U.S. 69 from County Line Road to I-80 Location Study

Project Number: NHS-069-4(121)--19-77

Final Report

Polk County, Iowa
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IOWA DOT | HDR

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

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12/23/2021

JOSEPH J. SPRADLING, P.E. (date)
License No. **20450**
My license renewal date is **December 31, 2022**
Pages of sheets covered by this seal:

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List of Abbreviations

- AADT: Annual Average Daily Traffic
- DART: Des Moines Area Regional Transit
- DLT: Displaced Left Turn Intersection
- DMAMPO: Des Moines Area Metropolitan Planning Organization
- DOT: Department of Transportation
- E MLK: East Martin Luther King Jr. (for Road Naming)
- FHWA: Federal Highway Administration
- GIS: Geographical Information System
- HCM: Highway Capacity Manual
- HMVMT: Hundred Million Vehicle Miles Travelled
- ICAT: Iowa Crash Analysis Tool
- ICE: Intersection Control Evaluation
- IHSDM: Interactive Highway Safety Design Model
- LOS: Level of Service
- LTOR: Left-Turn-on-Red
- LTS: Level of Traffic Stress
- MUT: Median U-Turn Intersection
- NOAA: National Oceanic and Atmospheric Administration
- ROW: Right-of-Way
- RTOR: Right-Turn-on-Red
- SICL: Safety Improvement Candidate Locations
- SUDAS: Statewide Urban Design and Specifications
- TDM: Travel Demand Model
- US 69: United States Highway 69

Introduction

The US 69 Location Study includes a review of travel safety and mobility in the US 69 corridor though Des Moines, Iowa, in order to plan for potential improvements in the corridor. The US 69 segments in Des Moines were originally constructed in the 1930s as part of a national highway route between southeast Texas and southern Minnesota. Since that time, the US 69 corridor has served as an important corridor to both the state of Iowa and the City of Des Moines. This diverse corridor serves a range of purposes and has a wide range of features:

- Traffic volumes on US 69 in Des Moines range between approximately 15,000 and 33,000 vehicles per day.
- The corridor serves a wide range of multimodal users, including:
  - DART buses
  - freight traffic
  - pedestrians
  - commuter trips
  - bicyclists
- The corridor serves a wide range of land uses, including:
  - residential
  - commercial
  - institutional
  - industrial
- The corridor also includes street cross sections that vary along the corridor between four-lane undivided, four-lane divided, five-lane divided, and one-way pairs.

The study area includes US 69 from immediately north of County Line Road on the south end of the corridor to immediately south of Interstates 80 and 35 on the north end of the corridor, for a total study area length of approximately 10 miles. The study corridor includes the one-way pairs for East 14th and East 15th Streets and includes cross streets up to 200 feet from either side of the US 69 corridor. To get an understanding of current and anticipated future needs, this study reviewed multimodal travel operations, safety, and travel reliability through the corridor. This review helped the study team identify and develop potential improvement concepts. The goal of these improvement concepts was to provide a balanced set of safety and mobility improvements for motorists, pedestrians, bicyclists, and transit users.

Figure 1. US 69 Study Area Limits

The US 69 Location Study scope of work included data collection, traffic operations analysis, traffic safety analysis, travel reliability analysis, the development of improvement alternatives, and stakeholder and public engagement. The study relied on readily available data and corridor surveys. Field studies, investigations, and surveys were not completed for this study.

Existing & Future No-Build Conditions

Site Conditions and Observation

Data Collection

Data was collected from numerous sources and site visits to evaluate study area roadways and intersections. Much of the data was supplied by the Iowa Department of Transportation (DOT). The collected data includes:

- Crash data (2014-2018) provided by Iowa DOT
- Geographic information systems (GIS) data
- Intersection turning movement counts (for the years 2016 and 2018) provided by Iowa DOT
- Traffic signal timings provided by the City of Des Moines
- Site conditions review completed in 2019

Pedestrian Observations

Pedestrian observations were conducted during AM and PM peak hours in May 2019 at various intersections within the study area where pedestrian safety issues and potential improvements could be identified. These locations are located primarily around schools, parks, and multi-family housing developments. Observations were collected at the following locations:

- Grand View University US 69 Pedestrian Crossing: Minimal number of students used the designated crosswalk. Instead, students crossed US 69 near Boyd Street.
- University Avenue – Hiatt Middle School: A significant number of pedestrians crossed at University Avenue during AM and PM peak hours. Students would occasionally use medians for refuge in order to cross US 69.
- Walker Street – East High School: Students were dropped off at “no drop off zones” along Southeast 14th Street causing queues during the AM peak hour.
- Grand Avenue, Capital Avenue, and Walnut Avenue – Capitol View Elementary: The presence of crossing guards at Grand Avenue increased pedestrian compliance, but mid-block crossing upstream and downstream of Grand Avenue was observed.
- Indianola Avenue and E Park Avenue – Weeks Middle School: Some students were dropped off in adjacent parking lots (i.e. Walgreens) and then crossed Indianola Avenue and/or E Park Avenue to Weeks Middle School.
- US 69 & Indianola Avenue – Weeks Middle School: Insufficient walk times were observed for pedestrians crossing US 69.
- Melbourne Way – Melbourne Apartment Complex: No crosswalk or signal is present at this location. During the observation period, residents crossed US 69 by seeking refuge at the raised median and continuing across when traffic cleared.

Environmental Conditions

Environmental constraints with the natural and human environment were identified through a series of desktop-level reviews of readily available data. The identification and review of these environmental constraints are shown in **Appendix A**. Project environmental constraints maps for the US 69 corridor are shown on multiple sheets from north to south.

Environmental and other related GIS data was collected from shapefiles available from Polk County, Iowa Department of Natural Resources, National Conservation Easement Database, Federal Emergency Management Agency, US Census Bureau, US Fish and Wildlife Service, National Wetlands Inventory, US Geological Survey, National Hydrography Dataset, and National Park Service. Municipal boundaries were acquired to identify the limits of Des Moines. Data acquired included shapefiles of the following:

- wetlands
- floodways
- floodplains
- former coal mines
- potential karst terrain
- conservation, recreation, and park area boundaries and trails
- stream lines
- leaking underground storage tank sites
- contaminated sites
- railroads
- levees
- police and fire stations
- demographic data (including percentage of minorities and low-income populations)
- schools and day care facilities

The National Park Service database of sites listed on the National Register of Historic Places was also reviewed. One historic cultural resource site is located adjacent to the corridor, shown on page 5 in **Appendix A**.

As recommendations from this study move into future phases, field studies will be needed to confirm the actual location of environmental constraints.

Traffic Operations Evaluation

Study area traffic operations were evaluated by analyzing existing (year 2018) and future no build (year 2050) conditions across 43 intersections along US 69, shown in **Figure 2**. The existing and future no-build operations evaluation is summarized in the following sections.

Traffic Volumes

Existing condition AM and PM peak hour volumes were developed for the US 69 corridor using existing turning movement volumes and AADT volumes that were obtained from the Iowa DOT turning movement ArcGIS portal.

Future condition AM and PM peak hour volumes were developed using daily traffic growth from the DMAMPO 2050 travel demand model. Future year forecasts were approved by Iowa DOT and vetted through DMAMPO in September 2020.

Existing and future volumes are shown in **Figure 2** and in **Appendix B**.

Analysis Methodology

Traffic analysis was completed with Synchro 10, a computerized analytical tool that utilizes deterministic relationships developed through past traffic flow research. Existing conditions analysis was completed for the AM and PM peak hours at study area intersections. Geometric conditions used in the analyses were based on aerial photography and field observations. Traffic signal timing information was based on timing plans provided by the City of Des Moines.

Performance Measure Criteria

This project's rating system evaluated traffic operations on a "good", "fair", "poor" rating scale for consistency. The project rating criteria are shown below:

- "Good" is LOS A and B
- "Fair" was LOS C and D
- "Poor" was LOS E and F

The following sections detail level-of-service criteria and summarize corridor operations.

Signalized Intersection Level of Service

Intersections where traffic is subject to control delay via a traffic signal are called "signalized". The control delay quantifies the increase in travel time due to traffic signal control. Signalized intersection delay thresholds and related performance criteria are shown in **Table 1**.

Table 1. Criteria for Signalized Intersection Traffic Operations

Rating	LOS	Control Delay (sec/veh[1])
GOOD	A	≤10
	B	>10-20
FAIR	C	>20-35
	D	>35-55
POOR	E	>55-80
	F	>80

Source: HCM 6th Edition.
[1] Seconds per vehicle.

Unsignalized Intersection Level of Service

Intersections where traffic is subject to control delay through yielding to other vehicles are called "unsignalized". Unsignalized intersection delay thresholds and related performance criteria are shown in **Table 2**.

Table 2. Criteria for Unsignalized Intersection Traffic Operations

Rating	LOS		Control Delay (sec/veh[2])
	Volume to Capacity ≤ 1.0	Volume to Capacity > 1.0 [1]	
GOOD	A	F	≤10
	B	F	>10-15
FAIR	C	F	>15-25
	D	F	>25-35
POOR	E	F	>35-50
	F	F	>50

Source: HCM 6th Edition.
[1] Any V/C ratio greater than 1.0 results in LOS F and a poor rating.
[2] Seconds per vehicle.

Existing and Future No-Build Conditions

Existing and future AM and PM peak hour volumes were analyzed to determine the current and future operations at intersections within the study area. The intersection operational results for existing and future conditions are shown in **Table 3**. Operational results are shown graphically in **Appendix B**.

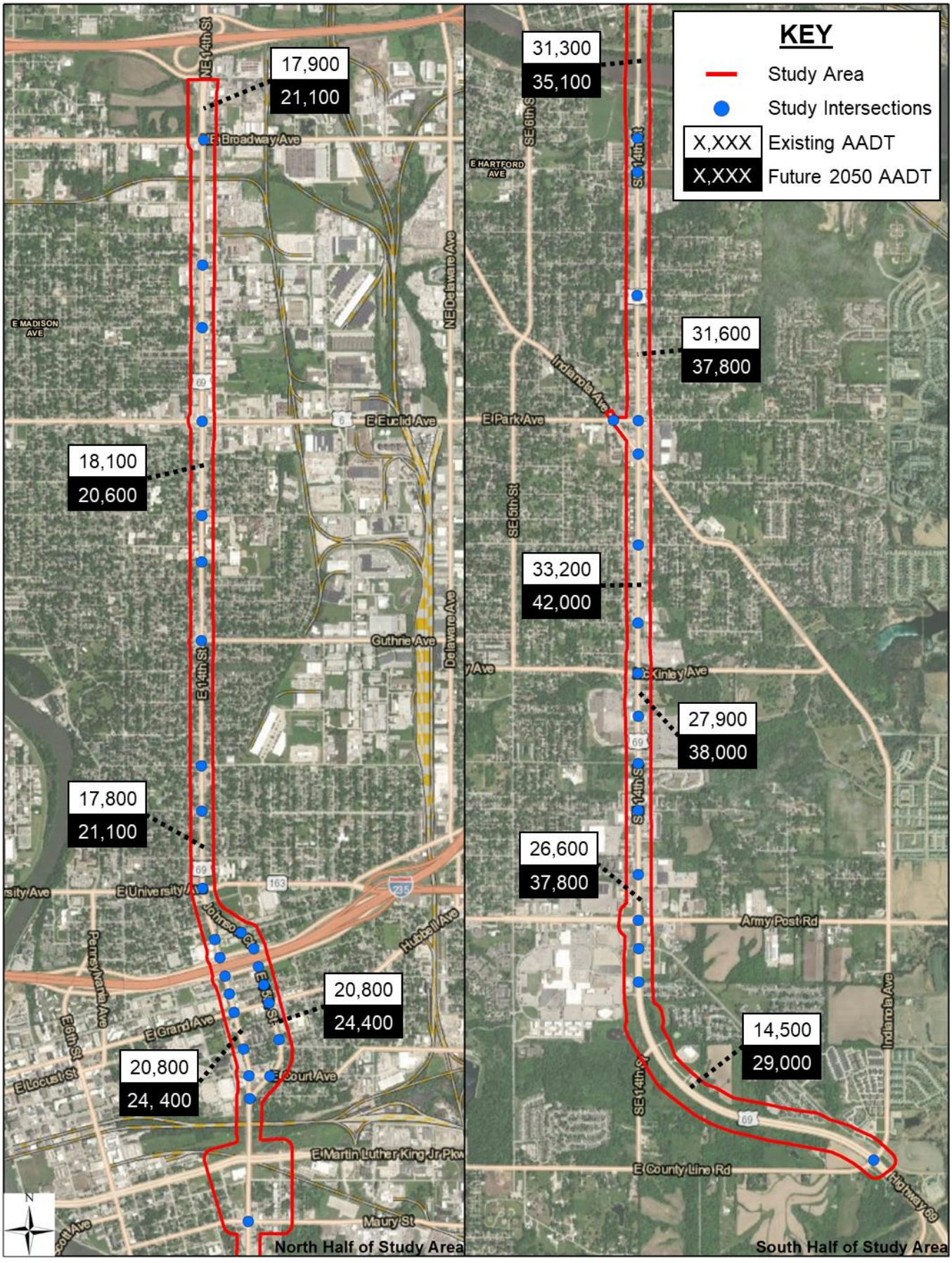


Figure 2. Study Area Limits, Intersections, and AADT

Existing Signalized Intersection Operational Results

The existing conditions intersection operational analysis indicates that all study area signalized intersections have good or fair ratings for the AM and PM peak hours. The highest delay intersections, which currently operate at LOS D, are:

- Maury Street during both the AM and PM peak hours
- University Avenue during the PM peak hour
- E Army Post Road during the PM peak hour

Future No-Build Signalized Intersection Operational Results

The future no-build condition intersection operational analysis indicates that nearly all signalized intersections will continue to have good or fair ratings during the AM and PM peak hours. The signalized intersections that are expected to operate worse than LOS D in the 2050 No-Build are:

- Maury Street (PM peak hour)
- E Army Post Road (PM peak hour)
- County Line Road (both AM and PM peak hours)

Existing and Future No-Build Unsignalized Intersection Operational Results

All unsignalized study intersections have an approach that operates at LOS F during at least one of the peak hours for the existing and future no-build conditions. Unsignalized intersections that were evaluated include:

- Des Moines Street / 14th Street
- Des Moines Street / 15th Street
- Edison Avenue
- Emma Avenue
- Kenyon Avenue
- Bloomfield Road

Operational deficiencies in 2050 are concentrated at Maury Street, E Army Post Road, and County Line Road due to heavy future year growth from the DMAMPO TDM in the southern half of the study area.

Table 3. Existing & Future No-Build Intersection Traffic Operations Results

Intersection	Existing (2018)		Future No-Build (2050)	
	Delay (sec/veh) / LOS [1]		Delay (sec/veh) / LOS [1]	
	AM Peak	PM Peak	AM Peak	PM Peak
Broadway Ave	25.8/C	30.9/C	30.5/C	28.8/C
Aurora Ave	12.6/B	8.3/A	10.4/B	13.4/B
Madison Ave	4.4/A	6.4/A	3.2/A	3.5/A
Euclid Ave	24.3/C	26.2/C	22.2/C	27.1/C
E Hull Ave	11.6/B	17.1/B	7.0/A	6.5/A
Morton Ave	2.6/A	8.6/A	2.5/A	6.4/A
Guthrie Ave	13.6/B	13.3/B	7.8/A	9.1/A
E Washington Ave	7.4/A	7.3/A	5.6/A	10.4/B
Cleveland Ave	5.7/A	6.5/A	3.6/A	5.4/A
University Ave	31.6/C	40.1/D	33.6/C	42.8/D
Walker St (14th St)	19.3/B	12.0/B	14.2/B	8.7/A
Walker St (15th St)	6.3/A	10.2/B	12.3/B	13.7/B
Maple St (14th St)	19.4/B	25.5/C	22.4/C	15.1/B
Maple St (15th St)	16.4/B	12.4/B	22.9/C	11.4/B
Lyon St (14th St)	21.2/C	21.7/C	23.4/C	24.2/C
Lyon St (15th St)	6.7/A	7.0/A	5.6/A	10.9/B
Grand Ave (14th St)	12.7/B	22.6/C	14.9/B	40.1/D
Grand Ave (15th St)	18.7/B	15.8/B	24.2/C	22.2/C
Walnut St (14th St)	5.5/A	5.1/A	9.1/A	13.3/B
Walnut St (15th St)	12.0/B	14.0/B	15.2/B	17.9/B
Court Ave (14th St)	10.0/B	15.0/B	9.2/A	23.5/C
Court Ave (15th St)	12.5/B	16.9/B	19.6/B	22.6/C
Maury St	39.7/D	41.2/D	54.9/D	60.3/E
Hartford Ave	23.9/C	19.6/B	18.5/B	45.8/D
Bell Ave	4.4/A	2.7/A	5.8/A	4.2/A
E Park Ave	30.0/C	28.4/C	34.0/C	27.8/C
Indianola Ave	32.3/C	31.6/C	31.6/C	39.2/D
Watrous Ave	13.7/B	18.7/B	18.7/B	20.5/C
McKinley Ave	10.0/B	14.6/B	15.1/B	22.4/C
Wal-Mart Entrance	7.1/A	19.6/B	6.8/A	21.5/C
Diehl Ave	8.0/A	7.8/A	7.6/A	7.2/A
Cummins Rd	2.1/A	10.7/B	2.1/A	9.5/A
E Army Post Rd	34.9/C	38.0/D	35.2/D	69.0/E
Southridge Mall Entrance	5.6/A	11.9/B	4.9/A	13.5/B
County Line Rd	22.5/C	17.1/B	178.2/F	136.4/F
Indianola Ave & E Park Ave	14.1/B	24.8/C	17.5/B	32.1/C

Source: Synchro 10 – HDR, November 2020.
[1] Results are based on the delay during the peak 15 minutes within the hour. Green highlighted cells indicate "good" operations, yellow highlighted cells indicate "fair" operations, and red highlighted cells indicate "poor" operations

Crash Evaluation

Traffic safety was evaluated for all study area segments and intersections. An existing conditions safety analysis was performed using recent historical crash data to determine locations that have high crashes.

Methodology

The existing conditions crash analysis included crash data for the five-year period from 2014-2018. Data was obtained from the State's ICAT. Segments were sectioned by comparable road features, such as median type, geometry, etc. Each segment and intersection were then graded based on the calculated crash rate and established project performance measures.

Performance Measure Criteria

Performance measure criteria were established to identify locations with a poor safety rating. The performance measure used was the calculated crash rate for each segment and intersection. This project's rating system evaluated traffic safety on a "good", "fair", "poor" rating scale for consistency.

Crash Rate Analysis - Arterial Segments

For segments, the middle of the "fair" category is based on the statewide crash average for Municipal US roads from 2012-2016. The "good" and "poor" thresholds are set to be within 15 percent from the average. **Table 4** details the criteria for each safety rating based on existing conditions for the following categories:

1) total crashes
2) fatal plus injury crashes

Table 4. Criteria for Total Crashes on Urban Arterial Segments

Rating	Crash Rate (Crashes per HMVMT)	
	Fatal + Injury Crash	All Crash
GOOD	< 66	< 218
FAIR	66 - 90	218 - 294
POOR	> 90	> 294

Crash Rate Analysis - Intersections

For intersections, the middle of the "fair" category is based on the statewide average for crash rates at municipal intersections with at least 25,000 daily entering vehicles. The "good" and "poor" thresholds are set with a 20 percent +/- range from the average.

The criteria for each safety rating based on existing conditions total crashes is provided in **Table 5**.

Table 5. Criteria for Total Crashes at Urban Intersections

Rating	Crash Rate (Crashes per MEV[1])
GOOD	< 0.8
FAIR	0.8 - 1.2
POOR	> 1.2

[1] Million Entering Vehicles

Existing Conditions

During the five-year crash analysis period, 3,224 study area crashes were reported, which resulted in:

- 3 fatal crashes (3 fatalities)
- 1,274 injury crashes (1,682 injuries)
- 1,947 property damage only (PDO) crashes.

A summary of the crash rates and the associated safety performance measures for study area segments and intersections is provided in **Table 6** and **Table 7**. Additionally, in-depth crash characteristics, including a crash heat map, can be found in **Appendix B**.

As shown in **Table 6**, the majority of arterial segments have crash rates that meet the "poor" criteria for both "fatal plus injury" and "all" crashes. The highest crash rates among arterial segments are Segments 4 and 5. Segment 10, the southern-most segment in the study area, received a "good" rating, which could be due to its divided median and relatively low traffic volumes.

Table 6. Existing Crash Rates for Segments

Segment	Crash Rate (Crashes/HMVMT)[1]	
	Fatal + Injury Crashes	All Crashes
1 - North Terminus to Ovid Ave	272	738
2 - Ovid Ave to Alpha Ave	224	611
3 - Alpha Ave to Fremont St	392	907
4 - 14th St: SB One-Way	532	1451
5 - 15th St: NB One-Way	448	1176
6 - Johnson Ct to Granger Ave	220	585
7 - Granger Ave to Glenwood Dr	152	350
8 - Glenwood Dr to McKinley Ave	272	713
9 - McKinley Ave to Southridge Mall	353	769
10 - Southridge Mall to South Terminus	57	178

Source: Crash Analysis - HDR, September 2019. Crashes from 2014-2018.
[1] Green highlighted cells indicate crash rates meeting the "good" criteria, yellow highlighted cells indicate crash rates meeting the "fair" criteria, and red highlighted cells indicate crash rates meeting the "poor" criteria.

