LUCAS COUNTY

JUNE 2023

Local Road Safety Plan

Kimley»Horn

LUCAS COUNTY
EST. 1846

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LOCAL ROAD SAFETY PLAN
LUCAS COUNTY

Prepared for:

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Acknowledgements

The Lucas County employees and partners were instrumental in the development, review, and refinement of this Local Road Safety Plan. The Iowa Department of Transportation and Kimley-Horn would like to express their appreciation to the supporting staff and partners for their participation and contributions.

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Mose Bear (Lucas County Secondary Roads Department)
Carla Brown (Lucas County Secondary Roads Department)
Larry Davis (Lucas County Board of Supervisors)
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Hanna Gwinn (Lucas County Treasurer)
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Laurie Hunter (Lucas County Recorder)
Mike Lamb (ADLM Emergency Management)
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For the June 2023 update to the local road safety plan, the following additional supporting staff and partners participated.

Partners

Mike Head (Lucas County Secondary Roads Department)
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Darcy Juline (Lucas County Health Center)
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Mitchell Hadfield (Kimley-Horn)

Statutory Notice

23 U.S.C. § 409: US Code - Section 407: Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

RESOLUTION FOR PARTICIPATION IN SS4A GRANT APPLICATION

Lucas County Resolution

WHEREAS, as part of the new Federal Transportation Bill, Infrastructure Investment and Jobs Act (IIJA), there is over $1B of roadway safety funding available in the form of Safe Streets and Roads for All (SS4A) grants. To be an eligible applicant for this new safety funding, a county MUST have an eligible Action Plan in place; and

WHEREAS, the Iowa County Engineers Association (ICEA) plans to apply for a SS4A grant to develop and supply all 99 counties in Iowa with an eligible Action Plan at no cost to the counties. ICEA encourages all 99 counties to participate in this grant application; and

WHEREAS, the Lucas County Board of Supervisors will commit to achieve significant declines in roadway fatalities and serious injuries in Lucas County; and

WHEREAS, the Lucas County Board of Supervisors recognizes the Action Plan and will assist the County Engineer's department in achieving the goal of a dramatic decrease in roadway fatalities and serious injuries and zero roadway fatalities and serious injuries by the years 2030 and 2050, respectively; and

WHEREAS, the Lucas County Board of Supervisors, after consulting with the Lucas County Engineer, desires to participate in a joint SS4A grant to develop and receive an eligible Action Plan for Lucas County.

THEREFORE, BE IT RESOLVED BY THE BOARD OF SUPERVISORS OF Lucas COUNTY that this County does hereby request to be included in the statewide SS4A grant to develop Actions Plans for all 99 counties in Iowa.

Resolution adopted this 20th day of July, 2022.

Lucas County Board of Supervisors

Board of Supervisors Chairperson

Member

Member

ATTEST:

Lucas County Auditor

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EXECUTIVE SUMMARY

In the United States over 38,824 people lost their lives in motor vehicle crashes in 2020. According to the Federal Highway Administration (FHWA), rural road safety is a concern because rural fatalities account for about 43% of all fatalities across the United States, yet less than 20% of the population lives in rural areas. In addition, the fatality rate on rural roads is 1.7 times higher than the fatality rate in urban areas.

There was an average of 2.9 fatal and serious injury crashes per year on county roads in Lucas County from 2012 to 2021, resulting in a county road fatal and serious injury crash rate of 14.57 crashes per 100 million vehicle miles traveled (HMVMT), more than three times the 4.65 statewide average fatal and serious injury crash rate over the same period.

In the past, many efforts have focused on safety for higher volume roads and reactionary or "black spot" analysis of high crash locations. However, there is a growing trend across the United States to focus on proactive safety improvements for rural roads.

The Iowa Department of Transportation (DOT) developed a Strategic Highway Safety Plan (SHSP) to provide technical assistance in prioritization and deployment of safety countermeasures within various jurisdictions throughout the state. The Local Road Safety Plan (LRSP) concept is designed to build on the foundation established by the SHSP. The LRSP provides the basis for proactive implementation of safety countermeasures specific to individual counties across Iowa. This allows the county to leverage the road safety planning process to meet county-specific needs.

This document satisfies the requirement for a Comprehensive Safety Action Plan. This meets the requirements the county needs in order to apply for Safe Streets and Roads for All (SS4A) grant funding. This LRSP acts as an existing action plan needed for grant funding.

E.1. What is an LRSP?

An LRSP is a document that provides a basis for systemic safety improvements along local roads. Rather than addressing "black spots," the LRSP identifies systemic safety improvements along the roadway based on a risk factor analysis of the roadway. LRSPs not only assist local practitioners in understanding the types of crashes occurring on local roadways, but they also define a locally focused plan for practitioners to make informed, prioritized safety decisions. Additional benefits of LRSPs include:

- Coordination between various agencies within the county
- Use of the results of the analysis to leverage and apply for funding
- Focus on all the five E's of safety (Engineering, Emergency Response, Education, Enforcement, and Everyone)

The LRSP process has been successfully initiated in several states including Minnesota, North Dakota, Kansas, California and Nevada.

E.1.1. Five E's of Safety

In some states, LRSPs generally focus on engineering improvements to mitigate crashes at the county level. In Iowa, LRSPs are also assessing what is being conducted at the county level to address all of the five E's of safety.

While engineering improvements can make the roadways safer, engineering improvements alone cannot prevent all motor vehicle crashes. According to the National Highway Traffic Safety Administration (NHTSA), over 90% of all crashes are the result of driver-related factors. Because such a high percentage of crashes are a result of driver-related factors, making roadways safer requires all of the five E's to be involved.

Working together with all of the E's at the county level will help make the county roads safer.

E.2. Purpose of the LRSP

The LRSP identifies a prioritized list of safety improvement projects that can be implemented within the county to address specific crash characteristics identified during the data collection portion of the project. The recommendations in this plan focus on transportation improvements with a high benefit of crash reductions by applying the principles established in the SHSP and through a systemic data analysis performed specifically for Lucas County. The recommended improvements take into consideration constraints within the local county network and incorporate feedback from the County Engineer and local stakeholders.

Phase 1 of the LRSP project was completed in March 2016, which included 12 Iowa counties throughout the state, two from each Iowa DOT District. Phase 2 of the project concluded in November 2017 and included 17 additional counties in the southeast part of the state. Phase 3 of the project concluded in August 2018 and included 18 counties. Phase 4 of the project concluded in October 2019 and included 11 counties located throughout the state.

Lucas County was updated as a part of Phase 2 of the project and was completed in September 2017. This is an update to the original LRSP for Lucas County.

Figure E-1 illustrates the counties completed in Phases 1, 2, 3 and 4 as well as Lucas County with respect to the state of Iowa.

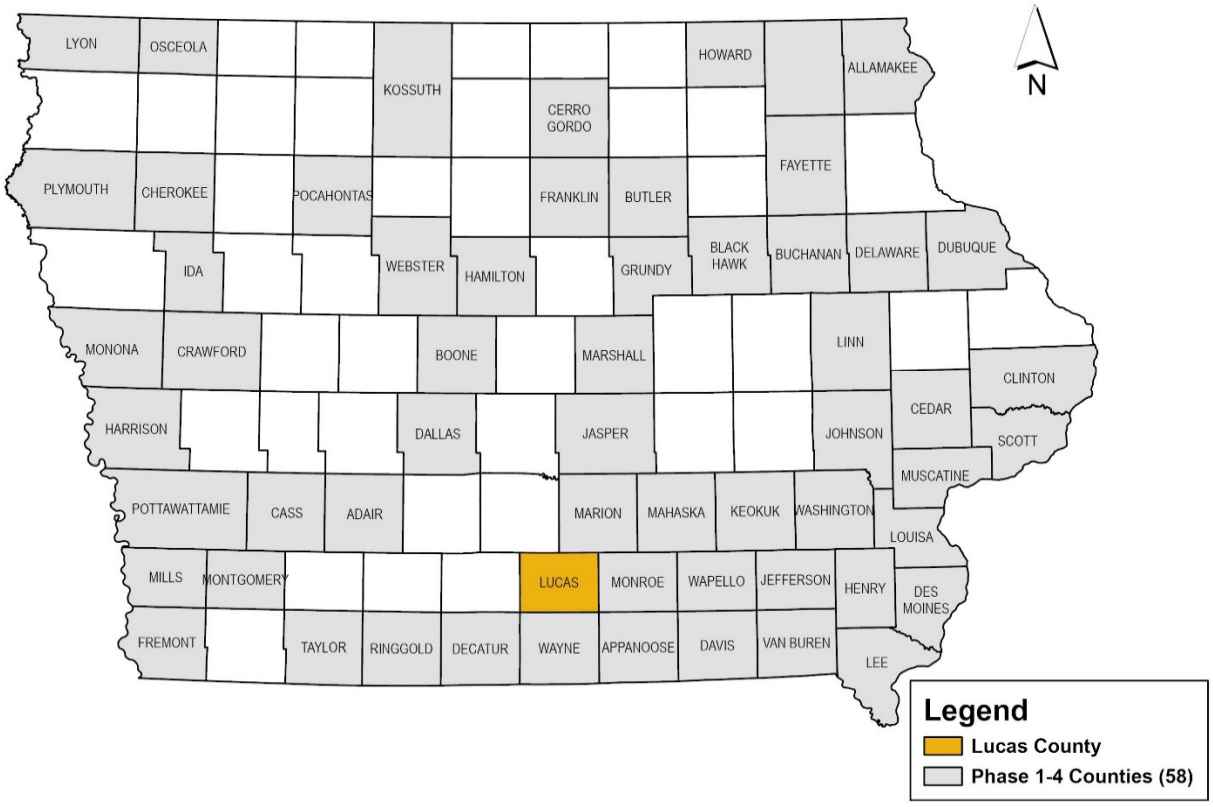

Figure E-1 – Location of LRSP Counties with Respect to Iowa

E.3. Lucas County

Lucas County is located in southern Iowa and is named after Robert Lucas, Iowa's first territorial governor. According to the 2020 census, the population of Lucas County was 8,636. Chariton, the County seat, is also the County's largest city.

Lucas County maintains approximately 648 miles of County roads, of which approximately 52 are paved. There were 360 crashes resulting in 29 fatal and serious injury crashes on county roads in Lucas County from 2012 to 2021.

E.4. LRSP Project Overview

The LRSP project includes seven primary task assignments. The following is a brief description of the tasks associated with this project, with a more detailed description of each task in subsequent sections of this document. **Figure E-2** illustrates the LRSP project process and timeline.

E.4.1. Gather Background Information

Under this task, relevant documents provided by the counties were reviewed as well as the Iowa SHSP, and potential funding sources. Data requests were made of the counties to provide the location and presence of rumble strips, destination lighting, stop signs, and other pertinent safety improvements.

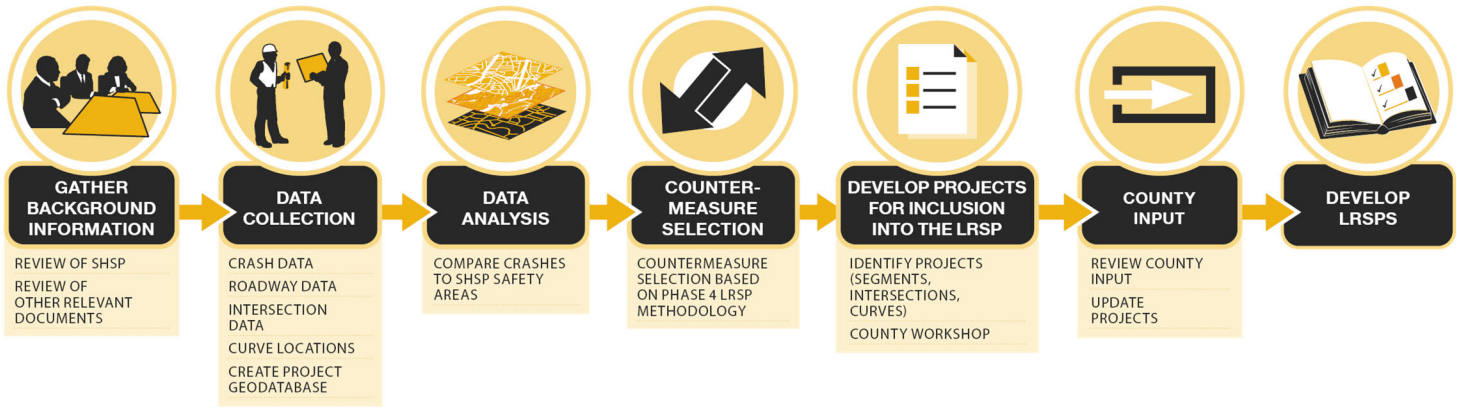

Figure E-2 – LRSP Project Process

E.4.2. Data Collection

A comprehensive Geographic Information System (GIS) project database was developed utilizing the following databases as provided by the Iowa DOT, the county, or collected as part of this project:

- Crash database
- Roadway database
- Access point database (911 address database)
- Pavement management database
- Roadside hazard database
- Horizontal curve database
- Stop sign database
- Intersection database

E.4.3. Data Analysis

After development of the comprehensive GIS project database, the crash data was analyzed for Lucas County. Crashes were compared to the Safety Emphasis Areas for the State of Iowa (as defined in the SHSP) and maps were prepared. Relevant information from the crash data analysis is included throughout this document.

E.4.4. Countermeasure Selection

In coordination with the Iowa DOT, a list of low-cost engineering-related safety countermeasures was developed for use as recommendations in the LRSP project. These countermeasures are discussed in **Section 5** of this report.

In addition, a workshop was held with the safety stakeholders of Lucas County. Prior to the workshop, a list of safety topics was developed and distributed to the county to foster discussion at the workshop on driver-related safety countermeasure implementation. During this workshop, the following items were discussed:

- The background and purpose of the LRSP
- The five E's of safety
- Crash data
- Driver-related countermeasures

Driver-related countermeasures were reviewed, and stakeholders discussed existing and proposed driver-related countermeasures. A summary of the countermeasures currently underway in the county, as well as those proposed at the workshop, are included within this document.

E.4.5. Develop Projects for Inclusion into the LRSP

A risk factor ranking process was developed for segments, intersections, and curves. Risk factors were calculated for all paved segments, intersections, and curves and within the county. Risk factors included roadway features such as curve radius, shoulder width, and traffic volumes. After conducting the risk factor analysis, recommended safety improvements were developed for the feature types based on the project selection decision trees. Improvements included items such as additional signage, pavement markings, and rumble strips. Project sheets detailing the recommended safety improvements at specific locations were then provided to the County Engineer for review.

E.4.6. County Input

As the systemic analysis was based solely upon available GIS data, the associated recommended countermeasures did not incorporate data regarding geometrics, turning movements, right-of-way, etc. Additional safety countermeasures could be applied at locations that were determined to have a high-risk factor ranking but may require additional site-specific information that may be known by the County Engineer. The project sheets, recommending countermeasures as determined by the project selection decision trees, were provided to the County Engineer for input for additional safety countermeasures. This step allowed the County Engineer to use engineering judgment and site-specific knowledge to recommend additional safety countermeasures at the identified/prioritized locations. At the county workshop, the project sheets and recommendations were reviewed.

E.4.7. Develop LRSPs

An LRSP was developed for the county including a summary of the LRSP process along with recommended safety projects for implementation by the county.

E.5. Recommendations

This LRSP identifies both driver- and engineering-related countermeasures. The following sections summarize the recommended countermeasures and improvements for the county.

E.5.1. Driver-Related Countermeasures

Out of the 18 safety emphasis areas, the 2019-2023 Iowa SHSP identifies eight (8) priority safety emphasis areas, of which six (6) are driver-related emphasis areas:

- Speed-related
- Unprotected persons
- Young drivers
- Impaired involved
- Older drivers
- Distracted or inattentive/driving

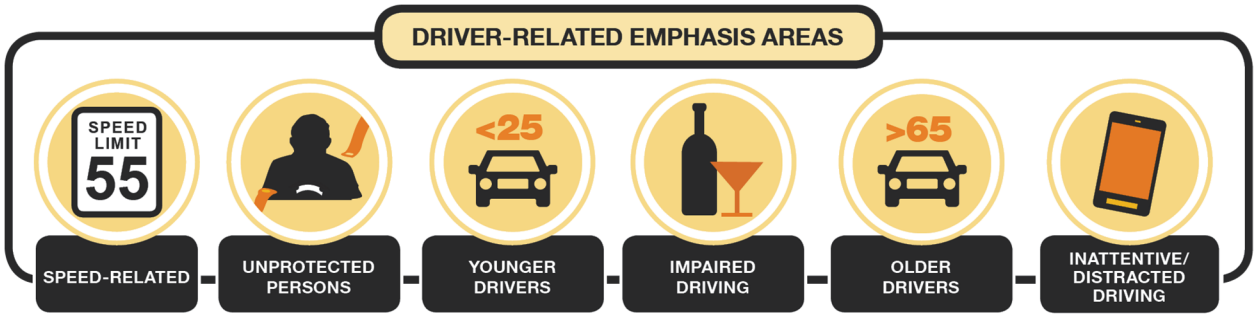

Figure E-3 – Iowa SHSP Driver-Related Emphasis Areas

During the workshop, attendees were provided information regarding fatal and serious injury crashes within the county and how that data aligned with the Iowa SHSP Key Safety Emphasis Areas. Potential countermeasures from the *National Cooperative Highway Research Program (NCHRP) Report 500 Series, Toward Zero Deaths* documents, and the results from Phases 1, 2, 3 and 4 of the LRSPs were provided to stakeholders to facilitate discussion on what action items were currently underway in the county with respect to driver-related crashes. The following statuses of implementation for the various driver-related countermeasures were defined based on the results of the discussion at the county workshop:

- Underway/Ongoing (currently being implemented);
- Area for Improvement (ongoing, but could be enhanced);
- Opportunity (not currently happening, but could be implemented); or
- Completed in the Past (has been completed in the past, but not planned to be implemented in the future).

Table E-1 provides a summary of the status of implementation of the driver-related countermeasures within Lucas County. It is recommended that the county continue to implement countermeasures that are underway/ongoing and look for opportunities to implement additional countermeasures not currently being implemented. This will require input from and coordination with all of the five E's of safety. **Section 5.5** provides details on the implementation of the following countermeasures.

Table E-1 – County Driver-Related Countermeasure Summary

Countermeasure	Status
Speed-Related	
Conduct speed enforcement - Some City Officers and the County participate in the Governor's Traffic Safety Bureau (GTSB) special Traffic Enforcement Program (sTEP) program - Targeted enforcement could take place based on data	Opportunity
Implement rigorous aggressive driving and speeding-related enforcement programs	Opportunity
Education campaigns relative to locations with high-risk of speed-related crashes, potentially in schools	Opportunity
Unprotected Persons	
Conduct publicized enforcement campaigns	Opportunity
Community locations for instruction in proper child restraint use Certified Child Passenger Technician available from Decatur County.	Underway/Ongoing
Conduct "child restraint inspection and/or installation" events at community locations Annually there is a publicized car seat check hosted by the Fire Department	Underway/Ongoing
Train law enforcement to check for proper child restraint use in all motorist encounters GTSB can provide "cheat sheets" for law enforcement on car seat laws.	Opportunity
Education campaigns in schools - Opportunity to provide seatbelt/helmet education in schools. - The hospital gives out helmets at schools annually.	Underway/Ongoing
Hand out ice cream gift certificates for children wearing bicycle helmets (law enforcement, Emergency Medical Services (EMS), and/or fire department)	Underway/Ongoing
Younger Drivers	
Improve content and delivery of driver's education/training Driver's education curriculum is privatized.	Opportunity
Conduct additional training in schools ("drunk goggles"; "don't veer for deer"; what to do when on an edge drop-off; training in health class; etc.) - Opportunity for individual teachers of health, physics, or other classes. - The Highway Patrol has "drunk goggles" that can be used at events.	Opportunity
"Operation Prom" mock disaster. Mock crash events have been conducted in the county.	Area for Improvement
After Prom Event held at the high school. Students are invited to an event at the high school from after Prom until 5:00AM, they are not allowed to leave except with a parent during that time.	Underway/Ongoing
Prosecute and impose sanctions on drivers not obeying school bus stop bars	Opportunity
Enforcement of graduated driver's license laws	Underway/Ongoing

Impaired Driving	
Conduct regular well-publicized safety checkpoints	Opportunity
Proactively conduct operating while intoxicated (OWI) enforcement - Enforcement is at times targeted at specific locations and around special events and holidays. There are known areas where officers focus on OWI enforcement.	Underway/Ongoing
Conduct regular well-publicized compliance checks of alcohol retailers to reduce sales to underage drivers The City Officers currently conduct compliance checks once per year.	Underway/Ongoing
Prosecute, impose sanctions on, and treat OWI offenders Attendees felt that violations are not booked as a lower tiered offense; however, they are being prosecuted that way.	Area for Improvement
Older Drivers	
Establish resource centers within communities to promote safe mobility choices Hospital has a program; however, the number of volunteers is limited.	Area for Improvement
Paratransit for older drivers County does have paratransit/dial-a-ride service for the elderly.	Underway/Ongoing
Provide materials on paratransit information at community centers	Opportunity
Recommend re-testing of older drivers involved in crashes and citations Retesting is situational, based on the recommendation of the officer.	Underway/Ongoing
Inattentive/Distracted Driving	
Incorporate information on distracted driving into education programs for young drivers	Opportunity
Conduct education and awareness campaigns Iowa DOT's "Transportation Matters" blog that update every Friday with that week's safety message can also be shared on social media.	Opportunity
Visibly enforce existing statutes to deter distracted and drowsy driving	Opportunity
County policy for "hands free" devices while driving county vehicle	Opportunity
Mobile simulator for distracted driving at community events or schools	Opportunity

E.5.2. Engineering Countermeasures

In addition to driver-related countermeasures, a list of safety engineering projects was developed for locations with high risk factor rankings along county paved roads. Projects were developed for high-priority county paved segments, intersections, and curves. Segment and curve projects included improvements such as enhanced signing and striping, rumble strips, and shoulders with safety edges. Intersection projects included improvements such as destination lighting, upgrading signs and pavement markings, and transverse rumble strips on stop-controlled approaches. **Table E-2** provides a consolidated cost summary of the recommended safety improvements developed for the county. **Section 6** of the LRSP and the **Appendices** include detailed project information.

Table E-2 – Engineering Countermeasures Cost Summary

Facility Type	Number of Locations	Estimated Project Cost
Segments	5	$2,197,000
Intersections	5	$190,000
Total Improvement Costs	**10**	**$2,387,000**

Due to the limited amount of available data, low traffic volumes, and limitations on the types of safety improvement projects that can be implemented on unpaved roads, location-specific recommendations were not developed for unpaved roadways. However, this LRSP includes safety recommendations that can be considered for implementation on the unpaved roadway system by the County Engineer.

E.6. Implementation

One of the goals of the LRSP project is to provide a document that is usable and can be frequently consulted by the County Engineer to aid in requesting funding and in the completion of traffic safety improvement projects on county-maintained roads. This section describes some recommendations on how this plan can be implemented within the county.

The project sheets developed and provided in **Appendix B2** and **Appendix C2** are intended to be used as a straightforward way to apply for safety improvement funding through the Highway Safety Improvement Program for Secondary Roads (HSIP-S). The recommendations contained within the project sheets lend themselves well to HSIP-S funding because they were developed based on a proactive risk factor assessment, with a focus on reducing the potential for fatal and serious injury crashes. The project sheets can also be used to apply for SS4A Implementation funding.

Additionally, there is a list of high-crash locations contained within **Section 7** of this document. It is recommended that the County Engineer consider applying for Traffic Safety Improvement Program (TSIP) funding at these locations because TSIP funding considers benefit-cost analysis. The County Engineer can review these locations to determine if safety improvements, similar to those outlined within **Section 6.2**, **Section 6.3**, and **Section 6.4** are applicable, and develop a TSIP application based on the recommended improvements.

The County Engineer should also review the projects within the Five-Year Program and consider including safety recommendations from the project sheets into those projects, where applicable. In future cycles of the Five-Year Program, it is recommended that the safety projects included on the project sheets be considered for inclusion in the program.

The County Engineer should also consider consulting the LRSP when developing a project for design or addressing a maintenance issue, in order to incorporate the types of safety improvement recommendations in the LRSP and in the project sheets. Doing so can help prioritize projects and emphasize safety in design and maintenance.

Finally, the LRSP can be consulted during routine maintenance activities such as striping and mowing (clearing and grubbing). The document can be used to provide instruction or education to maintenance crews about the safety implications of their work.

E.7. Next Steps

Project sheets containing the prioritized list of projects have been provided in **Appendix B2** and **Appendix C2** to aid the County Engineer in obtaining funding for safety improvements and/or for incorporating recommendations into planned roadway improvement projects. These sheets may require updating for funding applications in future years. The County Engineer may also make changes to the prepared project sheets based on local knowledge of the site, available funding, and/or specific needs.

It is recommended that the county continue to foster cooperation with other stakeholders and look for opportunities to improve and expand implementation of driver-related countermeasures. The county should continue its history of implementing a number of safety improvement projects annually. Based on current funding levels, it is anticipated that many of the engineering improvements listed in this plan could be implemented within five to ten years, or sooner. Additionally, this LRSP should be updated within five to ten years to reflect improvements that have been implemented, additional availability of roadway feature data, and changes in crash types and patterns.

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A	Serious Injury
AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
ARIDE	Advanced Roadside Impaired Driving Enforcement
Caltrans	California Department of Transportation
CMF	Crash Modification Factor
CRF	Crash Reduction Factor
CPST	Child Passenger Safety Technician
C-STEP	County-State Traffic Engineering Program
DARE	Drug Abuse Resistance Education
DEA	Drug Enforcement Administration
DEV	Daily Entering Vehicles
DOT	Department of Transportation
DRE	Drug Recognition Expert
EMS	Emergency Medical Services
FHWA	Federal Highway Administration
Five E's	Engineering, Emergency response, Education, Enforcement, and Everyone
FTYROW	Failure to Yield Right-of-Way
GDL	Graduated Driver's License
GIMS	Geographic Information Management System
GIS	Geographic Information System
GTSB	Governor's Traffic Safety Bureau
HFST	High Friction Surface Treatment
HPS	High Pressure Sodium
HSIP-S	Highway Safety Improvement Program – Secondary
HSM	Highway Safety Manual
HMVMT	Hundred Million Vehicle Miles Traveled
ICE	Intersection Configuration Evaluation
ICWS	Intersection Conflict Warning System
InTrans	Institute for Transportation at Iowa State University
IRI	International Roughness Index
ITSDS	Iowa Traffic Safety Data Service
K	Fatality
LED	Light-Emitting Diode
LRSP	Local Road Safety Plan
LRTF	Living Roadway Trust Fund
LTAP	Local Technical Assistance Program
MDST	Multi-Disciplinary Safety Team
MnDOT	Minnesota Department of Transportation
mph	miles per hour
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program

NHTSA	National Highway Traffic Safety Administration
OWI	Operating While Intoxicated
RSA	Road Safety Assessment
SHSP	Strategic Highway Safety Plan
SICL	Safety Improvement Candidate Location
SRPFCC	Sign Replacement Program for Cities and Counties
SS4A	Safe Streets and Roads for All
sTEP	Special Traffic Enforcement Program
SUDAS	Statewide Urban Design and Specifications
TEAP	Traffic Engineering Assistance Program
TSIP	Traffic Safety Improvement Program
usRAP	United States Road Assessment Program

1. INTRODUCTION

In the United States over 38,824 people lost their lives in motor vehicle crashes in 2020. According to the Federal Highway Administration (FHWA), rural road safety is a concern because rural fatalities account for about 43% of all fatalities across the United States, yet less than 20% of the population lives in rural areas. In addition, the fatality rate on rural roads is 1.7 times higher than the fatality rate in urban areas.

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1.1. What is an LRSP?

A LRSP is a document that provides a basis for systemic safety improvements along local roads. Rather than addressing “black spots,” the LRSP identifies systemic safety improvements along the roadway based on a risk factor analysis of the roadway. LRSPs not only assist local practitioners in understanding the types of crashes occurring on local roadways, but they also define a locally focused plan for practitioners to make informed, prioritized safety decisions. Additional benefits of LRSPs include:

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There were four phases of LRSPs performed in the state of Iowa that in total included 59 counties. Lucas County was completed in Phase 2 in March 2017. This LRSP will serve as an update the March 2016 LRSP in Lucas County with the latest data included. **Figure 1** illustrates the counties completed in Phases 1, 2, 3 and 4 as well as the location of Lucas County with respect to the state of Iowa.

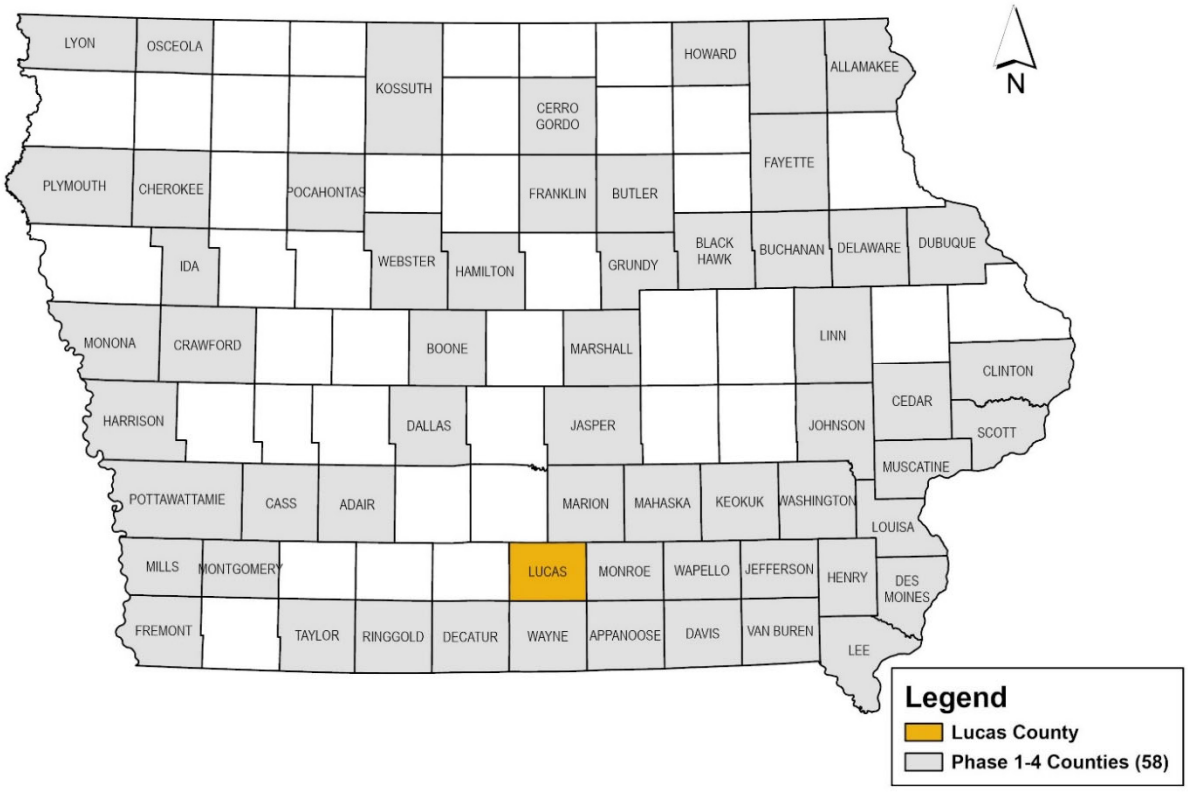

Figure 1 – Location of LRSP Counties with Respect to Iowa

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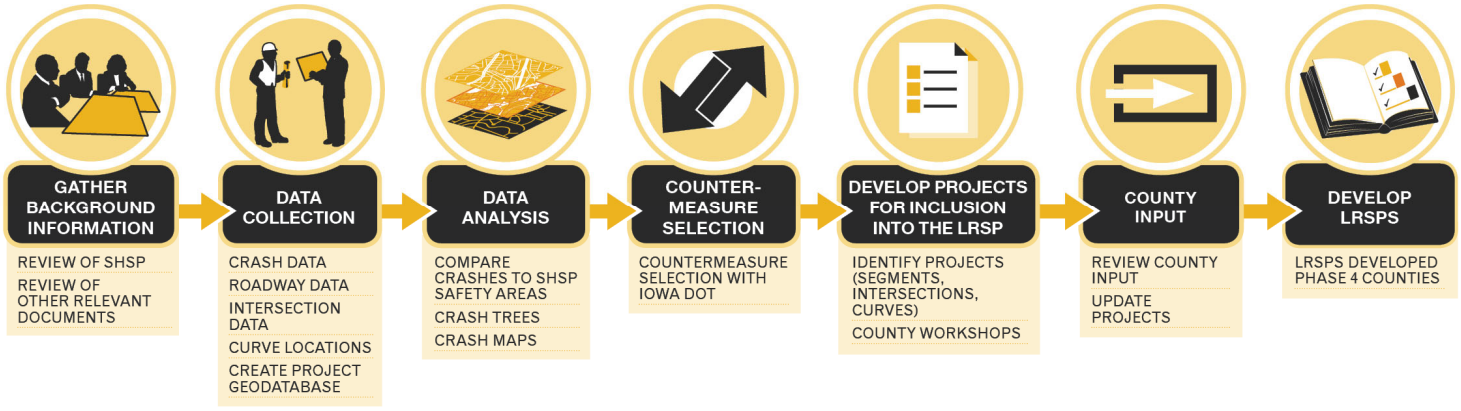

Figure 2 – LRSP Project Process

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- Access point database (911 address database)
- Pavement management database
- Horizontal curve database
- Stop sign database
- Intersection database

The project database that was collected for the 2017 Lucas County LRSP was reviewed against the most recent available data provided by the County. This analysis was performed with crash data from 2012 – 2021 to be consistent with the updated SHSP that will be released later this year.

1.4.3. Data Analysis

After development of the comprehensive GIS project database, the crash data was analyzed for Lucas County. Crashes were compared to the Safety Emphasis Areas for the State of Iowa (as defined in the SHSP). Relevant information from the crash data analysis is included within this document.

1.4.4. Countermeasure Selection

In coordination with the Iowa DOT, a list of low-cost engineering-related safety countermeasures was developed for use as recommendations in the LRSP project. These countermeasures are discussed in **Section 5** of this report.

In addition, one workshop was held with the safety stakeholders of Lucas County. Prior to the workshop, a list of safety topics was developed and distributed to the county to foster discussion at the workshop on driver-related safety countermeasure implementation. During this workshop, the following items were discussed:

- The background and purpose of the LRSP
- The five E's of safety
- Crash data
- Driver-related countermeasures

Driver-related countermeasures were reviewed, and stakeholders discussed existing and proposed driver-related countermeasures. A summary of the countermeasures currently underway in the county, as well as those proposed at the workshop, are included within this document.

1.4.5. Develop Projects for Inclusion into the LRSP

A risk factor ranking process was developed for segments, intersections, and curves. Risk factors were calculated for all paved segments, intersections, and curves and within the county. Risk factors included roadway features such as curve radius, shoulder width, and traffic volumes. After conducting the risk factor analysis, recommended safety improvements were developed for the feature types based on the project selection decision trees. Improvements included items such as additional signage, pavement markings, and rumble strips. Project sheets detailing the recommended safety improvements at specific locations were then provided to the County Engineer for review.

1.4.6. County Input

As the systemic analysis was based solely upon available GIS data, the associated recommended countermeasures did not incorporate data regarding geometrics, turning movements, right-of-way, etc. Additional safety countermeasures could be applied at locations that were determined to have a high risk factor ranking but may require additional site-specific information that may be known by the County Engineer. The project sheets, recommending countermeasures as determined by the project selection decision trees, were provided to the County Engineer for input for additional safety countermeasures. This step allowed the County Engineer to use engineering judgment and site-specific knowledge to recommend additional safety countermeasures at the identified/prioritized locations. At the county workshop, the project sheets and recommendations were reviewed.

1.4.7. Develop LRSPs

An LRSP was developed for the county, including a summary of the LRSP process, along with recommended safety projects for implementation by the county.

1.5. Document Organization

This document is organized into the following sections:

- **Section 1** presents the project background and purpose of the LRSP.
- **Section 2** provides a summary of relevant information reviewed as part of the study.
- **Section 3** summarizes the data collected and geodatabase developed for the analysis.
- **Section 4** describes the county crash data analysis.
- **Section 5** provides a summary of potential countermeasures and a summary of the driver-related countermeasure selection portion of the workshop.
- **Section 6** describes the methodology for project selection and safety improvement recommendations and provides a summary of the project selection portion of the workshop.
- **Section 7** includes a list of high crash segments, intersections, and curves for reference.
- **Section 8** provides a summary of the LRSP recommendations.
- **Appendices** include detailed county project sheets for paved segments, intersections, and curves as well as summary sheets including all locations that were analyzed as part of this LRSP.

2. BACKGROUND

Under this task, relevant documents were reviewed including the Iowa SHSP, funding sources, and other documents provided by the county. The following subsections summarize the background information that was gathered and reviewed as part of the LRSP.

2.1. Iowa SHSP

The most current Iowa SHSP is the 2019-2023 SHSP which is in effect until December 31, 2023. Iowa is currently working on the next SHSP which will be in effect from 2024 - 2027.

The current SHSP uses the analysis of crash data and extensive statewide input process with Iowa's traffic safety stakeholders to prioritize the 18 safety emphasis areas. This resulted in identifying eight of the 18 safety emphasis areas as priority safety emphasis areas. Each of the eight priority safety emphasis areas was reviewed to identify strategies to reduce fatalities and serious injuries.

As part of the 2019-2023 Iowa SHSP, five years of crash data for crashes resulting in fatalities and serious injuries were separated into 18 safety emphasis areas, which are generally defined by the American Association of State Highway and Transportation Officials (AASHTO) SHSP. This process determined the safety emphasis areas with the greatest number of crashes within Iowa and resulted in the focused opportunities for safety improvements on Iowa roadways.

There are 10 Key Safety Emphasis Areas that were determined by a data-driven process that took into account fatal and serious injury crashes by emphasis area, but also investigated trends within the emphasis areas. Identifying safety emphasis areas allows stakeholders to develop and prioritize strategies that can reduce fatal and serious injury crashes on Iowa roadways. Eight of the Key Safety Emphasis Areas which were defined in the 2017 SHSP are also presented in the 2019-2023 SHSP. Two additional Key Safety Emphasis Areas were noted: Roadside Collisions and Motorcycles. The Key Safety Emphasis Areas can be broken down into three categories: Infrastructure, Road Users, and Driver Behavior. Key emphasis areas in this report are from the 2019 to 2023 SHSP. Crash data for Iowa associated with those emphasis areas are from 2017 to 2021, which is from the 2024 – 2027 SHSP update that is currently in progress but not yet completed. Following is a summary of the eight (8) Key Safety Emphasis Areas and the local road emphasis areas for Iowa based on crash data from 2017- 2021:

- Infrastructure
  - Local Roads (69% of fatalities and serious injuries)
  - Intersections (29% of fatalities and serious injuries)
- Road Users
  - Unprotected Persons (37% of fatalities and serious injuries)
  - Younger Drivers (19% of fatalities and serious injuries)
  - Older Drivers (19% of fatalities and serious injuries)
  - Motorcycles (17% of fatalities and serious injuries)

- Driver Behavior
  - Speed-Related (52% of fatalities and serious injuries)
  - Unprotected persons (34% of fatalities and serious injuries
  - Impaired Driving (22% of fatalities and serious injuries)
  - Distracted Driving (13% of fatalities and serious injuries)

The Iowa SHSP identifies five basic components essential to meeting the goal:

- Education
- Enforcement
- Engineering
- Policy
- Data management and use

By focusing on all of these components, Iowa believes it is possible to achieve the improved safety goal set forth in the SHSP.

2.2. Iowa DOT Safety Programs

There are a wide variety of transportation safety funding sources available to counties within the State of Iowa. These funding programs can be used to implement treatments and recommendations for roadways and locations identified for improvements as part of this LRSP. The following Iowa DOT safety programs are available for the county to apply for funding to aid in implementation of the safety countermeasures identified within this LRSP.

- Iowa Grants and Programs Funding Guide
  http://www.iowadot.gov/pol_leg_services/Funding-Guide.pdf
- County-State Traffic Engineering Program (C-STEP)
  https://iowadot.gov/grants-programs/County-State-Traffic-Engineering-Program
- Highway Safety Improvement Program – Secondary (HSIP-S)
  https://www.iowadot.gov/traffic/sections/HSIP
- Traffic Engineering Assistance Program (TEAP)
  https://www.iowadot.gov/traffic/traffic-and-safety-programs/traffic-engineering-assistance-program-teap
- Traffic Safety Improvement Program (TSIP)
  https://iowadot.gov/traffic/traffic-and-safety-programs/tsip/tsip-program

2.3. Other Safety Funding Opportunities and Resources

This section describes various transportation safety funding opportunities and resources that are available for counties to improve safety on their roadways. It is recommended that the County Engineer review these resources and find programs or resources that are valuable and could be applied within the county.

- Safe Streets and Roads for All Grant Program (SS4A)
  https://www.transportation.gov/grants/SS4A

2.3.1. Iowa DOT Resources

2.3.1.1. Zero Fatalities

The Iowa DOT, the Department of Public Health, and the Department of Public Safety have committed to the ultimate goal of zero fatalities and have teamed up to provide safety information, answers to frequently asked safety questions, general crash statistics, and marketing materials at https://www.transportationmatters.iowadot.gov/zero-fatalities/.

2.3.1.2. Crash Maps

The Iowa DOT has a crash mapping website, which can be used to develop crash maps and data to compare crash history within a county. Crash maps can be created by anyone with an internet connection. There are also options to develop data summaries of crashes. https://icat.iowadot.gov/.

Crash maps can also be requested through the Iowa Traffic Safety Data Service (ITSDS). More information is available on the following website: www.ctre.iastate.edu/itsds/. ITSDS can provide crash analysis maps, diagrams, and reports such as:

- Crash histories for specific areas, roads, and intersections
- Fatalities and/or injuries
- Alcohol-related crashes
- Seatbelt status
- Cross-median crashes
- Pedestrian crashes
- Weather conditions

2.3.1.3. Roadside Chat

Iowa DOT's "Transportation Matters" blog includes an update every Friday that shows the week's safety message. Individuals can either check the blog each Friday, or sign up to receive updates via email by clicking the "Subscribe to Transportation Matters" button in the upper right corner of the each blog post https://www.transportationmatters.iowadot.gov/roadside-chat/. The information contained in the "Roadside Chat" can be posted to county websites or social media pages and can be used in the schools to educate students. **Figure 3** shows an example message from May 2023.

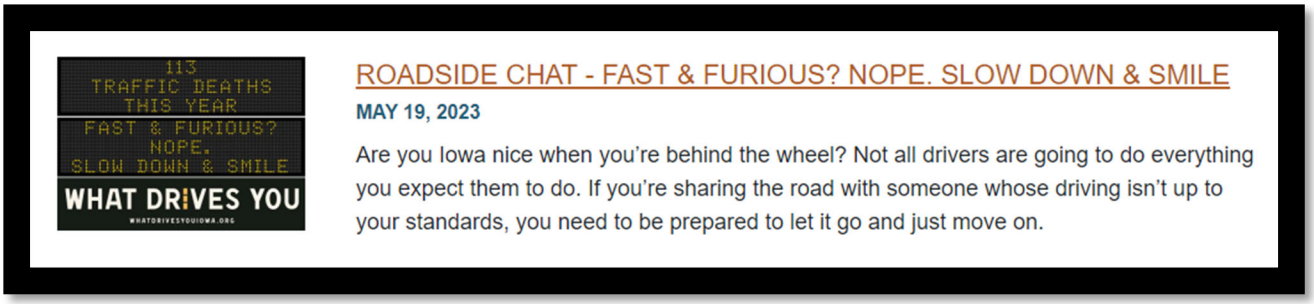


Figure 3 – Example Iowa DOT Transportation Matters Blog Post

2.3.1.4. Iowa Living Roadway Trust Fund (LRTF)

Since 1990, the LRTF has funded more than $17 million for research and demonstration projects, vegetation inventories, education and training programs, gateway landscaping, snow and erosion

control, roadside enhancement, and more. Establishing prairie plants in roadside rights-of-way reduces snow drift and winter glare and provides low maintenance weed and erosion control. Additional information is available at: https://www.iowadot.gov/lrtf.

2.3.1.5. CarFit

This program includes organized events designed to provide a quick and comprehensive check on how the driver and vehicle work together. Developed by the American Society on Aging, the focus of the program is on older drivers, but could benefit all drivers. Check the CarFit website at www.car-fit.org for an event in your community, or contact Iowa DOT's Driver and Identification Services to schedule an event (515-244-8725 or ods@iowadot.us). Visit the Iowa DOT website for more information on this program: https://iowadot.gov/mvd/carfit

2.3.1.6. Iowa Local Technical Assistance Program (LTAP)

Iowa LTAP serves local governments and helps them keep up with growing demands on local roads, streets, bridges, and public transportation. The center provides technical and management assistance to local transportation officials through multiple programs and trainings. https://www.iowaltap.iastate.edu/

2.3.1.7. Multi-Disciplinary Safety Teams (MDSTs)

Iowa's MDST Program facilitates the development and operations of local multi-discipline safety teams to help identify and resolve local crash causes and enhance local crash response practices (https://www.iowaltap.iastate.edu/MDST/). By coordinating communication and collaborating with other stakeholders, participants gain a broader perspective on safety issues and learn best practices from professionals outside their area of expertise. This ultimately leads to the development of solutions that may not have been considered otherwise. If you are interested in developing an MDST for your area, contact Theresa Litteral, Statewide MDST Facilitator, for more information (515-294-7465 or litteral@iastate.edu).

2.3.1.8. Road Safety Assessments (RSAs)

An RSA is a formal safety performance examination that reviews, in detail, the geometry of a roadway facility. As part of an RSA, an independent, multi-disciplinary team assesses the condition of a given roadway and provides short-, mid-, and long-term recommendations for safety improvements for all modes provided or planned to be provided by the facility. RSAs have been conducted throughout the United States and are generally accepted as a proactive, low-cost approach to improve safety. This countermeasure cost estimate listed in the project sheets does not include the cost of implementing the recommendations of the RSA.

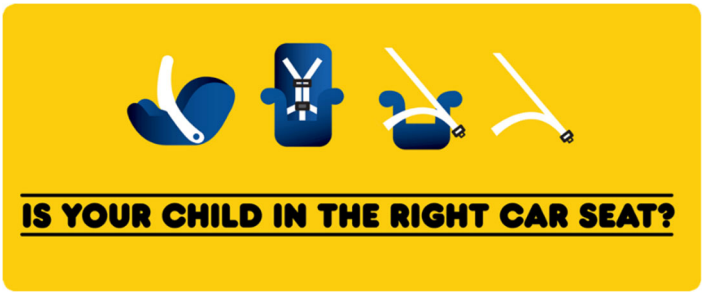
If you are interested in identifying funding for and conducting an RSA in your county, please contact David Veneziano, the LTAP Safety Circuit Rider, for more information (515-294-5480 or dvenez@iastate.edu).

2.3.2. Iowa Department of Public Safety Governor's Traffic Safety Bureau (GTSB)

"The Mission of the GTSB is to identify traffic safety problems and, partnering with city, county, state and local agencies, develop and implement traffic safety programs to reduce death and injury on Iowa's streets and highways. The GTSB provides federally funded grants to city, county and state entities, as well as hospitals, universities, and other non-profit agencies working to improve traffic safety in the State of Iowa." https://www.drivesmartiowa.com/.

2.3.2.1. Educational Materials

Educational materials are available from GTSB and can be accessed via their website (https://www.drivesmartiowa.com/). GTSB maintains fact sheets and media campaign information for the following driver-related countermeasures:



- Child Passenger Safety
- Impaired Driving
- Motorcycle Safety
- Seat Belts
- Distracted Driving

2.3.2.2. Enforcement Funding

Iowa's special Traffic Enforcement Program (sTEP) invites participation from law enforcement agencies to conduct "high-visibility" enforcement events in connection with national campaigns. This program provides up to $4,200 for overtime enforcement or equipment targeting traffic safety during designated sTEP waves throughout the year. A copy of the application for 405d funding is located in **Appendix F**.

2.3.2.3. Non-Enforcement Funding

Most non-enforcement agencies (hospitals, schools, etc.) have the option to apply for 402 funding because it is a broader traffic safety program that focuses specifically on alcohol/impairment programs. A copy of the application for 402 funding is located in **Appendix F**.

