Local Road Safety Plan

SALINE COUNTY

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Kansas Department of Transportation

TranSystems

WSP

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SALINE COUNTY LOCAL ROAD SAFETY PLAN

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Statutory Notice

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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.

EXECUTIVE SUMMARY

The Kansas Department of Transportation (KDOT), as part of their strategic goal to reduce fatalities and serious injuries within Kansas is conducting Phase 3 of the Local Road Safety Plan (LRSP) process for 20 counties within the state. Four counties were included in the Pilot Phase of this process, which was completed in 2018 and 39 counties were included in Phase 1 and 2. The LRSP concept is built on the foundation established by the Strategic Highway Safety Plan (SHSP). **Figure E1** shows the location of the Phase 3 counties as well as the counties in previous LRSP Phases.

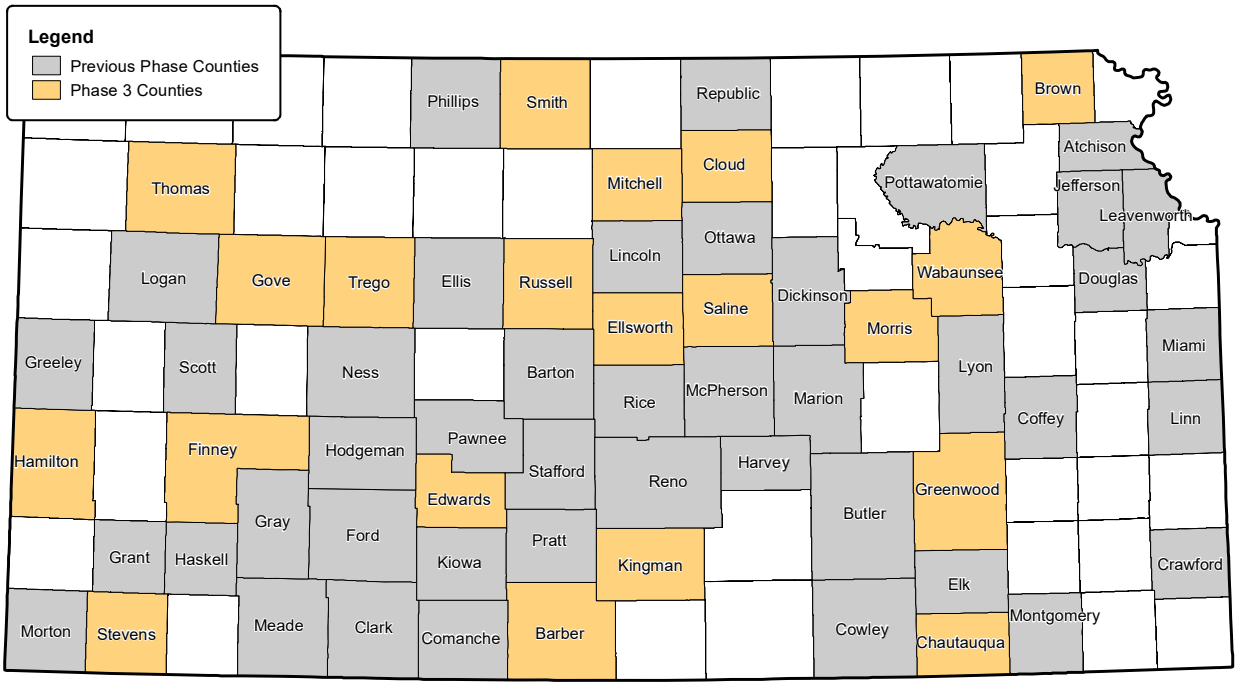

Figure E1 – Location of LRSP Counties

E.1. What is a Local Road Safety Plan (LRSP)?

As defined by the Federal Highway Administration (FHWA), an LRSP provides a framework for identifying, analyzing, and prioritizing roadway safety improvements on local roads. The LRSP development process and content are tailored to local issues and needs. The process results in a prioritized list of issues, risks, actions, and improvements that can be used to reduce fatalities and serious injuries on the local road network. LRSPs are one of the FHWA's Proven Safety Countermeasures based on its proven effectiveness and benefits in reducing serious injuries and fatalities on local roadways throughout the country.

An LRSP is a resource to assist local public authorities as they select and prioritize projects that will have the biggest impact on safety based on the crash types and high-risk roadway characteristics in their jurisdiction. Because of the random nature of crashes – in particular on lower-volume local roads – these plans place an emphasis on low-cost systemic improvements; that is, the approach is proactive rather than a reactive approach based on "hot spots" where crashes are occurring. An LRSP identifies proactive countermeasures, based on a

comprehensive systemic review, that are targeted at enhancing the overall safety for roadway users.

E.2. Saline County's LRSP Routes

The LRSP study routes within Saline County generally included all major collectors and all paved roads under the county's jurisdiction except subdivisions with speed limits lower than 35 mph. A total of 237 miles of roadway segments (72% paved, 28% unpaved), 264 intersections and 74 curves were analyzed as part of the Saline County LRSP. Interstate, US and Kansas Highway routes were not included as these are not maintained by the county.

E.3. LRSP Project Overview

This LRSP includes the following general tasks:

- Data collection – Analyze existing crash data and roadway data that can be used to identify systemic risk factors for the county's LRSP routes.
- Risk factor determination – Determine systemic risk factors associated with existing fatal or serious injury crashes that will be used in a systemic safety analysis.
- Countermeasure selection – Develop potential safety countermeasures to address the approved risk factors.
- Safety workshop – Engage county stakeholders in the LRSP process and gather feedback on potential safety countermeasures.
- Development of safety projects – Determine prioritized safety projects for the county's LRSP routes based on a systemic risk factor analysis of all LRSP segments, intersections, and curves.
- Final report – Document the LRSP process and findings in a final report.

E.4. Saline County's Recommended Improvements

The ten recommended safety improvement project locations identified as part of this LRSP, along with an opinion of their probable cost are shown in **Table E1**. The segment and intersection project sheets for Saline County are provided in **Appendix M** of this plan.

Table E1 – Saline County LRSP Project Locations and Opinion of Probable Cost

ID	Project Location Description	Opinion of Probable Cost			
		Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *
Segment 4	E Country Club Road between N Niles Road and S Kipp Road	$58,000	$489,000	$150,000	$1,196,000
Segments 106, 109, 110	W State St between Hedville Road and K-140	$222,000	$1,506,000	$390,000	$3,459,000
Segment 44	N Simpson Road between Old 40 Highway and E Country Club Road	$54,000	$552,000	$180,000	$1,344,000
Segment 108	W State St between S Brookville Road and S Hedville Road	$114,000	$527,000	$631,000	$2,115,000
Segments 29, 30	N Brookville Road between State Street and Ottawa Road (Ottawa County line)	$177,000	$915,000	$390,000	$2,449,000
Segment 34	N Halstead Road between I-70 and W State Street	$47,000	$290,000	$222,000	$959,000
Intersection 57	E Old 40 Highway and N Simpson Road	$29,000	$406,000	$450,000	$1,502,000
Intersection 226	W Crawford Street and S Burma Road	$37,000	$6,000	$450,000	$846,000
Intersection 49	E Old 40 Highway and E Stimmel Road	$14,000	$100,000	$0	$196,000
Intersection 56	E Old 40 Highway and N Niles Road	$21,000	$400,000	$458,000	$1,491,000
Total		**$773,000**	**$5,191,000**	**$3,321,000**	**$15,557,000**

** Includes estimates for mobilization, traffic control, contingency, design engineering, and construction inspection as identified on project sheet.*

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A	Serious Injury Crash
AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
BLP	Bureau of Local Projects
CMF	Crash Modification Factor
DASC	Kansas Data Access and Support Center
FHWA	Federal Highway Administration
GIS	Geographic Information System
HRRR	High Risk Rural Roads
HSM	Highway Safety Manual
K	Fatal Crash
KDOT	Kansas Department of Transportation
LRSP	Local Road Safety Plan
mph	Miles per Hour
MUTCD	Manual on Uniform Traffic Control Devices
NG911	Next Generation 911
SHSP	Strategic Highway Safety Plan
TEAP	Traffic Engineering Assistance Program

1. INTRODUCTION

The Kansas Department of Transportation (KDOT), as part of their strategic goal to reduce fatalities and serious injuries within Kansas is conducting Phase 3 of the Local Road Safety Plan (LRSP) process for 20 counties within the state. Four counties were included in the Pilot Phase of this process, 39 counties were included in Phase 1 and 2. The LRSP concept is built on the foundation established by the Strategic Highway Safety Plan (SHSP). **Figure 1** shows the location of the Phase 3 counties as well as the counties in previous LRSP Phases.

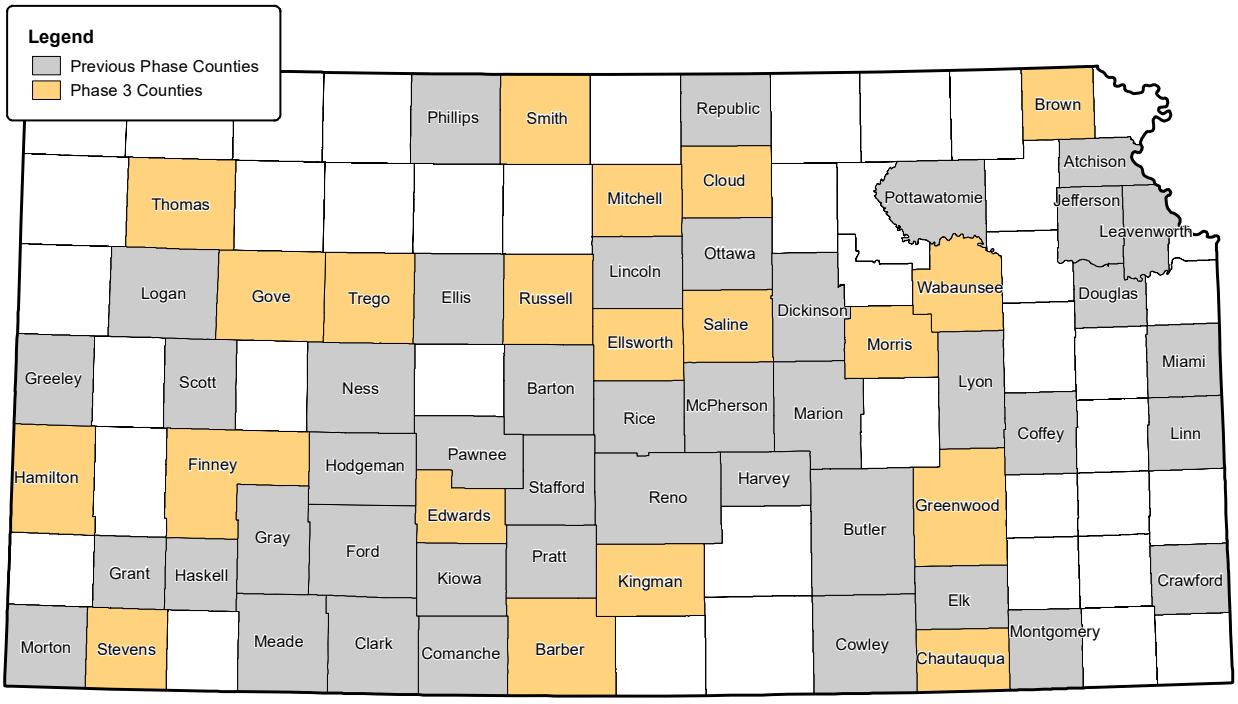


Figure 1 – Location of LRSP Counties

1.1. What is an LRSP?

As defined by the Federal Highway Administration (FHWA), an LRSP provides a framework for identifying, analyzing, and prioritizing roadway safety improvements on local roads. The LRSP development process and content are tailored to local issues and needs. The process results in a prioritized list of issues, risks, actions, and improvements that can be used to reduce fatalities and serious injuries on the local road network. LRSPs are one of the FHWA's Proven Safety Countermeasures based on its proven effectiveness and benefits in reducing serious injuries and fatalities on local roadways throughout the country.

1.2. Background and Purpose of the LRSP

Traffic on local roads in Kansas accounts for approximately 42% of the total vehicle miles traveled, and according to the Kansas SHSP 2020, crash data between 2014 and 2018 shows that 46% of fatalities and 55% of disabling injuries occurred on roads owned by local public authorities. Since the overall goal of the Kansas SHSP is to halve fatalities and serious injuries over the 20-year

period ending in 2029, locally owned roads must be included as a significant part of the plan. With limited funds, a county needs a plan to make an effective impact on reducing the fatalities and serious injuries on their roadways.

An LRSP is a resource to assist local public authorities as they select and prioritize projects that will have the biggest impact on safety based on the crash types and high-risk roadway characteristics in their jurisdiction. Because of the random nature of crashes—in particular on lower-volume local roads—these plans place an emphasis on low-cost systemic improvements; that is, the approach is proactive rather than reactive. An LRSP identifies several proactive measures, based on a comprehensive systemic review, that are targeted at enhancing the overall safety for roadway users.

The final LRSP provides a prioritized list of safety improvement projects with a preliminary opinion of probable cost. The prioritization is based on the systemic review process and risk factors determined as part of the LRSP process. Each project sheet includes low-cost, short-term safety recommendations, as well as longer term improvements, and is a resource for the county to use in applying for safety funds through the KDOT Bureau of Local Projects' (BLP) High Risk Rural Roads (HRRR) Program.

1.3. Saline County's LRSP Routes

The LRSP study routes within Saline County generally included all major collectors and all paved roads under the county's jurisdiction except subdivisions with speed limits lower than 35 mph. The location of the LRSP study routes within Saline County are identified on the map included in **Appendix A**. A total of 237 miles of roadway segments (72% paved, 28% unpaved), 264 intersections and 74 curves were analyzed as part of the Saline County LRSP. For the purposes of the analysis, a curve was defined using the following parameters: radius less than 2,500 feet and a length greater than 100 feet. Interstate, US and Kansas Highway routes were not included as these are not maintained by the county.

1.4. LRSP Project Overview

This LRSP includes the following general tasks:

- Data collection
- Crash analysis
- Roadway data analysis
- Risk factor determination
- Countermeasure selection
- County input and safety workshop
- Development of safety projects
- Final report

1.5. Document Organization

This LRSP is organized into the following sections:

- **Section 1** presents an introduction to the LRSP, along with the background and purpose.
- **Section 2** summarizes the LRSP data collection and crash analysis.
- **Section 3** introduces risk factors and identifies the approved risk factors for the project.

- **Section 4** provides a list of potential safety countermeasures to address the approved risk factors for the project.
- **Section 5** describes the process for selecting safety projects from the Saline County LRSP segments, intersections, and curves. It also includes the prioritized list of safety improvement projects.
- **Section 6** summarizes the recommended improvements and potential next steps.
- **Appendices**

2. DATA COLLECTION

2.1. Crash Analysis

For this LRSP, the crash analyses conducted during the previous LRSP Phases were determined to be applicable to the LRSP Phase 3 project. For reference, the Crash Analysis Technical Memorandum from Phase 1 of the LRSP process is included in **Appendix B**.

2.2. Crash Data for Saline County LRSP Routes

This section provides a summary of the crash data for the Saline County LRSP routes using records from the KDOT crash database for the project (2015 – 2019 data). **Table 1** contains a tabular summary of the Saline County LRSP route crashes by roadway type and **Figure 2** contains a graphical summary of the data. It is important to note that this information is exclusively for the LRSP study routes within the county rather than all county roads. For Saline County, nearly three-fourths of the LRSP study routes are paved roads.

Table 1 – Saline County LRSP Route Crashes by Roadway Type

Roadway Type		Total Crashes		Fatal and Serious Injury (K & A) Crashes	
		Count	Percent	Count	Percent
County Paved	Intersection	53	12%	1	8%
	Non-Intersection (On Curve)	16	4%	2	15%
	Non-Intersection (Off Curve)	312	73%	8	62%
	Other/Unknown	0	0%	0	0%
	Subtotal	**381**	**89%**	**11**	**85%**
County Unpaved	Intersection	7	2%	0	0%
	Non-Intersection (On Curve)	3	1%	0	0%
	Non-Intersection (Off Curve)	39	9%	2	15%
	Other/Unknown	0	0%	0	0%
	Subtotal	**49**	**11%**	**2**	**15%**
Total		**430**		**13**	

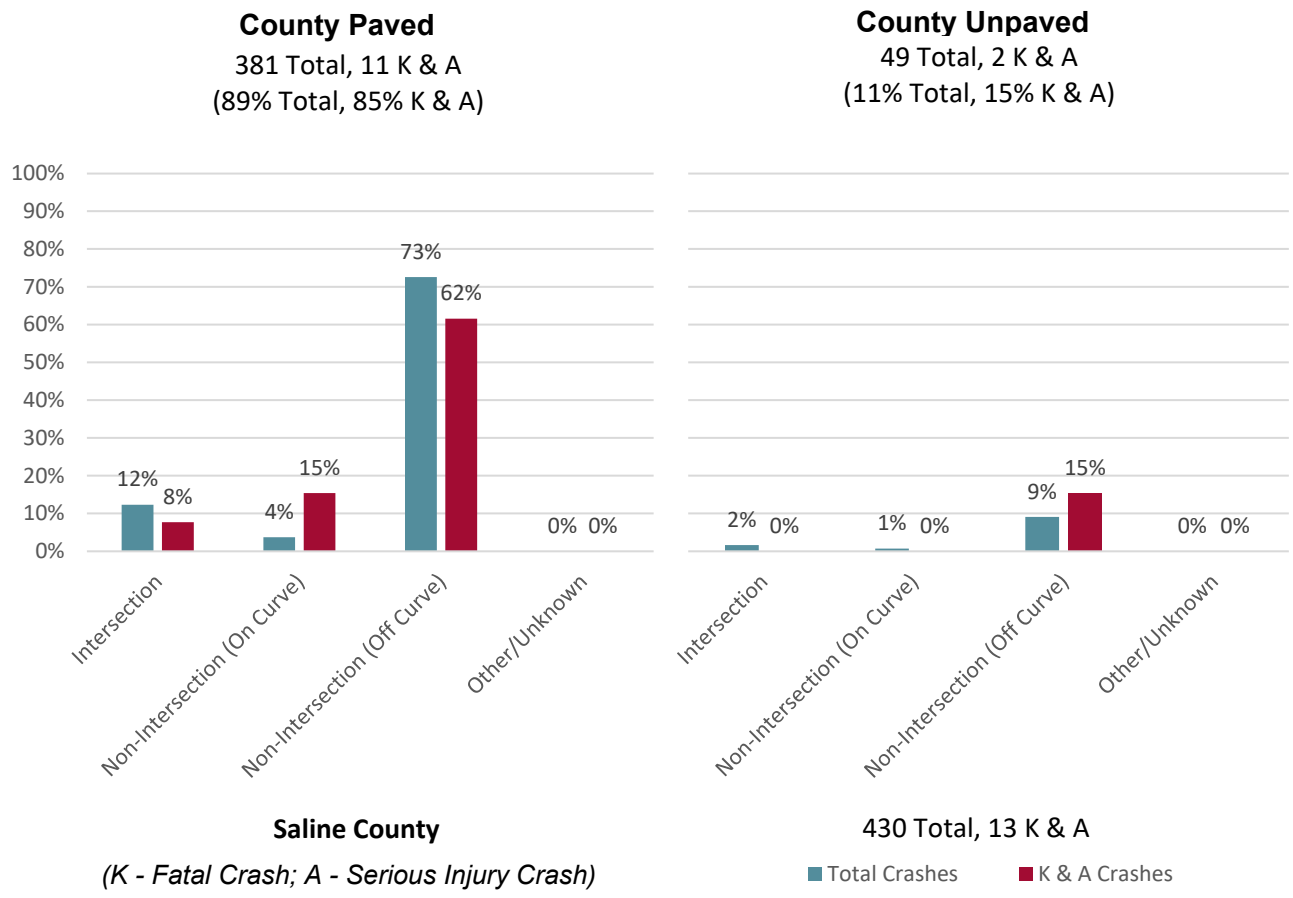


Figure 2 – Saline County LRSP Route Crashes by Roadway Type

The above findings indicate that from 2015 to 2019, there were a total of 430 crashes on the Saline County LRSP routes, including 13 fatal or serious injury crashes. Similar to the findings from the crash analysis for counties throughout the state (as included in **Appendix B**), roadway segment crashes (non-intersection, off-curve crashes) accounted for the majority of the total crashes (82%) for paved and unpaved roads combined, as well as 77% of the fatal or serious injury crashes. Total crashes were much less frequent at intersections or on curves, although three (3) fatal or serious injury crashes occurred at an intersection or on a curve.

2.2.1. Crash Location Map and Crash Heat Map

Although LRSPs use a proactive approach to identifying safety improvement locations rather than a reactive approach based on “hot spots” where crashes are occurring, the crash records for the 2015 to 2019 period were used to prepare a graphical representation of the total crashes along the Saline County LRSP routes in the form of a crash location and crash heat map. The map was prepared for the county’s use and is included in **Appendix C**. Brighter colors on the map indicate locations with a higher number of crashes.

2.2.2. Crash Frequencies

In addition to the crash location and crash heat map, a list of high crash locations for the LRSP study routes was prepared for the county's use. High crash locations were determined based on a comparison between the actual crash frequency (crashes per year) and the predicted average crash frequency using procedures outlined in the Highway Safety Manual (HSM). Tables of the Actual versus HSM Predicted Crash Frequencies for all the Saline County LRSP segments, intersections, and curves are included in **Appendix C**. It should be noted that crash frequencies were only included for locations that experienced a crash in the 5-year analysis period (2015 to 2019).

2.3. Roadway Data

A comprehensive Geographic Information Systems (GIS) database that includes pertinent roadway data that can be used to identify systemic risk factor rankings for the LRSP study routes was not available for use on the project. As a result, data was obtained by the project team through a variety of sources, including existing KDOT maps, county GIS data, maps of various existing features, readily available aerial photography (Google, Bing, etc.), and field inspections. A GIS database was created to store the attribute data collected for the LRSP segments, intersections, and curves.

2.3.1. KDOT Maps

KDOT District, county, and city traffic count maps were used as the primary source to obtain Average Daily Traffic (ADT) volumes on the LRSP study routes. If applicable, an additional source for obtaining ADTs was previous Traffic Engineering Assistance Program (TEAP) studies conducted at various locations throughout the county. Where ADT data was unavailable, estimates were used based on county input or neighboring segment ADT.

2.3.2. County Data

2.3.2.1. GIS Data

The Kansas Data Access and Support Center (DASC) provided GIS mapping of the county's current roadway centerline files and 911 address points. The roadway centerline files were used primarily to define segment names and length. Segments along the LRSP study routes were also identified based on attributes that generally remained similar along the segments, such as pavement or shoulder widths. Segments were also defined if there were major alignment changes in the route (i.e., a change from north/south alignment to east/west), or if the segment intersected a state highway or another LRSP route, particularly where traffic volume and characteristics changed.

The 911 address points file was developed according to the state specifications for Next Generation 911 (NG911), and for the most part, address points were identified on the buildings and not at the driveway entrances.

2.3.2.2. County Maps

Maps were provided to the counties for their use in identifying the location of various existing conditions and safety features along the LRSP study routes. Maps for the following items were provided for county input, and if returned, are included in **Appendix D** (no map is included if data was unavailable or not provided):

- Intersection lighting
- Overhead/Stop sign flashing beacons
- Centerline rumble strips
- Edgeline and/or shoulder rumble strips
- Transverse rumble strips
- Pavement width and type (material)
- Shoulder width and type (material)
- Edgeline pavement markings
- Centerline pavement markings
- Curve warning signs
- Curve superelevation

2.3.3. Aerial Photography

Readily available aerial photography sources (Google, Bing, etc.) were used to identify various data along the LRSP study routes, including the following data elements:

- Pavement width, where county data was unavailable
- Access points (driveways and intersections)
- Intersection skew angle
- Curve length and radius

2.3.4. Field Inspections

Field inspections of each LRSP study route were conducted by driving each roadway in the fall of 2020 and collecting pertinent field data that can be used to determine the presence of an approved risk factor. Geospatial video data was also recorded as part of this effort. Primary data elements collected as part of the field inspections or video review included:

- Edge condition rating
- Roadside assessment rating
- Shoulder width and type (material), where county data was unavailable
- Speed limit
- Intersection control
- Intersection sight distance
- Supplemental confirmation of other data elements provided by the county (e.g., lighting, curve signs, curve superelevation, etc.)

Data collection for some of the above items was more general in nature. For example, database entries for the presence of curve warning signs and curve superelevation were a simple “yes/no” or “present/not present”. An assessment of the existing curve superelevation or the appropriate Manual on Uniform Traffic Control Devices (MUTCD) curve signage could be a recommendation for a high-ranking curve, but these aspects were not reviewed in detail as part of this systemic review. For other items (e.g., intersection sight distance, edge condition and roadside assessment), general subjective ratings were identified based on field inspections or review of video data. For example, ratings of “adequate” or “limited” were used for intersection sight distance based on the video review. For edge condition and roadside assessment, ratings of “good”, “average”, or “poor” were also identified during the field work. Some photos which illustrate examples of the general subjective ratings, along with maps which show a graphical representation of the edge condition and roadside assessment ratings for the Saline County LRSP routes are included in **Appendix E**.

3. RISK FACTORS

3.1. Systemic Safety Risk Factors

The purpose of the LRSP project is to identify locations where systemic safety improvements can be implemented on county roads. The systemic approach focuses on risk and takes a broader view and looks at risk across an entire roadway system, rather than only applying improvements to locations where crashes have previously occurred.

When developing systemic safety improvements, it is important to note 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 be utilized to identify locations for systemic safety improvements. While all of the risk factors outlined below were not 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 versus 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
  - Average daily entering vehicles
  - 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

3.2. Approved Risk Factors

Based on the Crash Analysis Technical Memorandum prepared during previous phases of the KDOT LRSP project included in **Appendix B**, approved risk factors were reviewed and considered appropriate for use in the LRSP Phase 3 project. Each of the approved risk factors was used to analyze potential risk for the Saline County LRSP segments, intersections, and curves.

4. COUNTERMEASURE SELECTION

As part of the LRSP, potential safety countermeasures were developed for the project based on the approved risk factors. Details of the safety countermeasures for this project are documented in the Countermeasures Technical Memorandum which is included in **Appendix F**. A workshop was held with each of the Phase 3 LRSP counties to discuss the LRSP project, crash characteristics and safety countermeasures.

4.1. County Workshop

The Saline County LRSP Safety Workshop was held on the afternoon of Tuesday, May 18, 2021. The minutes of the meeting are included in **Appendix G**. Invitees included a wide range of stakeholders from the "Five E's" of highway safety.

4.1.1. Five E's of Safety

The first four "E's" refer to the Engineering, law Enforcement, Education, and Emergency response communities, while the fifth "E" refers to "everyone" and can include any stakeholders with a passion for roadway safety, such as elected officials, paratransit service providers, insurance providers, parents, or other civic groups. Each of these groups were invited to participate in the LRSP process.

This type of multidisciplinary approach is essential to enhancing overall safety of the roadway system. Studies have shown that over 90% of crashes are a result of driver factors, with the most common errors including recognition (41%), decision (33%) and performance (11%). All disciplines can play a role in developing strategies to both prevent crashes as well as lessen the severity of crashes. A number of topics were discussed during the workshop, including:

- Engineering measures: LRSP development, system enhancements, and "hot spot" analyses
- Enforcement measures: traffic-related enforcement, targeted enforcement using data-driven approaches to crime and traffic safety – identifying areas that have high incidences of crime and crashes to deploy law enforcement more effectively
- Education measures: public education and outreach programs, Seatbelts Are For Everyone (SAFE) outreach in schools
- Emergency response measures: "golden hour" – the first hour after the occurrence of a traumatic injury, considered the most critical for successful emergency treatment

A list of Kansas and nationally available safety resources was provided to the workshop attendees and is included in **Appendix H**.

4.1.2. Attendee Input and Feedback

Participants at the workshop were encouraged to provide feedback and input throughout the meeting. Specific group feedback times were provided to discuss locations of concern along the county's LRSP routes, along with the potential safety countermeasures that were presented. For the latter, photos and descriptions of many of the potential safety countermeasures were provided to the attendees as part of the workshop discussion (see **Appendix G**).

4.1.2.1. Locations of Concern

Participant input on specific locations of concern is documented as part of the meeting minutes in **Appendix G**, but included the following locations on the Saline County LRSP routes:

- Shipton Road between Ohio Street and Old 81 Highway
- Simpson Road between Country Club Road and Old 40 Highway
- Brookville Road between State Street and I-70
- Niles Road between Old 40 Highway and I-70
- Falun Road between Burma Road and I-135
- Hedville Road between I-70 and the north county line
- Old 81 Highway between Assaria (Falun Road) and I-135
- Crawford Street and Burma Road
- Burma Road and Falun Road
- Holmes Road and Water Well Road
- Curves on Old 40 Highway between the Salina east city limit and Marymount Road
- State Street and Hedville Road
- State Street and Powers Road
- Old 40 Highway and State Street

4.1.2.2. Potential Safety Countermeasures

Participant input on the potential safety countermeasures is documented as part of the meeting minutes in **Appendix G**, but treatments that were considered favorable or effective included:

- Centerline and edgeline pavement markings
- Transverse rumble strips
- Upgrading or installing guardrail with reflectors or retroreflective materials
- Flattening and widening foreslopes
- Constructing aggregate shoulders
- Providing aggregate edge wedges
- Clearing and grubbing
- Upgrading signs
- Using larger signs
- Installing a second Stop or Stop Ahead sign, and/or supplementing Stop signs with a "Cross Traffic Does Not Stop" warning plaque
- Retroreflective strips on sign posts
- Flashing beacons or LED flashing lights on Stop signs and warning signs
- Dynamic speed feedback signs
- Adequate and up-to-date curve signage
- Superelevation correction on curves

4.2. Approved Countermeasures

The approved segment, intersection, and curve countermeasures for this project, along with the corresponding Crash Modification Factors (CMFs) and estimated costs are included in the Countermeasures Technical Memorandum in **Appendix F**. It should be noted that the estimated costs were generally determined using estimated quantities with typical project unit costs applied. Due to the timing of the completion of the Technical Memorandum and the development of safety project recommendations, some of the costs for the items were adjusted to address increases in construction costs. More representative cost information was requested from each county, and if provided, was applied in the development of the final improvement project estimates.

5. SAFETY PROJECT DEVELOPMENT

5.1. Methodology

Using the GIS database that was created from the attribute data described in **Section 2** of this plan, each of the LRSP segments, intersections, and curves within the county were analyzed and assigned rankings based on the KDOT approved risk factors. The rankings of the LRSP segments, intersections, and curves were provided to the county, along with recommended safety improvement project locations. Based on the county's feedback, the recommended safety improvement project locations were finalized, the risk factors for each location were compared to the countermeasure project selection thresholds, and draft project sheets were developed. After review of the draft project sheets, final project sheets were developed which incorporated comments and additional improvements from the county. The subsections that follow further describe the major steps of the methodology.

5.1.1. GIS Database

Data obtained in coordination with KDOT and the county were incorporated into a GIS database along with roadway data collected by the project team. Data associated with each roadway segment, intersection, and horizontal curve was used in the analysis of risk along the LRSP routes throughout the county. The database elements are described in **Section 2** of this plan.

5.1.2. Risk Factor Ranking

Segments, intersections, and curves were analyzed throughout the county for risk factors identified in **Section 3** of this plan. Risk factors were determined to identify locations that have a higher likelihood of crashes involving serious injuries and/or fatalities. For every segment, intersection, and curve along the LRSP routes, risk factors were evaluated, and each location was ranked based on these risk factors. Risk factor scoring criteria was determined during the previous phases of the LRSP project and reviewed as part of the Phase 3 project. The review is documented in the Risk Factor Ranking and Countermeasure Selection Technical Memorandum which is included in **Appendix I**. The revised scoring criteria, which includes LRSP Phase 3 modifications, are identified in further detail in later subsections of **Section 5**. Some items of note:

- Volume is considered a significant risk factor since the probability of a crash is higher as volume (exposure) increases. The scoring has been weighted accordingly and criteria were established separately for each county based on the data that were collected as part of this project. (i.e., only volumes on Saline County Roads were compared to Saline County Roads as opposed to comparing volumes to other counties.)
- Scoring thresholds for several risk factors (e.g., edge condition and roadside assessment) were established separately for each county based on the data that were collected as part of this project.
- Crash experience is included in the scoring for all segments, intersections, and curves. However, this does not carry an overly significant weight since the intent is a systemic process rather than overvaluing "hot spot" locations.
- Access density scores were eliminated for intersections with ADT less than or equal to 400 vehicles per day (based on the American Association of State Highway and Transportation Officials' (AASHTO) guidelines for a very low-volume local road) and for segments and curves where the posted speed limit is less than or equal to 30 miles per

hour. Also, if a segment, intersection, or curve is located within a census-designated corporate area, it received no risk factor points for access density.

Specific risk factor scores determined for all of Saline County's LRSP segments, intersections, and curves are included in **Appendix J**, **Appendix K**, and **Appendix L**. Based on a review of the risk factor scores, the crash frequency lists, and locations of concern expressed during the Safety Workshop, the project team coordinated with KDOT and the county to develop a list of recommended safety improvement project locations (10 total) for the LRSP study routes.

5.1.3. Countermeasure Project Selection Thresholds

Countermeasure project selection thresholds for roadway segments, intersections, and curves were developed during previous phases of the LRSP project and reviewed as part of the Phase 3 project. The review is documented in the Risk Factor Ranking and Countermeasure Selection Technical Memorandum in **Appendix I**. Revised threshold tables developed as part of the review are included in the Technical Memorandum and allow uniform recommendations to be provided across the counties. Establishing thresholds allows for a unique set of recommendations to meet the specific safety needs of each location. Some items of note in the development of the thresholds are summarized below:

- Clearing and grubbing is recommended for all projects. For specific roadway segment project locations, the associated cost is based on a review of the site videos.
- A general threshold of an ADT greater than 400 vehicles per day was applied for several project types based on AASHTO's guidelines for a very low-volume local road.
- Edgeline or centerline rumble strip installation is recommended to include a feasibility review, primarily in consideration of the existing pavement types and/or width.
- New pavement treatments for segments or curves are recommended to include an appropriate amount of full depth reconstruction to accommodate the treatment, whether this is just partial reconstruction (e.g., shoulder paving to accommodate use of a safety edge) or full depth reconstruction to completely repave a roadway.
- Flattening and widening foreslopes is a long-term countermeasure that typically includes the extension of existing drainage pipes/culverts. The general intent of this is to complete as much shoulder and foreslope improvements as possible within the available right-of-way. Where applicable, the extension of existing drainage pipes/culverts was added as a site-specific countermeasure for segments where there may be a delay in funding for the ultimate long-term improvements.
- The use of retroreflective strips on stop signs and curve signage (chevrons) are low-cost effective treatments included for all projects.
- Installation of an additional "Stop" sign and "Stop Ahead" sign for an intersection approach includes these additional signs on the left side of the approach. The threshold identified for this countermeasure (minor road ADT greater than 400) was set to include this treatment on higher volume minor approaches and avoid overuse.
- Vertical grade modifications for intersections with a sight distance concern were not included as part of the project selection thresholds but can be added as a site-specific countermeasure for selected intersections based on county input.
- Curve countermeasure thresholds are consistent whether evaluated as part of a curve or a segment project.

5.1.4. Project Sheets

Unique project sheets were developed for each of the recommended safety improvement project locations (10 total). The draft project sheets were reviewed by the county and final project sheets were developed which incorporated the comments received as well as any additional improvements requested by the county. The final project locations and project sheets for Saline County are provided in **Appendix M** of this plan. Each project sheet includes the project location, project type, proposed improvements, and an opinion of probable cost. The project selection thresholds were applied to each location to assist in identifying which countermeasures should be applied to the location based on the attributes. Other things to note on the project sheets, include the following:

- Where multiple segments (or intersections or curves) are identified on a project sheet, the risk factor scoring information is for the highest ranked segment (or intersection or curve).
- The table on the back page of the project sheets is where additional site-specific improvements can be identified, such as culvert extensions, vertical grade adjustments, or in the case of some curves, total reconstruction.
- For projects along an LRSP segment (or group of segments) that also contain one or more LRSP curves, the project sheets include improvements for the curves. Some LRSP intersection improvements (e.g., transverse rumble strips on paved stop-controlled minor roads) may be included on the corresponding segment project sheets. Where applicable, these additional project benefits are generally identified on the back side of the project sheet.
- When a curve reconstruction project impacts an adjacent intersection, costs were included on the back of the project sheet for tying in the affected intersection legs.
- The project sheets are designed to provide the county with information needed when applying for HRRR funding through KDOT. For example, a crash history table has been added to the project sheet to assist the county in preparing their HRRR funding application.
- The estimated project cost summary on the back side of the project sheets includes line items for general items (e.g., mobilization, traffic control, design engineering, and construction inspection), as determined during the previous phases of the LRSP project, along with a contingency factor. It should be noted that the overall project cost summary reflects the total of the recommended safety improvements, rather than a smaller subset that the county might select for HRRR funding.

5.2. Segments

The following sections summarize the risk factor ranking criteria, project locations, and recommendations for the segments analyzed along the LRSP study routes.

5.2.1. Segment Risk Factor Ranking Criteria

Risk factor ranking criteria for the LRSP segments, including their associated point values, are illustrated in **Table 2**. Specific scores for all of Saline County's LRSP segments, along with the point breakdown for each risk factor, and a graphical representation of the scores are included in **Appendix J**.

Table 2 – Segment Risk Factor Ranking Criteria

Risk Factor	Measurement	Points	Max Points Available
Average Daily Traffic (ADT) volume	Average roadway segment volume per county	0: ADT within 0%-14.3% percentile range	6
		1: ADT within 14.3%-28.6% percentile range	
		2: ADT within 28.6%-42.9% percentile range	
		3: ADT within 42.9%-57.1% percentile range	
		4: ADT within 57.1%-71.4% percentile range	
		5: ADT within 71.4%-85.7% percentile range	
		6: ADT within 85.7%-100% percentile range	
Access density	Density of intersections and driveways per mile	0: Bottom third of the access density Crash Modification Factor (CMF)* or ≤ 30 mph	2
		1: Middle third of the access density CMF*	
		2: Top third of the access density CMF*	
Edge condition	Observed condition rating	0: Rating of 2.75–3	3
		1: Top third of remaining ratings	
		2: Middle third of remaining ratings	
		3: Bottom third of remaining ratings	
Roadside assessment	Observed condition rating	0: Rating of 2.75–3	3
		1: Top third of remaining ratings	
		2: Middle third of remaining ratings	
		3: Bottom third of remaining ratings	
Roadway width	Width in feet	0: Roadway width greater than or equal to 22 feet	2
		2: Roadway width less than 22 feet	
Shoulder width	Width in feet of recoverable area prior to a ditch or fill slope	0: 4-foot shoulder and greater, or unpaved road	2
		1: 2-foot shoulder to 4-foot shoulder	
		2: less than 2-foot shoulder	
Lane departure crash rate	Lane departure crashes per MVMT	0: Bottom fourth of roadway departure crash rates along the roadway segments	3
		1: Second lowest fourth of roadway departure crash rates along the roadway segments	
		2: Second highest fourth of roadway departure crash rates along the roadway segments	
		3: Top fourth of roadway departure crash rates along the roadway segments	
Presence of pavement markings	Observed presence of markings	0: Both centerline and edgeline present, or unpaved road	2
		1: Centerline or edgeline present	
		2: Neither centerline or edgeline present	
Surface type	Paved or unpaved	0: Paved	1
		1: Unpaved	

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

5.2.2. Segment Project Location Recommendations

Based on a review of the risk factor scores for all of Saline County's LRSP segments, as shown in **Appendix J**, the project team coordinated with the county to develop a list of recommended safety improvement project locations (up to a maximum of 10) for their LRSP. In addition to the risk factor scoring, input from the Safety Workshop and findings from the crash frequency listings were also considered as part of the project location selection. The following segments were identified for improvements:

- Segment 4: E Country Club Road between N Niles Road and S Kipp Road
- Segments 106, 109, and 110: W State Street between Hedville Road and K-140
- Segment 44: N Simpson Road between Old 40 Highway and E Country Club Road
- Segment 108: W State Street between S Brookville Road and S Hedville Road
- Segments 29 and 30: N Brookville Road between State Street and Ottawa Road (Ottawa County line)
- Segment 34: N Halstead Road between I-70 and W State Street

5.2.3. Prioritized Segment Recommendations

The final segment project sheets for Saline County are provided in **Appendix M** of this plan. Costs identified on the project sheets for the recommended improvements are shown in **Table 3**.

Table 3 – Opinion of Probable Cost for Segment Project Locations

ID	Segment Description	Opinion of Probable Cost			
		Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *
4	E Country Club Road between N Niles Road and S Kipp Road	$58,000	$489,000	$150,000	$1,196,000
106, 109, 110	W State Street between Hedville Road and K-140	$222,000	$1,506,000	$390,000	$3,459,000
44	N Simpson Road between Old 40 Highway and E Country Club Road	$54,000	$552,000	$180,000	$1,344,000
108	W State Street between S Brookville Road and S Hedville Road	$114,000	$527,000	$631,000	$2,115,000
29, 30	N Brookville Road between State Street and Ottawa Road (Ottawa County line)	$177,000	$915,000	$390,000	$2,449,000
34	N Halstead Road between I-70 and W State Street	$47,000	$290,000	$222,000	$959,000
Total		**$672,000**	**$4,279,000**	**$1,963,000**	**$11,522,000**

** Includes estimates for mobilization, traffic control, contingency, design engineering, and construction inspection as identified on project sheet.*

5.3. Intersections

The following sections describe the intersection risk factor ranking criteria, locations for improvements, and recommended improvements.

5.3.1. Intersection Risk Factor Ranking Criteria

Risk factor ranking criteria for the LRSP intersections, including their associated point values, are shown in **Table 4**. Specific scores for all of Saline County's LRSP intersections, along with the point breakdown for each risk factor, are included in **Appendix K**.

Table 4 – Intersection Risk Factor Ranking Criteria

Risk Factor	Measurement	Points	Max Points Available
Average Daily Traffic (ADT)	ADT on all approaches per intersection with a paved approach per county	0: ADT within 0%-14.3% percentile range	6
		1: ADT within 14.3%-28.6% percentile range	
		2: ADT within 28.6%-42.9% percentile range	
		3: ADT within 42.9%-57.1% percentile range	
		4: ADT within 57.1%-71.4% percentile range	
		5: ADT within 71.4%-85.7% percentile range	
		6: ADT within 85.7%-100% percentile range	
Proximity of driveway or another intersection	Number of driveways or intersections within 500 feet of the intersection	0: None (or ADT less than 400 or within census corporate limits)	2
		1: 1 or 2 access points	
		2: More than 2 access points	
Sight distance	Based on field observations	0: Adequate	3
		3: Limited	
Location on a curve	Intersection on a curve	0: No	3
		3: Yes	
Crash history	Fatal or debilitating injury crashes	0: None	3
		3: 1 or more	
Distance from previous stop sign (along the LRSP routes)	Miles - based on field data collection	0: 1.5 miles or less	3
		2: 1.5 miles to less than 5 miles	
		3: 5 miles or more	
Skew	Degrees	0: 75 degree to 90-degree intersection approaches	3
		3: 75 degree or less intersection approach	
Intersection control	Observed control type	0: Yield/none	1
		1: Stop	

5.3.2. Intersection Project Location Recommendations

Based on a review of the risk factor scores for all of Saline County's LRSP intersections, as shown in **Appendix K**, the project team coordinated with the county to develop a list of recommended safety improvement project locations (up to a maximum of 10) for their LRSP. In addition to the risk factor scoring, input from the Safety Workshop and findings from the crash frequency listings were also considered as part of the project location selection. Based on the analysis, the following intersections were selected:

- Intersection 57: E Old 40 Highway and N Simpson Road
- Intersection 226: W Crawford Street and S Burma Road
- Intersection 49: E Old 40 Highway and E Stimmel Road
- Intersection 56: E Old 40 Highway and N Niles Road

5.3.3. Prioritized Intersection Recommendations

The final intersection project sheets for Saline County are provided in **Appendix M** of this plan. Estimated costs identified on the project sheets for the recommended improvements are shown in **Table 5**.

Table 5 – Opinion of Probable Cost for Intersection Project Location

ID	Intersection Description	Opinion of Probable Cost			
		Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *
57	E Old 40 Highway and N Simpson Road	$29,000	$406,000	$450,000	$1,502,000
226	W Crawford Street and S Burma Road	$37,000	$6,000	$450,000	$846,000
49	E Old 40 Highway and E Stimmel Road	$14,000	$100,000	$0	$196,000
56	E Old 40 Highway and N Niles Road	$21,000	$400,000	$458,000	$1,491,000
Total		**$101,000**	**$912,000**	**$1,358,000**	**$4,035,000**

** Includes estimates for mobilization, traffic control, contingency, design engineering, and construction inspection as identified on project sheet.*

5.4. Curves

The following sections contain the risk factor ranking criteria, locations, and recommendations for curve improvements.

5.4.1. Curve Risk Factor Ranking Criteria

Risk factor ranking criteria for the LRSP curves, including their associated point values, are shown in **Table 6**. Specific scores for all of Saline County's LRSP curves, along with the point breakdown for each risk factor, are included in **Appendix L**.

Table 6 – Curve Risk Factor Ranking Criteria

Risk Factor	Measurement	Points	Max Points Available
Average Daily Traffic (ADT) volume	Average curve volume per county	0: ADT within 0%-14.3% percentile	6
		1: ADT within 14.3%-28.6% percentile	
		2: ADT within 28.6%-42.9% percentile	
		3: ADT within 42.9%-57.1% percentile	
		4: ADT within 57.1%-71.4% percentile	
		5: ADT within 71.4%-85.7% percentile	
		6: ADT within 85.7%-100% percentile	
Curve radius	Radius of curve in feet per county	0: Top fourth of curve radii	3
		1: Second highest fourth of curve radii	
		2: Second lowest fourth of curve radii	
		3: Bottom fourth of curve radii	
Access density	Intersections or driveways within 500 feet of the curve	0: None or speed limit ≤ 30 mph	2
		1: 1 or 2 access points	
		2: More than 2 access points	
Shoulder width	Width in feet of recoverable area prior to a ditch or fill slope	0: 4-foot shoulder and greater, or unpaved road	2
		1: 2-foot shoulder to 4-foot shoulder	
		2: less than 2-foot shoulder	
Edge condition	Observed condition rating	0: Rating of 3	2
		1: Rating of 2	
		2: Rating of 1	
Roadside assessment	Observed condition rating	0: Rating of 3	2
		1: Rating of 2	
		2: Rating of 1	
Superelevation	Presence of superelevation	0: Yes	2
		2: No	
Crash history	Fatal or debilitating injury crashes	0: None	3
		3: 1 or more	
Presence of warning signs	Observed presence	0: Present	2
		2: Not present	

5.4.2. Curve Project Location Recommendations

Based on a review of the risk factor scores for all of Saline County's LRSP curves, as shown in **Appendix L**, the project team coordinated with the county to develop a list of recommended safety improvement project locations (up to a maximum of 10) for their LRSP. In addition to the risk factor scoring, input from the Safety Workshop and findings from the crash frequency listings were also considered as part of the project location selection. Based on the analysis, the focus in Saline County was on segments and intersections, and specific recommendations were not developed for curves.

6. SUMMARY

6.1. Recommended Improvements

The ten recommended safety improvement project locations identified as part of this LRSP, along with an opinion of their probable cost are shown in **Table 7**.

Table 7 – Opinion of Probable Cost for Saline County LRSP Project Locations

ID	Project Location Description	Opinion of Probable Cost			
		Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *
Segment 4	E Country Club Road between N Niles Road and S Kipp Road	$58,000	$489,000	$150,000	$1,196,000
Segments 106, 109, 110	W State Street between Hedville Road and K-140	$222,000	$1,506,000	$390,000	$3,459,000
Segment 44	N Simpson Road between Old 40 Highway and E Country Club Road	$54,000	$552,000	$180,000	$1,344,000
Segment 108	W State Street between S Brookville Road and S Hedville Road	$114,000	$527,000	$631,000	$2,115,000
Segments 29, 30	N Brookville Road between State Street and Ottawa Road (Ottawa County line)	$177,000	$915,000	$390,000	$2,449,000
Segment 34	N Halstead Road between I-70 and W State Street	$47,000	$290,000	$222,000	$959,000
Intersection 57	E Old 40 Highway and N Simpson Road	$29,000	$406,000	$450,000	$1,502,000
Intersection 226	W Crawford Street and S Burma Road	$37,000	$6,000	$450,000	$846,000
Intersection 49	E Old 40 Highway and E Stimmel Road	$14,000	$100,000	$0	$196,000
Intersection 56	E Old 40 Highway and N Niles Road	$21,000	$400,000	$458,000	$1,491,000
Total		**$773,000**	**$5,191,000**	**$3,321,000**	**$15,557,000**

** Includes estimates for mobilization, traffic control, contingency, design engineering, and construction inspection as identified on project sheet.*

6.2. Next Steps

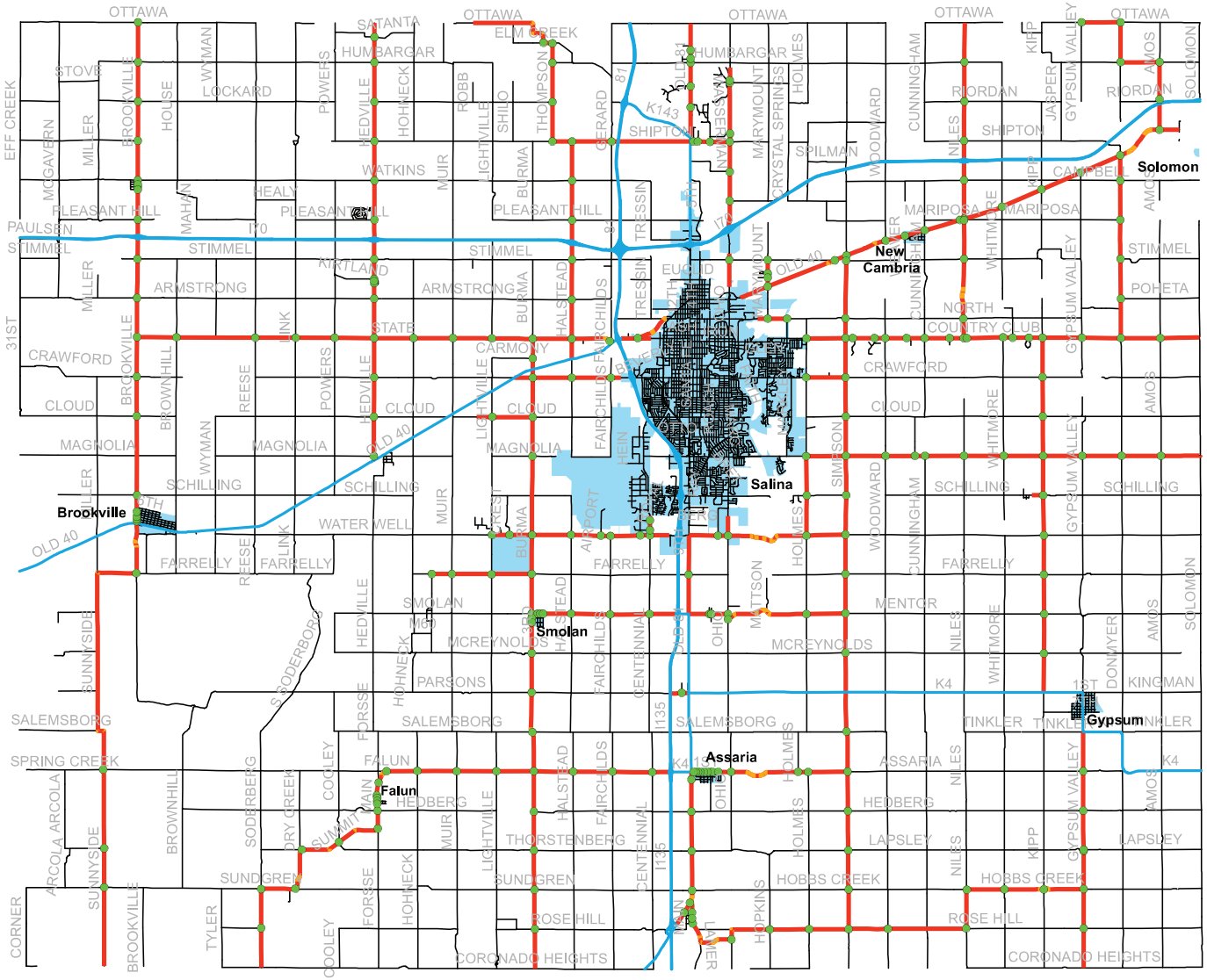
The process established as part of the Phase 3 LRSP project for KDOT has resulted in the identification of several recommended safety improvement projects throughout Saline County based on a systemic review of their LRSP study routes. Unique project sheets have been developed for each of these projects and have been designed to provide the county with the information needed to apply for HRRR funding through KDOT. An important and logical next step for the county would be to utilize these resources to implement safety improvements on their roadway network. Simply by completing this LRSP, the county is in a highly advantageous position to obtain some of these competitive safety funds.

Going forward, the project team recommends that the county consider designating a safety champion to lead the effort in implementing the results of this LRSP. This person could also lead, develop, or participate in a local safety coalition that takes part in the planning, implementing, evaluating, and updating of this LRSP. Stakeholders from all of the “Five E’s” should be included, starting with representatives who participated in this process by attending the Saline County Safety Workshop. As noted previously, this type of multidisciplinary approach is essential to enhancing overall safety of the roadway system.

Finally, an LRSP is intended to be a “living” document. As such, it would be appropriate to review, or update the plan on a regular basis (e.g., every five years or so) by reevaluating crash trends and changes to roadway characteristics. This review will aid in reprioritizing safety improvements for segments, intersections, and curves based on current local needs and priorities.

APPENDIX A

LRSP STUDY ROUTES



Saline County LRSP Study Routes

Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment
- LRSP Curve
- LRSP Intersection

Length of Segments: 237 miles
Paved: 171 miles (72%)
Unpaved: 66 miles (28%)
Number of Curves: 74
Number of Intersections: 264

APPENDIX B

CRASH ANALYSIS TECHNICAL MEMORANDUM (FROM PREVIOUS LRSP PHASES)

KDOT LOCAL ROAD SAFETY PLANS (LRSPS) – PHASE 1

KDOT PROJECT NO: 106 C-4790-02

CLARK, COMANCHE, COWLEY, CRAWFORD, DOUGLAS, ELLIS, FORD, GRANT, GRAY, HASKELL, JEFFERSON, KIOWA, LYON, MARION, MEADE, MONTGOMERY, NESS, PAWNEE, REPUBLIC, AND RICE COUNTIES

Prepared for:

KDOT Bureau of Local Projects
Eisenhower State Office Building
700 S.W. Harrison Street, 3rd Floor West
Topeka, Kansas 66603-3745
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Prepared by:

TranSystems
EXPERIENCE | Transportation

Kimley»Horn

May 2019
091841008

Kimley»Horn

TECHNICAL MEMORANDUM - CRASH ANALYSIS

FOR

KDOT LOCAL ROAD SAFETY PLANS (LRSPS) – PHASE 1

KDOT PROJECT NO: 106 C-4790-02

Prepared for:
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STATUTORY NOTICE

23 U.S.C. § 409: US Code - Section 409: 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.

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List of Acronyms

A	Serious Injury Crash
ADT	Average Daily Traffic
CMF	Crash Modification Factor
FHWA	Federal Highway Administration
K	Fatal Crash
KDOT	Kansas Department of Transportation
LRSP	Local Road Safety Plan
SHSP	Strategic Highway Safety Plan

1. INTRODUCTION

The Kansas Department of Transportation (KDOT), as part of their strategic goal to reduce fatalities and serious injuries within Kansas is conducting Phase 1 of the Local Road Safety Plan (LRSP) process for twenty counties within the state. Four counties were included in the Pilot Phase of this process, which was completed in 2018. The LRSP concept is built on the foundation established by the Strategic Highway Safety Plan (SHSP). Based on discussions with KDOT, crashes within a 37-county area, inclusive of KDOT District 3 and District 6, were analyzed as part of the LRSP Phase 1 project. As part of the Pilot Phase, the crash history within the 19-county region, included in the Kansas Department of Health and Environment's South Central Healthcare Coalition, was analyzed. **Figure 1** shows the location of the Phase 1 Crash Tree Analysis Area (District 3 and District 6 counties), the Phase 1 LRSP counties, the Pilot Phase Crash Tree Analysis Area (19-county region), and the Pilot Phase counties.

