











#### DRAFT PLAN

**FOR** 

# MARION COUNTY LOCAL ROAD SAFETY PLAN

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

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# **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 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). **Figure E1** shows the location of the Phase 1 LRSP counties and the Pilot Phase counties.

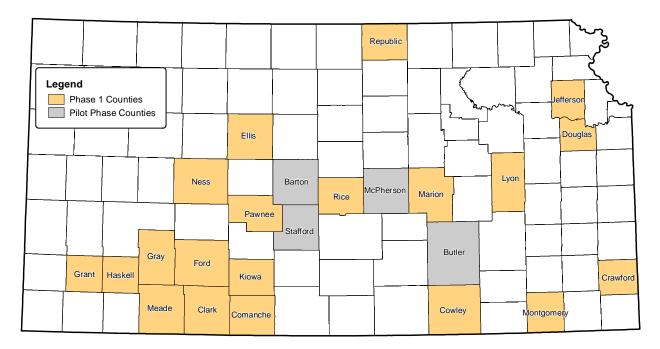


Figure E1 – Location of LRSP Counties

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

As defined by the Federal Highway Administration (FHWA), a 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.

A 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. A LRSP identifies several proactive measures, based on a comprehensive systemic review, that are targeted at enhancing the overall safety for roadway users.











# **E.2.** Marion County's LRSP Routes

The LRSP study routes within Marion 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 301 miles of roadway segments (60% paved, 40% unpaved), 304 intersections and 56 curves were analyzed as part of the Marion 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 on 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. Marion 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, intersection, and curve project sheets for Marion County are provided in **Appendix M** of this plan.

Table E1 - Marion County LRSP Project Locations and Opinion of Probable Cost

		Opinion of Probable Cost				
ID	Project Location  Description	Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *	
Segments 51, 52	60th Street between Limestone Road and S Locust Street (Peabody Southwest City Limit)	\$39,635	\$176,443	\$90,000	\$526,000	
Segments 83, 85, 89	Nighthawk Road between 140th Street and US-50	\$110,794	\$1,623,272	\$180,000	\$3,135,000	
Segment 100	Remington Road between 290th Street and 240th Street	\$57,759	\$379,110	\$195,000	\$1,085,000	
Segments 103, 105	Sunflower Road between 140th Street and US-50	\$87,538	\$1,271,155	\$315,000	\$2,754,000	
Segments 25, 26, 32	290th Street between K- 15 and Nighthawk Road	\$88,850	\$1,397,474	\$180,000	\$2,741,000	
Segments 12, 16	190th Street between Nighthawk Road and Remington Road (K-256)	\$69,695	\$961,685	\$90,000	\$1,876,000	
Segments 49, 50, 53	60th Street between S Maple Street (Peabody Southeast City Limit) and Timber Road	\$94,588	\$450,323	\$165,000	\$1,218,000	
Segments 1, 2	120th Street between K- 15 and Indigo Road	\$126,995	\$1,623,543	\$165,000	\$3,137,000	
Intersection 147	Nighthawk and 190th	\$24,300	\$0	\$40,000	\$111,000	
Curves 22, 30	Indigo Road near 130th Road	\$10,924	\$101,880	\$100,000	\$366,000	
	Total	\$711,078	\$7,984,885	\$1,520,000	\$16,949,000	

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

Marion County - Local Road Safety Plan.docx

Marion County LRSP August 2020







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#### LIST OF ACRONYMS

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 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). **Figure 1** shows the location of the Phase 1 LRSP counties and the Pilot Phase counties.

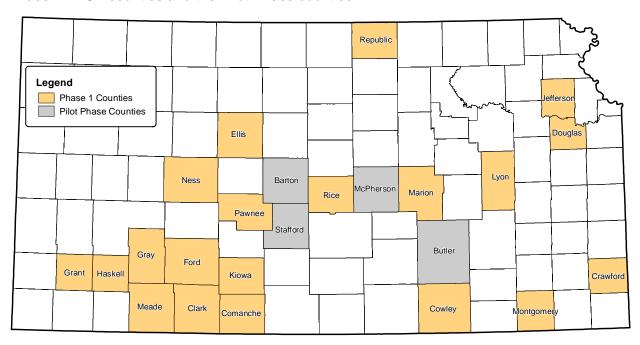


Figure 1 – Location of LRSP Counties

#### 1.1. What is a LRSP?

As defined by the Federal Highway Administration (FHWA), a 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 43% of the total vehicle miles traveled, and according to the Kansas SHSP 2017, crash data between 2010 and 2014 shows that 46% of fatalities and 54% 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. Marion County's LRSP Routes

The LRSP study routes within Marion 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 Marion County are identified on the map included in **Appendix A**. A total of 301 miles of roadway segments (60% paved, 40% unpaved), 304 intersections and 56 curves were analyzed as part of the Marion 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 a 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 Marion 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

As part of the LRSP, a comprehensive analysis was conducted to assess whether findings from the LRSP Pilot Phase crash analysis could be applied to the LRSP Phase 1 project. A particular emphasis was a comparison of where crashes are occurring (for example, at an uncontrolled intersection versus a curved segment of road) and the crash circumstances. Details of the analysis conducted for this project are documented in the Crash Analysis Technical Memorandum included in **Appendix B**.

# 2.2. Crash Data for Marion County LRSP Routes

This section provides a summary of the crash data for the Marion County LRSP routes using records from the KDOT crash database for the project (2013 – 2017 data). **Table 1** contains a tabular summary of the Marion County LRSP route crashes by roadway type and **Figure 2** contains a graphical summary of these 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 Marion County, slightly over half of the LRSP study routes are paved roads.

Table 1 – Marion County LRSP Route Crashes by Roadway Type

Roadway Type		Total Crashes		Fatal and Serious Injury (K & A) Crashes	
		Count	Percent	Count	Percent
	Intersection	3	1%	1	7%
	Non-Intersection (on curve)	13	4%	2	13%
County Paved	Non-Intersection (off curve)	302	86%	11	73%
1 4704	Other/Unknown	0	0%	0	0%
	Subtotal	318	91%	14	93%
	Intersection	0	0%	0	0%
	Non-Intersection (on curve)	1	0%	0	0%
County Unpaved	Non-Intersection (off curve)	31	9%	1	7%
Onpavea	Other/Unknown	0	0%	0	0%
	Subtotal	32	9%	1	7%
Total		350		15	









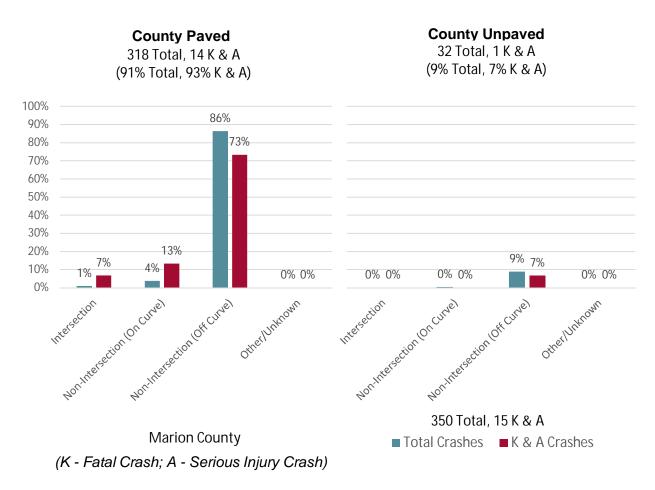


Figure 2 – Marion County LRSP Route Crashes by Roadway Type

The above findings indicate that from 2013 to 2017, there were a total of 350 crashes on the Marion County LRSP routes, including 15 fatal or serious injury crashes. Similar to the findings from the crash analysis, roadway segment crashes (non-intersection, off-curve crashes) accounted for the majority of the total crashes (95%) for paved and unpaved roads combined, as well as 80% of the fatal or serious injury crashes. Total crashes were much less frequent at intersections or on curves and accounted for the remaining 20% of the overall fatal or serious injury crashes along the Marion County LRSP routes.

#### 2.2.1. Crash Location 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 2013 to 2017 period were used to prepare a graphical representation of the total crashes along the Marion County LRSP routes in the form of a heat map. The heat 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 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 vs HSM Predicted Crash Frequencies for all the Marion 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 (2013-2017).

#### 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, and 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 ADTs.

