



Civil Engineering Professionals, Inc.
6080 Enterprise Dr. • Casper, WY 82609
Phone 307.266.4346
www.cepi-casper.com

East Yellowstone Intersection Improvement Study

Study Report - February 2022

Prepared by:

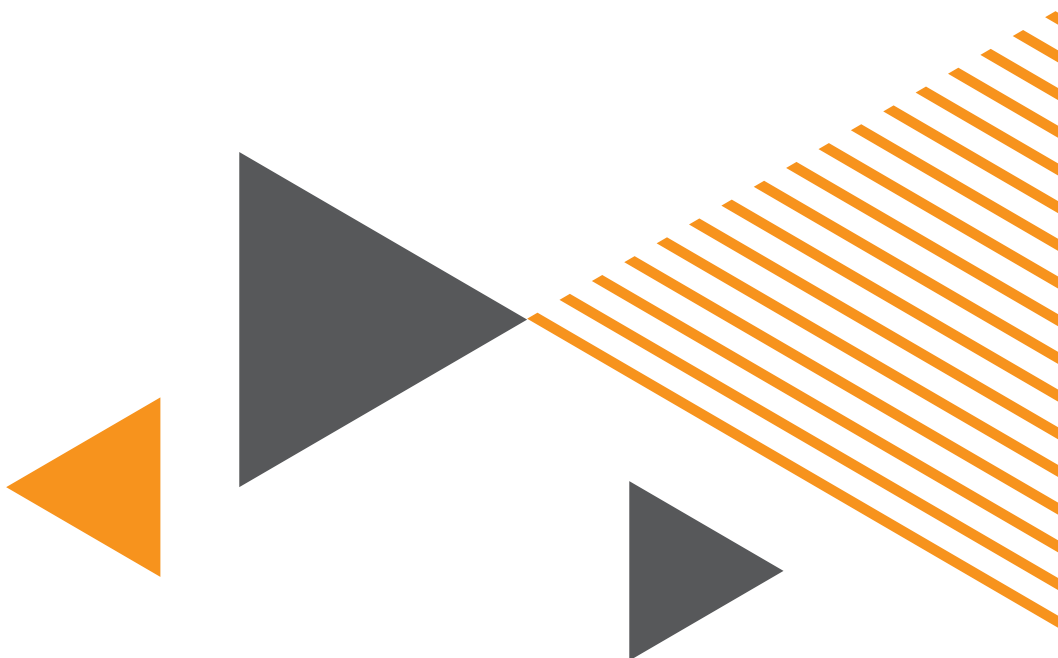
cepi

**Mead
& Hunt**



Table of Contents

INTRODUCTION.....	1
PUBLIC INVOLVEMENT	1
EXISTING CONDITIONS	2
STUDY AREA.....	2
EXISTING TRAFFIC VOLUME.....	4
EXISTING ROAD GEOMETRY	8
PEDESTRIAN AND BICYCLE INFRASTRUCTURE	11
PARKING.....	11
CRASH HISTORY.....	14
TRAFFIC OPERATIONS ANALYSIS.....	16
TRANSPORTATION NEEDS	19
EXISTING CONDITIONS SUMMARY	19



ALTERNATIVES DEVELOPMENT20

 No-Build Alternative21

 Kimball & 2nd Street Alternative.....21

 1st Street & Yellowstone Hwy: Option #121

 1st Street & Yellowstone Hwy: Option #2.....22

 1st Street & Yellowstone Hwy: Option #3.....22

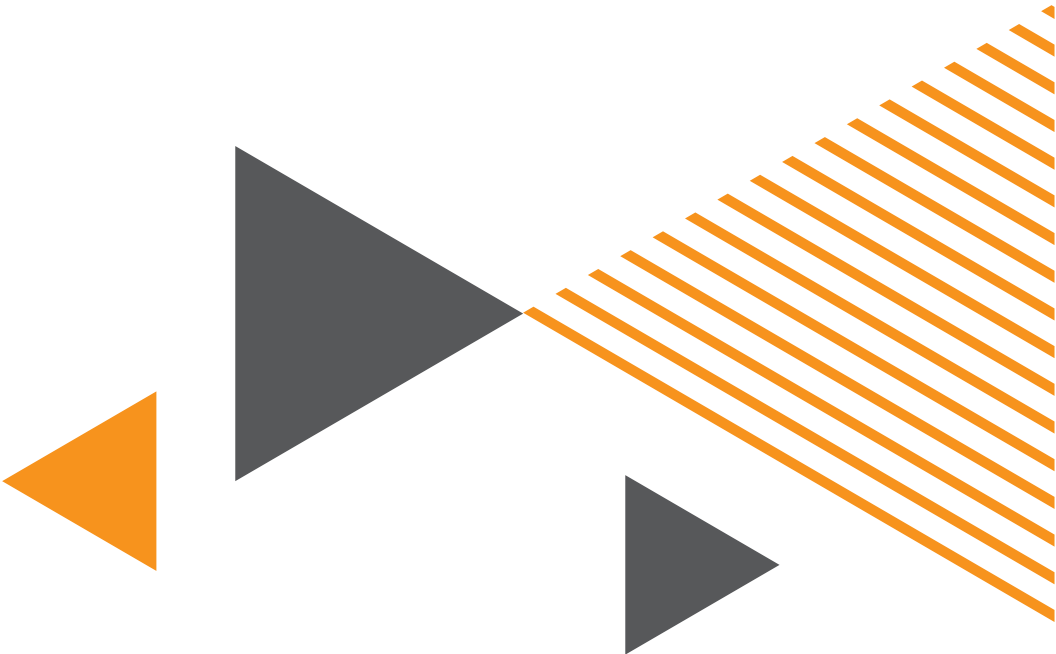
CONSTRUCTION COSTS28

 Kimball & 2nd Street Alternative.....28

 1st Street & Yellowstone Hwy: Option #2.....29

 1st Street & Yellowstone Hwy: Option #3.....30

FINDINGS AND RECOMMENDATIONS31





List of Figures & Tables

► List of Figures

Figure 1: Study Area	3
Figure 2: Average Daily Traffic Volumes	5
Figure 3: Existing Peak Hour Turning Movement Volumes	6
Figure 4: Existing Pedestrian Volumes	7
Figure 5: Existing Cross Section – Yellowstone Highway (South of 2 nd Street)	9
Figure 6: Existing Cross Section – Yellowstone Highway (North of 2 nd Street)	9
Figure 7: Existing Cross Section – Yellowstone Highway (South of 1 st Street)	9
Figure 8: Existing Cross Section – Yellowstone Highway (North of 1 st Street)	9
Figure 9: Existing Cross Section – 1 st Street (East of Yellowstone Hwy)	10
Figure 10: Existing Cross Section – 1 st Street (West of Yellowstone Hwy)	10
Figure 11: Existing Cross Section – 2 nd Street	10
Figure 12: Existing Pedestrian Infrastructure	12
Figure 13: Existing Parking Regulations	13
Figure 14: Map of Crash Locations in Study Area (2016-2020)	15
Figure 15: Intersection Level of Service (LOS) – Existing Conditions	18
Figure 16: Kimball & 2 nd Street Alternative	23
Figure 17: 1 st Street & Yellowstone Option #1	24
Figure 18: 1 st Street & Yellowstone Option #2	25
Figure 19: 1 st Street & Yellowstone Option #3	26
Figure 20: Alternative Cross Sections	27



► **List of Tables**

TABLE 1: Crash Types/Severity..... 15

TABLE 2: LOS/Delay/Queues 17

TABLE 3: Alternatives LOS/DELAY/QUEUES..... 27

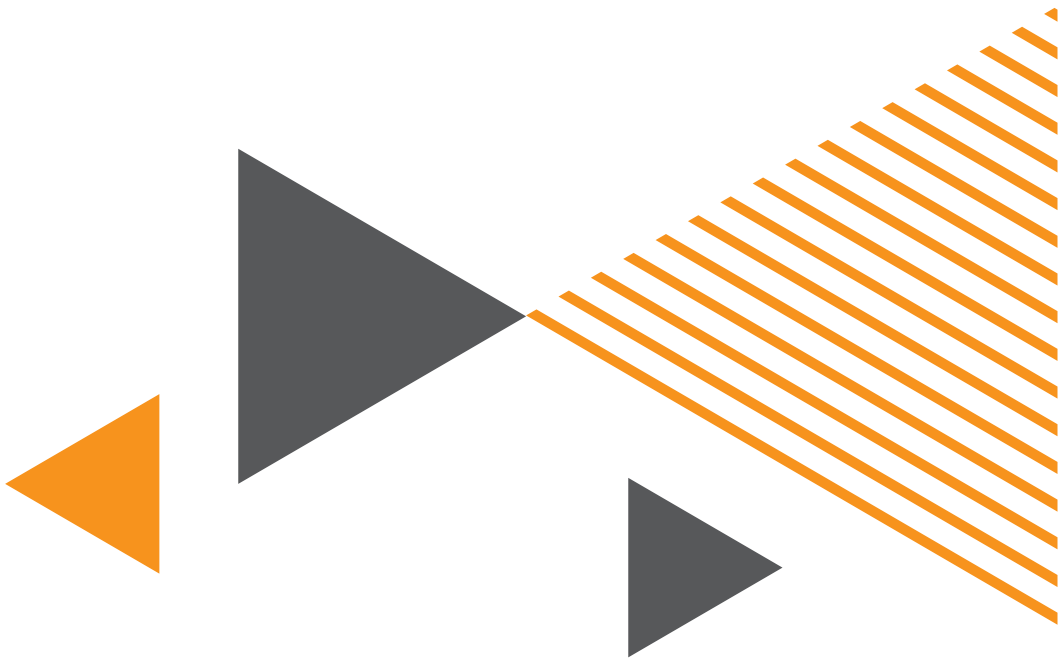
TABLE 4: Construction Costs - Kimball & 2nd Street..... 28

TABLE 5: Construction Costs - 1st Street & Yellowstone Hwy — Option #2 29

TABLE 6: Construction Costs - 1st Street & Yellowstone Hwy — Option #3 30

► **Appendices**

- A: Traffic Count Reports
- B: Traffic Capacity Analysis (Synchro) Worksheets
- C: Public Comment



► Introduction

The East Yellowstone Intersection Study was commissioned by the Casper Area Metropolitan Planning Organization (MPO) to analyze a section of Yellowstone Highway between 1st and 2nd Streets in Casper. This portion of Yellowstone Highway parallels one of the original railroad corridors in Casper and is mere blocks from the first structures built in the present-day City. The road alignment skews the adjacent city streets that were built on a North-South based grid system, causing difficult road geometry.

The project goal is to identify improvements for roadway safety and capacity, as well as improvements to bicycle and pedestrian safety and mobility through the East Yellowstone Highway corridor between 1st and 2nd Street. The report documents the existing conditions and transportation needs within the study area. The identified needs include addressing safety challenges, improving traffic operations, enhancing multimodal accessibility and safety, managing roadway access, and supporting local land use.

► Public Involvement

Gaining input and feedback from the public and key stakeholders is critical to the success of this study. A kickoff meeting was held with the MPO, City of Casper staff and other stakeholders to review the study scope, objective, schedule and deliverables. Relevant background information was obtained, including GIS mapping, existing roadway plans, existing traffic data, crash data, planned land use changes, programmed transportation improvements on any adjacent City roadways, and parking data. Previous transportation studies and master plans for downtown Casper (including "Connecting Crossroads", "Urban Center Parking Plan", "Generation Casper", "Casper Area Trails, Path and Bikeways Plan"), were reviewed to become familiar with prior recommendations for circulation, parking, pedestrian and bicycle improvements, plus City policies and goals.

One public input session, with both in-person and online components, was held to solicit input on existing conditions and issues, and proposed improvement alternatives.

Stakeholder meetings with both in-person and online components, were held with downtown property owners, residents, property managers, bicycle and pedestrian advocates, WYDOT, City of Casper, and adjacent property owners to solicit project input. Design challenges identified during the study include:

- skewed alignment
- multiple public street and driveway access points
- future traffic growth
- high speeds
- signal timing / phasing and lane assignment
- trail crossing
- long pedestrian crossings
- truck route
- utility impacts

The project will include a presentation at a City Council Meeting to present project findings and recommendations.



► Existing Conditions

Existing conditions were documented through desktop and field inventories and conversations with City and MPO staff. This included a comprehensive inventory of the existing intersection geometry and traffic controls including lane configuration and width, typical cross-sections, auxiliary lanes, posted speed limits, sight distance, access points, channelization, drainage, lighting, signing, marking, traffic signal displays and phasing, and pavement conditions. Pedestrian and bicycle infrastructure including sidewalks, crosswalks, median refuges, pedestrian signals, transit routes and stops were also inventoried, to identify gaps and barriers in the active transportation network.

► Study Area

The study area is approximately ¼ mile east of Downtown Casper, WY. Land use in the study area consists of mixed commercial with retail/office/service usage.

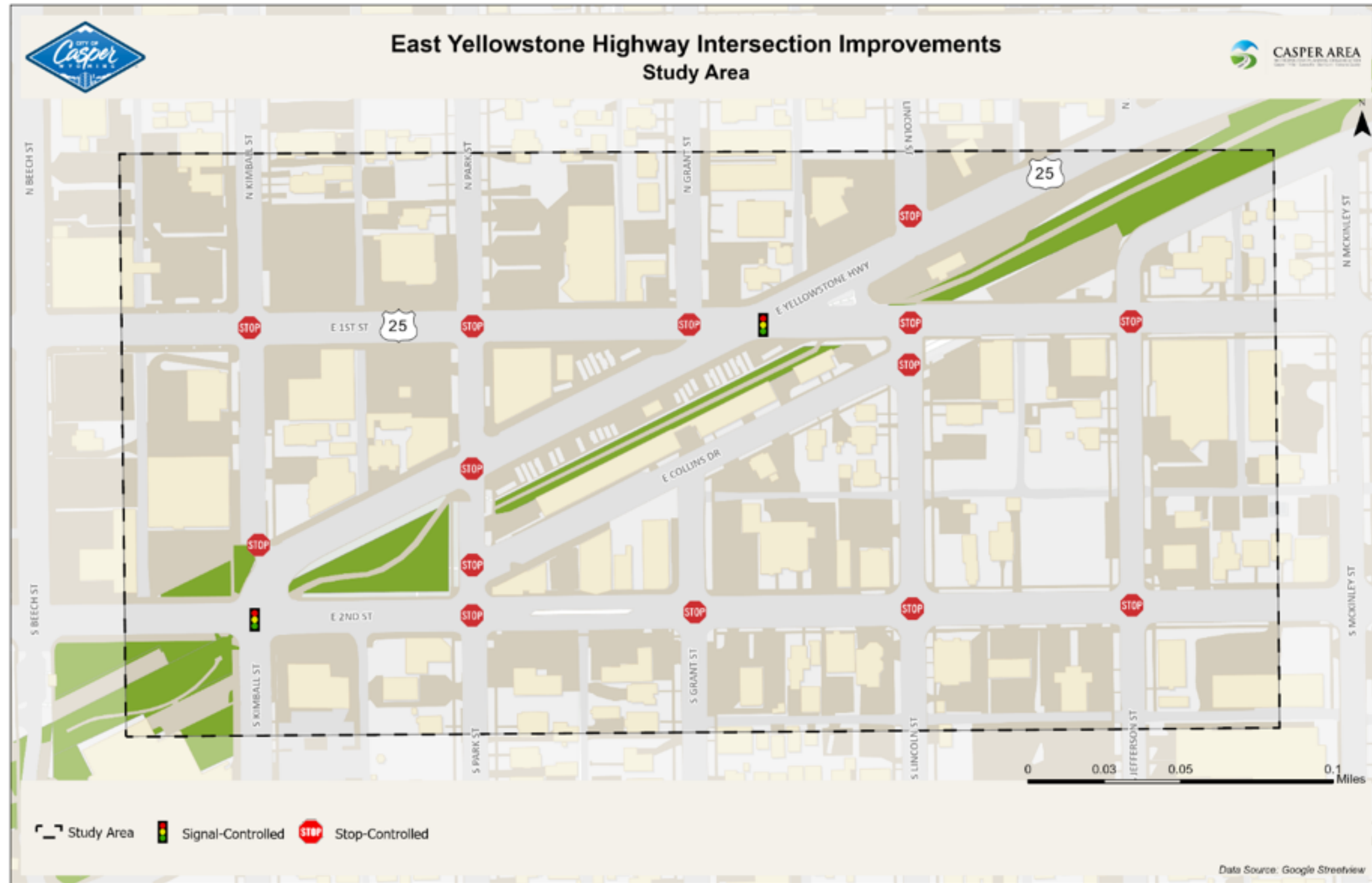
The following intersections are present within the study area, **FIGURE 1**:

- | | |
|---|---|
| ► E. 1 st Street / Kimball Street | ► E. Yellowstone Highway / Park Street |
| ► E. 1 st Street / Park Street | ► E. Collins Drive / Park Street |
| ► E. 1 st Street / Grant Street | ► E. Collins Drive / Lincoln Street |
| ► E. 1 st Street / E. Yellowstone Highway ** | ► E. 2 nd Street / Kimball Street ** |
| ► E. 1 st Street / Lincoln Street | ► E. 2 nd Street / Park Street |
| ► E. 1 st Street / Jefferson Street | ► E. 2 nd Street / Grant Street |
| ► E. Yellowstone Highway / Lincoln Street | ► E. 2 nd Street / Lincoln Street |
| ► E. Yellowstone Highway / Kimball Street | ► E. 2 nd Street / Jefferson Street |

** Primary Signalized Study Intersections



FIGURE1: STUDY AREA



► Existing Traffic Volumes

Daily and peak hour traffic counts were obtained from the City of Casper's 2016 traffic signal timing study and from 2021 signal detector data. Spot field counts were made at a few intersections to verify that the volumes within the study are reasonable random field observations and were made to document traffic conditions such as queue length and residual queuing, motorist behavior such as compliance with traffic control devices and conflicts with pedestrians and bicyclists. Average daily traffic volumes (ADTV) are shown on FIGURE 2, AM/PM peak hour traffic volumes are on **FIGURE 3**, and pedestrian volumes are on **FIGURE 4**.

ADT's of note:

- 10,076 E. 1st Street west of E. Yellowstone Highway
- 3,615 E. 1st Street east of E. Yellowstone Highway
- 7,812 E. 2nd Street west of E. Yellowstone Highway
- 11,783 E. 2nd Street east of E. Yellowstone Highway
- 2,501 E. Yellowstone Highway between E. 1st Street and E. 2nd Street
- 7,508 E. Yellowstone Highway north of E. 1st Street
- 5,718 S. Kimball Street south of E. 2nd Street

Turning-movement count data indicate that the PM peak hour volume is slightly higher than AM peak hour volume at the study intersections. This is typical for a business district as higher traffic volumes occur during normal business hours. Full traffic count reports are included in **Appendix A**.

FIGURE 4 shows the pedestrians entering and crossing at least one crosswalk at the two primary signalized intersections within the study area. There are more pedestrian crossings along E 2nd St, which is likely due to the presence of the Transit Depot at Beech Street and 2nd Street, park and roadway enhancements, such as landscaped medians. The skewed intersection of Yellowstone Highway and E 1st Street has longer distances to cross than other nearby crosswalks. East Yellowstone and E 1st Street crosswalks are approximately 120' compared to 60'- 80' at other 5 lane intersections.



