US 412 at SH 412B Junction

Traffic Analysis Memorandum

JP 35050(04)

CI-2440

Mayes County

Prepared for:

Engineer's Certification

I hereby certify that this Traffic Analysis Memorandum for the US 412 at SH 412B Junction was prepared by Garver under my direct supervision for the Oklahoma Department of Transportation.

Thomas Cusick, PE
State of Oklahoma PE License 33741

Table of Contents

List of Figures

List of Tables

List of Appendices

Appendix A: Traffic Data
Appendix B: Crash Data
Appendix C: Operations Analysis Results
Appendix D: Initial Concepts Matrix

1.0 Executive Summary

At the request of the Oklahoma Department of Transportation (ODOT), Garver evaluated the current and future traffic operations along US 412 and State Highway 412B (SH 412B) near the MidAmerica Industrial Park (MAIP) in Mayes County, Oklahoma. At 9,000 acres, MAIP is Oklahoma's largest industrial park. MAIP is located near the junction of US 69 and US 412 to the east of Tulsa, Oklahoma and midway between Dallas, Texas and Kansas City, Missouri. The Union Pacific Railroad serves MAIP as well as the Port of Catoosa MAIP and an on-site regional business jet airport. This connectivity has led over 80 businesses including seven Fortune 500 companies to locate within the industrial park. MAIP has several planned future developments that will impact the performance of the existing two-way stop-controlled intersection of US 412 and SH 412B that serves as an entrance to the park. The long-range plan for the US 412 corridor is to convert the highway to an interstate. The US 412 interstate conversion would enhance travel time connectivity. The need for a grade separated interchange would improve access control and also help local economic activity.

The study included data collection, field observations, assembling prior studies such as recently completed Traffic Impact Analyses (TIAs), and calculating new trips based on MAIP's developable land. This information was used to project 2045 future traffic volumes, develop alternative concepts, conduct operational analysis for each concept alternative, refine the alternatives, and ultimately select a preferred alternative.

The primary study area for the project includes US 412 one-half mile east of SH 412B and one-half mile west of Old Highway 33. The study area also includes one additional intersection along SH 412B at N4335 Road. The southern leg of the US 412 at SH 412B provides access to Chouteau Bend, a recreation area that offered camping sites and services before permanently closing. The road is still being used for access to boat ramps and fishing. The study area is depicted in **Figure 1** on the following page.

Field observations indicated potential site distance issues at the intersection of US 412 and SH 412B due to the close proximity of the Neosho River bridge as well as gap acceptance limitations for turning trucks. Traffic analysis of the existing conditions did not indicate major intersection delay issues within the study area but, as the left turn and crossing movements grow, more acceptable gaps will be needed. As volume increases, this intersection will be a safety risk and see large delays.

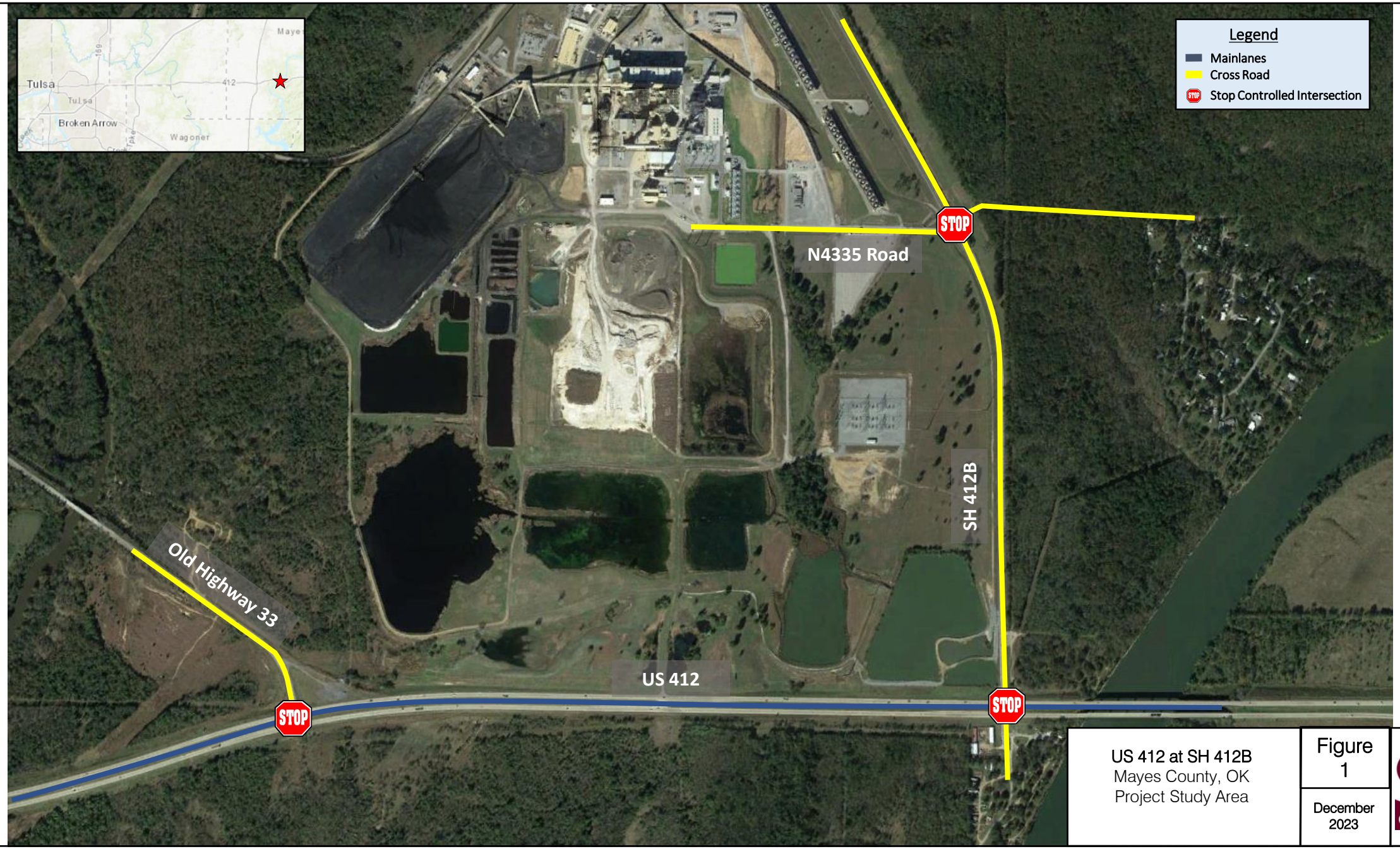
Garver analyzed multiple site plans for proposed developments in the industrial park and assumed trip generation for the remaining available parcels. Based on the site's proximity to the main study intersection of US 412 and SH 412B or the access to US 69, the developments trips were adjusted for the percentage of trips that would be using the intersection. Future trips for 2045 were estimated assuming 100% of the development was constructed. The trip generation process applied standard rates from the ITE Trip Generation Manual for multiple land use interactions as well as pass-by/diverted links trips to account for some trips that would use the development but not add new trips along the corridor. The total trip generation for the developments added approximately 9,900 daily trips on to SH 412B and approximately 1,450 trips in both the AM and PM peak hours. These trips were summed to determine the

overall impact at the study intersection and increased or decreased to determine when the concept alternatives would breakdown. This would allow for comparison purposes while highlighting the issues that would cause the concepts to begin to fail.

No Build scenarios were analyzed using the 2045 volume projections. The results indicated long delays and level of service (LOS) issues if no changes were made. Queuing would extend outside the available left turn lane storage and begin to impede the traffic flow along US 412.

13 preliminary improvement alternatives were developed for initial review. Preliminary analysis and conceptual layouts were generated for each option. The preliminary alternatives included:

- Three roundabout interchange options with different levels of access to the south and Old Hwy 33
- Two diamond interchanges; One traditional diamond and one with a button hook ramp and access to the south
- Three folded diamond options bridging over US 412 closer to the existing crossing and providing access to the south
- Three trumpet options providing access to Old Hwy 33 with different ramp locations and alignments to SH 412B
- One hybrid option combining the trumpet and folded diamond options
- One Single Point Urban Interchange (SPUI) option with US 412 bridging over the interchange



US 412 at SH 412B
Mayes County, OK
Project Study Area

Figure 1

December 2023

GARVER

After review with ODOT, five of the preliminary alternatives were brought forward for further refinement. Traffic volumes, operational performance, conceptual layouts, environmental impacts, utility, and construction impacts were generated for each option. The five alternatives brought forward from the preliminary analysis are described below:

- **Alternative 3 (Diamond_v2 - Button Hook On)**
  - **Description:** This alternative would create a diamond interchange approximately 0.4 miles to the west of SH 412B. The alternative would feature an eastbound button hook ramp to provide access and enough acceleration distance before the bridge over the Neosho River. The interchange will have signalized intersections at both the eastbound and westbound ramp terminals spaced at approximately 550 feet.
  - **Advantages:** This alternative can handle 90% of full MAIP build-out volumes in 2045 while providing direct access to the south. It has lower utility impacts compared to the other options and only requires two bridges.
  - **Disadvantages:** This alternative is not free flow meaning all movements will need to stop or yield, and it requires the third most linear footage of lane miles.
  - **Layout:** The conceptual layout of Alternative 3 can been seen below in **Figure 2**.

Figure 2: Alternative 3 Layout

- **Alternative 10 (Roundabout_v2)**
  - **Description:** This alternative would create a diamond interchange approximately 0.4 miles to the west of SH 412B. The interchange will have single lane roundabouts at both the eastbound and westbound ramp terminals spaced at approximately 375 feet. This alternative will provide a connection to Old Hwy 33 as well as a westbound right bypass at the westbound ramp terminal roundabout.
  - **Advantages:** This alternative can handle 80% of full MAIP build-out volumes in 2045 while providing direct access to the south and Old Hwy 33. It has lower utility impacts compared to the other options and only requires two bridges.

- **Disadvantages:** This alternative is semi-free flow and it requires the most linear footage of lane miles.
- **Layout:** The conceptual layout of Alternative 10 can been seen below in **Figure 3**.

Figure 3: Alternative 10 Layout

- **Alternative 11 (Trumpet_v5)**
  - **Description:** This alternative would create a trumpet interchange approximately 0.4 miles to the west of SH 412B. The interchange will provide ramps for all movements without requiring ramp terminals. This alternative will provide a connection to Old Hwy 33.
  - **Advantages:** This alternative can handle 170% of full MAIP build-out volumes in 2045 while providing direct access to Old Hwy 33. The trumpet interchange will allow for free flow movements meaning no movement will need to stop or yield.
  - **Disadvantages:** This alternative will require three bridges and the second most square footage of bridge deck as well as the second most linear footage of lane miles.
  - **Layout:** The conceptual layout of Alternative 11 can been seen below in **Figure 4**.

Figure 4: Alternative 11 Layout

- **Alternative 12 (Folded Diamond_v6)**
  - **Description:** This alternative would create a folded diamond interchange with SH 412B in nearly the same location. The interchange will have signalized intersections at both the eastbound and westbound ramp terminals spaced at approximately 0.4 miles. A connection to Old Hwy 33 will be provided and will cross to the south of US 412 to meet SH 412B south of the eastbound ramp terminal.
  - **Advantages:** This alternative can handle 75% of the full MAIP build-out volumes in 2045 with signalized intersections while providing direct access to the south and Old Hwy 33. This alternative only requires two bridges with the third lowest square footage of bridge deck and the lowest amount of linear footage of lines miles.
  - **Disadvantages:** This alternative is semi-free flow because free flow for southbound SH 412B movements to both eastbound and westbound US 412. It requires the largest utility impacts.
  - **Layout:** The conceptual layout of Alternative 12 can been seen below in **Figure 5**.

Figure 5: Alternative 12 Layout

- **Alternative 13 (Trumpet_v6)**
    - **Description:** This alternative would create a trumpet interchange approximately 0.2 miles to the west of SH 412B. The interchange will provide ramps for all movements without requiring ramp terminals. This alternative will provide a connection to Old Hwy 33 and to the south with a roadway connection near the existing SH 412B location.
    - **Advantages:** This alternative can handle 170% of full MAIP build-out volumes in 2045 while providing direct access to Old Hwy 33 and to the south. The trumpet interchange will allow for free flow movements and the second lowest linear footage of lane miles.
    - **Disadvantages:** This alternative will require three bridges and the largest utility impacts.
    - **Layout:** The conceptual layout of Alternative 13 can been seen below in **Figure 6**.

Figure 6: Alternative 13 Layout

These five alternatives were presented to ODOT in September 2023. After reviewing the operational performance, the Trumpet Alternatives 11 and 13 provide the best results from a traffic performance perspective when considering 100% build out of MAIP in 2045. However, all alternatives will provide acceptable performance upon opening and with the assumed background growth for 2045. The operations for the two Diamond Alternatives 3 and 12 can remain unsignalized until 40-50% of the MAIP build out and then will require signalization at the ramp terminals to continue providing acceptable conditions up to 75% of the full build out. All alternatives should be considered for further evaluation, and a recommendation should be made based on the alternative that limits construction, environmental, and right-of-way impacts while potentially offering access to Old Hwy 33 and Chouteau Bend to the south.

2.0 Introduction

Garver was retained by ODOT to conceptually evaluate potential alternatives to install a grade separated interchange for the intersection of US 412 and SH 412B in Mayes County, Oklahoma. This intersection serves as an entrance to MAIP which has several planned developments that will impact the performance of the existing two-way stop-controlled entrance at the intersection of US 412 and SH 412B. This development will create a need to improve the access control to a grade separated interchange while accommodating the high percentage of heavy vehicles using the connection. The long-range plan for the US 412 corridor is to convert the highway to an interstate to encourage economic development and expand opportunities for employment in the region by enhancing travel time connectivity and improving access.

2.1 Study Area

The project limits extend approximately 1.5 miles along US 412 from west of Old Highway 33 to east of SH 412B in Mayes County, Oklahoma. The existing US 412 facility is a 4-lane divided highway with 40-50’ median. Additionally, the study area extends to the north of US 412 on SH 412B into MAIP to include the intersection of SH 412B at N4335 Road. There are three two-way stop-controlled intersections within the study area, but the focus of the project is the junction of US 412 at SH 412B.

3.0 Existing Traffic Conditions

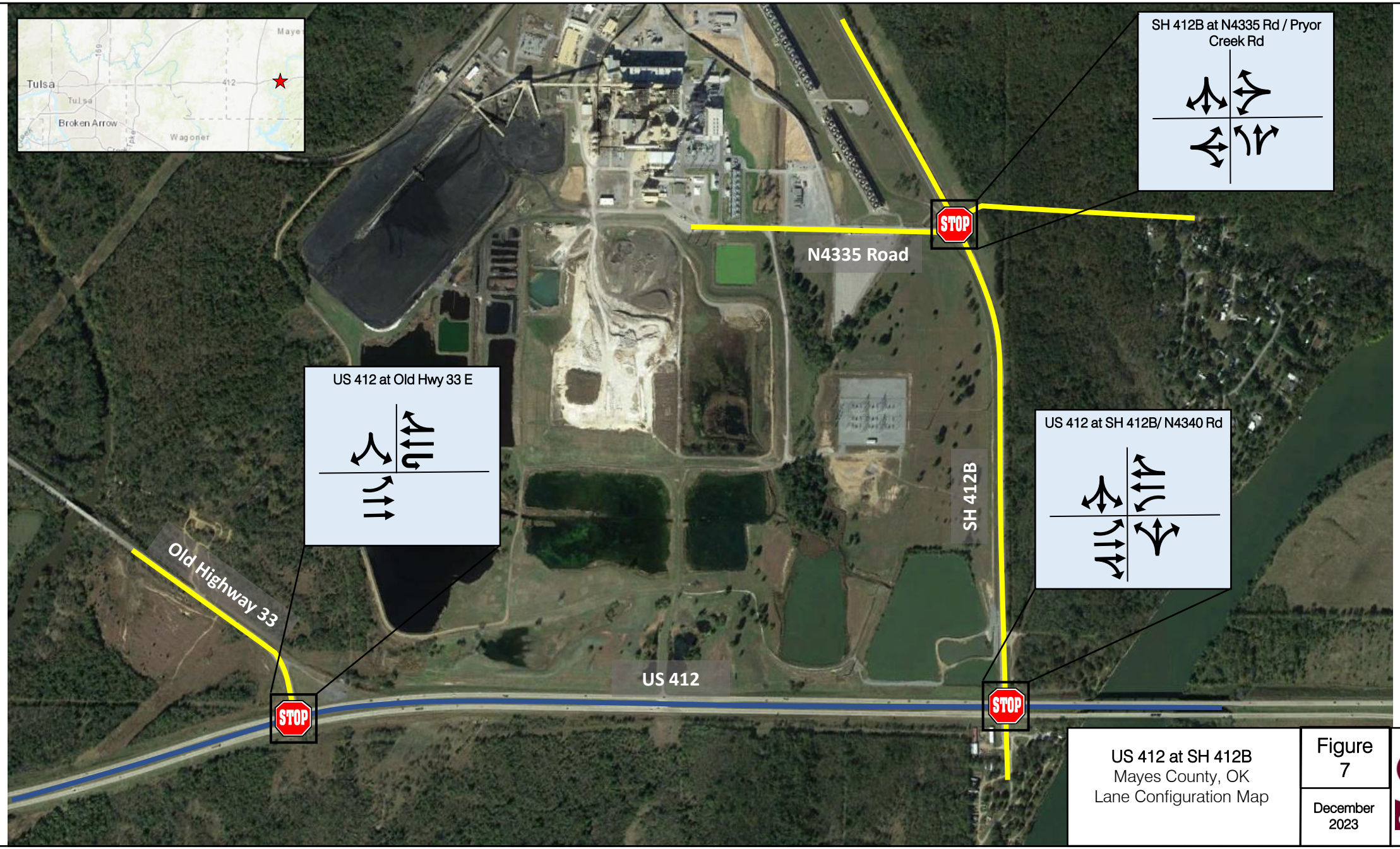
Current traffic conditions were observed, inventoried, and quantified using traffic analysis software. This section describes the existing lane configuration, traffic observations, daily and peak hour traffic volumes across the corridor, intersection level of service (LOS), and crash history.

3.1 Lane Configuration

The current lane configuration for the study area is captured in **Figure 7**. As shown, unsignalized intersections exist on US 412 at Old Highway 33 and SH 412B and along SH 412B at N4335 Road. The US 412 corridor features two through lanes in both directions along the study corridor and SH 412B features a single lane in both directions throughout the study corridor. The following describes the lane configuration at each intersection (see **Figure 7**):

- **US 412 at SH 412B (Unsignalized)**
    - Two lanes (thru and shared thru-right) on eastbound and westbound approach with single left turn lane (395’ storage length in eastbound direction and 340’ storage length in westbound direction)
    - Single lane approach in the northbound/southbound direction (stop-controlled)
    - Approximately 45’ median between the eastbound and westbound travel lanes
    - MidAmerica Industrial Park Entrance on the northern leg
    - Neosho River bridge approximately 600’ to the east
    - Chouteau Bend recreational area to the south

- **US 412 at Old Highway 33 E (Unsignalized)**
  - 3-leg intersection
  - Two lanes (thru and shared thru-right) on eastbound and westbound approach with single left turn lane in the eastbound direction (350’ of storage length) and a single U-turn lane in the westbound direction (340’ of storage length)
  - Approximately 45’ median between the eastbound and westbound travel lanes
  - Single lane approach in the southbound direction (stop-controlled)
- **SH 412B at N4335 Road (Unsignalized)**
  - Single left turn lane (65’ of storage length) with one shared thru-right lane in the northbound direction
  - Single lane approach in the southbound direction with space for future single left turn lane
  - Single lane approach in the eastbound/westbound direction (stop-controlled)
  - Grand River Dam Authority Entrance on the western leg
  - Residential area to the east



US 412 at SH 412B
Mayes County, OK
Lane Configuration Map

Figure 7

December 2023

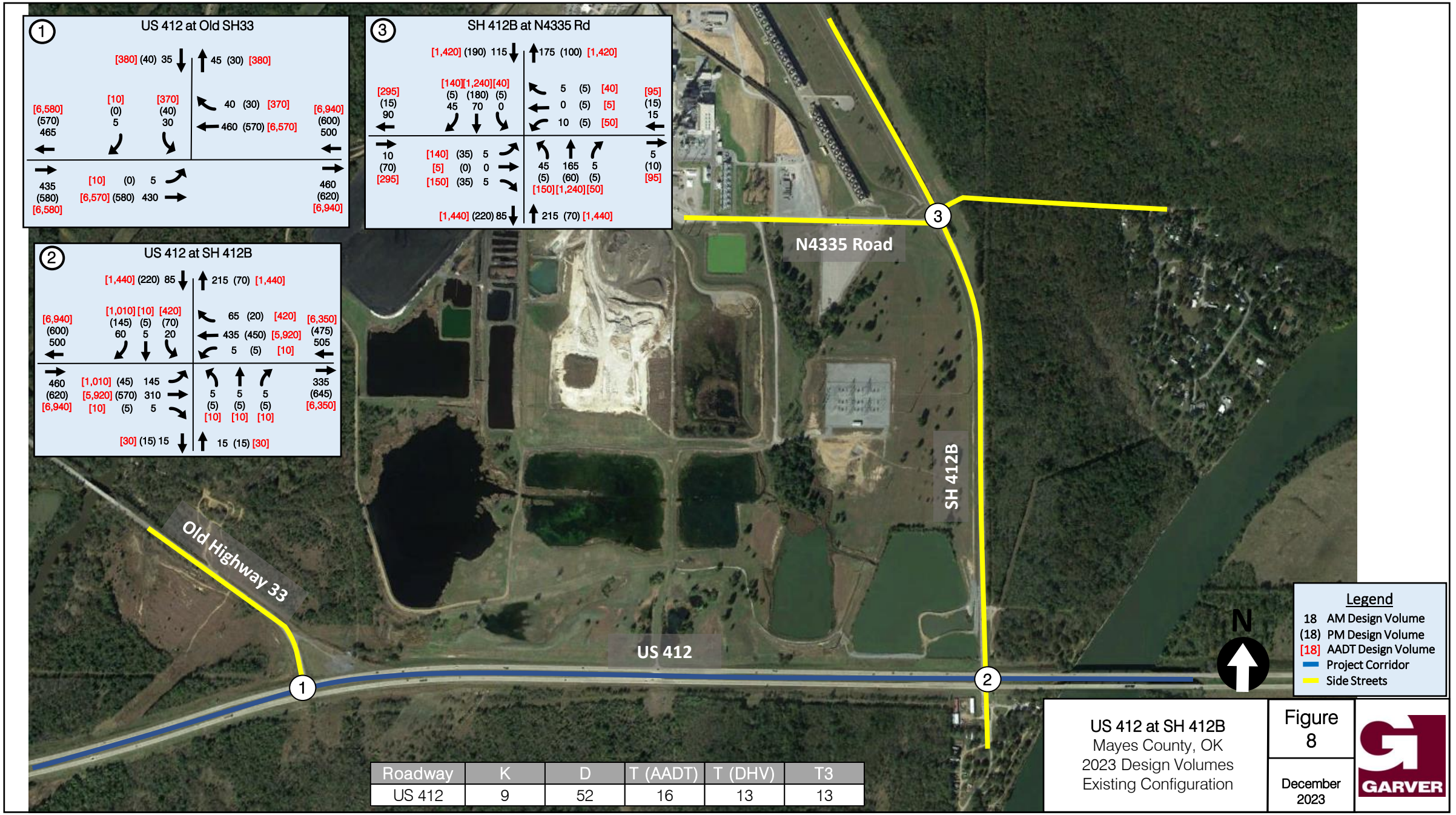
GARVER

3.2 Traffic Data

In February 2023, ODOT coordinated collection of 24-hour turning movement counts at the following locations along the US 412 and SH 412B corridors:

1. US 412 at Old Highway 33 N
2. US 412 at SH 412B
3. SH 412B at N4335 Road

The full 24-hr turning movement count sheets can be found in **Appendix A**. As shown in **Figure 8**, US 412 carries approximately 14,000 vehicles per day, SH 412B carries approximately 3,000 vehicles per day, and Old Highway 33 carries approximately 800 vehicles per day. The AM peak hour showed heavier volume traveling west on US 412 (approximately 60%) and traveling towards north along SH 412B (approximately 70%). The PM peak hour reversed to show heavier volume traveling east on US 412 (approximately 60%) and traveling towards south along SH 412B (approximately 70%). The daily heavy vehicle percentage seen on US 412 ranged from 13-16% and SH 412B ranged from 16-17%.