As shown in **Table 7**, all intersections have a crash rate in the "good" criteria range for crashes that resulted in injuries or fatalities. The inclusion of PDO crashes significantly raises the crash rate of nearly half of the intersections and lowers the rating from "good" to "fair" or "poor". The intersections included on the current Top 200 SICL list fall into the "fair to poor" range. There are several intersections within the study area with ratings that fall within the "poor" category that are not included on the SICL report.

The following types of crashes represent 94 percent of all crashes within the study area:

- Rear end (42%)
- Broadside (20%)
- Sideswipe, same direction (16%)
- Angle, oncoming left turn (9%)
- Non-collision crashes (7%)

The number of broadside and angle crashes, which have a propensity to result in more severe crashes, may be related to signal timing clearance deficiencies or areas that lack access control.

NON-MOTORIST CRASH EVALUATION

During the five-year period between 2014-2018, a total of 75 non-motorist crashes were reported, which resulted in:

- 43 injury crashes
- 29 possible or unknown injury crashes
- 3 property damage only crashes

Most non-motorist crashes, nearly 71 percent, occurred at intersections. Of the intersection crashes, 52 occurred at the main intersections within the study area. Euclid Ave had the highest number of non-motorist crashes with eight. A summary of the non-motorist crashes rates for the study area is provided in **Appendix B**.

Existing intersection crash rates, combined with a detailed review of crash types at study area intersections, were used to develop intersection alternatives to improve safety. IHSDM was used to test the potential crash reduction of intersection alternatives.

Table 7. Existing Crash Rates for Intersections

Intersection	Crash Rate (Crashes/MEV)[1]		SICL Top 200
	Fatal + Injury Crashes	All Crashes	
Broadway Ave	0.11	0.45	*NR*
Aurora Ave	0.09	0.27	*NR*
Madison Ave	0.49	1.04	*NR*
Euclid Ave	0.62	1.62	**#10**
E Hull Ave	0.21	0.48	*NR*
Morton Ave	0.03	0.31	*NR*
Guthrie Ave	0.28	0.66	*NR*
E Washington Ave	0.47	0.93	*NR*
Cleveland Ave	0.66	1.18	*NR*
University Ave	0.61	1.48	**#79**
Walker St (14th St)	0.22	0.55	*NR*
Walker St (15th St)	0.16	0.51	*NR*
Maple St (14th St)	0.56	1.62	*NR*
Maple St (15th St)	0.57	1.21	*NR*
Lyon St (14th St)	0.58	1.4	*NR*
Lyon St (15th St)	0.25	0.72	*NR*
Des Moines St (14th St)	0.28	1.17	*NR*
Des Moines St (15th St)	0.48	1.54	**#45**
Grand Ave (14th St)	0.41	1.12	**#143**
Grand Ave (15th St)	0.49	1.25	**#16**
Walnut St (14th St)	0.23	0.72	*NR*
Walnut St (15th St)	0.39	1.08	*NR*
Court Ave (14th St)	0.29	0.76	*NR*
Court Ave (15th St)	0.23	0.5	*NR*
Johnson Ct (U-turn)	0.03	0.11	*NR*
Maury St	0.60	1.55	**#26**
Edison Ave	0.10	0.26	*NR*
Hartford Ave	0.56	1.04	**#72**
Bell Ave	0.13	0.36	*NR*
E Park Ave	0.66	1.89	**#38**
Indianola Ave	0.43	1.06	**#22**
Watrous Ave	0.33	1.01	**#76**
Emma Ave	0.00	0.05	*NR*
McKinley Ave	0.42	0.68	*NR*
Wal-Mart Entrance	0.11	0.28	*NR*
Kenyon Ave	0.10	0.33	*NR*
Diehl Ave	0.31	0.72	*NR*
Cummins Rd	0.22	0.43	*NR*
E Army Post Rd	0.69	1.71	*NR*
Bloomfield Rd	0.70	1.09	*NR*
Southridge Mall Entrance	0.04	0.11	*NR*
County Line Rd	0.24	0.56	*NR*
Indianola Ave & E Park Ave	0.48	0.88	*NR*

Source: Crash Analysis - HDR, September 2019. Crashes from 2014-2018.
[1] Green highlighted cells indicate crash rates meeting the "good" criteria, yellow highlighted cells indicate crash rates meeting the "fair" criteria, and red highlighted cells indicate crash rates meeting the "poor" criteria.

Reliability Evaluation

The travel time reliability analysis on this project was a subcomponent of the overall traffic and safety study. The goal of this analysis was to identify challenges to travel that may result from the following:

- Seasonal and special event peaks in traffic volumes
- Crashes
- Non-crash incidents
- Work zones / general maintenance activity
- Adverse weather

Methodology

The limits for the US 69 travel time reliability analysis are from the I-80 eastbound ramps on the north end to Indianola Avenue/County Line Road on the south. The following data was used for the analysis:

- Travel Times
  - Source: INRIX travel time data (2018) was pulled for the 12 segments that represent the study area limits.
  - 95th percentile and 50th percentile travel times were calculated for each day. The hourly average travel time for each day between 5:00 PM and 6:00 PM was compared to determine 50th and 95th percentiles.
  - Travel times were calculated for percentiles by added the travel time for each INRIX segment for each respective time period (15-minute bins for 1 hour). Percentiles are calculated from the distribution across 2018.
- Weather Data
  - Source: National Oceanic and Atmospheric Administration, National Centers for Environment Information, Climate Data Online.
  - Rain and snow events were pulled from the Des Moines International Airport weather station for each day in 2018.
- Crash Data
  - Source: Iowa Crash Analysis Tool
  - Crash events (all severities) were pulled for each day in 2018 and tied to their nearest INRIX segment. The crash dataset was filtered to include crashes that occurred on US 69 or within an intersection of an east-west cross street. Crashes that occurred on an east-west cross street outside of an intersection were removed from the dataset.

Existing Conditions

The team first looked at overall travel times for the US 69 corridor throughout 2018. INRIX travel times were analyzed and plotted for the time frame of 5:00-6:00 PM for 2018. Travel times in this corridor (northbound and southbound) exhibit a wide variability, ranging between:

- Minimum Travel Time: 18.2-minute travel time
- 99th Percentile: 28.6-minute travel time

The 50th and 95th percentile travel times are as follows:

- Northbound Travel Times
  - 50th Percentile: 21.7-minute travel time
  - 95th Percentile: 25.6-minute travel time
- Southbound Travel Times
  - 50th Percentile: 21.4-minute travel time
  - 95th Percentile: 26.1-minute travel time

The 95th percentile travel times in the US 69 corridor have an approximate increase of 4 to 5 minutes of travel time when compared to the 50th percentile. The southbound travel times have a more severe peak from the 50th percentile to the 95th percentile. This indicates there may be more congestion, potential signal timing issues, or a more pronounced peak in this travel direction.

It is also important to note that the northbound travel distance on US 69 is slightly longer than the southbound travel distance (due to the one-way pair near I-235). However, southbound travel is experiencing more severe delay and worse travel times on some of its worst days compared to northbound travel.

A more in-depth discussion about reliability along the US 69 corridor is provided in **Appendix B**.

Alternatives Analysis

Design Criteria

The following design criteria was used to develop schematic and conceptual level alternatives along US 69. The preferred design criteria was used where practical, with acceptable design criteria used to avoid or minimize impacts to identified project constraints. The following sources were used to establish design criteria:

- Iowa DOT Design Manual (2019 Edition): https://iowadot.gov/design/Design-manual
- Iowa SUDAS Design Manual (2020 Edition): https://intrans.iastate.edu/app/uploads/sites/15/2020/03/5C-1.pdf

Design criteria for the various urban and rural roadway sections and proposed shared use path sections along US 69 are provided in **Appendix C**.

Performance Measures

Five performance measures were established during the location study to evaluate proposed build alternatives. The five performance measures were analyzed for the no-build and proposed build conditions.

- Traffic Operations: Use the HCM 6 methodologies to perform vehicular level-of-service analysis for the AM and PM peak hours (one hour in the morning and one hour in the afternoon).
- Safety: Complete crash prediction analysis using FHWA's IHSDM to evaluate crash prediction using default safety performance function values for crash trends based on geometry and traffic demand.
- Bicycle Level of Traffic Stress: Complete bicycle LTS analysis based on methodology from the Mineta Transportation Institute Report II-19: Low-Stress Bicycling and Network Connectivity (2012).
- Right-of-Way Impacts: Document the number of property impacts, the number of relocations, and the total amount of needed public right-of-way.
- Conceptual Level Construction Cost Estimates: Document the conceptual level construction cost estimate.

See FHWA's website for more information on IHSDM:

highways.dot.gov/research/safety/interactive-highway-safety-design-model/interactive-highway-safety-design-model-ihsdm-overview

Developed Alternatives

The following sections include intersection and corridor alternatives that are recommended along US 69. Specific intersection-level detail for study area intersections where proposed build alternatives were developed can be found in **Appendix D**.

Intersection Treatments

The following general intersection treatment alternatives are provided on the following pages:

- Left turn and right turn lanes
- Positive left turn offsets
- Displaced left turn intersections
- Median U-turn intersections
- Restricted left turn movements
- Protected only left turn phasing
- Prohibited right-turn-on-red and left-turn-on-red movements
- Roundabouts

Corridor Treatments

The following corridor treatment alternatives are provided on the following project pages:

- Access control: medians
- Access control: ¾ access and RIRO
- Converting outside lanes to right turn only lanes
- Adaptive signal control
- City of Des Moines Project Considerations
- Bicycle and pedestrian alternatives

E MLK Parkway Connectivity Alternatives

A more detailed review of the connection between US 69 and E MLK Parkway was performed. The following connectivity alternatives are provided on the following project pages:

- Quadrant intersection
- Offset "T" intersection
- Low speed interchange

Intersection Treatment: Left Turn and Right Turn Lanes

Description
Dedicated left and right turn lanes provide an exclusive lane for turning vehicles to make a left turn or right turn without interrupting the flow of through traffic at intersections.

Location
Improvement locations are shown in **Figure 3** and are listed below:

- Madison Avenue (northbound, southbound left turn lanes)
- Maury Street (eastbound, westbound right turn lanes)
- Hartford Avenue (northbound, southbound, eastbound right turn lanes)
  - E Army Post Road (westbound, northbound right turn lanes) - *see "Iowa DOT's ICE Process" discussion below*
- County Line Road (northbound, eastbound right turn lanes; dual westbound left turn lanes, northbound left turn lanes)

Schematic alternatives for additional turn lanes are shown in **Figure 4** and **Figure 5** for Maury Street and E Army Post Road, respectively.

Benefits

Traffic Operations
Adding left turns or right turns at the proposed locations improves the overall level-of-service at study area intersections. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

Safety
The addition of left and right turn lanes can improve safety at intersections by providing exclusive lanes for vehicles to decelerate and turn on uncontrolled approaches. Left and right turn lanes can also be designed to store queued vehicles on controlled approaches. This removes the turning vehicle from the traffic stream, which can reduce the number of rear-end collisions at the intersection. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

Iowa DOT's ICE Process

Iowa DOT recently developed an Intersection Control Evaluation Manual. ICE is a data-driven, performance-based framework and approach used to objectively screen alternatives and identify an optimal geometric and control solution for an intersection. This data-driven process was performed at select locations along US 69 including the intersection of US 69 and E Army Post Road. The ICE process resulted in the recommendation of traditional intersection improvements shown in Figure 5. Additional analysis and forms following Iowa DOT's ICE process are included in Appendix E.

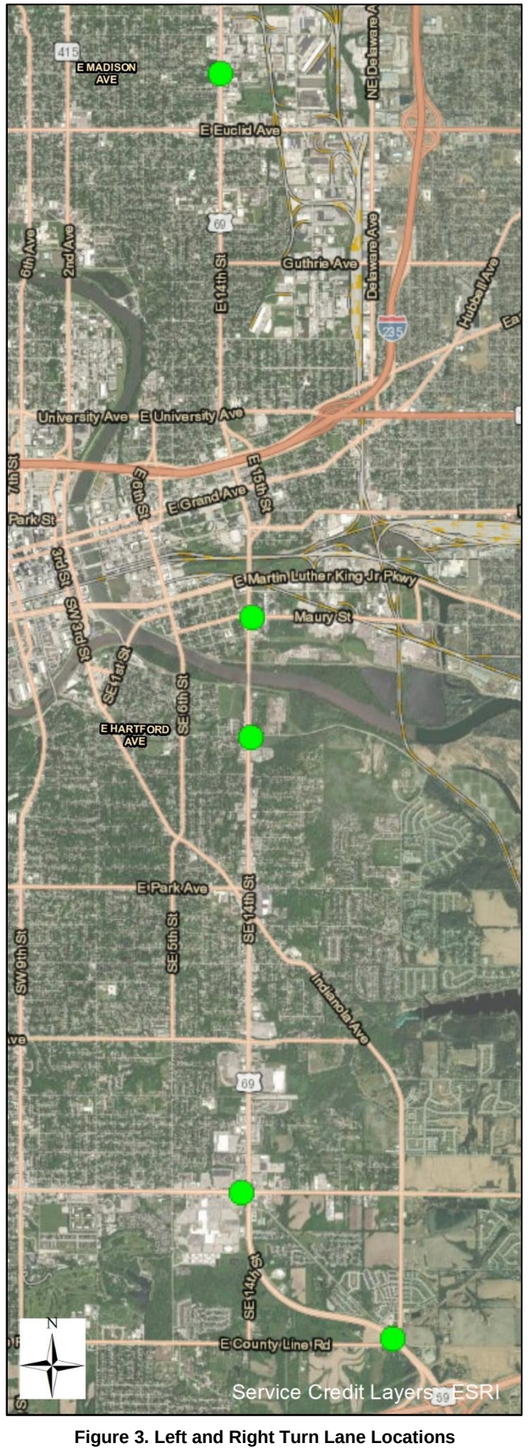


Figure 3. Left and Right Turn Lane Locations

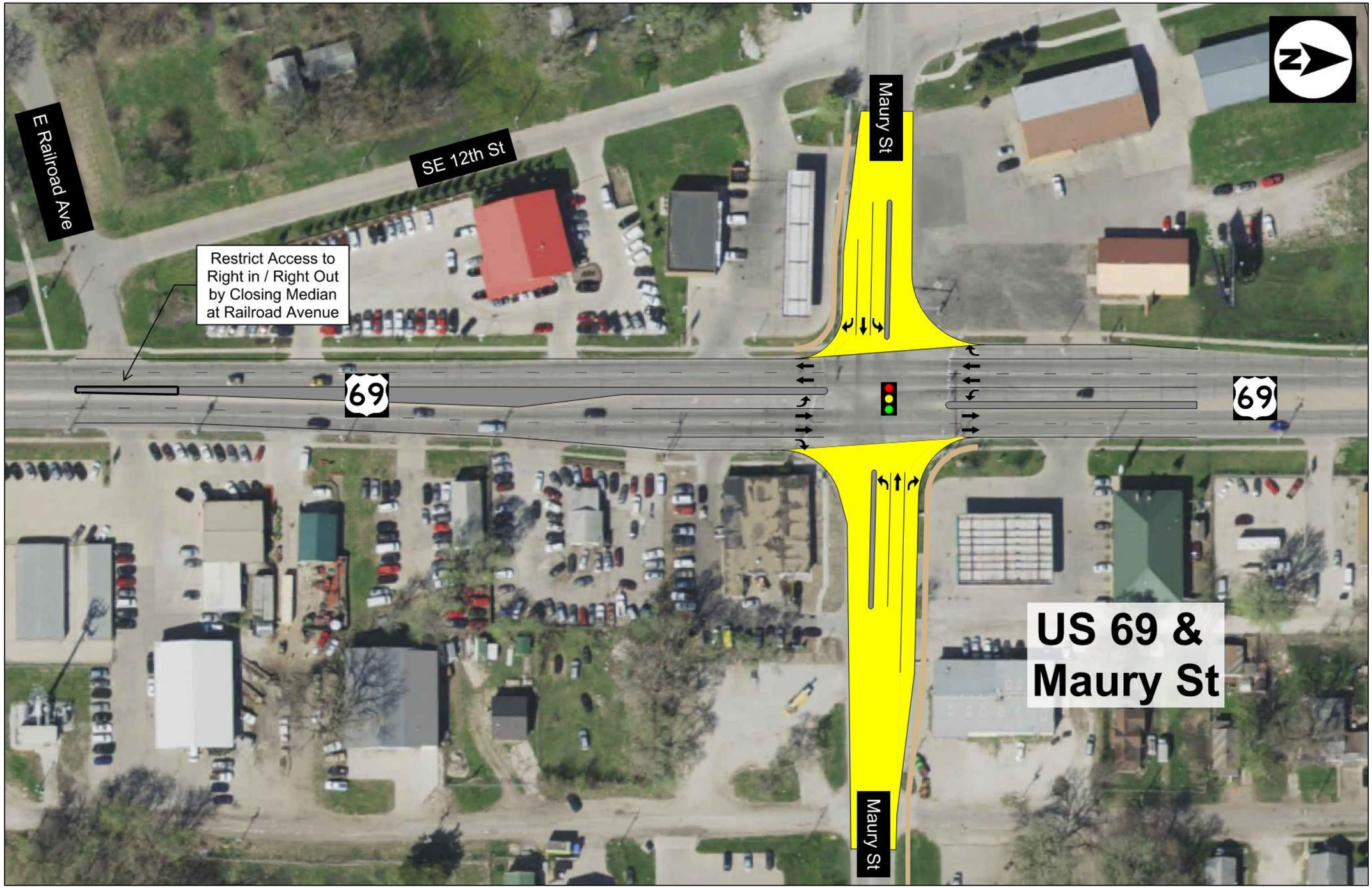


Figure 4. US 69 & Maury Street Schematic Alternative (Additional Turn Lanes)

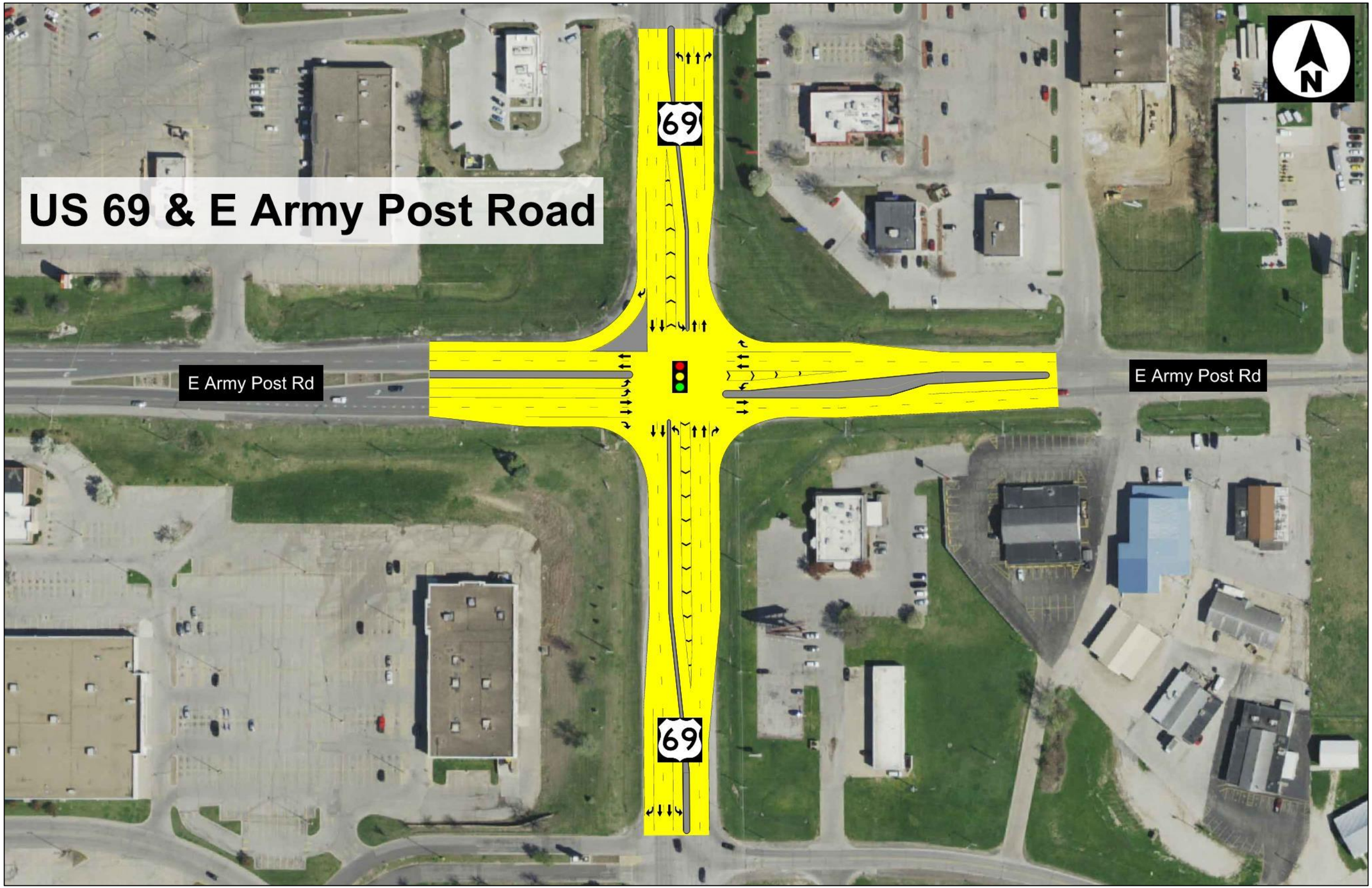


Figure 5. US 69 & E Army Post Road Schematic Alternative (Additional Turn Lanes and Positive Left Turn Offsets)

Intersection Treatment: Positive Left Turn Offsets

Description
Positive left turn offsets are where left-turn lanes are shifted to the left to enhance sight distance for opposing left-turn drivers. This shift improves a driver's ability to identify acceptable gaps at locations that have permitted left turn phasing. An example of left turn offset types is shown in **Figure 6**. A schematic alternative for positive left turn offsets is shown previously in **Figure 5** for E Army Post Road.