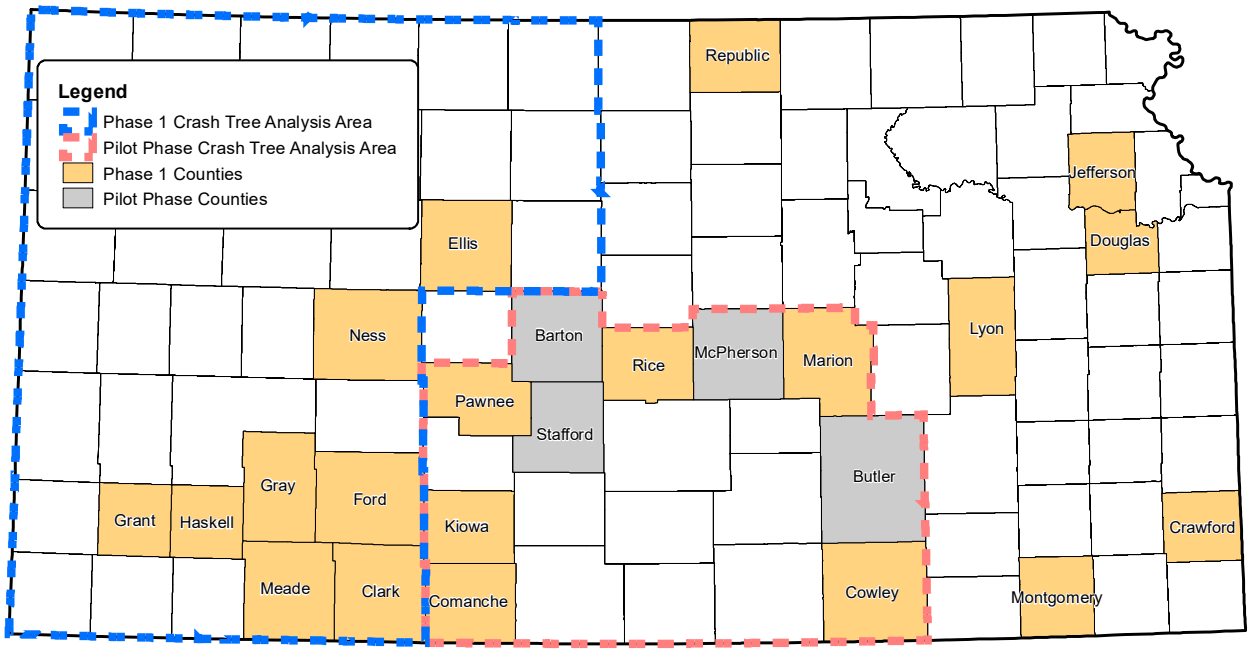


Figure 1 – Location of Crash Tree Analysis Regions and LRSP Counties

1.1. Purpose

This document has been prepared to provide a comparison of the crash trees developed for the LRSP Phase 1 project to the crash trees that were developed during the LRSP Pilot Phase. Based on the information contained in the crash trees and other known safety research, risk factors have been identified for determining the attributes for data collection, which are summarized in this document.

1.2. Document Organization

This Crash Analysis Technical Memorandum is organized into the following sections:

- **Section 1** presents the project background and purpose of the Technical Memorandum.
- **Section 2** summarizes the crash tree development and contains a comparison of the Phase 1 and Pilot Phase crash trees.
- **Section 3** details the risk factors recommended for the LRSP project.
- **Section 4** provides a summary of recommendations.
- **Section 5** includes the next steps in the project.

2. CRASH TREES

The following sections describe the process of developing the Pilot Phase Crash Trees and a comparison to the Phase 1 Crash Trees.

2.1. LRSP Pilot Phase Crash Trees (19-County Region)

The Pilot Phase Crash Tree Analysis Area included the following counties:

- Barber
- Barton
- Butler
- Comanche
- Cowley
- Edwards
- Harper
- Harvey
- Kingman
- Kiowa
- Marion
- McPherson
- Pawnee
- Pratt
- Reno
- Rice
- Sedgwick
- Stafford
- Sumner

2.1.1. Crash Data

Crash data was provided by KDOT including five years of data from 2011 to 2015. Over 86,000 crash records were included in the crash database. The database includes data on the crash level, vehicle level, and person level. For the purposes of this analysis the crash and vehicle level information were used.

The KABCO injury severity scale (National Safety Council, 1990) is used to summarize the crash data in the following charts. The KABCO scale is used by the investigating police officer on the scene to classify injury severity for occupants with five categories:

- K, killed;
- A, disabling injury;
- B, evident injury;
- C, possible injury;
- O, no apparent injury.

The focus of the LRSP is to identify systemic safety improvements that target reductions in fatal (Type K) and serious injury (Type A) crashes.

These definitions may vary slightly for different police agencies. Within this memorandum "K" signifies a fatal crash and "A" represents a serious injury crash.

Figure 2 shows a summary of the crashes within the 19-county region, all crashes as well as fatal and serious injury crashes. It should be noted that while only 15% of the region's crashes occur on county roads, 24% of the fatal or serious injury crashes occur on county roads.

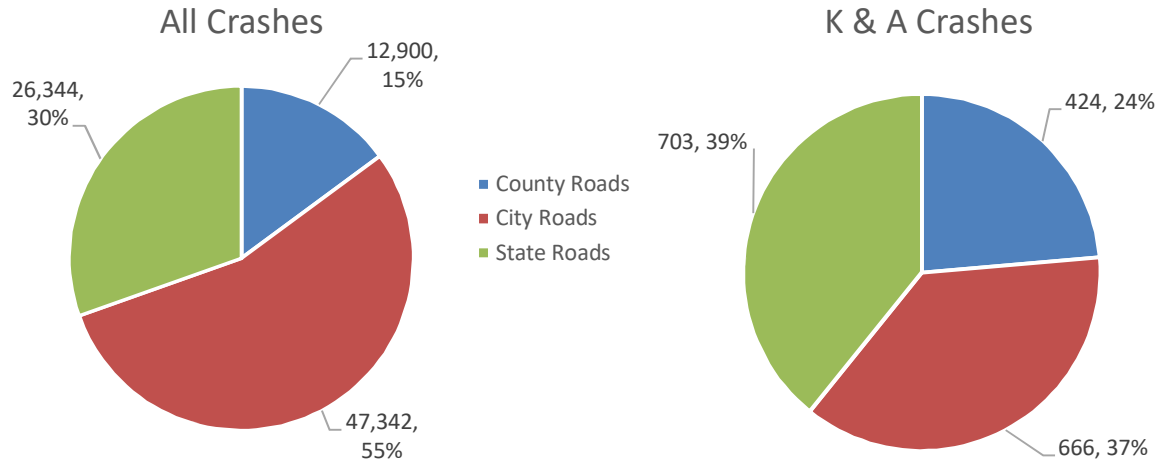


Figure 2 – Crashes within the Pilot Phase Crash Tree Analysis Area (2011-2015)

2.1.2. Crash Tree Development

Crash trees were developed using the Kansas DOT Crash Database. Crashes were included over the period from January 1, 2011 through December 31, 2015. Crashes were grouped into three categories: State, City, and County. Any crash that occurred on an Interstate, US, or Kansas highway was counted as a State crash. Crashes that did not fall into this category but occurred outside of a city were counted as County crashes. All remaining crashes within a City were counted as City crashes. In the crash database, the attribute "Surface Type" was used to determine if the crash occurred on a paved or unpaved roadway. Then, to determine if a crash occurred at an intersection, the "Accident Location" field was used. The "Traffic Controls" attribute was used to group intersection crashes by control type. Finally, to determine if non-intersection crashes occurred on a curve, the "Road Character" attribute was used.

2.1.2.1. Vehicle Action and Manner of Crash

"Vehicle Action" and "Manner of Crash" statistics are provided in the crash trees and are based on total crashes. The fatal and serious injury crashes had similar characteristics as the total crashes for the counties. Due to limited space, only the top four vehicle actions and manners of crash were typically listed under each category.

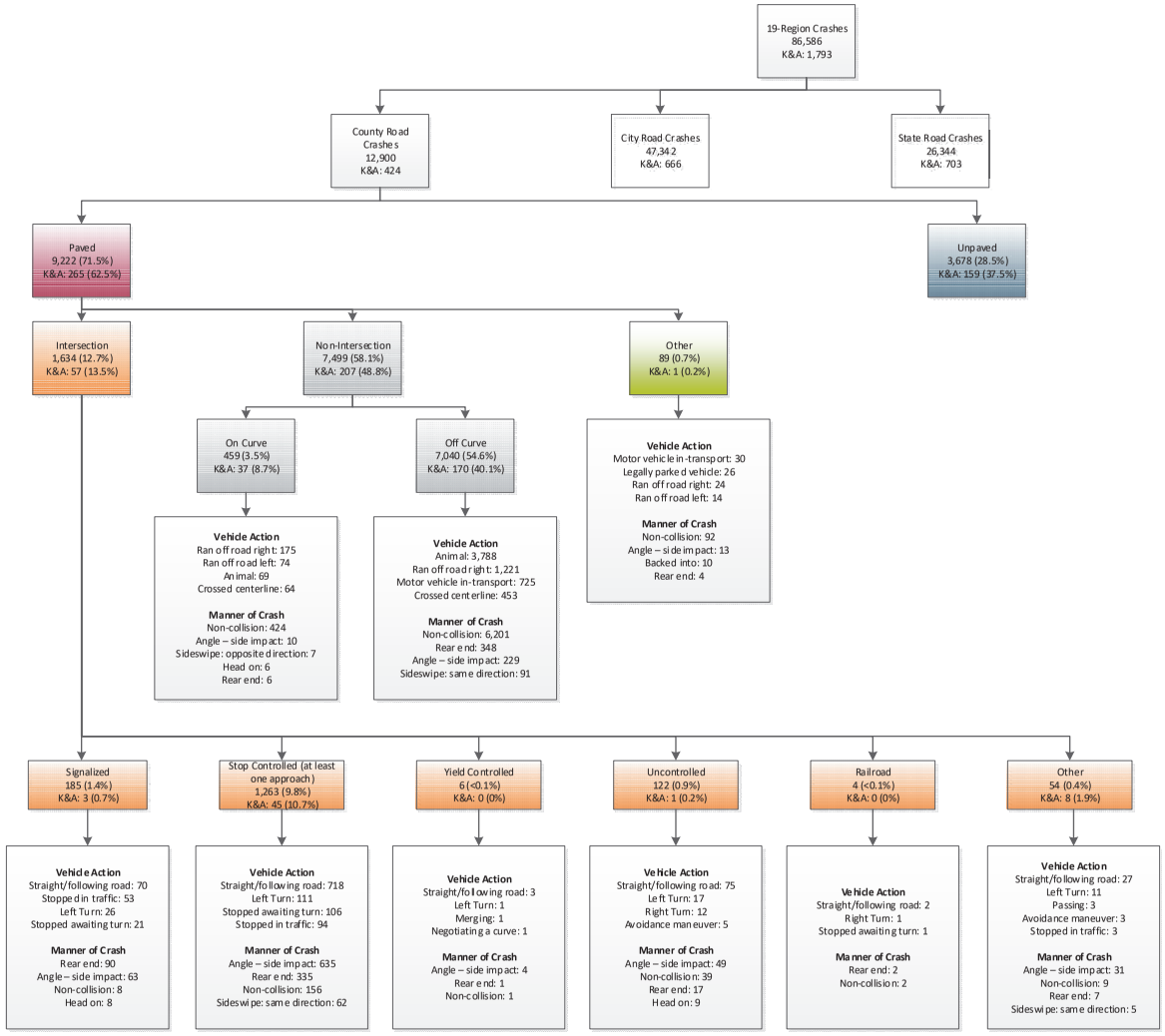
2.1.3. 19-County Region Crash Trees

In order to define the types of roadway features associated with crashes, a crash tree was developed for the 19-county region in the south-central part of the state. The crash tree includes total crashes as well as fatal and serious injury crashes; however, the vehicle action of the crash and manner of crash are reported only for total crashes. The fatal and serious injury crashes had similar vehicle actions and manners of crash as the total crashes for 19-county region. **Figure 3** shows the crash tree for paved county roads and **Figure 4** shows a crash tree for the unpaved county roads. Within the 19-county region, **71.5%** of all of county road crashes occurred on paved roadways, also **62.5%** of the county road fatal and serious injury crashes occurred on paved roads within the region. Also, **54.6%** of the county road crashes occurred on **straight roadway** segments along a paved county road, not at an intersection and not at a curve. These roadway crashes could be effectively mitigated with low-cost countermeasures such as clearing and

grubbing along the roadway, adding wider edgeline striping, widening the shoulder and/or installing rumble strips.

For both paved and unpaved roads, it should be noted that animal crashes were not removed from the analysis since there are some countermeasures that could be implemented to address these, primarily clearing the roadside foliage. However, these crashes generally do not result in a fatality or serious injury. Within the 19-county region, 2.5% of the county road fatal and serious injury (K&A) crashes involved an animal collision.

During the study period, 37.5% of the K&A crashes occurred on unpaved county roads. Just over 80% of those K&A crashes occurred on straight roadway segments.



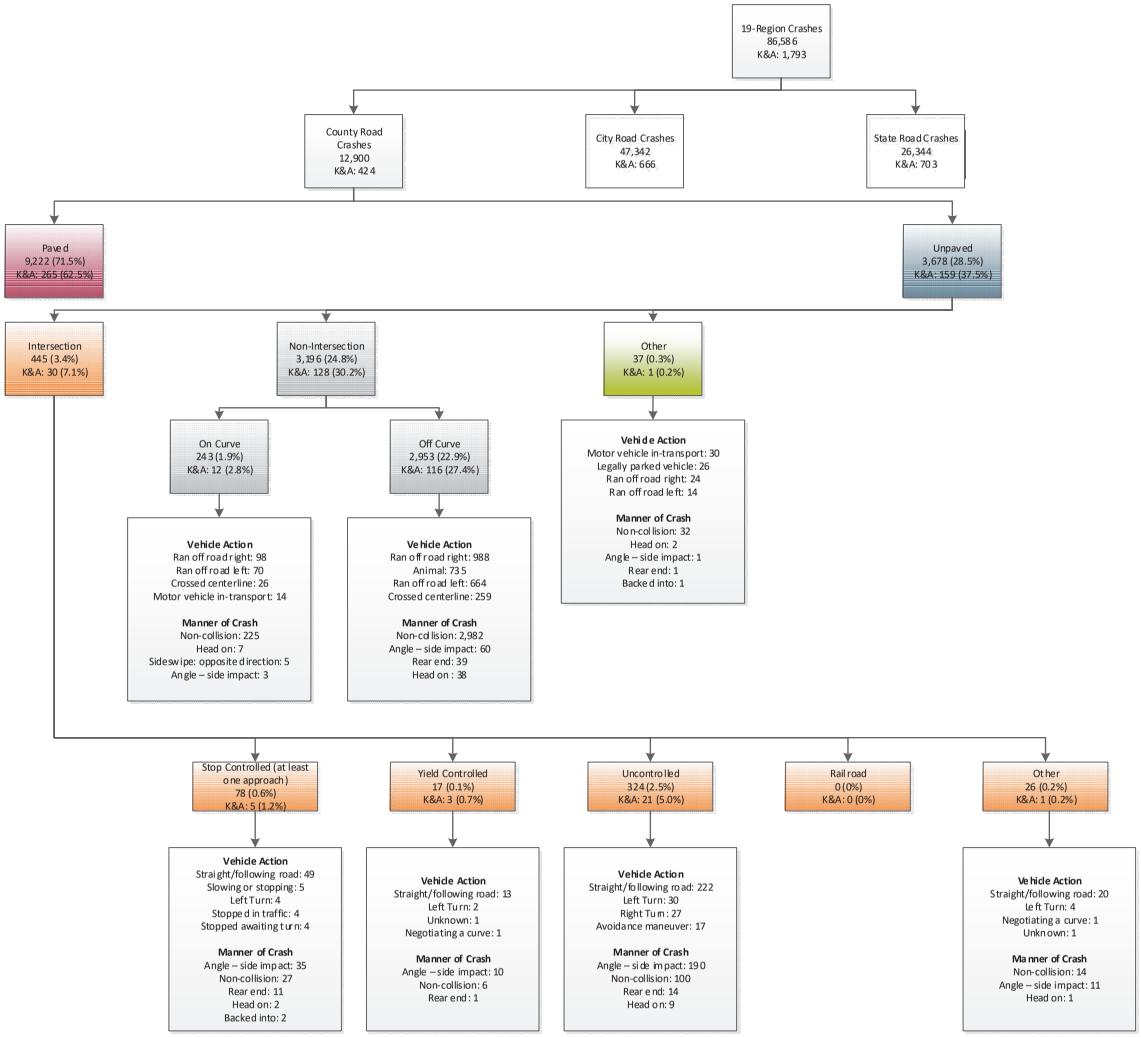
NOTE:

- Vehicle Action and Manner of Crash Statistics are based on Total Crashes.
- K&A Crashes had similar Vehicle Action and Manner of Crash.

ADDITIONAL INFORMATION:

- All percentages based on total County Road Crashes.
- "Non-Collision" – refers to a crash where the crash record did not have the "manner of crash" coded as a collision, which could be when a vehicle did not collide with another vehicle, such as a run off the road crash, jackknife, fire, tire or brake failure, etc.
- "Animal" – crash type refers to a crash that involved a collision with an animal.
- "Motor Vehicle in Transport" – vehicle action refers to a crash between two or more in-motion vehicles (as opposed to a crash with a parked vehicle).
- "Straight/following road" – refers to the vehicle action just prior to the unstabilized situation (loss of control, etc.).

Figure 3 – LRSP Pilot Phase Crash Tree – Paved (19-County Region)



NOTE:

- Vehicle Action and Manner of Crash Statistics are based on Total Crashes.
- K&A Crashes had similar Vehicle Action and Manner of Crash.

ADDITIONAL INFORMATION:

- All percentages based on total County Road Crashes.
- "Non-Collision" – refers to a crash where the crash record did not have the "manner of crash" coded as a collision, which could be when a vehicle did not collide with another vehicle, such as a run off the road crash, jackknife, fire, tire or brake failure, etc.
- "Animal" – crash type refers to a crash that involved a collision with an animal.
- "Motor Vehicle in Transport" – vehicle action refers to a crash between two or more in-motion vehicles (as opposed to a crash with a parked vehicle).
- "Straight/following road" – refers to the vehicle action just prior to the unstabilized situation (loss of control, etc.).

Figure 4 – LRSP Pilot Phase Crash Tree – Unpaved (19-County Region)

Table 1 contains a tabular summary of the Pilot Phase Crash Tree Analysis Area crashes by roadway type and **Figure 5** contains a graphical summary of the crashes, which is the same information that is presented in the crash trees.

Table 1 – Pilot Phase Crash Tree Data – Crashes by Roadway Type

Roadway Type		Total Crashes		Fatal and Serious Injury (K & A) Crashes	
		Count	Percent	Count	Percent
County Paved	Intersection	1,634	13%	57	13%
	Non-Intersection (on curve)	459	4%	37	9%
	Non-Intersection (off curve)	7,040	55%	170	40%
	Other/Unknown	89	1%	1	0%
	Subtotal	**9,222**	**71%**	**265**	**62%**
County Unpaved	Intersection	445	3%	30	7%
	Non-Intersection (on curve)	243	2%	12	3%
	Non-Intersection (off curve)	2,953	23%	116	27%
	Other/Unknown	37	0%	1	0%
	Subtotal	**3,678**	**29%**	**159**	**38%**
Total		**12,900**		**424**	

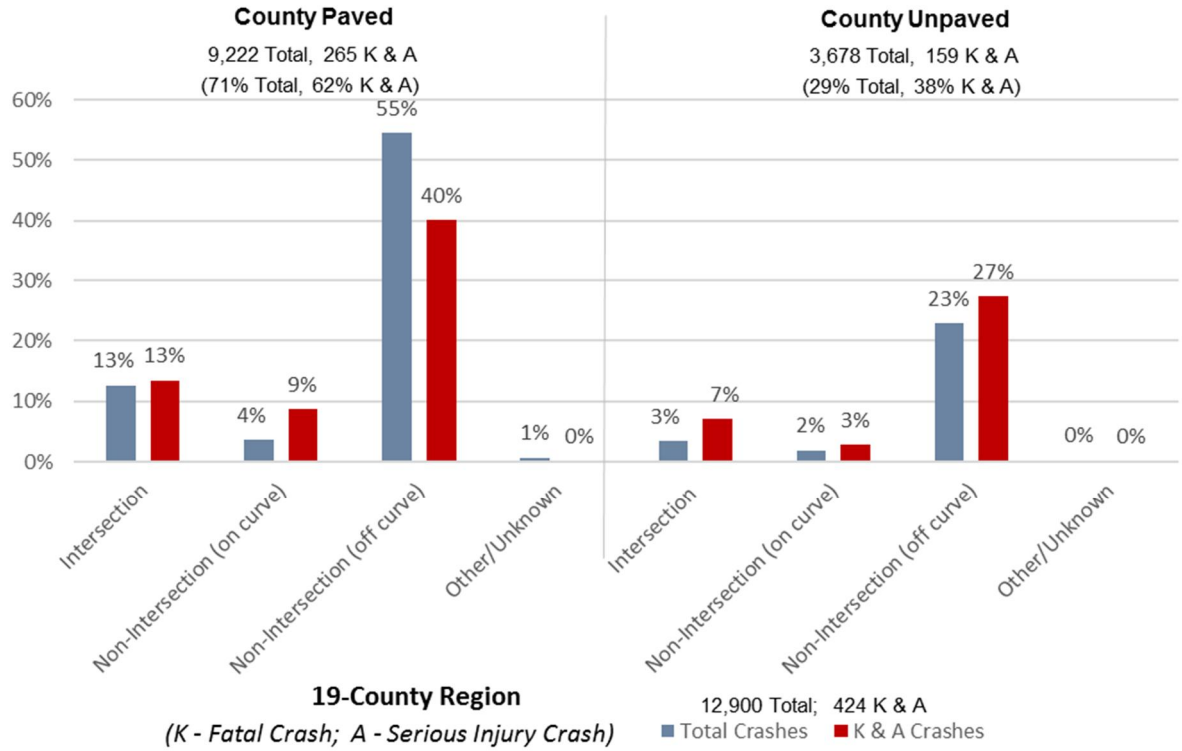


Figure 5 – Pilot Phase Crash Tree Data – Crashes by Roadway Type

2.2. LRSP Phase 1 Crash Trees (KDOT District 3 and District 6)

The development of the Phase 1 crash trees followed the same methodology as was described in the **Section 2.1 LRSP Pilot Phase Crash Trees**.

The Phase 1 Crash Tree Analysis Area included the following counties:

- Cheyenne
- Clark
- Decatur
- Ellis
- Finney
- Ford
- Gove
- Graham
- Grant
- Gray
- Greeley
- Hamilton
- Haskell
- Hodgeman
- Kearny
- Lane
- Logan
- Meade
- Morton
- Ness
- Norton
- Osborne
- Phillips
- Rawlins
- Rooks
- Russell
- Scott
- Seward
- Sheridan
- Sherman
- Smith
- Stanton
- Stevens
- Thomas
- Trego
- Wallace
- Wichita

2.2.1. Crash Data

Crash data was provided by KDOT including five years of data from 2013 to 2017. Over 25,000 crash records were included in the crash database. The database includes data on the crash level, vehicle level, and person level. For the purposes of this analysis the crash and vehicle level information were used.

Figure 6 shows a summary of the crashes within KDOT District 3 and District 6, all crashes as well as fatal and serious injury crashes. It should be noted that while only 14% of the area's crashes occur on county roads, 22% of the fatal or serious injury crashes occur on county roads. Based on data trends in other states, data analyzed during the Pilot Phase, and the nature of the county road system (design standards, etc.), it is expected that county roads in Kansas typically experience lower traffic volumes than state or city roads. It is anticipated that the fatal and serious injury crash rate on the county roads would be higher than the crash rate on state or city roads.

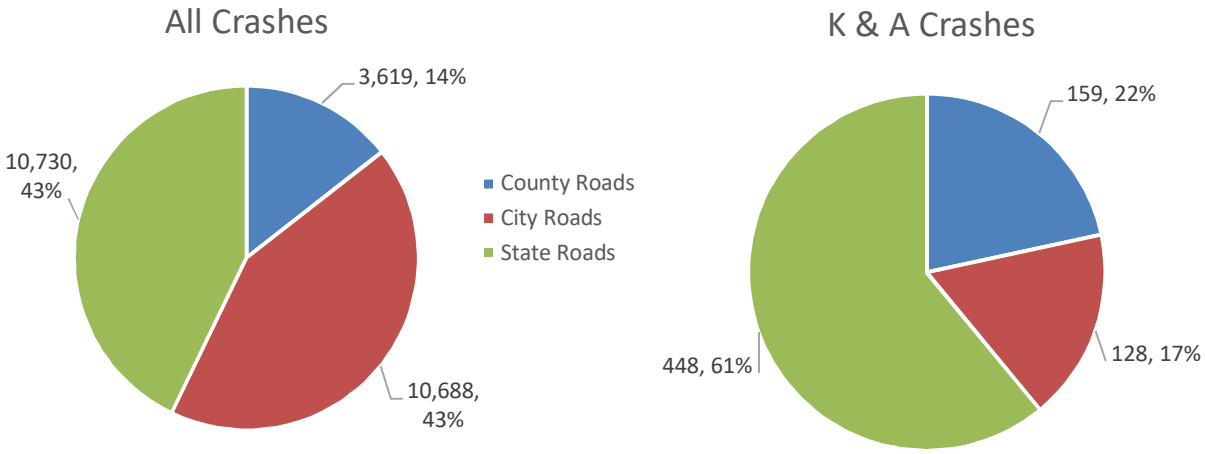


Figure 6 – Crashes within the Phase 1 Crash Tree Analysis Area (2013-2017)

2.2.2. KDOT District 3 and District 6 Crash Trees

In order to define the types of roadway features associated with crashes for Phase 1 of the LRSP project, a crash tree was developed for the KDOT District 3 and District 6 counties. Similar to the crash trees from the Pilot Phase, the crash tree includes total crashes as well as fatal and serious injury crashes; however, the vehicle action of the crash and manner of crash are reported only for total crashes. The fatal and serious injury crashes had similar vehicle actions and manners of crash as the total crashes for the KDOT District 3 and District 6 counties. **Figure 7** shows the crash tree for paved county roads and **Figure 8** shows a crash tree for the unpaved county roads. Within the KDOT District 3 and District 6 counties, **46.9%** of all county road crashes occurred on paved roadways, and **38.4%** of the county road K&A crashes occurred on paved roads within the area. Also, **32.7%** of the paved county road crashes occurred on straight roadway segments, not at an intersection and not at a curve. Similarly, as noted for the pilot phase crash analysis, these roadway crashes could be effectively mitigated with low-cost countermeasures such as clearing and grubbing along the roadway, adding wider edgeline striping, widening the shoulder and/or installing rumble strips.

Similar to the methodology in the pilot phase, for both paved and unpaved roads, animal crashes were not removed from the analysis since there are some countermeasures that could be implemented to address these, primarily clearing the roadside foliage. However, these crashes generally do not result in a fatality or serious injury. Within the KDOT District 3 and District 6 counties, 1.3% of the county road K&A crashes involved an animal collision.

Crashes on unpaved county roads within the KDOT District 3 and District 6 counties accounted for 53.1% of the total crashes and 61.6% of the K&A crashes. 82.7% of the K&A crashes on county unpaved roadways occurred on straight roadway segments.

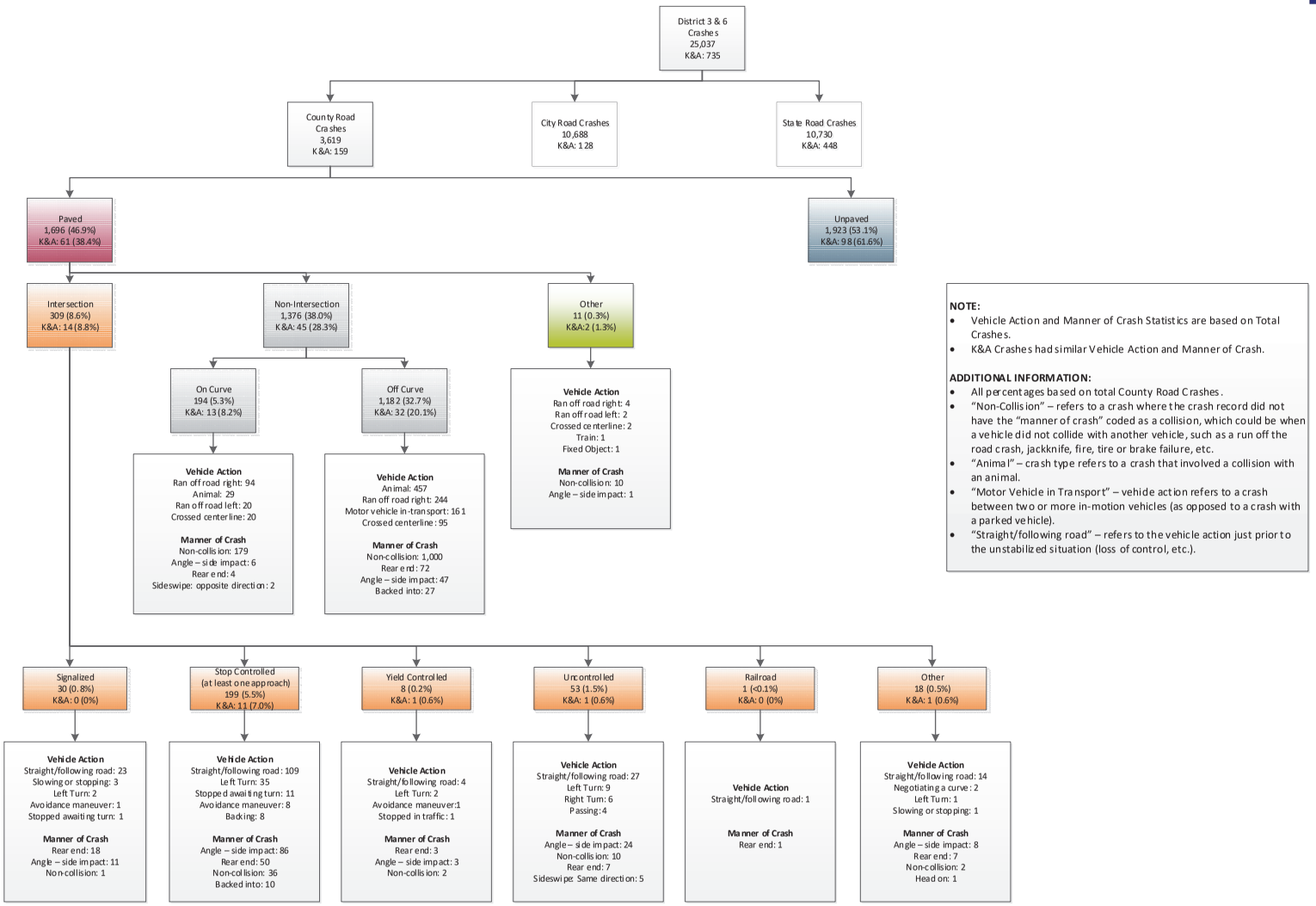


Figure 7 – LRSP Phase 1 Crash Tree – Paved (KDOT District 3 and District 6)

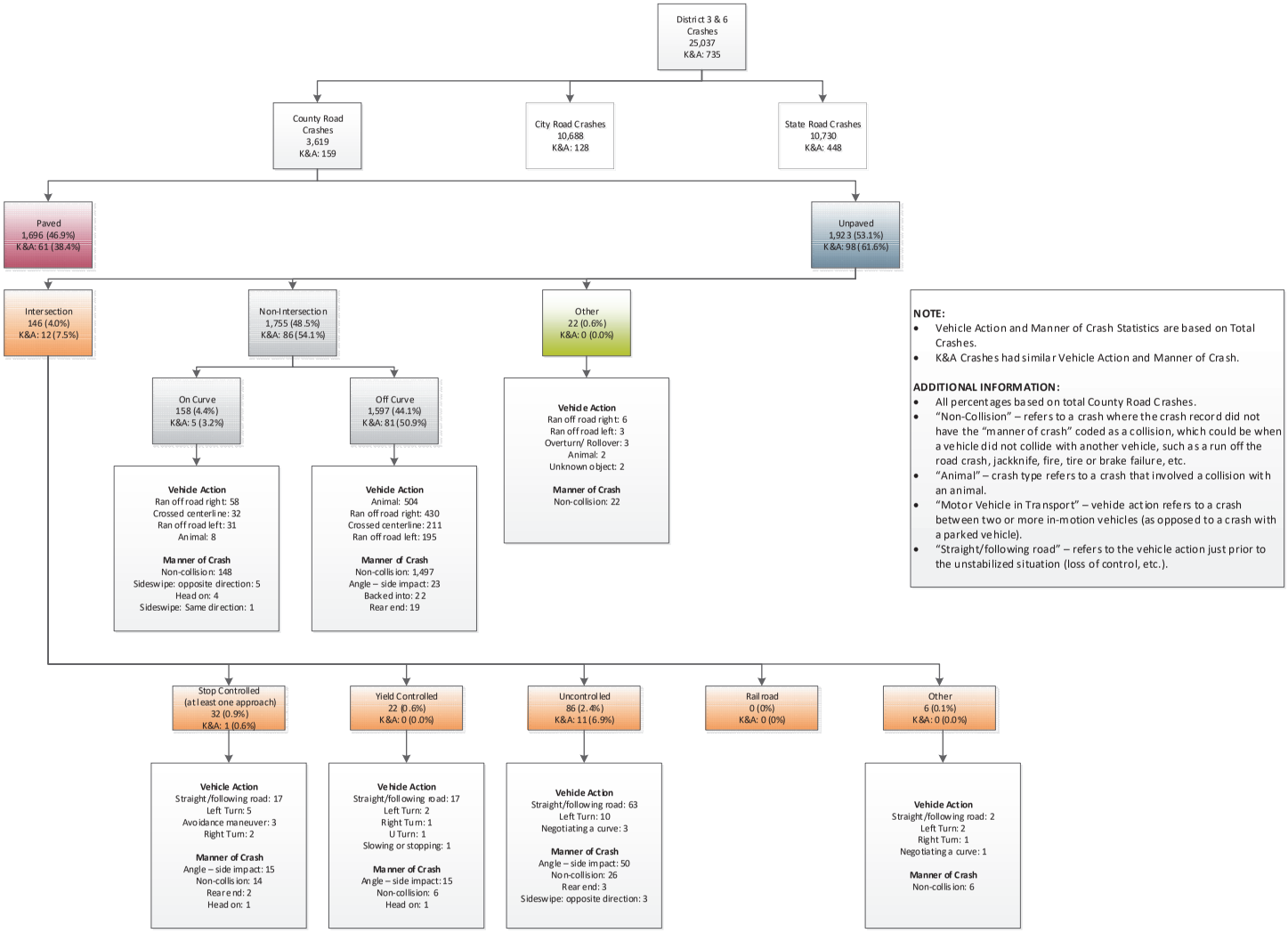


Figure 8 – LRSP Phase 1 Crash Tree – Unpaved (KDOT District 3 and District 6)

Table 2 contains a tabular summary of the KDOT District 3 and District 6 crashes by roadway type and **Figure 9** contains a graphical summary of the crash data, which is the same information that is presented in the crash trees.

Table 2 – Phase 1 Crash Tree Data – Crashes by Roadway Type

Roadway Type		Total Crashes		Fatal and Serious Injury (K & A) Crashes	
		Count	Percent	Count	Percent
County Paved	Intersection	309	9%	14	9%
	Non-Intersection (on curve)	194	5%	13	8%
	Non-Intersection (off curve)	1,182	33%	32	20%
	Other/Unknown	11	0%	2	1%
	Subtotal	**1,696**	**47%**	**61**	**38%**
County Unpaved	Intersection	146	4%	12	8%
	Non-Intersection (on curve)	158	4%	5	3%
	Non-Intersection (off curve)	1,597	44%	81	51%
	Other/Unknown	22	1%	0	0%
	Subtotal	**1,923**	**53%**	**98**	**62%**
Total		**3,619**		**159**	

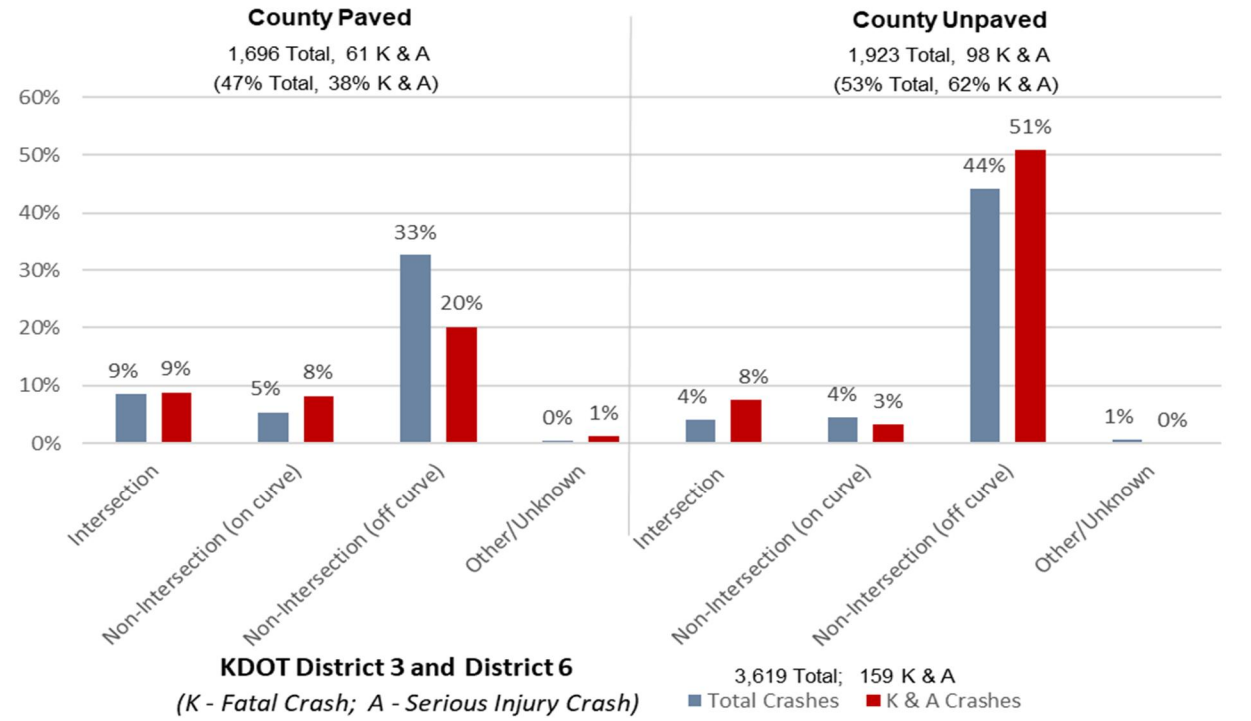


Figure 9 – Phase 1 Crash Tree Data – Crashes by Roadway Type

2.3. Comparison of Crash Trees

The Phase 1 crash tree has a larger percentage of unpaved county road crashes. It is our understanding that this corresponds to the larger percentage of unpaved county roads in the western, more rural portion of the state. The total number of crashes included in the Phase 1 crash tree was over 25,000 with 1,696 occurring on paved county roadways, while the Pilot Phase crash tree included over 86,000 crashes, with 9,222 occurring on paved county roadways. While the Phase 1 crash tree analysis area includes nearly twice the number of counties, there were less than one-third the number of total crashes as compared to the Pilot Phase due to the rural nature of the counties in the Phase 1 crash tree analysis area. The Phase 1 crash tree had a higher percentage of K&A crashes that occurred on state roadways than the Pilot Phase (61% compared to 39%), while the percentage of K&A crashes on county roads was similar (24% in Pilot Phase, 22% in Phase 1). This likely corresponds to higher K&A crash rates along county roads in Phase 1 and may be attributed to having fewer city roads in this area compared to the 19-county region.

The trends of the locations of crashes were similar, with the majority of crashes along straight roadway segments, fewer at intersections and the least at curves. In the Pilot Phase, 78% of the crashes occurred on straight segments, as well as 67% of K&A crashes. Similarly, in Phase 1, straight roadway segments accounted for 77% of the crashes and 71% of the K&A crashes. **Figure 10** shows the breakdown for all crashes for both the Pilot Phase and Phase 1 and **Figure 11** shows a similar comparison of K&A crashes.

There were a larger percentage of crashes on unpaved county roads within the KDOT District 3 and District 6 counties (Phase 1: 53.1%) than in the 19-county region (Pilot Phase: 28.5%). K&A crashes on unpaved county roads also accounted for a larger percentage of the total within KDOT District 3 and District 6, 61.6% compared to 37.5% in the 19-county region. Over 80% of the K&A crashes on county unpaved roadways occurred on straight roadway segments for both the Phase 1 and Pilot crash trees. As noted, the higher prevalence of unpaved county roads likely corresponds to these higher percentages in the Phase 1 crash tree analysis area.

The vehicle actions and manner of crashes were similar between the two crash trees, with many of the actions and manners following the same distribution order, with “ran off road right” being followed by “ran off road left”, for example.

Based on these findings, it is recommended that the risk factors developed during the Pilot Phase be used in the LRSP Phase 1 project. Using the same risk factors will also allow for more even comparison between counties and their recommended projects from the Pilot Phase, Phase 1, and future LRSP phases. The following section describes the risk factors used during the Pilot Phase.

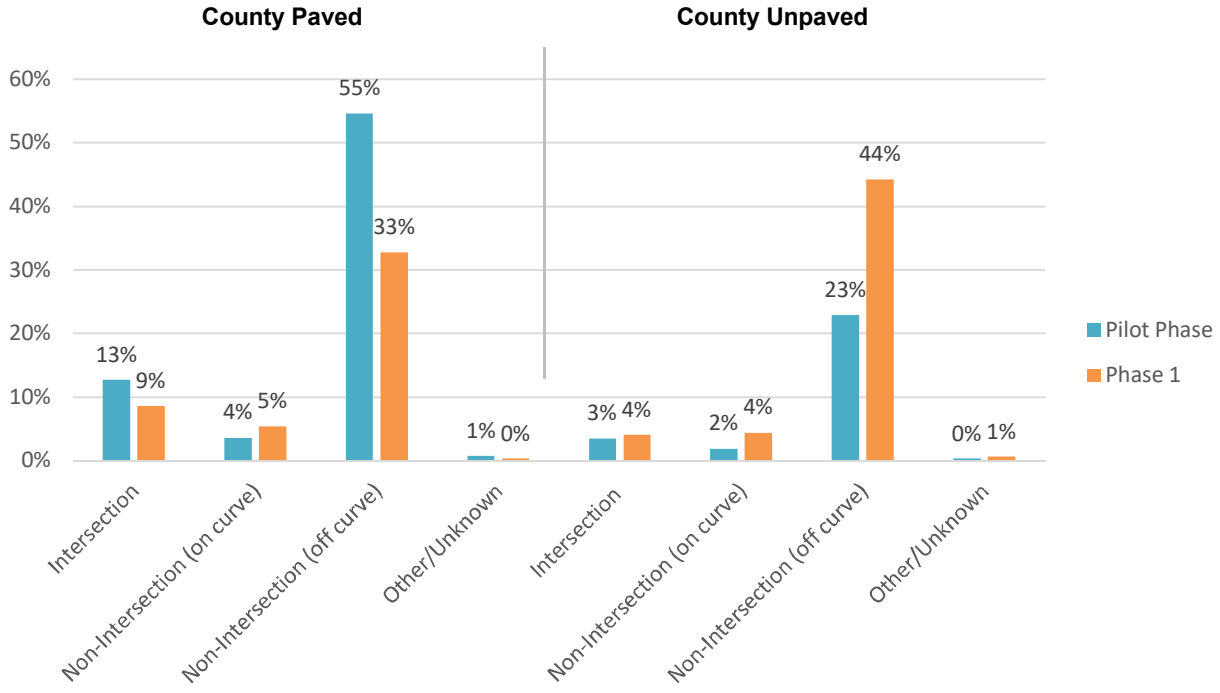


Figure 10 – All Crashes by Roadway Type (Phase 1 and Pilot Phase)

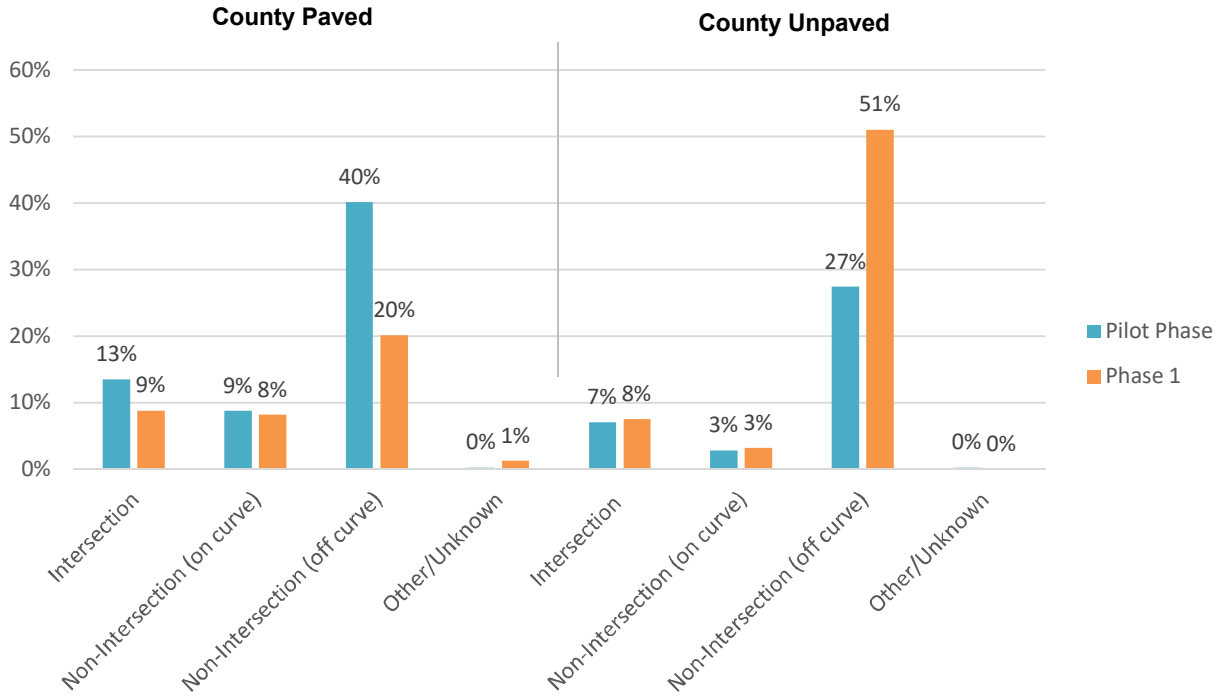


Figure 11 – K&A Crashes by Roadway Type (Phase 1 and Pilot Phase)

3. KANSAS LRSP RISK FACTORS

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

While there are many risk factors that could be used in systemic safety analysis, the following sections provide the risk factors approved by KDOT in the LRSP Pilot Phase, along with the safety issue or risk that they correspond and the method for collecting the associated data.

"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

3.1. Segment Risk Factors

Table 3 shows the risk factors, based on the crash analysis of the crash trees for segments. Each of these risk factors can be used to analyze potential risk.

Table 3 – Segment Risk Factors

Risk Factor	Issue
Average Daily Traffic (ADT) volumes	Exposure
Surface type (paved or unpaved)	Surface type
Roadway width	Staying on the roadway
Shoulder width	Staying on the roadway, recovery from crash
Access density	Conflicting movements along the segment
Presence of pavement markings	Staying on the roadway
Lane departure crash rate	History of issues staying on roadway
Edge condition	Ability of vehicle to recover from a roadway departure
Roadside assessment	Roadside collision hazard

3.2. Intersection Risk Factors

For analysis of the risk factors included in **Table 5**, data for every intersection along the study routes will be required with relevant information pertaining to each intersection. Each of these risk factors will be used to analyze potential crash risk.

Table 4 – Intersection Risk Factors

Risk Factor	Issue
Average Daily Traffic (ADT) on all approaches	Exposure
Distance from previous stop sign (along the LRSP routes)	Running the intersection
Location on a curve	Running the intersection, sight visibility
Skew	Running the intersection, sight visibility
Sight distance	Running the intersection, sight visibility
Proximity of driveway or another intersection	Conflicting movements near intersection
Fatal or serious injury crash history	History of potential safety issues
Intersection control	Control type

3.3. Curve Risk Factors

As shown in **Table 5,** many of the risk factor data associated with curves can be obtained simultaneously with the segment risk factors. One important distinction in curve risk factors, is to consider the use of curve radius, as research suggests, generally, that curves with larger radii historically have seen fewer crashes. Each of these risk factors will be used to analyze potential crash risk.

Table 5 – Horizontal Curve Risk Factors

Risk Factor	Issue
Average Daily Traffic (ADT) volumes	Exposure
Curve radius	Staying on roadway
Shoulder width	Staying on roadway, recovering from crash
Access density	Conflicting movements near horizontal curve, sight visibility
Fatal or serious injury crash history	History of potential safety issues
Presence of warning signs	Staying on roadway
Superelevation	Staying on roadway
Edge condition	Ability of vehicle to recover from a roadway departure
Roadside assessment	Roadside collision hazard

4. SUMMARY

The review of the Phase 1 Crash Tree Analysis Area (KDOT District 3 and District 6) found more crashes on unpaved roads than in the LRSP Pilot Phase analysis of the 19-county region. It is expected that this is likely due to the increased percentage of the number of unpaved roadways in western Kansas. The breakdown of individual crash characteristics (vehicle action and manner of crash) were similar between the Phase 1 and Pilot Phase crash trees as associated with roadway geometry and intersection control. Based on the findings of this review, it is recommended that the same risk factors be used for analysis of the LRSP Phase 1 project as were approved by KDOT for the LRSP Pilot project. These risk factors were developed to systemically assess crash risk along roadway segments, at intersections, and at horizontal curves as part of the LRSP process.

5. NEXT STEPS

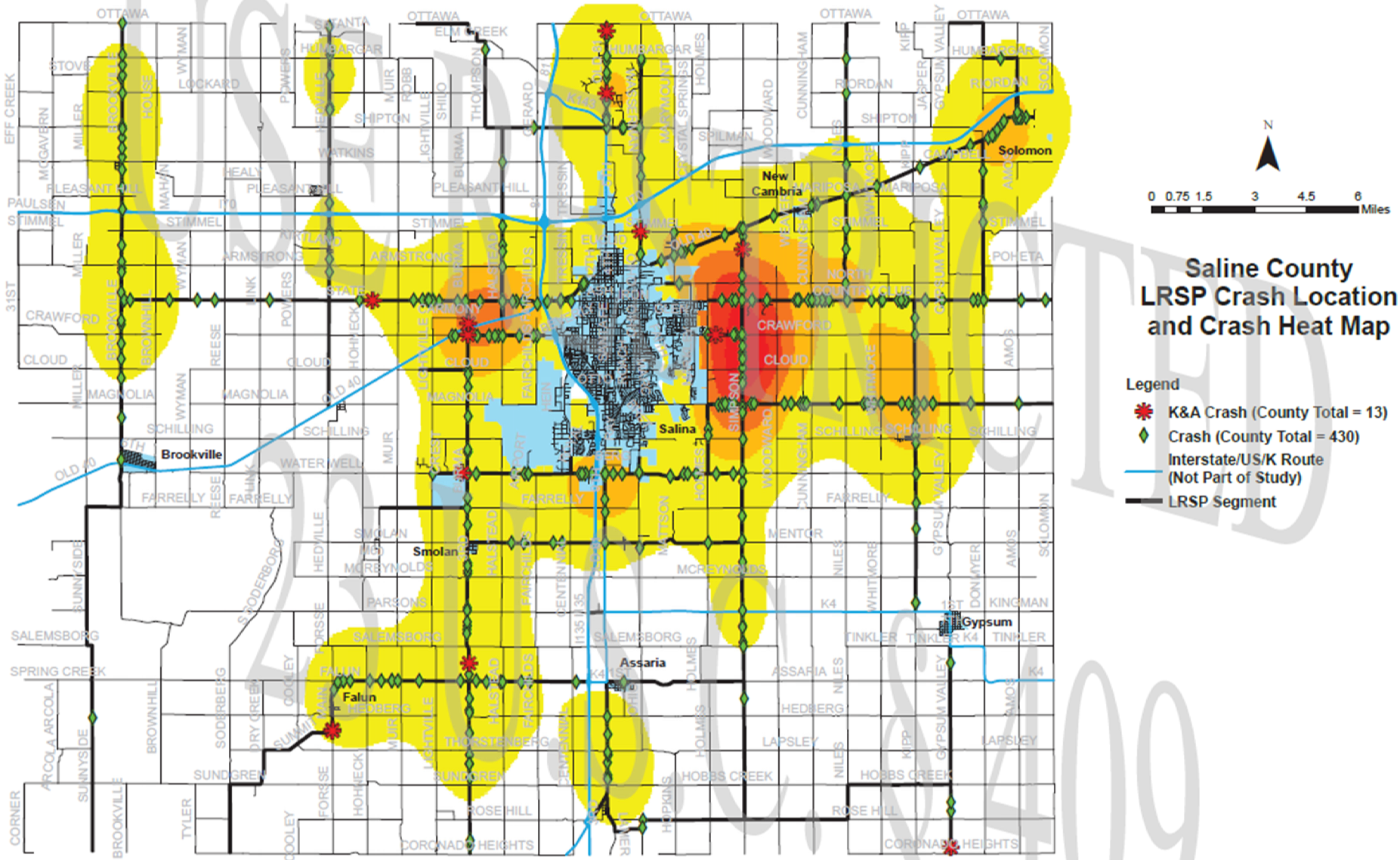
The next steps include collection of data to support the risk factors. Workshops will also be conducted with each of the twenty LRSP Phase 1 counties to discuss transportation safety strategies and countermeasures.

After the workshops are conducted, a systemic analysis will be conducted for the twenty LRSP Phase 1 counties to calculate risk factor scores for each roadway segment, intersection, and curve along the LRSP study routes. Project sheets will be created for the locations with the highest risk factor scores with associated recommended safety countermeasures.

Finally, a LRSP report will be produced for each county, providing a summary of the project, risk factor information, and the project sheets.

