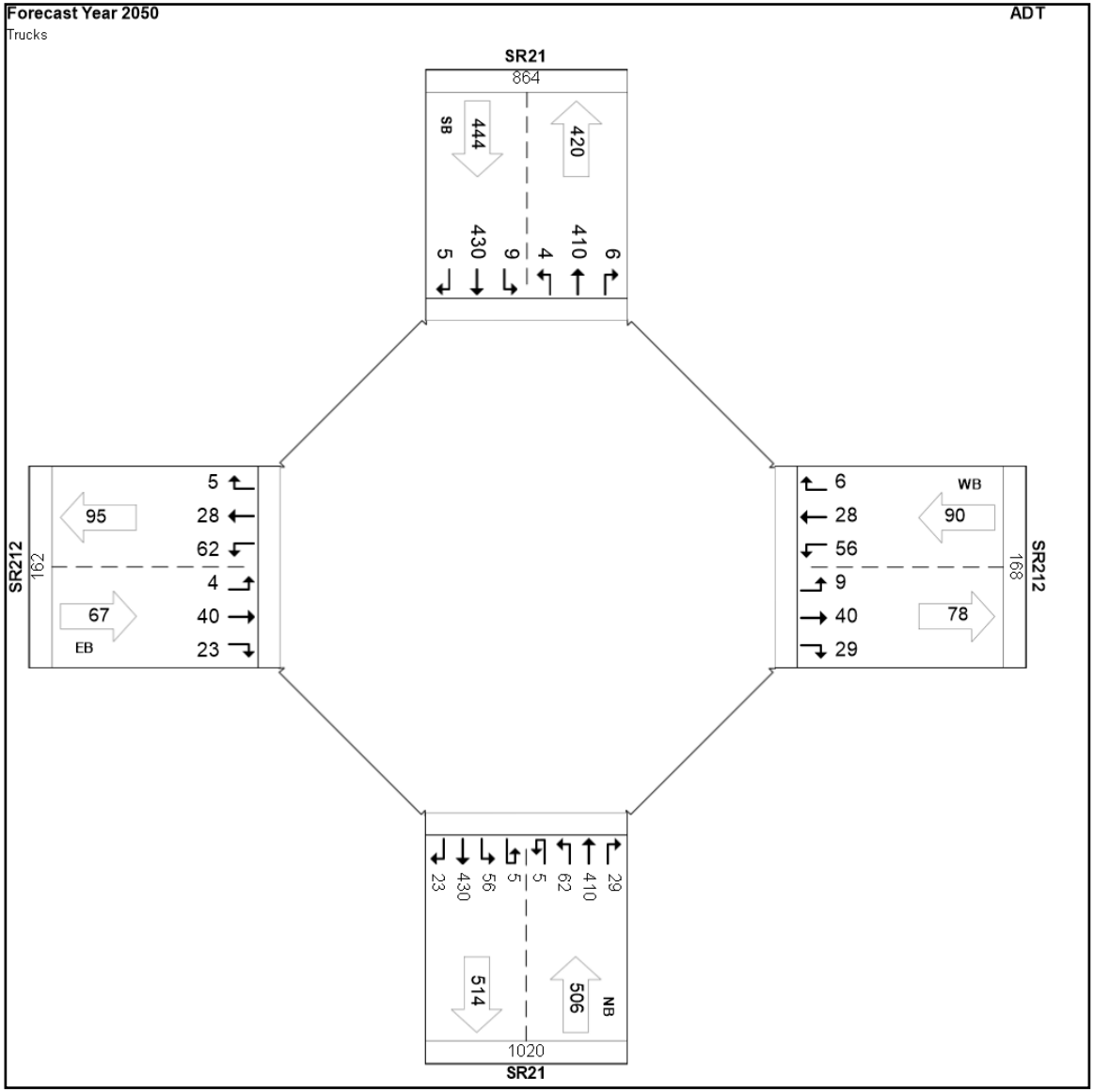
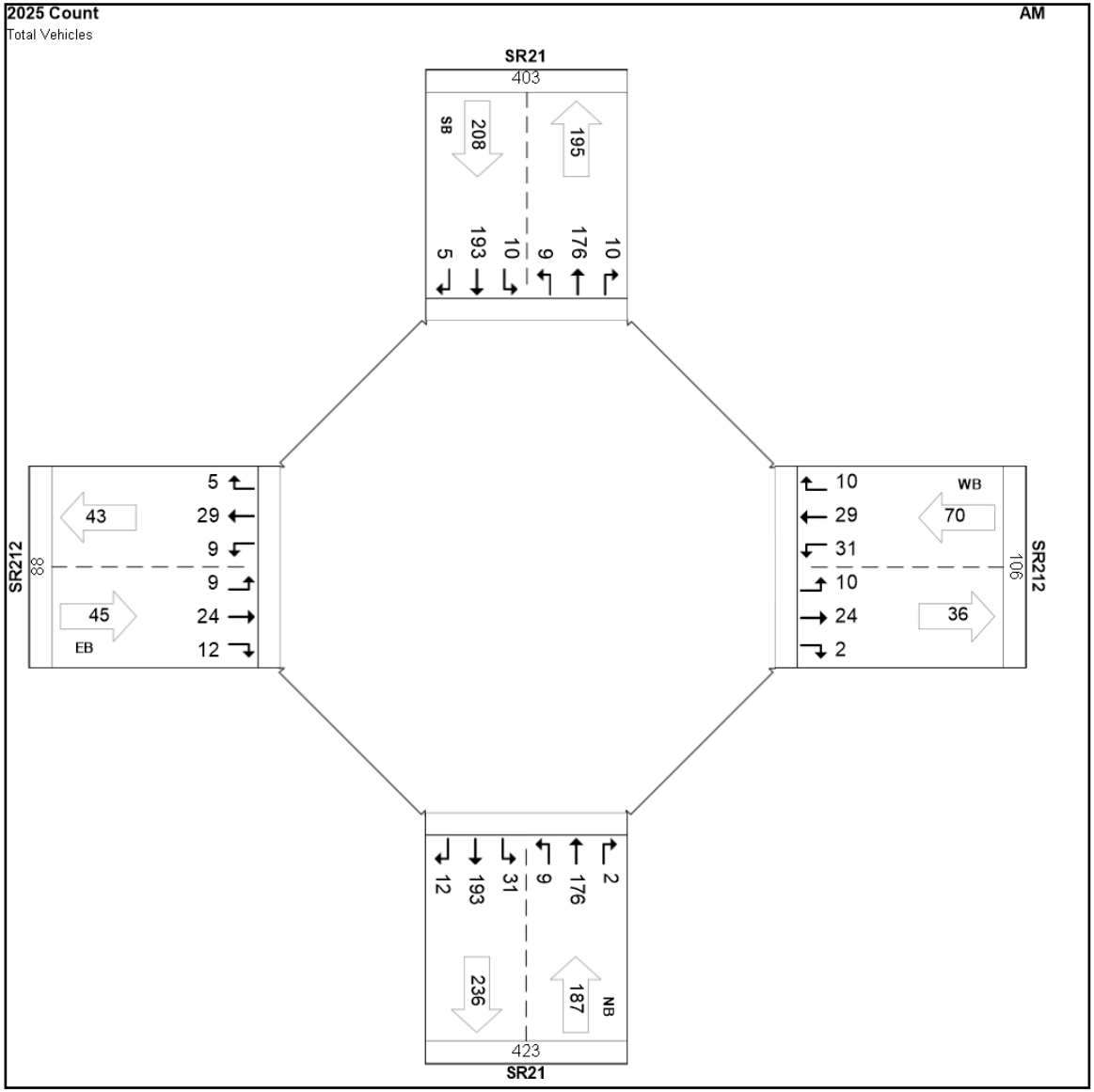


TFMS - Intersection Forecast Report

Pivot Point AM



TFMS - Intersection Forecast Report

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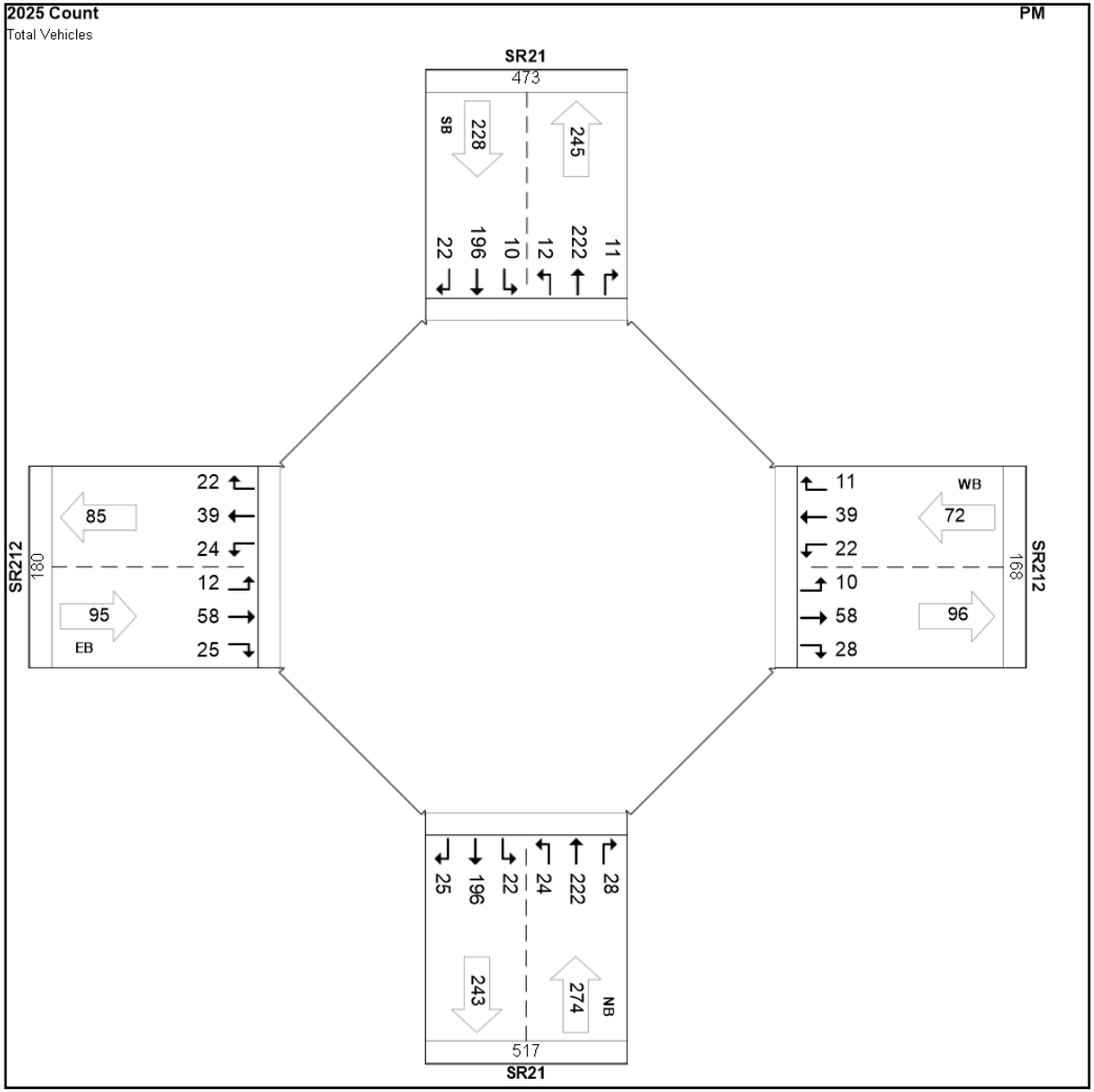

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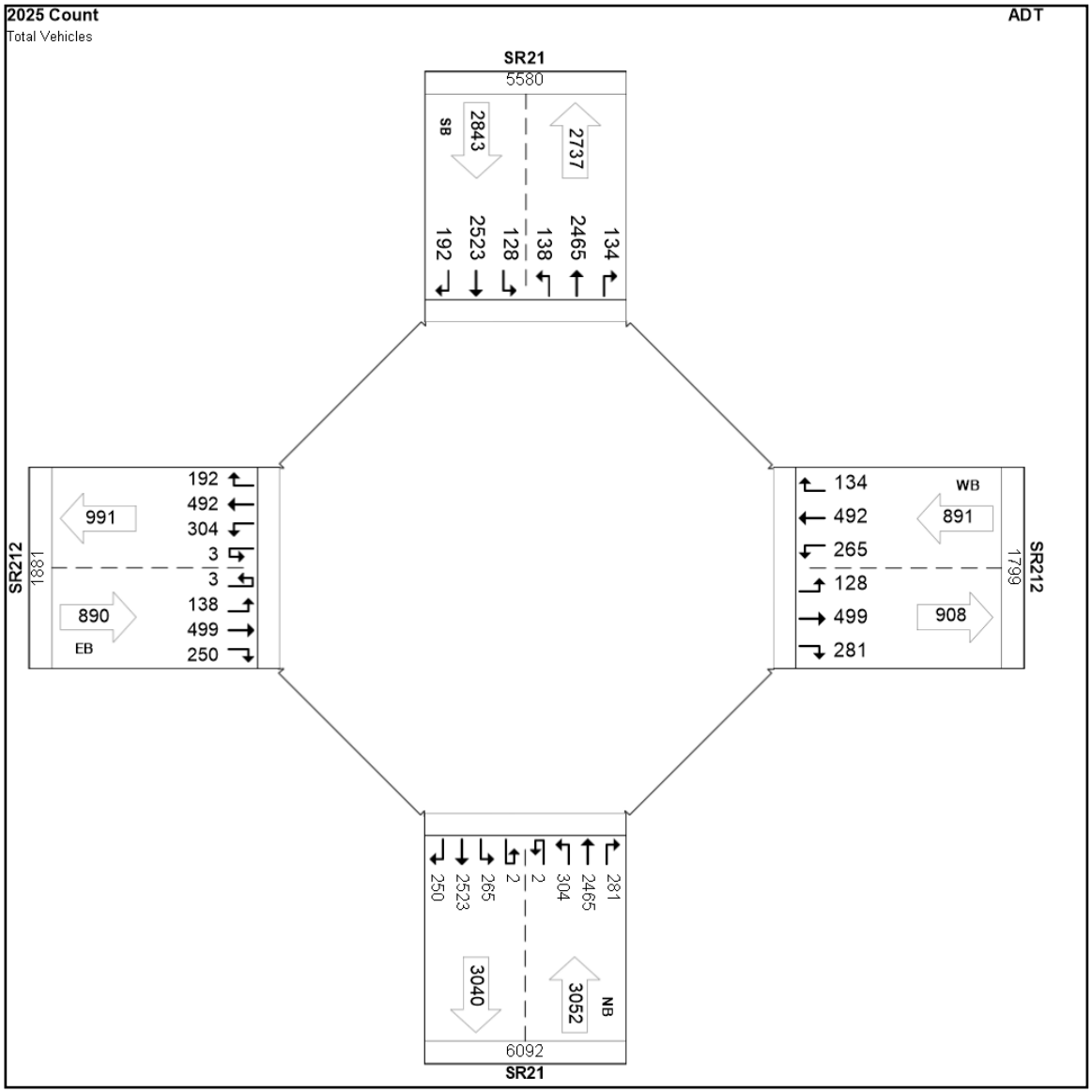

TFMS - Intersection Forecast Report

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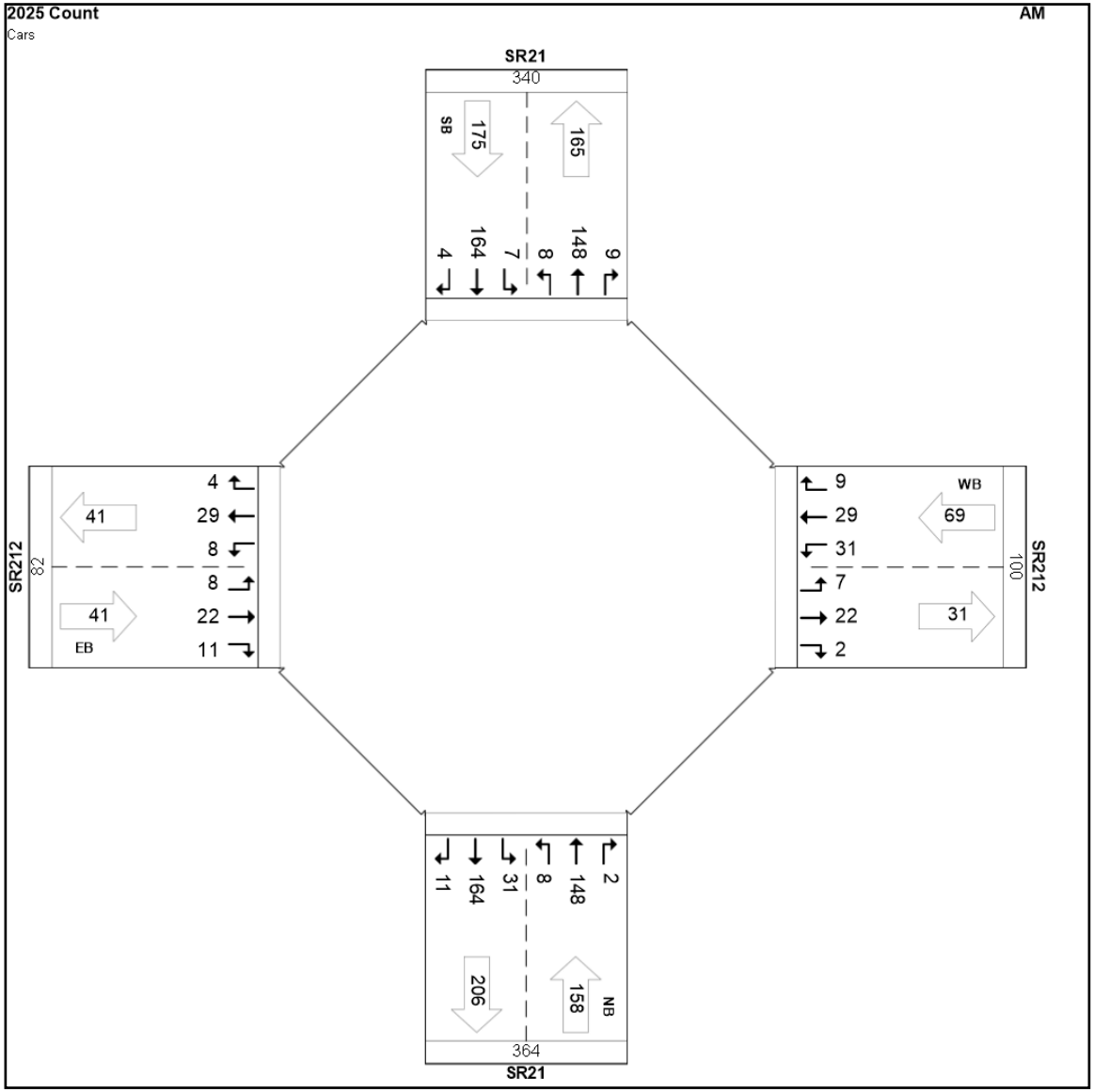

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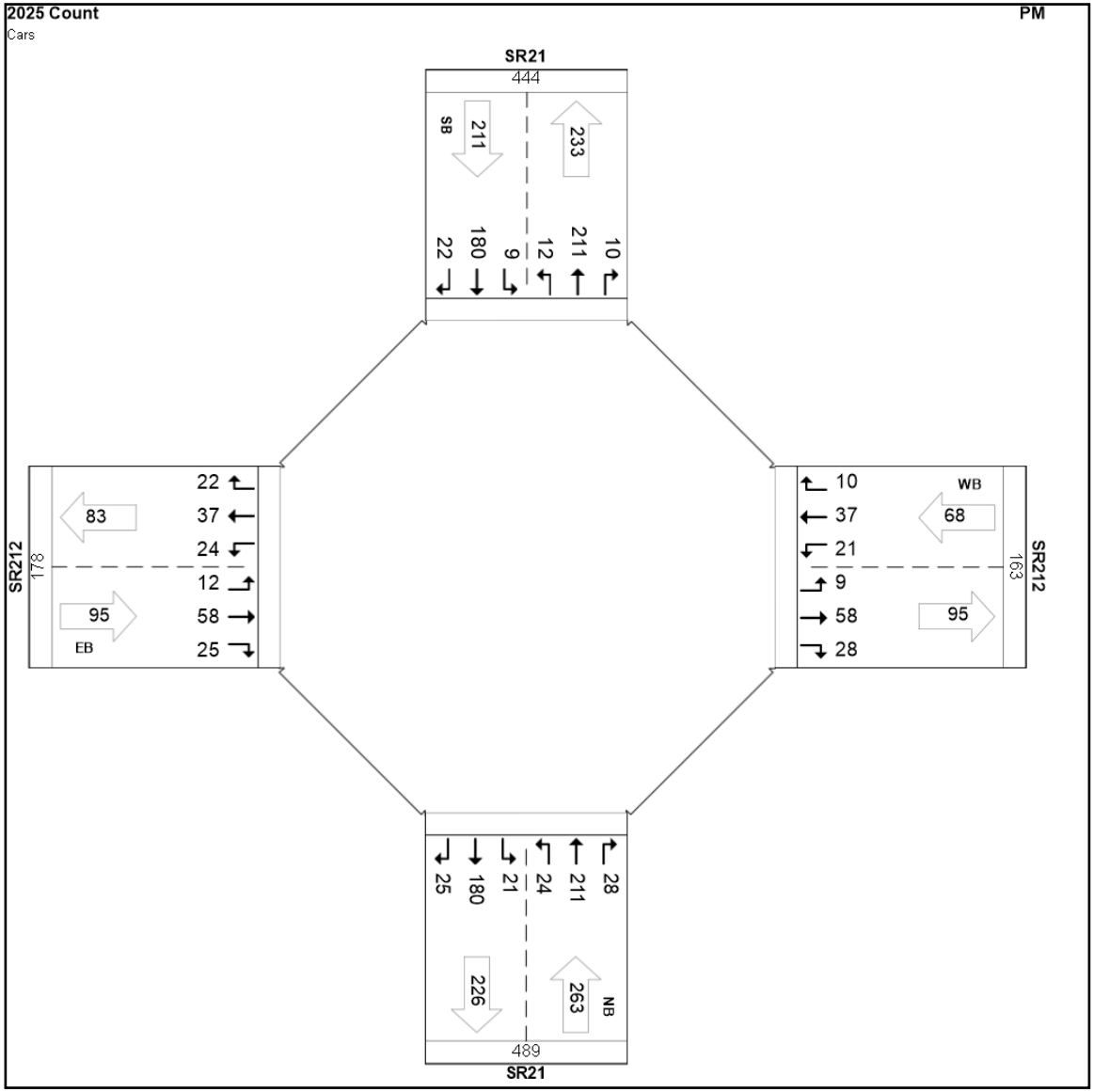