2.3.2.4. Safety Checkpoint Trailer

GTSB has a safety checkpoint trailer that contains all the equipment needed to set up a safety checkpoint. The trailer is available free of charge, and those wishing to use it should contact GTSB to schedule a date and pick-up/drop-off time.

2.3.2.5. Advanced Roadside Impaired Driving Enforcement (ARIDE)

GTSB provides training for Advanced Roadside Impaired Driving Enforcement (ARIDE) for law enforcement officers. This course is designed such that officers become more proficient at detecting, apprehending, testing, and successfully prosecuting impaired drivers.

2.3.2.6. Other GTSB Resources

GTSB has "drunk goggles" and a driving simulator that can be used for events to simulate the effects of impaired and distracted driving including reduced alertness, slow reaction time, visual distortion, alteration of depth and poor decision making. In addition, GTSB has summary sheets that can be provided to law enforcement succinctly summarizing Iowa child passenger safety, seat belts, and cell phone laws. Examples are included in **Appendix F**.

2.3.3. Blank Children's Hospital

2.3.3.1. Child Passenger Safety

Blank Children's Hospital provides an entire webpage focused on child passenger safety: https://www.unitypoint.org/blankchildrens/child-passenger-safety.aspx.

2.3.3.2. For Parents

Resources are available for parents including instructions on proper child restraint as well as registration for a free one-hour car seat safety class that is held twice a month. There is also information on locations for child safety seat inspections throughout the state.

2.3.3.3. National Child Passenger Safety Certification Training Program

The National Child Passenger Safety Certification Training Program is a three- to four-day training course that is paid for with funding provided by GTSB. The certification fee is $85.00.

2.3.3.4. Bike Safety

The Blank Children's Hospital has an *All Heads Covered: Our Wheeled-Sports Safety Program*. This program includes a curriculum kit that is designed to help educators teach bike and wheeled-sports safety in the classroom or community for elementary-aged children. They also have a Bike Safety Van that houses all the equipment to host a bike rodeo and is offered free of charge. Additionally, low-cost helmets are available through the program. Additional information is available on the following website: https://www.unitypoint.org/blankchildrens/bike-safety.aspx.

2.3.4. Other Websites and Resources

The following sections contain information on other websites and resources for traffic safety related information. Counties can use this information on their websites, social media outlets, or consider posting materials on bulletin boards in public spaces. An example can be seen in **Figure 4**, as found in Cedar County. Additionally, there are materials that can be used in schools to educate future and young drivers on the importance of wearing seatbelts.

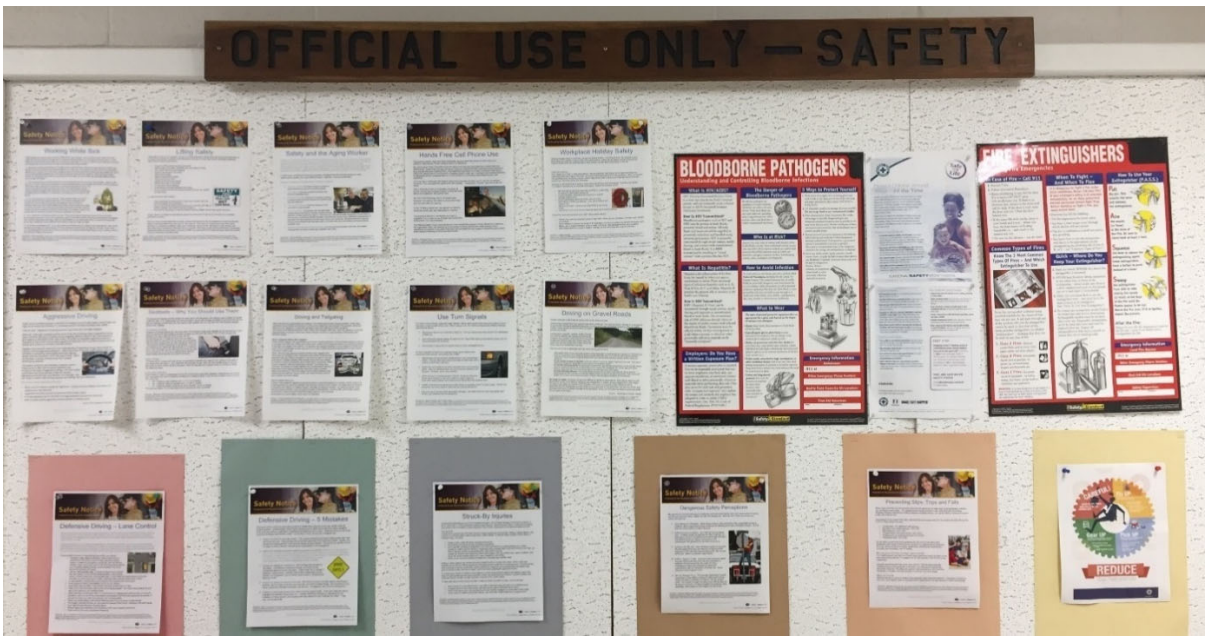


Figure 4 – Safety Bulletin Board in Cedar County

2.3.4.1. National Highway Traffic Safety Administration (NHTSA)

NHTSA has a wide variety of resources related to traffic safety which could be used by the county. NHTSA offers materials for numerous traffic safety campaigns, including impaired driving, car seats, vehicle safety, distracted driving, and motorcycles. These marketing tools offer a way to get involved through traditional media and online media (https://www.nhtsa.gov/).

2.3.4.2. Traffic Safety Marketing

Traffic Safety Marketing is an online resource for safety materials and can be used for safety campaigns. Counties are encouraged to download and use the traffic safety materials provided during campaigns and throughout the year. There are various materials that are free of charge and others that can be paid for. More information can be found at: https://www.trafficsafetymarketing.gov/.

2.3.4.3. Insurance Company Safety Information

Transportation safety information for young drivers is provided by various insurance companies, that could be used as a resource.

- Allstate Auto Insurance for Teen Drivers
  - https://www.allstate.com/auto-insurance/auto-insurance-for-teen-drivers.aspx
- GEICO Car Insurance for Teens and New Drivers
  - https://www.geico.com/information/safety/auto/teendriving/parents/
- Progressive Teen Driver Website
  - https://www.progressive.com/answers/teen-driver-insurance/
- State Farm Teen Driver Safety Website
  - https://www.statefarm.com/simple-insights/auto-and-vehicles/teen

2.3.4.4. Cell Phone Providers and Apps

AT&T has an “It Can Wait” Campaign that aims for users to take the pledge to never drive distracted. It provides tips for distraction free driving and real stories of people who have been impacted by distracted driving. More information can be found on their website: https://about.att.com/csr/itcanwait

There are various mobile applications (apps) that can be installed on phones to help prevent drivers from using their phones while driving. A few examples include:

- Cellcontrol (Truce Software)
- DriveMode
- EverDrive
- LifeSaver
- Polite

Verizon provides a website with a brief review of recommended apps to discourage texting while driving:

- https://www.verizonwireless.com/archive/mobile-living/home-and-family/apps-to-block-texting-while-driving/

DMV.org provides a resource and review of “Apps to Fight Distracted Driving” here:

- https://www.dmv.org/distracted-driving-apps.php

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3. Data Collection

As part of the LRSP project, a comprehensive GIS project database was developed utilizing crash data, roadway data, horizontal curve data, and the intersection database. The following sections describe the databases utilized for creation of the project geodatabase and later used for analysis.

3.1. Crash Data

The Iowa DOT statewide crash database includes crash history for all crashes occurring on a public roadway in the state that involve a personal injury or that satisfy a minimum property damage threshold of $1,500. This database is updated monthly.

The crash database provides crash-, driver/vehicle-, and person-level attributes. All crashes are geocoded. Crash data is available via the Iowa DOT open data portal. This LRSP utilizes 10 years of crash data for crashes occurring on roadways of interest between January 1, 2012 and December 31, 2021.

Crashes included in the crash database were identified based on their "County" and "Concatenated System" attribute values. "Concatenated System" is an Iowa DOT-derived attribute, conveying the roadway system(s) on which a crash was located. The three roadway systems in Iowa are the Primary system (state-owned), the Secondary system (county-owned), and the Municipal system (city-owned). All crashes with a "Concatenated System" value containing "Secondary," including intersections with state roadways, were selected for analysis for Lucas County.

3.2. Roadway Data

Various databases were used that contain different roadway data elements, including the GIMS, horizontal curve, intersection, pavement management, and roadside hazard databases. Information on location of existing stop signs and updates to the databases were also considered.

3.2.1. Horizontal Curve Database

A horizontal curve geospatial database was created for the Iowa DOT by the Wisconsin Traffic Operations and Safety Laboratory. This database includes horizontal curve alignments on the county road system.

3.2.2. Intersection Database

The Institute for Transportation at Iowa State University (InTrans) and the Iowa DOT have collaborated over the past several years to create a statewide intersection database. The foundation of this database is a GIS-based intersection point file created by the Iowa DOT's Office of Traffic and Safety. A selected set of inventory elements are being captured for each intersection and approach roadway with aerial imagery and street-level images.

3.2.3. Roadside Hazard Database

In coordination with InTrans, a roadside hazard ranking was developed using the United States Road Assessment Program (usRAP) guidance on roadside hazards and severity (www.usrap.org). The roadside assessment for the LRSPs is intended to represent the conditions along a half-mile section of roadway. The protocol was adapted from the usRAP approach. The following summarizes the general intent of the roadside assessment:

- Objects within 66 feet (20 meters) of the edge line were captured.
- A combination of the Street View and the aerial image was used to judge roadside distances and roadside conditions.
- Assessment based on the visible portion of Street View. Navigation along the roadway was limited, unless necessary to perform a better assessment.
- If the aerial image was clearly more recent than Street View, it was given additional consideration during assessment.
- Emphasis was on roadside conditions that could lead to a fatal or serious crash upon roadway departure.
- Generally overlooked isolated features, such as boulders, guardrail, etc.
- If the assessment point was at a special feature, like a bridge, the assessment point was repositioned to a more representative location.
- When no physical object was present along the roadside, the shape, foreslope, and backslope of the ditch were the primary consideration in the assessment.
- In some cases, multiple roadside hazards were present. The most hazardous was recorded.

A roadside assessment rating was assigned based on a combination of posted speed, distance to an object, and the object itself. The rating assignments used usRAP Road Attribute Risk Factors (operating and mean speed, roadside severity – object, roadside severity – distance). Ratings were calculated for both the driver and passenger side and averaged for each point. Finally, all the points within a roadway segment were averaged and an average roadside assessment rating was used to determine risk factor points, as described in later sections.

The roadside hazard rating was documented at half-mile intervals along each county paved roadway to assign crash risk factor points to individual segments.

3.2.4. 911 Address Database

The Lucas County 911 address database documents driveway addresses for businesses, homes, and structures within the county. It was utilized to obtain driveway locations along the county paved roadway system for this project. While this database does not document all access points along the roadway system, such as farm access roadways, it does capture locations with a higher number of vehicular turning movements, such as homes and businesses. Roadway segments with a greater number of access points have a higher risk for crashes, due to increased potential for vehicle conflicts.

3.2.5. Stop Sign Locations

While the intersection database contains the control type for the intersection (all-way stop, two-way stop, one-way stop, etc.), stop control at the approach level is not included. The County Engineer provided information indicating where stop signs were located along the county paved roadway system. This information was geocoded into the GIS database.

3.2.6. Existing Condition Updates to the Databases

Throughout the LRSP process, the County Engineer provided feedback on locations where the information contained within the existing databases was not current (for example, location of rumble strips, shoulder type and/or width, etc.). When these locations were identified, updates were made to the database.

4. DATA ANALYSIS

From January 1, 2012 to December 31, 2021, there were a total of 360 crashes on county roads in Lucas County, of which 29 resulted in fatalities and serious injuries. The following sections summarize the data analysis prepared for the county, noting how it compares to the state of Iowa as a whole.

4.1. Comparison of County Crashes to SHSP Key Safety Emphasis Areas

As part of the 2019 Iowa SHSP, five years of crash data for crashes resulting in fatalities and serious injuries were separated into 18 safety emphasis areas, which are generally defined by the AASHTO SHSP. This process determined the safety emphasis areas with the greatest number of crashes within Iowa and resulted in the focused opportunities for safety improvements on Iowa roadways.

For consistency with the four prior phases of the LRSP project, **Table 1** contains a comparison of Lucas County crashes resulting in fatalities and serious injuries to the Key Safety Emphasis Areas from the 2019-2023 Iowa SHSP. Because the SHSP was based on five years of crash data, five years of crash data (2017 to 2021) for the county was utilized to compare the crashes to the Iowa Key Safety Emphasis Areas. As shown in the table, the county crashes generally follow the same Key Safety Emphasis Areas as the state. **Table 2** shows the difference in rank for comparison. As shown in **Table 1** and **Table 2**, the Key Safety Emphasis Areas for the county generally rank the same as the Key Safety Emphasis Areas from the SHSP. It should be noted that this analysis includes all fatal and serious injury crashes within the county, not just on county roads.

Table 1 – County Fatalities and Serious Injuries by Safety Emphasis Area

Category	Safety Emphasis Area	Statewide Totals			Lucas County			Key Safety Emphasis Area
		Fatal and Serious Injury	% of Total	Rank	Fatal and Serious Injury	% of Total	Rank	
		8,570	100%	N/A	27	100%	N/A	
Drivers	Younger Drivers	1,600	19%	8	8	30%	6	X
	Older Drivers	1,593	19%	9	4	15%	10	X
	Speed-Related	4,482	52%	3	11	41%	4	X
	Impaired Driving	1,965	23%	7	6	22%	8	X
	Inattentive/Distracted Driving	1,294	15%	11	7	26%	7	X
	Unprotected Persons	3,151	37%	5	9	33%	5	X
Highway	Train	37	0%	18	0	0%	18	
	Lane Departures	4,520	53%	2	16	59%	1	X
	Roadside Collision	3,421	40%	4	12	44%	3	X
	Intersections	2,467	29%	6	6	22%	8	X
	Work Zone	150	2%	17	2	7%	14	
	Local Roads	5,923	69%	1	14	52%	2	
	Winter Road Conditions	538	6%	13	2	7%	13	
Special Users	Pedestrian	500	6%	14	3	11%	11	
	Bicycle	215	3%	15	1	4%	15	
Vehicles	Motorcycle	1,467	17%	10	2	7%	12	
	Heavy Truck	766	9%	12	0	0%	18	
	Other Special Vehicle	150	2%	16	0	0%	18	

Numbers in the columns may not add up to the totals because the injuries in one crash may be associated with multiple emphasis areas. For example, there could be a lane departure crash with serious injuries involving an impaired young driver on a local road.
Source: Iowa crash data records 2017-2021.
** Key safety emphasis areas are from the Iowa 2019-2023 SHSP*

Table 2 – County Fatalities and Serious Injuries Rank by Safety Emphasis Area

Category	Safety Emphasis Area	Rank			Key Safety Emphasis Area*
		Statewide Totals	Lucas County	Change in Rank	
Drivers	Younger Drivers	8	6	2	X
	Older Drivers	9	10	-1	X
	Speed-Related	3	4	-1	X
	Impaired Driving	7	8	-1	X
	Inattentive/Distracted Driving	11	7	4	X
	Unprotected Persons	5	5	0	X
Highway	Train	18	18	0	
	Lane Departures	2	1	1	X
	Roadside Collision	4	3	1	X
	Intersections	6	8	-2	X
	Work Zone	17	14	3	
	Local Roads	1	2	-1	
	Winter Road Conditions	13	13	0	
Special Users	Pedestrian	14	11	3	
	Bicycle	15	15	0	
Vehicles	Motorcycle	10	12	-2	
	Heavy Truck	12	18	-6	
	Other Special Vehicle	16	18	-2	

** Key safety emphasis areas are from the Iowa 2019-2023 SHSP*

Table 3 contains a tabular summary of the county crashes by roadway type and **Figure 5** contains a graphical summary of the county crashes by roadway type. K denotes a fatality and A denotes a serious injury.

Table 3 – County Crashes by Roadway Type

Roadway Type		Total Crashes		Fatal and Serious Injury (K & A) Crashes	
		Count	Percent	Count	Percent
County Paved	Intersection	19	5.3%	8	27.6%
	Non-Intersection	121	33.6%	13	44.8%
	Unknown / Not Reported	66	18.3%	0	0.0%
County Unpaved	Intersection	21	5.8%	0	0.0%
	Non-Intersection	105	29.2%	5	17.2%
	Unknown / Not Reported	25	6.9%	0	0.0%
County Unknown / Not Reported	Intersection	0	0.0%	0	0.0%
	Non-Intersection	2	0.6%	2	6.9%
	Unknown / Not Reported	1	0.3%	1	3.4%
Total		**360**		**29**	

**2012 to 2021 crash data*

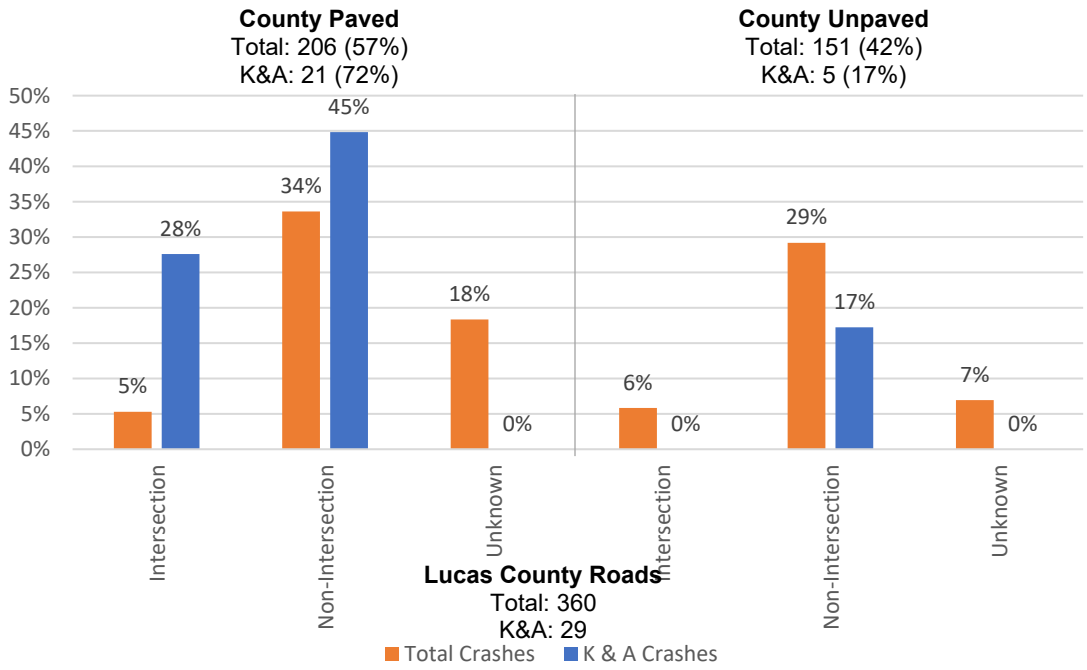


Figure 5 – County Crashes by Roadway Type

4.2. Total Crash Rates

From 2012 to 2021, there were a total of 360 crashes on county roadways within Lucas County. The Lucas County crash rate on county roads was higher than the Iowa crash rate, as shown in **Figure 6** which illustrates the comparison of the Lucas County crash rate on county roads to the overall Lucas County crash rate, and the Iowa crash rate during the same timeframe.

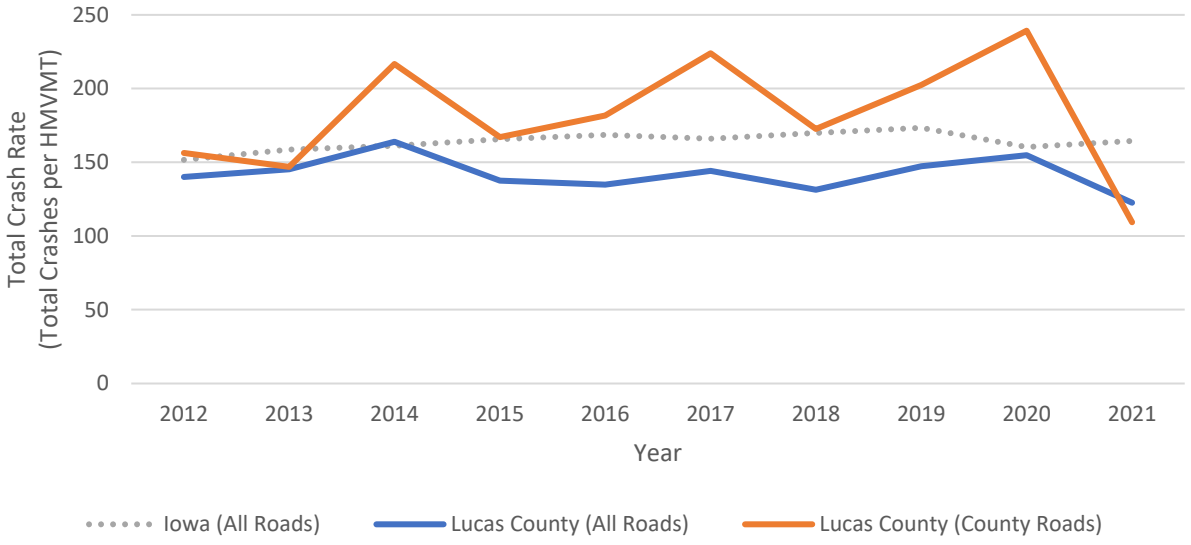


Figure 6 – Crash Rates (All Crash Severities)

4.3. Fatal and Serious Injury Crash Rates

From 2012 to 2021 there were a total of 29 fatal and serious injury crashes on county roads within Lucas County. Fatal and serious injury crash rates for all roads in Lucas County, the county-owned roads, and all roads in Iowa are illustrated in **Figure 7**. The Lucas County fatal and serious injury crash rate on county roads was higher than the Iowa crash rate.

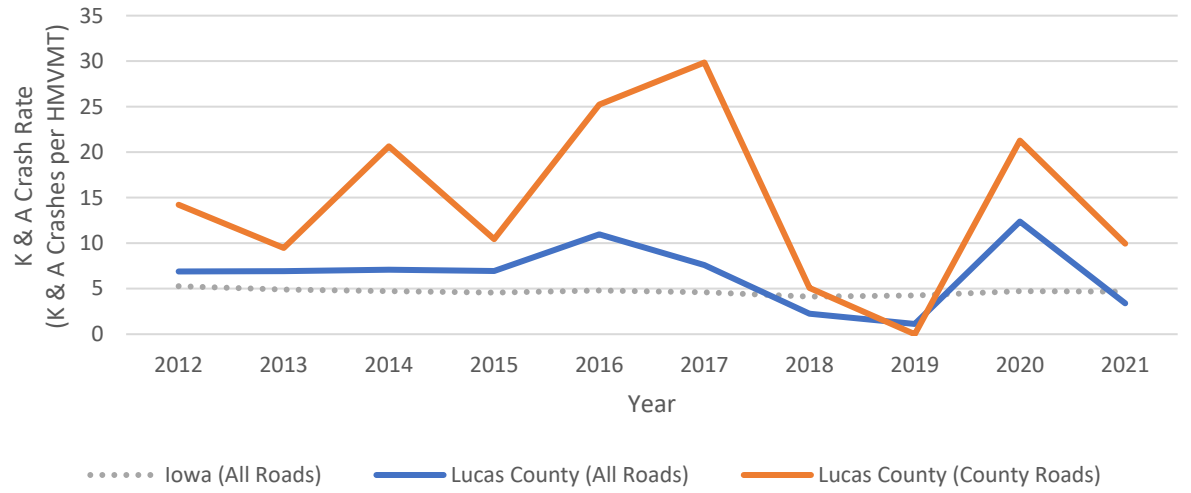


Figure 7 – Crash Rates (Fatal and Serious Injury Crashes)

4.4. Crash Rate Comparison

Figure 8 shows the average crash rates for all crashes as well as fatal and serious injury crash rates for both the county roads and statewide from 2012 to 2021. As illustrated in the figure, the county road crash rate for all crashes is higher than the statewide crash rate and the fatal and serious injury crash rate on county roads is higher than the fatal and serious injury crash rate statewide, demonstrating the importance of a focus on crashes on county roads.

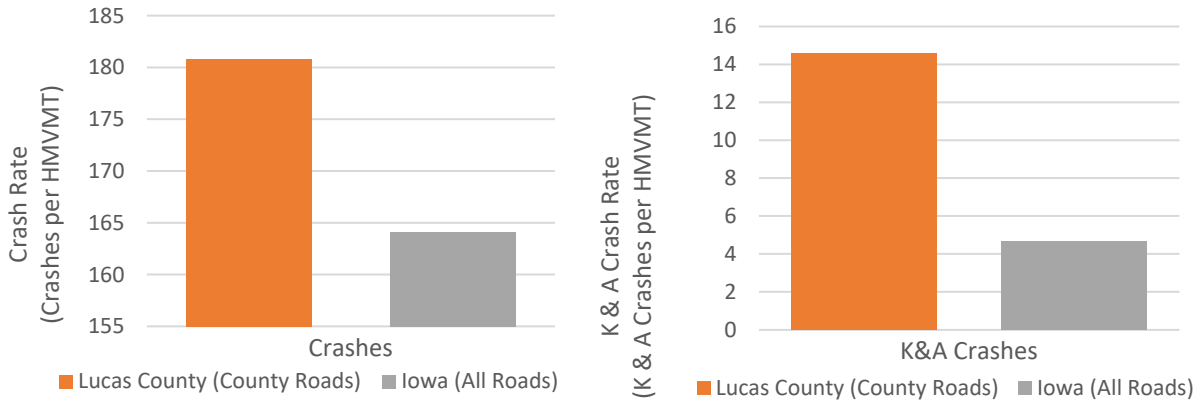


Figure 8 – County Road to Statewide Crash Rate Comparison

4.5. Additional Data Analysis

It should be noted that the Iowa DOT has made crash data available through a crash mapping website, which can be used to develop additional crash maps: https://icat.iowadot.gov. Crash maps can also be requested through the Iowa Traffic Safety Data Service (ITSDS). More information is available on the following website: www.ctre.iastate.edu/itsds/.

5. COUNTERMEASURE SELECTION

The following section summarizes systemic safety improvement countermeasures considered for this LRSP, risk factors, crash modification factors (CMFs), and countermeasures considered for inclusion in the LRSP. Additional information is provided summarizing the driver-related countermeasures underway within the county.

5.1. Potential Systemic Safety Improvement Countermeasures

The purpose of the LRSP project is to identify systemic safety improvements that can be implemented on county roads. The systemic approach takes a broad view of risk, examining it across an entire roadway system, rather than applying improvements to locations where crashes have previously occurred.

> ***"The systemic approach to safety involves widely implemented improvements based on high-risk roadway features correlated with specific severe crash types. The approach provides a more comprehensive method for safety planning and implementation that supplements and complements traditional site analysis. It helps agencies broaden their traffic safety efforts and consider risk as well as crash history when identifying where to make low cost safety improvements."***
>
> ***FHWA – Office of Traffic Safety***

5.2. Risk Factors

When developing systemic safety improvements, it is important to note potential risk factors associated with the crash types. The FHWA, as part of their Systemic Safety Project Selection Tool, has developed a list of potential risk factors that can help identify locations for systemic safety improvements. While not all the risk factors outlined below are utilized for the LRSP project due to data availability and crash types to be addressed, they have been included below for reference.

- Roadway and Intersection Features
  - Number of lanes
  - Lane width
  - Shoulder surface width and type
  - Median width and type
  - Horizontal curvature, superelevation, delineation, or advance warning devices
  - Horizontal curve density
  - Horizontal curve and tangent speed differential
  - Presence of a visual trap at a curve or combinations of vertical grade and horizontal curvature
  - Roadway gradient
  - Pavement condition and friction
  - Roadside or edge hazard rating (potentially including sideslope design)
  - Driveway presence, design, and density
  - Presence of shoulder or centerline rumble strips
  - Presence of lighting
  - Presence of on-street parking
  - Intersection skew angle
  - Intersection traffic control device

- Number of signal heads vs. number of lanes
- Presence of backplates
- Presence of advanced warning signs
- Intersection located in or near horizontal curve
- Presence of left-turn or right-turn lanes
- Left-turn phasing
- Allowance of right-turn-on-red
- Overhead versus pedestal-mounted signal heads
- Pedestrian crosswalk presence, crossing distance, signal head type

- Traffic Volume
  - Average Daily Traffic volumes (ADT)
  - Average Daily Entering Vehicles (DEV)
  - Proportion of commercial vehicles in traffic stream

- Other Features
  - Posted speed limit or operating speed
  - Presence of nearby railroad crossing
  - Presence of automated enforcement
  - Adjacent land use type (e.g., schools, commercial, or alcohol-sales establishments)
  - Location and presence of bus stops

5.3. Crash Modification Factors (CMFs)

When identifying potential systemic safety improvements, it is important to look at CMFs for the proposed improvements. The CMF Method is found in Part D of the HSM. CMFs are defined as the ratio of effectiveness of one condition in comparison to another condition and represents the relative change in crash frequency due to a change in one specific condition. In other words, a CMF is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. Countermeasures with CMFs less than one are expected to reduce crashes if applied, while those countermeasures with CMFs greater than one are expected to increase crashes. **Figure 9** illustrates the definition of CMFs.

$$CMF = \frac{\text{EXPECTED CRASHES WITH TREATMENT}}{\text{EXPECTED CRASHES WITHOUT TREATMENT}}$$

CMF = 1.0	Expected to have no impact on safety
CMF < 1.0	Expected to reduce crashes
CMF > 1.0	Expected to increase crashes

Figure 9 – CMF Calculation

The CMF Method is used to calculate the expected number of crashes by taking the observed number of crashes and multiplying those crashes by the applicable CMF for the proposed countermeasure. It is recommended that CMFs be applied to a minimum of three years of crash data for urban and suburban sites and five years of crash data for a rural site. **Figure 10** is a sample calculation of the CMF method with one CMF being applied to a particular site for a single year.

10.1 crashes / year x 0.91 (CMF) =	9.2 crashes / year: a reduction of 0.9 total crashes per year and a CRF of 9%

Figure 10 – CMF Method Sample Calculation

A Crash Reduction Factor (CRF) is similar to a CMF but stated in different terms. A CRF is defined as a percentage of crash reduction that might be expected after the implementation of a given countermeasure at a specific site. **Figure 11** shows how a CRF is calculated in relationship to a CMF.

$$CRF = (1 - CMF) \times 100$$

Figure 11 – CRF Calculation

Caution should be used in the selection of appropriate CMFs. The following guidance should be considered when selecting CMFs:

- CMFs should be selected from the HSM Part D or from FHWA's CMF Clearinghouse website (http://www.cmfclearinghouse.org).
- Read the countermeasure abstract to determine if the CMF is applicable to the proposed improvement.
- Only CMFs with a four-star rating or higher should be considered for use in analysis.
- Be sure the selected CMF is applicable to the set of crash data being used for analysis. Some CMFs may only be applicable to a subset of the crash data.
- The application of multiple CMFs can overestimate the expected crash reduction. Unless each CMF addresses independent crash types, multiple CMFs should not be used. It is suggested that no more than three independent CMFs be applied to a particular site.

5.4. Engineering Countermeasures

In **Section 6** of this report countermeasures are discussed and detailed in **Appendix B1**, **Appendix C1** and, **Appendix D1**. In some cases, CMFs are not available for particular countermeasures because sufficient data has yet to be collected, but the countermeasures are still believed to result in crash reductions. In other cases, the countermeasure is a proven FHWA countermeasure and the CMFs vary significantly based on the existing and proposed conditions. CMFs provided within this report were identified from the FHWA's CMF Clearinghouse (www.cmfclearinghouse.org) and are referenced in this report for information only to show the general benefit of the recommended countermeasures.

During Phases 1, 2, 3 and 4 of the LRSP project, the project team worked with 59 counties and the Iowa DOT to identify potential safety engineering countermeasures related to paved roadway segments, intersections, and curves. Additional countermeasures were identified during the District Road Safety Plan process that are incorporated into this project. The following sections summarize the proposed safety countermeasures for the county's LRSP.

Asterisk (*) denotes that upon consultation with the Phase 1, 2, 3 and 4 counties and the Iowa DOT, these countermeasures were determined to not be implemented at a systemic level; however, they should still be considered on a case-by-case basis by the County Engineer depending on the specific issues at a particular location and many have been provided on the back side of the project sheets.

5.4.1.1. County Paved Roadway Segment Countermeasures

The following roadway segment safety countermeasures were identified:

- Conduct an RSA
- Conduct an access control evaluation
- Wider pavement markings
- Improved pavement markings
- Shoulder width increase
- Safety edge
- Edgeline rumble strips
- Centerline rumble strips
- Install/enhance curve chevron, advanced curve warning, and advisory speed signs
- Remove obstructions within right-of-way (clearing and grubbing)
- Improve sight distance (clearing and grubbing)
- Flatten and widen foreslopes *
- On-pavement markings for speed control *
- Delineate roadside hazards (trees of utility poles) with retroreflective strips *
- Use of guardrails *
- Install post-mounted delineators *
- Install retroreflective strips on chevron sign posts *
- Transverse rumble strips prior to curves *
- Remove/relocate objects in hazardous locations *
- Superelevation correction on curves *
- Install High Friction Surface Treatment (HFST) on curves *
- Speed-activated flashers on chevron signs *
- Duplication of signage *
- Improved lighting *
- Improve access management (driveway policy) *
- Conduct speed studies *
- Modify lane width *

5.4.1.2. County Paved Intersection Countermeasures

The following paved intersection safety countermeasures were identified:

- Coordinate with local jurisdiction on signal modifications
- Signal warrant analysis to consider removal of signal
- Intersection Configuration Evaluation (ICE)
- Implement the results of ICE
- All-way stop analysis to convert two-way stop to all-way stop or remove stop signs
- Install destination lighting
- Increase size and/or retroreflectivity of stop signs
- Duplication of signage
- Wider pavement markings
- Improve pavement markings
- Flashing beacons on stop/yield signs
- Transverse rumble strips
- Install intersection warning signs and advanced street name plaques
- Improved sight distance (clearing and grubbing)
- Provide right-turn and/or left-turn lanes *
- Realign intersection approaches to reduce or eliminate intersection skew*

- Provide bypass lane on shoulder at T-intersections *
- Convert offset T-intersections to four-legged intersections *
- Use indirect left-turn treatments to minimize conflicts at divided highway intersections *
- Convert four-legged intersections to offset T-intersections *
- Flashing beacon on intersection warning signs *
- Stop signs with LED flashing lights
- Low-cost Intersection Conflict Warning Systems (ICWS) *
- Install a roundabout *
- Shoulder width increase *
- Safety edge *
- Use of retroreflective markers for trees or utility poles *
- Use of guardrails *
- Install retroreflective strips on stop sign posts *
- Access management *

5.4.1.3. County Paved Curve Countermeasures

The following horizontal curve safety countermeasures were identified:

- Wider pavement markings
- Shoulder width increase (paved)
- Safety edge
- Edgeline rumble strips
- Centerline rumble strips
- Install/enhance curve chevron signs
- Provide advance warning signage
- Remove obstructions within right of way (clearing and grubbing)
- Additional curve signage *
- Install retroreflective strips on chevron sign posts *
- Transverse rumble strips prior to curve *
- Superelevation correction *
- Install HFST on curves *
- Speed-activated flashers on chevron signs *
- Use of guardrails *
- On-pavement markings for speed control *
- Install post-mounted delineators *
- Use of retroreflective markers for trees or utility poles *
- Enhanced delineation and horizontal friction *

5.4.1.4. Additional Potential Countermeasures

The back side of the project sheets includes additional potential countermeasures for consideration by the County Engineer. For each location, there are a variety of other safety improvements that could be considered even though they were not recommended as part of this project due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. These additional countermeasures are discussed in **Section 6.2.6.**, **Section 6.3.6.**, and **Section 6.4.6.**

5.5. Driver-Related Countermeasures

A workshop was conducted in Lucas County on Monday, June 5, 2023, to discuss driver-related countermeasures and project selection. Representatives at the workshop included:

- Todde Folkerts (Lucas County Engineer)
- Carla Brown (Lucas County Secondary Roads Department)
- Mike Head (Lucas County Secondary Roads Department)
- Cathy Reece (Lucas County Board of Supervisors)
- Darcy Juline (Lucas County Health Center)
- Julie Masters (Lucas County Auditor)
- Brian Crozier (Lucas County Secondary Roads Department)
- Jayma Hoch (Lucas County Health Center)

The 2019-2023 Iowa SHSP has eight Key Safety Emphasis Areas, of which six are driver-related emphasis areas:

- Speed-related
- Unprotected persons
- Younger drivers
- Impaired driving
- Older drivers
- Inattentive/distracted driving

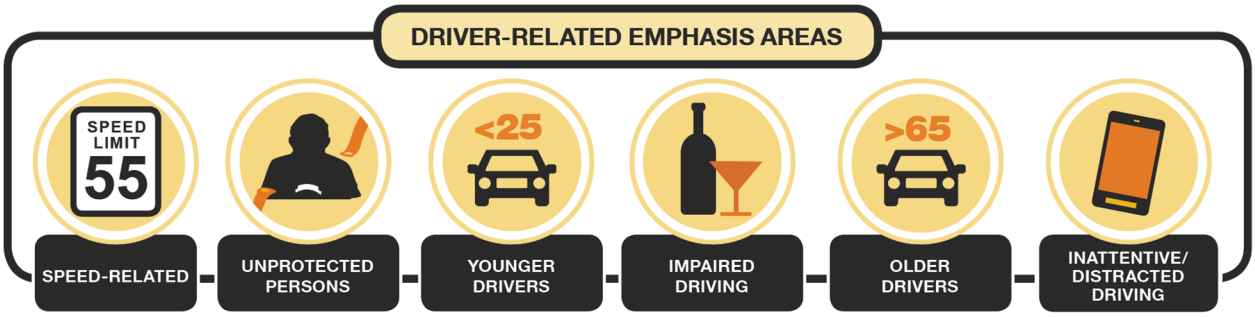


Figure 12 – Iowa SHSP Driver-Related Emphasis Areas

During the workshop, attendees were provided information regarding fatal and serious injury crashes within the county and how that data aligned with the Iowa SHSP Key Safety Emphasis Areas. Potential countermeasures were discussed with stakeholders to facilitate discussion on what action items were currently underway in the county with respect to driver-related crashes.

The following statuses of implementation for the various driver-related countermeasures were defined based on the results of the discussion at the county workshop:

- Underway/Ongoing (currently being done);
- Area for Improvement (ongoing, but could be enhanced);
- Opportunity (not being done, but could be implemented); or
- Completed in the Past (has been completed in the past, but not planned to be implemented in the future).

The following sections provide a summary of the status of implementation of the driver-related countermeasures within the county. It is recommended that the county continue to implement countermeasures that are currently underway/ongoing and look for additional opportunities to implement countermeasures that are not currently being implemented. This will require input from and coordination with all of the five E's of safety.

5.5.1.1. Speed-Related

Speed-related crashes are a common concern within all the LRSP counties, and account for half (52%) of fatal and serious injuries across the tate of Iowa. Many counties are facing budgetary constraints which limit the number of officers available to proactively conduct speed enforcement. Some counties stated that they could provide better enforcement with their available resources if speeding locations were identified on a map and/or if a speed trailer with the ability to log speed data by time of day and day of week were available to them. There is a common opportunity to provide an educational campaign with respect to speed-related crashes.

A topic of discussion in many of the County workshops involved drivers illegally passing school buses. While law enforcement in most counties are ticketing drivers for illegally passing school buses, it is unclear whether or not the Keep Aware Driving – Youth Need School Safety Act (Kadyn's Law) is being implemented in the court system. This law states that driving privileges will be suspended for 30 days for a first conviction, 90 days for a second conviction, and 180 days for a third or subsequent conviction along with fines.

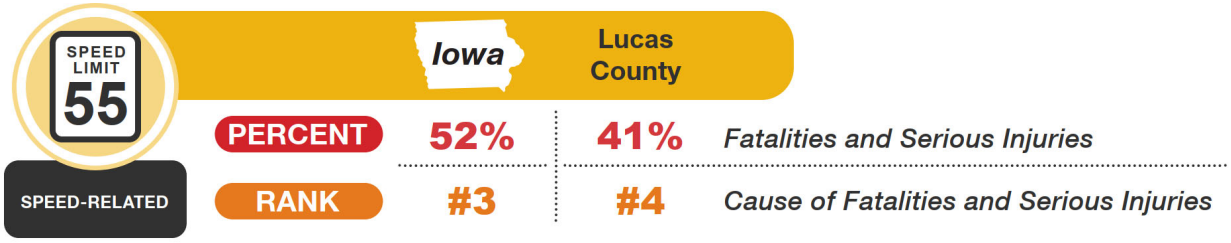


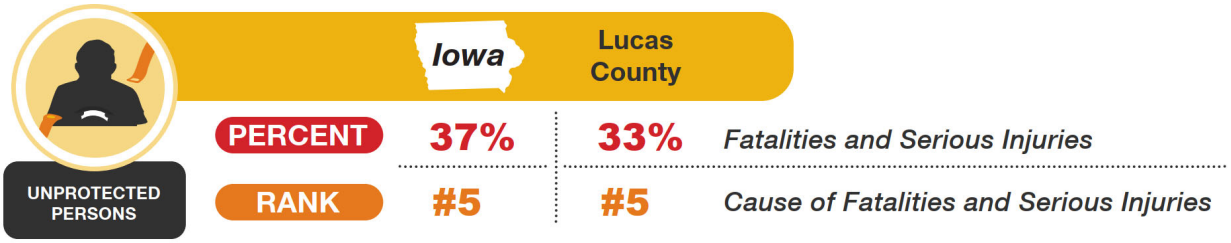
Table 4 provides a summary of the level of implementation of speed-related countermeasures in the county.

Table 4 – Speed-Related Countermeasure Implementation Status

Countermeasure	Status
Conduct speed enforcement - Some City Officers and the County participate in the Governor's Traffic Safety Bureau (GTSB) special Traffic Enforcement Program (sTEP) program. - Targeted enforcement could take place based on data.	Opportunity
Implement rigorous aggressive driving and speeding-related enforcement programs	Opportunity
Education campaigns relative to locations with high-risk of speed-related crashes, potentially in schools	Opportunity

5.5.1.2. Unprotected Persons

Many counties have seat belt compliance rates over 90%; however, unprotected persons still comprise more than one-third (37%) of the fatalities and serious injuries on Iowa roads. Most counties have at least one location within their community for instruction on proper child restraint use; however, there are opportunities to conduct "child restraint inspections and/or installation" events either individually or as part of a larger community event, such as the county fair, a safety fair, or a Fire Department open house. Additionally, counties could provide training to middle school children potentially through the Drug Abuse Resistance Education (DARE) program.



Several counties in Iowa have trained law enforcement to check for proper child restraints and provide them with a "cheat sheet" to keep in their vehicle so they are aware of the current laws. For example, Marshall County is in the process of developing a program where individuals who are cited for providing improper child restraint can attend a course on proper child restraints in lieu of paying the fine. A program such as this could provide valuable education on proper child restraints that can improve safety within Lucas County as well.

Multiple counties have programs where law enforcement or emergency medical service personnel (EMS) pass out ice cream certificates, pizza certificates, or candy to children wearing their helmets while riding their bikes. **Figure 13** shows some examples of certificates given out by Monroe County for bicycle helmet use. This is an excellent opportunity for positive reinforcement and encouragement for children to wear helmets. In Lucas County, ice cream certificates are being handed out for people wearing a helmet while riding their bicycle. It is important to note that since helmets are not required for motorcyclists in Iowa, there is little to no effort put forth to educate citizens on the importance of wearing a helmet when riding a motorcycle.

Source: Monroe County, IA

Figure 13 – Example Bicycle Helmet Reward Coupons

Unprotected person crashes resulted in nine (9) (33%) of the fatalities and serious injuries in Lucas County. The county receives GTSB funding for additional enforcement and documentation of seatbelt usage in the county. Workshop attendees felt the general public might not be aware of locations where parents or caregivers could have their child seats inspected. The Fire

Department hosts an annual event where certified Child Passenger Safety Technicians (CPSTs) check car seats.

A summary of unprotected persons countermeasure implementation in the county is included in **Table 5**.

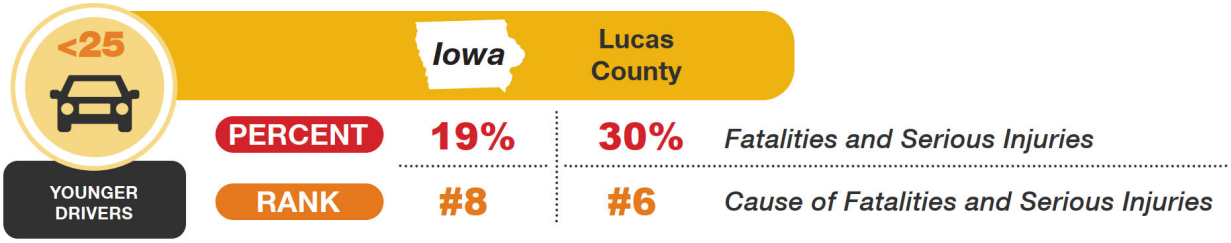
Table 5 – Unprotected Persons Countermeasure Implementation Status

Countermeasure	Status
Conduct publicized enforcement campaigns	Opportunity
Community locations for instruction in proper child restraint use - Certified Child Passenger Technician available from Decatur County	Underway/Ongoing
Conduct "child restraint inspection and/or installation" events at community locations - Annually there is a publicized car seat check hosted by the Fire Department	Underway/Ongoing
Train law enforcement to check for proper child restraint use in all motorist encounters - GTSB can provide "cheat sheets" for law enforcement on car seat laws	Opportunity
Education campaigns in schools - Opportunity to provide seatbelt/helmet education in schools - The hospital gives out helmets at schools annually	Underway/Ongoing
Hand out ice cream gift certificates for children wearing bicycle helmets (law enforcement, Emergency Medical Services (EMS), and/or fire department)	Underway/Ongoing

5.5.1.3. Younger Drivers

Crashes involving younger drivers account for about one-fifth (19%) of fatalities and serious injuries in Iowa. In counties where driver's education is still taught through the high schools, there is an opportunity for law enforcement to participate and provide training on targeted topic areas such as distracted driving, impaired driving, and seatbelt use. In locations where driver's education is privatized, it can be more difficult for law enforcement to become involved in additional training during driver's education courses.

Although schools have strict curricula to adhere to, there is still the opportunity for education with respect to younger drivers' issues such as "don't veer for deer"; texting and driving; what to do on an edge drop-off; etc. to occur through health classes or other programs within the schools. Many schools are participating in mock prom disaster events to raise awareness of impaired and distracted driving. It is important to note that counties can apply for TEAP funding to obtain assistance in reviewing traffic/safety issues around existing school sites.



Younger driver crashes account for eight (8) (30%) of the fatalities and serious injuries in Lucas County. Law enforcement noted that graduated driver's license (GDL) laws are difficult to enforce as written, but when violations are encountered, they are cited.

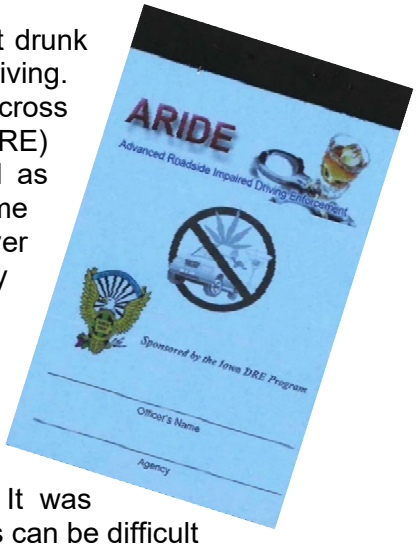
Mock Prom events were previously held every other year because prom is for juniors and seniors. As part of the Mock Prom event, drunk goggles were used to help educate younger drivers of the impact of impairment. GTSB recently brought a simulator to Woodbine to aid in younger driver education, and the behavioral health coalition has conducted the Drug Enforcement Administration (DEA) 360 Program in schools in an effort to reduce substance abuse. There is a health improvement plan conducted in the schools that covers mental health and substance abuse. There could be an opportunity for additional education as part of this program. Workshop attendees shared about the difficulty of a majority of the driver's education course being offered online now versus in person.

