APPENDIX D: EXISTING TRANSPORTATION CONDITIONS REPORT - ADDENDUM 1

PROPEL US 31

Smarter Transportation. Stronger Communities.

US 31 SOUTH

EXISTING TRANSPORTATION CONDITIONS

BETWEEN 276TH STREET (HAMILTON COUNTY) AND CR W 300 N (MIAMI COUNTY)

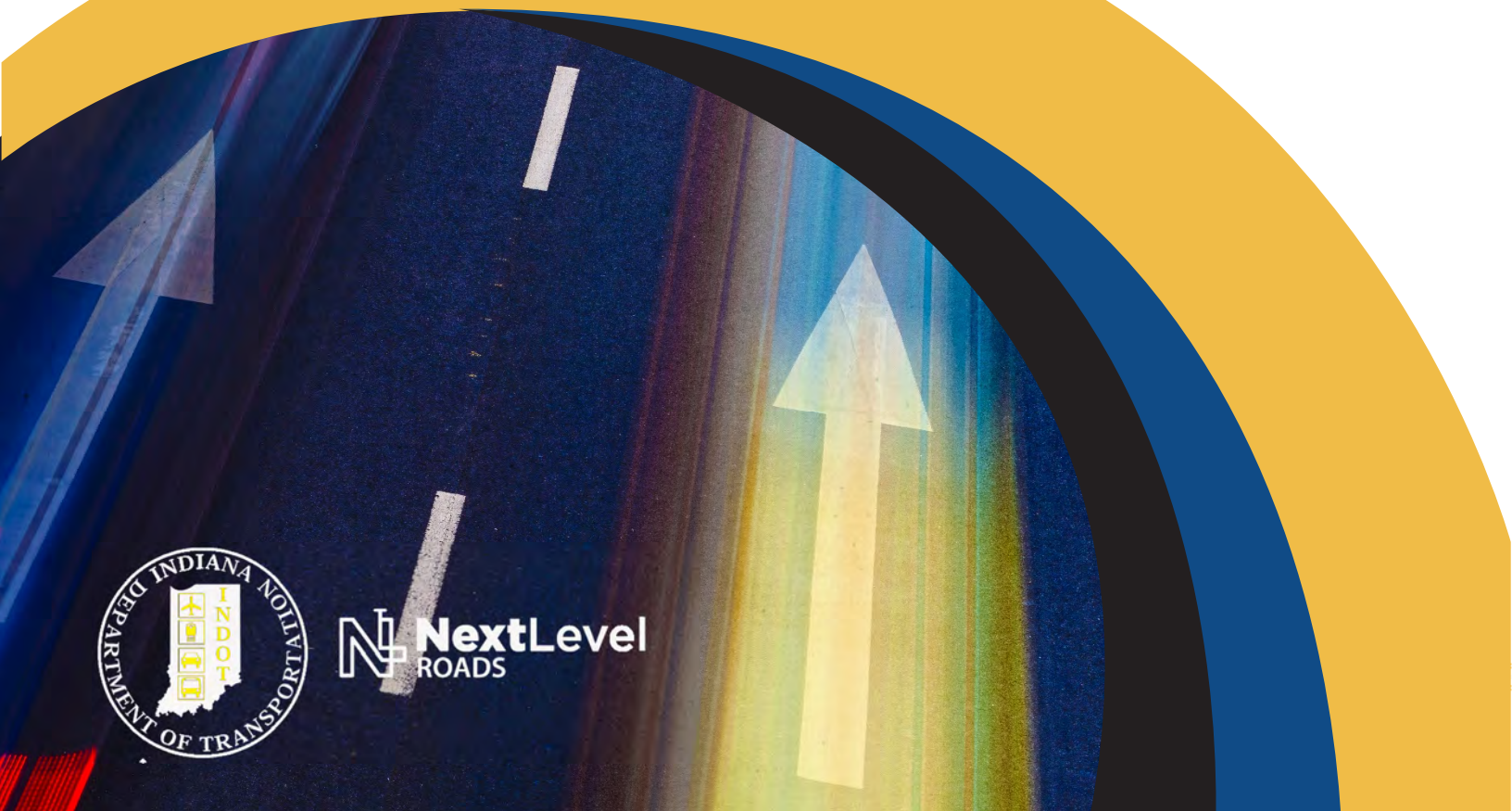
Addendum 1 - July 23, 2024

Prepared By

HNTB

This report was finalized prior to the issuance of several Executive Orders (EOs) and one United States Department of Transportation (USDOT) order, including:

- *Federal EOs: EO 14154, EO 14148, EO 14173, and EO 14281;*
- *State EOs: EO 25-49, EO 25-37, and EO 25-14;*
- *USDOT Order 2100.7*



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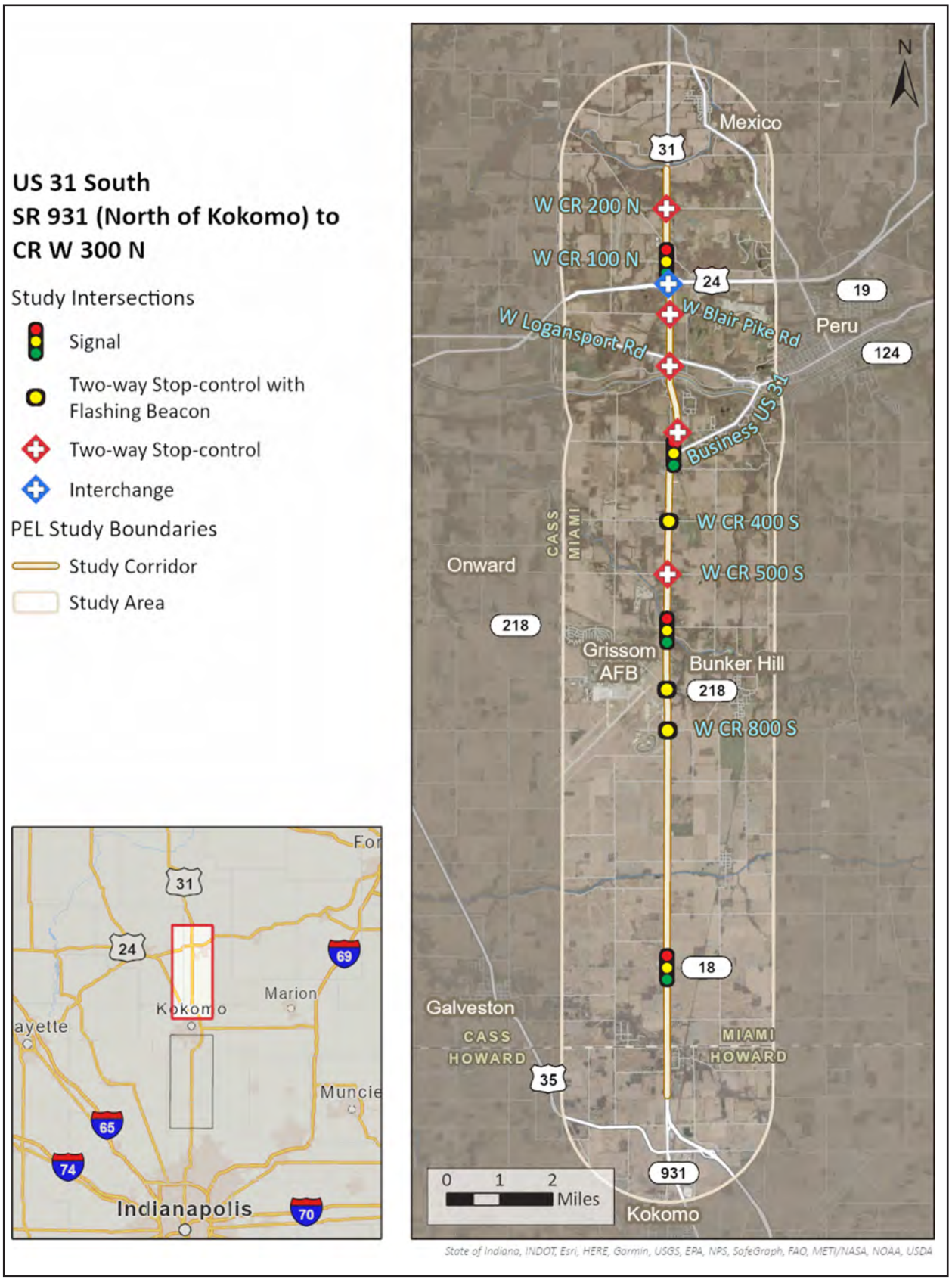
1. INTRODUCTION

This addendum adds the W CR 400 S intersection to the US 31 South ProPEL study as a study intersection. Maintaining access to Pipe Creek Elementary School, located immediately adjacent to the US 31 at W CR 400 S intersection, is important to the communities in this area. As such, this intersection has been elevated in importance from a secondary intersection to a primary intersection for purposes of this study, bringing the total number of primary intersections to eighteen. The updated study location map for the segment north of Kokomo is provided in **Figure 1-1**. Analysis of intersection safety and operations is provided in **Section 2** as an addendum to the *US 31 South Existing Transportation Conditions Report*.

Additionally, this addendum documents traffic volumes at the US 31 at Division Road intersection that were recounted in 2024 to ensure that the traffic counts and analysis reflected conditions not affected by the 2022 construction in the area. These updated counts, and the associated intersection operational analysis, are provided in **Section 3** as an addendum to the *US 31 South Existing Transportation Conditions Report*.

Figure 1-1: Study Locations, SR 931 (North of Kokomo) to CR W 300 N



2. US 31 AT W CR 400 S

2.1. SAFETY ANALYSIS

2.1.1. CRASH HISTORY

Historical crash information was obtained for this intersection in the time period from January 1, 2017 to December 31, 2021. The resulting nine crashes were then analyzed to determine crash characteristics at the intersection. A detailed breakdown of the W CR 400 S intersection crashes is provided in **Table 2-1**.

Table 2-1: W CR 400 S - Summary of Crash Types and Severities

Crash Type	Severity			Total	Percentage
	Fatal and Incapacitating Injury	Non-Incapacitating Injury	Property Damage Only (PDO)		
Ran off Road	0	0	2	2	22.2%
Same Direction Sideswipe	0	0	4	4	44.4%
Collision with Animal	0	0	3	3	33.3%
Total	0	0	9	9	100%

2.1.2. ROADHAT ANALYSIS

Using the RoadHAT crash analysis software, the W CR 400 S intersection was analyzed to determine its performance in comparison to similar intersections within Indiana.

Table 2-2 summarizes the RoadHAT analysis results for the W CR 400 S intersection. Both ICC and ICF values are less than zero, indicating crash frequency and severity are less than expected. The detailed analysis output is provided in **Appendix A**. The collision with animal crashes shown in **Table 2-1** were excluded from the RoadHAT analysis, as these crashes are not considered to be correctable through engineering solutions.

Table 2-2: RoadHat Analysis Summary

Location	ICF	ICC
US 31 at W CR 400 S	-0.38	-0.75

2.2. TRAFFIC OPERATIONS

2.2.1. EXISTING TRAFFIC VOLUMES

Average Annual Daily Traffic (AADT) volumes were collected from the INDOT Traffic Count Database System (TCDS) along US 31 and on study intersection side streets, where available. Vehicle turning movement counts (TMCs), collected in November of 2023, were provided by INDOT for the W CR 400 S intersection.