APPENDIX C

CRASH LOCATION MAP, CRASH HEAT MAP, AND CRASH FREQUENCIES



Saline County
Local Road Safety Plan (LRSP)
Segment Crash Frequencies (Actual vs. Predicted)
Five-Year Analysis Period: 2015 – 2019

ID	LRSP Segment	Location	Total Crashes	Lane Departure Crashes	Animal Crashes	Crash Frequency (crashes per year)		
						Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)
30	N Brookville Rd	From W Ottawa Rd to I-70	14	5	8	2.80	0.75	2.05
96	W Falun Rd	From S Forsse Rd to S Burma Rd	11	4	7	2.20	0.67	1.53
48	Old 40 Hwy	From N Donmyer Rd to N Amos Rd	12	3	7	2.40	0.96	1.44
65	S Burma Rd	From W Smolan Rd to W Falun Rd	12	4	8	2.40	1.12	1.28
12	E Magnolia Rd	From S Kipp Rd to S Solomon Rd	7	3	3	1.40	0.27	1.13
4	E Country Club Rd	From N Niles Rd to S Kipp Rd	11	4	7	2.20	1.10	1.10
77	S Kipp Rd	From E Magnolia Rd to E Schilling Rd	7	1	6	1.40	0.41	0.99
85	S Simpson Rd	From E Crawford St to E Magnolia Rd	10	5	5	2.00	1.06	0.94
59	S Brookville Rd	From W State St to N Brookville CL	6	3	2	1.20	0.31	0.89
29	N Brookville Rd	From I-70 to W State St	5	3	2	1.00	0.23	0.77
47	Old 40 Hwy	From N Amos Rd to N Field Rd	6	2	3	1.20	0.46	0.74
89	S Simpson Rd	From K-4 to E Assaria Rd	4	4	0	0.80	0.06	0.74
25	E Water Well Rd	From S Ohio St to S Holmes Rd	4	2	1	0.80	0.17	0.63
11	E Magnolia Rd	From S Holmes Rd to S Simpson Rd	7	1	6	1.40	0.87	0.53
87	S Simpson Rd	From E Mentor Rd to K-4	3	1	1	0.60	0.08	0.52
114	W Water Well Rd	From S Centennial Rd to Salina West CL	4	0	4	0.80	0.29	0.51
88	S Simpson Rd	From E Water Well Rd to E Mentor Rd	3	3	0	0.60	0.11	0.49
40	N Niles Rd	From Old 40 Hwy to E Country Club Rd	3	2	1	0.60	0.14	0.46
108	W State St	From S Brookville Rd to S Hedville Rd	6	4	2	1.20	0.74	0.46
69	S Forsse Rd	From W Summit Rd to W Falun Rd	4	4	0	0.80	0.35	0.45
63	S Burma Rd	From W Falun Rd to W Thorstenberg Rd	5	0	5	1.00	0.55	0.45
110	W State St	From S Hedville Rd to S Burma Rd	10	8	2	2.00	1.57	0.43
64	S Burma Rd	From W Thorstenberg Rd to W Coronado Heights Rd	6	3	3	1.20	0.78	0.42
70	S Gypsum Valley Rd	From E Hobbs Creek Rd to E Coronado Heights Rd	3	1	2	0.60	0.20	0.40
81	S Ohio St	From E Rose Hill Rd (N) to E Rose Hill Rd (S)	2	2	0	0.40	0.01	0.39

ID	LRSP Segment	Location	Total Crashes	Lane Departure Crashes	Animal Crashes	Crash Frequency (crashes per year)		
						Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)
60	S Burma Rd	From Old 40 Hwy to W State St	2	2	0	0.40	0.05	0.35
95	W Falun Rd	From S Burma Rd to I-135	7	3	4	1.40	1.07	0.33
24	E Water Well Rd	From S Holmes Rd to S Simpson Rd	2	2	0	0.40	0.11	0.29
86	S Simpson Rd	From E Magnolia Rd to E Water Well Rd	4	2	1	0.80	0.60	0.20
10	E Humbargar Rd	From N Donmyer Rd to N Amos Rd	1	1	0	0.20	0.01	0.19
13	E Magnolia Rd	From S Simpson Rd to S Kipp Rd	17	2	15	3.40	3.22	0.18
73	S Hedville Rd	From Ottawa County Line to I-70	10	2	8	2.00	1.82	0.18
33	N Donmyer Rd	From Old 40 Hwy to E Country Club Rd	5	3	2	1.00	0.83	0.17
28	N Amos Rd	From I-70 to E Old Hwy 40	1	0	0	0.20	0.04	0.16
103	W Shipton Rd	From N Halstead Rd to 81 Hwy	1	0	1	0.20	0.04	0.16
22	E Shipton Rd	From Old 81 Hwy to N Ohio St	4	4	0	0.80	0.64	0.16
82	S Ohio St	From Salina South CL to E Water Well Rd	1	1	0	0.20	0.04	0.16
45	N Thompson Rd	From W Elm Creek Rd to W Lockard Rd	1	0	0	0.20	0.05	0.15
57	S Brookville Rd	From N Brookville CL to Old 40 Hwy	1	1	0	0.20	0.07	0.13
72	S Hedville Rd	From I-70 to W State St	5	2	2	1.00	0.87	0.13
8	E Crawford St	From S Holmes Rd to S Simpson Rd	5	4	1	1.00	0.88	0.12
92	W Cloud St	From 0.4 mile west of S Lightville Rd to S Burma Rd	1	1	0	0.20	0.08	0.12
34	N Halstead Rd	From I-70 to W State St	3	1	1	0.60	0.48	0.12
83	S Simpson Rd	From E Assaria Rd to E Rose Hill Rd	1	0	1	0.20	0.09	0.11
53	Old 81 Hwy	From E Assaria Rd to S Lamer Rd	8	1	7	1.60	1.49	0.11
62	S Burma Rd	From W Cloud St to W Water Well Rd	6	2	3	1.20	1.09	0.11
115	W Water Well Rd	From S Lightville Rd to S Burma Rd	2	2	0	0.40	0.30	0.10
91	S Sunnyside Rd	From W Farrelly Rd to McPherson County Line	1	1	0	0.20	0.11	0.09
6	E Country Club Rd	From S Kipp Rd to S Donmyer Rd	4	0	3	0.80	0.84	-0.04
14	E Mentor Rd	From Old 81 Hwy to S Ohio St	1	1	0	0.20	0.34	-0.14
39	N Niles Rd	From I-70 to Old 40 Hwy	1	0	1	0.20	0.39	-0.19
106	W State St	From N Halstead Rd to Old 40 Hwy	3	0	1	0.60	0.80	-0.20
105	W Smolan Rd	From S Burma Rd to I-135	4	1	3	0.80	1.02	-0.22
7	E Country Club Rd	From S Simpson Rd to N Niles Rd	13	1	12	2.60	2.83	-0.23

ID	LRSP Segment	Location	Total Crashes	Lane Departure Crashes	Animal Crashes	Crash Frequency (crashes per year)		
						Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)
5	E Country Club Rd	From S Donmyer Rd to S Solomon Rd	2	0	1	0.40	0.65	-0.25
38	N Niles Rd	From E Ottawa Rd to I-70	1	1	0	0.20	0.46	-0.26
98	W Old Hwy 40	From I-135 to W State St	1	0	0	0.20	0.47	-0.27
113	W Water Well Rd	From S Burma Rd to S Centennial Rd	5	2	3	1.00	1.27	-0.27
71	S Gypsum Valley Rd	From K-4 to E Hobbs Creek Rd	1	0	1	0.20	0.48	-0.28
66	S Burma Rd	From W Water Well Rd to W Smolan Rd	1	0	1	0.20	0.55	-0.35
16	E North St	From Salina East CL to N Eastborough Rd	2	2	0	0.40	0.81	-0.41
109	W State St	From S Burma Rd to N Halstead Rd	1	0	1	0.20	0.66	-0.46
99	W Old Hwy 40	From W State St to Salina West CL	2	1	0	0.40	0.88	-0.48
43	N Ohio St	From E Shipton Rd to I-70	2	0	2	0.40	0.88	-0.48
107	W State St	From Old Hwy 40 to Salina West CL	3	3	0	0.60	1.09	-0.49
54	Old 81 Hwy	From W Ottawa Rd to K-143	15	6	9	3.00	3.53	-0.53
44	N Simpson Rd	From Old 40 Hwy to E Country Club Rd	6	1	4	1.20	1.74	-0.54
75	S Holmes Rd	From E Magnolia Rd to E Water Well Rd	2	1	1	0.40	1.05	-0.65
76	S Kipp Rd	From E Country Club Rd to E Magnolia Rd	1	0	1	0.20	0.89	-0.69
49	Old 40 Hwy	From N Marymount Rd to N Simpson Rd	6	2	4	1.20	1.96	-0.76
3	E Country Club Rd	From N Holmes Rd to N Simpson Rd	3	2	1	0.60	1.37	-0.77
52	Old 40 Hwy	From Salina North CL to N Marymount Rd	1	0	0	0.20	0.99	-0.79
78	S Kipp Rd	From E Schilling Rd to K-4	5	1	4	1.00	1.88	-0.88
42	N Ohio St	From 0.16 mile North of E Stimmel Rd to Salina North CL	6	3	0	1.20	2.08	-0.88
93	W Crawford St	From Old 40 Hwy to Salina West CL	9	6	2	1.80	2.84	-1.04
2	E Assaria Rd	From Old 81 Hwy to N Anderson St	1	1	0	0.20	1.50	-1.30
23	E Water Well Rd	From Old 81 Hwy to S Ohio St	2	0	0	0.40	2.12	-1.72
50	Old 40 Hwy	From N Niles Rd to N Donmyer Rd	4	2	1	0.80	2.55	-1.75
56	Old 81 Hwy	From E Water Well Rd to E Mentor Rd	2	1	0	0.40	2.61	-2.21
51	Old 40 Hwy	From N Simpson Rd to N Niles Rd	3	1	2	0.60	2.94	-2.34

Saline County
Local Road Safety Plan (LRSP)
Curve Crash Frequencies (Actual vs. Predicted)
Five-Year Analysis Period: 2015 – 2019

ID	LRSP Curve	Total Crashes	Crash Frequency (crashes per year)		
			Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)
70	W Summit Rd & S Forsse Rd	2	0.40	0.03	0.37
14	E Old 40 Hwy 0.19 mi east of N Donmyer Rd	3	0.60	0.24	0.36
46	S Forsse Rd & W Falun Rd	2	0.40	0.05	0.35
57	S Simpson Rd & E Salemsborg Rd (S)	1	0.20	0.02	0.18
27	E Water Well Rd 0.88 mi east of S Ohio St	1	0.20	0.02	0.18
53	S Ohio St & E Rose Hill Rd (S)	1	0.20	0.02	0.18
25	E Water Well Rd 0.72 mi west of S Holmes Rd	1	0.20	0.04	0.16
54	S Ohio St & E Rose Hill Rd (N)	1	0.20	0.06	0.14
16	E Old 40 Hwy 0.23 mi west of N Woodward Rd	1	0.20	0.17	0.03
69	W State St 0.79 mi east of N Halstead Rd	1	0.20	0.18	0.02
15	E Old 40 Hwy 0.19 mi west of N Amos Rd	1	0.20	0.23	-0.03
68	W State St & W Old 40 Hwy	1	0.20	0.90	-0.70

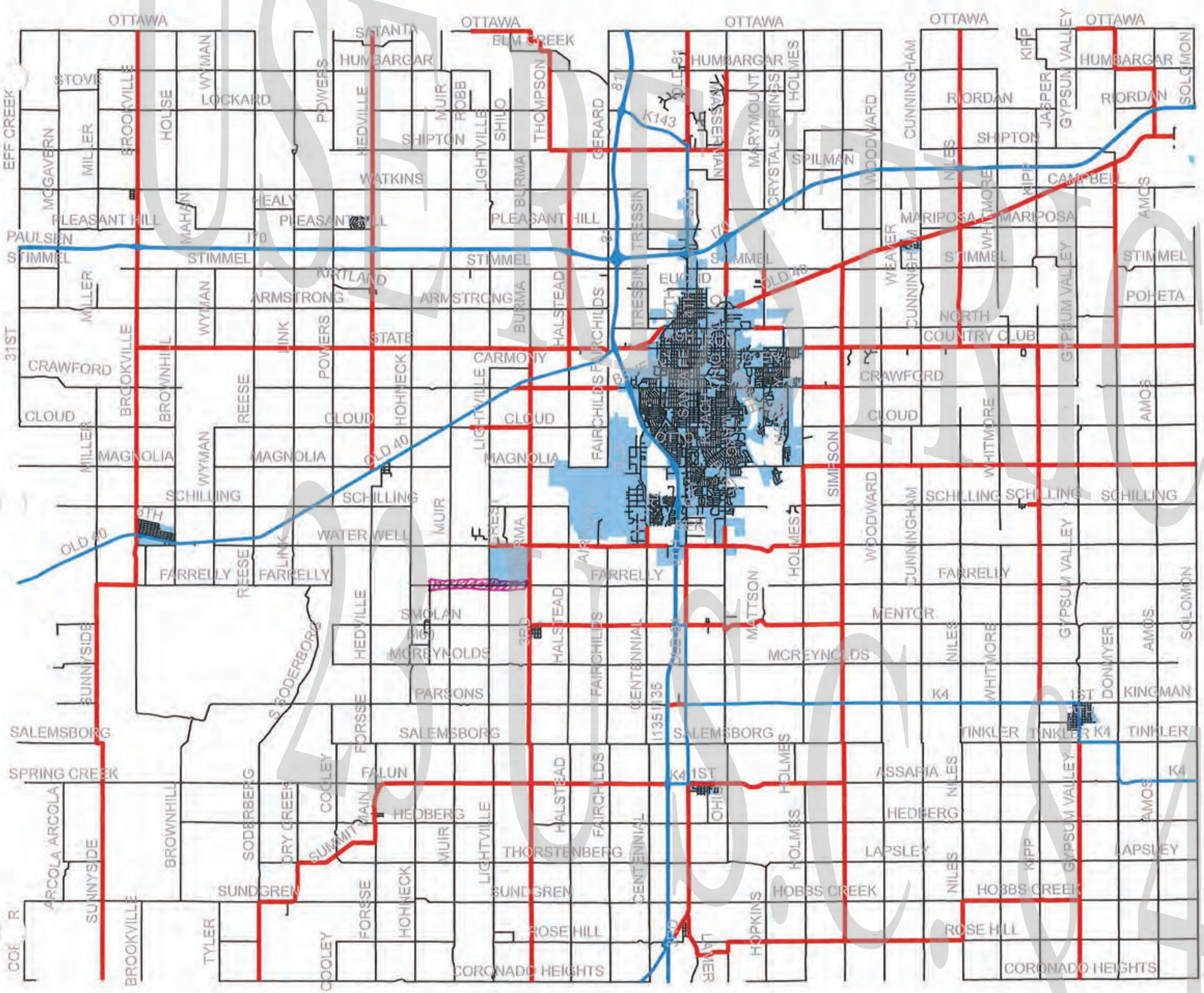
Saline County
Local Road Safety Plan (LRSP)
Intersection Crash Frequencies (Actual vs. Predicted)
Five-Year Analysis Period: 2015 – 2019

ID	LRSP Intersection	Total Crashes	Crash Frequency (crashes per year)		
			Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)
56	E Old 40 Hwy & N Niles Rd	4	0.80	0.14	0.66
57	E Old 40 Hwy & N Simpson Rd	4	0.80	0.27	0.53
246	W State St & N Halstead Rd	3	0.60	0.09	0.51
259	W Water Well Rd & S Burma Rd	3	0.60	0.13	0.47
129	N Ohio St & E Stimmel Rd	3	0.60	0.20	0.40
226	W Crawford St & S Burma St	3	0.60	0.20	0.40
199	S Ohio St & E Mentor Rd (S)	2	0.40	0.001	0.40
210	S Simpson Rd & E Crawford St	3	0.60	0.22	0.38
55	E Old 40 Hwy & N Marymount Rd	2	0.40	0.08	0.32
26	E Crawford St & S Holmes Rd	2	0.40	0.11	0.29
117	N Marymount Rd & E Stimmel Rd	1	0.20	0.001	0.20
30	E Magnolia Rd & S Amos Rd	1	0.20	0.002	0.20
96	N Halstead Rd & W Armstrong Rd	1	0.20	0.01	0.19
122	N Niles Rd & E Riordan Rd	1	0.20	0.01	0.19
43	E Mentor Rd & S Holmes Rd	1	0.20	0.01	0.19

ID	LRSP Intersection	Total Crashes	Crash Frequency (crashes per year)		
			Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)
249	W State St & N Lightville Rd	1	0.20	0.01	0.19
100	N Halstead Rd & W Watkins Rd	1	0.20	0.01	0.19
67	E Shipton Rd & N Wasserman Way	1	0.20	0.01	0.19
169	S Burma Rd W Farrelly Rd	1	0.20	0.01	0.19
190	S Kipp Rd & E Crawford St	1	0.20	0.01	0.19
195	S Kipp Rd & E Water Well Rd	1	0.20	0.02	0.18
39	E Magnolia Rd & S Whitmore Rd	1	0.20	0.03	0.17
19	E Country Club Rd & S Cunningham Rd	1	0.20	0.03	0.17
205	S Old 81 Hwy & W Hedberg Rd	1	0.20	0.03	0.17
51	E Old 40 Hwy & N Cunningham Rd	1	0.20	0.04	0.16
228	W Crawford St & S Halstead Rd	1	0.20	0.05	0.15
70	E Water Well Rd & S Ohio St	1	0.20	0.06	0.14
36	E Magnolia Rd & S Kipp Rd	1	0.20	0.13	0.07
137	N Simpson Rd & E Country Club Rd	1	0.20	0.30	-0.10

APPENDIX D

DATA MAPS



Saline County

N

0 0.75 1.5 3 4.5 6 Miles

Legend

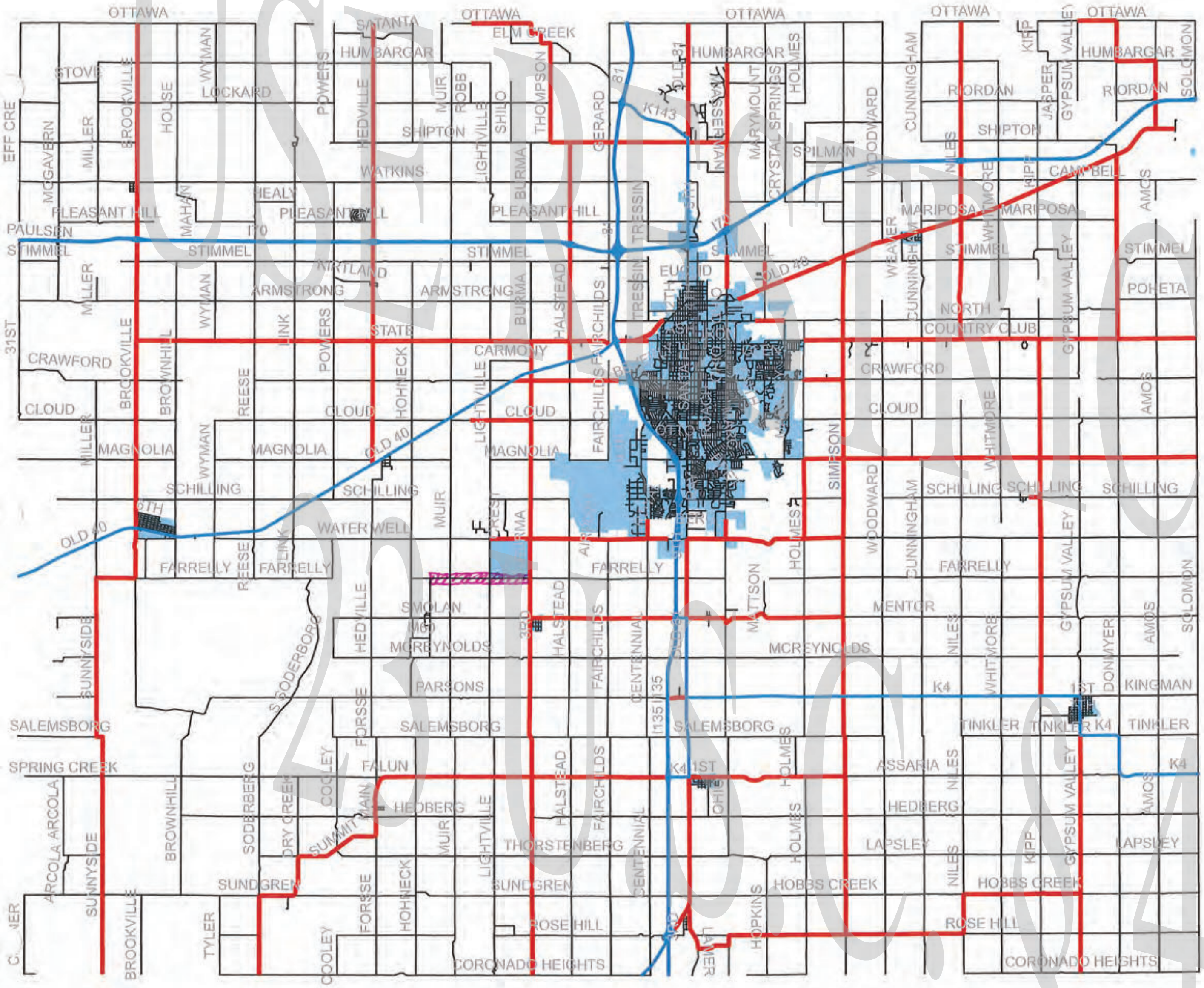
Interstate/US/K Route (Not Part of Study)

LRSP Segment

Edge Line And/Or Shoulder Rumble Strips:

Please provide locations of edge line and/or shoulder rumble strips along the County LRSP routes.

None



Saline County

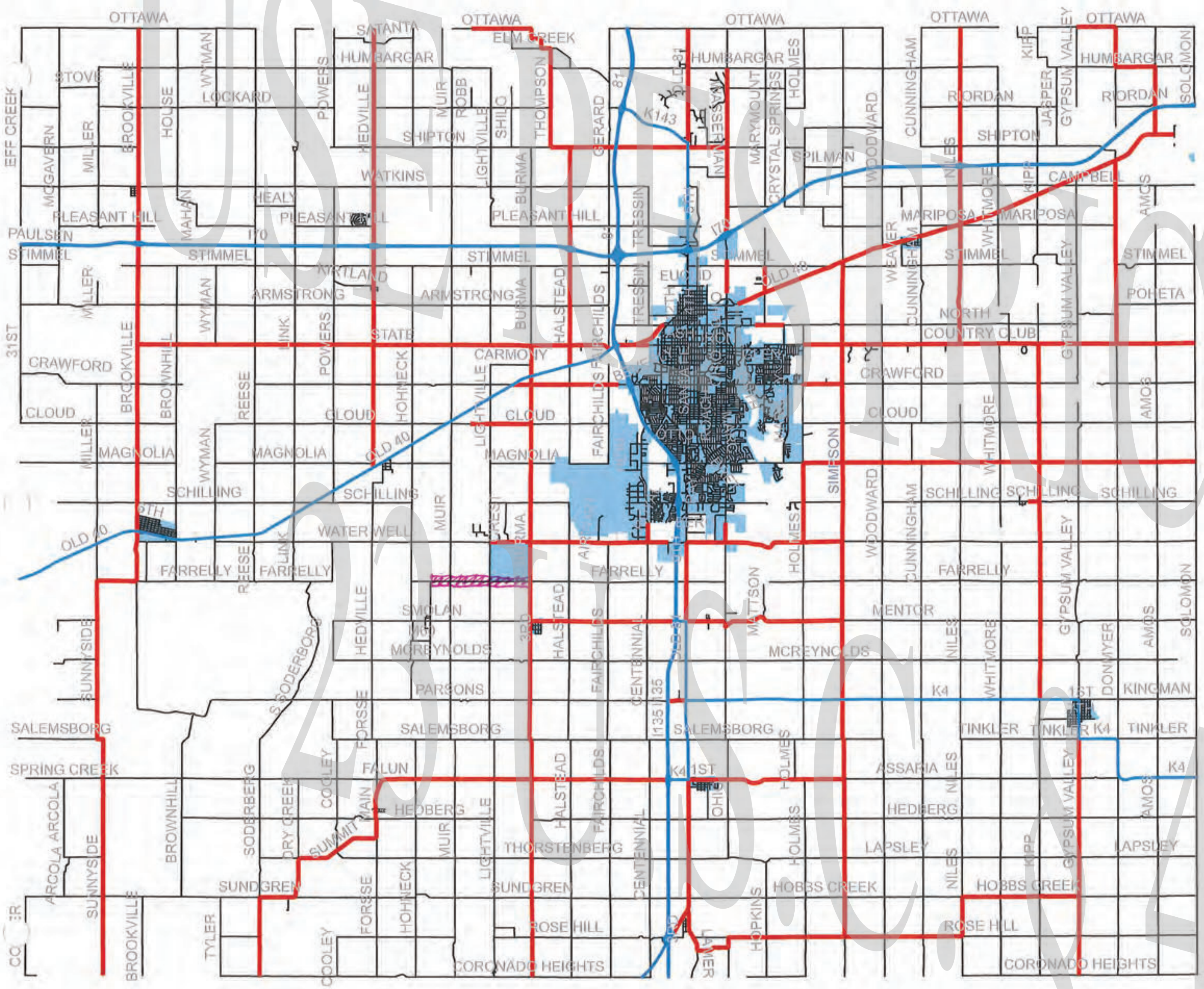
Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

Transverse Rumble Strips:

Please provide locations of transverse rumble strips at intersections along the County LRSP routes.

None



0 0.75 1.5 3 4.5 6 Miles

N

Saline County

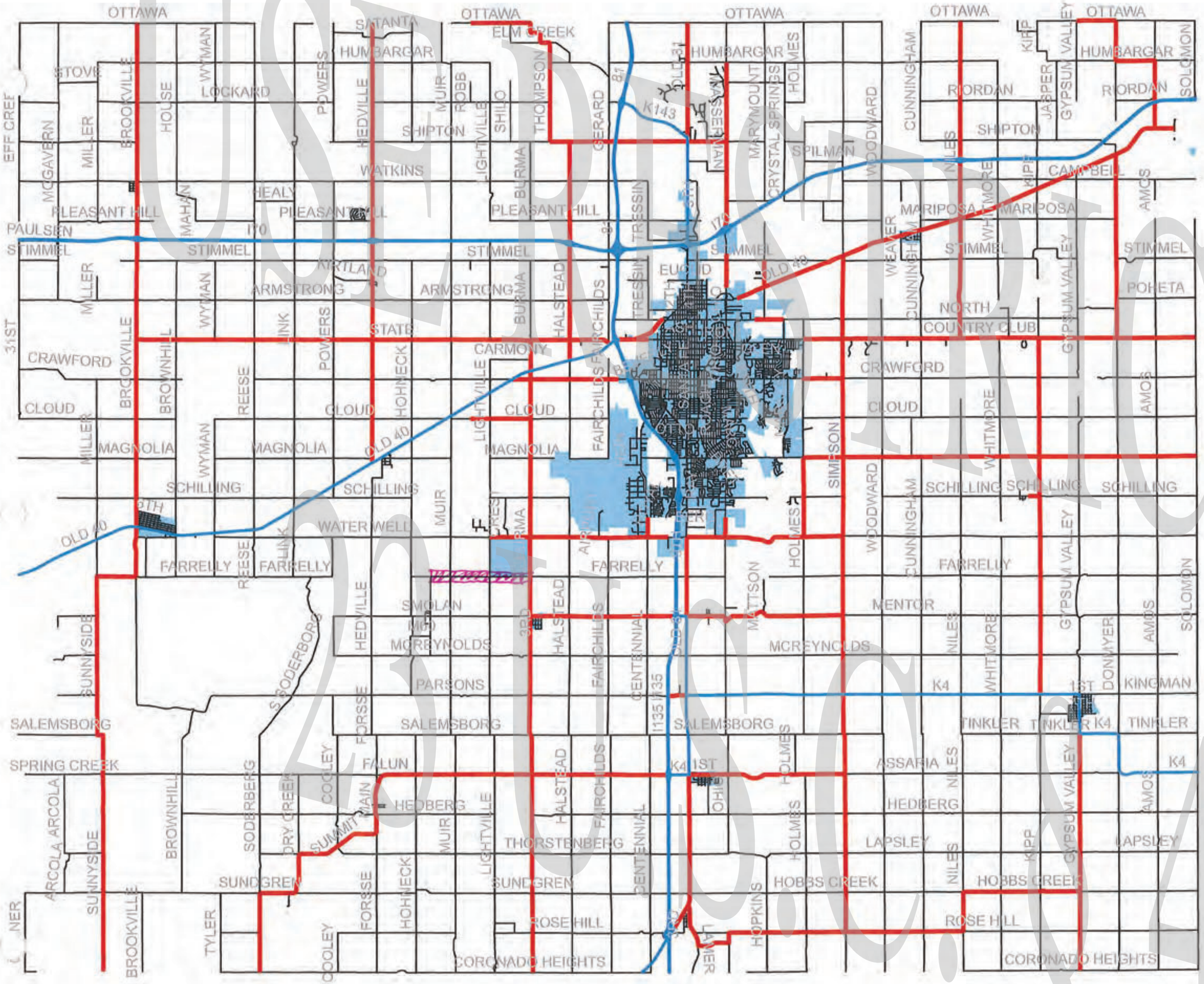
Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

Centerline Rumble Strips:

Please provide locations of centerline rumble strips along the County LRSP routes.

None



Saline County

N

0 0.75 1.5 3 4.5 6 Miles

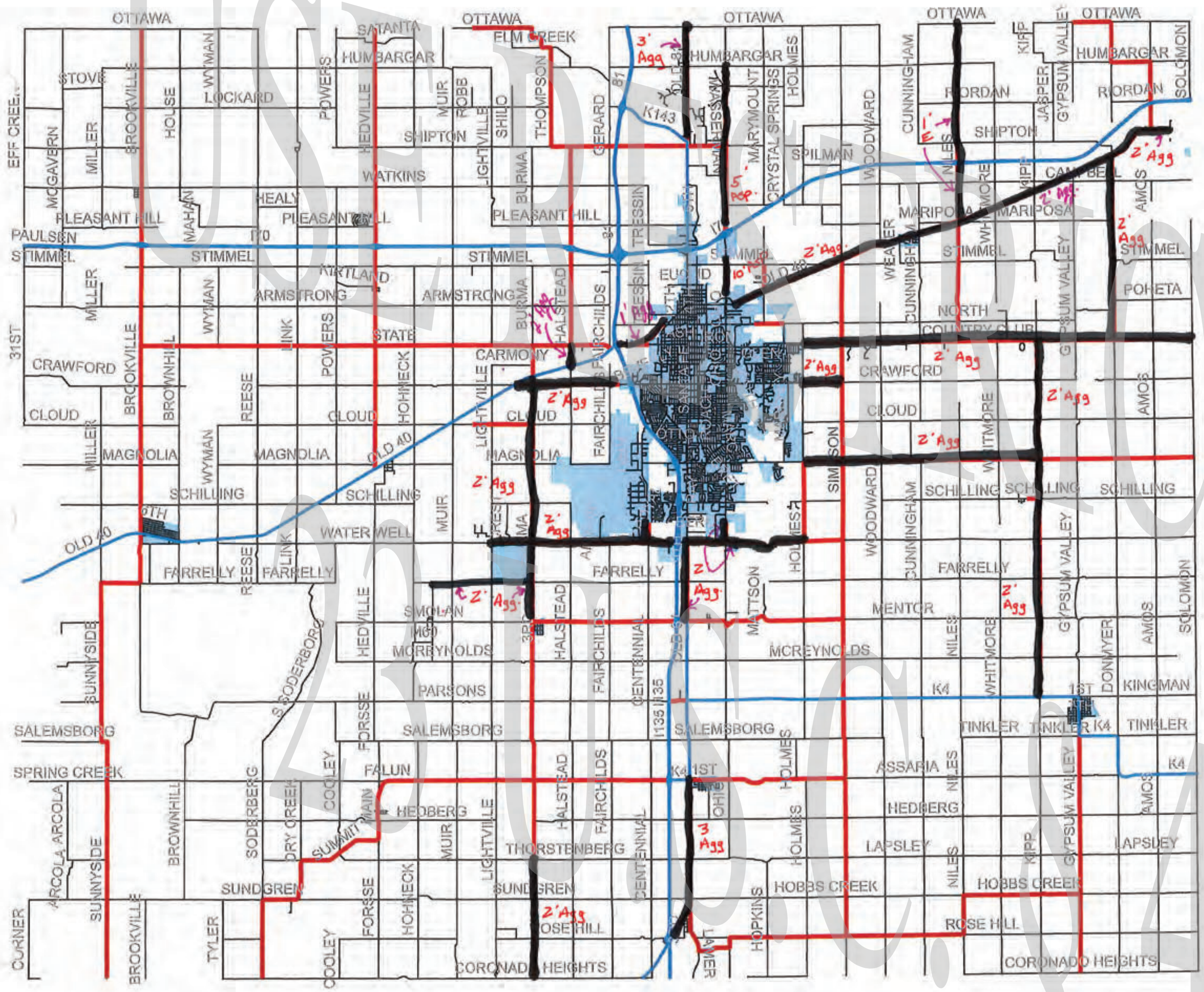
Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

Overhead/Stop Sign Flashing Beacons:

Please indicate which intersections along the County LRSP routes have overhead or stop sign flashing beacons.

None



Saline County

0 0.75 1.5 3 4.5 6 Miles

N

Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

Shoulder Width and Type (Material):

Please provide information regarding the shoulder width and type along the County LRSP routes.

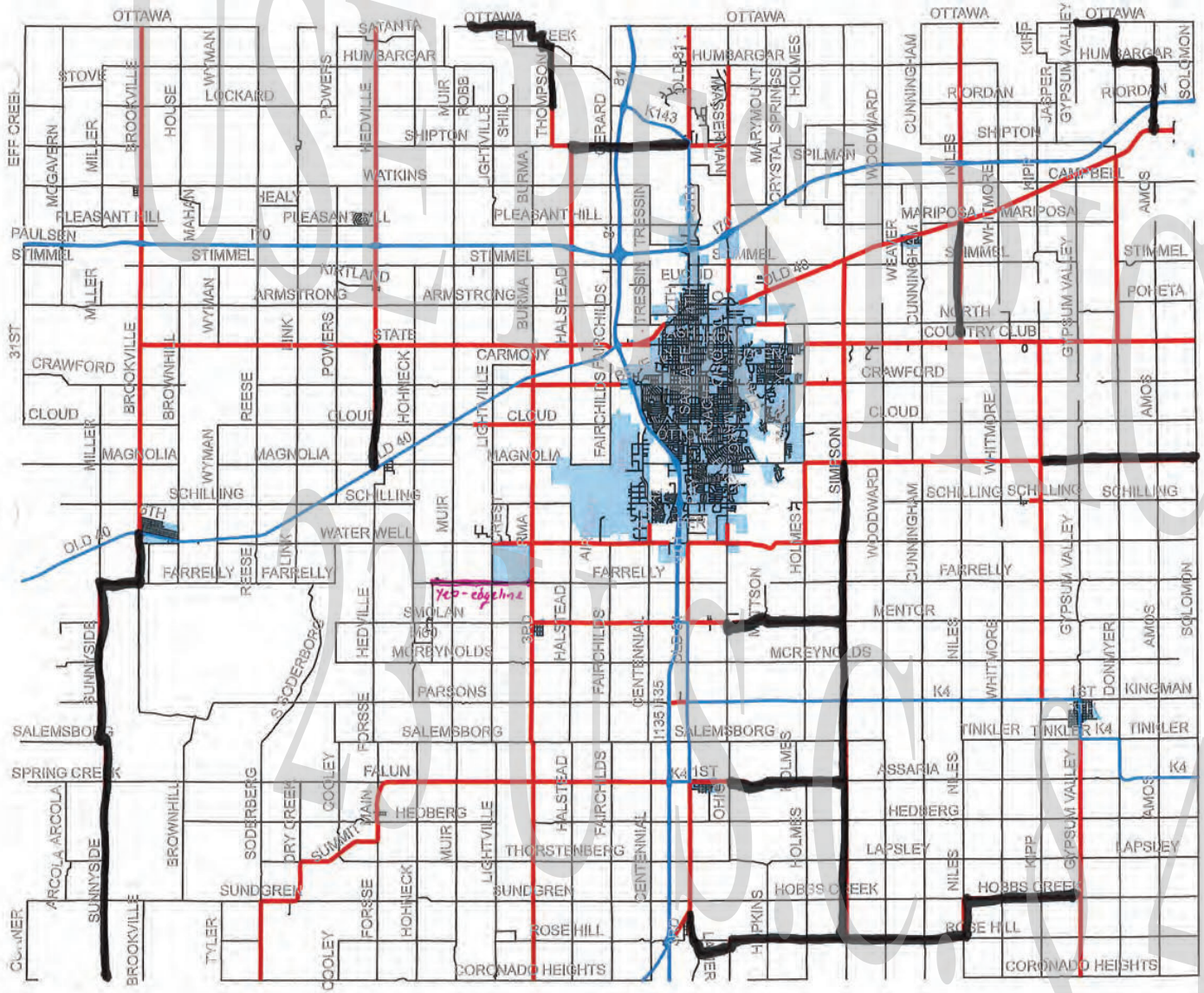
(black line) = Roadway with Shoulders

(red line) = No Shoulders

Agg = Aggregate

Asp = Asphalt

E = Earth



N

0 0.75 1.5 3 4.5 6 Miles

Saline County

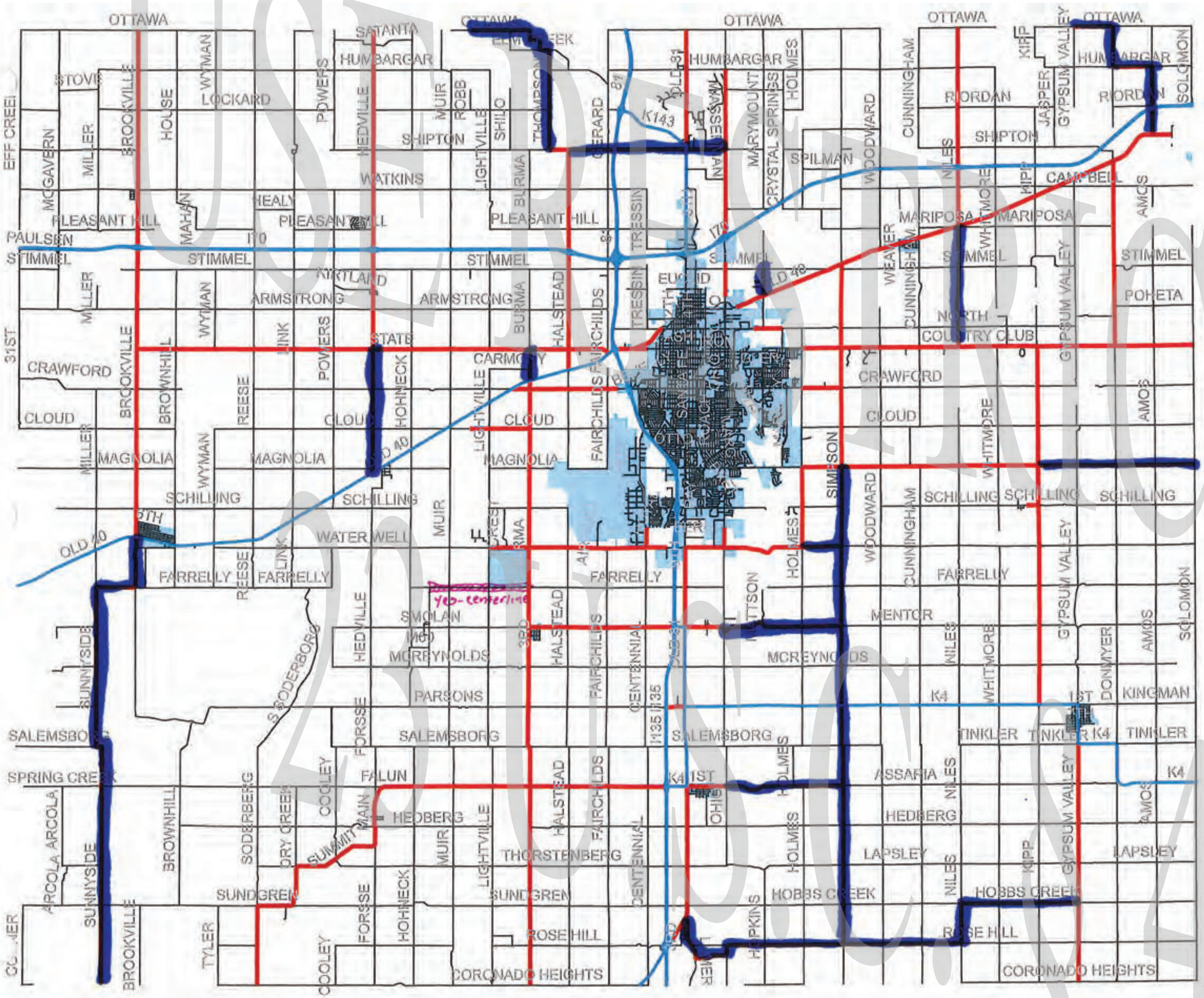
Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

Edge Line Pavement Markings:

Please provide locations of edge line pavement markings along the County LRSP routes.

- No Edgeline Markings
- Edgeline Markings



Saline County

N

0 0.75 1.5 3 4.5 6 Miles

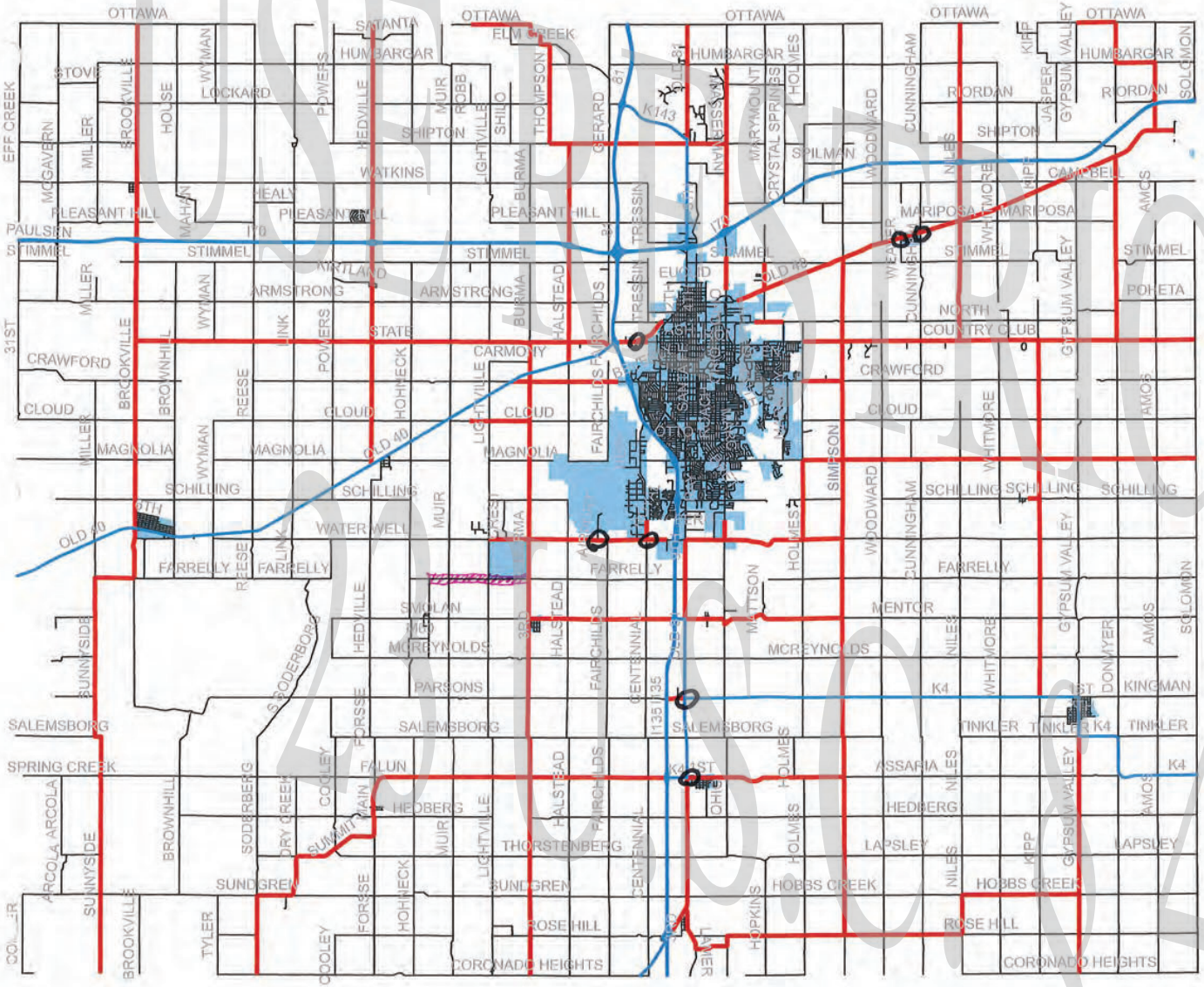
Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

Centerline Pavement Markings:

Please provide locations of centerline pavement markings along the County LRSP routes.

(blue) = No Centerline Markings
(red) = Centerline Markings



Saline County

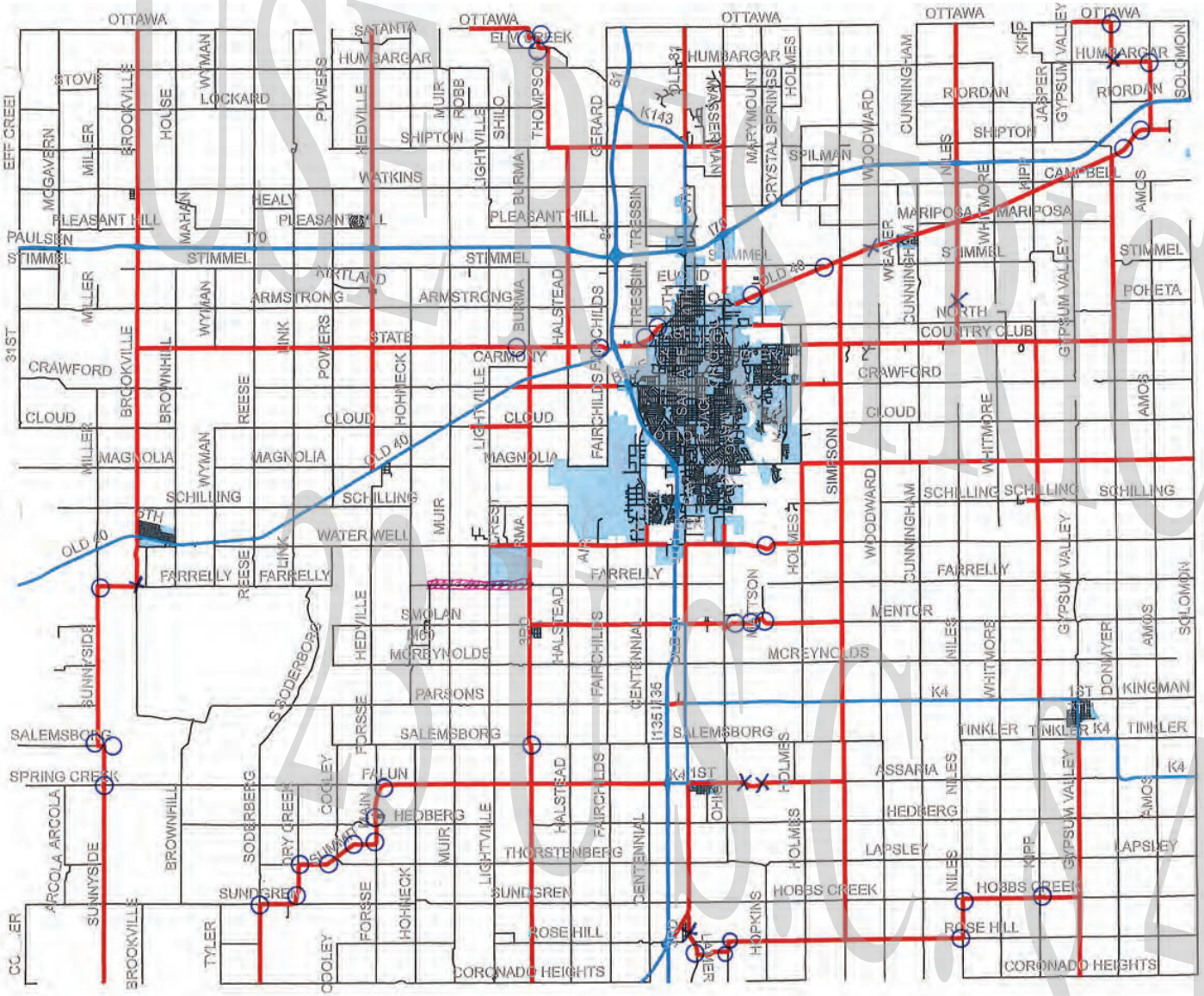
Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

Intersection Lighting:

Please indicate which intersections along the County LRSP routes have intersection lighting.

O = Intersection with Lighting



Saline County

Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

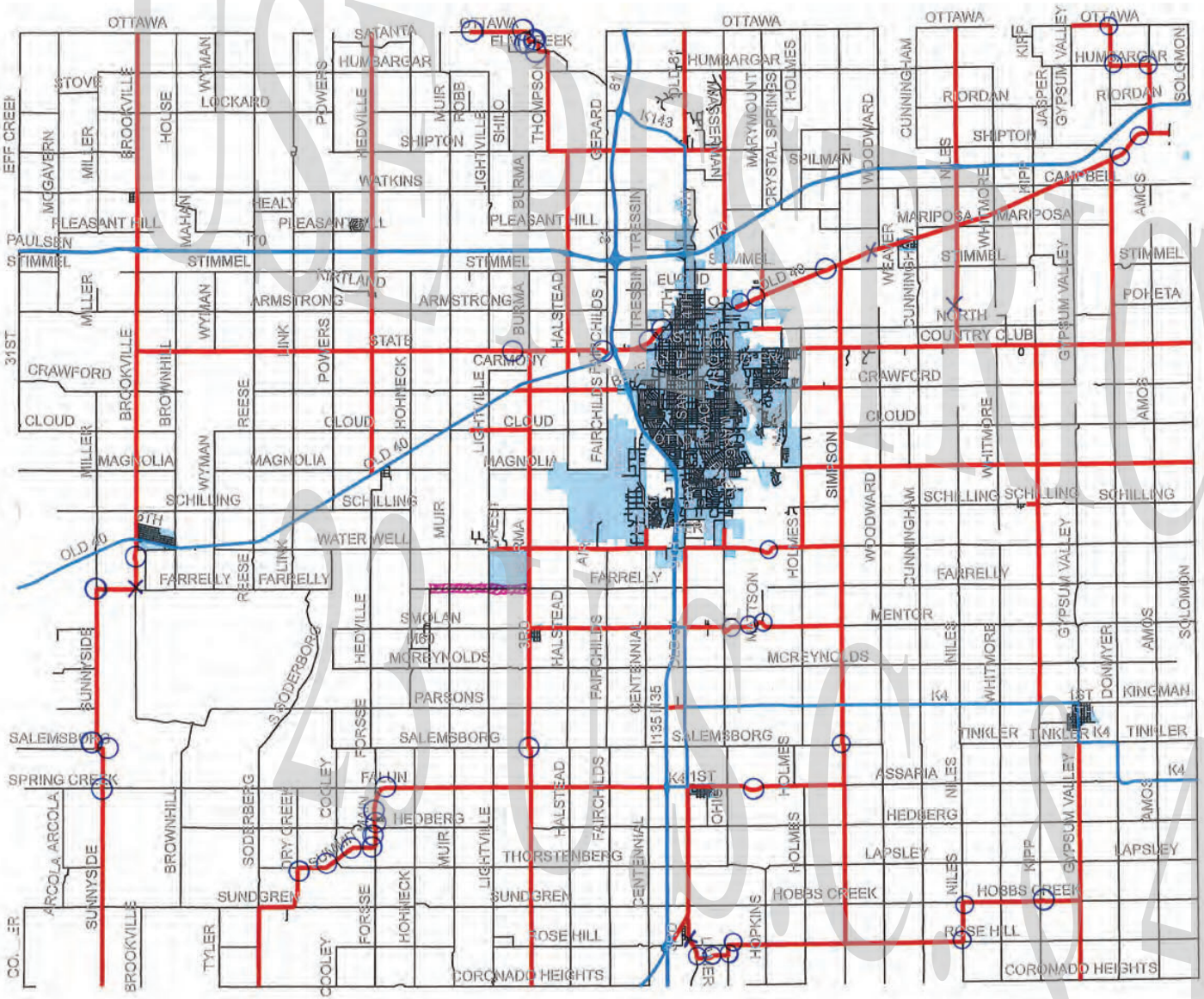
Curve Superelevation:

Please identity curves along the County LRSP routes that have superelevation.

Note – the degree of superelevation does not need to be identified; only a "yes" or "no" if the curve has any superelevation.

○ Yes superelevation

X No superelevation



N

0 0.75 1.5 3 4.5 6 Miles

Saline County

Legend

- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

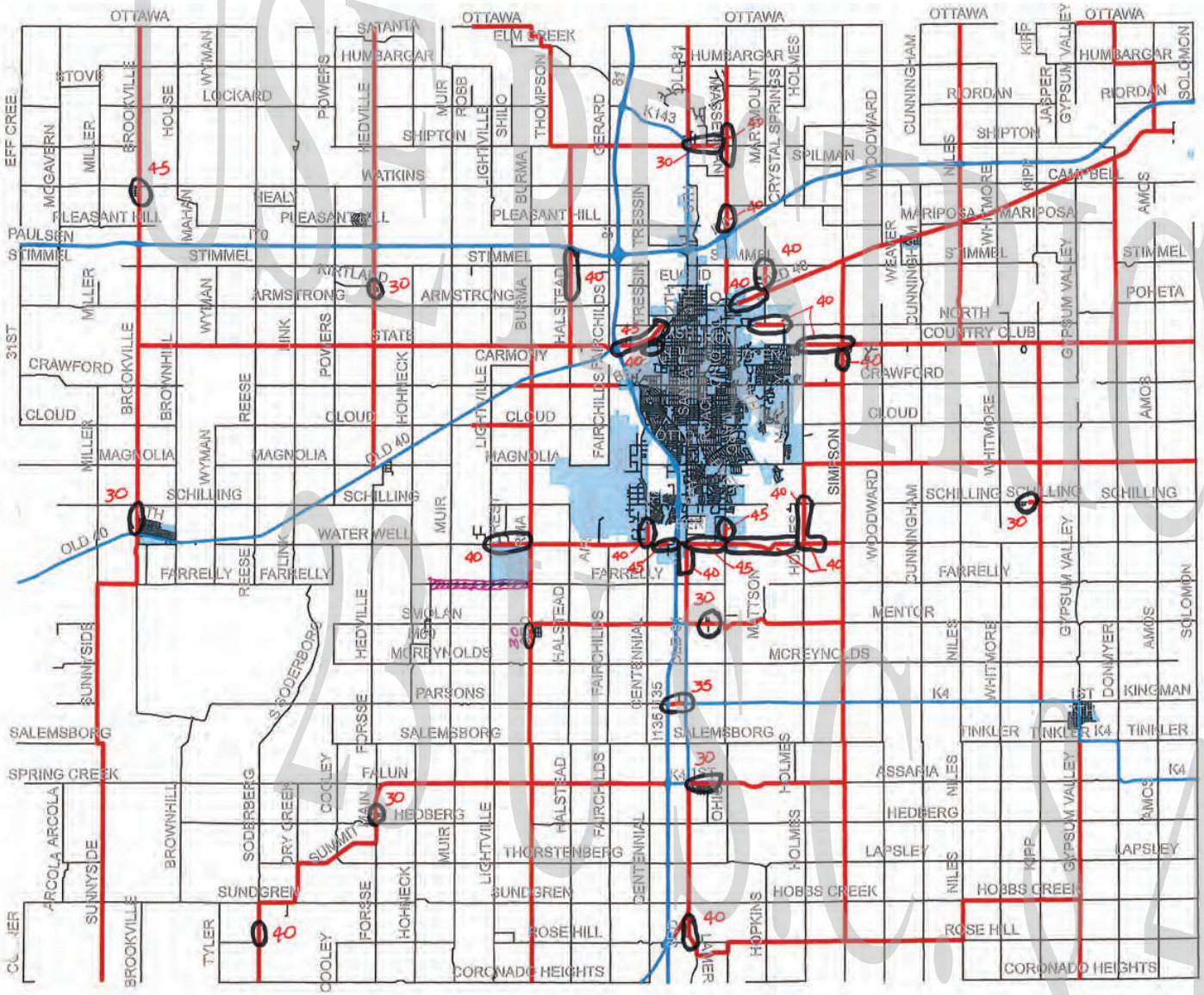
Curve Warning Signs:

Please identity curves along the County LRSP routes that have horizontal alignment warning signs.

Note - the type of warning signs do not need to be identified; only a "yes" or "no" if the curve has any horizontal alignment warning signs.

○ Yes Warning Signs

X No Warning Signs



N

0 0.75 1.5 3 4.5 6 Miles

Saline County

Legend

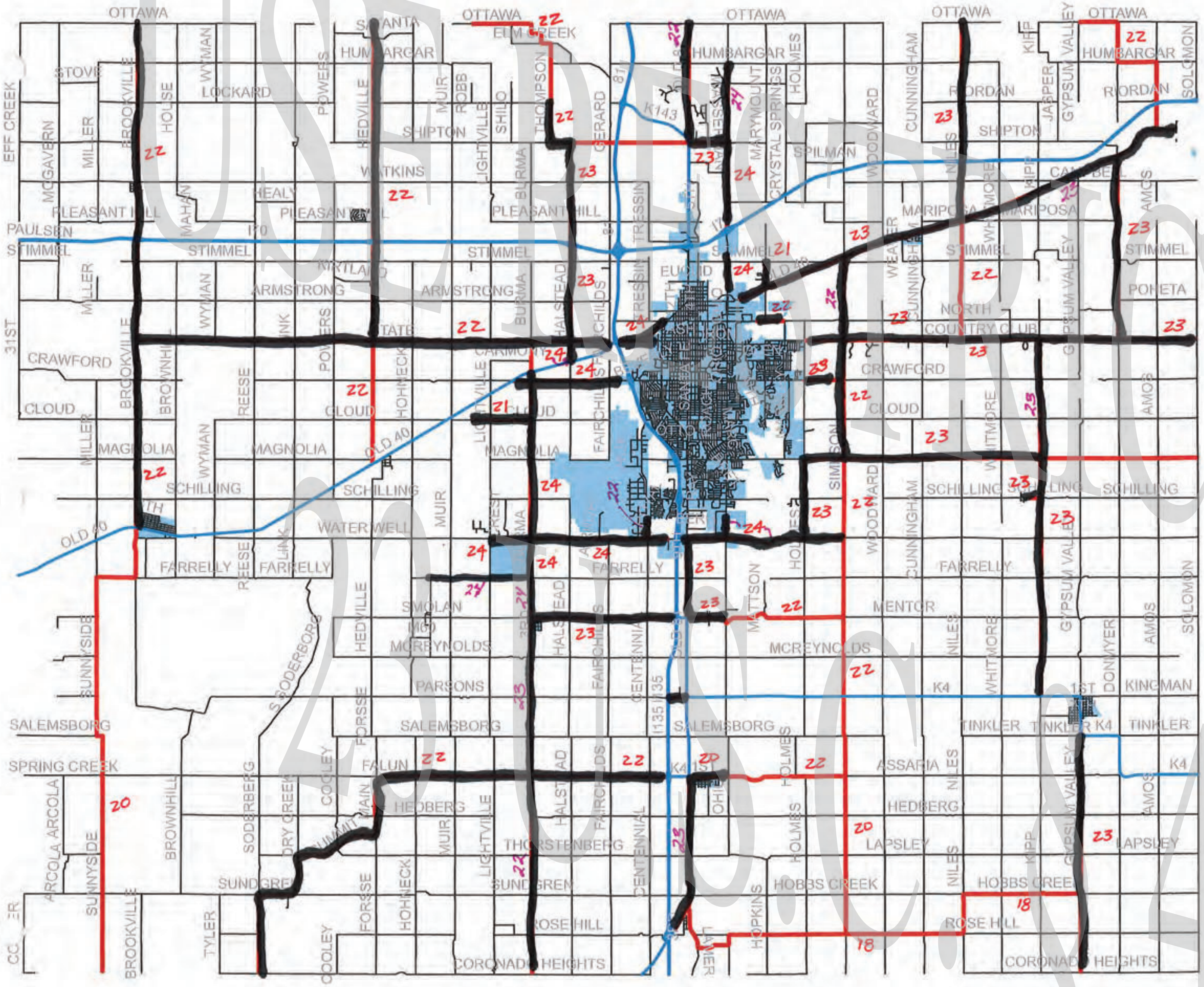
- Interstate/US/K Route (Not Part of Study)
- LRSP Segment

Speed Limits:

Please provide posted speed limit information for the County LRSP routes.