TFMS - Intersection Forecast Report

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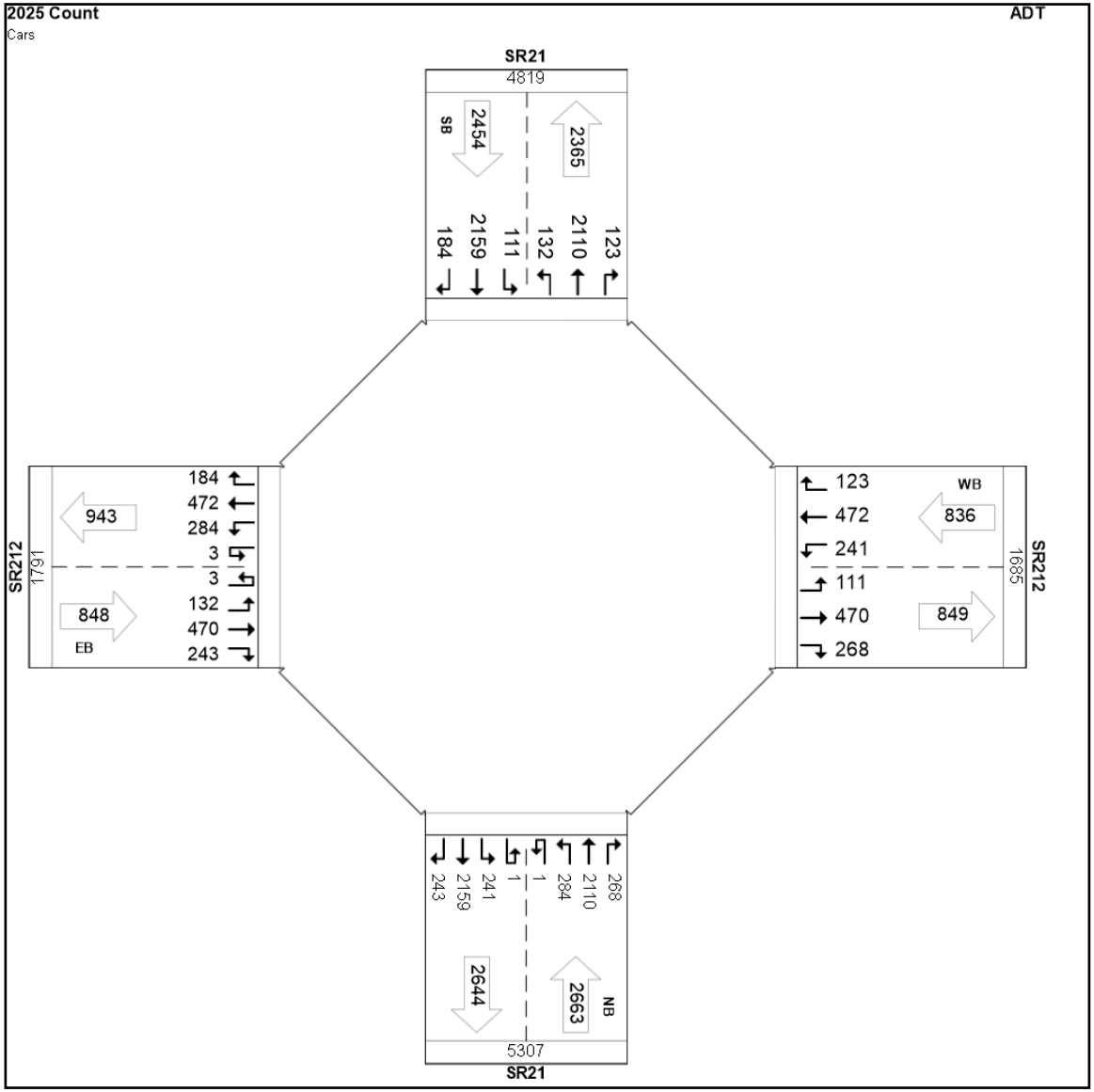
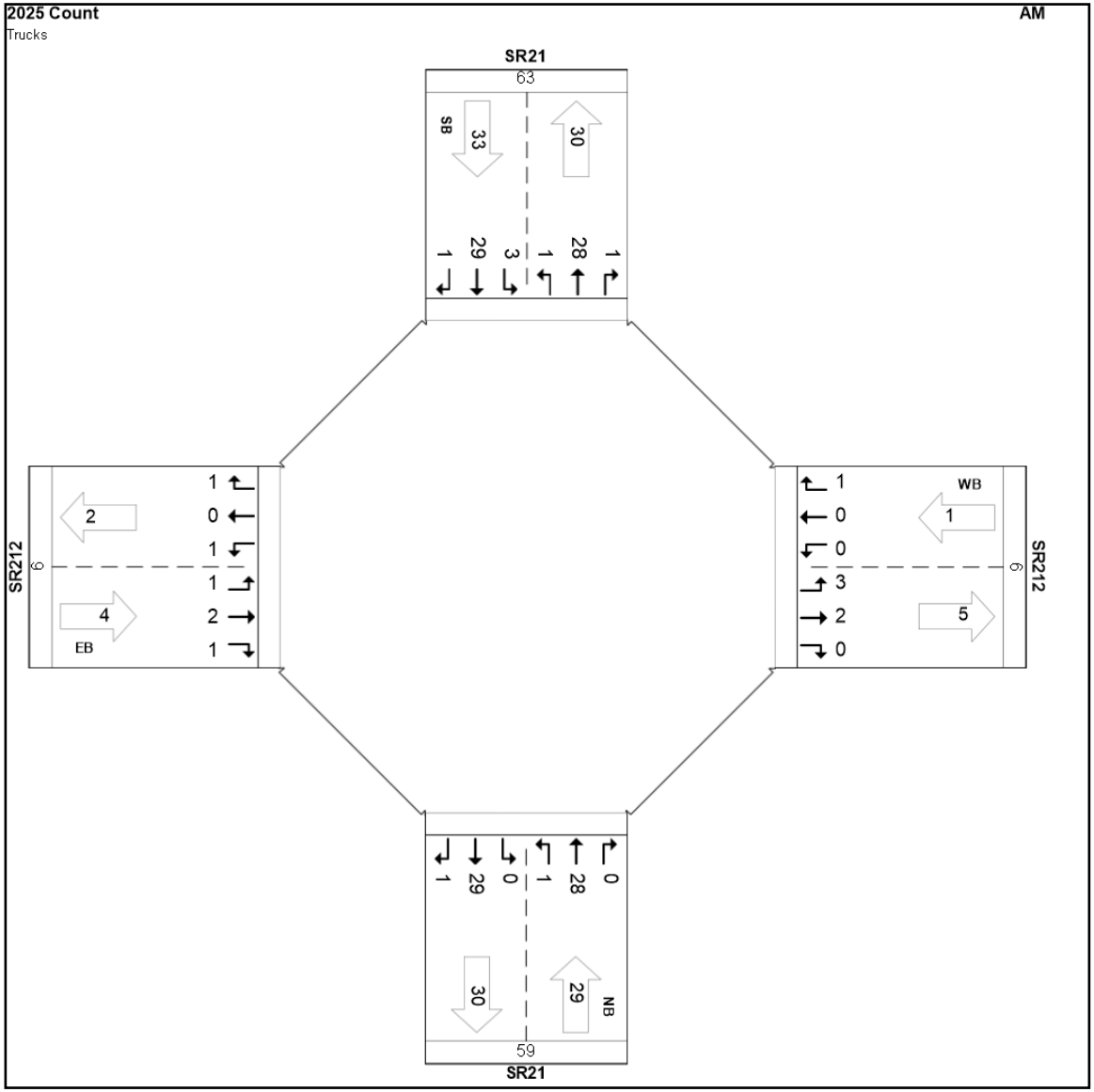


TFMS - Intersection Forecast Report

Pivot Point Trucks AM



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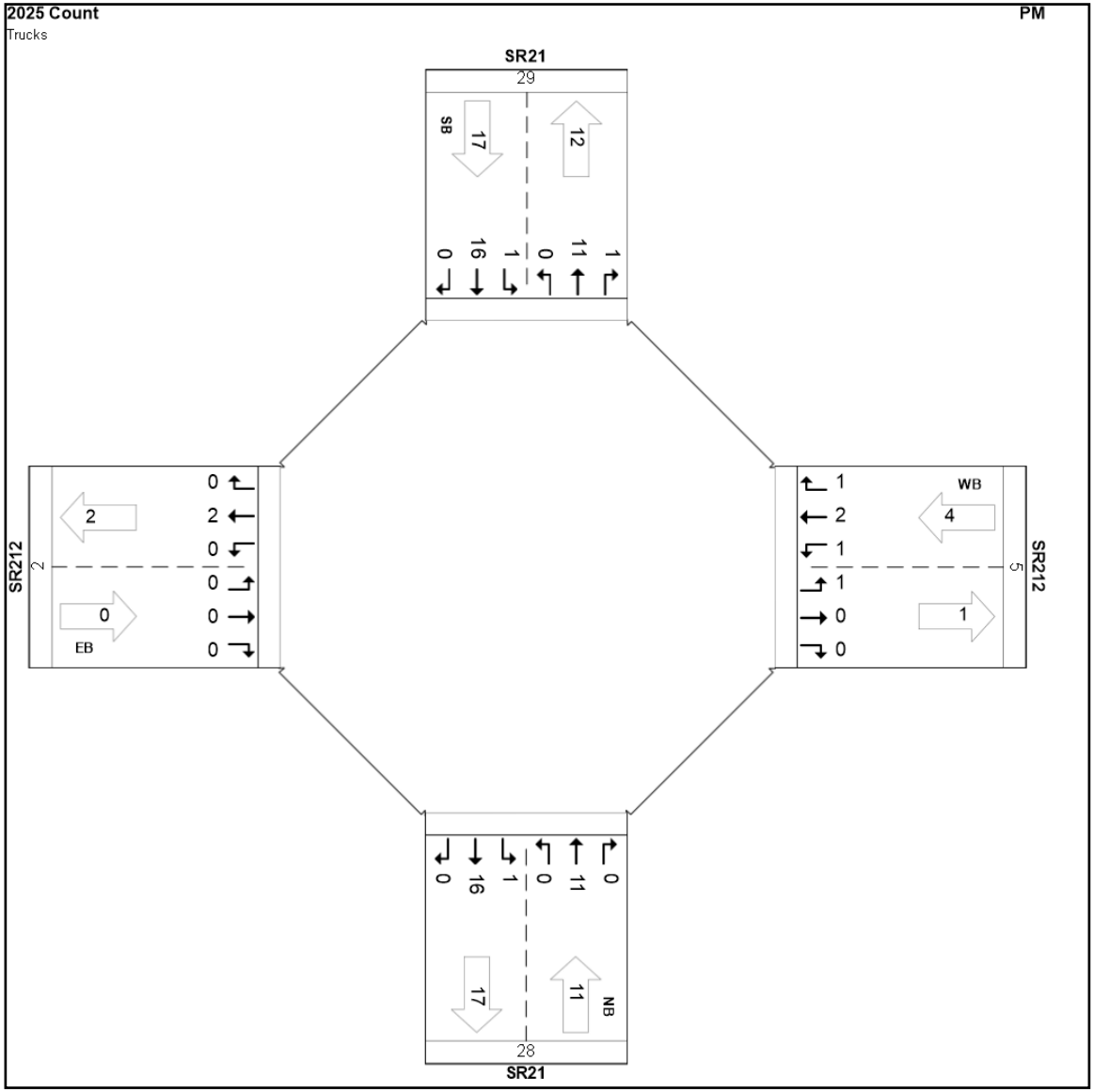

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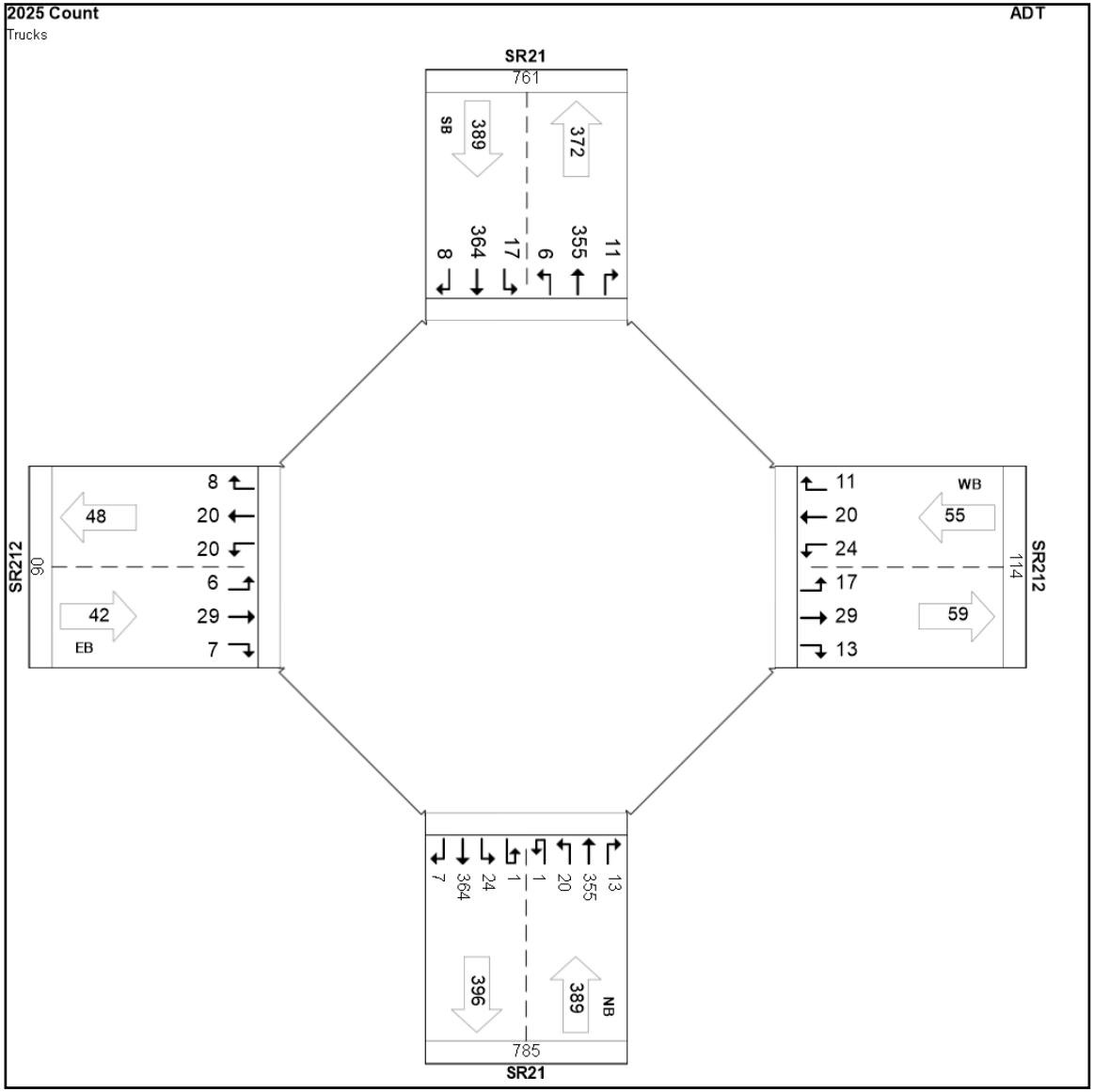

TFMS - Intersection Forecast Report

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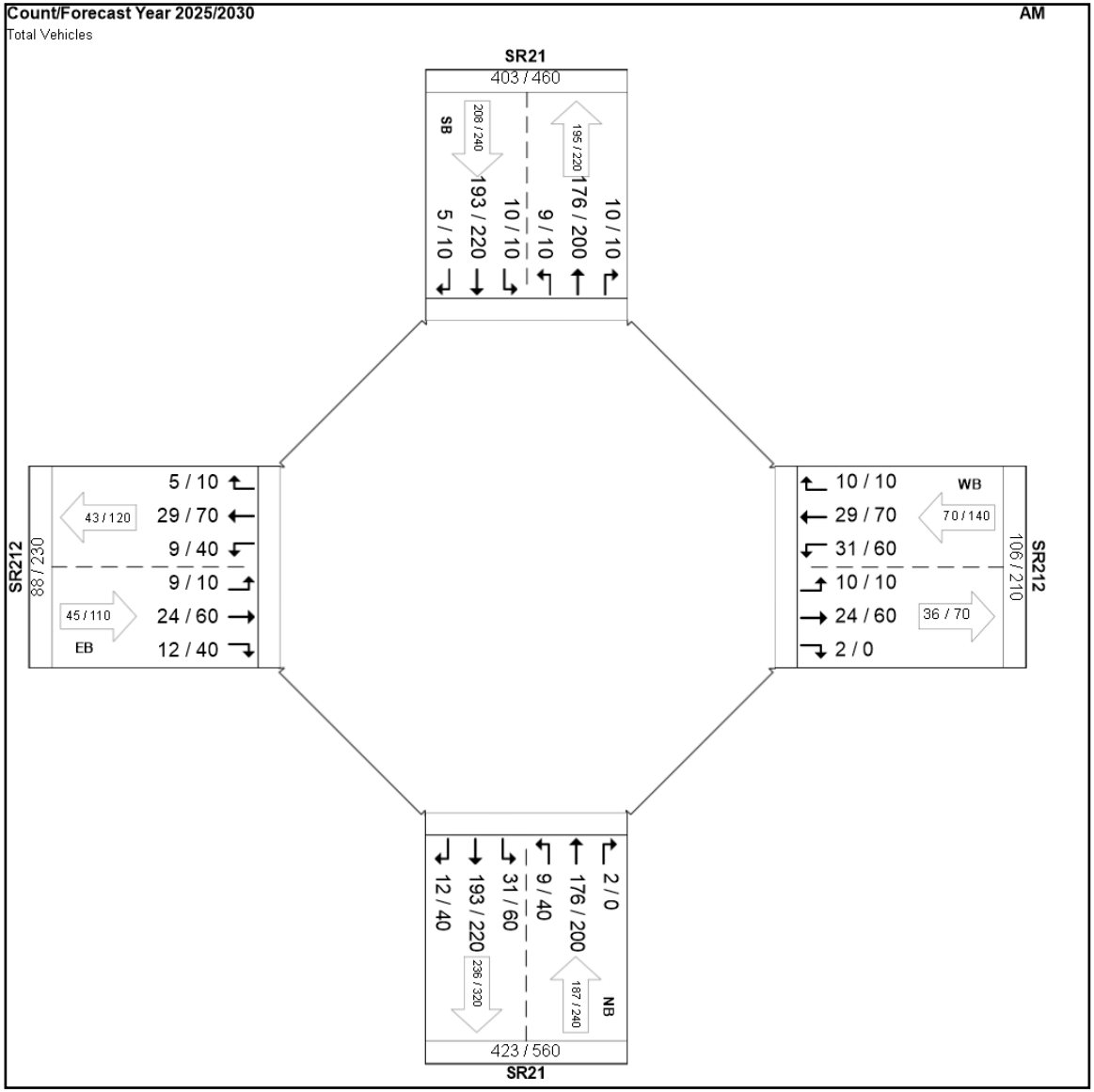
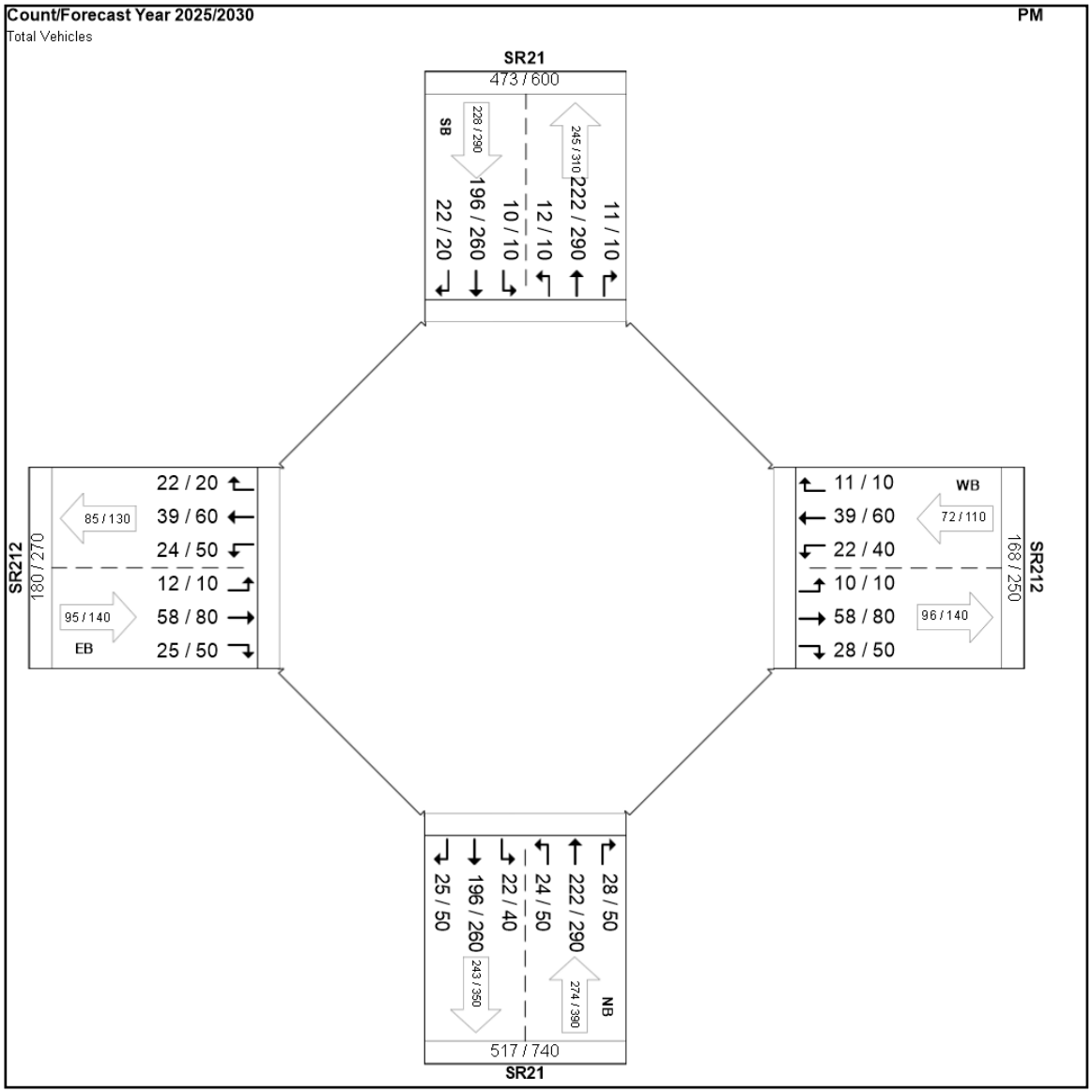