Location
Improvement locations are shown in **Figure 7** and are listed below:

- Euclid Avenue
- E Army Post Road

Benefits

Traffic Operations

Operational benefits can vary for positive left turn offsets. In locations where left turn phasing is currently permitted-protected, there is no operational benefit that can be quantified in Synchro. In locations where left turn phasing is currently protected only due to sight distance limitations, positive left turn offsets can provide the opportunity to modify signal phasing to permitted-protected phasing. This improves the overall level-of-service by shifting green time from left turns to other movements that are over capacity. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

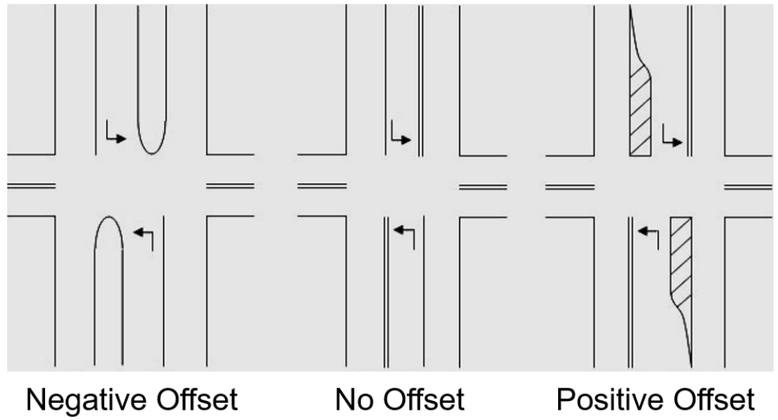


Figure 6. Positive Offset Example
Source: FHWA

Safety

Positive left turn offset improves sight distance for left-turning vehicles yielding to opposing through vehicles. The positive left turn offset places opposing left-turning vehicles further away from adjacent through lanes allowing drivers to see opposing through vehicles without their sightline being blocked by the opposing left-turning vehicle. This treatment has been shown to reduce left-turning angle crashes. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

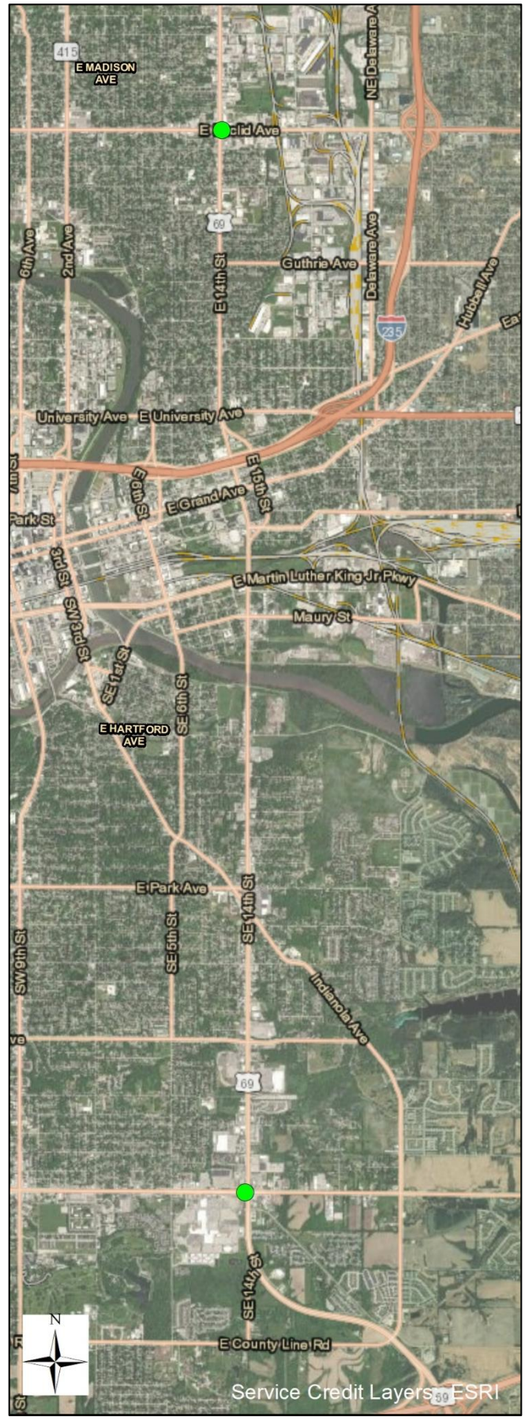


Figure 7. Positive Left Turn Offset Locations

Intersection Treatment: Displaced Left Turn Intersections

Description
A DLT intersection relocates traffic that would normally turn left at the main intersection to the other side of the opposing travel lanes. These movements travel parallel to the opposing lanes and complete the left-turn movement simultaneously with the through movements, eliminating the left-turn phase for the approach at the main intersection. An example of a DLT intersection is shown in **Figure 8**.

Location
Improvement locations are shown in **Figure 9** and are listed below. Schematic alternatives for DLT intersections were developed at both improvement locations:

- E Park Avenue (**Figure 10**)
- E Army Post Road: (**Figure 11** and **Figure 12**)

Both improvement locations identified have high historic crash rates that are above statewide averages.

Benefits

Traffic Operations
A DLT intersection improves traffic operations by reducing the number of signal phases at the main intersection. Referring to the example in **Figure 8**, eastbound and westbound through and left turn traffic can run concurrently, which increases the overall capacity of the intersection. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

Safety
The DLT intersection has fewer conflict points than a standard four-leg intersection, which may lead to fewer opportunities for multi-vehicle crashes. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

Other Considerations
Enforcement is a main consideration for an alternative that restricting left turn movements and re-routes users to a new intersection. Special consideration should be given to geometric improvements that reduce the potential for illegal left turns in the build condition.

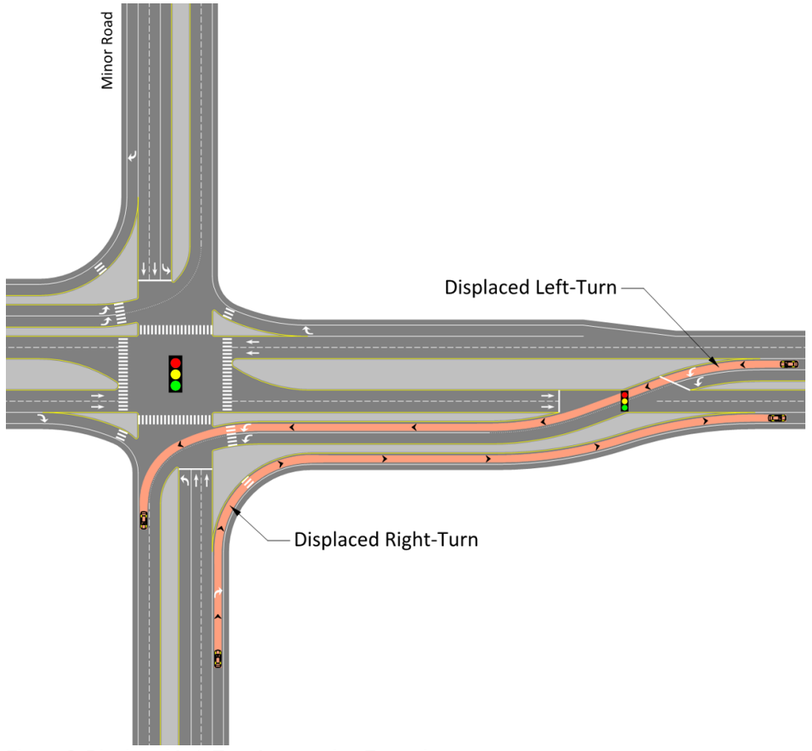


Figure 8. Displaced Left Turn Intersection Example
Source: Iowa DOT Intersection Control Evaluation

Iowa DOT's ICE Process

Iowa DOT recently developed an ICE Manual. ICE is a data-driven, performance-based framework and approach used to objectively screen alternatives and identify an optimal geometric and control solution for an intersection. This data-driven process was performed at select locations along US 69 including the intersection of US 69 and E Army Post Road. The ICE process resulted in the development of a hybrid Displaced Left Turn / Median U-Turn alternative shown in Figure 13. Additional analysis and forms following Iowa DOT's ICE process are included in Appendix E.

Figure 9. Displaced Left Turn Intersection Locations

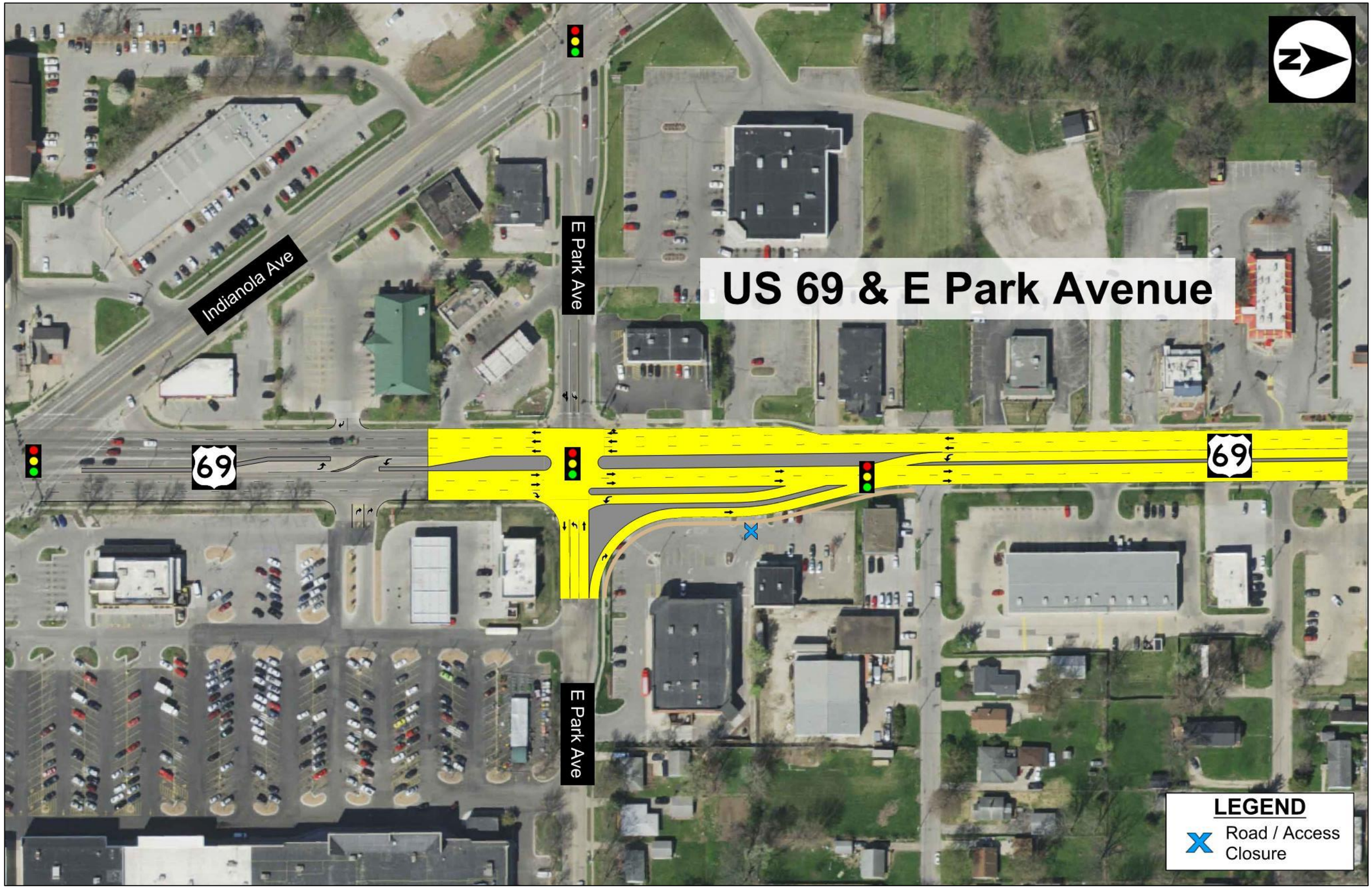


Figure 10. US 69 & E Park Avenue Schematic Alternative (DLT Intersection)

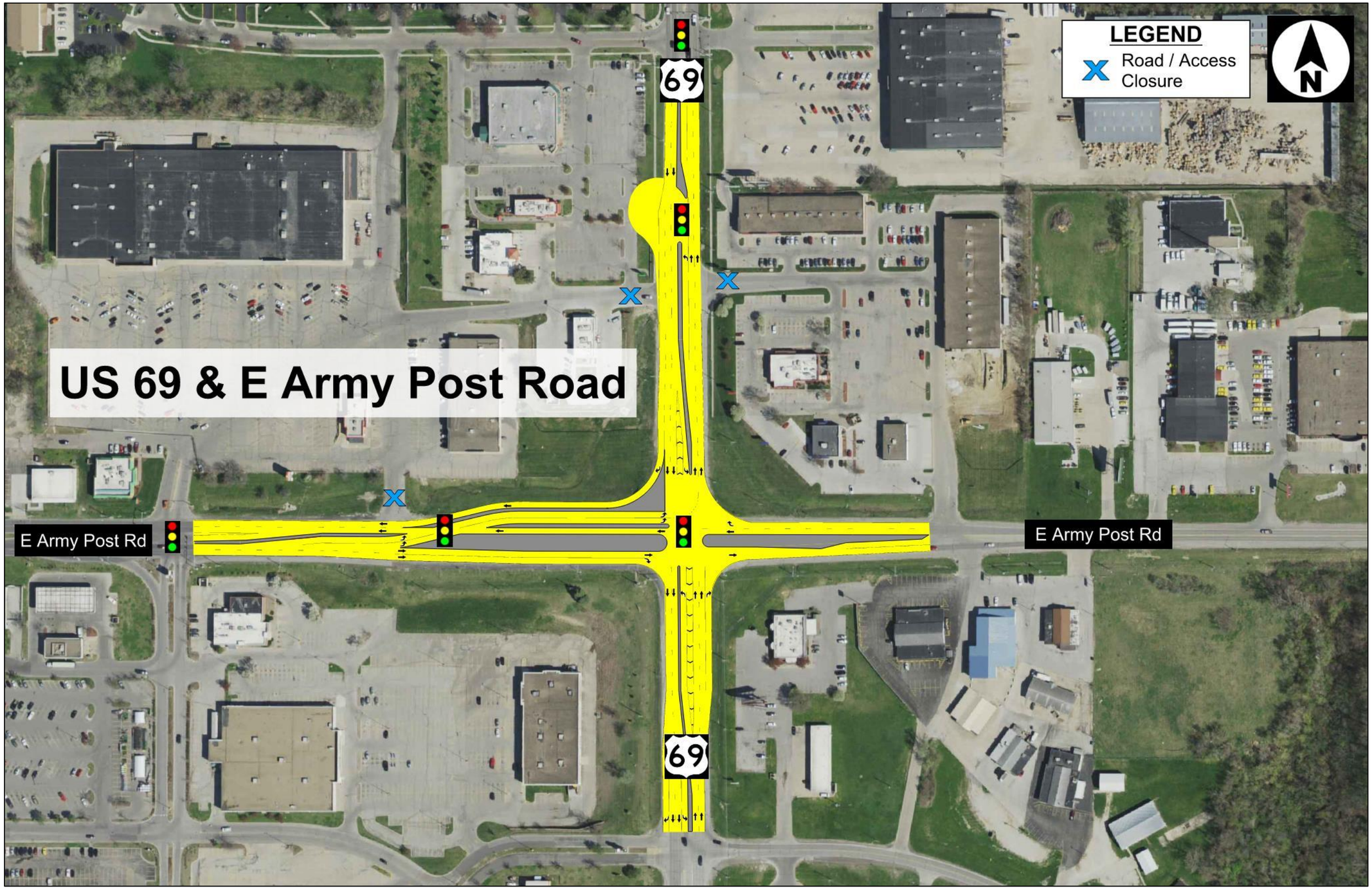


Figure 11. US 69 & E Army Post Road Schematic Alternative (DLT Intersection with MUT on North Leg)

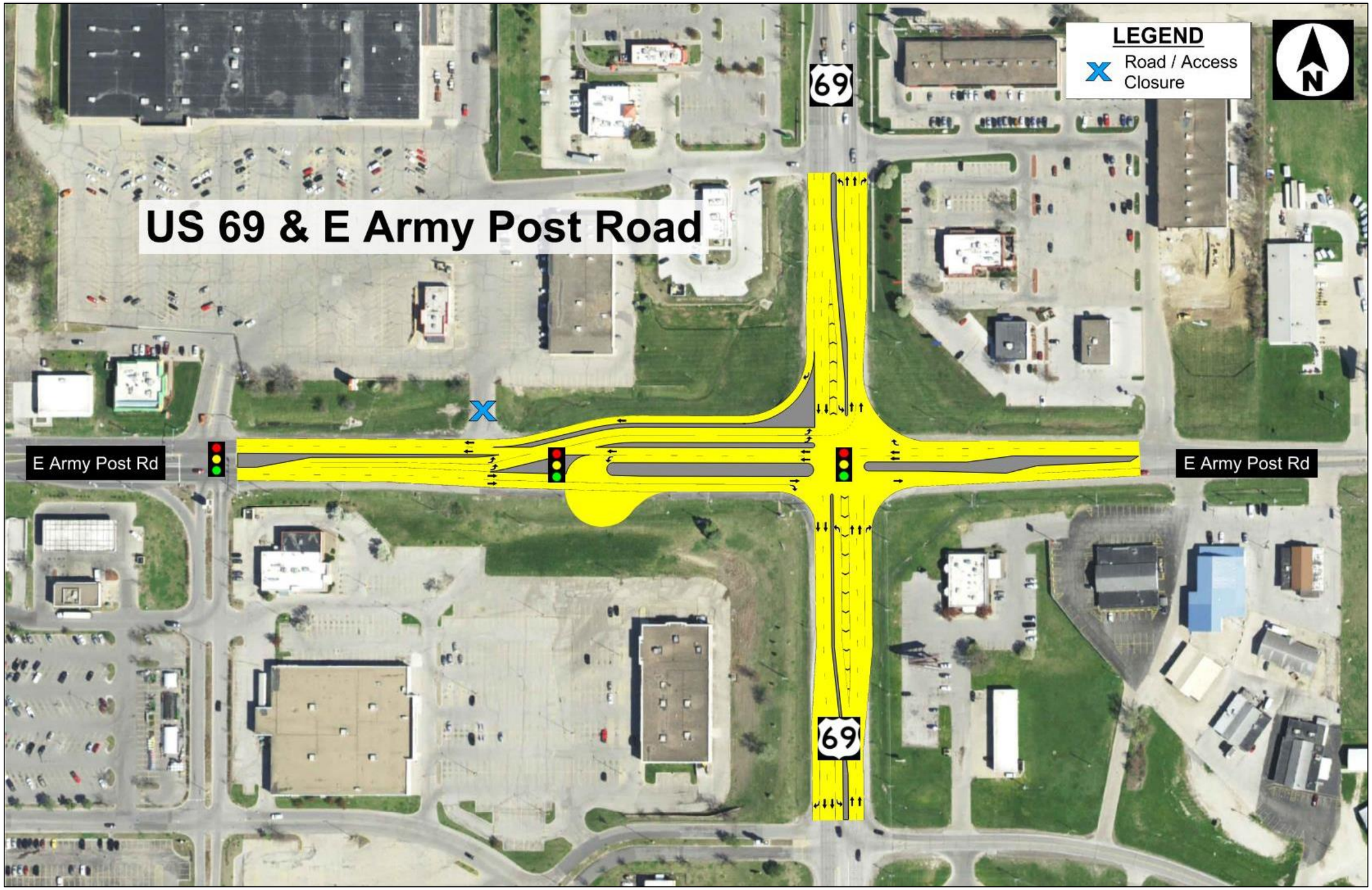


Figure 12. US 69 & E Army Post Road Schematic Alternative (DLT Intersection with MUT on West Leg)

Intersection Treatment: Median U-Turn Intersections

Description
A MUT is an intersection treatment that eliminates direct left-turns at signalized intersections from major and minor approaches and replaces them with U-turns on the major or minor road. Hybrid schematic alternatives, which combine MUT intersection treatments with other intersection treatments, are shown previously in **Figure 11** and **Figure 12** at E Army Post Road.