#### 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 as of May 2019. 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 in all but a few exceptions, 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 spring of 2019 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 our field inspections or on review of the 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 Marion 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 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

"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

- Presence of lighting
- Presence of on-street parking
- Intersection skew angle
- Intersection traffic control device
- Number of signal heads vs. number of lanes
- Presence of backplates
- Presence of advanced warning signs
- Intersection located in or near horizontal curve
- Presence of left-turn or right-turn lanes
- Left-turn phasing
- Allowance of right-turn-on-red
- Overhead versus pedestalmounted signal heads
- Pedestrian crosswalk presence, crossing distance, signal head type











#### Traffic Volume:

- Average daily traffic volumes
- Average daily entering vehicles

#### Other Features:

- Posted speed limit or operating speed
- Presence of nearby railroad crossing
- Presence of automated enforcement

- Proportion of commercial vehicles in traffic stream
- Adjacent land use type (e.g., schools, commercial, or alcoholsales establishments)
- Location and presence of bus stops

# 3.2. Approved Risk Factors

Based on the Crash Analysis Technical Memorandum for the project included in **Appendix B**, risk factors approved by KDOT in the LRSP Pilot Phase were reviewed and considered appropriate for use on the LRSP Phase 1 project. Each of the approved risk factors was used to analyze potential risk for the Marion 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 1 LRSP counties to discuss the LRSP project and these countermeasures based on the crash characteristics within the region.

#### 4.1. County Workshop

The Marion County LRSP Safety Workshop was held on the morning of Wednesday, August 14, 2019. The minutes of the meeting are included in **Appendix G**. Invitees included a wide range of stakeholders from the "5E'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.

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 these were discussed during the workshop, including:

- Engineering measures: LRSP development, system enhancements, and "hot spot" analyses
- Enforcement measures: traffic-related enforcement, targeted enforcement using datadriven 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
- 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 Marion County LRSP routes:

- Nighthawk and 190th intersection
- 90th at Chisholm Trail
- Diamond at 370th
- 90th and Falcon intersection
- Kanza Road between 240th and 270th
- 1st/360th and D Streets near Quail Creek Road (in Ramona)
- Pawnee and 210th intersection
- Sunflower and 180th intersection
- Old Mill Road between 50th and 60th
- 290th between Mustang Road and Nighthawk

#### 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:

- Clearing and grubbing along roadways, particularly any foliage/brush within the right of way
- Removing/relocating fixed objects, or delineating these with retroreflective markers
- Aggregate shoulder treatments where mild shoulder is available
- Paved shoulders with safety edge treatment, where applicable
- Use of 6-inch edge lines rather than 4-inch
- Intersection lighting
- Transverse rumble strips on paved, stop-controlled approaches
- The use of flags, beacons, LEDs or even strobe lights on signs
- Dynamic speed feedback signs in areas that typically experience higher vehicle speeds
- Warning sign upgrades and delineators for 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. 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 Pilot Phase of the LRSP project and reviewed as part of the Phase 1 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 1 modifications, are identified in further detail in later subsections of **Section 5**. Some items of note:

- The proposed risk factor scoring reflects a maximum possible score of 24 points for any segment, intersection, or curve. This was completed to address the potential for score comparison across the three categories, even though separate rankings have been 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 were established separately for each county based on the data that were collected as part of this project. (i.e., only volumes on Marion County Roads were compared to Marion County Roads as opposed to comparing volumes to other counties.)
- Thresholds identified for scoring of pavement and shoulder width have been determined from the data collected and are consistent for all 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 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 were eliminated since these were either not applicable (e.g., the presence of pavement markings) or poorly defined (e.g., shoulder width).

Specific risk factor scores determined for all of Marion County's LRSP segments, intersections, and curves are included in **Appendix J, Appendix K**, and **Appendix L**. Based on a review of the scores, the crash frequency lists, and locations of concern expressed during the Safety Workshops, the project team coordinated with KDOT and the counties 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 the Pilot Phase of the LRSP project and reviewed as part of the Phase 1 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 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 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 that is 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 KDOT and the counties, 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 Marion 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 curves) are identified on a project sheet, the risk factor scoring information is for the highest ranked segment (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 side 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 page of the project sheets includes line items for general items (e.g., mobilization, traffic control, design engineering, and construction inspection), as determined during the Pilot Phase 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 Marion 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	
		0: ADT within 0%-14.3% percentile range		
	Average	1: ADT within 14.3%-28.6% percentile range		
	roadway	2: ADT within 28.6%-42.9% percentile range		
Volume	segment volume	3: ADT within 42.9%-57.1% percentile range	6	
	per county (ADT)	4: ADT within 57.1%-71.4% percentile range		
	(ADT)	5: ADT within 71.4%-85.7% percentile range		
		6: ADT within 85.7%-100% percentile range		
Access	Density of intersections	0: Bottom third of the access density Crash Modification Factor (CMF)*		
density	and driveways	1: Middle third of the access density CMF*	2	
	per mile	2: Top third of the access density CMF*		
		0: Rating of 2.75–3		
Edge	Observed condition rating	1: Top third of remaining ratings	3	
condition		2: Middle third of remaining ratings	ა	
		3: Bottom third of remaining ratings		
		0: Rating of 2.75–3		
Roadside	Observed	1: Top third of remaining ratings		
assessment	condition rating	2: Middle third of remaining ratings	3	
		3: Bottom third of remaining ratings		
Roadway	Width in feet	0: Roadway width greater than or equal to 22 feet	2	
width	width in feet	2: Roadway width less than 22 feet	2	
	Width in feet of	0: 4-foot shoulder and greater, or unpaved road		
Shoulder	recoverable	1: 2-foot shoulder to 4-foot shoulder	2	
width	area prior to a ditch or fill slope	2: less than 2-foot shoulder		











Table 2 – Segment Risk Factor Ranking Criteria (Continued)

Risk Factor	Measurement	Points	Max Points Available	
		Bottom fourth of roadway departure crash rates along the roadway segments		
Lane	Lane departure crashes per	Second lowest fourth of roadway departure crash rates along the roadway segments	3	
departure crash rate	MVMT	2: Second highest fourth of roadway departure crash rates along the roadway segments	3	
		3: Top fourth of roadway departure crash rates along the roadway segments		
Presence of Observed		0: Both centerline and edgeline present, or unpaved road		
pavement markings	presence of markings	1: Centerline or edgeline present	2	
markings		2: Neither centerline or edgeline present		
Surface type	Paved or	0: Paved	1	
Surface type	unpaved	1: Unpaved	1	

<sup>\*</sup> 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 Marion County's LRSP segments, as shown in **Appendix J**, the project team coordinated with KDOT and 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 Workshops and findings from the crash frequency listings were also considered as part of the project location selection. The following segments were identified for improvements:

- Segments 51 & 52: 60th Street between Limestone Road and S Locust Street (Peabody Southwest City Limit)
- Segments 83, 85, & 89: Nighthawk Road between 140th Street and US-50
- Segment 100: Remington Road between 290th Street and 240th Street
- Segments 103 & 105: Sunflower Road between 140th Street and US-50
- Segments 25, 26, & 32: 290th Street between K-15 and Nighthawk Road
- Segments 12 & 16: 190th Street between Nighthawk Road and Remington Road (K-256)
- Segments 49, 50, & 53: 60th Street between S Maple Street (Peabody Southeast City Limit) and Timber Road
- Segments 1 & 2: 120<sup>th</sup> Street between K-15 and Indigo Road









## 5.2.3. Prioritized Segment Recommendations

The final segment project sheets for Marion 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

			Opinion of P	robable Cost	
ID	Segment Description	Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *
51, 52	60th Street between Limestone Road and S Locust Street (Peabody Southwest City Limit)	\$39,635	\$176,443	\$90,000	\$526,000
83, 85, 89	Nighthawk Road between 140th Street and US-50	\$110,794	\$1,623,272	\$180,000	\$3,135,000
100	Remington Road between 290th Street and 240th Street	\$57,759	\$379,110	\$195,000	\$1,085,000
103, 105	Sunflower Road between 140th Street and US-50	\$87,538	\$1,271,155	\$315,000	\$2,754,000
25, 26, 32	290th Street between K-15 and Nighthawk Road	\$88,850	\$1,397,474	\$180,000	\$2,741,000
12, 16	190th Street between Nighthawk Road and Remington Road (K-256)	\$69,695	\$961,685	\$90,000	\$1,876,000
49, 50, 53	60th Street between S Maple Street (Peabody Southeast City Limit) and Timber Road	\$94,588	\$450,323	\$165,000	\$1,218,000
1, 2	120th Street between K-15 and Indigo Road	\$126,995	\$1,623,543	\$165,000	\$3,137,000
	Total	\$675,854	\$7,883,005	\$1,380,000	\$16,472,000