The TMCs of this intersection were adjusted, using INDOT's Traffic Adjustment Factors, to the peak season of the existing (2022) analysis year. With these adjustment factors, 2022 peak season turning movement volumes (TMVs) were estimated for use in the existing conditions AM and PM peak hour analysis.

The adjusted existing (2022) AADT volumes at, and near, the W CR 400 S intersection are shown in **Figure 2-1**. Summaries of the TMCs for the AM and PM peak hours are provided in **Appendix B**.

2.2.2. PROJECTED TRAFFIC VOLUMES

To estimate future 2045 design year volumes, an average annual traffic growth rate of 0.6% was calculated using outputs from the Indiana Statewide Traffic Model (updated for the US 30/US 31 PEL Studies).

This growth rate was applied to the 2022 peak season TMVs to estimate the 2045 design year TMVs for the AM and PM peak hours. The peak hour turning movement volumes (TMVs) for the W CR 400 S intersection that result from this methodology are provided in **Appendix B**. Additionally, this growth rate was applied to the existing (2022) AADT volumes to estimate the 2045 design year AADT volumes. These projected design year (2045) AADT volumes are shown in **Figure 2-2**.

Figure 2-1: 2022 Annual Average Daily Traffic (AADT) Volumes, W CR 800 S to W CR 400 S

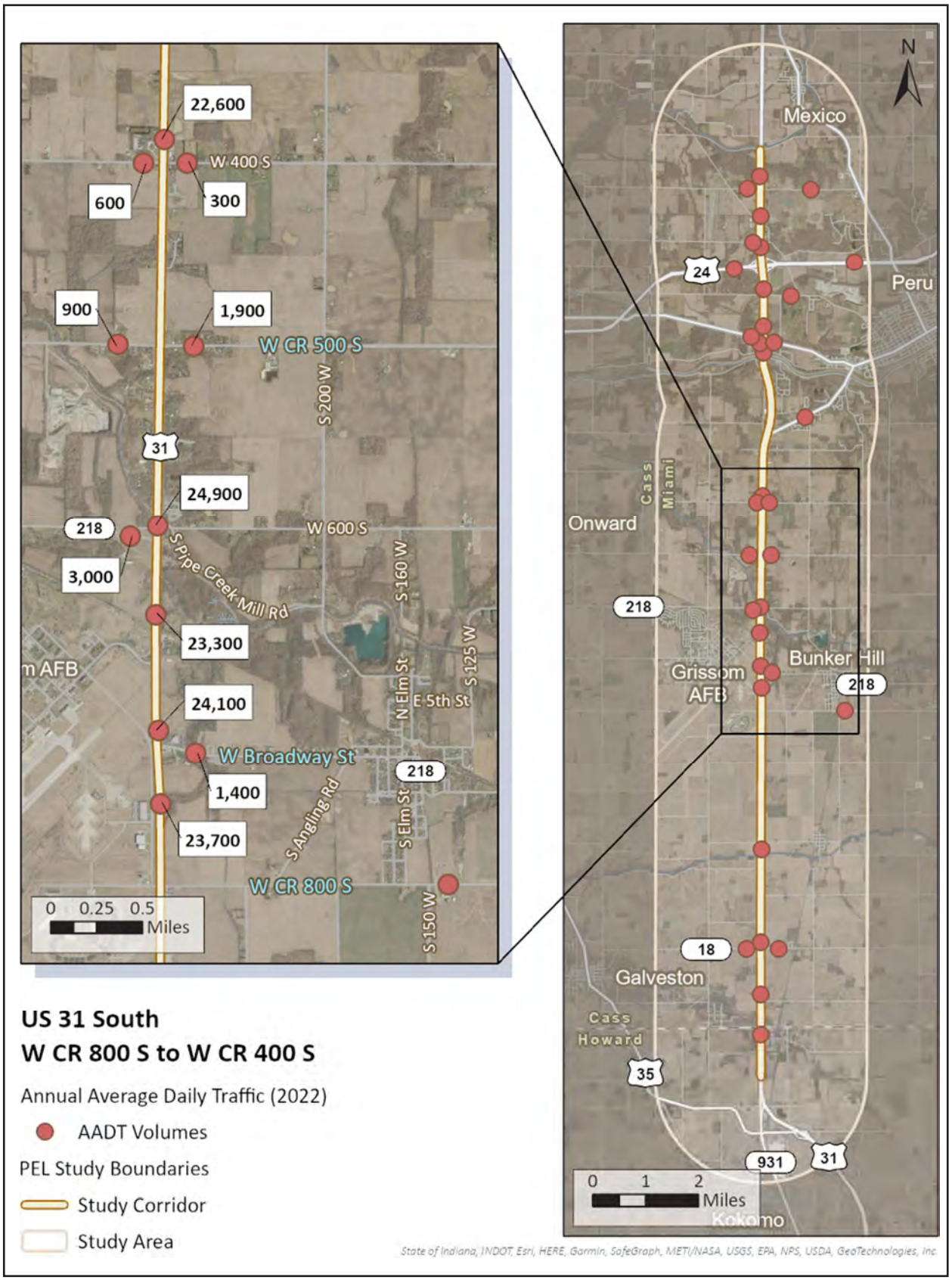
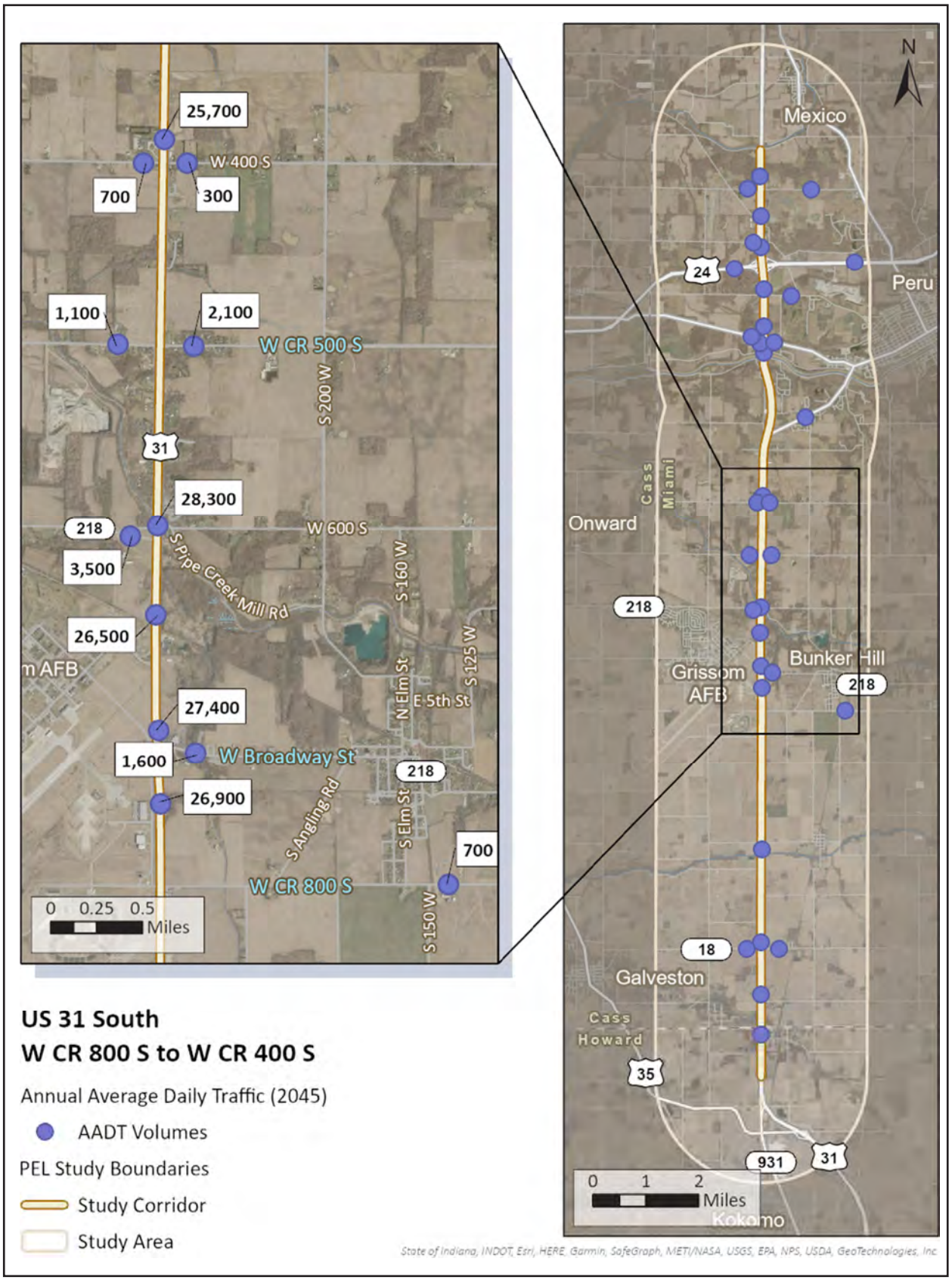


Figure 2-2: 2045 Annual Average Daily Traffic (AADT) Volumes, W CR 800 S to W CR 400 S



EASTBOUND / WESTBOUND THROUGH AND LEFT-TURN VOLUMES

Using the 2045 design year TMVs, eastbound and westbound approach volumes going through or left at US 31 were summarized. These projected design year (2045) TMVs are shown in **Table 2-3**.

Table 2-3: Eastbound / Westbound Through and Left-turn Design Year (2045) Volumes

Intersection	EB/WB Through and Left-turning Vehicles		
	AM Peak	PM Peak	Rank*
US 31 & W CR 400 S	40	57	10

* Intersection ranked according to the sum of the AM and PM peak hour volumes in comparison to the other study intersections reported in the *US 31 South Existing Transportation Conditions Report*.

2.2.3. OPERATIONAL ANALYSIS

Using the existing (2022) and future (2045) volumes, the W CR 400 S intersection was analyzed with Synchro 11 software, using the Highway Capacity Manual (HCM) methodology for stop-controlled intersections.

EXISTING (2022) OPERATIONAL ANALYSIS

The results of the existing (2022) operational analysis are summarized in **Table 2-4**, with the detailed analysis output sheets provided in **Appendix C**.

Table 2-4: Existing (2022) Operational Analysis Results

Intersection	Approach	AM Peak		PM Peak	
		LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
US 31 at W CR 400 S (TWSC)	Eastbound	C	17.4	D	26.4
	Westbound	C	20.8	C	20.8

FUTURE NO-BUILD (2045) OPERATIONAL ANALYSIS

The results of the future no-build (2045) operational analysis are summarized in **Table 2-5**, with the detailed analysis output sheets provided in **Appendix D**. This analysis assumes no changes to the existing intersection and is intended to determine if operational deficiencies are likely to occur in the future.