Table 6 provides a summary of the level of implementation of younger driver-related countermeasures in the county.

Table 6 – Younger Drivers Countermeasure Implementation Status

Countermeasure	Status
Improve content and delivery of driver's education/training - Driver's education curriculum is privatized.	Opportunity
Conduct additional training in schools ("drunk goggles"; "don't veer for deer"; what to do when on an edge drop-off; training in health class; etc.) - Opportunity for individual teachers of health, physics, or other classes. - The Highway Patrol has "drunk goggles" that can be used at events.	Opportunity
"Operation Prom" mock disaster - Mock crash events have been conducted in the county.	Area for Improvement
After Prom Event held at the high school - Students are invited to an event at the high school from after Prom until 5:00AM, they are not allowed to leave except with a parent during that time.	Underway/Ongoing
Prosecute and impose sanctions on drivers not obeying school bus stop bars	Opportunity
Enforcement of graduated driver's license laws	Underway/Ongoing

5.5.1.4. Impaired Driving

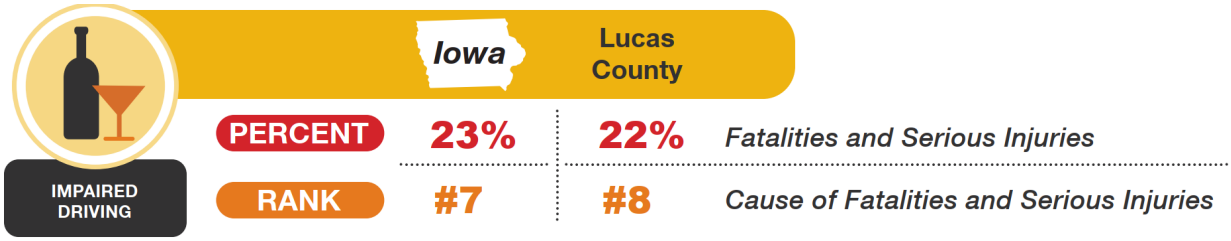


During the workshops, many counties noted that, while they felt that drunk driving was on the decline, there has been an increase in "drug" driving. Impaired driving accounts for 23% of fatalities and serious injuries across the state. Most counties have access to a Drug Recognition Expert (DRE) to assist in determining intoxication in routine traffic stops as well as crashes. Most counties proactively conduct OWI enforcement, and some counties receive GTSB grants for additional targeted enforcement. Over the years, some counties have conducted safety checkpoints. Safety checkpoints require a significant amount of resources from multiple jurisdictions, thus making them more difficult to conduct with the limited resources available. GTSB has a trailer that is available to counties and contains all of the supplies required to conduct a safety checkpoint.

In multiple workshops the topic of repeat OWIs was discussed. It was mentioned that prosecuting and imposing sanctions on OWI offenders can be difficult and, that at times, second and third offenses were being recorded as first and second offenses. Workshop attendees voiced the concern that considerable discretion is given to the County Attorney for plea bargains and diversion programs in order to manage caseloads. In Lucas County, workshop attendees felt that violations are not booked as a lower tiered offense; however, they are being prosecuted in that way.

In Muscatine County, they allow OWI offenders to perform manual labor as part of an alternative sentencing program. More information on the program can be found on the county website: http://www.co.muscatine.ia.us/159/Alternative-Sentencing and could be considered in Lucas County.

Another idea for helping rehabilitate OWI offenders that has been successfully implemented in other states is the "24/7 Sobriety Program." More information on the current program in South Dakota is available at: http://apps.sd.gov/atg/dui247/.



A total of 6 (22%) of the fatalities and serious injuries in Lucas County during the study period involved impaired driving. A summary of the impaired driving countermeasures discussed during the workshop along with the county's level of implementation is included in **Table 7**.

Table 7 – Impaired Driving Countermeasure Implementation Status

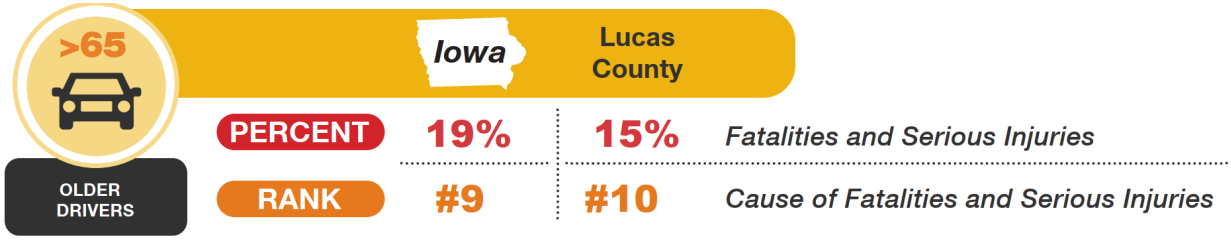
Countermeasure	Status
Conduct regular well-publicized safety checkpoints	Opportunity
Proactively conduct operating while intoxicated (OWI) enforcement - Enforcement is at times targeted at specific locations and around special events and holidays. - There are known areas where officers focus on OWI enforcement.	Underway/Ongoing
Conduct regular well-publicized compliance checks of alcohol retailers to reduce sales to underage drivers - The City Officers currently conduct compliance checks once per year.	Underway/Ongoing
Prosecute, impose sanctions on, and treat OWI offenders - Attendees felt that violations are not booked as a lower tiered offense; however, they are being prosecuted that way.	Area for Improvement

5.5.1.5. Older Drivers

Older driver crashes accounted for 19% of fatalities and serious injuries statewide. The counties mentioned that engineering countermeasures such as larger text, signs, and advanced intersection signage could be useful for older drivers. Retesting is successfully being implemented in many counties in situations where older drivers were at fault in a crash or as a result of a traffic stop. However, law enforcement in several counties noted that even when older drivers lose their driver's license, they still tend to drive due to the rural nature of the state and their need to access services. Older drivers are a consistent issue as driving is considered a form of independence that can be difficult to deny for life-long rural drivers.

In several counties, law enforcement noted a high percentage of older drivers on the roads during severe weather because they were following their daily routine regardless of the weather. There are opportunities to use local radio/TV stations to raise awareness of adverse weather conditions when drivers (particularly older drivers) should not drive. General weather/driving education could be given through community centers as well.

The Iowa DOT Driver and Identification Services sponsors events through the CarFit program, helping older drivers with the "fit" of their vehicle. The CarFit program includes discussions on mirror adjustments, foot positioning of the gas and brake pedals, position of the driver with respect to the steering wheel, and application of safety features of the vehicle. This program could be an opportunity for the county.



Older driver crashes resulted in 4 (15%) of the fatalities and serious injuries in Lucas County. A summary of older driver countermeasure implementation by the county is included in **Table 8**.

Table 8 – Older Driver Countermeasure Implementation Status

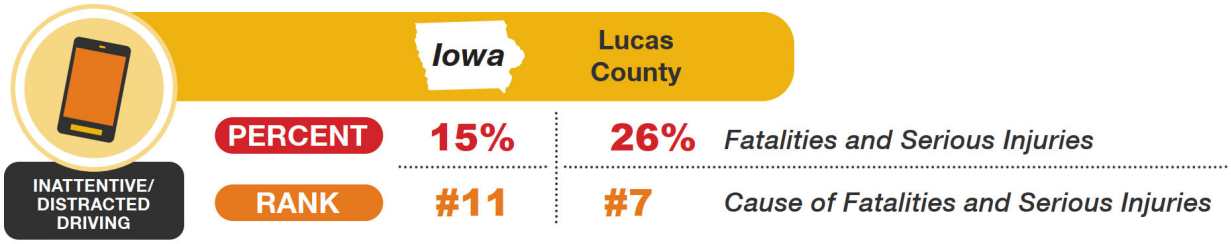
Countermeasure	Status
Establish resource centers within communities to promote safe mobility choices - Hospital has a program; however, the number of volunteers is limited.	Area for Improvement
Paratransit for older drivers - County does have paratransit/dial-a-ride service for the elderly.	Underway/Ongoing
Provide materials on paratransit information at community centers	Opportunity
Recommend re-testing of older drivers involved in crashes and citations - Retesting is situational, based on the recommendation of the officer.	Underway/Ongoing

5.5.1.6. Inattentive/Distracted Driving

During the workshops, it was noted that inattentive/distracted driving was most likely largely underreported, as it is difficult for law enforcement to determine what events specifically led to the crash. Workshop attendees noted that as cell phone coverage increases in rural areas, drivers using their cell phones will most likely increase. Additionally, Iowa does not have a "hands free" law as a primary offense, so law enforcement does not have the ability to pull drivers over and cite them for using their cell phones unless they are engaged in another illegal action. There is a hands-free bill in legislation that could be made effective this year.

There are opportunities to conduct education and awareness campaigns with respect to inattentive/distracted driving, either through schools, social media, radio, or TV. The City of Waterloo (located in Black Hawk County) is currently using TSIP funding for driver safety awareness campaigns, and Lucas County could apply for these funds as well. The Cerro Gordo County Sheriff utilized the distracted driving video simulator from *It Can Wait* (http://www.itcanwaitsimulator.org/) at their county fair. The simulator is a free download from the website, and all that is needed is a video game steering wheel, cell phone, and laptop. According to the County Sheriff, it was very popular, easy to use, and they are looking for opportunities to utilize it at future events. GTSB also has a simulator that can be used for events.

Many counties in Iowa have policies permitting only hands-free cell phone usage while on county business or within a county vehicle. Many of these policies were based on state policies such as that of the Iowa DOT. A hands-free policy is an opportunity for Lucas County to consider.



Inattentive/distracted driving crashes resulted in 7 (26%) of the fatalities and serious injuries in Lucas County. **Table 9** summarizes the implementation status of the inattentive/distracted driver countermeasures as recorded in the workshop.

Table 9 – Inattentive/Distracted Driving Countermeasure Implementation Status

Countermeasure	Status
Incorporate information on distracted driving into education programs for young drivers	Opportunity
Conduct education and awareness campaigns - Iowa DOT's "Transportation Matters" blog that update every Friday with that week's safety message can also be shared on social media.	Opportunity
Visibly enforce existing statutes to deter distracted and drowsy driving	Opportunity
County policy for "hands free" devices while driving county vehicle	Opportunity
Mobile simulator for distracted driving at community events or schools	Opportunity

6. Safety Project Development

Safety improvement projects were developed at high-priority locations along paved roadway segments, intersections, and horizontal curves within the county. Due to the limited amount of available data, low traffic volumes, and limitations on the types of systemic safety improvement projects that can be implemented on unpaved roads, location-specific recommendations were not developed for unpaved roadways. However, this LRSP includes safety recommendations that can be considered for implementation on the unpaved roadway system by the County Engineer.

This section describes the methodology of data analysis for project selection and prioritization for safety improvement projects for paved roadway segments, intersections, and horizontal curves.

6.1. Methodology

As shown in **Figure 14**, GIS data, as described in **Section 3**, was utilized to rank each of the county paved roadway segments, intersections, and curves based on risk factors. After the facilities were ranked, a decision tree was used to develop safety improvement recommendations along the facilities with the highest risk factor rankings. Draft project sheets for the highest-ranking facilities were developed summarizing the recommendations and estimated implementation costs for the project recommendations. The project sheets were provided to the county for review and comment, then finalized. Each of the methodology steps is described in detail in the following sections.

Figure 14 – Project Analysis Methodology

6.1.1. GIS Data

GIS data for the county paved road segments, intersections, and curves was utilized to perform a systemic analysis of the county-owned roadway facilities. Databases were obtained through collaboration and coordination with the county. Descriptions of the databases utilized for the analysis are included in **Section 3** of this document.

Once obtained, the data was analyzed using ArcMap GIS software as described in the following sections. Every roadway segment, intersection, and curve along the county-owned paved roadway system was analyzed.

6.1.2. Risk Factor Ranking

Iowa DOT crash data from 2012 to 2021 was utilized for analysis. This represents the most recent 10 years of crash data available at the time this project phase began. Risk factors along roadway segments, at intersections, and along curves were assessed to determine locations that may be more susceptible to crashes involving serious injuries and/or fatalities in the future, as opposed

to focusing only on locations that have had such crashes previously. In this analysis, various attributes were assessed in determining risk. The attributes that were assessed for determining risk are included in the subsequent sections for segments, intersections, and curves. Rankings of those attributes were developed for the LRSP in coordination with the Iowa DOT.

6.1.3. Project Selection Decision Tree

To aid in the systematic selection of safety improvement recommendations for the roadway segments, intersections, and curves with the highest risk factor rankings, three project decision trees were developed. A decision tree was developed for each facility type and are individually described in subsequent sections. A logical flow was created within the decision trees based on traffic volumes and roadway characteristics. Facility data was utilized to select which safety countermeasures (projects) were recommended at each location.

6.1.4. Draft Project Sheets

To summarize the information used in the analysis of the roadway segments, intersections, and curves within the county, individual project sheets were developed for those facilities with the highest risk factor scores. The draft project sheets included location, systematic ranking data, crash data, geometric data, and opinion of probable cost for the recommended safety improvements. **Figure 15** summarizes the general organization of and information contained within the project sheets.

6.1.5. Driver-Related Countermeasure and Project Selection Workshop

After development of the potential location-specific safety improvements and project sheets, an in-person workshop was conducted in Lucas County on Monday, June 5, 2023, to review implementation of the driver-related countermeasures along with the engineering safety countermeasures that were recommended for specific locations on the draft project sheets.

6.1.6. Project Sheets

After addressing the comments from the county, the project sheets for segments, intersections, and curves were finalized. The project sheets included in **Appendix B2** and **Appendix C2** are based on the best available information as of May 2023.

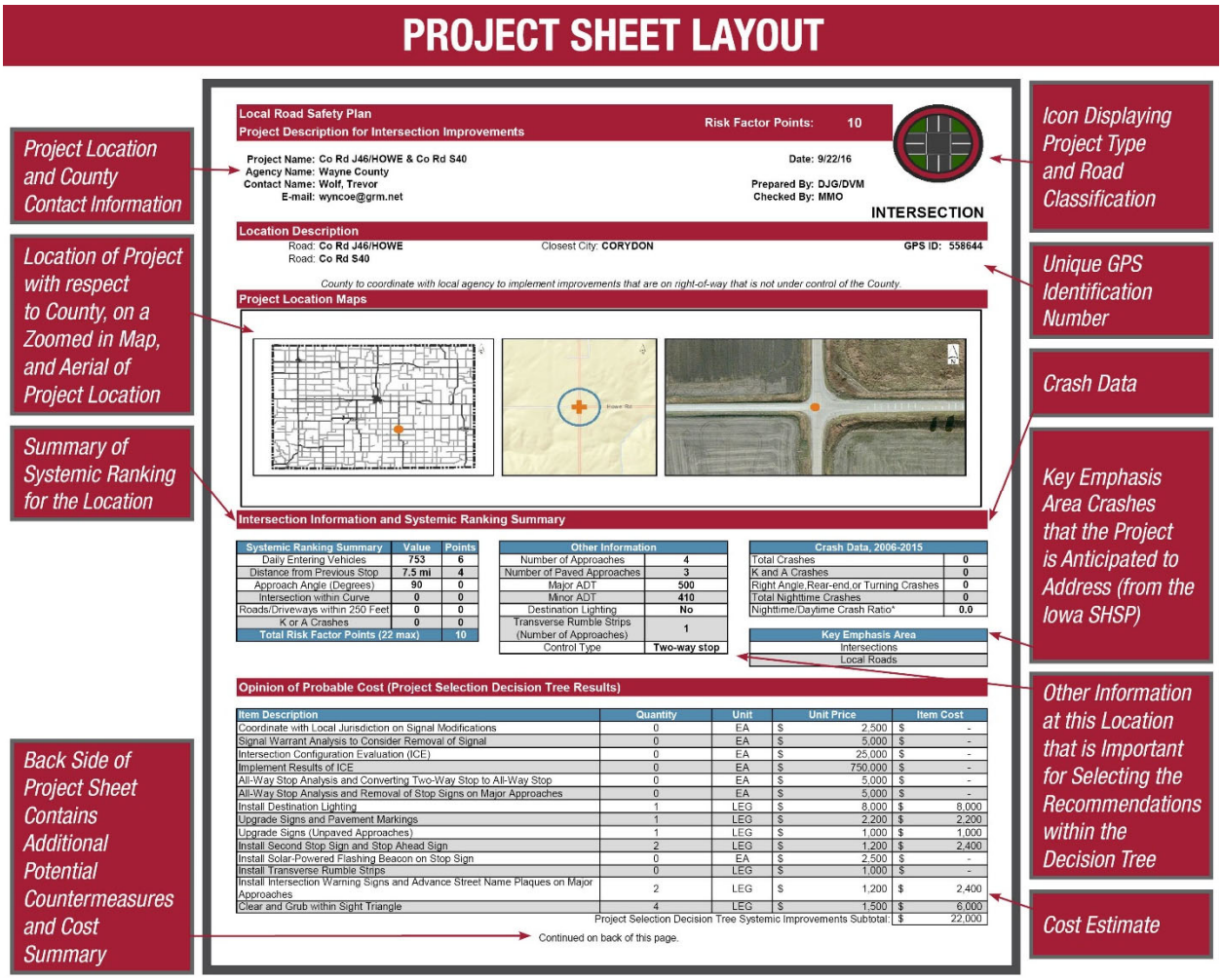


Figure 15 **– Project Sheet Summary**

6.1.6.1. Project Recommendations Disclaimer

The recommended improvements contained in the project sheets were developed through a system-wide GIS database risk assessment and project decision tree selection process, as described previously. Kimley-Horn could not confirm or control the accuracy of the GIS databases nor the suitability of the specific improvements for the location and has provided recommended improvements for consideration by the County Engineer. Site surveys were not conducted at the specific locations detailed in the project sheets. The County Engineer may use these project sheets as part of due diligence, but these project sheets should not be used as the sole basis for the County Engineer's decision-making. The County Engineer can make changes to the prepared project sheets using individual discretion. Kimley-Horn endeavored to research issues and constraints to the extent practical given the scope, budget, and schedule of the project. This assessment is based in large part on information provided by others (DOT, county staff, etc.) and therefore is only as accurate and complete as the information provided. The project sheets included in **Appendix B2** and **Appendix C2** are based on the best available information as of May 2023.

6.2. Segments

The methodology described in **Section 6.1** was followed for county-wide analysis of roadway segments based on the determined risk factors.

The road segment limits were determined based on relevant roadway attribute changes along a roadway including pavement width, shoulder width, and street name.

6.2.1. Risk Factor Summary

Each county paved road segment was assigned risk factor points based on the following seven roadway attributes:

- **Traffic Volume (ADT):** the daily average number of vehicles along the roadway segment. The ADTs for all the segments within Lucas County were compared against each other to assign higher risk factor points to segments with higher ADTs within the county.
- **Pavement and Shoulder Width:** the width of pavement and shoulders were used to assign risk factor points to each segment. Segments with narrower pavement and shoulder widths were assigned more risk factor points. **Table 10** further describes the number of points assigned for various width combinations.
- **Pavement Condition:** the average of the recorded roughness indices for the length of the segment. Segments with an International Roughness Index (IRI) value over 95 could potentially cause safety concerns and were assigned risk factor points. Per the FHWA, roadways with IRI values less than 95 are considered “good” condition, 95-170 are “acceptable,” and less than 170 are “poor.” Risk factor points were assigned to roadways with acceptable or poor ratings. Research has shown that a rougher ride can contribute to loss of control of a vehicle, particularly when braking or turning.
- **Roadside Hazards:** the average roadside hazard rating from both sides of the road for the length of the segment. Segments with higher roadside hazard ratings, as collected using usRAP procedures (see **Section 3.2.5.**), received higher risk factor points.
- **Access Density:** risk factor points were assessed based on the number of driveways and/or intersections per mile. Segments with higher access densities were assigned more points.
- **High-Risk Curve Density:** the number of high-risk curves per mile with a radius between 500 and 1,200 feet. Segments with a higher curve density were assigned more risk factor points.
- **Crash Experience:** the number of lane departure crashes for each segment in the county was reviewed to assign risk factor points to segments where there was a history of lane departure crashes.

Recommendations were made where segments were greater than 0.5 miles in length and where the posted speed limit was 40 miles per hour (mph) or higher. This was agreed upon based on the nature of the recommendations, which are more applicable to rural roadway segments, and to provide segments of sufficient length to justify mobilization of construction/maintenance crews and equipment.

Table 10 summarizes the risk factors used as well as the points developed in coordination with the Iowa DOT. As shown in Table 10, the maximum number of available points for roadway segment risk was 25 points.

Table 10 – County Paved Roadway Segments – Risk Factor Ranking

Risk Factor	Measurement	Points	Risk Factor Weight	Max Points Available
Traffic Volume	Average Daily Traffic (ADT)	0: ADT percentile is 0%-14.3%	1	6
		1: ADT percentile is 14.3%-28.6%		
		2: ADT percentile is 28.6%-42.9%		
		3: ADT percentile is 42.9%-57.1%		
		4: ADT percentile is 57.1%-71.4%		
		5: ADT percentile is 71.4%-85.7%		
		6: ADT percentile is 85.7%-100%		
Pavement and shoulder width	Pavement and shoulder width in feet (ft)	0: Pavement width ≥ 22 ft and shoulder width ≥ 2 ft	2	4
		0: Pavement width > 18 ft and < 22 ft, and shoulder width ≥ 4 ft		
		1: Pavement width ≥ 22 ft and shoulder width < 2 ft		
		1: Pavement width > 18 ft and < 22 ft and shoulder width ≥ 2 ft and < 4 ft		
		1: Pavement width ≤ 18 ft and shoulder width ≥ 4 ft		
		2: Pavement width > 18 ft and < 22 ft, and shoulder width < 2 ft		
		2: Pavement width ≤ 18 ft and shoulder width < 4 ft		
Pavement condition	Average International Roughness Index (IRI)	0: Less than 95	2	4
		1: 95 to 170		
		2: More than 170		
Roadside hazards	Average roadside hazard rating	0: Less than 1.5	2	4
		1: 1.5-3.0		
		2: More than 3.0		
Access density	Number of intersections and driveways per mile (driveway location per 911 address database)	0: Bottom quarter? of the access density Crash Modification Factor (CMF) *	1	3
		1: Second lowest fourth of the access density CMF *		
		2: Second highest fourth of the access density CMF *		
		3: Top fourth of the access density CMF *		
High-risk curve density	Number of curves per mile with a radius between 500 and 1,200 ft	0: Segments with no curves	1	2
		1: Curve density percentile is 1%-50% of segments with curves		
		2: Curve density percentile is more than 50% of segments with curves		
Crash experience	Number of lane departure crashes	0: No lane departure crashes	2	2
		1: One or more lane departure crashes		
Total available points				**25**

** Access Density CMF Equation as presented in the Highway Safety Manual (Equation 13-7)*

6.2.2. Risk Factor Rankings

Segment risk factor ranking calculations were performed on all county paved roadway segments (greater than 0.5 miles in length and with posted speed limits of 40 mph or greater). The result of the rankings is shown in **Figure 16**.

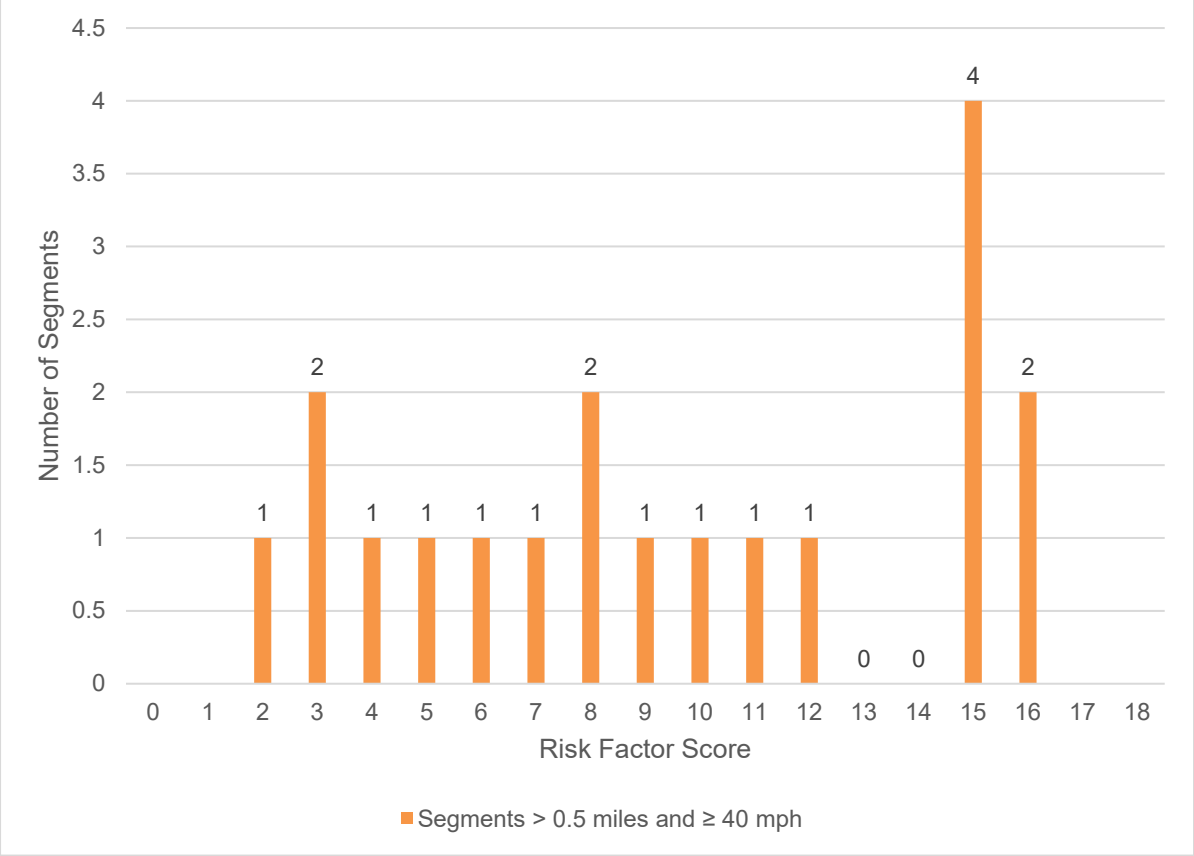


Figure 16 – County Paved Roadway Segment Risk Factor Ranking Summary

For visualization purposes, **Figure** 17 shows the location and summary of risk factor ranking of each of the roadway segments analyzed within the LRSP.

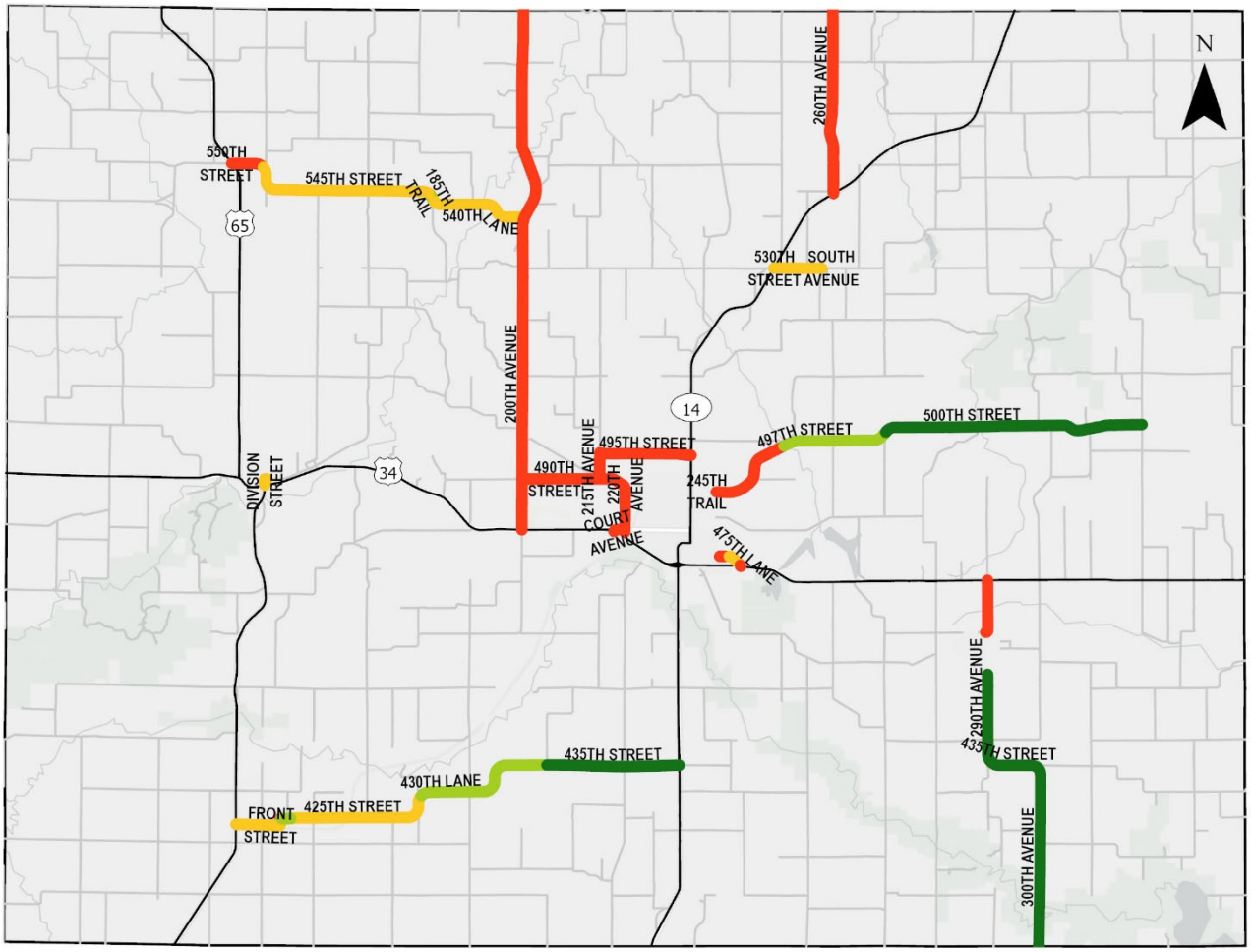


Figure 17 – County Roadway Segment Risk Factor Score Map

Legend

Segment Score

- High
- Medium - High
- Medium - Low
- Low

Roadways

- State Roads
- County Paved Roads
- County Unpaved Roads
- Corporate Limits

6.2.3. Segment Countermeasures

Table 11 summarizes the segment countermeasures for consideration including CMFs and estimated costs. **Appendix B1** provides detailed descriptions for each segment safety countermeasure.

Table 11 – County Paved Roadway Segment Safety Countermeasure Summary

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost
Conduct Road Safety Audit (RSA)	0.40 – 0.90 FHWA Proven Safety Countermeasure	$40,000/each
Conduct Access Control Analysis	CMF varies based on recommendations	$30,000/each
Install 4” Retroreflective Centerline	0.76 when installed in combination with edgelines	$3,000/mile
Install 6” Retroreflective Edgeline (Both Sides of Road)	0.63 – 0.78 FHWA Proven Safety Countermeasure	$6,000/mile
Edgeline Rumble Strips	0.61 – 0.86	$5,000/mile
Centerline Rumble Strips	0.66 – 0.96	$2,000/mile
Pave Shoulder with Safety Edge	0.79 – 0.89 FHWA Proven Safety Countermeasure	$150,000/mile
Review and Provide/Upgrade Curve Chevrons, Curve Warning Signs, and Speed Advisory Plaques to Meet the Manual on Uniform Traffic Control Devices (MUTCD) and Iowa DOT Standards	0.59 – 0.61 for warning signs/plaques; 0.75 – 0.84 for chevrons FHWA Proven Safety Countermeasure	$1,000/curve (upgrade) - $3,500/curve (install
Clear and Grub (Both Sides of Road)	0.78	$30,000/mile

Figure 18 illustrates the proposed roadway segment safety improvements as described in the previous sections. It is important to note that the County Engineer should follow all applicable guidelines and standards when implementing the roadway segment improvements including the Manual on Uniform Traffic Control Devices (MUTCD).

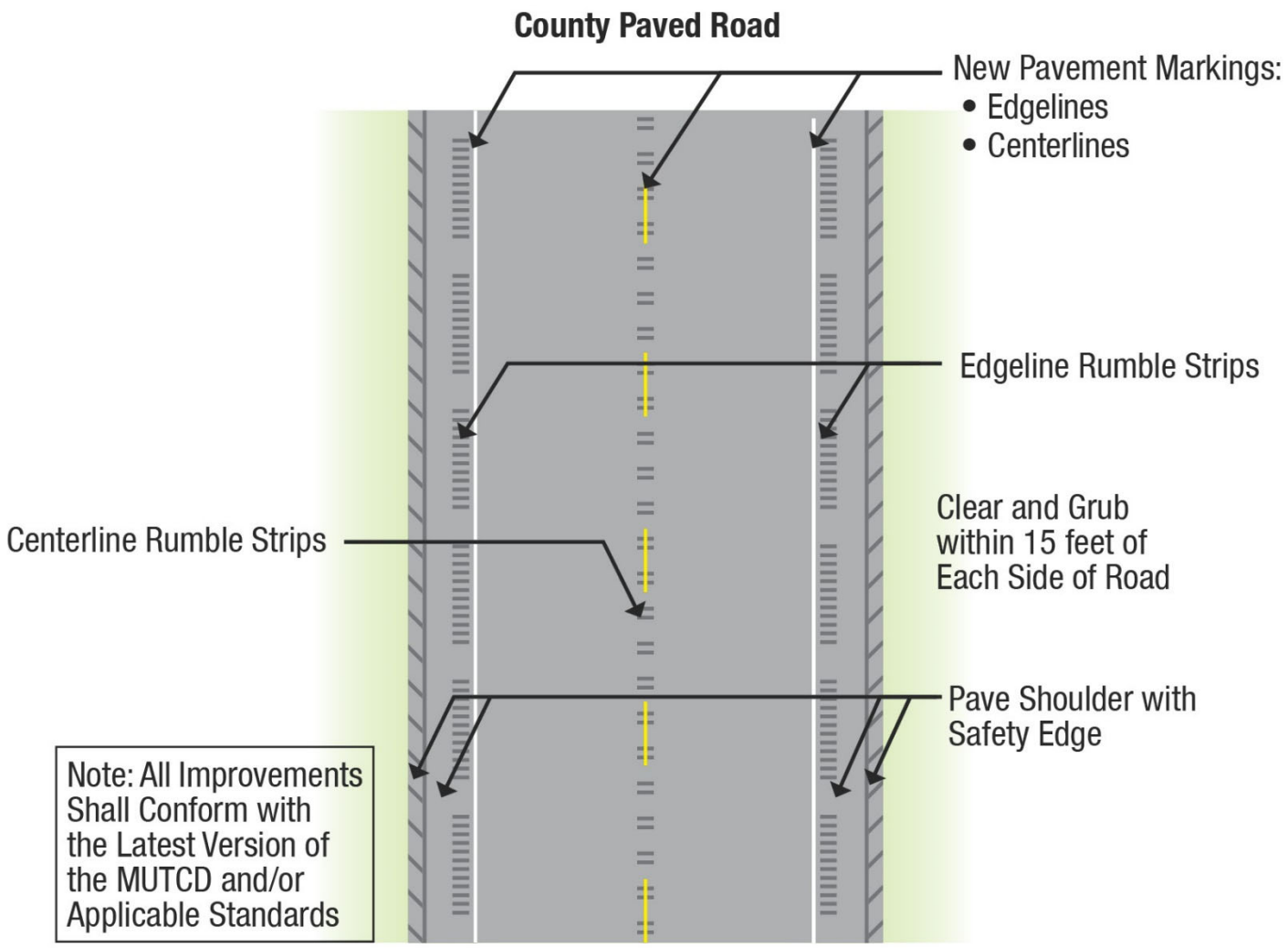


Figure 18 – County Paved Roadway Segment Safety Improvements

6.2.4. Project Selection Decision Tree

After conducting the risk factor calculations and rankings for all paved roadway segments within the county, and developing the segment safety countermeasures, a project selection decision tree was developed. The decision tree was utilized to develop and systemically define projects for the segments based on the characteristics of the segments (shoulder material type, lane width, etc.). The decision tree for roadway segment safety improvements is shown in **Figure 19**.

Each possible decision tree outcome represents a set of potential safety improvements for the roadway segment. The decision tree was utilized to determine projects for the segments with the highest risk factor rankings. Project sheets were developed for a minimum of the ten top-scoring segments in the county. Not all improvements are recommended at all locations and the project sheets contain the recommended improvements for the specific location based on the decision tree process, existing conditions, and defined criteria.

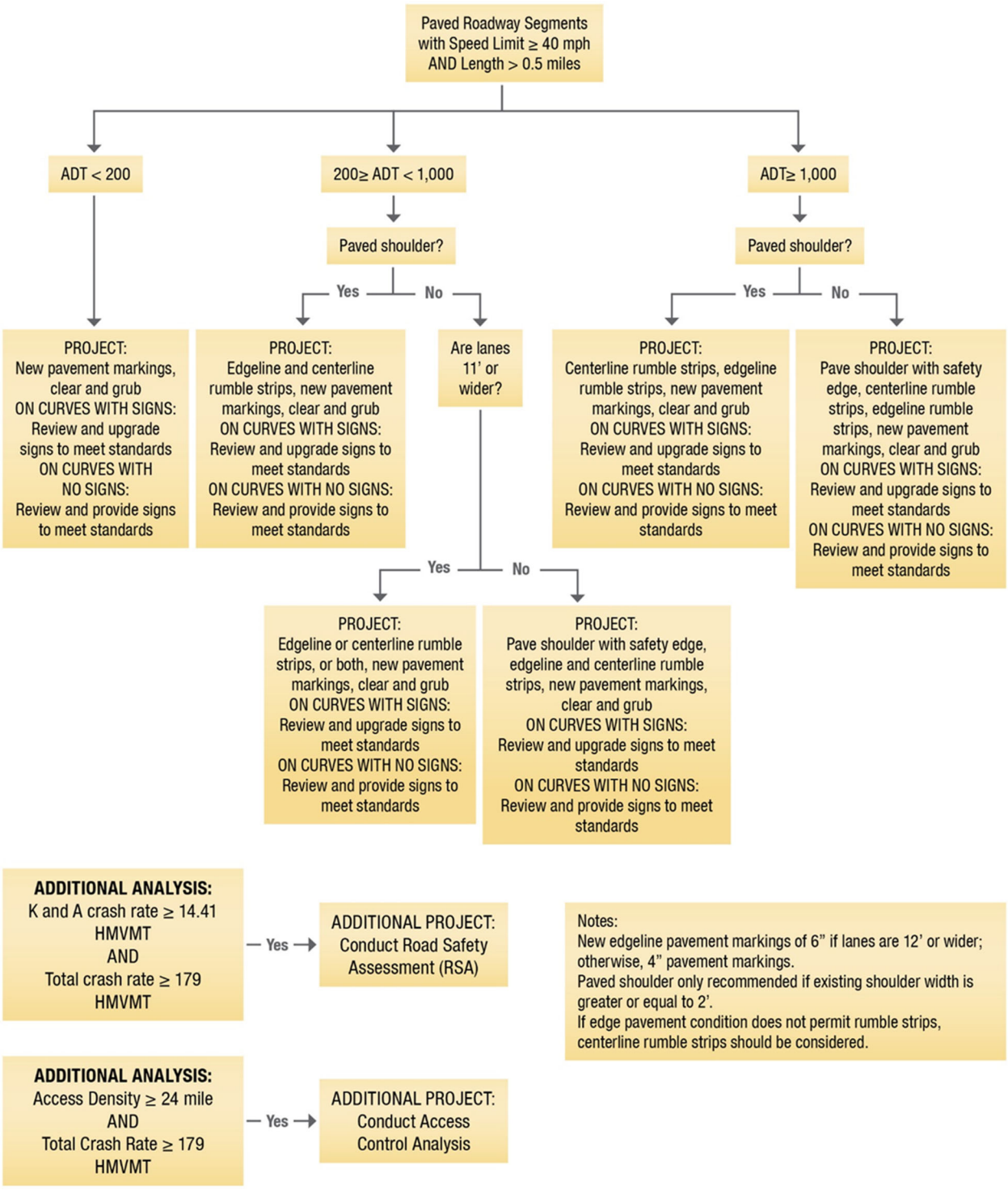


Figure 19 – County Paved Roadway Segment Project Decision Tree

6.2.5. Prioritized Segment Recommendations

After the decision tree was utilized to determine projects for the roadway segments with the greatest amount of risk factor points, project sheets were developed for these locations. The segments for which project sheets were developed (those with the greatest amount of risk factor points) are summarized in **Table 12** and the project sheets are included in **Appendix B2**. Also included in the table are the high scoring intersections and high scoring curves that fall within the segments.

Table 12 – County Paved Roadway Segment Prioritized Project Cost Summary

GPS ID	Segment	Segment Length (miles)	Risk Factor Points	High Scoring Intersections	High Scoring Curves	Estimated Project Cost
887-888	290th Ave between Iowa 14 and US 65	2.72	16			$705,000
593-890-891-892	Highway 306 between Iowa 14 and US 65	8.64	8	336885, 337009	45267-45268-45416	$540,000
497-901-904	Broad St between 155th Avenue and 150th Avenue	0.67	14			$74,000
882	S23 between Iowa state line and US 34	10.18	12			$566,000
649	550th St between 290th Avenue and US 65	6.20	11			$312,000
Total (5 Segments)						**$2,197,000**

Figure 20 shows the locations of the roadway segments with highest risk factor ranking, where project sheets and specific segment recommendations were made.

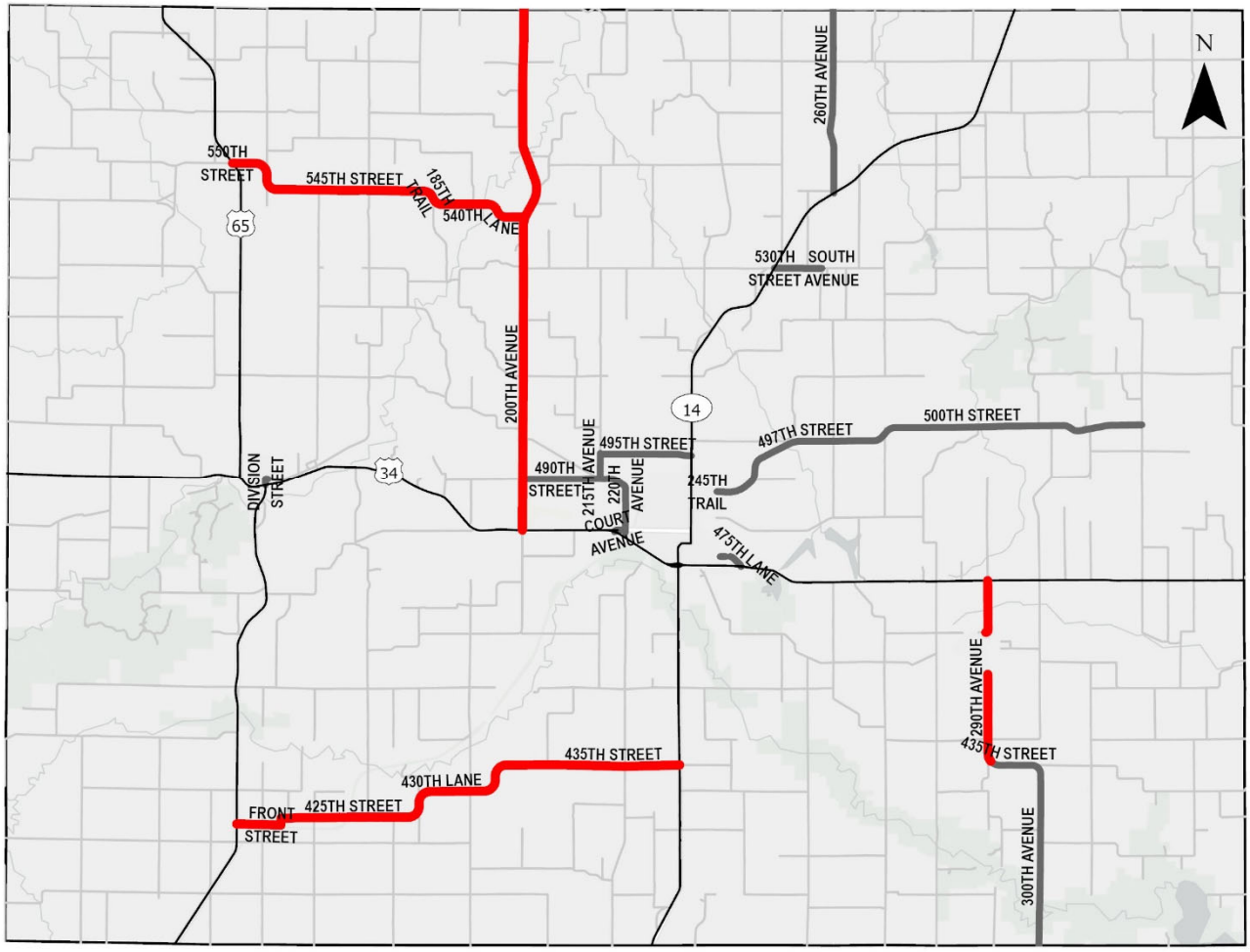
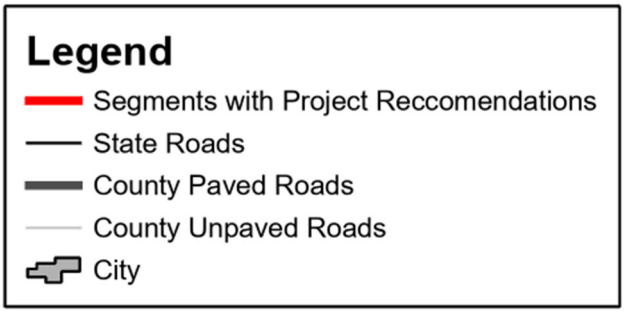


Figure 20 – County Paved Roadway Segment Prioritized Project Locations



Project sheets for the roadway segments with project recommendations are included in **Appendix B2**. The segment risk factor ranking results and relevant data for every analyzed roadway segment is included in **Appendix B3**.

6.2.6. Other Segment Countermeasures

As previously stated, the purpose of the LRSP project is to identify low-cost systemic safety improvement projects using a GIS analysis and a project selection decision tree. Safety improvements not included on the first page of the roadway segment project sheet may still merit consideration at a specific location. There are a variety of other safety improvements that could be considered that were not included in the project decision tree due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed at roadway segments throughout the county. **Table 13** provides a summary of several other roadway segment safety improvements that could be considered appropriate by the county and that were included on the back side of the project sheets as additional potential improvements. The CMFs, where they have been defined, and estimated costs of these countermeasures are included in the table. Detailed descriptions of each of the countermeasures is provided in **Appendix B1.** Estimated costs for these countermeasures were noted on the back side of the project sheet at the workshop, as directed by the County Engineer. However, the County Engineer could choose to add or remove such countermeasures from consideration at any time, based on engineering judgment or new information.

Table 13 – Additional Potential Roadway Segment Safety Countermeasure Summary

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost
Flattening and Widening Foreslopes	0.58 – 0.92 FHWA Proven Safety Countermeasure	$85,000/mile
On-Pavement Marking for Speed Control	CMF not defined	$3,000/each
Delineate Roadside Hazard with Retroreflective Marker	CMF not defined	$100/each
Guardrail	0.53 - 0.56 New Guardrail Along Embankment	$35/foot (if 500 feet or more) - $80/foot (if less than 500 feet)
Post-Mounted Delineators	0.55 when installed in combination with edgelines and centerlines	$5,000/mile
Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards	0.59 – 0.61 for warning signs/plaques; 0.75 – 0.84 for chevrons FHWA Proven Safety Countermeasure	$1,000/curve (upgrade) - $3,500/curve (install)
Retroreflective Strip on Chevron Sign Post	CMF not defined	$500/curve
Transverse Rumble Strips Prior to Curve	0.66 Install Transverse Rumble Strips as Traffic Calming Device	$5,000/curve
Remove/Relocate Object in Hazardous Location	0.56 – 0.78 FHWA Proven Safety Countermeasure	$1,000/each
Superelevation Correction on Curve	CMF varies based on rate of change	$20,000/curve (unpaved) - $50,000/curve (paved)
Install High Friction Surface Treatment (HFST) on Curve	0.27 – 0.58 FHWA Proven Safety Countermeasure	$20,000 - $50,000/curve
Speed Activated Flashers on Chevron Sign	0.40 FHWA Proven Safety Countermeasure	$4,000/sign

6.3. Intersections

The methodology described in **Section 6.1** was followed for a systematic analysis of county paved intersections based on the determined risk factors. Additional details on the risk factor calculations, risk factor ranking results, project selection decision tree, and project sheets are described in the following sections.