Roadway	K	D	T (AADT)	T (DHV)	T3
US 412	9	52	16	13	13

US 412 at SH 412B
Mayes County, OK
2023 Design Volumes
Existing Configuration

Figure 8

December 2023

GARVER

3.3 Field Observations

Field observations were performed in May 2023. Photos from the site visit can be seen in **Figure 9** on the next page. US 412 is classified as a rural principal arterial with partial access control in this area. There are no private businesses or residences with driveways directly connecting to US 412 in the study area. The intersection of US 412 and SH 412B did not have any major observed delay issues. The width of the median allows for two-stage turn storage for the crossing and left turn movements. The heavy vehicles require larger gap acceptance to safely make left turns and to accelerate up to speed after turning onto US 412. When two or more heavy vehicles arrive at the same time, longer queues and delays will be seen for short periods. On SH 412B and Old Hwy 33, the stop bars are deficient or nonexistent.

The following field observations were conducted during the morning and evening peak periods:

- **Morning Peak Period**
  - Traffic begins to peak around the 6:15AM and remains steady throughout the middle of the day
  - Volume is noticeably heavier in the westbound direction to the east of SH 412B but balanced on the west side of SH 412B
  - The majority of vehicles using SH 412B are heading northbound into MAIP
- **Evening Peak Period**
  - Traffic begins to peak around the 2:30PM and remains steady until starting to drop off around 6:30PM
  - Volume is noticeably heavier in the eastbound direction to the east of SH 412B but balanced on the west side of SH 412B
  - The majority of vehicles using SH 412B are heading southbound out of MAIP
  - Multiple trucks are leaving MAIP at the same time created longer queues and delays

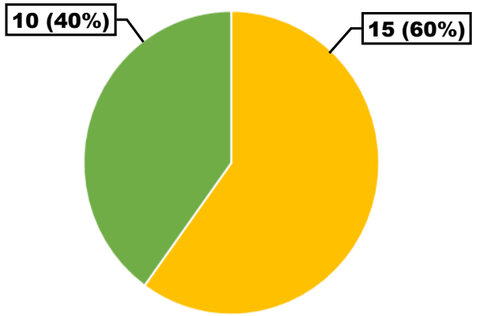
Figure 9: Site Visit Photos

3.4 Crash Data

Historical crash data was obtained within the study area for the five-year period of 2017 to 2021 using ODOT's crash database. **Figure 10** provides a crash summary graphic that provides insights on trends related to crash location, type, severity, and outside sources such as weather and light conditions. A total number of 25 crashes were recorded during this five-year period. Of these recorded crashes, 40% were non-injury, 20% were possible injury, 28% were non-incapacitating injury, 8% were incapacitating injury, and 4% were fatal. The study area includes one fatal crash involving a lane change, which caused a same direction sideswipe collision, followed by roadway departure. Crashes along high-speed routes can lead to very severe results. The full list of crashes during the five-year period can be found in **Appendix B**.

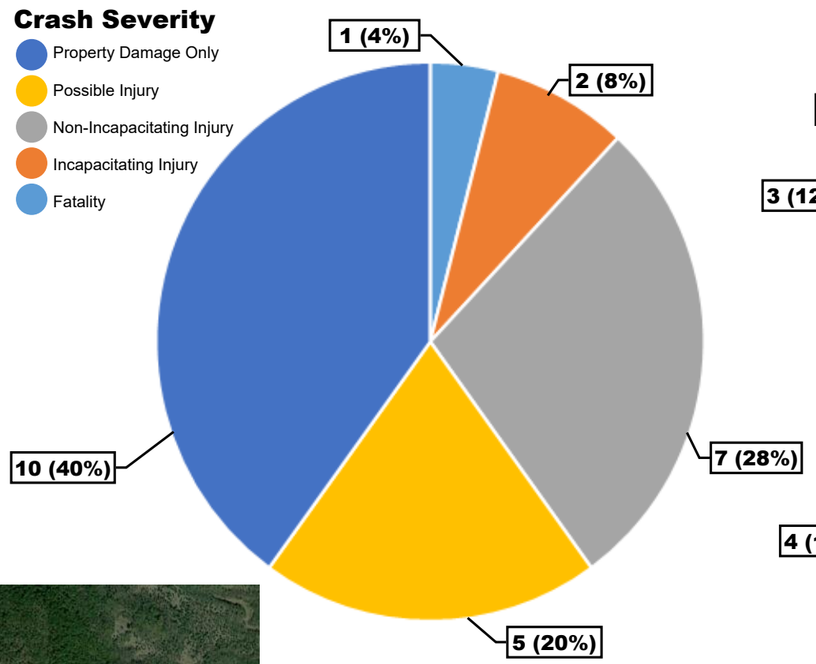
Total Number of Crashes

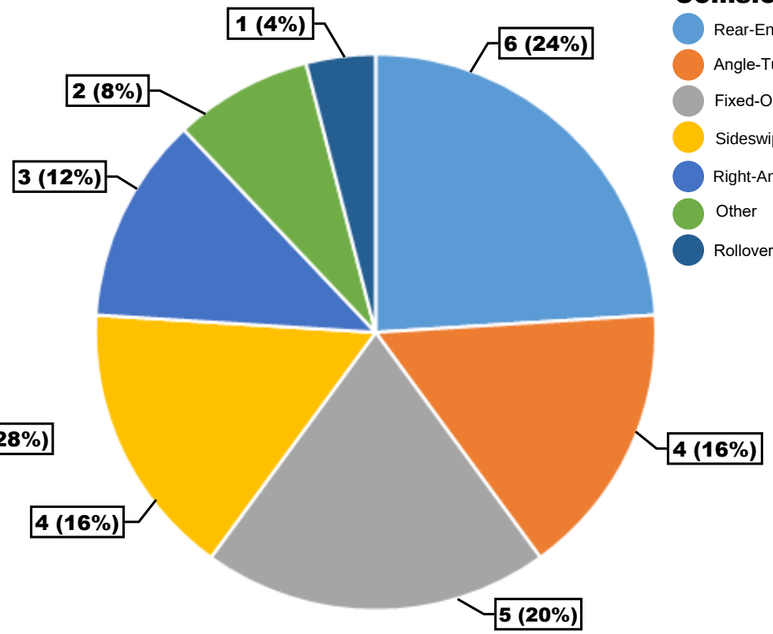
25

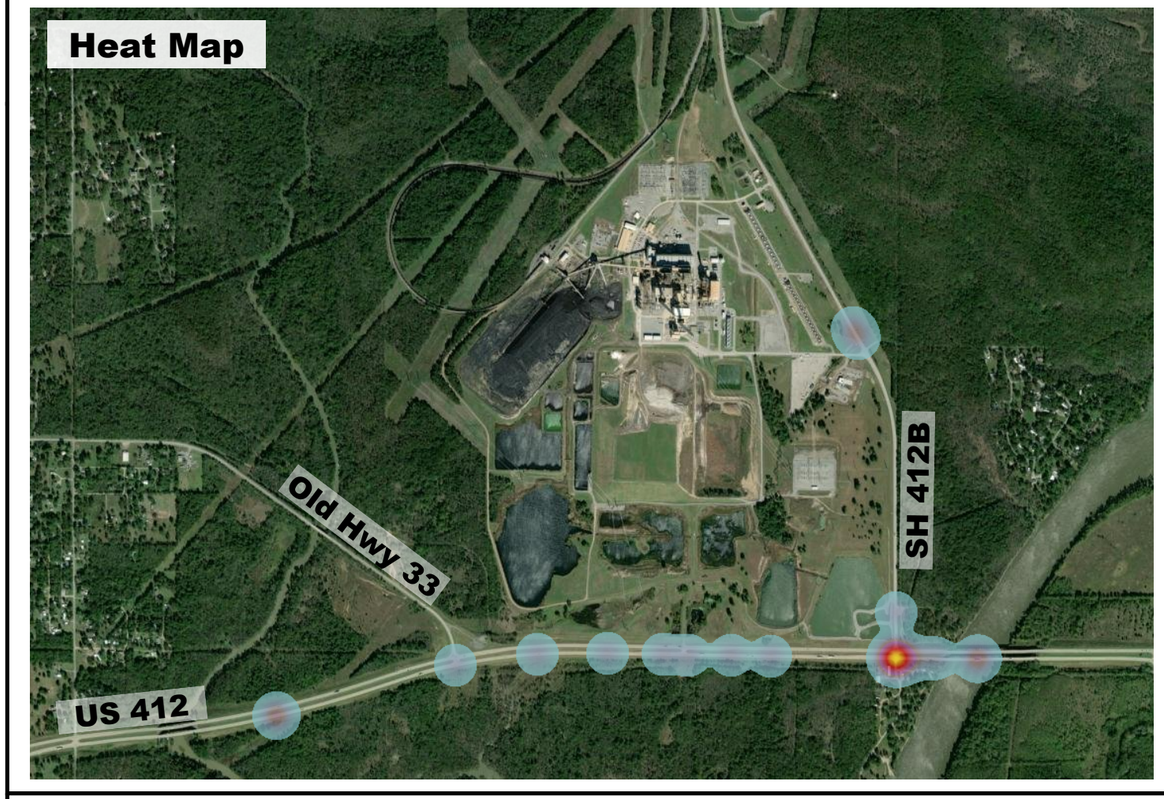


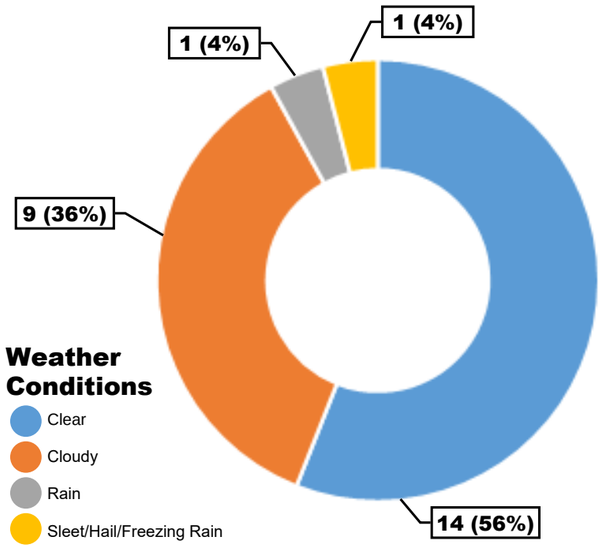
Intersection Relation

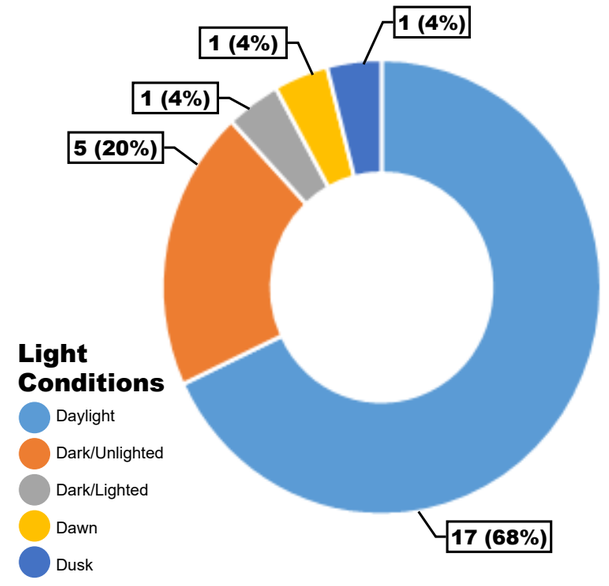
- Intersection Related
- Not Intersection Related











US-412 at SH 412B Junction

ODOT JP 35050(04)

Crash Analysis Summary 2017-2021

Source: Oklahoma Safe-T Database

Figure 10

3.5 Capacity Analysis

The operation of the study intersections under the present configuration and demand was analyzed. The methodology and results of the capacity analysis for the existing conditions are presented below.

3.5.1 Methodology

The quality of operations at the study intersections was evaluated in terms of LOS. LOS is a concept defined by the *Highway Capacity Manual* (*HCM*) to qualitatively describe operating conditions within a traffic stream. LOS is typically stratified into six categories (A through F). These range from LOS A indicating free-flow, low density, or nearly negligible delay conditions to LOS F where demand exceeds capacity and large queues are experienced. LOS D is generally considered the minimal acceptable LOS for an intersection movement.

Synchro 11.1 software was used to determine the expected LOS using a procedure consistent with the equation-based *HCM* methodology. For unsignalized and signalized intersections, the *HCM* uses control delay for the basis of determining LOS. Control delay at an intersection is the average stopped time per vehicle traveling thru the intersection plus the movements at slower speeds due to the vehicles moving up in the queue or slowing down upstream of the approach. The LOS thresholds defined by *HCM 7th Edition* (pg. 905 for signalized intersections, pgs. 994 and 1085 for unsignalized intersections) are shown in **Table 1**.

Table 1: LOS Thresholds for Intersections

Level of Service	Description	Control Delay Range (sec/veh)	
		Unsignalized	Signalized
A	Most vehicles do not stop	0 to 10	0 to 10
B	Some vehicles stop	> 10 to 15	> 10 to 20
C	Significant number of stops	> 15 to 25	> 20 to 35
D	Many stop, individual cycle failure	> 25 to 35	> 35 to 55
E	Frequent individual cycle failure, at capacity	> 35 to 50	> 55 to 80
F	Arrival rate exceeds capacity	> 50	> 80

3.5.2 Intersection Level of Service

To evaluate the existing intersection LOS, roadway geometry, and an 13% truck factor were used to develop a traffic analysis model. The results of the intersection capacity analysis for 2023 are summarized in **Table 2** with full results provided in **Appendix B**. The operational analysis results reflect acceptable LOS conditions at all intersection in both the AM and PM peak periods. All movements are operating at LOS C or better. Since the majority of the volume at the intersections is free flow along US 412, low overall delay values were expected. *Synchro* allows turning vehicles from the minor street to use median storage to perform the left turn in two stages. This setting more accurately matches what was observed in the field.

Table 2: Intersection Capacity Analysis (2023 Existing)

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
US 412 @ SH 412B	AM	TWSC	LOS	A	n/a[1]		A	n/a[1]		C			B			A
			Delay	9.5	n/a[1]		8.2	n/a[1]		15.5			13.5			2.6
	PM		LOS	A	n/a[1]		A	n/a[1]		C			C			A
			Delay	8.8	n/a[1]		9.1	n/a[1]		15.1			16.5			3.2
US 412 @ Old Hwy 33	AM	TWSC	LOS	A	n/a[1]			n/a[1]					C		n/a[2]	A
			Delay	8.8	n/a[1]			n/a[1]					15.9		n/a[2]	0.6
	PM		LOS	n/a[3]	n/a[1]			n/a[1]					B		n/a[3]	A
			Delay	n/a[3]	n/a[1]			n/a[1]					14.9		n/a[3]	0.5
SH 412B @ N4335 Rd	AM	TWSC	LOS	A			B			A	n/a[1]		A			A
			Delay	8.3			11.0			7.7	n/a[1]		0.0			1.7
	PM		LOS	A			B			A	n/a[1]		A			A
			Delay	8.0			10.3			7.8	n/a[1]		7.5			2.3

n/a[1] free movement

n/a[2] right turn channelized movement

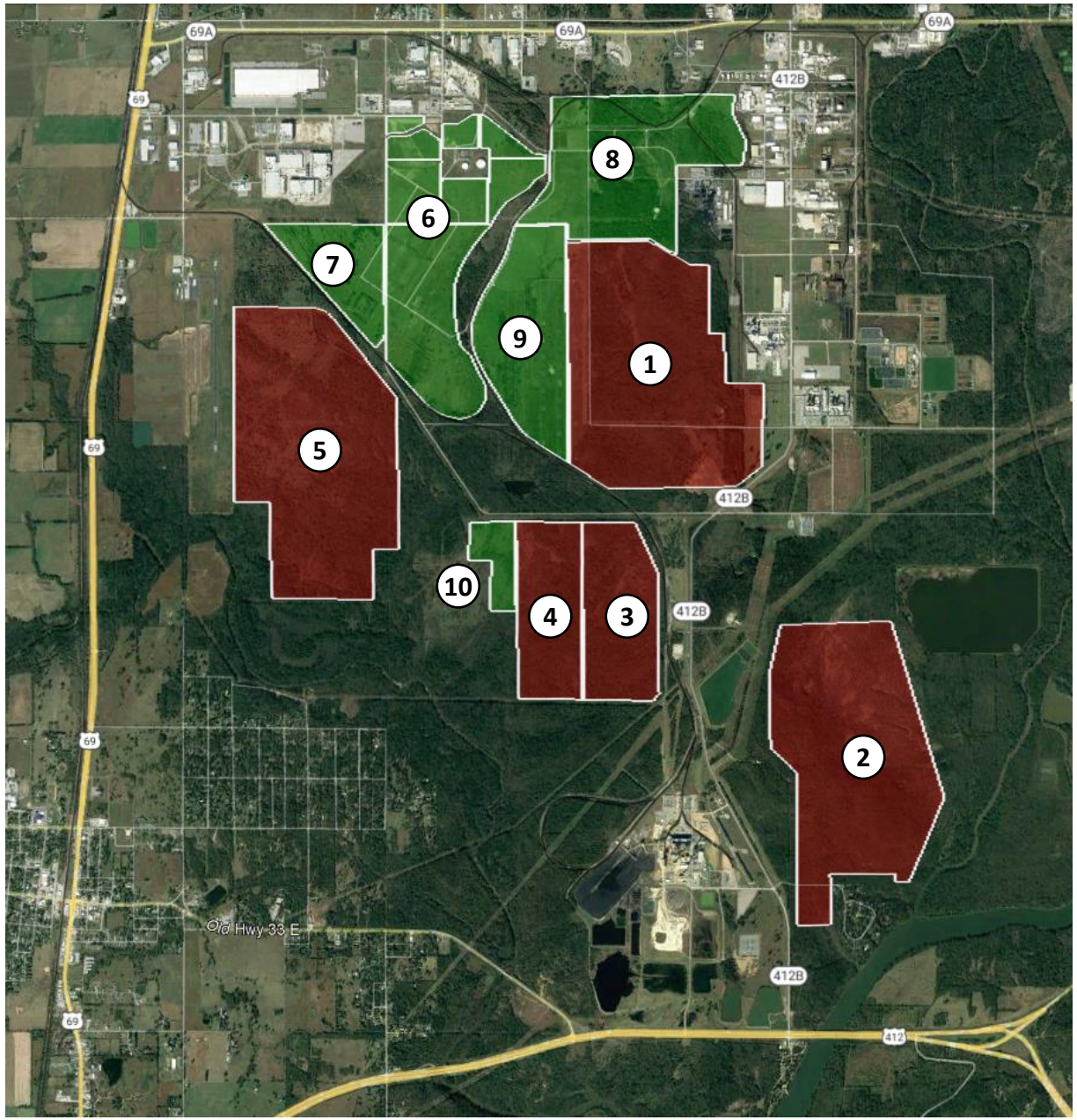
n/a[3] no volume modeled

4.0 No Build Conditions

The future traffic demand at the study intersections was projected and analyzed to estimate the delay expected to occur in a No Build scenario. The projections were also made to assess the effectiveness of any proposed improvements. After the generation phase, the trips were assigned throughout the local street network and combined with a background growth to produce 2045 volume projections for the corridor.

4.1 Development Trip Generation

Garver analyzed 10 locations for planned or potential developments within MAIP with varied land uses from industrial, residential, and office. **Figure 11** depicts the location, approximate size of the known developments, and number of total daily trips added. Based on proximity to the main study intersection of US 412 and SH 412B, the development trips were reduced to adjust for the percentage of trips that would be using the intersection. Garver estimated the future trips for 2045 assuming 100% of the development was constructed. The trip generation process applied standard rates for multiple land use interactions as well as pass-by/diverted links trips to account for some trips that would use the development but not add new trips along the corridor. The total trip generation for the developments added approximately 9,900 daily trips on to SH 412B and approximately 1,450 trips in both the AM and PM peak hours. The trip generation increased the existing volume on US 412 by approximately 100% and along SH 412B by 350%. These additional trips were distributed throughout adjacent intersections with the assumption that 70% of the volume was coming from the west (Tulsa, OK) and 30% of the volume was coming from the east (Arkansas).