FIGURE 2: AVERAGE DAILY TRAFFIC VOLUMES

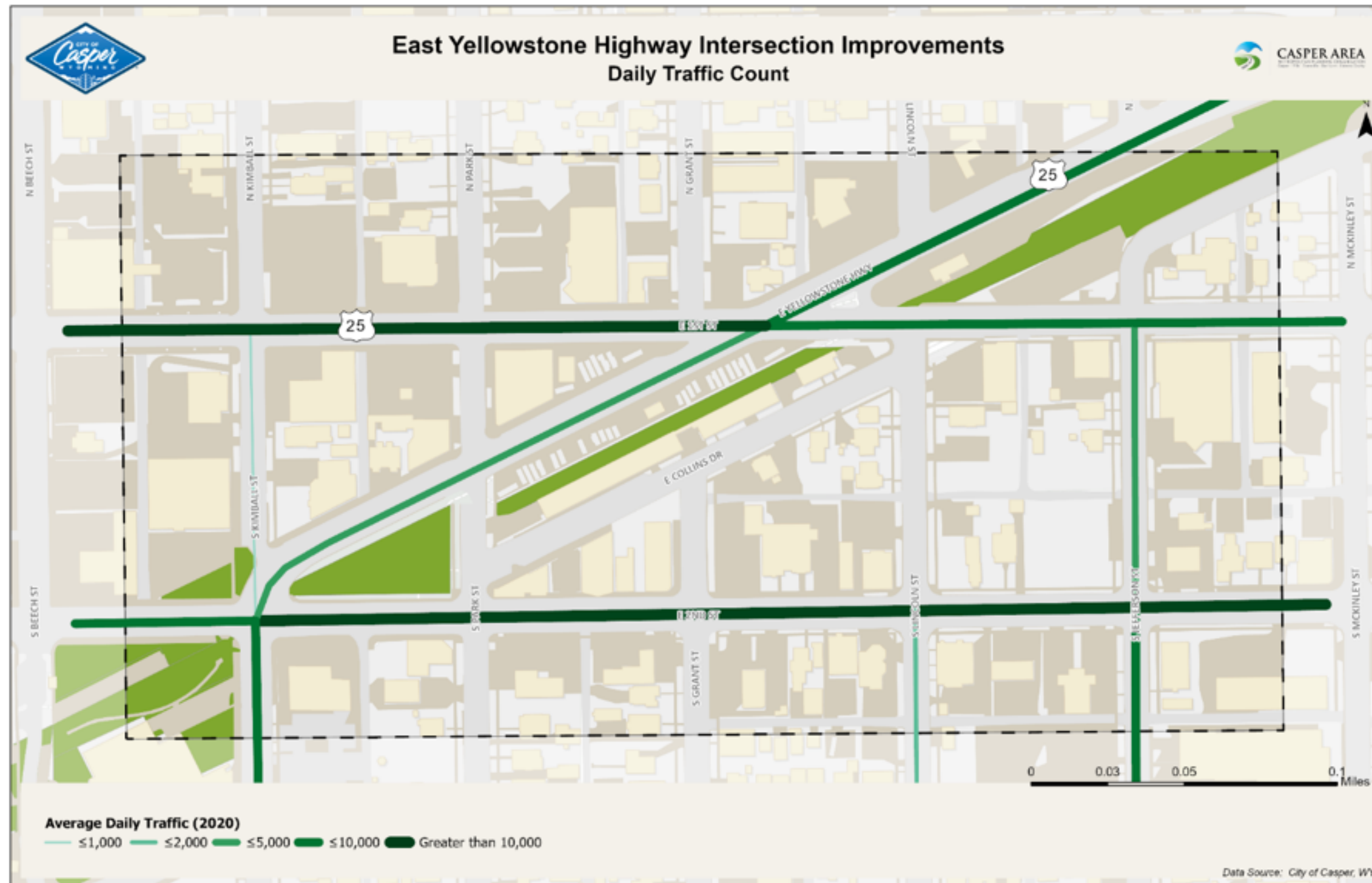


FIGURE 3: EXISTING PEAK HOUR TURNING MOVEMENT VOLUMES

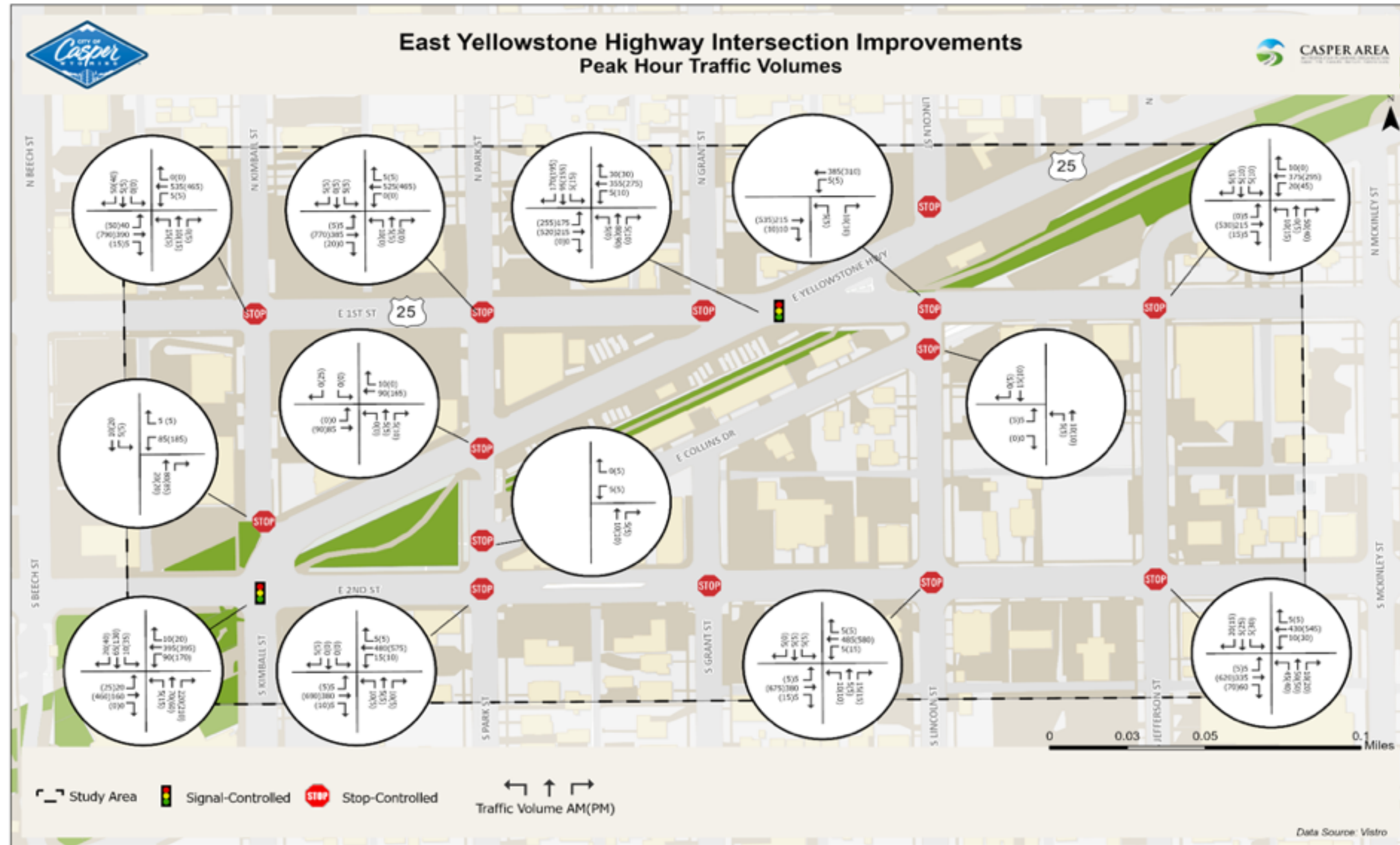
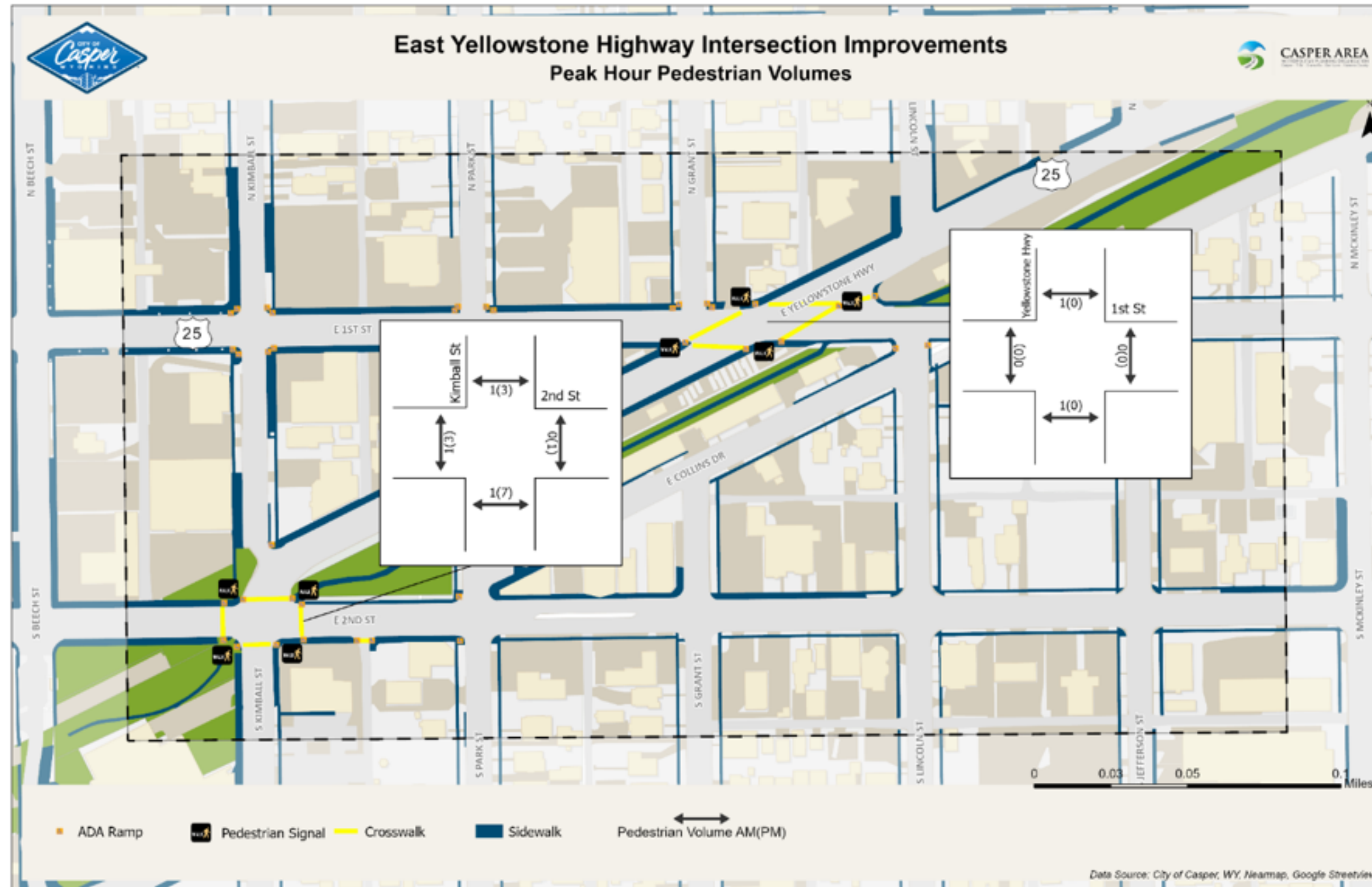


FIGURE 4: EXISTING PEDESTRIAN VOLUMES



► Existing Road Geometry

Road geometry varies from block to block. **FIGURES 5-11** illustrated the road cross sections on some key blocks. Existing Pedestrian Infrastructure is highlighted on **FIGURE 12**. Curbside parking regulations in the study area are presented on **FIGURE 13**.

Within the Study Area, E. Yellowstone Highway is situated in a northeast/southwest direction and consists of a 4-lane section with 2 through lanes each direction with parallel parking permitted between E. 1st Street and E. 2nd Street. East Yellowstone Highway has curbs, gutters, and sidewalks in place as well as wide driveways along the south side serving a large parking area for the adjacent development. There is a 10-foot wide multi-use path parallel to and offset approximately 50' south of E. Yellowstone Highway.

East 1st Street and E. 2nd Street are east/west, parallel routes approximately 450' apart. Both roadways consist of a five-lane section with two travel lanes in each direction and a middle turn lane area. Both roadways have curb and gutters with sidewalks on both sides. There is no on street parking permitted on these roadways within the study area.

The intersection of E. 1st Street and East Yellowstone Highway is signalized. The signals are maintained and controlled by WYDOT. East 1st Street is the mainline roadway. As shown in **FIGURES 7, 8, 9 and 10**, there are two approach lanes, one exclusive through lane and one shared through/right turn lane, and an exclusive left turn lane on both the EB and WB sides of E. 1st Street. Both the NB and SB side of East Yellowstone Highway have two approach lanes, one shared through/left turn lane and one shared through/right turn lane.

The intersection of E. 2nd Street and East Yellowstone Highway/South Kimball Street is signalized. The signals are maintained and controlled by WYDOT. E. 2nd Street is the mainline roadway. As shown in **FIGURES 5, 6 and 11**, there are two approach lanes, one exclusive through lane and one shared through/right turn lane, and an exclusive left turn lane on both the EB and WB sides of E. 2nd Street. The NB side of Kimball Street has one shared through/ right turn lane and an exclusive left turn lane. The SB side of East Yellowstone Highway has one exclusive through lane, one shared through/right turn lane and an exclusive left turn lane.

The posted speed limit on E. Yellowstone Highway in the project area is 30 mph. The speed limit is reduced to 20 mph approaching the curve southwesterly at S. Kimball Street and E. 2nd Street. The posted speed limit along E. 1st Street is 30 mph. On E. 2nd Street, the speed limit is 20 mph between S. Park Street and Kimball Street and 30 mph between S. Park Street and S. Jefferson Street.

Crosswalk markings at E. 1st Street and E. Yellowstone Highway consist of wide longitudinal white markings (Continental), with black borders for contrast, while at E. 2nd Street and E. Yellowstone Highway they consist of red (brick color) placed concrete/asphalt. Stop bars were not present at either signalized intersection.



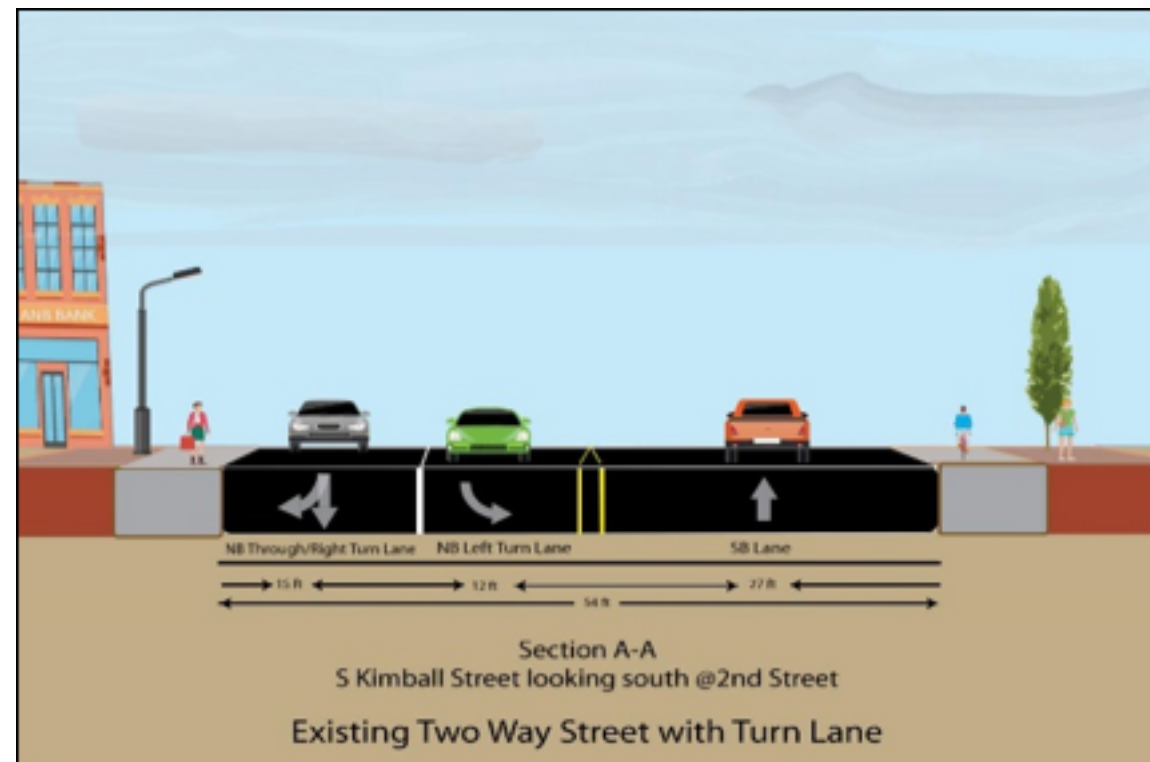


Figure 5: Existing Cross Section – Yellowstone Highway (South of 2nd Street)

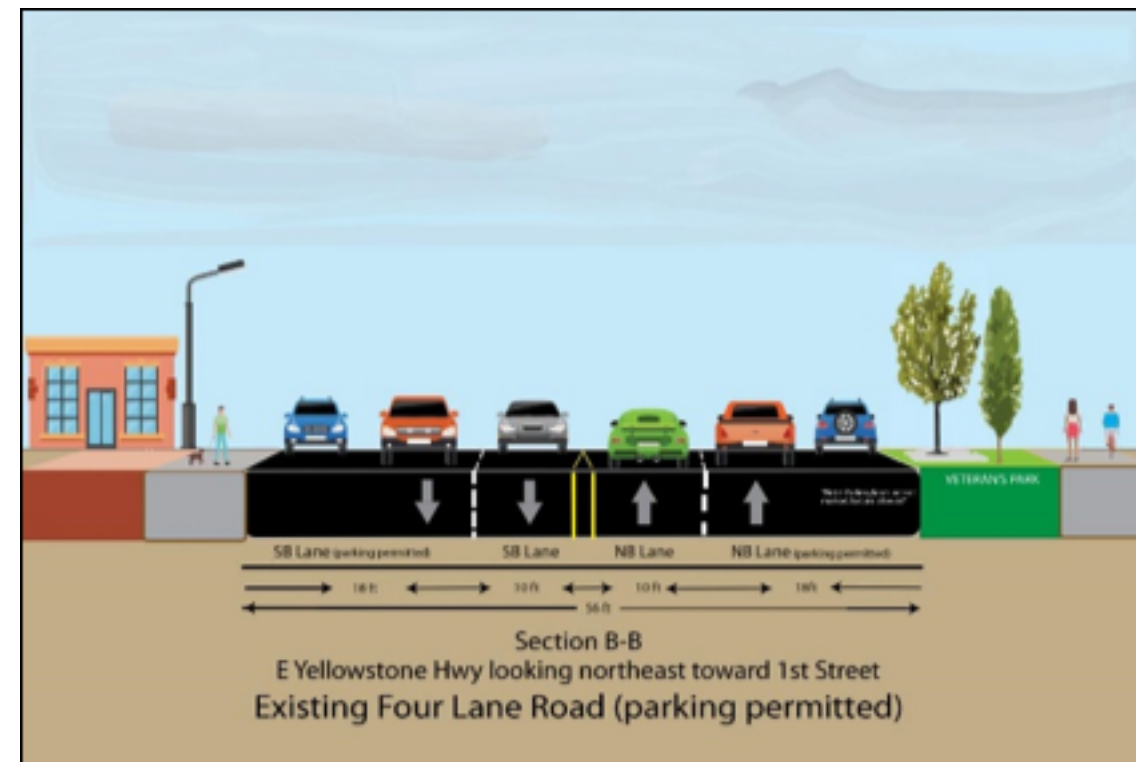


Figure 6: Existing Cross Section – Yellowstone Highway (North of 2nd Street)