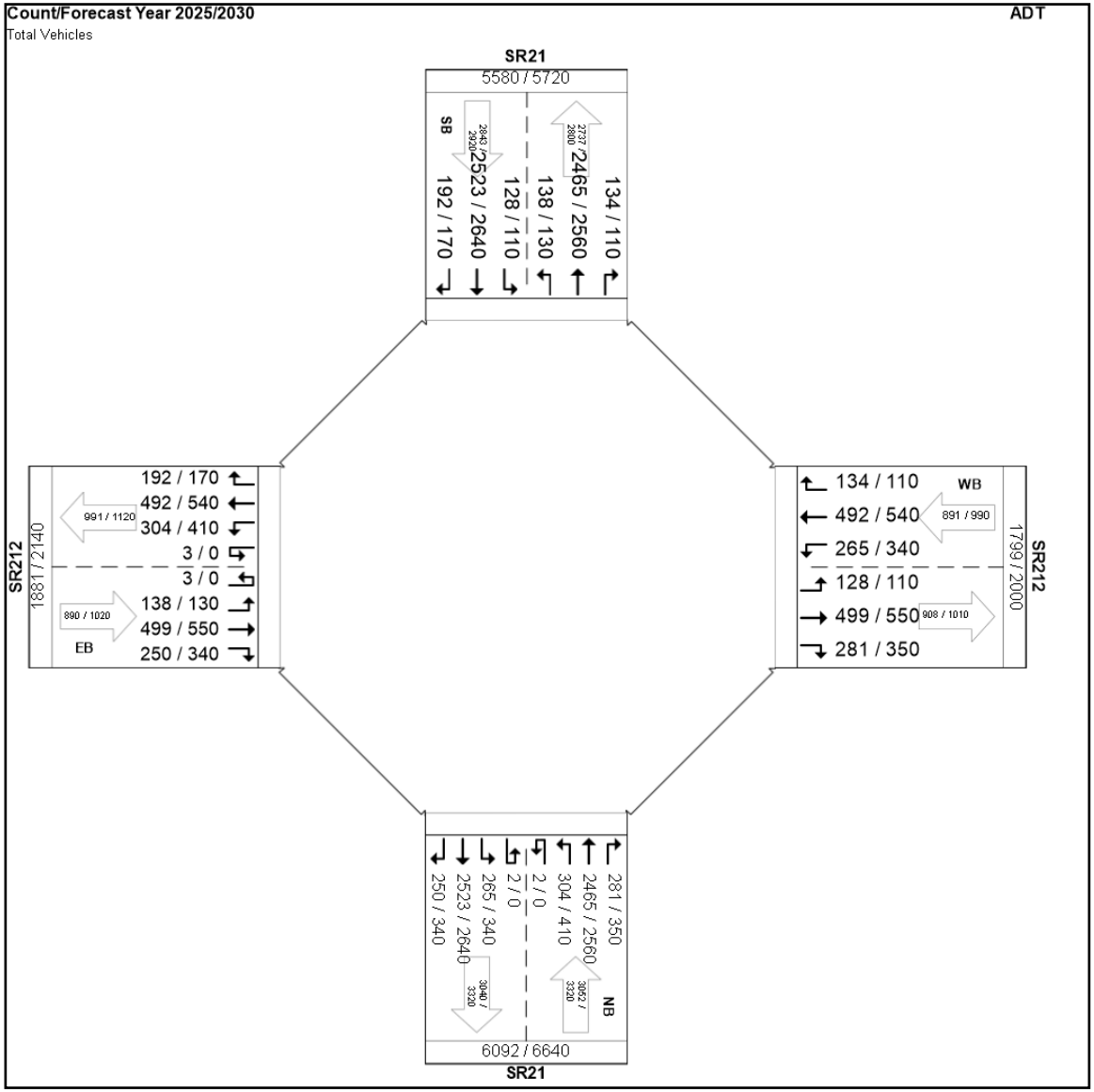
TFMS - Intersection Forecast Report

Count VS Opening Year PM



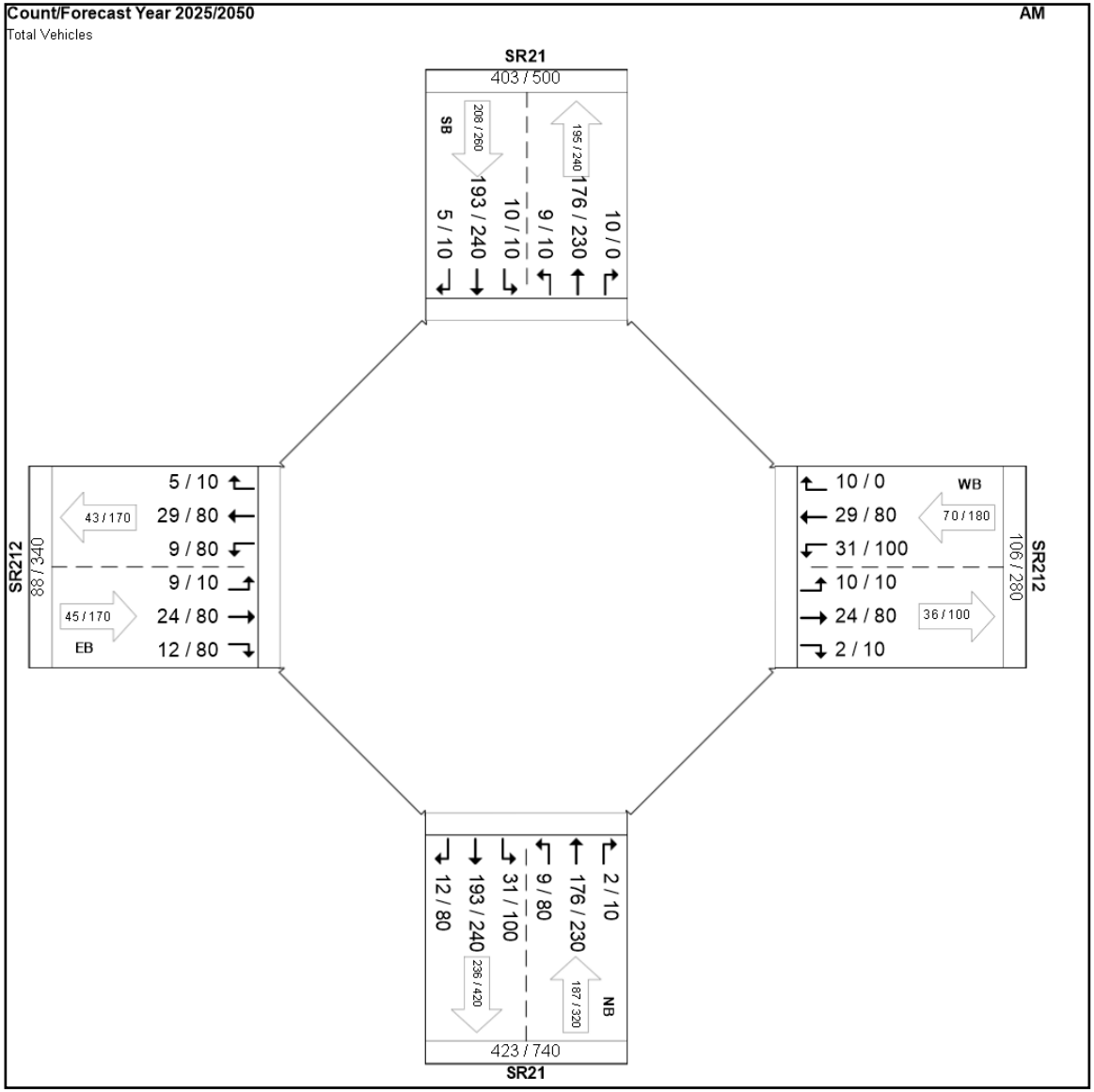
TFMS - Intersection Forecast Report

Count VS Opening Year ADT



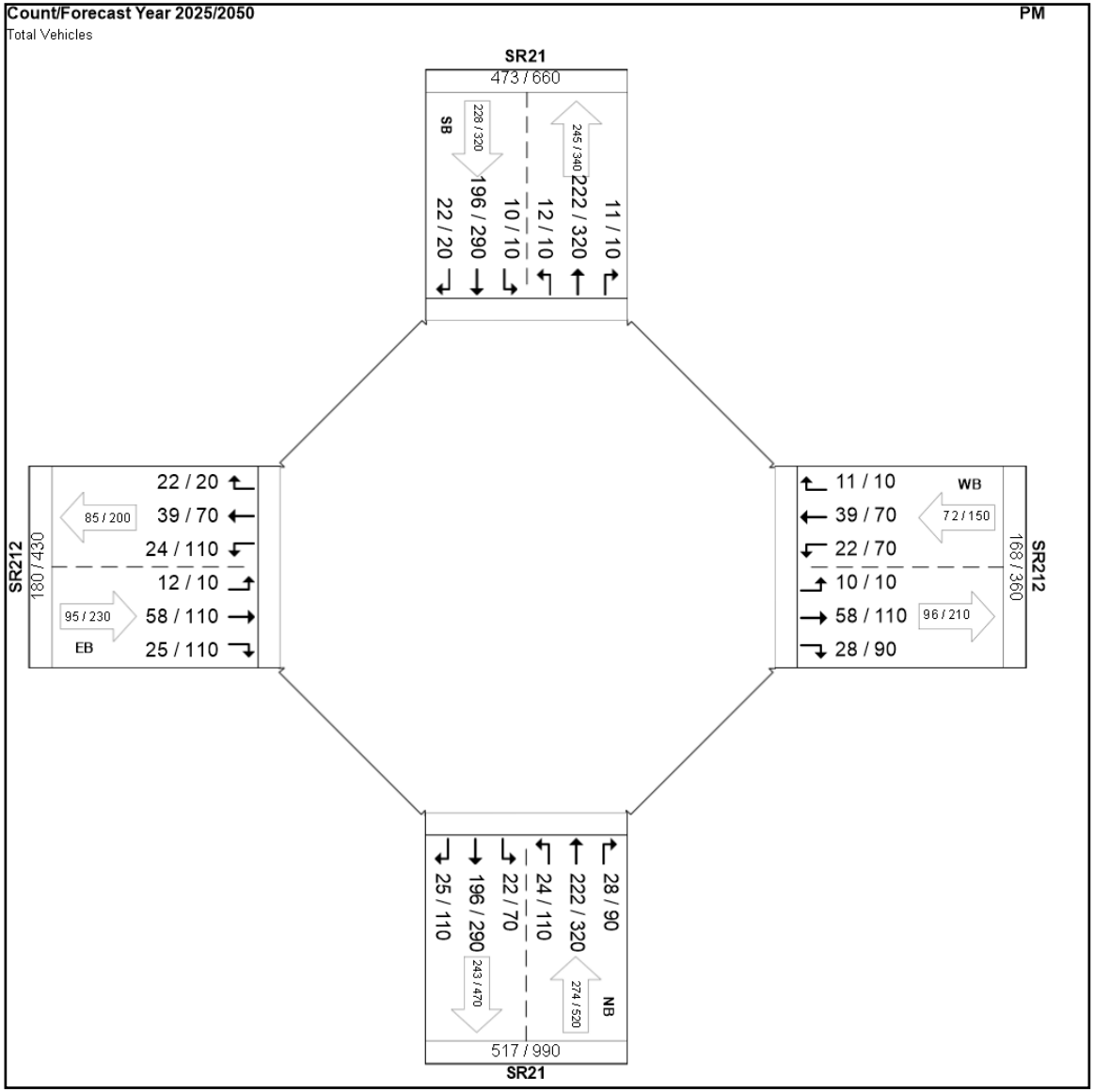
TFMS - Intersection Forecast Report

Count VS Design Year AM



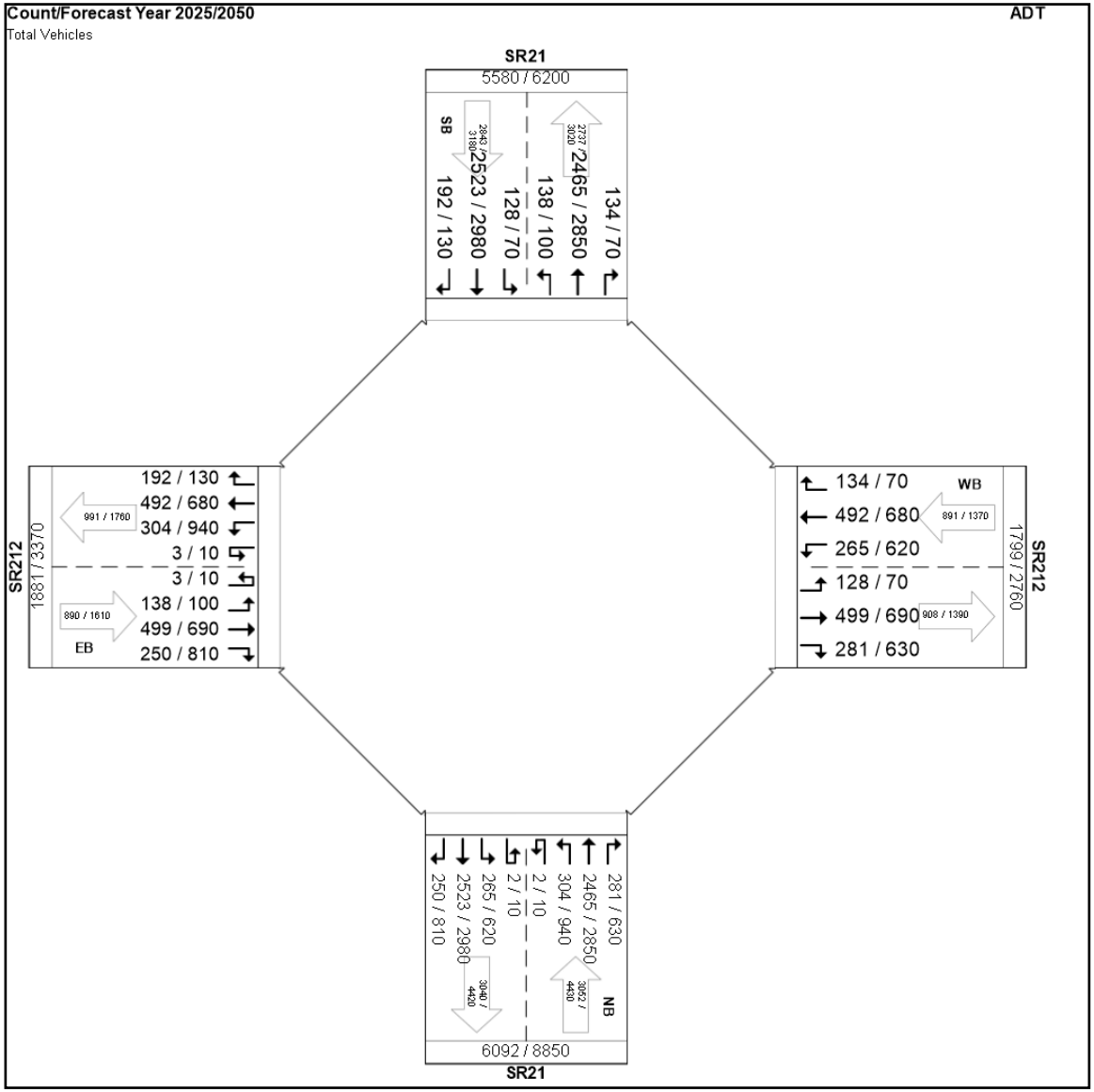
TFMS - Intersection Forecast Report

Count VS Design Year PM



TFMS - Intersection Forecast Report

Count VS Design Year ADT



Appendix D

Highway Capacity Software Output

Appendix D

Highway Capacity Software Output – No-Build Alternative

HCS Two-Way Stop-Control Report

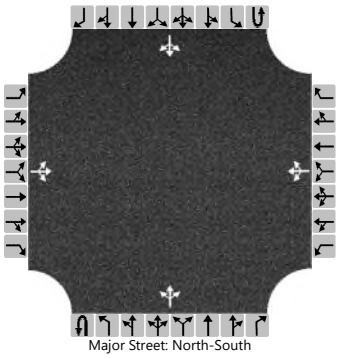
General Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	7/24/2025
Analysis Year	2030
Time Analyzed	No-Build Alternative - AM
Intersection Orientation	North-South
Project Description	PID #122290 - STW Safety Studies 2025-5

Site Information

Intersection	Erie Avenue SW (SR 21) and Dolphin Street S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		10	60	40		60	70	10		40	200	10		10	220	10
Percent Heavy Vehicles (%)		9	9	9		1	1	1		16				16		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.19	6.59	6.29		7.11	6.51	6.21		4.26				4.26		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.58	4.08	3.38		3.51	4.01	3.31		2.34				2.34		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			122				156			44				11		
Capacity, c (veh/h)			456				353			1232				1256		
v/c Ratio			0.27				0.44			0.04				0.01		
95% Queue Length, Q_{95} (veh)			1.1				2.2			0.1				0.0		
95% Queue Length, Q_{95} (ft)			29.5				55.6			2.5				0.0		
Control Delay (s/veh)			15.7				23.0			8.0	0.3	0.3		7.9	0.1	0.1
Level of Service (LOS)			C				C			A	A	A		A	A	A
Approach Delay (s/veh)		15.7				23.0				1.6				0.4		
Approach LOS		C				C				A				A		

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HCS Two-Way Stop-Control Report

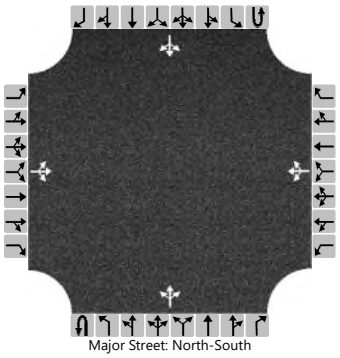
General Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	7/24/2025
Analysis Year	2030
Time Analyzed	No-Build Alternative - PM
Intersection Orientation	North-South
Project Description	PID #122290 - STW Safety Studies 2025-5

Site Information

Intersection	Erie Avenue SW (SR 21) and Dolphin Street S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		10	80	50		40	60	10		50	290	50		10	260	20
Percent Heavy Vehicles (%)		1	1	1		6	6	6		4				8		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.16	6.56	6.26		4.14				4.18		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.55	4.05	3.35		2.24				2.27		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			147				116			53				11		
Capacity, c (veh/h)			384				265			1255				1171		
v/c Ratio			0.38				0.44			0.04				0.01		
95% Queue Length, Q_{95} (veh)			1.8				2.1			0.1				0.0		
95% Queue Length, Q_{95} (ft)			45.4				54.9			2.5				0.0		
Control Delay (s/veh)			20.1				28.8			8.0	0.4	0.4		8.1	0.1	0.1
Level of Service (LOS)			C				D			A	A	A		A	A	A
Approach Delay (s/veh)	20.1				28.8				1.4				0.4			
Approach LOS	C				D				A				A			

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HCS Two-Way Stop-Control Report

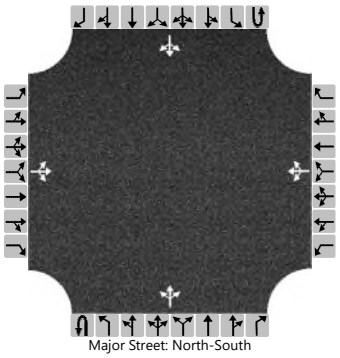
General Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	7/24/2025
Analysis Year	2050
Time Analyzed	No-Build Alternative - AM
Intersection Orientation	North-South
Project Description	PID #122290 - STW Safety Studies 2025-5

Site Information

Intersection	Erie Avenue SW (SR 21) and Dolphin Street S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		10	80	80		100	80	10		80	230	10		10	240	10
Percent Heavy Vehicles (%)		9	9	9		1	1	1		16				16		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.19	6.59	6.29		7.11	6.51	6.21		4.26				4.26		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.58	4.08	3.38		3.51	4.01	3.31		2.34				2.34		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			189				211			89				11		
Capacity, c (veh/h)			405				222			1209				1220		
v/c Ratio			0.47				0.95			0.07				0.01		
95% Queue Length, Q_{95} (veh)			2.4				8.2			0.2				0.0		
95% Queue Length, Q_{95} (ft)			64.3				207.3			5.0				0.0		
Control Delay (s/veh)			21.4				94.3			8.2	0.7	0.7		8.0	0.1	0.1
Level of Service (LOS)			C				F			A	A	A		A	A	A
Approach Delay (s/veh)	21.4				94.3				2.6				0.4			
Approach LOS	C				F				A				A			

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HCS Two-Way Stop-Control Report

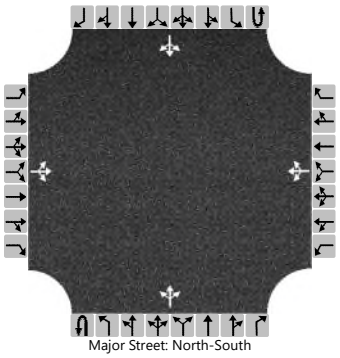
General Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	7/24/2025
Analysis Year	2050
Time Analyzed	No-Build Alternative - PM
Intersection Orientation	North-South
Project Description	PID #122290 - STW Safety Studies 2025-5

Site Information

Intersection	Erie Avenue SW (SR 21) and Dolphin Street S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		10	110	110		70	70	10		110	320	90		10	290	20
Percent Heavy Vehicles (%)		1	1	1		6	6	6		4				8		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.16	6.56	6.26		4.14				4.18		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.55	4.05	3.35		2.24				2.27		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			242				158			116				11		
Capacity, c (veh/h)			307				112			1222				1099		
v/c Ratio			0.79				1.42			0.09				0.01		
95% Queue Length, Q_{95} (veh)			6.3				11.1			0.3				0.0		
95% Queue Length, Q_{95} (ft)			158.8				289.9			7.5				0.0		
Control Delay (s/veh)			49.2				302.1			8.3	1.0	1.0		8.3	0.1	0.1
Level of Service (LOS)			E				F			A	A	A		A	A	A
Approach Delay (s/veh)	49.2				302.1				2.6				0.4			
Approach LOS	E				F				A				A			

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Appendix D

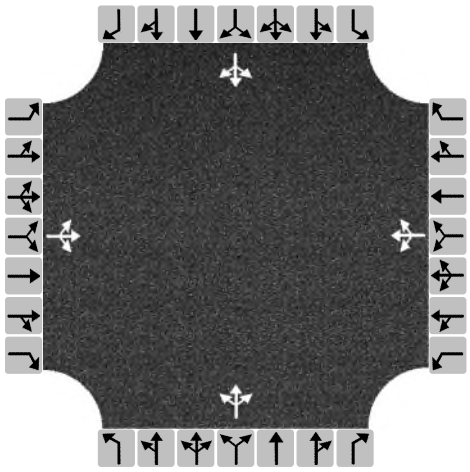
Highway Capacity Software Output – AWSC Alternative

HCS All-Way Stop Control Report

General and Site Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2030
Analysis Time Period (hrs)	0.25
Time Analyzed	AWSC - AM
Project Description	PID #122290 - STW Safety Studies 20...
Intersection	Erie Avenue SW (SR 21) and Dolphin S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.90

Lanes



Turning Movement Demand Volumes

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume (veh/h)	10	60	40	60	70	10	40	200	10	10	220	10
% Thrus in Shared Lane												

Lane Flow Rate and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	122			156			278			267		
Percent Heavy Vehicles	9			1			16			16		
Initial Departure Headway, h_d (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.109			0.138			0.247			0.237		
Final Departure Headway, h_d (s)	5.65			5.69			5.42			5.41		
Final Degree of Utilization, x	0.192			0.246			0.418			0.401		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, t_s (s)	3.65			3.69			3.42			3.41		

Capacity, Delay and Level of Service

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	122			156			278			267		
Capacity (veh/h)	637			633			664			665		
95% Queue Length, Q_{95} (veh)	0.7			1.0			2.1			1.9		
95% Queue Length, Q_{95} (ft)	18.8			25.2			59.2			53.6		
Control Delay (s/veh)	10.0			10.5			12.3			12.0		
Level of Service, LOS	A			B			B			B		
Approach Delay (s/veh) | LOS	10.0	A		10.5	B		12.3	B		12.0	B	
Intersection Delay (s/veh) | LOS	11.5						B					

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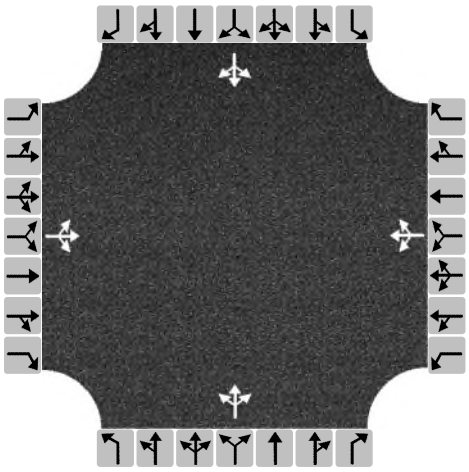
HCS All-Way Stop Control Report

General and Site Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2030
Analysis Time Period (hrs)	0.25
Time Analyzed	AWSC - PM
Project Description	PID #122290 - STW Safety Studies 20...
Intersection	Erie Avenue SW (SR 21) and Dolphin S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.95

Lanes



Turning Movement Demand Volumes

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume (veh/h)	10	80	50	40	60	10	50	290	50	10	260	20
% Thrus in Shared Lane												

Lane Flow Rate and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	147			116			411			305		
Percent Heavy Vehicles	1			6			4			8		
Initial Departure Headway, h_d (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.131			0.103			0.365			0.271		
Final Departure Headway, h_d (s)	5.88			6.25			5.22			5.45		
Final Degree of Utilization, x	0.241			0.201			0.596			0.462		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, t_s (s)	3.88			4.25			3.22			3.45		

Capacity, Delay and Level of Service

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	147			116			411			305		
Capacity (veh/h)	612			576			689			661		
95% Queue Length, Q_{95} (veh)	0.9			0.7			4.0			2.4		
95% Queue Length, Q_{95} (ft)	22.7			18.3			103.2			63.8		
Control Delay (s/veh)	10.7			10.8			15.6			13.0		
Level of Service, LOS	B			B			C			B		
Approach Delay (s/veh) | LOS	10.7	B		10.8	B		15.6	C		13.0	B	
Intersection Delay (s/veh) | LOS	13.5						B					

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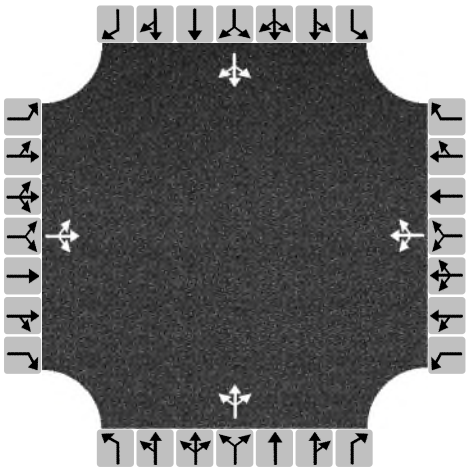
HCS All-Way Stop Control Report

General and Site Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2050
Analysis Time Period (hrs)	0.25
Time Analyzed	AWSC - AM
Project Description	PID #122290 - STW Safety Studies 20...
Intersection	Erie Avenue SW (SR 21) and Dolphin S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.90

Lanes



Turning Movement Demand Volumes

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume (veh/h)	10	80	80	100	80	10	80	230	10	10	240	10
% Thrus in Shared Lane												

Lane Flow Rate and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	189			211			356			289		
Percent Heavy Vehicles	9			1			16			16		
Initial Departure Headway, h_d (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.168			0.188			0.316			0.257		
Final Departure Headway, h_d (s)	6.32			6.46			6.12			6.21		
Final Degree of Utilization, x	0.332			0.379			0.605			0.498		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, t_s (s)	4.32			4.46			4.12			4.21		