No. #	Development Name	Land Use	Total Daily Trips	Daily Trips using SH 412B	Acres
1	Canoo	Industrial	4,957	2,725 (55%)	615
2	Estates at Ridgeview	Residential	2,573	1,930 (75%)	570
3	Apex	Industrial	1,931	1,060 (55%)	200
4	Josie	Industrial	7,942	4,370 (55%)	180
5	Google Campus	Office	1,038	310 (30%)	620
6	Armin Road Developments	Industrial	1,704	510 (30%)	416
7	Future Development	Industrial	748	225 (30%)	124
8	Future Development	Industrial	1,559	465 (30%)	365
9	Future Development	Industrial	1,222	365 (30%)	255
10	Future Development	Industrial	392	115 (30%)	48
			Total Daily Trips	**Total Daily Trips using SH 412B**	**Total Acres**
			24,066	**12,075**	**3,033**

Legend

- Planned Development
- Future Developable Land

MidAmerica Industrial Park
Development Map

Figure 11

December 2023

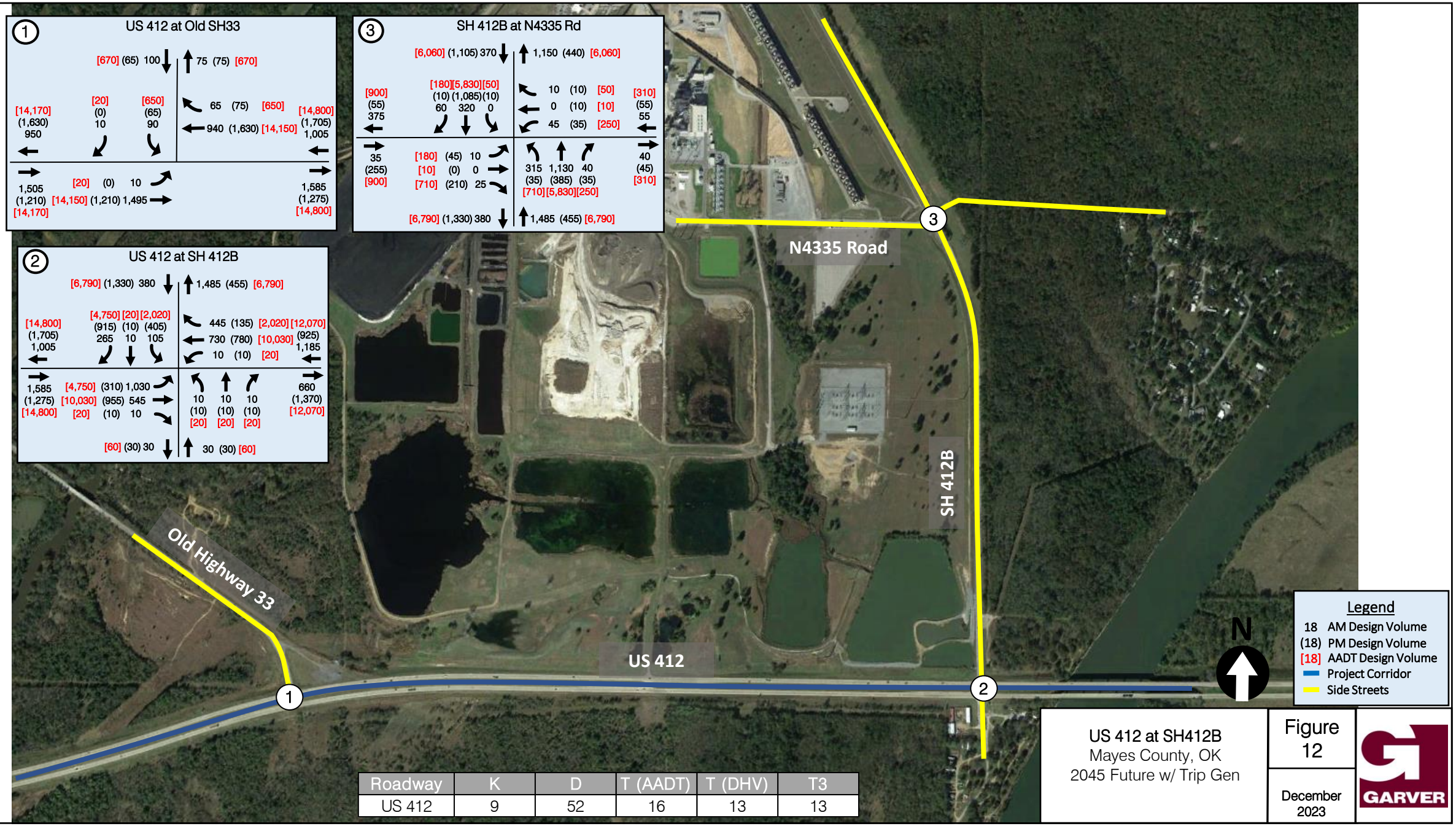
GARVER

4.2 Background Growth

In addition to the growth from planned developments, historic traffic volumes were obtained at several nearby locations from ODOT's Interactive AADT Map to determine a background growth. Count stations on US 412, US 69, and SH 412B provided historical AADT data for the years of 2012-2021. Along US 412, mainline growth rate of 3.4% was used based on historical data and because of the future interstate demand. A separate growth rate of 1.2% was used for SH 412B because the growth in volume will be accounted for by the development trip generation. Future year 2045 traffic volumes, shown in **Figure 12**, were obtained by summing the volumes from the existing traffic data with an annual background growth, and the total trip generation volume. The volumes from the intersection of US 412 and SH 412B were used to determine the on and off ramp volumes and the turning movements that would be seen at the ramp terminal intersections.

4.3 No Build Traffic Operations

Synchro models were created for No Build 2045 traffic conditions. With the planned volume increase to/from SH 412B, the approaches at study intersections being stop-controlled will provide extremely high delay values and queues.



Roadway	K	D	T (AADT)	T (DHV)	T3
US 412	9	52	16	13	13

US 412 at SH412B
Mayes County, OK
2045 Future w/ Trip Gen

Figure 12

December 2023

GARVER

4.3.1 Intersection Capacity Analysis - 2045 No Build Intersection LOS

The results of the intersection capacity analysis for 2045 are summarized in **Table 3** with full results provided in **Appendix B**. The operational analysis results reflect failing LOS conditions for nearly all stop-controlled movements. The free movements have grown so large that the stop controlled movements are not able to find acceptable gaps. In the AM peak, the eastbound left from US 412 to SH 412B is also unable to find gaps and creates large delays that fail the overall level of service at the main study intersection. The intersections within the study area would operate poorly under the 2045 future no build conditions.

Table 3: Intersection Capacity Analysis (2045 No Build)

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
US 412 @ SH 412B	AM	TWSC	LOS	F	n/a[1]		A	n/a[1]		F			F			F
			Delay	569.3	n/a[1]		9.0	n/a[1]		n/a[4]			n/a[4]			184.0
	PM		LOS	C	n/a[1]		B	n/a[1]		F			F			A
			Delay	16.4	n/a[1]		11.0	n/a[1]		n/a[4]			n/a[4]			1.5
US 412 @ Old Hwy 33	AM	TWSC	LOS	B	n/a[1]			n/a[1]					F		n/a[2]	C
			Delay	11.2	n/a[1]			n/a[1]					490.2		n/a[2]	18.8
	PM		LOS	n/a[3]	n/a[1]			n/a[1]					F		n/a[2]	A
			Delay	n/a[3]	n/a[1]			n/a[1]					98.2		n/a[2]	2.1
SH 412B @ N4335 Rd	AM	TWSC	LOS	F			F			A	n/a[1]		A			D
			Delay	104.1			997.4			9.7	n/a[1]		0.0			31.6
	PM		LOS	F			F			B	n/a[1]		A			F
			Delay	182.0			n/a[4]			11.9	n/a[1]		8.4			500.8

n/a[1] free movement
n/a[2] right turn channelized movement
n/a[3] no volume modeled
n/a[4] delay exceeds the methodology of HCM

5.0 Final Alternative Development

13 preliminary improvement alternatives were developed for initial review. Preliminary analysis and conceptual layouts were generated for each option. The preliminary alternatives included:

- Three roundabout interchange options which different levels of access to the south and Old Hwy 33
- Two diamond interchanges; One traditional diamond and one diamond with a button hook ramp and access to the south
- Three folded diamond options bridging over US 412 closer to the existing crossing and providing access to the south
- Three trumpet options providing access to Old Hwy 33 with different ramp locations and alignments to SH 412B
- One hybrid option combining the trumpet and folded diamond options
- One Single Point Urban Interchange (SPUI) option with US 412 bridging over the interchange

After review with ODOT, five of the preliminary alternatives were brought forward for further refinement. Traffic volumes, operational performance, conceptual layouts, cost estimates, environmental impacts, utility impacts, right-of-way impacts, and construction impacts were generated for each option. Example of

preliminary alternatives analyzed can be seen in **Figure 13** and **Figure 14** below. The results of the five alternatives brought forward from the preliminary analysis are described in the following sections.

Figure 13: Preliminary Alternative Examples

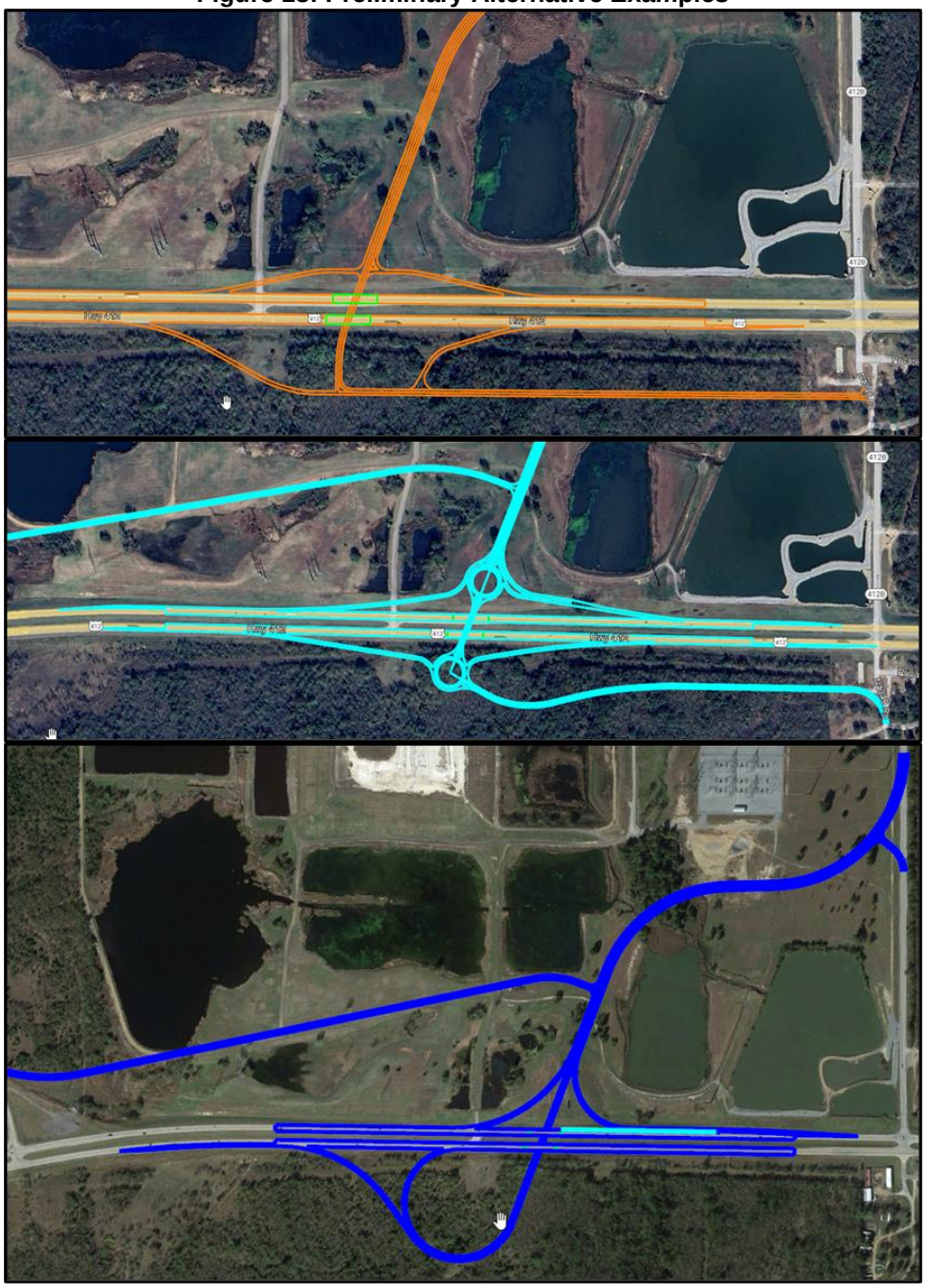
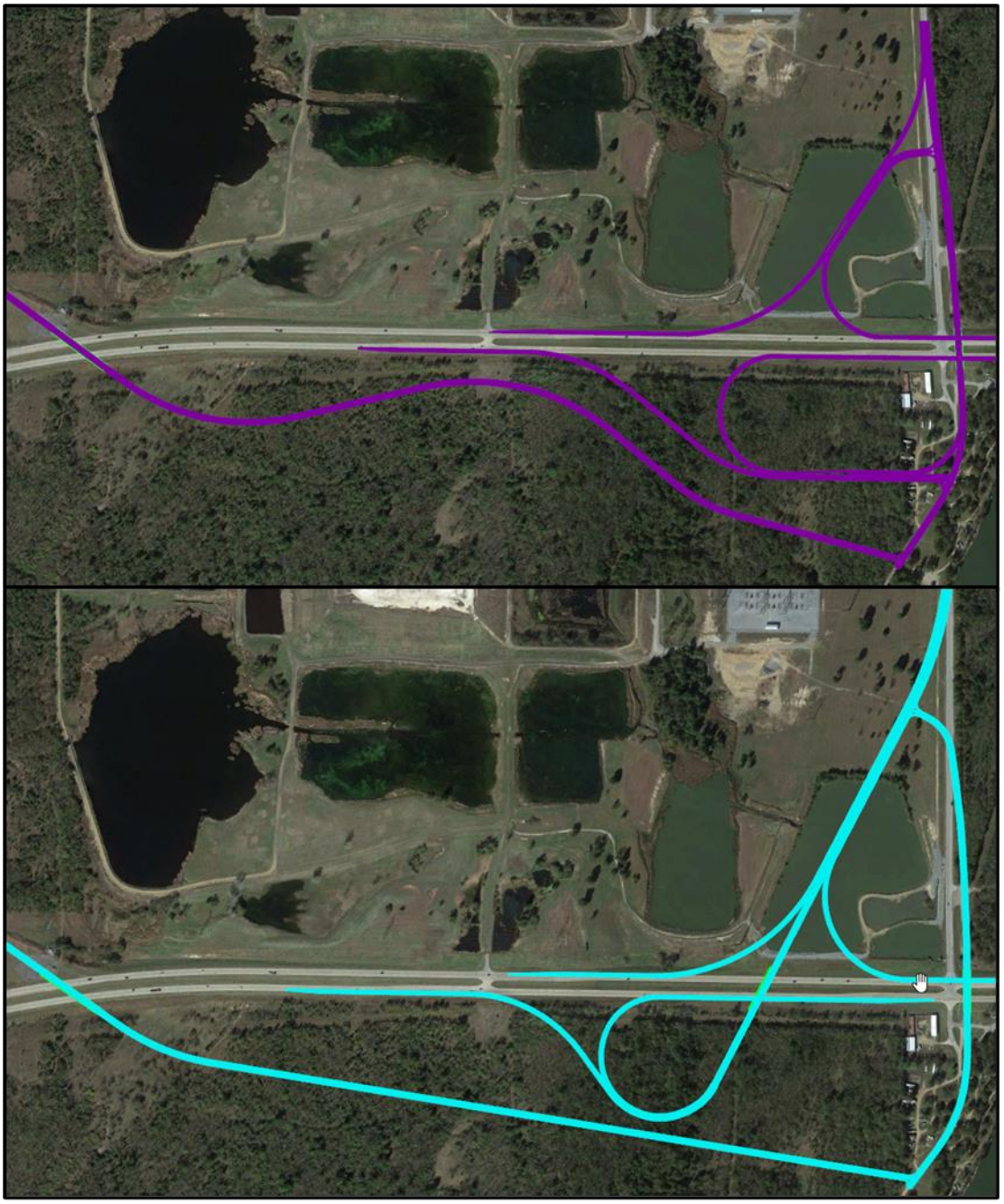


Figure 14: Preliminary Alternative Examples



5.1 Final Alternative Analysis

The five final alternatives were analyzed differently because of the configurations and intersection types they create. The diamond, roundabout, and folded diamond interchanges would create traditional intersections at the ramp terminals that could be analyzed using *Synchro*. However, the trumpet interchange would create free flow access from the freeway ramps. This condition lacks traditional intersections and cannot be evaluated in *Synchro,* so it was necessary to evaluate the LOS using Highway Capacity Software (HCS2023). HCS can produce operational analyses for basic freeway, merge, diverge, and weaving segments. The software uses the guidelines set forth in the HCM to provide LOS based on density. **Table 4** shows the relationship between density and LOS for basic freeway segments, weaving segments, and merge/diverge ramps. According to the HCM, for acceptable degrees of congestion, freeways should generally be design for LOS C in the design year.

Table 4: HCM LOS Criteria for Transportation Facilities

Level of Service (LOS)	Basic Freeway Segment Density (pc/mi/ln)	Freeway Weaving Segment Density (pc/mi/ln)	Freeway Merge & Diverge Segment Density (pc/mi/ln)
LOS A	0 to 11	0 to 10	0 to 10
LOS B	> 11 to 18	> 10 to 20	> 10 to 20
LOS C	> 18 to 26	> 20 to 28	> 20 to 28
LOS D	> 26 to 35	> 28 to 35	> 28 to 35
LOS E	> 35 to 45	> 35 to 43	> 35
LOS F	> 45	> 43	-

After producing the alternative LOS at 100% development build out, each alternative was analyzed iteratively to determine the life of the configuration and where operations would start to break down. For the alternatives showing failing LOS at full build out, a reduced percentage was used to find how much of MAIP could be developed before the interchange would fail. The remaining alternatives saw an increase in volume higher than full build out to show the potential capacity the alternatives could provide. The results of the breakdown percentages can be found below in **Table 5**. **Appendix D** includes the Initial Concepts Matrix.

Table 5: Final Alternatives Build Out Percentages

Alternative	Breakdown %	% Difference	Constraint
Alternative 3: Diamond_v2 (Button Hook On)	90%	-10%	Eastbound left to northbound through. Queueing between two interchange signals.
Alternative 10: Roundabout_v2	80%	-20%	Eastbound left from off-ramp is over 800 vph and needs extra capacity in the roundabout.
Alternative 11: Trumpet_v5	170%	+70%	After additional 70% volume, eastbound diverge becomes an issue in the AM
Alternative 12: Folded D_v6	75%	-25%	Westbound off-ramp volume at the northern intersection needs additional capacity
Alternative 13: Trumpet_v6	170%	+70%	After additional 70% volume, eastbound diverge becomes an issue in the AM

5.1.1 Freeway, Weaving, and Ramp Analysis

The HCS 7 Freeway Facility module was used to recreate the freeway study area using segments (basic, weaving, or ramp) with the appropriate lengths, lane configurations, and volume demands. The study area was analyzed and evaluated for 2045 (design year) with the forecasted traffic volumes.

Table 6 and **Table 7** present the HCS Freeway Facility results for the Trumpet alternatives, under AM and PM peak, at 2045 full build out conditions (100%). Geometrically the ramp connections and spacing are similar enough between the two alternatives that they produce the same LOS results. As shown, LOS for all segments along US 412 will operate at LOS C or better in 2045.

Table 6: 2045 Build Conditions HCS Analysis Results (Eastbound Trumpet)

US 412 Eastbound	2045 Build					
	Density (pc/mi/ln)		D/C Ratio		LOS	
Segment	AM	PM	AM	PM	AM	PM
Mainline - Before Off Ramp W/O SH 412B	14.0	11.2	0.41	0.33	B	B
Ramp - Off Ramp W/O SH 412B	17.8	13.8	0.41	0.33	B	A
Mainline - Between SH 412B Off and On Ramps	4.8	8.4	0.14	0.25	A	A
Ramp - On Ramp W/O SH 412B	6.3	13.2	0.17	0.35	B	B
Mainline - After On Ramp W/O SH 412B	5.8	12.1	0.17	0.35	A	B

Table 7: 2045 Build Conditions HCS Analysis Results (Westbound Trumpet)

US 412 Westbound	2045 Build					
	Density (pc/mi/ln)		D/C Ratio		LOS	
Segment	AM	PM	AM	PM	AM	PM
Mainline - Before Off Ramp E/O SH 412B	10.5	8.2	0.31	0.24	A	A
Ramp - Off Ramp E/O SH 412B	12.9	9.9	0.30	0.24	A	A
Mainline - Between SH 412B Off and On Ramps	6.5	7.0	0.19	0.20	A	A
Ramp - On Ramp W/O SH 412B	9.7	16.5	0.26	0.44	B	C
Mainline - After On Ramp W/O SH 412B	8.9	15.0	0.26	0.44	A	B

5.1.2 Intersection Analysis

The intersections created by the alternatives were also evaluated to ensure safe and efficient traffic operations at the ramp terminals. *Synchro* software was used to perform intersection analysis. The intersections were evaluated based on the intersection delay and corresponding LOS. Synchro software uses HCM7 methodology to calculate delay. Detailed outputs from the Synchro analysis are provided in **Appendix C**.

Table 8, **Table 9**, and **Table 10** presents the intersection LOS analysis results, under AM and PM peak, for future year 2045 full build out conditions (100%). As a result of the proposed alternatives in the build

conditions, one of the ramp terminals in each alternative is projected to operate at LOS E or worse in the design year indicating the alternatives cannot handle the full build out of MAIP. LOS D is generally considered the minimal acceptable LOS for an intersection movement. Based on the results, queueing is expected to extend from the ramp terminals to the mainline in all options.

Alternative 3 (results in **Table 8**) is experiencing queuing issues at the eastbound ramps and on the bridge heading northbound over US 412 between the two signals. This alternative can acceptably handle 40-50% build out with unsignalized intersections and adding signals will extend the life to approximately 90% of the full build out conditions. A potential improvement for this alternative would be adding a second lane for the eastbound left to northbound through movement through the interchange.

Table 8: 2045 Build Conditions Intersection Analysis Results (Alt 3 Diamond_v2)

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
US 412 EB Ramps @ SH 412B Connector	AM	Signal	LOS	E					A				E			E
			Delay	62.1					0.0				68.5			61.7
	PM		LOS	C					A				B			B
			Delay	27.2					0.0				13.1			18.7
US 412 WB Ramps @ SH 412B Connector	AM	Signal	LOS				F		n/a[2]	C				A	A	C
			Delay				83.1		n/a[2]	28.4				3.8	4.6	22.4
	PM		LOS				D		n/a[2]	A				A	B	A
			Delay				41.3		n/a[2]	1.2				1.9	16.1	9.8

n/a[1] free movement
n/a[2] right turn channelized movement
n/a[3] no volume modeled

Alternative 10 (results in **Table 9**) is experiencing queuing issues on the eastbound ramps with the entry into the roundabout. With the entry volume being over 800 vehicles per hour there is a need for additional capacity entering and circulating in the roundabout. This alternative begins to provide unacceptable LOS conditions at approximately 80% of the full build out conditions. A potential improvement is to make the roundabouts multilane to provide the needed capacity and reduce the lengthy queues on the eastbound ramps.

Table 9: 2045 Build Conditions Intersection Analysis Results (Alt 10 Roundabout_v2)

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
US 412 EB Ramps @ SH 412B Connector	AM	Round-about	LOS	F			C						A			F
			Delay	89.5			15.8						4.0			78.7
	PM		LOS	B			A						A			A
			Delay	12.5			8.0						6.6			9.1
US 412 WB Ramps @ SH 412B Connector	AM	Round-about	LOS				A			D			A		A	C
			Delay				9.8			32.4			4.1		5.2	25.0
	PM		LOS				A			A			A		C	B
			Delay				4.0			5.4			6.9		19.3	13.3

Alternative 12 (results in **Table 10**) is experiencing delay issues at the westbound ramp terminal. This alternative can acceptably handle 40-50% build out with unsignalized intersections. Signalizing the ramp

terminals will extend the life of the alternative but the westbound off ramp volume is required to turn left to travel northbound on SH 412B and this strains the signal performance when competing for time with the high volume northbound through from the eastbound ramps. This alternative with signals begins to provide unacceptable LOS conditions at approximately 75% of the full build out conditions. Additional turn lanes at the westbound ramp terminal would increase the capacity of the intersection and reduce delay.