Location
One improvement location at E Army Post Road is shown in **Figure 14**. A schematic alternative at this location is shown in **Figure 15**.

Benefits

Traffic Operations
A MUT intersection improves traffic operations by reducing the number of signal phases at the main intersection through the removal of left turns. A MUT intersection can result in shorter cycle lengths along a corridor, which can result in more flexibility for traffic signal progression. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

Safety
The MUT intersection has fewer conflict points than a standard four-leg intersection, which may lead to fewer opportunities for multi-vehicle crashes. The MUT provides more flexibility for traffic signal progression, potentially reducing chances for rear-end collisions. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

Other Considerations
Enforcement is a main consideration for an alternative that restricting left turn movements and re-routes users to a new intersection. Special consideration should be given to geometric improvements that reduce the potential for illegal left turns in the build condition.

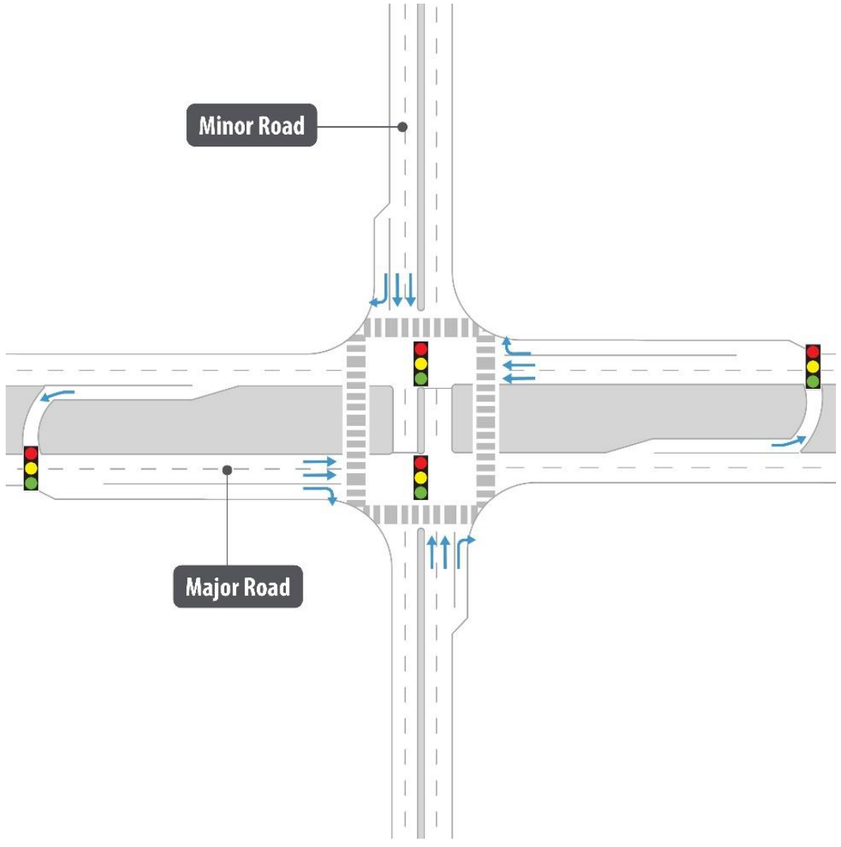


Figure 13. Median U-Turn Intersection Example
Source: Iowa DOT Intersection Control Evaluation

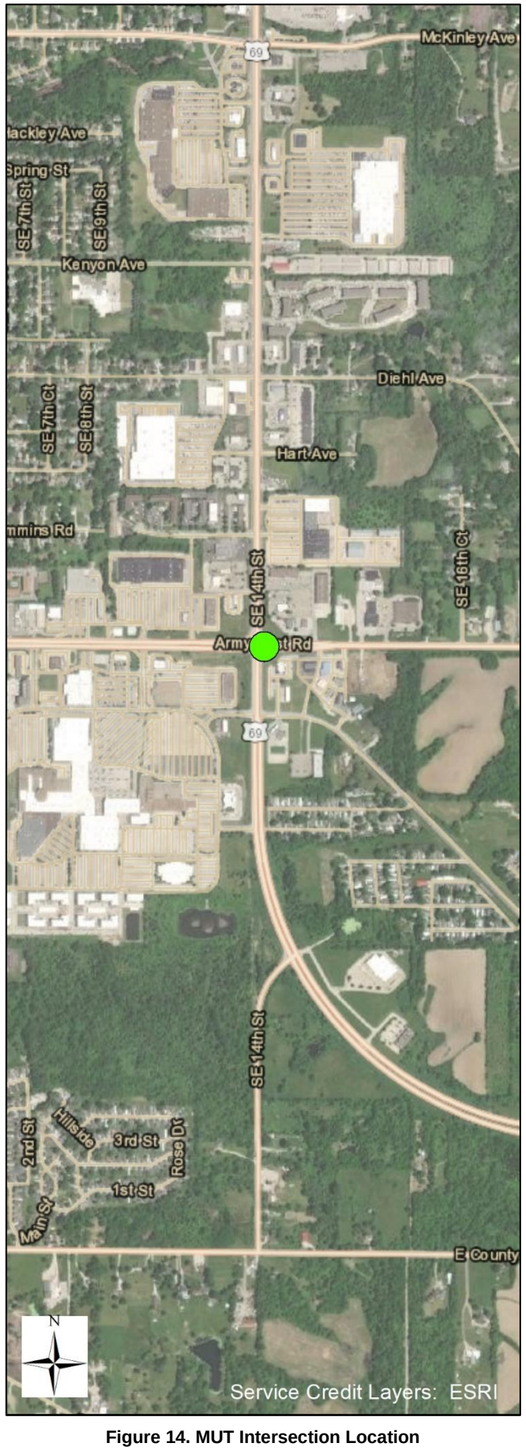


Figure 14. MUT Intersection Location

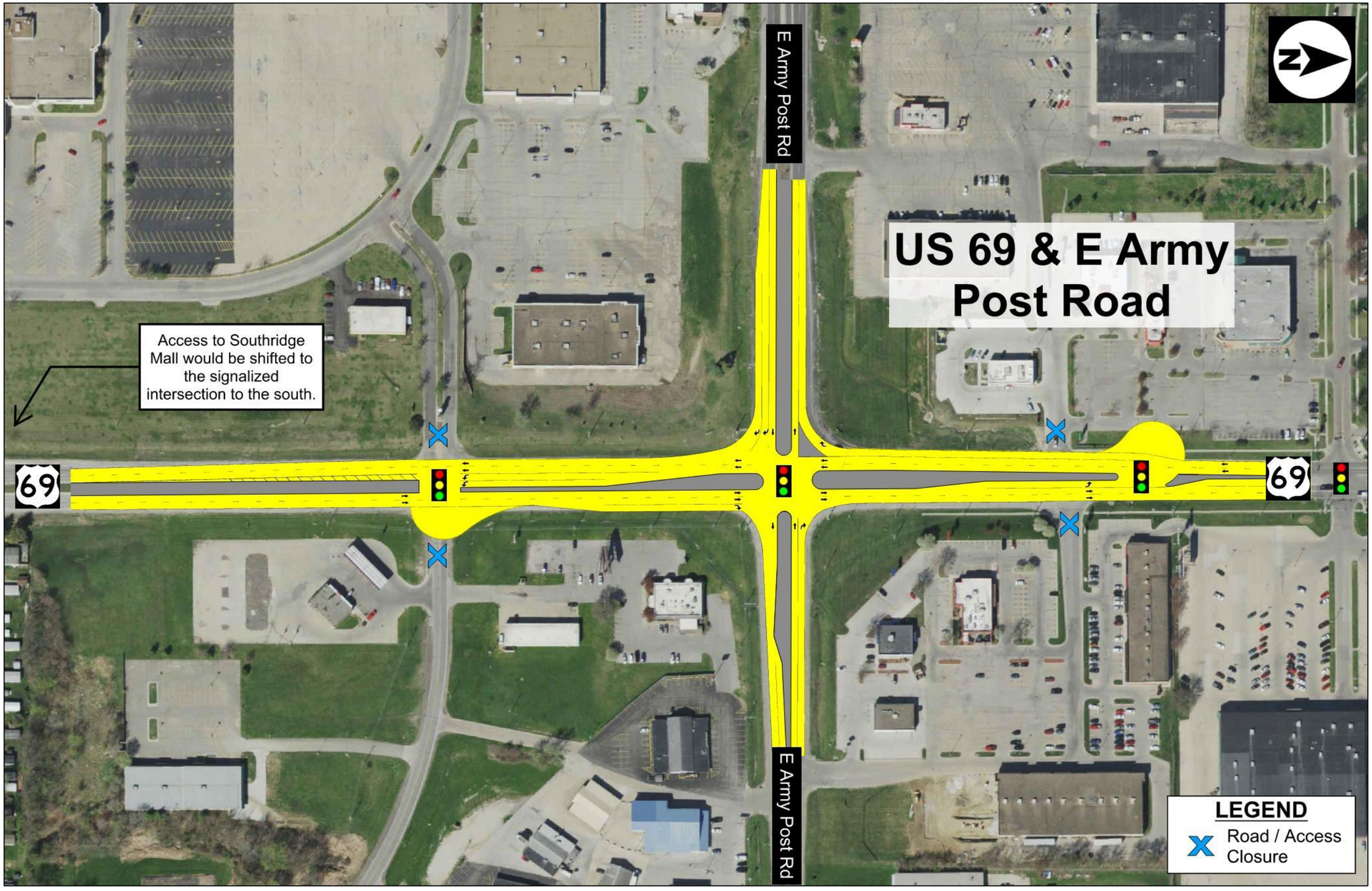


Figure 15. US 69 & E Army Post Road Schematic Alternative (MUT Intersection)

Intersection Treatment: Restricted Left Turn Movements

Description
Restricted left turn movements are intersection treatments that utilize roadway signing and striping to prohibit left turns at an intersection to improve safety and operations, shown in **Figure 16**. Restrictions can be used at low volume left turn locations where motorists can easily find an alternative route or at high volume locations where safety is a concern.

Figure 16. No Left Turn Sign
Source: MUTCD

Location
Improvement locations are shown in **Figure 17** and are listed below:

- US 69 & E Park Avenue (northbound, southbound)
- US 69 & Indianola Avenue (north-westbound, south-eastbound)
- Indianola Avenue & E Park Avenue (westbound)

Benefits

Traffic Operations
Restricting left turn movements at an intersection improves traffic operations by reducing the number of signal phases. Traffic operations at adjacent intersections can worsen due to left turn traffic re-routing to adjacent intersections. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

Safety
Restricting left-turn movements at an intersection removes opportunities for left-turning angle collisions to occur involving the left turn that is prohibited. The restriction may also mitigate rear-end collisions at locations where there is not an exclusive left-turn lane. This strategy is most effective at locations where left-turning vehicles yield to opposing through traffic as well as locations where dedicated left-turn lanes are not provided. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

Other Considerations
Wayfinding and enforcement are two project considerations when restricting left turn movements at any intersection. Special consideration should be given to geometric improvements that reduce the potential for illegal left turns in the build condition.

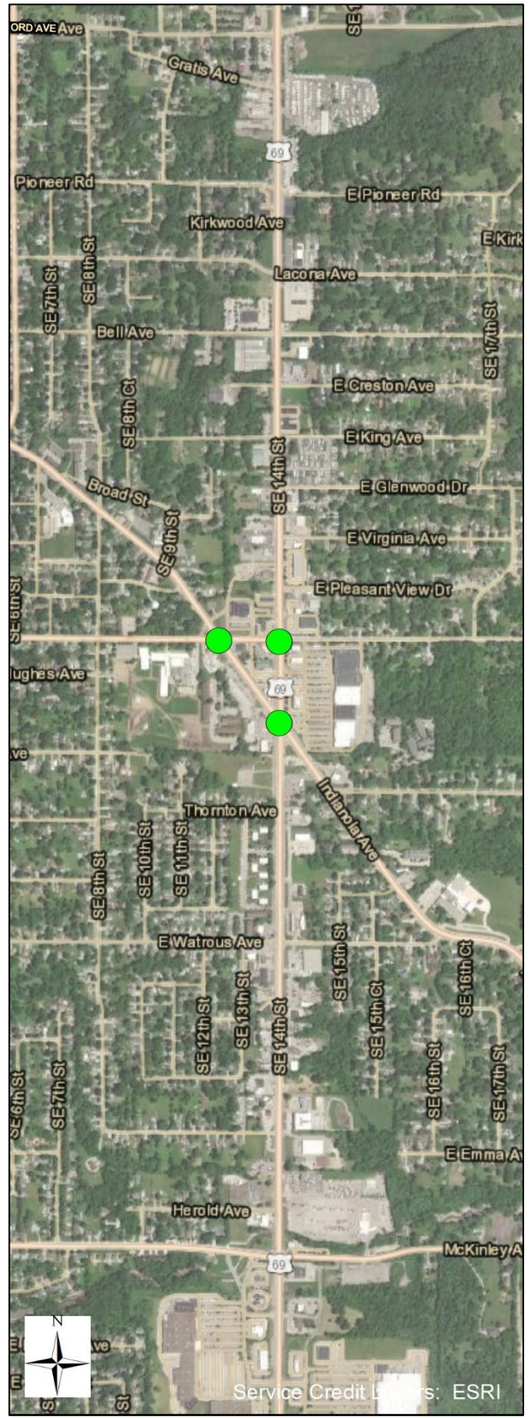


Figure 17. Restricted Left Turn Movement Locations

Intersection Treatment: Protected Only Left Turn Phasing

Description
Protected only left turn phasing is an intersection treatment that modifies left turn phasing from permitted only (green ball or flashing yellow arrow) or permitted-protected to protected only, shown in **Figure 18**. This intersection treatment requires a new left turn signal face and modified signal timings.

Location
Improvement locations are shown in **Figure 19** and are listed below:

- Euclid Avenue
- Hartford Avenue
- Watrous Avenue

Benefits

Traffic Operations
Modifying left turn phasing to protected only phasing is primarily a safety strategy discussed in the following section. Protected only phasing requires more green time for left turns, which reduces the amount of green time for the remaining movements at an intersection. Typically, overall intersection level-of-service at an intersection will worsen by one letter grade. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

Safety
Converting permissive and permitted-protected left turns to protected-only movements reduces the opportunity for left-turning angle crashes, especially at locations with limited sight distance. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

Other Considerations
At intersection locations on US 69 where protected-permissive lefts will remain in place, the study team recommends that flashing yellow arrow signal heads replace the current protected-permissive signal heads, shown in **Figure 18**.

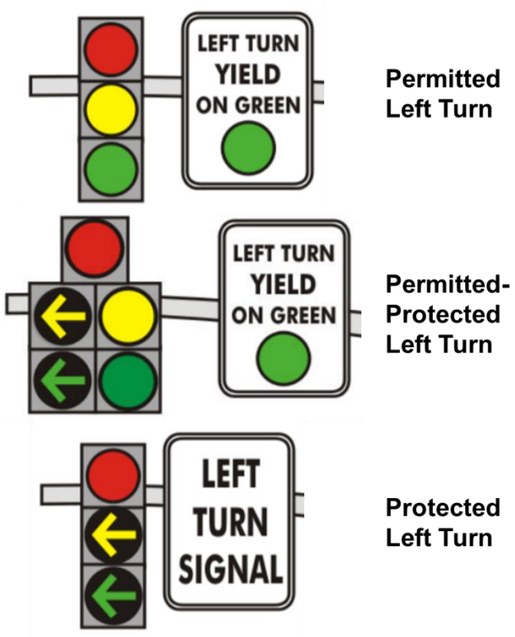


Figure 18. Left Turn Phasing Types
Source: FHWA

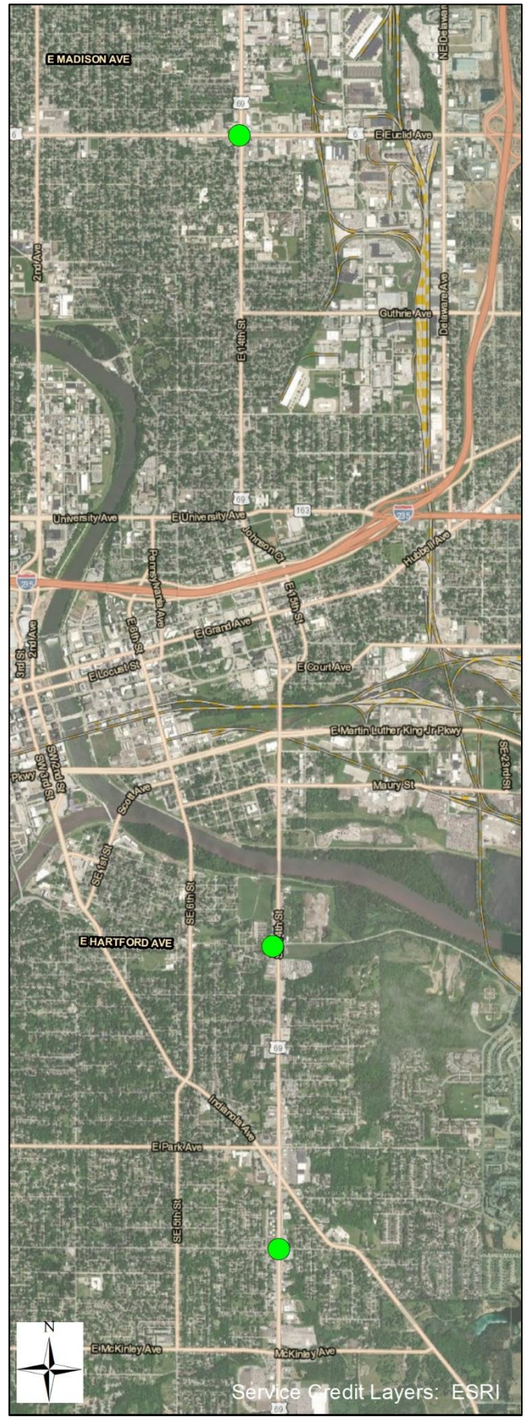


Figure 19. Protected Only Left Turn Phasing Locations

Intersection Treatment: Prohibited Right-Turn-on-Red and Left-Turn-on-Red Movements

Description
Prohibited RTOR and LTOR movements are an intersection treatment that adds a traffic signal sign restricting turns on red, shown in **Figure 20**.

Location
Improvement locations are shown in **Figure 21** and are listed below:

- Walker Street & E 14th / 15th Streets
- I-235 ramps & E 14th / 15th Streets
- E Grand Avenue & E 14th / 15th Streets
- E Walnut Street & E 14th / 15th Streets
- E Court Avenue & E 14th / 15th Streets

The study team recommends “No Turn on Red” signs to be placed on all intersection approaches at the improvement locations.

Benefits

Traffic Operations
Prohibiting turns on red is primarily a safety strategy discussed in the following section. Prohibiting turns on red increases the amount of delay of select turning vehicles at an intersection. This can impact the overall level-of-service at an intersection, but not significantly. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

Safety
Prohibiting RTOR and LTOR movements reduces the opportunities for turning-related collisions, especially at locations with limited sight distance. Additionally, vehicle-pedestrian conflicts may also be reduced. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

Figure 20. No Turn on Red Sign
Source: MUTCD

Other Considerations
Enforcement is a main consideration for “No Turn on Red” implementation. Special consideration should be given to outreach efforts to improve the level of compliance of “No Turn on Red” signage.

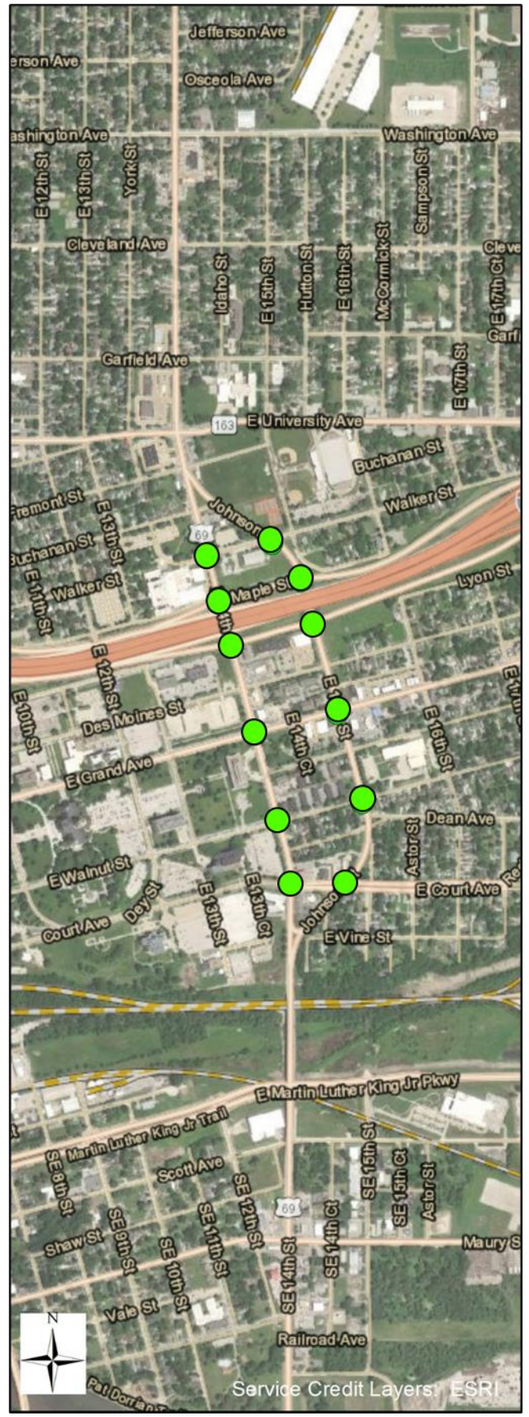


Figure 21. Prohibited RTOR and LTOR Movement Locations

Intersection Treatment: Roundabouts

Description
A roundabout is an intersection treatment that replaces a stop controlled or signalized intersection with a rotary movement with channelized approaches with yield control on all approaches.