Table 2-5: Future No-Build (2045) Operational Analysis Results

Intersection	Approach	AM Peak		PM Peak	
		LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
US 31 at W CR 400 S (TWSC)	Eastbound	C	20.5	**E**	**36.0**
	Westbound	D	25.3	C	24.9

ANALYSIS SUMMARY

To determine if the W CR 400 S intersection is operationally deficient, the operational analysis results listed **Table 2-5** were compared to a minimal standard of LOS D. This standard was assumed based on information in Section 40-6.02(01) of the 2013 INDOT Design Manual, and was applied as follows:

- Unsignalized Intersections – Minimum standard of LOS D for all stop-controlled approaches.

Operational analysis indicated the following deficiencies:

- Future (2045) No-Build Traffic Conditions
  - **US 31 at W CR 400 S** – Intersection is a 4-legged intersection with stop-control on the eastbound and westbound approaches and free-flow on US 31. By the 2045 design year, the eastbound approach is anticipated to operate at LOS E (PM peak hour).

2.2.4. SIGNAL WARRANT ANALYSIS

With the operational deficiency shown in the future (2045) traffic condition, signal warrant analysis was conducted for the unsignalized intersection. Meeting signal warrants does not indicate a traffic signal must be installed, but rather that a traffic signal is justified and may be an acceptable means of improving operations and/or safety. Per the IMUTCD:

- Section 4B.04(01) – "Since vehicular delay and the frequency of some types of crashes are sometimes greater under traffic signal control than under STOP sign control, consideration should be given to providing alternatives to traffic control signals even if one or more of the signal warrants has been satisfied."
- Section 4C.01(03) – "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal."

Each of the minor street approaches used in this analysis were single lane approaches, with no dedicated left or right-turn lanes. With no dedicated turn lanes, and the high approach speeds on US 31, no right-turn volume reduction was included in this analysis. A summary of the signal warrant analysis results is provided in **Table 2-6**. Signal warrants that are not applicable were not evaluated in this analysis. The signal warrant worksheets for applicable warrants are provided in **Appendix E**. Based on these results, signalization of the intersection is not recommended.

Table 2-6: Summary of Signal Warrant Analysis

Warrant	US 31 at W CR 400 S
1 - Eight-Hour Vehicular Volume*	**No (2 of 8 hours met)**
2 - Four-Hour Vehicular Volume*	**No (2 of 4 hours met)**
3 - Peak Hour	*Not Applicable*
4 - Pedestrian Volume	*Not Applicable*
5 - School Crossing	*Not Applicable*
6 - Coordinated Signal System	*Not Applicable*
7 - Crash Experience	*Not Applicable*
8 - Roadway Network	*Not Applicable*
9 - Intersection Near a Grade Crossing	*Not Applicable*

* Using 70% volume criteria.

3. US 31 AT DIVISION ROAD

3.1. SAFETY ANALYSIS

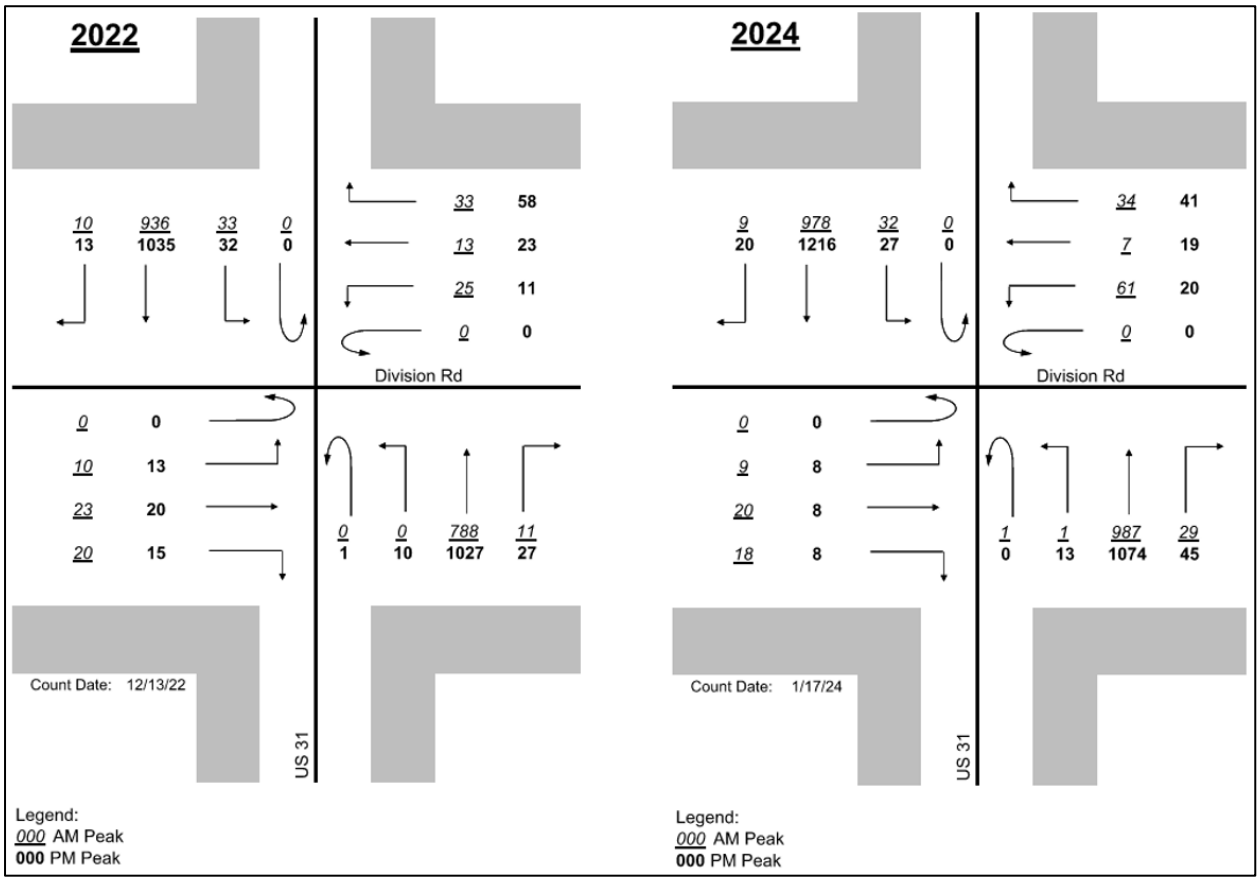
There are no changes to the safety analysis presented in the *US 31 South Existing Transportation Conditions Report* from the updated traffic volumes documented below.

3.2. TRAFFIC OPERATIONS

3.2.1. EXISTING TRAFFIC VOLUMES

Traffic counts at the US 31 at Division Road intersection were recounted in January 2024 to ensure that the traffic counts and analysis reflected conditions not affected by the 2022 construction in the area. These updated counts, and the associated intersection operational analysis, are provided in the following sections. A comparison of the prior (2022) counts and the more recent (2024) counts is provided in **Figure 3-1**.

Figure 3-1: US 31 & Division Road – Raw Count Summary



With the existing intersection counts collected in different months and years, the TMCs were adjusted using INDOT's Traffic Adjustment Factors. These factors allow for counts taken in different months and years to be adjusted to the peak season of the existing (2022) analysis year. With these adjustment factors, 2022 peak season turning movement volumes (TMVs) were estimated based on the more recent (2024) counts (see **Appendix B**) for use in the existing conditions AM and PM peak hour analysis discussed in this section. The adjusted existing (2022) AADT volumes at, and near, the Division Road intersection are shown in **Figure 3-2**.

3.2.2. PROJECTED TRAFFIC VOLUMES

To estimate future 2045 design year volumes, an average annual traffic growth rate of 0.6% was calculated using outputs from the Indiana Statewide Traffic Model (updated for the US 30/US 31 PEL Studies).

This growth rate was applied to the 2022 peak season TMVs to estimate the 2045 design year TMVs for the AM and PM peak hours. The peak hour TMVs for the Division Road intersection that result from this methodology are provided in **Appendix B**. Additionally, this growth rate was applied to the existing (2022) AADT volumes to estimate the 2045 design year AADT volumes. These projected design year (2045) AADT volumes are shown in **Figure 3-3**.

3.2.3. OPERATIONAL ANALYSIS

Using the existing (2022) and future (2045) volumes from the updated counts, the Division Road intersection was analyzed with Synchro 11 software, using the Highway Capacity Manual (HCM) methodology for signalized intersections.

EXISTING (2022) OPERATIONAL ANALYSIS

The results of the existing (2022) operational analysis are summarized in **Table 3-1**, with the detailed analysis output sheets provided in **Appendix C**.

Table 3-1: Existing (2022) Operational Analysis Results

Intersection	Approach	AM Peak		PM Peak	
		LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
US 31 at Division Road (Signalized)	Eastbound	D	36.1	D	39.5
	Westbound	D	51.6	D	43.9
	Northbound	B	11.4	A	5.7
	Southbound	B	12.1	A	8.0
	Overall	**B**	**14.1**	**A**	**8.4**

Figure 3-2: 2022 Annual Average Daily Traffic (AADT) Volumes, W CR 250 S to W CR 100 N