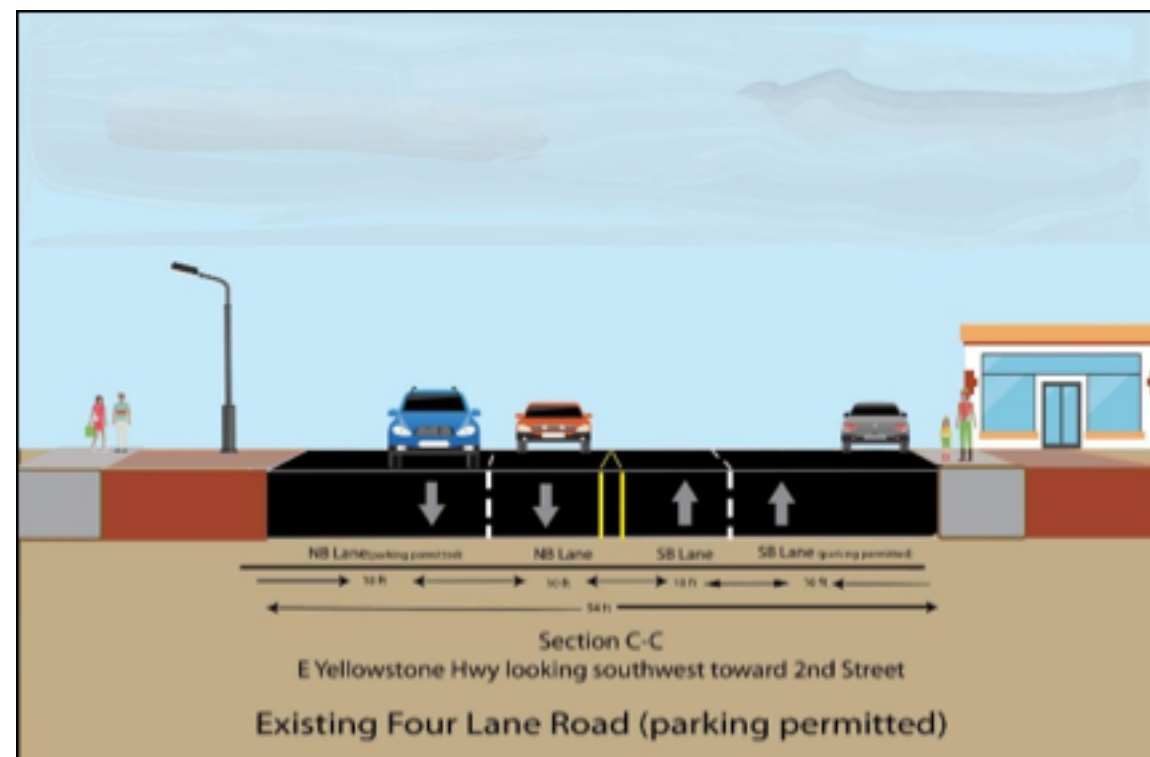


Figure 7: Existing Cross Section – Yellowstone Highway (South of 1st Street)



Figure 8: Existing Cross Section – Yellowstone Highway (North of 1st Street)



Figure 9: Existing Cross Section – 1st Street (East of Yellowstone Highway)



Figure 10: Existing Cross Section – 1st Street (West of Yellowstone Highway)

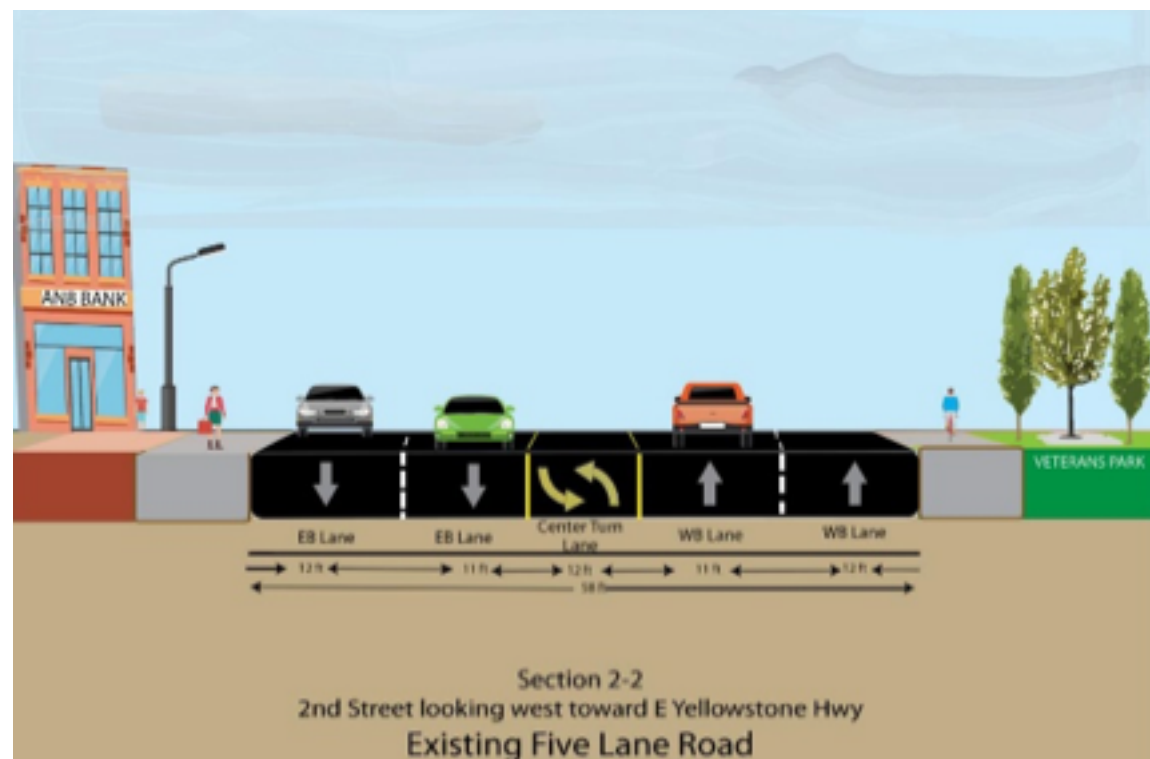


Figure 11: Existing Cross Section – 2nd Street

► Pedestrian and Bicycle Infrastructure

Pedestrian infrastructure in the study area is shown in **FIGURE 12**. Sidewalks are located throughout the study area. Most intersections also have marked crosswalks and ADA curb ramps. The signalized intersections (E. Yellowstone Highway at E. 1st Street and E. 2nd Street) have pedestrian treatments including pedestrian signal indications and push buttons. There is a wide concrete pathway within the study area, the Casper Area Rail Trail, but there are no designated bike lanes or signs provided within the study area.

► Parking

On-street park in the study area is shown in **FIGURE 13**. There is parallel parking along East Yellowstone Highway between E. 1st Street and E. 2nd Street. This parallel parking consists of both time restricted parking, 30-minutes, and time restricted/time of day restricted parking, 30-minutes & 2 hours/8am-6pm.

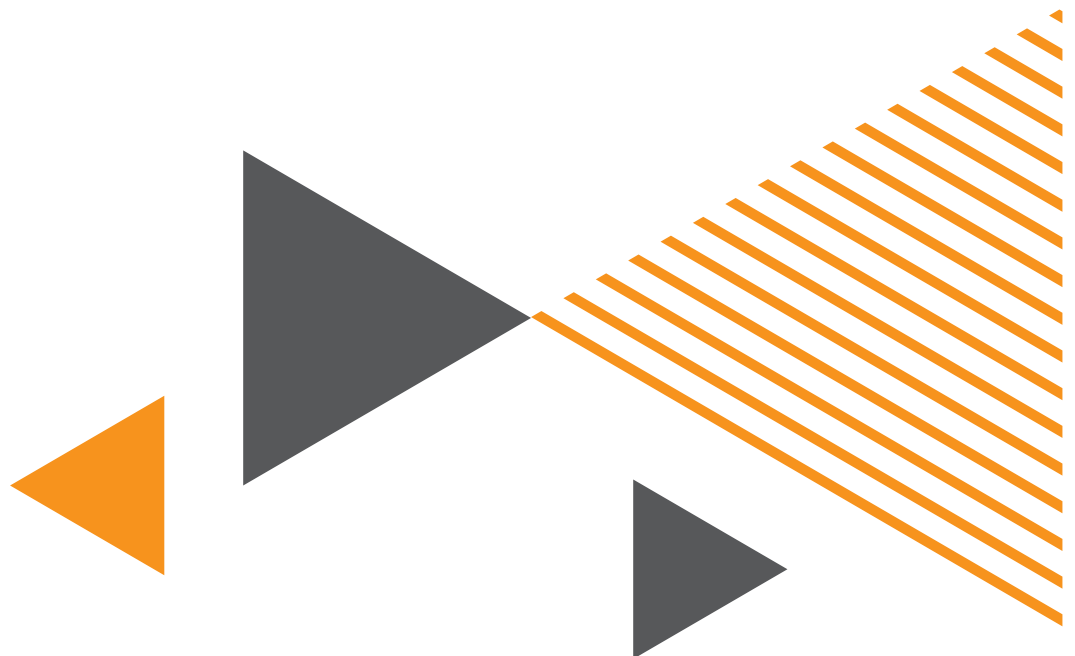


FIGURE 12: EXISTING PEDESTRIAN INFRASTRUCTURE

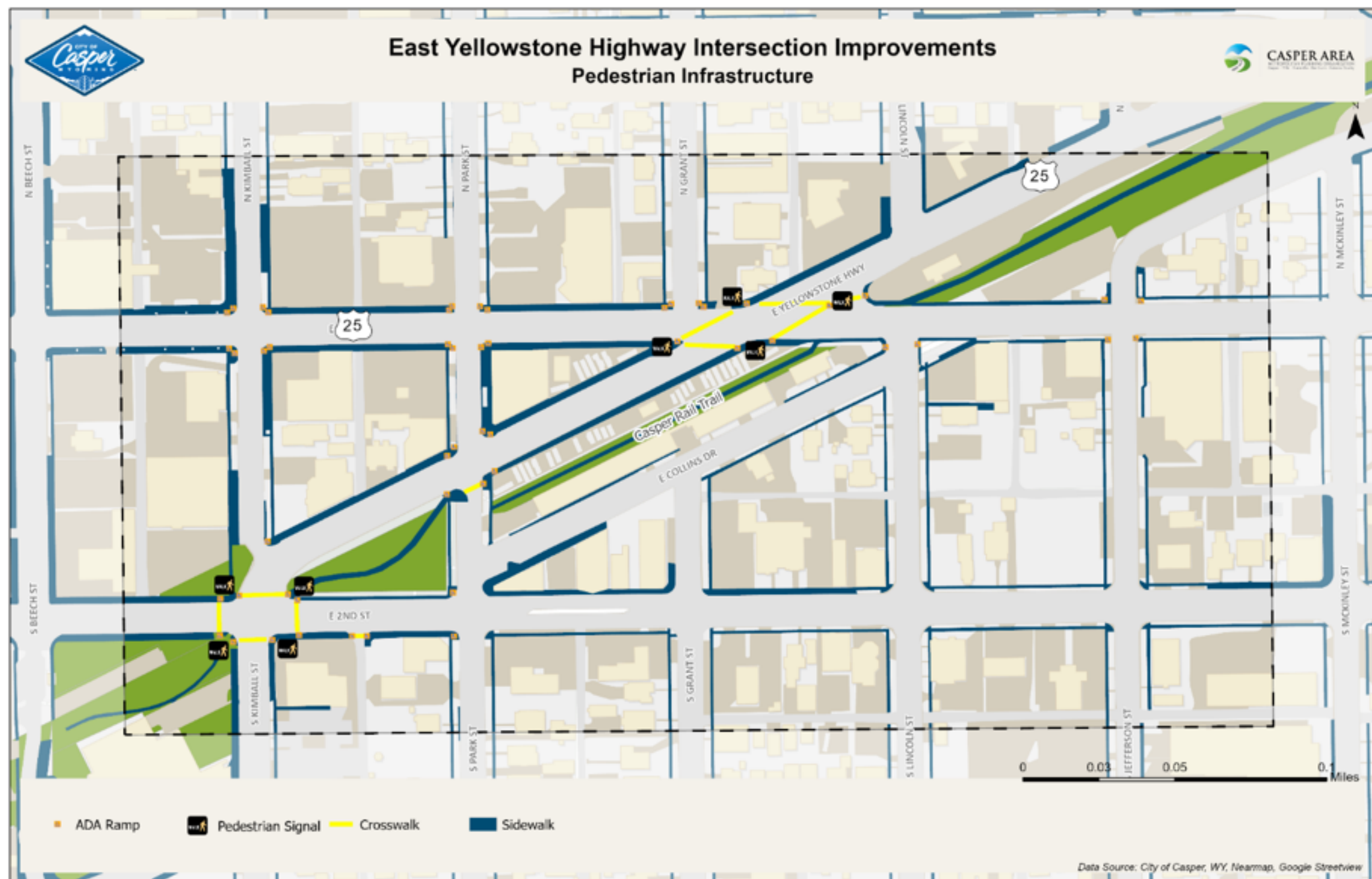
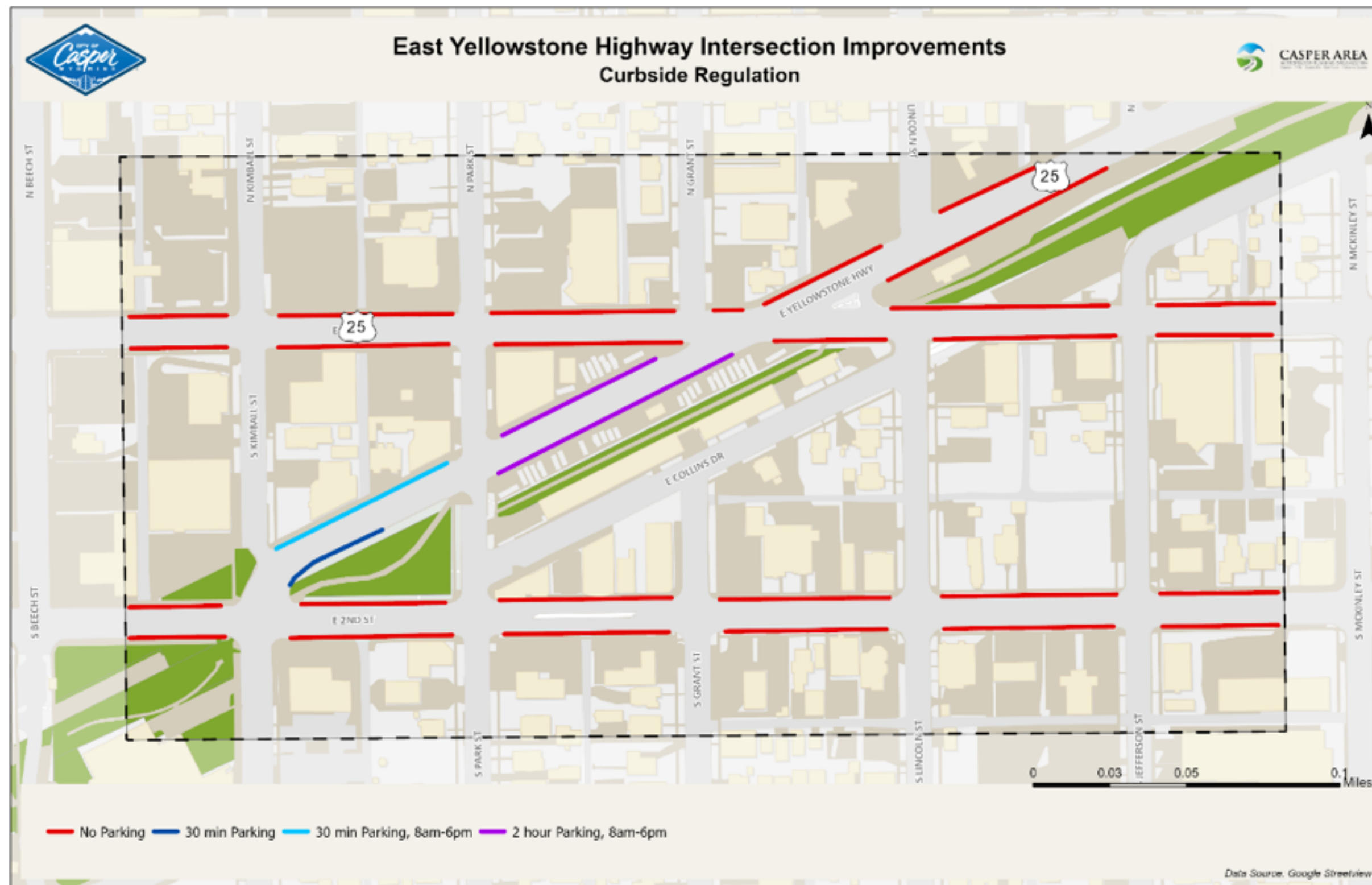
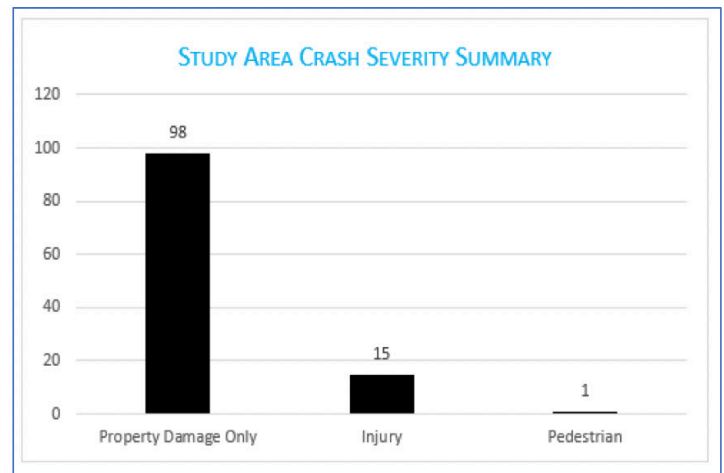
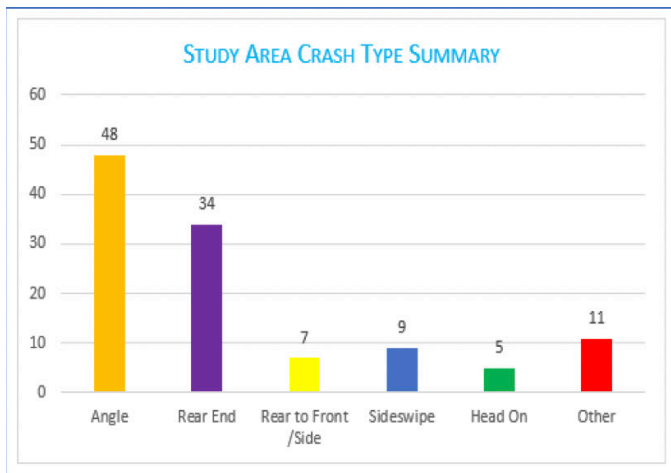


FIGURE13: EXISTING PARKING REGULATION



► Crash History

The crash analysis is based on data provided by WYDOT for the period from 2016 to 2019. There was a total of 114 police-reported collisions within or adjacent to the study area. **FIGURE 14** summarizes the crash data. The data was analyzed to identify any recurring crash types and trends, as well as probable cause or contributing factors that can be summarized and correlated to documented physical or operational deficiencies. The following are key conclusions from the data:



- 86% of the crashes resulted in property damage only. Fifteen crashes (13%) resulted in an injury. There was 1 pedestrian collision (1%). There was one bicycle fatality in 2014 near these intersections.
- The most frequent collision types were angle collisions (42%) and rear-end collisions (30%). One crash involving a pedestrian occurred during this period.
- 18 of the collisions occurred at E. 1st Street and E. Yellowstone Highway (16%).
- 24 crashes near E. 2nd Street (11 @ E. 2nd Street and E. Yellowstone Highway -10% & 13 @ E. Yellowstone Highway and S. Kimball Street-11%).

The severe skew angle at E. 1st Street and E. Yellowstone Highway is a probable factor for the higher incidence of angle and rear-end collisions. The proximity and intersection configuration of S. Kimball Street adjacent to E. 2nd Street and E. Yellowstone Highway is a probable factor for the crashes at these intersections.



