Comprehensive Engineering Services

Traffic Memorandum

(Volume I)

To:	Andy Wilson Project Manager ODOT	From:	Chris DeRosia, PE, PTOE Senior Transportation Engineer EST Inc,
Re:	EC-2119-SH 51 from Western Rd, East 2.0 miles to Junction of US-177, Payne County, Oklahoma	Date:	February 12, 2021

INTRODUCTION

The Oklahoma Department of Transportation (ODOT) is proposing improvements to SH-51 (6th Avenue) that will increase capacity and improve pavement conditions to the existing four-lane facility beginning just west of the Western Road intersection and extending east 2 miles just to the west of the US-177 junction in the City of Stillwater, OK (COS) in Payne County. The project location is shown in Figure 1 of Attachment A.

The proposed improvements will add a center two-way left turn lane (TWLTL) and Americans with Disabilities Act (ADA) compliant sidewalks with curb ramps throughout the project limits. The primary purpose of this project is to reconstruct the existing lanes and widen the facility to five (5) lanes with curb and gutter and consider potential bicycle and pedestrian route improvements, where feasible. This traffic impact analysis will confirm adequate accommodations are provided with the proposed improvements. The peak hour volume during the typical AM/PM peak period was used in the analysis to quantify traffic impacts along the corridor.

The data collected, the analysis methodology employed, the results, and recommended improvements are contained in this Traffic Memorandum (Volume I). Volume II contains the support data for the study.

EXISTING CONDITIONS/DATA COLLECTION

EST has collected, reviewed, and compiled data from a variety of sources, including traffic counts, field investigations and available data from the COS, ODOT, and Oklahoma State University (OSU). COS provided information to better understand their transportation infrastructure and OSU assisted in identifying impacts related to campus events and facilities adjacent the 6th Avenue corridor. Data collected included but was not limited to:

- Daily directional traffic volumes
- Peak hour turning movements
- Multimodal planning documents
- Raw crash data collected from the SAFE-T database of recent years with corresponding crash reports of aggregated data
- Land use data from the City's GIS system
- Comprehensive plan and STEP plan information to understand expected plans for growth in the future
- Existing signal equipment, corridor signage, and any special roadway cross section elements
- Intersection and roadway geometry
- Bike/pedestrian facilities
- Access location and type- full, three-quarter, right-in/right-out (RIRO), etc.

- Roadside features via photographs
- Traffic control devices
- Traffic signal timings and settings

A field visit was performed to collect intersection and roadway geometric, lighting, signing, and traffic control features. Data included videos and photographs. Existing signal timings during the weekday morning and afternoon peak hours were collected to confirm reports that were available from the City's Centracs system. Signal timing data is included in Attachment F.

The current speed limit on SH-51 within the project limits varies from 40mph to 30mph. Specific corridor posted speeds and existing roadway segment and intersection geometry are shown in Figure 3 of Attachment A. A summary of this information is provided below for roadways and intersections:

- **SH-51 (6th Ave.)** is an existing east-west four-lane principal urban arterial within our study area. It serves as a primary east-west link across COS. The roadway widens to provide left turn lanes at the intersections with S. Monroe St., S. Washington St, S. Duck St, and S. Lewis St.

- **S. Western Rd** is a two-lane principal arterial road that runs north-south and intersects 6th Ave at a signalized intersection. North of Hall of Fame and south of 6th Avenue it is a minor arterial road.

- **S. Willis St.** is a two-lane local road owned by COS that runs north-south and intersects 6th Ave. at a stop-controlled intersection. With recent redevelopment of the school this is now provides primary access to the elementary school.

- **S. Kings St.** is a two-lane local road owned by COS that runs north-south and intersects 6th Ave twice. From the south, it intersects 6th Ave. at a one-way stop-controlled intersection. From the north, it tees into 6th Ave. at a signalized intersection and is one-way southbound. From the south it provides two-way operation and tees into 6th Avenue at a stop-controlled intersection. The was formerly the elementary school's primary route of access which also provided for on-street pick-up drop-off activity.

- **S. Stanley St.** is a two-lane local road owned by COS that runs north-south and intersects 6th Ave. at a signalized intersection.

- **S. Monroe St.** is a two-lane urban/major county collector road that runs north-south and intersects 6th Ave. at a signalized intersection. South of 6th Avenue it is a minor collector.