6.3.1. Risk Factor Summary

Every intersection containing at least one county-maintained paved roadway leg was analyzed for risk according to the following eight key attributes:

- **Distance from Previous Stop Sign:** if any stop-controlled approach had a distance of at least 1.5 miles from the previous stop sign, risk points were assigned. The longer the distance a driver travels without stopping, the more likely they are to fail to stop at the next stop sign because they are not expecting it.
- **Intersection Skew:** the intersection was assigned risk factor points if any of the side roads had an approach angle (skew) of less than 85 degrees. Based on Iowa crash data analyzed by InTrans, crash experience increases at intersections with skew at 85 degrees and 70 degrees. According to the *Highway Design Handbook for Older Drivers and Pedestrians*, "Skew angles in excess of 75 degrees often create special problems at stop-controlled rural intersections. The angle complicates the vision triangle for the stopped vehicle; increases the time to cross the through road; and results in a larger, more potentially confusing intersection."
- **Horizontal Curvature:** the number of curves (with length more than 100 feet and radius less than 1,000 feet) within 250 feet of the intersection on any county- or state-maintained approach. Risk factor points were assigned to intersections with one or more curves within close proximity of the intersection. Roadway curves in close proximity to intersections can limit sight distance, increasing crash potential.
- **Traffic Volume (DEV):** the average number of vehicles entering the intersection per day. The DEVs for all the intersections in the county were compared against each other to assign higher risk factor points to intersections with higher DEVs within the county. It is understood that more vehicles entering an intersection creates more exposure and therefore, increases the risk of a crash.
- **Minor Street Volume:** with a higher minor street volume, there is an increase in crash exposure, specifically with angle crashes. The third highest approach volume was used for the minor street volume, and volumes, as compared to other minor street volumes throughout the county were used to assign higher risk factor points where minor street volumes were higher.
- **Access Management:** risk points were assigned if an access point (driveway or other intersection) was located within 250 feet of the intersection. Driveways and other access points located within the functional area of intersections create additional opportunities for conflict points and cause drivers to make more decisions within the functional area of an intersection, increasing risk for a crash.
- **Crash Experience:** each intersection was assigned risk factor points if a K or A crash occurred within 150 feet of the intersection. This attribute takes into account crash history, which may be indicative of improvement needs.
- **Intersection Configuration:** as an additional risk factor to capture potential conflicts at an intersection, the number of approaches were considered as a risk factor. If an intersection had four or more approaches, it was assigned a risk factor point.

Table 14 summarizes the risk factors utilized for the risk factor analysis as well as the points developed in coordination with the Iowa DOT. The maximum number of available points for intersection risk was 22.

Table 14 – County Paved Intersections – Risk Factor Ranking

Risk Factor	Measurement	Points	Risk Factor Weight	Max Points Available
Traffic Volume	Daily entering vehicles (DEV)	0: DEV percentile is 0%-14.3%	1	6
		1: DEV percentile is 14.3%-28.6%		
		2: DEV percentile is 28.6%-42.9%		
		3: DEV percentile is 42.9%-57.1%		
		4: DEV percentile is 57.1%-71.4%		
		5: DEV percentile is 71.4%-85.7%		
		6: DEV percentile is 85.7%-100%		
Distance from previous stop sign	Stop sign locations based on information provided by the County Engineer	0: Less than 1.5 miles	4	4
		1: 1.5 miles or more		
Intersection skew	Skew angle of most skewed approach	0: 85-90 degrees	2	4
		1: 70-85 degrees		
		2: Less than 70 degrees		
Horizontal curvature	Intersection on or within 200 feet of a curve (Length > 100' and 500' < Radius < 2,500')	0: None	4	4
		1: 1 or more		
Access management	Driveways or another intersection within 250 feet of the intersection	0: None	1	2
		1: 1 or 2		
		2: More than 2		
Crash experience	Fatal or serious injury (K or A) crash within 150 feet of the intersection	0: None	2	2
		1: 1 or more		
Total available points				**22**

6.3.2. Risk Factor Rankings

Risk factor calculations were performed for each of the intersections in the county containing at least one county-maintained paved approach. The results of the risk factor rankings are provided in **Figure 21**. To further aid the county in determining which projects they may want to pursue, the intersections were divided into two categories:

- **County-State:** This includes intersections of county roads with Iowa DOT-maintained roads.
- **County-County and County-Other:** This includes intersections of county roads with other county roads as well as intersections of county roads with other roads that are not maintained by the county or the Iowa DOT (such as city streets).

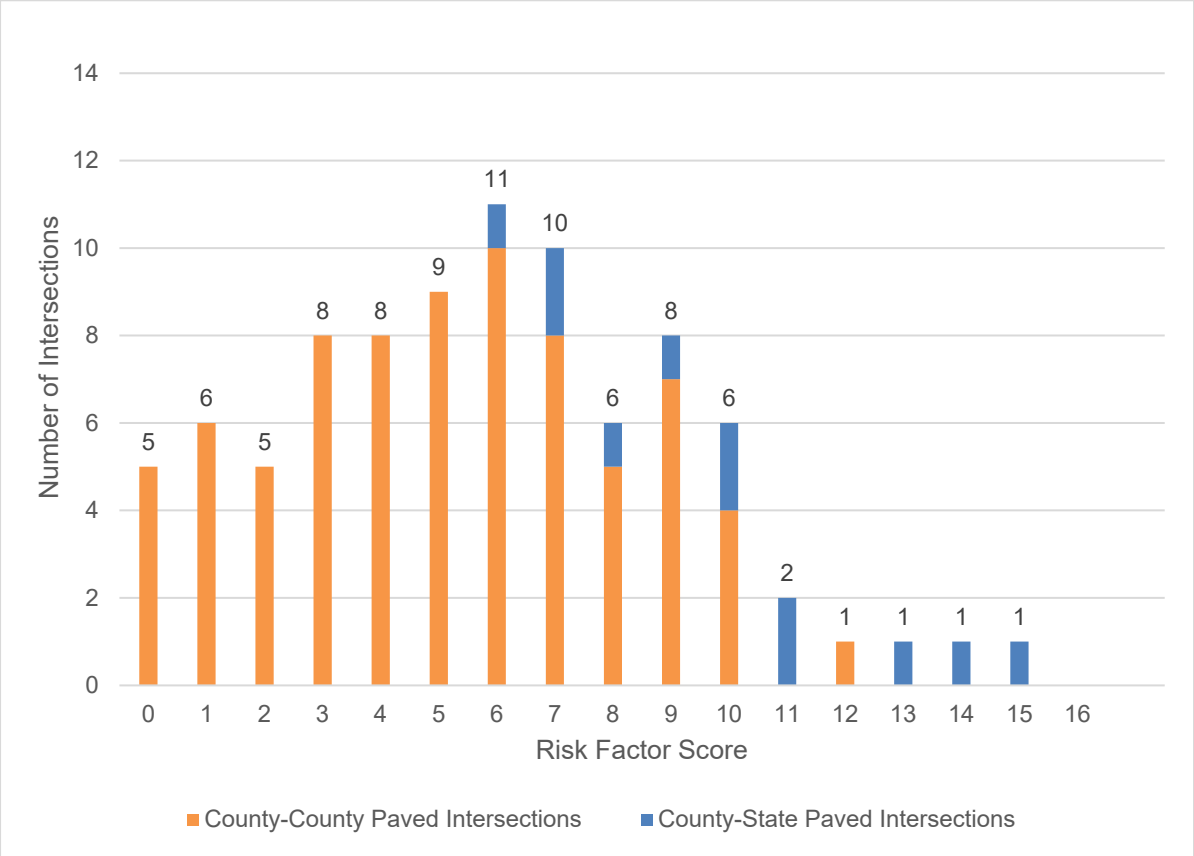


Figure 21 – County Paved Intersection Risk Factor Ranking Summary

For visualization purposes, **Figure 22** on the following page shows the location and risk factor score of each intersection analyzed within the LRSP.

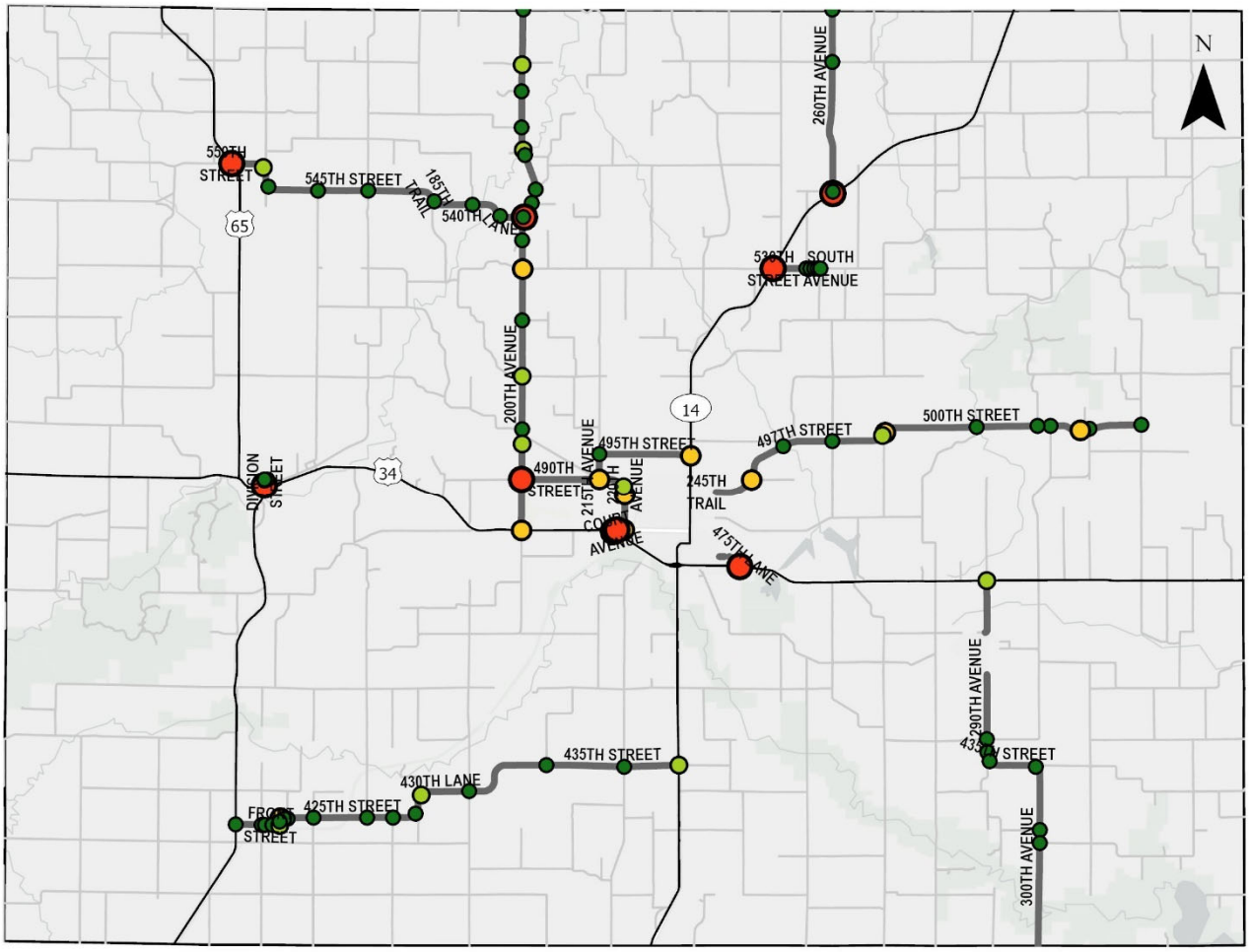


Figure 22 – County Paved Intersection Risk Factor Score Map

Legend

Intersection Score

- High
- Medium - High
- Medium - Low
- Low
- State Roads
- County Paved Roads
- County Unpaved Roads
- Corporate Limits

6.3.3. Intersection Countermeasures

Table 15 summarizes the intersection countermeasures for consideration including CMFs and estimated costs at the county paved intersections. **Appendix C1** provides detailed descriptions for each intersection safety countermeasure.

Table 15 – County Paved Intersection Safety Countermeasure Summary

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost
Coordinate with Local Jurisdiction on Signal Modifications	Varies based on modifications	$2,500/each
Signal warrant analysis to consider removal of signal	0.76 Remove Unwarranted Signal	$5,000/each
Intersection Configuration Evaluation (ICE)	Varies based on recommendations	$25,000/each
Implement Results of ICE	FHWA Proven Countermeasure 0.18 - 0.42 Convert Stop-Control to Roundabout 0.23 - 0.56 Install Traffic Signal FHWA Proven Countermeasure 0.65 - 0.8 Restrict Left Turn Movements	$750,000/each
All-Way Stop Warrant Analysis and Converting Two-Way Stop to All-Way Stop	0.52 – 1.12	$1,200/each
All-Way Stop Warrant Analysis and Removal of Stop Signs on Major Approach	CMF not defined	$500/leg
Destination Lighting	0.62	$5,500/each
Upgrade Signs and Pavement Markings (Paved Approach)	FHWA Proven Countermeasures 0.59 – 0.61 “Stop Ahead”	$1,100/ unpaved leg - $2,200/ paved leg
Implement Systemic Signing and marking improvements at Stop-Controlled Intersections	FHWA Proven Countermeasure 0.89 - 0.92	$2,200/leg
Install Second Stop Sign and Stop Ahead Sign	0.73 – 0.90 FHWA Proven Safety Countermeasure	$1,500/leg
Flashing Beacon on All Stop Signs	0.84 – 0.87 “Beacon on Stop Sign”	$2,500/sign
Transverse Rumble Strips on All or Minor Approach	0.71 – 0.87	$2,500/leg
Install Intersection Warning Sign and Advance Street Name Plaque on Major Approach	0.59 – 0.61 for warning signs/plaques;	$1,100/ unpaved leg - $2,200/ paved leg
Clear and Grub	0.78	$5,000/leg

Figure 23 illustrates the proposed intersection improvements as described in the previous sections. It is important to note that the County Engineer should follow all applicable guidelines and standards when implementing the intersection improvements.

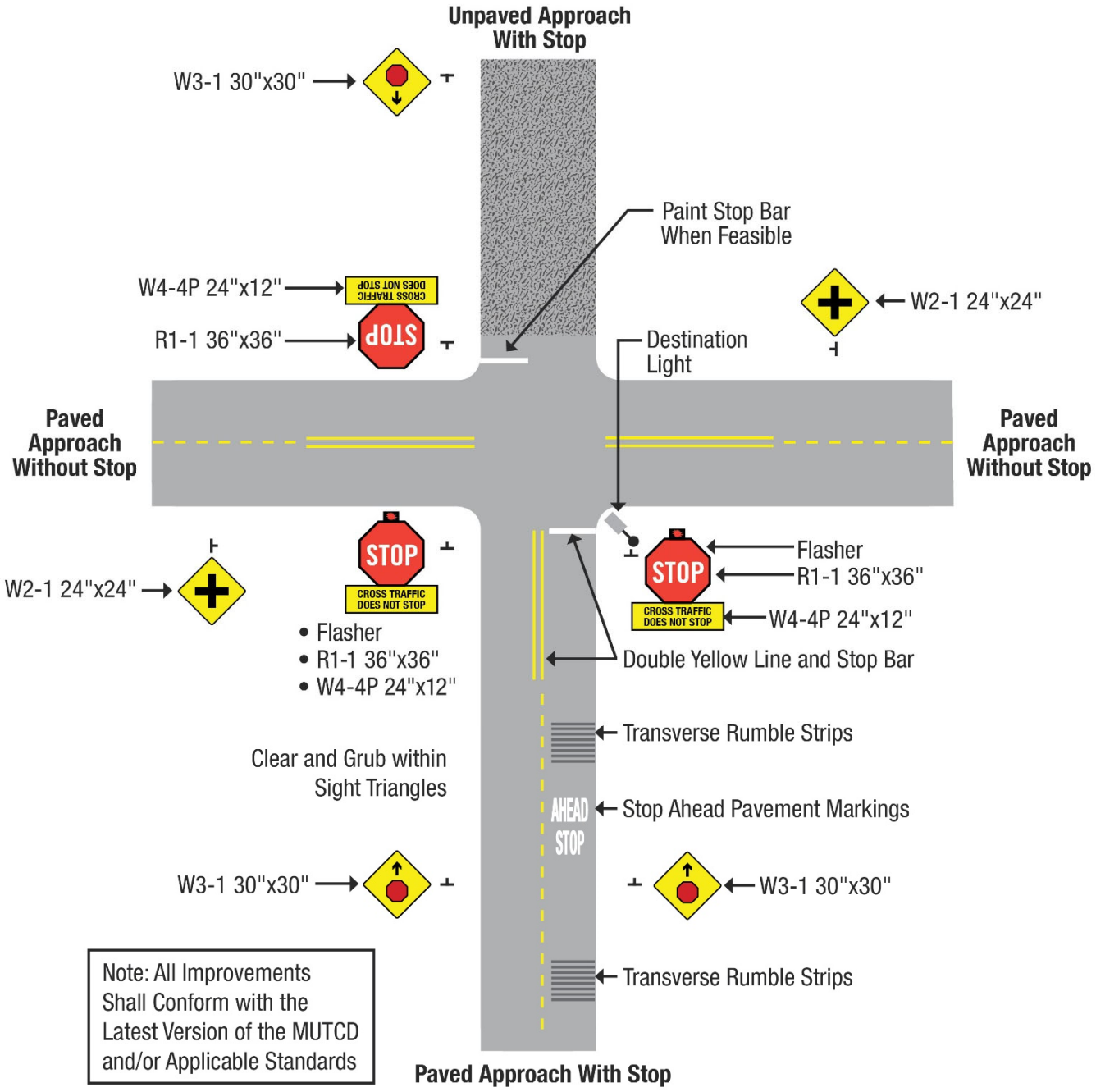


Figure 23 – County Paved Intersection Safety Improvements

6.3.4. Project Selection Decision Tree

After conducting the risk factor calculations and rankings for all intersections within the county, and developing the county paved intersection countermeasures, a project selection decision tree was developed. The decision tree was utilized to develop and systemically define location-specific safety recommendations for the intersections based on the characteristics of the intersections (DEV, paved approaches, crash history, major approach ADT, minor approach ADT, etc.). The decision tree for intersection safety improvements is shown in **Figure 24**.

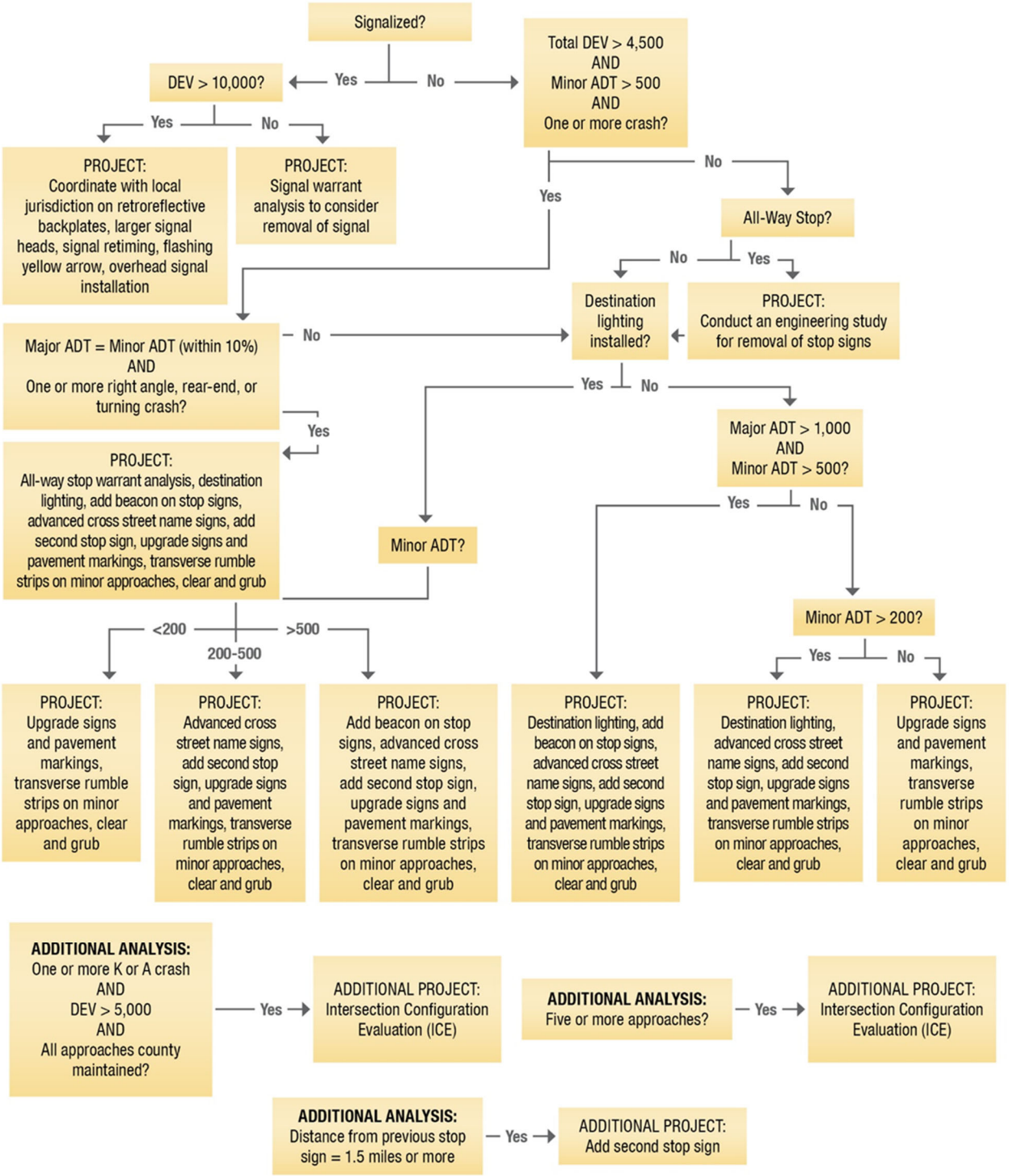


Figure 24 – County Paved Intersection Project Decision Tree

Each possible decision tree outcome represents a set of potential safety improvements for the intersection. The decision tree was utilized to determine projects for the intersections with the highest risk factor rankings. Project sheets were developed for a minimum of the five top-scoring intersections in the County-County and County-Other and County-State categories. Not all improvements are recommended at all locations and the project sheets contain the recommended

improvements for the specific location based on the decision tree process, existing conditions, and defined criteria.

6.3.5. Prioritized Intersection Recommendations

After the decision tree was utilized to identify safety improvement projects for the intersections with the greatest amount of risk factor points, project sheets were developed for these locations. The intersections for which project sheets were developed (those with the greatest amount of risk factor points) are summarized in **Table 16** and the project sheets are located in **Appendix C2**. For those intersections located on a high scoring roadway segment, the GPS ID of the segment is listed in the table.

Table 16 – County Paved Intersection Prioritized Project Cost Summary

GPS ID	Intersection	Risk Factor Points	High Scoring Segment	Estimated Project Cost
County-State Intersections				
337109	IA 14 & County Road S45/260TH Avenue	15	$42,000	$ 42,000
337097	IA 14 & County Road H20/530TH Street	11	$35,000	$ 35,000
337071	IA 14 & County Road H30/495TH Street	8	$42,000	$ 42,000
336885	US 65 & County Road H50/HIGHWAY 306	6	$36,000	$ 36,000
337009	IA 14 & County Road H50/435TH Street	7	$35,000	$ 35,000
County-State Total (5 Intersections)				**$ 190,000**
Intersection Total (5 Intersections)				**$ 190,000**

Figure 25 illustrates the locations of the intersections with highest risk factor ranking, where project sheets and specific intersection improvement recommendations were made.

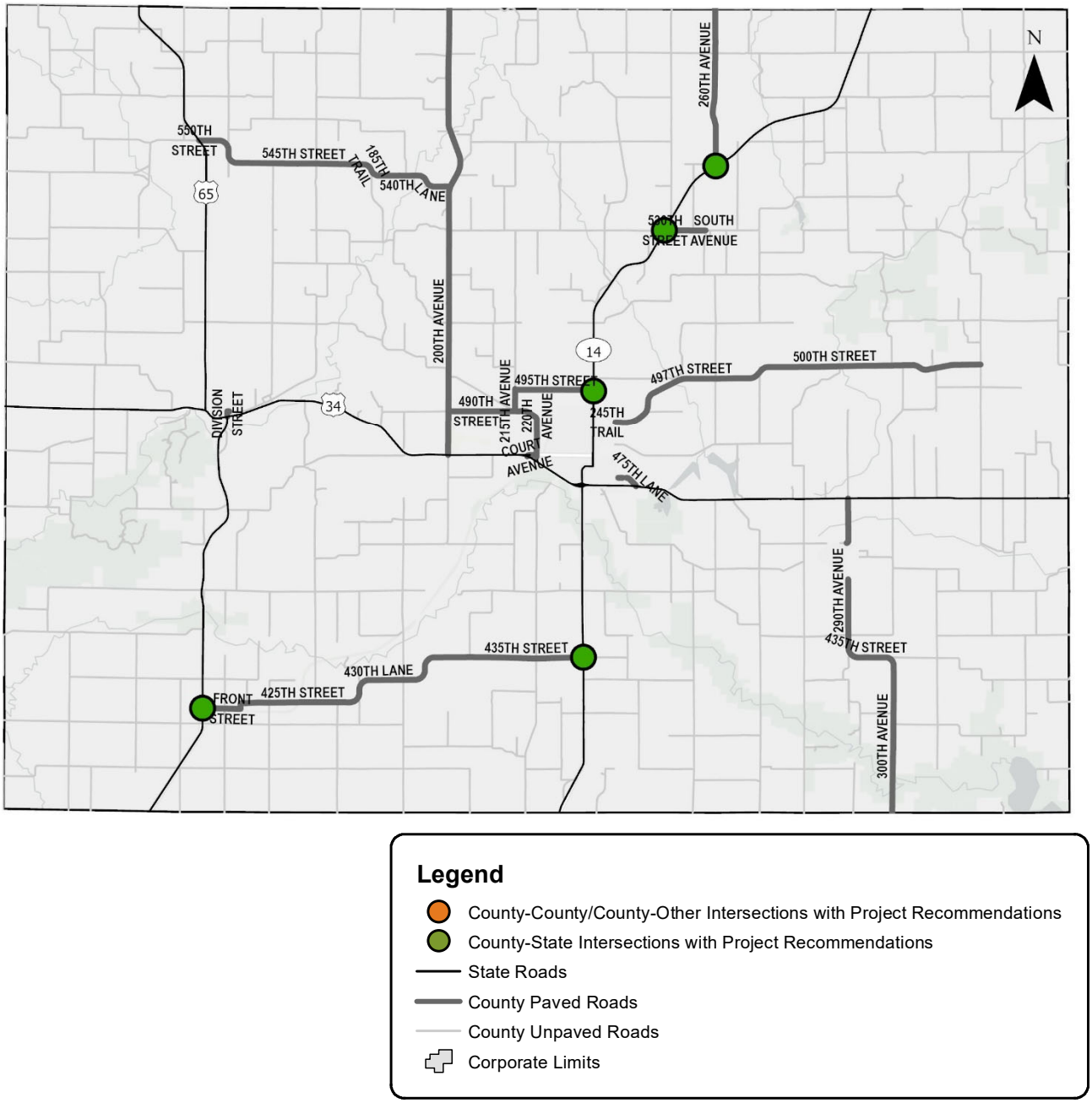


Figure 25 – County Paved Intersection Prioritized Project Location

Project sheets for the intersections with project recommendations are included in **Appendix C2**. The intersection risk factor ranking results and relevant data for every analyzed intersection is included in the summary spreadsheet included in **Appendix C3**.

6.3.6. Other Intersection Countermeasures

The purpose of the LRSP project is to identify low-cost systemic safety improvement projects using a GIS analysis and a project selection decision tree. A safety improvement that is not included on the project sheet may still merit consideration at a particular location. There are a variety of safety improvements that could be considered that were not included in the project decision tree due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed at intersections throughout the county. **Table 17** provides a summary of several other intersection safety improvements that could be considered appropriate by the county and that were included on the back side of the project sheets as additional potential improvements. The CMFs, where they have been defined, and estimated costs of these countermeasures are included in the table. Detailed descriptions of each of the countermeasures is provided in **Appendix C1.** Estimated costs for these countermeasures were noted on the back side of the project sheet at the workshop, as directed by the County Engineer. However, the County Engineer could choose to add or remove such countermeasures from consideration at any time, based on engineering judgment or new information.

Table 17 – County Paved Intersection Additional Project Improvement Summary

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost
Provide Left-Turn Lane at Intersection	0.42 – 0.52 FHWA Proven Safety Countermeasure	$150,000/leg
Provide Right-Turn Lane at Intersection	0.76 – 0.86 FHWA Proven Safety Countermeasure	$150,000/leg
Realign Intersection Approaches to Reduce or Eliminate Skew	CMF varies based on original skew angle 0.57: from 45 degrees to 90 0.60: from 60 degrees to 90 0.67: from 75 degrees to 90	$100,000/ unpaved leg - $300,000/ paved leg
Provide Bypass Lane on Shoulder at T-Intersection	CMF not defined	$75,000/each
Convert Offset T-Intersection to Four-Legged Intersection	CMF not defined	$50,000/each unpaved - $300,000/ each paved
Use Indirect Left-Turn Treatments to Minimize Conflicts	FHWA Proven Countermeasure 0.8	$75,000/leg
Convert Four-Legged Intersection to Offset T-Intersection	CMF not defined for rural areas	$300,000/each
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	CMF not defined	$2,500/leg
Install Stop Sign with LED Flashing Lights	0.84 – 0.87 “Beacon on Stop Sign”	$2,500/leg
Install Retroreflective Strip on Stop Sign Post	CMF not defined	$500/each
Low-Cost Intersection Conflict Warning System (ICWS)	0.45 – 0.95	$100,000/each

6.4. Horizontal Curves

The methodology described in **Section 6.1** was followed for county-wide analysis of paved horizontal curves based on the determined risk factors. Additional details on the risk factor calculations, risk factor ranking results, project selection decision tree, and project sheets are described in the following sections.

6.4.1. Risk Factor Summary

Each paved horizontal curve that was identified in the horizontal curve database (January 2016 update) within the county was systematically analyzed for risk according to the following six key attributes:

- **Traffic Volume (ADT):** the average number of vehicles per day along the roadway curve. The ADTs for all the curves within the county were compared against each other to assign higher risk to curves with higher ADT within the county. It is understood that more vehicles traveling along a curve increases the risk of a crash.
- **Curve Radius:** all curves with radii smaller than 2,500 feet and greater than 500 feet were assessed risk factor points. Curves with radii smaller than 1,200 feet were assigned additional points based on the crash data reviewed for county paved horizontal curves, showing more crashes on curves with smaller radii.
- **Shoulder Width:** risk factor points were assigned to all curves with shoulder widths less than six feet, with more risk factor points associated with narrower shoulders. This was based on the HSM Chapter 10, Table 10-9 and 10-10, which illustrates that with wider shoulders, crash risk is reduced.
- **Pavement Condition:** the average of the recorded roughness indices for the length of the segment. Pavement with an IRI value over 95 could potentially cause safety concerns and were assigned risk factor points.
- **Access Management:** risk was assessed if a driveway was within 200 feet of the curve. Additional risk points were assessed if an intersection was within 200 feet of the curve. Driveways and other access points located on or near curves create additional opportunities for conflict points and cause drivers to make additional decisions within the curve, with a potential for reduced sight distance, increasing risk of a crash.
- **Crash Experience:** each curve was assigned risk factor points if a K or A crash occurred within 200 feet of the curve. This attribute takes into account crash history, which may be indicative of improvement needs.

Table 18 summarizes the risk factors used for the risk factor analysis as well as the points developed in coordination with the Iowa DOT. As can be seen, the maximum number of available for curve risk factor points was 22.

Table 18 – County Paved Horizontal Curves – Risk Factor Ranking

Risk Factor	Measurement	Points	Risk Factor Weight	Max Points Available
Traffic Volume	Average Daily Traffic (ADT)	0: ADT percentile is 0%-14.3%	1	6
		1: ADT percentile is 14.3%-28.6%		
		2: ADT percentile is 28.6%-42.9%		
		3: ADT percentile is 42.9%-57.1%		
		4: ADT percentile is 57.1%-71.4%		
		5: ADT percentile is 71.4%-85.7%		
		6: ADT percentile is 85.7%-100%		
Curve radius	Radius of curve in feet	0: curve radius greater than or equal to 2,500 feet or less than 500 feet	2	4
		1: curve radius less than 2,500 feet and greater than 1,200 feet		
		2: curve radius between 500 and 1,200 feet		
Shoulder width	Shoulder width in feet	0: 6-foot shoulder and greater	2	4
		1: 2-foot shoulder to 6-foot shoulder		
		2: less than 2-foot shoulder		
Pavement condition	Average International Roughness Index (IRI)	0: Less than 95	2	4
		1: 95 to 170		
		2: More than 170		
Access Management	Intersections and driveways within 200 feet of the curve	0: no intersection or driveway within 200 feet	1	2
		1: driveway within 200 feet		
		2: intersection within 200 feet		
Crash Experience	Fatal or serious injury (K or A) crash within 200 feet of the curve	0: none	2	2
		1: 1 or more		
Total available points				**22**

6.4.2. Risk Factor Rankings

The risk factor calculations were performed on each of the curves on paved roads in the county which have a length greater than or equal to 100 feet and a radius less than 2,500 feet. The results of the risk factor rankings are provided in **Figure 26**.

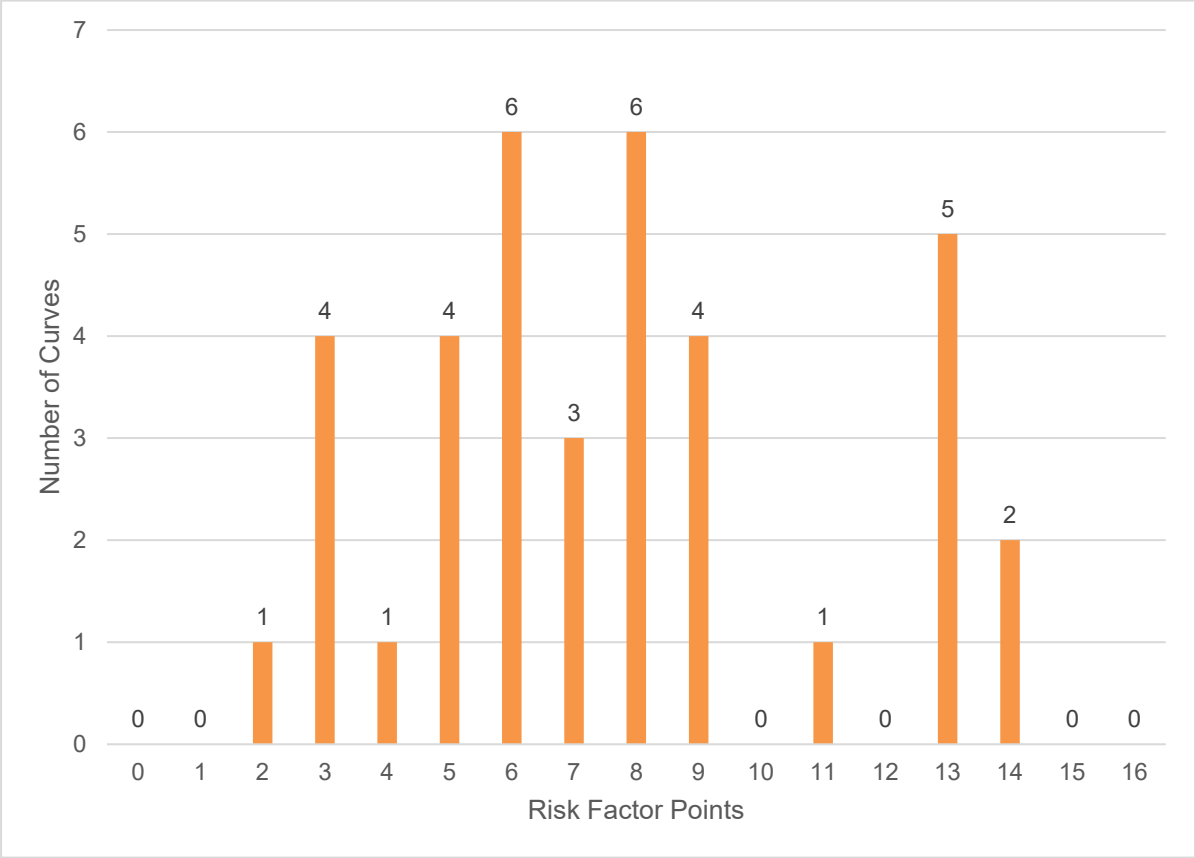


Figure 26 – County Paved Horizontal Curve Risk Factor Ranking Summary

For visualization purposes, **Figure 27** on the following page shows the location and risk factor ranking of each curve analyzed within the LRSP.

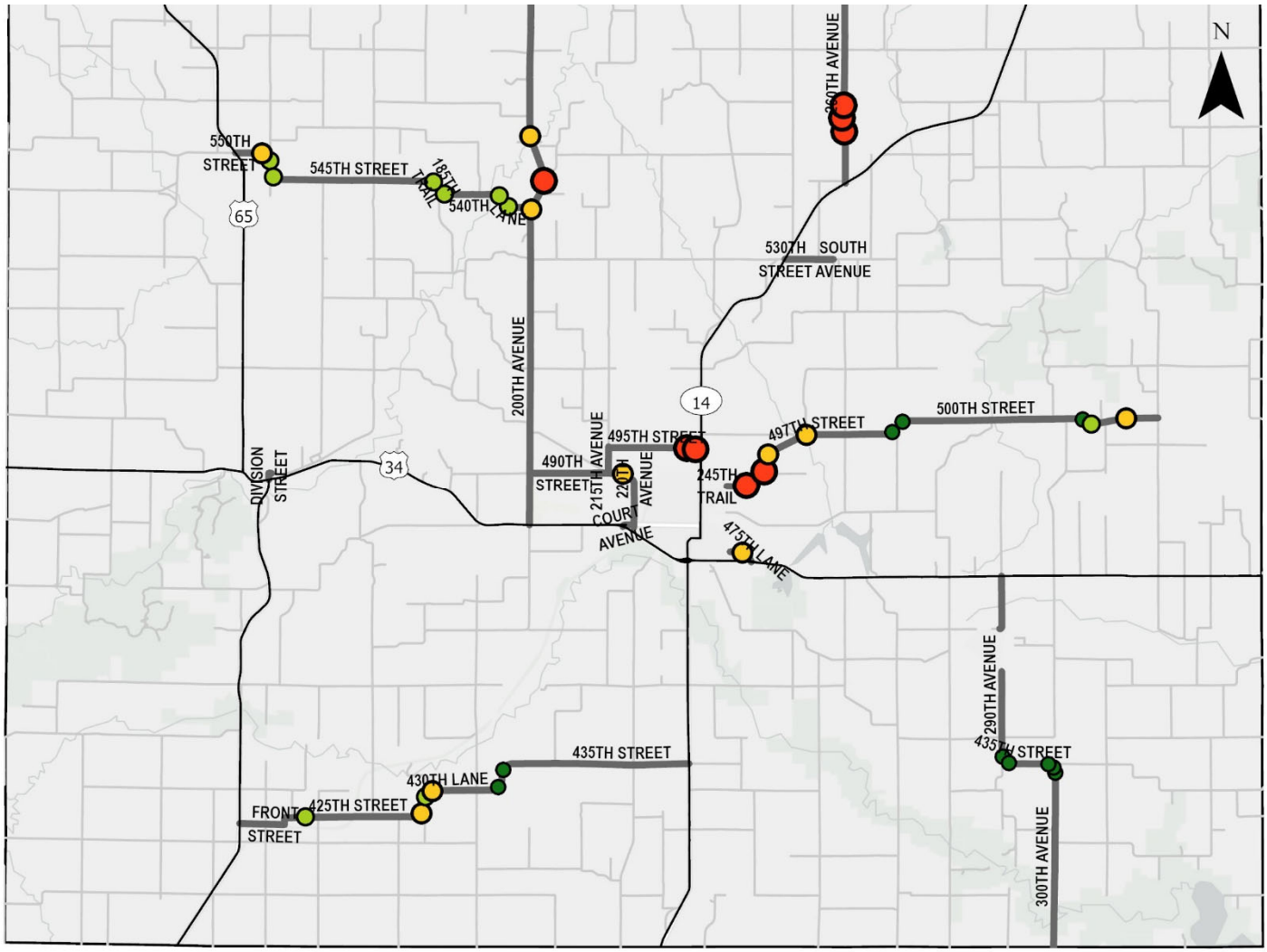


Figure 27 – Horizontal Curve Risk Factor Score Map

Legend

Curve Score

- High
- Medium - High
- Medium - Low
- Low

Roadways

- State Roads
- County Paved Roads
- County Unpaved Roads
- Corporate Limits

6.4.3. Curve Countermeasures

Table 19 summarizes the curve countermeasures for consideration including CMFs and estimated costs. **Appendix D1** provides detailed descriptions for each curve safety countermeasure.

Table 19 – County Paved Horizontal Curve Safety Countermeasure Summary

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost
Install 4" Retroreflective Edgeline and Centerline	0.76 when installed in combination with edgelines	$3,000/mile
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.63 – 0.78 FHWA Proven Safety Countermeasure	$6,000/mile
Pave Shoulder with Safety Edge	0.79 – 0.89 FHWA Proven Safety Countermeasure	$150,000/mile
Edge line Rumble Strips	0.61 – 0.86	$5,000/mile
Centerline Rumble Strips	0.66 – 0.96	$2,000/mile
Review and Provide/Upgrade Curve Chevrons, Curve Warning Signs, and Speed Advisory Plaques to Meet the Manual on Uniform Traffic Control Devices (MUTCD) and Iowa DOT Standards	0.59 – 0.61 for warning signs/plaques; 0.75 – 0.84 for chevrons FHWA Proven Safety Countermeasure	$1,000/curve (upgrade) - $3,500/curve (install)
Clear and Grub	0.78	$30,000/mile

Figure 28 illustrates the proposed horizontal curve safety improvements as described in the previous sections. It is important to note that the County Engineer should follow all applicable guidelines and standards when implementing the curve improvements.

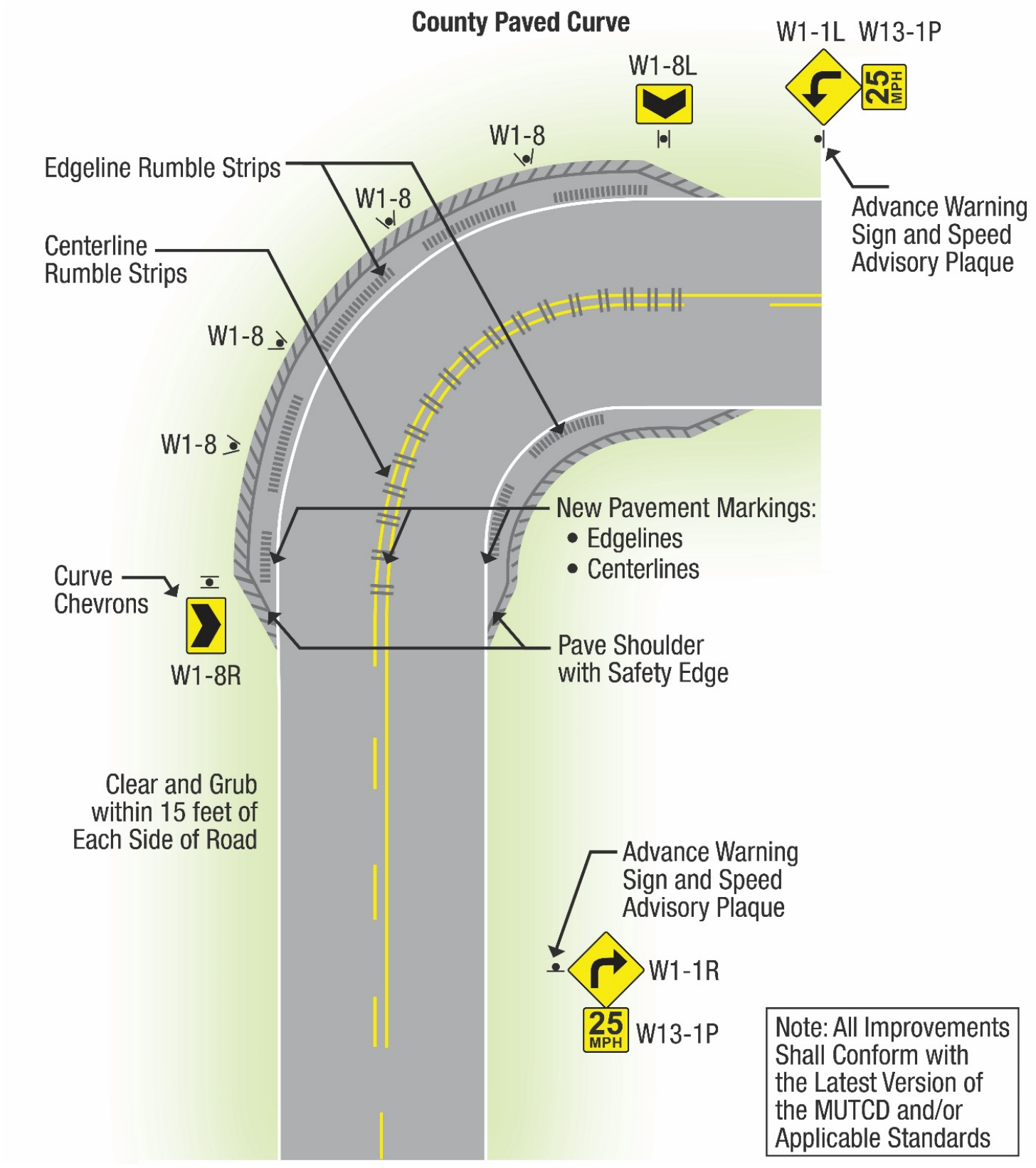


Figure 28 – County Paved Horizontal Curve Safety Improvements

6.4.4. Project Selection Decision Tree

After conducting the risk factor calculations and rankings for all paved curves within the county, and developing the curve safety countermeasures, a project selection decision tree was developed. The decision tree was utilized to develop and systemically define location-specific recommendations for the curves based on the characteristics of the curves (ADT, radius, paved shoulder, lane width, etc.). The decision tree for curve safety improvements is shown in **Figure 29**.

Each possible decision tree outcome represents a set of potential safety improvements for the curve. The decision tree was utilized to determine projects for the curves with the highest risk factor rankings and project sheets were developed for those curves. Not all improvements are recommended at all locations and the project sheets contain the recommended improvements for the specific location based on the decision tree process, existing conditions, and defined criteria.