FIGURE14: MAP OF CRASH LOCATIONS IN STUDY AREA (2016-2020)

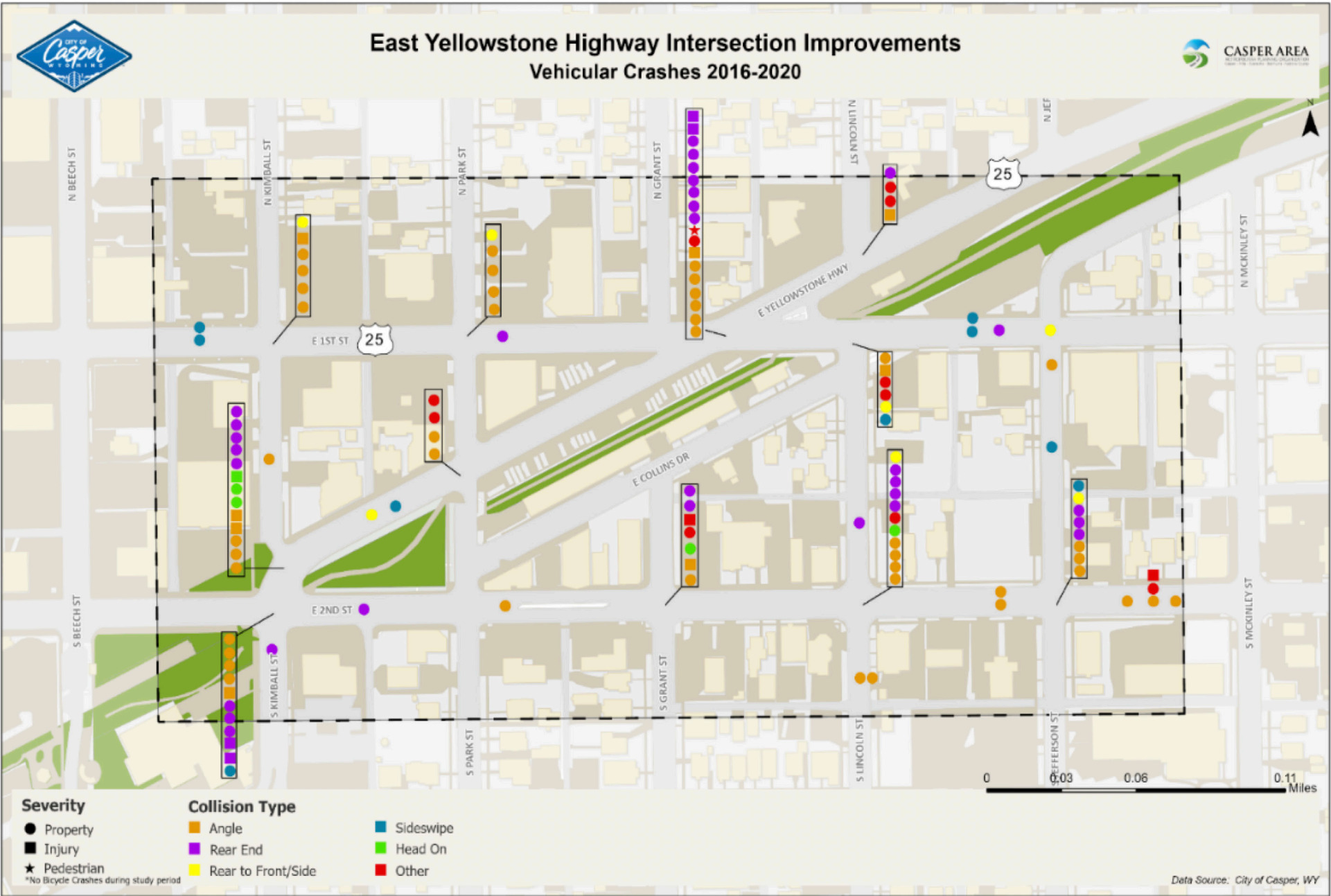


TABLE 1: CRASH TYPES / SEVERITY

		Intersection Crashes										Non-Intersection Crashes				TOTAL
Intersection / Location		E. Yellowstone Highway/ E. 1st St	E. Yellowstone Highway/S. Kimball	E. Yellowstone Highway/ E. 2nd St	E. 2nd St/ S Lincoln St	E. 2nd St/ S Jefferson St	E. 1st St/ N Kimball St	E. 1st St/ S Lincoln St	E. 1st St/ N Park St			E. 1st Street	E. 2nd St	E. Yellowstone Highway	All other roadway	
Collision Type	Angle	7	5	5	4	3	2	5	2	4	1		6		4	48
	Rear End	9	5	5	4	3	2				1	2	1		2	34
	Rear to Front /Side	-			1	1		1	1	1		1		1		7
	Sideswipe	-		1		1			1			4		1	1	9
	Head On	-	3		1		1									5
	Other	2			1		2		2		2		2			11
TOTAL		18	13	11	11	8	7	6	6	5	4	7	9	2	7	114
Severity	Property Damage	14	10	8	11	8	5	5	5	5	3	7	8	2	7	98
	Injury	3	3	3			2	1	1		1		1			15
	Pedestrian	1														1



► Traffic Operations Analysis

A capacity analysis was performed using “Synchro 11” traffic analysis software, which incorporates the methodology of the 6th edition of the Highway Capacity Manual (HCM2000), for the existing study intersections. New Synchro models with 2021 traffic volumes were developed by Mead & Hunt, incorporating existing roadway geometry/ lane configurations and signal timing data/stop sign control data. Signal timing data was obtained from the City of Casper and WYDOT.

Level of Service (LOS) is a qualitative measure describing operational conditions of an intersection or any other transportation facility. LOS measures the quality of traffic service, and may be determined for intersections, roadway segments, or arterial corridors based on delay, congested speed, volume to capacity (v/c) ratio, or vehicle density by functional class. At intersections, LOS is a letter designation that corresponds to a certain range of roadway operating conditions. The levels of service range from ‘A’ to ‘F’, with ‘A’ indicating the best operating conditions and ‘F’ indicating the worst, or a failing, operating condition.

The volume-to-capacity ratio (v/c ratio) is the ratio of current flow rate to the capacity of the intersection. This ratio is used to determine how much of the capacity for a given roadway is being utilized. A ratio of 1.0 indicates that the roadway is operating at capacity. A ratio of greater than 1.0 indicates that the vehicle volume exceeds the roadway capacity. A ratio of less than 1.0 indicates vehicle volume is below the roadway capacity.

Delay (Control delay) is the portion of delay attributed to traffic signal operation for signalized intersections. Control delay (overall delay) can be categorized into deceleration delay, stopped delay, and acceleration delay.

Existing traffic operations were analyzed in Synchro. The results of the analysis are summarized in **FIGURE 15**. Full Synchro reports are included in **Appendix B**.

The signalized intersection of E. 1st Street and E. Yellowstone Highway operates with 2 signal phases. There are no protected left turn signal phases for either street. Pedestrian signal heads and buttons are present to accommodate pedestrian crossings for each of the 4 legs of the intersection. The level of service for left turns and through movements on both the EB and WB approach of E. 1st Street for both the AM and PM peak hours is LOS A. The SW approach of E. Yellowstone Highway operates at a level of service B for both AM and PM peak hours. The NE approach of E. Yellowstone Highway operates at a level of service C for both AM and PM peak hours. The overall intersection LOS for this signal is an LOS A for both AM and PM peak hours.

The signalized intersection of E. 2nd Street and E. Yellowstone Highway operates with 3 signal phases, including opposing left turn phases for both EB and WB approaches of E. 2nd Street. There are no protected left turn signal phases for SB E. Yellowstone Highway or NB Kimball Street. Pedestrian signal heads and buttons are present to accommodate pedestrian crossings for each of the 4 legs of the intersection. The level of service for the left turn phases for both the EB and WB approach of E. 2nd Street for both the AM and PM peak hours is LOS A. For E. 2nd Street, the EB is a LOS A in the AM and PM and the WB is a LOS B in the AM and PM. The SB approach of E. Yellowstone Highway operates at a LOS C during the AM and a LOS D during the PM peak hours. The NB approach of Kimball Street operates at a LOS D during the AM peak and a LOS C during the PM peak hours. The overall intersection LOS for this signal is an LOS B for both AM and PM peak hours.



As discussed above and shown in the tables and figures, each intersection performs at an overall acceptable level of service; no intersection has, or are forecast to have, an overall level of service that is below a LOS C.

TABLE 2: LOS/DELAY/QUEUES

E Yellowstone Highway @	AM			PM		
	LOS	Delay	Max Queue, Direction	LOS	Delay	Max Queue, Direction
E 1 st St	A	7.9 s	57' SB	A	8.6 s	78' SB
E 2 nd St	B	18 s	187' NB	B	17.6 s	154' NB

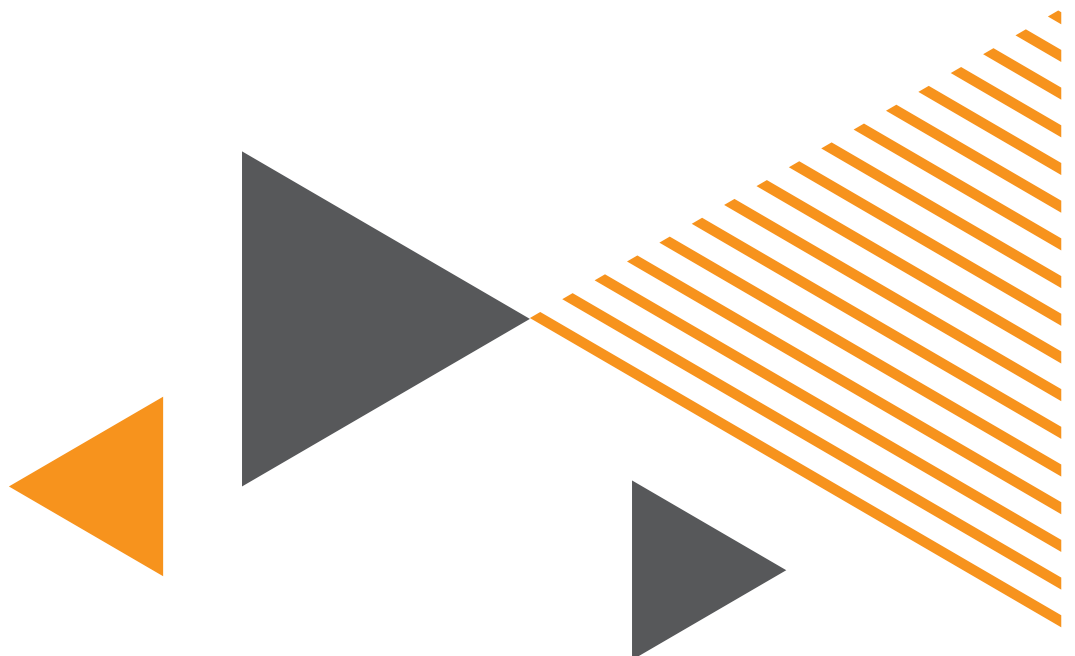
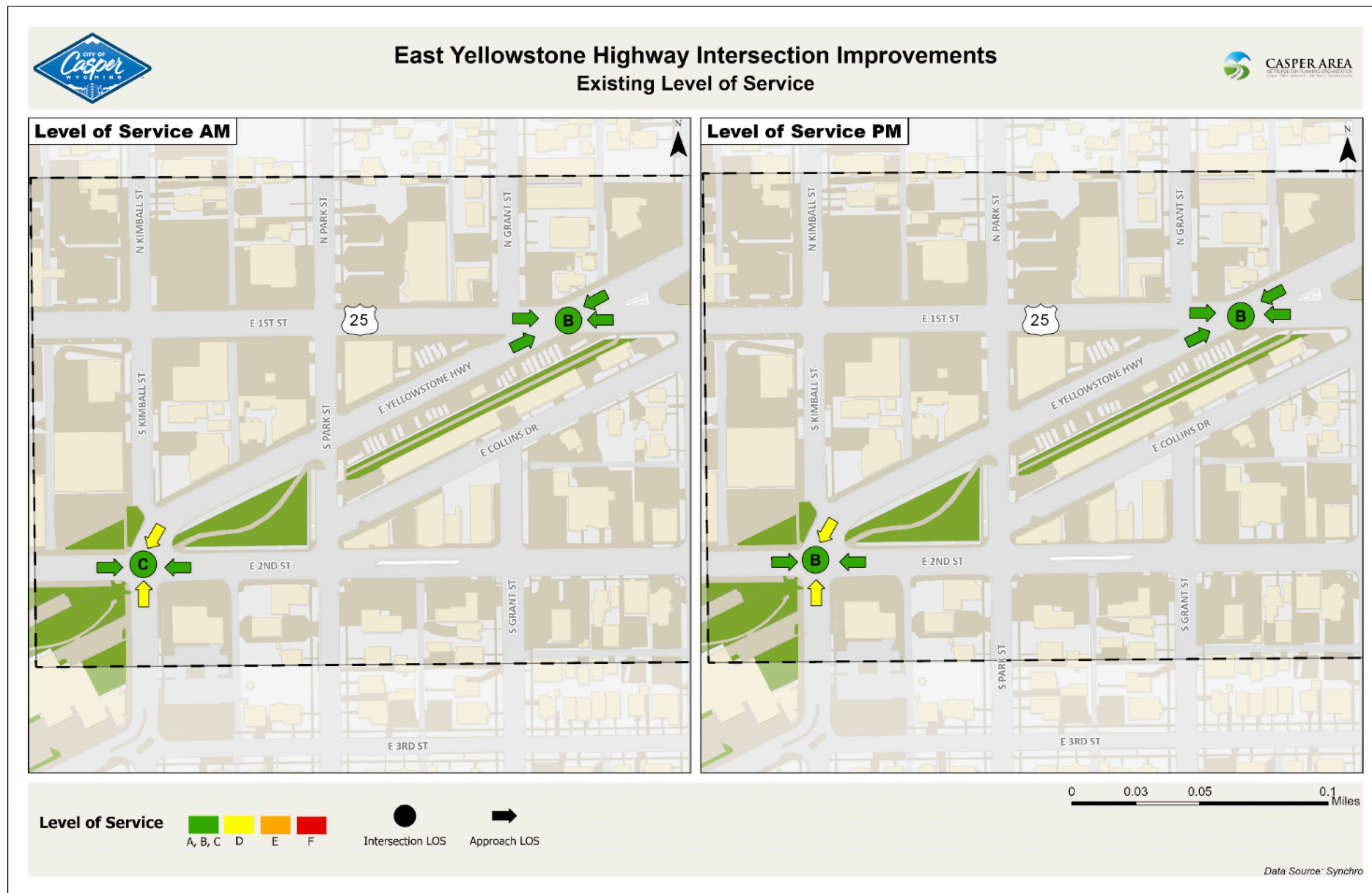


FIGURE 15: Intersection Level of Service (LOS) – Existing Conditions



► Transportation Needs

Based on the analysis, the transportation needs in the project area include improving traffic safety for both motorists and pedestrians. Providing alternatives to address the skewed intersection at E. 1st Street and E. Yellowstone Highway will improve the safety at this signal. Providing alternatives to address the proximity of S. Kimball Street with the intersection of E. 2nd Street and E. Yellowstone Highway will also enhance the safety of this area.

► Existing Conditions Summary

E. Yellowstone Highway is a 4-lane roadway between E. 1st Street and E. 2nd Street in Casper, WY. Traffic safety concerns indicate revisions to the two signalized intersections may improve traffic safety for both motorists and pedestrians. Key findings include:

- The study area is currently operating as commercial with retail/office/service usage. Traffic volumes do not exceed existing roadway capacity on any of the roadways in the study area. PM peak hour volumes are higher than the AM peak, and pedestrian volumes are higher around 2nd Street, near the park.
- The existing level of service is acceptable at all intersections in the study area, performing at an LOS C or higher, using current count volumes.
- Crashes in the study area are primarily angle and rear end crashes, with most crashes resulting in only property damage.
- Overall, the pedestrian infrastructure is mostly complete, while the bicycle infrastructure is incomplete.

This information presents a technical foundation for discussing the City's goals for E. Yellowstone Highway including increased transportation options for all modes and improved health and safety of all roadway users.



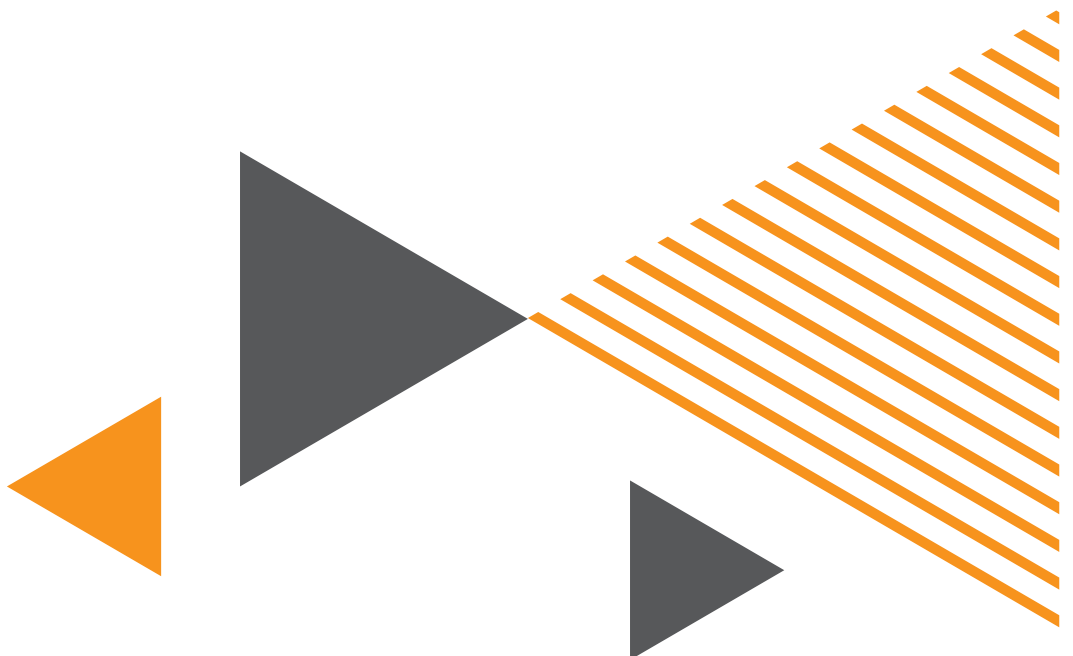
► Alternatives Development

The existing alignments, proximity of alleyways and other streets to the study intersections as well as overall topography of the study area presented unique challenges when developing viable alternatives. The study team took a holistic approach when analyzing and developing alternatives, looking at impacts beyond just the study area. In order to identify the best alternatives many different options were developed and screened by the team, the City of Casper, WYDOT and the Casper Area MPO staff. The goals of the alternatives are:

- To meet the needs identified in the study;
- To be cost-effective;
- To be feasible and implementable; and
- To improve intersection operation for all user types.

The alternatives include:

- **Islands** – the inclusion of islands could serve to provide delineation between directions of travel, access management, pedestrian refuge and streetscape improvements.
- **Road Diets** – eliminating four-lane roadways where they are not warranted could create opportunities for dedicated bike lanes, and center turn lanes that could enhance safety.
- **Traffic Control** – evaluation of traffic control changes (multiway stop, flashing beacon, and traffic signals) were also considered to ensure safe and efficient intersection operations.
- **Intersection Alignment** – Intersecting roads should be aligned at right angles where possible. This reduces multi-modal crossing distances, improves visibility and decrease vehicle exposure times..



No Build Alternative

The option to keep each intersection as-is is viable. Each intersection performs relatively satisfactorily as currently design.