- **S. Washington St.** is a two-lane minor collector road owned by COS that runs north-south and intersects 6th Ave. at a signalized intersection.

- **Hester St.** is a two-lane COS urban/major collector road that runs north-south and intersects 6th Ave. at a signalized intersection. It widens at the intersection to include a left turn lane on either side. South of 6th Avenue it is a minor collector route.

- **S. Knoblock St.** is a two-lane local road owned by COS that runs north-south and intersects 6th Ave. at a stop-controlled intersection.

- **S. Duck St.** is a four-lane minor arterial that runs north-south and intersects 6th Ave. at a signalized intersection. It widens at the intersection to include a left turn lane on either side.

- **S. Duncan St.** is a two-lane local road owned by COS that runs north-south and intersects 6th Ave. at a stop-controlled intersection.

- **S. Husband St.** is a two-lane local road owned by COS that runs north-south and intersects 6th Ave. at a signalized intersection. It widens at the intersection to include a left turn lane on either side.

- **S. Main St.** is a four-lane minor arterial road owned by COS that runs north-south and intersects 6th Ave. at a signalized intersection. It widens at the intersection to accommodate left and right turn lanes on both sides and is a principal arterial north of 6th Avenue.

- **S. Lewis St.** is a two-lane local road owned by COS that runs north-south and intersects 6th Ave. at a signalized intersection. It widens at the intersection to accommodate a left turn lane on both the north and south sides.

- **S. Lowry St.** is a two-lane local road owned by COS that runs north-south and intersects 6th Ave. at a stop-controlled intersection.

Traffic Counts

The traffic count locations are shown in Figure 2 of Attachment A and indicate the type and location of the various traffic counts collected during the week of August 24th, 2020. A summary of raw 2020 traffic volumes is shown in Figure 4 of Attachment A. Raw traffic count data is included in Volume II, Attachment E.

EST collected the following three types of traffic counts for this project. Traffic data was collected on non-holiday workdays, when OSU was in session, and in good weather with no precipitation. OSU was under a modified operating plan call "Cowboys Coming Back" with phased reopening. COS Public Schools were not holding in-person classes. COVID-19 restrictions were in place at the time of the traffic counts (post-quarantine) consistent with the rest of the country though nobody was restricted from driving.

- Daily Traffic volumes were collected in the form of 24-hour counts in 15-minute increments. At minimum, this data included directional distribution, truck volumes (three specific classifications), bike/pedestrians and vehicular speed collected at 4 strategic locations along SH-51.
- Intersection Turning Movement Counts (TMC) were collected at 15 intersections for 24 hours. TMC's were collected at ten signalized intersections and five minor, non-signalized intersections which potentially warrant a traffic signal in the future. TMC's included bike/pedestrian counts.

At the request of the city, peak hour traffic counts were collected at Willis St. to support analysis of a signal warrant evaluation that considers decommissioning the Kings St. traffic signal and constructing a new signal at Willis St. to accommodate the redevelopment of the adjacent Westwood Elementary School site. The school was conducting remote learning due to COVID-19 restrictions at the time of the counts, so volumes were not representative of full school operations (approach to warranting a signal at Willis St. is presented below).

Pedestrian and bicycle traffic counts along the corridor are shown on the raw traffic count data sheets included in Volume II. This data will be used to assess and or support the need of upgraded pedestrian and bike accommodations and crossings along 6th Ave.

A traffic count was collected at Perkins to establish corridor retiming and is not part of our operations analysis as it was recently upgraded.

Note that the COVID-19 outbreak was limiting to OSU college football event operations, and no data was able to be collected that was representative of peak outflow after a typical gameday.

DESIGN DEVELOPMENT TRAFFIC

Design traffic was developed by adjusting the raw data for Seasonal and Truck factors, plus an estimated factor to account for the effects of COVID-19 on normal travel demand. These factors are as follows:

- Seasonal factor: 0.970
- Truck factor: 0.898
- COVID-19 factor: 1.100

The design traffic data for 2020 and 2045, shown in Figures 5 and 6 of Attachment A, show AADT and peak hour volumes used in the analysis to quantify traffic impacts along the corridor. The adjusted raw traffic data and the current and future year design traffic data was reviewed and approved by ODOT in an e-mail from ODOT on September 28, 2020.