<sup>\*</sup> 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 Marion 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	
		0: ADT percentile is 0%-14.3%		
	Average Daily Traffic	1: ADT percentile is 14.3%-28.6%		
	(ADT) on all approaches	2: ADT percentile is 28.6%-42.9%		
Volume	per intersection with a	3: ADT percentile is 42.9%-57.1%	6	
	paved approach per county	4: ADT percentile is 57.1%-71.4%		
	- oounty	5: ADT percentile is 71.4%-85.7%		
		6: ADT percentile is 85.7%-100%		
	Number of driveways or	0: None (or ADT less than 400)		
Access density	intersections within 500	1: 1 or 2 Access Points	2	
	feet of the intersection	2: More than 2 Access Points		
Sight distance	Based on field	0: Adequate	3	
Signit distance	observations	3: Limited	J	
Horizontal curvature	Intersection on a curve	0: No	3	
Tionzontal cuivature	intersection on a curve	3: Yes	3	
Crash experience	Fatal or serious injury	0: None	3	
Crash expendice	crashes	3: 1 or more	3	
D'ata a a fue	December California	0: 1.5 miles or less		
Distance from previous stop sign	Based on field data collection	2: 1.5 miles to less than 5 miles	3	
providuo otop olgii	00110011011	3: 5 miles or more		
Skewed approach	Degrees	0: 75 degree to 90-degree intersection approaches	3	
экемей арргоаст	Deglees	3: 75 degree or less intersection approach	] 3	
Intersection control	Observed control type	0: Yield/None	1	
intersection control	Observed control type	1: Stop		











## 5.3.2. Intersection Project Location Recommendations

Based on a review of the risk factor scores for all of Marion County's LRSP intersections, as shown in **Appendix K**, the project team coordinated with KDOT and 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 Workshops and findings from the crash frequency listings were also considered as part of the project location selection. Based on the analysis, the following intersection was selected:

Intersection 147: Nighthawk and 190<sup>th</sup>

#### 5.3.3. Prioritized Intersection Recommendations

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

Table 5 - Opinion of Probable Cost for Intersection Project Locations

		Opinion of Probable Cost			
ID	Intersection Description	Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *
147	Nighthawk and 190th	\$24,300	\$0	\$40,000	\$111,000
	Total	\$24,300	\$0	\$40,000	\$111,000

<sup>\*</sup> 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 Marion 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	
		0: ADT within 0%-14.3% percentile		
		1: ADT within 14.3%-28.6% percentile		
	A. (a. ra. g. a. (m. (a. ) (al. (m. a.	2: ADT within 28.6%-42.9% percentile		
Volume	Average curve volume per county	3: ADT within 42.9%-57.1% percentile	6	
	por ocumy	4: ADT within 57.1%-71.4% percentile		
		5: ADT within 71.4%-85.7% percentile		
		6: ADT within 85.7%-100% percentile		
		0: Top fourth of curve radii		
O	Radius of curve in feet	1: Second highest fourth of curve radii	0	
Curve radius	per county	2: Second lowest fourth of curve radii	3	
		3: Bottom fourth of curve radii		
	Intersections or driveways within 500 feet of the curve	0: None		
Access density		1: 1 or 2 Access Points	2	
		2: More than 2 Access Points		
	Width in feet of recoverable area prior to a ditch or fill slope	0: 4-foot shoulder and greater, or unpaved road		
Shoulder width		1: 2-foot shoulder to 4-foot shoulder	2	
	to a ditorr or fill slope	2: less than 2-foot shoulder		
	01 1 177	0: Rating of 3		
Edge condition	Observed condition rating	1: Rating of 2	2	
	rating	2: Rating of 1		
Daadaida	Observed condition	0: Rating of 3		
Roadside assessment	Observed condition rating	1: Rating of 2	2	
accessinon.	raang	2: Rating of 1		
Superelevation	Presence of	0: Yes	2	
	superelevation	2: No		
Crash experience	Fatal or serious injury	0: None	3	
Crash expendiction	crashes	3: 1 or more	3	
Presence of	Observed presence	0: Present	2	
warning signs	Oboot voa prodottoo	2: Not present	_	

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Marion County LRSP August 2020











# 5.4.2. Curve Project Location Recommendations

Based on a review of the risk factor scores for all of Marion County's LRSP curves, as shown in **Appendix L**, the project team coordinated with KDOT and 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 Workshops and findings from the crash frequency listings were also considered as part of the project location selection. Based on the analysis, the following curves were identified for improvements:

Curves 22 & 30: Indigo Road near 130<sup>th</sup> Road

#### 5.4.3. Prioritized Curve Recommendations

The final curve project sheets for Marion County are provided in **Appendix M** of this plan. Costs identified on the project sheets for the recommended improvements are included in **Table 7**.

Table 7 – Opinion of Probable Cost for Curve Project Locations

			Opinion of P	robable Cost	
ID	Curve Description	Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *
22, 30	Indigo Road near 130th Road	\$10,924	\$101,880	\$100,000	\$366,000
	Total	\$10,924	\$101,880	\$100,000	\$366,000

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











# 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 8**.

# 6.2. Next Steps

The process established as part of the Phase 1 LRSP project for KDOT has resulted in the identification of several recommended safety improvement projects throughout Marion 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 Marion 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 5 years or so) by reevaluating crash trends, changes to roadway characteristics. This review will aid in reprioritizing safety improvements for segments, intersections, and curves based on current local needs and priorities.











# Table 8 - Opinion of Probable Cost for Marion County LRSP Project Locations

ID	Project Location Description	Opinion of Probable Cost			
		Short Term Improvements	Longer Term Improvements	Additional Potential Improvements	Estimated Project Total *
Segments 51, 52	60th Street between Limestone Road and S Locust Street (Peabody Southwest City Limit)	\$39,635	\$176,443	\$90,000	\$526,000
Segments 83, 85, 89	Nighthawk Road between 140th Street and US-50	\$110,794	\$1,623,272	\$180,000	\$3,135,000
Segment 100	Remington Road between 290th Street and 240th Street	\$57,759	\$379,110	\$195,000	\$1,085,000
Segments 103, 105	Sunflower Road between 140th Street and US-50	\$87,538	\$1,271,155	\$315,000	\$2,754,000
Segments 25, 26, 32	290th Street between K- 15 and Nighthawk Road	\$88,850	\$1,397,474	\$180,000	\$2,741,000
Segments 12, 16	190th Street between Nighthawk Road and Remington Road (K-256)	\$69,695	\$961,685	\$90,000	\$1,876,000
Segments 49, 50, 53	60th Street between S Maple Street (Peabody Southeast City Limit) and Timber Road	\$94,588	\$450,323	\$165,000	\$1,218,000
Segments 1, 2	120th Street between K- 15 and Indigo Road	\$126,995	\$1,623,543	\$165,000	\$3,137,000
Intersection 147	Nighthawk and 190th	\$24,300	\$0	\$40,000	\$111,000
Curves 22, 30	Indigo Road near 130th Road	\$10,924	\$101,880	\$100,000	\$366,000
	Total	\$711,078	\$7,984,885	\$1,520,000	\$16,949,000

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

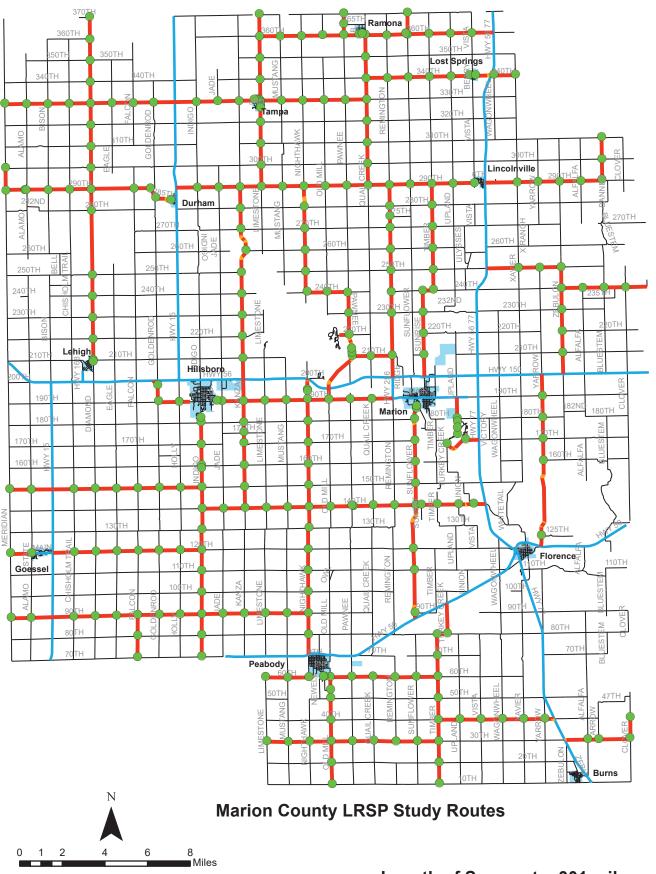








# **APPENDIX A LRSP STUDY ROUTES**





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

LRSP Segment

LRSP Curve

LRSP Intersection

Length of Segments: 301 miles Paved: 180 miles (60%)