Kimball & 2nd Street Alternative

This alternative would make Kimball Street from 1st to 2nd Street the primary route. The current alignment has a large curb extension that directs traffic to eastbound Yellowstone Highway. Islands would serve to channelize traffic, prevent unwanted turning movements and provide pedestrian refuge mid-crossing. The additional landscaped area at Veteran's Park would allow the 2nd Street crosswalk to be moved closer to the intersection, increasing multi-modal safety in the crosswalk.

The Kimball & 2nd Street alternative is shown in **FIGURE 16**.

1st Street & Yellowstone Highway: Option #1

The 1st Street & Yellowstone Highway intersection option #1 makes Yellowstone Highway south of the intersection a right turn in and out only, the thru-traffic option on westbound Yellowstone would be eliminated. Traffic heading south would be directed to the intersection of Kimball and 1st Street in order to continue in that direction. A HAWK signal would be installed on the east side of the intersection of E. 1st Street and Lincoln Street, in addition to curb extensions to increase multi-modal visibility and safety. An island would be installed where the existing turn lane from westbound 1st Street to southbound Yellowstone Highway was previously.

1st Street & Yellowstone Option #1 is shown in **FIGURE 17**.

1st Street & Yellowstone Highway: Option #2

Option #2 for the intersection of 1st Street and Yellowstone realigns Yellowstone Highway at the north leg of the intersection to create a signalized T-intersection. Southbound traffic from Yellowstone will have a free right turn onto westbound 1st Street thanks to a large island that will channelize traffic and create the new intersection alignment. Traffic at the south leg of the intersection will be right turn in and right turn out only, no thru traffic will be allowed from westbound 1st Street or southbound Yellowstone Highway. Traffic heading south would be directed to the intersection of Kimball and 1st Street in order to continue in that direction. Islands will be installed in 1st Street to channelize traffic, reduce crossing distances and provide pedestrian refuge.

FIGURE 18 shows 1st Street & Yellowstone Highway Option #2.



1st Street & Yellowstone Highway: Option #3

The third option evaluated for the intersection of 1st Street & Yellowstone Highway provides reduced crossing distances for pedestrians, a free right turn for traffic going from southbound Yellowstone to westbound 1st Street and a free right turn for westbound 1st Street to northbound Yellowstone Highway traffic. The south leg of the intersection is a right turn in and right turn out on Yellowstone. Traffic heading south would be directed to the intersection of Kimball Street and 1st Street in order to continue in that direction. The eastbound turning movement from southbound Yellowstone has been eliminated. Traffic would be redirected to Jackson Street to continue in this direction.

Option #3 is shown in **FIGURE 19**.

FIGURE 20 shows the road cross sections for the proposed road diet.

Table 3: Alternatives LOS/DELAY/QUEUES

#	Intersection	Approach	Existing - AM (PM)			Option 2 - AM (PM)			Option 3 - AM (PM)		
			LOS	Delay [s]	V/C	LOS	Delay [s]	V/C	LOS	Delay [s]	V/C
1	1st St & Yellowstone Hwy	Overall	B (B)	11.1 (11.1)	0.28 (0.39)	A (A)	5.1 (7.0)	0.34 (0.48)	A (A)	4.5 (7.6)	0.38 (0.53)
		EB	A (A)	3.6 (4.1)	0.28 (0.37)	A (A)	3.8 (6.5)	0.34 (0.50)	A (B)	7.7 (11.8)	0.38 (0.60)
		WB	A (A)	3.2 (3.2)	0.16 (0.13)	A (A)	6.3 (6.9)	0.35 (0.30)	A (A)	3.4 (3.6)	0.31 (0.26)
		NB	C (C)	27.6 (27.1)	0.20 (0.20)	-	-	-	C (C)	26.8 (26.9)	0.02 (0.05)
		SB	C (C)	28.1 (28.6)	0.32 (0.48)	D (D)	37.3 (43.3)	0.16 (0.44)	A (A)	0.2 (0.3)	0.18 (0.24)
2	2nd St & Kimball St	Overall	C (B)	22.2 (19.8)	0.31 (0.36)	B (B)	19.4 (19.1)	0.22 (0.37)	B (B)	19.4 (19.1)	0.22 (0.37)
		EB	A (B)	8.8 (10.9)	0.08 (0.25)	A (B)	6.5 (10.9)	0.08 (0.25)	A (B)	6.5 (10.9)	0.08 (0.25)
		WB	A (A)	8.3 (7.9)	0.20 (0.29)	A (A)	6.0 (7.9)	0.19 (0.29)	A (A)	6.0 (7.9)	0.19 (0.29)
		NB	D (D)	49.0 (44.5)	0.72 (0.62)	D (D)	41.9 (37.5)	0.40 (0.24)	D (D)	41.9 (37.5)	0.40 (0.24)
		SB	D (D)	36.7 (40.9)	0.24 (0.52)	D (D)	43.5 (44.1)	0.43 (0.65)	D (D)	43.5 (44.1)	0.43 (0.65)
3	Kimball & E Yellowstone Hwy*	Overall	-	-	-	-	-	-	-	-	-
		EB	A (A)	9.0 (9.3)	0.02 (0.03)	-	-	-	-	-	-
		WB	-	-	-	A (A)	9.0 (9.0)	0.01 (0.02)	A (A)	9.0 (9.0)	0.01 (0.02)
		NB	A (A)	1.5 (1.5)	0.03 (0.04)	A (A)	0.0 (0.0)	0.06 (0.07)	A (A)	0.0 (0.0)	0.06 (0.07)
		SB	A (A)	0.0 (0.0)	0.04 (0.08)	A (A)	0.0 (0.0)	0.04 (0.07)	A (A)	0.0 (0.0)	0.04 (0.07)

*Kimball Street is EB in existing and NB-SB in Alternatives



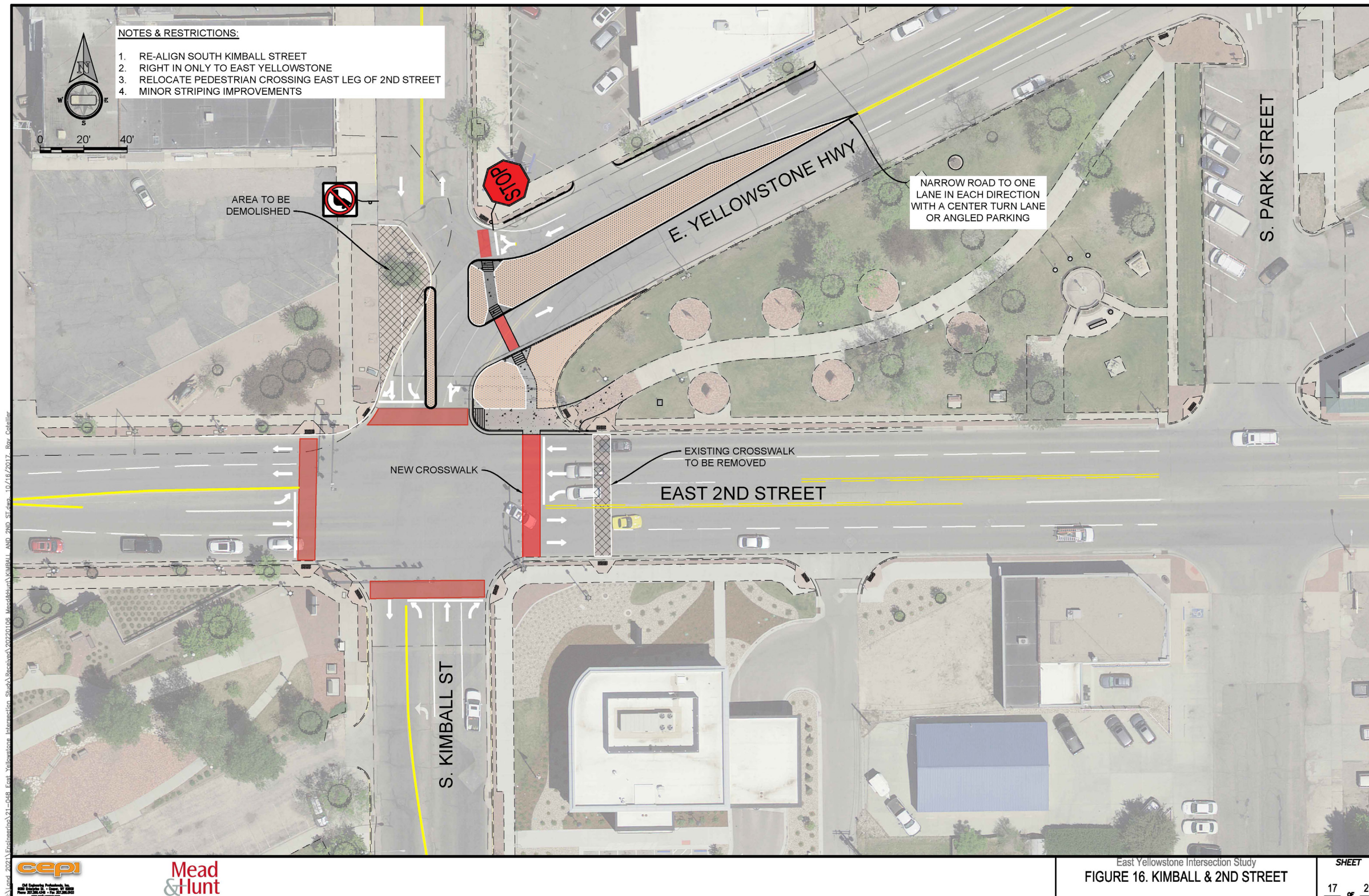
Figure 16: Kimball & 2nd Street

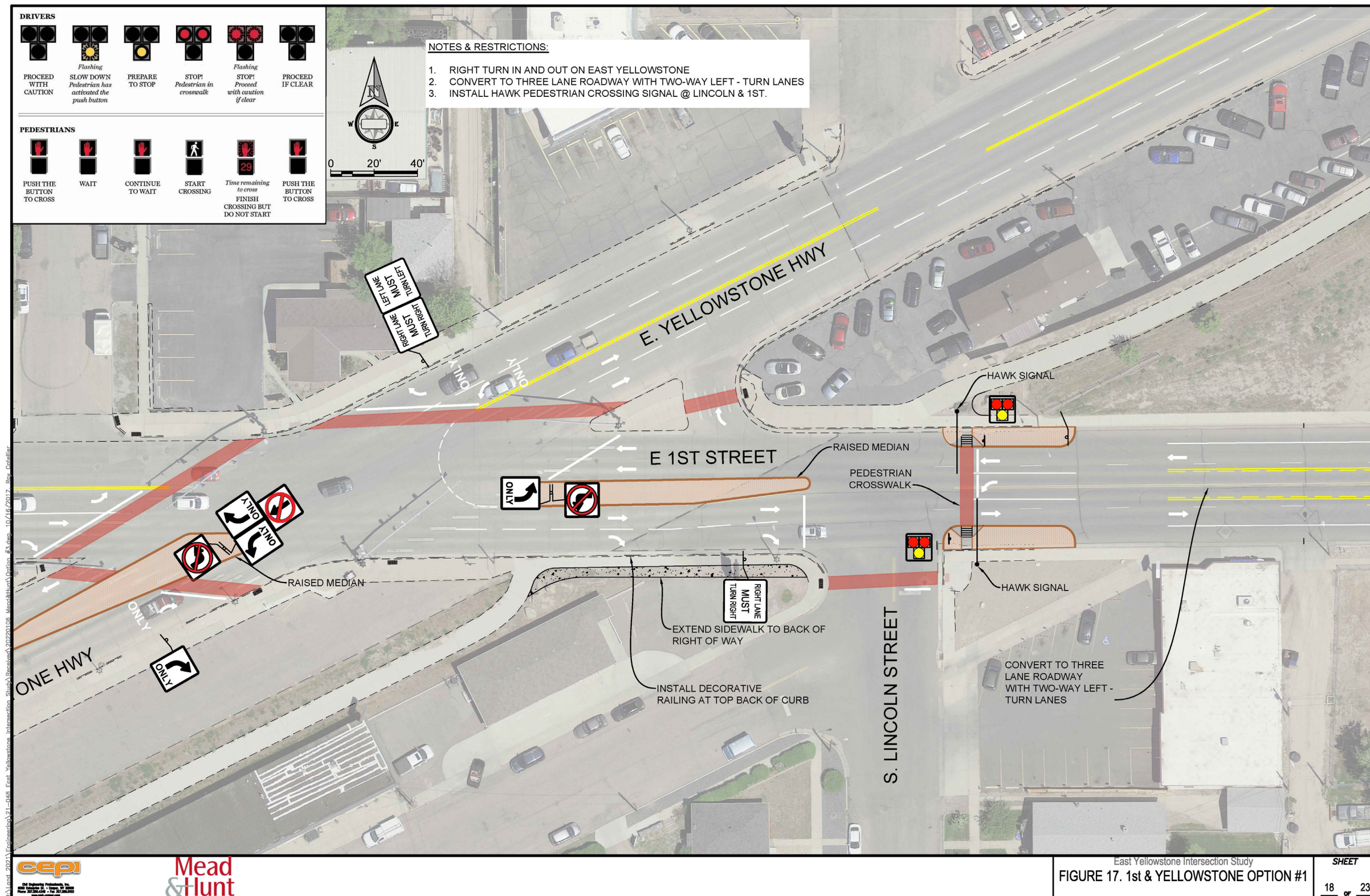
Figure 17: 1st Street & Yellowstone — Option #1