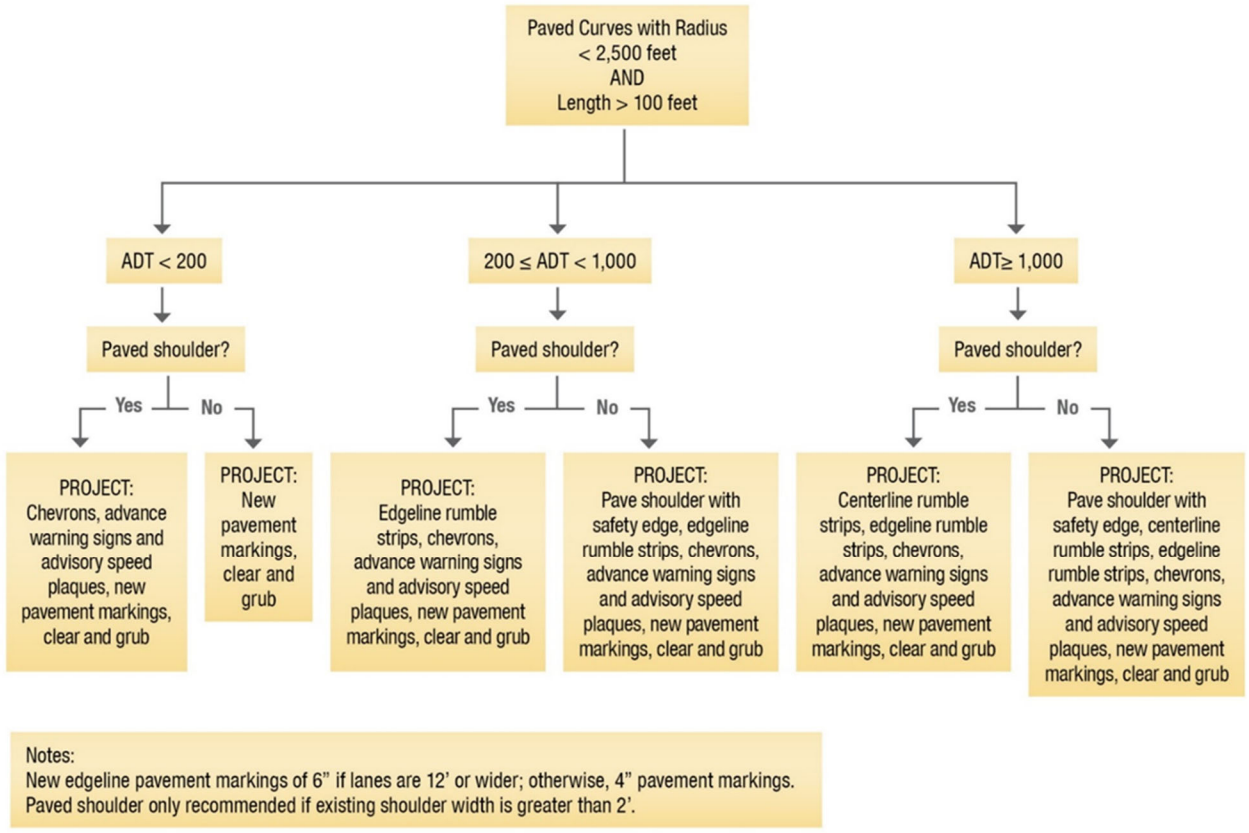


Figure 29 – County Paved Horizontal Curve Project Decision Tree

6.4.5. Prioritized Curve Recommendations

After the decision tree was utilized to determine projects for the roadway segments with the greatest amount of risk factor points. Project sheets were not developed for these curves since the county engineer wanted to prioritize projects for high scoring segments and intersections.

6.4.6. Other Curve Countermeasures

The purpose of the LRSP project is to identify systemic safety improvement projects using a GIS analysis and a project selection decision tree. However, just because a safety improvement is not included within the project sheet does not mean that it should not be considered at the location. There are a variety of safety improvements that could be considered that were not included in the project decision tree due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed at curves throughout the county. **Table 20** provides a summary of several other curve safety improvements that could be considered appropriate by the county and that were included on the back side of the project sheets as additional potential improvements. The CMFs, where they have been defined, and estimated costs of these countermeasures are included in the table. Detailed descriptions of each of the countermeasures is provided in **Appendix D1.** Estimated costs for these countermeasures were noted on the back side of the project sheet at the workshop, as directed by the County Engineer. However, the County Engineer could choose to add or remove such countermeasures from consideration at any time, based on engineering judgment or new information.

Table 20 – County Paved Curve Additional Potential Improvements Summary

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost
Additional Curve Signage	CMF not defined	$1,000/curve
Retroreflective Strip on Chevron Sign Post	CMF not defined	$500/curve
Transverse Rumble Strips Prior to Curve	0.66 Install Transverse Rumble Strips as Traffic Calming Device	$50,000/curve
Superelevation Correction	CMF varies based on rate of change	$100,000/each
High Friction Surface Treatment (HFST)	0.27 – 0.58 FHWA Proven Safety Countermeasure	$20,000 - $50,000/curve
Speed Activated Flashers on Chevron Sign	0.40 FHWA Proven Safety Countermeasure	$4,000/sign
Guardrail	0.53-0.56 New Guardrail Along Embankment	$35/foot (if 500 feet or more) - $80/foot (if less than 500 feet)
On-Pavement Marking for Speed Control	CMF not defined	$3000/each
Post-Mounted Delineators	0.55 Install Edgelines, Centerlines, and Post-Mounted Delineators	$5,000/mile

6.5. Unpaved Roadways

Lucas County maintains approximately 648 miles of county roads, of which approximately 596 miles are unpaved (92%). Unpaved road crashes accounted for 151 of the 360 crashes (42%) in Lucas County from 2012 to 2021. Unpaved roadways were not included in the analysis based on limited data availability, low traffic volumes, and limited types of safety improvements that can be systemically implemented on unpaved roads. Even though location-specific recommendations were not made as part of this project, safety along unpaved segments, at unpaved intersections, and along unpaved curves is also important. Potential projects and/or activities that could be implemented by the County Engineer on unpaved roadways include the following items:

- Maintenance of gravel
- Major rehabilitation
- Upgrade signs
- Realign intersection
- Improve/increase shoulder/lane width
- Delineate roadside hazards with retroreflective markers
- Curve chevrons
- Advance curve warning signs and speed advisory plaques
- Driveway entrance policy
- Clear and grub
- Winter maintenance

Descriptions of each of these unpaved roadway safety countermeasures are provided in **Appendix E**.

7. SUMMARY

The Lucas County LRSP was developed to aid the County Engineer in identifying and prioritizing roadway segments, intersections, and curves for safety improvements. The LRSP followed a data-driven process to develop systemic safety improvements on Lucas County paved roads. The LRSP was developed through a seven-step process that included gathering background information, data collection, data analysis, countermeasure selection, project development, county input, and development of the LRSP.

- **Gather Background Information:** Relevant documents provided by the counties were reviewed as well as the Iowa SHSP, and potential funding sources. Data requests were made of the counties to provide the location and presence of rumble strips, destination lighting, stop signs, and other pertinent safety improvements.
- **Data Collection:** A comprehensive GIS project database was developed utilizing the following databases as provided by Iowa DOT, the county, or collected as part of this project:
  - Crash database
  - Roadway database
  - Pavement management database
  - Roadside hazard database
  - Horizontal curve database
  - County stop sign locations
  - Intersection database
- **Data Analysis:** After development of the comprehensive GIS project database, the crash data was analyzed for the county. Crashes were compared to the SHSP Key Safety Emphasis Areas for the State of Iowa, and maps were prepared for the county.
- **Countermeasure Selection:** Following data analysis, a workshop was held with the safety stakeholders of the county. At the workshop, driver-related countermeasures were reviewed, and stakeholders discussed existing and proposed driver-related countermeasures.
- **Develop Projects for Inclusion into the LRSP:** A risk factor ranking process was developed for segments, intersections, and curves, and risk factor scores were calculated for all the segments, intersections, and curves within Lucas County. After conducting the risk factor analysis, safety improvement recommendations were developed for the feature types based on the project selection decision trees and summarized in location-specific project sheets. These project sheets, detailing the recommended safety improvements at specific locations, were then provided to the County Engineer for review.
- **County Input:** The draft project sheets were reviewed at the county workshop. The County Engineer provided input for additional safety countermeasures based on engineering judgment and site-specific knowledge.
- **Develop LRSPs:** An LRSP was developed for Lucas County including a summary of the LRSP process along with recommended safety projects for implementation by the county.

7.1. Recommended Improvements

This LRSP identified driver-related countermeasures in addition to engineering-related countermeasures. The following sections summarize the recommended countermeasures and improvements for Lucas County.

7.1.1. Driver-Related Countermeasures

During the county workshop, attendees were provided information regarding fatal and serious injury crashes within the county and how that data aligned with the Iowa SHSP Key Safety Emphasis Areas. Potential countermeasures were provided to stakeholders to facilitate discussion on what action items were currently underway in the county with respect to driver-related crashes. Countermeasures were grouped according to the 2019-2023 Iowa SHSP Key Safety Emphasis Areas, of which six are driver-related emphasis areas.

- Speed-related
- Unprotected persons
- Younger drivers
- Impairment involved
- Older drivers
- Distracted or inattentive drivers

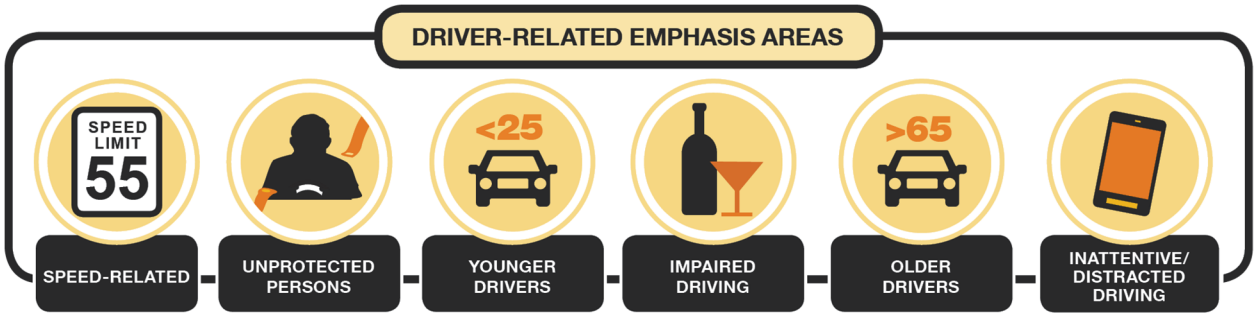


Figure 30 – Iowa SHSP Driver-Related Emphasis Areas

Based on discussions at the workshop, the following implementation statuses were defined for various driver-related countermeasures in the County: Underway/Ongoing, Area for Improvement, Opportunity, or Completed in the Past.

Table 21 provides a summary of the status of implementation of the driver-related countermeasures within the county. It is recommended that the county continue to implement countermeasures that are currently underway/ongoing and look for opportunities to implement additional countermeasures that are not currently being implemented. This will require input and coordination from all of the five E's of safety.

Table 21 – County Driver-Related Countermeasure Summary

Countermeasure	Status
Speed-Related	
Conduct speed enforcement - Some City Officers and the County participate in the Governor's Traffic Safety Bureau (GTSB) special Traffic Enforcement Program (sTEP) program. Targeted enforcement could take place based on data.	Opportunity
Implement rigorous aggressive driving and speeding-related enforcement programs	Opportunity
Education campaigns relative to locations with high-risk of speed-related crashes, potentially in schools	Opportunity
Unprotected Persons	
Conduct publicized enforcement campaigns	Opportunity
Community locations for instruction in proper child restraint use Certified Child Passenger Technician available from Decatur County.	Underway/Ongoing
Conduct "child restraint inspection and/or installation" events at community locations Annually there is a publicized car seat check hosted by the Fire Department	Underway/Ongoing
Train law enforcement to check for proper child restraint use in all motorist encounters GTSB can provide "cheat sheets" for law enforcement on car seat laws.	Opportunity
Education campaigns in schools - Opportunity to provide seatbelt/helmet education in schools. The hospital gives out helmets at schools annually.	Underway/Ongoing
Hand out ice cream gift certificates for children wearing bicycle helmets (law enforcement, Emergency Medical Services (EMS), and/or fire department)	Underway/Ongoing
Younger Drivers	
Improve content and delivery of driver's education/training Driver's education curriculum is privatized.	Opportunity
Conduct additional training in schools ("drunk goggles"; "don't veer for deer"; what to do when on an edge drop-off; training in health class; etc.) - Opportunity for individual teachers of health, physics, or other classes. The Highway Patrol has "drunk goggles" that can be used at events.	Opportunity
"Operation Prom" mock disaster Mock crash events have been conducted in the county.	Area for Improvement
After Prom Event held at the high school Students are invited to an event at the high school from after Prom until 5:00AM, they are not allowed to leave except with a parent during that time.	Underway/Ongoing
Prosecute and impose sanctions on drivers not obeying school bus stop bars	Opportunity
Enforcement of graduated driver's license laws	Underway/Ongoing

Impaired Driving	
Conduct regular well-publicized safety checkpoints	Opportunity
Proactively conduct operating while intoxicated (OWI) enforcement - Enforcement is at times targeted at specific locations and around special events and holidays. There are known areas where officers focus on OWI enforcement.	Underway/Ongoing
Conduct regular well-publicized compliance checks of alcohol retailers to reduce sales to underage drivers The City Officers currently conduct compliance checks once per year.	Underway/Ongoing
Prosecute, impose sanctions on, and treat OWI offenders Attendees felt that violations are not booked as a lower tiered offense; however, they are being prosecuted that way.	Area for Improvement
Older Drivers	
Establish resource centers within communities to promote safe mobility choices Hospital has a program; however, the number of volunteers is limited.	Area for Improvement
Paratransit for older drivers County does have paratransit/dial-a-ride service for the elderly.	Underway/Ongoing
Provide materials on paratransit information at community centers	Opportunity
Recommend re-testing of older drivers involved in crashes and citations Retesting is situational, based on the recommendation of the officer.	Underway/Ongoing
Inattentive/Distracted Driving	
Incorporate information on distracted driving into education programs for young drivers	Opportunity
Conduct education and awareness campaigns Iowa DOT's "Transportation Matters" blog that update every Friday with that week's safety message can also be shared on social media.	Opportunity
Visibly enforce existing statutes to deter distracted and drowsy driving	Opportunity
County policy for "hands free" devices while driving county vehicle	Opportunity
Mobile simulator for distracted driving at community events or schools	Opportunity

7.1.2. Engineering Countermeasures

In addition to the driver-related countermeasures, engineering projects were developed for roadway segments, intersections, and horizontal curves on county paved roads that had high risk factor rankings based on the analysis methodology. **Table 22** provides a cost summary of the projects developed for the county.

Table 22 – Engineering Countermeasures Cost Summary

Facility Type	Number of Locations	Estimated Project Cost
Segments	10	$2,197,000
Intersections	10	$190,000
Total Improvement Costs	**10**	**$2,387,000**

7.2. Implementation

One of the goals of the LRSP project is to provide a document that is usable and can be frequently consulted by the County Engineer to aid in requesting funding and in the completion of traffic safety improvement projects on county-maintained roads. This section describes some recommendations on how this plan can be implemented within the county.

The project sheets developed and provided in **Appendix B2** and **Appendix C2** are intended to be used as a straightforward way to apply for safety improvement funding through HSIP-S. The recommendations contained within the project sheets lend themselves well to HSIP-S funding because they were developed based on a proactive risk factor assessment, with a focus on reducing the potential for fatal and serious injury crashes.

Additionally, there is a list of high-crash locations contained within **Section 7** of this document. It is recommended that the County Engineer consider applying for TSIP funding at these locations because TSIP funding considers benefit-cost analysis. The County Engineer can review these locations to determine if safety improvements, similar to the ones outlined within **Section 6.2**, **Section 6.3**, and **Section 6.4** are applicable, and develop a TSIP application based on the recommended improvements.

The County Engineer should also review the projects within the Five-Year Program and consider including safety recommendations from the project sheets into those projects, where applicable. In future cycles of the Five-Year Program, it is recommended that the safety projects included on the project sheets be considered for inclusion in the program.

The County Engineer should also consider consulting the LRSP when developing a project for design or addressing a maintenance issue, in order to incorporate the types of safety improvement recommendations in the LRSP and in the project sheets. Doing so can help prioritize projects and emphasize safety in design and maintenance.

Finally, the LRSP can be consulted during routine maintenance activities such as striping and mowing (clearing and grubbing). The document can be used to provide instruction or education to maintenance crews about the safety implications of their work.

7.3. Next Steps

Project sheets containing the prioritized list of projects have been provided in **Appendix B2** and **Appendix C2** to aid the County Engineer in obtaining funding for safety improvements and/or for incorporating recommendations into planned roadway improvement projects. These sheets may require updating for funding applications in future years. The County Engineer may also make changes to the prepared project sheets based on local knowledge of the site, available funding, and/or specific needs. These project sheets can be used for SS4A implementation Grant Applications.

It is recommended that the county continue to foster cooperation with other stakeholders and look for opportunities to improve and expand implementation of driver-related countermeasures. The county should continue its history of implementing a number of safety improvement projects annually. Based on current funding levels, it is anticipated that many of the engineering improvements listed in this plan could be implemented within five to ten years, or sooner. Additionally, this LRSP should be updated within five to ten years to reflect improvements that have been implemented, additional availability of roadway feature data, and changes in crash types and patterns.

8. 2023 UPDATE

8.1. County Progress

Lucas County will measure progress of their LRSP through two different methods: tracking fatalities and serious injuries using the Iowa Crash Analysis Tool (ICAT) along with documenting completion of projects identified within the LRSP.

After April 15th of each year, the county will update the table of fatalities and serious injuries to track their progress towards zero fatalities and serious injuries. **Table 23** contains a summary of fatalities and serious injuries for the county from 2012 to 2021.

Table 23 – County Tracking of Fatalities and Serious Injuries

Year	Fatalities	Serious Injuries	Fatalities and Serious Injuries
2012	1	2	3
2013	0	2	2
2014	0	4	4
2015	0	2	2
2016	0	5	5
2017	2	4	6
2018	0	1	1
2019	0	0	0
2020	0	4	4
2021	0	2	2

Source: Iowa DOT Open Data, Iowa Department of Transportation - Open Data (arcgis.com), May 23, 2023.

At the same time as the county updates its fatalities and serious injuries, the county will provide a list of prioritized projects that have been completed as identified within the LRSP. The projects noted in **Table 24**, **Table 25**, and **Table 26** include the prioritized projects as identified in the previous 2017 LRSP (for segments, intersections, and curves respectively) that have been at least partially implemented or are currently planned for implementation. The county has completed or is in the process of completing five of the segment projects, five of the intersection projects, and none of the horizontal curve projects.

Table 24 - County Paved Segment Prioritized Project Cost Summary

GPS ID	Segment	Segment Length (miles)	Risk Factor Points	Notes
884	220TH AVE between 260 ft S of CURTIS AVE and 490TH ST	0.91	15	North 400ft currently under contract
883	215TH AVE between Co Rd H32/490TH ST and 110 ft N of 495TH ST	0.51	14	Currently under contract
887	290TH AVE between US 34 and CEDAR ST	1.02	14	No change
886	S45 between IOWA 14 and LUCAS/MARION COUNTY LINE	3.57	13	Resurfaced in 2017
894	490TH ST between Co Rd S23/200TH AVE and 220TH AVE & CURTIS AVE	2.01	13	C059 (71) above currently under contract
895	495TH ST between IOWA 14 and 215TH AVE	1.76	13	Currently under contract
649	550TH ST between US 65 and 150TH AVE	0.63	10	No change
882	S23 between US 34 and LUCAS/WARREN COUNTY LINE	10.18	10	No change
899	540TH LN between 185TH TRL and Co Rd S23/200TH AVE	1.87	9	
896	497TH ST between 497TH ST (to 252ND TRL) and 270TH AVE	2.04	8	
Total (10 Segments)				

Table 25 - County Paved Intersection Prioritized Project Cost Summary

GPS ID	Intersection	Risk Factor Points	Notes
County-County / County-Other Intersections			
337898	Co Rd H32/490TH ST & Co Rd S23/200TH AVE	12	C059 (71) currently under contract
337792	220TH AVE & OSCEOLA AVE	11	
338188	Co Rd H20/540TH LN & Co Rd S23/200TH AVE & 200TH TRL	11	
338196	Co Rd H20/530TH ST & Co Rd S23/200TH AVE	11	
337856	Co Rd S23/200TH AVE & 510TH ST	10	
337892	Co Rd H30/215TH AVE & Co Rd H32/490TH ST & 495TH LN *	9	C059 (71) currently under contract
337880	Co Rd H30/495TH ST/215TH AVE *	5	Currently under contact
County-County / County-Other Total (7 Intersections)			
County-State Intersections			
337109	IA 14 & Co Rd S45/260TH AVE	15	
337097	IA 14 & Co Rd H20/530TH ST	13	C059 (71) currently under contract
6001085	US 34/NE RAMP US34 & Co Rd H34/COURT AVE	13	
336807	US 34 & Co Rd H34/475TH LN	12	
669676	US 34 & Co Rd H34/COURT AVE	11	
336977	US 65 & Co Rd H20/550TH ST *	10	
336845	US 34 & Co Rd S56/290TH AVE *	7	
337071	IA 14 & Co Rd H30/495TH ST *	6	C059 (71) currently under contract
County-State Total (8 Intersections)			
Intersection Total (15 Intersections)			

Table 26 - County Paved Horizontal Curve Prioritized Project Cost Summary

GPS ID	Curve	Risk Factor Points	Notes
47156	Curve 47156 on 495TH ST	14	
47157	Curve 47157 on 495TH ST	14	
29182	Curve 29182 on 260TH AVE	13	
29183	Curve 29183 on 260TH AVE	13	
17650	Curve 17650 on 540TH LN	11	
47328	Curve 47328 on 500TH ST	11	
48735	Curve 48735 on 550TH ST	11	
26736	Curve 26736 on 245TH TRL	9	
45267	Curve 45267 on 425TH ST	9	
45416	Curve 45416 on 430TH LN	9	
46738	Curve 46738 on 475TH LN	9	
47051	Curve 47051 on 490TH ST	9	
47192	Curve 47192 on 497TH ST	9	
48548	Curve 48548 on 540TH LN	9	
48549	Curve 48549 on 540TH LN	9	
48550	Curve 48550 on 540TH LN	9	
48639	Curve 48639 on 545TH ST	9	
48642	Curve 48642 on 545TH ST	9	
Total (18 Curves)			

APPENDIX A

RECOMMENDATIONS KEY MAP

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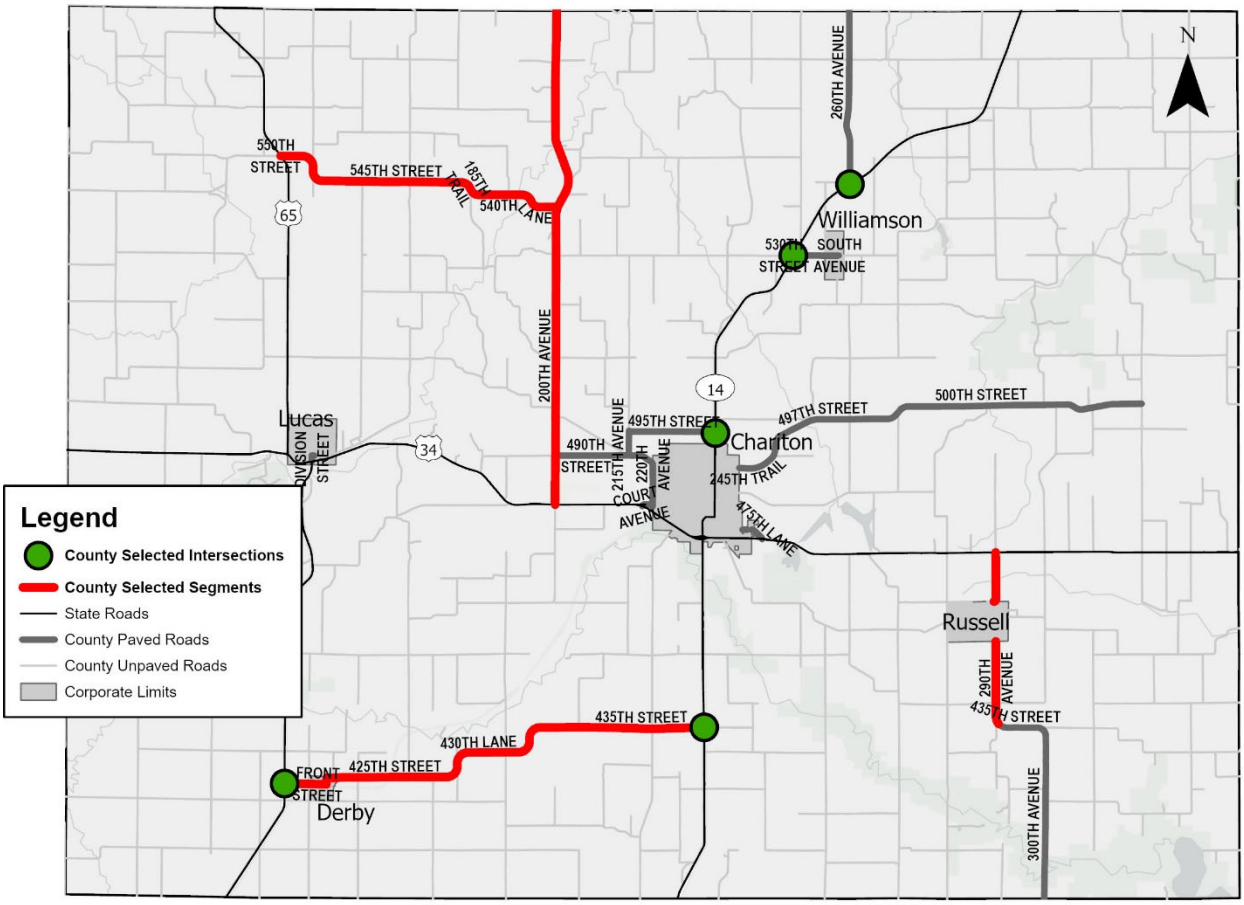

Figure A1 – Lucas County Recommendations Key Map

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APPENDIX B1

SEGMENT SAFETY COUNTERMEASURES

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This appendix summarizes the **segment** safety countermeasures for consideration and provides detailed descriptions for each countermeasure from both the project selection decision tree as well as the additional potential improvements listed on the back side of the project sheets.

Segment Countermeasures from Project Selection Decision Tree

The countermeasures in this section were included in the project selection decision tree and recommended on the segment project sheets based on the criteria described in **Section 6.2.1.**

Conduct a Road Safety Assessment (RSA)

An RSA is a formal safety performance examination that reviews, in detail, the geometry of a roadway facility. As part of an RSA, an independent, multi-disciplinary team assesses the condition of a given roadway and provides short-, mid-, and long-term recommendations for safety improvements for all modes currently, or planned to be provided by the facility. RSAs have been conducted throughout the United States and are generally accepted as a proactive, low-cost approach to improve safety. This countermeasure cost estimate does not include the cost of implementing the recommendations of the RSA.

Conduct Access Control Analysis

An access control analysis can aid in determining access management decisions along a corridor. This countermeasure is intended to provide additional information on a specific facility as to the most appropriate access control treatments. Consolidating driveways reduces the number of conflict points on a given roadway and concentrates access where through-drivers can expect and anticipate left and/or right-turning vehicles, thus improving safety. The cost estimate associated with this countermeasure does not include implementing the findings of the access control analysis.

New Pavement Markings

This safety countermeasure includes new centerline and edgeline pavement markings along the curve. The updated markings can clarify and further delineate the curve, reducing the risk of a run-off-the-road crash. If the lanes were 12 feet or wider, new edgeline pavement markings of six inches were recommended; Research suggests that widening pavement markings from four to six inches in rural areas results in a CMF of 0.64 to 0.83. Otherwise, new four-inch pavement markings were recommended. Research suggests that installing new four-inch pavement markings in rural areas results in a CMF of 0.61 to 0.74.

Edgeline Rumble Strips

Edgeline rumble strips provide tactile and audible warning to a driver if they are beginning to depart the lane. This safety improvement has recorded CMFs in the range of 0.61 to 0.67. Depending on the conditions of the roadway, the County Engineer may choose to install rumble strips placed in the shoulder offset from the edgeline, or they may place the rumble strips on the edgeline and provide pavement markings over them, resulting in edgeline rumble stripes. For purposes of this document, both will be called rumble strips.

Centerline Rumble Strips

CMFs of 0.55 to 0.91 represent the safety benefit from the installation of centerline rumble strips. In Iowa, rumble strips placed in the centerline of the roadway generally have pavement markings over them. To be consistent with the Iowa DOT Design Manual 3C-5, centerline rumble strips will be referred to as rumble strips even though in circumstances they may technically be “rumble stripes”. This safety improvement provides an audible and tactile warning to drivers when crossing the centerline and can aid in the avoidance of some high severity lane departure crashes.

Pave Shoulder with Safety Edge

Constructing or increasing the width of an existing paved shoulder can reduce the potential for a severe crash as the result of a lane departure. CMFs associated with paving the shoulder in rural areas range from 0.75 to 0.99. At locations where paved shoulders are recommended, it is suggested that the County Engineer consider a minimum of a two-foot shoulder; however, based on right-of-way and roadway characteristics, the County Engineer may choose to install a wider shoulder.

According to the FHWA, a Safety Edge is “a simple but effective solution that can help save lives by allowing drivers who drift off [roadways] to return to the road safely. Instead of a vertical drop-off, the Safety Edge shapes the edge of pavement to 30 degrees.” The installation of a Safety Edge has CMFs of 0.77 - 0.96 and is an FHWA Proven Safety Countermeasure.

Clear and Grub

This countermeasure includes clearing and grubbing the areas within the clear zone of the roadway (defined here as 15 feet on each side of the road). This safety countermeasure decreases the hazard of a run off the road crash by reducing the number of obstructions a vehicle could impact after a lane departure. A 0.78 CMF has been documented as distance from roadside features was increased.

*For descriptions on curve countermeasures see **Appendix D1**.*

Other Segment Countermeasures

Safety improvements not included on the first page of the roadway segment project sheet may still merit consideration at a specific location. There are a variety of other safety improvements that could be considered that were not included in the project selection decision tree due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed at road segments throughout the county. The following sections describe several other roadway segment safety improvements that could be considered appropriate by the county and that were included on the back side of the project sheets.

Flattening and Widening Foreslopes

This improvement includes flattening the foreslopes of the roadway edge from 2V:1H (typical) to 3V:1H to increase the ability of a driver after a lane departure to return to the roadway safely. CMFs for flattening side slopes are in the range of 0.9, while flattening to 4:1 or 6:1 are in the range of 0.58 to 0.71.

On-pavement Markings for Speed Control

This improvement includes installing in-lane pavement markings including the speed limit to reinforce the posted speed limit. On-pavement markings can serve as additional information and

reminders to drivers of the posted speed limit and the importance of observing their speed. A CMF of 0.62 has been recorded for adding additional on-pavement markings.

Delineate Roadside Hazards with Retroreflective Markers

Retroreflective markers can be applied to roadside objects and trees, increasing the visibility of hazards, and helping delineate the roadway where minimal delineation may exist.

Guardrail

Installing guardrail can help redirect vehicles after a lane departure to remain on the roadway and avoid roadside hazards. CMFs in the range of 0.53 to 0.56 have been recorded for installing new guardrail along an embankment.

Post-Mounted Delineators

As stated in the MUTCD, “delineators are particularly beneficial at locations where the [roadway] alignment might be confusing or unexpected, such as at lane-reduction transitions and curves. Delineators are effective guidance devices at night and during adverse weather. An important advantage of delineators in certain locations is that they remain visible when the roadway is wet, or snow covered.” Providing post-mounted retroreflective delineators along the roadway can give additional information to drivers as to the location of the roadside edge and alignment. The CMF for installing post-mounted delineators in combination with edgelines and centerlines has been recorded at 0.55.

Remove/Relocate Objects in Hazardous Locations

This countermeasure includes removing or relocating objects from within the clear zone of the roadside. This allows drivers who run off the road to potentially return to the road or have a less severe consequence when departing the roadway. A CMF of 0.62 is associated with this countermeasure.

*For descriptions on additional curve countermeasures see **Appendix D1**.*

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APPENDIX B2

SEGMENT PROJECT SHEETS

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Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 16

Project Name: 290TH AVE between Iowa 14 and US 65
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

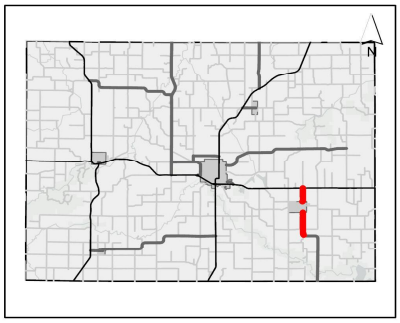
SEGMENT

Location Description

Road: **290TH AVE**
From: Iowa 14
To: US 65
Length (miles): **2.72**

GPS ID: 887, 888

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Average Daily Traffic (ADT)	1,200	6
Pavement | Shoulder Width (ft)	24' | 2'	0
Avg. Pavement Condition (IRI)	121	2
Average Roadside Risk	7.59	4
Access Points per Mile	6.8	2
High Risk Curve Density/Mile	0.0	0
Lane Dept.Crash Rate (HMVMT)	133.7	2
Total Risk Factor Points (25 max)		**16**

Other Information	
Paved Shoulder	No
Shoulder Width (ft)	2
Speed Limit (mph)	55
Lane Width (ft)	12
Number of Lanes	2
Edgeline Rumble Strips	No
Centerline Rumble Strips	No
Curves (L>100', 500'≤R≤1,200')	0
Curves with Chevrons	0

Crash Data, 2012-2021	
Total Crashes	8
K and A Crashes	1
Lane Departure Crashes	6
Lane Departure K and A Crashes	6
Total Crash Rate (per HMVMT)	178.3
K and A Crash Rate (per HMVMT)	22.3

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Conduct Road Safety Assessment (RSA)	0	EA	$ 40,000	$ -
Conduct Access Control Analysis	0	EA	$ 30,000	$ -
Install 4" Retroreflective Edgeline (Both Sides of Road)	0	MILE	$ 1,200	$ -
Install 6" Retroreflective Edgeline (Both Sides of Road)	2.72	MILE	$ 6,000	$ 16,304
Install 4" Retroreflective Centerline	2.72	MILE	$ 3,000	$ 8,152
Pave 2' Shoulder with Safety Edge (Both Sides of Road)	2.72	MILE	$ 150,000	$ 407,605
Install Edgeline Rumble Strips (Both Sides of Road)	2.72	MILE	$ 2,000	$ 5,435
Install Centerline Rumble Strips	2.72	MILE	$ 1,000	$ 2,717
Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 3,500	$ -
Review and Upgrade Curve Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 1,000	$ -
Clear and Grub (15 ft Both Sides of Road)**	2.72	MILE	$ 30,000	$ 81,521
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 521,734

Continued on back of this page.

** Unit price varies based on average roadside risk score.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 16

Project Name: 290TH AVE between Iowa 14 and US 65
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 887, 888

County to check the box for those improvements recommended for consideration.

	Item Description	Quantity	Unit	Unit Price	Item Cost
	Flatten and Widen Foreslopes (both sides of road)		MILE	$ 85,000	$ -
	On-Pavement Markings for Speed Control		EA	$ 3,000	$ -
	Delineate Roadside Hazards (trees or utility poles) with Retroreflective Tape		EA	$ 100	$ -
	Guardrail		FOOT	$ 80	$ -
	Post-Mounted Delineators		MILE	$ 1,000	$ -
	Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed		CURVE	$ 5,000	$ -
	Retroreflective Strips on Chevron Sign Posts		CURVE	$ 500	$ -
	Transverse Rumble Strips Prior to Curve		EA	$ 5,000	$ -
	Superelevation Correction on Curves		EA	$ 50,000	$ -
	Install High Friction Surface Treatment (HFST) on Curves		MILE	$ 50,000	$ -
	Speed Activated Flashers on Chevron Signs		EA	$ 4,000	$ -
	Other:				
	Other:				
	Other:				
	Other:				

Additional Potential Improvements Subtotal:		$ -
Project Selection Decision Tree Systemic Improvements Subtotal:		$ 521,734
Subtotal:		$ 521,734
Mobilization: (% +/-)*	10%	$ 52,180
Traffic Control: (% +/-)	5%	$ 26,217
Contingency: (% +/-)	20%	$ 104,869
Estimated Project Cost		**$ 705,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
Kimley-Horn has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Kimley-Horn at this time and represent only Kimley-Horn's judgment as a design professional familiar with the construction industry. Kimley-Horn cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Project Description Form Disclaimer:
The recommended improvements contained in this project description form were developed through a Geographic Information System (GIS) database risk assessment and project decision tree selection process, as specifically stated in our scope of services. Kimley-Horn has no control over the accuracy of the GIS databases nor the suitability of the specific improvements for the location, and has provided recommended improvements for consideration by the County Engineer. The County Engineer may use this project description form to aid in the selection and development of projects, but this project description form should not be used as the sole basis for the County Engineer's decision making process. We endeavored to research issues and constraints to the extent practical given the scope, budget, and schedule agreed to with the Client. Our assessment is based in large part on information provided to us by others (DOT, county staff, etc.) and therefore is only as accurate and complete as the information provided to us. No formal assessment was made for the improvement recommendations contained on this page, if in question, it is recommended that a study/analysis of this location be made to warrant the above indicated improvements. This project description form is based on our knowledge as of May 2023.

End of Project Description

Back Page

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 8

Project Name: HIGHWAY 306 between Iowa 14 and US 65
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

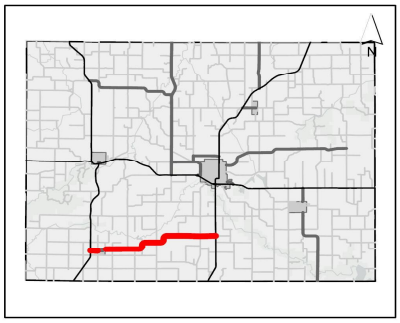
SEGMENT

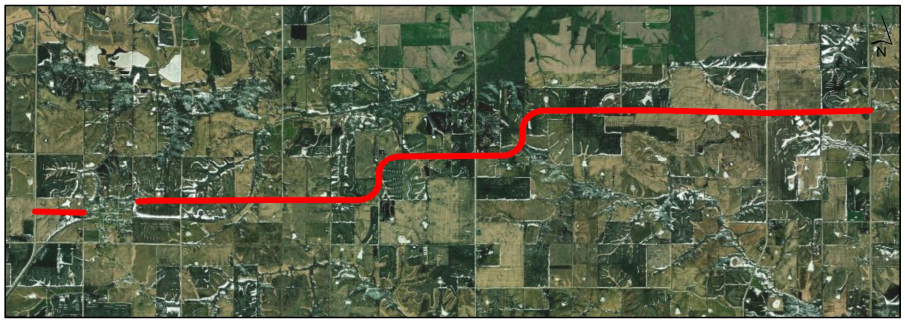
Location Description

Road: **HIGHWAY 306**
From: Iowa 14
To: US 65
Length (miles): **8.64**

GPS ID: 593, 890, 891, 892

Project Location Maps





Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Average Daily Traffic (ADT)	380	0
Pavement | Shoulder Width (ft)	26' | 1'-9'	0
Avg. Pavement Condition (IRI)	133	2
Average Roadside Risk	2.70	2
Access Points per Mile	16.1	0
High Risk Curve Density/Mile	2.0	2
Lane Dept.Crash Rate (HMVMT)	145.2	2
Total Risk Factor Points (25 max)		**8**

Other Information	
Paved Shoulder	No
Shoulder Width (ft)	1' - 9'
Speed Limit (mph)	55
Lane Width (ft)	11
Number of Lanes	2
Edgeline Rumble Strips	No
Centerline Rumble Strips	No
Curves (L>100', 500'≤R≤1,200')	1
Curves with Chevrons	0

Crash Data, 2012-2021	
Total Crashes	3
K and A Crashes	0
Lane Departure Crashes	1
Lane Departure K and A Crashes	1
Total Crash Rate (per HMVMT)	435.6
K and A Crash Rate (per HMVMT)	0.0

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Conduct Road Safety Assessment (RSA)	0	EA	$ 40,000	$ -
Conduct Access Control Analysis	0	EA	$ 30,000	$ -
Install 4" Retroreflective Edgeline (Both Sides of Road)	8.64	MILE	$ 1,200	$ 10,365
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.00	MILE	$ 6,000	$ -
Install 4" Retroreflective Centerline	8.64	MILE	$ 3,000	$ 25,913
Pave 2' Shoulder with Safety Edge (Both Sides of Road)	0.50	MILE	$ 150,000	$ 75,000
Install Edgeline Rumble Strips (Both Sides of Road)	8.64	MILE	$ 2,000	$ 17,275
Install Centerline Rumble Strips	8.64	MILE	$ 1,000	$ 8,638
Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed	1	CURVE	$ 3,500	$ 3,500
Review and Upgrade Curve Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 1,000	$ -
Clear and Grub (15 ft Both Sides of Road)**	8.64	MILE	$ 30,000	$ 259,127
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 399,818

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** Unit price varies based on average roadside risk score.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 8

Project Name: HIGHWAY 306 between Iowa 14 and US 65
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 593, 890, 891, 892

County to check the box for those improvements recommended for consideration.

	Item Description	Quantity	Unit	Unit Price	Item Cost
	Flatten and Widen Foreslopes (both sides of road)		MILE	$ 85,000	$ -
	On-Pavement Markings for Speed Control		EA	$ 3,000	$ -
	Delineate Roadside Hazards (trees or utility poles) with Retroreflective Tape		EA	$ 100	$ -
	Guardrail		MILE	$ 80	$ -
	Post-Mounted Delineators		MILE	$ 1,000	$ -
	Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed		CURVE	$ 5,000	$ -
	Retroreflective Strips on Chevron Sign Posts		CURVE	$ 500	$ -
	Transverse Rumble Strips Prior to Curve		EA	$ 5,000	$ -
	Superelevation Correction on Curves		EA	$ 50,000	$ -
	Install High Friction Surface Treatment (HFST) on Curves		MILE	$ 50,000	$ -
	Speed Activated Flashers on Chevron Signs		EA	$ 4,000	$ -
	Other:				
	Other:				
	Other:				
	Other:				

Additional Potential Improvements Subtotal:		$ -
Project Selection Decision Tree Systemic Improvements Subtotal:		$ 399,818
Subtotal:		$ 399,818
Mobilization: (% +/-)*	10%	$ 39,990
Traffic Control: (% +/-)	5%	$ 20,038
Contingency: (% +/-)	20%	$ 80,154
Estimated Project Cost		**$ 540,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
Kimley-Horn has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Kimley-Horn at this time and represent only Kimley-Horn's judgment as a design professional familiar with the construction industry. Kimley-Horn cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Project Description Form Disclaimer:
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End of Project Description

Back Page

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 14

Project Name: BROAD ST between 155th Avenue and 150th Avenue
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

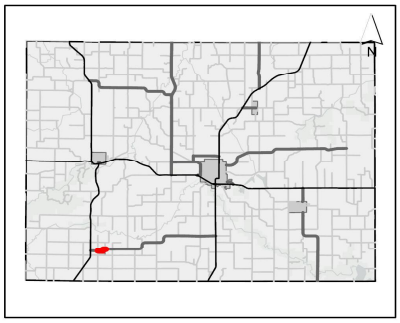
SEGMENT

Location Description

Road: **BROAD ST**
From: 155th Avenue
To: 150th Avenue
Length (miles): **0.67**

GPS ID: 497, 901, 904

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Average Daily Traffic (ADT)	**439**	**3**
Pavement | Shoulder Width (ft)	**22' | 1'-4'**	**2**
Avg. Pavement Condition (IRI)	**220**	**4**
Average Roadside Risk	**0.00**	**0**
Access Points per Mile	**209.8**	**3**
High Risk Curve Density/Mile	**0.0**	**0**
Lane Dept.Crash Rate (HMVMT)	**467.1**	**2**
Total Risk Factor Points (25 max)		**14**

Other Information	
Paved Shoulder	**No**
Shoulder Width (ft)	**1' - 4'**
Speed Limit (mph)	**20**
Lane Width (ft)	**11**
Number of Lanes	**2**
Edgeline Rumble Strips	**No**
Centerline Rumble Strips	**No**
Curves (L>100', 500'≤R≤1,200')	**0**
Curves with Chevrons	**0**

Crash Data, 2012-2021	
Total Crashes	**1**
K and A Crashes	**0**
Lane Departure Crashes	**1**
Lane Departure K and A Crashes	**1**
Total Crash Rate (per HMVMT)	**467.1**
K and A Crash Rate (per HMVMT)	**0.0**

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Conduct Road Safety Assessment (RSA)	0	EA	$ 40,000	$ -
Conduct Access Control Analysis	1	EA	$ 30,000	$ 30,000
Install 4" Retroreflective Edgeline (Both Sides of Road)	0.67	MILE	$ 1,200	$ 800
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.00	MILE	$ 6,000	$ -
Install 4" Retroreflective Centerline	0.67	MILE	$ 3,000	$ 1,999
Pave 2' Shoulder with Safety Edge (Both Sides of Road)	0.00	MILE	$ 150,000	$ -
Install Edgeline Rumble Strips (Both Sides of Road)	0.67	MILE	$ 2,000	$ 1,333
Install Centerline Rumble Strips	0.67	MILE	$ 1,000	$ 666
Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 3,500	$ -
Review and Upgrade Curve Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 1,000	$ -
Clear and Grub (15 ft Both Sides of Road)**	0.67	MILE	$ 30,000	$ 19,993
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 54,791

Continued on back of this page.

** Unit price varies based on average roadside risk score.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 14

Project Name: BROAD ST between 155th Avenue and 150th Avenue
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 497, 901, 904

County to check the box for those improvements recommended for consideration.

	Item Description	Quantity	Unit	Unit Price	Item Cost
	Flatten and Widen Foreslopes (both sides of road)		MILE	$ 85,000	$ -
	On-Pavement Markings for Speed Control		EA	$ 3,000	$ -
	Delineate Roadside Hazards (trees or utility poles) with Retroreflective Tape		EA	$ 100	$ -
	Guardrail		MILE	$ 80	$ -
	Post-Mounted Delineators		MILE	$ 1,000	$ -
	Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed		CURVE	$ 5,000	$ -
	Retroreflective Strips on Chevron Sign Posts		CURVE	$ 500	$ -
	Transverse Rumble Strips Prior to Curve		EA	$ 5,000	$ -
	Superelevation Correction on Curves		EA	$ 50,000	$ -
	Install High Friction Surface Treatment (HFST) on Curves		MILE	$ 50,000	$ -
	Speed Activated Flashers on Chevron Signs		EA	$ 4,000	$ -
	Other:				
	Other:				
	Other:				
	Other:				

Additional Potential Improvements Subtotal:		$ -
Project Selection Decision Tree Systemic Improvements Subtotal:		$ 54,791
Subtotal:		$ 54,791
Mobilization: (% +/-)*	10%	$ 5,480
Traffic Control: (% +/-)	5%	$ 2,746
Contingency: (% +/-)	20%	$ 10,983
Estimated Project Cost		**$ 74,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
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End of Project Description

Back Page

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 12

Project Name: S23 between Iowa state line and US 34
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

SEGMENT

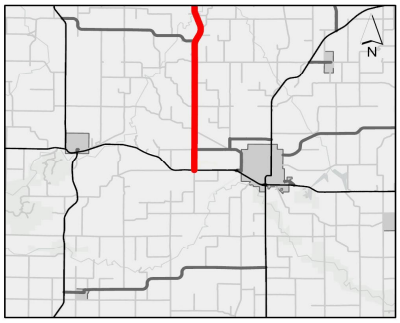
Location Description

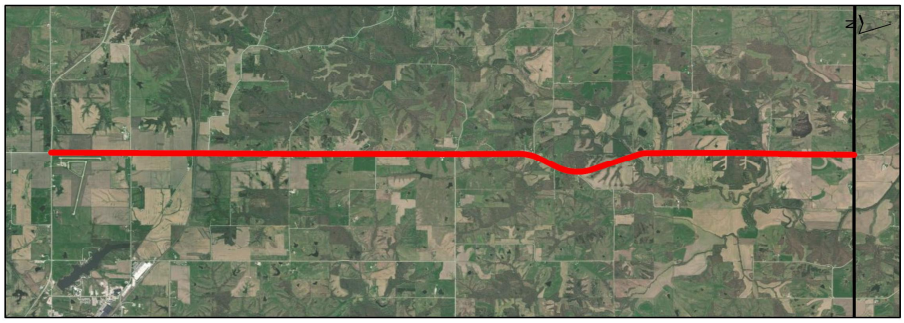
Road: **S23**
From: Iowa state line
To: US 34
Length (miles): **10.18**

GPS ID: 882

This segment contains the following high scoring intersections: GPS IDs 337856, 337898, 338188, and 338196
This segment contains the following high scoring curve: GPS ID 17650

Project Location Maps





Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Average Daily Traffic (ADT)	**698**	**5**
Pavement | Shoulder Width (ft)	**22' | 6'**	**0**
Avg. Pavement Condition (IRI)	**59**	**0**
Average Roadside Risk	**1.55**	**2**
Access Points per Mile	**6.3**	**2**
High Risk Curve Density/Mile	**0.3**	**1**
Lane Dept.Crash Rate (HMVMT)	**50.1**	**2**
Total Risk Factor Points (25 max)		**12**

Other Information	
Paved Shoulder	**No**
Shoulder Width (ft)	**1**
Speed Limit (mph)	**25**
Lane Width (ft)	**11**
Number of Lanes	**2**
Edgeline Rumble Strips	**No**
Centerline Rumble Strips	**No**
Curves (L>100', 500'≤R≤1,200')	**0**
Curves with Chevrons	**0**

Crash Data, 2012-2021	
Total Crashes	**83**
K and A Crashes	**5**
Lane Departure Crashes	**13**
Lane Departure K and A Crashes	**13**
Total Crash Rate (per HMVMT)	**319.9**
K and A Crash Rate (per HMVMT)	**19.3**

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Conduct Road Safety Assessment (RSA)	1	EA	$ 40,000	$ 40,000
Conduct Access Control Analysis	0	EA	$ 30,000	$ -
Install 4" Retroreflective Edgeline (Both Sides of Road)	10.18	MILE	$ 1,200	$ 12,220
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.00	MILE	$ 6,000	$ -
Install 4" Retroreflective Centerline	10.18	MILE	$ 3,000	$ 30,550
Pave 2' Shoulder with Safety Edge (Both Sides of Road)	0.00	MILE	$ 150,000	$ -
Install Edgeline Rumble Strips (Both Sides of Road)	10.18	MILE	$ 2,000	$ 20,367
Install Centerline Rumble Strips	10.18	MILE	$ 1,000	$ 10,183
Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 3,500	$ -
Review and Upgrade Curve Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 1,000	$ -
Clear and Grub (15 ft Both Sides of Road)**	10.18	MILE	$ 30,000	$ 305,498
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 418,818

Continued on back of this page.