Future Land Use and Trip Generation

Through early coordination with COS it was determined that there are currently no proposed developments within the study limits and/or adjacent to 6th Avenue intersections that would impact future traffic projections. However, in late October, EST was notified that there were to be three large multi-story apartment complexes built near downtown and near the OSU campus Two of the residential developments have access to Hester St. and the other accesses 5th Avenue. When site plans are provided by COS with density information trip generation estimates can be made, as necessary, and an updated capacity analysis can be performed to determine any additional accommodations that may be needed on 6th Avenue. Two of the developments were complete at the time traffic counts were collected. Recently Stillwater Public Schools shifted to a modified schedule where half of the students attend classes on Tuesday and Thursday and the other half attend classes on Monday and Wednesday.

OSU identified one redevelopment of their property that would impact future traffic projections the new Michael and Anne Greenwood School of Music on Hester St (McKnight Center). A Land Use Map is included as Figure 7 in Attachment A showing the location of this development. This facility was to be opened just before our traffic counts were performed. It is assumed that events taking place at this center will be off-peak, therefore, the analysis outlined below is not affected.

Future Access

An inventory of access points to private and public properties along the corridor was conducted and results are summarized in four strip maps in Figure 8 of Attachment A Corridor Access Inventory. The study corridor includes more than 30 stop-controlled cross street intersections and ten signalized intersections (nine within the improvement limits). There are approximately 107 driveways (12 industrial full access, 24 residential full access, 52 commercial full access, 5 right in only, 3 right out only, and 11 cross street access). Consideration and analysis of the safety and condition is discussed later.

OPERATIONAL ANALYSIS

Using design traffic volumes, geometric data, and traffic control data, a detailed traffic operation analyses was conducted for SH-51 within the study corridor. Capacity and Level of Service (LOS) methodologies for signalized intersections, and unsignalized intersections as described in the Highway Capacity Manual (HCM), 6th Edition (Transportation Research Board [TRB], 2016) were applied to these analyses using Synchro/SimTraffic v10. Existing and 2045 conditions for the signalized and unsignalized intersections. Software output is included in Attachment G. This includes optimization of traffic signal timing in the future condition.

Results from existing traffic operation analysis established baseline conditions for the study corridor, identified locations of operational deficiency where significant delay and local congestion occur, and provided estimates of how much "spare" capacity a specific highway segment or intersection has to accommodate potential traffic growth.

As described earlier, the traffic study of the project includes analysis of nine signalized and four (does not include Willis St.) unsignalized intersections including Turning Movement Counts (TMC) in the AM and PM peak periods were collected. TMCs are surface volumes the queue lengths that may occur at the intersection. Calculated queues were used to support selection of appropriate storage and taper lengths for various turning movements along the corridor.

Signalized Intersections – LOS Analysis

Level of Service (LOS) for signalized intersections is determined by the amount of wait time, or delay, that a vehicle experiences for a movement at a traffic signal. The delay includes the time from when a vehicle joins a queue or is the first to start a queue and stops when the vehicle can complete the movement.

Signalized intersections analyzed to determine LOS, delays, and queues within the 6th Avenue corridor are listed below:

Western Rd.	Duck St.
Kings St.	Husband St.
Monroe St.	Main St.
Washington St.	Lewis St.
Hester St.	

The results of the operational analysis are shown in the LOS and Queue Tables below. All intersections are operating at an acceptable LOS D or better for 2020 and 2045 design years except Western Road during the AM peak hour where the northbound and southbound approaches are operating at LOS E. However, they are less than one second of average delay over the threshold for LOS D. All peak hour queue lengths are acceptable and can be contained within existing storage bays except that which is recommended for improvement, and this is discussed in the recommendations section of this memorandum.

Un-signalized Intersections LOS Analysis and Accesses

The LOS analysis for un-signalized intersections is also based on delay determined by the amount of wait time a vehicle experiences before being able to complete a maneuver. Since there are no stop signs for the east or west approaches on 6th Avenue, the delay is negligible in these directions. Vehicles on the minor/crossing roadway approaches which are stop sign controlled, experience some delay and the LOS drops accordingly.

Un-signalized intersections along the study corridor on 6th Ave are listed below:

Stanley St.	Duncan St.
Knoblock St.	Lowry St.

The results of the LOS analysis for the signalized intersections and approach LOS for unsignalized intersections are summarized in Table 1.