Figure 18: 1st Street & Yellowstone — Option #2

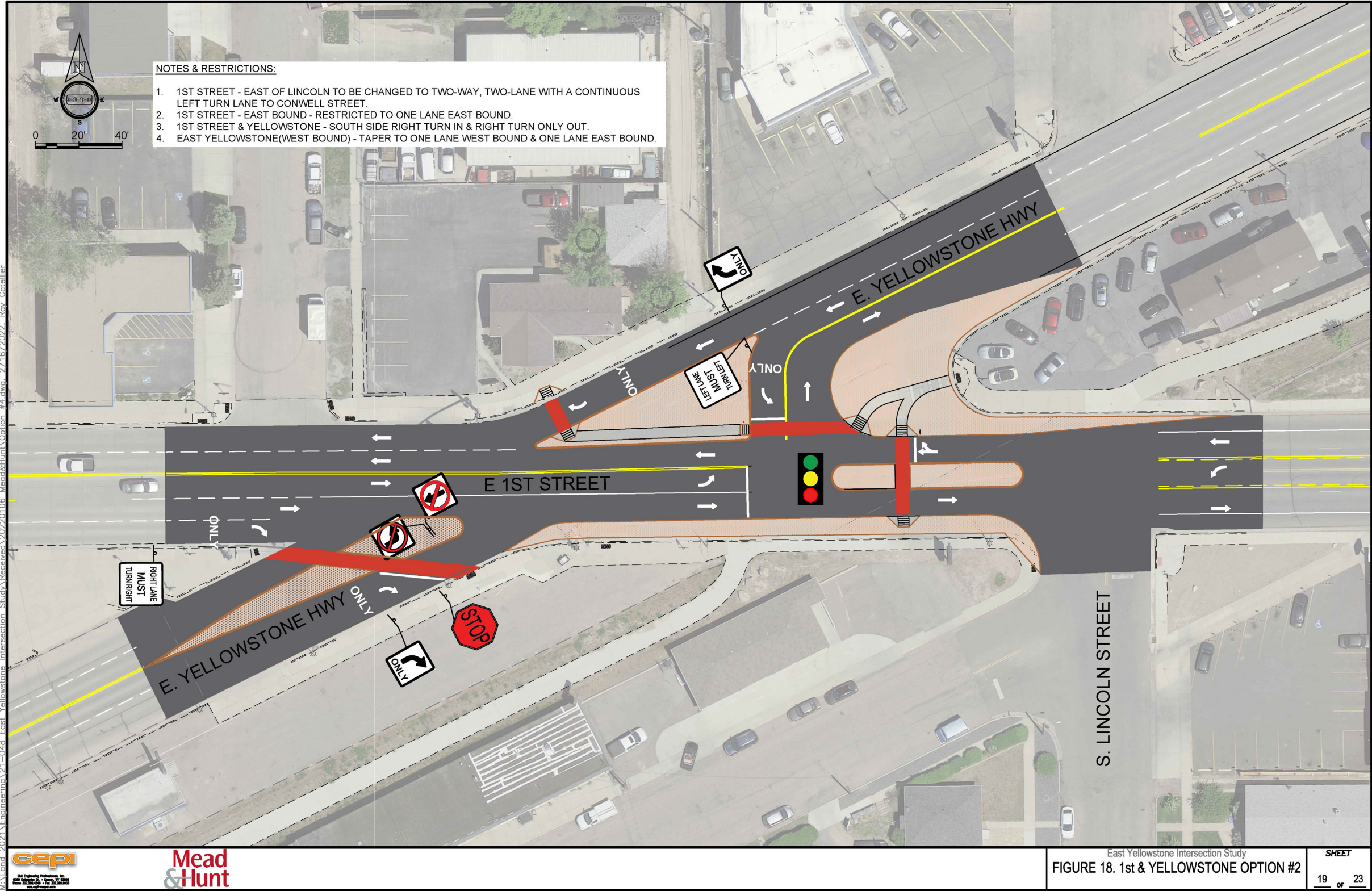


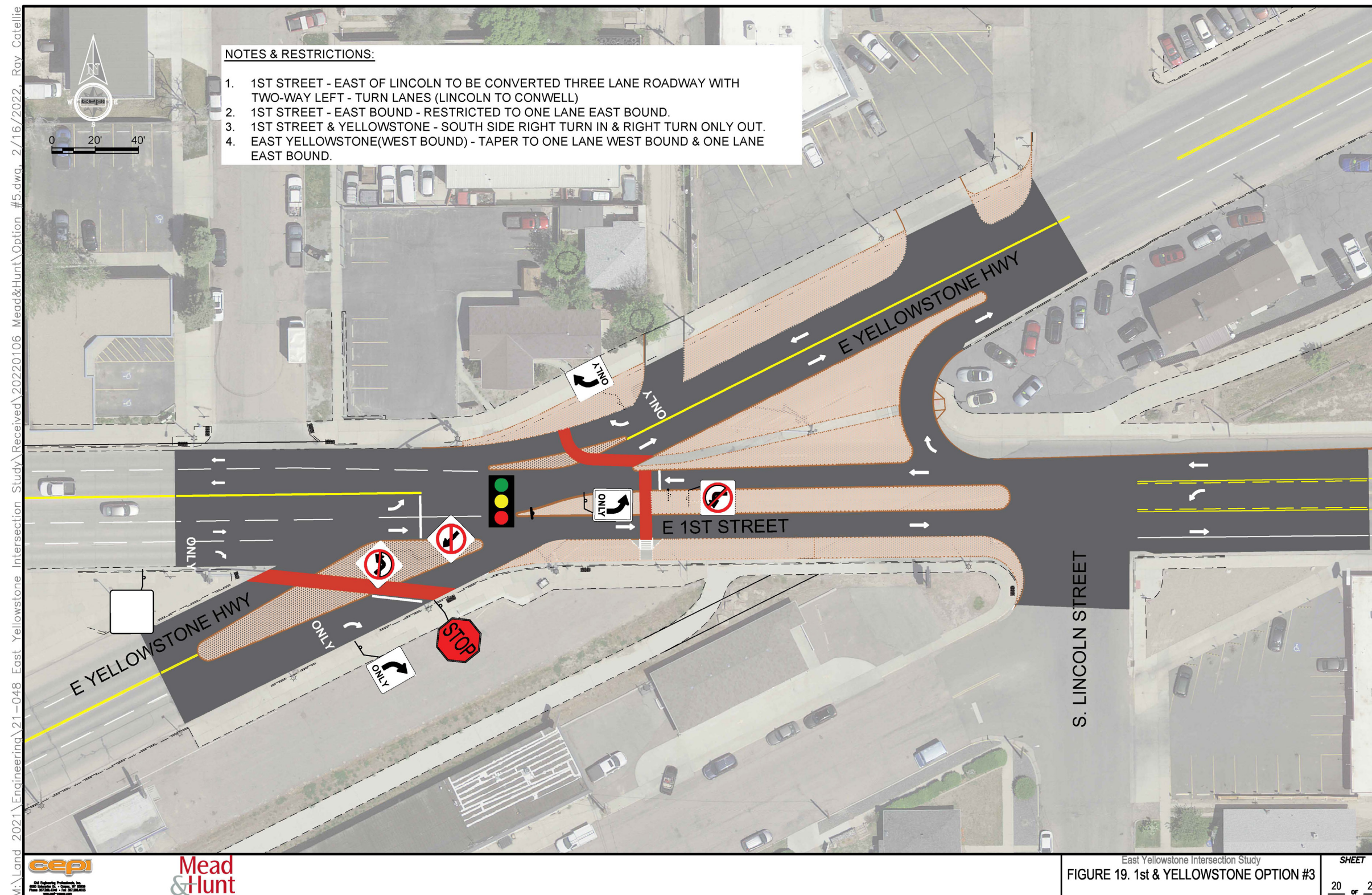
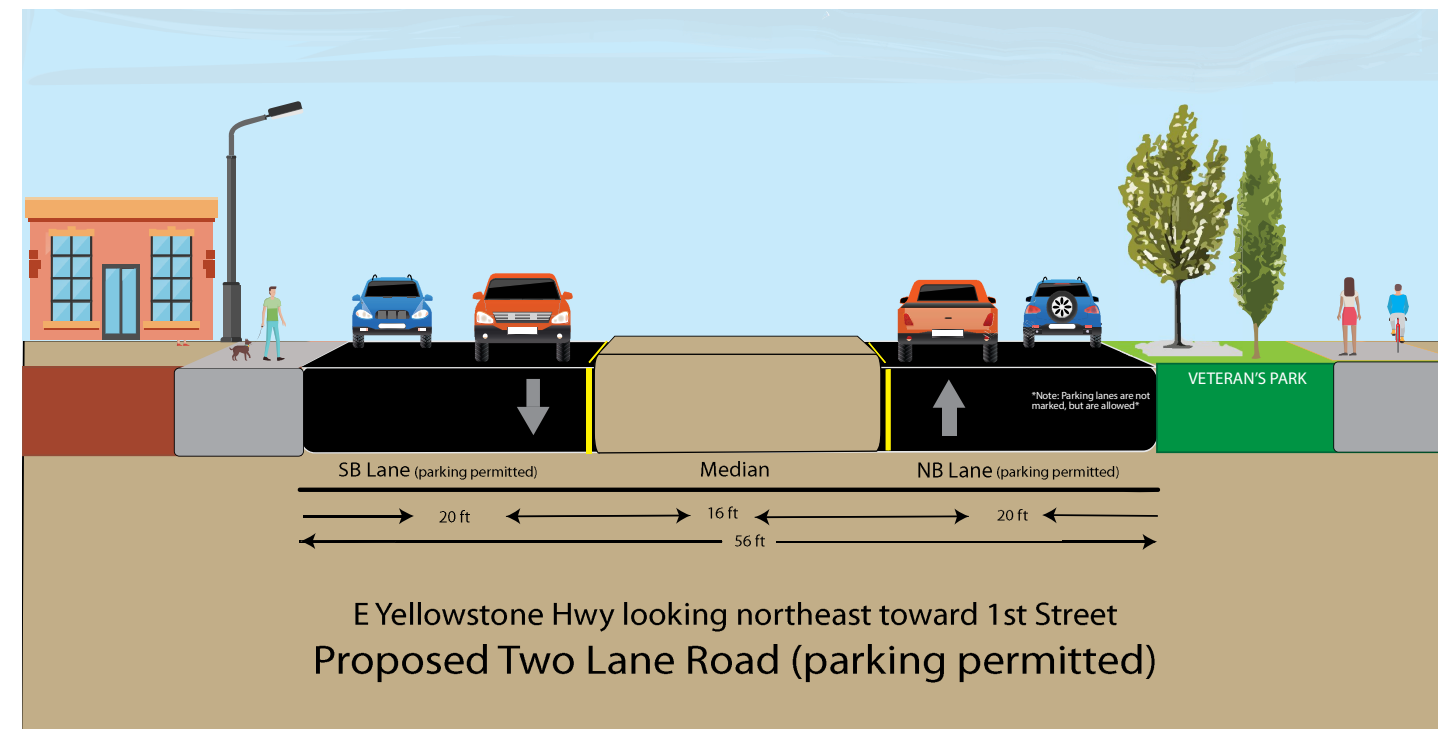
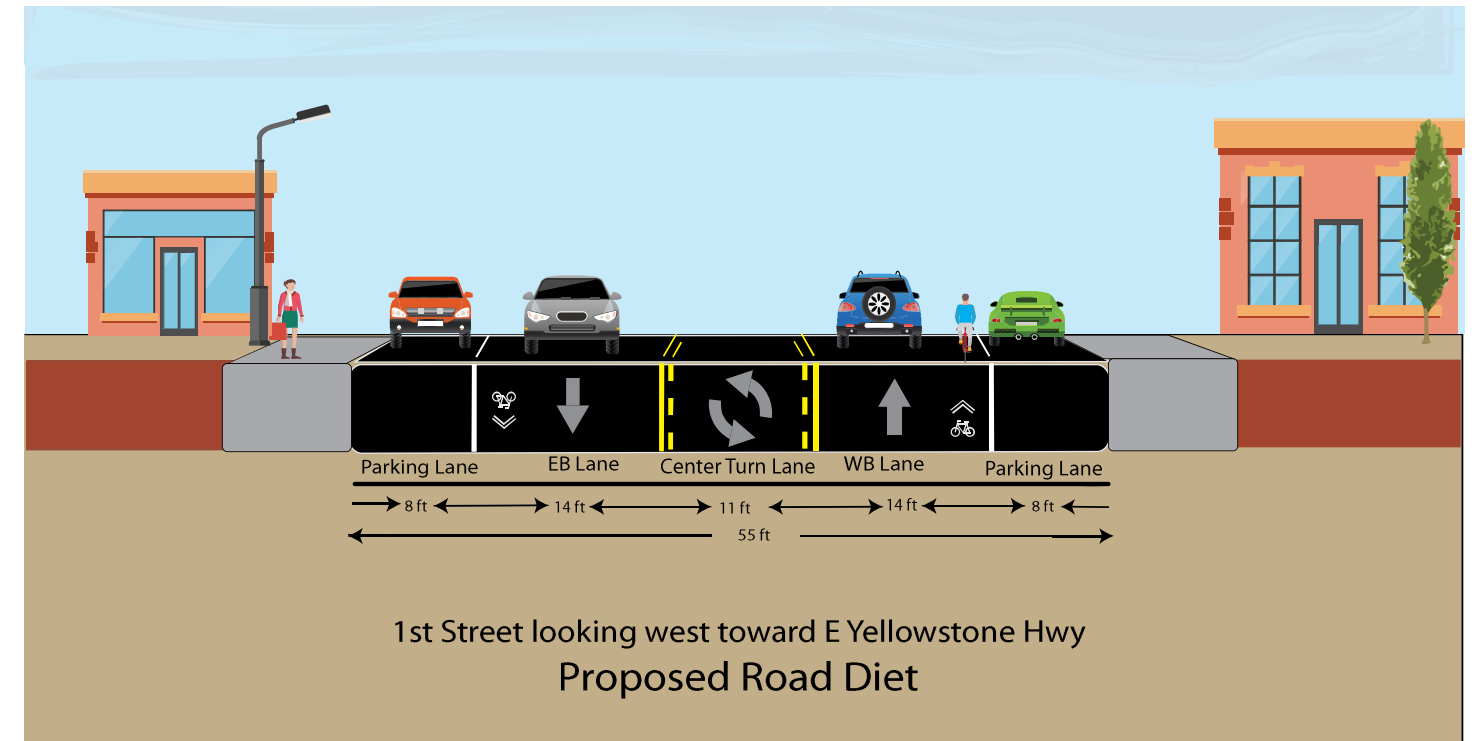
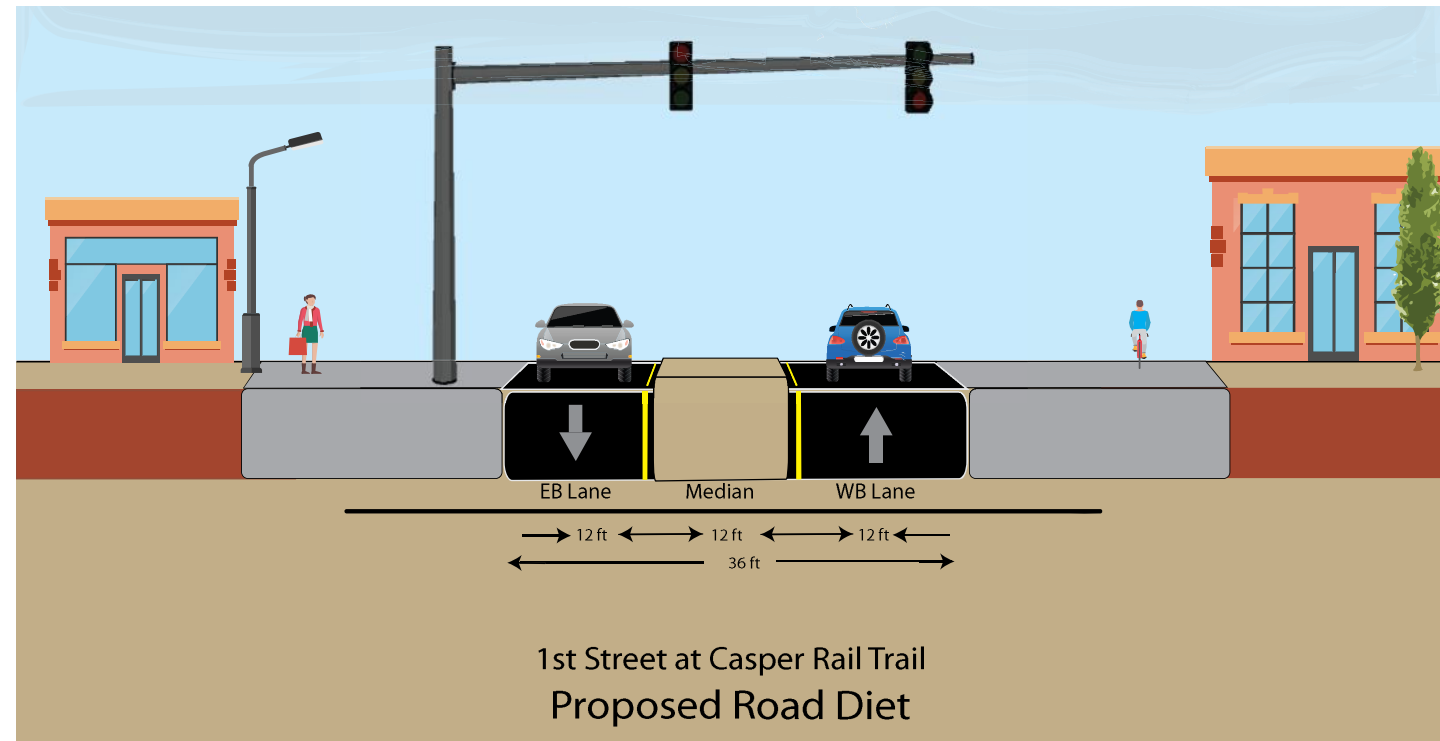
Figure 19: 1st Street & Yellowstone — Option #3

Figure 20: Alternative Cross Sections



► Construction Costs

Public Stakeholders met to discuss the alternatives presented above. Each option was retained with the exception of 1st Street and Yellowstone Highway Option #1. This option did not effectively accomplish the goals of the study in a cost effective and implementable manner. Cost estimates for each of the retained alternatives were developed to a planning and preliminary engineering stage level. Quantities used in each cost estimate were based on the conceptual engineering plans. Total cost and unit prices are calculated in present value dollars (February 2022). Adjustments should be made for inflation costs to future years if improvements are delayed. Costs include engineering and design fees as well as engineering services during construction. No right-of-way acquisition was identified as being necessary to complete these alternatives and therefore no associated costs were included in these estimates. Lastly, these estimates assume full resurfacing of the roadway (e.g. mill and overlay) for any partial roadway work.

Detailed cost estimates for Kimball & 2nd Street, 1st Street & Yellowstone Highway Option #2, and 1st Street & Yellowstone Highway Option #3 are included in the following tables.

Table 4: Kimball & 2nd Street

KIMBALL & 2ND STREET					
Preparation of Final Design and Specifications					\$30,800.00
Permitting and Mitigation					\$5,000.00
Legal Fees					\$0.00
Acquisition of Access and Right-of-way					\$0.00
Construction Costs					
MOBILIZATION & BONDS	LS	1	\$28,000.00	\$28,000.00	
DEMOLITION & REMOVAL	LS	1	\$15,000.00	\$15,000.00	
WATER LINE RELOCATION	LS	1	\$15,000.00	\$15,000.00	
CONCRETE WALK WITH ADA RAMPS	LS	1	\$20,000.00	\$20,000.00	
RAISED MEDIAN/ISLANDS	LS	1	\$100,000.00	\$100,000.00	
ASPHALT REPLACEMENTS	LS	1	\$70,000.00	\$70,000.00	
STRIPING & SIGNAGE	LS	1	\$5,000.00	\$5,000.00	
LANDSCAPING	LS	1	\$25,000.00	\$25,000.00	
IRRIGATION	LS	1	\$10,000.00	\$10,000.00	
ROADWAY LIGHTING	LS	1	\$10,000.00	\$10,000.00	
TRAFFIC CONTROL	LS	1	\$10,000.00	\$10,000.00	
Construction Cost Subtotal No. 1					\$308,000.00
Engineering Services During Construction (10%)					\$30,800.00
Construction Cost Subtotal No. 2					\$338,800.00
Contingency (25% of CCS No. 2)					\$84,700.00
Construction Cost Total					\$423,500.00
TOTAL PROJECT COST					\$460,000.00



Table 5: 1st Street & Yellowstone Highway — Option #2

1ST STREET & YELLOWSTONE: OPTION #2					
Preparation of Final Design and Specifications					\$84,500.00
Permitting and Mitigation					\$5,000.00
Legal Fees					\$0.00
Acquisition of Access and Right-of-way					\$0.00
Construction Costs					
MOBILIZATION & BONDS	LS	1	\$75,000.00	\$75,000.00	
DEMOLITION & REMOVAL	LS	1	\$30,000.00	\$30,000.00	
CONCRETE WALK WITH ADA RAMPS	LS	1	\$35,000.00	\$35,000.00	
RAISED MEDIAN/ISLANDS	LS	1	\$240,000.00	\$240,000.00	
ASPHALT REPLACEMENTS	LS	1	\$100,000.00	\$100,000.00	
STRIPING & SIGNAGE	LS	1	\$25,000.00	\$25,000.00	
LANDSCAPING	LS	1	\$50,000.00	\$50,000.00	
IRRIGATION	LS	1	\$20,000.00	\$20,000.00	
TRAFFIC SIGNAL	LS	1	\$250,000.00	\$250,000.00	
TRAFFIC CONTROL	LS	1	\$20,000.00	\$20,000.00	
Construction Cost Subtotal No. 1					\$845,000.00
Engineering Services During Construction (10%)					\$84,500.00
Construction Cost Subtotal No. 2					\$929,500.00
Contingency (25% of CCS No. 2)					\$232,370.00
Construction Cost Total					\$1,161,870.00
TOTAL PROJECT COST					\$1,252,000.00



Table 6: 1st Street & Yellowstone Highway — Option #3

1ST STREET & YELLOWSTONE: OPTION #3					
Preparation of Final Design and Specifications					\$71,000.00
Permitting and Mitigation					\$5,000.00
Legal Fees					\$0.00
Acquisition of Access and Right-of-way					\$0.00
Construction Costs					
MOBILIZATION & BONDS	LS	1	\$70,000.00	\$70,000.00	
DEMOLITION & REMOVAL	LS	1	\$30,000.00	\$30,000.00	
CONCRETE WALK WITH ADA RAMPS	LS	1	\$20,000.00	\$20,000.00	
RAISED MEDIAN/ISLANDS	LS	1	\$300,000.00	\$300,000.00	
ASPHALT REPLACEMENTS	LS	1	\$80,000.00	\$80,000.00	
STRIPING & SIGNAGE	LS	1	\$20,000.00	\$20,000.00	
LANDSCAPING	LS	1	\$50,000.00	\$50,000.00	
IRRIGATION	LS	1	\$20,000.00	\$20,000.00	
TRAFFIC SIGNAL MODIFICATIONS	LS	1	\$100,000.00	\$100,000.00	
TRAFFIC CONTROL	LS	1	\$20,000.00	\$20,000.00	
Construction Cost Subtotal No. 1					\$710,000.00
Engineering Services During Construction (10%)					\$71,000.00
Construction Cost Subtotal No. 2					\$781,000.00
Contingency (25% of CCS No. 2)					\$195,250.00
Construction Cost Total					\$976,250.00
TOTAL PROJECT COST					\$1,053,000.00



► Findings and Recommendations

This report evaluated existing conditions for the intersection of E. Yellowstone Highway with 1st and 2nd Streets including traffic volumes, traffic operations, traffic safety, signal operations, and multi-modal accessibility. These intersections were identified in previous transportation plans as being problem intersections.

Based on stakeholder feedback, public input and technical analysis, **it is recommended that the intersection of Kimball and 2nd Street be redesigned to make Kimball Street the primary north-south route** between 1st Street and 2nd Street as shown in **Figure 16**. This redesign increases multimodal safety during crossing movements, reduces driver confusion and allows for increased beautification at the entrance to downtown Casper. **It is further recommended that the intersection of East Yellowstone Highway and 1st Street be realigned to create a T-intersection (Option #2)**. A T-intersection reduces crossing distances for both vehicles and multimodal users. The channelized free right turn reduces travel times and reduces the potential for angle crashes. These intersection improvements would improve overall user safety and increase accessibility to multi-modal transportation options.

In addition to the intersection improvements identified above it is recommended that a road diet be implemented on 1st Street between Lincoln Street and Conwell Street to create one travel lane in each direction, a center turn lane and dedicated bike lanes on each side of the road. Minor striping improvements can achieve this recommendation in the short term. Future improvements could create a protected bike lane to increase safety for multi-modal user.

Detailed engineering design plans for each intersection should be developed and additional community outreach should be conducted during design. Driver education and community acceptance will be key to the success of the redesign of these areas.



The background of the page is a dark gray triangle pointing towards the top right corner, set against a white background. In the bottom left corner, there is a solid orange triangle pointing towards the bottom left corner.