Location
Improvement locations are shown in **Figure 23** and are listed below:

- E Hull Avenue (**Figure 22**)
- Morton Avenue (**Figure 24**)
- Guthrie Avenue (**Figure 25**)
- E Washington Avenue (**Figure 26**)
- Cleveland Avenue (**Figure 27**)

Benefits

Traffic Operations
Roundabouts were only recommended at locations where the overall intersection level-of-service would stay at acceptable levels. Approach delay would likely be reduced at the 5 proposed locations. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

Safety
Roundabouts have been shown to reduce fatal and injury crashes when compared to signalized and minor-road stop-controlled intersections. When vehicle collisions occur at roundabouts, they are typically at low speeds and are not broadside crashes, resulting in fewer injuries. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

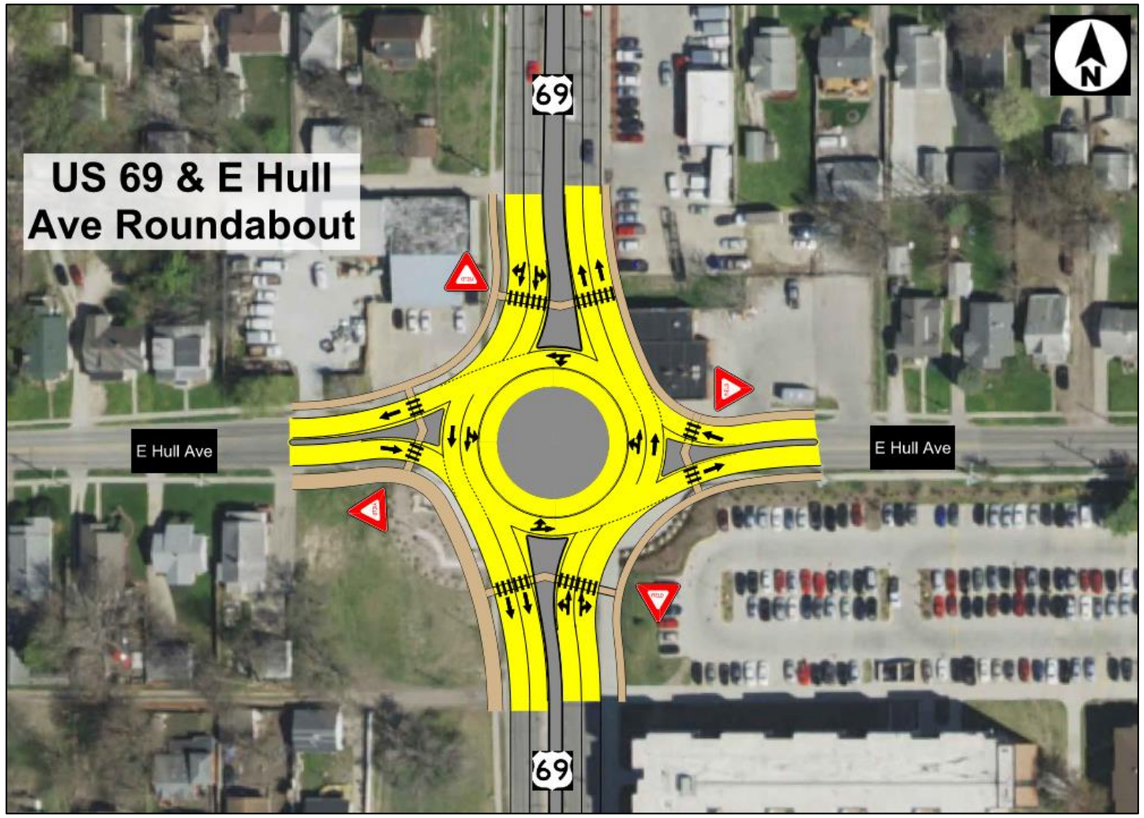


Figure 22. US 69 & E Hull Avenue Schematic Alternative

Other Considerations
It is recommended that roundabouts are constructed in a series, not a standalone measure at one intersection location. This improves driver expectancy and improves the overall traffic calming and speed reduction effect of roundabouts.

If this project moves into design, special consideration will be given to pedestrian crossing locations. The determination of passive versus active crossings will be included in the evaluation at that time.

Iowa DOT's ICE Process

Iowa DOT recently developed an ICE Manual. ICE is a data-driven, performance-based framework and approach used to objectively screen alternatives and identify an optimal geometric and control solution for an intersection. This data-driven process was performed at select locations along US 69 including the intersection of US 69 and Cleveland Avenue. One alternative that was selected via the ICE process was a two-lane roundabout shown in Figure 27. Additional analysis and forms following Iowa DOT's ICE process are included in Appendix E.

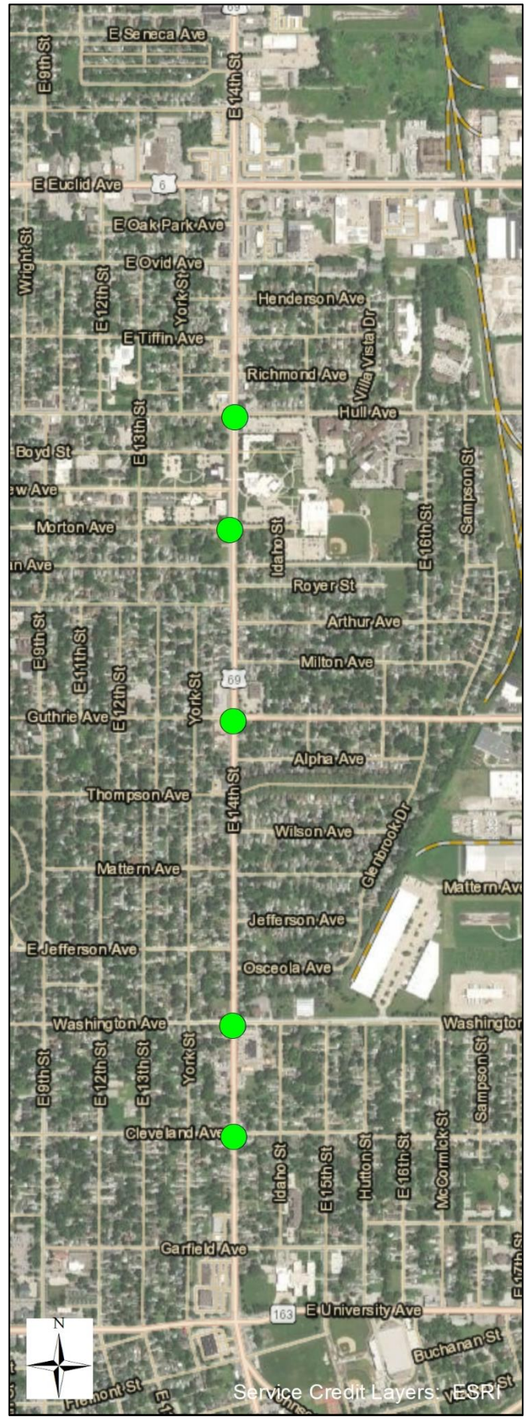


Figure 23. Roundabout Locations

Intersection Treatment: Roundabouts (continued)

Figure 25. US 69 & Morton Avenue Schematic Alternative

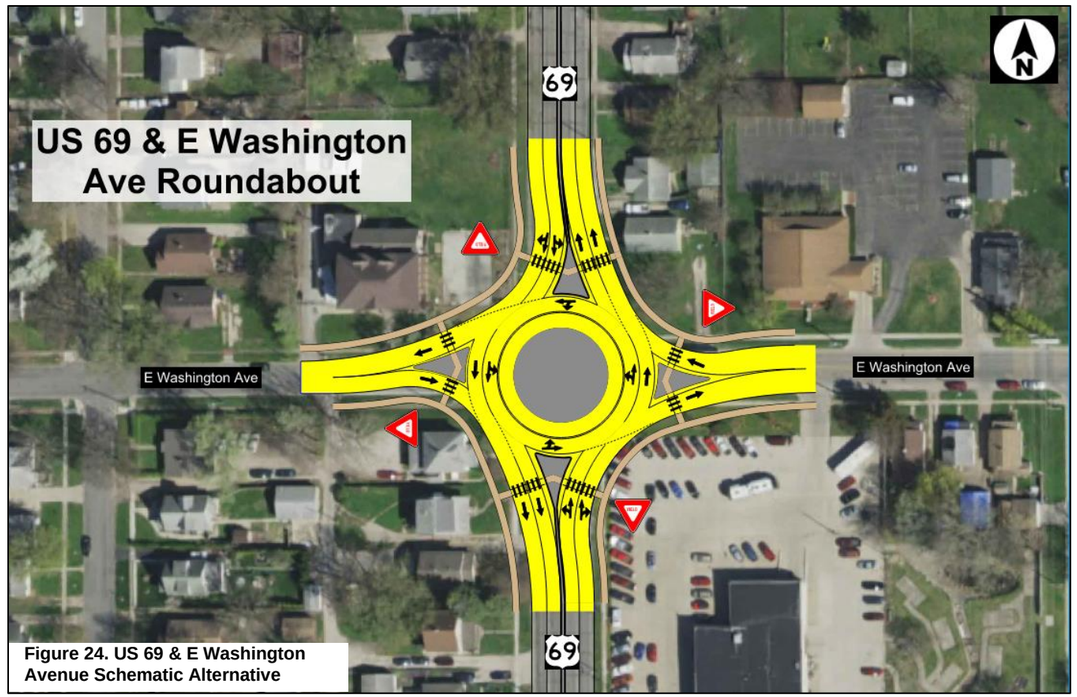


Figure 24. US 69 & E Washington Avenue Schematic Alternative

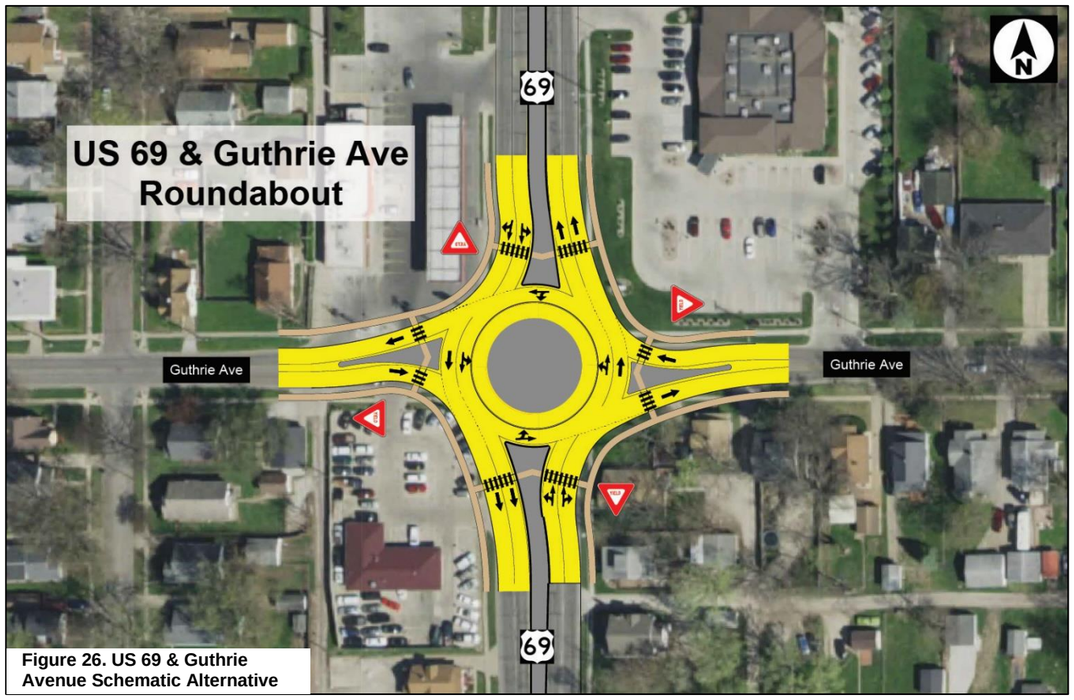


Figure 26. US 69 & Guthrie Avenue Schematic Alternative

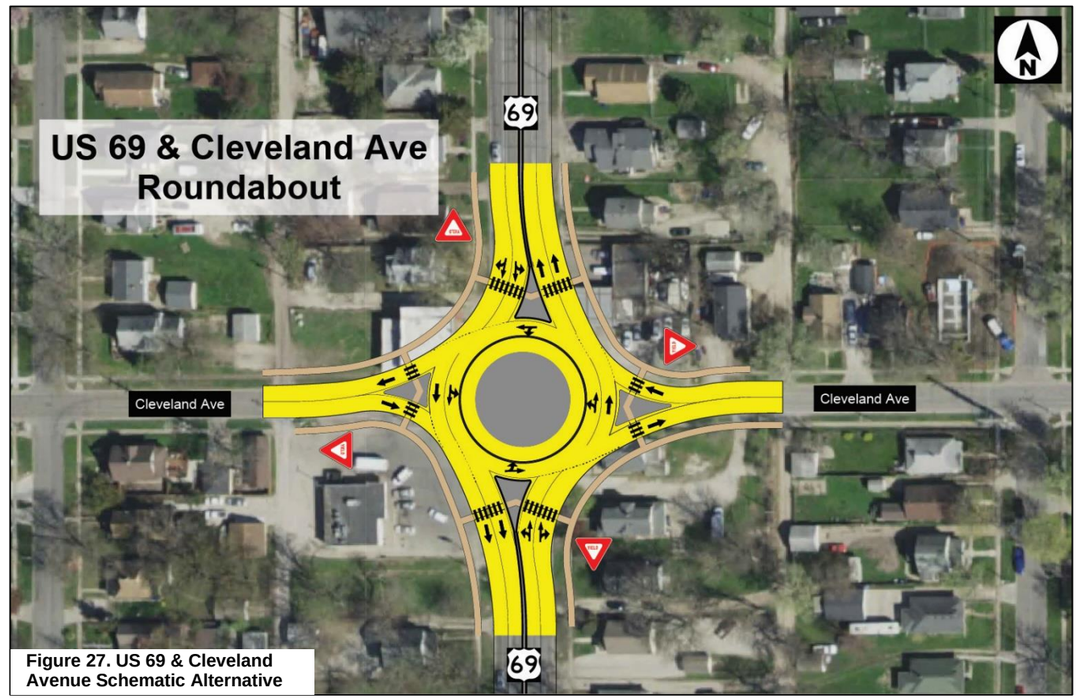


Figure 27. US 69 & Cleveland Avenue Schematic Alternative

Corridor Treatment: Access Control (Medians)

Description
A median is an access control measure that prohibits left turns at every access along a corridor. Medians can be continuous or have breaks to provide vehicular access at select locations.

Location
Improvement locations are shown in **Figure 30** and are listed below:

- North Terminus: Euclid Avenue
- South Terminus: University Avenue

Benefits

Traffic Operations
In general, a median will improve traffic operations along US 69 by eliminating left turns from US 69. This will reduce slow-downs and braking that occurs on 4-lane undivided roadways. Note that traffic analysis was not conducted at non-study area intersections.

Safety
Installing a median to prohibit left turns along a corridor has the potential to reduce left-turn angle collisions. Rear end collisions caused by stopped left-turning vehicles in the travelled way may also be reduced. Note that safety analysis was not conducted at non-study area intersections.

Other Considerations

Lane Widths
To fit a 3-foot strip median within the existing curb line, proposed lane widths would need to be reduced from current conditions. A comparison of the existing and proposed configuration is shown in **Figure 28** and **Figure 29**, respectively.

Roundabout Consideration
As shown in **Figure 30**, the study team recommends the combination of the median alternative with the 5 roundabout locations. The roundabouts would provide access to nearby residents and business along US 69 via U-Turn movements at roundabout locations.

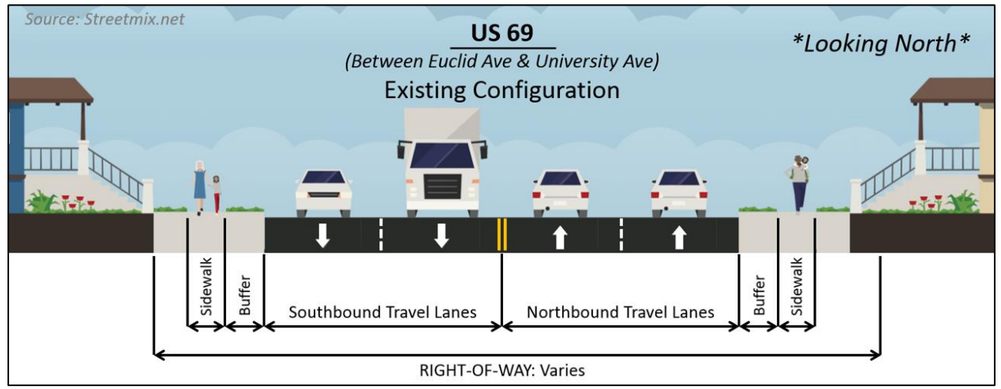


Figure 28 Existing US 69 Typical Section Between Euclid Avenue & University Avenue

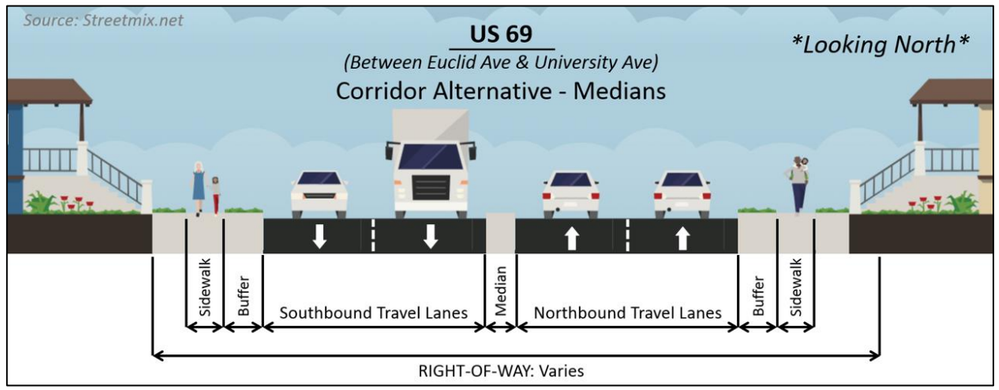


Figure 29. Proposed US 69 Typical Section Between Euclid Avenue & University Avenue

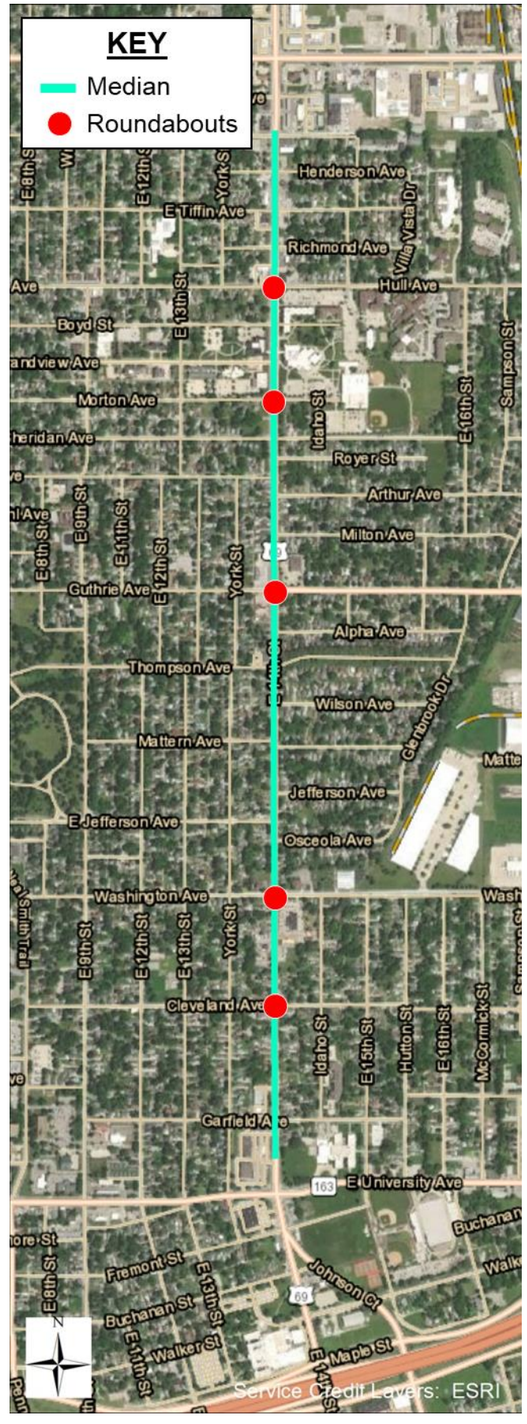


Figure 30. Median and Roundabout Locations

Corridor Treatment: Access Control (¾ Access and Right-In/Right-Out)

Description

A ¾ access is an unsignalized intersection treatment that allows a left turn from an arterial while prohibiting left turns on, as shown in **Figure 31**. A ¾ access can be provided on one-way streets via a porkchop median on the far side of the intersection, shown in **Figure 32**. In areas where low volume left turns from an arterial exist or have a viable alternative route, a median can be provided to provide RIRO access only.