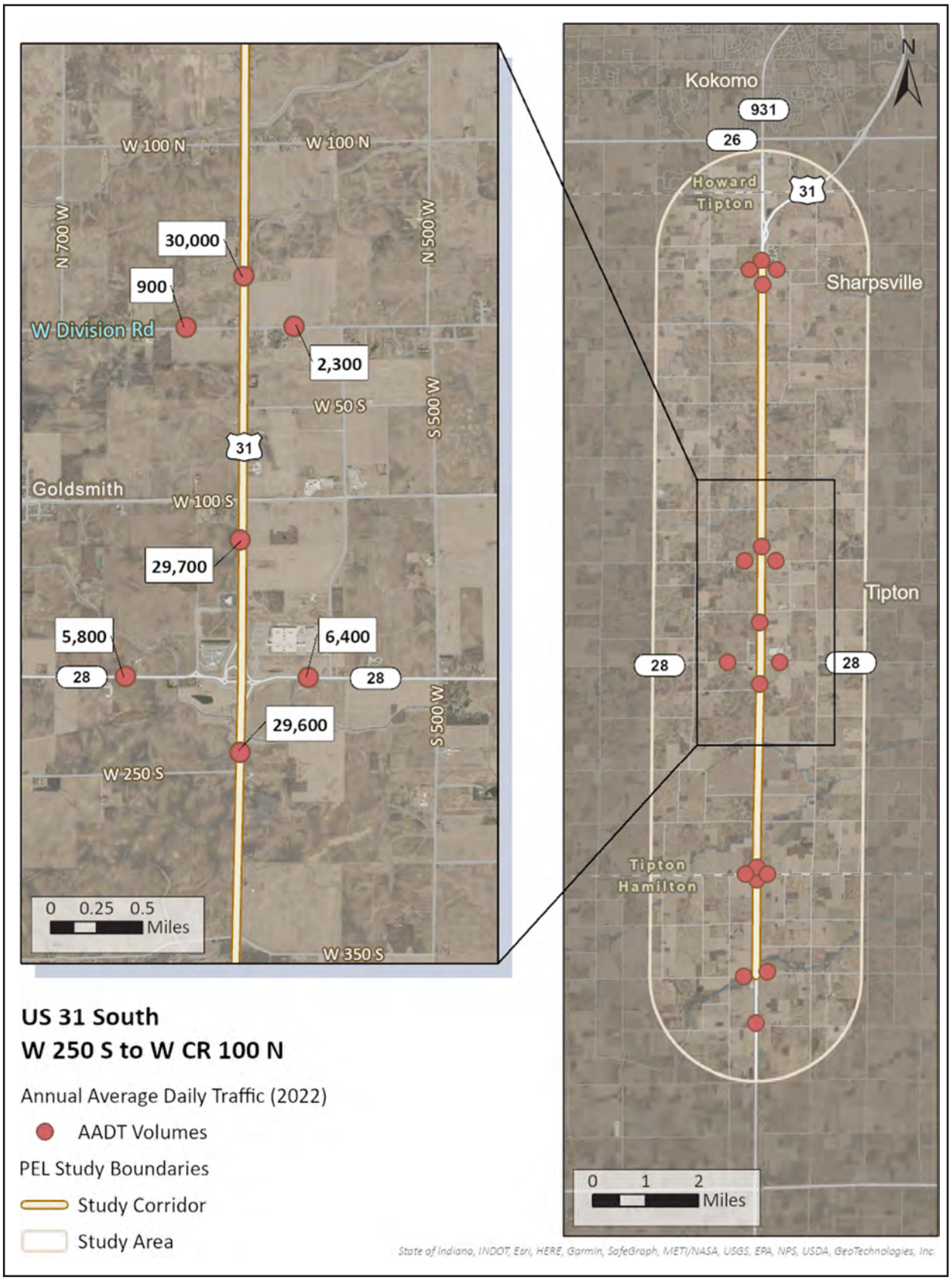
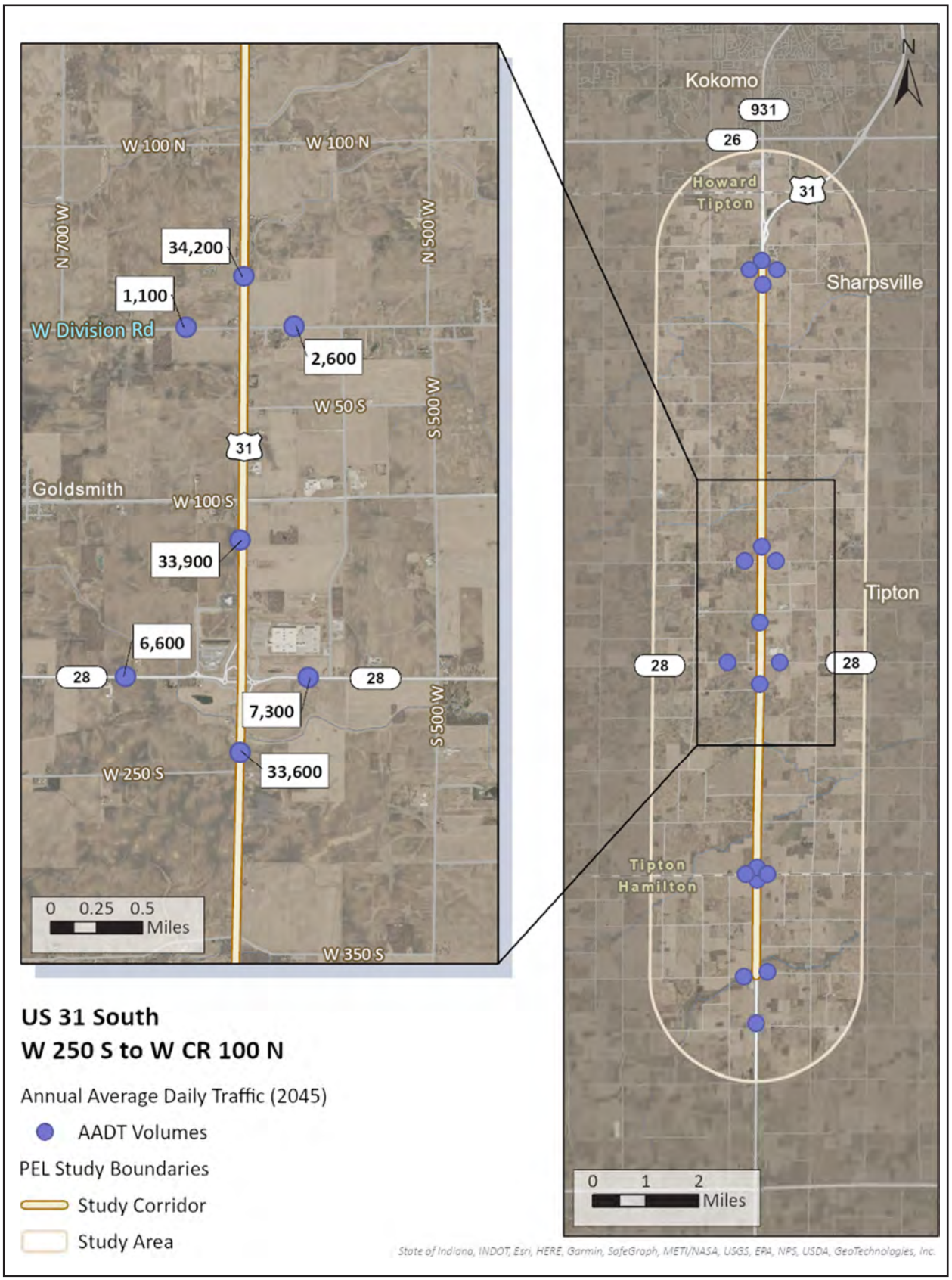


Figure 3-3: 2045 Annual Average Daily Traffic (AADT) Volumes, W CR 250 S to W CR 100 N



FUTURE NO-BUILD (2045) OPERATIONAL ANALYSIS

The results of the future no-build (2045) operational analysis are summarized in **Table 3-2**, with the detailed analysis output sheets provided in **Appendix D**. This analysis assumes no changes to the existing intersection, other than signal timing adjustments, and is intended to determine if operational deficiencies are likely to occur in the future.

Table 3-2: Future No-Build (2045) Operational Analysis Results

Intersection	Approach	AM Peak		PM Peak	
		LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
US 31 at Division Road (Signalized)	Eastbound	D	35.1	D	41.8
	Westbound	D	54.0	D	47.4
	Northbound	B	15.4	A	7.0
	Southbound	B	16.3	B	10.8
	Overall	**B**	**18.0**	**B**	**10.6**

ANALYSIS SUMMARY

To determine which study locations are operationally deficient, the previously reported operational analysis results were compared to a minimal standard of LOS D. This standard was assumed based on information in Section 40-6.02(01) of the 2013 INDOT Design Manual, and was applied as follows:

- Signalized Intersections – Minimum standard of LOS D for the overall intersection with no approaches operating at LOS F.

With the updated traffic counts, analysis of US 31 at Division Road indicates that intersection operations will meet the LOS standard through the 2045 design year.

Based on review of the updated counts and associated operational analysis, no changes to any conclusions previously made in the ProPEL US 31 South study are expected to be necessary.

APPENDIX A: SUMMARY OF CRASHES

Intersection Crash Summaries

US 31 at W CR 400 S

Number of Collisions by Type					
	Fatal and Incapacitating Injury	**Non-Incapacitating Injury**	**Property Damage Only**	**Total**	**Percentage**
Ran off Road	0	0	2	**2**	22%
Same Direction Sideswipe	0	0	4	**4**	44%
Collision with Animal*	0	0	3	**3**	33%
Total	**0**	**0**	**9**	**9**	100%
* Deer and other animal crashes are not included in the RoadHAT analysis					
RoadHAT Output					
ICF	-0.38				
ICC	-0.75				

Index of Crash Frequency and Cost - Form F1

Settings: Indiana state settings	Version: Version 4.1	
Location	US 31 at W CR 400 S	
GIS		
Post		
Analyst	JCA	
Date		

INPUT	
Road Facility Type	Unsignalized Rural State Intersection One AADT
Busiest Road AADT (veh/day)	23500
T Intersection Indicator (1 if present, 0 otherwise)	0
Crossing Road Principal or Minor Arterial Indicator (1 if present, 0 otherwise)	0
Crossing Road Major or Minor Collector Indicator (1 if present, 0 otherwise)	0
First Year with Crash Data (yyyy)	2017
Last Year with Crash Data (yyyy)	2021
Number of Crashes (crash/period)	
Fatal and Incapacitating Injury Crashes	0
Non-Incapacitating and Possible Injury Crashes	0
Property Damage Only Crashes	6
Route or Road Type	Unsignalized Rural State Intersection One AADT
Average Crash Costs ($)	
Fatal and Incapacitating Injury Crashes	2335800
Non-Incapacitating and Possible Injury Crashes	389500
Property Damage Only Crashes	32200
Crash Cost Year (yyyy)	2017
OUTPUT	
Expected Crash Frequency (crash/year)	
Fatal and Incapacitating Injury Crashes	0.294
Non-Incapacitating and Possible Injury Crashes	0.17
Property Damage Only Crashes	1.36
All Crashes	1.83
Index of Crash Frequency	**-0.38**
Index of Crash Cost	**-0.75**

RoadHAT 4D

Index of Crash Frequency and Cost - Form F1

Settings: Indiana state settings	Version: Version 4.1	
Location	US 31 at W CR 400 S	
GIS		
Post		
Analyst	JCA	
Date		

Comments:

APPENDIX B: TRAFFIC VOLUME SUMMARIES

PEAK HOUR - TURNING MOVEMENT COUNTS

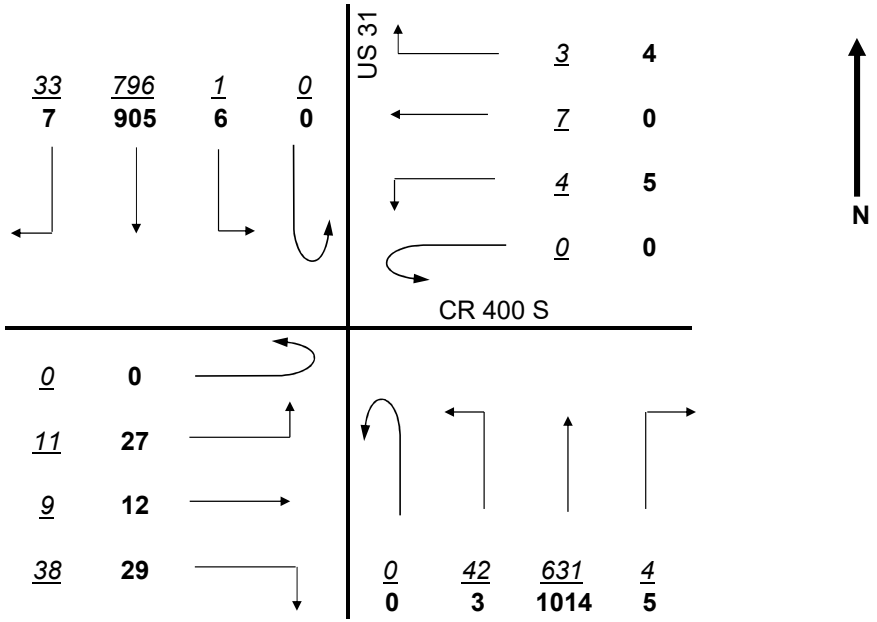
US 31 at CR 400 S **VEHICLES (CARS & TRUCKS)**