O = Speed Zone

35 = Speed Limit with Zone



Saline County

Legend

Interstate/US/K Route (Not Part of Study)

LRSP Segment

0 0.75 1.5 3 4.5 6 Miles

Pavement Width and Type (Material):

Please provide information regarding the pavement width and type along the County LRSP routes.

= Asphat Surfacing

= Aggregate Surfacing

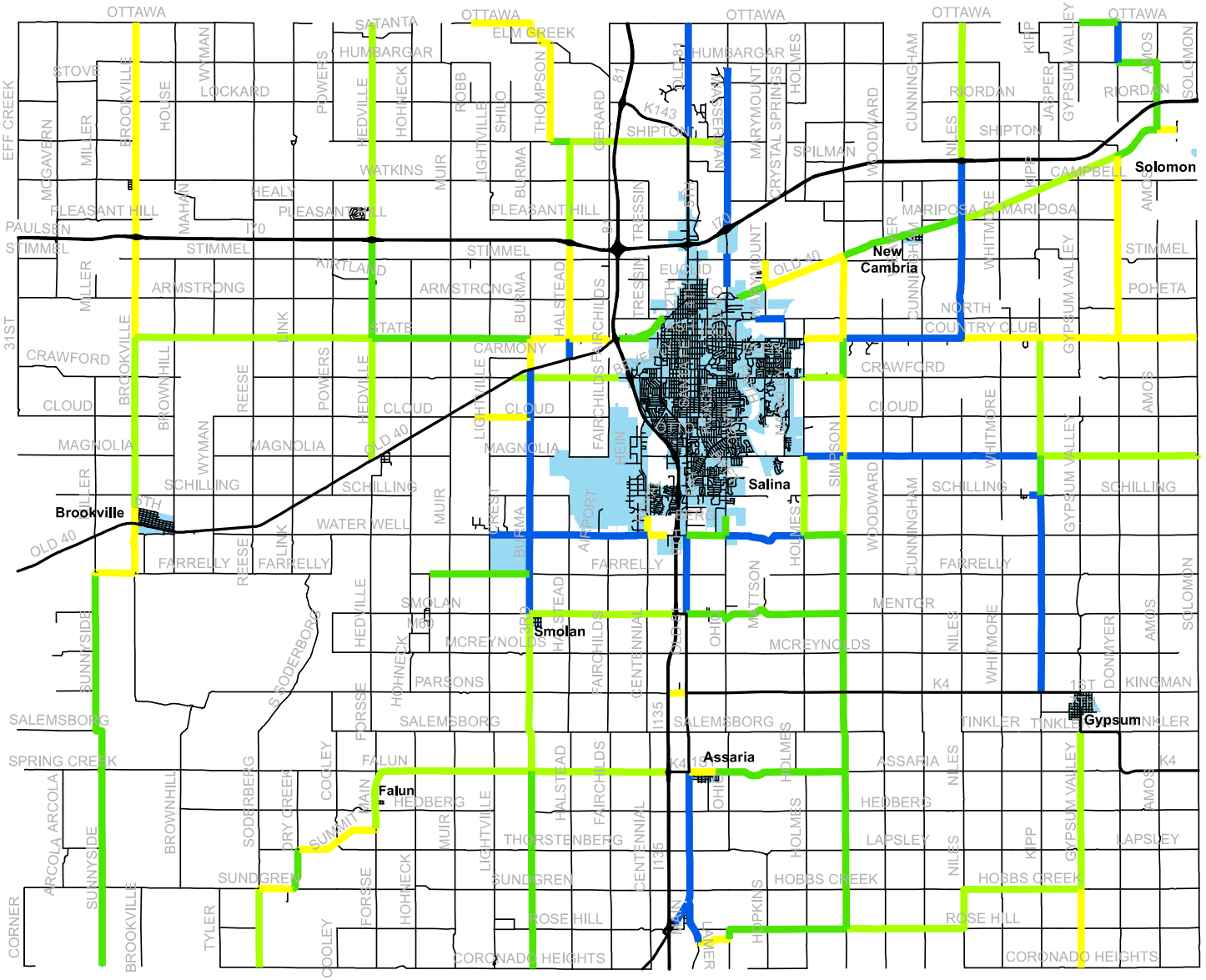
22 = Width of Pavement

APPENDIX E

EDGE CONDITION AND ROADSIDE ASSESSMENT RATINGS

EDGE CONDITION RATINGS

Good (3)	  A rating of 3: • No pavement edge drop offs. • Foreslopes are relatively flat, roll over risk is very low **OR** several feet of shoulder are available before steeper foreslopes begin.
Average (2)	  A rating of 2: • Minor edge drop offs (1-3”) along sections of the route. • Foreslopes are gradual, some risk of roll over.
Poor (1)	  A rating of 1: • Significant edge drop offs (4”+) along sections of the route. • Foreslopes are steep, potential for roll overs is high.



Saline County
Edge Condition Ratings

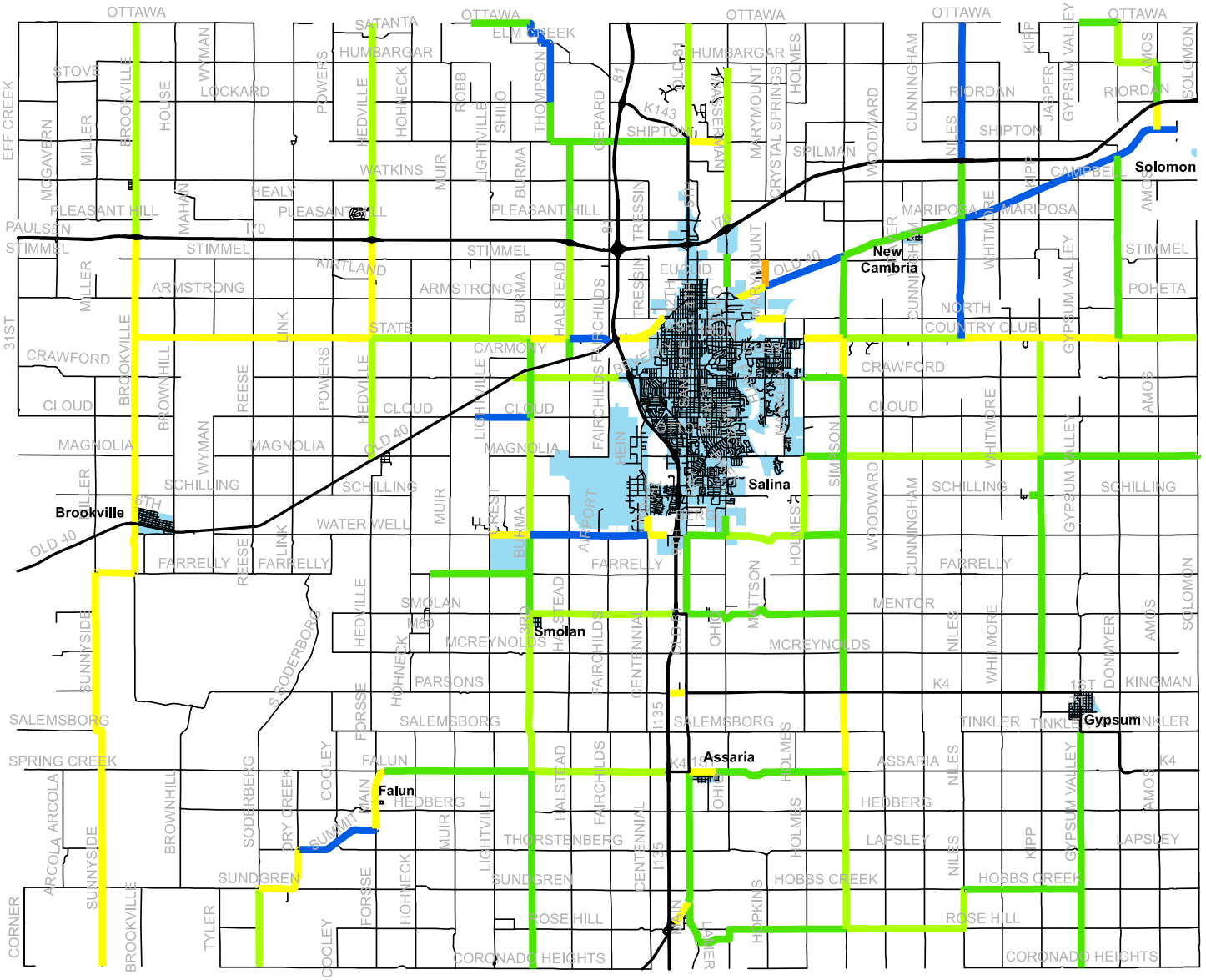
Legend

Edge Condition Rating

- 2.8 - 3.0
- 2.4 - 2.7
- 2.1 - 2.3
- 1.7 - 2.0
- 1.4 - 1.6
- 1.0 - 1.3

ROADSIDE ASSESSMENT RATINGS

Good (3)	  A rating of 3: • Very few fixed objects (trees, utility poles) are present **OR** fixed objects are present but have been cleared to the edge of ROW (fence line). • About 15 feet of clear zone along the route.
Average (2)	  A rating of 2: • Some fixed objects are present within the ROW, such as utility poles at 200’ spacings. Trees are occasional but do not form a solid hedgerow. • About 5-10 feet of clear zone along the route.
Poor (1)	  A rating of 1: • Heavy concentrations of fixed objects within the ROW. Solid hedgerows and treelines are the most common case for RA = 1.



Saline County Roadside Assessment Ratings

Legend

Roadside Assessment Rating

- 2.8 - 3.0
- 2.4 - 2.7
- 2.1 - 2.3
- 1.7 - 2.0
- 1.4 - 1.6
- 1.0 - 1.3

APPENDIX F

COUNTERMEASURES TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM – COUNTERMEASURES

KDOT LOCAL ROAD SAFETY PLANS (LRSPS) – PHASE 3

KDOT PROJECT NO: 106 C-4790-04

BARBER, BROWN, CHAUTAUQUA, CLOUD, EDWARDS, ELLSWORTH, FINNEY, GOVE, GREENWOOD, HAMILTON, KINGMAN, MITCHELL, MORRIS, RUSSELL, SALINE, SMITH, STEVENS, THOMAS, TREGO, AND WABAUNSEE COUNTIES

Prepared for:

KDOT Bureau of Local Projects
Eisenhower State Office Building
700 S.W. Harrison Street, 3rd Floor West
Topeka, Kansas 66603-3745
785-296-3861

Prepared by:

TranSystems
EXPERIENCE | Transportation

Kimley»Horn

March 2021
091841010

Kimley»Horn

TECHNICAL MEMORANDUM - COUNTERMEASURES

FOR

KDOT LOCAL ROAD SAFETY PLANS (LRSPS) – PHASE 3

KDOT PROJECT NO: 106 C-4790-04

Prepared for:
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Eisenhower State Office Building
700 S.W. Harrison Street, 3rd Floor West
Topeka, Kansas 66603-3745
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STATUTORY NOTICE

23 U.S.C. § 409: US Code - Section 409: 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.

LIST OF FIGURES

LIST OF TABLES

List of Acronyms

ADT	Average Daily Traffic
CMF	Crash Modification Factor
CRF	Crash Reduction Factor
FHWA	Federal Highway Administration
HFST	High Friction Surface Treatment
HSM	Highway Safety Manual
ICE	Intersection Control Evaluation
KDOT	Kansas Department of Transportation
LRSP	Local Road Safety Plan
MUTCD	Manual on Uniform Traffic Control Devices
RCUT	Restricted Crossing U-Turn Intersection
ROW	Right-of-Way
RSA	Road Safety Assessment/Audit
SHSP	Strategic Highway Safety Plan

1. INTRODUCTION

The Kansas Department of Transportation (KDOT), as part of their strategic goal to reduce fatalities and serious injuries within Kansas is conducting Phase 3 of the Local Road Safety Plan (LRSP) project for twenty counties within the state. Forty-three counties were included in the previous phases of this process. The LRSP concept is built on the foundation established by the Strategic Highway Safety Plan (SHSP). **Figure 1** shows the location of the Phase 3 LRSP counties and the previous phase counties.

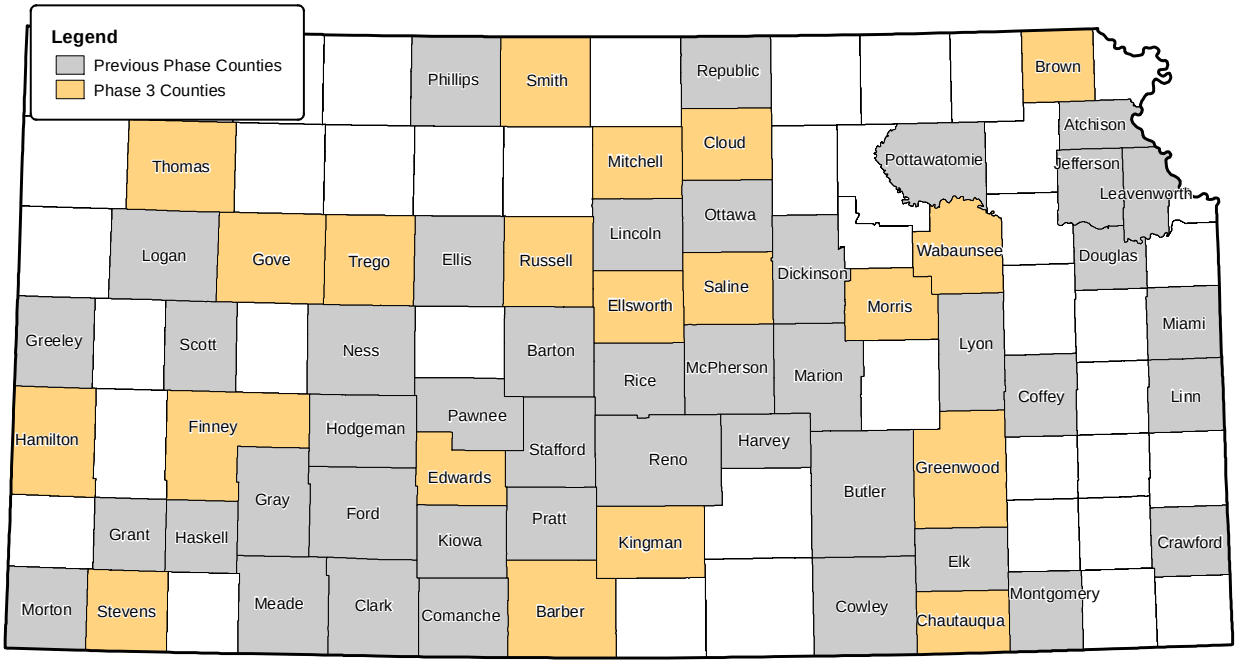

Figure 1 – Location of LRSP Counties

1.1. Purpose

This technical memorandum has been prepared to provide a list of potential safety countermeasures. The countermeasures presented in this document were selected to address the risk factors previously approved. A similar memorandum was prepared for the previous LRSP Phases. This document has been updated based on a review of national resources and best practices.

1.2. Document Organization

This technical memorandum is organized into the following sections:

- **Section 1** presents the project background and purpose of the technical memorandum.
- **Section 2** provides a review of the approved risk factors from the previous LRSP phases and includes a list of the previously approved LRSP safety countermeasures.
- **Section 3** includes additional countermeasures to be considered as part of Phase 3 of the LRSP project.
- **Section 4** summarizes the next steps in the project.

2. SYSTEMIC SAFETY COUNTERMEASURES

While there are many safety countermeasures that could be used to systemically improve roadway safety, the following sections provide countermeasures approved in the previous LRSP phases and additional countermeasures for consideration by KDOT and the counties based on the risk factors approved by KDOT. In addition to the systemic safety countermeasures described in this section, with additional site-specific information, such as turning volumes, travel patterns, vertical alignment, and other known concerns, additional location specific safety countermeasures may be appropriate. This section also describes additional countermeasures that could be considered by the counties where segments, intersections, or curves are identified with high risk factor scores. At the request of the counties, the additional safety countermeasures can be added to the project sheets.

Along with the countermeasure list, the Crash Modification Factors (CMFs) associated with each countermeasure are provided. **Section 2.1** contains a discussion of CMFs and how they are used in predictive crash analysis. The following sections and CMFs in this technical memorandum are provided for reference and to show the potential positive impact to safety, if applied. The LRSP project does not include predictive crash analysis based on calculating the number of crashes that will be reduced by applying a specific countermeasure; as such, the CMFs have been provided for reference to aid the counties in understanding potential reductions from crashes by different countermeasures.

2.1. Crash Modification Factors

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 Highway Safety Manual (HSM). CMFs are defined as the ratio of effectiveness of one condition in comparison to another condition and represent 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 2** 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 2 – 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 rural sites. **Figure 3** is a sample calculation of the CMF method with one CMF being applied to a 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 3 – CMF Method Sample Calculation

Crash Reduction Factors (CRFs) are related to CMFs 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 4** shows how a CRF is calculated in relationship to a CMF.

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

Figure 4 – CRF Calculation

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

- CMFs should be selected from the HSM Part D or from the Federal Highway Administration's (FHWA) 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.

The countermeasures proposed in this document were chosen because of their effectiveness in reducing crashes, particularly those associated with the approved LRSP risk factors. Some safety countermeasures that are recommended do not yet have CMF ratings (indicated by "CMF not defined" within this document), due to the amount of data and peer review that is required; however, preliminary studies show safety benefits as a result of these countermeasures.

Nationally, there are relatively low percentages of fatal and serious injury crashes that occur on unpaved roadways when compared to paved roadways. As such, safety research has focused on paved roadways. The lack of research on the unpaved system results in very few CMFs defined for safety countermeasures on unpaved roadways.

2.2. Segments

2.2.1. Segment Risk Factors

The following risk factors for roadway segments were approved by KDOT for use in the LRSP project.

- Average Daily Traffic (ADT) volumes
- Access density
- Edge condition
- Roadside assessment
- Roadway width
- Shoulder width
- Lane departure crash rate
- Presence of pavement markings
- Surface type (paved or unpaved)

2.2.2. Approved Segment Countermeasures

Table 1 lists segment countermeasures approved in the previous LRSP phases, CMFs, and planning-level estimated costs. It should be noted that the CMFs were reviewed and updated for each countermeasure based on the latest information available on the CMF Clearinghouse. The CMF Clearinghouse is regularly updated with new information from safety studies; and at each phase of the LRSPs, it is important to check the CMF Clearinghouse to determine if there are updates needed to the CMFs to reflect recent studies and updates.

The countermeasures were selected based on the approved risk factors for segments. The CMFs in the table are at times provided as a range, showing the variance each potential crash modification countermeasure can have based on differing research, specific crash types, or specific volume-level roadways (i.e., CMF can vary based on the amount of traffic on the road, vary based on reducing crash severity, or vary between rear-end and run-off-road crashes). The costs included in the table are planning-level estimates prepared as part of the previous LRSP Phases and have been based on costs from other Midwest states and national averages. These cost estimates can be adjusted per the counties or KDOT to be more specific to their area if desired.

It should be noted that some curve countermeasures are included with the segment countermeasures to address potential risk at curves within a certain segment. Also, some of the countermeasures will require additional information from the county, as the data collected as part of this project is for a more high-level/systemic review. For example, information on vehicle speeds or superelevation rates were not collected. At the request of the counties, based on their local knowledge of the roadway network, the additional safety countermeasures can be added to the project sheets.

Table 1 also has two columns indicating the applicability of each countermeasure to paved or unpaved roadways.

Table 1 – Approved Segment Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF) **	Estimated Cost	Paved	Unpaved
Countermeasures where Risk Factor Data for Recommendations has been Collected				
Install/Upgrade Guardrail with Reflectors	0.53 – 0.56 New Guardrail along Embankment	$35/foot (if 500 feet or more) - $80/foot (if less than 500 feet)	X	X
Delineate Roadside Hazards with Retroreflective Markers	CMF not defined	$100/each	X	X
Remove/Relocate Fixed Objects in Clear Zone (e.g. rock/brick mailboxes, non-breakaway poles)	FHWA Proven Countermeasure	$1,000/each	X	X
Review Pavement Condition/Type and Install Centerline Rumble Strips	0.66 – 0.96	$2,000/mile	X	
Install 4” Retroreflective Centerline	0.76 when installed in combination with edgelines	$2,100/mile	X	
Install 6” Retroreflective Edgeline (both sides of the road)	0.64 – 0.88	$4,200/mile	X	
Review Pavement Condition/Type and Install Edgeline Rumble Strips (Both Sides of Road)	0.61 – 0.86	$5,000/mile	X	
Install Post-Mounted Delineators	0.55 when installed in combination with edgelines and centerlines	$5,000/mile	X	X
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations (Both Sides of Road)	CMF not defined	$5,000/mile	X	
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	CMF not defined	$25,000/mile	X	
Clear and Grub (15 feet Off Edge of Road)	0.78	$30,000/mile	X	X
Flattening and Widening Foreslopes (Excludes Culvert Extensions)	0.58 – 0.90	$75,000/mile	X	X
Pave 2’ Shoulder with Safety Edge (Both Sides of Road - Includes Earthwork)	0.82 – 0.94 “Pave Shoulder” 0.65 – 0.96 “Safety Edge”	$150,000/mile	X	

Safety Countermeasure	Crash Modification Factor (CMF) **	Estimated Cost	Paved	Unpaved
Countermeasures for a Segment that also has Curves				
Retroreflective Strips on Curve Signage	CMF not defined	$100/curve	X	X
Review and Install/Upgrade Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet the Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	0.59 – 0.61 for warning signs/plaques; 0.75 – 0.96 for chevrons	$1,000/curve (upgrade) - $3,500/curve (install)	X	X
Install In-Lane Curve Warning Pavement Markings	0.65	$2,000/curve	X	
Install High-Friction Surface Treatment (HFST) on Curve	0.27 – 0.58	$20,000 - $50,000/curve	X	
Countermeasures for Specific Locations where Additional Data/Information is Needed				
Reshape/Repair Roadway Surface and Apply Dust Suppressants	0.95	$1,000 – $5,000/mile		X
On-Pavement Markings for Speed Control	CMF not defined	$3,000/each	X	
Transverse Rumble Strips Prior to Curve	0.66 Install Transverse Rumble Strips as Traffic Calming Device	$3,000/curve	X	
Install Speed Activated Flashers on Chevron Signs	CMF not defined	$4,000/each	X	X
Install a Dynamic Speed Feedback Sign on Curve Warning Sign	0.93 – 0.95	$4,000/each	X	X
Upgrade Roadway Surface (e.g., millings, well-graded rock mix with adequate binder)	CMF not defined	$8,000/mile		X
Improve/Increase Roadway Width (to meet standards) with Safety Edge	0.67 – 0.71	$20,000/mile unpaved - $30,000/mile paved	X	X
Remove/Relocate/Combine Driveways	0.75 from 10-24 to less than 10 per/mile 0.69 from 26-48 to 10-24 per/mile	$20,000/each (unpaved) - $40,000/each (paved)	X	X
Conduct Road Safety Audit/Assessment (RSA) *	CMF varies based on recommendations	$40,000/each	X	X

Safety Countermeasure	Crash Modification Factor (CMF) **	Estimated Cost	Paved	Unpaved
Superelevation Correction on Curves	CMF varies based on rate of change	$20,000/curve (unpaved) - $50,000/curve (paved)	X	X
Pave Roadway with Safety Edge	CMF not defined	$850,000/mile		X

** Countermeasure recommended on segments with high crash rates*
*** The CMFs in this table are for information only, showing the range of potential crash modification the countermeasure can have based on differing research, specific crash types, or specific volume-level roadways (i.e., CMF can vary based on the amount of traffic on the road, vary based on reducing crash severity, or vary between crash type). The CMFs in this table should not be used for crash prediction without first assuring the CMF applies to the specific location and countermeasure implementation.*

Additional segment countermeasures for consideration are included in **Section 3**.

2.3. Intersections

2.3.1. Intersection Risk Factors

The following risk factors for intersections were approved by KDOT for use in the LRSP project.

- Average Daily Traffic (ADT) on all approaches
- Proximity of driveway or another intersection
- Sight distance
- Intersection control
- Fatal or debilitating injury crash history
- Distance from previous stop sign (along the LRSP routes)
- Location on a curve
- Skew

2.3.2. Approved Intersection Countermeasures

Table 2 lists intersection countermeasures approved in the previous LRSP phases, CMFs, and estimated costs. It should be noted that the CMFs were reviewed and updated for each countermeasure. The CMF Clearinghouse is regularly updated with new information from safety studies; and at each phase of the LRSPs, it is important to check the CMF Clearinghouse to determine if there are updates needed to the CMFs to reflect recent studies and updates.

The countermeasures were selected based on the approved risk factors for intersections. Some of the countermeasures will require additional information from the county. At the request of the counties, based on their local knowledge of the roadway network, the additional safety countermeasures can be added to the project sheets.

Table 2 also has two columns indicating the applicability of each countermeasure to paved or unpaved roadways.

Table 2 – Approved Intersection Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF) **	Estimated Cost	Paved	Unpaved
Countermeasures where Risk Factor Data for Recommendations has been Collected				
Retroreflective Strips on Stop Sign Posts	CMF not defined	$100/ intersection	X	X
Upgrade Signs and Pavement Markings	FHWA Proven Safety Countermeasure 0.34 – 0.69 "Stop Ahead Pavement Markings" 0.75 – 0.91 "New Stop Sign" CMF not defined "Intersection Warning Sign with Advance Street Name Sign Plaque" CMF not defined "Stop Line" CMF not defined "Stop Ahead Sign"	$1,100/ unpaved leg - $2,200/ paved leg	X	X (signs only)
Install Second Stop Sign and Stop Ahead Signs	Included in FHWA Proven Safety Countermeasure of "Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections"	$1,500/leg	X	X
Review Pavement Condition/Type and Install Transverse Rumble Strips on Paved, Stop-Controlled Approaches	0.71 – 0.87	$2,500/leg	X	
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	0.84 – 0.87 "Beacon on Stop Sign"	$2,500/sign	X	X
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	CMF not defined	$2,500/sign	X	X
Clear and Grub	0.78	$2,500/leg	X	X
Intersection Lighting (One Luminaire)	0.62	$5,500/each	X	X
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	X	X

Safety Countermeasure	Crash Modification Factor (CMF) **	Estimated Cost	Paved	Unpaved
Countermeasures for Specific Locations where Additional Data/Information is Needed *				
Removal of Unwarranted Stop Signs on Major Approach	CMF not defined	$500/leg	X	X
Install Raised Pavement Markers (150'-300' on Intersection Approach)	0.87	$500/leg	X	
Remove Sweeping Right Turns	CMF not defined	$5,000/each unpaved - $15,000/each paved	X	X
Convert Two-Way Stop to All-Way Stop (if MUTCD warrants are met)	0.52 – 1.12	$1,200/leg	X	X
Reshape Intersection for Control Type	CMF not defined	$2,500/each		X
Install a Dynamic Speed Feedback Sign on Intersection Warning Sign	0.93 – 0.95	$4,000/sign	X	X
Convert Offset T-Intersection to Four-Legged Intersection	CMF not defined	$50,000/each unpaved - $300,000/ each paved	X	X
Install Intersection Conflict Warning System	0.45 – 0.95	$40,000/each	X	X
Provide Bypass Lane on Shoulder at T-intersection	CMF not defined	$50,000/each	X	
Provide Left-Turn Lanes at Intersection	0.42 – 0.52	$150,000/leg	X	
Provide Right-Turn Lanes at Intersection and Remove Sweeping Right Turns	0.74 – 0.92	$150,000/leg	X	
Install Traffic Signal (Rural) (if MUTCD warrants are met)	0.56 - 072	$250,000/ each	X	
Install a Restricted Crossing U-Turn (RCUT) / J-Turn Intersection	0.65 – 0.80	$250,000/ each	X	
Convert Stop-Control to Roundabout	0.18 – 0.42	$2,000,000/ each	X	

** An Intersection Control Evaluation (ICE) is recommended for intersection control changes (estimated cost of $7,500 – $20,000/each)*

*** The CMFs in this table are for information only, showing the range of potential crash modification the countermeasure can have based on differing research, specific crash types, or specific volume-level roadways (i.e., CMF can vary based on the amount of traffic on the road, vary based on reducing crash severity, or vary between crash type). The CMFs in this table should not be used for crash prediction without first assuring the CMF applies to the specific location and countermeasure implementation.*

2.4. Curves

2.4.1. Curve Risk Factors

The following risk factors for horizontal curves were approved by KDOT for use in the LRSP project.

- Average Daily Traffic (ADT) volumes
- Curve radius
- Access density
- Shoulder width
- Edge condition
- Roadside assessment
- Presence of warning signs
- Superelevation
- Fatal or debilitating injury crash history

2.4.2. Approved Curve Countermeasures

Table 3 lists curve countermeasures approved in the previous LRSP phases, CMFs, and estimated costs. It should be noted that the CMFs were reviewed and updated for each countermeasure. The CMF Clearinghouse is regularly updated with new information from safety studies; and at each phase of the LRSPs, it is important to check the CMF Clearinghouse to determine if there are updates needed to the CMFs to reflect recent studies and updates. For example, there have been updates to the CMF Clearinghouse since Phase 2 of the project, and separate CMFs are now available for centerline and edgeline rumble strips in curves. **Table 3** has been updated accordingly to reflect that change and the curve rumble strip CMFs are now different than the segment rumble strips.

The countermeasures were selected based on approved risk factors for horizontal curves. Some of the countermeasures will require additional information from the county. At the request of the counties and based on their local knowledge of the roadway network, the additional safety countermeasures can be added to the project sheets.

Table 3 also has two columns indicating the applicability of each countermeasure to paved or unpaved roadways, or both.

Table 3 – Approved Curve Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF) *	Estimated Cost	Paved	Unpaved
Countermeasures where Risk Factor Data for Recommendations has been Collected				
Install/Upgrade Guardrail with Reflectors	0.53 – 0.56 New Guardrail along Embankment	$35/foot (if 500 feet or more) - $80/foot (if less than 500 feet)	X	X
Retroreflective Strips on Curve Signage	CMF not defined	$100/curve	X	X
Install In-Lane Curve Warning Pavement Markings	0.65	$1,000/each	X	
Review and Install/Upgrade Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet the Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	0.59 – 0.61 for warning signs/plaques; 0.75 – 0.96 for chevrons	$1,000/curve (upgrade) - $3,500/curve (install)	X	X
Review Pavement Condition/Type and Install Centerline Rumble Strips	0.63 – 0.94	$2,000/mile	X	
Install 4” Retroreflective Centerline	0.76 when installed in combination with edgelines	$2,100/mile	X	
Clear and Grub (15 feet off edge of road)	0.78	$2,500/curve	X	X
Install 6” Retroreflective Edgeline (Both Sides of Road)	0.64 – 0.88	$4,200/mile	X	
Review Pavement Condition/Type and Install Edgeline Rumble Strips	0.64 – 0.79	$5,000/mile	X	
Install Post-Mounted Delineators	0.55 when installed in combination with edgelines and centerlines	$5,000/mile	X	X
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	CMF not defined	$5,000/mile	X	
Install 18-inch Aggregate Shoulder Treatment (with transition to earth)	CMF not defined	$25,000/mile	X	
Install High-Friction Surface Treatment (HFST)	0.27 – 0.58	$20,000 - $50,000/curve	X	
Pave 2’ Shoulder with Safety Edge (Both Sides of Road - Includes Earthwork)	0.82 – 0.94 “Pave Shoulder” 0.65 – 0.96 “Safety Edge”	$150,000/mile	X	

Safety Countermeasure	Crash Modification Factor (CMF) *	Estimated Cost	Paved	Unpaved
Countermeasures for Specific Locations where Additional Data/Information is Needed				
Install Raised Pavement Markers (150'-300' in advance of and along curve)	0.87	$1,000/curve	X	
Reshape/Repair Roadway Surface and Apply Dust Suppressants	CMF not defined	$1,000 – $5,000/mile		X
On-Pavement Markings for Speed Control	CMF not defined	$3,000/each	X	
Review Pavement Condition/Type and Install Transverse Rumble Strips Prior to Curve	0.66 Install Transverse Rumble Strips as Traffic Calming Device	$5,000/curve	X	
Install Speed Activated Flashers on Chevron Signs	CMF not defined	$4,000/each	X	X
Install a Dynamic Speed Feedback Sign on Curve Warning Sign	0.93 – 0.95	$4,000/sign	X	X
Superelevation Correction on Curves	CMF varies based on rate of change	$20,000/curve (unpaved) - $50,000/curve (paved)	X	X

** The CMFs in this table are for information only, showing the range of potential crash modification the countermeasure can have based on differing research, specific crash types, or specific volume-level roadways (i.e., CMF can vary based on the amount of traffic on the road, vary based on reducing crash severity, or vary between crash type). The CMFs in this table should not be used for crash prediction without first assuring the CMF applies to the specific location and countermeasure implementation.*

3. ADDITIONAL POTENTIAL COUNTERMEASURES/OTHER CONSIDERATIONS

With continuing research in transportation safety, it is necessary to frequently review national best practices and recommended safety countermeasures. As part of the update to this Technical Memorandum national resources were reviewed, and the following sections include additional safety countermeasures for KDOT and the Phase 3 counties to consider including as recommendations where site location data/information would be needed. It is also recommended that with Phase 4 and future phases of the LRSP project, countermeasure research be reviewed again to recommend additional safety countermeasures, if applicable.

3.1. Painted Centerline Buffer

Where enough right-of-way (ROW) exists, a painted centerline buffer could be a potential countermeasure to decrease opposite direction crashes and total crashes overall. At minimum, a 4-foot buffer with two separate double yellow pavement markings and rumble strips would be placed in the center of the roadway. The countermeasure, which would lead to a decrease in shoulder width, is ideal for areas with a high number of opposite direction crashes as well as a ROW wide enough to support the addition.

Issues may arise from left-turning movements if a dedicated left turn lane is not included on the road, as users may attempt to use the buffer as a turn lane. This can be alleviated by focusing on segments of roadway where access density is relatively low.

Though research with the Texas Department of Transportation is still ongoing regarding the potential CMF of this countermeasure, preliminary studies have shown early signs of effective crash reduction overall and with opposite direction crashes. Same direction and sideswipe crashes have slightly increased, which may be due to the shoulder reduction, but overall, the decrease in frequency and severity outweighs the increase in less-severe crashes.

3.2. Mumble Strips

Mumble strips are a different method of constructing rumble strips. Mumble strips are sinusoidal rumble strips, which differ from traditional rumble strips in that they have a wave pattern engrained in the pavement and lessen the external noise produced when traversing over them, while not considerably decreasing the internal noise produced. Mumble strips could be used in lieu of rumble strips in rural areas where residences are or will be located near the roadway in order to reduce the noise pollution in these areas, yet still have the positive impact of rumble strips to the driver. There are currently no specific CMFs associated with mumble strips.

4. ADDITIONAL POTENTIAL UNPAVED ROADWAY COUNTERMEASURES

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. 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*). **Figure 5** shows examples of proper unpaved road shapes.

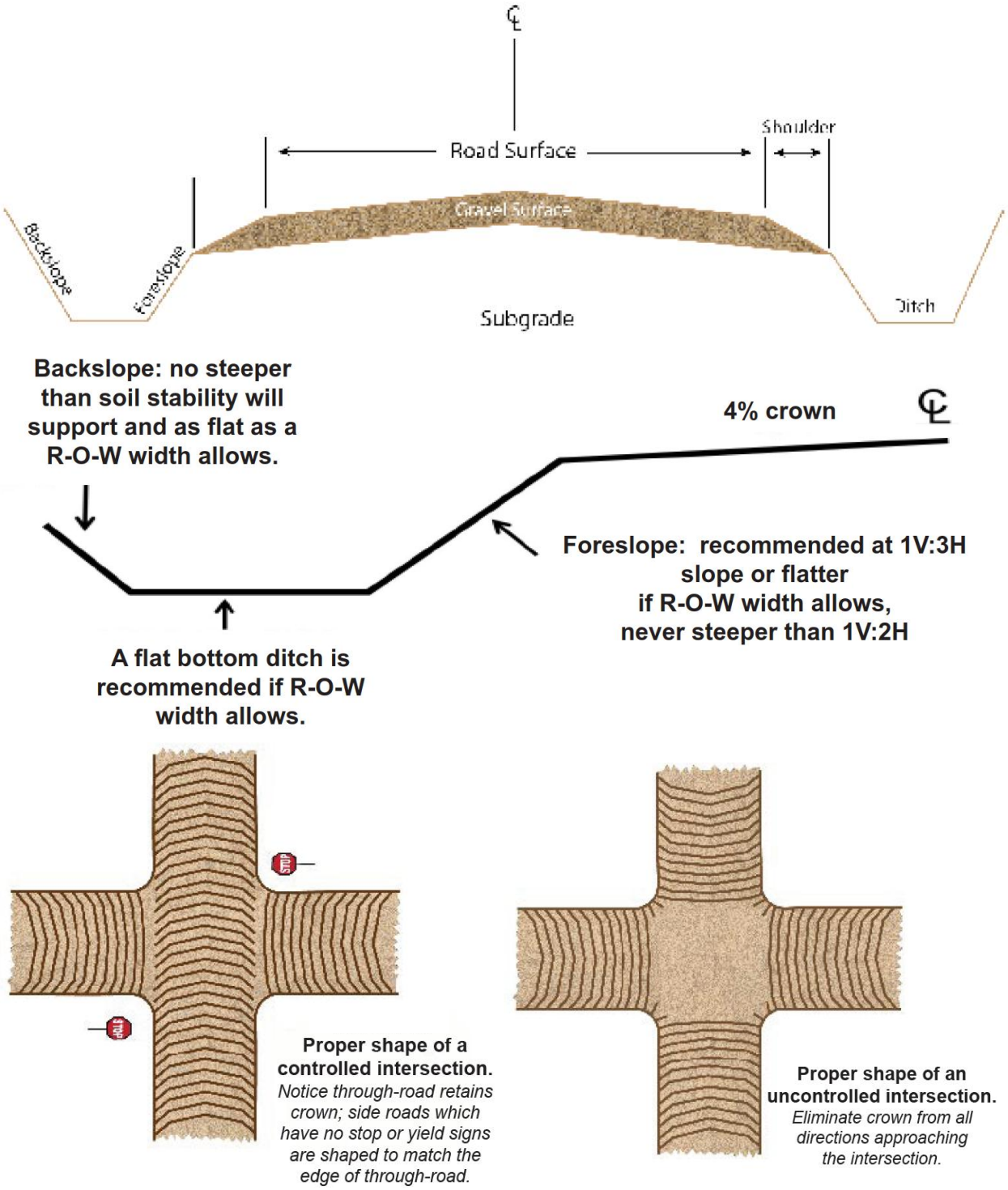

Figure 5 – Unpaved Roadway Proper Shape Guidance
(*Gravel Roads Construction & Maintenance Guide*, FHWA, 2015)

5. NEXT STEPS

The next steps include data processing to support the analysis of risk factors. Workshops will be conducted with each of the twenty Phase 3 LRSP counties to discuss transportation safety strategies and countermeasures.

After the workshops are conducted, a systemic analysis will be conducted for the Phase 3 LRSP counties to calculate risk factor scores for each roadway segment, intersection, and curve along the LRSP study routes. The segments, intersections, and curves with the highest risk factor scores will be reviewed and 10 locations will be selected for safety improvement consideration. Project sheets will be created for the locations selected which include associated recommended safety countermeasures.

Finally, a LRSP report will be produced for the counties, providing a summary of the project, risk factor information, and the project sheets.

APPENDIX G

LRSP SAFETY WORKSHOP MEETING MINUTES (WITHOUT EXHIBITS)

Meeting Minutes

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ATTENDEES:	Justin Mader (Saline County)
	Jim Stanek (TranSystems)
	Lindsay Francis (WSP)
	See Attached Attendance Sheet for additional attendees

DATE:	September 24, 2021
FROM:	James Stanek
JOB NAME:	KDOT Local Road Safety Plans
JOB NO:	P101190098
RE:	Saline County LRSP Safety Workshop

CC:	Meeting attendees

MINUTES:

The Saline County Local Road Safety Plan (LRSP) Safety Workshop was held at the Saline County Road and Bridge Training Room (3424 Airport Road, Salina, KS) on May 18, 2021, from approximately 1:00 to 4:00 p.m. TranSystems provided a PowerPoint presentation, presentation handout and maps of Saline County's LRSP routes. A copy of the presentation is included with these minutes.

The primary agenda items included the LRSP Background and Purpose, 5E's of Safety, an Overview of Crash Data, Systemic Risk Factors, and Potential Safety Countermeasures. Audience participation was encouraged throughout and group feedback times were provided to discuss locations of concern along the county's LRSP routes, along with the safety countermeasures that were presented. The feedback received and discussion regarding these topics is summarized below:

5E's of Safety

As part of the 5E's discussion, Jim noted the benefits of the S.A.F.E. (Seatbelts Are For Everyone) program as an outreach to younger drivers. Saline County has several schools (Salina Central High School; Lakewood Middle School; Salina South Middle and High Schools; Sacred Heart Junior/Senior High School; and, Southeast of Saline High School) involved in the S.A.F.E. program for the 2020-2021 school year. If there is an interest in expanding the S.A.F.E program to other schools in Saline County, please contact the Kansas Traffic Safety Resource Office (800-416-2522), for more information.

LRSP Routes

Participants were given time to review the supplied map of Saline County's LRSP routes and give feedback on specific locations of concern. Below are the specific locations mentioned or discussed:

1. A number of general concerns were noted by attendees during the discussion about Saline County's LRSP routes:
   - Trees and vegetation: A comment was made that many of the county road intersections have issues with trees and overgrown weeds or brush that obscure sight lines. Specific locations were not identified but ensuring there is adequate sight lines at intersections was identified as a general concern. Jim noted that some coordination may be possible with land owners to help clear trees outside of the right of way to enhance sight lines.
   - Gravel road intersection approaches on paved roads: A concern was identified about locations where a gravel road intersects with a paved road, since traffic on the unpaved road typically drags out gravel/rocks onto the paved road when entering the intersection. The loose gravel on the pavement can create some safety concerns for some vehicle types, primarily motorcycles. This was considered more of a concern where an unpaved road intersects along a paved curve. Paving an apron on the unpaved road was identified as a countermeasure that has worked for the county at some of these locations, most notably a curve on Summit Road at Forsse Road.
   - Narrow rights of way: Many of the county roads have narrow rights of way which limits road and shoulder widths, as well as the available clear zones outside of the travelway.
   - Data sharing: A general concern was expressed that the road department doesn't have access to crash data from local law enforcement. This doesn't allow them to track historical trends or to respond to current conditions. A law enforcement attendee noted that they can share a program with Road & Bridge staff that will allow them to access more "live" crash data on a map of the county; a tool that displays the location and other information about crashes within 1 – 2 days of their occurrence.
   - Driver and vehicle characteristics during harvest: It was noted that driver and vehicle characteristics change during harvest times, which impacts safety throughout the county. Some of the concerns identified include younger drivers (some without licenses), more tractor-trailers on the roads, higher speeds, farm equipment without proper lighting, aggressive driving to and from the grain elevators, etc. It was suggested that it may be beneficial to provide some additional driver education or public service messages during these times of the year. **In follow-up, links to two resources that could be of use to the county are included below:**
     a. An article that provides some safety tips for drivers and producers during harvest prepared by the South Dakota State University Extension office can be found at: https://extension.sdstate.edu/roadway-safety-during-harvest
     b. Driver Education Provider grants are available through KDOT's IKE Program – The Eisenhower Legacy Transportation Program. A Fact Sheet can be found at: https://www.ksdot.org/Assets/wwwksdotorg/bureaus/burTrafficSaf/pdf/DRIVER_EDUCATION_PROVIDER_FACT_SHEET.pdf
2. Several road segments were identified with safety concerns associated with narrow or non-existent shoulders and steep foreslopes to the ditches:
   - Shipton Road between Ohio Street and Old 81 Hwy: This 1-mile segment is also somewhat narrow, carries a moderate volume of traffic and has several driveways and intersections.
   - Simpson Road between Country Club Road and Old 40 Hwy: This road segment carries a moderate volume of traffic.
   - Brookville Road between State Street and I-70: This road carries a high volume of truck traffic.
   - Niles Road between Old 40 Hwy and I-70: This road segment carries a moderate volume of traffic.
   - Falun Road between Burma Road and I-135
   - Hedville Road between I-70 and the north county line
3. Old 81 Hwy between Assaria (Falun Road) and I-135: This road segment has safety concerns associated with pavement edge drop-offs. It is a fairly narrow road that gets a lot of wide farm equipment that regularly damages the existing shoulders.

4. Crawford Street and Burma Road: This is an intersection of two LRSP routes that has two-way stop control on the north/south approaches (Burma Road). There have been some angle crashes at this intersection.
5. Burma Road and Falun Road: This is an intersection of two LRSP routes that has two-way stop control on the east/west approaches (Falun Road). The intersection carries a higher volume of traffic and there are some sight line limitations when looking north due to several trees on both sides of Burma Road. There have been some crashes at this intersection as well.
6. Holmes Road and Water Well Road: This is an intersection of two LRSP routes that has two-way stop control on the north/south approaches (Holmes Road). There are concerns with the uneven and rolling vertical terrain on Water Well Road west of the intersection, sometimes referred to as "Sparks Boulevard".
7. Water Well Road and Old 81 Hwy (9th Street): This is an intersection of two LRSP routes that has two-way stop control on the east/west approaches (Water Well Road). The intersection carries a high volume of traffic given its proximity to the city of Salina. There have been several crashes at the intersection, and many of these have involved drivers who confuse the intersection for a multiway stop. At the workshop, it was noted that the intersection may move under city jurisdiction in the near future. **In follow-up, TranSystems was informed that the intersection was annexed by the city in the summer of 2021. As a result, it will not be included as part of this LRSP.**
8. Curves on Old 40 Hwy between the Salina east city limit and Marymount Road: There is a mild reverse curve section in this area, but the curve visibility is somewhat limited due to several trees in the vicinity. These conditions combined with high speed traffic have resulted in some serious crashes over the years. Attendees noted that some improvements may have already been made in this section.
9. State Street and Hedville Road: This is an intersection of two LRSP routes that has two-way stop control on the north/south approaches (Hedville Road). There is a vertical curve on State Street to the east of the intersection which impacts sight lines for traffic on Hedville Road.
10. State Street and Powers Road: This is an intersection that has two-way stop control on the north/south approaches (Powers Road). There is a vertical curve on State Street to the east of the intersection which impacts sight lines for traffic on Powers Road.
11. Old 40 Hwy and State Street: This is a Y-intersection with three curved approaches and a somewhat sharp skew angle for the stop-controlled westbound approach. The existing geometry complicates many of the turning movements and limits sight lines for drivers attempting to enter Old 40 Hwy. Attendees expressed an interest in either reconstructing the intersection approaches or perhaps constructing a roundabout. Another complicating feature is the close proximity of a rail-grade crossing on the east leg of the intersection.
12. Some locations on KDOT's system were identified as part of the discussion:
    - K-4 east of K-104: General safety concerns were identified for this highway segment, particularly at a number of the intersections (e.g., Holmes, Simpson, and Woodward) due to limited sight lines. Jim noted that a roughly 7-mile segment of this highway is currently under design and scheduled for reconstruction within the next few years. **In follow-up, the project limits are from the Smoky Hill River Bridge through Kipp Road.**
    - K-104 at Old 81 Hwy/Mentor Road: Law enforcement attendees noted that there have been several crashes at this intersection located roughly ¼-mile east of an interchange with I-135.
    - I-135 NB Ramp at State Street: Concerns were expressed about limited sight lines for drivers on this ramp when looking to the west along State Street. Contributing factors include a horizontal curve along State Street and the presence of the I-135 bridges.

    All of these locations were noted as a concern even though all are on KDOT's system and not part of the LRSP project.

Crash Data

Some items noted in the discussion of the crash data:

1. Findings for Saline County are excluded to crashes along the LRSP routes rather than all county roads.
2. The Crash Location and Crash Heat map (Exhibit 3D) is included to show the location and intensity of crashes along the LRSP routes during the 5-year analysis period. It was noted that while some crash characteristics

will be considered as part of the risk factors on the project, the focus of the project is a systemic review of the LRSP routes rather than just targeting existing "hot spots". Some other attendee comments on this crash exhibit included:

a. Darren Fishel asked about the "hot spot" and cluster of crashes along Old 40 Hwy near Solomon, and if weather or road surface conditions were issues for the curves in this area. **In follow-up, TranSystems found that there were nine (9) crashes on this segment of Old 40 Hwy through these two curves for the 2015 – 2019 time period. Five (5) of these were animal crashes, three (3) were lane departure crashes; and, one (1) was coded as "other/non-collision". None of the crashes were coded as DUI's. Most of the crashes occurred during no adverse weather conditions, although wet pavement conditions were reported in two (2) of the three (3) lane departure crashes. There were no apparent day of week or month of year patterns, but it is somewhat notable that eight (8) of the nine (9) crashes occurred during hours of darkness.**

3. A list of high crash locations will be developed as part of the project and provided to Justin Mader for the county's use.

Potential Safety Countermeasures

Potential safety countermeasures for the LRSP segments, intersections and curves were identified. Participants were then asked to give feedback on specific countermeasures that are either of interest or concern. The feedback received and subsequent discussion is summarized below:

1. The county already has centerline and edge line pavement markings on many of their paved roads and these are considered beneficial countermeasures. Justin noted that he would be concerned about using 6-inch edge lines given their somewhat narrow road widths, and they've found that traffic is always wearing down the 4-inch edge lines (more so than centerline). They do a lot of chip seal pavement work which also reduces marking durability. Most of their markings are restriped every year due to the chip seal pavement.
2. Raised pavement markers or raised rumble strips were not considered practical countermeasures for Saline County. They use motor graders to remove snow, which puts more down pressure on the roads than regular snow plows. Anything raised on the pavement surface would likely need to be maintained or replaced frequently.
3. Edge line and centerline rumble strips were briefly discussed, but attendees could not identify any paved roads that are wide enough to allow for installation. Attendees also mentioned that these likely would not be effective due to their chip seal pavements.
4. Transverse rumble strips were also discussed and while the county does not have any of these at present, they would consider using them depending on the location. A concern that Justin has observed is that some drivers avoid these by driving around them in the opposing traffic lane. Jim noted that these could be a positive countermeasure for selected intersection or curve locations that have documented safety issues.
5. Upgrading or installing guardrail with reflectors or retroreflective materials was considered a favorable countermeasure, although it was acknowledged that this may need to be maintained more frequently since it's another object that can be hit. In addition, many of their roads don't have adequate shoulder to install guardrail. After additional discussion, it was generally agreed that this would be most effective at spot locations where there are more significant edge drop-offs, such as near bridges and culverts.
6. Countermeasures targeted to shoulder improvements (e.g., flattening/widening foreslopes, constructing aggregate shoulders, providing aggregate edge wedges) were considered the most necessary and helpful long-term measures, but Justin noted that they generally don't have right of way available to do this type of work.
7. Clearing and grubbing was considered effective, and the county regularly performs this type of maintenance along road segments and at intersection corners. Justin noted that this is frequent ongoing work for their staff, and they are typically in "catch-up" mode given all the clearing and grubbing needs in the county.
8. Favorable intersection improvements included upgrading signs, using larger signs, installing a second Stop or Stop Ahead sign, and/or supplementing Stop signs with a "Cross Traffic Does Not Stop" warning plaque. The county would also consider using retroreflective strips on sign posts since these are relatively low cost and easy to install devices that can help capture a driver's attention.

9. Attendees recognized the benefits of flashing beacons or LED flashing lights, whether on Stop signs or warning signs, but concerns were expressed about the potential for vandalism. Attendees thought these might be more effective closer to populated areas where they would be less susceptible to vandalism.
10. The county has a dynamic speed feedback sign that they move around regularly throughout the county. This was generally considered beneficial, although its effectiveness has not been reviewed.
11. Intersection conflict warning systems were considered a less favorable improvement, primarily due to ongoing maintenance concerns. Justin noted that this type of countermeasure would be further down the county's list of preferred options. Intersection lighting was also considered less favorable, although the county has a light in place at the intersection of Old 40 Hwy and State Street. Vandalism concerns were also mentioned for these countermeasures.
12. Roundabouts were discussed, but no locations were identified where this type of improvement would be needed or practical at present.
13. Ensuring there is adequate and up-to-date curve signage in place was identified as an important countermeasure. Justin noted that most of their curves already have adequate warning signage in place, and that most of their curves are relatively gentle. An attendee suggested that some may need chevrons.
14. Superelevation correction on curves was considered a positive countermeasure and Justin noted that the county may be able to do some of this with their own forces in conjunction with overlay projects. This type of curve modification was considered more practical for the county to implement than high friction surface treatments.

Conclusion

As part of the Next Steps discussion, Jim explained how Saline County can benefit from their LRSP by using information in the report to apply for safety funding through KDOT's High Risk Rural Roads (HRRR) program for improvements at their top safety project locations. Earlier in the presentation, Jim noted that the KDOT Bureau of Local Projects (BLP) has started requiring counties to have an LRSP in place (or in progress) in order to receive HRRR funding. The LRSP process uses a data driven approach for selecting safety improvement project locations which is required to receive this federal funding. Previous KDOT guidance has indicated that the funds need to be used for a systemic improvement rather than a maintenance project.

Reports from some of the other counties with completed LRSPs were available for the participants to review. Jim noted that several other counties involved in the LRSP program have received HRRR funding for improvement projects by using the information provided within their report.

The participants were encouraged to contact James Stanek (TranSystems) or Justin Mader (Saline County) if they have any additional comments about the information that was presented.

The meeting concluded at approximately 4:00 p.m.