Unpaved: 121 miles (40%) Number of Curves: 56

**Number of Intersections: 304** 









# **APPENDIX B CRASH ANALYSIS TECHNICAL MEMORANDUM**

# **TECHNICAL MEMORANDUM - CRASH ANALYSIS**

# 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, 3<sup>rd</sup> Floor West Topeka, Kansas 66603-3745 785-296-3861

#### Prepared by:





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#### **TECHNICAL MEMORANDUM - CRASH ANALYSIS**

**FOR** 

# KDOT LOCAL ROAD SAFETY PLANS (LRSPs) – PHASE 1

**KDOT PROJECT NO: 106 C-4790-02** 

Prepared for:

**KDOT Bureau of Local Projects**Eisenhower State Office Building

700 S.W. Harrison Street, 3<sup>rd</sup> Floor West Topeka, Kansas 66603-3745 785-296-3861

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0918	841008 KDOT LRSPs –	Phase 1



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#### **LIST OF ACRONYMS**

Α Serious Injury Crash ADT Average Daily Traffic

Crash Modification Factor CMF

Federal Highway Administration **FHWA** 

K Fatal Crash

**KDOT** Kansas Department of Transportation

**LRSP** Local Road Safety Plan

Strategic Highway Safety Plan SHSP







#### 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.

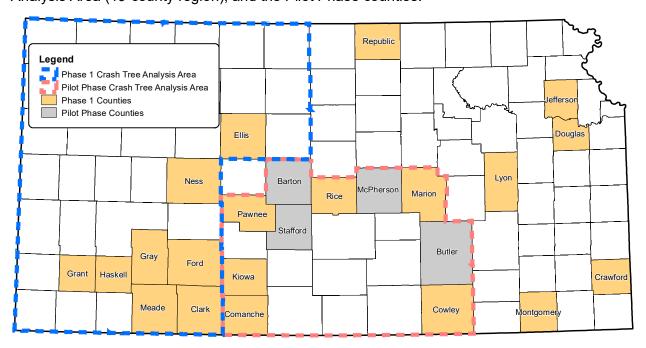


Figure 1 - Location of Crash Tree Analysis Regions and LRSP Counties

#### 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.

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#### 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:

_	<b>D</b> -	حا۔.	
-	Ra	rn	er

- Edwards
- Marion
- Rice

- Barton
- Harper
- McPherson
- Sedgwick

- Butler
- Harvey
- Pawnee
- Stafford

- Comanche
- Kingman
- Pratt

Sumner

- Cowley
- Kiowa
- Reno

#### 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.







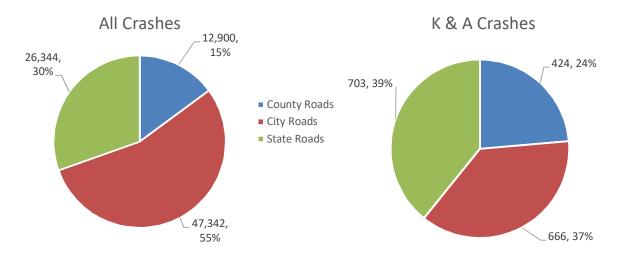


Figure 2 – Crashes within the Pilot Phase Crash Tree Analysis Area (2011-2015)

#### 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.

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an animal.
"Motor Vehide in Transport" – vehide 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.).

ADDITIONAL INFORMATION:

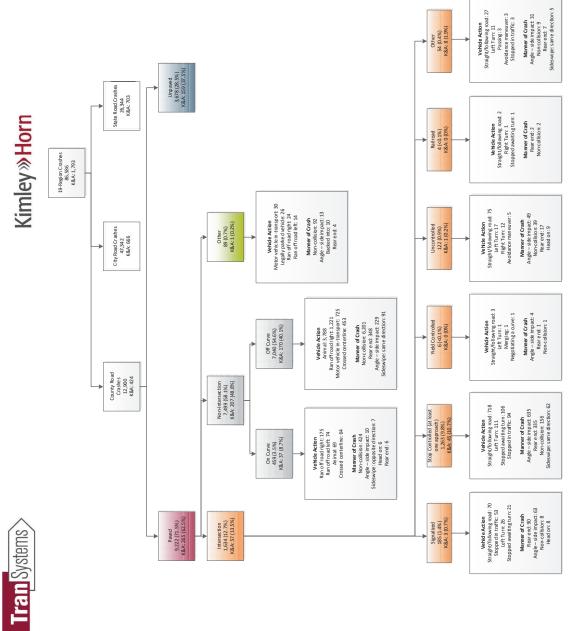
All precratege based on total County Road Crashes.

"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 collision with could be when a vehicle did not croille with another which, such as a run off the road crash, packnife. If et, tire or brake failure, etc.
"Animal" – crash type refers to a crash that involved a collision with

Vehicle Action and Manner of Crash Statistics are based on Total Crashes.

K&A Crashes had similar Vehicle Action and Manner of Crash.

NOTE:



B-9

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

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

ADDITIONAL INFORMATION:



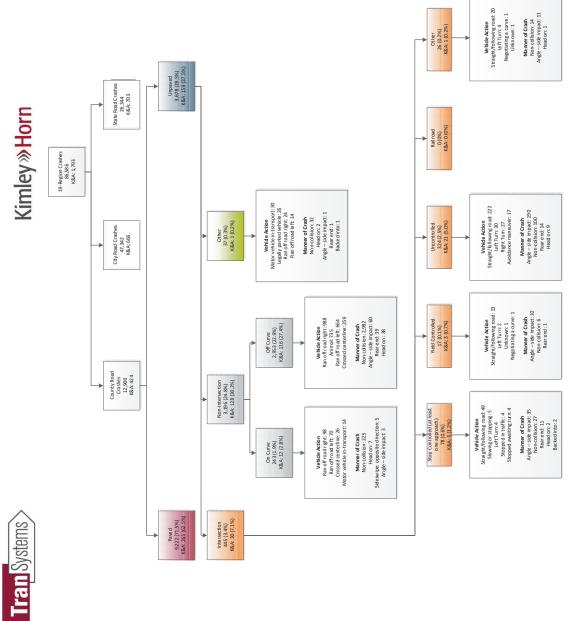


Figure 4 - LRSP Pilot Phase Crash Tree - Unpaved (19-County Region)







**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 C	rashes	Fatal and Serious Injury (K & A) Crashes		
		Count	Percent	Count	Percent	
	Intersection	1,634	13%	57	13%	
_	Non-Intersection (on curve)	459	4%	37	9%	
County Paved	Non-Intersection (off curve)	7,040	55%	170	40%	
1 4754	Other/Unknown	89	1%	1	0%	
	Subtotal	9,222	71%	265	62%	
	Intersection	445	3%	30	7%	
	Non-Intersection (on curve)	243	2%	12	3%	
County Unpaved	Non-Intersection (off curve)	2,953	23%	116	27%	
5pu. 3u	Other/Unknown	37	0%	1	0%	
	Subtotal	3,678	29%	159	38%	
	Total	12,	900	424		

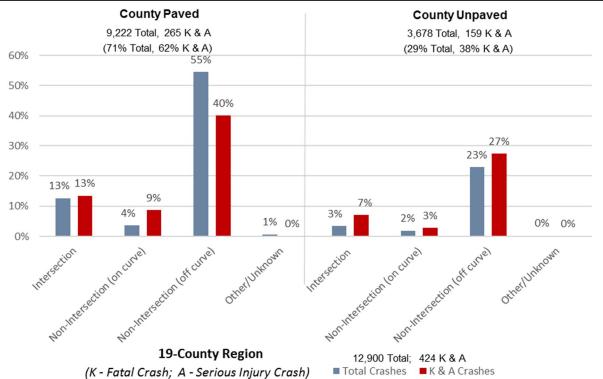


Figure 5 - Pilot Phase Crash Tree Data - Crashes by Roadway Type







#### 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.

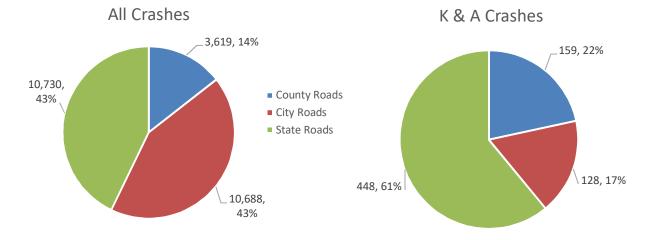


Figure 6 – Crashes within the Phase 1 Crash Tree Analysis Area (2013-2017)