RAW 15-MINUTE VOLUMES	EB VEHICLES CR 400 S				WB VEHICLES CR 400 S				NB VEHICLES US 31				SB VEHICLES US 31				INTERSECTION TOTAL
	UTURN	LT	THRU	RT	UTURN	LT	THRU	RT	UTURN	LT	THRU	RT	UTURN	LT	THRU	RT	VEHICLES
AM PEAK																	
8:15-8:30	0	1	3	2	0	2	0	0	0	8	138	0	0	1	239	4	398
8:30-8:45	0	1	1	0	0	1	0	1	0	7	179	1	0	0	198	6	395
8:45-9:00	0	0	0	7	0	0	4	1	0	8	151	3	0	0	187	8	369
9:00-9:15	0	9	5	29	0	1	3	1	0	19	163	0	0	0	172	15	417
PM PEAK																	
4:00-4:15	0	15	3	15	0	1	0	1	0	1	258	2	0	2	223	2	523
4:15-4:30	0	6	3	4	0	0	0	2	0	0	230	2	0	0	222	1	470
4:30-4:45	0	3	4	6	0	4	0	0	0	2	262	0	0	1	247	0	529
4:45-5:00	0	3	2	4	0	0	0	1	0	0	264	1	0	3	213	4	495
TOTAL VOLUMES																	
AM PEAK	0	11	9	38	0	4	7	3	0	42	631	4	0	1	796	33	1579
PM PEAK	0	27	12	29	0	5	0	4	0	3	1014	5	0	6	905	7	2017
% TRUCKS																	
AM PEAK	0.0%	0.0%	0.0%	21.1%	0.0%	0.0%	14.3%	0.0%	0.0%	11.9%	20.9%	25.0%	0.0%	0.0%	14.4%	0.0%	
PM PEAK	0.0%	0.0%	16.7%	17.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.7%	20.0%	0.0%	0.0%	21.7%	0.0%	

	PHF
AM PEAK	0.95
PM PEAK	0.95

TURNING MOVEMENT COUNTS
US 31 at CR 400 S

Count Date: 11/27/23

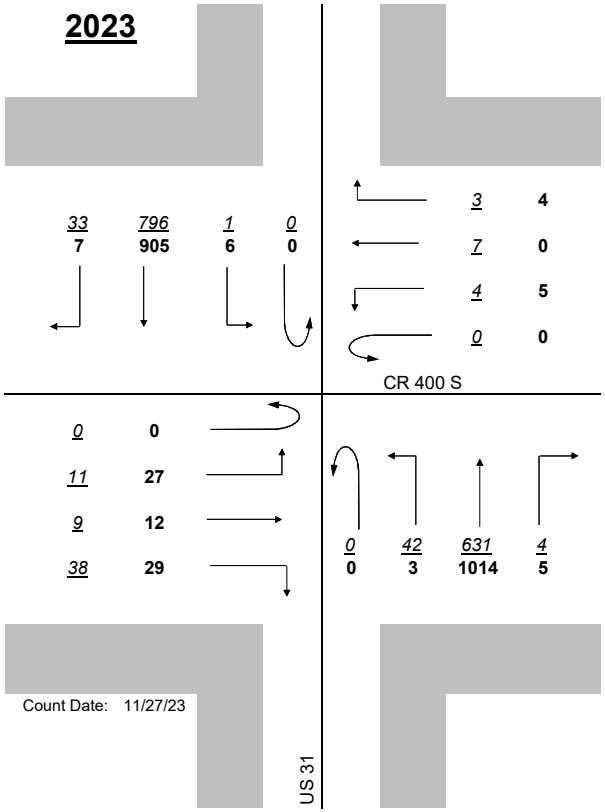


Legend:

000 AM Peak 8:15 AM-9:15 AM

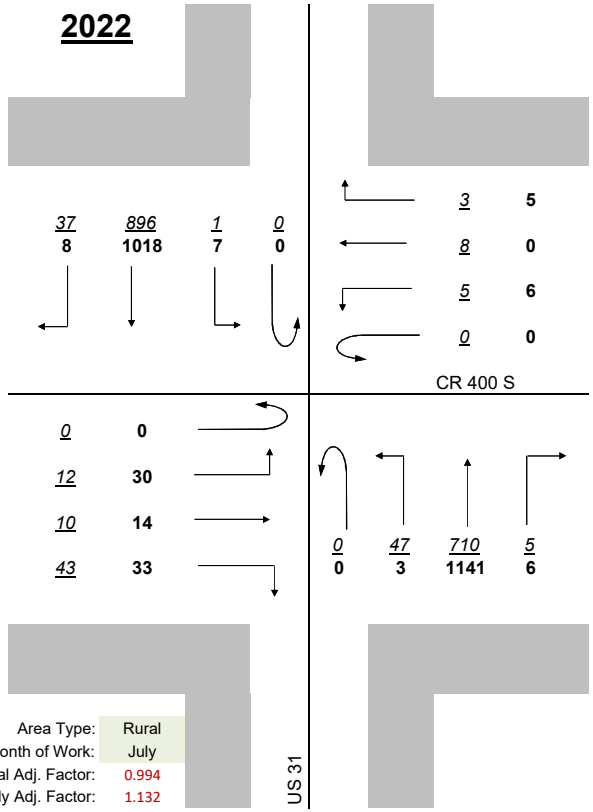
000 PM Peak 4:00 PM-5:00 PM

Raw Counts



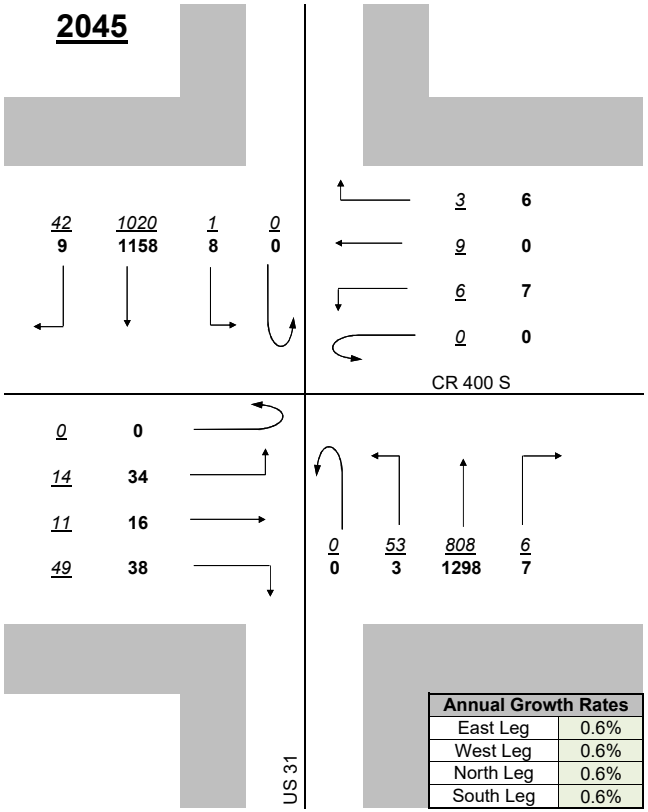
Count Date: 11/27/23

Adjusted Existing Volumes



Area Type:	Rural
Month of Work:	July
Annual Adj. Factor:	0.994
Monthly Adj. Factor:	1.132

Design Year



Annual Growth Rates	
East Leg	0.6%
West Leg	0.6%
North Leg	0.6%
South Leg	0.6%

Legend:
000 AM Peak
000 PM Peak

PEAK HOUR - TURNING MOVEMENT COUNTS

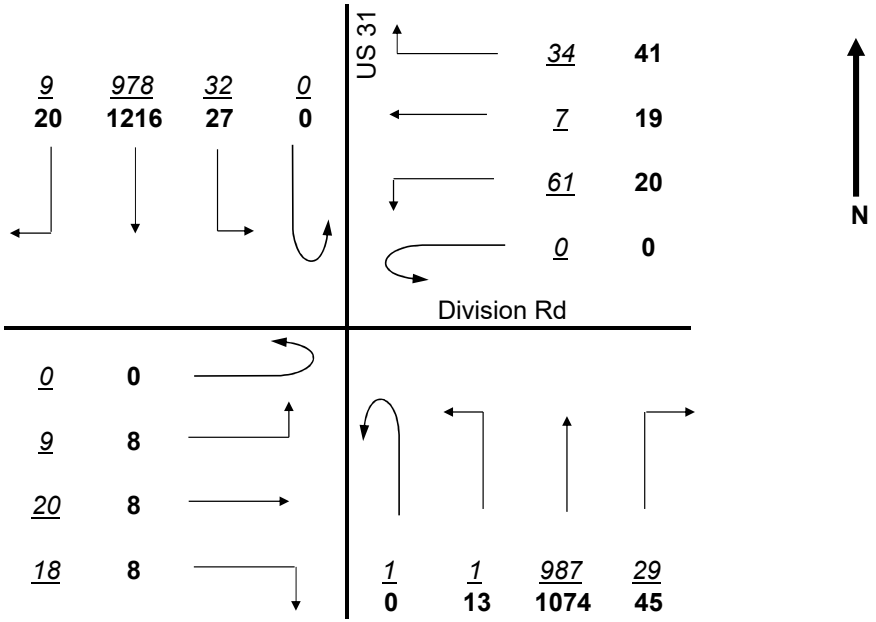
US 31 at Division Rd **VEHICLES (CARS & TRUCKS)**

RAW 15-MINUTE VOLUMES	EB VEHICLES Division Rd				WB VEHICLES Division Rd				NB VEHICLES US 31				SB VEHICLES US 31				INTERSECTION TOTAL
	UTURN	LT	THRU	RT	UTURN	LT	THRU	RT	UTURN	LT	THRU	RT	UTURN	LT	THRU	RT	VEHICLES
AM PEAK																	
7:00-7:15	0	1	5	7	0	13	1	14	1	1	223	3	0	2	223	1	495
7:15-7:30	0	1	4	7	0	19	2	9	0	0	231	9	0	10	242	1	535
7:30-7:45	0	6	6	1	0	11	2	5	0	0	291	11	0	10	260	6	609
7:45-8:00	0	1	5	3	0	18	2	6	0	0	242	6	0	10	253	1	547
PM PEAK																	
4:15-4:30	0	1	1	3	0	4	6	9	0	3	270	14	0	5	317	6	639
4:30-4:45	0	2	1	1	0	7	7	10	0	1	272	5	0	4	326	5	641
4:45-5:00	0	1	4	4	0	4	2	5	0	4	268	8	0	8	289	5	602
5:00-5:15	0	4	2	0	0	5	4	17	0	5	264	18	0	10	284	4	617
TOTAL VOLUMES																	
AM PEAK	0	9	20	18	0	61	7	34	1	1	987	29	0	32	978	9	2186
PM PEAK	0	8	8	8	0	20	19	41	0	13	1074	45	0	27	1216	20	2499
% TRUCKS																	
AM PEAK	0.0%	0.0%	10.0%	5.6%	0.0%	6.6%	57.1%	5.9%	0.0%	0.0%	13.6%	37.9%	0.0%	0.0%	7.4%	0.0%	
PM PEAK	0.0%	0.0%	0.0%	12.5%	0.0%	10.0%	0.0%	2.4%	0.0%	7.7%	8.9%	17.8%	0.0%	3.7%	11.2%	0.0%	