TranSystems
EXPERIENCE | Transportation

LRSP Workshop - Saline County
Saline County Road and Bridge
3424 Airport Road; Salina, KS 67401

Date: 5/18/2021

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	First	Last			
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13	Hannah	Stambaugh	" "	785-309-5810	hannah.stambaugh@saline.org
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16					
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Saline County
Local Road Safety Plan (LRSP)
Safety Workshop

Tuesday, May 18, 2021

1:00 PM – 4:00 PM

Saline County Road and Bridge

training room

3424 Airport Road; Salina, KS 67401

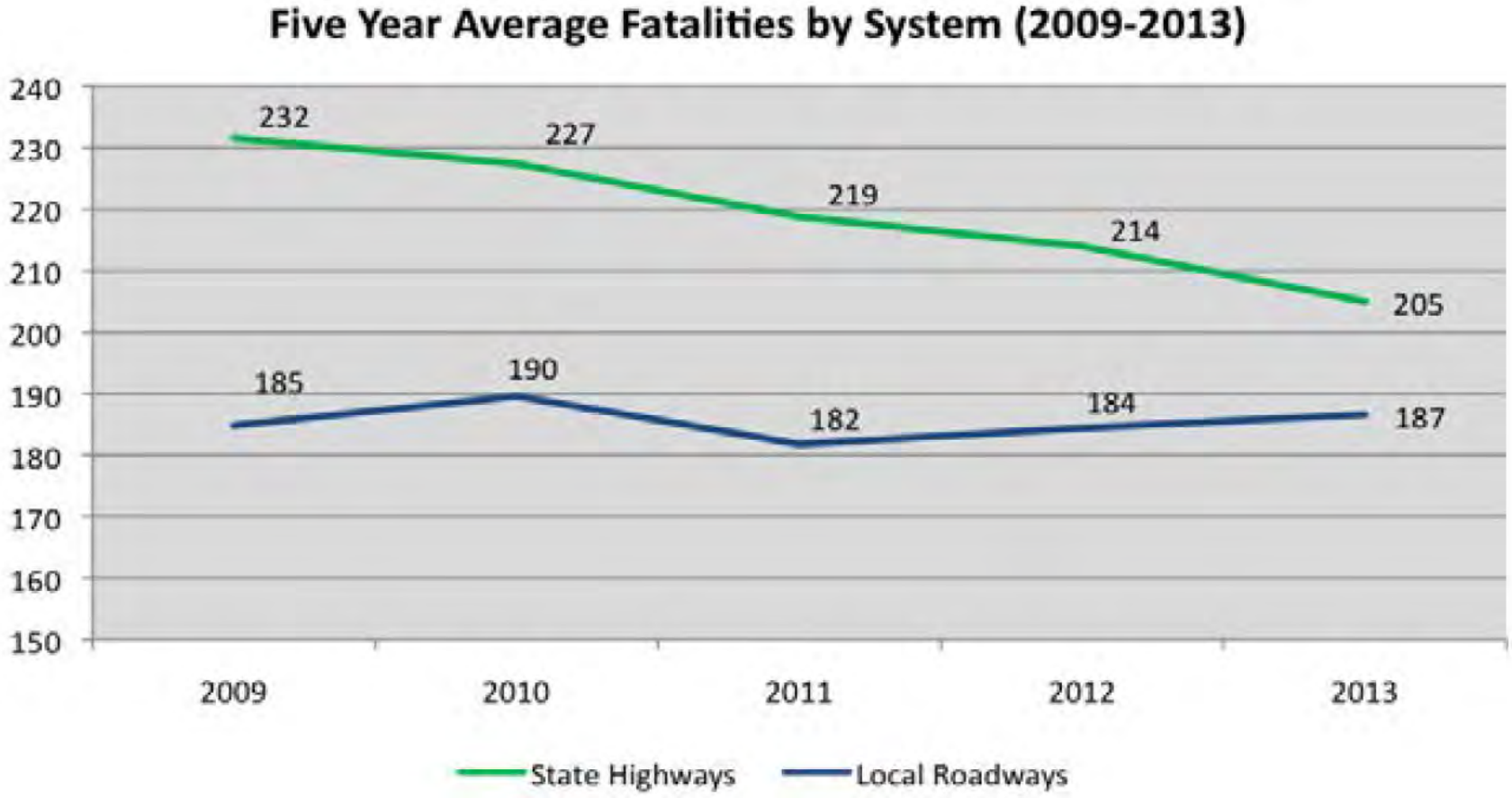
Agenda

- Introductions and Safety Briefing
- LRSP Background and Purpose
- 5E's of Safety
- Overview of Crash Data
  - LRSP Pilot Phase, LRSP Phase 1 and Your LRSP Routes
- Systemic Risk Factors
  - Segments, Intersections and Horizontal Curves
- Potential Safety Countermeasures
  - Segments, Intersections and Horizontal Curves
- Next Steps

LRSP Background and Purpose

- Kansas' Strategic Highway Safety Plan (SHSP)
  - Goal is to reduce fatalities and serious injuries by half on all public roads in the state over a 20-year period ending in 2029
  - For 2009-2013, 48% of fatalities and 55% of disabling injuries occurred on roads owned by local public authorities

LRSP Background and Purpose



With limited funds, a County needs a plan to effectively make an impact on their crash statistics

LRSP Background and Purpose

- Identify locations where systemic safety improvements can be implemented
- Proactive approach with a broader view of risk
- Less reliant on "hot spot" analysis

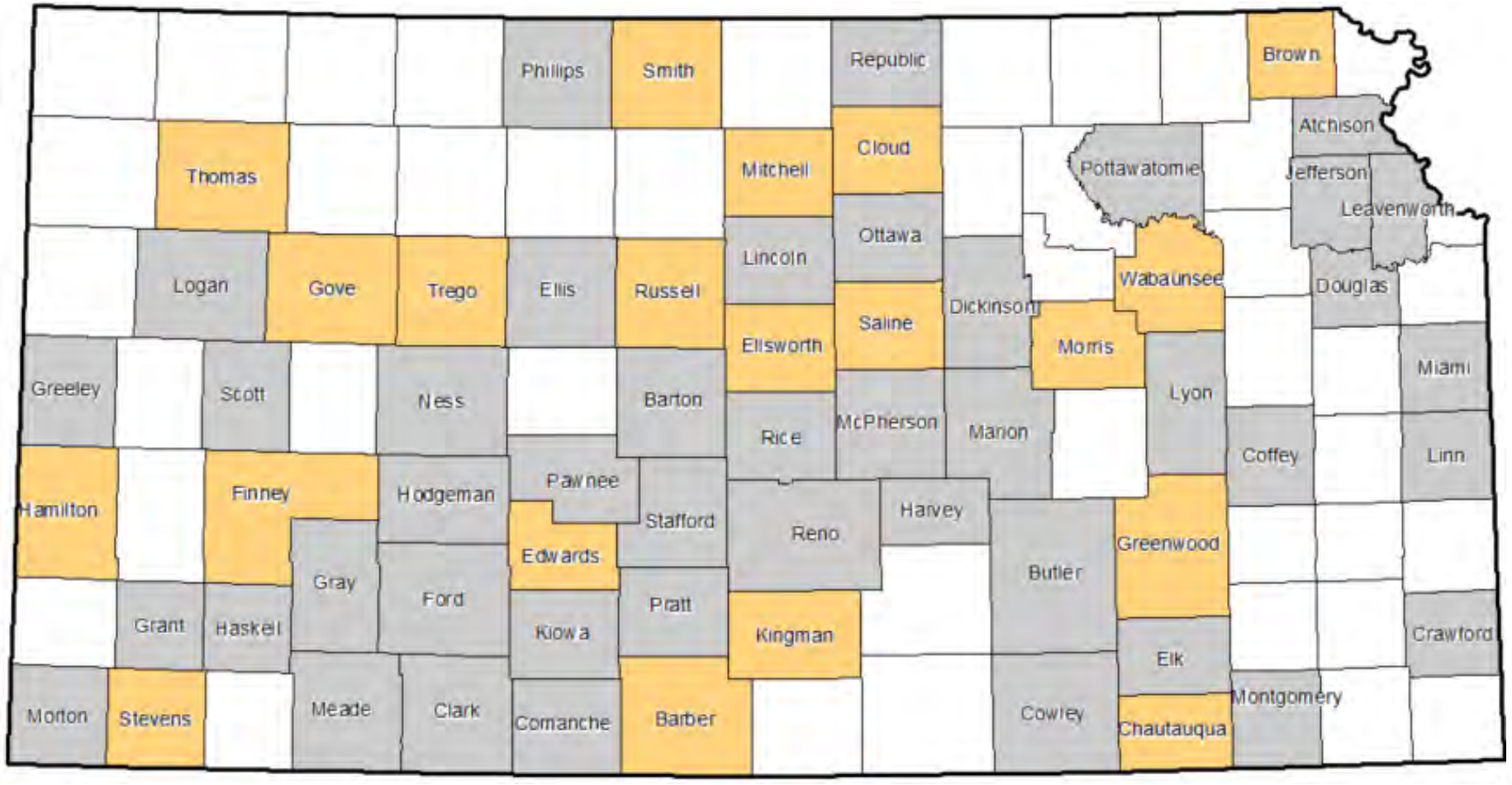
"The systemic approach to safety involves widely implemented improvements based on high-risk roadway features correlated with specific severe crash types. The approach provides a more comprehensive method for safety planning and implementation that supplements and complements traditional site analysis. 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

LRSP Background and Purpose

- Advantageous for the County in securing future safety funds through High Risk Rural Roads (HRRR) Program
  - 2020 HRRR Awards: 6 counties received $2.1 million
  - 2021 HRRR Awards: 10 counties received $6.7 million

LRSP Background and Purpose



5E's of Safety

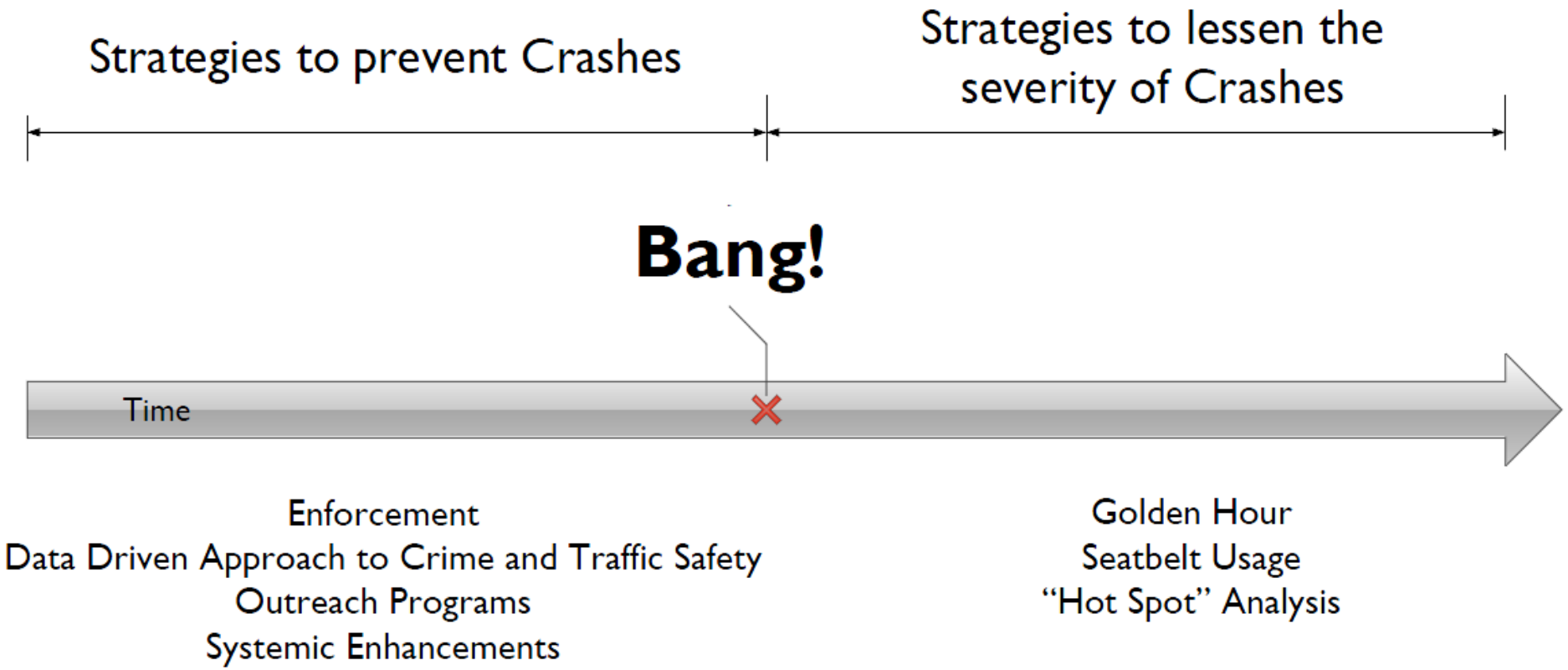
- "Driver" factors cited in an estimated **94%** of crashes

We are still enforcing the speed limit on I-435. This driver told the officer, "when I looked down at the speedometer, I was doing 128 mph". Well, the officer locked her vehicle speed at 149 mph. SLOW DOWN!

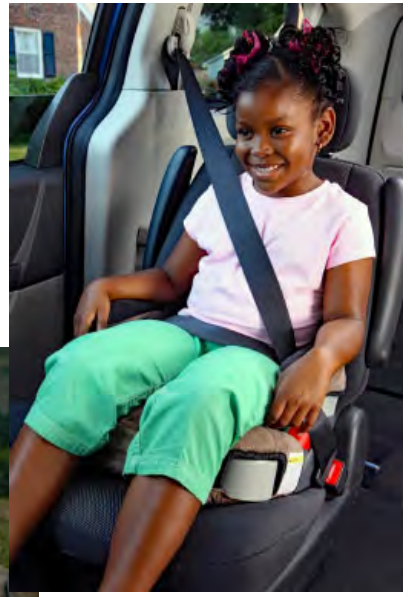
5E's of Safety

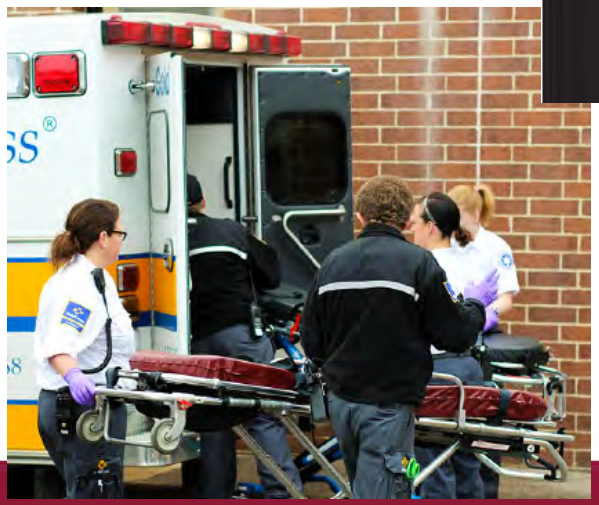
- Multidisciplinary approach is needed
- Perpetuate a "Culture of Safety"

5E's of Safety



5E's of Safety





5E's of Safety

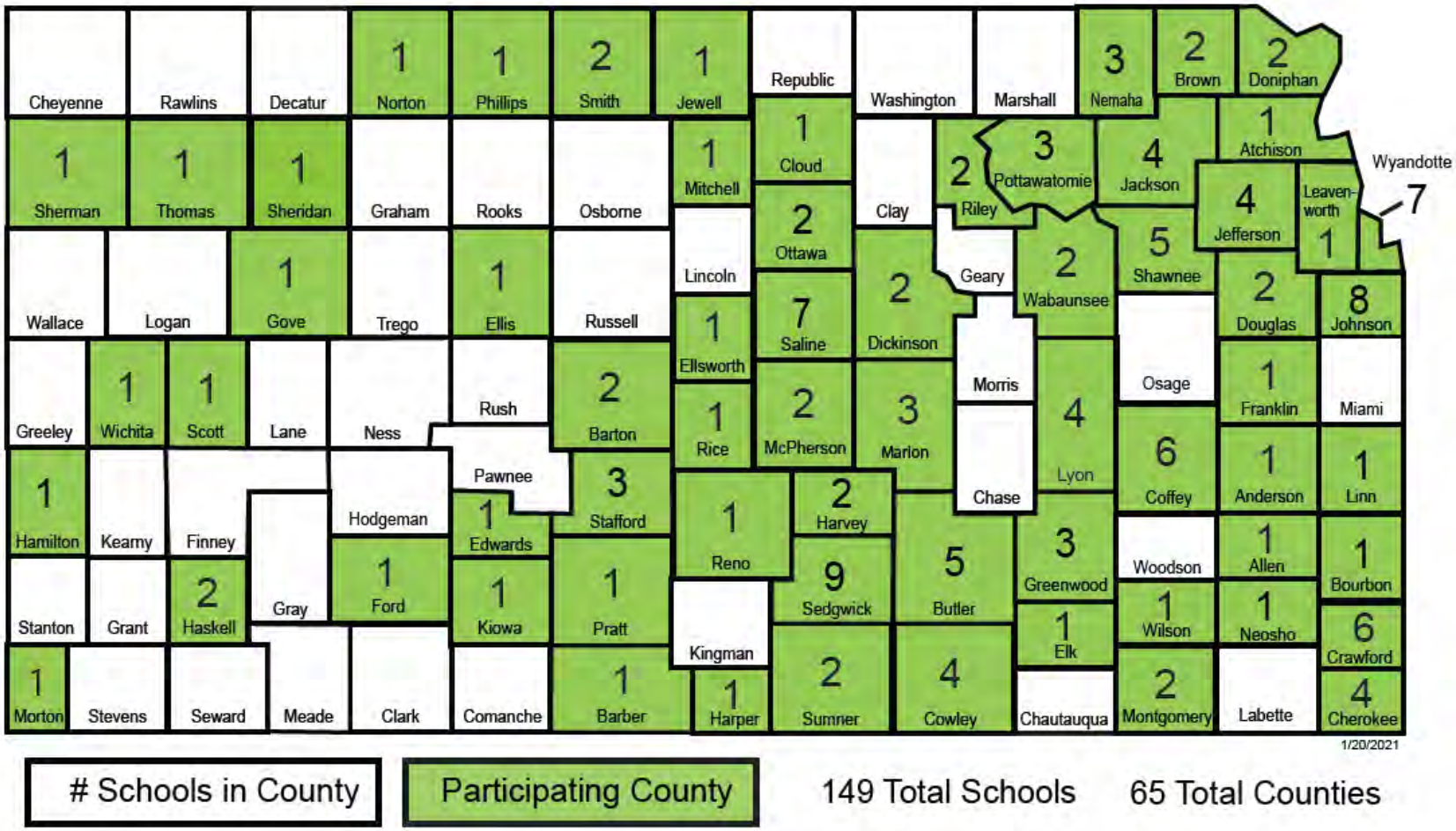
- SAFE is a teen-run, peer-to-peer program
- Supported by local law enforcement, school staff, and the Kansas Traffic Safety Resource Office (KTSRO)
- Education focus areas:
  - restraint use
  - distracted driving
  - driver impairment

SAFE

Seatbelts Are For Everyone

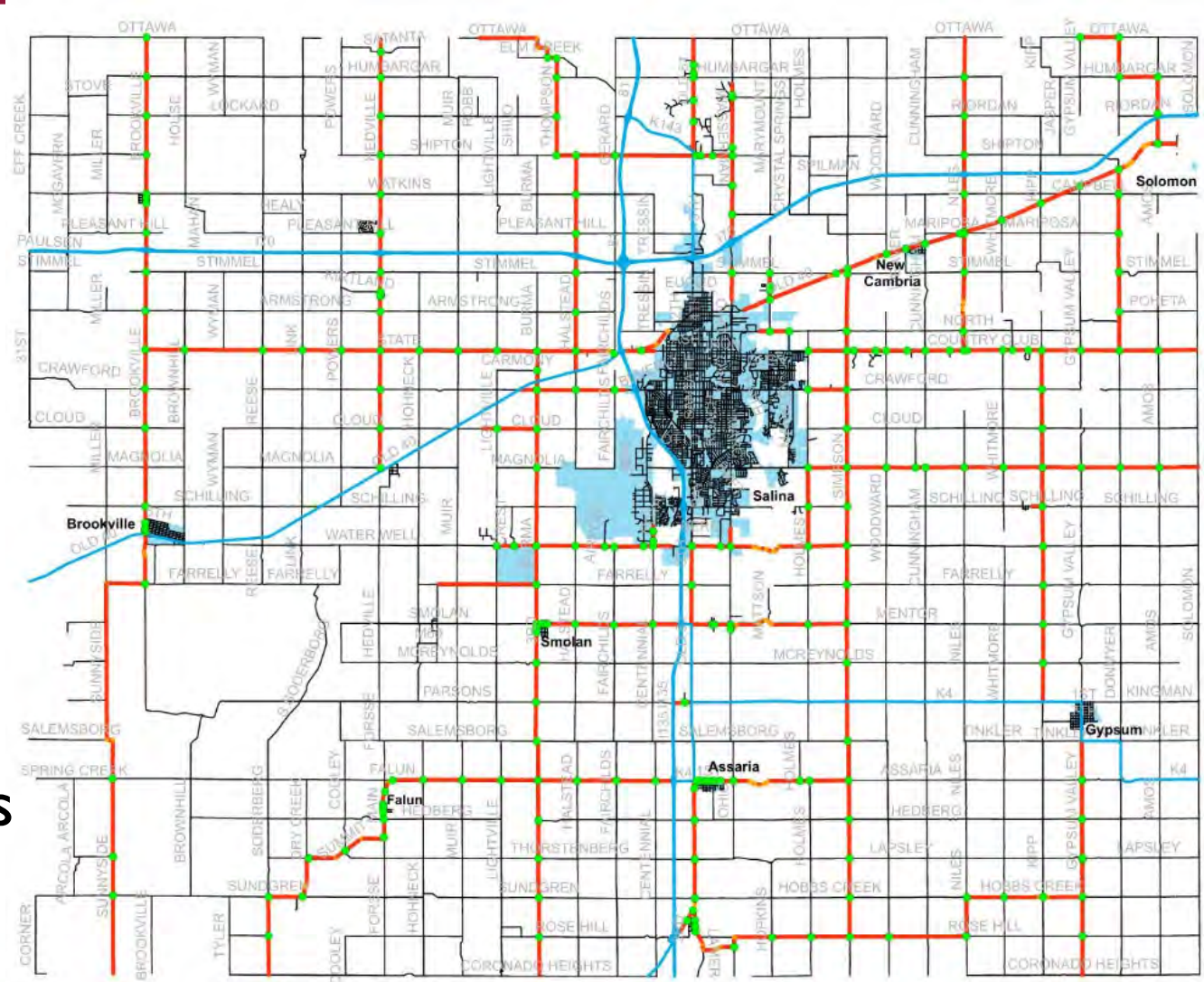
5E's of Safety

- SAFE 2020-2021 Participation Map



Your LRSP Routes

- 237 miles of segments
  - Paved: 171 miles (72%)
  - Unpaved: 66 miles (28%)
- 262 intersections
- 74 curves



Your LRSP Routes

Workshop Feedback Opportunity:

- Where are your specific locations of concern on Your LRSP Routes?
  - Segments
  - Intersections
  - Curves

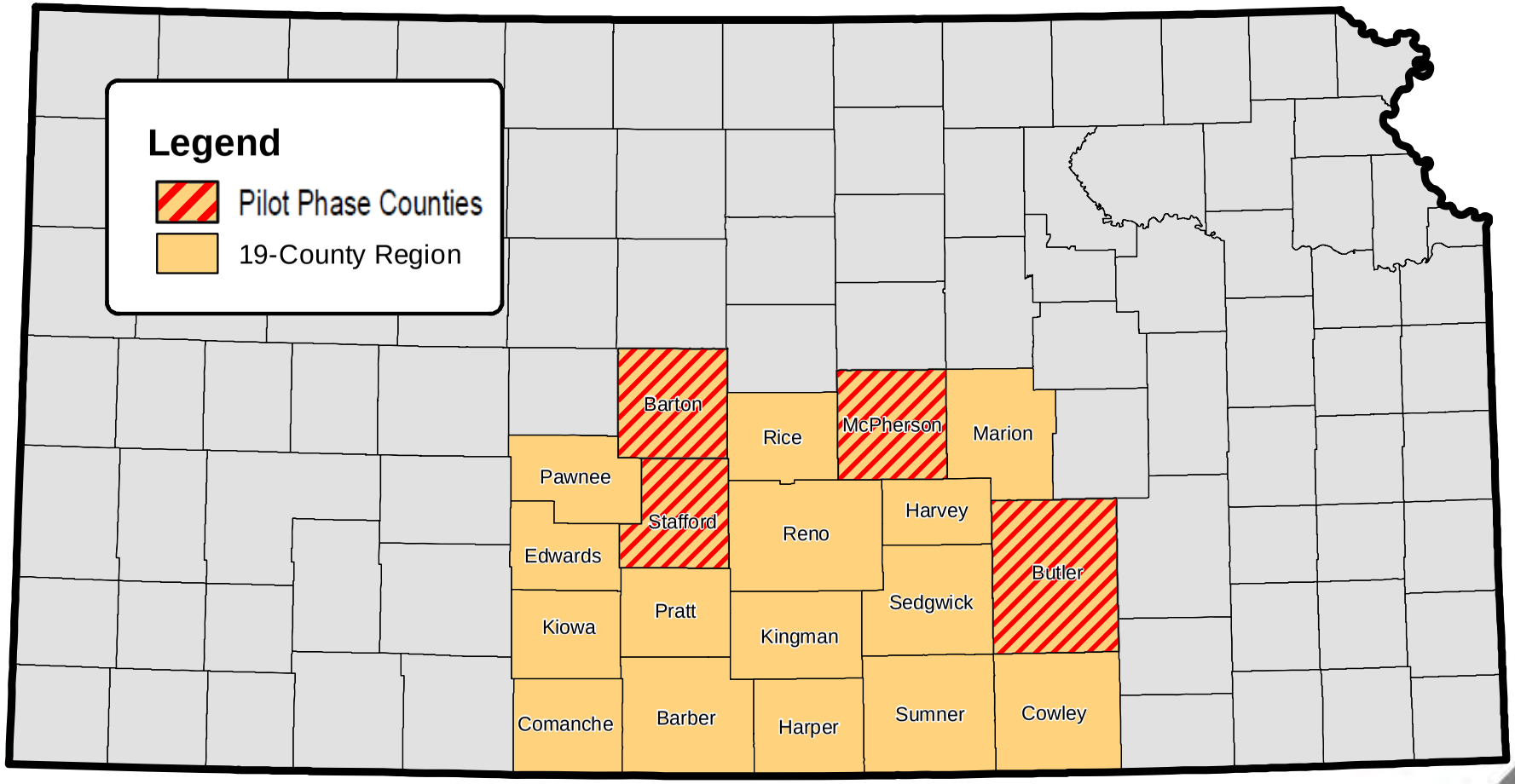
Overview of Crash Data

- Five years of data reviewed (reported crashes only)
  - Pilot Phase: 2011 – 2015
  - Phase 1: 2013 – 2017
  - Phase 2: 2014 – 2018
  - Phase 3: 2015 – 2019
- KABCO Injury Severity Scale (National Safety Council, 1990)
  - K, killed
  - A, disabling injury
  - B, evident injury
  - C, possible injury
  - O, no apparent injury

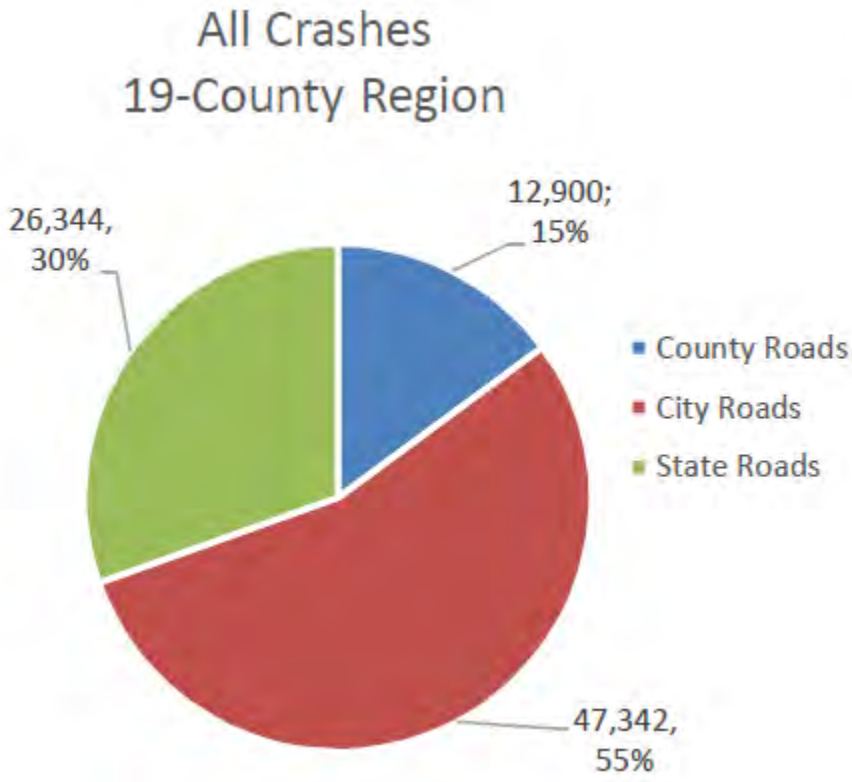
The focus of the LRSP is to identify systemic safety improvements that target reductions in fatal (Type K) and serious injury (Type A) crashes.

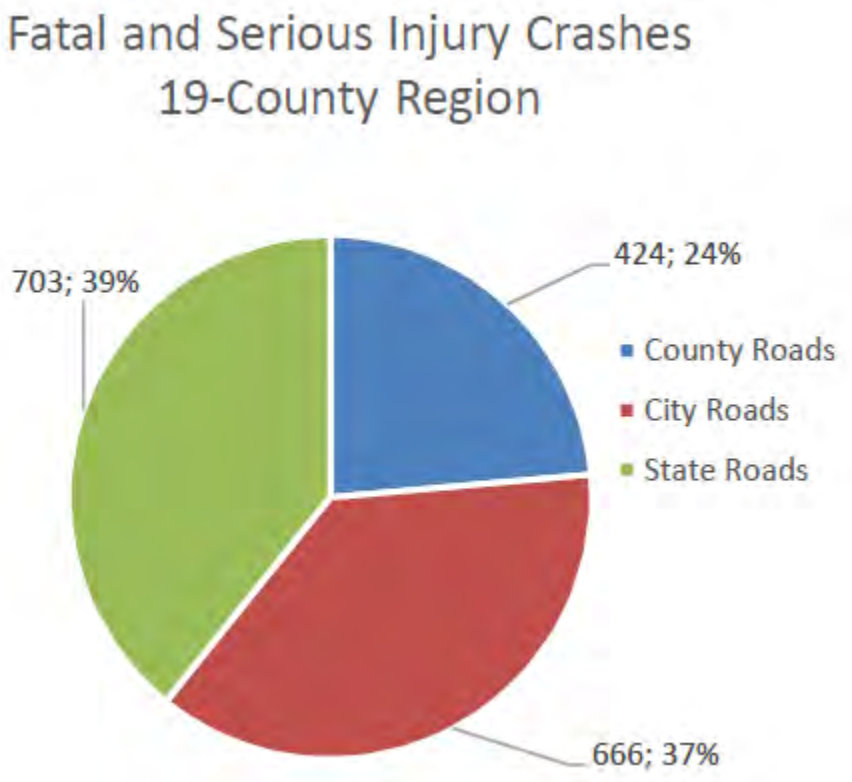
Crash Data: LRSP Pilot Phase

19-County Region in the Kansas Department of Health and Environment's South Central Healthcare Coalition



Crash Data: LRSP Pilot Phase



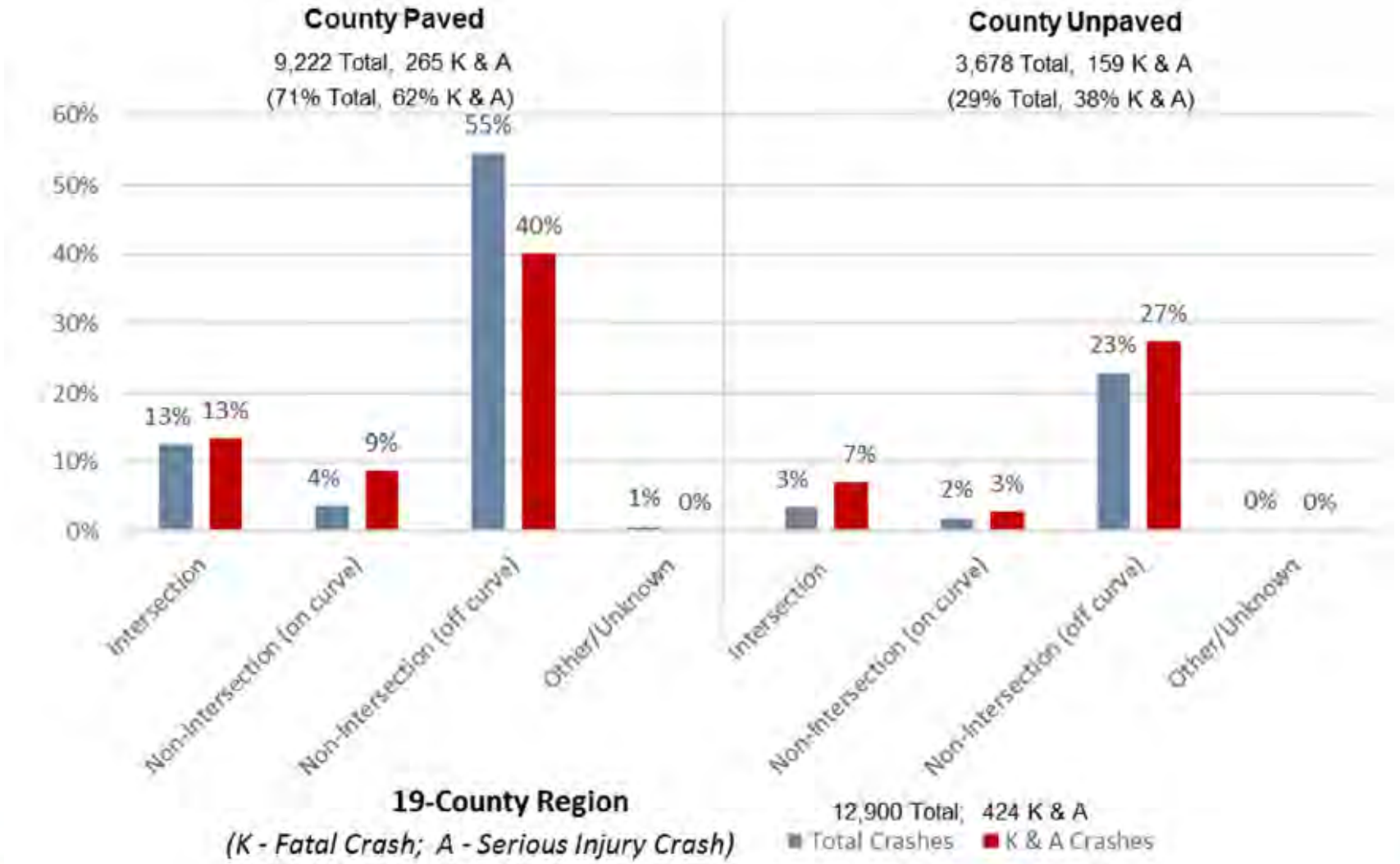


Crashes within the 19-County South Central Healthcare Coalition (2011-2015)

86,586 total crashes

1,793 resulted in a fatal or serious injury

Crash Data: LRSP Pilot Phase



Crash Data: LRSP Pilot Phase

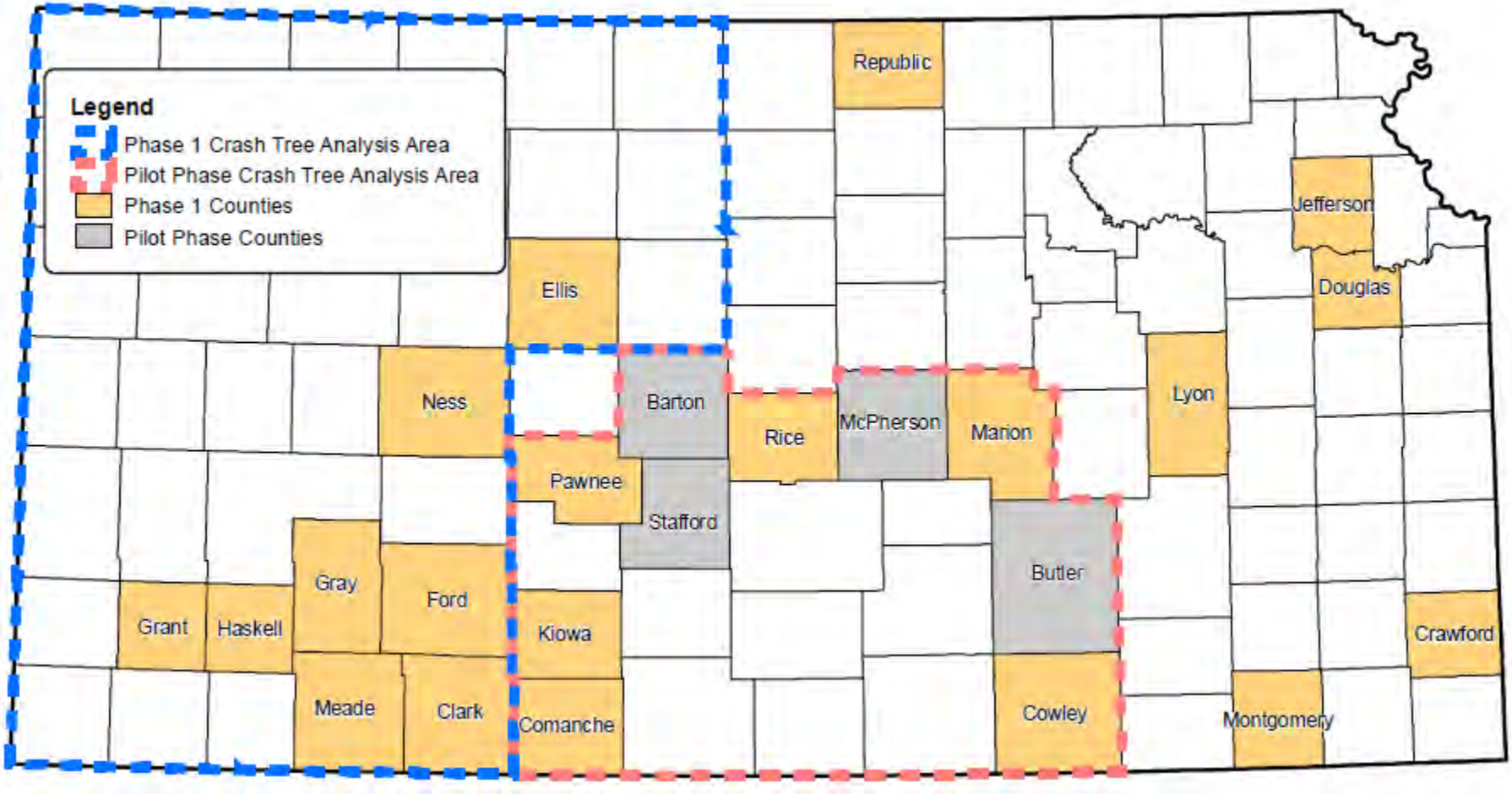
- Crashes on straight roadway segments (paved or unpaved) are most common:
  - 78% of all crashes, with 67% of the K+A crashes

Crash Data: LRSP Pilot Phase

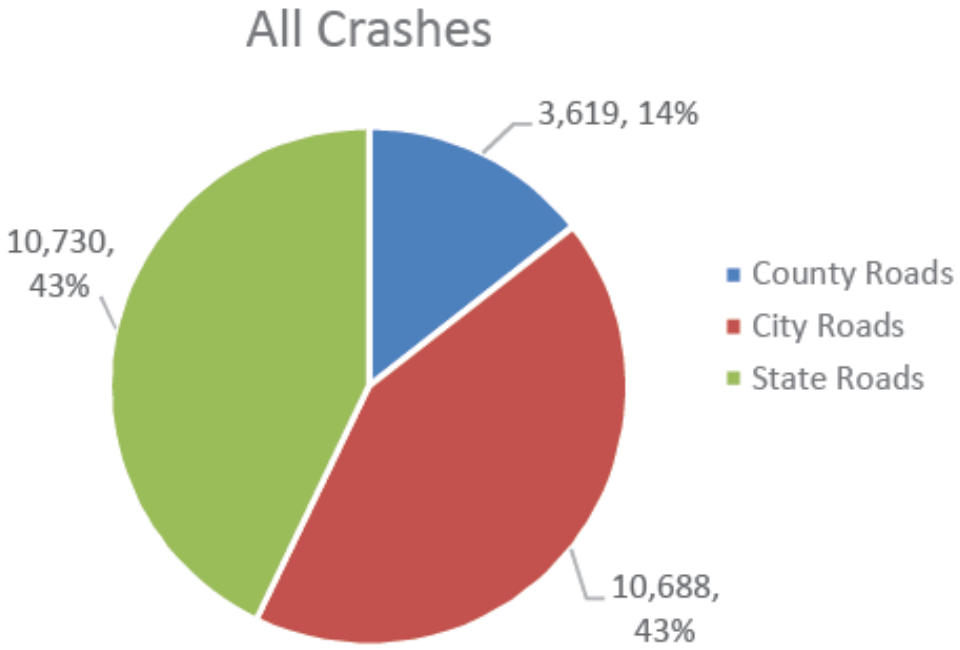
- Crashes on straight roadway segments:
  - Many involved running off road (right or left), animal collisions (hitting or swerving to avoid), or crossing centerline
  - Many coded as "non-collision" meaning the vehicle did not collide with another vehicle or object
- Crashes at intersections were primarily angle or side-impact crashes
- Crashes on curves were less frequent, but generally more severe (6% of all crashes, but 12% of the K+A crashes)

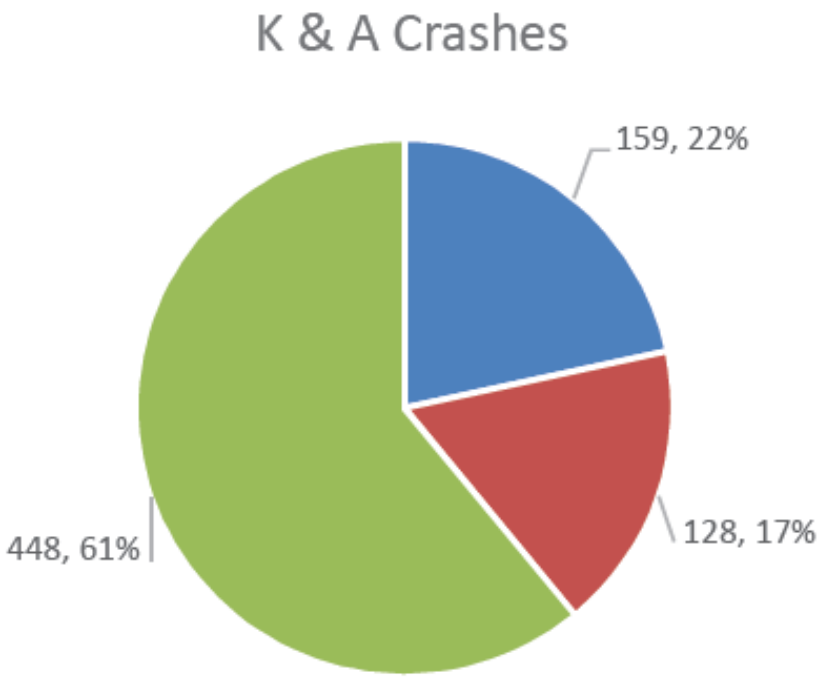
Crash Data: LRSP Phase I

37-County Region inclusive of KDOT District 3 and District 6



Crash Data: LRSP Phase 1



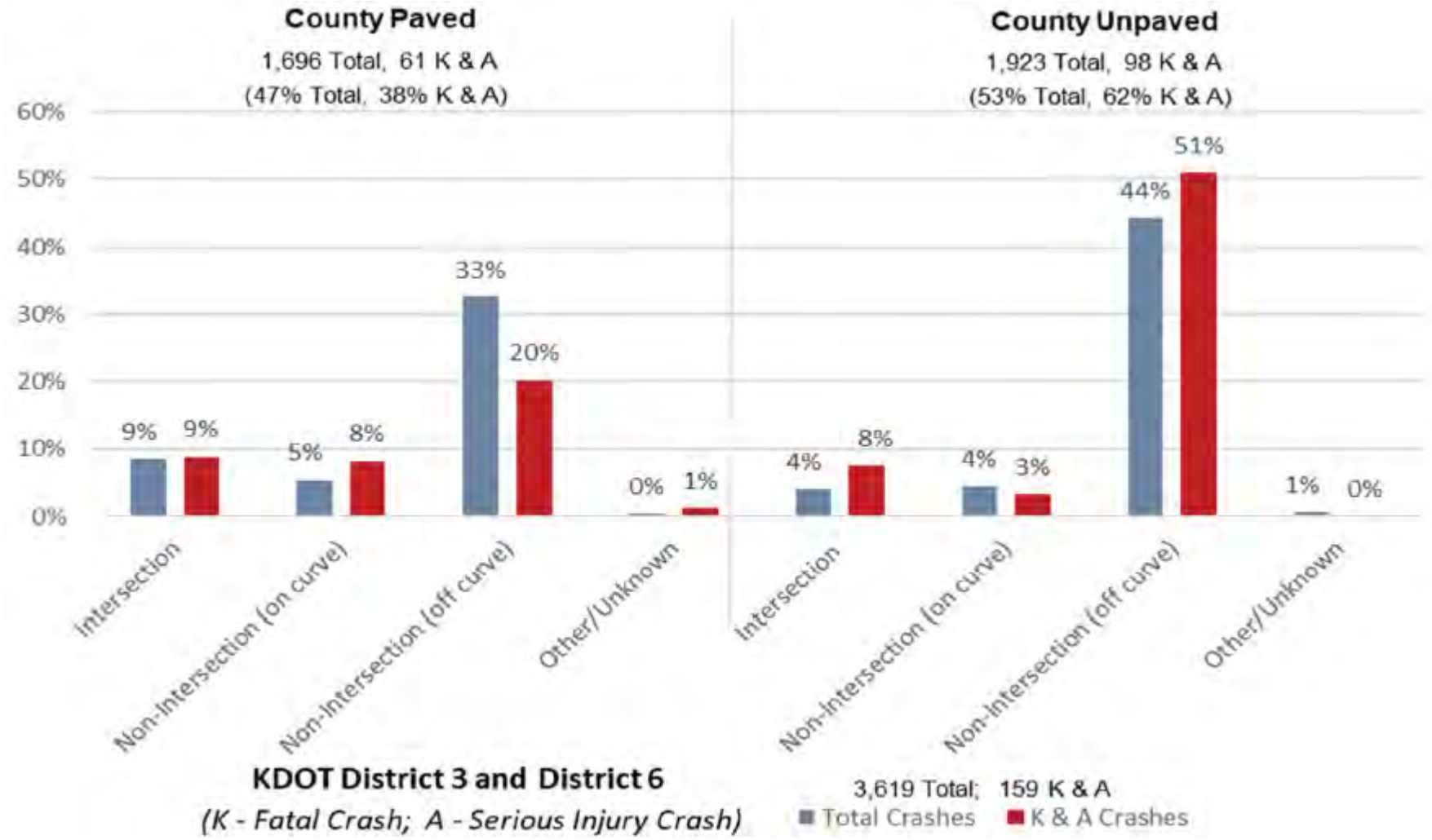


Crashes within the 37-County Phase 1 Analysis Area (2013-2017)

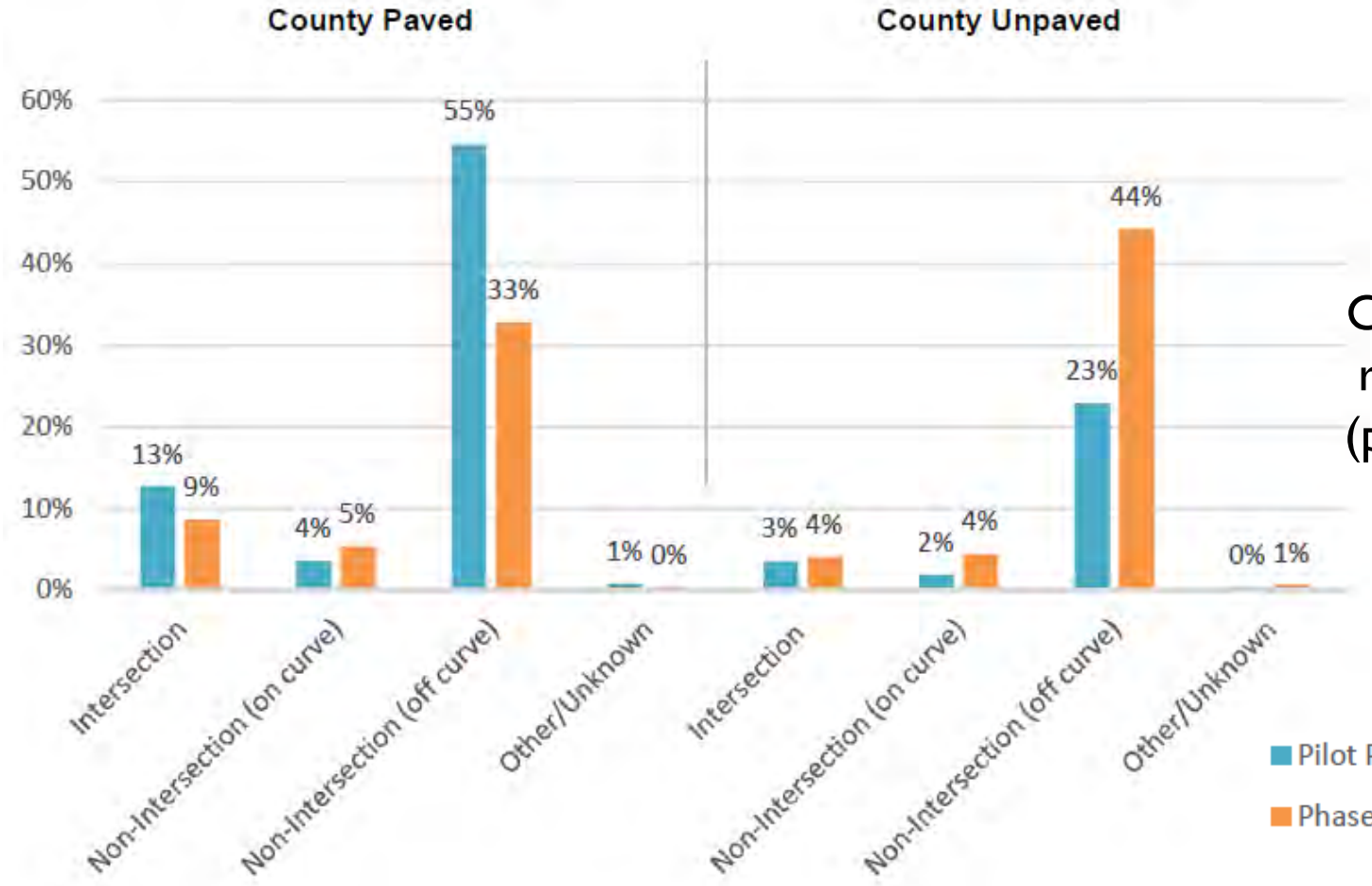
25,037 total crashes

735 resulted in a fatal or serious injury

Crash Data: LRSP Phase I



Crash Data: Phase 1 vs. Pilot Phase



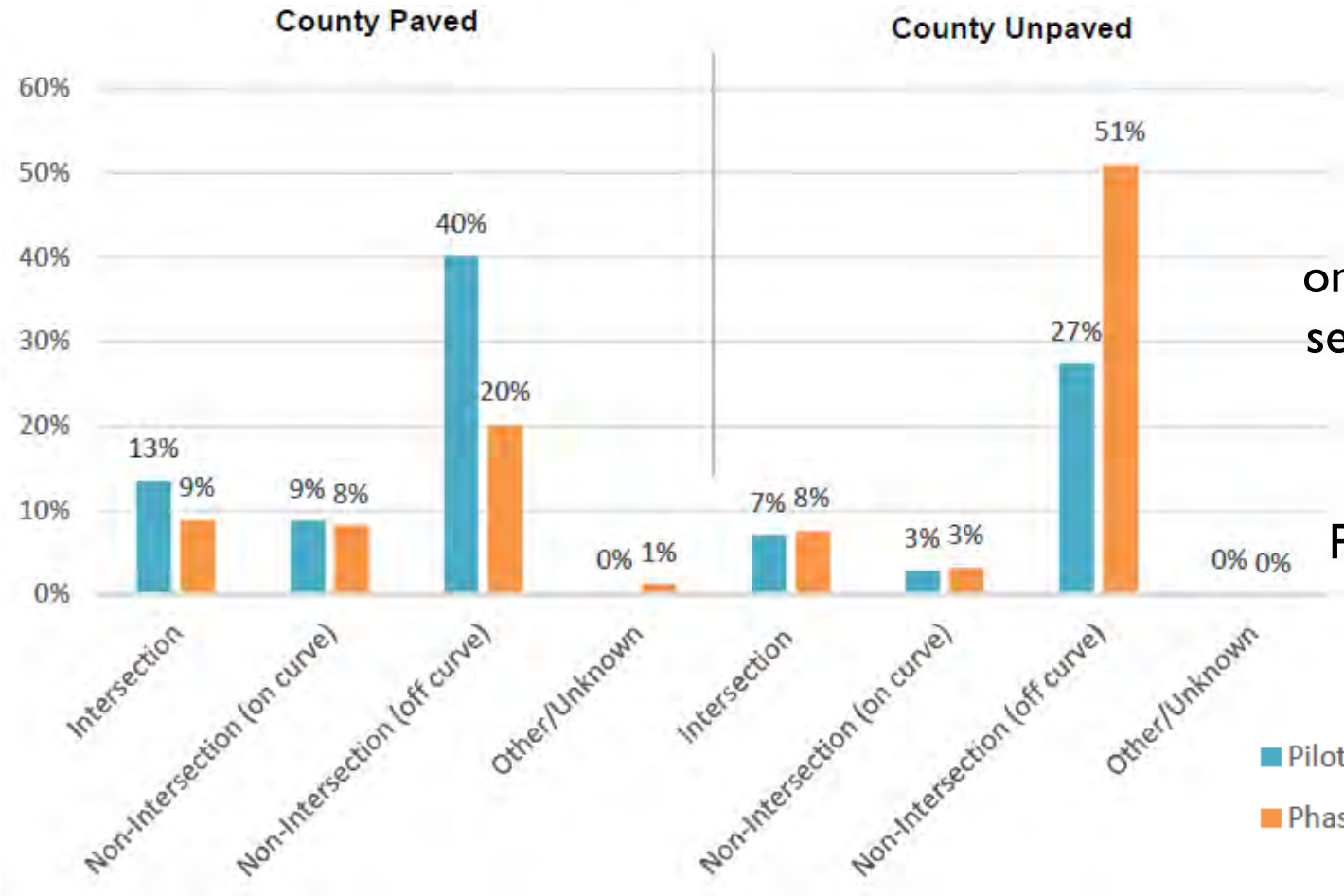
Crashes on straight roadway segments (paved or unpaved):

Phase 1 - 77%

Pilot Phase - 78%

All Crashes by Roadway Type (Phase 1 and Pilot Phase)

Crash Data: Phase 1 vs. Pilot Phase



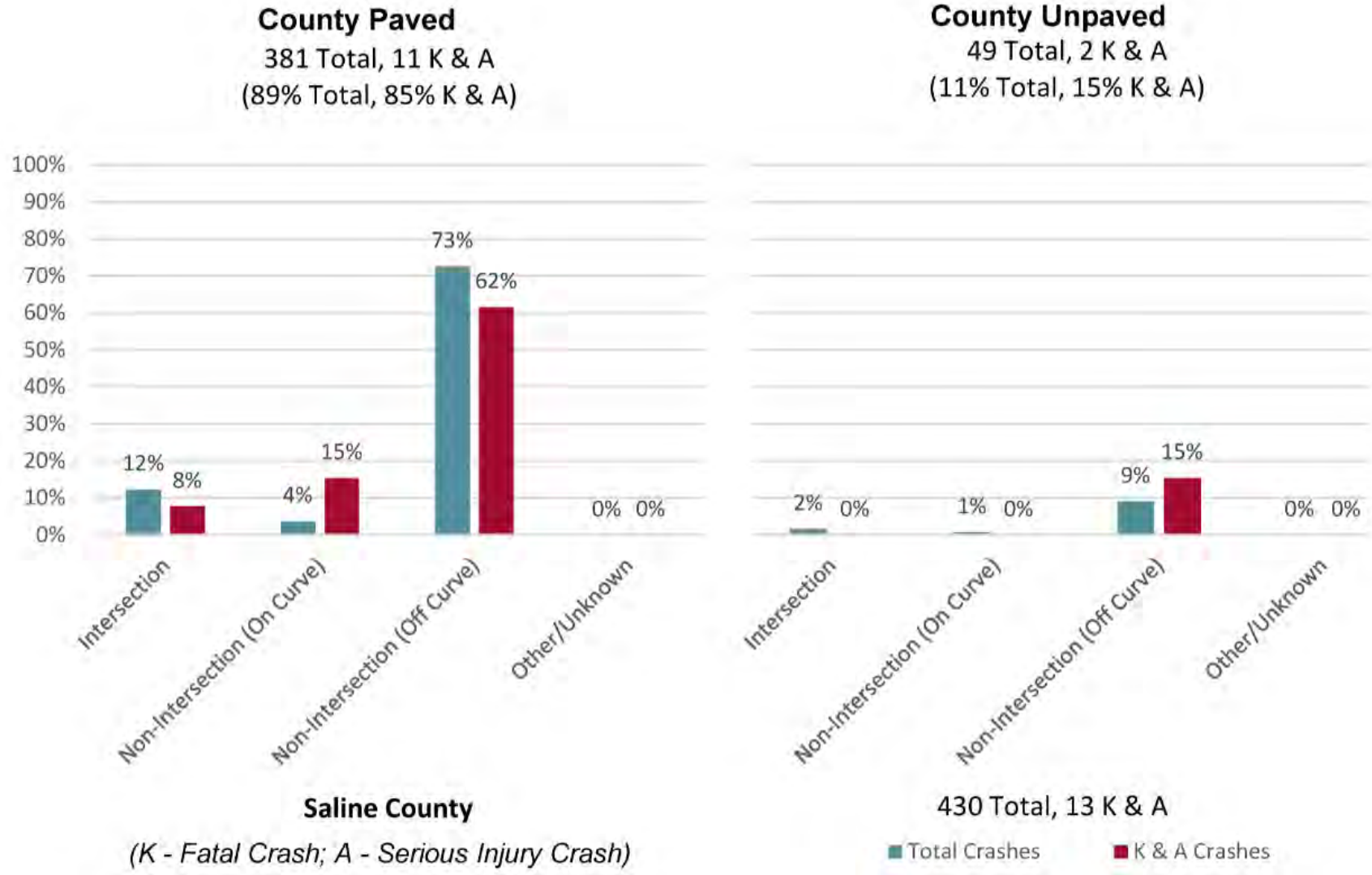
K& A crashes on straight roadway segments (paved or unpaved):