In isolation, the stop-controlled approaches on these streets will show unacceptable LOS (E or F). However, using SimTraffic (microsimulation) shows that adjacent signals within the corridor provide adequate gaps in the through traffic to provide for entry to 6th Avenue from cross streets within a reasonable range of delay (see Table 2).

Table 1- SH-51 Stillwater - 2045 AM/PM -Proposed Geometry - LOS and Delay

Location	Intersection Type	Approach	AM		PM	
			LOS	Delay (Sec)	LOS	Delay (Sec)
Washington St. & SH-51	**Signalized**	EB	B	14.1	A	3.3
		WB	B	16.8	A	5.2
		NB	C	31.1	D	35.3
		SB	C	30.7	C	30.1
		Intersection	**B**	**17.7**	**A**	**8.1**
Western Rd. & & SH-51	**Signalized**	EB	D	46.3	C	31.6
		WB	D	36.2	D	53.8
		NB	E	55.6	D	40.7
		SB	E	57.6	D	51.9
		Intersection	**D**	**46.6**	**D**	**49.8**
Monroe St. & SH-51	**Signalized**	EB	B	13.2	D	39.9
		WB	A	1.1	A	1.8
		NB	D	54.9	D	48.6
		SB	D	54.7	D	43.1
		Intersection	**B**	**13.2**	**C**	**28.5**
Hester St. & SH-51	**Signalized**	EB	A	0.4	A	0.5
		WB	A	0.9	A	0.8
		NB	D	53	D	50.3
		SB	D	54	D	51.5
		Intersection	**A**	**4.4**	**A**	**3.8**
Duck St. & SH-51	**Signalized**	EB	C	26.8	D	36.3
		WB	A	8.3	A	8.4
		NB	D	36.3	C	34.9
		SB	D	44.8	D	36.1
		Intersection	**C**	**24.4**	**C**	**28.4**
Husband St. & SH-52	**Signalized**	EB	A	1	A	7.9
		WB	A	1.4	A	1.9
		NB	C	33.7	B	19.9
		SB	C	33.5	B	19.3
		Intersection	**A**	**3.2**	**A**	**6.8**
Main St. & SH-53	**Signalized**	EB	B	17	A	8.6
		WB	A	0.6	A	0.5
		NB	C	32.4	C	21
		SB	C	35	C	21.2
		Intersection	**B**	**16**	**B**	**10.3**
Lewis St. & SH-54	**Signalized**	EB	A	2.1	A	2.1
		WB	B	19.5	B	16.1
		NB	C	33.8	C	32.6
		SB	C	32.6	C	32.2
		Intersection	**B**	**14.5**	**B**	**11.5**
Kings St. & SH-55	**Signalized**	EB	B	15.7	B	15.1
		WB	B	15.6	B	15.7
		SB	A	7.5	A	8.5
		Intersection	**B**	**15.4**	**B**	**15.2**
Stanley St. & SH-51	**Unsignalized**	NB	C	24.5	E	46.6
		SB	F	123	F	72.7
Duncan St. & SH-51	**Unsignalized**	NB	F	124.1	E	44.7
		SB	F	72	E	43.2
Lowry St. & SH-51	**Unsignalized**	NB	F	289	F	260.9
		SB	F	255	F	384.9
Knoblock St. & SH-51	**Unsignalized**	NB	F	391	F	136.2
		SB	F	320.8	F	154.7

SAFETY ANALYSIS

A safety analysis was performed for the corridor as a segment considering the existing driveways and the future two-way left turn lane (TWLTL). Intersections showing crash patterns were inspected further to find no additional concerns between conflicting movements (see Attachment C for tables of the annual summary of crashes, total numbers of collisions, and a prediction of the crash frequency for a suburban street). The Highway Safety Manual 1st Edition 2010 methodologies were used to determine the crash frequency for the segment of 6th Ave, from Western Rd to US-177 (Perkins Rd). This analysis was performed for the Design Traffic Data years of 2020 and 2045. Results show a predicted total of 67.1 crashes per year for the design year 2020 and 84.2 crashes per year are expected for design year 2045. This represents a 25% increase compared to an overall traffic demand increase of 25%. Therefore, the increase in crashes is proportionate with the increase in traffic demand.