Location

Improvement locations are shown in **Figure 33**. Due to the number of unsignalized, full-access locations and right-of-way constraints between Euclid Avenue and University Avenue, it is recommended that a median be provided in this location. Locations shown with a green dot indicate the remaining unsignalized, full-access locations along US 69.

Benefits

Traffic Operations

In general, a ¾ access will reduce the approach delay at the minor stop-controlled approaches by eliminating left turns onto the major roadway. This improvement increases out of direction travel for minor road left turns and requires motorists to find an alternative route. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D** at study area intersections that overlap the proposed ¾ access or RIRO locations. Note that traffic analysis was not conducted at non-study area intersections.

Safety

A ¾ access intersection will eliminate the potential for a collision to occur involving a left-turning vehicle from the side street on two-way roadways. Additionally, RIRO intersections will also eliminate the potential for collisions to occur involving a left-turning vehicle from the major road approaches. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**. Note that safety analysis was not conducted at non-study area intersections.

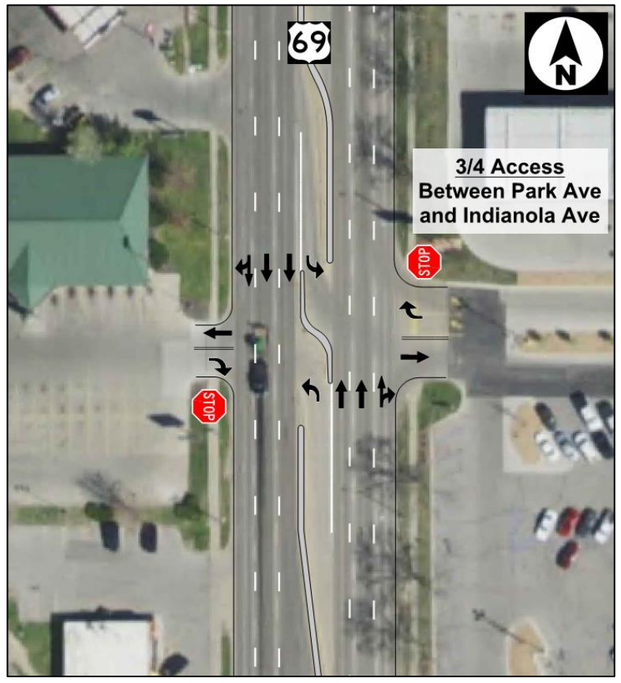


Figure 31. ¾ Access Between E Park Avenue & Indianola Avenue (Existing)

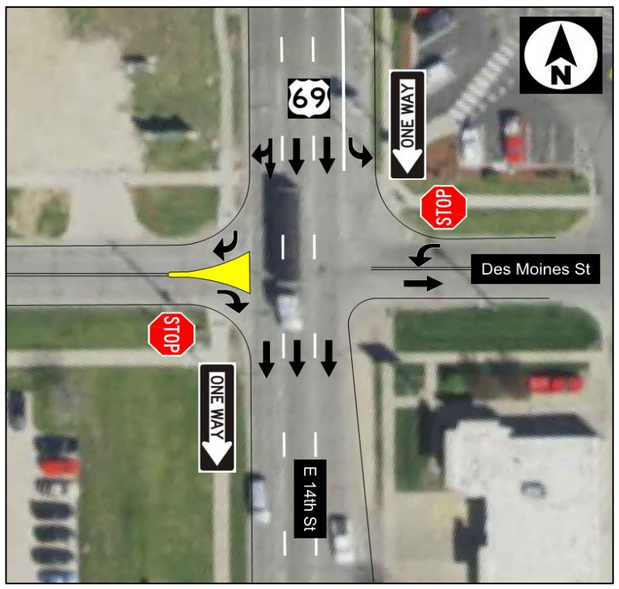


Figure 32. ¾ Access Example at E 14th Street & Des Moines Street (Proposed)

Figure 33. ¾ Access and Right-In/Right-Out Locations

Corridor Treatment: Converting Outside Lanes to Right Turn Only Lanes

Description
Converting outside lanes to right turn only lanes is a corridor treatment that converts the outside lane to individual right turn lanes at each intersection. This converts US 69 to a standard 4-lane divided roadway in the southern portion of the study area.

Location
Improvement locations are shown in **Figure 35** and are listed below:

- Near Watrous Avenue (northbound and southbound)
- McKinley Avenue to north of Kenyon Avenue (southbound)
- South of Kenyon Avenue to Hart Avenue (northbound and southbound)
- North of E Army Post Road (southbound)

Benefits

Traffic Operations

In the southern portion of the study area, the outside through lane is under-utilized since it is not continuous along US 69, highlighted in blue in **Figure 34**. Converting an under-utilized lane to a right turn only lane has a minor impact on traffic operations. In general, the overall intersection level-of-service worsens slightly. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**. Note that traffic analysis was not conducted at non-study area intersections.

Figure 34. Outside Through Lane Utilization at McKinley Avenue (Looking South)

Safety

Converting the outside lanes to right-turn lanes in the sections with three through lanes may have the potential to reduce three types of crashes:

- Rear-end collisions involving right-turning vehicles because through vehicles will be removed
- Same-direction sideswipe and rear-end collisions caused by merging vehicles in the vicinity of the through lanes dropping from three to two lanes
- Angle crashes involving left-turning vehicles because permitted left turns from US 69 that currently cross three lanes of traffic change to two lanes of traffic in the build condition

A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**. Note that safety analysis was not conducted at non-study area intersections.

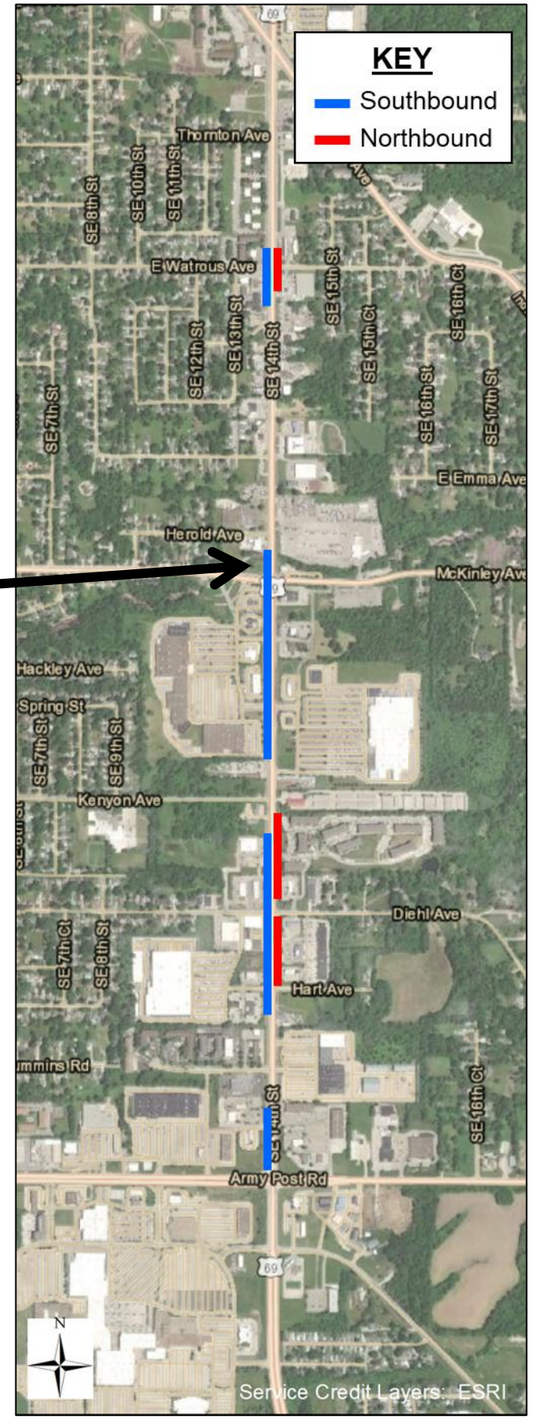


Figure 35. Converting Outside Lanes to Right Turn Only Lanes Locations

Corridor Treatment: Adaptive Signal Control

Description
Adaptive signal control technology adjusts signal timing to accommodate changing traffic patterns. It can accommodate volume changes throughout the day better than traditional signal timing methods that have a select number of time-of-day plans.

Location
Improvement locations include all signalized intersections between University Avenue and E Army Post Road, shown in **Figure 36**.

Benefits

Traffic Operations
The main benefits, noted by FHWA, of adaptive signal control technology over conventional signal systems are that it can:

- Continuously distribute green time equitably for all traffic movements
- Improve travel time reliability by progressively moving vehicles through green lights
- Reduce congestion by creating smoother flow
- Prolong the effectiveness of traffic signal timing

Safety
Installing adaptive signal control along a corridor has the potential to reduce rear-end collisions due to better signal progression.

Other Considerations

Near-Term Benefits
US 69 south of the one-way pair may benefit in the near-term from adaptive signal control, including signalized intersections in the vicinity of the “Triangle” area formed by US 69, Indianola Avenue, and Park Avenue.

Signal Equipment
In order to implement adaptive signal control, appropriate signal equipment (including detection) is necessary. Different adaptive signal systems have differing detection requirements. The necessity of a dedicated signal system management program depends on adaptive signal system brand.

Figure 36. Adaptive Signal Control Locations

Corridor Treatment: City of Des Moines Project Considerations

Description
The City of Des Moines has several proposed projects that intersect the US 69 corridor near the downtown area.

Location
Improvement locations are shown in **Figure 37** and are listed below:

- University Avenue: Proposed lane reduction with bike lanes
- Grand Avenue: Proposed lane reduction with bike lanes
- Court Avenue: Proposed lane reduction with bike lanes

Benefits

Traffic Operations
The lane reduction project will impact traffic operations at study area intersections. The lane reductions proposed at University Avenue and Grand Avenue result in poor peak hour operations. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

Safety
Lane reduction projects, combined with enhanced pedestrian crossings and narrower travel lanes, improve intersection safety for all users. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

Figure 37. City of Des Moines Project Consideration Locations

Corridor Treatment: Bicycle and Pedestrian Alternatives

Description

Bicycle and pedestrian alternatives were developed along US 69 and parallel routes following Iowa DOT's complete streets policy. A variety of bicycle and pedestrian alternatives were developed including shared-use paths, bike boulevards, and bike lanes to improve north-south connectivity.

Location

Improvement locations are shown in **Figure 38** and are listed below:

- Broadway Avenue to University Avenue:
  - Shared-use paths along US 69 where right-of-way is available
  - In areas where right-of-way is not available, bike boulevards, shown in **Figure 39**, are proposed on parallel side streets west of the US 69 corridor, including York Street and 13th Street.
- University Avenue to Court Avenue
  - Shared-use paths along E 14th Street and E 15th Street
- Court Avenue to south of Des Moines River:
  - Pedestrian facilities are currently provided along US 69 over the two viaducts south of downtown.
  - Off system bicycle facilities, existing and proposed, are used to provide north-south connectivity between Court Avenue and south of the Des Moines River via Court Avenue, 6th Street, and the Des Moines River Trail.
- South of Des Moines River to County Line Road:
  - Shared-use paths along US 69 where right-of-way is available
  - Off system bicycle facilities, existing and proposed, are used to provide north-south connectivity for users that are not destined for businesses along US 69. Off system facilities include existing bike lanes along Indianola Avenue from US 69 to E Army Post Road and a proposed shared use path from E Army Post Road to US 69.

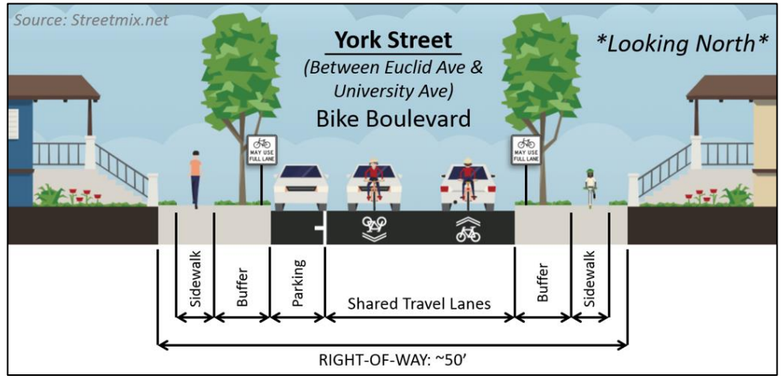


Figure 39. Proposed Bike Boulevard on York Street

Benefits

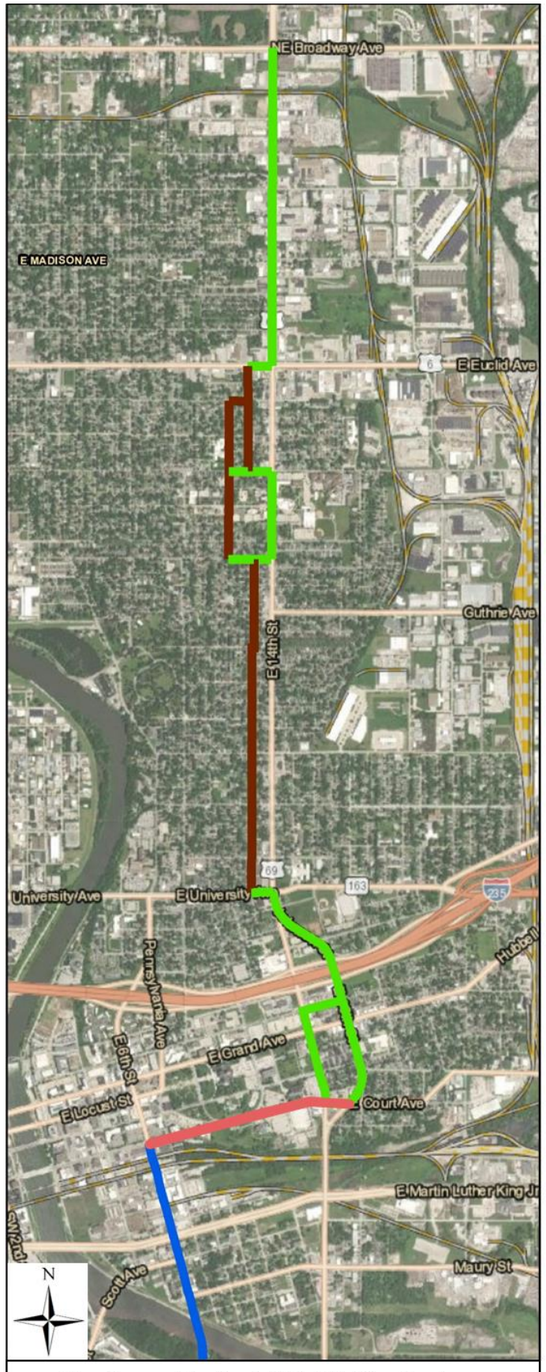
Level of Traffic Stress

Bicycle LTS is a performance measure that was included in the US 69 location study to measure a bicyclist's level of comfort. The combination of proposed shared-used paths, bike boulevards, and bike lanes is intended to provide a higher level of comfort for north-south connectivity. LTS evaluation results for the proposed improvements are shown in the alternatives evaluation section of this report.

Other Considerations

City of Des Moines Trail System

The City of Des Moines has a robust trail system that provides pedestrian and bicycle mobility throughout the metro area. The proposed system along the US 69 corridor will improve north-south connectivity. Additionally, Iowa DOT will work with the City of Des Moines on future bicycle network crossing locations at Thompson Avenue, Grand Avenue, and other future trail networks.



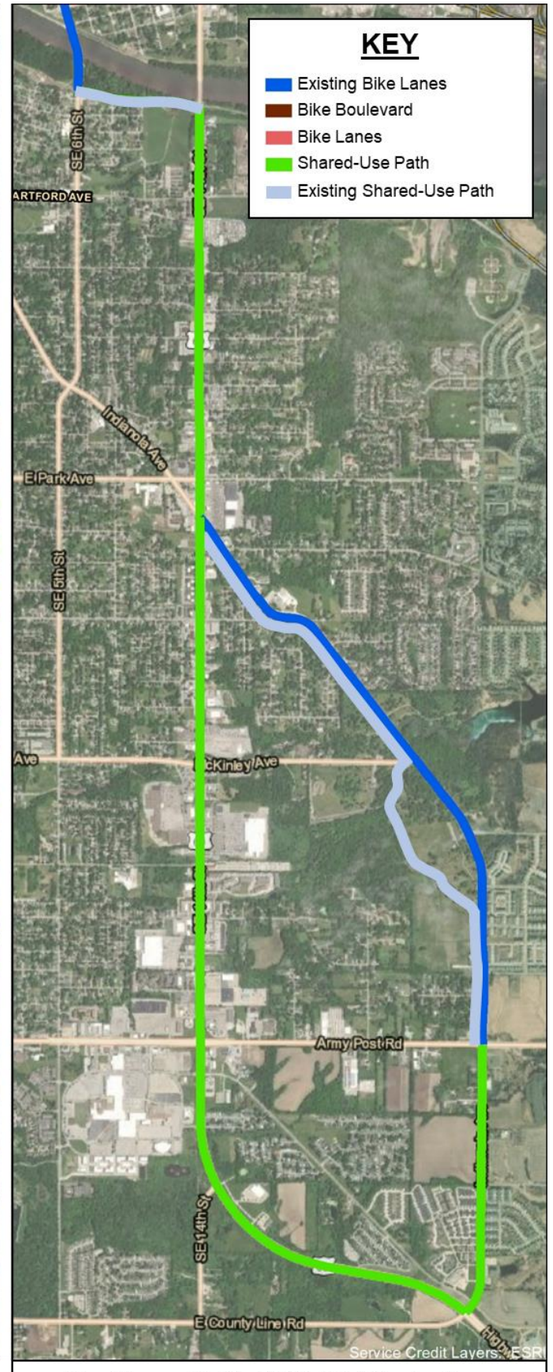


Figure 38. Bicycle and Pedestrian Alternative Locations

E MLK Parkway Connectivity Alternatives

Description
The connection between E MLK Parkway and US 69 was an area of focus for the US 69 Location Study due to crash history near Maury Street and the lack of direct connection between both roadways.

Location
The Maury Street intersection and E MLK Parkway connectivity schematic alternative limits are shown in **Figure 41**.

Three schematic alternatives were developed to address traffic operations, safety, and roadway connectivity including:

- US 69 & E MLK Parkway Quadrant Intersection (**Figure 42**)
- US 69 & Maury Street Offset 'T' Intersection (**Figure 43**)
- US 69 & E MLK Parkway Low Speed Interchange (**Figure 44**)

Benefits

Traffic Operations

For the quadrant and offset 'T' intersection alternatives, special consideration was given to queueing between signalized intersections. The northbound left turn to E MLK Parkway is a negative offset, requiring left turning vehicles to go through an adjacent signal before turning left. Typically, a positive offset, shown in **Figure 40**, is recommended for left turns, but the surrounding roadway network is not conducive to a positive offset 'T' intersection without major right-of-way impacts. For the low-speed urban interchange, special consideration was given to queuing between the signalized intersection at Maury Street and the low-speed ramps. The study team recommends microsimulation analysis to test the complex strategies in a follow-up study. A comparison of 2050 No-Build and 2050 Build traffic operations is provided in **Appendix D**.

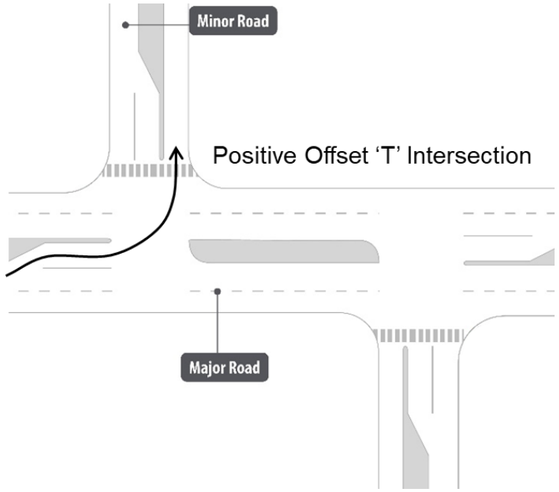


Figure 40. Positive Offset 'T' Intersection Example

Safety

All alternatives developed address safety concerns at Maury Street and nearby intersections in some capacity. The addition of a median at E Railroad Avenue will reduce cut-through traffic and eliminate rear-end and left-turn angle collisions that occur on US 69. The offset 'T' alternative has fewer conflict points than that of the four-leg Maury Street intersection. The reduction in conflict points has the potential to reduce multi-vehicle collisions. The low-speed interchange alternative will reduce the number of vehicles on the Maury Street approaches, which may reduce the number of intersection-related crashes at this location. A comparison of 2050 No-Build and 2050 Build safety analysis results is provided in **Appendix D**.