Phase 1 - 71%

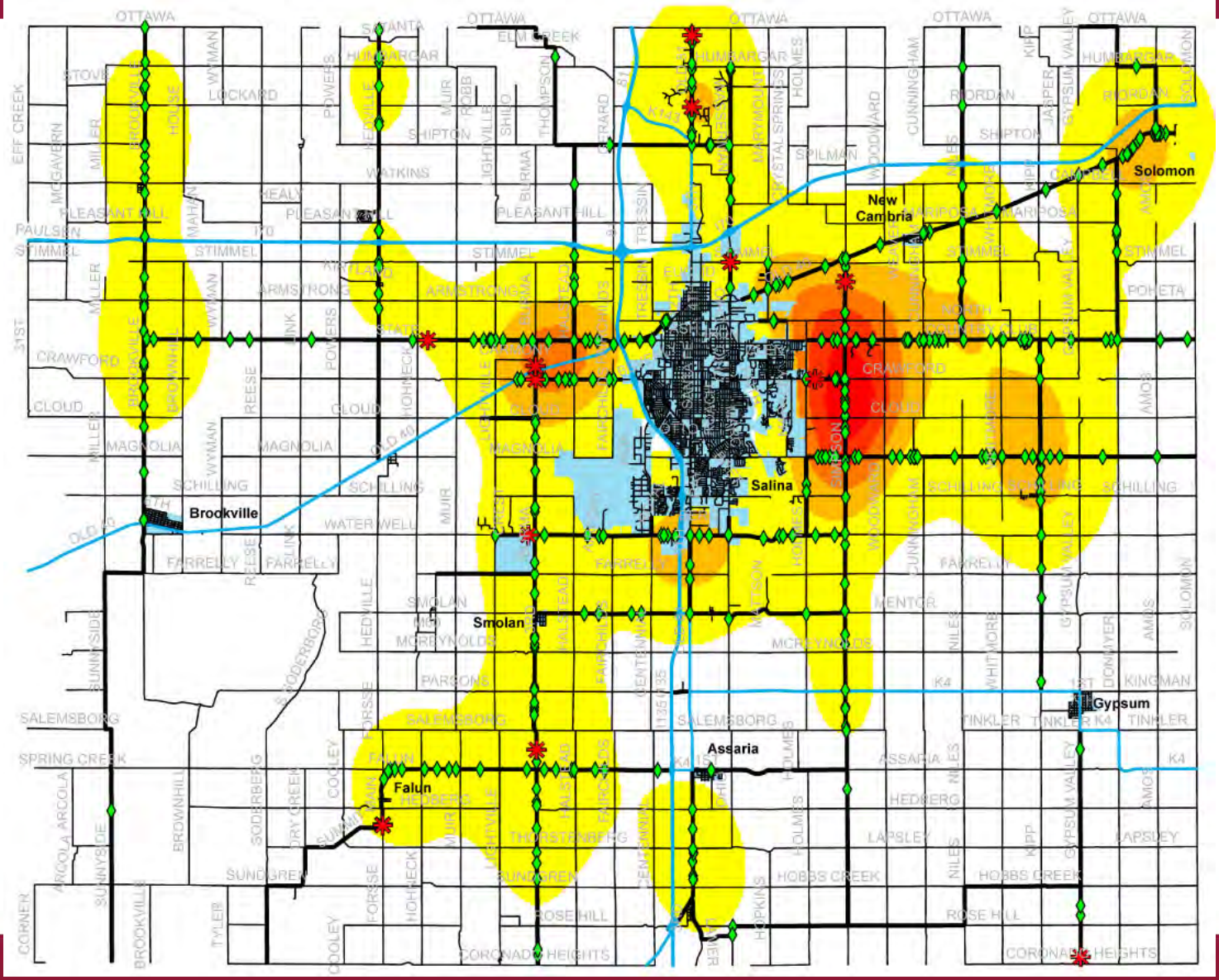
Pilot Phase - 67%

K&A Crashes by Roadway Type (Phase 1 and Pilot Phase)

Crash Data: Your LRSP Routes



Crash Data: Your LRSP Routes



Crash Location and Crash Heat Map

K&A Crash

Crash

Systemic Risk Factors – LRSP Segments

Risk Factor	Issue
Average Daily Traffic (ADT) volumes	Exposure
Surface type (paved or unpaved)	Surface type
Roadway width	Staying on the roadway
Shoulder width	Staying on the roadway, recovery from crash
Access density	Conflicting movements along the segment
Presence of pavement markings	Staying on the roadway
Lane departure crash rate	History of issues staying on roadway
Edge condition	Ability of vehicle to recover from a roadway departure
Roadside assessment	Roadside collision hazard

Systemic Risk Factors – LRSP Intersections

Risk Factor	Issue
Average Daily Traffic (ADT) on all approaches	Exposure
Distance from previous stop sign (along the LRSP routes)	Running the intersection
Location on a curve	Running the intersection, sight visibility
Skew	Running the intersection, sight visibility
Sight distance	Running the intersection, sight visibility
Proximity of driveway or another intersection	Conflicting movements near intersection
Fatal or serious injury crash history	History of potential safety issues
Intersection control	Control type

Systemic Risk Factors – LRSP Curves

Risk Factor	Issue
Average Daily Traffic (ADT) volumes	Exposure
Curve radius	Staying on roadway
Shoulder width	Staying on roadway, recovering from crash
Access density	Conflicting movements near horizontal curve, sight visibility
Fatal or serious injury crash history	History of potential safety issues
Presence of warning signs	Staying on roadway
Superelevation	Staying on roadway
Edge condition	Ability of vehicle to recover from a roadway departure
Roadside assessment	Roadside collision hazard

Potential Safety Countermeasures

- Engineering measures targeted at:
  - stopping the crash
  - providing crash forgiveness
- Examine the Crash Modification Factor (CMF) of potential systemic safety improvements, if available
- The CMF Method is found in Part D of the Highway Safety Manual (HSM)

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

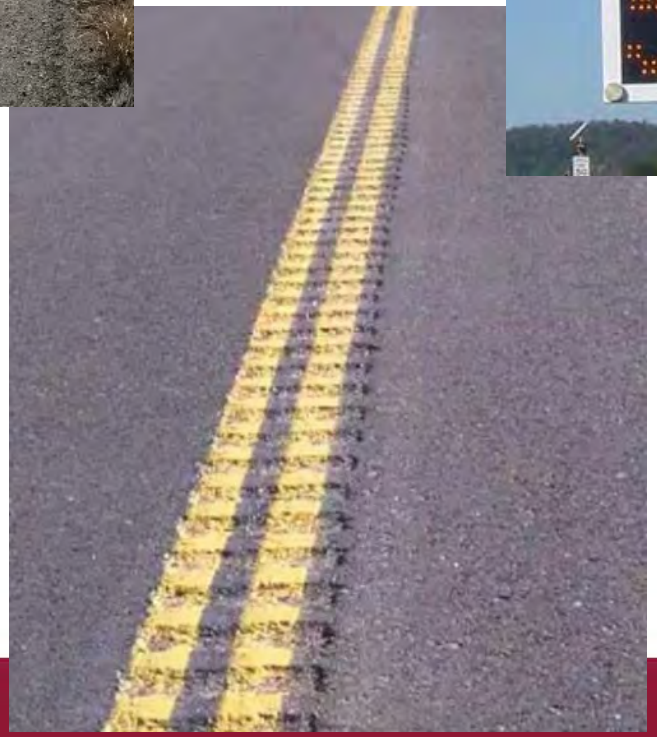
CMF = 1.0	Expected to have no impact on safety
CMF < 1.0	Expected to reduce crashes
CMF > 1.0	Expected to increase crashes

Potential Segment Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Install 6" Retroreflective Edgeline (both sides of the road)	0.64 – 0.88	$4,200/mile	X	
Install 4" Retroreflective Centerline	0.76 when installed in combination with edgelines	$2,100/mile	X	
Centerline Rumble Strips	0.66 – 0.96	$2,000/mile	X	
Edgeline Rumble Strips (both sides of road)	0.61 – 0.86	$5,000/mile	X	
Install a Dynamic Speed Feedback Sign	0.93 – 0.95	$4,000/sign	X	X

- Ranges indicate potential crash modification results based on:
  - differing research
  - crash types
  - volume levels

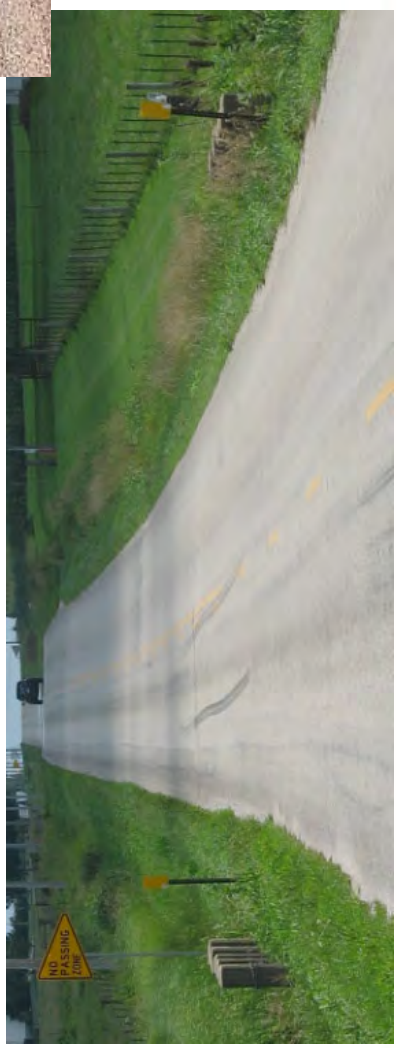
Potential Segment Countermeasures



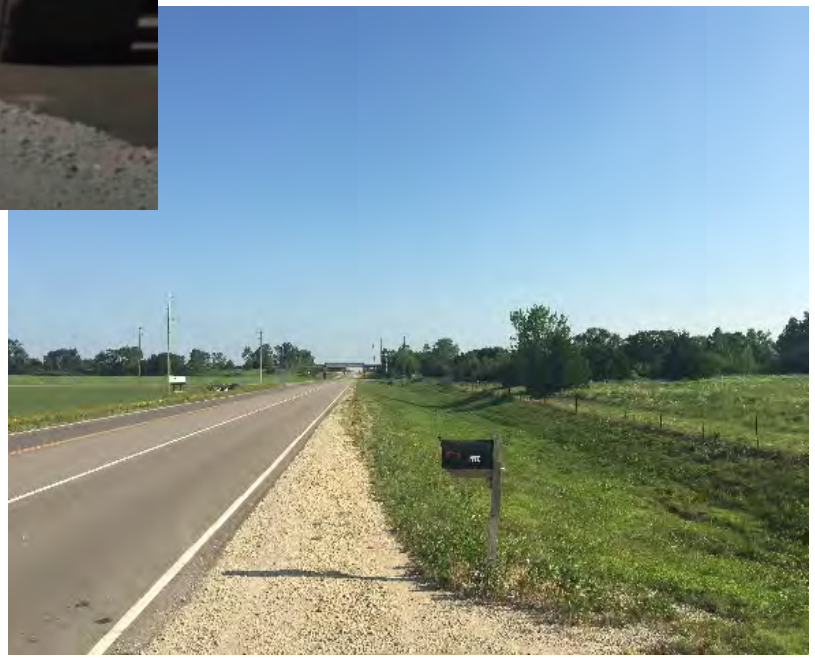
Potential Segment Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Delineate Roadside Hazards with Retroreflective Markers	CMF not defined	$100/each	X	X
Remove/Relocate Fixed Objects in Clear Zone (e.g. rock/brick mailboxes, non-breakaway poles)	FHWA Proven Countermeasure	$1,000/each	X	X
Post-Mounted Delineators	0.55 when installed in combination with edgelines and centerlines	$5,000/mile	X	X
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	CMF not defined	$5,000/mile	X	
Reshape/Repair Roadway Surface and Apply Dust Suppressants	0.95	$1,000 – $5,000/mile		X
Upgrade Roadway Surface (e.g., millings, well-graded rock mix with adequate binder)	CMF not defined	$8,000/mile		X
Install 18-inch Aggregate Shoulder Treatment (with transition to earth)	CMF not defined	$25,000/mile	X	
Clear and Grub (15 feet off edge of road)	0.78	$30,000/mile	X	X

Potential Segment Countermeasures



Potential Segment Countermeasures



Potential Segment Countermeasures

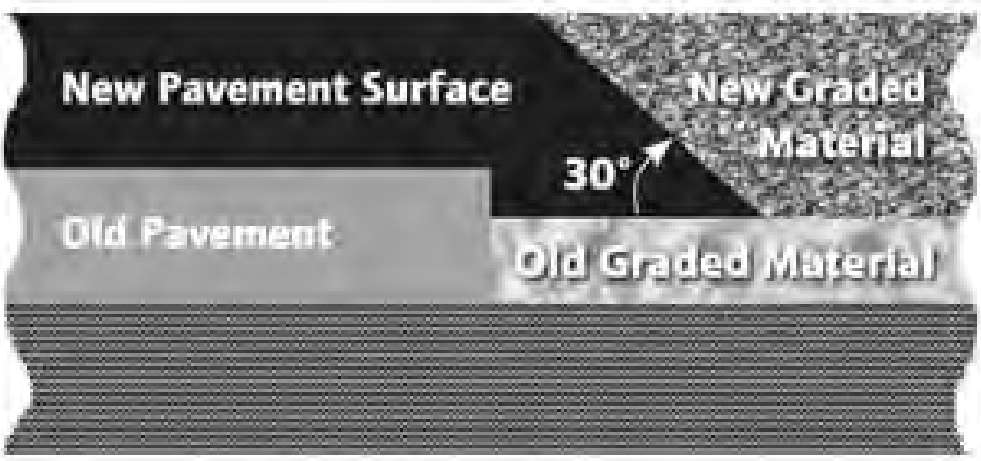
Potential Segment Countermeasures

Potential Segment Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Improve/Increase Roadway Width (to meet standards) with Safety Edge	0.67 – 0.71	$20,000/ mile unpaved - $30,000/mile paved	X	X
Install/Upgrade Guardrail with Reflectors	0.53 – 0.56 New Guardrail along Embankment	$35 - $80/foot	X	X
Flattening and Widening Foreslopes (excludes culvert extension costs)	0.58 – 0.90	$75,000/mile	X	X
Pave 2' Shoulder with Safety Edge (both sides of road - includes earthwork)	0.82 – 0.94 "Pave Shoulder" 0.65 – 0.96 "Safety Edge"	$150,000/mile	X	
Remove/Relocate/Combine Driveways	0.69 – 0.75 depending on reduction	$20,000/each unpaved - $40,000/each paved	X	X
Conduct Road Safety Audit/Assessment (RSA) *	CMF varies based on recommendations	$40,000/each	X	X
Pave Roadway	CMF not defined	$850,000/mile		X

* *Countermeasure recommended on segments with high crash rates*

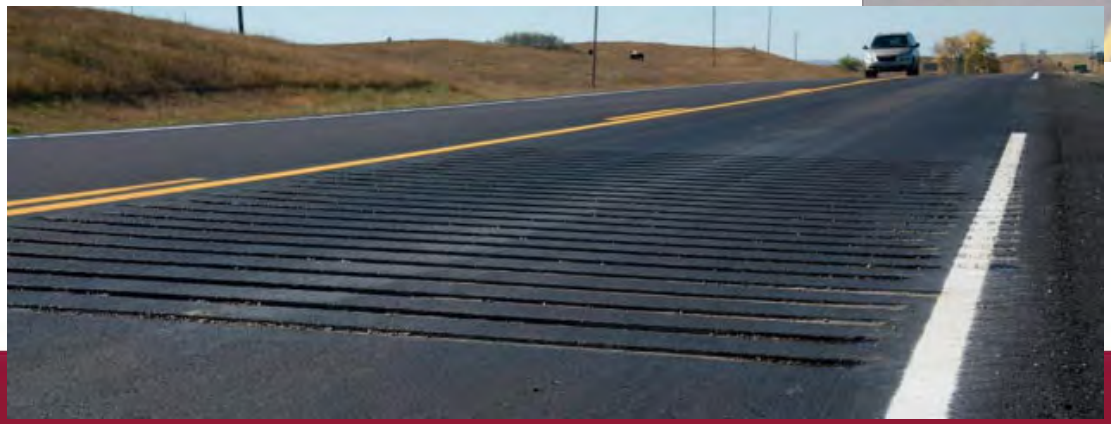
Potential Segment Countermeasures



Potential Intersection Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Retroreflective Strips on Stop Sign Posts	CMF not defined	$100/ intersection	X	X
Install Raised Pavement Markers (150'-300' on Intersection Approach)	0.87	$500/leg	X	
Upgrade Signs and Pavement Markings	FHWA Proven Safety Countermeasure 0.34 – 0.69 "Stop Ahead Pavement Markings" 0.75 – 0.91 "New Stop Sign" CMF not defined: "Intersection Warning Sign with Advance Street Name Sign Plaque" CMF not defined "Stop Line" CMF not defined "Stop Ahead Sign"	$1,100/ unpaved leg - $2,200/ paved leg	X	X (signs only)
Install Second Stop Sign and Stop Ahead Signs	FHWA Proven Safety Countermeasure	$1,500/leg	X	X
Transverse Rumble Strips on Paved, Stop-Controlled Approaches	0.71 – 0.87	$2,500/leg	X	

Potential Intersection Countermeasures



Potential Intersection Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	0.84 – 0.87 "Beacon on Stop Sign"	$2,500/sign	X	X
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	CMF not defined	$2,500/sign	X	X
Install a Dynamic Speed Feedback Sign on Intersection Warning Sign	0.93 – 0.95	$4,000/sign	X	X
Clear and Grub	0.78	$2,500/leg	X	X
Reshape Intersection for Control Type	CMF not defined	$2,500/each		X
Intersection Lighting (one luminaire)	0.62	$5,500/each	X	X
Realign Intersection Approaches to Reduce or Eliminate Skew	CMF varies based on original skew angle 0.57 Change from 45 degrees to 90 0.60 Change from 60 degrees to 90 0.67 Change from 75 degrees to 90	$100,000/ unpaved leg - $300,000/ paved leg	X	X

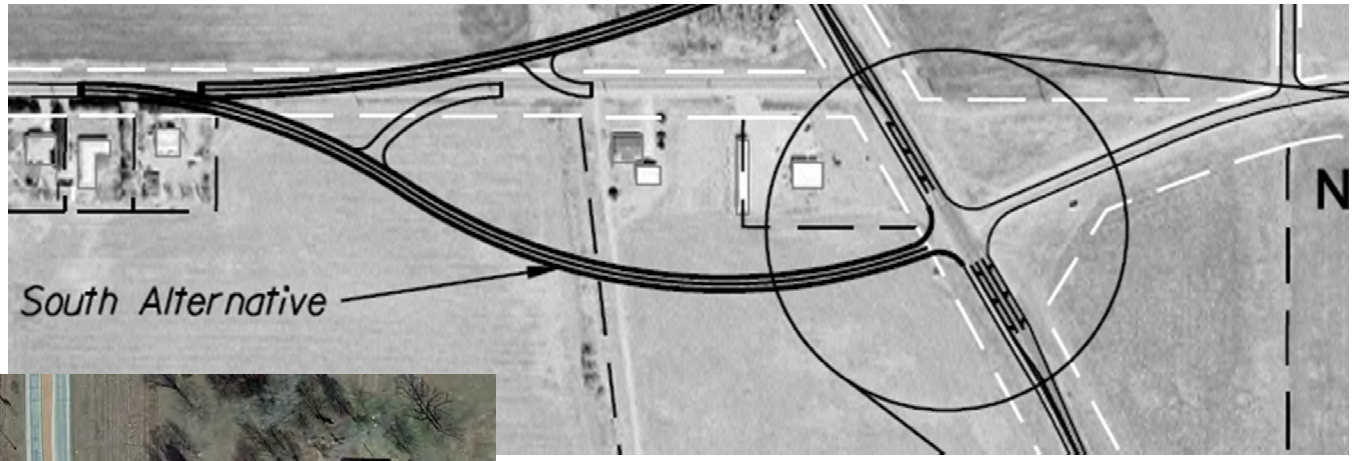
Potential Intersection Countermeasures

Potential Intersection Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Removal of Unwarranted Stop Signs on Major Approach *	CMF not defined	$500/leg	X	X
Remove Sweeping Right Turns *	CMF not defined	$5,000/each unpaved - $15,000/each paved	X	X
Convert Two-Way Stop to All-Way Stop (if MUTCD warrants are met) *	0.52 – 1.12	$1,200/leg	X	X
Convert Offset T-Intersection to Four-Legged Intersection *	CMF not defined	$50,000/each unpaved - $300,000/each paved	X	X
Install Intersection Conflict Warning System *	0.45 – 0.95	$40,000/each	X	X
Provide Bypass Lane on Shoulder at T-intersection *	CMF not defined	$50,000/each	X	
Provide Left-Turn Lanes at Intersection *	0.42 – 0.52	$150,000/leg	X	
Provide Right-Turn Lanes at Intersection and Remove Sweeping Right Turns *	0.74 – 0.92	$150,000/leg	X	
Install Traffic Signal (Rural) (if MUTCD warrants are met) *	0.56 – 0.72	$250,000/each	X	
Install a Restricted Crossing U-Turn (RCUT) / J-Turn Intersection *	0.65 – 0.80	$250,000/each	X	
Convert Stop-Control to Roundabout *	0.18 – 0.42	$2,000,000/each	X	

** An Intersection Control Evaluation (ICE) is recommended for intersection control changes (estimated cost of $7,500 – $20,000/each)*

Potential Intersection Countermeasures



Potential Curve Countermeasures

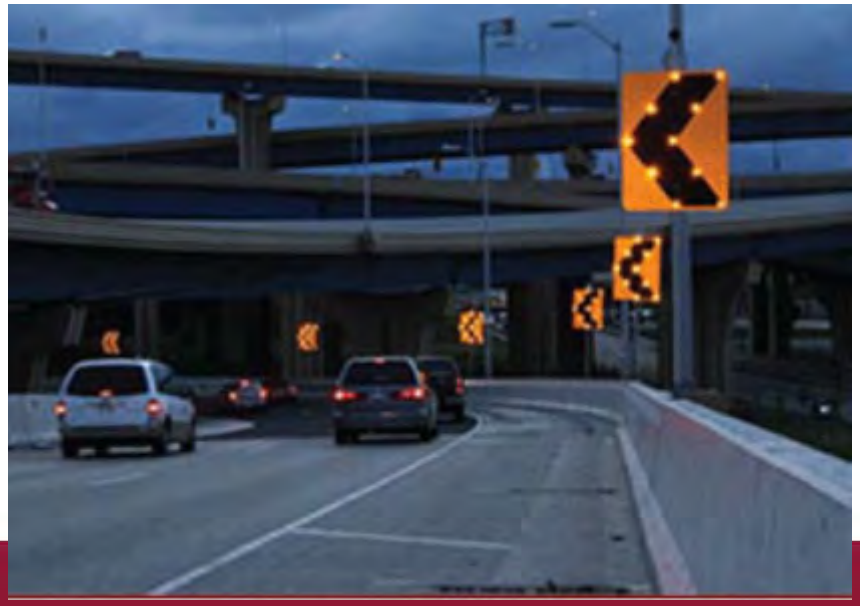
Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Retroreflective Strips on Curve Signage	CMF not defined	$100/curve	X	X
Install In-Lane Curve Warning Pavement Markings	0.65	$1,000/each	X	
Install Raised Pavement Markers (150'-300' in advance of and along curve)	0.87	$1,000/curve	X	
Install/Upgrade Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet the Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	0.59 – 0.61 for warning signs/plaques; 0.75 – 0.96 for chevrons	$1,000/curve (upgrade) - $3,500/curve (install)	X	X
On-Pavement Markings for Speed Control	CMF not defined	$3,000/each	X	
Transverse Rumble Strips Prior to Curve	0.66 Install Transverse Rumble Strips as Traffic Calming Device	$5,000/curve	X	

Potential Curve Countermeasures

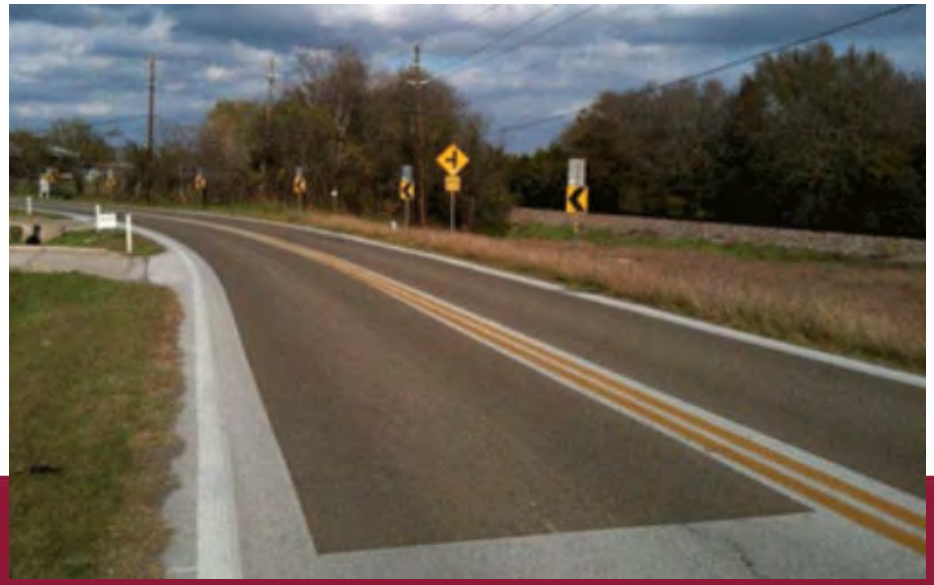
Potential Curve Countermeasures

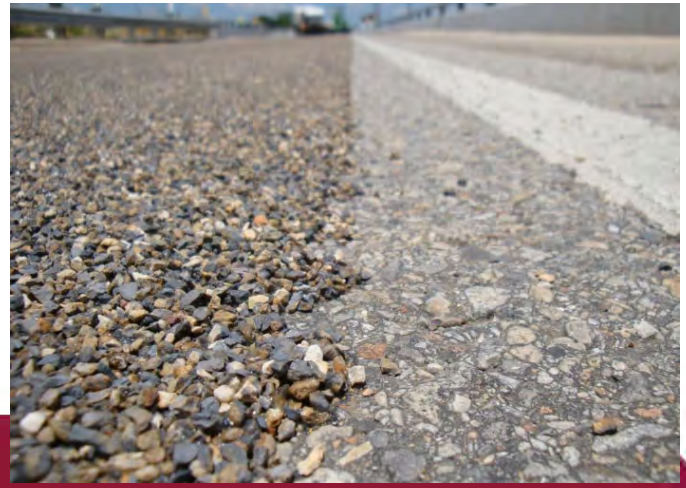
Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Install a Dynamic Speed Feedback Sign on Curve Warning Sign	0.93 – 0.95	$4,000/sign	X	X
Speed Activated Flashers on Chevron Signs	CMF not defined	$4,000/each	X	X
Install High-Friction Surface Treatment (HFST)	0.27 – 0.58	$20,000 - $50,000/curve	X	
Superelevation Correction on Curves	CMF varies based on rate of change	$20,000/curve (unpaved) - $50,000/curve (paved)	X	X

Potential Curve Countermeasures



Potential Curve Countermeasures





Potential Safety Countermeasures

Workshop Feedback Opportunity:

- What countermeasures interest you? Why?
- What countermeasures concern you? Why?

Next Steps

- Refine and Prioritize Strategies
- Rank Locations based on Risk Factor Scores
- Identify Safety Projects
- Develop LRSP Report with materials that can be used to apply for HRRR Funds

APPENDIX H

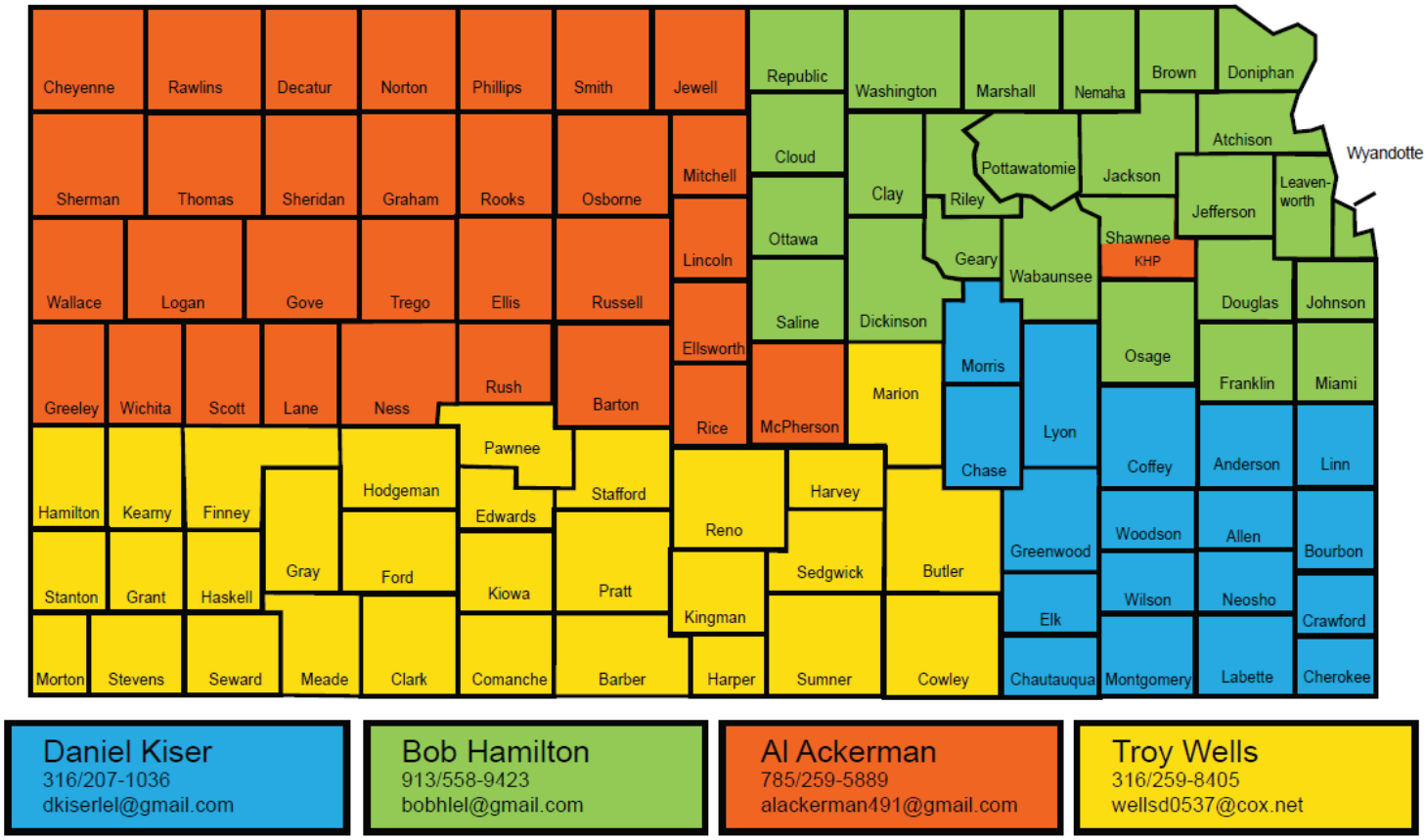
SAFETY RESOURCES

Safety Resources

KDOT's Traffic Safety Section Page
https://www.ksdot.org/bureaus/burTrafficSaf/default.asp

KDOT's Law Enforcement Liaison Program Page
https://www.ksdot.org/bureaus/burTrafficSaf/lel/lawEnL.asp

KDOT Law Enforcement Liaison Regions



Kansas Traffic Safety Resource Office
https://www.ktsro.org/

KDOT Crash Record Request
https://kdotapp.ksdot.org/CrashRecords/AcceptTerms.aspx

Vision Zero Webpage
http://visionzeronetwork.org/

ITE Vision Zero Page
http://www.ite.org/visionzero/

Focus on Reducing Rural Roadway Departures
https://safety.fhwa.dot.gov/FoRRRwd/

National Transportation Safety Board
https://www.ntsb.gov/Pages/default.aspx

National Highway Traffic Safety Administration
https://www.nhtsa.gov/

MADD State Statistics
https://www.madd.org/state-statistics

APPENDIX I

RISK FACTOR RANKING AND COUNTERMEASURE SELECTION TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM – RISK FACTOR RANKING AND COUNTERMEASURE SELECTION

KDOT LOCAL ROAD SAFETY PLANS (LRSPS) – PHASE 3

KDOT PROJECT NO: 106 C-4790-04

BARBER, BROWN, CHAUTAUQUA, CLOUD, EDWARDS, ELLSWORTH, FINNEY, GOVE, GREENWOOD, HAMILTON, KINGMAN, MITCHELL, MORRIS, RUSSELL, SALINE, SMITH, STEVENS, THOMAS, TREGO, AND WABAUNSEE COUNTIES

Prepared for:

KDOT Bureau of Local Projects
Eisenhower State Office Building
700 S.W. Harrison Street, 3rd Floor West
Topeka, Kansas 66603-3745
785-296-3861

Prepared by:

TranSystems
EXPERIENCE | Transportation

Kimley»Horn

June 2021
091841010

TECHNICAL MEMORANDUM – RISK FACTOR RANKING AND COUNTERMEASURE SELECTION

FOR

KDOT LOCAL ROAD SAFETY PLANS (LRSPS) – PHASE 3

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STATUTORY NOTICE

23 U.S.C. § 409: US Code - Section 409: 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.

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List of Acronyms

ADT	Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
CMF	Crash Modification Factor
FHWA	Federal Highway Administration
HFST	High-Friction Surface Treatment
KDOT	Kansas Department of Transportation
LRSP	Local Road Safety Plan
MUTCD	Manual on Uniform Traffic Control Devices
SHSP	Strategic Highway Safety Plan

1. INTRODUCTION

The Kansas Department of Transportation (KDOT), as part of their strategic goal to reduce fatalities and serious injuries within Kansas is conducting Phase 3 of the Local Road Safety Plan (LRSP) process for twenty counties within the state. Forty-three counties were included in the previous phases of this process. The LRSP concept is built on the foundation established by the Strategic Highway Safety Plan (SHSP). **Figure 1** shows the location of the Phase 3 LRSP counties and the counties included in previous phases.

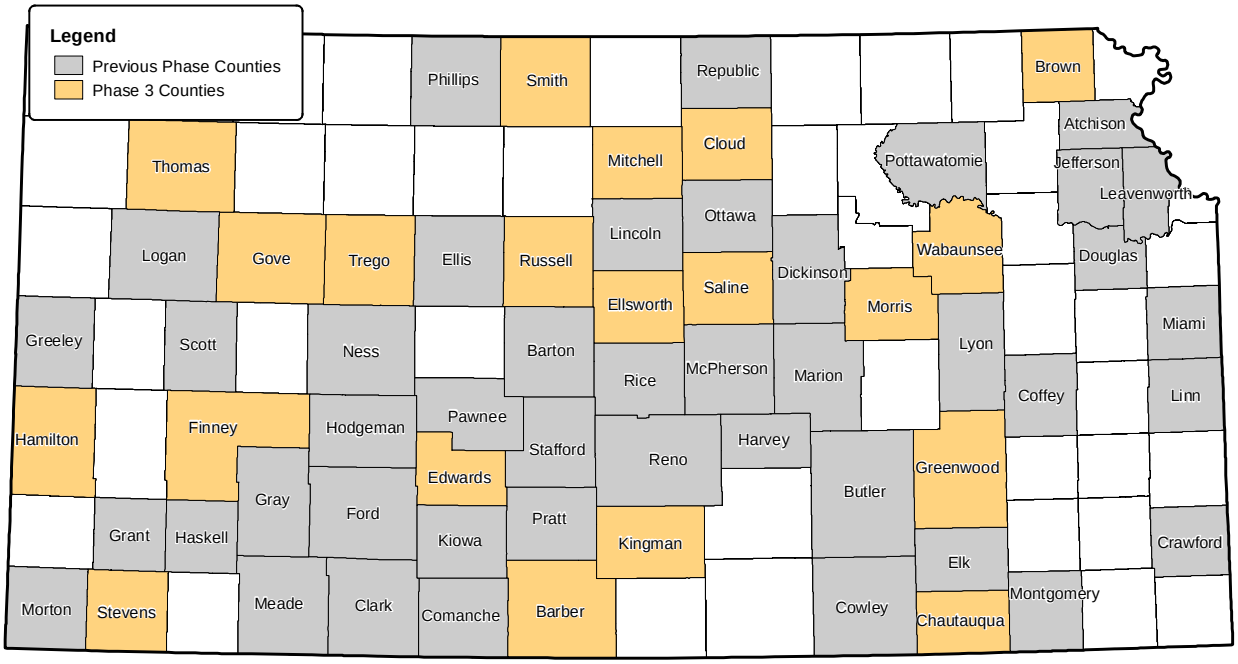


Figure 1 – Location of LRSP Counties

1.1. Purpose

This technical memorandum has been prepared to provide risk factor scoring criteria based on the approved risk factors as well as project selection threshold tables to be used in determining applicable countermeasures for identified safety project locations. The risk factors and countermeasures presented in this document were identified in the Phase 3 Countermeasures Technical Memorandum. It should be noted that the purpose of this risk factor scoring analysis is to help prioritize which segments, intersections, and curves share similar attributes that could contribute to crash risk and to identify countermeasures that could reduce the potential for a fatal or serious injury crash.

2. RISK FACTOR SCORING CRITERIA

Risk factor scoring criteria was determined during the previous LRSP phases and reviewed as part of the Phase 3 project. **Table 1** includes the risk factor scoring criteria for segments, **Table 2** for intersections, and **Table 3** for curves. Some items of note:

- The proposed risk factor scoring reflects a maximum possible score of 24 points for any segment, intersection, or curve. This allows for the potential for score comparison across the three categories, even though separate rankings will be prepared for segments, intersections, and curves.
- Volume is considered a significant risk factor since the probability of a crash is higher as volume (exposure) increases. The scoring has been weighted accordingly and criteria will be established separately for each county based on the collected data (i.e., only volumes within a particular county will be compared as opposed to comparing volumes to other counties.)
- Thresholds identified for scoring of pavement and shoulder width are consistent for all counties.
- Scoring thresholds for several risk factors (e.g., edge condition and roadside assessment) will be established separately for each county based on the collected data.
- Crash experience is included in the scoring for all segments, intersections, and curves. However, this does not carry an overly significant weight since the intent is a systemic process rather than overvaluing “hot spot” locations.
- Access density scores were eliminated for intersections with ADT less than or equal to 400 vehicles per day (based on the American Association of State Highway and Transportation Officials’ (AASHTO) guidelines for a very low-volume local road) and for segments and curves where the posted speed limit is less than or equal to 30 miles per hour.
- Given the characteristics of unpaved roads, some of the segment and curve risk factor scores are zero (0) since these are either not applicable (e.g., the presence of pavement markings) or poorly defined (e.g., shoulder width).

2.1. LRSP Phase 3 Scoring Modifications

Upon review of the Phase 2 risk factor ranking criteria, no modifications were recommended. The risk factor scores and criteria remain consistent from Phase 2 to Phase 3 of the LRSP project.

Table 1 – Segment Risk Factor Scoring Criteria

Risk Factor	Measurement	Points	Max Points Available
Average Daily Traffic (ADT) volume	Average roadway segment volume per county	0: ADT within 0%-14.3% percentile range	6
		1: ADT within 14.3%-28.6% percentile range	
		2: ADT within 28.6%-42.9% percentile range	
		3: ADT within 42.9%-57.1% percentile range	
		4: ADT within 57.1%-71.4% percentile range	
		5: ADT within 71.4%-85.7% percentile range	
		6: ADT within 85.7%-100% percentile range	
Access density	Density of intersections and driveways per mile	0: Bottom third of the access density Crash Modification Factor (CMF)* or ≤ 30 mph	2
		1: Middle third of the access density CMF*	
		2: Top third of the access density CMF*	
Edge condition	Observed condition rating	0: Rating of 2.75–3	3
		1: Top third of remaining ratings	
		2: Middle third of remaining ratings	
		3: Bottom third of remaining ratings	
Roadside assessment	Observed condition rating	0: Rating of 2.75–3	3
		1: Top third of remaining ratings	
		2: Middle third of remaining ratings	
		3: Bottom third of remaining ratings	
Roadway width	Width in feet	0: Roadway width greater than or equal to 22 feet	2
		2: Roadway width less than 22 feet	
Shoulder width	Width in feet of recoverable area prior to a ditch or fill slope	0: 4-foot shoulder and greater, or unpaved road	2
		1: 2-foot shoulder to 4-foot shoulder	
		2: less than 2-foot shoulder	
Lane departure crash rate	Lane departure crashes per MVMT	0: Bottom fourth of roadway departure crash rates along the roadway segments	3
		1: Second lowest fourth of roadway departure crash rates along the roadway segments	
		2: Second highest fourth of roadway departure crash rates along the roadway segments	
		3: Top fourth of roadway departure crash rates along the roadway segments	
Presence of pavement markings	Observed presence of markings	0: Both centerline and edgeline present, or unpaved road	2
		1: Centerline or edgeline present	
		2: Neither centerline or edgeline present	
Surface type	Paved or unpaved	0: Paved	1
		1: Unpaved	

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

Table 2 – Intersection Risk Factor Scoring Criteria

Risk Factor	Measurement	Points	Max Points Available
Average Daily Traffic (ADT)	ADT on all approaches per intersection with a paved approach per county	0: ADT within 0%-14.3% percentile range	6
		1: ADT within 14.3%-28.6% percentile range	
		2: ADT within 28.6%-42.9% percentile range	
		3: ADT within 42.9%-57.1% percentile range	
		4: ADT within 57.1%-71.4% percentile range	
		5: ADT within 71.4%-85.7% percentile range	
		6: ADT within 85.7%-100% percentile range	
Proximity of driveway or another intersection	Number of driveways or intersections within 500 feet of the intersection	0: None (or ADT less than 400 or within census corporate limits)	2
		1: 1 or 2 access points	
		2: More than 2 access points	
Sight distance	Based on field observations	0: Adequate	3
		3: Limited	
Location on a curve	Intersection on a curve	0: No	3
		3: Yes	
Crash history	Fatal or debilitating injury crashes	0: None	3
		3: 1 or more	
Distance from previous stop sign (along the LRSP routes)	Miles - based on field data collection	0: 1.5 miles or less	3
		2: 1.5 miles to less than 5 miles	
		3: 5 miles or more	
Skew	Degrees	0: 75 degree to 90-degree intersection approaches	3
		3: 75 degree or less intersection approach	
Intersection control	Observed control type	0: Yield/none	1
		1: Stop	

Table 3 – Curve Risk Factor Scoring Criteria

Risk Factor	Measurement	Points	Max Points Available
Average Daily Traffic (ADT) volume	Average curve volume per county	0: ADT within 0%-14.3% percentile range	6
		1: ADT within 14.3%-28.6% percentile range	
		2: ADT within 28.6%-42.9% percentile range	
		3: ADT within 42.9%-57.1% percentile range	
		4: ADT within 57.1%-71.4% percentile range	
		5: ADT within 71.4%-85.7% percentile range	
		6: ADT within 85.7%-100% percentile range	
Curve radius	Radius of curve in feet per county	0: Top fourth of curve radii	3
		1: Second highest fourth of curve radii	
		2: Second lowest fourth of curve radii	
		3: Bottom fourth of curve radii	
Access density	Intersections or driveways within 500 feet of the curve	0: None or speed limit ≤ 30 mph	2
		1: 1 or 2 access points	
		2: More than 2 access points	
Shoulder width	Width in feet of recoverable area prior to a ditch or fill slope	0: 4-foot shoulder and greater, or unpaved road	2
		1: 2-foot shoulder to 4-foot shoulder	
		2: less than 2-foot shoulder	
Edge condition	Observed condition rating	0: Rating of 3	2
		1: Rating of 2	
		2: Rating of 1	
Roadside assessment	Observed condition rating	0: Rating of 3	2
		1: Rating of 2	
		2: Rating of 1	
Superelevation	Presence of superelevation	0: Yes	2
		2: No	
Crash history	Fatal or debilitating injury crashes	0: None	3
		3: 1 or more	
Presence of warning signs	Observed presence	0: Present	2
		2: Not present	

3. PROJECT SELECTION THRESHOLD TABLES

Countermeasure project selection threshold tables were developed during the previous LRSP phases and reviewed as part of the Phase 3 project. **Table 4**, **Table 5**, and **Table 6** include the threshold tables for segments, intersections, and curves respectively. Some items of note in the development of the thresholds are summarized below:

- Clearing and grubbing is recommended for all projects. For specific roadway segment project locations, the associated cost will be based on a review of the site videos.
- One of the initial proposed countermeasures included use of a 45-degree aggregate edge wedge along segments. The description of this countermeasure was revised since this is intended to be more of a short-term or spot treatment of edge ruts/drop-offs, rather than something applied to a long length of road.
- A general threshold of an ADT greater than 400 vehicles per day was applied for several project types based on AASHTO's guidelines for a very low-volume local road.
- Edgeline or centerline rumble strip installation is recommended to include a feasibility review, primarily in consideration of the existing pavement types and/or width.
- New pavement treatments for segments or curves is recommended to include an appropriate amount of full depth reconstruction to accommodate the treatment, whether this is just partial reconstruction (e.g., shoulder paving to accommodate use of a safety edge) or full depth reconstruction to completely repave a roadway.
- Flattening and widening foreslopes is a long-term countermeasure that typically includes the extension of existing drainage pipes/culverts. The general intent of this is to complete as much shoulder and foreslope improvements as possible within the available right-of-way. Where applicable, the extension of existing drainage pipes/culverts will be added as a site-specific countermeasure for segments where there may be a delay in funding for the ultimate long-term improvements.
- The use of retroreflective strips on stop signs and curve signage (chevrons) are low-cost effective treatments included for all projects.
- Installation of an additional "Stop" sign and "Stop Ahead" sign for an intersection approach includes these additional signs on the left side of the approach. The threshold identified for this countermeasure (minor road ADT greater than 400) was set to include this treatment on higher volume minor approaches and avoid overuse.
- Vertical grade modifications for intersections with a sight distance concern are not included as part of the project selection thresholds but can be added as a site-specific countermeasure for selected intersections based on county input.
- Curve countermeasure thresholds are consistent whether evaluated as part of a curve or a segment project.
- Deviations of the thresholds may occur based on engineering judgement.

3.1. LRSP Phase 3 Threshold Modifications

Based on the findings of the previous LRSP phases and a review of appropriate countermeasures as documented in previous technical memoranda, some modifications were made to the thresholds and countermeasures included within the tables as detailed in the following sections.

3.1.1. General Modifications

The threshold tables from Phase 2 of the LRSP project were updated to match the language, updated crash modification factors (CMFs), and costs approved in the Phase 3 Countermeasures Technical Memorandum, which included various minor modifications.

3.1.2. New Countermeasure

The countermeasure "Upgrade Roadway Surface (e.g., millings, well-graded rock mix with adequate binder)" was added as a long-term countermeasure for all unpaved curves (both for curve projects and for the curves within a segment project).

Table 4 – Segment Countermeasure Project Selection Thresholds

Safety Countermeasure	CMF	Cost	Short-Term	Long-Term	Threshold
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.64 - 0.88	$4,200/mile	X		All paved roads
Install 4" Retroreflective Centerline	0.76	$2,100/mile	X		All paved roads
Delineate Roadside Hazards with Retroreflective Markers	not defined	$100/each	X		All (maximum of either 10 markers per mile or actual access points per mile)
Clear and Grub (15 feet Off Edge of Road)	0.78	$30,000/mile	X		All
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations (Both Sides of Road)	not defined	$5,000/mile	X		On paved road, edge condition ≤ 2 and unpaved shoulder
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible on Both Sides of Road)	0.61 - 0.86	$5,000/mile	X		On paved road, ADT > 400 and 11' lanes and edgeline rumble strips do not currently exist
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	0.66 - 0.96	$2,000/mile	X		On paved road, ADT > 400 and 11' lanes and centerline rumble strips do not currently exist
Install Post-Mounted Delineators	0.55	$5,000/mile	X		Roadside Assessment ≤ 2
Review and Upgrade Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	0.59 - 0.96	$1,000/curve	X		On all curves within the segment that currently have signage
Install Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet MUTCD and KDOT Standards	0.59 - 0.96	$3,500/curve	X		On all curves within the segment that do not have signage
Install In-Lane Curve Warning Pavement Markings	0.65	$2,000/curve	X		All paved curves (2 per curve)
Install Retroreflective Strips on Curve Signage	not defined	$100/curve	X		On all curve signage within the segment
Remove/Relocate Fixed Objects in Clear Zone (e.g. rock/brick mailboxes, non-breakaway poles)	FHWA Proven Safety Countermeasure	$1,000/each		X	All (based upon video review, minimum of 4 estimated for each project)
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	not defined	$25,000/mile		X	On paved road, ADT < 400, no paved shoulder, no existing aggregate shoulder and edge condition ≤ 2
Pave 2' Shoulder with Safety Edge (Both Sides of Road – Includes Earthwork)	0.65 - 0.96	$150,000/mile		X	On paved road, ADT > 400 or if existing paved shoulder < 2'
Install Edgeline Rumble Strips (Both Sides of Road)	0.61 - 0.86	$5,000/mile		X	On paved road, ADT > 400 and 11' lanes
Install Centerline Rumble Strips	0.66 - 0.96	$2,000/mile		X	On paved road, ADT > 400 and 11' lanes
Install/Upgrade Guardrail with Reflectors	0.53 - 0.56	$35 - $80/foot		X	All (based upon video review) $80/foot if less than 500 feet
Flattening and Widening Foreslopes (Excludes Culvert Extensions)	0.58 - 0.90	$75,000/mile		X	All
Install High Friction Surface Treatment (HFST) on Curve	0.27 - 0.58	$20,000 - $50,000/curve		X	On paved road, all curves with ADT > 400, radius ≤ 750 and no superelevation
Review and Upgrade Roadway Surface (e.g., millings, well-graded rock mix with adequate binder)	not defined	$8,000/mile		X	All unpaved curves

Table 5 – Intersection Countermeasure Project Selection Thresholds

Safety Countermeasure	CMF	Cost	Short-Term	Long-Term	Threshold
Retroreflective Strips on Stop Sign Posts	not defined	$100/intersection	X		All
Clear and Grub	0.78	$2,500/leg	X		All
Review Pavement Condition/Type and Install Transverse Rumble Strips on Paved, Stop-Controlled Approaches	0.71-0.87	$2,500/leg	X		All paved, stop-controlled approaches
Upgrade Signs and Pavement Markings	0.34-0.91	$1,100 (unpaved) - $2,200 (paved)/leg	X		All (signs only for unpaved approaches)
Install Second Stop Sign and Stop Ahead Signs	FHWA Proven Safety Countermeasure	$1,500/leg	X		Minor ADT > 400
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	0.84-0.87	$2,500/sign	X		Major ADT> 800 and Minor ADT > 400
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	not defined	$2,500/sign	X		Limited sight distance and Minor ADT > 400
Intersection Lighting (One Luminaire)	0.62	$5,500/each		X	Major ADT >800 and Minor ADT > 400
Realign Intersection Approaches to Reduce or Eliminate Skew	0.57-0.67	$100,000 (unpaved) - 300,000 (paved)/leg		X	Skew < 75 degrees

Table 6 – Curve Countermeasure Project Selection Thresholds

Safety Countermeasure	CMF	Cost	Short-Term	Long-Term	Threshold
Review and Upgrade Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	0.59 - 0.96	$1,000/curve	X		On all curves that currently have signage
Install Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet MUTCD and KDOT Standards	0.59 - 0.96	$3,500/curve	X		On all curves that do not have signage
Install In-Lane Curve Warning Pavement Markings	0.65	$2,000/curve	X		All paved curves (2 per curve)
Install Retroreflective Strips on Curve Signage	not defined	$100/curve	X		All
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.64 - 0.88	$4,200/mile	X		All paved curves
Install 4" Retroreflective Centerline	0.76	$2,100/mile	X		All paved curves
Clear and Grub (15 feet Off Edge of Road)	0.78	$2,500/curve	X		All
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	not defined	$5,000/mile	X		On paved road, edge Condition ≤ 2 and unpaved shoulder
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible on Both Sides of Road)	0.64 - 0.79	$5,000/mile	X		On paved curve, ADT > 400 and 11' lanes and edgeline rumble strips do not currently exist
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	0.63 - 0.94	$2,000/mile	X		On paved curve, ADT > 400 and 11' lanes and centerline rumble strips do not currently exist
Install Post-Mounted Delineators	0.55	$5,000/mile	X		Roadside Assessment ≤ 2
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	not defined	$25,000/mile		X	On paved road, ADT < 400, no paved shoulder, no existing aggregate shoulder and edge condition ≤ 2
Pave 2' Shoulder with Safety Edge (Both Sides of Road – Includes Earthwork)	0.65 - 0.96	$150,000/mile		X	On paved road, ADT > 400 or if existing paved shoulder < 2'
Install Edgeline Rumble Strips (Both Sides of Road)	0.64 - 0.79	$5,000/mile		X	On paved curve, ADT > 400 and 11' lanes
Install Centerline Rumble Strips	0.63 - 0.94	$2,000/mile		X	On paved curve, ADT > 400 and 11' lanes
Install/Upgrade Guardrail with Reflectors	0.53 - 0.56	$35 - $80/foot		X	All (based upon video review) $80/foot if less than 500 feet
Install High Friction Surface Treatment (HFST)	0.27 - 0.58	$20,000 - $50,000/curve		X	On paved road, ADT > 400, radius ≤ 750 and no superelevation
Review and Upgrade Roadway Surface (e.g., millings, well-graded rock mix with adequate binder)	not defined	$8,000/mile		X	All unpaved curves

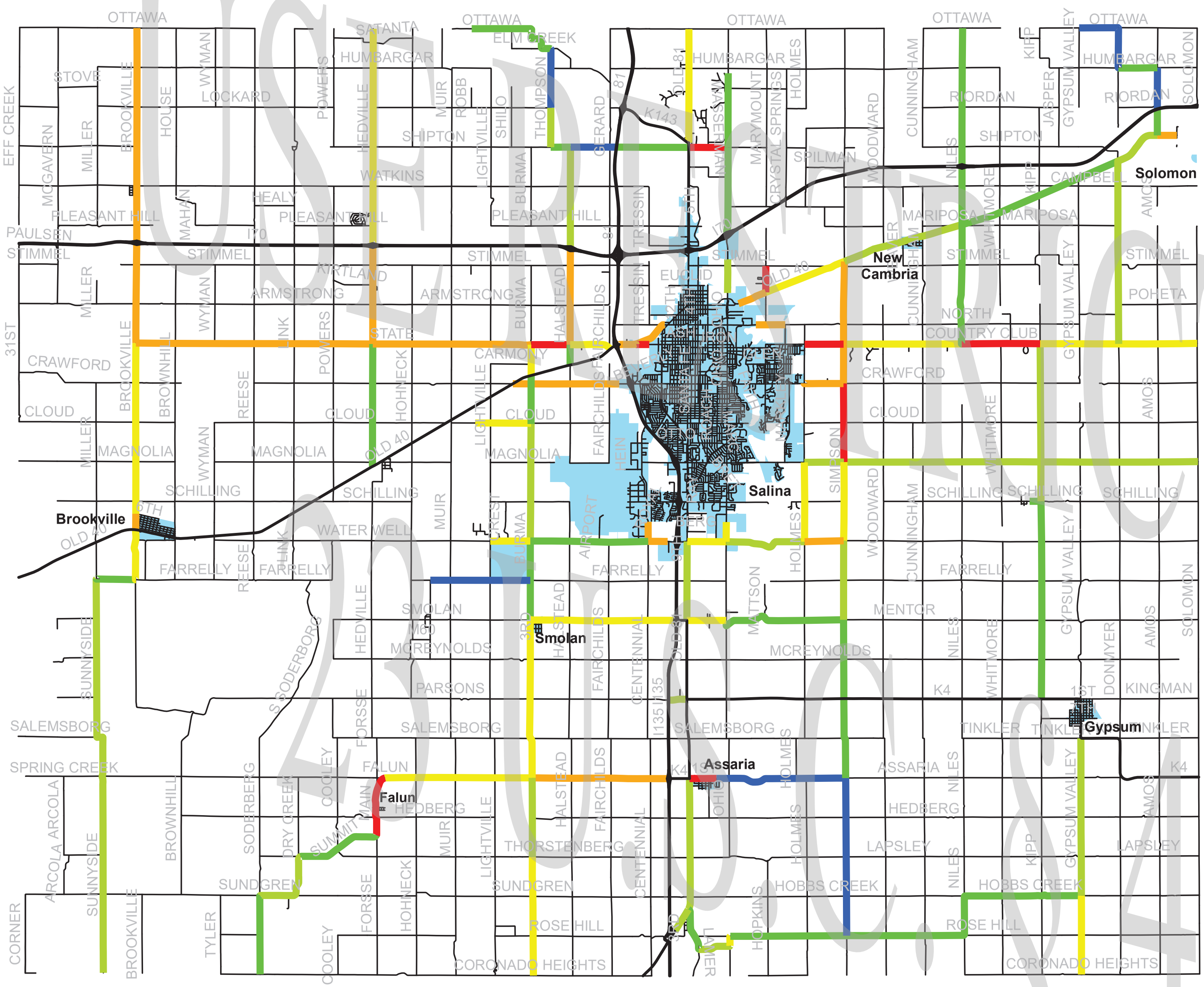
4. NEXT STEPS

Upon approval from KDOT of the risk factor scoring criteria and countermeasure project selection threshold tables, the next steps include a systemic analysis that will be conducted for the Phase 3 LRSP counties to calculate risk factor scores for each roadway segment, intersection, and curve along the LRSP study routes. The segments, intersections, and curves with the highest risk factor scores will be reviewed and 10 locations will be selected for safety improvement consideration. Project sheets will be created for the locations selected which will include associated recommended safety countermeasures.