** Unit price varies based on average roadside risk score.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 12

Project Name: S23 between Iowa state line and US 34
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 882

County to check the box for those improvements recommended for consideration.

	Item Description	Quantity	Unit	Unit Price	Item Cost
	Flatten and Widen Foreslopes (both sides of road)		MILE	$ 85,000	$ -
	On-Pavement Markings for Speed Control		EA	$ 3,000	$ -
	Delineate Roadside Hazards (trees or utility poles) with Retroreflective Tape		EA	$ 100	$ -
	Guardrail		MILE	$ 80	$ -
	Post-Mounted Delineators		MILE	$ 1,000	$ -
	Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed		CURVE	$ 5,000	$ -
	Retroreflective Strips on Chevron Sign Posts		CURVE	$ 500	$ -
	Transverse Rumble Strips Prior to Curve		EA	$ 5,000	$ -
	Superelevation Correction on Curves		EA	$ 50,000	$ -
	Install High Friction Surface Treatment (HFST) on Curves		MILE	$ 50,000	$ -
	Speed Activated Flashers on Chevron Signs		EA	$ 4,000	$ -
	Other:				
	Other:				
	Other:				
	Other:				

Additional Potential Improvements Subtotal:		$ -
Project Selection Decision Tree Systemic Improvements Subtotal:		$ 418,818
Subtotal:		$ 418,818
Mobilization: (% +/-)*	10%	$ 41,890
Traffic Control: (% +/-)	5%	$ 21,058
Contingency: (% +/-)	20%	$ 84,234
Estimated Project Cost		**$ 566,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
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End of Project Description

Back Page

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 11

Project Name: 550TH ST between 290th Avenue and US 65
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

SEGMENT

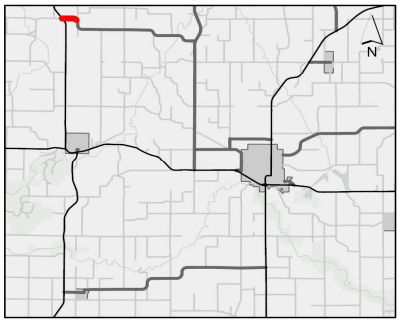
Location Description

Road: **550TH ST**
From: 290th Avenue
To: US 65
Length (miles): **6.20**

GPS ID: 481, 899, 900, 649

This segment contains the following high scoring curves: GPS IDs 48639 and 48735

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Average Daily Traffic (ADT)	390	2
Pavement | Shoulder Width (ft)	22' | 9'	0
Avg. Pavement Condition (IRI)	178	4
Average Roadside Risk	0.77	0
Access Points per Mile	11.1	3
High Risk Curve Density/Mile	0.0	0
Lane Dept.Crash Rate (HMVMT)	111.2	2
Total Risk Factor Points (25 max)		**11**

Other Information	
Paved Shoulder	No
Shoulder Width (ft)	9
Speed Limit (mph)	55
Lane Width (ft)	11
Number of Lanes	2
Edgeline Rumble Strips	No
Centerline Rumble Strips	No
Curves (L>100', 500'≤R≤1,200')	0
Curves with Chevrons	0

Crash Data, 2012-2021	
Total Crashes	1
K and A Crashes	0
Lane Departure Crashes	1
Lane Departure K and A Crashes	1
Total Crash Rate (per HMVMT)	111.2
K and A Crash Rate (per HMVMT)	0.0

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Conduct Road Safety Assessment (RSA)	0	EA	$ 40,000	$ -
Conduct Access Control Analysis	0	EA	$ 30,000	$ -
Install 4" Retroreflective Edgeline (Both Sides of Road)	6.20	MILE	$ 1,200	$ 7,445
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.00	MILE	$ 6,000	$ -
Install 4" Retroreflective Centerline	6.20	MILE	$ 3,000	$ 18,613
Pave 2' Shoulder with Safety Edge (Both Sides of Road)	0.00	MILE	$ 150,000	$ -
Install Edgeline Rumble Strips (Both Sides of Road)	6.20	MILE	$ 2,000	$ 12,409
Install Centerline Rumble Strips	6.20	MILE	$ 1,000	$ 6,204
Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 3,500	$ -
Review and Upgrade Curve Signage to Meet MUTCD and Iowa DOT Standards, if Needed	0	CURVE	$ 1,000	$ -
Clear and Grub (15 ft Both Sides of Road)**	6.20	MILE	$ 30,000	$ 186,130
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 230,801

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** Unit price varies based on average roadside risk score.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Points: 11

Project Name: 550TH ST between 290th Avenue and US 65
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 481, 899, 900, 649

County to check the box for those improvements recommended for consideration.

	Item Description	Quantity	Unit	Unit Price	Item Cost
	Flatten and Widen Foreslopes (both sides of road)		MILE	$ 85,000	$ -
	On-Pavement Markings for Speed Control		EA	$ 3,000	$ -
	Delineate Roadside Hazards (trees or utility poles) with Retroreflective Tape		EA	$ 100	$ -
	Guardrail		MILE	$ 80	$ -
	Post-Mounted Delineators		MILE	$ 1,000	$ -
	Review Curve and Provide Signage to Meet MUTCD and Iowa DOT Standards, if Needed		CURVE	$ 5,000	$ -
	Retroreflective Strips on Chevron Sign Posts		CURVE	$ 500	$ -
	Transverse Rumble Strips Prior to Curve		EA	$ 5,000	$ -
	Superelevation Correction on Curves		EA	$ 50,000	$ -
	Install High Friction Surface Treatment (HFST) on Curves		MILE	$ 50,000	$ -
	Speed Activated Flashers on Chevron Signs		EA	$ 4,000	$ -
	Other:				
	Other:				
	Other:				
	Other:				

Additional Potential Improvements Subtotal:		$ -
Project Selection Decision Tree Systemic Improvements Subtotal:		$ 230,801
Subtotal:		$ 230,801
Mobilization: (% +/-)*	10%	$ 23,090
Traffic Control: (% +/-)	5%	$ 11,622
Contingency: (% +/-)	20%	$ 46,487
Estimated Project Cost		**$ 312,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
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End of Project Description

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APPENDIX B3

SEGMENT RISK FACTOR RANKING RESULTS

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Segment ID	Length (mi)	Speed Limit	Total Risk	AADT	AADT Risk	Pavement Width (ft)	Shoulder Width (ft)	Pavement and Shoulder Width Risk	Pavement Condition	Pavement Condition Risk	Roadside Rating	Roadside Risk	Access Density (points/mile)	Access Density Risk	Alignment	Alignment Risk	Lane Departure Crashes (per HMVMT)	Lane Departure Crash Risk	Total Crash Rate (per HMVMT)	KA Crash Rate (per HMVMT)	Yes count	Total Crashes	K and A Crashes	Lane Departure Crashes
481	0.202370125	55	6	290.8304287	0	22	9	0	210.8061364	4	1.32	0	4.941440836	0	0	0	464.1484124	2	928.2968248	0	1	2	0	1
497	0.133460897	20	14	439.4284821	3	22	1	2	219.538125	4	0	0	209.7992789	3	0	0	467.0662477	2	467.0662477	0	1	1	0	1
569	0.110088119	45	11	1180.000414	6	22	4	0	67.97375	0	0.42	0	54.50179425	3	0	0	211.127262	2	211.127262	0	1	1	0	1
593	0.496370294	50	8	380.0000137	0	26	2	0	133.1664583	2	2.695	2	16.11699994	0	2.014624993	2	145.2129424	2	435.6388271	0	1	3	0	1
641	0.918609737	55	3	310.0000027	1	22	7	0	74.85198925	0	1.045	0	6.531609408	2	0	0	0	0	192.3726583	0	1	2	0	0
649	0.631675749	55	11	389.9999844	2	22	9	0	177.9856923	4	0.77	0	11.08163486	3	0	0	111.1798832	2	111.1798832	0	1	1	0	1
663	0.0517761	25	9	290.0000107	0	44	1	2	409.98	4	0	0	96.56965367	3	0	0	0	0	0	0	1	0	0	0
664	0.018704369	55	10	13801.47167	6	24	4	0	0	0	0	0	53.46344483	2	0	0	157.3144214	2	157.3144214	78.6572107	1	2	1	2
882	10.18326252	55	12	697.8851402	5	22	6	0	59.3710109	0	1.551	2	6.284822753	2	0.294601067	1	50.10214744	2	319.8829413	19.27005671	1	83	5	13
883	0.506001606	55	15	1310.798759	6	24	9	0	226.6757547	4	2.695	2	13.8339482	3	0	0	0	0	247.7758519	0	1	6	0	0
884	0.910369127	45	15	2124.317123	6	24	8	0	210.4505747	4	2.22	2	14.27992186	3	0	0	0	0	113.3052404	0	1	8	0	0
885	1.757326522	55	10	489.9999955	4	22	9	0	167.5859322	2	1.045	0	4.552369694	0	1.138092424	2	63.61755534	2	222.6614437	31.80877767	1	7	1	2
886	3.565689244	55	15	880.0000058	5	22	6	0	151.8150978	2	2.922857143	2	8.133069938	2	0.560901375	2	34.91491548	2	209.4894929	17.45745774	1	24	2	4
887	1.024404325	55	16	1200.000028	6	24	2	0	121.1439899	2	7.59	4	6.833239407	2	0	0	133.6884111	2	178.2512147	22.28140184	1	8	1	6
888	1.692959122	55	2	309.9999958	1	22	7	0	80.77658824	0	1.045	0	5.316135447	1	0	0	0	0	104.3800469	0	1	2	0	0
889	3.496790521	55	3	310.0000012	1	22	7	0	82.1901983	0	1.4025	0	4.003671342	0	0	0	151.6085715	2	454.8257146	50.53619051	1	18	2	6
890	2.822507559	55	8	459.9999998	2	22	9	0	81.34482456	0	1.87	2	5.668718211	1	0.354294888	1	42.21522402	2	316.6141801	21.10761201	1	15	1	2
891	2.762968348	55	6	460.0000043	4	22	9	0	74.00111111	0	1.045	0	5.067014254	0	0	0	129.2875509	2	258.5751019	21.54792516	1	12	1	6
892	2.55570388	55	4	459.9999968	2	22	9	0	67.69017857	0	1.21	0	3.130253103	0	0	0	23.29887006	2	139.7932204	0	1	6	0	1
893	0.277895691	55	9	1256.011748	6	24	4	0	84.89942308	0	0.57	0	32.38625247	1	0	0	157.3144214	2	157.3144214	0	1	2	0	2
894	2.010808753	55	15	1426.945325	6	22	7	0	138.2569347	2	2.145	2	12.43280842	3	0	0	38.18335507	2	219.5542917	0	1	23	0	4
895	1.762342965	55	16	629.9999986	5	24	9	0	177.2892151	4	2.75	2	5.106837987	1	1.134852886	2	24.66936089	2	148.0161653	0	1	6	0	1
896	2.044026946	55	7	310.9242858	1	22	9	0	145.8620773	2	1.38875	0	8.316915798	3	0.489230341	1	0	0	258.5849588	0	1	6	0	0
897	5.013078764	55	5	150.0000004	0	22	9	0	144.7353006	2	1.2925	0	5.984346429	2	0.199478214	1	0	0	364.2451342	0	1	10	0	0
898	0.644267139	35	8	520.0000198	4	24	4	0	120.5634677	2	0.42	0	10.86505826	0	0	0	81.75589521	2	735.8030569	245.2676856	1	9	3	1
899	1.866878636	55	8	390.000002	2	22	9	0	190.5374731	4	1.136666667	0	5.892188056	1	0.53565346	1	0	0	225.7132588	0	1	6	0	0
900	3.503416344	55	9	395.7441957	2	22	9	0	195.5108092	4	1.084285714	0	4.281535087	0	0.285435672	1	39.51509428	2	158.0603771	0	1	8	0	2
901	0.175740471	25	7	460.00002	3	22	4	0	146.5470588	2	0	0	45.5216715	2	0	0	0	0	0	0	1	0	0	0
902	0.221272112	55	13	2090.000065	6	36	10	0	219.2941667	4	0	0	36.15457879	1	0	0	116.9610443	2	350.883133	0	1	6	0	2
903	0.124771444	20	9	299.9999993	0	24	1	2	296.798	4	0	0	32.05861742	1	0	0	1463.497839	2	1463.497839	731.7489196	1	2	1	2
904	0.357215405	25	8	459.9999495	3	22	2	0	163.8795946	2	0	0	111.9772536	3	0	0	0	0	166.6944034	0	1	1	0	0
905	0.280316324	25	9	447.0398998	3	24	3	0	142.29625	2	0	0	39.24138214	2	0	0	218.5718755	2	437.143751	0	1	2	0	1

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APPENDIX C1

INTERSECTION SAFETY COUNTERMEASURES

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This appendix summarizes the **intersection** safety countermeasures for consideration and provides detailed descriptions for each countermeasure from both the project selection decision tree as well as the additional potential improvements listed on the back side of the project sheets.

Intersection Countermeasures from Project Selection Decision Tree

The countermeasures in this section were included in the project selection decision tree and recommended on the intersection project sheets based on the criteria described in **Section 6.3.1.**

Coordinate with Local Jurisdiction on Signal Modifications

Although there are not many traffic signals along the county road system which are operated and maintained by the county, the recommendations from this Local Road Safety Plan (LRSP) include a coordination item with the local jurisdiction at locations where signalized intersections scored high on the risk factor rankings. This coordination could include the installation of retroreflective backplates, installing larger signal heads, signal retiming, flashing yellow arrow implementation, and/or overhead signal installation.

Signal Warrant Analysis to Consider Removal of Signal

At locations where a signalized intersection may not be warranted, based on reported daily entering vehicles (DEVs), it is recommended that a signal warrant analysis, including the required traffic counts, be conducted to determine if the traffic signal is warranted. Removing an unwarranted traffic signal has a documented crash modification factor (CMF) as high as 0.76. The cost associated with this recommendation includes only the counts and analysis, not the physical removal of the traffic signal.

Intersection Configuration Evaluation (ICE)

Per the Minnesota Department of Transportation (MnDOT),

> "ICE is a process that identifies the best intersection control through a comprehensive analysis and documentation of the technical (safety and operational), economic, and political issues of viable alternatives" (http://www.dot.state.mn.us/trafficeng/safety/ice/).

This evaluation broadens the framework for consideration of intersection control beyond the traditional traffic signal. Through this evaluation process, the optimal control is anticipated to be recommended, based on an objective analysis. Stop signs, yield signs, channelized movements, access control, grade separation, roundabouts or fully signalized intersections can be the result of the ICE.

In 2007, the MnDOT's Office of Traffic, Safety, and Operations published an "Intersection Control Evaluation" manual (http://www.dot.state.mn.us/trafficeng/safety/ice/2007_ICE_Manual.pdf). This comprehensive manual describes in detail the process that is recommended in Minnesota. Many states currently have ICE policies and require ICE to be completed prior to determining intersection control and configurations, including: California, Indiana, Florida, Minnesota, Washington, and Wisconsin. The Iowa DOT is in the process of developing their own guidelines for ICE. The recommended process includes identifying intersections, collecting data, performing warrant analyses, analyzing alternatives, and selecting a preferred alternative. Following the scoping, an alternative is selected by preparing conceptual designs, identifying right-of-way requirements, estimating life-cycle costs, considering political impacts, reevaluating alternatives, and receiving staff approval. Finally, an ICE report is compiled, documenting the process and

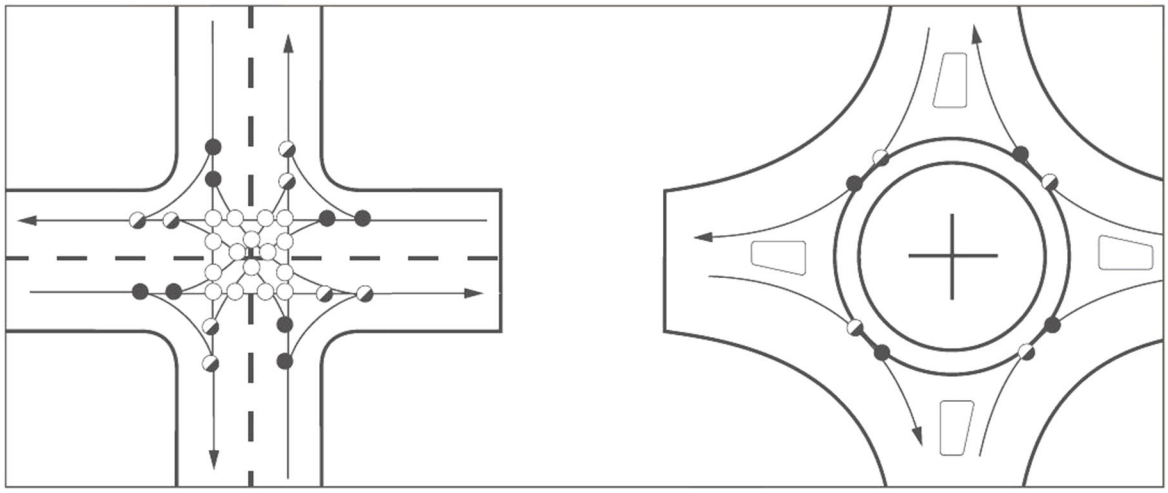
results. Additional guidance on ICE can be found in the California DOT (Caltrans) 2013 policy directive on ICE (http://www.dot.ca.gov/trafficops/ice.html).

The recommendation of conducting an ICE was based on fatal or serious injury crash (K or A crash) history, DEVs, and current signalization; or number of approaches. The cost estimate includes only the cost of the evaluation. The following countermeasure takes into account the cost for implementing the results of the ICE.

Implement Results of ICE

Along with the recommendation to evaluate with ICE, this recommendation includes implementing the selected intersection configuration. Since the evaluation is necessary to determine which configuration to implement, the cost associated with this recommendation is the estimated average of potential intersection configurations. Intersection configurations that could be considered include roundabouts, multi-way stop control, traffic signals, restricting left-turn movements, median U-turn intersections, and grade separation. While roundabouts are not appropriate in every scenario, more information is provided here as roundabouts should be considered as part of the ICE and are a less traditional intersection configuration in Iowa.

Roundabouts are a Federal Highway Administration (FHWA) proven safety countermeasure with marked safety improvements thoroughly documented. CMFs for converting a stop-controlled rural intersection to a roundabout have been recorded from 0.18 - 0.42 showing reductions in crashes as high as 82%. In addition to providing significant safety benefits, roundabouts are also able to accommodate abnormal intersections, such as intersections with more than four approaches or an angled minor or major approach. Many of the safety benefits of roundabouts stem from the fact that they have fewer conflict points (see **Figure C1**). In a conventional intersection, 32 conflict points exist at which a crash may occur. This is reduced to eight conflict points in a typical one-lane roundabout. Furthermore, the vehicle conflict points at a roundabout are unlikely to result in right-angle or head-on collisions which tend to be more severe crash types. Instead, the majority of crashes are rear-end or side-swipe collisions. In addition to less-severe crash types, crashes at roundabouts tend to occur at lower speeds which results in fewer injuries and fatalities.



Four-Leg Intersection
32 Conflict Points

Roundabout
8 Conflict Points

Source: Federal Highway Administration

Figure C1 – Conflict Points at Intersections

All-Way Stop Warrant Analysis (Install)

This safety countermeasure includes conducting an all-way stop warrant analysis on an existing two-way stop-controlled intersection. The analysis should include a review of traffic volumes, crash history and sight distance as detailed in the Manual of Uniform Traffic Control Devices (MUTCD) for an intersection that is not currently controlled by stop signs for all approaches. This safety countermeasure was recommended based on the CMFs in the range of 0.39 for converting a two-way stop-controlled intersection to all-way stop control. An engineering study is required to warrant the installation of all-way stop control. Only the analysis was recommended in the decision tree, based on traffic volumes that could potentially meet the minimum volume thresholds for an all-way stop to be warranted.

All-Way Stop Warrant Analysis (Remove)

This safety countermeasure includes conducting an all-way stop warrant analysis on an existing all-way stop-controlled intersection. The analysis should include a review of traffic volumes, crash history and sight distance as detailed in the MUTCD. An engineering study is required to warrant the removal of all-way stop control, converting to two-way stop control. Only the analysis was recommended in the decision tree, based on traffic volumes that would potentially not meet the minimum volume thresholds for an all-way stop to be warranted.

Destination Lighting

The Iowa DOT has a *Destination Lighting Specifics and Best Practices (2018)* document that should be consulted prior to installation of destination lighting. Various options are available including replacing existing HPS lights, new installations, and solar installations. The document provides detail on luminaire type, pole design, mounting height, pole placement, preferred luminaires, and sample specifications.

Destination lighting is different than typical intersection lighting, in that the purpose of destination lighting is to inform drivers, from a distance, that an intersection is located near the light. As can be seen in **Figure C2**, the High-Pressure Sodium (HPS) lighting option has traditionally provided a better spreading of light to the approaching driver when the Light-Emitting Diode (LED) system does not have a drop lens. LED lighting options without a drop lens dissipate less light outward and typically focus light down, towards the roadway. For the purpose of destination lighting, HPS or LED with drop lenses are preferred due to their dispersion of light. In rural situations, especially during nighttime conditions, intersections can be difficult to identify without the presence of destination lighting. For this purpose, destination lighting is recommended when certain volume thresholds defined in the decision tree are exceeded.

Figure C2 – Examples of Destination Lighting

Destination lighting, as a recommended safety countermeasure with a CMF of 0.62, can be installed on a new light pole or be attached to an existing utility pole near the subject intersection as shown in **Figure C3**. Some counties noted a preference to not install a new pole due to the increased maintenance and cost of a new pole while others have identified the coordination with the utility companies as a hindrance to installing destination lighting on an existing utility pole.

Figure C3 – Destination Lighting Installation Options

Upgrade Signs and Pavement Markings

Another low-cost intersection safety countermeasure includes the upgrading of signs and pavement markings. Providing “Stop Ahead” pavement markings has a recorded CMF range of 0.4 to 0.69 and increasing the retroreflectivity of stop signs (or replacing signs with new larger signs) has a CMF range of 0.75 to 0.91. The following improvements were recommended for applicable intersection approaches:

- Stop sign (R1-1 36”x36”) and post
  - Large stop sign for enhanced visibility from a greater distance
- All Way (plaque) (R1-3P 18”x6”) or
  Cross Traffic Does Not Stop (plaque) (W4-4P 24”x12”)
  - Informational plaque to provide valuable information to drivers
- Intersection Warning Sign and Post (W2-1 – W2-6 24”x24”)
  - Installed on uncontrolled intersection approaches to warn users of potential vehicle conflicts from the intersection roadway and/or vehicles slowing to make turns
- Stop ahead sign and post (W3-1 30”x30”)
  - This sign is installed upstream to inform drivers of upcoming stop-controlled conditions

- Stop ahead pavement markings
  - Installed as a supplement to the “Stop Ahead” sign, this on-pavement marking has a recorded CMF of 0.4 to 0.69 adding reinforcement of the upcoming stop-controlled condition
- Stop bar
  - Installed to delineate where the driver should stop to check for oncoming vehicles and reinforce the stop-controlled condition with on-pavement markings at the intersection. This pavement marking can also be visible from cross-traffic, further delineating the intersection. In the case of an unpaved minor approach a stop bar may not be feasible but is nevertheless recommended.
- Double yellow line 100’ back from the intersection
  - Provides additional delineation of the intersection

Implementing systemic signing and marking improvements at stop-controlled intersections is an FHWA Proven Countermeasure and has CMFs ranging from 0.89 to 0.92.

Install Second Stop Sign and Stop Ahead Signs

Installing a second stop sign and stop ahead sign on the left side of the roadway for reinforcement of the stop-controlled condition was another safety countermeasure that was suggested where certain volume thresholds were met. Installing the second stop sign and stop ahead signs on the left side of the roadway provides for additional visibility and reinforces the stop-controlled condition ahead.

Flashing Beacon on All Stop Signs

This countermeasure includes installing flashing beacons on top of all stop signs and/or yield signs at an intersection. It is anticipated that the flashing beacons would be solar-power LED beacons to expedite the installation and reduce the monthly cost associated with power for the lights. This countermeasure provides enhanced visibility and reinforcement of the stop/yield-controlled condition.

Transverse Rumble Strips on All or Minor Approaches

Installing transverse rumble strips can alert drivers of an upcoming stop sign. In the case of an all-way stop-controlled intersection, rumble strips are recommended on all approaches. For a one-way or two-way stop-controlled intersection, only the minor paved approaches (those that are stop-controlled) are recommended for rumble strip installation. Installing transverse rumble strips on stop-controlled approaches in rural areas has a CMF of 0.79 to 0.87.

Install Advanced Cross Street Name Signs (Major Approaches)

This safety countermeasure includes the installation of cross street name signs with the intersection warning signs in advance of an intersection on the major approaches to provide additional information to drivers, increasing their decision time and distance. This improvement also provides additional emphasis of an upcoming intersection.

Clear and Grub

This includes clearing and grubbing the areas within the sight triangles of the vehicles that approach stop signs at a given intersection. This safety countermeasure increases the sight distance for vehicles prior to entering an intersection. This is particularly beneficial under two-way stop-controlled or uncontrolled situations where conflicting vehicles may not stop or yield. A budgetary cost has been included in the project sheets; however, it is recommended that the County Engineer confirm the need to clear and grub as projects move forward.

Other Intersection Countermeasures

There are a variety of other safety improvements that could be considered that were not included in the project selection decision tree due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed at intersections throughout the county. The following sections describe several other intersection safety improvements that could be considered appropriate by the county and that were included on the back side of the project sheets.

Construction of Turn Lanes

Providing right- and left-turn lanes to remove slowing or turning vehicles from the through lanes has CMFs ranging from 0.52 to 0.74. This safety countermeasure needs to be evaluated on a case-by-case basis based on turning movement volumes, which were not available as part of this project. This improvement can be particularly effective where there are high amounts of conflicting movements at intersections. When considering turn lanes for a specific location, right-of-way constraints will need to be considered.

Realignment of Intersection to Reduce or Eliminate Skew

Intersection skew was reviewed as part of the risk factor analysis, but realignment of specific intersections was not recommended, due to constraints such as right-of-way and geometrics that could not be determined from a systemic approach. Depending on existing site conditions, this countermeasure could be particularly beneficial and should be considered where feasible. The CMF for intersection geometry reconfiguration is included in the Highway Safety Manual (HSM) and varies based on the existing skew angle. With the optimal 90-degree intersection configuration sight triangles are maximized, crossing distance is minimized, and the intersection meets typical driver expectations.

Provide Bypass Lane on Shoulder at T-Intersection

A bypass lane at a T-intersection allows through traffic a separate lane of travel from those vehicles intending to turn left at the intersection. This improvement removes some conflict points and has the potential to reduce the frequency of rear-end crashes.

Convert Offset T-Intersection to Four-Legged Intersection

Where two offset T-intersections are within close proximity, this countermeasure suggests combining the two intersections into a single four-legged intersection. The consolidation of the two intersections into one reduces conflict points and aligns better with driver expectations.

Use Indirect Left-Turn Treatments

Restricting or eliminating turning maneuvers by providing channelization or closing median openings can have significant safety benefits. This safety countermeasure could be implemented as part of an access management policy, referenced below. A CMF of 0.8 has been determined for providing indirect left-turn treatments.

Convert Four-Legged Intersection to Offset T-Intersection

Where a four-legged intersection has high opposing turning movements, two offset T-intersections may provide the needed traffic flow while reducing conflicts.

Install LED Flashing Beacons on Intersection Warning Signs

Flashing beacons draw the attention of drivers to the associated signage. This improvement enhances the conspicuity of intersection warning signs for drivers approaching the intersection. This sign/beacon combination can help increase awareness of drivers to potential upcoming vehicle conflicts. Flashing beacons on stop signs and curve chevron signs have measured safety benefits and are expected to provide safety benefits when applied to intersection warning signs as well.

Stop Signs with LED Flashing Lights

Installing stop signs with LEDs embedded in the border of the sign can increase the conspicuity of the sign from a greater distance, particularly at nighttime. A CMF of 0.59 has been recorded for replacing a standard stop sign with a stop sign with LED flashing lights.

Install Retroreflective Strips on Stop Sign Posts

This countermeasure includes the installation of retroreflective strips on the posts of stop signs. The strips can increase the visibility of the stop signs and increase driver awareness of a stop-controlled intersection.

Low-Cost Intersection Conflict Warning System (ICWS)

This safety improvement warns vehicles on the major approach of a two-way stop-controlled intersection when there is a vehicle present/stopped at the upcoming intersection. According to the FHWA,

> “These systems usually use a double set of detectors on the stop approach to identify approaching and stopped vehicles and warn traffic on the through approach of their presence using activated flashing beacons on passive intersection warning signs to indicate that a vehicle from the cross street may enter the intersection. They are often deployed at rural stop-controlled intersections that have either a history of crash experience or limited sight distance. Missouri, Minnesota, North Carolina, Pennsylvania, and Virginia have deployed these systems or variations of them.”

The FHWA also states that, this technology “has been successfully deployed… at a relatively low cost per intersection and has generally resulted in substantial intersection crash reductions.”

Access Management

According to the Transportation Research Board, “Access management is the systematic control of the location, spacing, design and operation of driveways, median openings, interchanges, and street connections to a roadway.” Various counties throughout Iowa have access management policies in place and substantial research has been conducted supporting the safety, operations, economic, and environmental effects of access management.

Figure C4 shows a generic definition of the functional area of an intersection. This area includes regions where vehicle speeds vary in order to change lanes and complete turns. Queues may also develop on the approach legs of the intersection. Driveways should be located outside of the functional area of the intersection so as not to negatively impact the operations of the intersection.

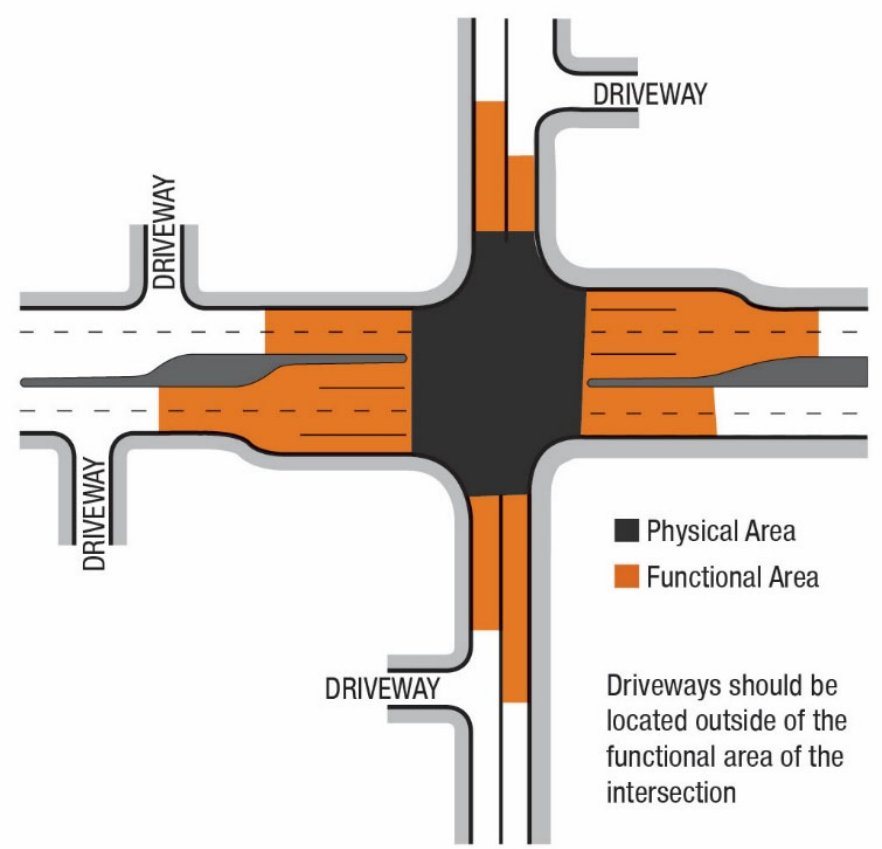


Figure C4 – Intersection Functional Area

In rural scenarios, access management is best applied by limiting left-turn movements onto high-speed roadways and providing sufficient spacing between roadway access points. Please refer to the *Statewide Urban Design and Specifications* (SUDAS) and AASHTO’s *A Policy on Geometric Design of Highways and Streets* (Green Book) for more information.

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APPENDIX C2

INTERSECTION PROJECT SHEETS

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Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 6

Project Name: US 65 & Co Rd H50/HIGHWAY 306
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

INTERSECTION

Location Description

Road: **US 65**
Road: **Co Rd H50/HIGHWAY 306**
Closest City: **DERBY**
GPS ID: 336885

County to coordinate with local agency to implement improvements that are on right-of-way that is not under control of the County.

Project Location Maps

Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Daily Entering Vehicles	1,465	6
Distance from Previous Stop	< 1.5 mi	0
Approach Angle (Degrees)	90	0
Intersection within Curve	0	0
Roads/Driveways within 250 Feet	0	0
K or A Crashes	0	0
Total Risk Factor Points (22 max)		**6**

Other Information	
Number of Approaches	3
Number of Paved Approaches	3
Major ADT	1,290
Minor ADT	380
Destination Lighting	No
Transverse Rumble Strips (Number of Approaches)	0
Control Type	One-way stop

Crash Data, 2012-2021	
Total Crashes	2
K and A Crashes	0
Right Angle,Rear-end,or Turning Crashes	0
Total Nighttime Crashes	1
Nighttime/Daytime Crash Ratio*	3.0

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Coordinate with Local Jurisdiction on Signal Modifications	0	EA	$ 2,500	$ -
Signal Warrant Analysis to Consider Removal of Signal	0	EA	$ 5,000	$ -
Intersection Configuration Evaluation (ICE)	0	EA	$ 25,000	$ -
Implement Results of ICE	0	EA	$ 750,000	$ -
All-Way Stop Analysis and Converting Two-Way Stop to All-Way Stop	0	LEG	$ 1,200	$ -
All-Way Stop Analysis and Removal of Stop Signs on Major Approaches	0	LEG	$ 500	$ -
Install Destination Lighting	1	EA	$ 5,500	$ 5,500
Upgrade Signs and Pavement Markings	1	LEG	$ 2,200	$ 2,200
Upgrade Signs (Unpaved Approaches)	0	LEG	$ 1,100	$ -
Install Second Stop Sign and Stop Ahead Sign	1	LEG	$ 1,500	$ 1,500
Install Solar-Powered Flashing Beacon on Stop Sign	0	EA	$ 2,500	$ -
Install Transverse Rumble Strips	1	LEG	$ 2,500	$ 2,500
Install Intersection Warning Signs and Advance Street Name Plaques on Major Approaches	2	LEG	$ 2,200	$ 4,400
Clear and Grub within Sight Triangle	2	LEG	$ 5,000	$ 10,000
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 26,100

Continued on back of this page.

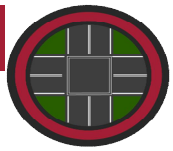
* Nighttime/Daytime Crash Ratio = 3 x nighttime crashes/daytime crashes per Iowa DOT I.M. 2.110 Attachment A.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 6



Project Name: US 65 & Co Rd H50/HIGHWAY 306
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 336885

County to check the box for those improvements recommended for consideration.

Item Description	NB	SB	EB	WB	Quantity	Unit	Unit Price	Item Cost
Provide Left-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Provide Right-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Realign Intersection Approaches to Reduce or Eliminate Intersection Skew						LEG	$ 300,000	$ -
Provide Bypass Lane on Shoulder at T-intersection						EA	$ 75,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection						EA	$ 300,000	$ -
Use Indirect Left-Turn Treatments to Minimize Conflicts at Divided Highway Intersection						LEG	$ 750,000	$ -
Convert Four-Legged Intersection to Offset T-Intersection						EA	$ 300,000	$ -
Install Solar-Powered Flashing Beacon on Intersection Warning Sign						LEG	$ 2,500	$ -
Install Stop Signs with LED Flashing Lights						LEG	$ 2,500	$ -
Install Retroreflective Strips on Stop Sign Posts						EA	$ 500	$ -
Other:								
Other:								
Other:								
Other:								
							Additional Potential Improvements Subtotal:	$ -
							Project Selection Decision Tree Systemic Improvements Subtotal:	$ 26,100
							Subtotal:	$ 26,100
							Mobilization: (% +/-)* 10%	$ 2,610
							Traffic Control: (% +/-) 5%	$ 1,458
							Contingency: (% +/-) 20%	$ 5,832
							Estimated Project Cost	**$ 36,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
Kimley-Horn has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Kimley-Horn at this time and represent only Kimley-Horn's judgment as a design professional familiar with the construction industry. Kimley-Horn cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Project Description Form Disclaimer:
The recommended improvements contained in this project description form were developed through a Geographic Information System (GIS) database risk assessment and project decision tree selection process, as specifically stated in our scope of services. Kimley-Horn has no control over the accuracy of the GIS databases nor the suitability of the specific improvements for the location, and has provided recommended improvements for consideration by the County Engineer. The County Engineer may use this project description form to aid in the selection and development of projects, but this project description form should not be used as the sole basis for the County Engineer's decision making process. We endeavored to research issues and constraints to the extent practical given the scope, budget, and schedule agreed to with the Client. Our assessment is based in large part on information provided to us by others (DOT, county staff, etc.) and therefore is only as accurate and complete as the information provided to us. No formal assessment was made for the improvement recommendations contained on this page, if in question, it is recommended that a study/analysis of this location be made to warrant the above indicated improvements. This project description form is based on our knowledge as of May 2023.

End of Project Description

Back Page

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 7

Project Name: IA 14 & Co Rd H50/435TH ST
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

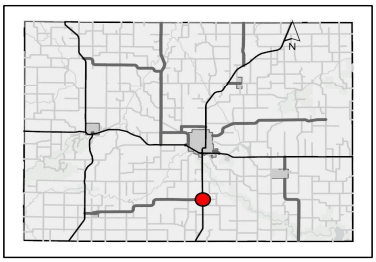
INTERSECTION

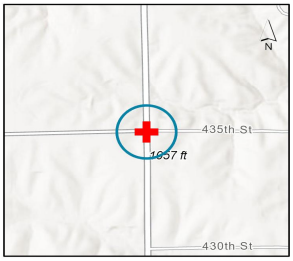
Location Description

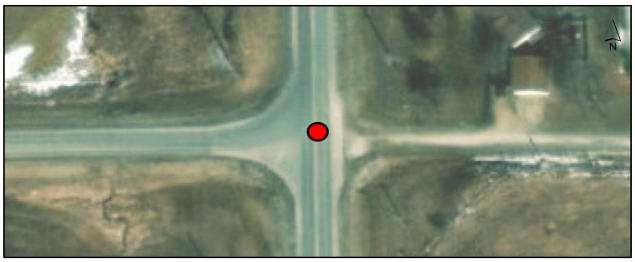
Road: **IA 14**
Road: **Co Rd H50/435TH ST**
Closest City: **DERBY**
GPS ID: 337009

County to coordinate with local agency to implement improvements that are on right-of-way that is not under control of the County.

Project Location Maps







Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Daily Entering Vehicles	2,117	6
Distance from Previous Stop	< 1.5 mi	0
Approach Angle (Degrees)	90	0
Intersection within Curve	0	0
Roads/Driveways within 250 Feet	1	1
K or A Crashes	0	0
Total Risk Factor Points (22 max)		**7**

Other Information	
Number of Approaches	4
Number of Paved Approaches	3
Major ADT	2,270
Minor ADT	15
Destination Lighting	No
Transverse Rumble Strips (Number of Approaches)	0
Control Type	Two-way stop

Crash Data, 2012-2021	
Total Crashes	2
K and A Crashes	0
Right Angle,Rear-end,or Turning Crashes	0
Total Nighttime Crashes	1
Nighttime/Daytime Crash Ratio*	3.0

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Coordinate with Local Jurisdiction on Signal Modifications	0	EA	$ 2,500	$ -
Signal Warrant Analysis to Consider Removal of Signal	0	EA	$ 5,000	$ -
Intersection Configuration Evaluation (ICE)	0	EA	$ 25,000	$ -
Implement Results of ICE	0	EA	$ 750,000	$ -
All-Way Stop Analysis and Converting Two-Way Stop to All-Way Stop	0	LEG	$ 1,200	$ -
All-Way Stop Analysis and Removal of Stop Signs on Major Approaches	0	LEG	$ 500	$ -
Install Destination Lighting	0	EA	$ 5,500	$ -
Upgrade Signs and Pavement Markings	1	LEG	$ 2,200	$ 2,200
Upgrade Signs (Unpaved Approaches)	1	LEG	$ 1,100	$ 1,100
Install Second Stop Sign and Stop Ahead Sign	0	LEG	$ 1,500	$ -
Install Solar-Powered Flashing Beacon on Stop Sign	0	EA	$ 2,500	$ -
Install Transverse Rumble Strips	1	LEG	$ 2,500	$ 2,500
Install Intersection Warning Signs and Advance Street Name Plaques on Major Approaches	0	LEG	$ 2,200	$ -
Clear and Grub within Sight Triangle	4	LEG	$ 5,000	$ 20,000
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 25,800

Continued on back of this page.

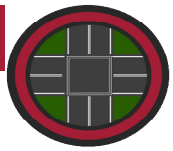
* Nighttime/Daytime Crash Ratio = 3 x nighttime crashes/daytime crashes per Iowa DOT I.M. 2.110 Attachment A.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 7



Project Name: IA 14 & Co Rd H50/435TH ST
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23

Prepared By: AKT
Checked By: DJG

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 337009

County to check the box for those improvements recommended for consideration.

Item Description	NB	SB	EB	WB	Quantity	Unit	Unit Price	Item Cost
Provide Left-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Provide Right-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Realign Intersection Approaches to Reduce or Eliminate Intersection Skew						LEG	$ 300,000	$ -
Provide Bypass Lane on Shoulder at T-intersection						EA	$ 75,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection						EA	$ 300,000	$ -
Use Indirect Left-Turn Treatments to Minimize Conflicts at Divided Highway Intersection						LEG	$ 750,000	$ -
Convert Four-Legged Intersection to Offset T-Intersection						EA	$ 300,000	$ -
Install Solar-Powered Flashing Beacon on Intersection Warning Sign						LEG	$ 2,500	$ -
Install Stop Signs with LED Flashing Lights						LEG	$ 2,500	$ -
Install Retroreflective Strips on Stop Sign Posts						EA	$ 500	$ -
Other:								
Other:								
Other:								
Other:								
							Additional Potential Improvements Subtotal:	$ -
							Project Selection Decision Tree Systemic Improvements Subtotal:	$ 25,800
							Subtotal:	$ 25,800
							Mobilization: (% +/-)* 10%	$ 2,580
							Traffic Control: (% +/-) 5%	$ 1,324
							Contingency: (% +/-) 20%	$ 5,296
							Estimated Project Cost	**$ 35,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
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End of Project Description

Back Page

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 8

Project sheet developed at the request of the County Engineer.

Project Name: IA 14 & Co Rd H30/495TH ST
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

INTERSECTION

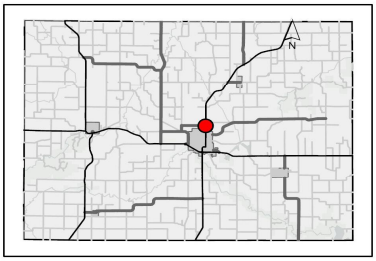
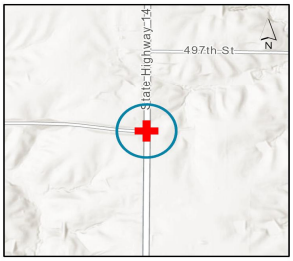
Location Description

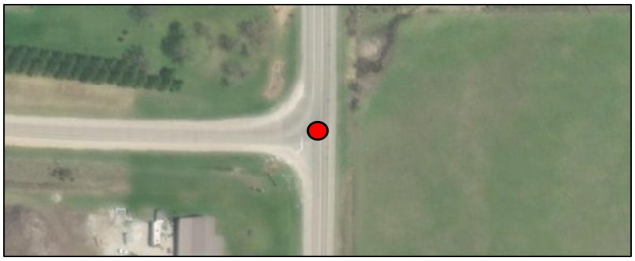
Road: **IA 14**
Road: **Co Rd H30/495TH ST**
Closest City: **CHARITON**
GPS ID: 337071

This intersection is located on the following high scoring segment: GPS ID 895

County to coordinate with local agency to implement improvements that are on right-of-way that is not under control of the County.

Project Location Maps



Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Daily Entering Vehicles	**3,285**	**6**
Distance from Previous Stop	**< 1.5 mi**	**0**
Approach Angle (Degrees)	**90**	**0**
Intersection within Curve	**0**	**0**
Roads/Driveways within 250 Feet	**0**	**0**
K or A Crashes	**3**	**2**
Total Risk Factor Points (22 max)		**8**

Other Information	
Number of Approaches	**3**
Number of Paved Approaches	**3**
Major ADT	**3,020**
Minor ADT	**630**
Destination Lighting	**No**
Transverse Rumble Strips (Number of Approaches)	**0**
Control Type	**One-way stop**

Crash Data, 2012-2021	
Total Crashes	**7**
K and A Crashes	**3**
Right Angle,Rear-end,or Turning Crashes	**2**
Total Nighttime Crashes	**2**
Nighttime/Daytime Crash Ratio*	**1.5**

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Coordinate with Local Jurisdiction on Signal Modifications	0	EA	$ 2,500	$ -
Signal Warrant Analysis to Consider Removal of Signal	0	EA	$ 5,000	$ -
Intersection Configuration Evaluation (ICE)	0	EA	$ 25,000	$ -
Implement Results of ICE	0	EA	$ 750,000	$ -
All-Way Stop Analysis and Converting Two-Way Stop to All-Way Stop	0	LEG	$ 1,200	$ -
All-Way Stop Analysis and Removal of Stop Signs on Major Approaches	0	LEG	$ 500	$ -
Install Destination Lighting	1	EA	$ 5,500	$ 5,500
Upgrade Signs and Pavement Markings	1	LEG	$ 2,200	$ 2,200
Upgrade Signs (Unpaved Approaches)	0	LEG	$ 1,100	$ -
Install Second Stop Sign and Stop Ahead Sign	1	LEG	$ 1,500	$ 1,500
Install Solar-Powered Flashing Beacon on Stop Sign	2	EA	$ 2,500	$ 5,000
Install Transverse Rumble Strips	1	LEG	$ 2,500	$ 2,500
Install Intersection Warning Signs and Advance Street Name Plaques on Major Approaches	2	LEG	$ 2,200	$ 4,400
Clear and Grub within Sight Triangle	2	LEG	$ 5,000	$ 10,000
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 31,100

Continued on back of this page.

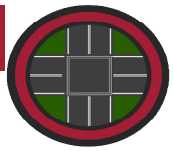
* Nighttime/Daytime Crash Ratio = 3 x nighttime crashes/daytime crashes per Iowa DOT I.M. 2.110 Attachment A.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 8



Project Name: IA 14 & Co Rd H30/495TH ST
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 337071

County to check the box for those improvements recommended for consideration.