Capacity, Delay and Level of Service

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	189			211			356			289		
Capacity (veh/h)	569			557			588			580		
95% Queue Length, Q_{95} (veh)	1.4			1.8			4.0			2.8		
95% Queue Length, Q_{95} (ft)	37.5			45.4			112.8			79.0		
Control Delay (s/veh)	12.4			13.3			18.0			15.2		
Level of Service, LOS	B			B			C			C		
Approach Delay (s/veh) | LOS	12.4	B		13.3	B		18.0	C		15.2	C	
Intersection Delay (s/veh) | LOS	15.3						C					

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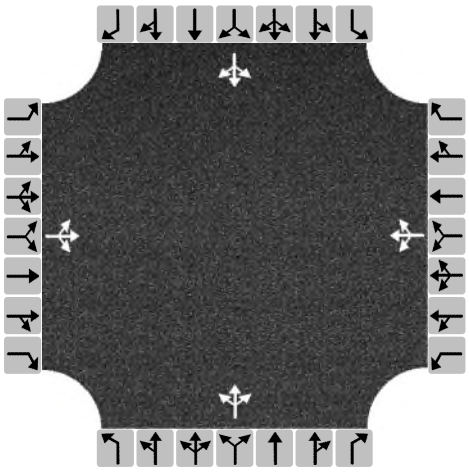
HCS All-Way Stop Control Report

General and Site Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2050
Analysis Time Period (hrs)	0.25
Time Analyzed	AWSC - PM
Project Description	PID #122290 - STW Safety Studies 20...
Intersection	Erie Avenue SW (SR 21) and Dolphin S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.95

Lanes



Turning Movement Demand Volumes

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume (veh/h)	10	110	110	70	70	10	110	320	90	10	290	20
% Thrus in Shared Lane												

Lane Flow Rate and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	242			158			547			337		
Percent Heavy Vehicles	1			6			4			8		
Initial Departure Headway, h_d (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.215			0.140			0.487			0.299		
Final Departure Headway, h_d (s)	6.92			7.62			6.15			6.67		
Final Degree of Utilization, x	0.466			0.334			0.936			0.624		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, t_s (s)	4.92			5.62			4.15			4.67		

Capacity, Delay and Level of Service

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	242			158			547			337		
Capacity (veh/h)	520			472			585			540		
95% Queue Length, Q_{95} (veh)	2.4			1.5			12.2			4.3		
95% Queue Length, Q_{95} (ft)	60.5			39.3			314.8			114.4		
Control Delay (s/veh)	15.8			14.4			47.6			20.1		
Level of Service, LOS	C			B			E			C		
Approach Delay (s/veh) | LOS	15.8	C		14.4	B		47.6	E		20.1	C	
Intersection Delay (s/veh) | LOS	30.3						D					

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Appendix D

Highway Capacity Software Output – Turn Lane Alternative

HCS Two-Way Stop-Control Report

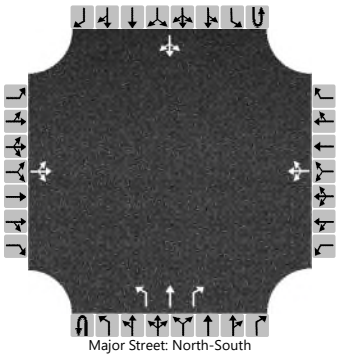
General Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	7/24/2025
Analysis Year	2030
Time Analyzed	Turn Lanes - AM
Intersection Orientation	North-South
Project Description	PID #122290 - STW Safety Studies 2025-5

Site Information

Intersection	Erie Avenue SW (SR 21) and Dolphin Street S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	1	1	0	0	1	0
Configuration			LTR				LTR			L	T	R			LTR	
Volume (veh/h)		10	60	40		60	70	10		40	200	10		10	220	10
Percent Heavy Vehicles (%)		9	9	9		1	1	1		16				16		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized										No						
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.19	6.59	6.29		7.11	6.51	6.21		4.26				4.26		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.58	4.08	3.38		3.51	4.01	3.31		2.34				2.34		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			122				156			44				11		
Capacity, c (veh/h)			459				358			1232				1256		
v/c Ratio			0.27				0.43			0.04				0.01		
95% Queue Length, Q_{95} (veh)			1.1				2.1			0.1				0.0		
95% Queue Length, Q_{95} (ft)			29.5				53.1			2.8				0.0		
Control Delay (s/veh)			15.7				22.6			8.0				7.9	0.1	0.1
Level of Service (LOS)			C				C			A				A	A	A
Approach Delay (s/veh)		15.7				22.6				1.3				0.4		
Approach LOS		C				C				A				A		

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HCS Two-Way Stop-Control Report

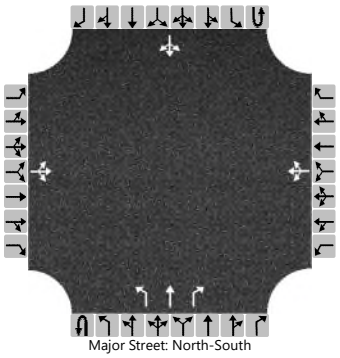
General Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	7/24/2025
Analysis Year	2030
Time Analyzed	Turn Lanes - PM
Intersection Orientation	North-South
Project Description	PID #122290 - STW Safety Studies 2025-5

Site Information

Intersection	Erie Avenue SW (SR 21) and Dolphin Street S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	1	1	0	0	1	0
Configuration			LTR				LTR			L	T	R			LTR	
Volume (veh/h)		10	80	50		40	60	10		50	290	50		10	260	20
Percent Heavy Vehicles (%)		1	1	1		6	6	6		4				8		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized										No						
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.16	6.56	6.26		4.14				4.18		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.55	4.05	3.35		2.24				2.27		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			147				116			53				11		
Capacity, c (veh/h)			388				278			1255				1171		
v/c Ratio			0.38				0.42			0.04				0.01		
95% Queue Length, Q_{95} (veh)			1.7				2.0			0.1				0.0		
95% Queue Length, Q_{95} (ft)			42.8				52.2			2.6				0.0		
Control Delay (s/veh)			19.9				26.9			8.0				8.1	0.1	0.1
Level of Service (LOS)			C				D			A				A	A	A
Approach Delay (s/veh)		19.9				26.9				1.0				0.4		
Approach LOS		C				D				A				A		

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HCS Two-Way Stop-Control Report

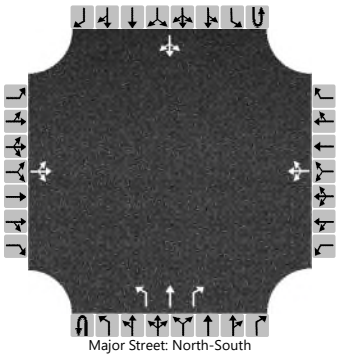
General Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2050
Time Analyzed	Turn Lanes - AM
Intersection Orientation	North-South
Project Description	PID #122290 - STW Safety Studies 2025-5

Site Information

Intersection	Erie Avenue SW (SR 21) and Dolphin Street S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	1	1	0	0	1	0
Configuration			LTR				LTR			L	T	R			LTR	
Volume (veh/h)		10	80	80		100	80	10		80	230	10		10	240	10
Percent Heavy Vehicles (%)		9	9	9		1	1	1		16				16		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized										No						
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.19	6.59	6.29		7.11	6.51	6.21		4.26				4.26		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.58	4.08	3.38		3.51	4.01	3.31		2.34				2.34		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			189				211			89				11		
Capacity, c (veh/h)			409				227			1209				1220		
v/c Ratio			0.46				0.93			0.07				0.01		
95% Queue Length, Q_{95} (veh)			2.4				7.9			0.2				0.0		
95% Queue Length, Q_{95} (ft)			64.3				199.7			5.6				0.0		
Control Delay (s/veh)			21.1				87.9			8.2				8.0	0.1	0.1
Level of Service (LOS)			C				F			A				A	A	A
Approach Delay (s/veh)		21.1				87.9				2.1				0.4		
Approach LOS		C				F				A				A		

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HCS Two-Way Stop-Control Report

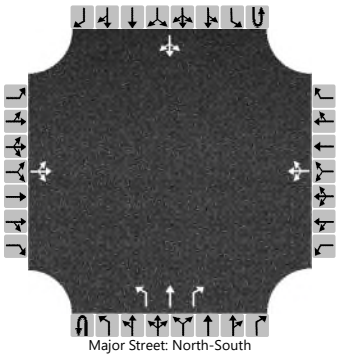
General Information

Analyst	Justin Maderia
Agency/Co.	Arcadis
Date Performed	7/24/2025
Analysis Year	2050
Time Analyzed	Turn Lanes - PM
Intersection Orientation	North-South
Project Description	PID #122290 - STW Safety Studies 2025-5

Site Information

Intersection	Erie Avenue SW (SR 21) and Dolphin Street S...
Jurisdiction	ODOT District 11
East/West Street	Dolphin Street SW (SR 212)
North/South Street	Erie Avenue SW (SR 21)
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	1	1	0	0	1	0
Configuration			LTR				LTR			L	T	R			LTR	
Volume (veh/h)		10	110	110		70	70	10		110	320	90		10	290	20
Percent Heavy Vehicles (%)		1	1	1		6	6	6		4				8		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized										No						
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.16	6.56	6.26		4.14				4.18		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.55	4.05	3.35		2.24				2.27		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			242				158			116				11		
Capacity, c (veh/h)			317				126			1222				1099		
v/c Ratio			0.76				1.25			0.09				0.01		
95% Queue Length, Q_{95} (veh)			5.9				9.9			0.3				0.0		
95% Queue Length, Q_{95} (ft)			148.7				258.6			7.7				0.0		
Control Delay (s/veh)			45.2				229.7			8.3				8.3	0.1	0.1
Level of Service (LOS)			E				F			A				A	A	A
Approach Delay (s/veh)		45.2				229.7				1.7				0.4		
Approach LOS		E				F				A				A		

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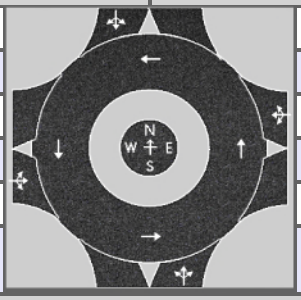
Appendix D

Highway Capacity Software Output – Roundabout Alternative

HCS Roundabouts Report

General Information

Analyst	Justin Maderia
Agency or Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2030
Time Analyzed	Roundabout - AM
Project Description	PID #122290 - STW Safety Studies 2025-5



Site Information

Intersection	Erie Avenue SW (SR 21) and...
E/W Street Name	Dolphin Street SW (SR 212)
N/S Street Name	Erie Avenue SW (SR 21)
Analysis Time Period, hrs	0.25
Peak Hour Factor	0.90
Jurisdiction	ODOT District 11

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	60	40	0	60	70	10	0	40	200	10	0	10	220	10
Percent Heavy Vehicles, %	0	9	9	9	0	1	1	1	0	16	16	16	0	16	16	16
Flow Rate (v_{PCE}), pc/h	0	12	73	48	0	67	79	11	0	52	258	13	0	13	284	13
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs, %	0															

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway, s		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway, s		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		133			157			323			310	
Entry Volume, veh/h		122			155			278			267	
Circulating Flow (v_c), pc/h	364			322			98			198		
Exiting Flow (v_{ex}), pc/h	99			144			281			399		
Capacity (c_{pce}), pc/h		952			994			1249			1128	
Capacity (c), veh/h		873			984			1076			972	
v/c Ratio (x)		0.14			0.16			0.26			0.27	

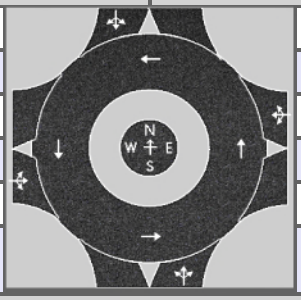
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.5			5.1			5.8			6.5	
Lane LOS		A			A			A			A	
95% Queue Length, Q_{95} (veh)		0.5			0.6			1.0			1.1	
95% Queue Length, Q_{95} (ft)		13.4			15.1			28.2			31.0	
Approach Delay, s/veh | LOS	5.5	A		5.1	A		5.8	A		6.5	A	
Intersection Delay, s/veh | LOS	5.8						A					

HCS Roundabouts Report

General Information

Analyst	Justin Maderia
Agency or Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2030
Time Analyzed	Roundabout - PM
Project Description	PID #122290 - STW Safety Studies 2025-5



Site Information

Intersection	Erie Avenue SW (SR 21) and...
E/W Street Name	Dolphin Street SW (SR 212)
N/S Street Name	Erie Avenue SW (SR 21)
Analysis Time Period, hrs	0.25
Peak Hour Factor	0.95
Jurisdiction	ODOT District 11

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	80	50	0	40	60	10	0	50	290	50	0	10	260	20
Percent Heavy Vehicles, %	0	1	1	1	0	6	6	6	0	4	4	4	0	8	8	8
Flow Rate (v_{PCE}), pc/h	0	11	85	53	0	45	67	11	0	55	317	55	0	11	296	23
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs, %	0															

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway, s		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway, s		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		149			123			427			330	
Entry Volume, veh/h		148			116			411			306	
Circulating Flow (v_c), pc/h	352			383			107			167		
Exiting Flow (v_{ex}), pc/h	151			145			339			394		
Capacity (c_{pce}), pc/h		964			934			1237			1164	
Capacity (c), veh/h		954			881			1190			1078	
v/c Ratio (x)		0.15			0.13			0.35			0.28	

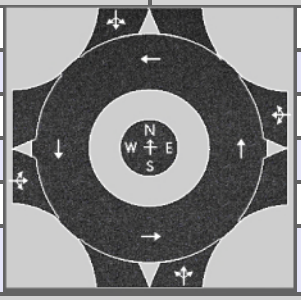
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.2			5.4			6.3			6.1	
Lane LOS		A			A			A			A	
95% Queue Length, Q_{95} (veh)		0.5			0.5			1.6			1.2	
95% Queue Length, Q_{95} (ft)		12.6			13.1			41.3			31.9	
Approach Delay, s/veh | LOS	5.2	A		5.4	A		6.3	A		6.1	A	
Intersection Delay, s/veh | LOS	6.0						A					

HCS Roundabouts Report

General Information

Analyst	Justin Maderia
Agency or Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2050
Time Analyzed	Roundabout - AM
Project Description	PID #122290 - STW Safety Studies 2025-5



Site Information

Intersection	Erie Avenue SW (SR 21) and...
E/W Street Name	Dolphin Street SW (SR 212)
N/S Street Name	Erie Avenue SW (SR 21)
Analysis Time Period, hrs	0.25
Peak Hour Factor	0.90
Jurisdiction	ODOT District 11

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	80	80	0	100	80	10	0	80	230	10	0	10	240	10
Percent Heavy Vehicles, %	0	9	9	9	0	1	1	1	0	16	16	16	0	16	16	16
Flow Rate (v_{PCE}), pc/h	0	12	97	97	0	112	90	11	0	103	296	13	0	13	309	13
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs, %	0															

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway, s		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway, s		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		206			213			412			335	
Entry Volume, veh/h		189			211			355			289	
Circulating Flow (v_c), pc/h	434			411			122			305		
Exiting Flow (v_{ex}), pc/h	123			206			319			518		
Capacity (c_{pce}), pc/h		886			907			1219			1011	
Capacity (c), veh/h		813			898			1050			872	
v/c Ratio (x)		0.23			0.23			0.34			0.33	

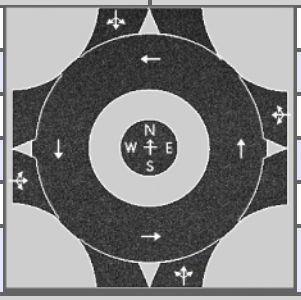
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.9			6.4			6.9			7.8	
Lane LOS		A			A			A			A	
95% Queue Length, Q_{95} (veh)		0.9			0.9			1.5			1.5	
95% Queue Length, Q_{95} (ft)		24.1			22.7			42.3			42.3	
Approach Delay, s/veh | LOS	6.9	A		6.4	A		6.9	A		7.8	A	
Intersection Delay, s/veh | LOS	7.0						A					

HCS Roundabouts Report

General Information

Analyst	Justin Maderia
Agency or Co.	Arcadis
Date Performed	11/12/2025
Analysis Year	2050
Time Analyzed	Roundabout - PM
Project Description	PID #122290 - STW Safety Studies 2025-5



Site Information

Intersection	Erie Avenue SW (SR 21) and...
E/W Street Name	Dolphin Street SW (SR 212)
N/S Street Name	Erie Avenue SW (SR 21)
Analysis Time Period, hrs	0.25
Peak Hour Factor	0.95
Jurisdiction	ODOT District 11

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	110	110	0	70	70	10	0	110	320	90	0	10	290	20
Percent Heavy Vehicles, %	0	1	1	1	0	6	6	6	0	4	4	4	0	8	8	8
Flow Rate (v_{PCE}), pc/h	0	11	117	117	0	78	78	11	0	120	350	99	0	11	330	23
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs, %	0															

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway, s		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway, s		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		245			167			569			364	
Entry Volume, veh/h		243			158			547			337	
Circulating Flow (v_c), pc/h	419			481			139			276		
Exiting Flow (v_{ex}), pc/h	227			221			372			525		
Capacity (c_{pce}), pc/h		900			845			1198			1041	
Capacity (c), veh/h		891			797			1152			964	
v/c Ratio (x)		0.27			0.20			0.48			0.35	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.9			6.6			8.3			7.5	
Lane LOS		A			A			A			A	
95% Queue Length, Q_{95} (veh)		1.1			0.7			2.6			1.6	
95% Queue Length, Q_{95} (ft)		27.7			18.3			67.1			42.6	
Approach Delay, s/veh | LOS	6.9	A		6.6	A		8.3	A		7.5	A	
Intersection Delay, s/veh | LOS	7.6						A					

Appendix E

Signal Warrant Spreadsheet Analysis Output

STUDY AND ANALYSIS INFORMATION

Municipality:	Beach City	**Traffic Volumes Obtained By:**	Miovision
County:	Tuscarawas	**Analysis Date:**	6/26/2025
ODOT Engineering District:	11	**Agency/ Company Name Performing Warrant Analysis:**	Arcadis
Google map link:	Map		

Analysis Information

Data Collection Date: 6/18/2025
Day of the Week: Wednesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: No

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: Erieview Avenue SW (SR 21)

Major Street Approach Direction: N-Bound / S-Bound

Number of Thru Lanes on Each Major Street Approach: 1 **LANE(S)**

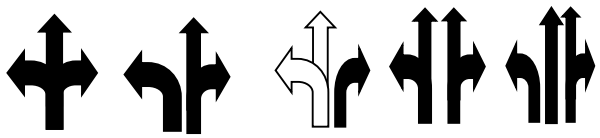
Speed Limit or 85th Percentile Speed on the Major Street*: 55 **MPH**

*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Dolphin Street SW (SR 212)

Minor Street Approach Configuration:
1 E-Bound
1 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 **LANE(S)**

Apply Right Turn Lane Reduction*: Yes

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Applicable?	100% Warrant Satisfied?	Notes and Comments: *Known error: if Speed Limit < 45mph, it may not state that it passes at 70%.	
Warrant 1, Eight-Hour Vehicular Volume	Yes	**No**		
Warrant 2, Four-Hour Vehicular Volume	Yes	**No**		
Warrant 3, Peak Hour	Yes	**No**	Signals installed under Warrant 3 should be traffic actuated.	**Peak Hour** 4:15 PM 5:15 PM
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)				
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.	**Peak Hour** 4:15 PM 5:15 PM
Warrant 5, School Crossing	No		N/A	
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)	
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.	
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)	
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9	
Multi-Way Stop Warrant	Yes	**Yes**	May be used as an interim measure if traffic signal warrants are satisfied.	

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

If no warrants are satisfied, additional options may be considered:

1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The **Modeling and Forecasting Section** should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. **Please fill inputs on PHB Score Sheet and submit to ODOT.**

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Do Not Install New Traffic Signal

Notes:

Start Time	Southbound Approach						Westbound Approach						Northbound Approach						Eastbound Approach					
	Southbound						Westbound						Nouthbound						Eastbound					
	Right	Thru	Left	U-Turn	Peds	App Total	Right	Thru	Left	U-Turn	Peds	App Total	Right	Thru	Left	U-Turn	Peds	App Total	Right	Thru	Left	U-Turn	Peds	App Total
12:00 AM						0						0						0						0
12:15 AM						0						0						0						0
12:30 AM						0						0						0						0
12:45 AM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00 AM						0						0						0						0
1:15 AM						0						0						0						0
1:30 AM						0						0						0						0
1:45 AM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00 AM						0						0						0						0
2:15 AM						0						0						0						0
2:30 AM						0						0						0						0
2:45 AM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 AM						0						0						0						0
3:15 AM						0						0						0						0
3:30 AM						0						0						0						0
3:45 AM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 AM						0						0						0						0
4:15 AM						0						0						0						0
4:30 AM						0						0						0						0
4:45 AM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 AM						0						0						0						0
5:15 AM						0						0						0						0
5:30 AM						0						0						0						0
5:45 AM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00 AM						0						0						0						0
6:15 AM						0						0						0						0
6:30 AM						0						0						0						0
6:45 AM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 AM	1	48	2			51	2	8	6			16	0	40	0			40	3	3	4			10
7:15 AM	0	44	3			47	3	9	6			18	1	45	5			51	1	8	1			10
7:30 AM	2	59	2			63	2	7	8			17	0	46	4			50	5	5	2			12
7:45 AM	2	42	3			47	3	5	11			19	1	45	0			46	3	8	2			13
Hourly Total	5	193	10	0	0	208	10	29	31	0	0	70	2	176	9	0	0	187	12	24	9	0	0	45
8:00 AM	1	39	0			40	1	10	7			18	3	26	3			32	2	3	3			8
8:15 AM	2	37	0			39	3	5	5			13	1	26	3			30	2	9	3			14
8:30 AM	4	38	2			44	1	8	6			15	2	29	2			33	5	7	1			13
8:45 AM	3	29	1			33	2	8	5			15	3	37	1			41	5	8	1			14
Hourly Total	10	143	3	0	0	156	7	31	23	0	0	61	9	118	9	0	0	136	14	27	8	0	0	49
9:00 AM	2	37	0			39	2	8	3			13	3	25	0			28	2	11	2			15
9:15 AM	2	30	1			33	1	10	4			15	2	25	2			29	3	5	3			11
9:30 AM	2	22	5			29	1	9	2			12	5	26	5			36	3	7	3			13
9:45 AM	2	36	3			41	2	8	9			19	1	38	6			45	1	4	0			5
Hourly Total	8	125	9	0	0	142	6	35	18	0	0	59	11	114	13	0	0	138	9	27	8	0	0	44
10:00 AM	2	28	2			32	4	8	2			14	4	35	7			46	4	4	1			9
10:15 AM	3	34	1			38	4	8	4			16	2	39	2			43	8	8	5			21
10:30 AM	0	28	0			28	1	3	2			6	0	39	5			44	3	4	5			12
10:45 AM	1	40	0			41	2	5	2			9	3	33	9			45	4	3	2			9
Hourly Total	6	130	3	0	0	139	11	24	10	0	0	45	9	146	23	0	0	178	19	19	13	0	0	51
11:00 AM	3	32	1			36	0	8	3			11	3	43	5			51	5	6	1			12
11:15 AM	6	26	1			33	2	6	3			11	5	37	6			48	8	4	4			16
11:30 AM	3	24	2			29	2	9	4			15	4	37	5			46	4	3	0			7
11:45 AM	4	33	1			38	2	2	4			8	2	28	3			33	5	5	2			12
Hourly Total	16	115	5	0	0	136	6	25	14	0	0	45	14	145	19	0	0	178	22	18	7	0	0	47
12:00 PM	1	38	1			40	4	2	3			9	2	31	3			36	2	13	4			19
12:15 PM	1	36	1			38	2	3	7			12	5	32	3			40	3	9	2			14
12:30 PM	1	45	0			46	2	9	1			12	5	42	12			59	7	8	4			19
12:45 PM	5	34	5			44	1	6	4			11	1	32	5			38	3	5	2			10
Hourly Total	8	153	7	0	0	168	9	20	15	0	0	44	13	137	23	0	0	173	15	35	12	0	0	62
1:00 PM	3	27	6			36	1	6	6			13	4	40	7			51	6	5	1			12
1:15 PM	6	42	1			49	3	4	5			12	8	42	9			59	2	7	2			11
1:30 PM	2	39	2			43	4	3	4			11	4	41	4			49	3	7	2			12
1:45 PM	6	45	2			53	2	5	3			10	7	24	10			41	0	6	4			10
Hourly Total	17	153	11	0	0	181	10	18	18	0	0	46	23	147	30	0	0	200	11	25	9	0	0	45
2:00 PM	3	46	1			50	0	8	3			11	10	57	5			72	3	8	1			12
2:15 PM	2	40	2			44	2	10	8			20	10	39	7			56	7	6	3			16
2:30 PM	3	46	4			53	5	9	5			19	11	46	6			63	1	10	2			13
2:45 PM	4	64	3			71	2	5	4			11	16	37	4			57	3	10	2			15
Hourly Total	12	196	10	0	0	218	9	32	20	0	0	61	47	179	22	0	0	248	14	34	8	0	0	56
3:00 PM	7	41	5			53	2	13	2			17	4	49	3			56	0	4	3			7
3:15 PM	3	62	1			66	4	9	0			13	10	52	2			64	5	13	0			18
3:30 PM	3	46	5			54	3	8	7			18	8	31	7			46	4	8	3			15
3:45 PM	2	56	2			60	2	11	2			15	8	47	4			59	5	17	2			24
Hourly Total	15	205	13	0	0	233	11	41	11	0	0	63	30	179	16	0	0	225	14	42	8	0	0	64
4:00 PM	2	55	3			60	3	12	4			19	3	49	6			58	8	17	1			26
4:15 PM	8	62	0			70	1	11	6			18	10	44	5			59	5	9	3			17
4:30 PM	4	44	3			51	6	8	8			22	8	64	7			79	4	20	1			25
4:45 PM	6	43	3			52	3	8	5			16	3	52	7			62	7	16	4			27
Hourly Total	20	204	9	0	0	233	13	39	23	0	0	75	24	209	25	0	0	258	24	62	9	0	0	95
5:00 PM	4	47	4			55	1	12	3			16	7	62	5			74	9	13	4			26
5:15 PM	3	59	2			64	1	12	4			17	3	45	8			56	6	13	3			22
5:30 PM	4	38	0			42	5	12	2			19	8	43	8			59	6	10	1			17
5:45 PM	5	31	1			37	2	14	4			20	4	31	6			41	4	7	0			11
Hourly Total	16	175	7	0	0	198	9	50	13	0	0	72	22	181	27	0	0	230	25	43	8	0	0	76
6:00 PM	4	36	6			46	1	5	2			8	5	43	9			57	3	10	3			16
6:15 PM	5	30	4			39	2	5	2			9	5	39	2			46	1	9	3			13
6:30 PM	1	26	0			27	0	11	4			15	3	37	4			44	4	3	2			9
6:45 PM	6	32	2			40	0	11	0			11	0	24	2			26	6	4	1			11
Hourly Total	16	124	12	0	0	152	3	32	8	0	0	43	13	143	17	0	0	173	14	26	9	0	0	49
7:00 PM						0						0						0						0
7:15 PM						0						0						0						0
7:30 PM						0						0						0						0
7:45 PM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 PM						0						0						0						0
8:15 PM						0						0						0						0
8:30 PM						0						0						0						0
8:45 PM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00 PM						0						0						0						0
9:15 PM						0						0						0						0
9:30 PM						0						0						0						0
9:45 PM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00 PM						0						0						0						0
10:15 PM						0						0						0						0
10:30 PM						0						0						0						0
10:45 PM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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11:15 PM						0						0						0						0
11:30 PM						0						0						0						0
11:45 PM						0						0						0						0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Southbound Approach Southbound					Westbound Approach Westbound					Northbound Approach Northbound					Eastbound Approach Eastbound				
	Right	Thru	Left	U-Turn	Peds	Right	Thru	Left	U-Turn	Peds	Right	Thru	Left	U-Turn	Peds	Right	Thru	Left	U-Turn	Peds
12:00 AM																				
12:15 AM																				
12:30 AM																				
12:45 AM																				
1:00 AM																				
1:15 AM																				
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6:00 AM																				
6:15 AM																				
6:30 AM																				
6:45 AM																				
7:00 AM	1	48	2			2	8	6			0	40	0			3	3	4		
7:15 AM	0	44	3			3	9	6			1	45	5			1	8	1		
7:30 AM	2	59	2			2	7	8			0	46	4			5	5	2		
7:45 AM	2	42	3			3	5	11			1	45	0			3	8	2		
8:00 AM	1	39	0			1	10	7			3	26	3			2	3	3		
8:15 AM	2	37	0			3	5	5			1	26	3			2	9	3		
8:30 AM	4	38	2			1	8	6			2	29	2			5	7	1		
8:45 AM	3	29	1			2	8	5			3	37	1			5	8	1		
9:00 AM	2	37	0			2	8	3			3	25	0			2	11	2		
9:15 AM	2	30	1			1	10	4			2	25	2			3	5	3		
9:30 AM	2	22	5			1	9	2			5	26	5			3	7	3		
9:45 AM	2	36	3			2	8	9			1	38	6			1	4	0		
10:00 AM	2	28	2			4	8	2			4	35	7			4	4	1		
10:15 AM	3	34	1			4	8	4			2	39	2			8	8	5		
10:30 AM	0	28	0			1	3	2			0	39	5			3	4	5		
10:45 AM	1	40	0			2	5	2			3	33	9			4	3	2		
11:00 AM	3	32	1			0	8	3			3	43	5			5	6	1		
11:15 AM	6	26	1			2	6	3			5	37	6			8	4	4		
11:30 AM	3	24	2			2	9	4			4	37	5			4	3	0		
11:45 AM	4	33	1			2	2	4			2	28	3			5	5	2		
12:00 PM	1	38	1			4	2	3			2	31	3			2	13	4		
12:15 PM	1	36	1			2	3	7			5	32	3			3	9	2		
12:30 PM	1	45	0			2	9	1			5	42	12			7	8	4		
12:45 PM	5	34	5			1	6	4			1	32	5			3	5	2		
1:00 PM	3	27	6			1	6	6			4	40	7			6	5	1		
1:15 PM	6	42	1			3	4	5			8	42	9			2	7	2		
1:30 PM	2	39	2			4	3	4			4	41	4			3	7	2		
1:45 PM	6	45	2			2	5	3			7	24	10			0	6	4		
2:00 PM	3	46	1			0	8	3			10	57	5			3	8	1		
2:15 PM	2	40	2			2	10	8			10	39	7			7	6	3		
2:30 PM	3	46	4			5	9	5			11	46	6			1	10	2		
2:45 PM	4	64	3			2	5	4			16	37	4			3	10	2		
3:00 PM	7	41	5			2	13	2			4	49	3			0	4	3		
3:15 PM	3	62	1			4	9	0			10	52	2			5	13	0		
3:30 PM	3	46	5			3	8	7			8	31	7			4	8	3		
3:45 PM	2	56	2			2	11	2			8	47	4			5	17	2		
4:00 PM	2	55	3			3	12	4			3	49	6			8	17	1		
4:15 PM	8	62	0			1	11	6			10	44	5			5	9	3		
4:30 PM	4	44	3			6	8	8			8	64	7			4	20	1		
4:45 PM	6	43	3			3	8	5			3	52	7			7	16	4		
5:00 PM	4	47	4			1	12	3			7	62	5			9	13	4		
5:15 PM	3	59	2			1	12	4			3	45	8			6	13	3		
5:30 PM	4	38	0			5	12	2			8	43	8			6	10	1		
5:45 PM	5	31	1			2	14	4			4	31	6			4	7	0		
6:00 PM	4	36	6			1	5	2			5	43	9			3	10	3		
6:15 PM	5	30	4			2	5	2			5	39	2			1	9	3		
6:30 PM	1	26	0			0	11	4			3	37	4			4	3	2		
6:45 PM	6	32	2			0	11	0			0	24	2			6	4	1		
7:00 PM																				
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11:00 PM																				
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11:30 PM																				
11:45 PM																				

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

**Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)*

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
											Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	100%		70%		100%		70%		80%		80%		56%		56%	
			Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1	X		500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
1:45 AM	0	0																
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5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	91	16																
6:30 AM	189	33																
6:45 AM	302	50													1			
7:00 AM	395	68			1													
7:15 AM	376	71																
7:30 AM	347	66																
7:45 AM	311	64													1			
8:00 AM	292	60																
8:15 AM	287	55																
8:30 AM	280	57																
8:45 AM	268	54																
9:00 AM	280	58													1			
9:15 AM	291	59																
9:30 AM	310	59																
9:45 AM	317	53																
10:00 AM	317	44													1			
10:15 AM	326	46																
10:30 AM	326	41																
10:45 AM	329	45																
11:00 AM	314	44													1			
11:15 AM	303	47																
11:30 AM	300	50																
11:45 AM	330	61																
12:00 PM	341	59													1			
12:15 PM	352	52			1													
12:30 PM	382	49																
12:45 PM	369	46																
1:00 PM	381	44													1			
1:15 PM	416	44			1						1							
1:30 PM	408	51																
1:45 PM	432	59															1	1
2:00 PM	466	60													1			
2:15 PM	453	65			1						1							
2:30 PM	483	58																
2:45 PM	467	57															1	1
3:00 PM	458	62													1			
3:15 PM	467	79			1						1							
3:30 PM	466	78																
3:45 PM	496	88															1	1

4:00 PM	491	91													1	1		
4:15 PM	502	90	1		1						1							
4:30 PM	493	95																
4:45 PM	464	87															1	1
5:00 PM	428	71													1			
5:15 PM	402	63			1						1							
5:30 PM	367	55																
5:45 PM	337	51																
6:00 PM	325	47													1			
6:15 PM	222	35																
6:30 PM	137	26																
6:45 PM	66	11																
7:00 PM	0	0																
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10:45 PM	0	0																
11:00 PM	0	0																
11:15 PM	0	0																
11:30 PM	0	0																
11:45 PM	0	0																
HOURS MET			**1**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**12**	**1**	**4**	**4**
WARRANT SATISFIED?			**NO**		**NO**		**NO**		**NO**		**NO**				**NO**			

Warrant Met: **No**

Notes:

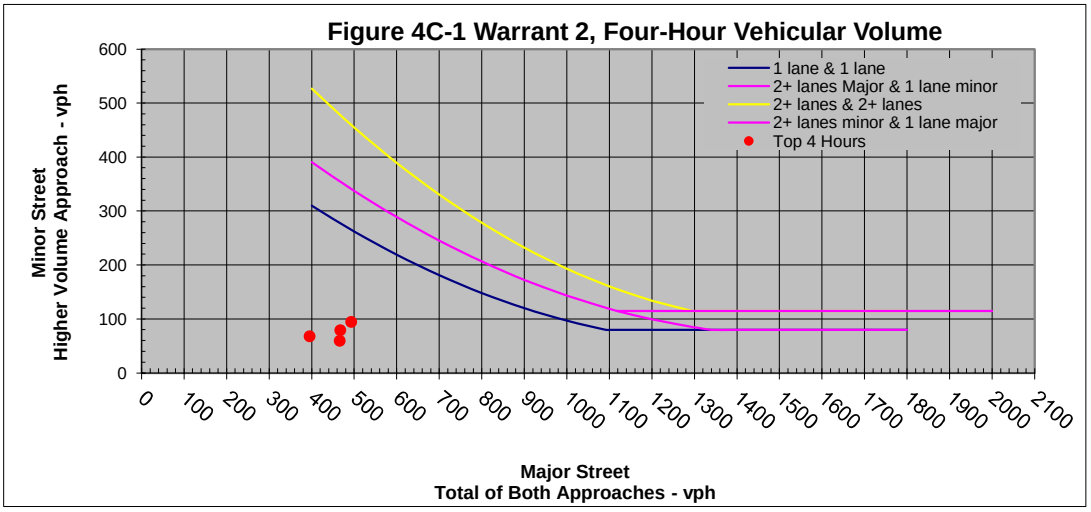
OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach		Total Number of Unique Hours Met on Figure 4C-1	0
Major street:	1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street:	1 Lane		

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

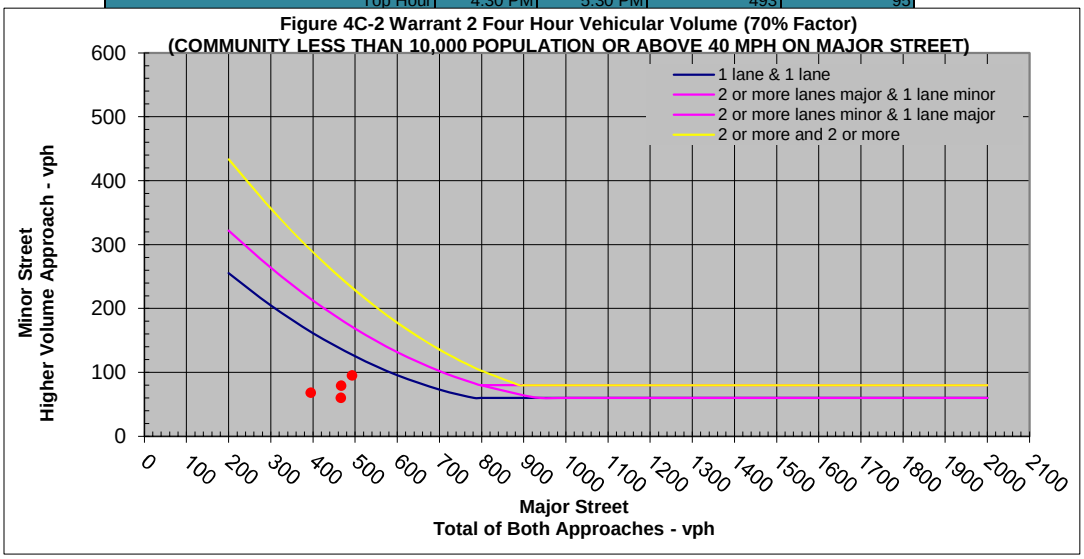
Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Required Minimum Minor Street For 4C-1	Required Minimum Minor Street For 4C-2	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - Erieview Avenue SW (SR 2		Minor - Dolphin Street SW (SR 212							
	N-Bound	S-Bound	W-Bound	E-Bound						
12:00 AM	0	0	0	0	0	550	377	0		
12:15 AM	0	0	0	0	0	550	377	0		
12:30 AM	0	0	0	0	0	550	377	0		
12:45 AM	0	0	0	0	0	550	377	0		
1:00 AM	0	0	0	0	0	550	377	0		
1:15 AM	0	0	0	0	0	550	377	0		
1:30 AM	0	0	0	0	0	550	377	0		
1:45 AM	0	0	0	0	0	550	377	0		
2:00 AM	0	0	0	0	0	550	377	0		
2:15 AM	0	0	0	0	0	550	377	0		
2:30 AM	0	0	0	0	0	550	377	0		
2:45 AM	0	0	0	0	0	550	377	0		
3:00 AM	0	0	0	0	0	550	377	0		
3:15 AM	0	0	0	0	0	550	377	0		
3:30 AM	0	0	0	0	0	550	377	0		
3:45 AM	0	0	0	0	0	550	377	0		
4:00 AM	0	0	0	0	0	550	377	0		
4:15 AM	0	0	0	0	0	550	377	0		
4:30 AM	0	0	0	0	0	550	377	0		
4:45 AM	0	0	0	0	0	550	377	0		
5:00 AM	0	0	0	0	0	550	377	0		
5:15 AM	0	0	0	0	0	550	377	0		
5:30 AM	0	0	0	0	0	550	377	0		
5:45 AM	0	0	0	0	0	550	377	0		
6:00 AM	0	0	0	0	0	550	377	0		
6:15 AM	40	51	16	10	91	489	318	16		
6:30 AM	91	98	33	20	189	427	261	33		
6:45 AM	141	161	50	31	302	361	204	50		
7:00 AM	187	208	68	43	395	312	164	68		
7:15 AM	179	197	71	41	376	322	171	71		
7:30 AM	158	189	66	45	347	337	184	66		
7:45 AM	141	170	64	46	311	356	200	64		
8:00 AM	136	156	60	47	292	367	209	60		
8:15 AM	132	155	55	54	287	370	211	55		
8:30 AM	131	149	57	50	280	374	214	57		
8:45 AM	134	134	54	51	268	380	220	54		
9:00 AM	138	142	58	43	280	374	214	58		
9:15 AM	156	135	59	36	291	367	209	59		
9:30 AM	170	140	59	45	310	357	200	59		
9:45 AM	178	139	53	44	317	353	197	53		
10:00 AM	178	139	43	44	317	353	197	44		
10:15 AM	183	143	41	46	326	348	193	46		
10:30 AM	188	138	36	41	326	348	193	41		
10:45 AM	190	139	45	36	329	347	192	45		
11:00 AM	178	136	44	39	314	355	198	44		
11:15 AM	163	140	41	47	303	361	204	47		
11:30 AM	155	145	42	50	300	362	205	50		
11:45 AM	168	162	39	61	330	346	191	61		
12:00 PM	173	168	43	59	341	340	186	59		
12:15 PM	188	164	47	52	352	334	181	52		
12:30 PM	207	175	47	49	382	319	169	49		
12:45 PM	197	172	46	43	369	326	174	46		
1:00 PM	200	181	44	43	381	319	169	44		
1:15 PM	221	195	43	44	416	302	155	44		
1:30 PM	218	190	51	48	408	306	158	51		
1:45 PM	232	200	59	49	432	294	149	59		
2:00 PM	248	218	60	54	466	278	137	60		

2:15 PM	232	221	65	49	453	284	141	65		
2:30 PM	240	243	58	52	483	270	131	58		
2:45 PM	223	244	57	53	467	277	136	57		
3:00 PM	225	233	61	62	458	281	140	62		
3:15 PM	227	240	63	79	467	277	136	79		
3:30 PM	222	244	69	78	466	278	137	78		
3:45 PM	255	241	72	88	496	264	126	88		
4:00 PM	258	233	73	91	491	266	128	91		
4:15 PM	274	228	70	90	502	261	124	90		
4:30 PM	271	222	69	95	493	265	127	95		
4:45 PM	251	213	66	87	464	279	137	87		
5:00 PM	230	198	71	71	428	296	151	71		
5:15 PM	213	189	63	63	402	309	161	63		
5:30 PM	203	164	54	55	367	327	175	55		
5:45 PM	188	149	51	47	337	342	188	51		
6:00 PM	173	152	43	47	325	349	193	47		
6:15 PM	116	106	35	31	222	407	244	35		
6:30 PM	70	67	26	16	137	459	291	26		
6:45 PM	26	40	11	9	66	505	334	11		
7:00 PM	0	0	0	0	0	550	377	0		
7:15 PM	0	0	0	0	0	550	377	0		
7:30 PM	0	0	0	0	0	550	377	0		
7:45 PM	0	0	0	0	0	550	377	0		
8:00 PM	0	0	0	0	0	550	377	0		
8:15 PM	0	0	0	0	0	550	377	0		
8:30 PM	0	0	0	0	0	550	377	0		
8:45 PM	0	0	0	0	0	550	377	0		
9:00 PM	0	0	0	0	0	550	377	0		
9:15 PM	0	0	0	0	0	550	377	0		
9:30 PM	0	0	0	0	0	550	377	0		
9:45 PM	0	0	0	0	0	550	377	0		
10:00 PM	**0**	**0**	**0**	**0**	0	550	377	0		
10:15 PM	**0**	**0**	**0**	**0**	0	550	377	0		
10:30 PM	**0**	**0**	**0**	**0**	0	550	377	0		
10:45 PM	**0**	**0**	**0**	**0**	0	550	377	0		
11:00 PM	**0**	**0**	**0**	**0**	0	550	377	0		
11:15 PM	**0**	**0**	**0**	**0**	0	550	377	0		
11:30 PM	**0**	**0**	**0**	**0**	0	550	377	0		
11:45 PM	**0**	**0**	**0**	**0**	0	550	377	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:30 PM	5:30 PM	493	95
2nd Highest Hour	3:15 PM	4:15 PM	467	79
3rd Highest Hour	2:00 PM	3:00 PM	466	60
4th Highest Hour	7:00 AM	8:00 AM	395	68

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:30 PM	5:30 PM	493	95



Are the requirements for Warrant 2 met?: **No**

OMUTCD WARRANT 3, PEAK HOUR

Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time	4:15 PM
Major Street:	1 Lane	Peak Hour End Time	5:15 PM
Minor Street:	1 Lane		

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	No
**If applicable, attach all supporting calculations and documentation.*	

Are the requirements for Warrant 3 met?:	**No**

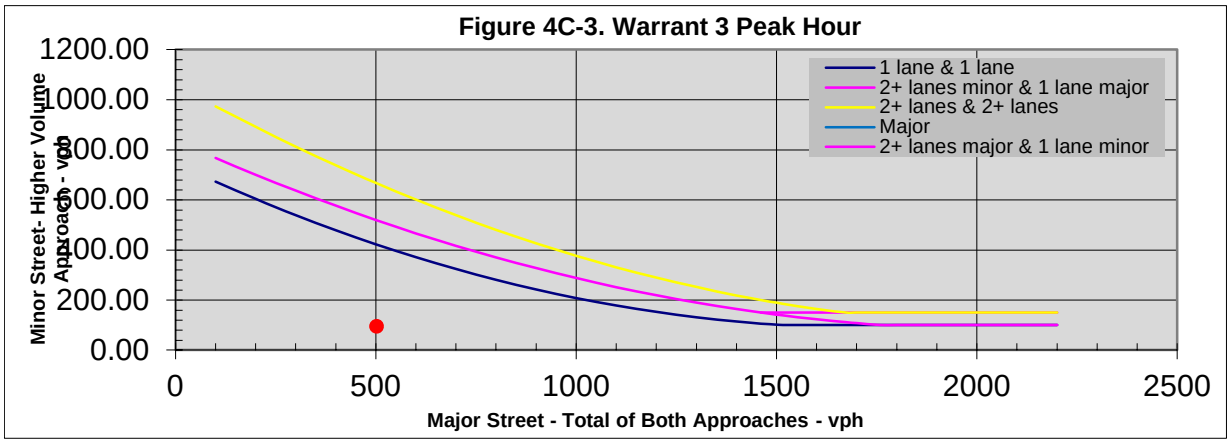
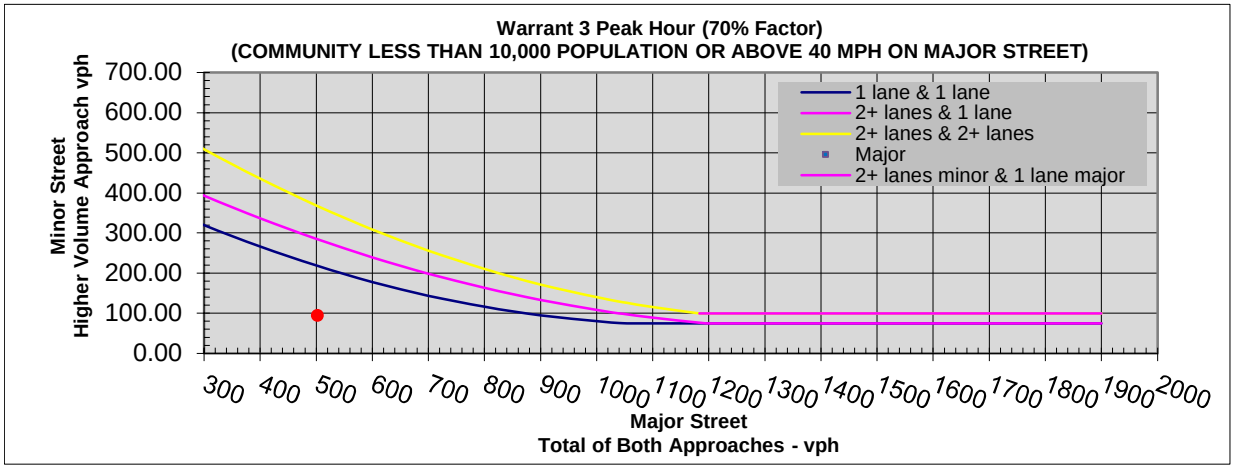


Figure 4C-3. Warrant 3 Peak Hour
Minor Street- Higher Volume Approach - vph
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
0
500
1000
1500
2000
2500
Major Street - Total of Both Approaches - vph
1 lane & 1 lane
2+ lanes minor & 1 lane major
2+ lanes & 2+ lanes
Major
2+ lanes major & 1 lane minor


Warrant 3 Peak Hour (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)
Minor Street
Higher Volume Approach vph
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000
Major Street
Total of Both Approaches - vph
1 lane & 1 lane
2+ lanes & 1 lane
2+ lanes & 2+ lanes
Major
2+ lanes minor & 1 lane major