Finally, a LRSP report will be produced for the counties, providing a summary of the project, risk factor scoring information, and the project sheets.

APPENDIX J

LRSP SEGMENT RISK FACTOR SCORES



Saline County LRSP Segment Risk Factor Scores

Legend

Total Score

- 15; 16
- 13; 14
- 11; 12
- 9; 10
- 6; 7; 8
- 3; 4; 5

Saline County
Local Road Safety Plan
Segment Risk Factor Points

ID	Segment Name	From	To	Length (mi)	Total Score	ADT Score	Access Density Score	Edge Condition Score	Roadside Assessment Score	Road Width Score	Shoulder Width Score	Lane Departure Crash Rate Score	Pavement Markings Score	Surface Type Score
107	W State St	Old Hwy 40	Salina West CL	0.34	16	6	2	1	3	0	2	2	0	0
2	E Assaria Rd	Old 81 Hwy	N Anderson St	0.69	16	5	0	3	3	2	2	1	0	0
4	E Country Club Rd	N Niles Rd	S Kipp Rd	2.00	16	5	2	3	3	0	1	2	0	0
37	N Marymount Rd	E Stimmel Rd	Old 40 Hwy	0.67	15	2	2	3	3	2	2	0	1	0
3	E Country Club Rd	N Holmes Rd	N Simpson Rd	0.99	15	5	2	3	3	0	1	1	0	0
85	S Simpson Rd	E Crawford St	E Magnolia Rd	2.00	15	5	1	3	2	0	2	2	0	0
22	E Shipton Rd	Old 81 Hwy	N Ohio St	1.00	15	4	0	2	3	0	2	3	1	0
69	S Forsse Rd	W Summit Rd	W Falun Rd	1.55	15	3	2	2	3	0	2	3	0	0
109	W State St	S Burma Rd	N Halstead Rd	0.99	15	5	2	3	3	0	2	0	0	0
29	N Brookville Rd	I-70	W State St	2.50	14	2	1	3	3	0	2	3	0	0
84	S Simpson Rd	E Country Club Rd	E Crawford St	1.00	14	6	2	1	3	0	2	0	0	0
44	N Simpson Rd	Old 40 Hwy	E Country Club Rd	2.10	14	6	1	3	2	0	2	0	0	0
8	E Crawford St	S Holmes Rd	S Simpson Rd	1.01	14	6	1	2	2	0	1	2	0	0
47	Old 40 Hwy	N Amos Rd	N Field Rd	0.50	14	6	2	3	0	0	1	2	0	0
16	E North St	Salina East CL	N Eastborough Rd	0.75	14	5	2	0	3	0	2	2	0	0
99	W Old Hwy 40	W State St	Salina West CL	0.91	14	5	2	1	3	0	2	1	0	0
67	S Centennial Rd	Salina South CL	W Water Well Rd	0.50	14	6	1	3	3	0	1	0	0	0
34	N Halstead Rd	I-70	W State St	2.39	14	3	2	3	3	0	2	1	0	0
30	N Brookville Rd	W Ottawa Rd	I-70	5.41	13	3	1	3	2	0	2	2	0	0
95	W Falun Rd	S Burma Rd	I-135	3.44	13	4	1	2	3	0	2	1	0	0
72	S Hedville Rd	I-70	W State St	2.45	13	3	2	2	3	0	2	1	0	0
108	W State St	S Brookville Rd	S Hedville Rd	6.04	13	3	1	2	3	0	2	2	0	0
98	W Old Hwy 40	I-135	W State St	0.43	13	5	2	1	3	0	2	0	0	0
93	W Crawford St	Old 40 Hwy	Salina West CL	2.71	13	6	1	2	2	0	1	1	0	0
24	E Water Well Rd	S Holmes Rd	S Simpson Rd	1.00	13	2	2	1	2	0	2	3	1	0
52	Old 40 Hwy	Salina North CL	N Marymount Rd	0.75	13	6	2	1	3	0	1	0	0	0
114	W Water Well Rd	S Centennial Rd	Salina West CL	0.50	13	5	1	3	3	0	1	0	0	0
57	S Brookville Rd	N Brookville CL	Old 40 Hwy	0.41	13	2	0	3	3	0	2	3	0	0
110	W State St	S Hedville Rd	S Burma Rd	4.04	13	4	2	1	2	0	2	2	0	0
106	W State St	N Halstead Rd	Old 40 Hwy	1.06	12	5	2	3	0	0	2	0	0	0
7	E Country Club Rd	S Simpson Rd	N Niles Rd	3.01	12	6	2	0	3	0	1	0	0	0
60	S Burma Rd	Old 40 Hwy	W State St	0.78	12	1	2	3	2	0	0	3	0	1
54	Old 81 Hwy	W Ottawa Rd	K-143	2.89	12	6	2	0	2	0	1	1	0	0
70	S Gypsum Valley Rd	E Hobbs Creek Rd	E Coronado Heights Rd	2.00	12	3	0	3	2	0	2	2	0	0
6	E Country Club Rd	S Kipp Rd	S Donmyer Rd	2.00	12	4	1	3	3	0	1	0	0	0
75	S Holmes Rd	E Magnolia Rd	E Water Well Rd	2.02	12	4	2	2	2	0	2	0	0	0
92	W Cloud St	0.4 mile west of S Lightville Rd	S Burma Rd	1.42	12	2	0	3	0	2	2	3	0	0
14	E Mentor Rd	Old 81 Hwy	S Ohio St	1.00	12	3	2	1	2	0	2	2	0	0

Saline County
Local Road Safety Plan
Segment Risk Factor Points

ID	Segment Name	From	To	Length (mi)	Total Score	ADT Score	Access Density Score	Edge Condition Score	Roadside Assessment Score	Road Width Score	Shoulder Width Score	Lane Departure Crash Rate Score	Pavement Markings Score	Surface Type Score
23	E Water Well Rd	Old 81 Hwy	S Ohio St	0.99	12	6	2	1	2	0	1	0	0	0
96	W Falun Rd	S Forsse Rd	S Burma Rd	3.75	11	3	0	2	2	0	2	2	0	0
73	S Hedville Rd	Ottawa County Line	I-70	5.47	11	4	0	2	3	0	2	0	0	0
58	S Brookville Rd	Old 40 Hwy	W Farrelly Rd	1.29	11	0	2	3	3	2	0	0	0	1
59	S Brookville Rd	W State St	N Brookville CL	4.34	11	2	0	2	3	0	2	2	0	0
64	S Burma Rd	W Thorstenberg Rd	W Coronado Heights Rd	3.02	11	4	1	2	2	0	1	1	0	0
65	S Burma Rd	W Smolan Rd	W Falun Rd	4.03	11	3	1	2	2	0	2	1	0	0
81	S Ohio St	E Rose Hill Rd (N)	E Rose Hill Rd (S)	0.25	11	0	2	1	2	2	0	3	0	1
105	W Smolan Rd	S Burma Rd	I-135	3.67	11	3	2	2	2	0	2	0	0	0
5	E Country Club Rd	S Donmyer Rd	S Solomon Rd	2.00	11	4	0	3	3	0	1	0	0	0
49	Old 40 Hwy	N Marymount Rd	N Simpson Rd	2.15	11	6	1	3	0	0	1	0	0	0
82	S Ohio St	Salina South CL	E Water Well Rd	0.50	11	2	2	1	2	0	1	3	0	0
86	S Simpson Rd	E Magnolia Rd	E Water Well Rd	2.00	11	4	1	2	2	0	0	1	0	1
115	W Water Well Rd	S Lightville Rd	S Burma Rd	1.02	11	4	1	0	3	0	1	2	0	0
71	S Gypsum Valley Rd	K-4	E Hobbs Creek Rd	4.00	10	3	1	2	2	0	2	0	0	0
91	S Sunnyside Rd	W Farrelly Rd	McPherson County Line	10.16	10	0	0	2	3	2	0	2	0	1
18	E Rose Hill Rd	S Lamer Rd	S Ohio St	0.82	10	0	2	3	2	2	0	0	0	1
88	S Simpson Rd	E Water Well Rd	E Mentor Rd	2.01	10	2	1	1	2	0	0	3	0	1
51	Old 40 Hwy	N Simpson Rd	N Niles Rd	3.15	10	6	1	1	1	0	1	0	0	0
33	N Donmyer Rd	Old 40 Hwy	E Country Club Rd	4.65	10	3	0	3	2	0	1	1	0	0
56	Old 81 Hwy	E Water Well Rd	E Mentor Rd	2.01	10	6	1	0	2	0	1	0	0	0
101	W Parsons Rd	I-135	Old 81 Hwy	0.46	10	0	2	3	3	0	2	0	0	0
55	Old 81 Hwy	NB I-135 Ramp	S Lamer Rd	0.66	10	5	1	0	3	0	1	0	0	0
77	S Kipp Rd	E Magnolia Rd	E Schilling Rd	1.00	10	5	0	1	2	0	1	1	0	0
63	S Burma Rd	W Falun Rd	W Thorstenberg Rd	2.01	10	4	1	1	2	0	2	0	0	0
112	W Sundgren Rd	S Soderberg Rd	S Dry Creek Rd	0.86	9	0	1	3	3	0	2	0	0	0
68	S Dry Creek Rd	W Thorstenberg Rd	W Sundgren Rd	1.06	9	2	1	1	3	0	2	0	0	0
62	S Burma Rd	W Cloud St	W Water Well Rd	3.00	9	4	1	0	2	0	1	1	0	0
35	N Halstead Rd	W Shipton Rd	I-70	2.53	9	3	1	2	1	0	2	0	0	0
53	Old 81 Hwy	E Assaria Rd	S Lamer Rd	3.34	9	5	1	0	2	0	1	0	0	0
12	E Magnolia Rd	S Kipp Rd	S Solomon Rd	4.00	9	2	0	2	1	0	0	3	0	1
13	E Magnolia Rd	S Simpson Rd	S Kipp Rd	5.02	9	5	1	0	2	0	1	0	0	0
76	S Kipp Rd	E Country Club Rd	E Magnolia Rd	3.01	9	4	0	2	2	0	1	0	0	0
11	E Magnolia Rd	S Holmes Rd	S Simpson Rd	1.01	9	6	0	0	2	0	1	0	0	0
48	Old 40 Hwy	N Donmyer Rd	N Amos Rd	1.28	9	6	0	1	0	0	1	1	0	0
25	E Water Well Rd	S Ohio St	S Holmes Rd	2.08	9	2	2	0	2	0	0	3	0	0
42	N Ohio St	0.16 mile North of E Stimmel Rd	Salina North CL	0.86	9	6	1	0	2	0	0	0	0	0
46	N Thompson Rd	W Lockard Rd	W Shipton Rd	1.00	9	1	0	3	2	0	2	0	1	0

Saline County
Local Road Safety Plan
Segment Risk Factor Points

ID	Segment Name	From	To	Length (mi)	Total Score	ADT Score	Access Density Score	Edge Condition Score	Roadside Assessment Score	Road Width Score	Shoulder Width Score	Lane Departure Crash Rate Score	Pavement Markings Score	Surface Type Score
36	N Halstead Rd	W State St	Old 40 Hwy	0.52	8	3	2	0	2	0	1	0	0	0
89	S Simpson Rd	K-4	E Assaria Rd	2.03	8	0	0	1	3	0	0	3	0	1
87	S Simpson Rd	E Mentor Rd	K-4	2.01	8	1	0	1	2	0	0	3	0	1
50	Old 40 Hwy	N Niles Rd	N Donmyer Rd	4.29	8	5	0	2	0	0	1	0	0	0
39	N Niles Rd	I-70	Old 40 Hwy	1.43	8	4	1	0	1	0	2	0	0	0
28	N Amos Rd	I-70	E Old Hwy 40	0.67	8	1	2	1	3	0	0	0	0	1
97	W Farrelly Rd	S Sunnyside Rd	S Brookville Rd	1.00	7	0	0	3	3	0	0	0	0	1
74	S Hedville Rd	W State St	Old 40 Hwy	3.11	7	1	0	2	3	0	0	0	0	1
111	W Summit Rd	S Dry Creek Rd	S Forsse Rd	2.11	7	2	0	3	0	0	2	0	0	0
66	S Burma Rd	W Water Well Rd	W Smolan Rd	2.01	7	4	0	0	2	0	1	0	0	0
43	N Ohio St	E Shipton Rd	I-70	2.16	7	5	0	0	2	0	0	0	0	0
104	W Shipton Rd	N Thompson Rd	N Halstead Rd	0.50	7	0	2	1	2	0	2	0	0	0
20	E Rose Hill Rd	S Simpson Rd	S Niles Rd	2.99	7	0	0	2	2	2	0	0	0	1
80	S Niles Rd	E Hobbs Creek Rd	E Rose Hill Rd	0.99	7	0	0	2	2	2	0	0	0	1
79	S Lamer Rd	Old 81 Hwy	E Rose Hill Rd	1.07	7	2	2	0	2	0	0	0	0	1
78	S Kipp Rd	E Schilling Rd	K-4	5.02	7	4	0	0	2	0	1	0	0	0
40	N Niles Rd	Old 40 Hwy	E Country Club Rd	3.04	7	2	1	0	0	0	0	3	0	1
38	N Niles Rd	E Ottawa Rd	I-70	3.47	7	3	0	2	0	0	2	0	0	0
10	E Humbargar Rd	N Donmyer Rd	N Amos Rd	1.00	7	0	0	1	2	0	0	3	0	1
94	W Elm Creek Rd	N Adams Rd	N Thompson Rd	0.23	7	1	2	3	0	0	0	0	0	1
61	S Burma Rd	W Cloud St	Old 40 Hwy	1.24	7	3	1	0	2	0	1	0	0	0
31	N Burma Rd	N Ottawa Rd	W Wolff Rd	0.25	7	1	2	3	0	0	0	0	0	1
116	W Wolff Rd	N Burma Rd	N Adams Rd	0.25	7	1	2	3	0	0	0	0	0	1
26	N Adams Rd	W Wolff Rd	W Elm Creek Rd	0.24	7	1	2	3	0	0	0	0	0	1
90	S Soderberg Rd	W Sundgren Rd	W Coronado Heights Rd	2.00	6	0	0	2	2	0	2	0	0	0
102	W Shipton Rd	81 Hwy	K-143	1.83	6	0	1	2	2	0	0	0	0	1
19	E Rose Hill Rd	S Ohio St	S Simpson Rd	2.96	6	0	0	2	1	2	0	0	0	1
9	E Hobbs Creek Rd	S Niles Rd	S Gypsum Valley Rd	2.99	6	0	0	2	1	2	0	0	0	1
15	E Mentor Rd	S Ohio St	S Simpson Rd	3.24	6	1	1	1	2	0	0	0	0	1
113	W Water Well Rd	S Burma Rd	S Centennial Rd	3.02	6	5	0	0	0	0	1	0	0	0
21	E Schilling Rd	0.07 mile East of S Bernard St	S Kipp Rd	0.29	6	2	0	0	2	0	2	0	0	0
41	N Ohio St	0.12 mile South of E Humbargar Rd	W Shipton Rd	1.89	6	3	1	0	2	0	0	0	0	0
100	W Ottawa Rd	1.02 miles West of N Shilo Rd	N Burma Rd	1.50	6	1	0	3	1	0	0	0	0	1
103	W Shipton Rd	N Halstead Rd	81 Hwy	1.16	5	0	0	2	2	0	0	0	0	1
45	N Thompson Rd	W Elm Creek Rd	W Lockard Rd	1.50	5	1	0	3	0	0	0	0	0	1
83	S Simpson Rd	E Assaria Rd	E Rose Hill Rd	4.01	5	0	1	1	2	0	0	0	0	1
17	E Ottawa Rd	N Gypsum Valley Rd	N Donmyer Rd	1.00	5	0	1	1	2	0	0	0	0	1
117	W Farrelly Rd	S Englund Rd	S Burma Rd	2.55	5	2	0	1	1	0	1	0	0	0

Saline County
Local Road Safety Plan
Segment Risk Factor Points

ID	Segment Name	From	To	Length (mi)	Total Score	ADT Score	Access Density Score	Edge Condition Score	Roadside Assessment Score	Road Width Score	Shoulder Width Score	Lane Departure Crash Rate Score	Pavement Markings Score	Surface Type Score
1	E Assaria Rd	N Anderson St	S Simpson Rd	3.33	4	0	0	2	1	0	0	0	0	1
27	N Amos Rd	E Humbargar Rd	I-70	1.05	4	0	0	1	2	0	0	0	0	1
32	N Donmyer Rd	E Ottawa Rd	E Humbargar Rd	1.02	3	0	0	0	2	0	0	0	0	1

APPENDIX K

LRSP INTERSECTION RISK FACTOR SCORES

Saline County
Local Road Safety Plan
Intersection Risk Factor Points

ID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score	Crash Experience Score	Distance from Previous Stop Score	Skewed Approach Score	Intersection Control Score
49	E Old 40 Hwy & E Stimmel Rd	18	6	2	3	3	0	0	3	1
255	W State St & W Old 40 Hwy	17	6	1	3	3	0	0	3	1
56	E Old 40 Hwy & N Niles Rd	15	6	2	0	0	0	3	3	1
57	E Old 40 Hwy & N Simpson Rd	14	6	2	0	0	0	2	3	1
48	E Old 40 Hwy & E Mariposa Rd	13	6	0	3	0	0	0	3	1
204	S Old 81 Hwy & S Lamer Rd	13	5	1	0	3	0	3	0	1
52	E Old 40 Hwy & N Donmyer Rd	13	6	1	0	0	0	2	3	1
226	W Crawford St & S Burma Rd	13	6	0	0	0	3	3	0	1
159	S Burma Rd & W Falun Rd	13	5	1	3	0	0	3	0	1
139	N Simpson Rd & E Stimmel Rd	12	6	2	3	0	0	0	0	1
55	E Old 40 Hwy & N Marymount Rd	12	6	2	0	0	0	0	3	1
176	S Forsse Rd & W Falun Rd	12	2	0	3	3	0	0	3	1
247	W State St & N Hedville Rd	12	4	1	3	0	0	3	0	1
21	E Country Club Rd & S Kipp Rd	11	5	2	0	0	0	3	0	1
36	E Magnolia Rd & S Kipp Rd	11	6	1	0	0	0	3	0	1
50	E Old 40 Hwy & N Amos Rd	11	6	2	0	0	0	2	0	1
70	E Water Well Rd & S Ohio St	11	6	2	0	0	0	2	0	1
129	N Ohio St & E Stimmel Rd	11	6	1	3	0	0	0	0	1
134	N Old 81 Hwy & W Humbargar Rd	11	6	1	3	0	0	0	0	1
136	N Old 81 Hwy & W Robson Rd	11	6	1	3	0	0	0	0	1
137	N Simpson Rd & E Country Club Rd	11	6	2	0	0	0	2	0	1
165	S Burma Rd & W Salemsborg Rd	11	3	1	0	3	0	0	3	1
170	S Dry Creek Rd & W Sundgren Rd	11	1	0	3	3	0	0	3	1
228	W Crawford St & S Halstead Rd	11	6	1	3	0	0	0	0	1
246	W State St & N Halstead Rd	11	5	2	0	0	0	3	0	1
35	E Magnolia Rd & S Holmes Rd	10	5	2	0	0	0	2	0	1
38	E Magnolia Rd & S Simpson Rd	10	6	0	0	0	0	3	0	1
51	E Old 40 Hwy & N Cunningham Rd	10	6	0	0	0	0	0	3	1
53	E Old 40 Hwy & N Gypsum Valley Rd	10	5	1	0	0	0	0	3	1
59	E Old 40 Hwy & N Whitmore Rd	10	5	1	0	0	0	0	3	1
60	E Old 40 Hwy & N Woodward Rd	10	6	0	0	0	0	0	3	1
65	E Shipton Rd & N Sandy Ave	10	4	2	3	0	0	0	0	1
67	E Shipton Rd & N Wasserman Way	10	4	2	3	0	0	0	0	1
210	S Simpson Rd & E Crawford St	10	6	1	0	0	0	2	0	1
243	W State St & Fairchilds Rd	10	5	1	0	3	0	0	0	1
248	W State St & N Hohneck Rd	10	4	2	3	0	0	0	0	1
259	W Water Well Rd & S Burma Rd	10	6	1	0	0	0	2	0	1
14	E Country Club Rd & N Niles Rd	9	5	1	0	0	0	2	0	1
17	E Country Club Rd & S Brenda Ln	9	4	1	3	0	0	0	0	1
23	E Country Club Rd & S Nelson Rd	9	5	0	3	0	0	0	0	1
25	E Country Club Rd & S Woodward Rd	9	6	2	0	0	0	0	0	1
45	E North St & N Eastborough Rd	9	6	2	0	0	0	0	0	1
54	E Old 40 Hwy & N Kipp Rd	9	5	0	0	0	0	0	3	1
66	E Shipton Rd & N Turner Ln	9	4	2	3	0	0	0	0	0
87	N Center Ave & W 1st St	9	5	0	3	0	0	0	0	1
94	N Elevator St & E 1st St	9	5	0	3	0	0	0	0	1
105	N Hedville Rd & W Pennsylvania Ave	9	3	2	3	0	0	0	0	1
110	N Hedville Rd & W Washington Ave	9	3	2	3	0	0	0	0	1
112	N Highland Ave & W 1st St	9	5	0	3	0	0	0	0	1
114	N Main St & S Forsse Rd	9	2	0	3	0	0	0	3	1
155	S Burma Rd & E Walnut St	9	3	2	3	0	0	0	0	1
172	S Forsse Rd & W 1st St	9	2	0	3	3	0	0	0	1
177	S Forsse Rd & W Hedberg Rd	9	2	0	0	3	0	0	3	1
251	W State St & N Muir Rd	9	4	1	3	0	0	0	0	1

Saline County
Local Road Safety Plan
Intersection Risk Factor Points

ID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score	Crash Experience Score	Distance from Previous Stop Score	Skewed Approach Score	Intersection Control Score
11	E Country Club Rd & E Shannon St	8	5	2	0	0	0	0	0	1
12	E Country Club Rd & N Donmyer Rd	8	4	1	0	0	0	2	0	1
19	E Country Club Rd & S Cunningham Rd	8	6	1	0	0	0	0	0	1
22	E Country Club Rd & S Morris Dr	8	5	2	0	0	0	0	0	1
31	S Cunningham Rd & E Magnolia Rd (E)	8	5	2	0	0	0	0	0	1
32	S Cunningham Rd & E Magnolia Rd (W)	8	5	2	0	0	0	0	0	1
37	E Magnolia Rd & S Niles Rd	8	5	2	0	0	0	0	0	1
41	E Mentor Rd & N Washington St	8	3	2	3	0	0	0	0	0
46	E North St & N Marymount Rd	8	5	2	0	0	0	0	0	1
69	E Water Well Rd & S Holmes Rd	8	3	2	0	0	0	2	0	1
109	N Hedville Rd & W Stimmel Rd	8	3	1	3	0	0	0	0	1
127	N Ohio St & E Granville Rd	8	4	0	3	0	0	0	0	1
132	N Old 81 Hwy & Clearview Rd	8	6	1	0	0	0	0	0	1
133	N Old 81 Hwy & E Bowen Dr	8	6	1	0	0	0	0	0	1
135	N Old 81 Hwy & W Prairie Ridge Rd	8	6	1	0	0	0	0	0	1
138	N Simpson Rd & E North St	8	6	1	0	0	0	0	0	1
166	S Burma Rd & W Smolan Rd	8	4	1	0	0	0	2	0	1
169	S Burma Rd W Farrelly Rd	8	4	1	0	0	0	2	0	1
171	S Dry Creek Rd & W Thorstenberg Rd	8	1	0	0	3	0	0	3	1
194	S Kipp Rd & E Schilling Rd	8	4	1	0	0	0	2	0	1
201	S Old 81 Hwy & E Farrelly Rd	8	6	1	0	0	0	0	0	1
227	W Crawford St & S Fairchilds Rd	8	6	1	0	0	0	0	0	1
241	W Smolan Rd & S Fairchilds Rd	8	3	1	3	0	0	0	0	1
257	W Summit Rd & S Forsse Rd	8	1	0	0	3	0	0	3	1
3	Centennial Rd & Vortex Ave	7	6	0	0	0	0	0	0	1
4	Centennial Rd & Wall St	7	6	0	0	0	0	0	0	1
10	E Country Club Rd & Country Ln	7	5	1	0	0	0	0	0	1
18	E Country Club Rd & S Country Estates Dr	7	5	1	0	0	0	0	0	1
26	E Crawford St & S Holmes Rd	7	6	0	0	0	0	0	0	1
39	E Magnolia Rd & S Whitmore Rd	7	5	1	0	0	0	0	0	1
40	E Magnolia Rd & S Woodward Rd	7	5	1	0	0	0	0	0	1
58	E Old 40 Hwy & N Weaver Rd	7	6	0	0	0	0	0	0	1
68	E Water Well Rd & Progress Dr	7	6	0	0	0	0	0	0	1
71	E Water Well Rd & S Simpson Rd	7	3	1	0	0	0	2	0	1
75	N Anderson St & E 1st St	7	3	0	3	0	0	0	0	1
97	N Halstead Rd & W Pleasant Hill Rd	7	3	0	3	0	0	0	0	1
98	N Halstead Rd & W Shipton Rd	7	3	0	0	0	0	3	0	1
128	N Ohio St & E Schippel Rd	7	4	2	0	0	0	0	0	1
131	N Ohio St & W Shipton Rd	7	4	2	0	0	0	0	0	1
144	North St & S Main St	7	3	0	3	0	0	0	0	1
156	S Burma Rd & Mattson St	7	3	0	3	0	0	0	0	1
158	S Burma Rd & W Cloud St	7	4	0	0	0	0	2	0	1
188	S Holmes Rd & E Schilling Rd	7	4	2	0	0	0	0	0	1
196	S Lamer Rd & E Perrill Rd	7	1	0	0	3	0	0	3	0
207	S Old 81 Hwy & W Thorstenberg Rd	7	5	1	0	0	0	0	0	1
209	S Simpson Rd & E Cloud St	7	5	1	0	0	0	0	0	1
260	W Water Well Rd & S Centennial Rd	7	6	0	0	0	0	0	0	1
261	W Water Well Rd & S Crest Ln	7	3	0	3	0	0	0	0	1
263	W Water Well Rd & S Halstead Rd	7	5	1	0	0	0	0	0	1
5	E 1st St & N Railroad Ave	6	5	0	0	0	0	0	0	1
13	E Country Club Rd & N Holmes Rd	6	4	1	0	0	0	0	0	1
15	E Country Club Rd & N Whitmore Rd	6	4	1	0	0	0	0	0	1
16	E Country Club Rd & S Amos Rd	6	4	1	0	0	0	0	0	1
24	E Country Club Rd & S Whitmore Rd	6	4	1	0	0	0	0	0	1

Saline County
Local Road Safety Plan
Intersection Risk Factor Points

ID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score	Crash Experience Score	Distance from Previous Stop Score	Skewed Approach Score	Intersection Control Score
28	E Hobbs Creek Rd & S Niles Rd	6	0	0	0	3	0	0	3	0
77	N Brookville Rd & E 2nd St	6	2	0	3	0	0	0	0	1
82	N Brookville Rd & W Ottawa Rd	6	2	0	3	0	0	0	0	1
86	N Brookville Rd & W Watkins Rd	6	2	0	3	0	0	0	0	1
95	N Fairchild Ave & W 1st St	6	5	0	0	0	0	0	0	1
96	N Halstead Rd & W Armstrong Rd	6	2	0	3	0	0	0	0	1
99	N Halstead Rd & W Stimmel Rd	6	2	0	3	0	0	0	0	1
102	N Hedville Rd & W Humbargar Rd	6	4	1	0	0	0	0	0	1
106	N Hedville Rd & W Pleasant Hill Rd	6	4	1	0	0	0	0	0	1
111	N Hedville Rd & W Watkins Rd	6	4	1	0	0	0	0	0	1
140	N Thompson Rd & W Elm Creek Rd	6	0	0	0	3	0	0	3	0
173	S Forsse Rd & W 2nd St	6	2	0	3	0	0	0	0	1
174	S Forsse Rd & W 3rd St	6	2	0	3	0	0	0	0	1
180	S Gypsum Valley Rd & E Hedberg Rd	6	2	0	3	0	0	0	0	1
181	S Gypsum Valley Rd & E Hobbs Creek Rd	6	2	0	0	0	0	3	0	1
189	S Kipp Rd & E Cloud St	6	4	1	0	0	0	0	0	1
191	S Kipp Rd & E Farrelly Rd	6	4	1	0	0	0	0	0	1
192	S Kipp Rd & E McReynolds Rd	6	4	1	0	0	0	0	0	1
195	S Kipp Rd & E Water Well Rd	6	4	1	0	0	0	0	0	1
197	S Niles Rd & E Rose Hill Rd	6	0	0	0	3	0	0	3	0
200	S Ohio St & E Rose Hill Rd	6	0	0	0	3	0	0	3	0
205	S Old 81 Hwy & W Hedberg Rd	6	5	0	0	0	0	0	0	1
206	S Old 81 Hwy & W Sundgren Rd	6	5	0	0	0	0	0	0	1
208	S Old 81 Hwy & W Walnut St	6	4	1	0	0	0	0	0	1
230	W Falun Rd & S Fairchilds Rd	6	3	2	0	0	0	0	0	1
232	W Falun Rd & S Hohneck Rd	6	2	0	3	0	0	0	0	1
242	W Smolan Rd & S Halstead Rd	6	3	2	0	0	0	0	0	1
244	W State St & N Brookville Rd	6	2	0	0	0	0	3	0	1
249	W State St & N Lightville Rd	6	4	1	0	0	0	0	0	1
250	W State St & N Link Rd	6	2	0	3	0	0	0	0	1
254	W State St & S Burma Rd	6	4	1	0	0	0	0	0	1
258	W Water Well Rd & S Airport Rd	6	5	0	0	0	0	0	0	1
262	W Water Well Rd & S Fairchilds Rd	6	5	0	0	0	0	0	0	1
265	W Water Well Rd & Scanlan Ave	6	5	0	0	0	0	0	0	1
252	W State St & N Powers Rd	6	2	0	3	0	0	0	0	1
1	Borgmeyer Ln & E Assaria Rd	5	5	0	0	0	0	0	0	0
2	Borgmeyer Ln & W 1st St	5	5	0	0	0	0	0	0	0
20	E Country Club Rd & S Gypsum Valley Rd	5	4	0	0	0	0	0	0	1
42	E Mentor Rd & S Grand St	5	3	2	0	0	0	0	0	0
44	E Mentor Rd & S Maxwell Rd	5	3	2	0	0	0	0	0	0
90	N Donmyer Rd & E Mariposa Rd	5	2	2	0	0	0	0	0	1
92	N Donmyer Rd & E Phoeta Rd	5	2	2	0	0	0	0	0	1
101	N Hedville Rd & W Armstrong Rd	5	3	1	0	0	0	0	0	1
103	N Hedville Rd & W Kirtland Rd	5	3	2	0	0	0	0	0	0
104	N Hedville Rd & W Lockard Rd	5	4	0	0	0	0	0	0	1
107	N Hedville Rd & W Satanta Rd	5	4	0	0	0	0	0	0	1
108	N Hedville Rd & W Shipton Rd	5	4	0	0	0	0	0	0	1
115	N Marymount Rd & E Gray Rd	5	1	0	3	0	0	0	0	1
116	N Marymount Rd & E Marcye Ln	5	1	0	3	0	0	0	0	1
124	N Niles Rd & E Stimmel Rd	5	1	0	3	0	0	0	0	1
126	N Ohio St & E Frisbie Way	5	1	0	3	0	0	0	0	1
145	Pine Ave & W 1st St	5	5	0	0	0	0	0	0	0
146	S Brookville Rd & W 2nd St	5	1	0	3	0	0	0	0	1
147	S Brookville Rd & W 3rd St	5	1	0	3	0	0	0	0	1

Saline County
Local Road Safety Plan
Intersection Risk Factor Points

ID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score	Crash Experience Score	Distance from Previous Stop Score	Skewed Approach Score	Intersection Control Score
148	S Brookville Rd & W 5th St	5	1	0	3	0	0	0	0	1
160	S Burma Rd & W Hedberg Rd	5	3	1	0	0	0	0	0	1
161	S Burma Rd & W Magnolia Rd	5	4	0	0	0	0	0	0	1
163	S Burma Rd & W Parsons Rd	5	3	1	0	0	0	0	0	1
164	S Burma Rd & W Rose Hill Rd	5	3	1	0	0	0	0	0	1
167	S Burma Rd & W Sundgren Rd	5	3	1	0	0	0	0	0	1
190	S Kipp Rd & E Crawford St	5	4	0	0	0	0	0	0	1
193	S Kipp Rd & E Mentor Rd	5	4	0	0	0	0	0	0	1
202	S Old 81 Hwy & E Founders Rd	5	4	0	0	0	0	0	0	1
219	S Simpson Rd & E Schilling Rd	5	4	1	0	0	0	0	0	0
240	W Smolan Rd & S Centennial Rd	5	3	1	0	0	0	0	0	1
256	W Summit Rd & S Cooley Rd	5	1	0	0	0	0	0	3	1
8	E Assaria Rd & S Ohio St	4	0	0	3	0	0	0	0	1
27	E Hobbs Creek Rd & S Kipp Rd	4	0	0	0	3	0	0	0	1
100	N Halstead Rd & W Watkins Rd	4	3	0	0	0	0	0	0	1
113	N Lamer Rd & E Walnut St	4	1	0	3	0	0	0	0	0
118	N Niles Rd & E Campbell Rd	4	3	0	0	0	0	0	0	1
143	N Thompson Rd & W Shipton Rd	4	0	0	0	0	0	3	0	1
162	S Burma Rd & W McReynolds Rd	4	3	0	0	0	0	0	0	1
168	S Burma Rd & W Thorstenberg Rd	4	3	0	0	0	0	0	0	1
178	S Front St & E Chestnut St	4	1	0	3	0	0	0	0	0
216	S Simpson Rd & E Mentor Rd	4	1	0	0	0	0	2	0	1
217	S Simpson Rd & E Rose Hill Rd	4	0	0	0	0	0	3	0	1
221	S Soderberg Rd & W Sundgren Rd	4	0	0	0	3	0	0	0	1
223	S Sunnyside Rd & W Spring Creek Rd	4	0	0	3	0	0	0	0	1
229	W Falun Rd & S Centennial Rd	4	3	0	0	0	0	0	0	1
231	W Falun Rd & S Halstead Rd	4	3	0	0	0	0	0	0	1
236	W North St & S 3rd St	4	3	0	0	0	0	0	0	1
9	S Simpson Rd & E Assaria Rd	3	0	0	0	0	0	2	0	1
47	E North St & S 5th St	3	3	0	0	0	0	0	0	0
72	N Adams Rd & W Elm Creek Rd	3	0	0	0	3	0	0	0	0
76	N Brookville Rd & E 1st St	3	2	0	0	0	0	0	0	1
78	N Brookville Rd & E 3rd St	3	2	0	0	0	0	0	0	1
80	N Brookville Rd & W Humbargar Rd	3	2	0	0	0	0	0	0	1
81	N Brookville Rd & W Lockard Rd	3	2	0	0	0	0	0	0	1
83	N Brookville Rd & W Pleasant Hill Rd	3	2	0	0	0	0	0	0	1
84	N Brookville Rd & W Shipton Rd	3	2	0	0	0	0	0	0	1
88	N Donmyer Rd & E Campbell Rd	3	2	0	0	0	0	0	0	1
89	N Donmyer Rd & E Humbargar Rd	3	0	0	0	3	0	0	0	0
91	N Donmyer Rd & E Ottawa Rd	3	0	0	0	3	0	0	0	0
93	N Donmyer Rd & E Stimmel Rd	3	2	0	0	0	0	0	0	1
119	N Niles Rd & E Humbargar Rd	3	2	0	0	0	0	0	0	1
122	N Niles Rd & E Riordan Rd	3	2	0	0	0	0	0	0	1
123	N Niles Rd & E Shipton Rd	3	2	0	0	0	0	0	0	1
175	S Forsse Rd & W 4th St	3	2	0	0	0	0	0	0	1
179	S Gypsum Valley Rd & E Assaria Rd	3	2	0	0	0	0	0	0	1
182	S Gypsum Valley Rd & E Lapsley Rd (N)	3	2	0	0	0	0	0	0	1
183	S Gypsum Valley Rd & E Lapsley Rd (S)	3	2	0	0	0	0	0	0	1
184	S Gypsum Valley Rd & E Rose Hill Rd	3	2	0	0	0	0	0	0	1
198	S Ohio St & E Mentor Rd (N)	3	2	0	0	0	0	0	0	1
233	W Falun Rd & S Lightville Rd	3	2	0	0	0	0	0	0	1
234	W Falun Rd & S Muir Rd	3	2	0	0	0	0	0	0	1
245	W State St & N Brownhill Rd	3	2	0	0	0	0	0	0	1
253	W State St & N Reese Rd	3	2	0	0	0	0	0	0	1

Saline County
Local Road Safety Plan
Intersection Risk Factor Points

ID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score	Crash Experience Score	Distance from Previous Stop Score	Skewed Approach Score	Intersection Control Score
264	W Water Well Rd & S Lightville Rd	3	2	0	0	0	0	0	0	1
33	E Magnolia Rd & S Donmyer Rd	2	1	0	0	0	0	0	0	1
43	E Mentor Rd & S Holmes Rd	2	1	0	0	0	0	0	0	1
79	N Brookville Rd & W Armstrong Rd	2	1	0	0	0	0	0	0	1
85	N Brookville Rd & W Stimmel Rd	2	1	0	0	0	0	0	0	1
120	N Niles Rd & E Mariposa Rd	2	1	0	0	0	0	0	0	1
121	N Niles Rd & E North St	2	1	0	0	0	0	0	0	1
130	N Ohio St & E Thacher Rd	2	1	0	0	0	0	0	0	1
149	S Brookville Rd & W Anderson St	2	1	0	0	0	0	0	0	1
150	S Brookville Rd & W Cloud St	2	1	0	0	0	0	0	0	1
151	S Brookville Rd & W Crawford St	2	1	0	0	0	0	0	0	1
153	S Brookville Rd & W Schilling Rd	2	1	0	0	0	0	0	0	1
211	S Simpson Rd & E Farrelly Rd	2	1	0	0	0	0	0	0	1
225	W Cloud St & S Lightville Rd	2	1	0	0	0	0	0	0	1
266	W Farrelly Rd & S Lightville Rd	2	1	0	0	0	0	0	0	1
267	W Farrelly Rd & S Muir Rd	2	1	0	0	0	0	0	0	1
268	W Farrelly Rd & S Englund Rd	2	1	0	0	0	0	0	0	1
7	S Holmes Rd & E Assaria Rd (W)	1	0	0	0	0	0	0	0	1
29	E Hobbs Creek Rd & S Whitmore Rd	1	0	0	0	0	0	0	0	1
30	E Magnolia Rd & S Amos Rd	1	1	0	0	0	0	0	0	0
34	E Magnolia Rd & S Gypsum Valley Rd	1	1	0	0	0	0	0	0	0
61	E Ottawa Rd & N Gypsum Valley Rd	1	0	0	0	0	0	0	0	1
63	E Rose Hill Rd & S Hopkins Rd	1	0	0	0	0	0	0	0	1
64	E Rose Hill Rd & S Woodward Rd	1	0	0	0	0	0	0	0	1
73	N Amos Rd & E Humbargar Rd	1	0	0	0	0	0	0	0	1
74	N Amos Rd & E Riordan Rd	1	0	0	0	0	0	0	0	1
125	N Ohio St & Annie Oakley Pt	1	1	0	0	0	0	0	0	0
157	S Burma Rd & W Carmony Rd	1	0	0	0	0	0	0	0	1
185	S Hedville Rd & W Cloud St	1	0	0	0	0	0	0	0	1
186	S Hedville Rd & W Crawford St	1	0	0	0	0	0	0	0	1
199	S Ohio St & E Mentor Rd (S)	1	0	0	0	0	0	0	0	1
212	S Simpson Rd & E Hedberg Rd	1	0	0	0	0	0	0	0	1
214	S Simpson Rd & E Lapsley Rd	1	0	0	0	0	0	0	0	1
215	S Simpson Rd & E McReynolds Rd	1	0	0	0	0	0	0	0	1
220	S Soderberg Rd & W Rose Hill Rd	1	0	0	0	0	0	0	0	1
222	S Sunnyside Rd & W Chapel Hill Rd	1	0	0	0	0	0	0	0	1
238	W Parsons Rd & S Tamara Ln	1	0	0	0	0	0	0	0	1
6	S Holmes Rd & E Assaria Rd (E)	0	0	0	0	0	0	0	0	0
62	E Rose Hill Rd & S Holmes Rd	0	0	0	0	0	0	0	0	0
117	N Marymount Rd & E Stimmel Rd	0	0	0	0	0	0	0	0	0
141	N Thompson Rd & W Humbargar Rd	0	0	0	0	0	0	0	0	0
142	N Thompson Rd & W Lockard Rd	0	0	0	0	0	0	0	0	0
152	S Brookville Rd & W Farrelly Rd	0	0	0	0	0	0	0	0	0
187	S Hedville Rd & W Magnolia Rd	0	0	0	0	0	0	0	0	0
213	S Simpson Rd & E Hobbs Creek Rd	0	0	0	0	0	0	0	0	0
218	S Simpson Rd & E Salemsborg Rd	0	0	0	0	0	0	0	0	0
224	S Sunnyside Rd & W Sundgren Rd	0	0	0	0	0	0	0	0	0
239	W Shipton Rd & N Gerard Rd	0	0	0	0	0	0	0	0	0

APPENDIX L

LRSP CURVE RISK FACTOR SCORES

Saline County
Local Road Safety Plan
Curve Risk Factor Points

ID	Location	Total Score	Volume Score	Curve Radius Score	Access Density Score	Shoulder Width Score	Edge Condition Score	Roadside Assessment Score	Super-elevation Score	Presence of Warning Signs Score	Crash Experience Score
51	S Forsse Rd & W Hedberg Rd (N)	16	5	3	2	2	1	1	2	0	0
70	W Summit Rd & S Forsse Rd	15	5	2	1	2	1	1	0	0	3
68	W State St & W Old 40 Hwy	14	6	3	0	2	0	1	2	0	0
33	N Main St 0.40 mi north of W Hedberg Rd	14	5	1	2	2	1	1	2	0	0
47	S Forsse Rd & W Hedberg Rd (S)	13	5	2	2	2	1	1	0	0	0
67	W Old 40 Hwy & W State St	13	6	0	2	2	0	1	2	0	0
65	W Old 40 Hwy 0.33 mi northeast of Railroad	13	6	2	2	2	0	1	0	0	0
34	N Main St 0.35 mi north of W Hedberg Rd	13	5	0	2	2	1	1	2	0	0
41	S Burma Rd & W Salemsborg Rd (N)	12	5	1	2	2	1	1	0	0	0
42	S Burma Rd & W Salemsborg Rd (S)	12	5	1	2	2	1	1	0	0	0
64	W Old 40 Hwy 0.35 mi north of W State St	12	6	1	2	2	0	1	0	0	0
16	E Old 40 Hwy 0.23 mi west of N Woodward Rd	12	6	0	1	1	0	0	2	2	0
46	S Forsse Rd & W Falun Rd	11	5	1	1	2	1	1	0	0	0
55	S Old 81 Hwy & S Lamer Rd	11	5	0	1	1	0	0	2	2	0
69	W State St 0.79 mi east of N Halstead Rd	11	6	0	2	2	1	0	0	0	0
18	E Old 40 Hwy 0.34 mi west of N Simpson Rd	11	6	1	2	1	1	0	0	0	0
58	S Soderberg Rd & W Sundgren Rd	10	2	3	1	2	1	1	0	0	0
44	S Dry Creek Rd 0.66 mi south of W Thorstenberg Rd	10	4	2	1	2	0	1	0	0	0
43	S Dry Creek Rd & W Thorstenberg Rd	10	4	2	1	2	0	1	0	0	0
71	W Summit Rd 0.55 mi west of S Forsse Rd	10	4	2	1	2	1	0	0	0	0
30	N Burma Rd & W Ottawa Rd	10	2	3	2	0	1	0	2	0	0
19	E Old 40 Hwy 0.47 mi west of N Simpson Rd	10	6	1	1	1	1	0	0	0	0
17	E Old 40 Hwy 0.24 mi west of N Simpson Rd	10	6	0	2	1	1	0	0	0	0
72	W Sundgren Rd 0.84 mi east of S Soderberg Rd	9	3	2	1	2	0	1	0	0	0
73	W Thorstenberg Rd 0.65 mi east of S Dry Creek Rd	9	4	2	0	2	1	0	0	0	0
49	S Lamer Rd & S Old 81 Hwy	9	3	2	2	0	0	0	2	0	0
48	S Front St & E Perrill Rd	9	3	0	2	0	0	0	2	2	0
38	N Thompson Rd & W Elm Creek Rd	9	2	3	1	0	1	0	2	0	0
25	E Water Well Rd 0.72 mi west of S Holmes Rd	9	4	2	2	0	0	1	0	0	0
26	E Water Well Rd 0.83 mi west of S Holmes Rd	9	4	2	2	0	0	1	0	0	0
35	N Niles Rd 0.37 mi north of E North St	9	3	1	1	0	0	0	2	2	0
39	S Brookville Rd 0.16 mi south of W Water Well Rd	8	1	1	2	0	1	1	2	0	0
45	S Dry Creek Rd 0.72 mi south of W Thorstenberg Rd	8	4	1	0	2	0	1	0	0	0
52	S Niles Rd & E Rose Hill Rd	8	1	3	2	0	1	1	0	0	0
57	S Simpson Rd & E Salemsborg Rd (S)	8	2	2	1	0	0	1	2	0	0
56	S Simpson Rd & E Salemsborg Rd (N)	8	2	2	1	0	0	1	2	0	0
14	E Old 40 Hwy 0.19 mi east of N Donmyer Rd	8	6	0	1	1	0	0	0	0	0
12	E Mentor Rd 0.88 mi east of S Ohio St	8	3	2	2	0	0	1	0	0	0
13	E Mentor Rd 0.90 mi west of S Holmes Rd	8	3	2	2	0	0	1	0	0	0
23	E Water Well Rd 0.55 mi east of S Ohio St	8	4	0	1	0	0	1	2	0	0
24	E Water Well Rd 0.68 mi east of S Ohio St	8	4	0	1	0	0	1	2	0	0
40	S Brookville Rd 0.28 mi south of W Water Well Rd	8	1	1	2	0	1	1	2	0	0
50	S Lamer Rd 0.35 mi south of E Perrill Rd	7	3	1	1	0	0	0	2	0	0
4	E Assaria Rd 0.78 mi west of S Holmes Rd	7	2	1	1	0	1	0	2	0	0
28	N Adams Rd & W Elm Creek Rd	7	2	3	1	0	1	0	0	0	0
29	N Adams Rd & W Wolff Rd	7	2	3	1	0	1	0	0	0	0
74	W Wolff Rd 0.21 mi west of N Adams Rd	7	2	3	1	0	1	0	0	0	0
31	N Donmyer Rd & E Humbargar Rd	7	0	3	1	0	0	1	2	0	0
15	E Old 40 Hwy 0.19 mi west of N Amos Rd	7	6	0	0	1	0	0	0	0	0
27	E Water Well Rd 0.88 mi east of S Ohio St	7	4	0	2	0	0	1	0	0	0
37	N Niles Rd 0.69 mi north of E North St	7	3	0	0	0	0	0	2	2	0
36	N Niles Rd 0.52 mi north of E North St	7	3	0	0	0	0	0	2	2	0
63	W Farrelly Rd & S Sunnyside Rd	6	0	3	1	0	1	1	0	0	0
66	W Salemsborg Rd 0.14 mi west of S Sunnyside Rd	6	0	3	1	0	1	1	0	0	0
59	S Sunnyside Rd & W Salemsborg Rd	6	0	3	1	0	1	1	0	0	0
54	S Ohio St & E Rose Hill Rd (N)	6	0	3	2	0	1	0	0	0	0
6	E Hobbs Creek Rd & S Niles Rd	6	1	3	1	0	1	0	0	0	0
1	E Assaria Rd 0.37 mi east of S Ohio St	6	2	0	1	0	1	0	2	0	0
2	E Assaria Rd 0.50 mi east of S Ohio St	6	2	0	1	0	1	0	2	0	0

Saline County
Local Road Safety Plan
Curve Risk Factor Points

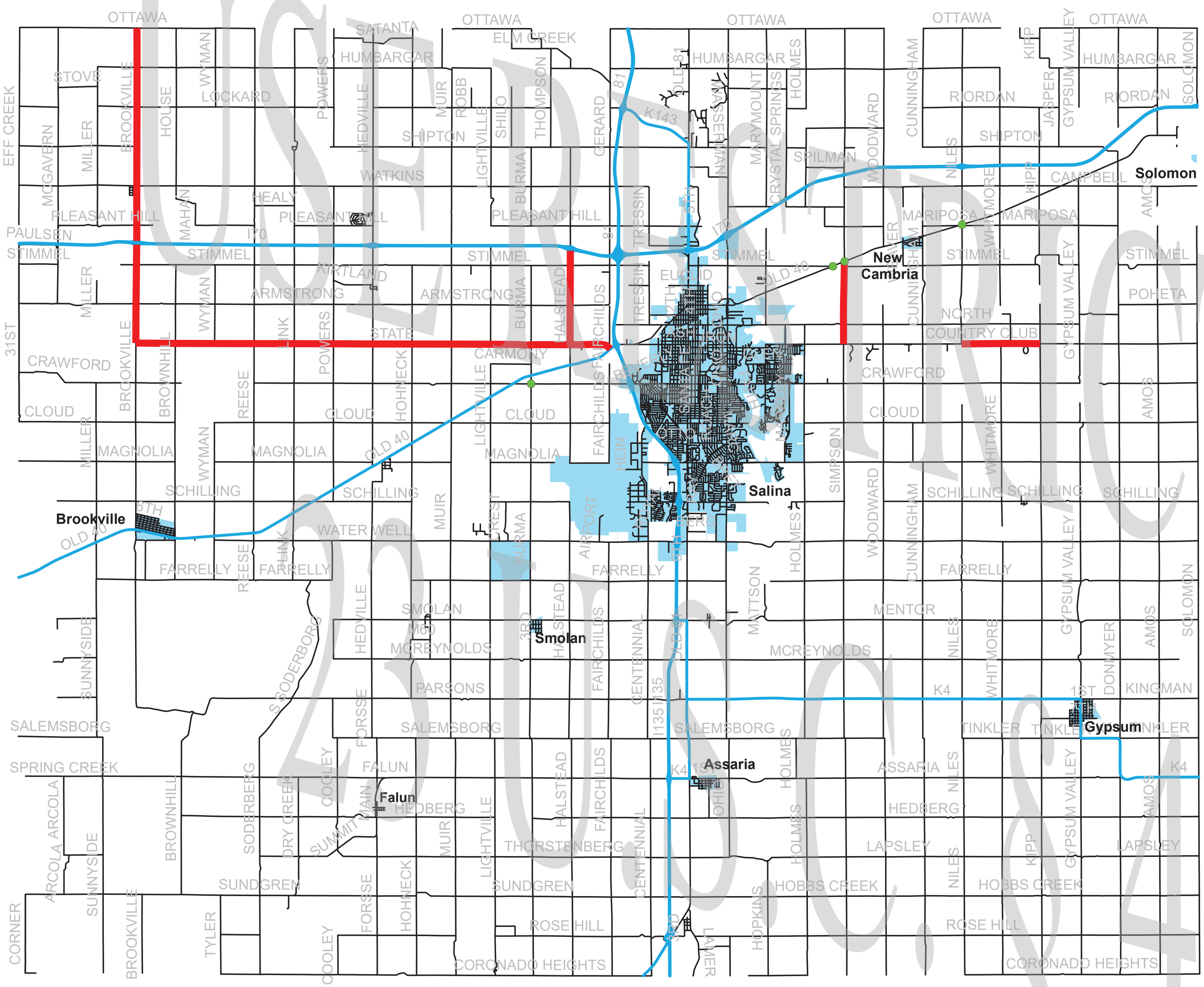
ID	Location	Total Score	Volume Score	Curve Radius Score	Access Density Score	Shoulder Width Score	Edge Condition Score	Roadside Assessment Score	Super-elevation Score	Presence of Warning Signs Score	Crash Experience Score
3	E Assaria Rd 0.71 mi east of S Ohio St	6	2	0	1	0	1	0	2	0	0
10	E Mentor Rd 0.16 mi east of S Ohio St	6	3	1	1	0	0	1	0	0	0
5	E Hobbs Creek Rd & S Kipp Rd	6	1	3	1	0	1	0	0	0	0
21	E Rose Hill Rd 0.42 mi west of S Ohio St	6	0	1	2	0	1	0	2	0	0
60	S Sunnyside Rd & W Spring Creek Rd	5	0	2	1	0	1	1	0	0	0
22	E Rose Hill Rd 0.51 mi south of E Perrill Rd	5	0	3	1	0	1	0	0	0	0
32	N Donmyer Rd & E Ottawa Rd	5	0	3	1	0	0	1	0	0	0
11	E Mentor Rd 0.69 mi east of S Ohio St	5	3	0	1	0	0	1	0	0	0
8	E Hobbs Creek Rd 0.05 mi east of S Kipp Rd	5	1	2	1	0	1	0	0	0	0
9	E Hobbs Creek Rd 0.10 mi east of S Kipp Rd	5	1	2	1	0	1	0	0	0	0
20	E Rose Hill Rd 0.33 mi west of S Ohio St	5	0	1	1	0	1	0	2	0	0
61	S Sunnyside Rd 0.03 mi north of W Falun Rd	4	0	1	1	0	1	1	0	0	0
62	S Sunnyside Rd 0.04 mi south of W Falun Rd	4	0	1	1	0	1	1	0	0	0
53	S Ohio St & E Rose Hill Rd (S)	4	0	3	1	0	0	0	0	0	0
7	E Hobbs Creek Rd 0.04 mi west of S Kipp Rd	4	1	0	2	0	1	0	0	0	0

APPENDIX M

LRSP PROJECT LOCATIONS AND PROJECT SHEETS

N

0 0.75 1.5 3 4.5 6 Miles



Saline County
LRSP Project Locations

Legend

- Interstate/US/K Route (Not Part of Study)
- Project Segment
- Project Intersection

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score: 16

Project Name: E Country Club Rd between N Niles Rd and S Kipp Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

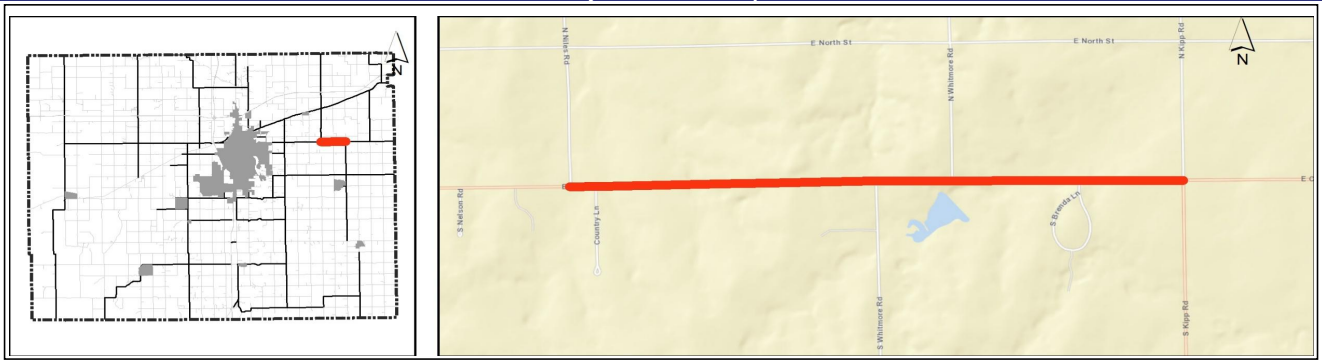
SEGMENT

Location Description

Road: **E Country Club Rd**
From: N Niles Rd
To: S Kipp Rd

GPS ID: 4
Length (miles): **2.00**

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score	
Average Daily Traffic (ADT)	1,005	5	
Access Points per Mile	9.5	2	
Edge Condition	2.0	3	
Roadside Assessment	2.0	3	
Pavement Width (ft)	23.0	0	
Shoulder Width (ft)	2.0	1	
Lane Departure Crash Rate	1.1	2	
Presence of Pavement Markings	Yes	0	**
Surface Type	Paved	0	
Total Risk Factor Score (24 max)		16	

Other Information	
Paved Shoulder	No
Shoulder Material	Gravel
Speed Limit (mph)	55
Number of Lanes	2
Lane Width (ft)	11.5
Edgeline Rumble Strips	Not Present
Centerline Rumble Strips	Not Present
Curves	0
Curves with Warning Signs	0

***Edgeline and Centerline*

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Install 6" Retroreflective Edgeline (Both Sides of Road)	2.00	MILE	$ 6,000	$ 12,020
Install 4" Retroreflective Centerline	2.00	MILE	$ 3,000	$ 6,010
Delineate Roadside Hazards with Retroreflective Markers	21	EACH	$ 100	$ 2,100
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.10	MILE	$ 30,000	$ 3,000
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	2.00	MILE	$ 5,000	$ 10,017
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible)	2.00	MILE	$ 5,000	$ 10,017
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	2.00	MILE	$ 2,000	$ 4,007
Post-Mounted Delineators	2.00	MILE	$ 5,000	$ 10,017
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	0	CURVE	$ 1,000	$ -
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	$ 3,500	$ -
Install In-Lane Curve Warning Pavement Markings	0	CURVE	$ 2,000	$ -
Retroreflective Strips on Curve Signage	0	CURVE	$ 100	$ -
			Short Term Improvements Subtotal:	*$ 58,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Remove/Relocate Fixed Objects in Clear Zone	4	EACH	$ 1,000	$ 4,000
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	0	MILE	$ 25,000	$ -
Pave 2' Shoulder with Safety Edge (Both Sides of Road - Includes Earthwork)	2.00	MILE	$ 150,000	$ 300,506
Install Edgeline Rumble Strips	2.00	MILE	$ 5,000	$ 10,017
Install Centerline Rumble Strips	2.00	MILE	$ 2,000	$ 4,007
Install/Upgrade Guardrail with Reflectors	0	FOOT	$ 80	$ -
Flattening and Widening Foreslopes (Excludes Culvert Extensions)	2.00	MILE	$ 85,000	$ 170,287
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	$ 50,000	$ -
Review and Updgrade Roadway Surface on Unpaved Curves	0	MILE	$ 8,000	$ -
			Longer Term Improvements Subtotal:	*$ 489,000*

Continued on back of this page.