Considering just the driveways located within the study corridor, the predictive models show 65.2 crashes for the design year 2020 and 81.5 crashes for the design year 2045. This is also an 25% increase from 2020 to 2045. Actual crashes experienced within this study corridor range between 86 and 121 which is a significantly higher number of crashes (to almost double) from the predicted crashes. The difference between the predicted rates and the actual rates can be attributed the number of driveways having direct access to 6th Ave. within this corridor. Most of the crashes in the study corridor are driveway related. A significant proportion of driveway related crashes will be corrected by adding the two-way left-turn lane (TWLTL). In addition, ODOT's safety tool generated a report with aggregation of high-level crash statistics shown graphically and in tabular format which is also part of Attachment C.

CORRIDOR MODIFICATIONS AND IMPROVEMENTS

The focus of this section is highway capacity improvements, traffic signal design requirements (potential new and existing locations) and includes concepts for potential bicycle and pedestrian improvements within the downtown area along SH-51.

This memo evaluated existing and long-term traffic conditions at all intersections. The intersections are projected to operate acceptably through the year 2045 with the recommended lane geometry and traffic control improvements. See Figure 9 of Attachment A.

Traffic Signal Warrants: Vehicular Volume

A traffic signal warrant evaluation was performed at five unsignalized intersections (listed previously) along the study area to determine the need for a traffic signal. The warrant analysis was done according to MUTCD guidance and tables outlining Warrant 1 and 2 analysis are provided in Attachment B. Warrant 1, Eight-Hour Vehicular Volume and Warrant 2, Four-Hour Vehicular Volume are applied in these analyses considering 2020 counts. Warrant 3 was not applicable at any of the locations.

Design Traffic volumes for 2020 at all of the locations are not sufficient to warrant a traffic signal (i.e. the minor street volumes are too low). Year 2045 volumes at Lowry Street are just over the Peak Hour threshold and thus the warrant is expected to be met in the long-term. However, a traffic signal must be met based on current day conditions and volumes thresholds are not expected to be met for many years. Therefore, based on inspection of volume thresholds no additional traffic signals are currently needed based on current or expected traffic volumes.

Traffic Signal at Westwood Elementary School

A traffic signal at Willis Street is being considered due to the relocation of Westwood Elementary School. At the time of the writing of this memorandum, the final school operations plan was not available. With this and any other pertinent information engineering study should be performed to consider safety and impact to internal and external site circulation related to these potential modifications. It is expected that school children will be crossing 6th Avenue during peak periods and bus and parent pick-up/drop-off activity will use Willis St. Warrant #5, School Crossing could be met, especially if the signal at Kings Street were decommissioned. In person classes were not held due to the COVID-19 outbreak when traffic counts were performed. Therefore, we are unable to confirm with absolute certainty if Warrant 5 is met. However, data shows there is an 18:1 teacher to student ratio and more than 30 classroom teachers are employed. This suggests there are more than 500 students enrolled. If just 5% of the students walk to/from school and cross 6th Avenue, then Warrant 5 is met. Other improvements that will be considered include warning signs and flashers, school speed zones, and school crossing guards. The existing traffic signal at Kings Street provides a crossing for school children which could be moved to Willis Street if the Kings Street traffic signal is decommissioned. A signal at Willis St would improve signal spacing as recommended by the ITE Traffic Engineering Handbook. The current condition is acceptable too. More information provided about current day school operations would help inform this decision.

Turn Lane Warrants & Design of Auxiliary Turn Lanes

EST's design complies with the ODOT design guide or guidance within Chapter 9 At-Grade Intersections. With exception to the Western Avenue intersection, no new turn lanes were warranted based on volume criteria in 9.3.1 and 9.3.2. The new turn lanes at Western Ave and other features of the future configuration are illustrated on Figure 9: Proposed Geometry of Attachment A.

At Western Avenue, improvements to the southbound to westbound right turn lane are recommended. The southbound approach was modified to better accommodate the existing 625 vehicles turning right during the afternoon peak hour and to better accommodate the anticipated gameday traffic demand for this movement. This modification detailed in the recommendation section includes an additional free flow right turn lane. In addition, a westbound to northbound right turn lane is recommended to provide improved operations during the typical peak hours and for ingress during gameday and other events when this is along a primary access route.

Using guidance from criteria in 9.3.3 of the ODOT design guide, turn lane bay lengths were determined for the major intersections and are reflected in the 15% roadway plan drawings. These drawings showing specific striping details according to ODOT standard T-103. In several places, transition sections (the 10:1 taper sections) restrict the calculated storage lengths. In such cases, modification to the standard taper lengths are suggested. For example, some locations are provided with tapers as low as 8:1 when tight spacing yields no other options. The design recommendations for left turn pockets within the TWLTL in Table 3 and Table 4 are presented on the next page.