Table 10: 2045 Build Conditions Intersection Analysis Results (Alt 12 Folded D_v6)

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
US 412 EB Ramps @ SH 412B	AM	Signal	LOS	B		n/a[2]					C			C	n/a[2]	B
			Delay	10.6		n/a[2]					27.4			27.7	n/a[2]	11.4
	PM		LOS	A		n/a[2]					A			A	n/a[2]	A
			Delay	7.6		n/a[2]					6.3			6.2	n/a[2]	7.4
US 412 WB Ramps @ SH 412B	AM	Signal	LOS	F		F					F			A	n/a[2]	F
			Delay	157.3		157.3					83.0			9.7	n/a[2]	98.7
	PM		LOS	B		B					A			A	n/a[2]	C
			Delay	13.6		13.6					4.7			5.6	n/a[2]	22.4

n/a[1] free movement
n/a[2] right turn channelized movement
n/a[3] no volume modeled

6.0 Conclusion

Preliminary traffic analysis and conceptual development were explored to develop a grade separated interchange to replace the existing stop-controlled intersection of US 412 at SH 412B. This intersection serves as an entrance to MAIP, one of the largest industrial parks in the nation with plans for future growth and expansion. The goal of the proposed interchange alternative is to meet the future needs of MAIP as it begins to build out even more with a design year of 2045. Traffic data, lane configurations, and future planned/unplanned developments were considered to define existing 2023 and future year 2045 conditions. These conditions were set forth as a baseline to determine the level of congestion that would occur if no improvements were made. Due to the number of future planned developments, 2045 conditions will have poor level of service and block free flowing volume on US 412 without additional improvements.

Garver analyzed multiple configurations for the US 412 at SH 412B interchange. The critical elements needing improvement were capacity and safety needs for SH 412B turning and crossing volume. As part of a systems analysis, intersections to the west and north of the study intersection were considered as well as construction, environmental, and right-of-way impacts.

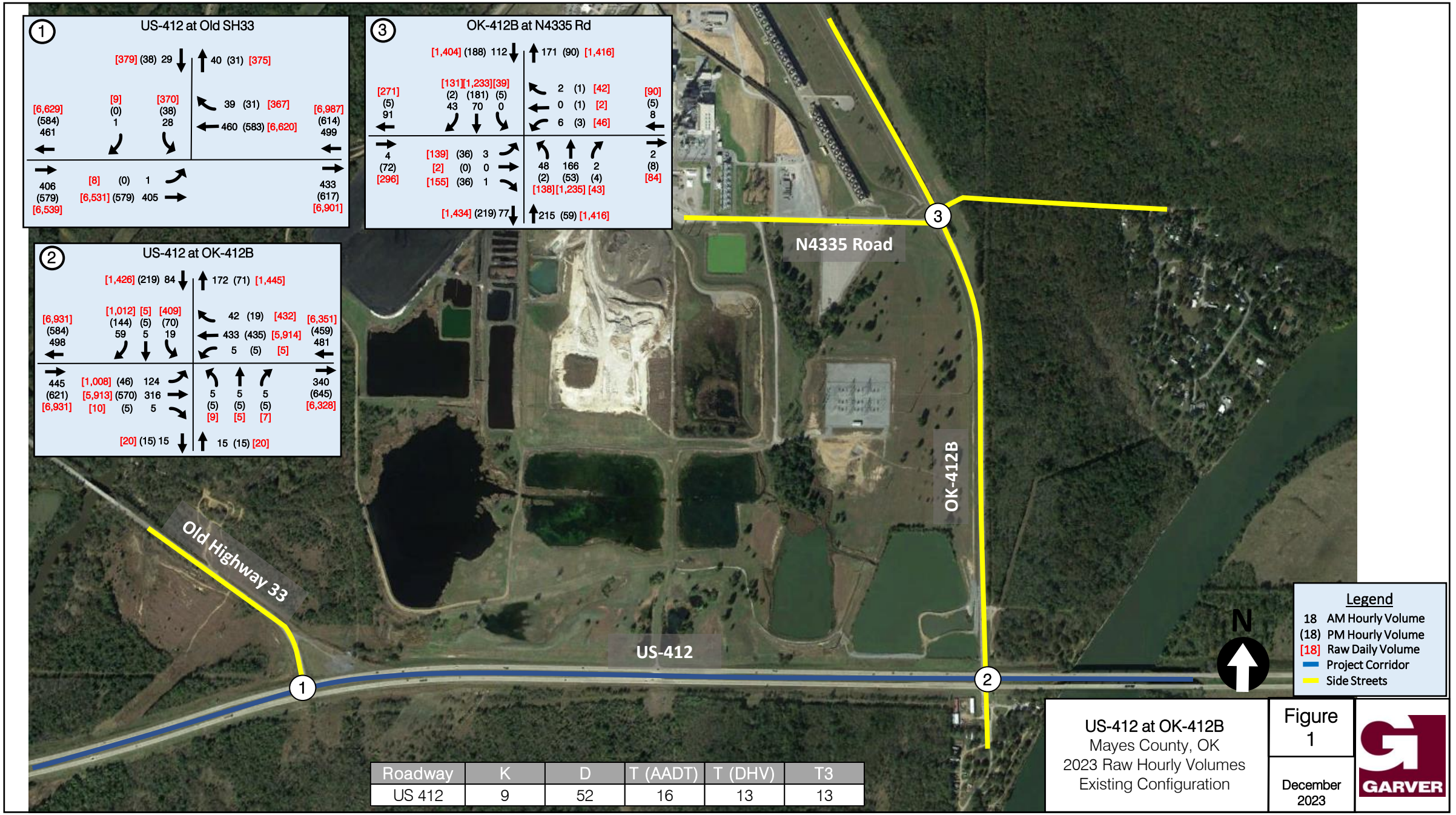
Numerous alternatives were initially evaluated for the US 412 interchange to provide connections between Old Hwy 33 and SH 412B. This list was narrowed down to five alternatives and discussed with ODOT in September 2023.

After reviewing the operational performance, the Trumpet Alternatives 11 and 13 provide the best results from a traffic performance perspective when considering 100% build out of MAIP in 2045. However, all

alternatives will provide acceptable performance upon opening and with the assumed background growth for 2045. The operations for the two Diamond Alternatives 3 and 12 can remain unsignalized until 40-50% of the MAIP build out and then will require signalization at the ramp terminals to continue providing acceptable conditions up to 75% of the full build out. All alternatives should be considered for further evaluation, and a recommendation should be made based on the alternative that limits construction, environmental, and right-of-way impacts while potentially offering access to Old Hwy 33 and Chouteau Bend to the south.

APPENDIX A

Traffic Data



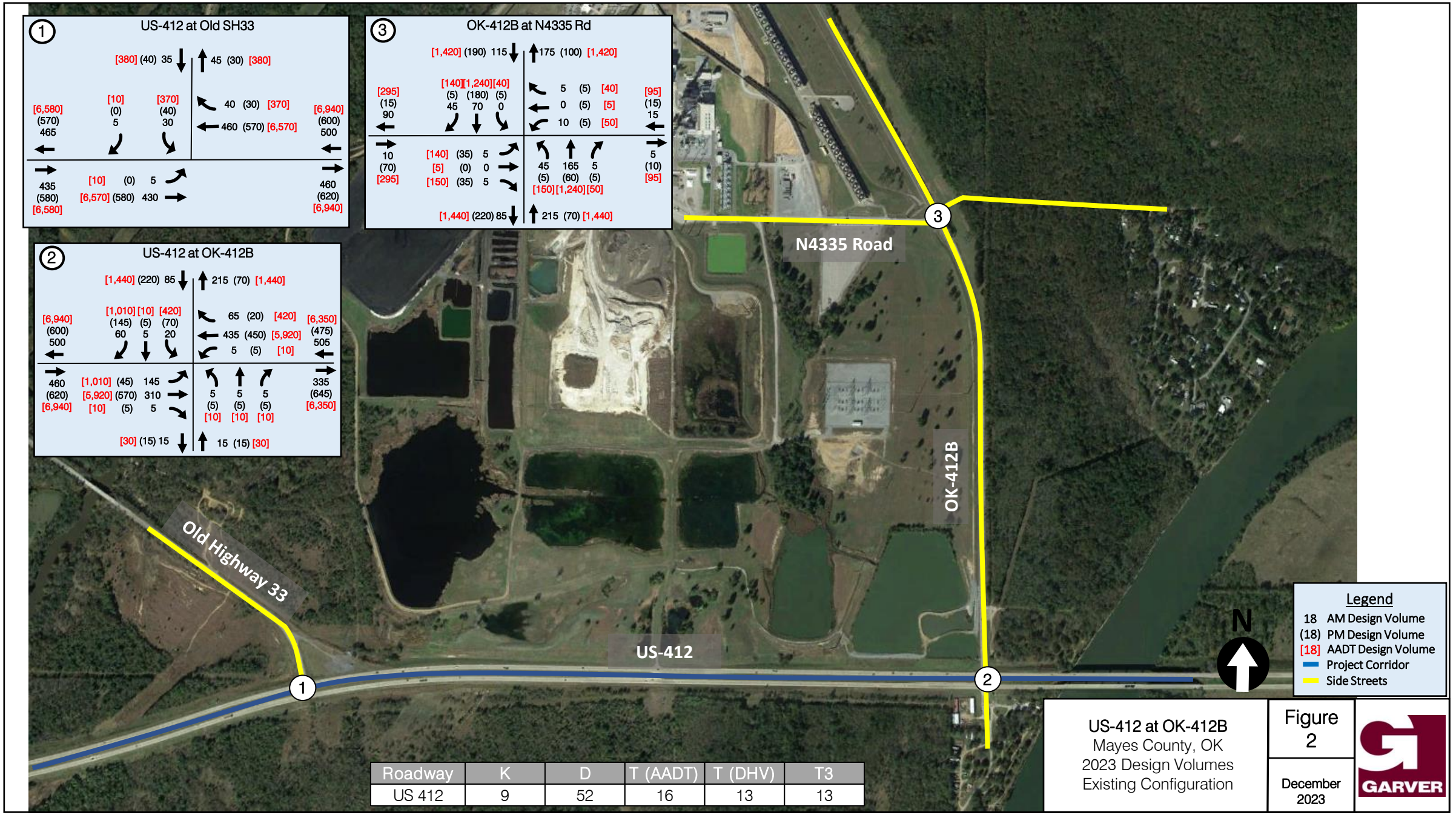
Roadway	K	D	T (AADT)	T (DHV)	T3
US 412	9	52	16	13	13

US-412 at OK-412B
Mayes County, OK
2023 Raw Hourly Volumes
Existing Configuration

Figure 1

December 2023

GARVER



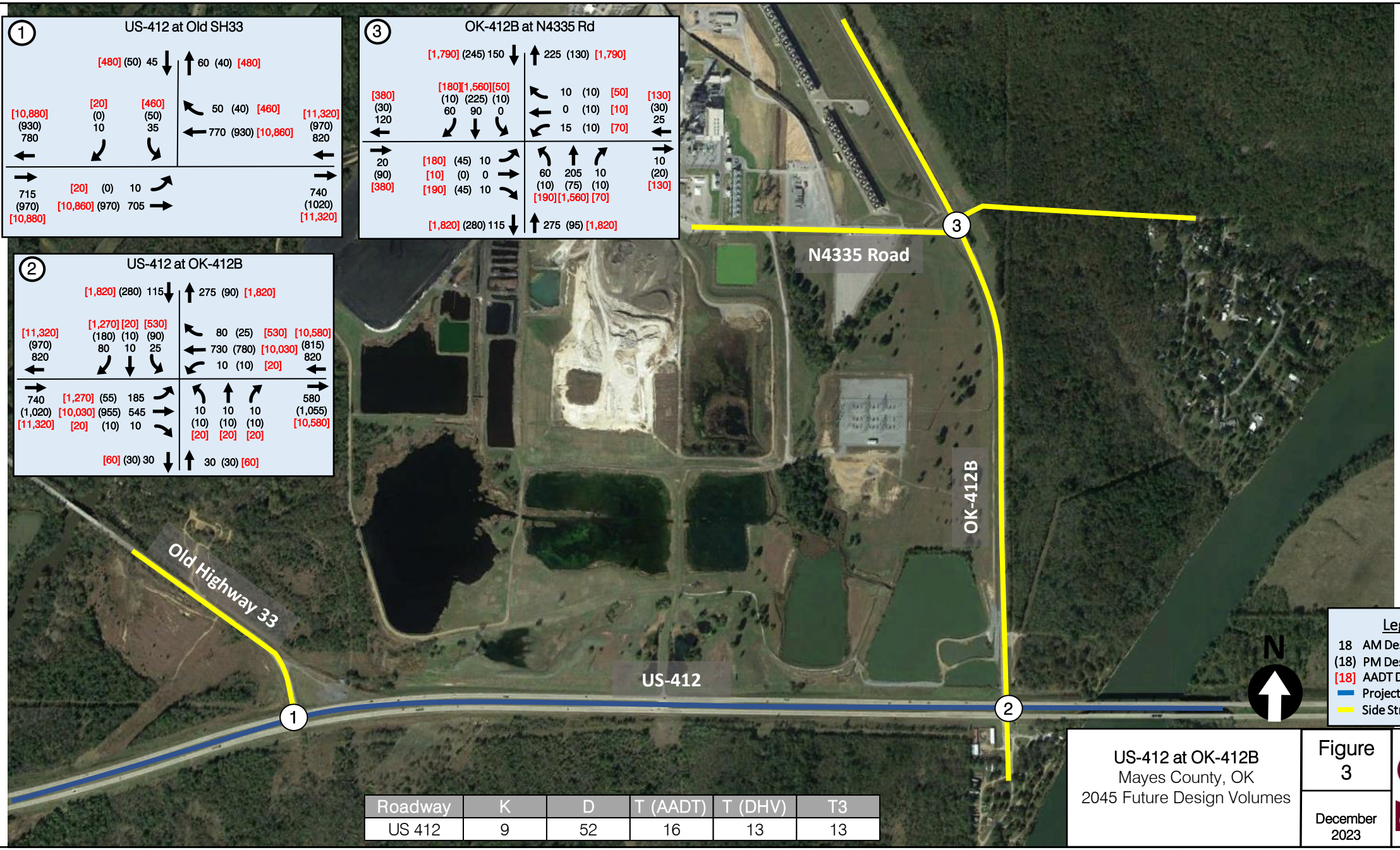
Roadway	K	D	T (AADT)	T (DHV)	T3
US 412	9	52	16	13	13

US-412 at OK-412B
Mayes County, OK
2023 Design Volumes
Existing Configuration

Figure 2

December 2023

GARVER



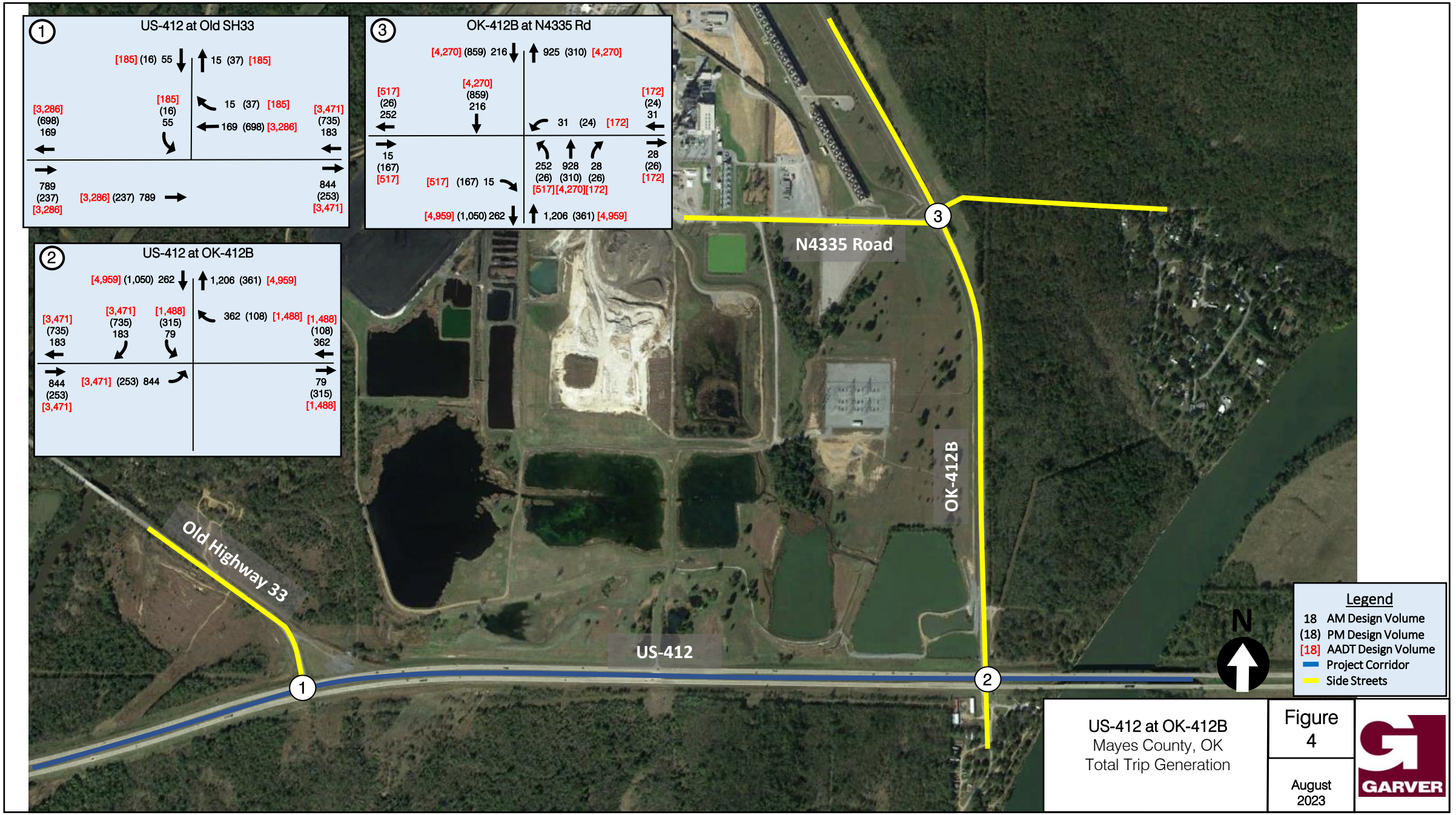
Roadway	K	D	T (AADT)	T (DHV)	T3
US 412	9	52	16	13	13

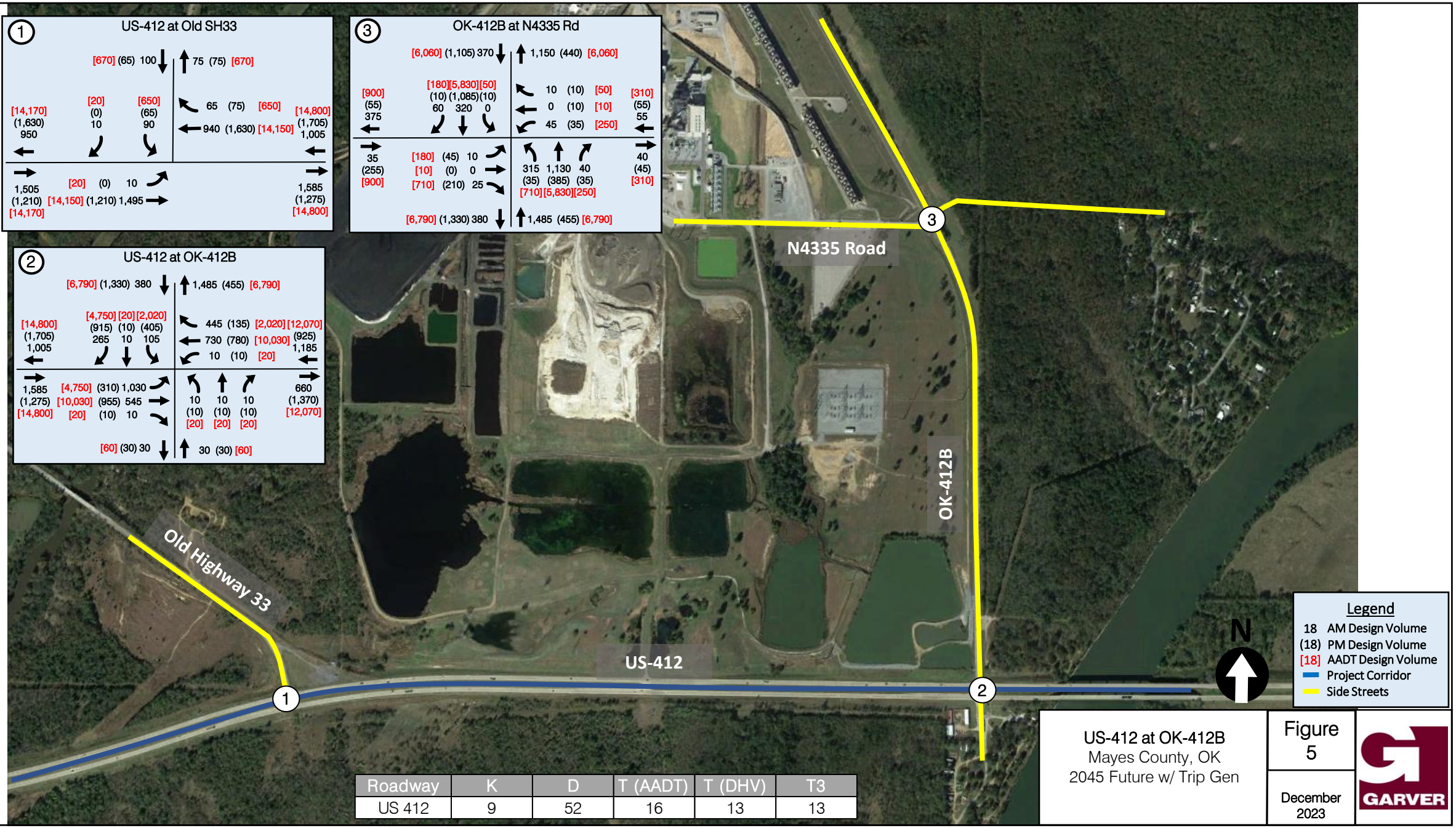
US-412 at OK-412B
Mayes County, OK
2045 Future Design Volumes

Figure 3

December 2023

GARVER


1
US-412 at Old SH33
[185] (16) 55
15 (37) [185]
[3,286] (698) 169
[185] (16) 55
15 (37) [185]
169 (698) [3,286]
[3,471] (735) 183
789 (237) [3,286]
[3,286] (237) 789
844 (253) [3,471]
2
US-412 at OK-412B
[4,959] (1,050) 262
1,206 (361) [4,959]
[3,471] (735) 183
[3,471] (735) 183
[1,488] (315) 79
362 (108) [1,488]
[1,488] (108) 362
844 (253) [3,471]
[3,471] (253) 844
79 (315) [1,488]
3
OK-412B at N4335 Rd
[4,270] (859) 216
925 (310) [4,270]
[517] (26) 252
[4,270] (859) 216
[172] (24) 31
31 (24) [172]
15 (167) [517]
252 (26) [517]
928 (310) [4,270]
28 (26) [172]
28 (26) [172]
[517] (167) 15
[4,959] (1,050) 262
1,206 (361) [4,959]
N4335 Road
OK-412B
Old Highway 33
US-412
1
2
3
N
Legend
18 AM Design Volume
(18) PM Design Volume
[18] AADT Design Volume
Project Corridor
Side Streets
US-412 at OK-412B
Mayes County, OK
Total Trip Generation
Figure 4
August 2023
GARVER