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

Front Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score: 16

Project Name: E Country Club Rd between N Niles Rd and S Kipp Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 4

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
On-Pavement Markings for Speed Control		EACH	$ 3,000	$ -
Remove/Relocate/Combine Driveways		EACH	$ 40,000	$ -
Pave Roadway		MILE	$ 850,000	$ -
Conduct Road Safety Audit/Assessment (RSA)		EACH	$ 40,000	$ -
Transverse Rumble Strips Prior to Curve		CURVE	$ 3,000	$ -
Superelevation Correction on Curves		CURVE	$ 50,000	$ -
Speed Activated Flashers on Chevron Signs		CURVE	$ 4,000	$ -
Speed Feedback Sign on Curve Warning Sign		EACH	$ 4,000	$ -
Extend Culverts	5	EACH	$ 30,000	$ 150,000
Other:				
Other:				
Other:				

Additional Potential Improvements Subtotal:	$ 150,000
Short Term Improvements Subtotal:	$ 58,000
Longer Term Improvements Subtotal:	$ 489,000
Construction Subtotal:	*$ 697,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 69,700
Traffic Control: (% +/-)	5%	$ 34,860
Contingency: (% +/-)	20%	$ 139,440
Estimated Construction Cost		*$ 941,000*

PE (Design)	12%	$ 112,920
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 141,150
Estimated Project Total		**$ 1,196,000**

Crash History Along this 2 Mile Roadway Segment

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	0	0
Number of Disabling Injuries	0	0	0	0	0
Number of Injury Crashes	0	1	1	0	1
Number of Injuries	0	1	1	0	1
Number of Property Damage Only Crashes	3	0	0	3	2

Opinion of Probable Construction Cost Disclaimer:
Kimley-Horn, TranSystems, and WSP have 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, TranSystems, and WSP at this time and represent only our judgment as design professionals familiar with the construction industry. Kimley-Horn, TranSystems, and WSP cannot and do not guarantee that proposals, bids, or actual construction costs will not vary from these 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 selection threshold process, as specifically stated in our scope of services. Kimley-Horn has no control over the accuracy of the GIS and crash databases and recommended improvements have been provided for consideration by County Staff. The County Staff 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 Staff'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 detailed assessment was made for the improvement recommendations contained on this page. If a recommendation is 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 November 2021.

End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score*: 15

Project Name: W State St between Hedville Road and K-140
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

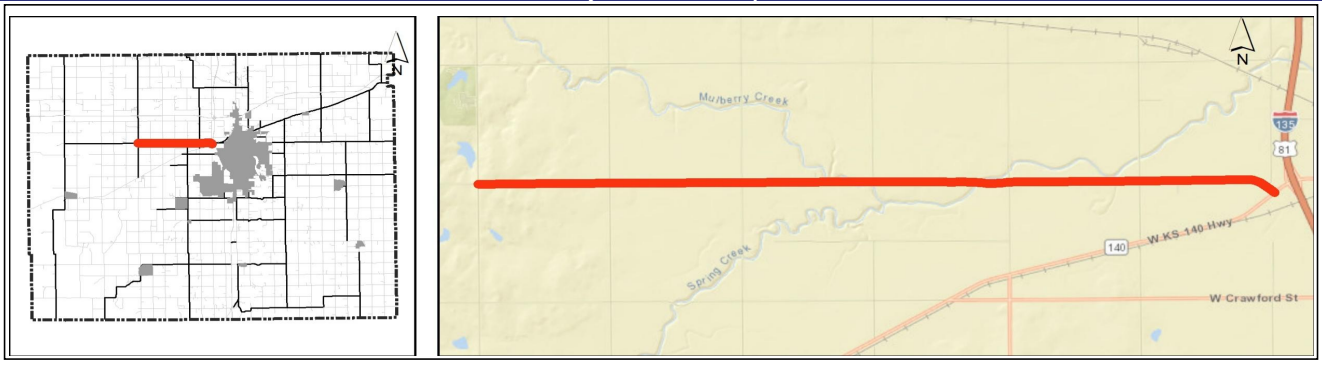
SEGMENT

Location Description

Road: **W State St**
From: Hedville Road
To: K-140

GPS ID: 106, 109, 110
Length (miles): **6.09**

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score*	
Average Daily Traffic (ADT)	1,035	5	
Access Points per Mile	13.1	2	
Edge Condition	2.0	3	
Roadside Assessment	2.0	3	
Pavement Width (ft)	22.0	0	
Shoulder Width (ft)	0.0	2	
Lane Departure Crash Rate	0.0	0	
Presence of Pavement Markings	Yes	0	**
Surface Type	Paved	0	
Total Risk Factor Score (24 max)		15	

*Score from highest ranking segment used

Other Information	
Paved Shoulder	No
Shoulder Material	None
Speed Limit (mph)	55
Number of Lanes	2
Lane Width (ft)	11
Edgeline Rumble Strips	Not Present
Centerline Rumble Strips	Not Present
Curves	1
Curves with Warning Signs	1

**Edgeline and Centerline

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Install 6" Retroreflective Edgeline (Both Sides of Road)	6.09	MILE	$ 6,000	$ 36,543
Install 4" Retroreflective Centerline	6.09	MILE	$ 3,000	$ 18,272
Delineate Roadside Hazards with Retroreflective Markers	80	EACH	$ 100	$ 8,000
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	1.75	MILE	$ 30,000	$ 52,500
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	6.09	MILE	$ 5,000	$ 30,453
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible)	6.09	MILE	$ 5,000	$ 30,453
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	6.09	MILE	$ 2,000	$ 12,181
Post-Mounted Delineators	6.09	MILE	$ 5,000	$ 30,453
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	1	CURVE	$ 1,000	$ 1,000
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	$ 3,500	$ -
Install In-Lane Curve Warning Pavement Markings	1	CURVE	$ 2,000	$ 2,000
Retroreflective Strips on Curve Signage	1	CURVE	$ 100	$ 100
			Short Term Improvements Subtotal:	*$ 222,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Remove/Relocate Fixed Objects in Clear Zone	4	EACH	$ 1,000	$ 4,000
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	0	MILE	$ 25,000	$ -
Pave 2' Shoulder with Safety Edge (Both Sides of Road - Includes Earthwork)	6.09	MILE	$ 150,000	$ 913,583
Install Edgeline Rumble Strips	6.09	MILE	$ 5,000	$ 30,453
Install Centerline Rumble Strips	6.09	MILE	$ 2,000	$ 12,181
Install/Upgrade Guardrail with Reflectors	800	FOOT	$ 35	$ 28,000
Flattening and Widening Foreslopes (Excludes Culvert Extensions)	6.09	MILE	$ 85,000	$ 517,697
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	$ 50,000	$ -
Review and Updgrade Roadway Surface on Unpaved Curves	0	MILE	$ 8,000	$ -
			Longer Term Improvements Subtotal:	*$ 1,506,000*

Continued on back of this page.

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

Front Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score*: 15

Project Name: W State St between Hedville Road and K-140
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 106, 109, 110

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
On-Pavement Markings for Speed Control		EACH	$ 3,000	$ -
Remove/Relocate/Combine Driveways		EACH	$ 40,000	$ -
Pave Roadway		MILE	$ 850,000	$ -
Conduct Road Safety Audit/Assessment (RSA)		EACH	$ 40,000	$ -
Transverse Rumble Strips Prior to Curve		CURVE	$ 3,000	$ -
Superelevation Correction on Curves		CURVE	$ 50,000	$ -
Speed Activated Flashers on Chevron Signs		CURVE	$ 4,000	$ -
Speed Feedback Sign on Curve Warning Sign		EACH	$ 4,000	$ -
Extend Culverts	13	EACH	$ 30,000	$ 390,000
Other:				
Other:				
Other:				

Additional Potential Improvements Subtotal:	$ 390,000
Short Term Improvements Subtotal:	$ 222,000
Longer Term Improvements Subtotal:	$ 1,506,000
Construction Subtotal:	*$ 2,118,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 75,000
Traffic Control: (% +/-)	5%	$ 106,000
Contingency: (% +/-)	20%	$ 424,000
Estimated Construction Cost		*$ 2,723,000*
PE (Design)	12%	$ 326,760
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 408,450
Estimated Project Total		**$ 3,459,000**

Additional Project Benefits:
The improvements recommended along this segment can also have the benefit of positively impacting the following identified facilities:
- Curve 69

Crash History Along this 6.09 Mile Roadway Segment

	2019	2018	2017	2016	2015
Number of Fatal Crashes	1	0	0	0	0
Number of Fatalities	1	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	0	0
Number of Disabling Injuries	0	0	0	0	0
Number of Injury Crashes	1	2	0	3	0
Number of Injuries	1	2	0	4	0
Number of Property Damage Only Crashes	0	3	2	2	0

Opinion of Probable Construction Cost Disclaimer:
Kimley-Horn, TranSystems, and WSP have 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, TranSystems, and WSP at this time and represent only our judgment as design professionals familiar with the construction industry. Kimley-Horn, TranSystems, and WSP cannot and do not guarantee that proposals, bids, or actual construction costs will not vary from these opinions of probable costs.

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End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score: 14

Project Name: N Simpson Rd between Old 40 Hwy and E Country Club Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

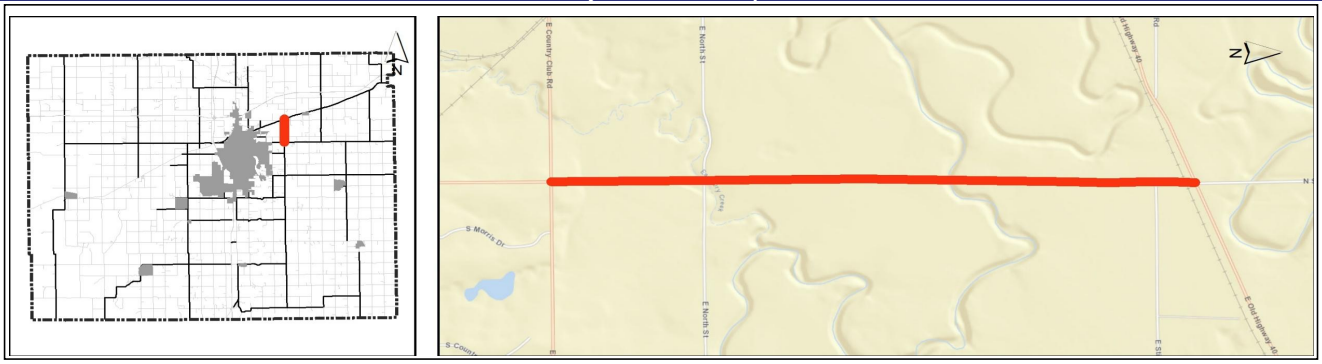
SEGMENT

Location Description

Road: **N Simpson Rd**
From: Old 40 Hwy
To: E Country Club Rd

GPS ID: **44**
Length (miles): **2.10**

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score
Average Daily Traffic (ADT)	1,535	6
Access Points per Mile	10.0	1
Edge Condition	2.0	3
Roadside Assessment	2.5	2
Pavement Width (ft)	22.0	0
Shoulder Width (ft)	0.0	2
Lane Departure Crash Rate	0.2	0
Presence of Pavement Markings	Yes	0 **
Surface Type	Paved	0
Total Risk Factor Score (24 max)		14

Other Information	
Paved Shoulder	No
Shoulder Material	None
Speed Limit (mph)	55
Number of Lanes	2
Lane Width (ft)	11
Edgeline Rumble Strips	Not Present
Centerline Rumble Strips	Not Present
Curves	0
Curves with Warning Signs	0

***Edgeline and Centerline*

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Install 6" Retroreflective Edgeline (Both Sides of Road)	2.10	MILE	$ 6,000	$ 12,622
Install 4" Retroreflective Centerline	2.10	MILE	$ 3,000	$ 6,311
Delineate Roadside Hazards with Retroreflective Markers	22	EACH	$ 100	$ 2,200
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.25	MILE	$ 30,000	$ 7,500
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	2.10	MILE	$ 5,000	$ 10,518
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible)	2.10	MILE	$ 5,000	$ 10,518
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	2.10	MILE	$ 2,000	$ 4,207
Post-Mounted Delineators	0	MILE	$ 5,000	$ -
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	0	CURVE	$ 1,000	$ -
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	$ 3,500	$ -
Install In-Lane Curve Warning Pavement Markings	0	CURVE	$ 2,000	$ -
Retroreflective Strips on Curve Signage	0	CURVE	$ 100	$ -
			Short Term Improvements Subtotal:	*$ 54,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Remove/Relocate Fixed Objects in Clear Zone	4	EACH	$ 1,000	$ 4,000
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	0	MILE	$ 25,000	$ -
Pave 2' Shoulder with Safety Edge (Both Sides of Road - Includes Earthwork)	2.10	MILE	$ 150,000	$ 315,551
Install Edgeline Rumble Strips	2.10	MILE	$ 5,000	$ 10,518
Install Centerline Rumble Strips	2.10	MILE	$ 2,000	$ 4,207
Install/Upgrade Guardrail with Reflectors	1,100	FOOT	$ 35	$ 38,500
Flattening and Widening Foreslopes (Excludes Culvert Extensions)	2.10	MILE	$ 85,000	$ 178,812
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	$ 50,000	$ -
Review and Updgrade Roadway Surface on Unpaved Curves	0	MILE	$ 8,000	$ -
			Longer Term Improvements Subtotal:	*$ 552,000*

Continued on back of this page.

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

Front Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score: 14

Project Name: N Simpson Rd between Old 40 Hwy and E Country Club Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 44

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
On-Pavement Markings for Speed Control		EACH	$ 3,000	$ -
Remove/Relocate/Combine Driveways		EACH	$ 40,000	$ -
Pave Roadway		MILE	$ 850,000	$ -
Conduct Road Safety Audit/Assessment (RSA)		EACH	$ 40,000	$ -
Transverse Rumble Strips Prior to Curve		CURVE	$ 3,000	$ -
Superelevation Correction on Curves		CURVE	$ 50,000	$ -
Speed Activated Flashers on Chevron Signs		CURVE	$ 4,000	$ -
Speed Feedback Sign on Curve Warning Sign		EACH	$ 4,000	$ -
Extend Culverts	6	EACH	$ 30,000	$ 180,000
Other:				
Other:				
Other:				

Additional Potential Improvements Subtotal:		$ 180,000
Short Term Improvements Subtotal:		$ 54,000
Longer Term Improvements Subtotal:		$ 552,000
Construction Subtotal:		*$ 786,000*
Mobilization: (% +/-)*	10%	$ 75,000
Traffic Control: (% +/-)	5%	$ 39,400
Contingency: (% +/-)	20%	$ 157,600
Estimated Construction Cost		*$ 1,058,000*
PE (Design)	12%	$ 126,960
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 158,700
Estimated Project Total		**$ 1,344,000**

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Additional Project Benefits:
The improvements recommended along this segment can also have the benefit of positively impacting the following identified facilities:
- Intersection 139

Crash History Along this 2.1 Mile Roadway Segment

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	1	0
Number of Disabling Injuries	0	0	0	1	0
Number of Injury Crashes	0	0	0	0	0
Number of Injuries	0	0	0	0	0
Number of Property Damage Only Crashes	0	1	1	1	2

Opinion of Probable Construction Cost Disclaimer:
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End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score: 13

Project Name: W State St between S Brookville Rd and S Hedville Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

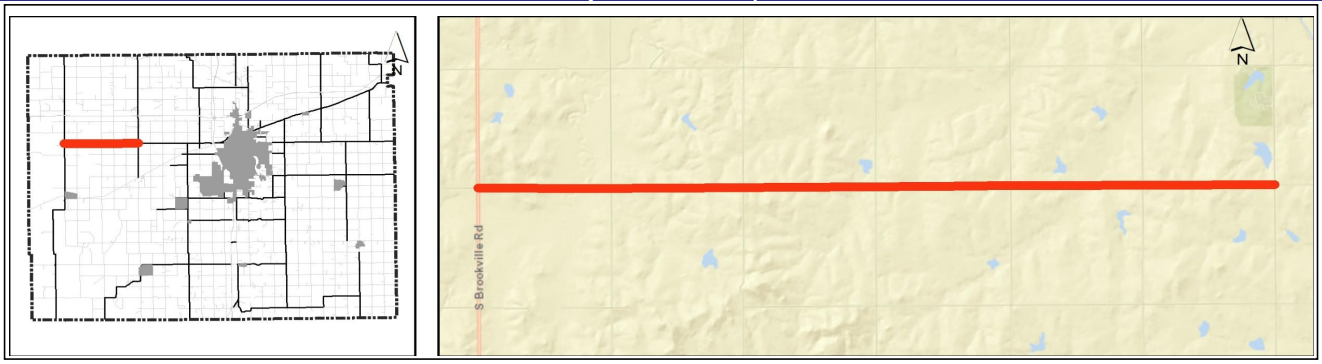
SEGMENT

Location Description

Road: **W State St**
From: S Brookville Rd
To: S Hedville Rd

GPS ID: 108
Length (miles): **6.04**

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score
Average Daily Traffic (ADT)	270	3
Access Points per Mile	5.3	1
Edge Condition	2.1	2
Roadside Assessment	2.0	3
Pavement Width (ft)	22.0	0
Shoulder Width (ft)	0.0	2
Lane Departure Crash Rate	1.3	2
Presence of Pavement Markings	Yes	0 **
Surface Type	Paved	0
Total Risk Factor Score (24 max)		13

Other Information	
Paved Shoulder	No
Shoulder Material	None
Speed Limit (mph)	55
Number of Lanes	2
Lane Width (ft)	11
Edgeline Rumble Strips	Not Present
Centerline Rumble Strips	Not Present
Curves	0
Curves with Warning Signs	0

***Edgeline and Centerline*

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Install 6" Retroreflective Edgeline (Both Sides of Road)	6.04	MILE	$ 6,000	$ 36,225
Install 4" Retroreflective Centerline	6.04	MILE	$ 3,000	$ 18,113
Delineate Roadside Hazards with Retroreflective Markers	61	EACH	$ 100	$ 6,100
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.75	MILE	$ 30,000	$ 22,500
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	0	MILE	$ 5,000	$ -
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible)	0	MILE	$ 5,000	$ -
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	0	MILE	$ 2,000	$ -
Post-Mounted Delineators	6.04	MILE	$ 5,000	$ 30,188
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	0	CURVE	$ 1,000	$ -
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	$ 3,500	$ -
Install In-Lane Curve Warning Pavement Markings	0	CURVE	$ 2,000	$ -
Retroreflective Strips on Curve Signage	0	CURVE	$ 100	$ -
			Short Term Improvements Subtotal:	*$ 114,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Remove/Relocate Fixed Objects in Clear Zone	4	EACH	$ 1,000	$ 4,000
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	0	MILE	$ 25,000	$ -
Pave 2' Shoulder with Safety Edge (Both Sides of Road - Includes Earthwork)	0	MILE	$ 150,000	$ -
Install Edgeline Rumble Strips	0	MILE	$ 5,000	$ -
Install Centerline Rumble Strips	0	MILE	$ 2,000	$ -
Install/Upgrade Guardrail with Reflectors	120	FOOT	$ 80	$ 9,600
Flattening and Widening Foreslopes (Excludes Culvert Extensions)	6.04	MILE	$ 85,000	$ 513,189
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	$ 50,000	$ -
Review and Updgrade Roadway Surface on Unpaved Curves	0	MILE	$ 8,000	$ -
			Longer Term Improvements Subtotal:	*$ 527,000*

Continued on back of this page.

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

Front Page

Kansas Department of Transportation · TranSystems · WSP · Kimley»Horn

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score: 13

Project Name: W State St between S Brookville Rd and S Hedville Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 108

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
On-Pavement Markings for Speed Control		EACH	$ 3,000	$ -
Remove/Relocate/Combine Driveways		EACH	$ 40,000	$ -
Pave Roadway		MILE	$ 850,000	$ -
Conduct Road Safety Audit/Assessment (RSA)		EACH	$ 40,000	$ -
Transverse Rumble Strips Prior to Curve		CURVE	$ 3,000	$ -
Superelevation Correction on Curves		CURVE	$ 50,000	$ -
Speed Activated Flashers on Chevron Signs		CURVE	$ 4,000	$ -
Speed Feedback Sign on Curve Warning Sign		EACH	$ 4,000	$ -
Extend Culverts	16	EACH	$ 30,000	$ 480,000
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	6.04	MILE	$ 25,000	$ 150,938
Other:				
Other:				

Additional Potential Improvements Subtotal:	$ 631,000
Short Term Improvements Subtotal:	$ 114,000
Longer Term Improvements Subtotal:	$ 527,000
Construction Subtotal:	*$ 1,272,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 75,000
Traffic Control: (% +/-)	5%	$ 63,600
Contingency: (% +/-)	20%	$ 254,400
Estimated Construction Cost		*$ 1,665,000*

PE (Design)	12%	$ 199,800
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 249,750
Estimated Project Total		**$ 2,115,000**

Crash History Along this 6.04 Mile Roadway Segment

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	0	0
Number of Disabling Injuries	0	0	0	0	0
Number of Injury Crashes	0	1	1	0	1
Number of Injuries	0	1	1	0	1
Number of Property Damage Only Crashes	3	0	0	0	0

Opinion of Probable Construction Cost Disclaimer:
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End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score*: 14

Project Name: N Brookville Rd between State Street and Ottawa Road (Ottawa County line)
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

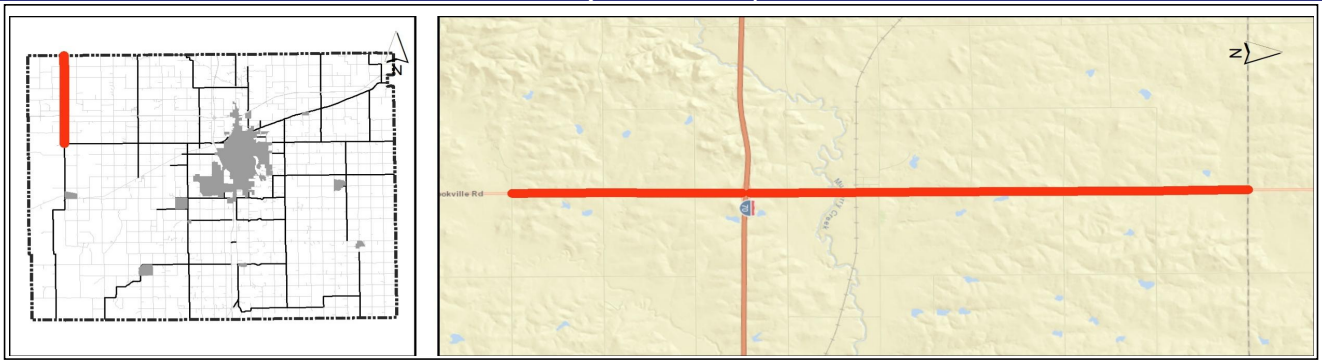
SEGMENT

Location Description

Road: **N Brookville Rd**
From: State Street
To: Ottawa Road (Ottawa County line)

GPS ID: **29, 30**
Length (miles): **7.92**

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score*
Average Daily Traffic (ADT)	200	2
Access Points per Mile	5.2	1
Edge Condition	2.0	3
Roadside Assessment	2.0	3
Pavement Width (ft)	22.0	0
Shoulder Width (ft)	0.0	2
Lane Departure Crash Rate	3.3	3
Presence of Pavement Markings	Yes	0 **
Surface Type	Paved	0
Total Risk Factor Score (24 max)		14

*Score from highest ranking segment used

Other Information	
Paved Shoulder	No
Shoulder Material	None
Speed Limit (mph)	55
Number of Lanes	2
Lane Width (ft)	11
Edgeline Rumble Strips	Not Present
Centerline Rumble Strips	Not Present
Curves	0
Curves with Warning Signs	0

**Edgeline and Centerline

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Install 6" Retroreflective Edgeline (Both Sides of Road)	7.92	MILE	$ 6,000	$ 47,494
Install 4" Retroreflective Centerline	7.92	MILE	$ 3,000	$ 23,747
Delineate Roadside Hazards with Retroreflective Markers	80	EACH	$ 100	$ 8,000
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.60	MILE	$ 30,000	$ 18,000
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	7.92	MILE	$ 5,000	$ 39,578
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible)	0	MILE	$ 5,000	$ -
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	0	MILE	$ 2,000	$ -
Post-Mounted Delineators	7.92	MILE	$ 5,000	$ 39,578
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	0	CURVE	$ 1,000	$ -
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	$ 3,500	$ -
Install In-Lane Curve Warning Pavement Markings	0	CURVE	$ 2,000	$ -
Retroreflective Strips on Curve Signage	0	CURVE	$ 100	$ -
			Short Term Improvements Subtotal:	*$ 177,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Remove/Relocate Fixed Objects in Clear Zone	4	EACH	$ 1,000	$ 4,000
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	7.92	MILE	$ 25,000	$ 197,890
Pave 2' Shoulder with Safety Edge (Both Sides of Road - Includes Earthwork)	0	MILE	$ 150,000	$ -
Install Edgeline Rumble Strips	0	MILE	$ 5,000	$ -
Install Centerline Rumble Strips	0	MILE	$ 2,000	$ -
Install/Upgrade Guardrail with Reflectors	1,150	FOOT	$ 35	$ 40,250
Flattening and Widening Foreslopes (Excludes Culvert Extensions)	7.92	MILE	$ 85,000	$ 672,825
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	$ 50,000	$ -
Review and Updgrade Roadway Surface on Unpaved Curves	0	MILE	$ 8,000	$ -
			Longer Term Improvements Subtotal:	*$ 915,000*

Continued on back of this page.

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

Front Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score*: 14

Project Name: N Brookville Rd between State Street and Ottawa Road (Ottawa County line)
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 29, 30

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
On-Pavement Markings for Speed Control		EACH	$ 3,000	$ -
Remove/Relocate/Combine Driveways		EACH	$ 40,000	$ -
Pave Roadway		MILE	$ 850,000	$ -
Conduct Road Safety Audit/Assessment (RSA)		EACH	$ 40,000	$ -
Transverse Rumble Strips Prior to Curve		CURVE	$ 3,000	$ -
Superelevation Correction on Curves		CURVE	$ 50,000	$ -
Speed Activated Flashers on Chevron Signs		CURVE	$ 4,000	$ -
Speed Feedback Sign on Curve Warning Sign		EACH	$ 4,000	$ -
Extend Culverts	13	EACH	$ 30,000	$ 390,000
Other:				
Other:				
Other:				

Additional Potential Improvements Subtotal:	$ 390,000
Short Term Improvements Subtotal:	$ 177,000
Longer Term Improvements Subtotal:	$ 915,000
Construction Subtotal:	*$ 1,482,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 75,000
Traffic Control: (% +/-)	5%	$ 74,200
Contingency: (% +/-)	20%	$ 296,800
Estimated Construction Cost		*$ 1,928,000*

PE (Design)	12%	$ 231,360
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 289,200
Estimated Project Total		**$ 2,449,000**

Crash History Along this 7.92 Mile Roadway Segment

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	0	0
Number of Disabling Injuries	0	0	0	0	0
Number of Injury Crashes	1	0	2	0	1
Number of Injuries	2	0	3	0	1
Number of Property Damage Only Crashes	4	2	2	3	4

Opinion of Probable Construction Cost Disclaimer:
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End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score: 14

Project Name: N Halstead Rd between I-70 and W State St
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

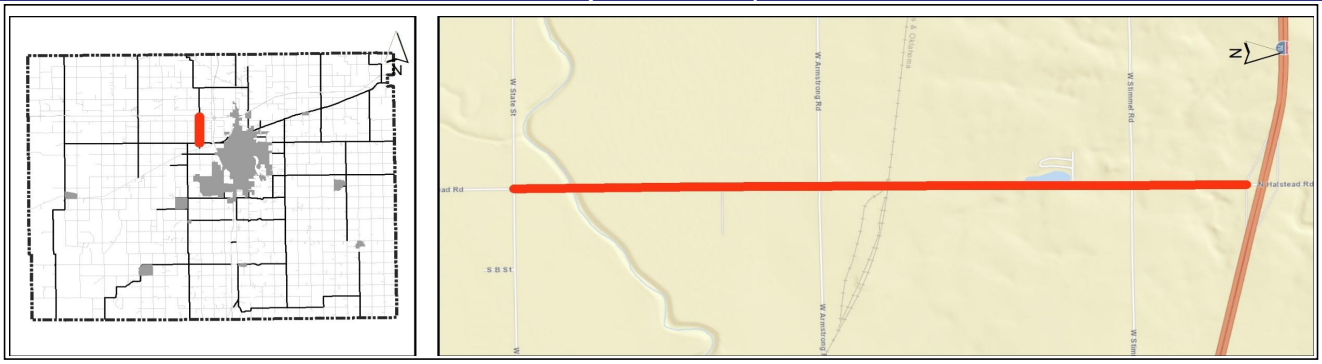
SEGMENT

Location Description

Road: **N Halstead Rd**
From: I-70
To: W State St

GPS ID: 34
Length (miles): **2.39**

Project Location Maps



Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score	
Average Daily Traffic (ADT)	305	3	
Access Points per Mile	14.6	2	
Edge Condition	2.0	3	
Roadside Assessment	2.1	3	
Pavement Width (ft)	23.0	0	
Shoulder Width (ft)	0.0	2	
Lane Departure Crash Rate	0.8	1	
Presence of Pavement Markings	Yes	0	**
Surface Type	Paved	0	
Total Risk Factor Score (24 max)		14	

Other Information	
Paved Shoulder	No
Shoulder Material	None
Speed Limit (mph)	40
Number of Lanes	2
Lane Width (ft)	11.5
Edgeline Rumble Strips	Not Present
Centerline Rumble Strips	Not Present
Curves	0
Curves with Warning Signs	0

***Edgeline and Centerline*

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Install 6" Retroreflective Edgeline (Both Sides of Road)	2.39	MILE	$ 6,000	$ 14,337
Install 4" Retroreflective Centerline	2.39	MILE	$ 3,000	$ 7,169
Delineate Roadside Hazards with Retroreflective Markers	35	EACH	$ 100	$ 3,500
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.30	MILE	$ 30,000	$ 9,091
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	2.39	MILE	$ 5,000	$ 11,948
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible)	0	MILE	$ 5,000	$ -
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	0	MILE	$ 2,000	$ -
Post-Mounted Delineators	0	MILE	$ 5,000	$ -
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	0	CURVE	$ 1,000	$ -
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	$ 3,500	$ -
Install In-Lane Curve Warning Pavement Markings	0	CURVE	$ 2,000	$ -
Retroreflective Strips on Curve Signage	0	CURVE	$ 100	$ -
			Short Term Improvements Subtotal:	*$ 47,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Remove/Relocate Fixed Objects in Clear Zone	4	EACH	$ 1,000	$ 4,000
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	2.39	MILE	$ 25,000	$ 59,738
Pave 2' Shoulder with Safety Edge (Both Sides of Road - Includes Earthwork)	0	MILE	$ 150,000	$ -
Install Edgeline Rumble Strips	0	MILE	$ 5,000	$ -
Install Centerline Rumble Strips	0	MILE	$ 2,000	$ -
Install/Upgrade Guardrail with Reflectors	280	FOOT	$ 80	$ 22,400
Flattening and Widening Foreslopes (Excludes Culvert Extensions)	2.39	MILE	$ 85,000	$ 203,110
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	$ 50,000	$ -
Review and Updgrade Roadway Surface on Unpaved Curves	0	MILE	$ 8,000	$ -
			Longer Term Improvements Subtotal:	*$ 290,000*

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

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Front Page

Saline County Local Road Safety Plan
Project Description for Roadway Segment Improvements

Risk Factor Score: 14

Project Name: N Halstead Rd between I-70 and W State St
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

SEGMENT

Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 34

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
On-Pavement Markings for Speed Control		EACH	$ 3,000	$ -
Remove/Relocate/Combine Driveways		EACH	$ 40,000	$ -
Pave Roadway		MILE	$ 850,000	$ -
Conduct Road Safety Audit/Assessment (RSA)		EACH	$ 40,000	$ -
Transverse Rumble Strips Prior to Curve		CURVE	$ 3,000	$ -
Superelevation Correction on Curves		CURVE	$ 50,000	$ -
Speed Activated Flashers on Chevron Signs		CURVE	$ 4,000	$ -
Speed Feedback Sign on Curve Warning Sign		EACH	$ 4,000	$ -
Extend Culverts	7	EACH	$ 30,000	$ 210,000
Post-Mounted Delineators	2.39	MILE	$ 5,000	$ 11,948
Other:				
Other:				

Additional Potential Improvements Subtotal:	$ 222,000
Short Term Improvements Subtotal:	$ 47,000
Longer Term Improvements Subtotal:	$ 290,000
Construction Subtotal:	*$ 559,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 55,900
Traffic Control: (% +/-)	5%	$ 28,020
Contingency: (% +/-)	20%	$ 112,080
Estimated Construction Cost		*$ 755,000*

PE (Design)	12%	$ 90,600
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 113,250
Estimated Project Total		**$ 959,000**

Crash History Along this 2.39 Mile Roadway Segment

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	0	0
Number of Disabling Injuries	0	0	0	0	0
Number of Injury Crashes	0	0	0	1	0
Number of Injuries	0	0	0	3	0
Number of Property Damage Only Crashes	0	1	0	0	1

Opinion of Probable Construction Cost Disclaimer:
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End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Score: 14

Project Name: E Old 40 Hwy & N Simpson Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

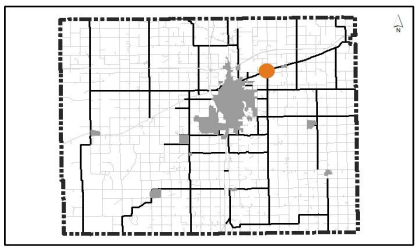
INTERSECTION

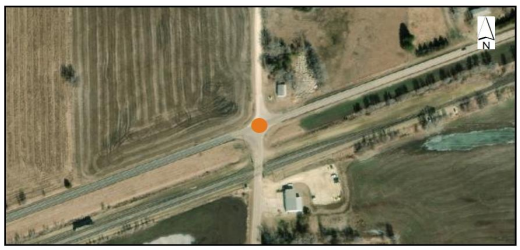
Location Description

Road: **E Old 40 Hwy**
Road: **N Simpson Rd**

GPS ID: 57

Project Location Maps



Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score
Average Daily Traffic (ADT)	2,900	6
Access Points within 500 feet	3	2
Sight Distance	Adequate	0
Intersection Control	Two-way stop	1
Fatal or Debilitating Injury Crashes	0	0
Dist. from Previous Stop Sign (mi)	2.1	2
Intersection on Curve	No	0
Minimum Approach Angle	60	3
Total Risk Factor Score (24 max)		14

Other Information	
Major Road ADT	2,110
Minor Road ADT	790
Intersection Crash Rate (TMEV)	7.6
Lighting	Not Present
Flashing Beacon	Not Present
Transverse Rumble Strips	Not Present
Number of Paved Approaches	3
Intersection Type	4ST

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Retroreflective Strips on Stop Sign Posts	1	INTERSECTION	$ 100	$ 100
Clear and Grub	4	LEG	$ 2,500	$ 10,000
Review Pavement Condition/Type and Install Transverse Rumble Strips on Paved, Stop-Controlled Approaches	1	LEG	$ 2,500	$ 2,500
Upgrade Signs and Pavement Markings (Paved Approaches)	3	LEG	$ 2,200	$ 6,600
Upgrade Signs (Unpaved Approaches)	1	LEG	$ 1,100	$ 1,100
Install Second Stop Sign and Stop Ahead Signs	2	LEG	$ 1,500	$ 3,000
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	2	SIGN	$ 2,500	$ 5,000
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	0	LEG	$ 2,500	$ -
			Short Term Improvements Subtotal:	*$ 29,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Intersection Lighting (One Luminaire)	1	EACH	$ 5,500	$ 5,500
Realign Intersection Approaches to Reduce or Eliminate Skew (Paved)	1	LEG	$ 300,000	$ 300,000
Realign Intersection Approaches to Reduce or Eliminate Skew (Unpaved)	1	LEG	$ 100,000	$ 100,000
			Longer Term Improvements Subtotal:	*$ 406,000*

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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

Front Page

Saline County Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Score: 14

Project Name: E Old 40 Hwy & N Simpson Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

Road: **E Old 40 Hwy**
Road: **N Simpson Rd**

GPS ID: 57

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
Convert Two-Way Stop to All-Way Stop		LEG	$ 1,200	$ -
Removal of Unwarranted Stop Signs on Major Approach		LEG	$ 500	$ -
Install Intersection Conflict Warning System		EACH	$ 40,000	$ -
Provide Left-Turn Lanes at Intersection	2	LEG	$ 150,000	$ 300,000
Provide Right-Turn Lanes at Intersection	1	LEG	$ 150,000	$ 150,000
Remove Sweeping Right Turns		EACH	$ 5,000	$ -
Install Traffic Signal (if MUTCD Warrants are Met)		EACH	$ 250,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection (Paved)		EACH	$ 300,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection (Unpaved)		EACH	$ 50,000	$ -
Convert Stop-Control to Roundabout		EACH	$ 2,000,000	$ -
Other:				
Other:				

Additional Potential Improvements Subtotal:	$ 450,000
Short Term Improvements Subtotal:	$ 29,000
Longer Term Improvements Subtotal:	$ 406,000
Construction Subtotal:	*$ 885,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 75,000
Traffic Control: (% +/-)	5%	$ 44,400
Contingency: (% +/-)	20%	$ 177,600
Estimated Construction Cost		*$ 1,182,000*

PE (Design)	12%	$ 141,840
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 177,300
Estimated Project Total		**$ 1,502,000**

Crash History at this intersection

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	0	0
Number of Disabling Injuries	0	0	0	0	0
Number of Injury Crashes	0	0	0	0	1
Number of Injuries	0	0	0	0	3
Number of Property Damage Only Crashes	0	2	0	1	0

Opinion of Probable Construction Cost Disclaimer:

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End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Score: 13

Project Name: W Crawford St & S Burma Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

INTERSECTION

Location Description

Road: **W Crawford St**
Road: **S Burma Rd**

GPS ID: 226

Project Location Maps

Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score
Average Daily Traffic (ADT)	2,810	6
Access Points within 500 feet	0	0
Sight Distance	Adequate	0
Intersection Control	Two-way stop	1
Fatal or Debilitating Injury Crashes	1	3
Dist. from Previous Stop Sign (mi)	10.0	3
Intersection on Curve	No	0
Minimum Approach Angle	90	0
Total Risk Factor Score (24 max)		13

Other Information	
Major Road ADT	2,235
Minor Road ADT	575
Intersection Crash Rate (TMEV)	5.8
Lighting	Not Present
Flashing Beacon	Not Present
Transverse Rumble Strips	Not Present
Number of Paved Approaches	4
Intersection Type	4ST

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Retroreflective Strips on Stop Sign Posts	1	INTERSECTION	$ 100	$ 100
Clear and Grub	4	LEG	$ 2,500	$ 10,000
Review Pavement Condition/Type and Install Transverse Rumble Strips on Paved, Stop-Controlled Approaches	2	LEG	$ 2,500	$ 5,000
Upgrade Signs and Pavement Markings (Paved Approaches)	4	LEG	$ 2,200	$ 8,800
Upgrade Signs (Unpaved Approaches)	0	LEG	$ 1,100	$ -
Install Second Stop Sign and Stop Ahead Signs	2	LEG	$ 1,500	$ 3,000
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	4	SIGN	$ 2,500	$ 10,000
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	0	LEG	$ 2,500	$ -
			Short Term Improvements Subtotal:	*$ 37,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Intersection Lighting (One Luminaire)	1	EACH	$ 5,500	$ 5,500
Realign Intersection Approaches to Reduce or Eliminate Skew (Paved)	0	LEG	$ 300,000	$ -
Realign Intersection Approaches to Reduce or Eliminate Skew (Unpaved)	0	LEG	$ 100,000	$ -
			Longer Term Improvements Subtotal:	*$ 6,000*

Continued on back of this page.

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

Front Page

Saline County Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Score: 13

Project Name: W Crawford St & S Burma Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

Road: **W Crawford St**
Road: **S Burma Rd**

GPS ID: 226

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
Convert Two-Way Stop to All-Way Stop		LEG	$ 1,200	$ -
Removal of Unwarranted Stop Signs on Major Approach		LEG	$ 500	$ -
Install Intersection Conflict Warning System		EACH	$ 40,000	$ -
Provide Left-Turn Lanes at Intersection	2	LEG	$ 150,000	$ 300,000
Provide Right-Turn Lanes at Intersection	1	LEG	$ 150,000	$ 150,000
Remove Sweeping Right Turns		EACH	$ 5,000	$ -
Install Traffic Signal (if MUTCD Warrants are Met)		EACH	$ 250,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection (Paved)		EACH	$ 300,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection (Unpaved)		EACH	$ 50,000	$ -
Convert Stop-Control to Roundabout		EACH	$ 2,000,000	$ -
Other:				
Other:				

Additional Potential Improvements Subtotal:	$ 450,000
Short Term Improvements Subtotal:	$ 37,000
Longer Term Improvements Subtotal:	$ 6,000
Construction Subtotal:	*$ 493,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 49,300
Traffic Control: (% +/-)	5%	$ 24,740
Contingency: (% +/-)	20%	$ 98,960
Estimated Construction Cost		*$ 666,000*

PE (Design)	12%	$ 79,920
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 99,900
Estimated Project Total		**$ 846,000**

Crash History at this intersection

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	1	0
Number of Disabling Injuries	0	0	0	2	0
Number of Injury Crashes	0	0	0	0	0
Number of Injuries	0	0	0	0	0
Number of Property Damage Only Crashes	1	1	0	0	0

Opinion of Probable Construction Cost Disclaimer:

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End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Score: 18

Project Name: E Old 40 Hwy & E Stimmel Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

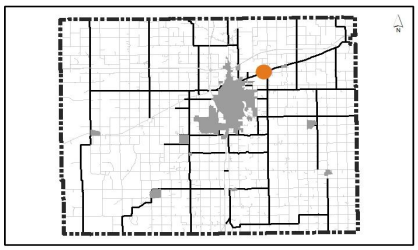
INTERSECTION

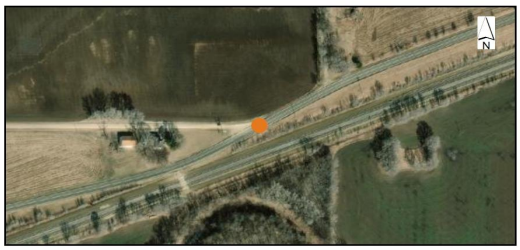
Location Description

Road: **E Old 40 Hwy**
Road: **E Stimmel Rd**

GPS ID: 49

Project Location Maps



Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score
Average Daily Traffic (ADT)	2,165	6
Access Points within 500 feet	3	2
Sight Distance	Limited	3
Intersection Control	One-way stop	1
Fatal or Debilitating Injury Crashes	0	0
Dist. from Previous Stop Sign (mi)	N/A	0
Intersection on Curve	Yes	3
Minimum Approach Angle	30	3
Total Risk Factor Score (24 max)		**18**

Other Information	
Major Road ADT	2,135
Minor Road ADT	60
Intersection Crash Rate (TMEV)	0.0
Lighting	Not Present
Flashing Beacon	Not Present
Transverse Rumble Strips	Not Present
Number of Paved Approaches	2
Intersection Type	3ST

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Retroreflective Strips on Stop Sign Posts	1	INTERSECTION	$ 100	$ 100
Clear and Grub	3	LEG	$ 2,500	$ 7,500
Review Pavement Condition/Type and Install Transverse Rumble Strips on Paved, Stop-Controlled Approaches	0	LEG	$ 2,500	$ -
Upgrade Signs and Pavement Markings (Paved Approaches)	2	LEG	$ 2,200	$ 4,400
Upgrade Signs (Unpaved Approaches)	1	LEG	$ 1,100	$ 1,100
Install Second Stop Sign and Stop Ahead Signs	0	LEG	$ 1,500	$ -
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	0	SIGN	$ 2,500	$ -
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	0	LEG	$ 2,500	$ -
			Short Term Improvements Subtotal:	*$ 14,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Intersection Lighting (One Luminaire)	0	EACH	$ 5,500	$ -
Realign Intersection Approaches to Reduce or Eliminate Skew (Paved)	0	LEG	$ 300,000	$ -
Realign Intersection Approaches to Reduce or Eliminate Skew (Unpaved)	1	LEG	$ 100,000	$ 100,000
			Longer Term Improvements Subtotal:	*$ 100,000*

Continued on back of this page.

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

Front Page

Saline County Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Score: 18

Project Name: E Old 40 Hwy & E Stimmel Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

Road: **E Old 40 Hwy**
Road: **E Stimmel Rd**

GPS ID: 49

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
Convert Two-Way Stop to All-Way Stop		LEG	$ 1,200	$ -
Removal of Unwarranted Stop Signs on Major Approach		LEG	$ 500	$ -
Install Intersection Conflict Warning System		EACH	$ 40,000	$ -
Provide Left-Turn Lanes at Intersection		LEG	$ 150,000	$ -
Provide Right-Turn Lanes at Intersection		LEG	$ 150,000	$ -
Remove Sweeping Right Turns		EACH	$ 5,000	$ -
Install Traffic Signal (if MUTCD Warrants are Met)		EACH	$ 250,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection (Paved)		EACH	$ 300,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection (Unpaved)		EACH	$ 50,000	$ -
Convert Stop-Control to Roundabout		EACH	$ 2,000,000	$ -
Other:				
Other:				

Additional Potential Improvements Subtotal:	$ -
Short Term Improvements Subtotal:	$ 14,000
Longer Term Improvements Subtotal:	$ 100,000
Construction Subtotal:	*$ 114,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 11,400
Traffic Control: (% +/-)	5%	$ 5,720
Contingency: (% +/-)	20%	$ 22,880
Estimated Construction Cost		*$ 154,000*

PE (Design)	12%	$ 18,480
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 23,100
Estimated Project Total		**$ 196,000**

Crash History at this intersection

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	0	0
Number of Disabling Injuries	0	0	0	0	0
Number of Injury Crashes	0	0	0	0	0
Number of Injuries	0	0	0	0	0
Number of Property Damage Only Crashes	0	0	0	0	0

Opinion of Probable Construction Cost Disclaimer:

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End of Project Description

Back Page

Saline County Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Score: 15

Project Name: E Old 40 Hwy & N Niles Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

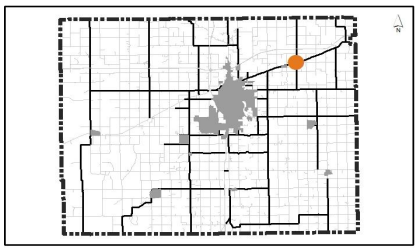
INTERSECTION

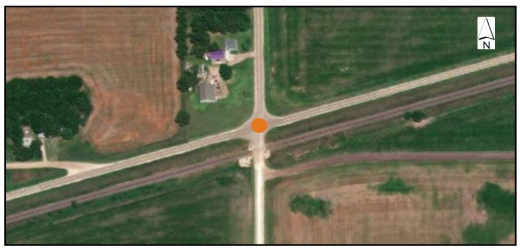
Location Description

Road: **E Old 40 Hwy**
Road: **N Niles Rd**

GPS ID: 56

Project Location Maps



Intersection Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score
Average Daily Traffic (ADT)	2,155	6
Access Points within 500 feet	3	2
Sight Distance	Adequate	0
Intersection Control	Two-way stop	1
Fatal or Debilitating Injury Crashes	0	0
Dist. from Previous Stop Sign (mi)	6.7	3
Intersection on Curve	No	0
Minimum Approach Angle	75	3
Total Risk Factor Score (24 max)		**15**

Other Information	
Major Road ADT	1,790
Minor Road ADT	365
Intersection Crash Rate (TMEV)	10.2
Lighting	Not Present
Flashing Beacon	Not Present
Transverse Rumble Strips	Not Present
Number of Paved Approaches	3
Intersection Type	4ST

Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Retroreflective Strips on Stop Sign Posts	1	INTERSECTION	$ 100	$ 100
Clear and Grub	4	LEG	$ 2,500	$ 10,000
Review Pavement Condition/Type and Install Transverse Rumble Strips on Paved, Stop-Controlled Approaches	1	LEG	$ 2,500	$ 2,500
Upgrade Signs and Pavement Markings (Paved Approaches)	3	LEG	$ 2,200	$ 6,600
Upgrade Signs (Unpaved Approaches)	1	LEG	$ 1,100	$ 1,100
Install Second Stop Sign and Stop Ahead Signs	0	LEG	$ 1,500	$ -
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	0	SIGN	$ 2,500	$ -
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	0	LEG	$ 2,500	$ -
			Short Term Improvements Subtotal:	*$ 21,000*

Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit	Unit Price	Item Cost
Intersection Lighting (One Luminaire)	0	EACH	$ 5,500	$ -
Realign Intersection Approaches to Reduce or Eliminate Skew (Paved)	1	LEG	$ 300,000	$ 300,000
Realign Intersection Approaches to Reduce or Eliminate Skew (Unpaved)	1	LEG	$ 100,000	$ 100,000
			Longer Term Improvements Subtotal:	*$ 400,000*

Continued on back of this page.

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

Front Page

Saline County Local Road Safety Plan
Project Description for Intersection Improvements

Risk Factor Score: 15

Project Name: E Old 40 Hwy & N Niles Rd
Contact Name: Justin Mader
E-mail: justin.mader@saline.org

Date: 12/2/21
Prepared By: OLW
Checked By: MMO

INTERSECTION

Opinion of Probable Cost (Additional Potential Improvements)

Road: **E Old 40 Hwy**
Road: **N Niles Rd**

GPS ID: 56

There are a variety of other safety improvements that could be considered that were not included on the front page of the project sheet due to availability of data, the need for site-specific information, and/or the appetite for the countermeasure to be deployed throughout the county. The following countermeasures could be considered appropriate by the county and included below as additional potential improvements.

Item Description	Quantity	Unit	Unit Price	Item Cost
Convert Two-Way Stop to All-Way Stop		LEG	$ 1,200	$ -
Removal of Unwarranted Stop Signs on Major Approach		LEG	$ 500	$ -
Install Intersection Conflict Warning System		EACH	$ 40,000	$ -
Provide Left-Turn Lanes at Intersection	2	LEG	$ 150,000	$ 300,000
Provide Right-Turn Lanes at Intersection	1	LEG	$ 150,000	$ 150,000
Remove Sweeping Right Turns		EACH	$ 5,000	$ -
Install Traffic Signal (if MUTCD Warrants are Met)		EACH	$ 250,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection (Paved)		EACH	$ 300,000	$ -
Convert Offset T-Intersection to Four-Legged Intersection (Unpaved)		EACH	$ 50,000	$ -
Convert Stop-Control to Roundabout		EACH	$ 2,000,000	$ -
Install Second Stop Sign and Stop Ahead Signs	2	LEG	$ 1,500	$ 3,000
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	2	SIGN	$ 2,500	$ 5,000
			Additional Potential Improvements Subtotal:	$ 458,000
			Short Term Improvements Subtotal:	$ 21,000
			Longer Term Improvements Subtotal:	$ 400,000
			Construction Subtotal:	*$ 879,000*

*Mobilization is 10% +/- of the subtotal with a minimum of $2,500 and a maximum of $75,000
**To be considered by county as they move forward with design of the recommendations

Mobilization: (% +/-)*	10%	$ 75,000
Traffic Control: (% +/-)	5%	$ 44,000
Contingency: (% +/-)	20%	$ 176,000
Estimated Construction Cost		*$ 1,174,000*

PE (Design)	12%	$ 140,880
Utilities**		$ -
ROW**		$ -
CE (Inspection)	15%	$ 176,100
Estimated Project Total		**$ 1,491,000**

Crash History at this intersection

	2019	2018	2017	2016	2015
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	0	0	0
Number of Disabling Injuries	0	0	0	0	0
Number of Injury Crashes	0	0	0	0	0
Number of Injuries	0	0	0	0	0
Number of Property Damage Only Crashes	1	0	1	2	0

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End of Project Description

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