Item Description	NB	SB	EB	WB	Quantity	Unit	Unit Price	Item Cost
Provide Left-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Provide Right-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Realign Intersection Approaches to Reduce or Eliminate Intersection Skew						LEG	$ 300,000	$ -
Provide Bypass Lane on Shoulder at T-intersection						EA	$ 75,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection						EA	$ 300,000	$ -
Use Indirect Left-Turn Treatments to Minimize Conflicts at Divided Highway Intersection						LEG	$ 750,000	$ -
Convert Four-Legged Intersection to Offset T-Intersection						EA	$ 300,000	$ -
Install Solar-Powered Flashing Beacon on Intersection Warning Sign						LEG	$ 2,500	$ -
Install Stop Signs with LED Flashing Lights						LEG	$ 2,500	$ -
Install Retroreflective Strips on Stop Sign Posts						EA	$ 500	$ -
Other:								
Other:								
Other:								
Other:								

Additional Potential Improvements Subtotal:		$ -
Project Selection Decision Tree Systemic Improvements Subtotal:		$ 31,100
Subtotal:		$ 31,100
Mobilization: (% +/-)*	10%	$ 3,110
Traffic Control: (% +/-)	5%	$ 1,558
Contingency: (% +/-)	20%	$ 6,232
Estimated Project Cost		**$ 42,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
Kimley-Horn has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Kimley-Horn at this time and represent only Kimley-Horn's judgment as a design professional familiar with the construction industry. Kimley-Horn cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

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End of Project Description

Back Page

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 11

Project Name: IA 14 & Co Rd H20/530TH ST
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

INTERSECTION

Location Description

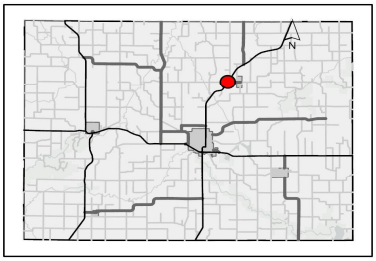
Road: **IA 14**
Road: **Co Rd H20/530TH ST**

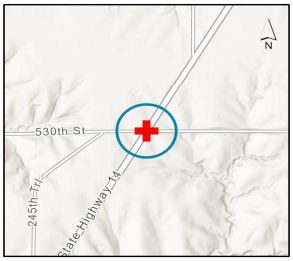
Closest City: **WILLIAMSON**

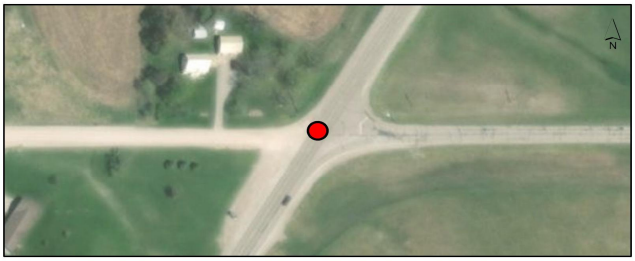
GPS ID: 337097

County to coordinate with local agency to implement improvements that are on right-of-way that is not under control of the County.

Project Location Maps







Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Daily Entering Vehicles	3,095	6
Distance from Previous Stop	< 1.5 mi	0
Approach Angle (Degrees)	60	4
Intersection within Curve	0	0
Roads/Driveways within 250 Feet	1	1
K or A Crashes	0	0
Total Risk Factor Points (22 max)		**11**

Other Information	
Number of Approaches	4
Number of Paved Approaches	3
Major ADT	2,920
Minor ADT	120
Destination Lighting	No
Transverse Rumble Strips (Number of Approaches)	0
Control Type	Two-way stop

Crash Data, 2012-2021	
Total Crashes	7
K and A Crashes	0
Right Angle,Rear-end,or Turning Crashes	1
Total Nighttime Crashes	3
Nighttime/Daytime Crash Ratio*	3.0

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Coordinate with Local Jurisdiction on Signal Modifications	0	EA	$ 2,500	$ -
Signal Warrant Analysis to Consider Removal of Signal	0	EA	$ 5,000	$ -
Intersection Configuration Evaluation (ICE)	0	EA	$ 25,000	$ -
Implement Results of ICE	0	EA	$ 750,000	$ -
All-Way Stop Analysis and Converting Two-Way Stop to All-Way Stop	0	LEG	$ 1,200	$ -
All-Way Stop Analysis and Removal of Stop Signs on Major Approaches	0	LEG	$ 500	$ -
Install Destination Lighting	0	EA	$ 5,500	$ -
Upgrade Signs and Pavement Markings	1	LEG	$ 2,200	$ 2,200
Upgrade Signs (Unpaved Approaches)	1	LEG	$ 1,100	$ 1,100
Install Second Stop Sign and Stop Ahead Sign	0	LEG	$ 1,500	$ -
Install Solar-Powered Flashing Beacon on Stop Sign	0	EA	$ 2,500	$ -
Install Transverse Rumble Strips	1	LEG	$ 2,500	$ 2,500
Install Intersection Warning Signs and Advance Street Name Plaques on Major Approaches	0	LEG	$ 2,200	$ -
Clear and Grub within Sight Triangle	4	LEG	$ 5,000	$ 20,000
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 25,800

Continued on back of this page.

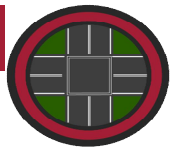
* Nighttime/Daytime Crash Ratio = 3 x nighttime crashes/daytime crashes per Iowa DOT I.M. 2.110 Attachment A.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 11



Project Name: IA 14 & Co Rd H20/530TH ST
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 337097

County to check the box for those improvements recommended for consideration.

Item Description	NB	SB	EB	WB	Quantity	Unit	Unit Price	Item Cost
Provide Left-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Provide Right-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Realign Intersection Approaches to Reduce or Eliminate Intersection Skew						LEG	$ 300,000	$ -
Provide Bypass Lane on Shoulder at T-intersection						EA	$ 75,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection						EA	$ 300,000	$ -
Use Indirect Left-Turn Treatments to Minimize Conflicts at Divided Highway Intersection						LEG	$ 750,000	$ -
Convert Four-Legged Intersection to Offset T-Intersection						EA	$ 300,000	$ -
Install Solar-Powered Flashing Beacon on Intersection Warning Sign						LEG	$ 2,500	$ -
Install Stop Signs with LED Flashing Lights						LEG	$ 2,500	$ -
Install Retroreflective Strips on Stop Sign Posts						EA	$ 500	$ -
Other:								
Other:								
Other:								
Other:								
							Additional Potential Improvements Subtotal:	$ -
							Project Selection Decision Tree Systemic Improvements Subtotal:	$ 25,800
							Subtotal:	$ 25,800
							Mobilization: (% +/-)* 10%	$ 2,580
							Traffic Control: (% +/-) 5%	$ 1,324
							Contingency: (% +/-) 20%	$ 5,296
							Estimated Project Cost	**$ 35,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

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End of Project Description

Back Page

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 15

Project Name: IA 14 & Co Rd S45/260TH AVE
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

INTERSECTION

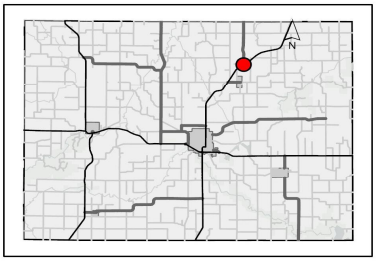
Location Description

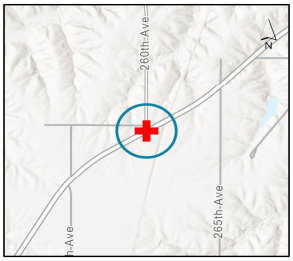
Road: **IA 14** Closest City: **WILLIAMSON** **GPS ID: 337109**
Road: **Co Rd S45/260TH AVE**

This intersection is located on the following high scoring segment: GPS ID 886

County to coordinate with local agency to implement improvements that are on right-of-way that is not under control of the County.

Project Location Maps





Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Points
Daily Entering Vehicles	2,725	6
Distance from Previous Stop	7 mi	4
Approach Angle (Degrees)	66	4
Intersection within Curve	0	0
Roads/Driveways within 250 Feet	1	1
K or A Crashes	0	0
Total Risk Factor Points (22 max)		**15**

Other Information	
Number of Approaches	3
Number of Paved Approaches	3
Major ADT	2,630
Minor ADT	880
Destination Lighting	No
Transverse Rumble Strips (Number of Approaches)	0
Control Type	One-way stop

Crash Data, 2012-2021	
Total Crashes	3
K and A Crashes	0
Right Angle,Rear-end,or Turning Crashes	1
Total Nighttime Crashes	1
Nighttime/Daytime Crash Ratio*	3.0

Opinion of Probable Cost (Project Selection Decision Tree Results)

Item Description	Quantity	Unit	Unit Price	Item Cost
Coordinate with Local Jurisdiction on Signal Modifications	0	EA	$ 2,500	$ -
Signal Warrant Analysis to Consider Removal of Signal	0	EA	$ 5,000	$ -
Intersection Configuration Evaluation (ICE)	0	EA	$ 25,000	$ -
Implement Results of ICE	0	EA	$ 750,000	$ -
All-Way Stop Analysis and Converting Two-Way Stop to All-Way Stop	0	LEG	$ 1,200	$ -
All-Way Stop Analysis and Removal of Stop Signs on Major Approaches	0	LEG	$ 500	$ -
Install Destination Lighting	1	EA	$ 5,500	$ 5,500
Upgrade Signs and Pavement Markings	1	LEG	$ 2,200	$ 2,200
Upgrade Signs (Unpaved Approaches)	0	LEG	$ 1,100	$ -
Install Second Stop Sign and Stop Ahead Sign	1	LEG	$ 1,500	$ 1,500
Install Solar-Powered Flashing Beacon on Stop Sign	2	EA	$ 2,500	$ 5,000
Install Transverse Rumble Strips	1	LEG	$ 2,500	$ 2,500
Install Intersection Warning Signs and Advance Street Name Plaques on Major Approaches	2	LEG	$ 2,200	$ 4,400
Clear and Grub within Sight Triangle	2	LEG	$ 5,000	$ 10,000
			Project Selection Decision Tree Systemic Improvements Subtotal:	$ 31,100

Continued on back of this page.

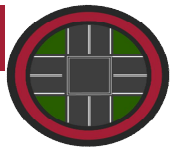
* Nighttime/Daytime Crash Ratio = 3 x nighttime crashes/daytime crashes per Iowa DOT I.M. 2.110 Attachment A.

Project Location Map Sources:
Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrip, IGN, IGP, swisstopo, and the GIS User Community

Kimley»Horn

Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Points: 15



Project Name: IA 14 & Co Rd S45/260TH AVE
Agency Name: Lucas County
Contact Name: Folkerts, Todde
E-mail: folkertst@lucasco.org

Date: 6/11/23
Prepared By: AKT
Checked By: DJG

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 337109

County to check the box for those improvements recommended for consideration.

Item Description	NB	SB	EB	WB	Quantity	Unit	Unit Price	Item Cost
Provide Left-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Provide Right-Turn Lanes at Intersection						LEG	$ 150,000	$ -
Realign Intersection Approaches to Reduce or Eliminate Intersection Skew						LEG	$ 300,000	$ -
Provide Bypass Lane on Shoulder at T-intersection						EA	$ 75,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection						EA	$ 300,000	$ -
Use Indirect Left-Turn Treatments to Minimize Conflicts at Divided Highway Intersection						LEG	$ 750,000	$ -
Convert Four-Legged Intersection to Offset T-Intersection						EA	$ 300,000	$ -
Install Solar-Powered Flashing Beacon on Intersection Warning Sign						LEG	$ 2,500	$ -
Install Stop Signs with LED Flashing Lights						LEG	$ 2,500	$ -
Install Retroreflective Strips on Stop Sign Posts						EA	$ 500	$ -
Other:								
Other:								
Other:								
Other:								

Additional Potential Improvements Subtotal:		$ -
Project Selection Decision Tree Systemic Improvements Subtotal:		$ 31,100
Subtotal:		$ 31,100
Mobilization: (% +/-)*	10%	$ 3,110
Traffic Control: (% +/-)	5%	$ 1,558
Contingency: (% +/-)	20%	$ 6,232
Estimated Project Cost		**$ 42,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000

Opinion of Probable Construction Cost Disclaimer:
Kimley-Horn has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Kimley-Horn at this time and represent only Kimley-Horn's judgment as a design professional familiar with the construction industry. Kimley-Horn cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Project Description Form Disclaimer:
The recommended improvements contained in this project description form were developed through a Geographic Information System (GIS) database risk assessment and project decision tree selection process, as specifically stated in our scope of services. Kimley-Horn has no control over the accuracy of the GIS databases nor the suitability of the specific improvements for the location, and has provided recommended improvements for consideration by the County Engineer. The County Engineer may use this project description form to aid in the selection and development of projects, but this project description form should not be used as the sole basis for the County Engineer's decision making process. We endeavored to research issues and constraints to the extent practical given the scope, budget, and schedule agreed to with the Client. Our assessment is based in large part on information provided to us by others (DOT, county staff, etc.) and therefore is only as accurate and complete as the information provided to us. No formal assessment was made for the improvement recommendations contained on this page, if in question, it is recommended that a study/analysis of this location be made to warrant the above indicated improvements. This project description form is based on our knowledge as of May 2023.

End of Project Description

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APPENDIX C3

INTERSECTION RISK FACTOR RANKING RESULTS

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ID - County	ID 2007	Intersection	Cross Street 1	Cross Street 2	County	Total Risk (Score)	Total Risk (%)	DEV	DEV Risk (Score)	Previous STOP (#)	Previous STOP Risk (Score)	Skew	Skew Risk (Score)	Curves	Curve Risk (Score)	Access Management	Access Risk (Score)	K or A Crashes	Crash Risk (Score)	COUNTY-COUNTY/COUNTY-STATE	Total Crashes	Daytime Crashes	Nighttime Crashes	Right Angle,Rear end,or Turning Crashes	Major ADT	Minor ADT	Destination Lighting	Transverse Rumble Strips (Number of Approaches)	Control Type
336729 - 59	336729	US 34 & Co Rd S23/200TH AVE	US 34	Co Rd S23/200TH AVE	59	9	0.409090909	4228.94257	6	0	0	90	0	0	0	2	1	1	2	CS	9	7	1	4	4190	240	No	0	Two-way stop
336807 - 59	336807	US 34 & Co Rd H34/475TH LN	US 34	Co Rd H34/475TH LN	59	10	0.454545455	3680	6	0	0	90	0	1	4	0	0	0	0	CS	3	1	0	0	440	440	No	0	One-way stop
336845 - 59	336845	US 34 & Co Rd S56/290TH AVE	US 34	Co Rd S56/290TH AVE	59	7	0.318181818	3245.000014	6	0	0	90	0	0	0	2	1	0	0	CS	5	2	2	0	3080	70	No	0	Two-way stop
336885 - 59	336885	US 65 & Co Rd H50/HIGHWAY 306	US 65	Co Rd H50/HIGHWAY 306	59	6	0.272727273	1465.000007	6	0	0	90	0	0	0	0	0	0	0	CS	2	1	1	0	1290	380	No	0	One-way stop
336977 - 59	336977	US 65 & Co Rd H20/550TH ST	US 65	Co Rd H20/550TH ST	59	10	0.454545455	1084.999992	5	0	0	55	4	0	0	1	1	0	0	CS	1	0	1	0	1690	90	No	0	Two-way stop
337009 - 59	337009	IA 14 & Co Rd H50/435TH ST	IA 14	Co Rd H50/435TH ST	59	7	0.318181818	2117.499998	6	0	0	90	0	0	0	1	1	0	0	CS	2	1	1	0	2270	15	No	0	Two-way stop
337071 - 59	337071	IA 14 & Co Rd H30/495TH ST	IA 14	Co Rd H30/495TH ST	59	8	0.363636364	3284.999999	6	0	0	90	0	0	0	0	0	3	2	CS	7	4	2	2	3020	630	No	0	One-way stop
337097 - 59	337097	IA 14 & Co Rd H20/530TH ST	IA 14	Co Rd H20/530TH ST	59	11	0.5	3095.00001	6	0	0	60	4	0	0	1	1	0	0	CS	7	3	3	1	2920	120	No	0	Two-way stop
337109 - 59	337109	IA 14 & Co Rd S45/260TH AVE	IA 14	Co Rd S45/260TH AVE	59	15	0.681818182	2725.000003	6	7	4	66.29	4	0	0	1	1	1	0	CS	3	1	1	1	2630	880	No	0	One-way stop
337155 - 59	337155	Co Rd H20/530TH ST & SOUTH AVE & 255TH AVE	Co Rd H20/530TH ST	SOUTH AVE & 255TH AVE	59	6	0.272727273	568.5199598	5	0	0	90	0	0	0	1	1	0	0	CC	0	0	0	0	520	170	No	0	One-way stop
337163 - 59	337163	Co Rd H50/HIGHWAY 306 & FRONT ST & 150TH AVE	Co Rd H50/HIGHWAY 306	FRONT ST & 150TH AVE	59	6	0.272727273	459.9999816	4	0	0	90	0	0	0	6	2	0	0	CC	0	0	0	0	460	20	Yes	0	Two-way stop
337169 - 59	337169	FRONT ST & CENTER ST	FRONT ST	CENTER ST	59	5	0.227272727	374.4999748	3	0	0	90	0	0	0	8	2	0	0	CC	1	1	0	0	460	289	Yes	0	One-way stop
337464 - 59	337464	Co Rd S56/290TH AVE & 440TH ST	Co Rd S56/290TH AVE	440TH ST	59	0	0	167.4999979	0	0	0	90	0	0	0	0	0	0	0	CC	0	0	0	0	310	5	No	0	Two-way stop
337486 - 59	337486	Co Rd S56/290TH AVE & 437TH ST	Co Rd S56/290TH AVE	437TH ST	59	0	0	159.9999979	0	0	0	90	0	0	0	0	0	0	0	CC	0	0	0	0	310	10	No	0	One-way stop
337488 - 59	337488	Co Rd S56/290TH AVE/435TH ST & 290TH TRL	Co Rd S56/290TH AVE/435TH ST	290TH TRL	59	7	0.318181818	322.4999992	2	0	0	90	0	3	4	1	1	0	0	CC	1	0	0	0	310	25	No	0	One-way stop
337489 - 59	337489	Co Rd S56/435TH ST/300TH AVE	Co Rd S56/435TH ST/300TH AVE	-	59	7	0.318181818	340.0000019	2	0	0	90	0	2	4	1	1	0	0	CC	1	1	0	0	310	60	No	0	One-way stop
337502 - 59	337502	Co Rd S56/300TH AVE & 422ND ST	Co Rd S56/300TH AVE	422ND ST	59	1	0.045454545	172.5000006	0	0	0	90	0	0	0	1	1	0	0	CC	0	0	0	0	310	35	No	0	One-way stop
337504 - 59	337504	Co Rd S56/300TH AVE & 420TH ST	Co Rd S56/300TH AVE	420TH ST	59	1	0.045454545	167.5000006	0	0	0	90	0	0	0	1	1	0	0	CC	1	1	0	0	310	25	No	0	One-way stop
337546 - 59	337546	Co Rd H50/435TH ST & 220TH AVE	Co Rd H50/435TH ST	220TH AVE	59	2	0.090909091	269.9999984	2	0	0	90	0	0	0	0	0	0	0	CC	0	0	0	0	460	30	No	0	Two-way stop
337613 - 59	337613	Co Rd H50/430TH LN/435TH ST & 205TH AVE	Co Rd H50/430TH LN/435TH ST	205TH AVE	59	4	0.181818182	472.5000005	4	0	0	90	0	0	0	0	0	0	0	CC	0	0	0	0	460	25	No	0	One-way stop
337620 - 59	337620	Co Rd H50/430TH LN & Co Rd S23/190TH AVE	Co Rd H50/430TH LN	Co Rd S23/190TH AVE	59	2	0.090909091	310.0000021	2	0	0	90	0	0	0	0	0	0	0	CC	1	1	0	0	460	60	No	0	One-way stop
337623 - 59	337623	Co Rd H50/425TH ST & 170TH AVE	Co Rd H50/425TH ST	170TH AVE	59	3	0.136363636	269.9999999	2	0	0	90	0	0	0	1	1	0	0	CC	0	0	0	0	460	80	No	0	One-way stop
337624 - 59	337624	Co Rd H50/425TH ST & 160TH AVE	Co Rd H50/425TH ST	160TH AVE	59	1	0.045454545	229.9999999	1	0	0	90	0	0	0	0	0	0	0	CC	2	1	1	0	460	460	No	0	One-way stop
337625 - 59	337625	Co Rd H50/425TH ST & 175TH AVE	Co Rd H50/425TH ST	175TH AVE	59	5	0.227272727	234.9942599	1	0	0	90	0	3	2	1	2	0	0	CC	0	0	0	0	460	10	No	0	One-way stop
337627 - 59	337627	Co Rd H50/425TH ST & 180TH AVE	Co Rd H50/425TH ST	180TH AVE	59	5	0.227272727	244.9999999	1	0	0	90	0	1	4	0	0	0	0	CC	1	0	0	0	460	30	No	0	One-way stop
337632 - 59	337632	Co Rd H50/430TH LN/425TH ST & 180TH TRL	Co Rd H50/430TH LN/425TH ST	180TH TRL	59	8	0.363636364	465.000002	4	0	0	98	0	2	4	0	0	0	0	CC	0	0	0	0	460	10	No	0	One-way stop
337710 - 59	337710	Co Rd H32/320TH AVE/500TH ST	Co Rd H32/320TH AVE/500TH ST	-	59	1	0.045454545	135.0000002	0	0	0	90	0	0	0	1	1	0	0	CC	0	0	0	0	150	60	No	0	One-way stop
337718 - 59	337718	Co Rd H32/500TH ST & 310TH AVE	Co Rd H32/500TH ST	310TH AVE	59	3	0.136363636	85.00000018	0	0	0	80	2	0	0	1	1	0	0	CC	0	0	0	0	150	20	No	0	One-way stop
337721 - 59	337721	Co Rd H32/500TH ST & 302ND AVE	Co Rd H32/500TH ST	302ND AVE	59	0	0	92.50000018	0	0	0	90	0	0	0	0	0	0	0	CC	1	1	0	0	150	35	No	0	One-way stop
337722 - 59	337722	Co Rd H32/500TH ST & 300TH TRL	Co Rd H32/500TH ST	300TH TRL	59	0	0	120.0000002	0	0	0	90	0	0	0	0	0	0	0	CC	0	0	0	0	150	90	No	0	One-way stop
337723 - 59	337723	Co Rd H32/500TH ST & 309TH AVE	Co Rd H32/500TH ST	309TH AVE	59	8	0.363636364	80.00000018	0	0	0	83	2	2	4	3	2	0	0	CC	0	0	0	0	150	10	No	0	One-way stop
337731 - 59	337731	Co Rd H32/500TH ST & Co Rd S50/277TH TRL	Co Rd H32/500TH ST	Co Rd S50/277TH TRL	59	0	0	85.00000018	0	0	0	90	0	0	0	0	0	0	0	CC	0	0	0	0	150	20	No	0	One-way stop
337763 - 59	337763	Co Rd H32/497TH ST/500TH ST & 270TH AVE	Co Rd H32/497TH ST/500TH ST	270TH AVE	59	9	0.409090909	250.4621431	1	0	0	75	2	1	4	3	2	0	0	CC	1	0	1	0	150	40	No	0	One-way stop
337772 - 59	337772	Co Rd H32/497TH ST & 260TH AVE	Co Rd H32/497TH ST	260TH AVE	59	2	0.181818182	250.4621429	1	0	0	90	0	0	0	1	1	0	0	CC	2	2	0	0	490	60	No	0	One-way stop
337773 - 59	337773	Co Rd H32/497TH ST & 270TH AVE	Co Rd H32/497TH ST	270TH AVE	59	6	0.272727273	175.4621429	0	0	0	78	2	1	4	0	0	0	0	CC	0	0	0	0	150	40	No	0	One-way stop
337779 - 59	337779	Co Rd H32/245TH TRL/497TH ST	Co Rd H32/245TH TRL/497TH ST	-	59	6	0.272727273	425.4621407	4	0	0	76	2	0	0	0	0	0	0	CC	0	0	0	0	490	50	No	0	One-way stop
337784 - 59	337784	Co Rd H32/245TH TRL & 490TH ST	Co Rd H32/245TH TRL	490TH ST	59	10	0.454545455	264.9999977	2	0	0	67	4	1	4	0	0	0	0	CC	0	0	0	0	490	40	No	0	One-way stop
337792 - 59	337792	220TH AVE & OSCEOLA AVE	220TH AVE	OSCEOLA AVE	59	2	0.090909091	1062.158562	5	0	0	81	2	0	0	1	1	0	0	CC	2	1	1	0	2780	2100	Yes	0	One-way stop
337855 - 59	337855	Co Rd S23/200TH AVE & 520TH ST	Co Rd S23/200TH AVE	520TH ST	59	3	0.136363636	356.4425701	3	0	0	90	0	0	0	0	0	0	0	CC	1	0	0	0	830	15	No	0	One-way stop
337856 - 59	337856	Co Rd S23/200TH AVE & 510TH ST	Co Rd S23/200TH AVE	510TH ST	59	9	0.409090909	396.4425701	4	0	0	90	0	1	4	1	1	0	0	CC	0	0	0	0	830	35	No	0	One-way stop
337880 - 59	337880	Co Rd H30/495TH ST/215TH AVE	Co Rd H30/495TH ST/215TH AVE	-	59	5	0.227272727	970.3993786	5	0	0	90	0	0	0	0	0	0	0	CC	0	0	0	0	1360	130	No	0	One-way stop
337892 - 59	337892	Co Rd H30/215TH AVE & Co Rd H32/490TH ST & 495TH LN	Co Rd H30/215TH AVE	Co Rd H32/490TH ST & 495TH LN	59	8	0.363636364	1368.872042	5	2.5	2	90	0	0	0	2	1	0	0	CC	4	3	1	1	2210	1160	No	0	One-way stop
337894 - 59	337894	Co Rd S23/200TH AVE & 505TH LN	Co Rd S23/200TH AVE	505TH LN	59	7	0.318181818	403.9425701	4	0	0	85	2	0	0	2	1	0	0	CC	1	0	0	0	1090	110	No	0	One-way stop
337896 - 59	337896	Co Rd S23/200TH AVE & 495TH LN	Co Rd S23/200TH AVE	495TH LN	59	10	0.454545455	578.9425701	4	0	0	57	4	0	0	0	0	1	2	CC	1	0	1	0	1090	60	No	0	One-way stop
337898 - 59	337898	Co Rd H32/490TH ST & Co Rd S23/200TH AVE	Co Rd H32/490TH ST	Co Rd S23/200TH AVE	59	10	0.454545455	1172.415232	5	7	4	90	0	0	0	1	1	0	0	CC	7	3	3	1	1160	220	No	3	All-way stop
337915 - 59	337915	Co Rd H32/490TH ST & 220TH AVE & CURTIS AVE	Co Rd H32/490TH ST	220TH AVE & CURTIS AVE	59	7	0.318181818	2345.631224	6	0	0	90	0	0	0	2	1	1	0	CC	2	1	1	1	2780	1140	No	0	One-way stop
337929 - 59	337929	Co Rd H34/COURT AVE & 220TH AVE	Co Rd H34/COURT AVE	220TH AVE	59	9	0.409090909	2107.158594	6	2.5	2	88	0	0	0	1	1	0	0	CC	4	2	1	0	3440	180	Yes	0	One-way stop
338059 - 59	338059	Co Rd S45/260TH AVE/50TH PL & WYOMING ST	Co Rd S45/260TH AVE/50TH PL	WYOMING ST	59	5	0.227272727	482.5000029	5	0	0	90	0	0	0	0	0	0	0	CC	1	0	0	0	880	25	No	0	Two-way stop
338060 - 59	338060	Co Rd S45/260TH AVE & 570TH ST	Co Rd S45/260TH AVE	570TH ST	59	6	0.272727273	487.5000029	5	0	0	90	0	0	0	1	1	0	0	CC	0	0	0	0	880	45	No	0	Two-way stop
338102 - 59	338102	Co Rd S45/260TH AVE & 545TH ST	Co Rd S45/260TH AVE	545TH ST	59	6	0.272727273	492.5000029	4	0	0	90	0	3	2	0	0	0	0	CC	2	1	0	0	880	20	No	0	Two-way stop
338141 - 59	338141	Co Rd S23/200TH AVE/HWY S23 & 580TH ST	Co Rd S23/200TH AVE/HWY S23	580TH ST	59	5	0.227272727	386.4425701	4	0	0	90	0	0	1	1	0	0	0	CC	3	2	0	0	400	15	No	0	Two-way stop
338148 - 59	338148	Co Rd S23/200TH AVE & 570TH ST	Co Rd S23/200TH AVE	570TH ST	59	9	0.409090909	376.4425701	3	0	0	80	2	1	4	0	0	0	0	CC	0	0	0	0	400	20	No	0	Two-way stop
338150 - 59	338150	Co Rd S23/200TH AVE & 564TH LN	Co Rd S23/200TH AVE	564TH LN	59	3	0.136363636	353.9425701	3	0	0	89	0	0	0	0	0	0	0	CC	0	0	0	0	400	10	No	0	One-way stop
338154 - 59	338154	Co Rd S23/200TH AVE & 560TH ST	Co Rd S23/200TH AVE	560TH ST	59	4	0.181818182	358.9425701	3	0	0	90	0	0	1	1	0	0	0	CC	0	0	0	0	400	20	No	0	One-way stop
338156 - 59	338156	Co Rd S23/200TH AVE & 553RD ST	Co Rd S23/200TH AVE	553RD ST	59	9	0.409090909	353.9425701	3	0	0	78	2	1	4	0	0	0	0	CC	1	0	0	0	400	10	No	0	One-way stop
338158 - 59	338158	Co Rd S23/200TH AVE & 552ND ST	Co Rd S23/200TH AVE	552ND ST	59	3	0.136363636	353.9425701	3	0	0	87	0	0	0	0	0	0	0	CC	0	0	0	0	400	10	No	0	One-way stop
338165 - 59	338165	Co Rd H20/545TH ST & 170TH AVE	Co Rd H20/545TH ST	170TH AVE	59	2	0.090909091	242.4999995	1	0	0	90	0	0	1	1	0	0	0	CC	1	0	0	0	390	45	No	0	Two-way stop
338166 - 59	338166	Co Rd H20/545TH ST & 160TH AVE	Co Rd H20/545TH ST	160TH AVE	59	2	0.090909091	209.9999995	1	0	0	90	0	0	1	1	0	0	0	CC	0	0	0	0	390	30	No	0	One-way stop
338174 - 59	338174	Co Rd H30/185TH TRL/540TH LN	Co Rd H30/185TH TRL/540TH LN	-	59	8	0.363636364	405.0000019	4	0	0	90	0	1	4	0	0	0	0	CC	0	0	0	0	390	30	No	0	One-way stop
338177 - 59	338177	Co Rd H20/540TH LN & 190TH AVE	Co Rd H20/540TH LN	190TH AVE	59	1	0.045454545	197.500001	0	0	0	90	0	0	1	1	0	0	0	CC	0	0	0	0	390	5	No	0	One-way stop
338179 - 59	338179	Co Rd H20/540TH LN	Co Rd H20/540TH LN	-	59	6	0.272727273	200.000001	1	0	0	90	0	2	4	1	1	0	0	CC	1	0	0	0	390	10	No	0	One-way stop
338184 - 59	338184	Co Rd S23/200TH AVE & 205TH TRL	Co Rd S23/200TH AVE	205TH TRL	59	6	0.272727273	366.4425701	3	0	0	73	2	0	0	1	1	0	0	CC	1	0	0	1	400	35	No	0	One-way stop
338186 - 59	338186	Co Rd S23/200TH AVE & 542ND ST	Co Rd S23/200TH AVE	542ND ST	59	4	0.181818182	361.4425701	2	0	0	81	2	0	0	0	0	0	0	CC	1	0	0	0	400	5	No	0	One-way stop
338188 - 59	338188	Co Rd H20/540TH LN & Co Rd S23/200TH AVE & 200TH TRL	Co Rd H20/540TH LN	Co Rd S23/200TH AVE & 200TH TRL	59	12	0.545454545	543.9425711	5	6	4	72	2	0	0	1	1	0	0	CC	1	1	0	0	830	390	No	0	One-way stop
338190 - 59	338190	Co Rd H20/540TH LN & Co Rd S23/200TH AVE & 200TH TRL	Co Rd H20/540TH LN	Co Rd S23/200TH AVE & 200TH TRL	59	6	0.272727273	215.000001	1	0	0	65	4	0	0	1	1	0	0	CC	1	1	0	0	390	40	No	0	One-way stop
338194 - 59	338194	Co Rd S23/200TH AVE & 535TH LN	Co Rd S23/200TH AVE	535TH LN	59	7	0.318181818	353.9425701	3	0	0	61	4	0	0	0	0	0	0	CC	0	0	0	0	830	10	No	0	One-way stop
338196 - 59	338196	Co Rd H20/530TH ST & Co Rd S23/200TH AVE	Co Rd H20/530TH ST	Co Rd S23/200TH AVE	59	10	0.454545455	458.9425701	4	0	0	82	2	1	4	0	0	0	0	CC	3	2	0	0	830	60	No	0	Two-way stop
338237 - 59	338237	Co Rd H20/550TH ST/545TH ST & 150TH AVE	Co Rd H20/550TH ST/545TH ST	150TH AVE	59	9	0.409090909	424.9999916	4	0	0	90	0	2	4	1	1	0	0	CC	1	1	0	0	390	70	No	0	One-way stop
338242 - 59	338242	Co Rd H20/545TH ST & 150TH AVE	Co Rd H20/545TH ST	150TH AVE	59	6	0.272727273	199.9999995	1	0	0	90	0	1	4	1	1	0	0	CC	0	0	0	0	390	10	No	0	One-way stop
338875 - 59	338875	CHARITON AVE & BROAD ST	CHARITON AVE	BROAD ST	59	9	0.409090909	758.7142411	5	0	0	80	2	0	0	5	2	0	0	CC	0	0	0	0	520	289	No	0	Uncontrolled
338879 - 59	338879	CHARITON AVE & 155TH AVE	CHARITON AVE	155TH AVE	59	4	0.181818182	235.00001	1	0	0	85	2	0	0	1	1	0	0	CC	0	0	0	0	460	10	No	0	One-way stop
338917 - 59	338917	DIVISION ST & W FRONT ST	DIVISION ST	W FRONT ST	59	1	0.045454545	149.9999996	0	0	0	90	0	0	0	1	1	0	0	CC	0	0	0	0	300	200	No	0	Uncontrolled
338919 - 59	338919	FRONT ST & E FRONT ST & WALNUT ST	FRONT ST	E FRONT ST & WALNUT ST	59	3	0.136363636	330.0000054	2	0	0	90	0	0	0	1	1	0	0	CC	0	0	0	0	290	80	No	0	One-way stop
338920 - 59	338920	FRONT ST & DIVISION ST	FRONT ST	DIVISION ST	59	5	0.227272727	295.000005	2	0	0	90	0	0	0	2	1	2	2	CC	0	0	0	0	300	260	No	0	One-way stop
669676 - 59	669676	US 34 & Co Rd H34/COURT AVE	US 34	Co Rd H34/COURT AVE	59	11	0.5	9940.000033	6	0	0	90	0	3	4	2	1	0	0	CS	5	4	1	2	2090	2090	No	0	One-way stop
669718 - 59	669718	SOUTH AVE & 3RD ST	SOUTH AVE	3RD ST	59	4	0.181818182	368.0199499	3	0	0	90	0	0	0	1	1	0	0	CC	1	0	1	0	480	289	No	0	One-way stop
669719 - 59	669719	SOUTH AVE & 2ND ST & BRENAMEN ST	SOUTH AVE	2ND ST & BRENAMEN ST	59	3	0.136363636	268.5199499	2	0	0	90	0	0	0	2	1	0	0	CC	0	0	0	0	480	90	No	0	One-way stop
669722 - 59	669722	SOUTH AVE & S RAILROAD ST	SOUTH AVE	S RAILROAD ST	59	5	0.227272727	368.0199499	3	0	0	90	0	0	0	3	2	0	0	CC	1	1	0	0	340	289	No	0	One-way stop
669724 - 59	669724	FRONT ST & NO NAME	FRONT ST	NO NAME	59	5	0.227272727	374.4999748	3	0	0	90	0	0	0	5	2	0	0	CC	0	0	0	0	460	289	Yes	0	One-way stop
669725 - 59	669725	FRONT ST & VINE ST	FRONT ST	VINE ST	59	4	0.181818182	264.9999748	2	0	0	90	0	0	0	3	2	0	0	CC	0	0	0	0	460	70	Yes	0	One-way stop
669972 - 59	669972	FRONT ST & BROAD ST	FRONT ST	BROAD ST	59	7	0.318181818	960.2142158	5	0	0	90	0	0	0	14	2	0	0	CC	0	0	0	0	981	40	Yes	0	Two-way stop
669977 - 59	669977	CHARITON AVE & JOHN ST	CHARITON AVE	JOHN ST	59	2	0.090909091	245.00001	1	0	0	86	0	0	0	1	1	0	0	CC	0	0	0	0	460	30	Yes	0	One-way stop
669983 - 59	669983	BROAD ST & PRAIRIE AVE	BROAD ST	PRAIRIE AVE	59	7	0.318181818	508.7142411	5	0	0	90	0	0	0	6	2	0	0	CC	1	1	0	0	420	289	Yes	0	Two-way stop
1000805 - 59	1000805	SOUTH AVE & S MAINE ST & N MAINE ST	SOUTH AVE	S MAINE ST & N MAINE ST	59	3	0.136363636	278.5199499	2	0	0	90	0	0	0	2	1	0	0	CC	1	1	0	0	480	110	No	0	One-way stop
5002979 - 59	5002979	SOUTH AVE & N RAILROAD ST	SOUTH AVE	N RAILROAD ST	59	7	0.318181818	368.0199499	3	0	0	78	2	0	0	3	2	0	0	CC	0	0	0	0	340	289	No	0	One-way stop
6001085 - 59	6001085	US 34/NE RAMP US34 & Co Rd H34/COURT AVE	US 34/NE RAMP US34	Co Rd H34/COURT AVE	59	13	0.590909091	2380.000033	6	0	0	20	2	1	4	1	1	0	0	CS	1	1	0	1	2670	2090	No	0	Uncontrolled
336685 - 59	336685	US 34 & US 65 & DIVISION ST	US 34	US 65 & DIVISION ST	59	14	0.64	5660	6	0	0	80	2	2	4	0	0	1	2	CS	1	0	0	0	3560	300	Yes	0	Two-way stop

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APPENDIX D1

CURVE SAFETY COUNTERMEASURES

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This appendix summarizes the **curve** safety countermeasures for consideration and provides detailed descriptions for each countermeasure from both the project selection decision tree as well as the additional potential improvements listed on the back side of the project sheets.

Curve Countermeasures from Project Selection Decision Tree

The countermeasures in this section were included in the project selection decision tree and recommended on the curve project sheets based on the criteria described in **Section 6.4.1.**

New Pavement Markings

This safety countermeasure includes new centerline and edgeline pavement markings along the curve. The updated markings can clarify and further delineate the curve, reducing the risk of a run-off-the-road crash. If the lanes were 12 feet or wider, new edgeline pavement markings of six inches were recommended; Research suggests that widening pavement markings from four to six inches in rural areas results in a crash modification factor (CMF) of 0.64 to 0.83. Otherwise, new four-inch pavement markings were recommended. Research suggests that installing new four-inch pavement markings in rural areas results in a CMF of 0.61 to 0.74.

Pave Shoulder with Safety Edge

Constructing or increasing the width of an existing paved shoulder can reduce the potential for a severe crash as the result of a lane departure. CMFs associated with paving the shoulder in rural areas range from 0.82 to 0.9. At locations where paved shoulders are recommended, it is suggested that the County Engineer consider a minimum of a two-foot shoulder; however, based on right-of-way and roadway characteristics, the County Engineer may choose to install a wider shoulder.

According to the Federal Highway Administration (FHWA), a Safety Edge is “a simple but effective solution that can help save lives by allowing drivers who drift off [roadways] to return to the road safely. Instead of a vertical drop-off, the Safety Edge shapes the edge of pavement to 30 degrees.” The installation of a Safety Edge has CMFs ranging from 0.85 to 0.92. According to the FHWA, from a maintenance standpoint, “because the Safety Edge provides an additional level of consolidation on the edge, edge raveling is decreased. This contributes to longer pavement life.”

Edgeline Rumble Strips

Edgeline rumble strips provide tactile and audible warning to a driver if they are beginning to depart the lane. This safety improvement has recorded CMFs in the range of 0.61 to 0.67 for rural run-off-the-road injury crashes. Depending on the conditions of the roadway, the County Engineer may choose to install rumble strips placed in the shoulder offset from the edgeline, or they may place the rumble strips on the edgeline and provide pavement markings over them, resulting in edgeline rumble stripes. For purposes of this document, both will be called rumble strips.

Centerline Rumble Strips

CMFs of 0.55 to 0.91 represent the safety benefit from the installation of centerline rumble strips. In Iowa, rumble strips placed in the centerline of the roadway generally have pavement markings over them. To be consistent with the Iowa DOT Design Manual 3C-5, centerline rumble strips will be referred to as rumble strips even though in circumstances they may technically be “rumble stripes”. This safety improvement provides an audible and tactile warning to drivers when crossing

the centerline and can aid in the avoidance of some high severity lane departure crashes on curves.

Review Curves and Install Chevron Signs and Curve Warning Signs

This safety countermeasure includes the review of the curve and the installation of curve chevron signs placed along the outer radius of the curve and advanced curve warning signs with advisory speed plaques. Installing curve chevron signs where advanced warning signs are currently in place has CMFs ranging from 0.75 to 0.96, and when installed together with new advance warning signage, has CMFs ranging from 0.59 to 0.61. The signs should meet current Manual of Uniform Traffic Control Devices (MUTCD) and Iowa DOT standards.

Review Curves and Upgrade Chevron Signs and Curve Warning Signs

Where curve chevron signs, advance curve warning signs, and speed advisory plaques are already installed, this countermeasure includes reviewing the curve and upgrading the signage to meet current MUTCD and Iowa DOT standards, if needed.

Clear and Grub

Clearing and grubbing the areas within the clear zone of the roadway increases the sight distance for vehicles prior to entering, during, and after exiting a curve. This safety countermeasure also reduces the hazard of a run-off-the-road crash by reducing the number of obstructions a vehicle could impact after a lane departure. A 0.78 CMF has been documented as distance from roadside features was increased.

Other Curve Countermeasures

There are a variety of other safety improvements that could be considered that were not included in the project decision tree due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed at curves throughout the county. The following sections describe several other curve safety improvements that could be considered appropriate by the county and that were included on the back side of the project sheets.

Additional Curve Signage

Curve signage in addition to the signage included in the project sheets could be considered, including the one direction large arrow sign (W1-6 48”x24”) and the combination horizontal alignment/advisory speed sign (W1-1a 36”x36”). This additional curve signage could be appropriate in some situations to provide further emphasis to the change in horizontal alignment of the roadway.

Retroreflective Strips on Chevron Sign Posts

The installation of retroreflective strips on sign posts is currently under study by Iowa State University (InTrans) and the preliminary results are positive. This countermeasure includes the installation of retroreflective strips on the posts of curve chevron signs. The strips can increase the visibility of curve chevron signs and increase driver awareness of changes in horizontal alignment. Public response to this countermeasure has been very positive.

Transverse Rumble Strips Prior to Curve

This treatment can provide additional tactile and audible warning to the driver of an upcoming curve. It is recommended that this treatment be used with caution as the driver may misinterpret

the warning since transverse rumble strips in Iowa are typically installed prior to stop-controlled intersections. Transverse rumble strips installed as a traffic calming device have seen CMFs of 0.66.

Superelevation Correction

The use of superelevation, where none exists, or the correction of existing superelevation, can provide a safety benefit, helping to keep vehicles within the travel lanes while negotiating a curve, particularly at high speeds. This countermeasure requires substantial reconstruction of a curve and could reduce the amount of friction needed for vehicles to remain on the roadway in wet or snowy conditions. This recommendation is site-specific and would need additional attention by the County Engineer in order to be implemented at a specific location.

High Friction Surface Treatment (HFST)

Increasing the pavement friction on curves by installation of HFST has CMFs ranging from 0.48 to 0.76. According to the FHWA,

> "HFSTs use aggregates that are both polish- and wear-resistant and develop channels to prevent water buildup on wet surfaces. The bonding materials such as epoxy and other available blends are designed to set quickly. HFST can be applied by machine at a similar speed to other paving surface treatments, or applied with hand tools, but the road surface must be durable with few to no cracks and crumbling."

This treatment can be particularly beneficial on high-speed curves and curves with small radii to decrease the risk of skidding-related crashes. This countermeasure is more cost-effective than other major curve improvements such as modifying the superelevation or realigning the roadway.

Speed Activated Flashers on Chevron Signs

This countermeasure includes the installation of speed activated flashers either as beacons or as LED lights around the border of curve chevron signs. This improvement can provide additional warning to drivers exceeding the suggested speed limit prior to a curved section of roadway. The flashers can increase the visibility of curve chevron signs and increase driver awareness of changes in horizontal alignment, specifically when they are exceeding a designated speed. Where speed activated flashers have been installed in combination with curve chevrons and curve warning signage, CMFs of 0.59 to 0.61 have been recorded.

Guardrail

Installing guardrail can help redirect vehicles after a lane departure to remain on the roadway and avoid roadside hazards. CMFs in the range of 0.53 have been recorded for installing new guardrail along an embankment.

On-pavement Markings for Speed Control

This improvement includes painting the speed limit on the pavement to reinforce the posted speed limit. On-pavement markings can serve as additional information and reminders to drivers of the posted speed limit and the importance of observing their speed. Research has shown a CMF of 0.62 for additional in-lane pavement markings.

Post-Mounted Delineators

As stated in the MUTCD, "delineators are particularly beneficial at locations where the [roadway] alignment might be confusing or unexpected, such as at lane-reduction transitions and curves. Delineators are effective guidance devices at night and during adverse weather. An important

advantage of delineators in certain locations is that they remain visible when the roadway is wet, or snow covered." Providing post-mounted retroreflective delineators along the roadway can give additional information to drivers as to the location of the roadside edge and alignment. The CMF for installing post-mounted delineators in combination with edgelines and centerlines has been recorded at 0.55.