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
12:00 AM	0	0	0	0
12:15 AM	0	0	0	0
12:30 AM	0	0	0	0
12:45 AM	0	0	0	0
1:00 AM	0	0	0	0
1:15 AM	0	0	0	0
1:30 AM	0	0	0	0
1:45 AM	0	0	0	0
2:00 AM	0	0	0	0
2:15 AM	0	0	0	0
2:30 AM	0	0	0	0
2:45 AM	0	0	0	0
3:00 AM	0	0	0	0
3:15 AM	0	0	0	0
3:30 AM	0	0	0	0
3:45 AM	0	0	0	0
4:00 AM	0	0	0	0
4:15 AM	0	0	0	0
4:30 AM	0	0	0	0
4:45 AM	0	0	0	0
5:00 AM	0	0	0	0
5:15 AM	0	0	0	0
5:30 AM	0	0	0	0
5:45 AM	0	0	0	0
6:00 AM	0	0	0	0
6:15 AM	91	16	107	117
6:30 AM	189	33	222	242
6:45 AM	302	50	352	383
7:00 AM	395	68	463	506
7:15 AM	376	71	447	488
7:30 AM	347	66	413	458
7:45 AM	311	64	375	421
8:00 AM	292	60	352	399
8:15 AM	287	55	342	396
8:30 AM	280	57	337	387
8:45 AM	268	54	322	373
9:00 AM	280	58	338	381
9:15 AM	291	59	350	386
9:30 AM	310	59	369	414
9:45 AM	317	53	370	414
10:00 AM	317	44	361	404
10:15 AM	326	46	372	413
10:30 AM	326	41	367	403
10:45 AM	329	45	374	410
11:00 AM	314	44	358	397
11:15 AM	303	47	350	391
11:30 AM	300	50	350	392
11:45 AM	330	61	391	430

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
502	95	421	218

12:00 PM	341	59	400	443
12:15 PM	352	52	404	451
12:30 PM	382	49	431	478
12:45 PM	369	46	415	458
1:00 PM	381	44	425	468
1:15 PM	416	44	460	503
1:30 PM	408	51	459	507
1:45 PM	432	59	491	540
2:00 PM	466	60	526	580
2:15 PM	453	65	518	567
2:30 PM	483	58	541	593
2:45 PM	467	57	524	577
3:00 PM	458	62	520	581
3:15 PM	467	79	546	609
3:30 PM	466	78	544	613
3:45 PM	496	88	584	656
4:00 PM	491	91	582	655
4:15 PM	502	90	592	662
4:30 PM	493	95	588	657
4:45 PM	464	87	551	617
5:00 PM	428	71	499	570
5:15 PM	402	63	465	528
5:30 PM	367	55	422	476
5:45 PM	337	51	388	435
6:00 PM	325	47	372	415
6:15 PM	222	35	257	288
6:30 PM	137	26	163	179
6:45 PM	66	11	77	86
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0
8:15 PM	0	0	0	0
8:30 PM	0	0	0	0
8:45 PM	0	0	0	0
9:00 PM	0	0	0	0
9:15 PM	0	0	0	0
9:30 PM	0	0	0	0
9:45 PM	0	0	0	0
10:00 PM	0	0	0	0
10:15 PM	0	0	0	0
10:30 PM	0	0	0	0
10:45 PM	0	0	0	0
11:00 PM	0	0	0	0
11:15 PM	0	0	0	0
11:30 PM	0	0	0	0
11:45 PM	0	0	0	0

Multi-Way Stop Application

OMUTCD Section 2B.07

	Warranted ?
A. Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.	No
B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multiway stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.	Yes
C. Minimum Volumes:	
1 The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day.	Yes
2 The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour.* *If this condition is satisfied, there must also be an average delay of at least 30 seconds per vehicle during the peak hour.	No
3 If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum volume warrants are 70 percent of the values provided in Items 1 and 2.	Yes
D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.	No

Other criteria that may be considered in an engineering study include:

A. The need to control left-turn conflicts;	Yes
B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;	No
C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and	No
D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.	No

Are the requirements for Multi-Way Stop Satisfied?: Yes

AUTOCALC table Each hour is individually checked and tallied if "met"								
Lanes Major/ Minor	**ADJUSTED VOLUMES**		**Condition C.1**		**Condition C.2**		**Condition D**	
	MAJOR	**MINOR**	**100%**		**70%**		**80%**	
			MAJ.	**MIN.**	**MAJ.**	**MIN.**	**MAJ.**	**MIN.**
Required Volumes			300	200	210	140	240	160
6:00 AM	0	0						
6:15 AM	91	16						
6:30 AM	189	33						
6:45 AM	302	50	1		1		1	
7:00 AM	395	68						
7:15 AM	376	71						
7:30 AM	347	66						
7:45 AM	311	64	1		1		1	
8:00 AM	292	60						
8:15 AM	287	55						
8:30 AM	280	57						
8:45 AM	268	54			1		1	
9:00 AM	280	58						
9:15 AM	291	59						
9:30 AM	310	59	1					
9:45 AM	317	53			1		1	
10:00 AM	317	44						
10:15 AM	326	46						
10:30 AM	326	41	1					
10:45 AM	329	45			1		1	
11:00 AM	314	44						
11:15 AM	303	47						
11:30 AM	300	50	1					
11:45 AM	330	61			1		1	
12:00 PM	341	59						
12:15 PM	352	52						
12:30 PM	382	49	1					
12:45 PM	369	46			1		1	
1:00 PM	381	44						
1:15 PM	416	44						
1:30 PM	408	51	1					
1:45 PM	432	59			1		1	
2:00 PM	466	60						
2:15 PM	453	65						
2:30 PM	483	58	1					
2:45 PM	467	57			1		1	
3:00 PM	458	62						
3:15 PM	467	79						
3:30 PM	466	78	1					
3:45 PM	496	88			1		1	
4:00 PM	491	91						
4:15 PM	502	90						
4:30 PM	493	95	1					
4:45 PM	464	87			1		1	
5:00 PM	428	71						
5:15 PM	402	63						
5:30 PM	367	55	1					

5:45 PM	337	51			1		1	
6:00 PM	325	47						
6:15 PM	222	35						
6:30 PM	137	26						
6:45 PM	66	11						
7:00 PM	0	0						
7:15 PM	0	0						
7:30 PM	0	0						
7:45 PM	0	0						
8:00 PM	0	0						
8:15 PM	0	0						
8:30 PM	0	0						
8:45 PM	0	0						
9:00 PM	0	0						
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9:30 PM	0	0						
9:45 PM	0	0						
10:00 PM	0	0						
10:15 PM	0	0						
10:30 PM	0	0						
10:45 PM	0	0						
11:00 PM	0	0						
11:15 PM	0	0						
11:30 PM	0	0						
11:45 PM	0	0						
HOURS MET			**11**	**0**	**12**	**0**	**12**	**0**
CONDITION SATISFIED?			**NO**		**NO**		**NO**	

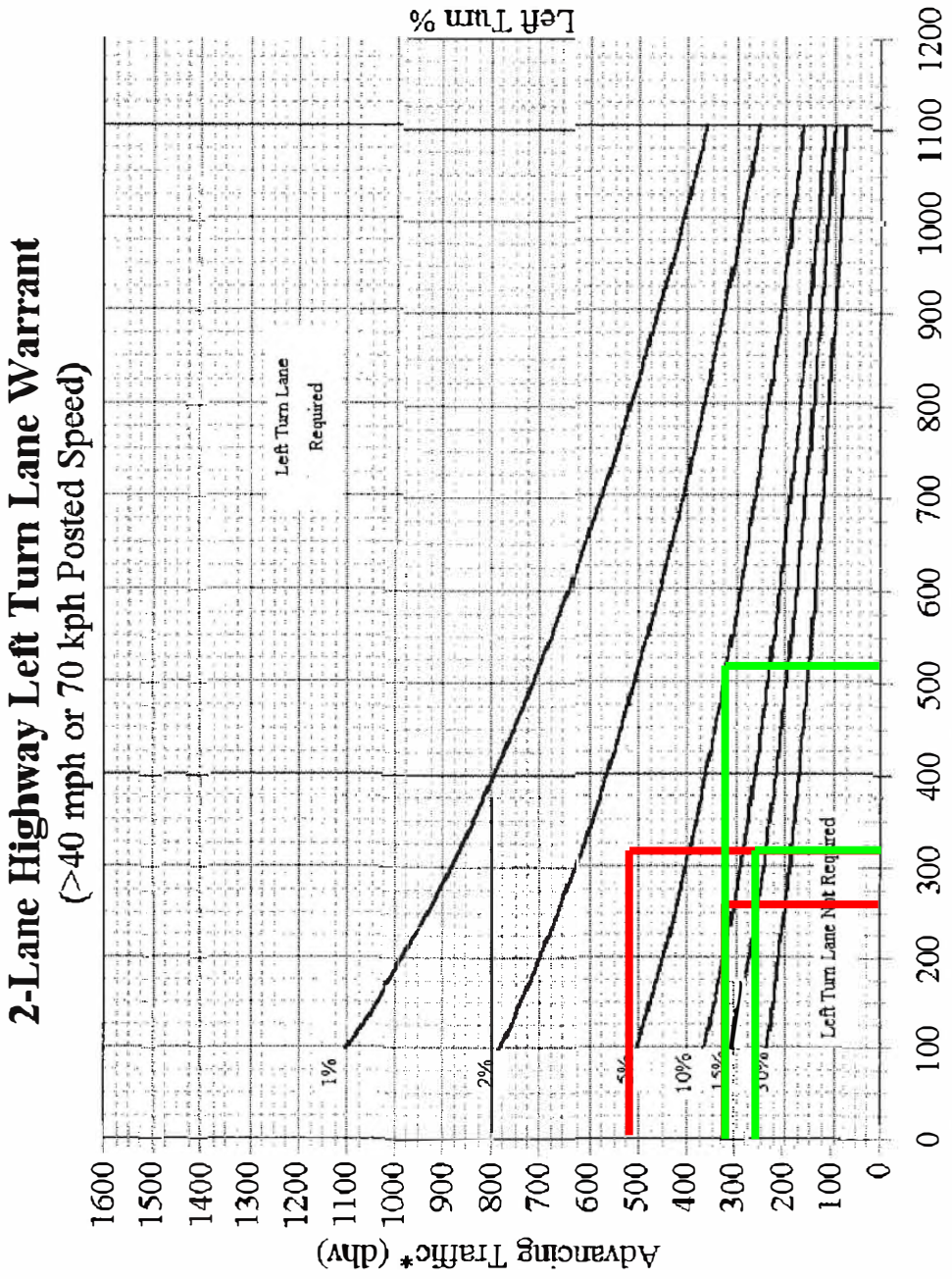
Appendix F

Turn Lane Warrant Analysis Results

2-LANE LEFT TURN LANE WARRANT (HIGH SPEED)

401-5b

REFERENCE SECTION
401.6.1



Scenario		Advancing Traffic	Opposing Traffic	Left Turn %	Warrant Met
SR21 and SR 212 Northbound LT Lane	2050 AM	320	260	25%	Yes
	2050 PM	520	320	21%	Yes
SR21 and SR 212 Southbound LT Lane	2050 AM	260	320	4%	No
	2050 PM	320	520	3%	No

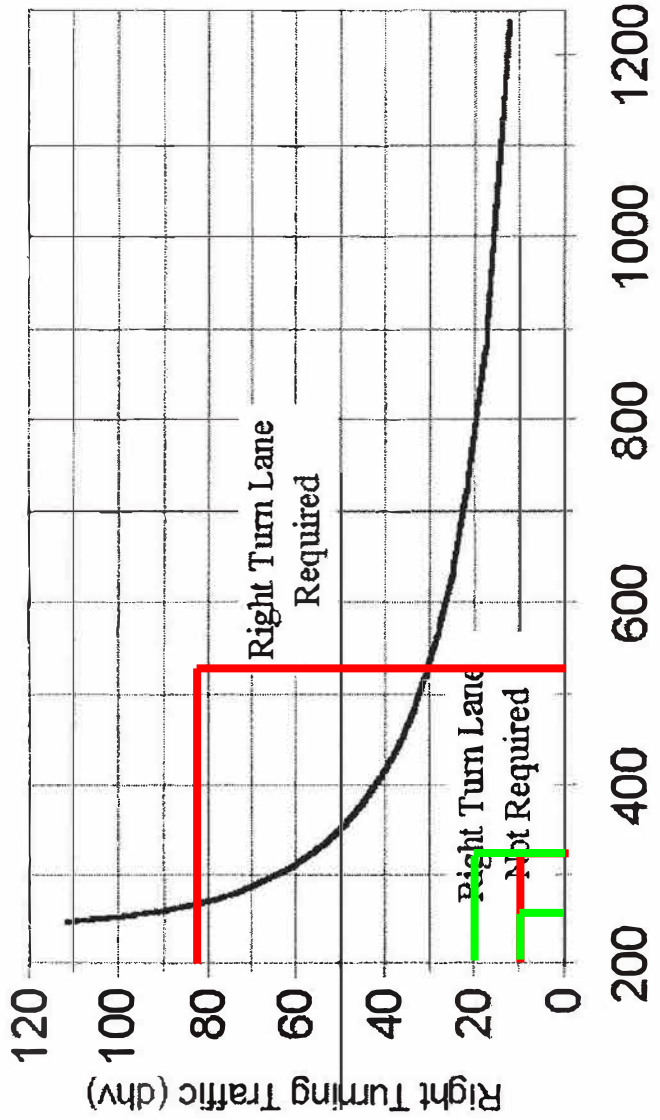
2-LANE RIGHT TURN LANE WARRANT (HIGH SPEED)

401-6b

REFERENCE SECTION
401.6.3

2-Lane Highway Right Turn Lane Warrant

> 40 mph or 70 kph Posted Speed



*Includes Right Turns

Scenario		Advancing Traffic	Right Turning	Warrant Met
SR 21 and SR 212 Northbound RT Lane	2050 AM	320	10	No
	2050 PM	520	90	Yes
SR 21 and SR 212 Southbound RT Lane	2050 AM	260	10	No
	2050 PM	320	20	No

Appendix G

Turn Lane Length Analysis Results

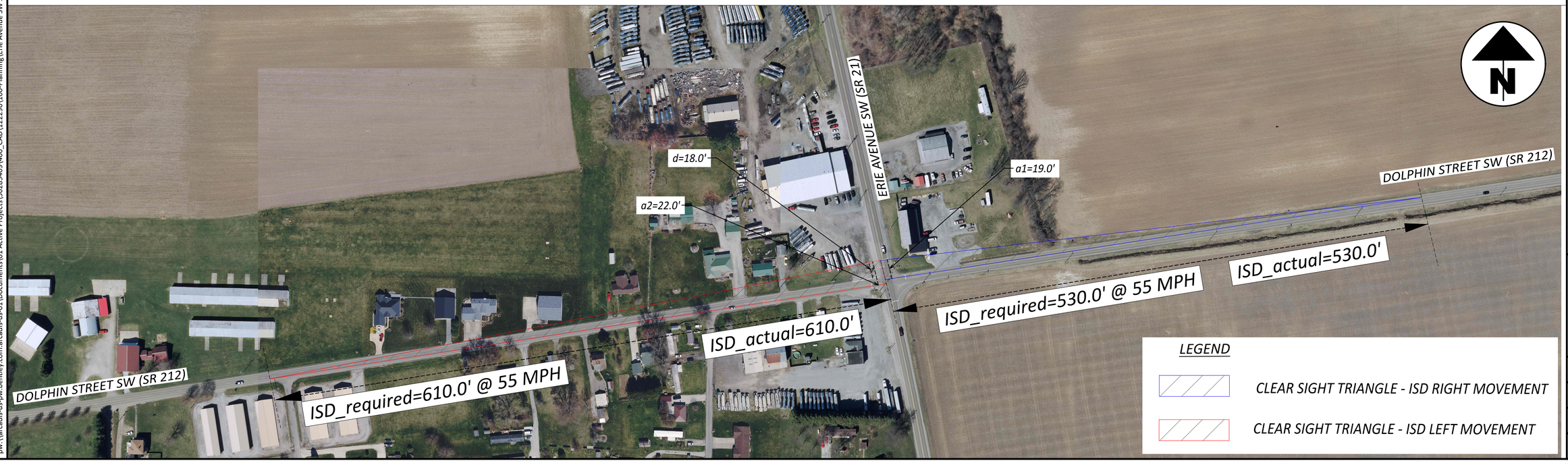
Turn Lane Length Calculation

Major Road	Minor Road	Intersection Type	Movement	Dual Left/Right Turn	Approach Lane Configuration	AM Proposed Turn Lane Length w/o Taper (ft.)	PM Proposed Turn Lane Length w/o Taper (ft.)	Proposed Turn Lane Length w/o Taper (ft.)	Existing Turn Lane Length w/o Taper (ft.)
SR 21	SR 212	Unsignalized	NBL	No	LTR	195	195	195	0
			NBR	No	LTR	/	195	195	0

Appendix H

Intersection Sight Distance Check Diagrams





HORIZONTAL SCALE IN FEET
0 50 100 150

INTERSECTION SIGHT DISTANCE - ERIE AVE SW (SR 21) & DOLPHIN ST SW (SR 212)

CTY-RTE-SECTION

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DESIGN AGENCY
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1111 SUPERIOR AVENUE SUITE 1300
CLEVELAND, OHIO 44114
(216) 781-5177
www.arcadis.com

DESIGNER A. VASHI
REVIEWER TBD 0
PROJECT ID 0
SHEET 0 TOTAL 0

HORIZONTAL SCALE IN FEET
0 50 100 150

INTERSECTION SIGHT DISTANCE - ERIE AVE SW (SR 21) & DOLPHIN ST SW (SR 212)

CTY-RTE-SECTION

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DESIGNER: A. VASHI
REVIEWER: TBD 0
PROJECT ID: 0
SHEET 0 TOTAL 0

Appendix I

Alternative Conceptual Schematics

ERIE AVENUE SW (SR 21) & DOLPHIN STREET SW (SR 212) - TRUCK TURN

CTY-RTE-SECTION

HORIZONTAL SCALE IN FEET
0 60 120 180

INSTALL W3-1 WARNING SIGN AS PER OMUTCD & ODOT L&D VOL. 1

DOLPHIN ST

EXISTING POLE & POWER LINE

495'

UPDATE PAVEMENT MARKING TO SOLID DOUBLE YELLOW CENTERLINE

ADD R1-3P

EXISTING STOP AHEAD SIGN TO REMAIN

ERIE AVE

MAINTAIN EXISTING OVERHEAD FLASHING LIGHT; REPLACE YELLOW LENSES FACING ERIE AVENUE SW (SR 21) WITH RED LENSES

STOP

ALL WAY

R=30'

Ex R/W

DOLPHIN STREET SW (SR 212)
LEGAL SPEED LIMIT = 55 MPH

2'

10'

11'

PROVIDE LANDSCAPING FOR WB-40 TRUCK TURN

ERIE AVENUE SW (SR 21)
LEGAL SPEED LIMIT = 55 MPH



NOTES:
1) R/W LINES ARE APPROXIMATE BASED ON THE STARK AND TUSCARAWAS COUNTY AUDITOR WEBSITES
2) UTILITIES ARE APPROXIMATE BASED ON GOOGLE STREET VIEW

LEGEND

- SEEDING
- REMOVE EXISTING PAVEMENT
- APPROX. WORK LIMITS

DESIGN AGENCY
ARCADIS
7575 HUNTINGTON PARK DR, STE 100
COLUMBUS, OHIO 43235
614.985.4999
www.arcadis.com

DESIGNER: A. VASHI
REVIEWER: TBD 0
PROJECT ID: 122290
SHEET 0 TOTAL 0

INSTALL W3-1 WARNING SIGN AS PER OMUTCD & ODOT L&D VOL. 1

DOLPHIN ST

EXISTING POLE & POWER LINE

495'

UPDATE PAVEMENT MARKING TO SOLID DOUBLE YELLOW CENTERLINE

ADD R1-3P

EXISTING STOP AHEAD SIGN TO REMAIN

ERIE AVE

MAINTAIN EXISTING OVERHEAD FLASHING LIGHT; REPLACE YELLOW LENSES FACING ERIE AVENUE SW (SR 21) WITH RED LENSES

STOP

ALL WAY

R=30'

Ex R/W

2'

10'

11'

DOLPHIN STREET SW (SR 212)
LEGAL SPEED LIMIT = 55 MPH

PROVIDE LANDSCAPING FOR WB-40 TRUCK TURN

INSTALL W3-1 WARNING SIGN AS PER OMUTCD & ODOT L&D VOL. 1

ERIE AVENUE SW (SR 21)
LEGAL SPEED LIMIT = 55 MPH

NOTES:
1) R/W LINES ARE APPROXIMATE BASED ON THE STARK AND TUSCARAWAS COUNTY AUDITOR WEBSITES
2) UTILITIES ARE APPROXIMATE BASED ON GOOGLE STREET VIEW

LEGEND

- SEEDING
- REMOVE EXISTING PAVEMENT
- APPROX. WORK LIMITS

HORIZONTAL SCALE IN FEET
0 60 120 180

ERIE AVENUE SW (SR 21) & DOLPHIN STREET SW (SR 212) - TRUCK TURN

CTY-RTE-SECTION

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614.846.5960
www.arcadis.com

DESIGNER
A. VASHI

REVIEWER
TBD 0

PROJECT ID
122290

SHEET 0 TOTAL 0

STW SAFETY STUDIES 2025 - 4

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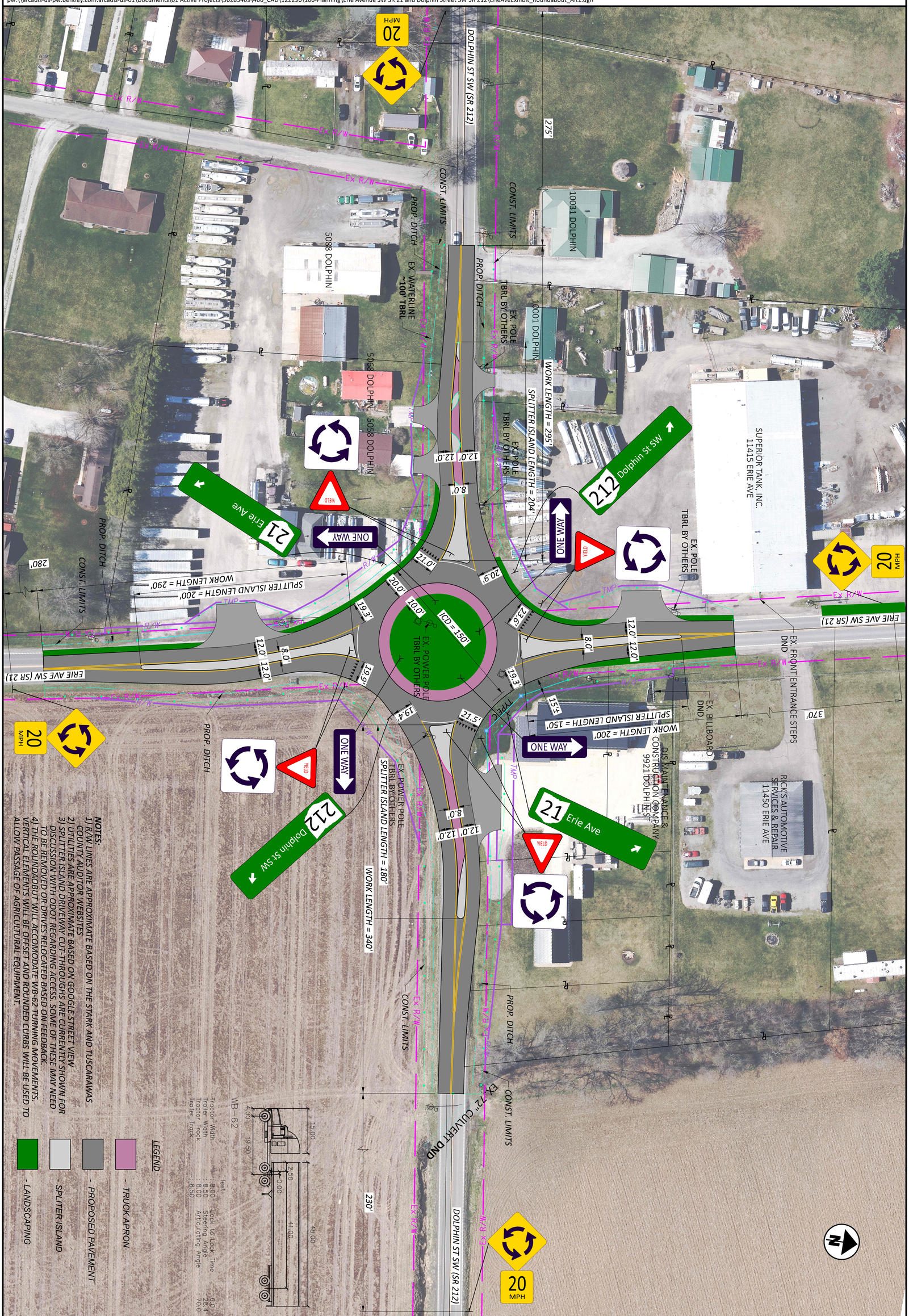

NOTES:

1) R/W LINES ARE APPROXIMATE BASED ON THE STARK AND TUSCARAWAS COUNTY AUDITOR WEBSITES
2) UTILITIES ARE APPROXIMATE BASED ON GOOGLE STREET VIEW.
3) SPLITTER ISLAND DRIVEWAY CUT-THROUGHS ARE CURRENTLY SHOWN FOR DISCUSSION WITH ODOT REGARDING ACCESS. SOME OF THESE MAY NEED TO BE REMOVED OR DRIVES RELOCATED BASED ON FEEDBACK.
4) THE ROUNDABOUT WILL ACCOMODATE WB-62 TURNING MOVEMENTS. VERTICAL ELEMENTS WILL BE OFFSET AND ROUNDED CURBS WILL BE USED TO ALLOW PASSAGE OF AGRICULTURAL EQUIPMENT.