Roadway	K	D	T (AADT)	T (DHV)	T3
US 412	9	52	16	13	13

US-412 at OK-412B
Mayes County, OK
2045 Future w/ Trip Gen

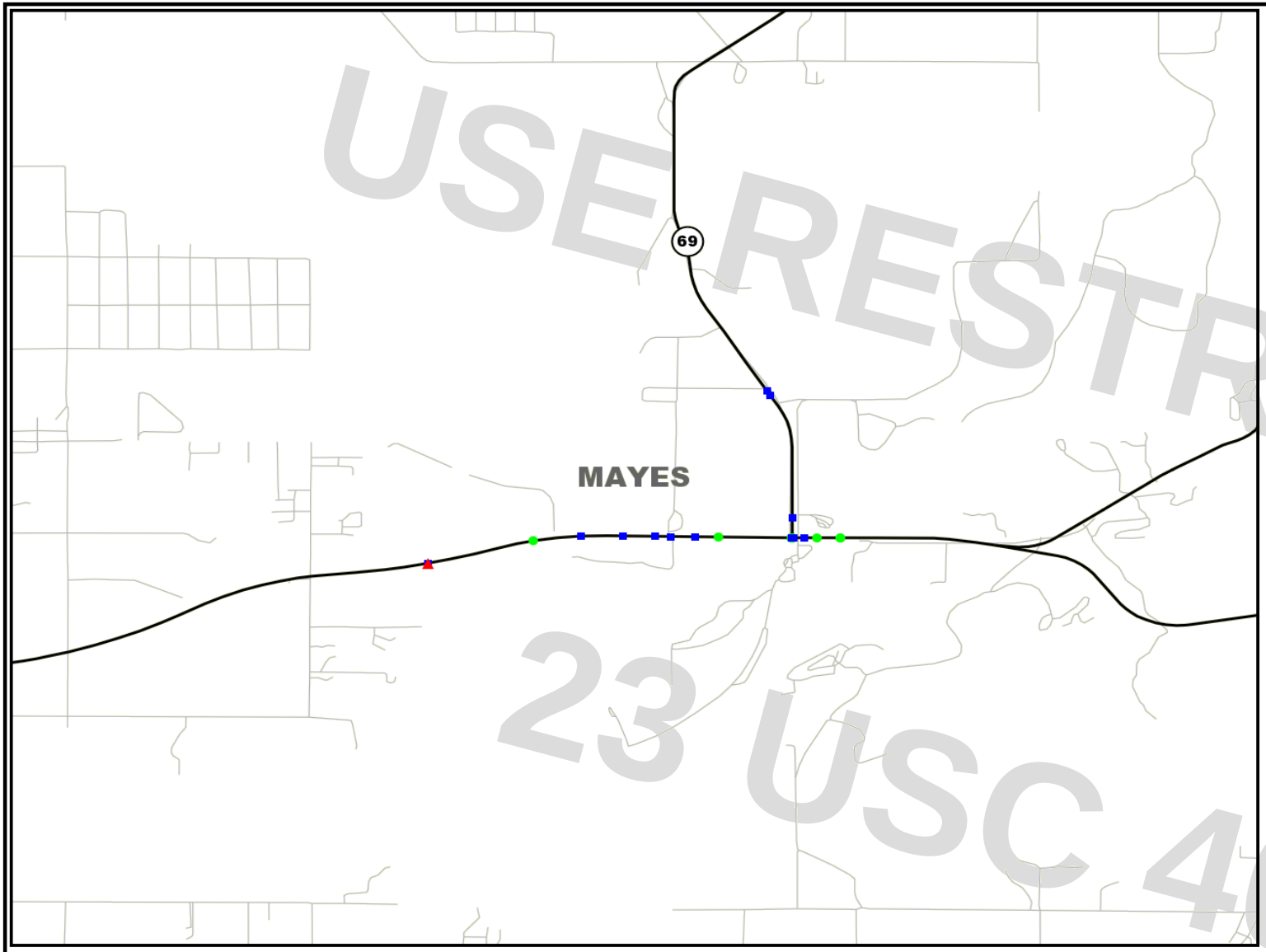
Figure 5

December 2023

GARVER

APPENDIX B

Crash Data



Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023
by Ashley Maggio

Study Map & Totals

Legend

- Fatality
- Injury
- Property Damage

N
W E
S

Remarks:

NONE

Date Range: 01-01-2017 thru 12-31-2021

	2017						2018						2019					
	Fat	SRS Inj	Non-Incap Inj	Poss Inj	PD	Tot	Fat	SRS Inj	Non-Incap Inj	Poss Inj	PD	Tot	Fat	SRS Inj	Non-Incap Inj	Poss Inj	PD	Tot
Collisions	1	1	1			3			5	1	2	8			1		5	6
Persons	1	1	2			4			11	3		14			2			2

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

	2020						2021*					
	Fat	SRS Inj	Non-Incap Inj	Poss Inj	PD	Tot	Fat	SRS Inj	Non-Incap Inj	Poss Inj	PD	Tot
Collisions				2	2	4		1		2	1	4
Persons				2		2		1		2		3

* DENOTES A YEAR FOR WHICH DATA MAY BE INCOMPLETE.

	Study Total					
	Fatality	Suspected Serious Injury	Non-Incapacitating Injury	Possible Injury	Property Damage	Total
Collisions	1	2	7	5	10	25
Persons	1	2	15	7		25

STUDY TOTALS - BY CITY AND HWY CLASS

Date Range: 01-01-2017 Thru 12-31-2021

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

STUDY TOTALS

	HIGHWAY COLLISIONS				CITY STREET COLLISIONS				COUNTY ROAD COLLISIONS				TOTAL COLLISIONS			
Year	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot
2017	1	2		3									1	2		3
2018		6	2	8										6	2	8
2019		1	5	6										1	5	6
2020		2	2	4										2	2	4
2021 *		3	1	4										3	1	4
Total:	1	14	10	25				0				0	1	14	10	25

*** DENOTES A YEAR FOR WHICH DATA MAY BE INCOMPLETE.**

County: (49) MAYES

	HIGHWAY COLLISIONS				CITY STREET COLLISIONS				COUNTY ROAD COLLISIONS				TOTAL COLLISIONS			
	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot
(00) - RURAL -	1	14	10	25									1	14	10	25

*** INCLUDES SUSPECTED SERIOUS, NON-INCAPACITATING, AND POSSIBLE INJURIES.**

TABULATION OF COLLISIONS

Date Range: 01-01-2017 Thru 12-31-2021

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

Collisions By Type Of Collision

Type Of Collision	2017				2018				2019				2020				2021*			
	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot
Rear-End (front-to-rear)		1		1							1	1		2		2		2		2
Head-On (front-to-front)						1		1												
Right Angle (front-to-side)						2	1	3												
Angle Turning		1		1		1		1			1	1			1	1				
Other Angle																				
Sideswipe Same Direction	1			1							1	1								
Sideswipe Opposite Direction																				
Fixed Object							1	1			1	1							1	1
Pedestrian																				
Pedal Cycle																				
Animal						1		1							1	1				
Overturn/Rollover																				
Vehicle-Train																				
Other Single Vehicle Crash																				
Other						1		1		1	1	2						1		1
Total	1	2		3		6	2	8		1	5	6		2	2	4		3	1	4
Percent	4.0	8.0		12.0		24.0	8.0	32.0		4.0	20.0	24.0		8.0	8.0	16.0		12.0	4.0	16.0

Collisions By Type Of Collision

Type Of Collision	Total				
	Fat	Inj *	PD	Tot	Pct
Rear-End (front-to-rear)		5	1	6	24.0
Head-On (front-to-front)		1		1	4.0
Right Angle (front-to-side)		2	1	3	12.0
Angle Turning		2	2	4	16.0
Other Angle					
Sideswipe Same Direction	1		1	2	8.0
Sideswipe Opposite Direction					
Fixed Object			3	3	12.0
Pedestrian					
Pedal Cycle					
Animal		1	1	2	8.0
Overturn/Rollover					
Vehicle-Train					
Other Single Vehicle Crash					
Other		3	1	4	16.0
Total	1	14	10	25	100
Percent	4.0	56.0	40.0	100	

*** INCLUDES SUSPECTED SERIOUS, NON-INCAPACITATING, AND POSSIBLE INJURIES.**

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

Units By Unit Type

Unit Type	2017				2018				2019				2020				2021*			
	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot
Train																				
Pedestrian																				
Animal						1		1							1	1				
Pedal Cycle																				
Parked Vehicle																				
CMV							1	1			1	1								
Other Single Vehicle						1		1			1	1			1	1			1	1
Other Multi-Vehicle	2	4		6		10	2	12		2	7	9		4	2	6		6		6
Total	2	4		6		12	3	15		2	9	11		4	4	8		6	1	7
Percent	4.3	8.5		12.8		25.5	6.4	31.9		4.3	19.1	23.4		8.5	8.5	17.0		12.8	2.1	14.9

Units By Unit Type

Unit Type	Total				
	Fat	Inj *	PD	Tot	Pct
Train					
Pedestrian					
Animal		1	1	2	4.3
Pedal Cycle					
Parked Vehicle					
CMV			2	2	4.3
Other Single Vehicle		1	3	4	8.5
Other Multi-Vehicle	2	26	11	39	83.0
Total	2	28	17	47	100
Percent	4.3	59.6	36.2	100	

* INCLUDES SUSPECTED SERIOUS, NON-INCAPACITATING, AND POSSIBLE INJURIES.

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

Vehicles By Vehicle Type

Vehice Type	2017				2018				2019				2020				2021*			
	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot
Passenger Vehicle-2 Door						1		1			1	1								
Passenger Vehicle-4 Door			1	1		4		4		1	1	2		2	2	4			1	1
Passenger Vehicle-Convertible																				
Pickup Truck	1	1	1	3		2	4	6			2	2			2	2		3	3	6
Single-Unit Truck (2 axles)			1	1																
Single-Unit Truck (3 or more axles)											1	1								
School Bus																				
Truck/Trailer																				
Truck-Tractor (bobtail)																				
Truck-Tractor/Semi-Trailer							1	1			1	1								
Truck-Tractor/Double																				
Truck-Tractor/Triple																				
Bus/Large Van (9-15 seats)																				
Bus (16+ seats)																				
Motorcycle																				
Motor Scooter/Moped																				
Motor Home																				
Farm Machinery																				
ATV																				
Sport Utility Vehicle (SUV)		1		1		2		2			3	3			1	1				
Passenger Van																				
Truck More Than 10,000 lbs.											1	1								
Van (10,000 lbs. or less)																				
Other																				
Total	1	2	3	6		9	5	14		1	10	11		2	5	7		3	4	7
Percent	2.2	4.4	6.7	13.3		20.0	11.1	31.1		2.2	22.2	24.4		4.4	11.1	15.6		6.7	8.9	15.6

* INCLUDES SUSPECTED SERIOUS, NON-INCAPACITATING, AND POSSIBLE INJURIES.

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

Vehicles By Vehicle Type

Vehice Type	Total				
	Fat	Inj *	PD	Tot	Pct
Passenger Vehicle-2 Door		1	1	2	4.4
Passenger Vehicle-4 Door		7	5	12	26.7
Passenger Vehicle-Convertible					
Pickup Truck	1	6	12	19	42.2
Single-Unit Truck (2 axles)			1	1	2.2
Single-Unit Truck (3 or more axles)			1	1	2.2
School Bus					
Truck/Trailer					
Truck-Tractor (bobtail)					
Truck-Tractor/Semi-Trailer			2	2	4.4
Truck-Tractor/Double					
Truck-Tractor/Triple					
Bus/Large Van (9-15 seats)					
Bus (16+ seats)					
Motorcycle					
Motor Scooter/Moped					
Motor Home					
Farm Machinery					
ATV					
Sport Utility Vehicle (SUV)		3	4	7	15.6
Passenger Van					
Truck More Than 10,000 lbs.			1	1	2.2
Van (10,000 lbs. or less)					
Other					
Total	1	17	27	45	100
Percent	2.2	37.8	60.0	100	

* INCLUDES SUSPECTED SERIOUS, NON-INCAPACITATING, AND POSSIBLE INJURIES.

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

Day And Time Of Occurrence Of Collisions

Day	Hour Of The Day																									
	AM															PM										
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	Tot	Pcnt
Sunday							1		1																2	8.0
Monday					1		1			1	1					1			1						6	24.0
Tuesday								1								1									2	8.0
Wednesday										1			1												2	8.0
Thursday					1									2	1								1		5	20.0
Friday						1								1											2	8.0
Saturday			1										1		1		1					1	1		6	24.0
	Early Morning - Sunrise						Morning Peak			Mid Morning/Afternoon						PM Peak			Evening - Late Night						Tot	100
Total	4						4			10						3			4						25	
Percent	16.0						16.0			40.0						12.0			16.0						100	

Roadway/Lighting

Roadway Conditions	Lighting Conditions					Total	Percent
	Daylight	Darkness	Twilight	Lighted	Unknown		
Dry	13	5	1	1		20	80.0
Wet (Water)	1		1			2	8.0
Ice, Snow, or Slush	3					3	12.0
Mud, Dirt, Gravel, or Sand							
Other							
Total	17	5	2	1		25	100
Percent	68.0	20.0	8.0	4.0		100	

Weather Conditions

Weather Conditions	Total	Percent
Clear	14	56.0
Clouds Present	9	36.0
Raining/Fog	1	4.0
Snowing/Sleet/Hail	1	4.0
Other		
Total	25	100

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

Drivers By Driver Conditions

Unsafe/Unlawful	Apparently Normal			Alcohol Involved						Sleep Suspected			Drug Use Indicated			Unknown Condition			Total				
				Ability Impaired			Odor Detected																
	Fat	Inj *	PD	Fat	Inj *	PD	Fat	Inj *	PD	Fat	Inj *	PD	Fat	Inj *	PD	Fat	Inj *	PD	Fat	Inj *	PD	Total	Pcnt
Failed to Yield		2	2																	2	2	4	8.9
Failed to Stop		1																		1		1	2.2
Failed to Signal																							
Improper Turn																							
Improper Start																							
Improper Stop																							
Improper Backing																							
Improper Parking																							
Improper Passing																							
Improper Lane Change			1																		1	1	2.2
Left of Center		1																		1		1	2.2
Following Too Close		1																		1		1	2.2
Unsafe Speed		2	3																	2	3	5	11.1
DWI					1	1														1	1	2	4.4
Inattention		2									1									3		3	6.7
Negligent Driving		2	1																	2	1	3	6.7
Defective Vehicle			1																		1	1	2.2
Wrong Way																							
No Improper Action	1	14	7																1	14	7	22	48.9
Other	1																		1			1	2.2
Total	2	25	15		1	1					1								2	27	16	45	100
Percent	4.4	55.6	33.3		2.2	2.2					2.2								4.4	60.0	35.6	100	

Severities Indicate Highest Severity in Collision

Collisions By Special Feature

Special Feature	Total			
	Fat	Inj *	PD	Tot
Bridge			1	1
Work Zone				
Cross Median				
Train Collision				

* INCLUDES SUSPECTED SERIOUS, NON-INCAPACITATING, AND POSSIBLE INJURIES.

STUDY CRITERIA

Date Range: 01-01-2017 Thru 12-31-2021

Program Provided by:
Traffic Engineering Division
Collision Analysis and Safety Branch
(405) 522-0985
Created: 08/25/2023 by Ashley Maggio

ROADWAY / REGION

QUERY OVER	SELECTIONS
Draw Area on Map	User Selection on Map

DATE

Date Range	01-01-2017 to 12-31-2021

REPORT SECTIONS

Collision Map & Study Totals	(Included)
Collision Analysis Tables	(Included)
- Totals By City, Hwy Class	Checked
- Other Analysis Tables	Checked
Rate Analysis	(Included)
Query Criteria	(Included)

FILTER COLLISIONS

Roadway Type	All Collision Data
Incl. Crashes Assoc. w/ Every Int.	Checked
Environment Fields	

REPORT FORMAT OPTIONS

Print Watermark	Checked
Print DPS Case Numbers	Unchecked

APPENDIX C

Operational Analysis Results

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	145	310	5	5	435	65	5	5	5	20	5	60
Future Vol, veh/h	145	310	5	5	435	65	5	5	5	20	5	60
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	375	-	-	355	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13	13	13	13	13	13
Mvmt Flow	154	330	5	5	463	69	5	5	5	21	5	64

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	532	0	0	335	0	0	885	1183	168	984	1151	266
Stage 1	-	-	-	-	-	-	641	641	-	508	508	-
Stage 2	-	-	-	-	-	-	244	542	-	476	643	-
Critical Hdwy	4.36	-	-	4.36	-	-	7.76	6.76	7.16	7.76	6.76	7.16
Critical Hdwy Stg 1	-	-	-	-	-	-	6.76	5.76	-	6.76	5.76	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.76	5.76	-	6.76	5.76	-
Follow-up Hdwy	2.33	-	-	2.33	-	-	3.63	4.13	3.43	3.63	4.13	3.43
Pot Cap-1 Maneuver	959	-	-	1145	-	-	223	173	813	188	181	700
Stage 1	-	-	-	-	-	-	404	441	-	488	510	-
Stage 2	-	-	-	-	-	-	708	492	-	511	440	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	959	-	-	1145	-	-	175	145	813	161	151	700
Mov Cap-2 Maneuver	-	-	-	-	-	-	297	268	-	312	309	-
Stage 1	-	-	-	-	-	-	339	370	-	409	508	-
Stage 2	-	-	-	-	-	-	634	490	-	420	369	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3	0.1	15.5	13.5
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	360	959	-	-	1145	-	-	512
HCM Lane V/C Ratio	0.044	0.161	-	-	0.005	-	-	0.177
HCM Control Delay (s)	15.5	9.5	-	-	8.2	-	-	13.5
HCM Lane LOS	C	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0.6	-	-	0	-	-	0.6

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBU	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	5	430	0	460	40	30	5
Future Vol, veh/h	5	430	0	460	40	30	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	-	None	-	Yield
Storage Length	350	-	330	-	-	0	-
Veh in Median Storage, #	-	0	-	0	-	0	-
Grade, %	-	0	-	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13
Mvmt Flow	5	457	0	489	43	32	5

Major/Minor	Major1		Major2			Minor2	
Conflicting Flow All	532	0	457	-	0	750	266
Stage 1	-	-	-	-	-	511	-
Stage 2	-	-	-	-	-	239	-
Critical Hdwy	4.36	-	6.66	-	-	7.06	7.16
Critical Hdwy Stg 1	-	-	-	-	-	6.06	-
Critical Hdwy Stg 2	-	-	-	-	-	6.06	-
Follow-up Hdwy	2.33	-	2.63	-	-	3.63	3.43
Pot Cap-1 Maneuver	959	-	691	-	-	325	700
Stage 1	-	-	-	-	-	537	-
Stage 2	-	-	-	-	-	746	-
Platoon blocked, %		-		-	-		
Mov Cap-1 Maneuver	959	-	691	-	-	323	700
Mov Cap-2 Maneuver	-	-	-	-	-	323	-
Stage 1	-	-	-	-	-	534	-
Stage 2	-	-	-	-	-	746	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	15.6
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBU	WBT	WBR	SBLn1
Capacity (veh/h)	959	-	691	-	-	377
HCM Lane V/C Ratio	0.006	-	-	-	-	0.099
HCM Control Delay (s)	8.8	-	0	-	-	15.6
HCM Lane LOS	A	-	A	-	-	C
HCM 95th %tile Q(veh)	0	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	0	5	10	0	5	45	165	5	0	70	45
Future Vol, veh/h	5	0	5	10	0	5	45	165	5	0	70	45
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	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	65	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13	13	13	13	13	13
Mvmt Flow	5	0	5	11	0	5	48	176	5	0	74	48

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	375	375	98	373	397	179	122	0	0	181	0	0
Stage 1	98	98	-	275	275	-	-	-	-	-	-	-
Stage 2	277	277	-	98	122	-	-	-	-	-	-	-
Critical Hdwy	7.23	6.63	6.33	7.23	6.63	6.33	4.23	-	-	4.23	-	-
Critical Hdwy Stg 1	6.23	5.63	-	6.23	5.63	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.23	5.63	-	6.23	5.63	-	-	-	-	-	-	-
Follow-up Hdwy	3.617	4.117	3.417	3.617	4.117	3.417	2.317	-	-	2.317	-	-
Pot Cap-1 Maneuver	563	539	929	564	524	836	1400	-	-	1331	-	-
Stage 1	882	793	-	708	663	-	-	-	-	-	-	-
Stage 2	706	662	-	882	774	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	545	521	929	546	506	836	1400	-	-	1331	-	-
Mov Cap-2 Maneuver	545	521	-	546	506	-	-	-	-	-	-	-
Stage 1	852	793	-	684	640	-	-	-	-	-	-	-
Stage 2	677	639	-	877	774	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.3	11	1.6	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1400	-	-	1090	617	1331	-	-
HCM Lane V/C Ratio	0.034	-	-	0.01	0.026	-	-	-
HCM Control Delay (s)	7.7	-	-	8.3	11	0	-	-
HCM Lane LOS	A	-	-	A	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0	0.1	0	-	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	45	570	5	5	450	20	5	5	5	70	5	145
Future Vol, veh/h	45	570	5	5	450	20	5	5	5	70	5	145
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	375	-	-	355	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13	13	13	13	13	13
Mvmt Flow	48	606	5	5	479	21	5	5	5	74	5	154

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	500	0	0	611	0	0	957	1215	306	902	1207	250
Stage 1	-	-	-	-	-	-	705	705	-	500	500	-
Stage 2	-	-	-	-	-	-	252	510	-	402	707	-
Critical Hdwy	4.36	-	-	4.36	-	-	7.76	6.76	7.16	7.76	6.76	7.16
Critical Hdwy Stg 1	-	-	-	-	-	-	6.76	5.76	-	6.76	5.76	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.76	5.76	-	6.76	5.76	-
Follow-up Hdwy	2.33	-	-	2.33	-	-	3.63	4.13	3.43	3.63	4.13	3.43
Pot Cap-1 Maneuver	987	-	-	893	-	-	196	165	658	216	167	717
Stage 1	-	-	-	-	-	-	369	411	-	494	515	-
Stage 2	-	-	-	-	-	-	700	509	-	567	411	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	987	-	-	893	-	-	146	156	658	203	158	717
Mov Cap-2 Maneuver	-	-	-	-	-	-	298	314	-	376	323	-
Stage 1	-	-	-	-	-	-	351	391	-	470	512	-
Stage 2	-	-	-	-	-	-	541	506	-	528	391	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.1	15.1	16.5
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	372	987	-	-	893	-	-	545
HCM Lane V/C Ratio	0.043	0.049	-	-	0.006	-	-	0.429
HCM Control Delay (s)	15.1	8.8	-	-	9.1	-	-	16.5
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.1	0.2	-	-	0	-	-	2.1