	PHF
AM PEAK	0.90
PM PEAK	0.97

TURNING MOVEMENT COUNTS
US 31 at Division Rd

Count Date: 1/17/24

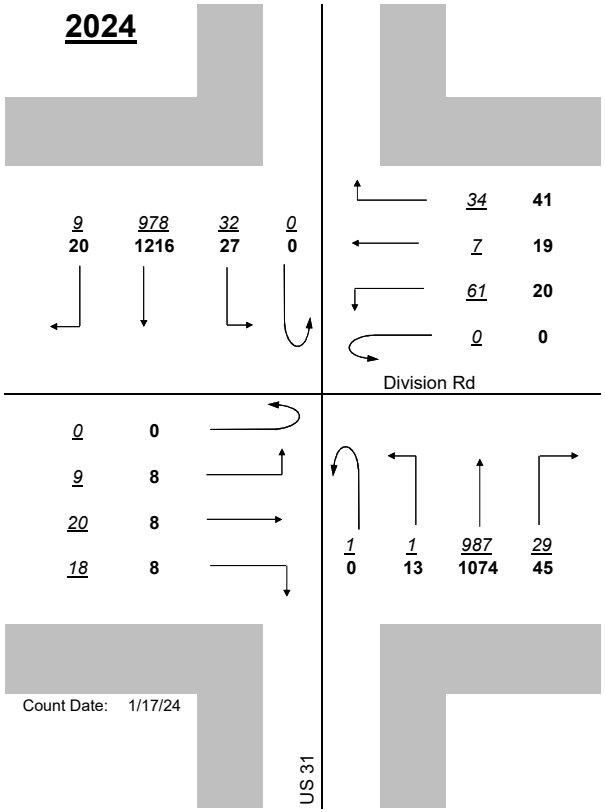


Legend:

000 AM Peak 7:00 AM-8:00 AM

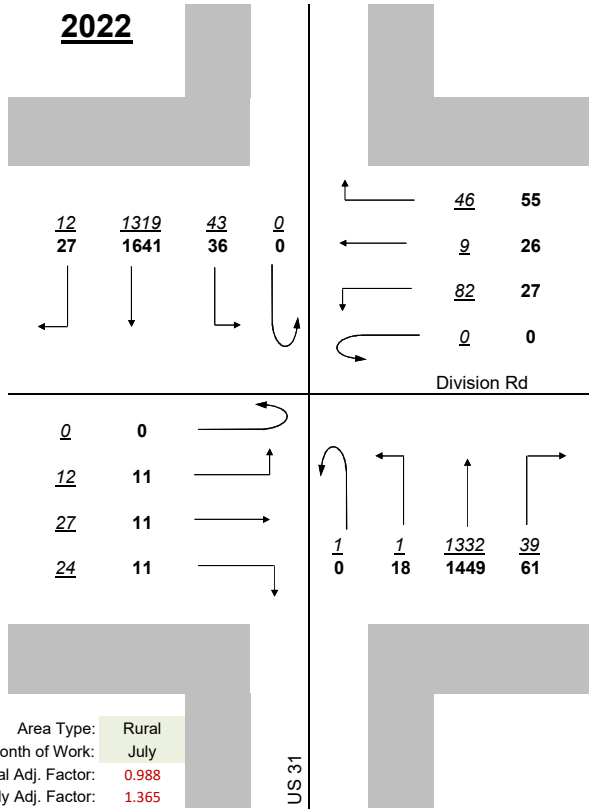
000 PM Peak 4:15 PM-5:15 PM

Raw Counts



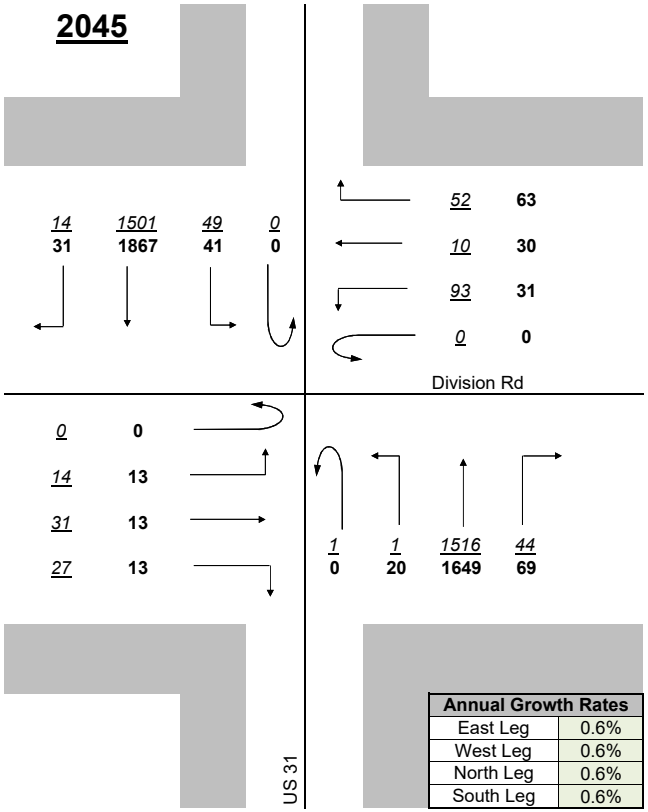
Count Date: 1/17/24

Adjusted Existing Volumes



Area Type:	Rural
Month of Work:	July
Annual Adj. Factor:	0.988
Monthly Adj. Factor:	1.365

Design Year



Annual Growth Rates	
East Leg	0.6%
West Leg	0.6%
North Leg	0.6%
South Leg	0.6%

Legend:
000 AM Peak
000 PM Peak

APPENDIX C: EXISTING (2022) TRAFFIC ANALYSIS

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	10	43	5	8	3	47	710	5	1	896	37
Future Vol, veh/h	12	10	43	5	8	3	47	710	5	1	896	37
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	425	-	150	425	-	175
Veh in Median Storage, #	-	2	-	-	2	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	21	0	14	0	12	21	25	0	14	0
Mvmt Flow	13	11	45	5	8	3	49	747	5	1	943	39

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1421	1795	472	1324	1829	374	982	0	0	752	0	0
Stage 1	945	945	-	845	845	-	-	-	-	-	-	-
Stage 2	476	850	-	479	984	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	7.32	7.5	6.78	6.9	4.34	-	-	4.1	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.5	5.78	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.5	5.78	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.51	3.5	4.14	3.3	2.32	-	-	2.2	-	-
Pot Cap-1 Maneuver	98	81	490	116	66	629	641	-	-	867	-	-
Stage 1	285	343	-	328	350	-	-	-	-	-	-	-
Stage 2	544	380	-	542	299	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	89	75	490	96	61	629	641	-	-	867	-	-
Mov Cap-2 Maneuver	230	243	-	249	196	-	-	-	-	-	-	-
Stage 1	263	343	-	303	323	-	-	-	-	-	-	-
Stage 2	487	351	-	476	299	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.4	20.8	0.7	0
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	641	-	-	359	244	867	-	-
HCM Lane V/C Ratio	0.077	-	-	0.191	0.069	0.001	-	-
HCM Control Delay (s)	11.1	-	-	17.4	20.8	9.2	-	-
HCM Lane LOS	B	-	-	C	C	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	0.7	0.2	0	-	-

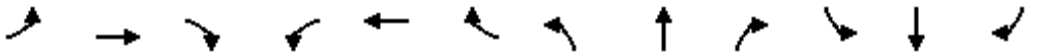
Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	14	33	6	0	5	3	1141	6	7	1018	8
Future Vol, veh/h	30	14	33	6	0	5	3	1141	6	7	1018	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	425	-	150	425	-	175
Veh in Median Storage, #	-	2	-	-	2	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	17	17	0	0	0	0	10	20	0	22	0
Mvmt Flow	32	15	35	6	0	5	3	1201	6	7	1072	8

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1693	2299	536	1765	2301	601	1080	0	0	1207	0	0
Stage 1	1086	1086	-	1207	1207	-	-	-	-	-	-	-
Stage 2	607	1213	-	558	1094	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.84	7.24	7.5	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.5	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.17	3.47	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	62	31	452	54	39	448	653	-	-	585	-	-
Stage 1	234	261	-	198	259	-	-	-	-	-	-	-
Stage 2	455	225	-	487	292	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	61	30	452	46	38	448	653	-	-	585	-	-
Mov Cap-2 Maneuver	201	158	-	172	183	-	-	-	-	-	-	-
Stage 1	233	258	-	197	258	-	-	-	-	-	-	-
Stage 2	448	224	-	419	288	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	26.4	20.8	0	0.1
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	653	-	-	248	239	585	-	-
HCM Lane V/C Ratio	0.005	-	-	0.327	0.048	0.013	-	-
HCM Control Delay (s)	10.5	-	-	26.4	20.8	11.2	-	-
HCM Lane LOS	B	-	-	D	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	1.4	0.2	0	-	-



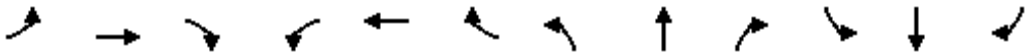
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	27	24	82	9	46	2	1332	39	43	1319	12
Future Volume (veh/h)	12	27	24	82	9	46	2	1332	39	43	1319	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1752	1811	1796	1055	1811	1900	1693	1337	1900	1781	1900
Adj Flow Rate, veh/h	13	30	27	91	10	51	2	1480	43	48	1466	13
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	10	6	7	57	6	0	14	38	0	8	0
Cap, veh/h	74	150	115	143	18	53	227	2173	765	208	2323	21
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.68	0.68	0.68	0.68	0.68	0.68
Sat Flow, veh/h	179	807	619	470	98	287	363	3216	1133	348	3438	30
Grp Volume(v), veh/h	70	0	0	152	0	0	2	1480	43	48	721	758
Grp Sat Flow(s),veh/h/ln	1604	0	0	855	0	0	363	1608	1133	348	1692	1776
Q Serve(g_s), s	0.0	0.0	0.0	14.4	0.0	0.0	0.3	28.6	1.3	10.0	25.0	25.0
Cycle Q Clear(g_c), s	3.8	0.0	0.0	18.2	0.0	0.0	25.3	28.6	1.3	38.6	25.0	25.0
Prop In Lane	0.19		0.39	0.60		0.34	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	340	0	0	215	0	0	227	2173	765	208	1143	1200
V/C Ratio(X)	0.21	0.00	0.00	0.71	0.00	0.00	0.01	0.68	0.06	0.23	0.63	0.63
Avail Cap(c_a), veh/h	340	0	0	215	0	0	232	2216	781	213	1166	1224
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.8	0.0	0.0	41.4	0.0	0.0	16.7	10.1	5.7	21.7	9.5	9.5
Incr Delay (d2), s/veh	0.3	0.0	0.0	10.2	0.0	0.0	0.1	1.5	0.1	2.0	2.2	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	0.0	4.4	0.0	0.0	0.0	7.7	0.3	0.9	7.4	7.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.1	0.0	0.0	51.6	0.0	0.0	16.7	11.6	5.8	23.7	11.7	11.6
LnGrp LOS	D	A	A	D	A	A	B	B	A	C	B	B
Approach Vol, veh/h		70			152			1525			1527	
Approach Delay, s/veh		36.1			51.6			11.4			12.1	
Approach LOS		D			D			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		77.6		26.0		77.6		26.0				
Change Period (Y+Rc), s		7.6		6.7		7.6		6.7				
Max Green Setting (Gmax), s		71.4		19.3		71.4		19.3				
Max Q Clear Time (g_c+I1), s		30.6		5.8		40.6		20.2				
Green Ext Time (p_c), s		30.9		0.2		25.0		0.0				