Multi-Modal: Accommodations for Bicycle, Pedestrian, and ADA

Attachment D includes a Pedestrian and Bicycle Accommodations Map.

Current bicycle accommodations in the vicinity of the study area include "sharrows" or lanes shared by bicycles and vehicles and are in the following locations:

- 9th: Western to Hartford
- 4th: Kings to West, 3rd West to JARDOT line
- Kings: 12th to Hall of Fame
- Monroe: 9th to Hall of Fame except dedicated bike lane 6th to University

Additional bicycle accommodations include bike lanes along University from Western to Knoblock and 12th from Western to Duck, then a shared lane to Hartford.

Pedestrian accommodations include a sidewalk network on the east half of the corridor that is largely complete though roadway plans will bring all up to standard including adherence to ADA requirements. Based on upcoming stakeholder meetings, improvements to the multimodal network are anticipated which may be done in conjunction with ODOT project work or separate depending on the extent and timing of construction activity planned. Future coordination with COS will better define the specific improvements that can be accommodated in this project. Provision for bike lanes on 6th Avenue is not recommended, especially unprotected and unbuffered bike lanes which would deviate from industry best practice and raise safety concerns. There is no available ROW for protected and/or buffered bike lanes along this corridor.

Bus Routes

There are three Oklahoma State University transit/bus routes in the vicinity. The Brown, Scarlett, and Purple lines. The Purple route travels along 6th Ave. from the west end of the project limits to Orchard St. The Brown route crosses 6th Ave. at Washington St. The Scarlett route runs along 6th Ave. from Hester St. to Duck St. More detailed information can be seen in the Figure 10: Bus Routes in Attachment A.

Table 2: SimTraffic Queue Summary

Sim-Traffic 10					
Location	Intersection Type	Approach	Movement	AM	PM
				95th Queue(ft)	95th Queue(ft)
Stanley St. & SH-51	Unsignalized	NB	L	26	24
			TR	24	40
		SB	LTR	42	37
Duncan St. & SH-51	Unsignalized	NB	LTR	42	44
		SB	LTR	43	44
Lowry St. & SH-51	Unsignalized	NB	LTR	88	76
		SB	LTR	39	33
Knoblock St. & SH-51	Unsignalized	NB	LTR	62	31
		SB	LTR	41	45

Table 3
Auxiliary Turn Lanes:
Unsignalized Intersection

Location	Approach	DHV	PHF	Storage Length based on Eq. page 9.3 (11)	Queue Length 95th (ft)	Min Storage Length (ft)	Proposed Storage Length	Existing Storage Length (ft)	
Stanley	EBL	18	0.75	21	2	50	No storage	115	Minor
	WBL	45	0.73	49	6	50	No storage	130	Minor
Knoblock	EBL	49	0.83	49	7	50	No storage	NA	Minor
	WBL	13	0.5	22	3	50	No storage	NA	Minor
Duncan	EBL	13	0.56	19	3	50	No storage	NA	Minor
	WBL	9	0.63	12	1	50	No storage	NA	Minor
Lowry	EBL	9	0.42	18	3	50	No storage	NA	Minor
	WBL	51	0.81	52	5	52	No storage	NA	Minor