#### 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.

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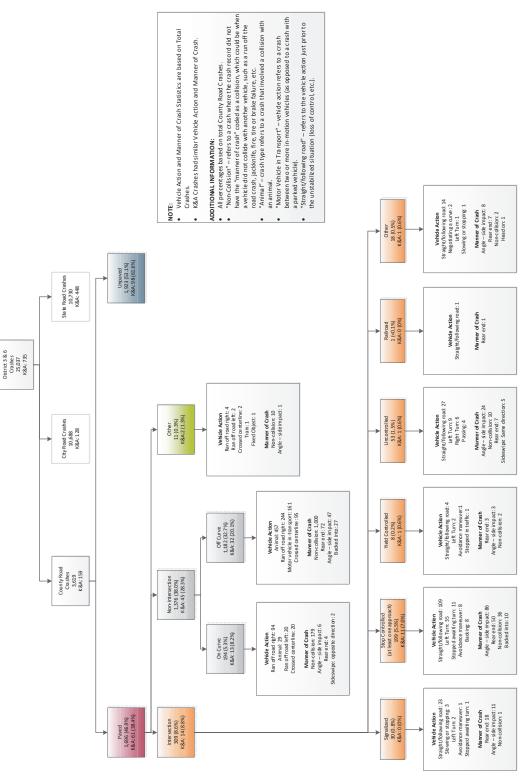


Figure 7 – LRSP Phase 1 Crash Tree – Paved (KDOT District 3 and District 6)

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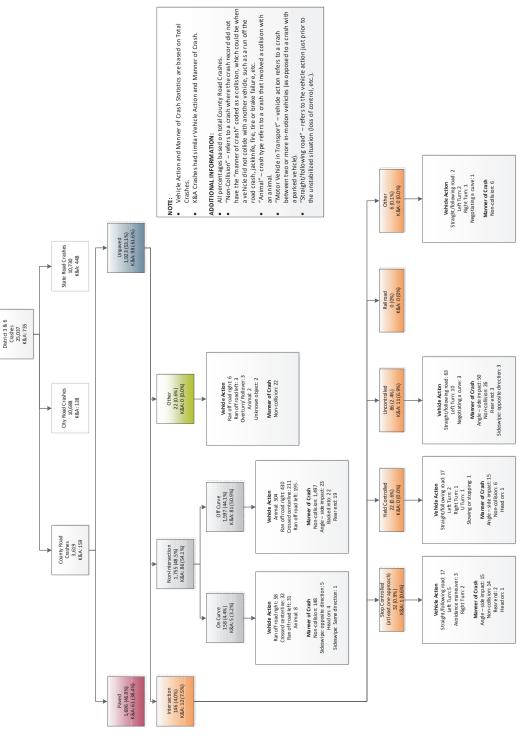


Figure 8 – LRSP Phase 1 Crash Tree – Unpaved (KDOT District 3 and District 6)

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**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 C	rashes	Fatal and Serious Injury (K & A) Crashes		
		Count	Percent	Count	Percent	
	Intersection	309	9%	14	9%	
_	Non-Intersection (on curve)	194	5%	13	8%	
County Paved	Non-Intersection (off curve)	1,182	33%	32	20%	
	Other/Unknown	11	0%	2	1%	
	Subtotal	1,696	47%	61	38%	
	Intersection	146	4%	12	8%	
	Non-Intersection (on curve)	158	4%	5	3%	
County Unpaved	Non-Intersection (off curve)	1,597	44%	81	51%	
opa.voa	Other/Unknown	22	1%	0	0%	
	Subtotal	1,923	53%	98	62%	
	Total	3,€	19	159		

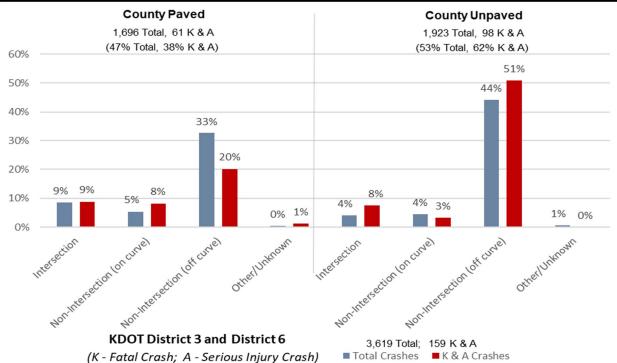


Figure 9 – Phase 1 Crash Tree Data – Crashes by Roadway Type

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#### 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.







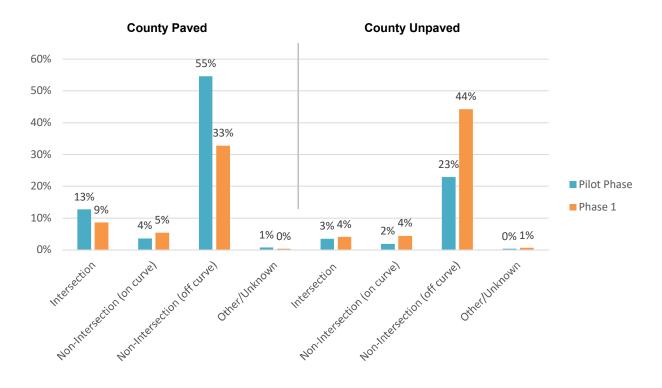


Figure 10 – All Crashes by Roadway Type (Phase 1 and Pilot Phase)

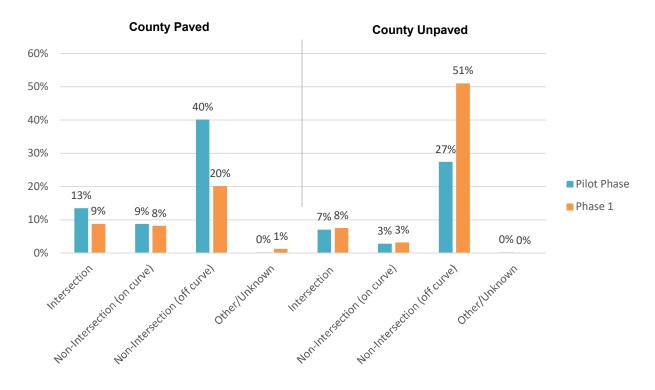


Figure 11 – K&A Crashes by Roadway Type (Phase 1 and Pilot Phase)







#### 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.

#### 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.

"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

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







#### **Intersection Risk Factors** 3.2.

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

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#### 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.





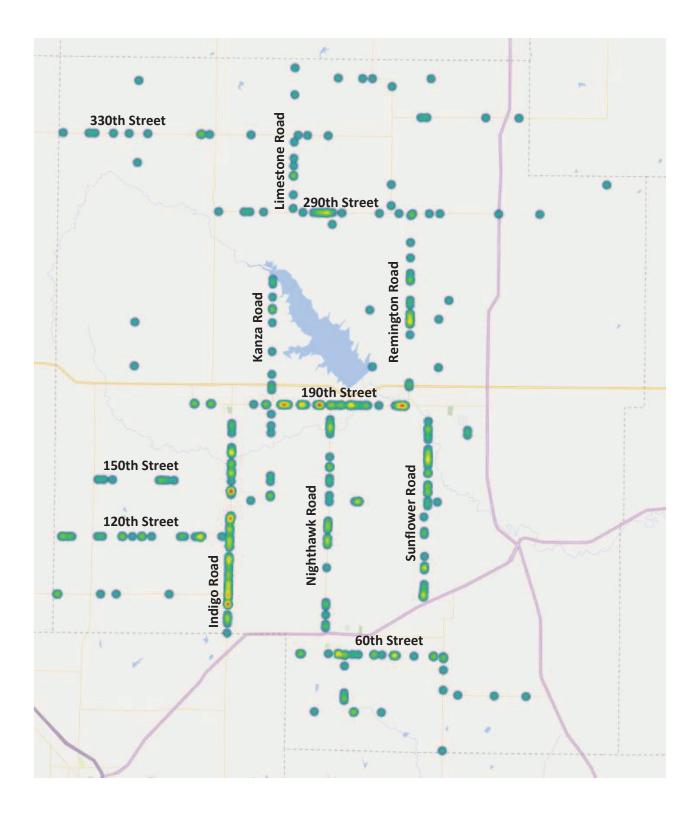




## **APPENDIX C CRASH LOCATION HEAT MAP AND CRASH FREQUENCIES**

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# Crash Location Heat Map Marion County LRSP Routes Total Crashes