Intersection Summary												
HCM 6th Ctrl Delay			14.1									
HCM 6th LOS			B									

HCM 6th Signalized Intersection Summary
40: US 31 (South of Kokomo) & Division Road

02/22/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	11	11	27	26	55	18	1449	61	36	1641	27
Future Volume (veh/h)	11	11	11	27	26	55	18	1449	61	36	1641	27
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1707	1752	1900	1856	1781	1767	1633	1841	1737	1900
Adj Flow Rate, veh/h	11	11	11	28	27	57	19	1494	63	37	1692	28
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	0	0	13	10	0	3	8	9	18	4	11	0
Cap, veh/h	83	73	52	75	45	74	214	2542	1048	261	2516	42
Arrive On Green	0.09	0.09	0.09	0.09	0.09	0.09	0.76	0.76	0.76	0.76	0.76	0.76
Sat Flow, veh/h	352	826	589	302	506	837	269	3357	1384	326	3322	55
Grp Volume(v), veh/h	33	0	0	112	0	0	19	1494	63	37	839	881
Grp Sat Flow(s),veh/h/ln	1767	0	0	1645	0	0	269	1678	1384	326	1650	1727
Q Serve(g_s), s	0.0	0.0	0.0	4.1	0.0	0.0	3.5	18.0	1.1	5.2	23.2	23.4
Cycle Q Clear(g_c), s	1.6	0.0	0.0	6.1	0.0	0.0	26.8	18.0	1.1	23.2	23.2	23.4
Prop In Lane	0.33		0.33	0.25		0.51	1.00		1.00	1.00		0.03
Lane Grp Cap(c), veh/h	208	0	0	194	0	0	214	2542	1048	261	1250	1308
V/C Ratio(X)	0.16	0.00	0.00	0.58	0.00	0.00	0.09	0.59	0.06	0.14	0.67	0.67
Avail Cap(c_a), veh/h	313	0	0	301	0	0	232	2774	1144	284	1364	1427
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.2	0.0	0.0	41.2	0.0	0.0	12.2	4.9	2.9	10.0	5.5	5.6
Incr Delay (d2), s/veh	0.4	0.0	0.0	2.7	0.0	0.0	0.6	0.8	0.1	0.9	2.4	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	2.6	0.0	0.0	0.2	3.3	0.2	0.4	4.6	4.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.5	0.0	0.0	43.9	0.0	0.0	12.9	5.7	2.9	10.9	8.0	7.9
LnGrp LOS	D	A	A	D	A	A	B	A	A	B	A	A
Approach Vol, veh/h		33			112			1576			1757	
Approach Delay, s/veh		39.5			43.9			5.7			8.0	
Approach LOS		D			D			A			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		77.6		14.8		77.6		14.8				
Change Period (Y+Rc), s		7.6		6.7		7.6		6.7				
Max Green Setting (Gmax), s		76.4		14.3		76.4		14.3				
Max Q Clear Time (g_c+I1), s		28.8		3.6		25.4		8.1				
Green Ext Time (p_c), s		36.0		0.1		42.7		0.2				

Intersection Summary												
HCM 6th Ctrl Delay			8.4									
HCM 6th LOS			A									

APPENDIX D: FUTURE (2045) TRAFFIC ANALYSIS

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	11	49	6	9	3	53	808	6	1	1020	42
Future Vol, veh/h	14	11	49	6	9	3	53	808	6	1	1020	42
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	425	-	150	425	-	175
Veh in Median Storage, #	-	2	-	-	2	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	21	0	14	0	12	21	25	0	14	0
Mvmt Flow	15	12	52	6	9	3	56	851	6	1	1074	44

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1618	2045	537	1508	2083	426	1118	0	0	857	0	0
Stage 1	1076	1076	-	963	963	-	-	-	-	-	-	-
Stage 2	542	969	-	545	1120	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	7.32	7.5	6.78	6.9	4.34	-	-	4.1	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.5	5.78	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.5	5.78	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.51	3.5	4.14	3.3	2.32	-	-	2.2	-	-
Pot Cap-1 Maneuver	70	57	442	85	45	582	566	-	-	792	-	-
Stage 1	238	298	-	278	306	-	-	-	-	-	-	-
Stage 2	497	334	-	495	256	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	61	51	442	66	41	582	566	-	-	792	-	-
Mov Cap-2 Maneuver	187	205	-	204	157	-	-	-	-	-	-	-
Stage 1	214	298	-	250	276	-	-	-	-	-	-	-
Stage 2	430	301	-	420	256	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	20.5	25.3	0.7	0
HCM LOS	C	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	566	-	-	309	196	792	-	-
HCM Lane V/C Ratio	0.099	-	-	0.252	0.097	0.001	-	-
HCM Control Delay (s)	12.1	-	-	20.5	25.3	9.6	-	-
HCM Lane LOS	B	-	-	C	D	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	1	0.3	0	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	34	16	38	7	0	6	3	1298	7	8	1158	9
Future Vol, veh/h	34	16	38	7	0	6	3	1298	7	8	1158	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	425	-	150	425	-	175
Veh in Median Storage, #	-	2	-	-	2	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	17	17	0	0	0	0	10	20	0	22	0
Mvmt Flow	36	17	40	7	0	6	3	1366	7	8	1219	9

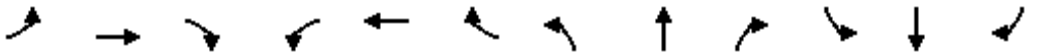
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1924	2614	610	2006	2616	683	1228	0	0	1373	0	0
Stage 1	1235	1235	-	1372	1372	-	-	-	-	-	-	-
Stage 2	689	1379	-	634	1244	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.84	7.24	7.5	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.5	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.17	3.47	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	41	19	402	36	25	396	575	-	-	506	-	-
Stage 1	190	219	-	156	216	-	-	-	-	-	-	-
Stage 2	407	185	-	439	248	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	40	19	402	29	24	396	575	-	-	506	-	-
Mov Cap-2 Maneuver	163	128	-	136	151	-	-	-	-	-	-	-
Stage 1	189	215	-	155	215	-	-	-	-	-	-	-
Stage 2	398	184	-	359	244	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	36	24.9	0	0.1
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	575	-	-	206	195	506	-	-
HCM Lane V/C Ratio	0.005	-	-	0.45	0.07	0.017	-	-
HCM Control Delay (s)	11.3	-	-	36	24.9	12.2	-	-
HCM Lane LOS	B	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	2.1	0.2	0.1	-	-

HCM 6th Signalized Intersection Summary
40: US 31 (South of Kokomo) & Division Road

02/26/2024



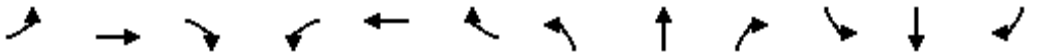
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	31	27	93	10	52	2	1516	44	49	1501	14
Future Volume (veh/h)	14	31	27	93	10	52	2	1516	44	49	1501	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1752	1811	1796	1055	1811	1900	1693	1337	1900	1781	1900
Adj Flow Rate, veh/h	16	34	30	103	11	58	2	1684	49	54	1668	16
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	10	6	7	57	6	0	14	38	0	8	0
Cap, veh/h	83	160	121	152	19	59	169	2120	747	150	2264	22
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.66	0.66	0.66	0.66	0.66	0.66
Sat Flow, veh/h	205	786	595	473	92	288	298	3216	1133	284	3435	33
Grp Volume(v), veh/h	80	0	0	172	0	0	2	1684	49	54	821	863
Grp Sat Flow(s),veh/h/ln	1586	0	0	853	0	0	298	1608	1133	284	1692	1776
Q Serve(g_s), s	0.0	0.0	0.0	16.7	0.0	0.0	0.5	39.1	1.6	17.6	33.5	33.7
Cycle Q Clear(g_c), s	4.3	0.0	0.0	21.0	0.0	0.0	34.1	39.1	1.6	56.7	33.5	33.7
Prop In Lane	0.20		0.37	0.60		0.34	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	365	0	0	229	0	0	169	2120	747	150	1115	1170
V/C Ratio(X)	0.22	0.00	0.00	0.75	0.00	0.00	0.01	0.79	0.07	0.36	0.74	0.74
Avail Cap(c_a), veh/h	365	0	0	229	0	0	171	2137	753	151	1125	1180
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.8	0.0	0.0	41.0	0.0	0.0	23.1	12.7	6.3	33.0	11.8	11.8
Incr Delay (d2), s/veh	0.3	0.0	0.0	12.9	0.0	0.0	0.1	2.9	0.1	5.2	3.9	3.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.0	0.0	5.1	0.0	0.0	0.0	11.2	0.3	1.3	10.5	11.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.1	0.0	0.0	54.0	0.0	0.0	23.2	15.6	6.5	38.3	15.6	15.5
LnGrp LOS	D	A	A	D	A	A	C	B	A	D	B	B
Approach Vol, veh/h		80			172			1735			1738	
Approach Delay, s/veh		35.1			54.0			15.4			16.3	
Approach LOS		D			D			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		76.4		28.0		76.4		28.0				
Change Period (Y+Rc), s		7.6		6.7		7.6		6.7				
Max Green Setting (Gmax), s		69.4		21.3		69.4		21.3				
Max Q Clear Time (g_c+I1), s		41.1		6.3		58.7		23.0				
Green Ext Time (p_c), s		24.8		0.3		10.1		0.0				

Intersection Summary												
HCM 6th Ctrl Delay			18.0									
HCM 6th LOS			B									

HCM 6th Signalized Intersection Summary
40: US 31 (South of Kokomo) & Division Road