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBU	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	0	580	0	570	30	40	0
Future Vol, veh/h	0	580	0	570	30	40	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	-	None	-	Yield
Storage Length	350	-	330	-	-	0	-
Veh in Median Storage, #	-	0	-	0	-	2	-
Grade, %	-	0	-	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13
Mvmt Flow	0	617	0	606	32	43	0

Major/Minor	Major1		Major2			Minor2	
Conflicting Flow All	638	0	617	-	0	931	319
Stage 1	-	-	-	-	-	622	-
Stage 2	-	-	-	-	-	309	-
Critical Hdwy	4.36	-	6.66	-	-	7.06	7.16
Critical Hdwy Stg 1	-	-	-	-	-	6.06	-
Critical Hdwy Stg 2	-	-	-	-	-	6.06	-
Follow-up Hdwy	2.33	-	2.63	-	-	3.63	3.43
Pot Cap-1 Maneuver	871	-	543	-	-	246	645
Stage 1	-	-	-	-	-	469	-
Stage 2	-	-	-	-	-	686	-
Platoon blocked, %		-		-	-		
Mov Cap-1 Maneuver	871	-	543	-	-	246	645
Mov Cap-2 Maneuver	-	-	-	-	-	414	-
Stage 1	-	-	-	-	-	469	-
Stage 2	-	-	-	-	-	686	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	14.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBU	WBT	WBR	SBLn1
Capacity (veh/h)	871	-	543	-	-	414
HCM Lane V/C Ratio	-	-	-	-	-	0.103
HCM Control Delay (s)	0	-	0	-	-	14.7
HCM Lane LOS	A	-	A	-	-	B
HCM 95th %tile Q(veh)	0	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	35	0	35	5	5	5	5	60	5	5	180	5
Future Vol, veh/h	35	0	35	5	5	5	5	60	5	5	180	5
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	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	65	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13	13	13	13	13	13
Mvmt Flow	37	0	37	5	5	5	5	64	5	5	191	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	286	283	194	281	283	67	196	0	0	69	0	0
Stage 1	204	204	-	77	77	-	-	-	-	-	-	-
Stage 2	82	79	-	204	206	-	-	-	-	-	-	-
Critical Hdwy	7.23	6.63	6.33	7.23	6.63	6.33	4.23	-	-	4.23	-	-
Critical Hdwy Stg 1	6.23	5.63	-	6.23	5.63	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.23	5.63	-	6.23	5.63	-	-	-	-	-	-	-
Follow-up Hdwy	3.617	4.117	3.417	3.617	4.117	3.417	2.317	-	-	2.317	-	-
Pot Cap-1 Maneuver	645	608	820	650	608	967	1314	-	-	1465	-	-
Stage 1	773	713	-	905	810	-	-	-	-	-	-	-
Stage 2	900	808	-	773	711	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	633	603	820	617	603	967	1314	-	-	1465	-	-
Mov Cap-2 Maneuver	633	603	-	617	603	-	-	-	-	-	-	-
Stage 1	770	710	-	901	807	-	-	-	-	-	-	-
Stage 2	886	805	-	735	708	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8	10.3	0.6	0.2
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1314	-	-	1266	696	1465	-	-
HCM Lane V/C Ratio	0.004	-	-	0.059	0.023	0.004	-	-
HCM Control Delay (s)	7.8	-	-	8	10.3	7.5	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	184.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1030	545	10	10	730	445	10	10	10	105	10	265
Future Vol, veh/h	1030	545	10	10	730	445	10	10	10	105	10	265
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	375	-	-	355	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13	13	13	13	13	13
Mvmt Flow	1096	580	11	11	777	473	11	11	11	112	11	282

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1250	0	0	591	0	0	3194	4050	296	3524	3819	625
Stage 1	-	-	-	-	-	-	2778	2778	-	1036	1036	-
Stage 2	-	-	-	-	-	-	416	1272	-	2488	2783	-
Critical Hdwy	4.36	-	-	4.36	-	-	7.76	6.76	7.16	7.76	6.76	7.16
Critical Hdwy Stg 1	-	-	-	-	-	-	6.76	5.76	-	6.76	5.76	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.76	5.76	-	6.76	5.76	-
Follow-up Hdwy	2.33	-	-	2.33	-	-	3.63	4.13	3.43	3.63	4.13	3.43
Pot Cap-1 Maneuver	~ 496	-	-	909	-	-	~ 3	~ 2	669	~ 2	~ 3	402
Stage 1	-	-	-	-	-	-	16	34	-	228	284	-
Stage 2	-	-	-	-	-	-	556	217	-	~ 25	34	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	~ 496	-	-	909	-	-	-	0	669	-	0	402
Mov Cap-2 Maneuver	-	-	-	-	-	-	15	0	-	~ -11	~ -10	-
Stage 1	-	-	-	-	-	-	16	0	-	228	281	-
Stage 2	-	-	-	-	-	-	158	214	-	-	0	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 370	0.1		
HCM LOS			-	-

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	~ 496	-	-	909	-	-	-
HCM Lane V/C Ratio	-	2.209	-	-	0.012	-	-	-
HCM Control Delay (s)	-	-$ 569.3	-	-	9	-	-	-
HCM Lane LOS	-	F	-	-	A	-	-	-
HCM 95th %tile Q(veh)	-	80.1	-	-	0	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	18.8

Movement	EBL	EBT	WBU	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	10	1495	0	940	65	90	10
Future Vol, veh/h	10	1495	0	940	65	90	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	-	None	-	Yield
Storage Length	350	-	330	-	-	0	-
Veh in Median Storage, #	-	0	-	0	-	0	-
Grade, %	-	0	-	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13
Mvmt Flow	11	1590	0	1000	69	96	11

Major/Minor	Major1		Major2			Minor2	
Conflicting Flow All	1069	0	1590	-	0	1852	535
Stage 1	-	-	-	-	-	1035	-
Stage 2	-	-	-	-	-	817	-
Critical Hdwy	4.36	-	6.66	-	-	7.06	7.16
Critical Hdwy Stg 1	-	-	-	-	-	6.06	-
Critical Hdwy Stg 2	-	-	-	-	-	6.06	-
Follow-up Hdwy	2.33	-	2.63	-	-	3.63	3.43
Pot Cap-1 Maneuver	587	-	122	-	-	~ 58	462
Stage 1	-	-	-	-	-	280	-
Stage 2	-	-	-	-	-	368	-
Platoon blocked, %		-		-	-		
Mov Cap-1 Maneuver	587	-	122	-	-	~ 57	462
Mov Cap-2 Maneuver	-	-	-	-	-	~ 57	-
Stage 1	-	-	-	-	-	275	-
Stage 2	-	-	-	-	-	368	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	$ 490.2
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBU	WBT	WBR	SBLn1
Capacity (veh/h)	587	-	122	-	-	62
HCM Lane V/C Ratio	0.018	-	-	-	-	1.716
HCM Control Delay (s)	11.2	-	0	-	-	-$ 490.2
HCM Lane LOS	B	-	A	-	-	F
HCM 95th %tile Q(veh)	0.1	-	0	-	-	9.7

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	31.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	0	25	45	0	10	315	1130	40	0	310	60
Future Vol, veh/h	10	0	25	45	0	10	315	1130	40	0	310	60
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	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	65	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13	13	13	13	13	13
Mvmt Flow	11	0	27	48	0	11	335	1202	43	0	330	64

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2261	2277	362	2256	2288	1224	394	0	0	1245	0	0
Stage 1	362	362	-	1894	1894	-	-	-	-	-	-	-
Stage 2	1899	1915	-	362	394	-	-	-	-	-	-	-
Critical Hdwy	7.23	6.63	6.33	7.23	6.63	6.33	4.23	-	-	4.23	-	-
Critical Hdwy Stg 1	6.23	5.63	-	6.23	5.63	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.23	5.63	-	6.23	5.63	-	-	-	-	-	-	-
Follow-up Hdwy	3.617	4.117	3.417	3.617	4.117	3.417	2.317	-	-	2.317	-	-
Pot Cap-1 Maneuver	27	37	659	~ 27	37	207	1107	-	-	523	-	-
Stage 1	635	606	-	84	111	-	-	-	-	-	-	-
Stage 2	83	108	-	635	587	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	20	26	659	~ 20	26	207	1107	-	-	523	-	-
Mov Cap-2 Maneuver	20	26	-	~ 20	26	-	-	-	-	-	-	-
Stage 1	443	606	-	59	77	-	-	-	-	-	-	-
Stage 2	55	75	-	609	587	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	104.1	$ 997.4	2	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1107	-	-	70	24	523	-	-
HCM Lane V/C Ratio	0.303	-	-	0.532	2.438	-	-	-
HCM Control Delay (s)	9.7	-	-	104.1	$ 997.4	0	-	-
HCM Lane LOS	A	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	1.3	-	-	2.2	7.3	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	310	955	10	10	780	135	10	10	10	405	10	915
Future Vol, veh/h	310	955	10	10	780	135	10	10	10	405	10	915
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	375	-	-	355	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13	13	13	13	13	13
Mvmt Flow	330	1016	11	11	830	144	11	11	11	431	11	973

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	974	0	0	1027	0	0	2125	2678	514	2098	2611	487
Stage 1	-	-	-	-	-	-	1682	1682	-	924	924	-
Stage 2	-	-	-	-	-	-	443	996	-	1174	1687	-
Critical Hdwy	4.36	-	-	4.36	-	-	7.76	6.76	7.16	7.76	6.76	7.16
Critical Hdwy Stg 1	-	-	-	-	-	-	6.76	5.76	-	6.76	5.76	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.76	5.76	-	6.76	5.76	-
Follow-up Hdwy	2.33	-	-	2.33	-	-	3.63	4.13	3.43	3.63	4.13	3.43
Pot Cap-1 Maneuver	640	-	-	610	-	-	25	18	478	~ 26	20	~ 498
Stage 1	-	-	-	-	-	-	88	133	-	~ 269	322	-
Stage 2	-	-	-	-	-	-	535	297	-	~ 187	133	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	640	-	-	610	-	-	-	~ 9	478	-	~ 10	~ 498
Mov Cap-2 Maneuver	-	-	-	-	-	-	40	~ 1	-	~ 51	50	-
Stage 1	-	-	-	-	-	-	43	64	-	~ 130	316	-
Stage 2	-	-	-	-	-	-	-	292	-	~ 74	64	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4	0.1		
HCM LOS			-	-

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	640	-	-	610	-	-	-
HCM Lane V/C Ratio	-	0.515	-	-	0.017	-	-	-
HCM Control Delay (s)	-	16.4	-	-	11	-	-	-
HCM Lane LOS	-	C	-	-	B	-	-	-
HCM 95th %tile Q(veh)	-	3	-	-	0.1	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBU	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	0	1210	0	1630	75	65	0
Future Vol, veh/h	0	1210	0	1630	75	65	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	-	None	-	Yield
Storage Length	350	-	330	-	-	0	-
Veh in Median Storage, #	-	0	-	0	-	2	-
Grade, %	-	0	-	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13
Mvmt Flow	0	1287	0	1734	80	69	0

Major/Minor	Major1		Major2			Minor2	
Conflicting Flow All	1814	0	1287	-	0	2418	907
Stage 1	-	-	-	-	-	1774	-
Stage 2	-	-	-	-	-	644	-
Critical Hdwy	4.36	-	6.66	-	-	7.06	7.16
Critical Hdwy Stg 1	-	-	-	-	-	6.06	-
Critical Hdwy Stg 2	-	-	-	-	-	6.06	-
Follow-up Hdwy	2.33	-	2.63	-	-	3.63	3.43
Pot Cap-1 Maneuver	292	-	195	-	-	~ 23	258
Stage 1	-	-	-	-	-	108	-
Stage 2	-	-	-	-	-	456	-
Platoon blocked, %		-		-	-		
Mov Cap-1 Maneuver	292	-	195	-	-	~ 23	258
Mov Cap-2 Maneuver	-	-	-	-	-	100	-
Stage 1	-	-	-	-	-	108	-
Stage 2	-	-	-	-	-	456	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	98.2
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBU	WBT	WBR	SBLn1
Capacity (veh/h)	292	-	195	-	-	100
HCM Lane V/C Ratio	-	-	-	-	-	0.691
HCM Control Delay (s)	0	-	0	-	-	98.2
HCM Lane LOS	A	-	A	-	-	F
HCM 95th %tile Q(veh)	0	-	0	-	-	3.5

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	500.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	45	0	210	35	10	10	35	385	35	10	1085	10
Future Vol, veh/h	45	0	210	35	10	10	35	385	35	10	1085	10
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	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	65	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	13	13	13	13	13	13	13	13	13	13
Mvmt Flow	48	0	223	37	11	11	37	410	37	11	1154	11

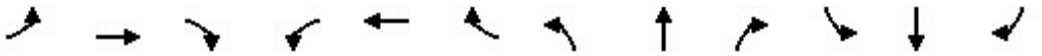
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1696	1703	1160	1685	1690	429	1165	0	0	447	0	0
Stage 1	1182	1182	-	503	503	-	-	-	-	-	-	-
Stage 2	514	521	-	1182	1187	-	-	-	-	-	-	-
Critical Hdwy	7.23	6.63	6.33	7.23	6.63	6.33	4.23	-	-	4.23	-	-
Critical Hdwy Stg 1	6.23	5.63	-	6.23	5.63	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.23	5.63	-	6.23	5.63	-	-	-	-	-	-	-
Follow-up Hdwy	3.617	4.117	3.417	3.617	4.117	3.417	2.317	-	-	2.317	-	-
Pot Cap-1 Maneuver	69	86	226	70	88	603	562	-	-	1057	-	-
Stage 1	220	251	-	531	524	-	-	-	-	-	-	-
Stage 2	524	514	-	220	250	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	57	78	226	~ 1	80	603	562	-	-	1057	-	-
Mov Cap-2 Maneuver	57	78	-	~ 1	80	-	-	-	-	-	-	-
Stage 1	205	243	-	496	489	-	-	-	-	-	-	-
Stage 2	470	480	-	~ 2	243	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	182.6	$ 16169.6	0.9	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	562	-	-	220	2	1057	-	-
HCM Lane V/C Ratio	0.066	-	-	1.233	29.255	0.01	-	-
HCM Control Delay (s)	11.9	-	-	182.6	$ 16169.6	8.4	0	-
HCM Lane LOS	B	-	-	F	F	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	13.8	9.4	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 6th Edition methodology does not support Non-NEMA phasing.



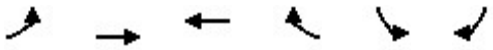
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	10	0	445	10	1040	0	0	115	265
Future Volume (veh/h)	0	0	0	10	0	445	10	1040	0	0	115	265
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				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	
Adj Sat Flow, veh/h/ln				1575	0	1575	1575	1575	0	0	1575	1575
Adj Flow Rate, veh/h				11	0	0	11	1143	0	0	126	291
Peak Hour Factor				0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %				16	0	16	16	16	0	0	16	16
Cap, veh/h				19	0		35	1188	0	0	1196	1014
Arrive On Green				0.01	0.00	0.00	0.76	0.76	0.00	0.00	0.76	0.76
Sat Flow, veh/h				1500	0	1335	6	1565	0	0	1575	1335
Grp Volume(v), veh/h				11	0	0	1154	0	0	0	126	291
Grp Sat Flow(s),veh/h/ln				1500	0	1335	1571	0	0	0	1575	1335
Q Serve(g_s), s				0.9	0.0	0.0	24.2	0.0	0.0	0.0	2.5	8.1
Cycle Q Clear(g_c), s				0.9	0.0	0.0	79.8	0.0	0.0	0.0	2.5	8.1
Prop In Lane				1.00		1.00	0.01		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				19	0		1223	0	0	0	1196	1014
V/C Ratio(X)				0.57	0.00		0.94	0.00	0.00	0.00	0.11	0.29
Avail Cap(c_a), veh/h				131	0		1345	0	0	0	1319	1118
HCM Platoon Ratio				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	0.00	1.00	1.00
Uniform Delay (d), s/veh				58.9	0.0	0.0	13.0	0.0	0.0	0.0	3.8	4.4
Incr Delay (d2), s/veh				24.2	0.0	0.0	15.4	0.0	0.0	0.0	0.0	0.2
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.5	0.0	0.0	24.5	0.0	0.0	0.0	0.6	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				83.1	0.0	0.0	28.4	0.0	0.0	0.0	3.8	4.6
LnGrp LOS				F	A		C	A	A	A	A	A
Approach Vol, veh/h					11			1154			417	
Approach Delay, s/veh					83.1			28.4			4.4	
Approach LOS					F			C			A	

Timer - Assigned Phs	4	6	8
Phs Duration (G+Y+Rc), s	95.6	6.0	95.6
Change Period (Y+Rc), s	4.5	4.5	4.5
Max Green Setting (Gmax), s	100.5	10.5	100.5
Max Q Clear Time (g_c+I1), s	10.1	2.9	81.8
Green Ext Time (p_c), s	1.7	0.0	9.3

Intersection Summary	
HCM 6th Ctrl Delay	22.4
HCM 6th LOS	C

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.



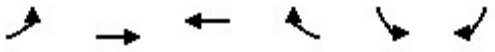
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	0	0	0
Future Volume (veh/h)	0	0	0	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1575	1575	1575	1575	1575	0
Adj Flow Rate, veh/h	0	0	0	0	0	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	16	16	16	16	16	0
Cap, veh/h	0	630	630		0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.00	0.00
Sat Flow, veh/h	0	1575	1575	0	0	0
Grp Volume(v), veh/h	0	0	0	0	0	0
Grp Sat Flow(s),veh/h/ln	0	1575	1575	0	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane	0.00			0.00	0.00	0.00
Lane Grp Cap(c), veh/h	0	630	630		0	0
V/C Ratio(X)	0.00	0.00	0.00		0.00	0.00
Avail Cap(c_a), veh/h	0	630	630		0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
LnGrp LOS	A	A	A		A	A
Approach Vol, veh/h		0	0		0	
Approach Delay, s/veh		0.0	0.0		0.0	
Approach LOS						

Timer - Assigned Phs		4		6	8
Phs Duration (G+Y+Rc), s		22.5		22.5	22.5
Change Period (Y+Rc), s		4.5		4.5	4.5
Max Green Setting (Gmax), s		18.0		18.0	18.0
Max Q Clear Time (g_c+I1), s		0.0		0.0	0.0
Green Ext Time (p_c), s		0.0		0.0	0.0

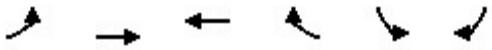
Intersection Summary	
HCM 6th Ctrl Delay	0.0
HCM 6th LOS	A

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.



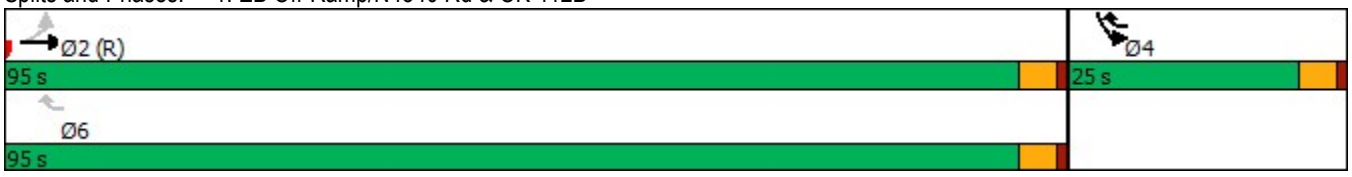
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6
Lane Configurations							
Traffic Volume (vph)	1030	10	0	20	125	0	
Future Volume (vph)	1030	10	0	20	125	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt				0.865			
Flt Protected		0.953			0.950		
Satd. Flow (prot)	0	1479	0	1342	1474	0	
Flt Permitted		0.953			0.950		
Satd. Flow (perm)	0	1479	0	1342	1474	0	
Right Turn on Red				Yes		Yes	
Satd. Flow (RTOR)							
Link Speed (mph)		45	45		45		
Link Distance (ft)		1065	533		580		
Travel Time (s)		16.1	8.1		8.8		
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	
Adj. Flow (vph)	1132	11	0	22	137	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	0	1143	0	22	137	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Left	Left	Right	Left	Right	
Median Width(ft)		0	0		12		
Link Offset(ft)		0	0		0		
Crosswalk Width(ft)		24	24		24		
Two way Left Turn Lane							
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	
Turning Speed (mph)	15			9	15	9	
Number of Detectors	1	2		0	0		
Detector Template	Left	Thru					
Leading Detector (ft)	20	100		0	0		
Trailing Detector (ft)	0	0		0	0		
Detector 1 Position(ft)	0	0		0	0		
Detector 1 Size(ft)	20	6		20	20		
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		
Detector 2 Position(ft)		94					
Detector 2 Size(ft)		6					
Detector 2 Type		Cl+Ex					
Detector 2 Channel							
Detector 2 Extend (s)		0.0					
Turn Type	Perm	NA		pm+ov	Prot		
Protected Phases		2		4	4		6
Permitted Phases	2			6			
Detector Phase	2	2		4	4		
Switch Phase							
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0

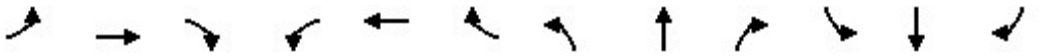


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6
Minimum Split (s)	22.5	22.5		22.5	22.5		22.5
Total Split (s)	95.0	95.0		25.0	25.0		95.0
Total Split (%)	79.2%	79.2%		20.8%	20.8%		79%
Maximum Green (s)	90.5	90.5		20.5	20.5		90.5
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0
Lost Time Adjust (s)		0.0		0.0	0.0		
Total Lost Time (s)		4.5		4.5	4.5		
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0
Recall Mode	C-Min	C-Min		None	None		Min
Act Effct Green (s)		95.1		120.0	15.9		
Actuated g/C Ratio		0.79		1.00	0.13		
v/c Ratio		0.98		0.02	0.70		
Control Delay		34.9		0.0	68.5		
Queue Delay		27.1		0.0	0.0		
Total Delay		62.1		0.0	68.5		
LOS		E		A	E		
Approach Delay		62.1			68.5		
Approach LOS		E			E		

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 120			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.98			
Intersection Signal Delay: 61.7		Intersection LOS: E	
Intersection Capacity Utilization 75.6%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 1: EB Off-Ramp/N4340 Rd & OK 412B