Appendix A

Traffic Count Reports

All Traffic Data Services, LLC
www.alltrafficdata.net

Page 1

Date Start: 27-Apr-21
Site Code: 33
Station ID: 153
E YELLOWSTONE HWY E.O. N MCKINLEY ST

Start Time	27-Apr-21 Tue	EB	WB	Total
12:00 AM		11	19	30
01:00		6	5	11
02:00		12	9	21
03:00		14	23	37
04:00		22	28	50
05:00		53	75	128
06:00		157	127	284
07:00		245	250	495
08:00		238	291	529
09:00		238	215	453
10:00		279	285	564
11:00		297	274	571
12:00 PM		325	287	612
01:00		286	321	607
02:00		330	275	605
03:00		322	335	657
04:00		401	298	699
05:00		368	269	637
06:00		164	159	323
07:00		110	117	227
08:00		105	70	175
09:00		61	57	118
10:00		25	26	51
11:00		25	17	42
Total		4094	3832	7926
Percent		51.7%	48.3%	
AM Peak	-	11:00	08:00	-
Vol.	-	297	291	-
PM Peak	-	16:00	15:00	-
Vol.	-	401	335	-
Grand Total		4094	3832	7926
Percent		51.7%	48.3%	
ADT		ADT 7,926	AADT 7,926	

Date Start: 29-Apr-21
Site Code: 13
Station ID: 178
E 1ST ST E.O. S KIMBALL ST

Start Time	29-Apr-21 Thu	EB	WB							Total
12:00 AM		25	24							49
01:00		20	8							28
02:00		12	11							23
03:00		21	26							47
04:00		26	45							71
05:00		53	114							167
06:00		154	203							357
07:00		297	390							687
08:00		355	322							677
09:00		302	276							578
10:00		358	316							674
11:00		393	340							733
12:00 PM		464	408							872
01:00		408	349							757
02:00		393	308							701
03:00		421	341							762
04:00		423	332							755
05:00		399	331							730
06:00		227	209							436
07:00		183	175							358
08:00		150	116							266
09:00		107	78							185
10:00		64	40							104
11:00		34	25							59
Total		5289	4787							10076
Percent		52.5%	47.5%							
AM Peak	-	11:00	07:00	-	-	-	-	-	-	11:00
Vol.	-	393	390	-	-	-	-	-	-	733
PM Peak	-	12:00	12:00	-	-	-	-	-	-	12:00
Vol.	-	464	408	-	-	-	-	-	-	872
Grand Total		5289	4787							10076
Percent		52.5%	47.5%							
ADT		ADT 10,076	AADT 10,076							

All Traffic Data Services

www.alltrafficdata.net

Page 1

Date Start: 29-Apr-21

Site Code: 51

Station ID: 186

S KIMBALL ST S.O. E 2ND ST

Start Time	29-Apr-21 Thu	NB	SB							Total
12:00 AM		9	6							15
01:00		4	4							8
02:00		5	4							9
03:00		4	3							7
04:00		9	10							19
05:00		19	13							32
06:00		80	44							124
07:00		190	116							306
08:00		212	164							376
09:00		205	156							361
10:00		197	146							343
11:00		243	218							461
12:00 PM		232	215							447
01:00		245	216							461
02:00		200	214							414
03:00		293	216							509
04:00		252	251							503
05:00		216	241							457
06:00		165	167							332
07:00		93	100							193
08:00		73	88							161
09:00		49	56							105
10:00		28	26							54
11:00		12	9							21
Total		3035	2683							5718
Percent		53.1%	46.9%							
AM Peak	-	11:00	11:00	-	-	-	-	-	-	11:00
Vol.	-	243	218	-	-	-	-	-	-	461
PM Peak	-	15:00	16:00	-	-	-	-	-	-	15:00
Vol.	-	293	251	-	-	-	-	-	-	509
Grand Total		3035	2683							5718
Percent		53.1%	46.9%							
ADT		ADT 5,718	AADT 5,718							

Date Start: 29-Apr-21
Site Code: 88
Station ID: 189
W YELLOWSTONE HWY E.O. ELM ST

Start Time	29-Apr-21 Thu	EB	WB	Total
12:00 AM		2	0	2
01:00		2	2	4
02:00		0	1	1
03:00		0	2	2
04:00		4	4	8
05:00		7	10	17
06:00		29	16	45
07:00		99	66	165
08:00		108	98	206
09:00		91	84	175
10:00		82	70	152
11:00		98	105	203
12:00 PM		131	116	247
01:00		109	87	196
02:00		98	101	199
03:00		128	96	224
04:00		106	92	198
05:00		97	84	181
06:00		70	54	124
07:00		54	38	92
08:00		55	37	92
09:00		15	30	45
10:00		9	9	18
11:00		2	6	8
Total		1396	1208	2604
Percent		53.6%	46.4%	
AM Peak	-	08:00	11:00	08:00
Vol.	-	108	105	206
PM Peak	-	12:00	12:00	12:00
Vol.	-	131	116	247
Grand Total		1396	1208	2604
Percent		53.6%	46.4%	
ADT		ADT 2,604	AADT 2,604	

Date Start: 29-Apr-21
Site Code: 16
Station ID: 492
E 2ND ST E.O. S JEFFERSON ST

Start Time	29-Apr-21 Thu	EB	WB							Total
12:00 AM		11	20							31
01:00		10	12							22
02:00		7	14							21
03:00		12	4							16
04:00		12	16							28
05:00		24	38							62
06:00		99	110							209
07:00		252	286							538
08:00		284	344							628
09:00		331	357							688
10:00		399	421							820
11:00		482	471							953
12:00 PM		500	547							1047
01:00		480	516							996
02:00		424	444							868
03:00		504	460							964
04:00		476	426							902
05:00		458	411							869
06:00		341	358							699
07:00		246	226							472
08:00		217	217							434
09:00		139	159							298
10:00		64	86							150
11:00		37	31							68
Total		5809	5974							11783
Percent		49.3%	50.7%							
AM Peak	-	11:00	11:00	-	-	-	-	-	-	11:00
Vol.	-	482	471	-	-	-	-	-	-	953
PM Peak	-	15:00	12:00	-	-	-	-	-	-	12:00
Vol.	-	504	547	-	-	-	-	-	-	1047
Grand Total		5809	5974							11783
Percent		49.3%	50.7%							
ADT		ADT 11,783	AADT 11,783							

All Traffic Data Services, LLC
www.alltrafficdata.net

Page 1

Date Start: 29-Apr-21
Site Code: 2
Station ID: 697
EAST A ST E.O. N KIMBALL ST

Start Time	29-Apr-21 Thu	EB	WB	Total
12:00 AM		3	1	4
01:00		0	0	0
02:00		1	2	3
03:00		2	2	4
04:00		1	4	5
05:00		3	2	5
06:00		2	11	13
07:00		19	22	41
08:00		32	35	67
09:00		48	36	84
10:00		38	36	74
11:00		46	40	86
12:00 PM		57	43	100
01:00		48	46	94
02:00		43	47	90
03:00		64	36	100
04:00		52	40	92
05:00		48	30	78
06:00		26	17	43
07:00		26	13	39
08:00		18	7	25
09:00		14	7	21
10:00		5	6	11
11:00		3	4	7
Total		599	487	1086
Percent		55.2%	44.8%	
AM Peak	-	09:00	11:00	- - - - - 11:00
Vol.	-	48	40	- - - - - 86
PM Peak	-	15:00	14:00	- - - - - 12:00
Vol.	-	64	47	- - - - - 100
Grand Total		599	487	1086
Percent		55.2%	44.8%	
ADT		ADT 1,086	AADT 1,086	

www.alltrafficdata.net

Date Start: 27-Apr-21

Site Code: 63

Station ID: 1051

N MCKINLEY ST S.O. BURLINGTON AVE

Start Time	27-Apr-21 Tue	NB	SB							Total
12:00 AM		15	18							33
01:00		8	5							13
02:00		6	11							17
03:00		11	10							21
04:00		22	11							33
05:00		69	58							127
06:00		67	78							145
07:00		187	252							439
08:00		188	315							503
09:00		142	321							463
10:00		164	251							415
11:00		183	298							481
12:00 PM		174	241							415
01:00		168	243							411
02:00		227	271							498
03:00		224	265							489
04:00		214	307							521
05:00		226	278							504
06:00		132	148							280
07:00		71	101							172
08:00		67	96							163
09:00		42	43							85
10:00		31	34							65
11:00		13	25							38
Total		2651	3680							6331
Percent		41.9%	58.1%							
AM Peak	-	08:00	09:00	-	-	-	-	-	-	08:00
Vol.	-	188	321	-	-	-	-	-	-	503
PM Peak	-	14:00	16:00	-	-	-	-	-	-	16:00
Vol.	-	227	307	-	-	-	-	-	-	521
Grand Total		2651	3680							6331
Percent		41.9%	58.1%							
ADT		ADT 6,331	AADT 6,331							

Date Start: 29-Apr-21
Site Code: 18
Station ID: 1335
E 2ND ST E.O. S KIMBALL ST

Start Time	29-Apr-21 Thu	EB	WB							Total
12:00 AM		12	17							29
01:00		10	10							20
02:00		9	9							18
03:00		10	5							15
04:00		9	15							24
05:00		19	41							60
06:00		82	107							189
07:00		229	254							483
08:00		288	303							591
09:00		285	331							616
10:00		360	391							751
11:00		430	436							866
12:00 PM		457	497							954
01:00		402	455							857
02:00		355	403							758
03:00		507	479							986
04:00		417	387							804
05:00		410	379							789
06:00		307	323							630
07:00		222	194							416
08:00		189	194							383
09:00		126	145							271
10:00		64	70							134
11:00		33	30							63
Total		5232	5475							10707
Percent		48.9%	51.1%							
AM Peak	-	11:00	11:00	-	-	-	-	-	-	11:00
Vol.	-	430	436	-	-	-	-	-	-	866
PM Peak	-	15:00	12:00	-	-	-	-	-	-	15:00
Vol.	-	507	497	-	-	-	-	-	-	986
Grand Total		5232	5475							10707
Percent		48.9%	51.1%							
ADT		ADT 10,707	AADT 10,707							

Appendix B




Traffic Capacity Analysis (Synchro) Worksheets

HCM Unsignalized Intersection Capacity Analysis

16: Kimball St & Yellowstone Hwy

02/16/2022

























Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	10	20	80	85	5
Future Volume (Veh/h)	5	10	20	80	85	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	11	22	87	92	5
Pedestrians					10	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					3.5	
Percent Blockage					1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)				104	950	
pX, platoon unblocked						
vC, conflicting volume	192	48	97			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	192	48	97			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	99			
cM capacity (veh/h)	760	1010	1494			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	16	51	58	61	36	
Volume Left	5	22	0	0	0	
Volume Right	11	0	0	0	5	
cSH	916	1494	1700	1700	1700	
Volume to Capacity	0.02	0.01	0.03	0.04	0.02	
Queue Length 95th (ft)	1	1	0	0	0	
Control Delay (s)	9.0	3.3	0.0	0.0	0.0	
Lane LOS	A	A				
Approach Delay (s)	9.0	1.5		0.0		
Approach LOS	A					
Intersection Summary						
Average Delay			1.4			
Intersection Capacity Utilization			17.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

1: Yellowstone Hwy & 1st St






















10/19/2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	175	215	0	5	355	30	5	80	5	5	95	170
Future Volume (vph)	175	215	0	5	355	30	5	80	5	5	95	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4		5.4	5.4			4.2			4.2	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	0.99			0.99			0.91	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1770	3539		1770	3497			3503			3201	
Flt Permitted	0.51	1.00		0.61	1.00			0.93			0.95	
Satd. Flow (perm)	944	3539		1129	3497			3273			3045	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	190	234	0	5	386	33	5	87	5	5	103	185
RTOR Reduction (vph)	0	0	0	0	7	0	0	4	0	0	159	0
Lane Group Flow (vph)	190	234	0	5	412	0	0	93	0	0	134	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	52.4	52.4		52.4	52.4			10.0			10.0	
Effective Green, g (s)	52.4	52.4		52.4	52.4			10.0			10.0	
Actuated g/C Ratio	0.73	0.73		0.73	0.73			0.14			0.14	
Clearance Time (s)	5.4	5.4		5.4	5.4			4.2			4.2	
Vehicle Extension (s)	1.0	1.0		1.0	1.0			1.0			1.0	
Lane Grp Cap (vph)	687	2575		821	2545			454			422	
v/s Ratio Prot		0.07			0.12							
v/s Ratio Perm	c0.20			0.00				0.03			c0.04	
v/c Ratio	0.28	0.09		0.01	0.16			0.20			0.32	
Uniform Delay, d1	3.3	2.9		2.7	3.0			27.5			27.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.0	0.1		0.0	0.1			0.1			0.2	
Delay (s)	4.3	2.9		2.7	3.2			27.6			28.1	
Level of Service	A	A		A	A			C			C	
Approach Delay (s)		3.6			3.2			27.6			28.1	
Approach LOS		A			A			C			C	
Intersection Summary												
HCM 2000 Control Delay	11.1			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.28											
Actuated Cycle Length (s)	72.0			Sum of lost time (s)			9.6					
Intersection Capacity Utilization	49.1%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

2: Kimball St & 2nd St

10/19/2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	160	0	90	395	10	5	70	220	10	65	20
Future Volume (vph)	20	160	0	90	395	10	5	70	220	10	65	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.7		6.4	7.6		6.3	6.3		6.3	6.3	6.3
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00		1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539		1770	3526		1770	1651		1770	1863	1583
Flt Permitted	0.50	1.00		0.61	1.00		0.71	1.00		0.25	1.00	1.00
Satd. Flow (perm)	925	3539		1135	3526		1324	1651		466	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	174	0	98	429	11	5	76	239	11	71	22
RTOR Reduction (vph)	0	0	0	0	2	0	0	124	0	0	0	18
Lane Group Flow (vph)	22	174	0	98	438	0	5	191	0	11	71	4
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6			2			8			4		4
Actuated Green, G (s)	61.5	59.0		66.8	61.2		16.0	16.0		16.0	16.0	16.0
Effective Green, g (s)	61.5	59.0		66.8	61.2		16.0	16.0		16.0	16.0	16.0
Actuated g/C Ratio	0.62	0.59		0.67	0.61		0.16	0.16		0.16	0.16	0.16
Clearance Time (s)	6.4	6.7		6.4	7.6		6.3	6.3		6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	590	2088		793	2157		211	264		74	298	253
v/s Ratio Prot	0.00	0.05		c0.01	c0.12			c0.12			0.04	
v/s Ratio Perm	0.02			0.08			0.00			0.02		0.00
v/c Ratio	0.04	0.08		0.12	0.20		0.02	0.72		0.15	0.24	0.01
Uniform Delay, d1	7.5	8.8		5.9	8.6		35.4	39.9		36.1	36.7	35.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.0	0.1		0.1	0.2		0.0	9.4		0.9	0.4	0.0
Delay (s)	7.5	8.9		6.0	8.8		35.5	49.3		37.1	37.1	35.4
Level of Service	A	A		A	A		D	D		D	D	D
Approach Delay (s)		8.8			8.3			49.0			36.7	
Approach LOS		A			A			D			D	
Intersection Summary												
HCM 2000 Control Delay	22.2			HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio	0.31											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			20.3					
Intersection Capacity Utilization	50.9%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

16: Kimball St & Yellowstone Hwy

02/16/2022






















Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			↑↑	↑↑	
Traffic Volume (veh/h)	5	20	20	85	185	5
Future Volume (Veh/h)	5	20	20	85	185	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	22	22	92	201	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)				104	950	
pX, platoon unblocked						
vC, conflicting volume	294	103	206			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	294	103	206			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	98			
cM capacity (veh/h)	663	932	1363			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	27	53	61	134	72	
Volume Left	5	22	0	0	0	
Volume Right	22	0	0	0	5	
cSH	867	1363	1700	1700	1700	
Volume to Capacity	0.03	0.02	0.04	0.08	0.04	
Queue Length 95th (ft)	2	1	0	0	0	
Control Delay (s)	9.3	3.3	0.0	0.0	0.0	
Lane LOS	A	A				
Approach Delay (s)	9.3	1.5		0.0		
Approach LOS	A					
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			21.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

1: Yellowstone Hwy & 1st St






















10/19/2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	255	520	0	10	275	30	0	90	10	15	155	195
Future Volume (vph)	255	520	0	10	275	30	0	90	10	15	155	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4		5.4	5.4			4.2			4.2	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	0.99			0.98			0.92	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1770	3539		1770	3486			3486			3248	
Flt Permitted	0.55	1.00		0.44	1.00			1.00			0.94	
Satd. Flow (perm)	1027	3539		819	3486			3486			3061	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	565	0	11	299	33	0	98	11	16	168	212
RTOR Reduction (vph)	0	0	0	0	8	0	0	9	0	0	181	0
Lane Group Flow (vph)	277	565	0	11	324	0	0	100	0	0	215	0
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	51.9	51.9		51.9	51.9			10.5			10.5	
Effective Green, g (s)	51.9	51.9		51.9	51.9			10.5			10.5	
Actuated g/C Ratio	0.72	0.72		0.72	0.72			0.15			0.15	
Clearance Time (s)	5.4	5.4		5.4	5.4			4.2			4.2	
Vehicle Extension (s)	1.0	1.0		1.0	1.0			1.0			1.0	
Lane Grp Cap (vph)	740	2551		590	2512			508			446	
v/s Ratio Prot		0.16			0.09			0.03				
v/s Ratio Perm	c0.27			0.01							c0.07	
v/c Ratio	0.37	0.22		0.02	0.13			0.20			0.48	
Uniform Delay, d1	3.8	3.3		2.8	3.1			27.0			28.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.4	0.2		0.1	0.1			0.1			0.3	
Delay (s)	5.3	3.5		2.9	3.2			27.1			28.6	
Level of Service	A	A		A	A			C			C	
Approach Delay (s)		4.1			3.2			27.1			28.6	
Approach LOS		A			A			C			C	
Intersection Summary												
HCM 2000 Control Delay	11.1			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.39											
Actuated Cycle Length (s)	72.0			Sum of lost time (s)			9.6					
Intersection Capacity Utilization	53.7%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

2: Kimball St & 2nd St










10/19/2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	460	0	170	395	20	15	60	210	35	130	40
Future Volume (vph)	25	460	0	170	395	20	15	60	210	35	130	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.7		6.4	7.6		6.3	6.3		6.3	6.3	6.3
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99		1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539		1770	3513		1770	1645		1770	1863	1583
Flt Permitted	0.49	1.00		0.42	1.00		0.62	1.00		0.27	1.00	1.00
Satd. Flow (perm)	916	3539		789	3513		1162	1645		507	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	500	0	185	429	22	16	65	228	38	141	43
RTOR Reduction (vph)	0	0	0	0	3	0	0	143	0	0	0	37
Lane Group Flow (vph)	27	500	0	185	448	0	16	150	0	38	141	6
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6			2			8			4		4
Actuated Green, G (s)	60.7	56.9		70.2	61.2		14.7	14.7		14.7	14.7	14.7
Effective Green, g (s)	60.7	56.9		70.2	61.2		14.7	14.7		14.7	14.7	14.7
Actuated g/C Ratio	0.61	0.57		0.70	0.61		0.15	0.15		0.15	0.15	0.15
Clearance Time (s)	6.4	6.7		6.4	7.6		6.3	6.3		6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	588	2013		642	2149		170	241		74	273	232
v/s Ratio Prot	0.00	0.14		c0.03	0.13			c0.09			0.08	
v/s Ratio Perm	0.03			c0.18			0.01			0.07		0.00
v/c Ratio	0.05	0.25		0.29	0.21		0.09	0.62		0.51	0.52	0.03
Uniform Delay, d1	7.8	10.8		5.2	8.6		36.9	40.0		39.4	39.4	36.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3		0.2	0.2		0.2	4.9		5.9	1.6	0.0
Delay (s)	7.9	11.1		5.4	8.8		37.1	44.9		45.3	41.0	36.6
Level of Service	A	B		A	A		D	D		D	D	D
Approach Delay (s)		10.9			7.9			44.5			40.9	
Approach LOS		B			A			D			D	
Intersection Summary												
HCM 2000 Control Delay	19.8			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.36											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			20.3					
Intersection Capacity Utilization	65.5%			ICU Level of Service			C					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

16: Kimball St & Yellowstone Hwy

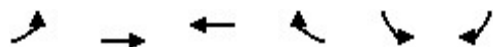
02/16/2022

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	5	55	45	0	65
Future Volume (Veh/h)	5	5	55	45	0	65
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	60	49	0	71
Pedestrians	10					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	1					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)			104			
pX, platoon unblocked	0.97	0.97			0.97	
vC, conflicting volume	166	94			119	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	121	48			73	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	838	979			1463	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	10	109	71			
Volume Left	5	0	0			
Volume Right	5	49	0			
cSH	903	1700	1700			
Volume to Capacity	0.01	0.06	0.04			
Queue Length 95th (ft)	1	0	0			
Control Delay (s)	9.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			15.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