02/22/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	13	13	31	30	63	20	1649	69	41	1867	31
Future Volume (veh/h)	13	13	13	31	30	63	20	1649	69	41	1867	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1707	1752	1900	1856	1781	1767	1633	1841	1737	1900
Adj Flow Rate, veh/h	13	13	13	32	31	65	21	1700	71	42	1925	32
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	0	0	13	10	0	3	8	9	18	4	11	0
Cap, veh/h	84	77	57	75	49	80	164	2549	1051	208	2523	42
Arrive On Green	0.10	0.10	0.10	0.10	0.10	0.10	0.76	0.76	0.76	0.76	0.76	0.76
Sat Flow, veh/h	373	801	587	305	504	834	214	3357	1384	265	3322	55
Grp Volume(v), veh/h	39	0	0	128	0	0	21	1700	71	42	953	1004
Grp Sat Flow(s),veh/h/ln	1761	0	0	1643	0	0	214	1678	1384	265	1650	1727
Q Serve(g_s), s	0.0	0.0	0.0	5.2	0.0	0.0	6.2	24.5	1.3	9.1	32.7	33.1
Cycle Q Clear(g_c), s	2.0	0.0	0.0	7.5	0.0	0.0	39.3	24.5	1.3	33.6	32.7	33.1
Prop In Lane	0.33		0.33	0.25		0.51	1.00		1.00	1.00		0.03
Lane Grp Cap(c), veh/h	218	0	0	204	0	0	164	2549	1051	208	1253	1312
V/C Ratio(X)	0.18	0.00	0.00	0.63	0.00	0.00	0.13	0.67	0.07	0.20	0.76	0.77
Avail Cap(c_a), veh/h	262	0	0	248	0	0	170	2652	1094	217	1304	1365
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	41.4	0.0	0.0	43.8	0.0	0.0	18.1	5.8	3.0	14.0	6.8	6.9
Incr Delay (d2), s/veh	0.4	0.0	0.0	3.5	0.0	0.0	1.3	1.2	0.1	1.7	3.9	3.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	3.2	0.0	0.0	0.3	4.9	0.2	0.6	7.3	7.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.8	0.0	0.0	47.4	0.0	0.0	19.4	7.0	3.1	15.7	10.7	10.7
LnGrp LOS	D	A	A	D	A	A	B	A	A	B	B	B
Approach Vol, veh/h		39			128			1792			1999	
Approach Delay, s/veh		41.8			47.4			7.0			10.8	
Approach LOS		D			D			A			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		82.9		16.3		82.9		16.3				
Change Period (Y+Rc), s		7.6		6.7		7.6		6.7				
Max Green Setting (Gmax), s		78.4		12.3		78.4		12.3				
Max Q Clear Time (g_c+I1), s		41.3		4.0		35.6		9.5				
Green Ext Time (p_c), s		32.3		0.1		39.7		0.1				

Intersection Summary												
HCM 6th Ctrl Delay			10.6									
HCM 6th LOS			B									

APPENDIX E: SIGNAL WARRANT WORKSHEETS

TRAFFIC SIGNAL WARRANT SUMMARY

City:	Peru	Engineer:	Jeremy Ashlock
County:	Miami	Date:	February 23, 2024
District:	Fort Wayne		

Major Street:	US 31	Lanes:	2	Major Approach Speed:	60
Minor Street:	CR 400 S	Lanes:	1	Minor Approach Speed:	45

MUTCD Electronic Reference to Chapter 4: http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part4.pdf

Volume Level Criteria

1. Is the posted speed or 85th-percentile of major street > 40 mph (70 km/h)? ☑ Yes ☐ No
2. Is the intersection in a built-up area of an isolated community with a population < 10,000? ☐ Yes ☑ No

"70%" volume level **may** be used if Question 1 **or** 2 above is answered "Yes" ☑ 70% ☑ 100%

WARRANT 1 - EIGHT-HOUR VEHICULAR VOLUME

Warrant 1 is satisfied if Condition A or Condition B is "100%" satisfied for eight hours. ☐ Yes ☑ No

Warrant 1 is also satisfied if both Condition A and Condition B are "80%" satisfied (should only be applied after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems). ☐ Yes ☑ No

Condition A - Minimum Vehicular Volume

Condition A is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

100% Satisfied: ☐ Yes ☑ No
80% Satisfied: ☐ Yes ☑ No
70% Satisfied: ☐ Yes ☑ No

Number of Lanes for moving traffic on each approach		Vehicles per hour on major-street (total of both approaches)			Vehicles per hour on minor-street (one direction only)		
Major	Minor	100%[a]	80%[b]	70%[c]	100%[a]	80%[b]	70%[c]
1	1	500	400	350	150	120	105
2 or more	1	600	480	420	150	120	105
2 or more	2 or more	600	480	420	200	160	140
1	2 or more	500	400	350	200	160	140

[a] Basic Minimum hourly volume
[b] Used for combination of Conditions A and B after adequate trial of other remedial measures
[c] May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Record 8 highest hours and the corresponding major-street and minor-street volumes in the Instructions Sheet.

Street	Eight Highest Hours							
	8 AM to 9 AM	9 AM to 10 AM	12 PM to 1 PM	1 PM to 2 PM	3 PM to 4 PM	4 PM to 5 PM	5 PM to 6 PM	7 PM to 8 PM
Major	1,460	1,372	1,522	1,605	1,737	1,940	1,902	1,141
Minor	16	77	34	21	23	68	13	20

Existing Volumes

TRAFFIC SIGNAL WARRANT SUMMARY

Condition B - Interruption of Continuous Traffic

Condition B is intended for application where Condition A is not satisfied and the traffic volume on a major street is so heavy that traffic on the minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Applicable:	☑ Yes	☐ No
100% Satisfied:	☐ Yes	☑ No
80% Satisfied:	☐ Yes	☑ No
70% Satisfied:	☐ Yes	☑ No

Number of Lanes for moving traffic on each approach		Vehicles per hour on major-street (total of both approaches)			Vehicles per hour on minor-street (one direction only)		
Major	**Minor**	**100%[a]**	**80%[b]**	**70%[c]**	**100%[a]**	**80%[b]**	**70%[c]**
1	1	750	600	525	75	60	53
2 or more	1	900	720	630	75	60	53
2 or more	2 or more	900	720	630	100	80	70
1	2 or more	750	600	525	100	80	70

[a] Basic Minimum hourly volume

[b] Used for combination of Conditions A and B after adequate trial of other remedial measures

[c] May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Record 8 highest hours and the corresponding major-street and minor-street volumes in the Instructions Sheet.

Eight Highest Hours								
Street	**8 AM to 9 AM**	**9 AM to 10 AM**	**12 PM to 1 PM**	**1 PM to 2 PM**	**3 PM to 4 PM**	**4 PM to 5 PM**	**5 PM to 6 PM**	**7 PM to 8 PM**
Major	1,460	1,372	1,522	1,605	1,737	1,940	1,902	1,141
Minor	16	77	34	21	23	68	13	20

Existing Volumes

TRAFFIC SIGNAL WARRANT SUMMARY

City:	Peru	Engineer:	Jeremy Ashlock
County:	Miami	Date:	February 23, 2024
District:	Fort Wayne		

Major Street:	US 31	Lanes:	2	Major Approach Speed:	60
Minor Street:	CR 400 S	Lanes:	1	Minor Approach Speed:	45

MUTCD Electronic Reference to Chapter 4: http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part4.pdf

Volume Level Criteria

1. Is the posted speed or 85th-percentile of major street > 40 mph (70 km/h)? ☑ Yes ☐ No
2. Is the intersection in a built-up area of an isolated community with a population < 10,000? ☐ Yes ☑ No

"70%" volume level **may** be used if Question 1 **or** 2 above is answered "Yes" ☑ Yes ☐ No

WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME

If all four points lie above the appropriate line, then the warrant is satisfied.

Applicable: ☑ Yes ☐ No

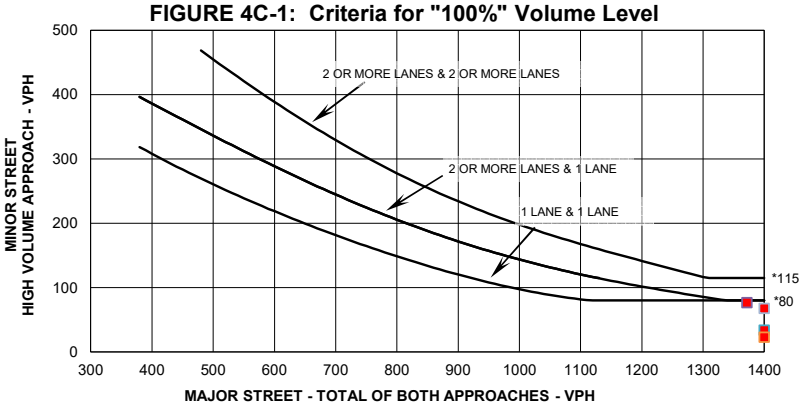
Satisfied: ☐ Yes ☑ No

Plot four volume combinations on the applicable figure below.

100% Volume Level

Four Highest Hours	Volumes	
	Major Street	Minor Street
9 AM to 10 AM	1372	77
12 PM to 1 PM	1522	34
3 PM to 4 PM	1737	23
4 PM to 5 PM	1940	68

FIGURE 4C-1: Criteria for "100%" Volume Level



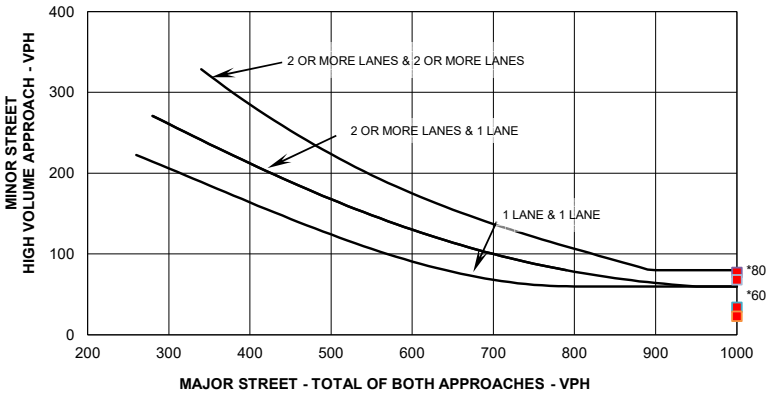
** Note: 115 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 80 vph applies as the lower threshold volume threshold for a minor street approach with one lane.*

70% Volume Level

Four Highest Hours	Volumes	
	Major Street	Minor Street
9 AM to 10 AM	1372	77
12 PM to 1 PM	1522	34
3 PM to 4 PM	1737	23
4 PM to 5 PM	1940	68

FIGURE 4C-2: Criteria for "70%" Volume Level

(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** Note: 80 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 60 vph applies as the lower threshold volume threshold for a minor street approach with one lane.*

TRAFFIC SIGNAL WARRANT SUMMARY

City:	**Peru**	Engineer:	**Jeremy Ashlock**
County:	**Miami**	Date:	**February 23, 2024**
District:	**Fort Wayne**		

Major Street:	**US 31**	Lanes:	**2**	Major Approach Speed:	**60**
Minor Street:	**CR 400 S**	Lanes:	**1**	Minor Approach Speed:	**45**

MUTCD Electronic Reference to Chapter 4: http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part4.pdf

CONCLUSIONS

Remarks:
Warrant 1 is **not** met. Using 70% volume criteria, 2 of the 8 hours are met.
Warrant 2 is **not** met. Using 70% volume criteria, 2 of the 4 hours are met.

WARRANTS SATISFIED:

☐	Warrant 1	☐	Not Applicable
☐	Warrant 2	☐	Not Applicable
☐	Warrant 3	☑	Not Applicable
☐	Warrant 4	☑	Not Applicable
☐	Warrant 5	☑	Not Applicable
☐	Warrant 6	☑	Not Applicable
☐	Warrant 7	☑	Not Applicable
☐	Warrant 8	☑	Not Applicable
☐	Warrant 9	☑	Not Applicable