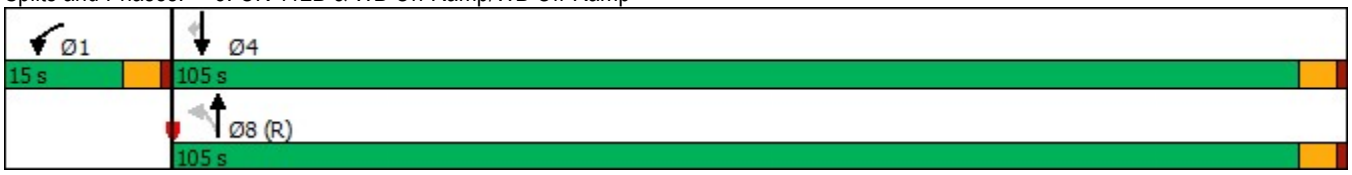


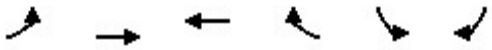
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	10	0	445	10	1040	0	0	115	265
Future Volume (vph)	0	0	0	10	0	445	10	1040	0	0	115	265
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	0		0	0		30	0		0	0		0
Storage Lanes	0		0	1		1	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected				0.950								
Satd. Flow (prot)	0	0	0	1474	0	1319	0	1552	0	0	1552	1319
Flt Permitted				0.950				0.998				
Satd. Flow (perm)	0	0	0	1474	0	1319	0	1549	0	0	1552	1319
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						268						291
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		656			816			580			3418	
Travel Time (s)		9.9			12.4			8.8			51.8	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	11	0	489	11	1143	0	0	126	291
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	11	0	489	0	1154	0	0	126	291
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		24			24			24			24	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors				1		1	1	2			2	1
Detector Template				Left		Right	Left	Thru			Thru	Right
Leading Detector (ft)				20		20	20	100			100	20
Trailing Detector (ft)				0		0	0	0			0	0
Detector 1 Position(ft)				0		0	0	0			0	0
Detector 1 Size(ft)				20		20	20	6			6	20
Detector 1 Type				Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)				0.0		0.0	0.0	0.0			0.0	0.0
Detector 1 Queue (s)				0.0		0.0	0.0	0.0			0.0	0.0
Detector 1 Delay (s)				0.0		0.0	0.0	0.0			0.0	0.0
Detector 2 Position(ft)								94			94	
Detector 2 Size(ft)								6			6	
Detector 2 Type								Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)								0.0			0.0	
Turn Type				Prot		Free	Perm	NA			NA	Perm
Protected Phases				1				8			4	
Permitted Phases						Free	8					4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase				1			8	8			4	4
Switch Phase												
Minimum Initial (s)				5.0			5.0	5.0			5.0	5.0
Minimum Split (s)				9.5			22.5	22.5			22.5	22.5
Total Split (s)				15.0			105.0	105.0			105.0	105.0
Total Split (%)				12.5%			87.5%	87.5%			87.5%	87.5%
Maximum Green (s)				10.5			100.5	100.5			100.5	100.5
Yellow Time (s)				3.5			3.5	3.5			3.5	3.5
All-Red Time (s)				1.0			1.0	1.0			1.0	1.0
Lost Time Adjust (s)				0.0				0.0			0.0	0.0
Total Lost Time (s)				4.5				4.5			4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0			3.0	3.0			3.0	3.0
Recall Mode				None			C-Min	C-Min			None	None
Act Effct Green (s)				6.5		120.0		116.6			116.6	116.6
Actuated g/C Ratio				0.05		1.00		0.97			0.97	0.97
v/c Ratio				0.14		0.37		0.77			0.08	0.23
Control Delay				57.2		0.8		6.9			0.6	0.5
Queue Delay				0.0		0.0		0.8			0.0	0.0
Total Delay				57.2		0.8		7.7			0.6	0.5
LOS				E		A		A			A	A
Approach Delay					2.0			7.7			0.5	
Approach LOS					A			A			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 50 (42%), Referenced to phase 8:NBTL, Start of Green			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.77			
Intersection Signal Delay: 4.9		Intersection LOS: A	
Intersection Capacity Utilization 83.2%		ICU Level of Service E	
Analysis Period (min) 15			

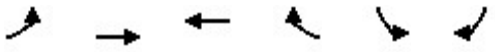
Splits and Phases: 3: OK 412B & WB On-Ramp/WB Off-Ramp



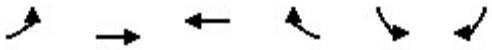


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	105	30	20	10	0	0
Future Volume (vph)	105	30	20	10	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.955			
Flt Protected		0.963				
Satd. Flow (prot)	0	1494	1482	0	0	0
Flt Permitted		0.963				
Satd. Flow (perm)	0	1494	1482	0	0	0
Link Speed (mph)		30	30		30	
Link Distance (ft)		533	1970		600	
Travel Time (s)		12.1	44.8		13.6	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	115	33	22	11	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	148	33	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		40	40		40	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15			9	15	9
Sign Control		Yield	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 17.8%		ICU Level of Service A	
Analysis Period (min) 15			



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1552	1552	0	1552	0
Flt Permitted						
Satd. Flow (perm)	0	1552	1552	0	1552	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)						
Link Speed (mph)		30	30		30	
Link Distance (ft)		338	484		251	
Travel Time (s)		7.7	11.0		5.7	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	60			60	60	60
Turn Type					Prot	
Protected Phases		4	8		6	
Permitted Phases	4					
Minimum Split (s)	22.5	22.5	22.5		22.5	
Total Split (s)	22.5	22.5	22.5		22.5	
Total Split (%)	28.1%	28.1%	28.1%		28.1%	
Maximum Green (s)	18.0	18.0	18.0		18.0	
Yellow Time (s)	3.5	3.5	3.5		3.5	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)		0.0	0.0		0.0	
Total Lost Time (s)		4.5	4.5		4.5	
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	
Pedestrian Calls (#/hr)	0	0	0		0	
Act Effct Green (s)						
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						

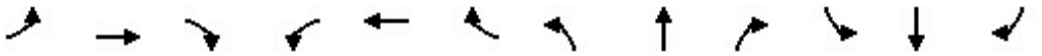


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
LOS						
Approach Delay						
Approach LOS						

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green			
Natural Cycle: 45			
Control Type: Pretimed			
Maximum v/c Ratio: 0.00			
Intersection Signal Delay: 0.0		Intersection LOS: A	
Intersection Capacity Utilization 0.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 12:

HCM 6th Edition methodology does not support Non-NEMA phasing.



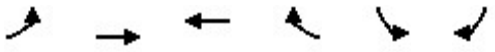
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	10	0	135	10	320	0	0	415	915
Future Volume (veh/h)	0	0	0	10	0	135	10	320	0	0	415	915
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				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	
Adj Sat Flow, veh/h/ln				1688	0	1688	1688	1688	0	0	1688	1688
Adj Flow Rate, veh/h				12	0	0	12	376	0	0	488	1076
Peak Hour Factor				0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %				8	0	8	8	8	0	0	8	8
Cap, veh/h				24	0		80	1361	0	0	1386	1174
Arrive On Green				0.02	0.00	0.00	0.82	0.82	0.00	0.00	0.82	0.82
Sat Flow, veh/h				1607	0	1430	15	1658	0	0	1688	1430
Grp Volume(v), veh/h				12	0	0	388	0	0	0	488	1076
Grp Sat Flow(s),veh/h/ln				1607	0	1430	1673	0	0	0	1688	1430
Q Serve(g_s), s				0.4	0.0	0.0	0.0	0.0	0.0	0.0	4.0	29.9
Cycle Q Clear(g_c), s				0.4	0.0	0.0	2.9	0.0	0.0	0.0	4.0	29.9
Prop In Lane				1.00		1.00	0.03		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				24	0		1441	0	0	0	1386	1174
V/C Ratio(X)				0.49	0.00		0.27	0.00	0.00	0.00	0.35	0.92
Avail Cap(c_a), veh/h				219	0		1441	0	0	0	1386	1174
HCM Platoon Ratio				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	0.00	1.00	1.00
Uniform Delay (d), s/veh				26.9	0.0	0.0	1.1	0.0	0.0	0.0	1.2	3.6
Incr Delay (d2), s/veh				14.4	0.0	0.0	0.1	0.0	0.0	0.0	0.7	12.6
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	4.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				41.3	0.0	0.0	1.2	0.0	0.0	0.0	1.9	16.1
LnGrp LOS				D	A		A	A	A	A	A	B
Approach Vol, veh/h					12			388			1564	
Approach Delay, s/veh					41.3			1.2			11.7	
Approach LOS					D			A			B	

Timer - Assigned Phs	4	6	8
Phs Duration (G+Y+Rc), s	49.7	5.3	49.7
Change Period (Y+Rc), s	4.5	4.5	4.5
Max Green Setting (Gmax), s	38.5	7.5	38.5
Max Q Clear Time (g_c+I1), s	31.9	2.4	4.9
Green Ext Time (p_c), s	4.2	0.0	2.3

Intersection Summary	
HCM 6th Ctrl Delay	9.8
HCM 6th LOS	A

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.



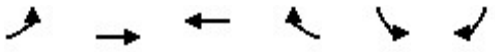
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	0	0	0
Future Volume (veh/h)	0	0	0	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1688	1688	1688	1688	1688	0
Adj Flow Rate, veh/h	0	0	0	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	8	8	8	8	8	0
Cap, veh/h	0	675	675		0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.00	0.00
Sat Flow, veh/h	0	1688	1688	0	0	0
Grp Volume(v), veh/h	0	0	0	0	0	0
Grp Sat Flow(s),veh/h/ln	0	1688	1688	0	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane	0.00			0.00	0.00	0.00
Lane Grp Cap(c), veh/h	0	675	675		0	0
V/C Ratio(X)	0.00	0.00	0.00		0.00	0.00
Avail Cap(c_a), veh/h	0	675	675		0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
LnGrp LOS	A	A	A		A	A
Approach Vol, veh/h		0	0		0	
Approach Delay, s/veh		0.0	0.0		0.0	
Approach LOS						

Timer - Assigned Phs		4		6	8
Phs Duration (G+Y+Rc), s		22.5		22.5	22.5
Change Period (Y+Rc), s		4.5		4.5	4.5
Max Green Setting (Gmax), s		18.0		18.0	18.0
Max Q Clear Time (g_c+I1), s		0.0		0.0	0.0
Green Ext Time (p_c), s		0.0		0.0	0.0

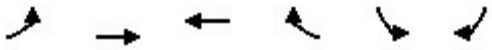
Intersection Summary	
HCM 6th Ctrl Delay	0.0
HCM 6th LOS	A

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.



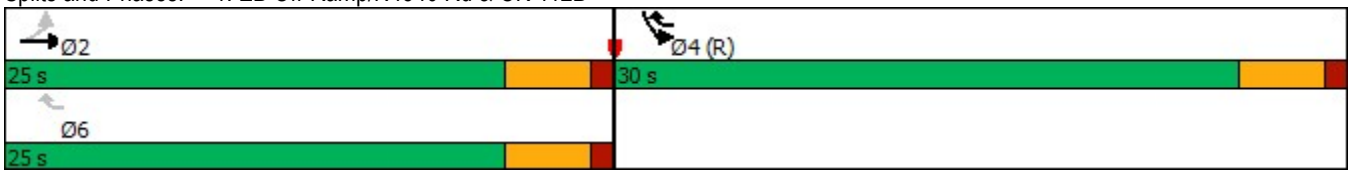
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6
Lane Configurations							
Traffic Volume (vph)	310	10	0	20	425	0	
Future Volume (vph)	310	10	0	20	425	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt				0.865			
Flt Protected		0.954			0.950		
Satd. Flow (prot)	0	1590	0	1442	1583	0	
Flt Permitted		0.954			0.950		
Satd. Flow (perm)	0	1590	0	1442	1583	0	
Right Turn on Red				Yes		Yes	
Satd. Flow (RTOR)							
Link Speed (mph)		45	45		45		
Link Distance (ft)		1065	533		580		
Travel Time (s)		16.1	8.1		8.8		
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	
Adj. Flow (vph)	365	12	0	24	500	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	0	377	0	24	500	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Left	Left	Right	Left	Right	
Median Width(ft)		0	0		12		
Link Offset(ft)		0	0		0		
Crosswalk Width(ft)		24	24		24		
Two way Left Turn Lane							
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	
Turning Speed (mph)	60			60	60	60	
Number of Detectors	1	2		0	0		
Detector Template	Left	Thru					
Leading Detector (ft)	20	100		0	0		
Trailing Detector (ft)	0	0		0	0		
Detector 1 Position(ft)	0	0		0	0		
Detector 1 Size(ft)	20	6		20	20		
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		
Detector 2 Position(ft)		94					
Detector 2 Size(ft)		6					
Detector 2 Type		Cl+Ex					
Detector 2 Channel							
Detector 2 Extend (s)		0.0					
Turn Type	Perm	NA		pm+ov	Prot		
Protected Phases		2		4	4		6
Permitted Phases	2			6			
Detector Phase	2	2		4	4		
Switch Phase							
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0

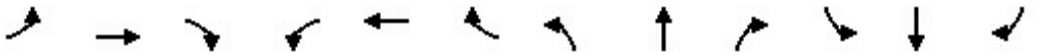


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6
Minimum Split (s)	22.5	22.5		22.5	22.5		22.5
Total Split (s)	25.0	25.0		30.0	30.0		25.0
Total Split (%)	45.5%	45.5%		54.5%	54.5%		45%
Maximum Green (s)	20.5	20.5		25.5	25.5		20.5
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0
Lost Time Adjust (s)		0.0		0.0	0.0		
Total Lost Time (s)		4.5		4.5	4.5		
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0
Recall Mode	None	None		C-Min	C-Min		None
Walk Time (s)	7.0	7.0		7.0	7.0		7.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0
Pedestrian Calls (#/hr)	0	0		0	0		0
Act Effct Green (s)		17.2		55.0	28.8		
Actuated g/C Ratio		0.31		1.00	0.52		
v/c Ratio		0.76		0.02	0.60		
Control Delay		27.2		0.0	13.1		
Queue Delay		0.0		0.0	0.0		
Total Delay		27.2		0.0	13.1		
LOS		C		A	B		
Approach Delay		27.2			13.1		
Approach LOS		C			B		

Intersection Summary			
Area Type:	Other		
Cycle Length: 55			
Actuated Cycle Length: 55			
Offset: 10 (18%), Referenced to phase 4:SBL, Start of Green			
Natural Cycle: 50			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.76			
Intersection Signal Delay: 18.7		Intersection LOS: B	
Intersection Capacity Utilization 51.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: EB Off-Ramp/N4340 Rd & OK 412B



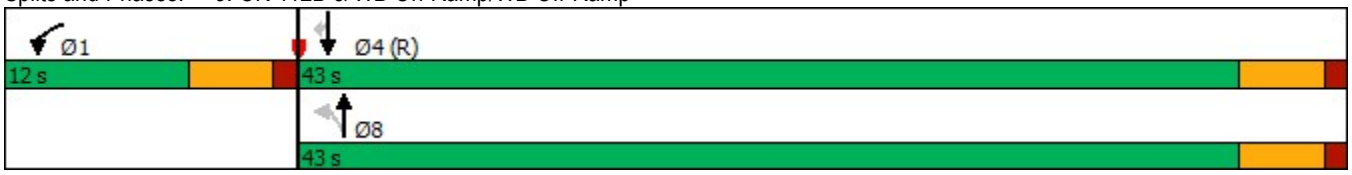


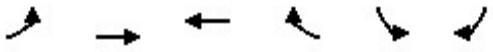
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	10	0	135	10	320	0	0	415	915
Future Volume (vph)	0	0	0	10	0	135	10	320	0	0	415	915
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	0		0	0		30	0		0	0		0
Storage Lanes	0		0	1		1	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected				0.950				0.998				
Satd. Flow (prot)	0	0	0	1583	0	1417	0	1663	0	0	1667	1417
Flt Permitted				0.950				0.986				
Satd. Flow (perm)	0	0	0	1583	0	1417	0	1643	0	0	1667	1417
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						159						1076
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		656			816			580			3418	
Travel Time (s)		9.9			12.4			8.8			51.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	0	0	12	0	159	12	376	0	0	488	1076
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	12	0	159	0	388	0	0	488	1076
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		24			24			24			24	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	60		60	60		60	60		60	60		60
Number of Detectors				1		1	1	2			2	1
Detector Template				Left		Right	Left	Thru			Thru	Right
Leading Detector (ft)				20		20	20	100			100	20
Trailing Detector (ft)				0		0	0	0			0	0
Detector 1 Position(ft)				0		0	0	0			0	0
Detector 1 Size(ft)				20		20	20	6			6	20
Detector 1 Type				Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)				0.0		0.0	0.0	0.0			0.0	0.0
Detector 1 Queue (s)				0.0		0.0	0.0	0.0			0.0	0.0
Detector 1 Delay (s)				0.0		0.0	0.0	0.0			0.0	0.0
Detector 2 Position(ft)								94			94	
Detector 2 Size(ft)								6			6	
Detector 2 Type								Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)								0.0			0.0	
Turn Type				Prot		Free	Perm	NA			NA	Perm
Protected Phases				1				8			4	
Permitted Phases						Free	8					4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase				1			8	8			4	4
Switch Phase												
Minimum Initial (s)				5.0			5.0	5.0			5.0	5.0
Minimum Split (s)				9.5			22.5	22.5			22.5	22.5
Total Split (s)				12.0			43.0	43.0			43.0	43.0
Total Split (%)				21.8%			78.2%	78.2%			78.2%	78.2%
Maximum Green (s)				7.5			38.5	38.5			38.5	38.5
Yellow Time (s)				3.5			3.5	3.5			3.5	3.5
All-Red Time (s)				1.0			1.0	1.0			1.0	1.0
Lost Time Adjust (s)				0.0				0.0			0.0	0.0
Total Lost Time (s)				4.5				4.5			4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0			3.0	3.0			3.0	3.0
Recall Mode				None			Min	Min			C-Min	C-Min
Act Effct Green (s)				6.0		55.0		51.8			51.8	51.8
Actuated g/C Ratio				0.11		1.00		0.94			0.94	0.94
v/c Ratio				0.07		0.11		0.25			0.31	0.77
Control Delay				22.6		0.2		0.8			1.7	5.6
Queue Delay				0.0		0.0		0.0			0.0	0.0
Total Delay				22.6		0.2		0.8			1.7	5.6
LOS				C		A		A			A	A
Approach Delay					1.7			0.8			4.4	
Approach LOS					A			A			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 55			
Actuated Cycle Length: 55			
Offset: 51 (93%), Referenced to phase 4:SBT, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.77			
Intersection Signal Delay: 3.5		Intersection LOS: A	
Intersection Capacity Utilization 85.7%		ICU Level of Service E	
Analysis Period (min) 15			

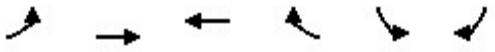
Splits and Phases: 3: OK 412B & WB On-Ramp/WB Off-Ramp



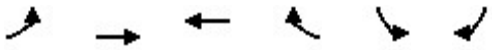


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	405	30	20	10	0	0
Future Volume (vph)	405	30	20	10	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.955			
Flt Protected		0.955				
Satd. Flow (prot)	0	1592	1592	0	0	0
Flt Permitted		0.955				
Satd. Flow (perm)	0	1592	1592	0	0	0
Link Speed (mph)		45	45		45	
Link Distance (ft)		533	1970		600	
Travel Time (s)		8.1	29.8		9.1	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	476	35	24	12	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	511	36	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		40	40		40	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	60			60	60	60
Sign Control		Yield	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 35.3%		ICU Level of Service A	
Analysis Period (min) 15			



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1667	1667	0	1667	0
Flt Permitted						
Satd. Flow (perm)	0	1667	1667	0	1667	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)						
Link Speed (mph)		45	45		45	
Link Distance (ft)		338	484		251	
Travel Time (s)		5.1	7.3		3.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	0	0	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	60			60	60	60
Turn Type					Prot	
Protected Phases		4	8		6	
Permitted Phases	4					
Minimum Split (s)	22.5	22.5	22.5		22.5	
Total Split (s)	22.5	22.5	22.5		22.5	
Total Split (%)	28.1%	28.1%	28.1%		28.1%	
Maximum Green (s)	18.0	18.0	18.0		18.0	
Yellow Time (s)	3.5	3.5	3.5		3.5	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)		0.0	0.0		0.0	
Total Lost Time (s)		4.5	4.5		4.5	
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	
Pedestrian Calls (#/hr)	0	0	0		0	
Act Effct Green (s)						
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
LOS						
Approach Delay						
Approach LOS						

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green			
Natural Cycle: 45			
Control Type: Pretimed			
Maximum v/c Ratio: 0.00			
Intersection Signal Delay: 0.0		Intersection LOS: A	
Intersection Capacity Utilization 0.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 12:

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	1030	10	10	20	20	105
Future Volume (veh/h)	1030	10	10	20	20	105
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1575	1575	1575	1575	1575	1575
Adj Flow Rate, veh/h	1132	0	11	22	22	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	16	16	16	16	16	16
Cap, veh/h	1184		103	41	81	
Arrive On Green	0.79	0.00	0.05	0.05	0.05	0.00
Sat Flow, veh/h	1499	0	355	805	1575	0
Grp Volume(v), veh/h	1133	0	33	0	22	0
Grp Sat Flow(s),veh/h/ln	1500	0	1160	0	1575	0
Q Serve(g_s), s	36.7	0.0	1.1	0.0	0.8	0.0
Cycle Q Clear(g_c), s	36.7	0.0	1.8	0.0	0.8	0.0
Prop In Lane	1.00	0.00	0.33			0.00
Lane Grp Cap(c), veh/h	1185		144	0	81	
V/C Ratio(X)	0.96		0.23	0.00	0.27	
Avail Cap(c_a), veh/h	2423		567	0	542	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	5.1	0.0	26.6	0.0	25.9	0.0
Incr Delay (d2), s/veh	5.5	0.0	0.8	0.0	1.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	0.4	0.0	0.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	10.6	0.0	27.4	0.0	27.7	0.0
LnGrp LOS	B		C	A	C	
Approach Vol, veh/h	1133			33	22	
Approach Delay, s/veh	10.6			27.4	27.7	
Approach LOS	B			C	C	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		7.4		49.3		7.4
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		19.5		91.5		19.5
Max Q Clear Time (g_c+I1), s		3.8		38.7		2.8
Green Ext Time (p_c), s		0.1		6.1		0.0

Intersection Summary		
HCM 6th Ctrl Delay		11.4
HCM 6th LOS		B

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	445	10	10	1040	115	265
Future Volume (veh/h)	445	10	10	1040	115	265
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1575	1575	1575	1575	1575	1575
Adj Flow Rate, veh/h	489	11	11	1143	126	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	16	16	16	16	16	16
Cap, veh/h	414	9	28	1029	1034	
Arrive On Green	0.28	0.28	0.66	0.66	0.66	0.00
Sat Flow, veh/h	1461	33	6	1566	1575	0
Grp Volume(v), veh/h	501	0	1154	0	126	0
Grp Sat Flow(s),veh/h/ln	1496	0	1573	0	1575	0
Q Serve(g_s), s	42.5	0.0	42.3	0.0	4.5	0.0
Cycle Q Clear(g_c), s	42.5	0.0	98.5	0.0	4.5	0.0
Prop In Lane	0.98	0.02	0.01			0.00
Lane Grp Cap(c), veh/h	424	0	1057	0	1034	
V/C Ratio(X)	1.18	0.00	1.09	0.00	0.12	
Avail Cap(c_a), veh/h	424	0	1057	0	1034	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	53.8	0.0	26.8	0.0	9.6	0.0
Incr Delay (d2), s/veh	103.5	0.0	56.2	0.0	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	27.7	0.0	51.1	0.0	1.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	157.3	0.0	83.0	0.0	9.7	0.0
LnGrp LOS	F	A	F	A	A	
Approach Vol, veh/h	501			1154	126	
Approach Delay, s/veh	157.3			83.0	9.7	
Approach LOS	F			F	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		103.0		47.0		103.0
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		98.5		42.5		98.5
Max Q Clear Time (g_c+I1), s		100.5		44.5		6.5
Green Ext Time (p_c), s		0.0		0.0		0.7