1: 1st St & Yellowstone Hwy

02/16/2022



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	255	220	360	30	5	0
Future Volume (vph)	255	220	360	30	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4	5.4		4.2	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.99		1.00	
Flt Protected	0.95	1.00	1.00		0.95	
Satd. Flow (prot)	1770	1863	1843		1770	
Flt Permitted	0.49	1.00	1.00		0.95	
Satd. Flow (perm)	914	1863	1843		1770	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	239	391	33	5	0
RTOR Reduction (vph)	0	0	2	0	0	0
Lane Group Flow (vph)	277	239	422	0	5	0
Turn Type	pm+pt	NA	NA		Prot	
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	55.7	47.2	47.2		1.3	
Effective Green, g (s)	55.7	47.2	47.2		1.3	
Actuated g/C Ratio	0.77	0.66	0.66		0.02	
Clearance Time (s)	5.4	5.4	5.4		4.2	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	808	1221	1208		31	
v/s Ratio Prot	c0.04	0.13	c0.23		c0.00	
v/s Ratio Perm	0.22					
v/c Ratio	0.34	0.20	0.35		0.16	
Uniform Delay, d1	2.2	4.9	5.5		34.8	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.3	0.4	0.8		2.4	
Delay (s)	2.5	5.3	6.3		37.3	
Level of Service	A	A	A		D	
Approach Delay (s)		3.8	6.3		37.3	
Approach LOS		A	A		D	

Intersection Summary























HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	72.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Kimball St & 2nd St










02/16/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	160	0	90	395	10	5	70	220	15	65	20
Future Volume (vph)	20	160	0	90	395	10	5	70	220	15	65	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.7		6.4	7.6		6.3	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539		1770	3526		1770	1863	1583	1770	1797	
Flt Permitted	0.50	1.00		0.61	1.00		0.70	1.00	1.00	0.71	1.00	
Satd. Flow (perm)	925	3539		1137	3526		1298	1863	1583	1318	1797	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	174	0	98	429	11	5	76	239	16	71	22
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	215	0	13	0
Lane Group Flow (vph)	22	174	0	98	439	0	5	76	24	16	80	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6			2			8		8	4		
Actuated Green, G (s)	67.1	64.6		72.8	67.0		10.2	10.2	10.2	10.2	10.2	
Effective Green, g (s)	67.1	64.6		72.8	67.0		10.2	10.2	10.2	10.2	10.2	
Actuated g/C Ratio	0.67	0.65		0.73	0.67		0.10	0.10	0.10	0.10	0.10	
Clearance Time (s)	6.4	6.7		6.4	7.6		6.3	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	641	2286		864	2362		132	190	161	134	183	
v/s Ratio Prot	0.00	0.05		c0.01	c0.12			0.04			c0.04	
v/s Ratio Perm	0.02			0.08			0.00		0.02	0.01		
v/c Ratio	0.03	0.08		0.11	0.19		0.04	0.40	0.15	0.12	0.43	
Uniform Delay, d1	5.5	6.6		4.0	6.2		40.5	42.0	41.0	40.8	42.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.1		0.1	0.2		0.1	1.4	0.4	0.4	1.7	
Delay (s)	5.5	6.7		4.0	6.4		40.6	43.4	41.4	41.2	43.8	
Level of Service	A	A		A	A		D	D	D	D	D	
Approach Delay (s)		6.5			6.0			41.9			43.5	
Approach LOS		A			A			D			D	
Intersection Summary												
HCM 2000 Control Delay	19.4			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.22											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			20.3					
Intersection Capacity Utilization	48.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

16: Kimball St & Yellowstone Hwy

02/16/2022

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	15	80	25	0	110
Future Volume (Veh/h)	5	15	80	25	0	110
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	16	87	27	0	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			104			
pX, platoon unblocked	0.98	0.98			0.98	
vC, conflicting volume	220	100			114	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	191	68			82	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			100	
cM capacity (veh/h)	780	973			1481	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	21	114	120			
Volume Left	5	0	0			
Volume Right	16	27	0			
cSH	919	1700	1700			
Volume to Capacity	0.02	0.07	0.07			
Queue Length 95th (ft)	2	0	0			
Control Delay (s)	9.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization		15.8%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Signalized Intersection Capacity Analysis

1: 1st St & Yellowstone Hwy

02/16/2022

























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	345	530	285	30	15	0
Future Volume (vph)	345	530	285	30	15	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4	5.4		4.2	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.99		1.00	
Flt Protected	0.95	1.00	1.00		0.95	
Satd. Flow (prot)	1770	1863	1839		1770	
Flt Permitted	0.54	1.00	1.00		0.95	
Satd. Flow (perm)	1011	1863	1839		1770	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	375	576	310	33	16	0
RTOR Reduction (vph)	0	0	3	0	0	0
Lane Group Flow (vph)	375	576	340	0	16	0
Turn Type	pm+pt	NA	NA		Prot	
Protected Phases	5	2	6		4	
Permitted Phases	2					
Actuated Green, G (s)	55.5	44.9	44.9		1.5	
Effective Green, g (s)	55.5	44.9	44.9		1.5	
Actuated g/C Ratio	0.77	0.62	0.62		0.02	
Clearance Time (s)	5.4	5.4	5.4		4.2	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	891	1161	1146		36	
v/s Ratio Prot	c0.06	c0.31	0.18		c0.01	
v/s Ratio Perm	0.26					
v/c Ratio	0.42	0.50	0.30		0.44	
Uniform Delay, d1	2.4	7.4	6.3		34.8	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.3	1.5	0.7		8.5	
Delay (s)	2.7	8.9	6.9		43.3	
Level of Service	A	A	A		D	
Approach Delay (s)		6.5	6.9		43.3	
Approach LOS		A	A		D	
Intersection Summary						
HCM 2000 Control Delay			7.0		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.48			
Actuated Cycle Length (s)			72.0		Sum of lost time (s)	15.0
Intersection Capacity Utilization			52.6%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Kimball St & 2nd St



















02/16/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	460	0	170	395	20	15	60	210	40	130	40
Future Volume (vph)	25	460	0	170	395	20	15	60	210	40	130	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.7		6.4	7.6		6.3	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539		1770	3513		1770	1863	1583	1770	1797	
Flt Permitted	0.49	1.00		0.42	1.00		0.49	1.00	1.00	0.71	1.00	
Satd. Flow (perm)	916	3539		790	3513		920	1863	1583	1331	1797	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	500	0	185	429	22	16	65	228	43	141	43
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	194	0	13	0
Lane Group Flow (vph)	27	500	0	185	448	0	16	65	34	43	171	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6			2			8		8	4		
Actuated Green, G (s)	60.7	56.9		70.0	61.1		14.8	14.8	14.8	14.8	14.8	
Effective Green, g (s)	60.7	56.9		70.0	61.1		14.8	14.8	14.8	14.8	14.8	
Actuated g/C Ratio	0.61	0.57		0.70	0.61		0.15	0.15	0.15	0.15	0.15	
Clearance Time (s)	6.4	6.7		6.4	7.6		6.3	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	588	2013		640	2146		136	275	234	196	265	
v/s Ratio Prot	0.00	0.14		c0.03	0.13			0.03			c0.10	
v/s Ratio Perm	0.03			c0.18			0.02		0.02	0.03		
v/c Ratio	0.05	0.25		0.29	0.21		0.12	0.24	0.14	0.22	0.65	
Uniform Delay, d1	7.8	10.8		5.2	8.7		36.9	37.6	37.1	37.5	40.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.3		0.3	0.2		0.4	0.4	0.3	0.6	5.3	
Delay (s)	7.9	11.1		5.5	8.9		37.3	38.1	37.4	38.1	45.5	
Level of Service	A	B		A	A		D	D	D	D	D	
Approach Delay (s)		10.9			7.9			37.5			44.1	
Approach LOS		B			A			D			D	
Intersection Summary												
HCM 2000 Control Delay	19.1			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.37											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			20.3					
Intersection Capacity Utilization	50.8%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

1: Yellowstone Hwy & 1st St























02/16/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	255	215	0	0	360	30	0	0	5	0	0	265
Future Volume (vph)	255	215	0	0	360	30	0	0	5	0	0	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4			5.4				4.2			4.0
Lane Util. Factor	1.00	1.00			1.00				1.00			1.00
Frt	1.00	1.00			0.99				0.86			0.86
Flt Protected	0.95	1.00			1.00				1.00			1.00
Satd. Flow (prot)	1770	1863			1843				1611			1611
Flt Permitted	0.51	1.00			1.00				1.00			1.00
Satd. Flow (perm)	944	1863			1843				1611			1611
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	234	0	0	391	33	0	0	5	0	0	288
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	277	234	0	0	421	0	0	0	5	0	0	288
Turn Type	pm+pt	NA	Free		NA				Prot			Free
Protected Phases	5	2			6 8				8			
Permitted Phases	2		Free									Free
Actuated Green, G (s)	47.0	37.2			52.6				10.0			72.0
Effective Green, g (s)	47.0	37.2			52.6				10.0			72.0
Actuated g/C Ratio	0.65	0.52			0.73				0.14			1.00
Clearance Time (s)	5.4	5.4							4.2			
Vehicle Extension (s)	3.0	1.0							1.0			
Lane Grp Cap (vph)	728	962			1346				223			1611
v/s Ratio Prot	c0.05	0.13			c0.23				0.00			
v/s Ratio Perm	c0.20											0.18
v/c Ratio	0.38	0.24			0.31				0.02			0.18
Uniform Delay, d1	5.1	9.6			3.4				26.8			0.0
Progression Factor	1.00	1.00			1.00				1.00			1.00
Incremental Delay, d2	0.3	0.6			0.0				0.0			0.2
Delay (s)	5.5	10.2			3.4				26.8			0.2
Level of Service	A	B			A				C			A
Approach Delay (s)		7.7			3.4			26.8			0.2	
Approach LOS		A			A			C			A	
Intersection Summary												
HCM 2000 Control Delay			4.5		HCM 2000 Level of Service				A			
HCM 2000 Volume to Capacity ratio			0.38									
Actuated Cycle Length (s)			72.0		Sum of lost time (s)				15.0			
Intersection Capacity Utilization			43.9%		ICU Level of Service				A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

2: Kimball St & 2nd St



















02/16/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	160	0	90	395	10	5	70	220	15	65	20
Future Volume (vph)	20	160	0	90	395	10	5	70	220	15	65	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.7		6.4	7.6		6.3	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539		1770	3526		1770	1863	1583	1770	1797	
Flt Permitted	0.50	1.00		0.61	1.00		0.70	1.00	1.00	0.71	1.00	
Satd. Flow (perm)	925	3539		1137	3526		1298	1863	1583	1318	1797	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	174	0	98	429	11	5	76	239	16	71	22
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	215	0	13	0
Lane Group Flow (vph)	22	174	0	98	439	0	5	76	24	16	80	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6			2			8		8	4		
Actuated Green, G (s)	67.1	64.6		72.8	67.0		10.2	10.2	10.2	10.2	10.2	
Effective Green, g (s)	67.1	64.6		72.8	67.0		10.2	10.2	10.2	10.2	10.2	
Actuated g/C Ratio	0.67	0.65		0.73	0.67		0.10	0.10	0.10	0.10	0.10	
Clearance Time (s)	6.4	6.7		6.4	7.6		6.3	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	641	2286		864	2362		132	190	161	134	183	
v/s Ratio Prot	0.00	0.05		c0.01	c0.12			0.04			c0.04	
v/s Ratio Perm	0.02			0.08			0.00		0.02	0.01		
v/c Ratio	0.03	0.08		0.11	0.19		0.04	0.40	0.15	0.12	0.43	
Uniform Delay, d1	5.5	6.6		4.0	6.2		40.5	42.0	41.0	40.8	42.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.1		0.1	0.2		0.1	1.4	0.4	0.4	1.7	
Delay (s)	5.5	6.7		4.0	6.4		40.6	43.4	41.4	41.2	43.8	
Level of Service	A	A		A	A		D	D	D	D	D	
Approach Delay (s)		6.5			6.0			41.9			43.5	
Approach LOS		A			A			D			D	
Intersection Summary												
HCM 2000 Control Delay	19.4			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.22											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			20.3					
Intersection Capacity Utilization	48.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

1: Yellowstone Hwy & 1st St

























02/16/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	345	520	0	0	285	30	0	0	10	0	0	350
Future Volume (vph)	345	520	0	0	285	30	0	0	10	0	0	350
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4			5.4				4.2			4.0
Lane Util. Factor	1.00	1.00			1.00				1.00			1.00
Frt	1.00	1.00			0.99				0.86			0.86
Flt Protected	0.95	1.00			1.00				1.00			1.00
Satd. Flow (prot)	1770	1863			1839				1611			1611
Flt Permitted	0.55	1.00			1.00				1.00			1.00
Satd. Flow (perm)	1033	1863			1839				1611			1611
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	375	565	0	0	310	33	0	0	11	0	0	380
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	375	565	0	0	339	0	0	0	11	0	0	380
Turn Type	pm+pt	NA	Free		NA				Prot			Free
Protected Phases	5	2			6	8			8			
Permitted Phases	2		Free									Free
Actuated Green, G (s)	47.0	36.1			51.5				10.0			72.0
Effective Green, g (s)	47.0	36.1			51.5				10.0			72.0
Actuated g/C Ratio	0.65	0.50			0.72				0.14			1.00
Clearance Time (s)	5.4	5.4							4.2			
Vehicle Extension (s)	3.0	1.0							1.0			
Lane Grp Cap (vph)	785	934			1315				223			1611
v/s Ratio Prot	c0.07	c0.30			0.18				0.01			
v/s Ratio Perm	0.24											c0.24
v/c Ratio	0.48	0.60			0.26				0.05			0.24
Uniform Delay, d1	5.5	12.8			3.6				26.9			0.0
Progression Factor	1.00	1.00			1.00				1.00			1.00
Incremental Delay, d2	0.5	2.9			0.0				0.0			0.3
Delay (s)	6.0	15.7			3.6				26.9			0.3
Level of Service	A	B			A				C			A
Approach Delay (s)		11.8			3.6			26.9			0.3	
Approach LOS		B			A			C			A	
Intersection Summary												
HCM 2000 Control Delay			7.6		HCM 2000 Level of Service				A			
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			72.0		Sum of lost time (s)				15.0			
Intersection Capacity Utilization			44.9%		ICU Level of Service				A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

2: Kimball St & 2nd St

02/16/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Traffic Volume (vph)	25	460	0	170	395	20	15	60	210	40	130	40
Future Volume (vph)	25	460	0	170	395	20	15	60	210	40	130	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.7		6.4	7.6		6.3	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539		1770	3513		1770	1863	1583	1770	1797	
Flt Permitted	0.49	1.00		0.42	1.00		0.49	1.00	1.00	0.71	1.00	
Satd. Flow (perm)	916	3539		790	3513		920	1863	1583	1331	1797	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	500	0	185	429	22	16	65	228	43	141	43
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	194	0	13	0
Lane Group Flow (vph)	27	500	0	185	448	0	16	65	34	43	171	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6			2			8		8	4		
Actuated Green, G (s)	60.7	56.9		70.0	61.1		14.8	14.8	14.8	14.8	14.8	
Effective Green, g (s)	60.7	56.9		70.0	61.1		14.8	14.8	14.8	14.8	14.8	
Actuated g/C Ratio	0.61	0.57		0.70	0.61		0.15	0.15	0.15	0.15	0.15	
Clearance Time (s)	6.4	6.7		6.4	7.6		6.3	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	588	2013		640	2146		136	275	234	196	265	
v/s Ratio Prot	0.00	0.14		c0.03	0.13			0.03			c0.10	
v/s Ratio Perm	0.03			c0.18			0.02		0.02	0.03		
v/c Ratio	0.05	0.25		0.29	0.21		0.12	0.24	0.14	0.22	0.65	
Uniform Delay, d1	7.8	10.8		5.2	8.7		36.9	37.6	37.1	37.5	40.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.3		0.3	0.2		0.4	0.4	0.3	0.6	5.3	
Delay (s)	7.9	11.1		5.5	8.9		37.3	38.1	37.4	38.1	45.5	
Level of Service	A	B		A	A		D	D	D	D	D	
Approach Delay (s)		10.9			7.9			37.5			44.1	
Approach LOS		B			A			D			D	
Intersection Summary												
HCM 2000 Control Delay	19.1			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.37											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			20.3					
Intersection Capacity Utilization	50.8%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

The cover page features a dark gray background with a white diagonal line running from the top left to the middle right. An orange triangle is located in the bottom left corner. The text 'Appendix C' is in white, and 'Public Comment' is in orange.

Appendix C

Public Comment



Public Comments

- ▶ Option one in the packet (pg. 30 of 65) does not address the complicated intersection. You will still have cars making an odd turn from east bound 1st to north bound yellowstone, which is one of the primary reasons we have accidents. . It is how I ended up in my accident, and end up almost getting hit other times.
- ▶ Option two addresses the odd turn angle, but it restricts traffic on Yellowstone.
- ▶ It seems to me that the added median on the second st. and kimball/yellowstone intersection drawing (the one on yellowstone) would be unnecessary. I know y'all want it to discourage certain traffic patterns, but I don't think it would be overall helpful. We have a lot of large pick-ups in this town, and while this option would probably fit with most metro planning tools, I don't think it's a good fit for Casper/Wyoming.
- ▶ In your option 2 drawing for yellowstone & first, no one - in any vehicle, will be able to make the right hand turn off of east bound first onto southbound yellowstone. That angle is too tight and the medians are definitely not demonstrated as being feasible.
- ▶ Could I suggest that the city - before investing a lot of money into restructuring the entire area - instead install turn signals on first street, and change the lights to reflect those turns? Maybe pattern it a little after the first and poplar intersection? Where Yellowstone can travel both directions at the same time, but first street lights alternate? Maybe allow the straight through to travel and then work in the turn signals (they CANNOT turn at the same time from both east bound and west bound first street!). It would seem to me that installing turn signals and adjusting the timing would be less costly than remodeling the entire area. I know it doesn't address pedestrian cross traffic, but if the lights work for turns, then the pedestrian crossing could be addressed.
- ▶ Thank you again for trying to tackle this project. I just don't think the two options for first and yellowstone are great options.

▶ If they do use option 3 - I would recommend adding the pedestrian crosswalk thing back by Lincoln street like it is shown in option 1.

▶ NO, it stops west travel down Yellowstone to Collins, creates a snow plowing and street sweeping debacle with all the islands.

▶ Essentially then y'all are planning on making it so no one travels through on E Yellowstone Hwy. That's a horrible idea.

And option 2 is the only one that reasonable addresses the awkward turns onto yellowstone off of first street.

What do our plow drivers (not their mangers) think about all these medians? How will they impact snow removal - not just plowing, but where the snow is put when it's removed from the street.

Can't you just add turn signals and design the traffic flow a little like first & poplar?

I like the pedestrian crossing options on 1 better than 2 or 3 for yellowstone & first.

▶ This looks like a mess. No continuous west travel on Yellowstone which is going to route people to busier downtown streets to get back to where they need to be on Yellowstone. For East travel on Yellowstone you've set up a double turn to achieve continuous travel on Yellowstone. Stop at a sign, turn right on First, immediately having to switch lanes at a stop light to make a left turn back on to Yellowstone. This setup looks like a great setup for traffic jams and wrecks around the 8am and 5pm increased traffic times.

▶ Those responsible for maintaing the roads, whether it be proper striping, building streets that last longer than a year or two, keeping them clean and free of debris, etc lack the ability to do so. And you want to change what can not be maintained? No. Do better than you are now before making changes like these with our tax dollars. Stop paying lower bidder and begin with quality workmanship. Build a budget to be able to do extras. Always complaining about no funds and want to tax more. Wrong approach. Enough said for now. Great place to begin.

▶ Who was the brain child that designed this. No sense of traffic flow...at all.



East Yellowstone Intersection Improvement Study

Study Report - February 2022

Civil Engineering Professionals, Inc.
6080 Enterprise Dr. • Casper, WY 82609
Phone 307.266.4346
www.cepi-casper.com