LEGEND

- LANDSCAPING
- SPLITTER ISLAND
- PROPOSED PAVEMENT
- TRUCK APRON

SHEET	TOTAL
P.0	0

PROJECT ID: 0

REVIEWER: XXX MM-DD-YY

DESIGNER: SRO

ARCADIS
4665 CORNELL RD, STE 200
CINCINNATI, OHIO 45241
(513) 985-8025
www.arcadis.com

DESIGN AGENCY

PRELIMINARY ROUNDABOUT - ERIE (SR 21) & DOLPHIN (SR 212) - ALT 1

HORIZONTAL SCALE IN FEET

0 40
20 80

STW SAFETY STUDIES 2025 - 4

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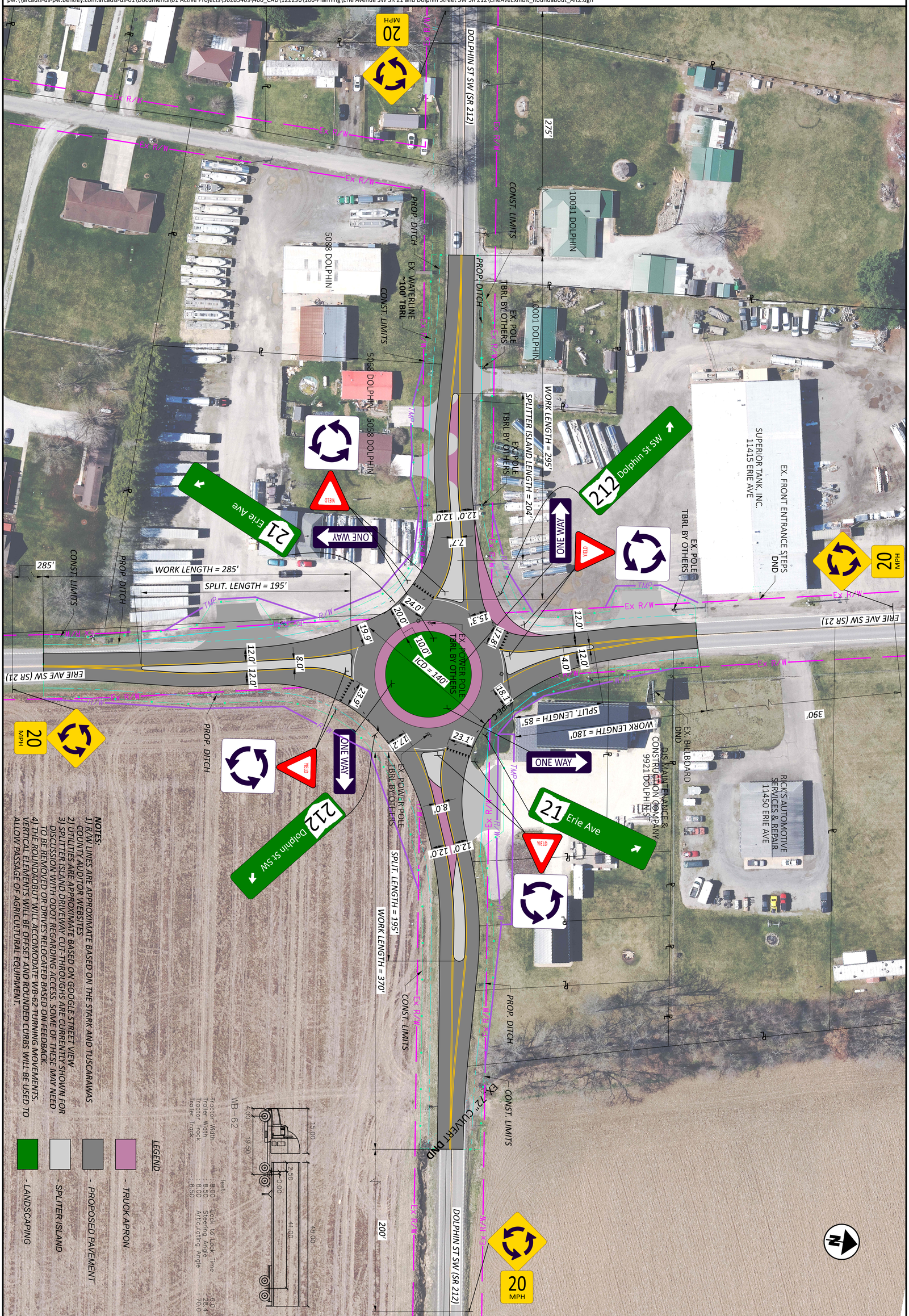


NOTES:

1) R/W LINES ARE APPROXIMATE BASED ON GOOGLE STREET VIEW, COUNTY AUDITOR WEBSITES
2) UTILITIES ARE APPROXIMATE BASED ON GOOGLE STREET VIEW
3) SPLITTER ISLAND DRIVEWAY CUT-THROUGHS ARE CURRENTLY SHOWN FOR DISCUSSION WITH ODOT REGARDING ACCESS. SOME OF THESE MAY NEED TO BE REMOVED OR DRIVES RELOCATED BASED ON FEEDBACK.
4) THE ROUNDABOUT WILL ACCOMODATE WB-62 TURNING MOVEMENTS. VERTICAL ELEMENTS WILL BE OFFSET AND ROUNDED CURBS WILL BE USED TO ALLOW PASSAGE OF AGRICULTURAL EQUIPMENT.

LEGEND

- LANDSCAPING
- SPLITTER ISLAND
- PROPOSED PAVEMENT
- TRUCK APRON

	feet
Tractor Width	8.00
Tractor Lock to Lock Time	6.0
Trailer Width	8.00
Design Speed	25.0
Tractor Track	8.00
Articulating Angle	70.0
Trailer Track	8.50

SHEET	TOTAL
P.0	0

PROJECT ID: 0

REVIEWER: XXX MM-DD-YY

DESIGNER: SRO

DESIGN AGENCY: ARCADIS
4665 CORNELL RD, STE 200
CINCINNATI, OHIO 45241
(513) 985-8025
www.arcadis.com

PRELIMINARY ROUNDABOUT - ERIE (SR 21) & DOLPHIN (SR 212) - ALT 2

HORIZONTAL SCALE IN FEET
0 40
20 80



SHEET P.0 | TOTAL 0	PROJECT ID 0	DESIGNER SRO	ARCADIS 4665 CORNELL RD, STE 200 CINCINNATI, OHIO 45241 (513) 985-8025 www.arcadis.com	DESIGN AGENCY	PRELIMINARY ROUNDABOUT - ERIE (SR 21) & DOLPHIN (SR 212) - ALT 2
	XXX MM-DD-YY	REVIEWER			HORIZONTAL SCALE IN FEET 0 40 20 80

Appendix J

Detailed Cost Estimates

Estimate Erie1

Estimated Cost:$18,589.05

Contingency: 2.50%

Estimated Total: $19,053.78

Erie Ave. and Dolphin St. AWS
2.5% Inflation to Fall 2026

Base Date: 03/12/26

Spec Year: 23

Unit System: E

Work Type: ASPHALT

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SPRING

County:

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District:

Federal/State Project Number:

Prepared by System Administrator

Line #	Item Number	Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
Group 0010: Items of Work						
0069	202E23000	PAVEMENT REMOVED	137.000	SY	$33.18536	$4,546.39
0070	630E80100	SIGN, FLAT SHEET	65.000	SF	$24.26262	$1,577.07
0071	630E03100	GROUND MOUNTED SUPPORT, NO. 3 POST	156.000	FT	$16.01024	$2,497.60
0072	614E11000	MAINTAINING TRAFFIC	1.000	LS	$2,500.00000	$2,500.00
0073	624E10000	MOBILIZATION	1.000	LS	$1,000.00000	$1,000.00
0074	642E00500	STOP LINE, TYPE 1	24.000	FT	$6.99968	$167.99
0075	690E21000	SPECIAL - *25% Design Contingency*	1.000	LS	$4,000.00000	$4,000.00
0076	632E04000	VEHICULAR SIGNAL HEAD, MISC.: *Replace Lenses*	4.000	EACH	$75.00000	$300.00
0077	642E50040	PAVEMENT MARKING, MISC.: *Project Pvt. Markings*	1.000	LS	$2,000.00000	$2,000.00

Total for Group 0010:$18,589.05

Estimate Erie3

Estimated Cost:$2,705,459.33

Contingency: 19.70%

Estimated Total: $3,238,434.82

Erie Ave. and Dolphin St. Roundabout Alt 2
19.7% Inflation to Summer 2031

Base Date: 03/30/26

Spec Year: 23

Unit System: E

Work Type: ASPHALT

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SPRING

County:

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District:

Federal/State Project Number:

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 0100: Roadway

0068	201E11000 CLEARING AND GRUBBING	1.000	LS	$5,000.00000	$5,000.00
0069	202E23000 PAVEMENT REMOVED	5,221.000	SY	$13.39200	$69,919.63
0070	202E35100 PIPE REMOVED, 24" AND UNDER	266.000	FT	$26.72956	$7,110.06
0071	202E58100 CATCH BASIN REMOVED	2.000	EACH	$679.94810	$1,359.90
0072	203E10000 EXCAVATION	3,000.000	CY	$24.50899	$73,526.97
0073	203E20000 EMBANKMENT	2,000.000	CY	$22.04009	$44,080.18
0074	206E15020 CEMENT STABILIZED SUBGRADE, 14 INCHES DEEP	6,083.000	SY	$3.97912	$24,204.99
0075	690E50350 SPECIAL - MAILBOX REMOVED AND RESET	3.000	EACH	$274.80227	$824.41

Total for Group 0100:$226,026.14

Group 0200: Erosion Control

0014	601E21050 TIED CONCRETE BLOCK MAT WITH TYPE 1 UNDERLAYMENT	35.000	SY	$151.61696	$5,306.59
0015	659E00300 TOPSOIL	447.000	CY	$45.23071	$20,218.13
0023	832E30000 EROSION CONTROL	30,000.000	EACH	$1.07706	$32,311.80
0078	832E15000 STORM WATER POLLUTION PREVENTION PLAN	1.000	LS	$3,000.00000	$3,000.00
0079	832E15010 STORM WATER POLLUTION PREVENTION INSPECTION SOFTWARE	1.000	LS	$3,500.00000	$3,500.00
0080	832E15002 STORM WATER POLLUTION PREVENTION INSPECTIONS	1.000	LS	$5,000.00000	$5,000.00

Total for Group 0200:$69,336.52

Group 0300: Drainage

0024	605E14000	2,876.000	FT	$14.87599	$42,783.35

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	6" BASE PIPE UNDERDRAINS				
0025	611E04400 12" CONDUIT, TYPE B	200.000	FT	$138.20431	$27,640.86
0026	611E04600 12" CONDUIT, TYPE C	92.000	FT	$119.13987	$10,960.87
0027	611E04900 12" CONDUIT, TYPE D	390.000	FT	$100.61436	$39,239.60
0028	611E98450 CATCH BASIN, NO. 2-2A	2.000	EACH	$3,371.48408	$6,742.97

Total for Group 0300:$127,367.65

Group 0400: Pavement

0029	301E56000 ASPHALT CONCRETE BASE, PG64-22, (449) , 7"	1,043.000	CY	$193.37072	$201,685.66
0030	304E20000 AGGREGATE BASE , 6"	1,014.000	CY	$83.58192	$84,752.07
0031	407E20000 NON-TRACKING TACK COAT	575.000	GAL	$3.23993	$1,862.96
0032	441E70500 ASPHALT CONCRETE SURFACE COURSE, TYPE 1, (449), (DRIVEWAYS)	28.000	CY	$408.94855	$11,450.56
0033	442E22100 ASPHALT CONCRETE SURFACE COURSE, 12.5 MM, TYPE A (449) , 1.5"	201.000	CY	$316.99990	$63,716.98
0034	442E22300 ASPHALT CONCRETE INTERMEDIATE COURSE, 12.5 MM, TYPE A (449) , 1.75"	234.000	CY	$280.01949	$65,524.56
0035	452E13010 9" NON-REINFORCED CONCRETE PAVEMENT, CLASS QC 1P	1,269.000	SY	$87.15367	$110,598.01
0036	609E18000 COMBINATION CURB AND GUTTER, TYPE 3	2,364.000	FT	$32.00000	$75,648.00
0037	609E26000 CURB, TYPE 6	424.000	FT	$39.97904	$16,951.11
0038	609E31000 COMBINATION CURB AND GUTTER, TYPE 9	1,945.000	FT	$27.83346	$54,136.08

Total for Group 0400:$686,325.99

Group 0700: Lighting

Line #	Item Number	Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0039	625E98200	LIGHTING, MISC.: *Project Lighting*	1.000	LS	$150,000.00000	$150,000.00

Total for Group 0700:$150,000.00

Group 1100: Traffic Control

0054	630E03100	GROUND MOUNTED SUPPORT, NO. 3 POST	560.000	FT	$13.84314	$7,752.16
0055	630E08600	SIGN POST REFLECTOR	9.000	EACH	$43.72953	$393.57
0056	630E80100	SIGN, FLAT SHEET	230.000	SF	$22.59340	$5,196.48
0057	630E84900	REMOVAL OF GROUND MOUNTED SIGN AND DISPOSAL	28.000	EACH	$19.21954	$538.15
0058	644E00104	EDGE LINE, 6"	0.313	MILE	$3,720.69247	$1,164.58
0059	644E00300	CENTER LINE	0.128	MILE	$8,243.37398	$1,055.15
0060	644E20800	YIELD LINE	86.000	FT	$15.15051	$1,302.94

Total for Group 1100:$17,403.03

Group 1300: Landscaping

0061	661E99000	SPECIAL - LANDSCAPING	1.000	LS	$20,000.00000	$20,000.00

Total for Group 1300:$20,000.00

Group 2300: Incidentals

0064	614E11000	MAINTAINING TRAFFIC	1.000	LS	$200,000.00000	$200,000.00
0066	623E10000	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1.000	LS	$25,000.00000	$25,000.00
0067	624E10000	MOBILIZATION	1.000	LS	$100,000.00000	$100,000.00
0076	690E21000	SPECIAL - *30% Design Contingency*	1.000	LS	$400,000.00000	$400,000.00
0081	690E21000	SPECIAL -	1.000	LS	$84,000.00000	$84,000.00

Line #	Item Number	Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
		RW Costs				
0082	690E21000	SPECIAL -	1.000	LS	$500,000.00000	$500,000.00
		PE Environmental				
0083	690E21000	SPECIAL -	1.000	LS	$100,000.00000	$100,000.00
		PE Detailed Design				

Total for Group 2300:$1,409,000.00

Appendix K

ECAT Spreadsheet

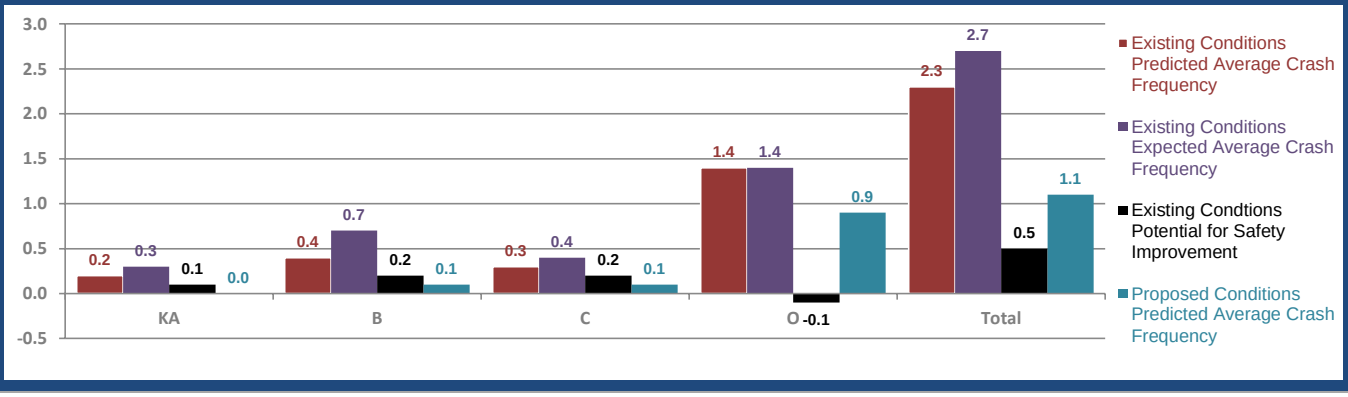
Project Safety Performance Report

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Summary of Anticipated Safety Performance of the Project (average crashes/year)



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
$N_{predicted}$ - Existing Conditions	0.1756	0.4257	0.2836	1.4096	2.2945
$N_{expected}$ - Existing Conditions	0.2754	0.6678	0.4447	1.3586	2.7465
$N_{potential\ for\ improvement}$ - Existing Conditions	**0.0998**	**0.2421**	**0.1611**	-0.0510	**0.4520**
$N_{expected}$ - Proposed Conditions	0.0268	0.1475	0.0852	0.8721	1.1316

Project Safety Performance Report

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Existing Conditions Project Element Predicted Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR21: 1.47	Erie Avenue and Dolphin Street	0.1756	0.4257	0.2836	1.4096	2.2945

Project Safety Performance Report

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Existing Conditions Project Element Expected Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR21: 1.47	Erie Avenue and Dolphin Street	0.2754	0.6678	0.4447	1.3586	2.7465

Project Safety Performance Report

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Existing Conditions Project Element Potential for Safety Improvement Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR21: 1.47	Erie Avenue and Dolphin Street	0.0998	0.2421	0.1611	-0.051	0.452

Project Safety Performance Report

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Proposed Conditions Project Element Predicted Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR21: 1.47	Erie Avenue and Dolphin Street	0.0268	0.1475	0.0852	0.8721	1.1316

ECAT
Economic Crash Analysis Tool

Project Safety Performance Report

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Predicted Crash Frequency
Unknown	0.0092	0.0103	**0.0011**	0.0063
Head On	0.0201	0.0276	**0.0075**	0.0150
Rear End	0.4882	0.5674	**0.0792**	0.1220
Backing	0.0900	0.0897	-0.0003	0.0937
Sideswipe - Meeting	0.0667	0.0815	**0.0148**	0.0012
Sideswipe - Passing	0.1027	0.1141	**0.0114**	0.0607
Angle	0.8836	1.1213	**0.2377**	0.4525
Parked Vehicle	0.0800	0.0826	**0.0026**	0.0561
Pedestrian	0.0117	0.0172	**0.0055**	0.0064
Animal	0.0000	0.0000	0.0000	0.0954
Train	0.0004	0.0005	**0.0001**	0.0006
Pedalcycles	0.0087	0.0122	**0.0035**	0.0036
Other Non-Vehicle	0.0002	0.0003	**0.0001**	0.0000
Fixed Object	0.3823	0.4384	**0.0561**	0.1954
Other Object	0.0132	0.0136	**0.0004**	0.0167
Overturning	0.0236	0.0321	**0.0085**	0.0088
Other Non-Collision	0.0299	0.0319	**0.0020**	0.0209
Left Turn	0.0840	0.1058	**0.0218**	0.0364
Right Turn	0.0000	0.0000	0.0000	0.0353

Safety Benefit - Cost Analysis

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Select Site Types to be used in Benefit-Cost Analysis:

All Sites

Comments:

Countermeasure Service Lives, Costs, and Safety Benefits

Countermeasures	Service Life (Years)	Initial Cost of Countermeasure	Annual Maintenance & Energy Costs	Salvage Value	Net Present Cost of Countermeasure	Total Cost of Countermeasures	Summary of Annual Crash Modifications	Net Present Value of Safety Benefits
Site Characteristic Improvements (i.e. Lane widening)	10	$0.00			$0.00	$0.00	-1.163	$910,871
Site Characteristic Improvements (i.e. Lighting)		$0.00			$0.00	$0.00		
Site Characteristic Improvements (i.e. Signal Phasing)		$0.00			$0.00	$0.00		
Site Characteristic Improvements (i.e. Added Right Turn Lane)		$0.00			$0.00	$0.00		
AWSC	10	$19,053.78			$19,053.78	$19,053.78	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
Totals		**$19,053.78**	**$0.00**	**$0.00**	**$19,053.78**	**$19,053.78**	**-1.163**	**$910,871**

Safety Benefit - Cost Analysis

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Benefit - Cost Calculator

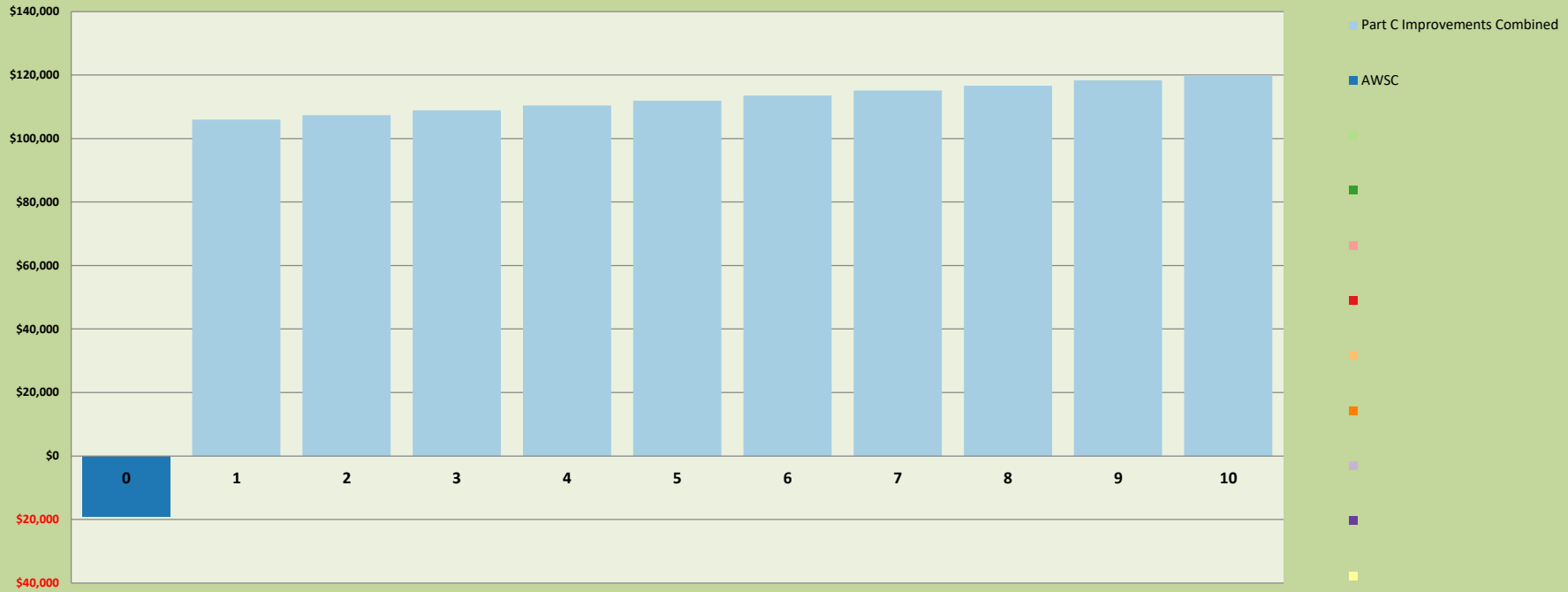
Net Present Value of Project	$19,053.78
Net Present Value of Safety Benefits	$910,871.18
Net Benefit	$891,817.40
Benefit / Cost Ratio	47.81