# Use Restricted 23 U.S.C. § 409 Marion County

#### Local Road Safety Plan (LRSP)

#### **Segment Crash Frequencies (Actual vs. Predicted)** Five-Year Analysis Period: 2013-2017

	LRSP Segment	Location		Lane Departure Crashes	Animal Crashes	Crash Frequency (crashes per year)			
ID			Total Crashes			Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)	
104	SUNFLOWER	From 140TH to E. FOREST	23	3	17	4.60	1.39	3.21	
13	190TH	From KANZA to NIGHTHAWK	19	9	9	3.80	1.32	2.48	
70	INDIGO	From 90TH to 70TH	15	4	11	3.00	0.86	2.14	
71	INDIGO	From 120TH to 90TH	18	6	11	3.60	1.91	1.69	
84	NIGHTHAWK	From 190TH to 150TH	10	6	3	2.00	0.42	1.58	
1	120TH	From EAGLE to INDIGO	10	2	8	2.00	0.49	1.51	
103	SUNFLOWER	From 110TH to HWY 50	10	8	2	2.00	0.65	1.35	
12	190TH	From OLD MILL to REMINGTON	14	10	3	2.80	1.50	1.30	
99	REMINGTON	From 240TH to 210TH	7	0	7	1.40	0.17	1.23	
85	NIGHTHAWK	From 140TH to 120TH	7	5	2	1.40	0.21	1.19	
2	120TH	From HWY 15 to EAGLE	8	3	5	1.60	0.49	1.11	
16	190TH	From NIGHTHAWK to OLD MILL	8	4	2	1.60	0.51	1.09	
49	60TH	From QUAIL CREEK to TIMBER	7	3	3	1.40	0.33	1.07	
80	LIMESTONE	From 330TH to 290TH	7	5	2	1.40	0.36	1.04	
50	60TH	From OLD MILL to QUAIL CREEK	6	2	4	1.20	0.22	0.98	
100	REMINGTON	From 290TH to 240TH	8	5	3	1.60	0.66	0.94	
26	290TH	From LIMESTONE to NIGHTHAWK	7	4	3	1.40	0.48	0.92	
74	KANZA	From 190TH to 140TH	7	4	3	1.40	0.52	0.88	
9	150TH	From EAGLE to INDIGO	6	3	3	1.20	0.32	0.88	
69	INDIGO	From 150TH to BLAIRWOOD	14	1	12	2.80	2.03	0.77	
3	120TH	From MERIDIAN to ALAMO	4	1	1	0.80	0.10	0.70	
118	KANZA	From 240TH to US HWY 56	6	2	3	1.20	0.51	0.69	
14	190TH	From GOLDENROD to WEST OF HILLSBORO	4	4	0	0.80	0.13	0.67	
36	330TH	From MERIDIAN to DIAMOND	5	2	3	1.00	0.34	0.66	
72	INDIGO	From 140TH to 150TH	6	2	3	1.20	0.60	0.60	
10	150TH	From K-15 to EAGLE	4	0	4	0.80	0.21	0.59	
7	140TH	From NIGHTHAWK to PAWNEE	3	3	0	0.60	0.05	0.55	
52	60TH	From 0.25 MILE WEST OF NIGHTHAWK to S LOCUST	3	2	1	0.60	0.07	0.53	
90	OLD MILL	From 60TH to 30TH	5	3	0	1.00	0.47	0.53	
51	60TH	From LIMESTONE to 0.25 MILE WEST OF NIGHTHAWK	3	2	1	0.60	0.15	0.45	
35	30TH	From OLD MILL to TIMBER	3	1	2	0.60	0.16	0.44	
39	330TH	From DIAMOND to HWY 15	4	2	2	0.80	0.40	0.40	

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		036 17631110	TICLEU ZU U.U.	<u> </u>	Crasl	Crash Frequency (crashes per year)		
l			Total	Lane	Animal	Crusi	Highway Safety	Difference
ID	LRSP Segment	Location	Crashes	Departure Crashes	Crashes	Actual	Manual (HSM)	(actual -
				Crasiles			Predicted Average	predicted)
89	NIGHTHAWK	From 90TH to HWY 50	4	3	1	0.80	0.41	0.39
109	TIMBER	From 60TH to 40TH	3	3	0	0.60	0.22	0.38
73	INDIGO	From 140TH to 120TH	8	5	3	1.60	1.23	0.37
101	REMINGTON	From 210TH to HWY 56	2	0	1	0.40	0.06	0.34
46	360TH	From PAWNEE to QUAIL CREEK	2	2	0	0.40	0.08	0.32
53	60TH	From S MAPLE to OLD MILL	2	1	1	0.40	0.10	0.30
66	DIAMOND	From 250TH to 210TH	2	2	0	0.40	0.10	0.30
88	NIGHTHAWK	From 150TH to 140TH	2	1	1	0.40	0.10	0.30
105	SUNFLOWER	From 140TH to 110TH	5	4	1	1.00	0.72	0.28
45	360TH	From LIMESTONE to PAWNEE	3	2	0	0.60	0.33	0.27
55	90TH	From MERIDIAN to K15	2	0	2	0.40	0.13	0.27
76	KANZA	From 270TH to 240TH	3	0	3	0.60	0.34	0.26
47	40TH	From TIMBER to WAGONWHEEL	2	1	1	0.40	0.15	0.25
40	340TH	From QUAIL CREEK to N WASHINGTON	3	2	1	0.60	0.36	0.24
28	290TH	From HWY 56 to BLUESTEM	2	1	1	0.40	0.19	0.21
23	290TH	From REMINGTON to TIMBER	3	3	0	0.60	0.39	0.21
106	SUNRISE	From 240TH to HWY 56	2	1	0	0.40	0.22	0.18
102	SUNFLOWER	From 370TH to 360TH	1	1	0	0.20	0.02	0.18
83	NIGHTHAWK	From 120TH to 90TH	4	1	3	0.80	0.62	0.18
97	QUAIL CREEK	From 330TH to 290TH	2	1	1	0.40	0.23	0.17
113	UPLAND	From HWY 256 to LAKESHORE	2	1	0	0.40	0.23	0.17
25	290TH	From HWY 15 to KANZA	4	1	3	0.80	0.64	0.16
8	140TH	From INDIGO to KANZA	1	0	1	0.20	0.04	0.16
81	LIMESTONE	From 370TH to 360TH	1	1	0	0.20	0.05	0.15
61	BLUESTEM	From 310TH to 290TH	1	1	0	0.20	0.06	0.14
94	PAWNEE	From 240TH to 230TH	1	1	0	0.20	0.06	0.14
107	TIMBER	From 30TH to 10TH	1	1	0	0.20	0.06	0.14
60	90TH	From K15 to CHISOLM TRAIL	1	0	1	0.20	0.07	0.13
41	340TH	From US HWY 77 to XAVIER	1	0	1	0.20	0.07	0.13
108	TIMBER	From 290TH to 240TH	1	1	0	0.20	0.08	0.12
67	FALCON	From 90TH to 70TH	1	0	0	0.20	0.11	0.09
95	PAWNEE	From 360TH to 370TH	1	1	0	0.20	0.11	0.09
63	DIAMOND	From 370TH to 330TH	1	0	1	0.20	0.11	0.09
20	240TH	From NIGHTHAWK to PAWNEE	1	1	0	0.20	0.12	0.08
48	40TH	From WAGONWHEEL to HWY 77	1	1	0	0.20	0.12	0.08
96	QUAIL CREEK	From 360TH to 340TH	1	1	0	0.20	0.12	0.08
77	KANZA	From US HWY 56 to 190TH	1	1	0	0.20	0.13	0.07
87	NIGHTHAWK	From HWY 56 to 190TH	1	0	0	0.20	0.13	0.07