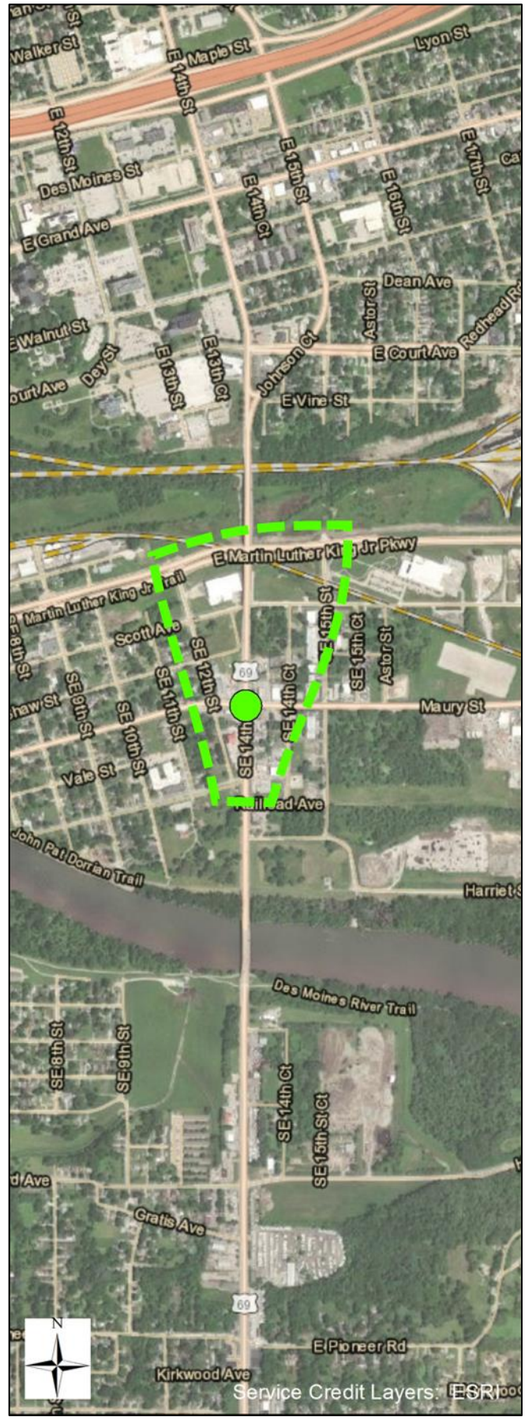


Figure 41. E MLK Parkway Connectivity Alternative Locations

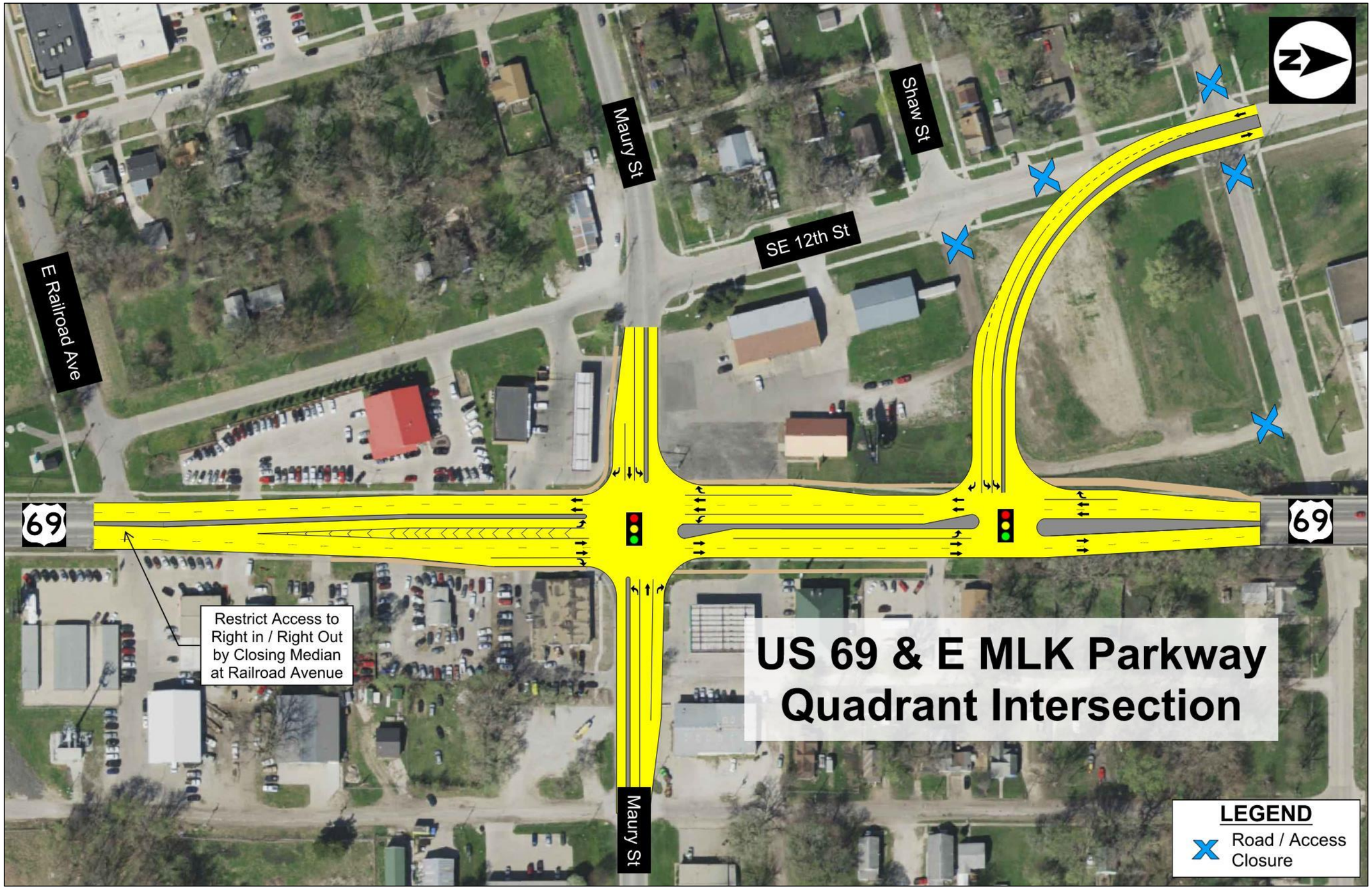


Figure 42. US 69 & E MLK Parkway Schematic Alternative (Quadrant Intersection)

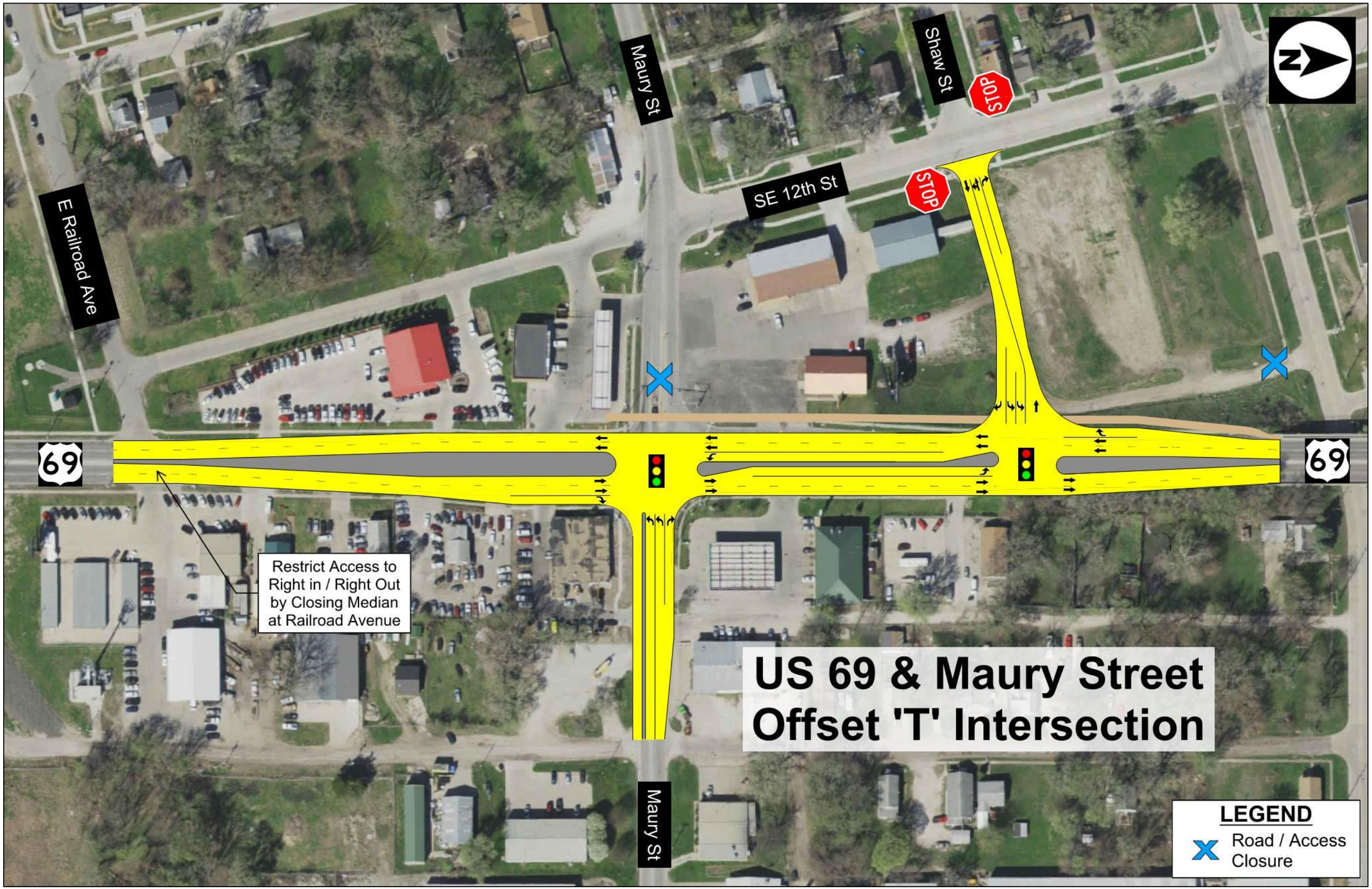


Figure 43. US 69 & Maury Street Schematic Alternative (Offset 'T' Intersection)

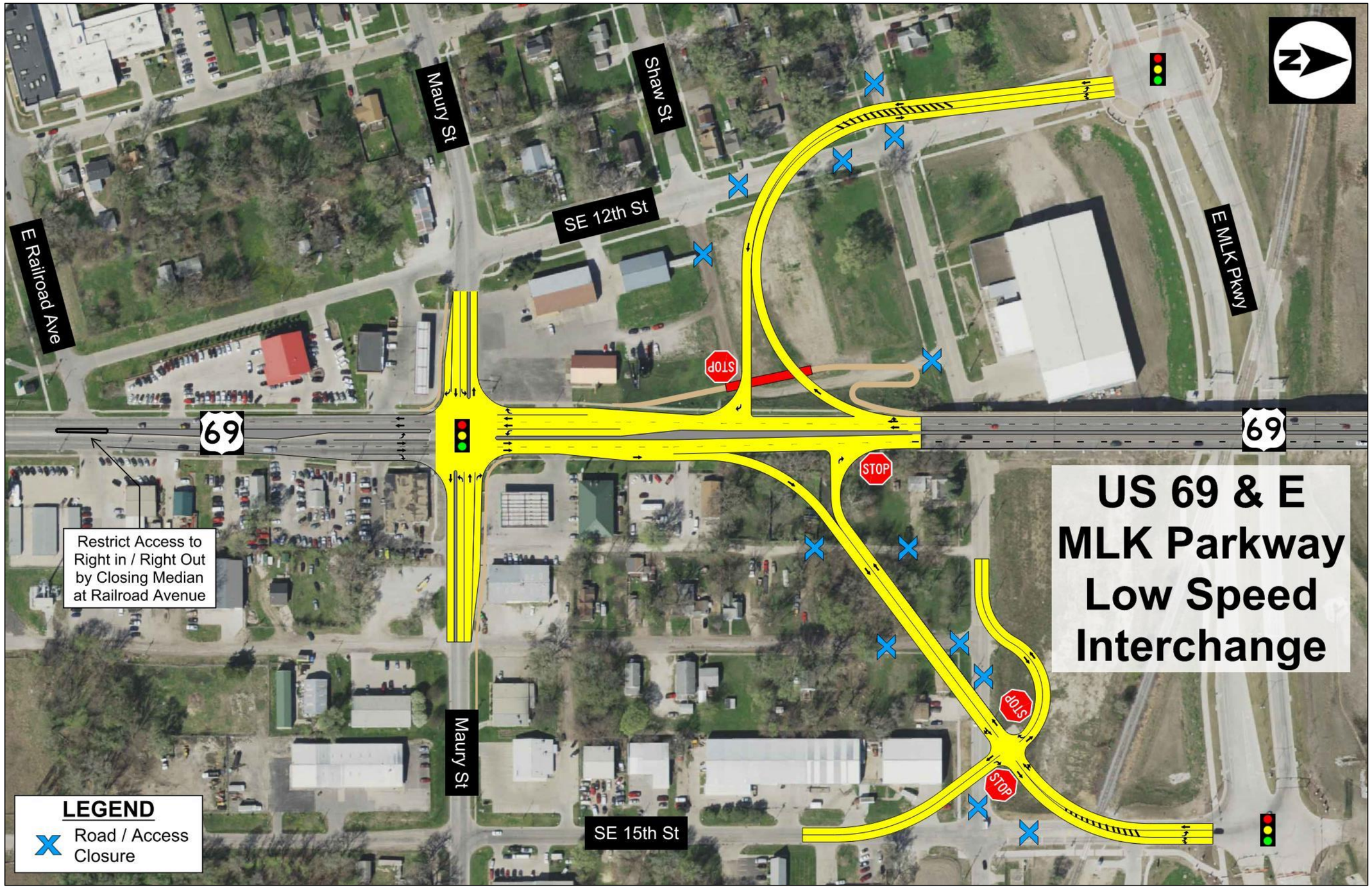


Figure 44. US 69 & E MLK Parkway Schematic Alternative (Low Speed Interchange)

Alternatives Evaluation

A high-level evaluation of the five performance measures established at the beginning of the study was developed for intersection and corridor treatments. At locations where two or more schematic alternatives were developed, a more detailed evaluation was performed. The results from the alternatives evaluation for the performance measures are provided in the "high-level" and "detailed" evaluation sections. Note that bicycle LTS was only evaluated for the bicycle and pedestrian corridor treatments.

High-Level Evaluation

Intersection Treatments

Table 8. Intersection Treatment Evaluation

Intersection Treatment	Traffic Operations	Safety	ROW Impacts	Conceptual Cost Estimates
Left Turn and Right Turn Lanes	✓	✓	MEDIUM	$$
Positive Left Turn Offsets	✓	✓	MEDIUM	$$
Displaced Left Turn Intersections	✓	✓	HIGH	$$$+
Median U-turn intersections	✓	✓	MEDIUM	$$$+
Restricted left turn movements	✓	✓	NONE	<$
Protected only left turn phasing	✗	✓	NONE	$
Prohibited RTOR and LTOR movements	✗	✓	NONE	<$
Roundabouts	✓	✓	HIGH[1]	$$$

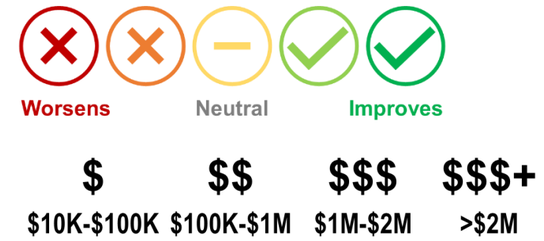
[1] ROW Impacts at the proposed locations between E Hull Avenue and Cleveland Avenue are high due to the constrained ROW

Corridor Treatments

Table 9. Corridor Treatment Evaluation

Corridor Treatment	Traffic Operations	Safety	ROW Impacts	Conceptual Cost Estimates
Access Control: Medians	✓	✓	NONE	$$ [1]
Access Control: ¾ Access and RIRO	✓	✓	LOW	$ [2]
Converting Outside Lanes to Right Turn Only Lanes	✗	✓	NONE	$$ [2]
Adaptive Signal Control	✓	–	NONE	$ [2]
City of Des Moines Project Considerations	✗	✓	LOW	*See Note 3*

[1] Per Mile of Roadway [2] Per Intersection Location [3] City of Des Moines to determine individual project costs



Corridor Treatment Evaluation: Bicycle and Pedestrian Alternatives

Bicycle LTS was used to measure how comfortable a user is biking near traffic. The following range, based on methodology from the Mineta Transportation Institute Report II-19: Low-Stress Bicycling and Network Connectivity (2012), is shown below:

- **LTS 1**: Comfortable for all ages and abilities (i.e. trails and bike boulevards)
- **LTS 2**: Comfortable for most adults (i.e. buffered bike lanes)
- **LTS 3**: Comfortable for confident bicyclists (i.e. sharrows and minor arterials)
- **LTS 4**: Uncomfortable for most bicyclists (i.e. major arterial with no bicycle facilities)

A comparison between existing LTS and Build Alternative LTS is provided in **Figure 45** and **Figure 46**. The study team developed build alternatives to provide a comfortable LTS 1 or LTS 2 throughout the entirety of the US 69 corridor through shared-use paths, bike boulevards, and existing bicycle infrastructure running adjacent to the US 69 corridor.