APPENDIX D2

CURVE RISK FACTOR RANKING RESULTS

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GPS ID - County	Curve ID	County	Road Name	Length (ft)	Total Risk (Score)	AADT	AADT Risk (Score)	Radius (ft)	Radius Risk (Score)	Shoulder Width	Shoulder Width Risk (Score)	IRI	IRI Risk (Score)	Driveways | Intersections	Access Management Risk (Score)	K or A Crashes	Crash Risk (Score)	Total Crashes	VMT	Surface Width	Speed Limit	Edgeline Rumble Strips	Curve Chevrons	Lane Departures
17650 - 59	17650	59	540TH LN	1948.564955	9	390.000002	3	1056.417662	4	9	0	45.8755	0	3 | 3	2	0	0	0	143.928094	22	55	No	No	0
17651 - 59	17651	59	200TH AVE	2182.182023	14	697.8851402	6	758.0659636	4	7	0	59.1655814	0	3 | 2	2	1	2	1	288.4303802	22	55	No	No	0
17652 - 59	17652	59	200TH AVE	354.450381	8	697.8851402	6	312.418886	0	7	0	61.0525	0	0 | 1	2	0	0	2	46.84955565	22	55	No	No	0
26736 - 59	26736	59	245TH TRL	1972.109171	14	489.9999955	5	792.4618022	4	9	0	135.9142308	2	2 | 0	1	1	2	0	183.0177054	22	55	No	No	0
26737 - 59	26737	59	245TH TRL	1412.062606	13	489.9999955	5	500.6716301	4	9	0	141.17	2	0 | 1	2	0	0	1	131.0436876	22	55	No	No	0
26738 - 59	26738	59	245TH TRL	1278.749824	8	489.9999955	5	355.8542847	0	9	0	161.6367308	2	1 | 0	1	0	0	0	118.6718576	22	55	No	No	0
29182 - 59	29182	59	260TH AVE	1209.220939	13	880.0000058	6	897.7528554	4	6	0	149.5504	2	1 | 0	1	0	0	1	201.5368244	22	55	No	No	0
29183 - 59	29183	59	260TH AVE	1603.955423	13	880.0000058	6	899.2710411	4	6	0	141.4115625	2	5 | 0	1	0	0	1	267.3259055	22	55	No	No	1
29184 - 59	29184	59	260TH AVE	900.682773	11	880.0000058	6	1978.901162	2	6	0	154.9394737	2	3 | 0	1	0	0	0	150.1137965	22	55	No	No	0
34379 - 59	34379	59	290TH AVE	706.1512153	2	309.9999958	0	307.7093056	0	7	0	68.35	0	0 | 1	2	0	0	0	41.45963519	22	55	No	No	0
36094 - 59	36094	59	300TH AVE	395.036273	3	310.0000012	1	363.5058388	0	7	0	72.64388889	0	0 | 0	0	2	2	1	23.19341763	22	55	No	No	0
36095 - 59	36095	59	300TH AVE	611.7491124	3	310.0000012	1	258.3516869	0	7	0	69.82035714	0	0 | 0	0	2	2	0	35.91708817	22	55	No	No	0
45264 - 59	45264	59	425TH ST	480.623991	6	459.9999998	4	2006.284663	2	9	0	76.28227273	0	0 | 0	0	0	0	0	41.87254465	22	55	No	No	0
45267 - 59	45267	59	425TH ST	1937.003494	8	459.9999998	4	367.9790975	0	9	0	76.1725641	0	1 | 1	2	1	2	1	168.7540922	22	55	No	No	0
45268 - 59	45268	59	425TH ST	678.1551689	6	459.9999998	4	313.6114351	0	9	0	71.595	0	0 | 1	2	0	0	1	59.08170029	22	55	No	No	1
45416 - 59	45416	59	430TH LN	903.0279933	8	460.0000043	4	346.866862	0	9	0	74.73552632	0	0 | 1	2	1	2	0	78.67289409	22	55	No	No	0
45417 - 59	45417	59	430TH LN	1468.795541	5	460.0000043	4	316.1687343	0	9	0	70.37233333	0	2 | 0	1	0	0	0	127.9632491	22	55	No	No	0
45418 - 59	45418	59	430TH LN	2360.905196	5	460.0000043	4	358.1796667	0	9	0	82.54946809	0	1 | 0	1	0	0	0	205.6849243	22	55	No	No	0
45600 - 59	45600	59	435TH ST	1003.151567	3	310.0000027	1	359.0080016	0	7	0	68.17142857	0	0 | 1	2	0	0	0	58.89715689	22	55	No	No	0
45601 - 59	45601	59	435TH ST	611.712826	3	310.0000027	1	91.99857213	0	7	0	63.70653846	0	1 | 1	2	0	0	0	35.91495789	22	55	No	No	0
46738 - 59	46738	59	475TH LN	386.1445006	9	1151.242215	6	163.4540429	0	4	2	88.97444444	0	3 | 0	1	0	0	1	84.19428981	24	55	No	No	0
47051 - 59	47051	59	490TH ST	627.2597667	9	1426.945325	6	312.986468	0	7	0	147.0353846	2	2 | 0	1	0	0	0	169.5199605	22	45	No	No	0
47156 - 59	47156	59	495TH ST	632.9447866	13	629.9999986	5	899.6364742	4	9	0	194.7957143	4	0 | 0	0	0	0	0	75.52182096	24	55	No	No	0
47157 - 59	47157	59	495TH ST	524.641638	13	629.9999986	5	848.6571008	4	9	0	219.5566667	4	0 | 0	0	0	0	0	62.5992862	24	55	No	No	0
47192 - 59	47192	59	497TH ST	1250.513452	8	310.9242858	1	786.1585229	4	9	0	155.5775	2	1 | 0	1	0	0	1	73.63920495	22	55	No	No	0
47193 - 59	47193	59	497TH ST	1325.876771	5	310.9242858	1	446.4892148	0	9	0	128.3407407	2	2 | 1	2	0	0	0	78.07713791	22	55	No	No	0
47325 - 59	47325	59	500TH ST	1052.984829	4	150.0000004	0	373.7840751	0	9	0	133.1063636	2	3 | 1	2	0	0	0	29.91434179	22	55	No	No	0
47326 - 59	47326	59	500TH ST	839.099013	5	150.0000004	0	401.4437146	0	9	0	193.4872222	4	1 | 0	1	0	0	0	23.8380402	22	55	No	No	0
47327 - 59	47327	59	500TH ST	1022.760244	6	150.0000004	0	399.3484653	0	9	0	194.9888095	4	2 | 1	2	0	0	1	29.05568883	22	55	No	No	0
47328 - 59	47328	59	500TH ST	365.2906349	9	150.0000004	0	765.4573285	4	9	0	174.0072222	4	1 | 0	1	0	0	0	10.37757488	22	55	No	No	0
48548 - 59	48548	59	540TH LN	1251.512429	7	390.000002	3	327.4705129	0	9	0	194.3234615	4	0 | 0	0	0	0	1	92.44125941	22	55	No	No	0
48549 - 59	48549	59	540TH LN	1068.682676	7	390.000002	3	292.2583702	0	9	0	172.2379545	4	0 | 0	0	0	0	0	78.93678893	22	55	No	No	0
48550 - 59	48550	59	540TH LN	615.5273113	7	390.000002	3	240.6423603	0	9	0	207.5235714	4	0 | 0	0	0	0	0	45.46508573	22	55	No	No	0
48639 - 59	48639	59	545TH ST	796.9436662	6	389.9999989	2	358.9716158	0	9	0	239.1367647	4	0 | 0	0	0	0	0	58.86515699	22	55	No	No	0
48640 - 59	48640	59	545TH ST	1465.327656	6	389.9999989	2	274.3919672	0	9	0	193.1425	4	0 | 0	0	0	0	0	108.2344288	22	55	No	No	0
48642 - 59	48642	59	545TH ST	722.3124933	6	389.9999989	2	249.8552514	0	9	0	225.4053333	4	0 | 0	0	0	0	1	53.3526272	22	55	No	No	0
48735 - 59	48735	59	550TH ST	1219.657673	8	389.9999844	2	416.0880611	0	9	0	175.4152	4	0 | 1	2	0	0	0	90.08834723	22	55	No	No	0

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APPENDIX E

UNPAVED ROADWAY SAFETY COUNTERMEASURES

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This appendix summarizes various **unpaved** road safety countermeasures for consideration and provides descriptions for each countermeasure.

Gravel Roads Construction & Maintenance Guide – Federal Highway Administration (FHWA) 2015

A thorough resource on unpaved roads is provided by the FHWA entitled: ***Gravel Roads Construction & Maintenance Guide***, which can be found at the following website: https://www.fhwa.dot.gov/construction/pubs/ots15002.pdf. This guide is quoted throughout this appendix. The guide includes detailed sections on the following topics:

- Routine Maintenance and Rehabilitation
- Drainage
- Surface Gravel
- Dust Control/Stabilization
- Innovations

The summary of the guide states: "The first and most basic thing to understand in road maintenance and construction is proper shape of the cross section. The road surface must have enough crown to drain water to the shoulder, but not excessive crown which impacts roadway safety." "When proper shape is established and good surface gravel is placed, many gravel road maintenance problems simply go away, and road users are provided the best possible service from gravel roads" (*Gravel Roads Construction & Maintenance Guide, FHWA, 2015*).

Unpaved Roadway Safety Countermeasures

The following sections provide general information on additional safety countermeasures for unpaved roadways

Maintenance of Gravel

It is important to preserve and maintain a proper road crown (four to six percent) for proper drainage to avoid ponding in potholes and/or ruts. Regular grading can help keep the roadway surface maintained, reducing water infiltration, and enhancing erosion control. According to the FHWA, "improper maintenance can lead to very quick deterioration of a gravel road, especially in wet weather". It is also important to perform preventive maintenance to ensure that high shoulders, secondary ditches, berms, or curbs do not form. Per the FHWA, "when a gravel road develops high shoulders, it restricts the surface water from draining into the designed ditch. This creates a serious safety hazard. The time spent in eliminating a high shoulder (secondary ditch) will result in a road that is easier to maintain afterwards."

Similar to the information provided on the paved Safety Edge, the maintenance of edge slopes on unpaved roads can allow vehicles that depart the travel lane to safely return to the roadway.

Major Rehabilitation

"At certain intervals, virtually every gravel road requires some major rehabilitation" (FHWA, 2015). This countermeasure involves not only reshaping the road surface, but the shoulder, foreslope and ditches. It is important that the redeveloped cross section be uniform, and that good drainage is provided, prior to replacing the surface gravel – failure to provide proper drainage or crown in

the road surface can lead to corrugation or washboarding, which can lead to loss of vehicle control.

The use of electronic slope controls has proven useful in gravel road maintenance, rehabilitation, and basic reconstruction. It is recommended that the county consider installing electronic slope controls on existing equipment to create a proper profile for new surfaces more efficiently.

Upgrade Signs

The following countermeasures relate to potential sign upgrades on the unpaved roadway system.

Stop Signs

A low-cost safety countermeasure that could be considered along unpaved roadways includes upgrading existing stop signs. Increasing the retroreflectivity of stop signs (or replacing signs with new signs) has crash modification factors (CMFs) from 0.75 to 0.91. This improvement increases the visibility of the signs, giving drivers more time to react to the stop-controlled condition.

Curve Chevrons

This safety countermeasure includes the installation of curve chevrons placed along the outer radius of the curved roadway segment. In some instances, County Engineers have relocated older curve chevrons, when replaced on their paved system, along curves located on their unpaved system. Installing curve chevron signs has CMFs ranging from 0.75 to 0.96, and when installed in combination with other advance warning signage, has CMFs ranging from 0.59 to 0.61.

Advance Curve Warning Signs and Speed Advisory Plaques

Providing advance warning of unexpected changes in horizontal alignment in conjunction with curve chevron signs has reported CMFs ranging from 0.59 to 0.61.

Delineate Roadside Hazards with Retroreflective Markers

Retroreflective markers can be applied to roadside objects and trees, increasing the visibility of hazards and helping delineate the roadway where minimal delineation may exist.

Realign Intersection

Based on right-of-way and site conditions, this countermeasure could be particularly beneficial and should be considered where feasible at locations where there is intersection skew. The CMF for intersection geometry reconfiguration is included in the Highway Safety Manual (HSM) and varies based on the existing skew angle. With the optimal 90-degree intersection configuration, sight triangles are maximized, crossing distance is minimized, and the intersection meets typical driver expectations.

Improve/Increase Shoulder/Lane Width

The County Engineer could consider the recommendation to improve/increase the shoulder width or lane width to accommodate traffic volumes and/or speed. This countermeasure could add safety benefits when applied properly, but could also encourage driving in excess of the speed limit, so it should be applied with caution.

Driveway Entrance Policy

It is recommended by the FHWA that, “to reduce maintenance problems [at driveways along unpaved roadways], [counties should] implement a permitting process. It should address the proper control of grade to match road edge, adequate width, and drainage.”

Clear and Grub

Vegetation should be kept clear of the roadway, although a natural vegetation buffer between the roadway and any ditches or waterways can help reduce runoff velocity and provide some erosion control. This safety countermeasure reduces the hazard of a run off the road crash by reducing the number of obstructions a vehicle could impact after a lane departure.

In addition, clearing and grubbing the areas within the sight triangles of the vehicles at intersections should also be considered. This safety countermeasure increases the sight distance for vehicles prior to entering an intersection. This is particularly beneficial under two-way stop-controlled or uncontrolled situations where conflicting vehicles may not stop or yield. Per the FHWA, “there is yet another great benefit of mowing [clearing and grubbing]; by removing the standing vegetation, drifting snow will not be trapped on the roadway, resulting in drastically reduced snow removal costs.”

Winter Maintenance

As salt cannot be used on gravel roads and frozen ground cannot be graded, sand is recommended for increased traction on curves and corners during winter events.

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APPENDIX F

ADDITIONAL SAFETY RESOURCES

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GOVERNOR'S TRAFFIC SAFETY BUREAU

215 East 7th Street, 3rd Floor, Des Moines, IA 50319-0248

PHONE: 515-725-6123 * FAX: 515-725-6133 * E-Mail: oertwig@dps.state.ia.us

MATERIALS REQUEST FORM

Name & Date of Event:

Audience: ***Today's Date:***

AVAILABLE ITEMS

Quantities are Limited

Brochures/Booklets:		
1. Is Your Child In The Right Car Seat?	50 pack	
2. Booze + Cruise = Lose	100 pack	
3. Sure, It's the Law - ***English/Spanish***	50 pack	
Other:		
4. Sitting Up High ***Activity Book with Safety Messages***	50 pack	
5. Public Guide *Child Restraint Law* **English**	100 pack	
6. Public Guide *Child Restraint Law* **Spanish**	100 pack	
7. Public Guide *OWI Law*	100 pack	

Please Complete to Ensure Request is Ready when Needed

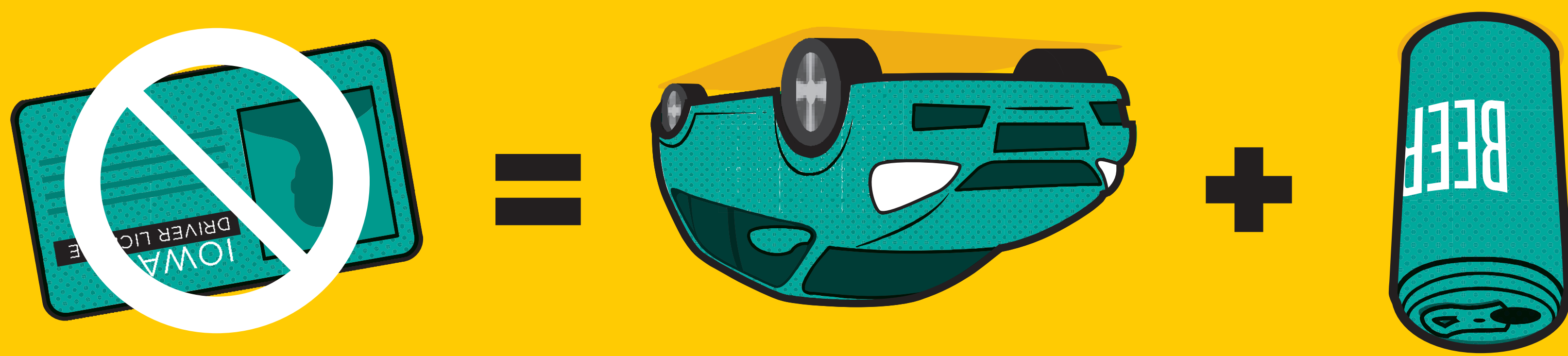
Orders can be picked up or shipped. Business ☐ Residential ☐

Agency & Name & E-mail

Address:

Phone: **Pick Up/Ship Date:**

BOOZE + CRUISE = LOSE



Iowa Governor's Traffic Safety Bureau

WHAT CAN YOU DO?

- Don't drink and drive!
- Don't ride with someone who's been drinking!
- Stop your friends from driving after they've been drinking!
- Call a cab — get a ride home with someone who's sober.
- If you're under 21, just don't drink. In Iowa, it's against the law.
- And wear your seat belt — it's your best chance for survival if you're hit by a drunk driver.

www.iowagtsb.org

Produced with federal highway safety funds.

IOWA'S DRUNK DRIVING LAW IS TOUGH!

If you're under 21 and caught driving drunk, here's what happens:

- At .08 you are legally drunk and subject to the penalties of the drunk driving law.
- You lose your driver's license for 180 days for a first offense.
- In most cases, you won't get a work driving permit for at least 60 days.
- If you refuse a sobriety test, you lose your license for one year with no work driving permit for 90 days.
- For second and subsequent offenses, you lose your license for at least a year and won't get a work permit, period!
- Upon arrest for a second or subsequent offense, or for driving while revoked, your car can be impounded.

ARE YOU UNDER 21?

IS ONE BEER WORTH IT?

If you're under 21 and caught driving with a blood alcohol content of as little as .02, here's what happens:

- You lose your driver's license for 60 days for first-time offenders — two months without driving!
- You lose your driver's license for 90 days for subsequent offenses — three months without driving!
- No temporary permits for any reason!
- Alcohol is alcohol, whether it's beer, wine or liquor.
- For most people, .02 is as little as one beer, one glass of wine or one mixed drink — for some even less!

DRIVING WHILE REVOKED

A person who drives while his or her license is revoked under the OWI chapter (whether the revocation is administrative or court-ordered, and whether for an OWI or for a .02 violation) commits a serious misdemeanor and must pay a fine of $1,000. Law enforcement officers may impound vehicles if the driver's license is revoked for an OWI. If such a driver is convicted of a second or subsequent offense while driving with a revoked license, the vehicle must be seized and forfeited to the state.

The owner of a vehicle who lends the vehicle to a person whose license is revoked for an OWI commits a simple misdemeanor and is jointly liable for any damages the driver causes if the owner knew, should have known, or gave consent to the operation of the vehicle by a driver with a revoked license.

VEHICLE IMPOUNDMENT/IMMOBILIZATION

A person arrested for a second or subsequent OWI, or for driving while a license is revoked for an OWI, may have the motor vehicle seized and impounded immediately upon arrest. The impoundment (or immobilization) continues for at least 180 days or until the driver's license revocation is completed — whichever period is longer. If the vehicle is not impounded at the time of arrest, it may be impounded or immobilized upon conviction for the second or subsequent OWI offense. If a vehicle is operated in violation of an order of impoundment or immobilization, it shall be seized and forfeited to the state. Operation of the vehicle is a serious misdemeanor.

REINSTATING A DRIVER'S LICENSE

If a motor vehicle license or nonresident operating privilege has been revoked for any OWI offense under chapter 321J (whether as a result of a court order or administrative action), the license or privilege may not be reinstated until the person:

- Pays a $200 civil penalty.
- Presents proof of completion of a course for driving under the influence.
- Presents proof of completion of a substance abuse evaluation and treatment or rehabilitation services.
- Complies with financial responsibility laws, if applicable.
- Complies with ignition interlock requirements, if applicable.

DRUNK DRIVING. OVER THE LIMIT. UNDER ARREST.

www.iowagtsb.org • drivesmartiowa.com
Phone: (515) 725-6123 • Fax: (515) 725-6133

Purchased with federal highway safety funds. 15M

Iowa's OWI Law

Operating a motor vehicle while intoxicated or drugged

UPDATED JULY 1, 2018

It is unlawful to operate a motor vehicle in Iowa in any of the following conditions:

1. While under the influence of an alcoholic beverage, other drugs or combination of such substances.
2. While having an alcohol concentration of .08 or more.
3. While any amount of a controlled substance is present in the person, as measured in the person's blood or urine.

CRIMINAL PENALTIES FOR OWI

First Offense A serious misdemeanor, punishable by up to one year in jail and a fine of $1,250, or both. The minimum jail time is 48 hours, which may be served in an OWI program with law enforcement security. The judge may waive up to $625 of the fine if the crime did not result in a personal injury or property damage. As an alternative to a portion or all of the fine, the court may order the person to perform unpaid community service. These offenders must also be ordered to complete a substance abuse evaluation and treatment course for drinking drivers and, in some cases, a reality education substance abuse prevention program.

Second Offense An aggravated misdemeanor, punishable by up to two years in prison. A minimum of seven days in jail must be served. A fine of $1,875 to $6,250 must be paid. These offenders must also be ordered to complete a substance abuse evaluation and treatment course for drinking drivers and, in some cases, a reality education substance abuse prevention program.

Third or Subsequent Offense A Class "D" felony, punishable by imprisonment up to five years and a fine of $3,125 to $9,375. A minimum of 30 days in jail must be served. These offenders must also be ordered to complete a substance abuse evaluation and treatment course for drinking drivers and, in some cases, a reality education substance abuse prevention program.

NOTE: OWI convictions and deferred judgments that occurred anywhere in the United States within the preceding 12 years will count in determining whether the offense charged is a second or third offense. Also, deferred judgments, deferred sentences or probation without service of the mandatory minimum period of incarceration may be granted in an OWI case only if the defendant:

- Has never been previously convicted or received a deferred judgment for OWI anywhere in the United States.
- At the time of arrest, agreed to take a chemical test and had a test result of no higher than .15.
- Did not cause injury to another person by driving while intoxicated.

All persons convicted must undergo a substance abuse evaluation (at the offender's expense) prior to sentencing, and the court must order the defendant to follow the recommendations of the evaluation.

Victims may receive restitution for all damages caused by a defendant. Public agencies may receive up to $500 for costs incurred as a result of a defendant's crime requiring an emergency response.

CRIMINAL PENALTIES FOR OWI CAUSING DEATH OR SERIOUS INJURY

OWI which causes the death of another person is a Class "B" felony, punishable by up to 25 years in prison. This sentence cannot be suspended, and a defendant cannot be released on bail before sentencing, or while on appeal. There is no fine, but victim restitution of $150,000 will be ordered. OWI which causes a serious injury to another person is a class "D" felony, punishable by up to five years in prison. This sentence cannot be suspended. A fine of $750 to $7,500 may be imposed, and victim restitution may be ordered.

DRIVER'S LICENSE REVOCATIONS

Administrative — Test Failure:

First Offense When a chemical test indicates an alcohol level of .08 or more or the presence of a controlled substance and the person has had no OWI-related revocations in the previous 12 years.....180 days

The Department shall require the defendant to install an ignition interlock device of a type approved by the commissioner of public safety on all vehicles owned or operated by the defendant if the defendant seeks a temporary restricted license.

Second or More One or more revocations in the previous 12 years.....1 year

The Department shall require the defendant to install an ignition interlock device of a type approved by the commissioner of public safety on all vehicles owned or operated by the defendant if the defendant seeks a temporary restricted license.

Administrative — Test Refusal (includes refusal of a urine or blood test if the officer requests such a test after a person has submitted a breath test; however, alternative to blood test must be offered unless a warrant is obtained):

First Offense When a chemical test is refused and the person has had no OWI-related revocations in the previous 12 years ..... 1 year

The Department shall require the defendant to install an ignition interlock device of a type approved by the commissioner of public safety on all vehicles owned or operated by the defendant if the defendant seeks a temporary restricted license.

Second or More One or more revocations in the previous 12 years ..... 2 years

The Department shall require the defendant to install an ignition interlock device of a type approved by the commissioner of public safety on all vehicles owned or operated by the defendant if the defendant seeks a temporary restricted license.

Administrative — Driver Under 18:

If a driver is under the age of 18 and his or her license or operating privileges are revoked administratively or by a court order, the revocation continues until the revocation expires or until the person reaches 18, whichever is later.

Upon Conviction for OWI — If Not Otherwise Revoked Administratively:

First Offense Upon conviction, if no convictions or revocations in the preceding 12 years ..... 1 year; 180 days if evidence of a test.

The Department shall require the defendant to install an ignition interlock device of a type approved by the commissioner of public safety on all vehicles owned or operated by the defendant if the defendant seeks a temporary restricted license.

Second Offense One or more revocations in the preceding 12 years ..... 2 years; 1 year if evidence of a test.

The Department shall require the defendant to install an ignition interlock device of a type approved by the commissioner of public safety on all vehicles owned or operated by the defendant if the defendant seeks a temporary restricted license.

Deferred If license is not otherwise revoked and court defers judgment..... 30 – 90 days

The Department shall require the defendant to install an ignition interlock device of a type approved by the commissioner of public safety on all vehicles owned or operated by the defendant if the defendant seeks a temporary restricted license.

Administrative — in Addition to Other Revocations:

Third Offense — Upon Conviction: ..... 6 years

The Department shall require the defendant to install an ignition interlock device of a type approved by the commissioner of public safety on all vehicles owned or operated by the defendant if the defendant seeks a temporary restricted license.

Court Ordered — In Addition to Other Administrative or Court-Ordered Revocations:

Any level of offense involving serious injury caused by OWI..... 1 year in addition to any other revocation.

May apply for a temporary restricted license; ignition interlock device must be installed on all vehicles.

Any level of offense involving a death caused by OWI ..... 6 years

May apply for a temporary restricted license after two years if ignition interlock device is installed on all vehicles.

.02/"ZERO TOLERANCE" ADMINISTRATIVE LICENSE REVOCATIONS FOR DRIVERS UNDER 21

The license of a person under 21 who submits to a chemical test which indicates an alcohol level of .02 or more, but less than .08, will be revoked for 60 days on a first violation and 90 days on subsequent violations. If such a person is suspected of operating with an alcohol level of .02 or more and refuses chemical testing, the license revocation will be one year on a first violation and two years on a second or subsequent violation. These revocations, .02/"zero tolerance" revocations, are administrative and are not dependent upon criminal charges being filed. If a license is revoked for a .02/"zero tolerance" violation, the driver is not eligible for a temporary restricted license at any time during the revocation.

A GUIDE TO THE IOWA CHILD RESTRAINT LAW

Iowa Code 321.446, Data Code 198a - as of July 2010

Key Points:

- A child under 1 year old and weighing less than 20 lbs. must be secured in a rear-facing child restraint system
- A child age 1 up to 6 years old must be secured in a child restraint system (a safety seat or booster seat--NOT a seat belt)
- A child from age 6 up to age 11 must be secured in a child restraint system or by a safety belt
- Rear seat occupants up to age 18 must be secured by a safety belt

A "child restraint system" is a specially designed seating system, including an internal harness or a belt positioning booster seat that meets federal motor vehicle safety standards.

- The misdemeanor fine is $100.00, plus costs (non-moving violation) totaling at least $195.00
- The law applies to both residents and non-residents of Iowa
- The child restraint system must be used in accordance with the manufacturer's instructions
- The child must be secured in the child restraint and the child restraint must be properly secured to the vehicle
- Non-use of a child restraint is probable cause to stop a vehicle
- An officer may investigate a suspected violation
- For unrestrained passengers age 0-13, the driver receives the citation, and for unrestrained passengers 14-17, the passenger receives the citation
- **1st offense citation will not result in conviction if driver "produces in court" proof of acquisition of child restraint**

Exceptions:

- Children certified by a physician as having a medical, physical or mental disability making restraint use inadvisable
- Children on bus, including a school bus
- Children riding on motorcycles
- Children riding in vehicles manufactured before 1966
- Children transported in authorized emergency vehicles
- Children transported by peace officers on official duty
- Children riding in motor homes except if riding in the front passenger seat (where they must be restrained)
- Children for whom a seat belt is not available due to all other belts being used (example: 4th child in back seat with only 3 belts)

This is only a guide, provided through the courtesy of

Iowa Governor's Traffic Safety Bureau
Department of Public Safety

Produced with Federal Highway Safety Funds 02/14 20M

A GUIDE TO SAFELY TRANSPORTING CHILDREN IN A MOVING VEHICLE

COMMON CHILD SAFETY SEAT MISUSE:

- Latch System used incorrectly
- Not securing top tether strap for forward facing seats
- Not buckling child into restraint
- Not securely anchoring the child restraint to the vehicle
- Improper seat for child's age and size
- Use of after-market products
- Harness retainer clip not at armpit level
- Loose harness straps

To graduate to an adult belt -- a child must pass the Belt Fit Test. To be able to sit with their back/buttocks against the seat, their knees bent at the edge of the seat and their feet touch the floor. The belt system must be snug across the center of the child's chest and across their lap at the hips.

COMMON SAFETY BELT MISUSED FOR CHILDREN:

- Lap belt up on abdomen
- Shoulder belt crossing on a child's face or neck
- Shoulder belt behind back
- Shoulder belt under their arm

For your Child's sake, go above and beyond Iowa's Child Passenger Safety Law!

IOWA LAW	BEST PRACTICE
Children must ride in an appropriate rear facing seat until one year of age and at least 20 pounds.	Children should ride in an appropriate rear facing seat until the maximum weight limit of the seat is reached.
Children must ride in a child safety seat or booster through the age of 5. (Seats must be used in accordance with manufacturer's directions)	A child should be restrained in a 5-point harness until the maximum weight limit for the seat is reached. This is usually 50-65 pounds, although some are now 80-90 pounds.
Children must be in a booster seat or seat belt between 6 and 11 years old, regardless of their seating position within a vehicle.	At maximum harness weight a child should graduate into a booster seat. A child should ride in a booster until they pass the **Belt Fit Test** mentioned above.
Rear seat occupants up to age 18 must be secured by a safety belt.	

For further information on child restraints, contact the

Iowa Child Passenger Safety Helpline
1-800-258-6419

For Certified Child Passenger Technicians & Child Restraint Checks
Visit this Website: **www.blankchildrens.org/cps**

Use of Electronic Communication Devices While Driving & Penalties

Code Section & Applicable Motorist	Fine
321.178(2)(a) 16-18 yrs. – Work/Family Permits **Class C Restriction "6"** **Primary Enforcement**	**$30**
-Shall not use electronic communication device or entertainment device while driving a motor vehicle.	
-May use when at complete stop off the traveled road.	
-May use electronic devices permanently installed in a motor vehicle or portable device operated through permanently installed equipment.	
321.180B(6)(a) Instruction Permit or Intermediate DL **Class C or Y Restriction "2"** **Primary Enforcement**	**$50**
-Shall not use electronic communication device or entertainment device while driving a motor vehicle.	
-May use when at complete stop off the traveled road.	
-May use electronic devices permanently installed in a motor vehicle or portable device operated through permanently installed equipment.	
321.194(1)(c) 14-18 yrs. Special Minor's License **Class C Restriction "7"** **Primary Enforcement**	**$50**
-Shall not use electronic communication device or entertainment device while driving a motor vehicle.	
-May use when at complete stop off the traveled road.	
-May use electronic devices permanently installed in a motor vehicle or portable device operated through permanently installed equipment.	
321.276 Use of Electronic Messaging While Driving **All Classes/Drivers** **Primary Enforcement**	**$30**
-Shall not use any portable electronic device to manually write, send, or view a text, instant message, email, internet site, social media or game while driving.	
-Write, send, and view include manual entry, transmission, or retrieval of electronic messages and include playing, browsing, or accessing a message.	
-May write, send or view an electronic message when at a complete stop off the traveled portion of the roadway.	
-May use voice-operated or hands-free device without the use of either hand except to activate or deactivate a feature or function.	
-May use wireless communication device as part of a digital dispatch system.	
-May use a GPS or navigation system.	
-May engage in a call, including selecting or entering a telephone number or name in a hand-held mobile telephone.	
Persons Exempt from Restriction on writing, sending, or viewing an electronic message: member of a public safety agency performing official duties; health care professional in the course of an emergency situation; individuals receiving safety-related info including emergency, traffic, or weather alerts.	

Use of Electronic Communication Devices While Driving & Penalties

Frequently Asked Questions:

Q) What is a "hand-held electronic communication device"?

A) Iowa code defines a "hand-held electronic communication device" as a mobile telephone or other portable electronic communication device capable of being used to write, send, or view and electronic message, and includes devices temporarily mounted in the vehicle unless the device is voice-operated or hands-free. It does not include a voice-operated or hands-free device which allows the user to write, send or view an electronic message without the use of either hand except to activate or deactivate a feature or function, or a wireless digital dispatch system.

Q) What is an "electronic message"?

A) Iowa code defines "electronic message" as an image visible on the screen of a hand-held electronic communication device and includes a text message, an instant message, email, an internet site, a social media application, or a game.

Q) Can I pull over an adult, fully licensed driver for using their phone as a GPS or navigation system?

A) No. However, If the use of the device as a navigation system results in erratic driving and lane deviations, that can support a stop of the vehicle for other violations.

Q) Can I pull over an adult, fully licensed driver for talking on a cell phone while driving?

A) No. Iowa code does not prohibit an adult, fully licensed driver from engaging in a telephone call, or activating or deactivating a feature or function of the device.

Q) Can I pull over an adult, fully licensed driver for texting, playing, browsing, accessing or viewing an electronic message?

A) Yes. Using an electronic device while driving is a primary offense for all drivers. It is imperative that you observe and document the driver's use of the phone, multiple key strokes, eyes away from the roadway, and/or any erratic driving to overcome a claim of dialing a phone number or activating or deactivating a function of the device. This will likely require some sustained observation. Reasonable suspicion or probable cause to make a traffic stop would also permit requesting consent to view the phone. Taking and inspecting the phone without consent requires a search warrant.

Q) Can I pull over a 16-year-old who is talking on the phone?

A) Yes. Laws applicable to drivers within the GDL system or those with a minor's work or school permit are prohibited from using electronic devices entirely, unless the vehicle is stopped and off the traveled portion of the roadway or the device is permanently installed in the vehicle or operated through permanently installed equipment.

Child Passenger Safety

A PARENT'S PRIMER

When you're an expectant mother, it's important to always wear your seat belt to protect you and your unborn child. Wear the lap belt across your hips and below your belly with the shoulder belt across your chest (between your breasts). Once your baby is born, follow these important safety steps.

GROWING UP SAFE: It's a four-step process.

As children grow, how they sit in your car, truck or SUV should change.
Save your child from injury or death by observing all four steps:

1 **REAR-FACING SEATS**

For the best possible protection keep infants in the back seat, in rear-facing child safety seats, as long as possible up to the height or weight limit of the particular seat. At a minimum, keep infants rear-facing until a minimum of age 1 **and** at least 20 pounds.

2 **FORWARD-FACING SEATS**

When children outgrow their rear-facing seats (at a minimum age 1 **and** at least 20 pounds) they should ride in forward-facing child safety seats, in the back seat, until they reach the upper weight or height limit of the particular seat (usually around age 4 and 40 pounds).

3 **BOOSTER SEATS**

Once children outgrow their forward-facing seats (usually around age 4 and 40 pounds), they should ride in booster seats, in the back seat, until the vehicle seat belts fit properly. Seat belts fit properly when the lap belt lays across the upper thighs and the shoulder belt fits across the chest (usually at age 8 or when they are 4'9" tall).

4 **SEAT BELTS**

When children outgrow their booster seats, (usually at age 8 or when they are 4'9" tall) they can use the adult seat belt in the back seat, if it fits properly (lap belt lays across the upper thighs and the shoulder belt fits across the chest).

Get Help!

ON THE WEB

Go to **www.nhtsa.gov** and choose Child Safety Seat Information from the menu or click on the child passenger safety icon. The site includes child safety seat installation tips, product ratings, recalls, and other useful information.

BY PHONE

For more information about child safety seats, booster seats, inspection/fitting stations in your area, seat belts, air bags, and other highway safety issues, call the DOT Vehicle Safety Hotline at: 1-888-327-4236.

NEAR YOU

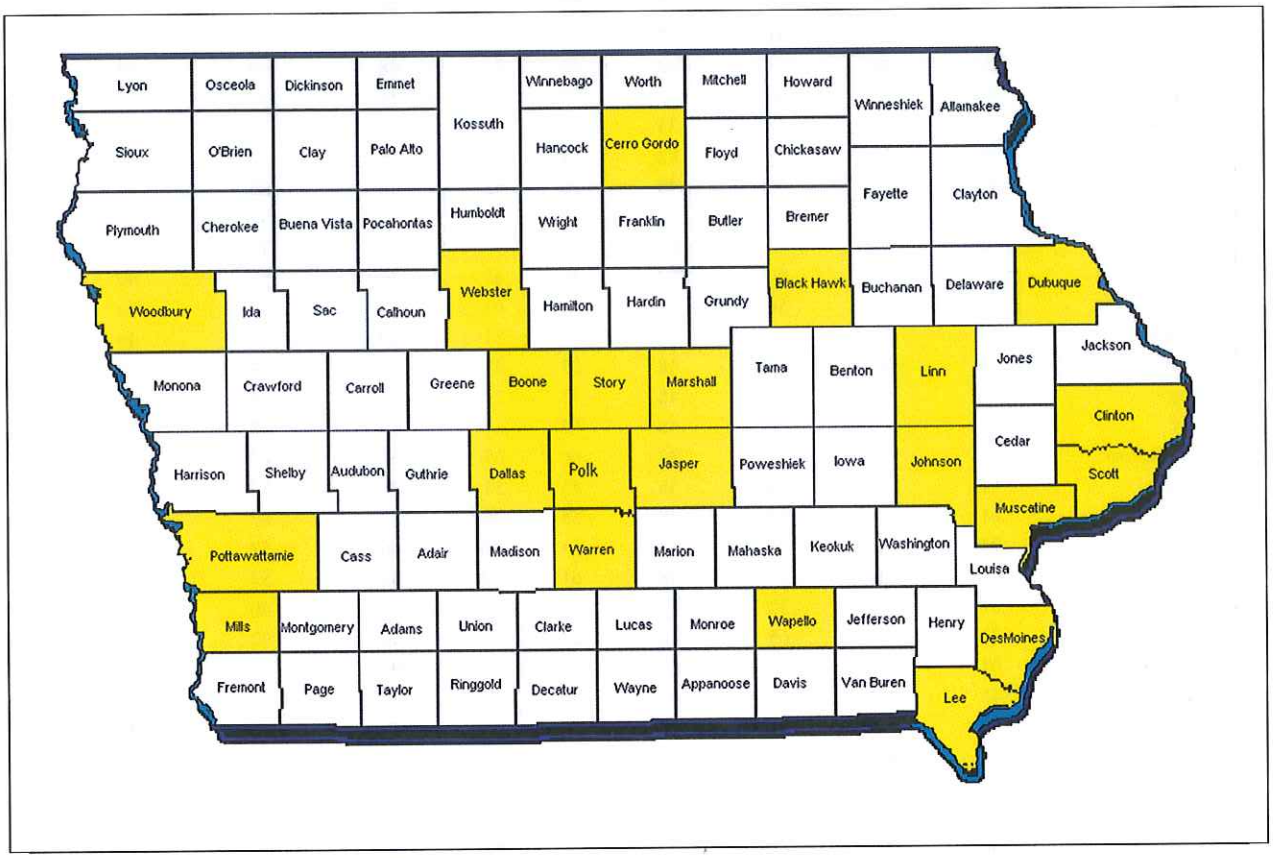
A certified child passenger safety technician can check your installation and answer questions. To find a technician or an inspection station near you, go to **www.nhtsa.gov** , click on the child passenger safety icon, and then click on the Fitting/ Inspection Station link or go to **www.seatcheck.org.**

REMEMBER: All children under 13 should ride in the back seat.

Always read the child restraint instructions and the vehicle owner's manual.

NHTSA
www.nhtsa.gov

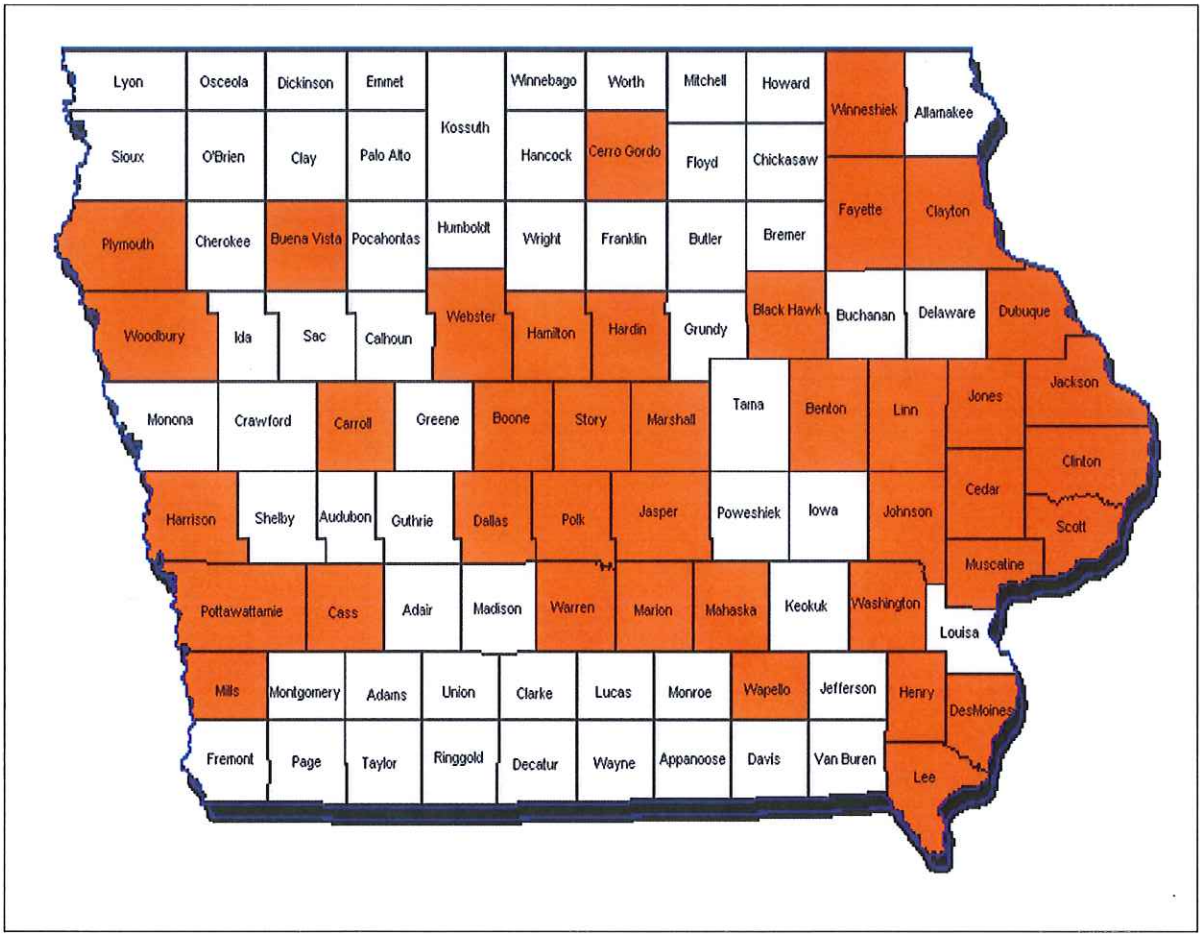
IOWA'S "TOP 22" PROBLEM IDENTIFICATION COUNTIES – FFY 2019



Black Hawk	Dubuque	Mills	Wapello
Boone	Jasper	Muscatine	Warren
Cerro Gordo	Johnson	Polk	Webster
Clinton	Lee	Pottawattamie	Woodbury
Dallas	Linn	Scott	
Des Moines	Marshall	Story	

Eligible for Section 402 Grant Funding

IOWA'S "TOP 40" PROBLEM IDENTIFICATION COUNTIES – FFY 2019



Benton	Clayton	Harrison	Mahaska	Scott
Black Hawk	Clinton	Henry	Marion	Story
Boone	Dallas	Jackson	Marshall	Wapello
Buena Vista	Des Moines	Jasper	Mills	Warren
Carroll	Dubuque	Johnson	Muscatine	Washington
Cass	Fayette	Jones	Plymouth	Webster
Cedar	Hamilton	Lee	Polk	Winneshiek
Cerro Gordo	Hardin	Linn	Pottawattamie	Woodbury

Eligible for Section 405d Grant Funding

Registering with the State of Iowa A & A System (Authorization & Authenticity)
&
Registering with the www.iowagrants.gov System

Phase 1

1. Log on to **www.iowagrants.gov**
2. Scroll down and **Click** on **New Users Register Here** (bottom right side of screen).
3. Type in your First Name and Last Name and then Click **Register**. On the next screen, type in your Email Address and then type it again to confirm it. Now, Click "**Save Account Details.**" **You're done with Phase 1**
   (Note the Account ID the system assigned you *(typically your firstname.lastname@iowaid)*.

Phase 2

4. An e-mail will be sent to the address you provided containing your Account ID and Instructions to Complete your Registration.
5. Click on the link provided in the e-mail. It will take you to a page to create your Identity Baseline by answering 3 questions *(2 the system generates and 1 you'll create).*
6. On the next screen, you will Create your Password. **You're done with Phase 2**

Phase 3

7. Go back to www.iowagrants.gov. Scroll down to **Returning Users Login Here** and sign into the system using your Account ID and Password. *(Your Account ID not case sensitive; but your Password is case sensitive.)*
8. Follow the on-line directions to complete your Registration in the IowaGrants System.

   *Select **Governor's Traffic Safety Bureau** as the **"Department of Interest."**

Registration Approval

After you have registered, you will receive a second e-mail that you've been approved.

Keep your Account ID and Password to manage your grant.

The GTSB is unable to assist with Account ID or Password issues

For Registration Problems:

Contact: Deb Scrowther: 515-281-7076 or debra.scrowther@iowa.gov

You will need to provide:

1) First and Last Name
2) User ID in IowaGrants.gov
3) Email address (*your association in A&A - crucial information*)
4) First Time User *or* Returning User
5) Phone #

2022 Section 402/405d Online Application Instructions

After completing the Registration Process for both the State of Iowa A&A System and the IowaGrants.gov System, you're ready to apply for the Grant.

1. Go to **www.iowagrants.gov**
2. Scroll down and on the right side of the page, Click on **Returning Users Login Here.**
3. Enter the **Account ID** and **Password** given to you.
4. At the Main Menu, click **Funding Opportunities.**
5. Click **2022 GTSB LE Highway Safety Grants or 2022 GTSB Media Highway Safety Grants**
6. ***BEFORE*** starting an application scroll down and **read Guidelines For Section 402 Funding (found in the Description link).**
7. Go back near the top and Click **Start New Application.**
8. Your name should appear in Registered Applicant. For Project Title enter **Agency Name 2022 402** (Anytown Police Department 2022 402). Your agency's name should already be in Organization. At the top right of the screen, click **Save.**
9. On the next screen, Click **Go To Application Forms** - right side of the screen. Complete each form in its entirety. When done entering click save and mark as complete.

After saving, review information entered. **If needed**, Click **Edit** to make necessary changes. SAVE.
This applies to all sections. You can edit any section until you actually submit.

10. Select preview to verify information entered. Select **Print** for a copy of your application. Select go to application forms. Click **Submit**. You must then type your name and verify you understand the application and are approved to apply. Go to the top and Click **Submit** again. You will receive an "Application Submitted Confirmation" when completed.

For questions or assistance with your application, contact Crystal Young at 515-725-6126
For ID or Password problems, contact Deb Scrowther: 515-281-7076 or debra.scrowther@iowa.gov

Iowa GTSB Funding Proposal Guidelines for Section 405c
(State Traffic Safety Information Systems Programs)

Funding is available from the Iowa Governor's Traffic Safety Bureau (GTSB) for state agencies to conduct programs which will make quantifiable and measureable improvements in traffic safety data gathering, analysis, dissemination and use in Iowa to help identify priorities to assist in the reduction of crashes, injuries and deaths on Iowa roadways. Core data systems include crash data, driver license/history data, injury surveillance and EMS data, roadway data, citation/adjudication data, and vehicle registration data. Projects are expected to improve

systems in the areas of accuracy, completeness, integration, timeliness, uniformity and/or accessibility.

Applications must be completed and received by April 16, 2021 by the Governor's Traffic Safety Bureau (GTSB) to be considered for the FFY 2022 funding period (October 1, 2021 – September 30, 2022). GTSB funding is provided on a reimbursement basis only. Agencies must first pay for expenses incurred and then submit documentation of expenses and proof of payment to be reimbursed.

Funding requests may be reduced depending on the volume of applications. Funding decisions are made by the GTSB after a review of all applications. The Statewide Traffic Records Coordinating Committee (STRCC) will also approve the Bureau's funding decisions as part of the state's Traffic Records Strategic Plan before a contract is drawn between the GTSB and the agency.

Funded agencies must conduct program activities within the time frame of the contract and submit timely, detailed quarterly reports and a final accumulative report on program activities, progress and problems. Agencies must submit reimbursement claims within 90 days of expenses being paid. **There are two exceptions to the 90-day limit**. Any and all expenses incurred in June or prior months must be claimed by August 15th due to the state fiscal year. June and prior expenses claimed after August 15th must go to the State Appeals Board and reimbursement may be delayed by up to four months. The final claim for all remaining expenses must be submitted by November 15th to close out the federal fiscal year. No claims for reimbursement will be accepted after the November 15 deadline. Other requirements hinge on specific elements which may be funded and are noted in the grant application.

If you have questions regarding the data improvement program and/or the 405c application/process, please feel free to contact Mick Mulhern at 515/725-0148, mulhern@dps.state.ia.us. The GTSB staff may contact you for further explanation or details in regard to the submitted application.

Signed applications emailed to Crystal Young at cyoung@dps.state.ia.us by close of business on April 16, 2021, will meet the deadline; however, **hard copies, with original signature(s) must also be submitted to**:

Crystal Young, Grants Administrator
Governor's Traffic Safety Bureau
Iowa Department of Public Safety
215 E 7th Street
Des Moines, IA 50319