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		036 11631110		1			n Frequency (crashes	per year)
ID	LRSP Segment	Location	Total Crashes	Lane Departure Crashes	Animal Crashes	Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)
58	90TH	From CHISHOLM TRAIL to EAGLE	1	0	1	0.20	0.13	0.07
64	DIAMOND	From 330TH to 290TH	1	0	1	0.20	0.13	0.07
79	LIMESTONE	From 360TH to 330TH	1	1	0	0.20	0.15	0.05
86	NIGHTHAWK	From 290TH to 240TH	1	1	0	0.20	0.16	0.04
37	330TH	From LIMESTONE to QUAIL CREEK	3	0	3	0.60	0.57	0.03
30	290TH	From QUAIL CREEK to REMINGTON	1	0	1	0.20	0.20	0.00
6	140TH	From SUNFLOWER to ULYSSES	1	0	1	0.20	0.21	-0.01
33	30TH	From LIMESTONE to OLD MILL	1	0	1	0.20	0.22	-0.02
15	190TH	From PRAIRIE to KANZA	3	3	0	0.60	0.66	-0.06
91	OLD MILL	From 210TH to 190TH	1	1	0	0.20	0.36	-0.16
93	PAWNEE	From 230TH to 210TH	1	0	0	0.20	0.39	-0.19
38	330TH	From HWY 15 to LIMESTONE	1	0	1	0.20	0.42	-0.22
24	290TH	From NIGHTHAWK to QUAIL CREEK	2	1	0	0.40	0.64	-0.24

# Marion County Local Road Safety Plan (LRSP) Curve Crash Frequencies (Actual vs. Predicted) Five-Year Analysis Period: 2013-2017

			Crash Frequency (crashes per			
ID	LRSP Curve	Total Crashes	Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)	
20	GOLDENROD RD & 190TH	2	0.40	0.05	0.35	
47	SUNFLOWER 1.2M N OF 120TH	1	0.20	0.03	0.17	
33	NIGHTHAWK 0.02M S OF 130TH	1	0.20	0.08	0.12	
39	SUNFLOWER 0.10M N OF 90TH	1	0.20	0.09	0.11	
45	SUNFLOWER 0.37 M N OF 90TH	1	0.20	0.11	0.09	
43	SUNFLOWER 0.09 M S OF 180TH	1	0.20	0.18	0.02	
22	INDIGO 0.07M S OF 130TH	1	0.20	0.22	-0.02	
14	360TH & PAWNEE	1	0.20	0.43	-0.23	
17	60TH & S MAPLE	1	0.20	0.44	-0.24	

# Use Restricted 23 U.S.C. § 409 Marion County

#### Local Road Safety Plan (LRSP)

### **Intersection Crash Frequencies (Actual vs. Predicted)**

Five-Year Analysis Period: 2013-2017

	LRSP Intersection	Total Crashes	Crash Frequency (crashes per year)		
ID			Actual	Highway Safety Manual (HSM) Predicted Average	Difference (actual - predicted)
137	NEEDLE & 60TH	1	0.20	0.003	0.20
68	INDIGO & 120TH	1	0.20	0.005	0.20
147	NIGHTHAWK & 190TH	1	0.20	0.08	0.12











# **APPENDIX D**

**DATA MAPS** 

#### Hamm, Jesse

From:

jjstanek@transystems.com

Sent:

Wednesday, May 8, 2019 9:48 AM

To:

Hamm, Jesse

Cc:

csproberts@transystems.com; David.Church@wsp.com; jay.aber@wsp.com

Subject:

RE: Marion County LRSP Data Request

Good morning Jesse – just a friendly reminder that the team would like to receive the map information requested below by <u>Friday, May 10, 2019</u>. I recognize you may have other priorities with all the rain we've been receiving. We appreciate your efforts in providing this information as timely as possible so we can keep the project on schedule.

Thank you,

Jim

From: KC-James Stanek

Sent: Thursday, April 25, 2019 11:44 AM

To: Jesse Hamm (jhamm@marioncoks.net) < jhamm@marioncoks.net>

Cc: KC-Chris S.P. Roberts <csproberts@transystems.com>; David Church (David.Church@wsp.com)

<David.Church@wsp.com>; Jay Aber (jay.aber@wsp.com) <jay.aber@wsp.com>

Subject: Marion County LRSP Data Request

Jesse:

In order to enhance the quality of your LRSP, we would like to obtain the following sets of information regarding the **LRSP** routes in your County. Please indicate the following information within your County on the attached maps:

- 1. Intersection Lighting: Please indicate which intersections along the County LRSP routes have intersection lighting.
- 2. Overhead/Stop Sign Flashing Beacons: Please indicate which intersections along the County <u>LRSP</u> routes have overhead or stop sign flashing beacons. 2 Flashing stop signs at 190th 4 Nighthauk
- 3. **Centerline Rumble Strips:** Please provide locations of centerline rumble strips along the County <u>LRSP</u> routes if these are available. Nove
- 4. **Edge line and/or Shoulder Rumble Strips:** Please provide locations of edge line and/or shoulder rumble strips along the County **LRSP** routes if these are available.
- 5. Transverse Rumble Strips: Please provide locations of transverse rumble strips at intersections along the County LRSP routes if these are available. None
- 6. Pavement width and type (material): Please provide information regarding the pavement width and type along the County LRSP routes if it is available. Paved roads are asphalt 4 drip 4 seal roads. They range from 22 feet to 24 feet wide
- 7. Shoulder width and type (material): Please provide information regarding the shoulder width and type along the County <u>LRSP</u> routes if it is available. 1-13 mile stretch has 110° ROW the rest of the roads are 60° to 64° ROW
- 8. **Edge Line pavement markings**: Please provide locations of edge line pavement markings along the County **LRSP** routes if these are available.

- 9. **Centerline pavement markings**: Please provide locations of center line pavement markings along the County <u>LRSP</u> routes if these are available.
- 10. Curve Warning Signs: Please indicate which curves along the County <u>LRSP</u> routes have horizontal alignment warning signs (e.g., Turn or Curve warning signs, curve chevrons, etc.). 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.
- 11. Curve Superelevation: Please identify 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.

Some of these should be fairly simple, but others may take some time unless you already have the information in a digital format (e.g., a signing database). We have received a number of GIS files for your county, so please advise if you think we have some of this information already.

If possible, please provide this information by <u>Friday, May 10, 2019</u>. Thank you and please feel free to contact me with any questions you may have regarding this data request.

Jim

James J. Stanek PE, PTOE Senior Traffic Engineer



#### **TranSystems**

2400 Pershing Road, Suite 400 Kansas City, MO 64108

Main: 816-329-8600 Direct: 816-329-8632 Fax: 816-329-8601 Cell: 816-589-3009 www.transystems.com

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**Total Control Panel** 

Login

To: jhamm@marioncoks.net

Remove this sender from my allow list

From: jjstanek@transystems.com

You received this message because the sender is on your allow list.

### Information regarding the LRSP maps

**Question 1** – Hwy 50 and Indigo intersection, Hwy 50 and Nighthawk intersection, Hwy 50 and Sunflower intersection all have lighting

Question 2 – Two flashing stop signs at the intersection of 190<sup>th</sup> and Nighthawk Road

Question 3 - No Centerline Rumble Strips in the county

Question 4 – No Edge Line Rumble Strips in the county

Question 5 - No Transverse Rumble Strips in the county

Question 6 - Paved roads are Asphalt and Chip & Seal Roads they all range from 22' to 24' wide

**Question 7** – Indigo Road has 4' to 5' width of shoulder the rest of the roads in the county range from 6" to one foot of shoulder

**Question 8 & 9** are the same – Indigo Road, 90<sup>th</sup> from Meridian to Chisholm Trail, 120<sup>th</sup> from Meridian to Indigo, 150<sup>th</sup> from Hwy 15 to Indigo, 190<sup>th</sup> from Goldenrod to Remingtion, Sunflower from 180<sup>th</sup> to Hwy 50, 330<sup>th</sup> from Meridian to Limestone, Limestone from 330<sup>th</sup> to 290<sup>th</sup>, Quail Creek from 370<sup>th</sup> to 290<sup>th</sup>, Remington from 290<sup>th</sup> to Hwy 56, 290<sup>th</sup> from Diamond to Hwy 77, 60<sup>th</sup> from Old Mill to Timber, Timber from 60<sup>th</sup> to 10<sup>th</sup>, 40<sup>th</sup> from Timber to Hwy 77 all have edge line and center line markings.