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.149
Number of Injury Crashes	-0.625
Number of Total Crashes	-1.163

Comments:

Safety Benefits and Project Costs Combined Cash Flows By Countermeasure Per Year



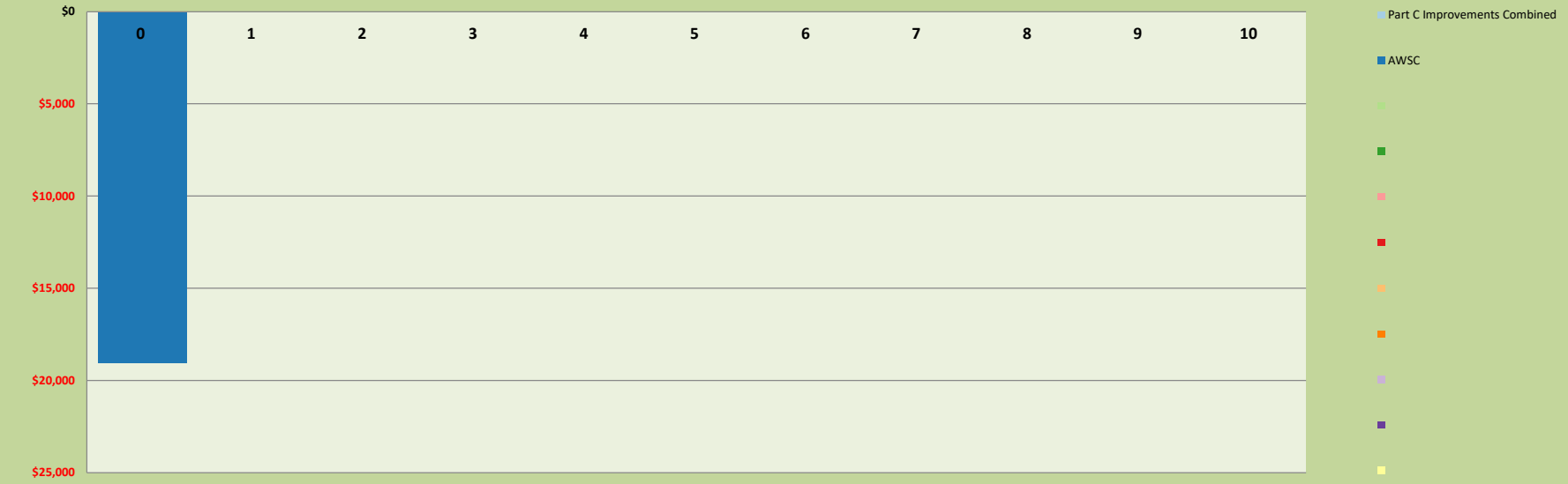
Safety Benefit - Cost Analysis

ECAT Economic Crash Analysis Tool

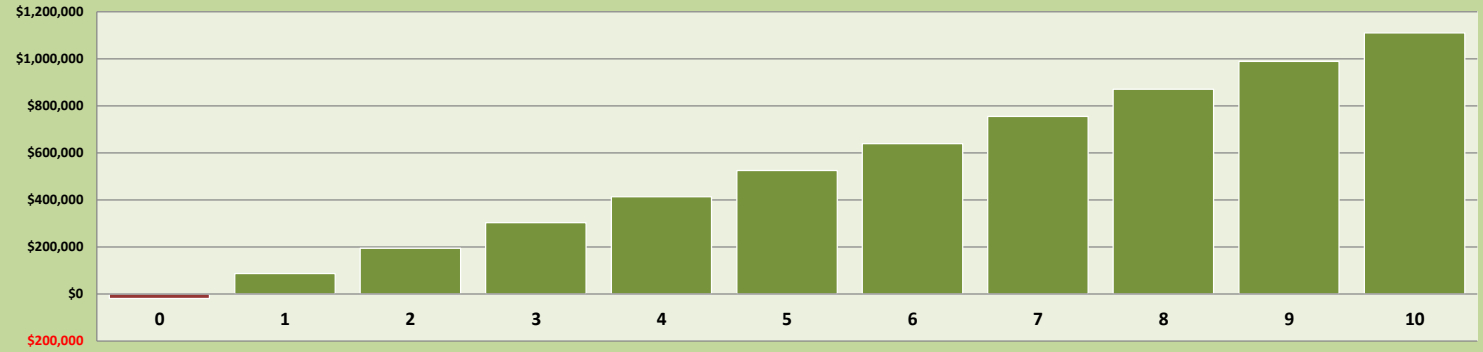
General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



First year to observe a positive return on investiment: 2051 (1 years)

Percentage of Service Life to observe a continuous Positive Return on Investment: 100.00%

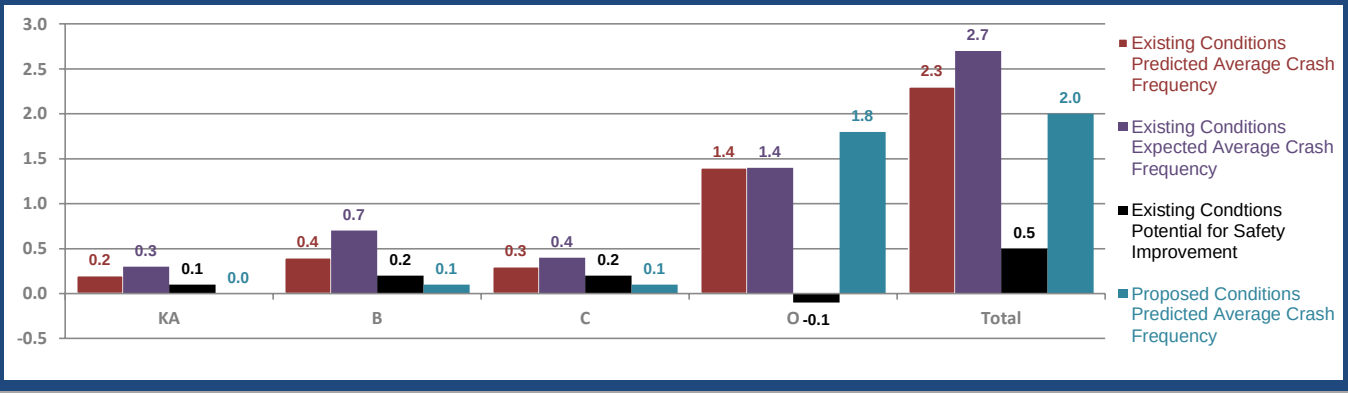
Project Safety Performance Report

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Summary of Anticipated Safety Performance of the Project (average crashes/year)



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
$N_{predicted}$ - Existing Conditions	0.1756	0.4257	0.2836	1.4096	2.2945
$N_{expected}$ - Existing Conditions	0.2754	0.6678	0.4447	1.3586	2.7465
$N_{potential\ for\ improvement}$ - Existing Conditions	**0.0998**	**0.2421**	**0.1611**	-0.0510	**0.4520**
$N_{expected}$ - Proposed Conditions	0.0084	0.0705	0.0870	1.8296	1.9955

Project Safety Performance Report

ECAT Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Existing Conditions Project Element Predicted Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR21: 1.47	Erie Avenue and Dolphin Street	0.1756	0.4257	0.2836	1.4096	2.2945

Project Safety Performance Report

ECAT Economic Crash Analysis Tool

General Information

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Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Existing Conditions Project Element Expected Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR21: 1.47	Erie Avenue and Dolphin Street	0.2754	0.6678	0.4447	1.3586	2.7465

Project Safety Performance Report

ECAT Economic Crash Analysis Tool

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Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Existing Conditions Project Element Potential for Safety Improvement Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR21: 1.47	Erie Avenue and Dolphin Street	0.0998	0.2421	0.1611	-0.051	0.452

Project Safety Performance Report

ECAT
Economic Crash Analysis Tool

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Proposed Conditions Project Element Predicted Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR21: 1.47	Erie Avenue and Dolphin Street	0.0084	0.0705	0.087	1.8296	1.9955

ECAT
Economic Crash Analysis Tool

Project Safety Performance Report

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Predicted Crash Frequency
Unknown	0.0092	0.0103	**0.0011**	0.0570
Head On	0.0201	0.0276	**0.0075**	0.0017
Rear End	0.4882	0.5674	**0.0792**	0.3039
Backing	0.0900	0.0897	-0.0003	0.0185
Sideswipe - Meeting	0.0667	0.0815	**0.0148**	0.0000
Sideswipe - Passing	0.1027	0.1141	**0.0114**	0.6266
Angle	0.8836	1.1213	**0.2377**	0.5628
Parked Vehicle	0.0800	0.0826	**0.0026**	0.0000
Pedestrian	0.0117	0.0172	**0.0055**	0.0017
Animal	0.0000	0.0000	0.0000	0.0202
Train	0.0004	0.0005	**0.0001**	0.0000
Pedalcycles	0.0087	0.0122	**0.0035**	0.0017
Other Non-Vehicle	0.0002	0.0003	**0.0001**	0.0000
Fixed Object	0.3823	0.4384	**0.0561**	0.2015
Other Object	0.0132	0.0136	**0.0004**	0.0000
Overturning	0.0236	0.0321	**0.0085**	0.0017
Other Non-Collision	0.0299	0.0319	**0.0020**	0.0387
Left Turn	0.0840	0.1058	**0.0218**	0.0437
Right Turn	0.0000	0.0000	0.0000	0.1360

ECAT
Economic Crash Analysis Tool

Safety Benefit - Cost Analysis

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Select Site Types to be used in Benefit-Cost Analysis:

All Sites

Comments:

Countermeasure Service Lives, Costs, and Safety Benefits

Countermeasures	Service Life (Years)	Initial Cost of Countermeasure	Annual Maintenance & Energy Costs	Salvage Value	Net Present Cost of Countermeasure	Total Cost of Countermeasures	Summary of Annual Crash Modifications	Net Present Value of Safety Benefits
Site Characteristic Improvements (i.e. Lane widening)	25	$0.00			$0.00	$0.00	-0.299	$2,178,186
Site Characteristic Improvements (i.e. Lighting)		$0.00			$0.00	$0.00		
Site Characteristic Improvements (i.e. Signal Phasing)		$0.00			$0.00	$0.00		
Site Characteristic Improvements (i.e. Added Right Turn Lane)		$0.00			$0.00	$0.00		
Single Lane Roundabout	25	$3,238,434.82			$3,238,434.82	$3,238,434.82	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
		$0.00			$0.00	$0.00	0.000	$0
Totals		**$3,238,434.82**	**$0.00**	**$0.00**	**$3,238,434.82**	**$3,238,434.82**	**-0.299**	**$2,178,186**

ECAT
Economic Crash Analysis Tool

Safety Benefit - Cost Analysis

General Information

Project Name	ODOT Statewide Safety Studies	Contact Email	qingyi.ai@arcadis.com
Project Description	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)	Contact Phone	
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Benefit - Cost Calculator

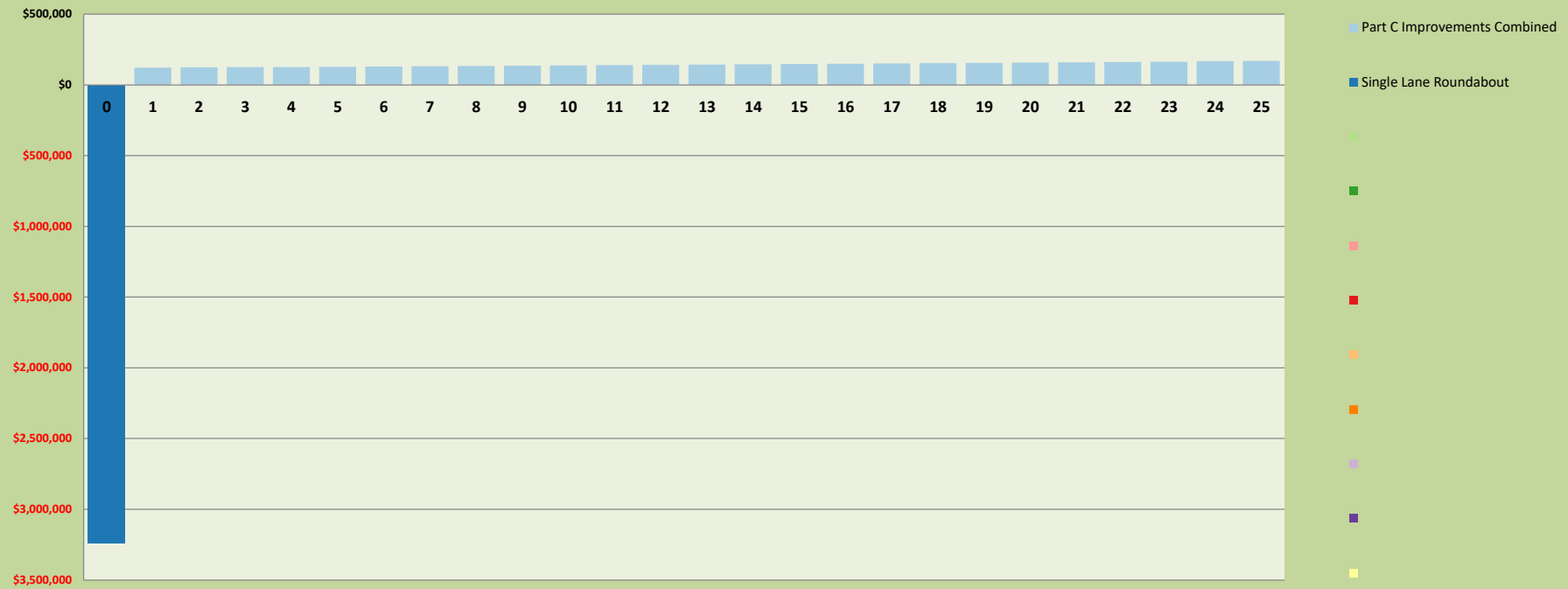
Net Present Value of Project	$3,238,434.82
Net Present Value of Safety Benefits	$2,178,186.04
Net Benefit	($1,060,248.78)
Benefit / Cost Ratio	0.67

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.167
Number of Injury Crashes	-0.719
Number of Total Crashes	-0.299

Comments:

Safety Benefits and Project Costs Combined Cash Flows By Countermeasure Per Year



Safety Benefit - Cost Analysis

ECAT Economic Crash Analysis Tool

General Information

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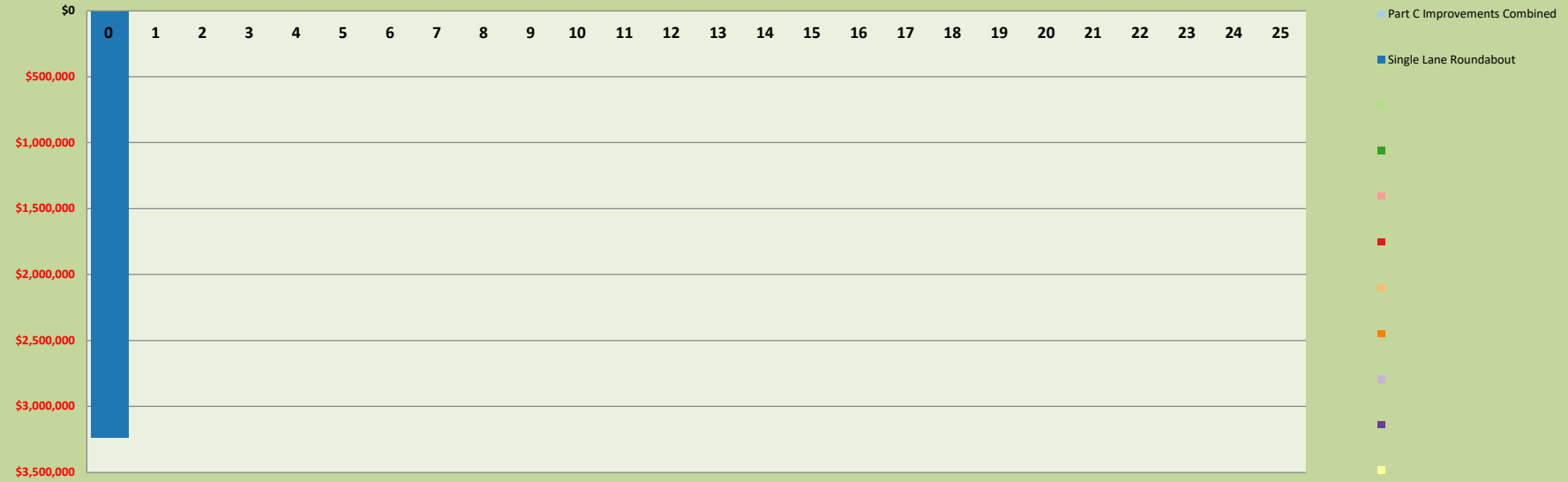
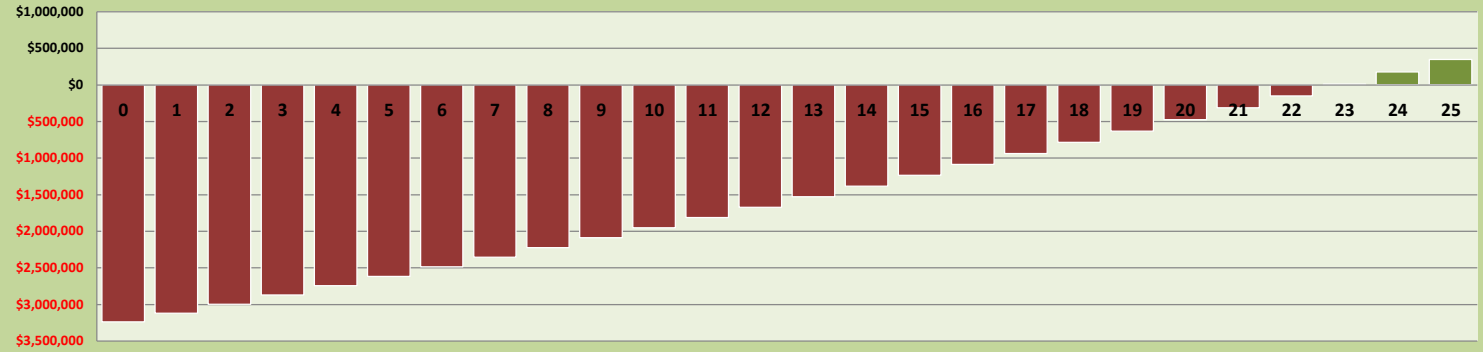
Reference Number		Date Performed	12/1/2025
Analyst	Qai	Analysis Year	2050
Agency/Company	Arcadis		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



First year to observe a positive return on investiment: 2073 (23 years)

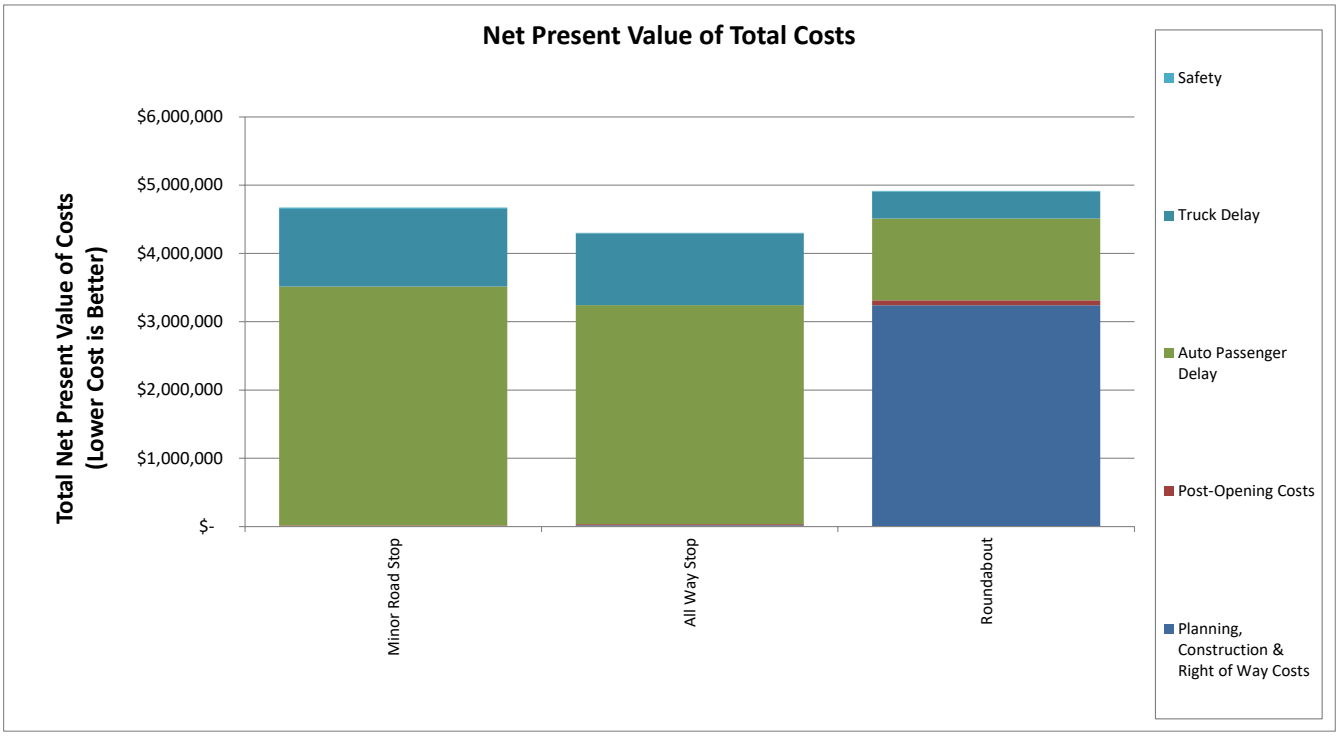
Percentage of Service Life to observe a continuous Positive Return on Investment: 12.00%

Outputs	This sheet compiles the data from summary tables in individual alternatives sheets. To populate the output sheet press the "Setup Worksheets" button in the Volumes tab.
Analyst:	Justin Maderia
Agency/Company:	Arcadis
Intersection:	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)
Route:	SSTASR00021**C; STUSSR00021**C
Logpoint:	1.47
Common Name:	Erie Avenue SW (SR 21) and Dolphin Street SW (SR 212)
Date Performed:	2/16/2026
Analysis Type	At-Grade Intersection

Analysis Summary

Cost Categories	Net Present Value of Costs		
	Minor Road Stop	All Way Stop	Roundabout
Planning, Construction & Right of Way Costs	$ -	$ 19,054	$ 3,238,435
Post-Opening Costs	$ 14,590	$ 14,590	$ 72,952
Auto Passenger Delay	$ 3,498,551	$ 3,209,233	$ 1,198,466
Truck Delay	$ 1,137,202	$ 1,051,281	$ 394,303
Safety	$ 21,074	$ 7,381	$ 10,853
Total cost	**$4,671,418**	**$4,301,540**	**$4,915,009**

Select Base Case for Benefit-Cost Comparison: (Choose from list)	Minor Road Stop		
Benefit Categories	**Net Present Value of Benefits Relative to Base Case**		
	Minor Road Stop	**All Way Stop**	**Roundabout**
Auto Passenger Delay		$ 289,318	$ 2,300,085
Truck Delay		$ 85,922	$ 742,899
Safety		$ 13,693	$ 10,221
Net Present Value of Benefits		**$ 388,932**	**$ 3,053,205**
Net Present Value of Costs		**$ 19,054**	**$ 3,296,796**
Net Present Value of Improvement		**$ 369,878**	**$ (243,591)**
Benefit-Cost (B/C) Ratio		**20.41**	**0.93**
Delay B/C		**19.69**	**0.92**
Safety B/C		**0.72**	**0.00**


Net Present Value of Total Costs
Total Net Present Value of Costs
(Lower Cost is Better)
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$-
Minor Road Stop
All Way Stop
Roundabout
Safety
Truck Delay
Auto Passenger Delay
Post-Opening Costs
Planning, Construction & Right of Way Costs