Corridor Treatment Evaluation: Bicycle and Pedestrian Alternatives

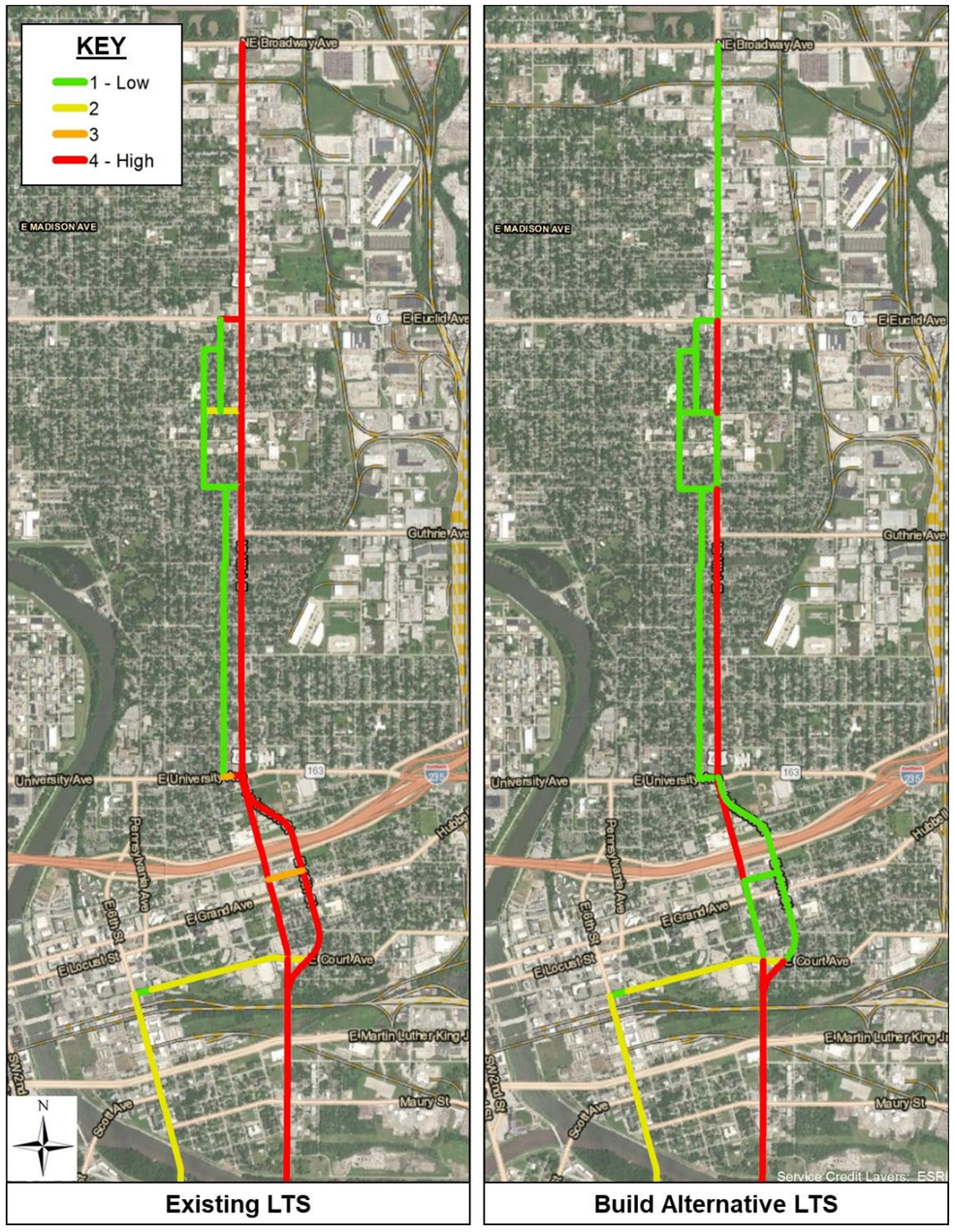


Figure 45. Existing and Build Level of Traffic Stress Comparison (North Half of Study Area)

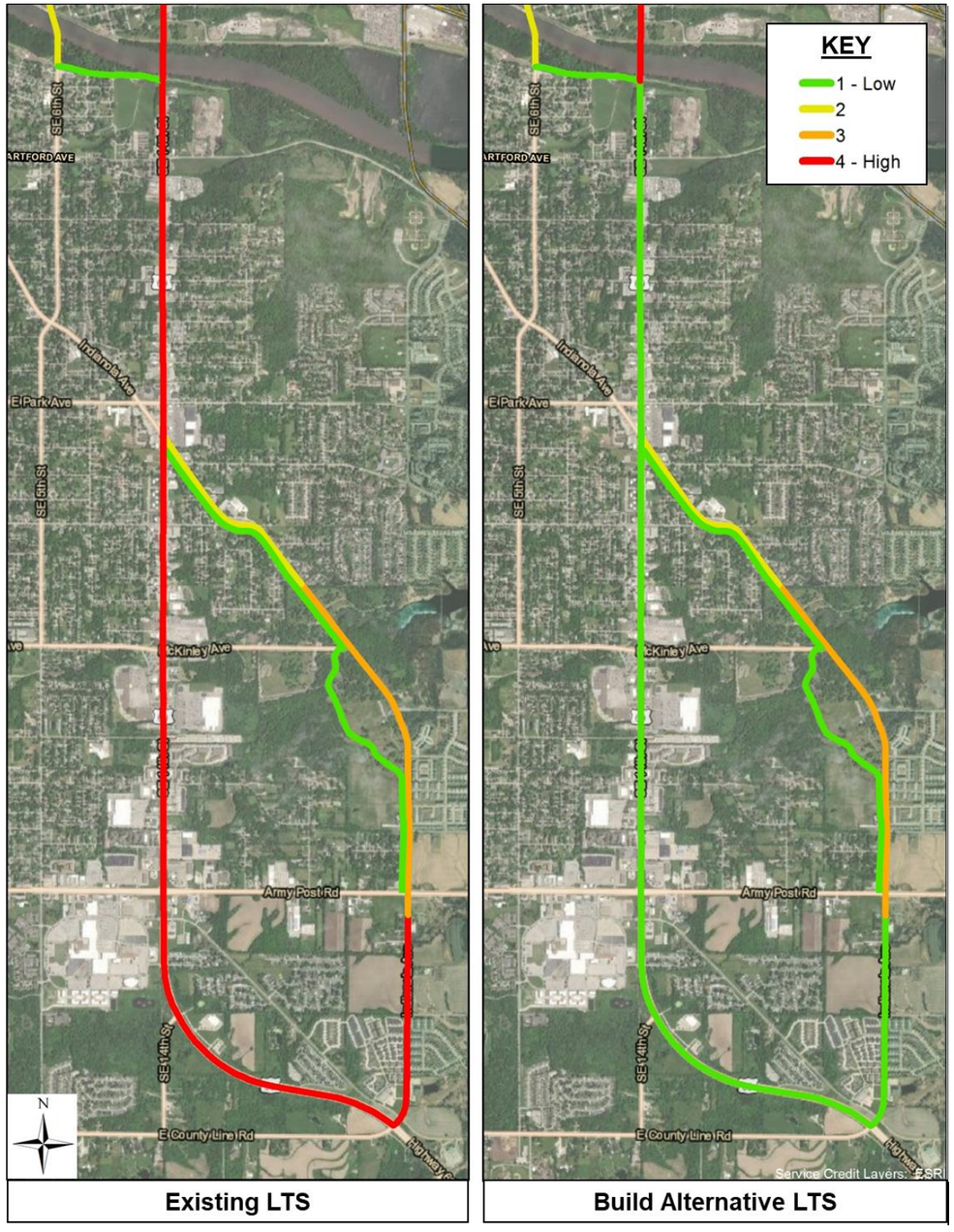


Figure 46. Existing and Build Level of Traffic Stress Comparison (South Half of Study Area)

Detailed Evaluation

Detailed evaluation results for each study area intersection can be found in **Appendix D**.

Estimated construction costs were developed for each schematic alternative in current year dollars based on recent bid prices. These costs include construction costs and right-of-way costs only. No costs associated with planning, design, permitting, or legal services have been estimated.

E MLK Parkway Connectivity Alternatives

The following connectivity alternatives were evaluated, including a No-Build alternative.

Table 10. E MLK Parkway Connectivity Alternative Comparison Matrix

Option	Traffic Operations[1] (Delay / LOS)	Predictive Safety Results[1] (Number / Percent Change)	Right-of-Way Impacts	Estimated Construction Cost	Figure
No Build	AM: 54.9 / D PM: 60.3 / E	Total: 7.03 Fatal + Injury: 2.49	---	---	---
Traditional Intersection Improvements	AM: 34.0 / C PM: 58.7 / E	Total: 6.50 / -8% Fatal + Injury: 2.31 / -8%	0.05 Acres	$0.25 - $0.30M	Figure 4
Quadrant Intersection	AM: 27.0 / C PM: 22.0 / C	Total: 5.79 / -18% Fatal + Injury: 2.06 / -18%	0.15 Acres	$1.7 - $2.0M	Figure 42
Offset "T" Intersection	AM: 24.5 / C PM: 13.9 / B	Total: 5.27 / -25% Fatal + Injury: 1.63 / -35%	0.05 Acres	$1.4 - $1.7M	Figure 43
Low Speed Interchange	AM: 28.2 / C PM: 26.3 / C	Total: 5.79 / -18% Fatal + Injury: 2.06 / -18%	• Up to 5 Total Acquisitions • 0.30 Acres	$3.2 - $3.7M	Figure 44

[1] Note that safety results are compared at the Maury Street Intersection – for additional information at new intersections see Appendix D.

E Park Avenue & US 69 Alternatives

The following schematic alternatives were evaluated, including a No-Build alternative.

Table 11. E Park Avenue Alternative Comparison Matrix

Option	Traffic Operations (Delay / LOS)	Predictive Safety Results (Number / Percent Change)	Right-of-Way Impacts	Estimated Construction Cost	Figure
No Build	AM: 34.0 / C PM: 27.8 / C	Total: 7.13 Fatal + Injury: 3.80	---	---	---
Displaced Left Turn	AM: 27.1 / C PM: 32.4 / C	Total: 4.56 / -36% Fatal + Injury: 1.62 / -57%	• Up to 1 Total Acquisitions • 0.15 Acres	$2.1 - $2.3M	Figure 10

E Army Post Road & US 69 Alternatives

The following schematic alternatives were evaluated, including a No-Build alternative.

Per the ICE Process, the study team recommends traditional intersection improvements at E Army Post Road. This is the only location within the study area where one alternative is recommended.

Table 12. E Army Post Road Alternative Comparison Matrix

Option	Traffic Operations (Delay / LOS)	Predictive Safety Results (Number / Percent Change)	Right-of-Way Impacts	Estimated Construction Cost	Figure
No Build	AM: 35.2 / D PM: 69.0 / E	Total: 6.00 Fatal + Injury: 2.13	---	---	---
Traditional Intersection Improvements	AM: 27.2 / C PM: 40.1 / D	Total: 3.59 / -40% Fatal + Injury: 0.96 / -55%	0.03 Acres	$1.3 - $1.6M	Figure 5
Eastbound DLT & Northbound U-Turn	AM: 42.1 / D PM: 39.8 / D	Total: 3.15 / -48% Fatal + Injury: 0.84 / -60%	0.20 Acres	$3.2 - $3.6M	Figure 11
Median U-Turn Intersection	AM: 34.5 / C PM: 45.4 / D	Total: NA Fatal + Injury: NA	0.25 Acres	$2.2 - $2.5M	Figure 15
Eastbound DLT & Westbound U-Turn	AM: 35.9 / D PM: 41.4 / D	Total: 2.57 / -57% Fatal + Injury: 0.61 / -71%	0.03 Acres	$2.8 - $3.1M	Figure 12

Roundabout Alternative

The following schematic alternatives were evaluated, including a No-Build alternative.

Table 13. Roundabout Alternative Comparison Matrix

Option	Traffic Operations (Delay / LOS)	Predictive Safety Results (Number / Percent Change)	Right-of-Way Impacts	Estimated Construction Cost	Figure
No Build	AM: 2.5-7.8 / A PM: 5.4-10.4 / A-B	Total: 2.99 – 5.58 Fatal + Injury: 1.04 – 1.93	---	---	---
E Hull Avenue	AM: 6.2 / A PM: 8.5 / A	Total: 3.16 / +4% Fatal + Injury: 0.56 / -46%	• Up to 1 Total Acquisitions • 0.20 Acres	$1.4 - $1.6M	Figure 22
Morton Avenue	AM: 5.6 / A PM: 7.5 / A	Total: 3.41 / +7% Fatal + Injury: 0.65 / -44%	• Up to 1 Total Acquisitions • 0.25 Acres	$1.3 - $1.5M	Figure 24
Guthrie Avenue	AM: 7.6 / A PM: 10.4 / B	Total: 3.65 / +6% Fatal + Injury: 0.65 / -45%	• Up to 2 Total Acquisitions • 0.20 Acres	$1.2 - $1.4M	Figure 25
E Washington Avenue	AM: 6.8 / A PM: 9.5 / A	Total: 4.82 / -14% Fatal + Injury: 0.87 / -55%	• Up to 1 Total Acquisitions • 0.25 Acres	$1.3 - $1.5M	Figure 26
Cleveland Avenue	AM; 6.4 / A PM: 7.5 / A	Total: 4.13 / -14% Fatal + Injury: 0.76 / -55%	• Up to 3 Total Acquisitions • 0.30 Acres	$1.3 - $1.5M	Figure 27

Workshops & Public Meetings

A variety of workshops and public meetings were hosted throughout the life of the study to:

- Communicate the project purpose, need, and results clearly and consistently.
- Provide multiple opportunities for meaningful involvement and participation from stakeholders and the pubic throughout the project.

The following provides a high-level overview of stakeholder and public involvement. Additional workshop and public meeting materials can be found in **Appendix F**.

Complete Streets Workshop
Representatives from Iowa DOT, the City of Des Moines and technical experts from HDR presented a wide variety of complete streets concepts and performance measures used in other areas of the country in a meeting on April 2, 2019. Additionally, the meeting provided an overview of the corridor and related issues, concerns and opportunities and discussed potential treatments that could be implemented along the study corridor.

Public Visioning & Scoping Workshop
A public visioning & scoping workshop was held at the Richard A. Clark Municipal Service Center in Des Moines, Iowa on Monday, April 29, 2019 from 5:00 p.m. to 6:30 p.m. The informal, open house format allowed for discussions to take place on the needs and vision of the US 69 corridor. Approximately 20 members of the public attended the workshop.

Alternatives Public Meeting
An online public information meeting was held on November 30, 2020. The purpose for the meeting was to discuss the proposed bicycle, and pedestrian alternatives on US 69. The online meeting was attended by 100 people.

Recommendations Public Meeting
A public information meeting to discuss the recommended road, bicycle, and pedestrian alternatives on US 69. An in-person public meeting with approximately 21 attendees was held on October 12, 2021 from 5:00 p.m. to 6:30 p.m. An at-your-own-pace online meeting with approximately 143 attendees was held from October 12 through October 25, 2021.

Implementation Strategy

A prioritized implementation action plan was developed to achieve the goal of improving public user safety, operations, and reliability in the study area. This action plan identifies a prioritized, phased implementation strategy to address the study recommendations for intersection treatments, key intersection improvements, bicycle and pedestrian improvements, and corridor-wide improvements. Given the high-level nature of this location study, the strategy focuses more on prioritizing critical safety and operations improvements and less on costs and impacts to environmental resources and rights-of-way. The implementation strategy includes the following improvement timeline categories:

- Near-Term: 1-5 Years
- Mid-Term: 6-15 Years
- Long-Term: Over 15 Years

The improvement recommendations in these categories are based solely on the results of the study – other factors outside the scope of this study can influence the project priority and ultimate implementation timeline. Furthermore, the improvement recommendations will require further community engagement, planning, design, and permitting efforts prior to implementation, all of which can impact priority and project development timelines.

Near-Term Improvements

The projects in this category should be given top priority when contemplating next steps for project development and generating 5-year capital improvement programs and budgets. These projects represent the most urgent needs to improve safety, operations, and reliability within the study area.

Table 14. Near-Term Implementation Improvements

Location	Project(s)	Rationale	Lead Agency(s)
US 69 / Maury Street / E MLK Parkway	Improvements to provide better connectivity to E MLK Parkway	The MLK connectivity project has been a high priority for Iowa DOT and the City of Des Moines due to traffic congestion, cut-through traffic on residential streets, and existing/predicted crashes. A more well-defined connection between US 69 and E MLK Parkway combined with access control at E Railroad Avenue and capacity improvements will improve congestion and safety.	Iowa DOT
E 14th St One-Way E 15th St One-Way I-235 Ramp Terminals	Prohibit RTOR & LTOR	These one-way pair segments through the downtown area have high crash rates. Restricting RTOR and LTOR at signalized intersection will improve safety for motorists and pedestrians.	Iowa DOT
Freemont Street Des Moines Street[1] Virginia Avenue Thornton Avenue	¾ Access	Restricting through and left turning movements from driveways and side streets reduces the opportunity for left-turning angle crashes, especially at locations with limited sight distance.	Iowa DOT & City of Des Moines
NE 43rd Avenue to Broadway Avenue	Construct 5-ft-wide sidewalk on both sides of US 69	This lower cost improvement will help improve multi-modal connectivity and safety throughout and across the segment.	City of Des Moines
East side of US 69 - Euclid Avenue to East Shawnee Avenue	Construct 5-ft wide sidewalk in existing segment gaps.	This lower cost improvement will help improve multi-modal connectivity and safety throughout and across the segment.	City of Des Moines
Broadway Avenue to Court Avenue	Off-street bicycle facilities: • Shared-use paths • Bike boulevards	Currently, the lack of on- or off-street bicycle facilities in this segment creates high bicycle LTS and potentially creates safety issues. Providing a dedicated bicycle route near US 69 will help improve multi-modal connectivity.	City of Des Moines
Indianola Avenue "Triangle" Area	Restricting left-turn movements	Lower cost turning movement restrictions can be implemented immediately.	Iowa DOT
Euclid Avenue Hartford Avenue Watrous Avenue	Protected only left turn phasing	The lower cost improvement of converting permissive and permitted-protected left turns to protected-only movements reduce the opportunity for left-turning angle crashes, especially at locations with limited sight distance.	City of Des Moines

[1] At E 14th Street and E 15th Street

Mid-Term Improvements

The projects in this category should be given priority when contemplating next steps for project development and formulating capital improvement programs and budgets beyond the next 5 years. These projects represent the next tier of needs to improve safety, operations, and reliability within the study area.

Table 15. Mid-Term Implementation Improvements

Location	Project(s)	Rationale	Lead Agency(s)
E Army Post Road	Traditional intersection improvements (turn lanes, positive left turn offsets)	Intersection capacity needs at E Army Post Road are driven by expected growth in the area. Continued Southridge Mall redevelopment could accelerate the need to address these intersection improvements sooner than in the mid-term.	Iowa DOT & City of Des Moines
E Park Avenue	Displaced left turn at E Park Ave.	Southbound displaced left turn at E Park Avenue is intended to address the higher rate of broadside or angle-type crashes at E Park Avenue.	Iowa DOT & City of Des Moines
Cleveland Avenue[1] E Hull Avenue Morton Avenue Guthrie Avenue E Washington Avenue	• 2-lane urban roundabouts • Raised median on US 69 (Euclid Avenue to University Avenue)	In addition to the multimodal safety improvements roundabouts provide, this corridor is heavily residential with private drives lining US 69. The roundabouts and raised medians will provide a higher level of access control, traffic calming, and improved safety.	Iowa DOT & City of Des Moines
Watrous Avenue to E Army Post Road (both directions)	Converting outside 3rd through lanes to right-turn only lanes	Non-continuous third outside lanes have poor driver expectancy and are under-utilized as a through lane. Conversion to right-turn only lanes will improve driver expectancy, eliminate lane merges on US 69, and improve safety at signalized intersections with permitted left turns.	Iowa DOT & City of Des Moines
Euclid Avenue	Positive left turn offsets[2]	Positive left turn offsets improve sight distance for left-turning vehicles yielding to opposing through vehicles.	Iowa DOT & City of Des Moines
University Avenue to E Army Post Road	Adaptive traffic signal control	Improves traffic operations and corridor reliability for peak and non-peak times.	City of Des Moines

[1] The Iowa DOT ICE process resulted in a recommendation of a roundabout at the Cleveland Avenue intersection
[2] Positive left turn offsets are recommended if protected only phasing (recommended in near-term improvements) does not improve safety at Euclid Avenue

Long-Term Improvements

The projects in this category should be considered in long-range transportation planning efforts. These projects could be moved up in priority as needs change over time or a redevelopment occurs along the corridor.

Table 16. Long-Term Implementation Improvements

Location	Project(s)	Rationale	Lead Agency(s)
Alpha Avenue to Fremont Street	¾ Access and RIRO access improvements	Restricting through and left turning movements from driveways and side streets reduces the opportunity for left-turning angle crashes, especially at locations with limited sight distance.	Iowa DOT & City of Des Moines
McKinley Avenue to Southridge Mall Entrance	¾ Access and RIRO access improvements	Restricting through and left turning movements from driveways and side streets reduces the opportunity for left-turning angle crashes, especially at locations with limited sight distance.	Iowa DOT & City of Des Moines
Broadway Avenue to Ovid Avenue	¾ Access and RIRO access improvements	Restricting through and left turning movements from driveways and side streets reduces the opportunity for left-turning angle crashes, especially at locations with limited sight distance.	Iowa DOT & City of Des Moines
Remaining High Crash Unsignalized Locations	¾ Access and RIRO access improvements	Restricting through and left turning movements from driveways and side streets reduces the opportunity for left-turning angle crashes, especially at locations with limited sight distance.	Iowa DOT & City of Des Moines
South of Des Moines River to County Line Road	Off-street bicycle facilities: Shared-use paths	Currently, the lack of on- or off-street bicycle facilities in this segment creates high bicycle LTS and potentially creates safety issues.	City of Des Moines
Corridor-Wide	Reconstruct sub-standard sidewalk to 5-ft wide.	Improves multi-modal connectivity and safety throughout and across the corridor. Sidewalk construction projects should be coordinated with public and private projects within the US 69 corridor.	City of Des Moines
Madison Avenue Hartford Avenue County Line Road	Turn lanes	Addition of left and right turn lanes can improve safety at operations at intersections that experience traffic growth in the future.	Iowa DOT & City of Des Moines

Conclusion / Next Steps

Improvement Recommendations

This high-level location study has identified many of the safety, operational, and reliability challenges along the study area of US 69 from immediately north of County Line Road on the south end to immediately south of Interstates 80 and 35 on the north end. Through engineering observations, data collection, and analyses, project improvement alternatives and recommendations were developed to mitigate these corridor challenges. These improvement recommendations were prioritized into an implementation strategy that serves as an action plan for the Iowa DOT and the City of Des Moines for the next 15 years and beyond.

This action plan identifies a prioritized, phased implementation strategy to address the study recommendations for intersection treatments, key intersection improvements, bicycle and pedestrian improvements, and corridor-wide improvements. Given the high-level nature of this location study, the improvement recommendations will require further community engagement, planning, design, and permitting efforts prior to implementation, all of which can impact priority and project development timelines.

Project Funding

The other factor that can impact improvement priority and project development timelines is the identification and administration of project funding. Beyond the standard local, state, and federal surface transportation infrastructure funding sources, many of these improvement recommendations would qualify for competitive State grant funding opportunities including:

- TSIP: Iowa DOT's Transportation Safety Improvement Program
- TAP: Transportation Alternatives Program
- ICAAP: Iowa Clean Air Attainment Program

Many of these improvement recommendations would also qualify for competitive USDOT discretionary grant programs including:

- RAISE: Rebuilding American Infrastructure with Sustainability and Equity
- INFRA: Infrastructure for Rebuilding America

Securing funding through either State or USDOT programs will help keep project development moving towards implementation and realization of the safety, operational, and reliability benefits these projects bring to the users of the corridor and the community.