Intersection Summary		
HCM 6th Ctrl Delay	98.7	
HCM 6th LOS	F	

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	310	10	10	20	20	405
Future Volume (veh/h)	310	10	10	20	20	405
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1688	1688	1688	1688	1688	1688
Adj Flow Rate, veh/h	365	0	12	24	24	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	8	8	8	8	8	8
Cap, veh/h	534		296	316	402	
Arrive On Green	0.33	0.00	0.24	0.24	0.24	0.00
Sat Flow, veh/h	1603	0	283	1326	1688	0
Grp Volume(v), veh/h	366	0	36	0	24	0
Grp Sat Flow(s),veh/h/ln	1608	0	1609	0	1688	0
Q Serve(g_s), s	4.1	0.0	0.0	0.0	0.2	0.0
Cycle Q Clear(g_c), s	4.1	0.0	0.3	0.0	0.2	0.0
Prop In Lane	1.00	0.00	0.33			0.00
Lane Grp Cap(c), veh/h	536		612	0	402	
V/C Ratio(X)	0.68		0.06	0.00	0.06	
Avail Cap(c_a), veh/h	1378		1568	0	1447	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	6.0	0.0	6.2	0.0	6.2	0.0
Incr Delay (d2), s/veh	1.5	0.0	0.0	0.0	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	7.6	0.0	6.3	0.0	6.2	0.0
LnGrp LOS	A		A	A	A	
Approach Vol, veh/h	366			36	24	
Approach Delay, s/veh	7.6			6.3	6.2	
Approach LOS	A			A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		9.5		11.5		9.5
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		18.0		18.0		18.0
Max Q Clear Time (g_c+I1), s		2.3		6.1		2.2
Green Ext Time (p_c), s		0.1		0.9		0.0

Intersection Summary	
HCM 6th Ctrl Delay	7.4
HCM 6th LOS	A

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	135	10	10	320	415	915
Future Volume (veh/h)	135	10	10	320	415	915
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1688	1688	1688	1688	1688	1688
Adj Flow Rate, veh/h	159	12	12	376	488	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	8	8	8	8	8	8
Cap, veh/h	216	16	174	746	761	
Arrive On Green	0.15	0.15	0.45	0.45	0.45	0.00
Sat Flow, veh/h	1474	111	18	1653	1688	0
Grp Volume(v), veh/h	172	0	388	0	488	0
Grp Sat Flow(s),veh/h/ln	1594	0	1671	0	1688	0
Q Serve(g_s), s	2.3	0.0	0.0	0.0	5.0	0.0
Cycle Q Clear(g_c), s	2.3	0.0	3.7	0.0	5.0	0.0
Prop In Lane	0.92	0.07	0.03			0.00
Lane Grp Cap(c), veh/h	234	0	920	0	761	
V/C Ratio(X)	0.74	0.00	0.42	0.00	0.64	
Avail Cap(c_a), veh/h	1389	0	9080	0	9162	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	9.1	0.0	4.4	0.0	4.7	0.0
Incr Delay (d2), s/veh	4.5	0.0	0.3	0.0	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.1	0.0	0.2	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	13.6	0.0	4.7	0.0	5.6	0.0
LnGrp LOS	B	A	A	A	A	
Approach Vol, veh/h	172			388	488	
Approach Delay, s/veh	13.6			4.7	5.6	
Approach LOS	B			A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		14.6		7.8		14.6
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		121.5		19.5		121.5
Max Q Clear Time (g_c+I1), s		5.7		4.3		7.0
Green Ext Time (p_c), s		2.4		0.4		3.1

Intersection Summary	
HCM 6th Ctrl Delay	6.6
HCM 6th LOS	A

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Intersection Delay, s/veh	78.7
Intersection LOS	F

Approach	NB	SB	SE	SW
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	33	137	1143	0
Demand Flow Rate, veh/h	39	159	1326	0
Vehicles Circulating, veh/h	1446	0	159	1339
Vehicles Exiting, veh/h	39	1339	0	146
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	15.8	4.0	89.5	0.0
Approach LOS	C	A	F	-

Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	R
Assumed Moves	TR	LT	LR	R
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	39	159	1326	0
Cap Entry Lane, veh/h	316	1380	1173	352
Entry HV Adj Factor	0.857	0.864	0.862	1.000
Flow Entry, veh/h	33	137	1143	0
Cap Entry, veh/h	271	1193	1011	352
V/C Ratio	0.124	0.115	1.130	0.000
Control Delay, s/veh	15.8	4.0	89.5	10.2
LOS	C	A	F	B
95th %tile Queue, veh	0	0	31	0

Intersection	
Intersection Delay, s/veh	25.0
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	0	11	1154	417
Demand Flow Rate, veh/h	0	13	1339	484
Vehicles Circulating, veh/h	159	1339	0	26
Vehicles Exiting, veh/h	351	0	159	1326
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	0.0	9.8	32.4	4.9
Approach LOS	-	A	D	A

Lane	Left	Left	Left	Left	Right
Designated Moves	R	LT	LT	LT	R
Assumed Moves	R	LT	LT	LT	R
RT Channelized					
Lane Util	1.000	1.000	1.000	0.302	0.698
Follow-Up Headway, s	2.535	2.535	2.535	2.667	2.535
Critical Headway, s	4.328	4.328	4.328	4.645	4.328
Entry Flow, veh/h	0	13	1339	146	338
Cap Entry Lane, veh/h	1241	455	1420	1318	1389
Entry HV Adj Factor	1.000	0.846	0.862	0.862	0.861
Flow Entry, veh/h	0	11	1154	126	291
Cap Entry, veh/h	1241	385	1224	1136	1196
V/C Ratio	0.000	0.029	0.943	0.111	0.243
Control Delay, s/veh	2.9	9.8	32.4	4.1	5.2
LOS	A	A	D	A	A
95th %tile Queue, veh	0	0	17	0	1

Intersection	
Intersection Delay, s/veh	9.1
Intersection LOS	A

Approach	NB	SB	SE	SW
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	36	500	377	0
Demand Flow Rate, veh/h	39	540	407	0
Vehicles Circulating, veh/h	908	0	540	420
Vehicles Exiting, veh/h	39	420	0	527
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.0	6.6	12.5	0.0
Approach LOS	A	A	B	-

Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	R
Assumed Moves	TR	LT	LR	R
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	39	540	407	0
Cap Entry Lane, veh/h	547	1380	796	899
Entry HV Adj Factor	0.925	0.926	0.926	1.000
Flow Entry, veh/h	36	500	377	0
Cap Entry, veh/h	506	1278	737	899
V/C Ratio	0.071	0.391	0.512	0.000
Control Delay, s/veh	8.0	6.6	12.5	4.0
LOS	A	A	B	A
95th %tile Queue, veh	0	2	3	0

Intersection	
Intersection Delay, s/veh	13.3
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	0	12	388	1564
Demand Flow Rate, veh/h	0	13	419	1689
Vehicles Circulating, veh/h	540	419	0	26
Vehicles Exiting, veh/h	1175	0	540	406
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	0.0	4.0	5.4	15.4
Approach LOS	-	A	A	C

Lane	Left	Left	Left	Left	Right
Designated Moves	R	LT	LT	LT	R
Assumed Moves	R	LT	LT	LT	R
RT Channelized					
Lane Util	1.000	1.000	1.000	0.312	0.688
Follow-Up Headway, s	2.535	2.535	2.535	2.667	2.535
Critical Headway, s	4.328	4.328	4.328	4.645	4.328
Entry Flow, veh/h	0	13	419	527	1162
Cap Entry Lane, veh/h	897	995	1420	1318	1389
Entry HV Adj Factor	1.000	0.923	0.926	0.926	0.926
Flow Entry, veh/h	0	12	388	488	1076
Cap Entry, veh/h	897	918	1315	1220	1286
V/C Ratio	0.000	0.013	0.295	0.400	0.837
Control Delay, s/veh	4.0	4.0	5.4	6.9	19.3
LOS	A	A	A	A	C
95th %tile Queue, veh	0	0	1	2	11

HCS Freeway Facilities Report

Project Information

Analyst	Thomas Cusick	Date	09/01/2023
Agency	Garver	Analysis Year	2045 Build
Jurisdiction	Mayes County, OK	Time Analyzed	AM
Facility Name		Units	U.S. Customary
Project Description	US 412 EB - 70-30 Split (Trumpet_v5)		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	1.49		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	Before Off Ramp W/O OK412B	2000	2
2	Diverge	Diverge	Off Ramp W/O OK412B	1500	2
3	Basic	Basic	Between OK412B Off and On Ramps	875	2
4	Merge	Merge	On Ramp W/O OK412B	1500	2
5	Basic	Basic	After On Ramp W/O OK412B	2000	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1956	4800	0.41	70.0	14.0	B

Segment 2: Diverge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1956	1284	4800	2000	0.41	0.64	54.8	54.8	17.8	10.3	B

Segment 3: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	673	4800	0.14	67.8	4.8	A

Segment 4: Merge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	815	142	4800	2000	0.17	0.07	64.4	64.4	6.3	11.8	B

Segment 5: Basic

AP	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.94	0.862	815	4800	0.17	69.7	5.8	A

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	420	386	0.60	15.08	64.1	10.2	8.7	1.40	B

Facility Overall Results

Space Mean Speed, mi/h	64.1	Average Density, veh/mi/ln	8.7
Average Travel Time, min	1.40	Average Density, pc/mi/ln	10.2
Total VMT, veh-mi	420	Total VHD, veh-h	0.60
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	15.08

HCS Freeway Facilities Report

Project Information

Analyst	Thomas Cusick	Date	09/01/2023
Agency	Garver	Analysis Year	2045 Build
Jurisdiction	Mayes County, OK	Time Analyzed	PM
Facility Name		Units	U.S. Customary
Project Description	US 412 EB - 70-30 Split (Trumpet_v5)		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	1.49		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	Before Off Ramp W/O OK412B	2000	2
2	Diverge	Diverge	Off Ramp W/O OK412B	1500	2
3	Basic	Basic	Between OK412B Off and On Ramps	875	2
4	Merge	Merge	On Ramp W/O OK412B	1500	2
5	Basic	Basic	After On Ramp W/O OK412B	2000	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1574	4800	0.33	70.0	11.2	B

Segment 2: Diverge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1574	395	4800	2000	0.33	0.20	57.0	57.0	13.8	7.0	A

Segment 3: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1179	4800	0.25	68.1	8.4	A

Segment 4: Merge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1691	512	4800	2000	0.35	0.26	64.0	64.0	13.2	18.5	B

Segment 5: Basic

AP	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.94	0.862	1691	4800	0.35	69.6	12.1	B

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	509	448	0.59	14.63	65.7	12.0	10.3	1.40	B

Facility Overall Results

Space Mean Speed, mi/h	65.7	Average Density, veh/mi/ln	10.3
Average Travel Time, min	1.40	Average Density, pc/mi/ln	12.0
Total VMT, veh-mi	509	Total VHD, veh-h	0.59
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	14.63

HCS Freeway Facilities Report

Project Information

Analyst	Thomas Cusick	Date	09/01/2023
Agency	Garver	Analysis Year	2045 Build
Jurisdiction	Mayes County, OK	Time Analyzed	AM
Facility Name		Units	U.S. Customary
Project Description	US 412 EB - 70-30 Split (Trumpet_v6)		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	1.52		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	Before Off Ramp W/O OK412B	2000	2
2	Diverge	Diverge	Off Ramp W/O OK412B	1500	2
3	Basic	Basic	Between OK412B Off and On Ramps	1015	2
4	Merge	Merge	On Ramp W/O OK412B	1500	2
5	Basic	Basic	After On Ramp W/O OK412B	2000	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1956	4800	0.41	70.0	14.0	B

Segment 2: Diverge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1956	1284	4800	2000	0.41	0.64	54.8	54.8	17.8	10.3	B

Segment 3: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	673	4800	0.14	68.0	4.8	A

Segment 4: Merge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	815	142	4800	2000	0.17	0.07	64.4	64.4	6.3	11.8	B

Segment 5: Basic

AP	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.94	0.862	815	4800	0.17	69.7	5.8	A

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	424	390	0.60	15.09	64.1	10.1	8.7	1.40	B

Facility Overall Results

Space Mean Speed, mi/h	64.1	Average Density, veh/mi/ln	8.7
Average Travel Time, min	1.40	Average Density, pc/mi/ln	10.1
Total VMT, veh-mi	424	Total VHD, veh-h	0.60
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	15.09

HCS Freeway Facilities Report

Project Information

Analyst	Thomas Cusick	Date	09/01/2023
Agency	Garver	Analysis Year	2045 Build
Jurisdiction	Mayes County, OK	Time Analyzed	PM
Facility Name		Units	U.S. Customary
Project Description	US 412 EB - 70-30 Split (Trumpet_v6)		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	1.52		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	Before Off Ramp W/O SH 412B	2000	2
2	Diverge	Diverge	Off Ramp W/O SH 412B	1500	2
3	Basic	Basic	Between SH 412B Off and On Ramps	1015	2
4	Merge	Merge	On Ramp W/O SH 412B	1500	2
5	Basic	Basic	After On Ramp W/O SH 412B	2000	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1574	4800	0.33	70.0	11.2	B

Segment 2: Diverge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1574	395	4800	2000	0.33	0.20	57.0	57.0	13.8	7.0	A

Segment 3: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1179	4800	0.25	68.3	8.4	A

Segment 4: Merge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1691	512	4800	2000	0.35	0.26	64.0	64.0	13.2	18.5	B

Segment 5: Basic

AP	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.94	0.862	1691	4800	0.35	69.6	12.1	B

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	515	455	0.59	14.65	65.7	11.9	10.3	1.40	B

Facility Overall Results

Space Mean Speed, mi/h	65.7	Average Density, veh/mi/ln	10.3
Average Travel Time, min	1.40	Average Density, pc/mi/ln	11.9
Total VMT, veh-mi	515	Total VHD, veh-h	0.59
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	14.65

OD Travel Times (s)

ID	Origin-Destination	AP1
1	1 (Basic) -> 2 (Off-Ramp)	0.6
2	1 (Basic) -> 5 (Basic)	1.4
3	4 (On-Ramp) -> 5 (Basic)	0.6

HCS Freeway Facilities Report

Project Information

Analyst	Thomas Cusick	Date	09/01/2023
Agency	Garver	Analysis Year	2045 Build
Jurisdiction	Mayes County, OK	Time Analyzed	AM
Facility Name		Units	U.S. Customary
Project Description	US 412 WB - 70-30 Split (Trumpet_v5)		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	1.51		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	Before Off Ramp E/O SH 412B	2000	2
2	Diverge	Diverge	Off Ramp E/O SH 412B	1500	2
3	Basic	Basic	Between SH 412B Off and On Ramps	975	2
4	Merge	Merge	On Ramp W/O SH 412B	1500	2
5	Basic	Basic	After On Ramp W/O SH 412B	2000	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1464	4800	0.31	70.0	10.5	A

Segment 2: Diverge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1464	549	4800	2000	0.30	0.27	56.6	56.6	12.9	3.3	A

Segment 3: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	914	4800	0.19	68.2	6.5	A

Segment 4: Merge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1241	327	4800	2000	0.26	0.16	64.2	64.2	9.7	15.1	B

Segment 5: Basic

AP	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.94	0.862	1242	4800	0.26	69.7	8.9	A

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	423	379	0.50	12.50	65.4	9.9	8.6	1.40	B

Facility Overall Results

Space Mean Speed, mi/h	65.4	Average Density, veh/mi/ln	8.6
Average Travel Time, min	1.40	Average Density, pc/mi/ln	9.9
Total VMT, veh-mi	423	Total VHD, veh-h	0.50
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	12.50

HCS Freeway Facilities Report

Project Information

Analyst	Thomas Cusick	Date	09/01/2023
Agency	Garver	Analysis Year	2045 Build
Jurisdiction	Mayes County, OK	Time Analyzed	PM
Facility Name		Units	U.S. Customary
Project Description	US 412 WB - 70-30 Split (Trumpet_v5)		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	1.51		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	Before Off Ramp E/O SH 412B	2000	2
2	Diverge	Diverge	Off Ramp E/O SH 412B	1500	2
3	Basic	Basic	Between SH 412B Off and On Ramps	975	2
4	Merge	Merge	On Ramp W/O SH 412B	1500	2
5	Basic	Basic	After On Ramp W/O SH 412B	2000	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1143	4800	0.24	70.0	8.2	A

Segment 2: Diverge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1143	167	4800	2000	0.24	0.08	57.6	57.6	9.9	0.6	A

Segment 3: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	976	4800	0.20	68.3	7.0	A

Segment 4: Merge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	2105	1129	4800	2000	0.44	0.56	63.6	63.6	16.5	21.4	C

Segment 5: Basic

AP	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.94	0.862	2105	4800	0.44	69.6	15.0	B

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	503	408	0.56	13.98	66.1	11.6	10.0	1.40	B

Facility Overall Results

Space Mean Speed, mi/h	66.1	Average Density, veh/mi/ln	10.0
Average Travel Time, min	1.40	Average Density, pc/mi/ln	11.6
Total VMT, veh-mi	503	Total VHD, veh-h	0.56
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	13.98

HCS Freeway Facilities Report

Project Information

Analyst	Thomas Cusick	Date	09/01/2023
Agency	Garver	Analysis Year	2045 Build
Jurisdiction	Mayes County, OK	Time Analyzed	AM
Facility Name		Units	U.S. Customary
Project Description	US 412 WB - 70-30 Split (Trumpet_v6)		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	1.60		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	Before Off Ramp E/O SH 412B	2000	2
2	Diverge	Diverge	Off Ramp E/O SH 412B	1500	2
3	Basic	Basic	Between SH 412B Off and On Ramps	1450	2
4	Merge	Merge	On Ramp W/O SH 412B	1500	2
5	Basic	Basic	After On Ramp W/O SH 412B	2000	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1464	4800	0.31	70.0	10.5	A

Segment 2: Diverge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1464	549	4800	2000	0.30	0.27	56.6	56.6	12.9	3.3	A

Segment 3: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	914	4800	0.19	68.8	6.5	A

Segment 4: Merge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1241	327	4800	2000	0.26	0.16	64.2	64.2	9.7	15.1	B

Segment 5: Basic

AP	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.94	0.862	1242	4800	0.26	69.7	8.9	A

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	441	395	0.50	12.50	65.6	9.7	8.4	1.50	B

Facility Overall Results

Space Mean Speed, mi/h	65.6	Average Density, veh/mi/ln	8.4
Average Travel Time, min	1.50	Average Density, pc/mi/ln	9.7
Total VMT, veh-mi	441	Total VHD, veh-h	0.50
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	12.50

HCS Freeway Facilities Report

Project Information

Analyst	Thomas Cusick	Date	09/01/2023
Agency	Garver	Analysis Year	2045 Build
Jurisdiction	Mayes County, OK	Time Analyzed	PM
Facility Name		Units	U.S. Customary
Project Description	US 412 WB - 70-30 Split (Trumpet_v6)		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	1.60		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	Before Off Ramp E/O SH 412B	2000	2
2	Diverge	Diverge	Off Ramp E/O SH 412B	1500	2
3	Basic	Basic	Between SH 412B Off and On Ramps	1450	2
4	Merge	Merge	On Ramp W/O SH 412B	1500	2
5	Basic	Basic	After On Ramp W/O SH 412B	2000	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	1143	4800	0.24	70.0	8.2	A

Segment 2: Diverge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	1143	167	4800	2000	0.24	0.08	57.6	57.6	9.9	0.6	A

Segment 3: Basic

AP	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.862	976	4800	0.20	68.9	7.0	A

Segment 4: Merge

AP	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.862	0.862	2105	1129	4800	2000	0.44	0.56	63.6	63.6	16.5	21.4	C

Segment 5: Basic

AP	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.94	0.862	2105	4800	0.44	69.6	15.0	B

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	522	425	0.56	13.98	66.2	11.4	9.8	1.50	B

Facility Overall Results

Space Mean Speed, mi/h	66.2	Average Density, veh/mi/ln	9.8
Average Travel Time, min	1.50	Average Density, pc/mi/ln	11.4
Total VMT, veh-mi	522	Total VHD, veh-h	0.56
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	13.98

APPENDIX D

Initial Concepts Matrix

	ALTERNATIVE			PERFORMANCE	ACCESS			ENVIRONMENTAL IMPACTS				UTILITY IMPACTS					R.O.W. IMPACTS		CONSTRUCTION IMPACTS			
	NO.	DESC.	CONCEPTUAL SKETCH	% OF FULL MAIP BUILD-OUT FAILURE	FREE-FLOW?	ACCESS TO OLD HWY-33?	DIRECT ACCESS TO THE SOUTH?	SETTLEMENT PONDS	WETLANDS	STREAMS (LF)	RECREATION AREA	GRDA OHP Trans.	OHP	FIBER / TUG	WATER	GAS	USACE	MAIP	US-412 RAISED (412 over 412B)	BRIDGES (No. of Bridges)	BRIDGES (SF of Deck)	ROAD (LF of lane mi.)
WEST	3	Diamond_v2 (button hook on)		90%	No	POSSIBLE (Not Shown, but included in Costs & Impacts)	Yes	Moderate	Moderate	650	No	0	2	2	1	0	X	X	X	2	15,200	45,850
	10	Roundabout_v2		80%	Semi-Free	Yes	Yes	Moderate	Moderate	650	No	0	2	2	1	0	X	X	X	2	15,200	50,580
	11	Trumpet_v5		170%	Yes	Yes	POSSIBLE (Not Shown, but included in Costs & Impacts)	Moderate	Moderate	250	Moderate	0	2	3	3	0	X	X	X	3	23,200	46,380
EAST	12	Folded D_v6		75%	Semi-Free	Yes	Yes	Yes	Moderate	1050	Moderate	0	3	3	3	0	X	X		2	20,800	34,580
	13	Trumpet_v6		170%	Yes	Yes	Yes	Yes	Moderate	1300	Moderate	0	3	3	3	0	X	X		3	29,760	35,860

Notes:

- This matrix should be considered preliminary and used for general interchange configuration comparitive purposes only.
- Information shown in this table is based on conceptual design developed between 2/3/2023 - 5/5/2023, and high-level desk data obtained 2/3/2023 - 2/9/2023.
- Settlement Ponds could also be considered wetlands and will need further field investigations to make a determination.
- Alt 10 (Roundabout_v2) was appended to this matrix on 3/2/2023 to provide a roundabout configuration that realigns SH-412B west of the main settlement ponds.
- Alternatives 1, 2, and 4 - 9 were removed and Alternatives 11 - 13 were added to this matrix to provide a final comparison summary between the preferred Alternatives as of 6/2/2023.
- To provide a balanced comparison between alternatives, the impacts listed in this matrix are based on full build improvements which include access to both Old Hwy-33 and the south recreation area, even if not shown in the conceptual sketch.
- Performance (% of Full MAIP Build-Out Failure) added 9/7/2023 to establish an anticipated capacity breakdown for each alternative configuration using 2043 design volumes with 70/30 directional distribution for US-412.
- Utility Impacts revised 9/7/2023. Score based predominantly on schedule implications, using 0 (negligible) - 5 (significant).