Table 4 Auxiliary Turn Lanes:
Signalized Intersection

Location	Approach	DHV	V/C	Cycle length	Storage Length based on Figure 9.3 F	Queue Length 95th (ft)	Min storage Length (ft)	Proposed Storage Length (ft)	Existing Storage Length (ft)
Western	EBL	486	0.976	130	321 (for 2 lanes)	309	263	300 (for 2 lanes)	300 (for 2 lanes)
	WBL	108	0.822	110	145	187	148	190	230
	NBL	198	1.031	110	212 (for 2 lanes)	210	220	150	90
	SBL	116	0.378	110	110	148	110	185	185
Monroe	EBL	110	0.263	115	103	50	103	110	170
	WBL	99	0.273	115	95	95	95	100	125
	NBL	56	0.345	110	55	59	59	N/A	40
	SBL	146	0.684	110	149	139	149	N/A	105
Washington	EBL	36	0.117	110	< 50	8	50	50	75
	WBL	83	0.271	110	76	86	86	100	120
Hester	EBL	23	0.053	110	< 50	2	50	50	NA
	WBL	16	0.069	115	< 50	4	50	50	NA
	NBL	11	0.194	110	< 50	22	50	N/A	110
	SBL	14	0.138	110	< 50	30	50	N/A	95
Duck	EBL	189	0.479	110	180	193	193	200	130
	WBL	73	0.37	115	70	52	70	75	100
	NBL	88	0.515	115	84	86	86	N/A	130
	SBL	118	0.35	110	111	95	111	N/A	135
Husband	EBL	19	0.093	115	< 50	5	50	50	NA
	WBL	49	0.138	115	< 50	17	50	50	90
	NBL	20	0.058	110	< 50	21	50	N/A	60
	SBL	6	0.026	110	< 55	8	50	N/A	90
Main	EBL	196	0.455	110	184	?	184	125	140
	WBL	49	0.196	115	< 50	13	50	85	120
	NBL	39	0.742	115	< 50	39	50	N/A	100
	SBL	112	0.423	115	107	126	126	N/A	115
Lewis	EBL	21	0.052	115	< 50	8	50	75	120
	WBL	59	0.115	115	55	33	55	60	185
	NBL	45	0.146	110	< 50	55	55	N/A	120
	SBL	29	0.145	110	< 50	38	50	N/A	100

Gameday Special Event Traffic Management

In coordination with OSU, stadium gameday traffic control plans were obtained and are included in Figure 11 in Attachment A, along with the traffic management plan. This corridor is influenced by the occasional event traffic at two specific intersections: Western Road and Hester Street. The westbound OSU stadium traffic uses Western Road to access SH-51 to leave the City. Anecdotal information suggested that during the peak egress period of previous gamedays the southbound right turn fails occasionally. However, adequate data to explain operations at the Western Road intersection and confirm this. Attempts were made to gather data and collect it. Due to COVID-19 and the fact attendance at football games was strictly limited, the traffic counts collected for this study do not reflect gameday traffic demand. Also, 2014 data provided by the City of Stillwater from games on September 6th and 13th was not deemed representative for evaluation.

Operations at Hester Street north of University includes two-lane northbound before games and then conversion to two-lane southbound to University afterward. OSU has expressed an interest to extend this operation to 6th Avenue.

Conclusions and Recommendations

The proposed 6th Avenue Corridor segment (5-lane section with a continuous TWLTL) and intersection geometry from Western Road to US-177 is adequate to accommodate future (2045) weekday morning and afternoon peak hour traffic demand with implementation of improvements recommended below. This includes improvements to intersection turn lanes and median striping, which will be refined further in later stages of design based on agency and other stakeholders' feedback.

Recommended geometric improvements at the Western Road intersection include:

1. replacing the "sticks" (tubular markers) with a raised median on the eastbound approach,
2. extended northbound left turn lane (150-foot),
3. and an additional westbound right turn lane and reduced length to the left turn lane (190-foot).

Signing recommendations are not included in this memo though will be incorporated in future plan sets.

Discussion has begun regarding a potential traffic signal at Willis Street to replace the existing signal at Kings Street due to the relocation of Westwood Elementary School. However, bus operations remain along Kings Street. Therefore, it is recommended that future engineering study be performed to consider impact to internal and external site circulation related to these potential modifications.

A striped turn lane is recommended at the Stillwater Medical Center's emergency access to provide improvement operationally and to increase the potential for safety between motorists and emergency responders occasionally driving at high speeds. This will provide them with refugee for entry and for others driving in who we would anticipate are distracted. It is recommended this driveway be a one-way in only.

Based on the evaluation of current bicycle facilities included in preliminary design alternatives it is recommended that unprotected and unbuffered bike lanes not be provided on 6th Avenue.

Based on stakeholder feedback, decisions will be made to identify which design elements can be incorporated into future engineering drawings for the corridor. Upgrades to the pedestrian accommodations with ADA accessible curb ramps and rectification of sidewalk gaps are included.

Enclosed

Volume I
Attachment A-Figures
Attachment B-Traffic Signal Warrant Analysis
Attachment C-Crash Data Summary and Safety Analysis
Attachment D-COS Pedestrian and Bicycle Accommodations

Volume II
Attachment E-Raw Traffic Data
Attachment F-Signal Timings
Attachment G-Synchro Output and SimTraffic Simulation and Queue Report

Attachments Table of Contents