Question 10 - Yes all have curve warning signs

**Question 11** – Yes south of Sunflower and 140<sup>th</sup> intersection I would say is the only area that has Curve Superelevation

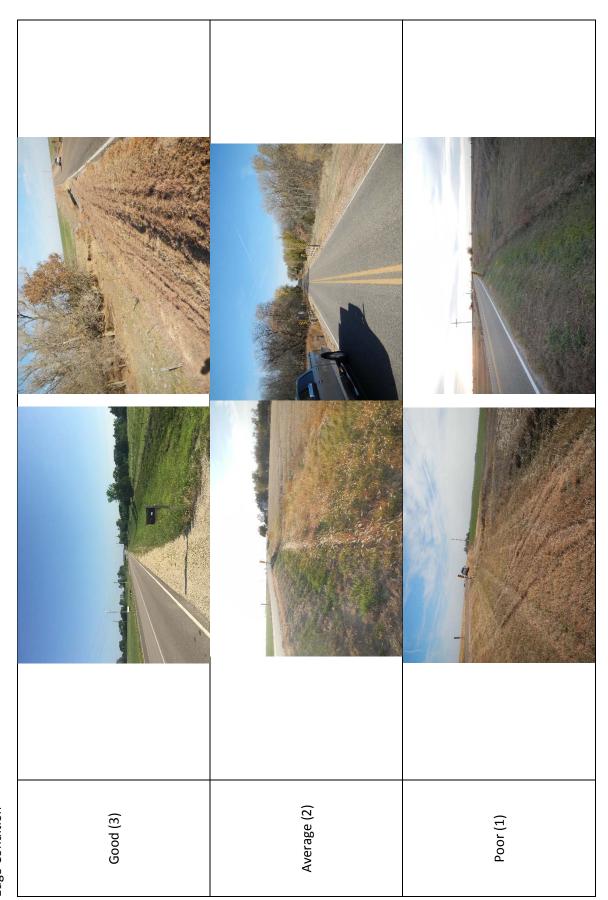




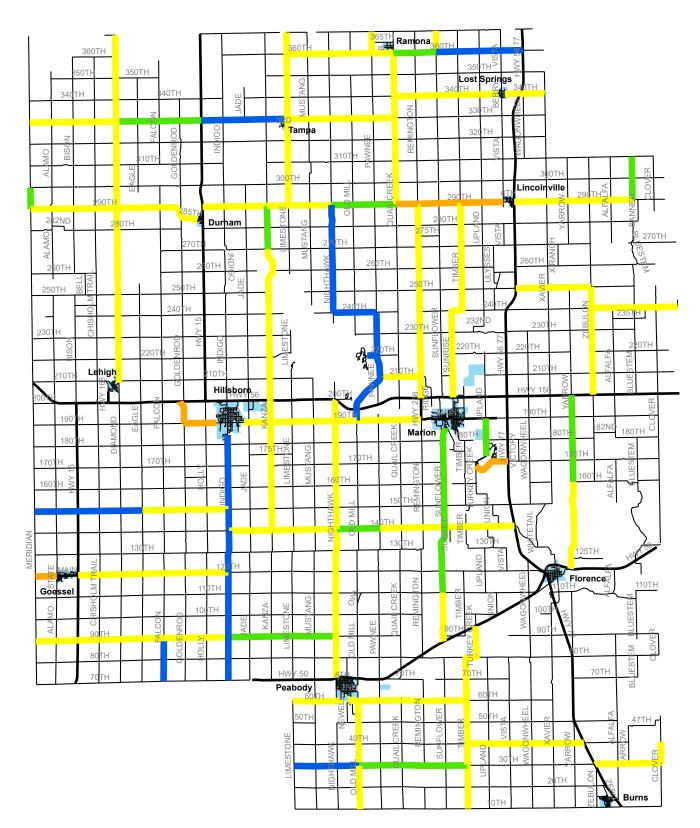




### **APPENDIX E EDGE CONDITION AND ROADSIDE ASSESSMENT RATINGS**

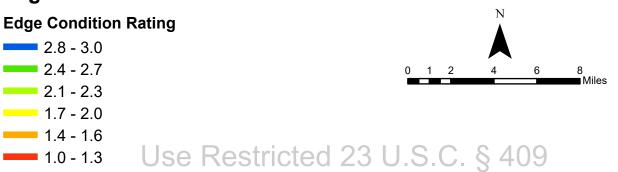


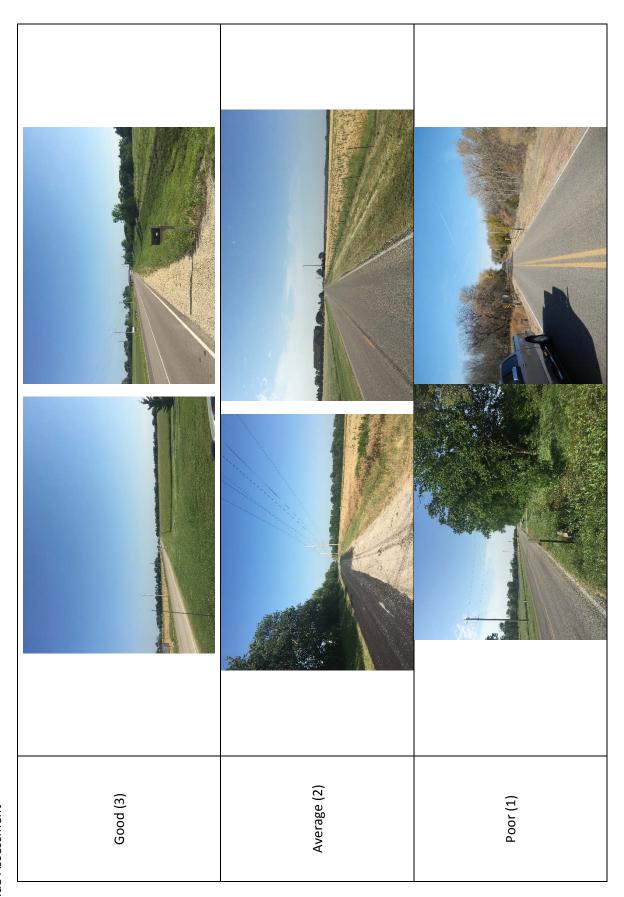
**Edge Condition** 



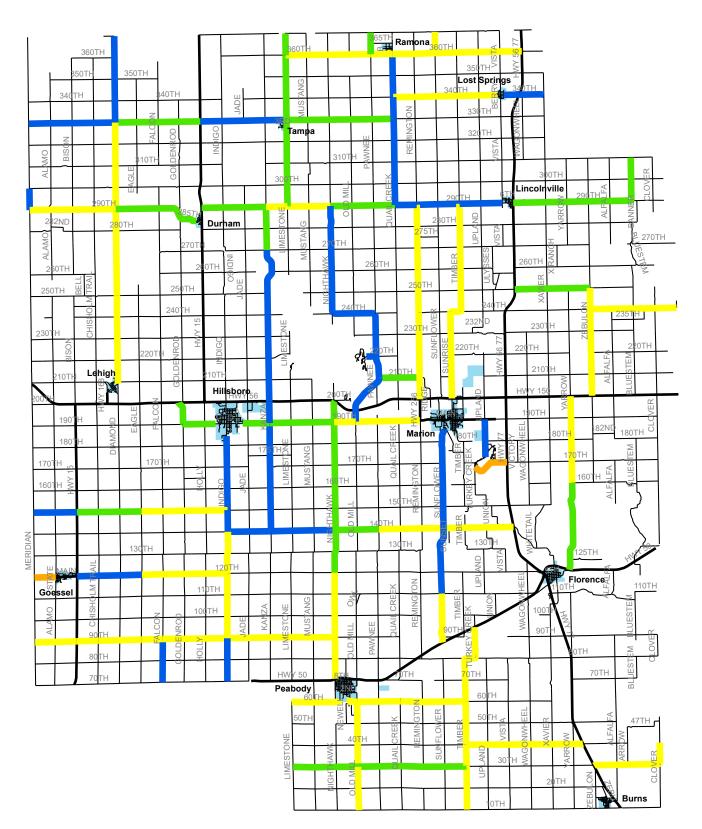
# **Marion County Edge Condition Ratings**

### Legend





Roadside Assessment



### **Marion County Roadside Assessment Ratings**

### Legend











## **APPENDIX F COUNTERMEASURES TECHNICAL MEMORANDUM**

### TECHNICAL MEMORANDUM – COUNTERMEASURES

### 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, 3<sup>rd</sup> Floor West Topeka, Kansas 66603-3745 785-296-3861

### Prepared by:





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### **TECHNICAL MEMORANDUM - COUNTERMEASURES**

**FOR** 

### KDOT LOCAL ROAD SAFETY PLANS (LRSPS) -PHASE 1

**KDOT PROJECT NO: 106 C-4790-02** 

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:

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**TranSystems Corporation** 2400 Pershing Road Suite 400 Kansas City, MO 64108 816-329-8600

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ADT

**RSA** 

SHSP

### Kimley » Horn



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### **LIST OF ACRONYMS**

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

Road Safety Assessment/Audit

Strategic Highway Safety Plan

Average Daily Traffic







### 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). Figure 1 shows the location of the Phase 1 LRSP counties and the Pilot Phase counties.

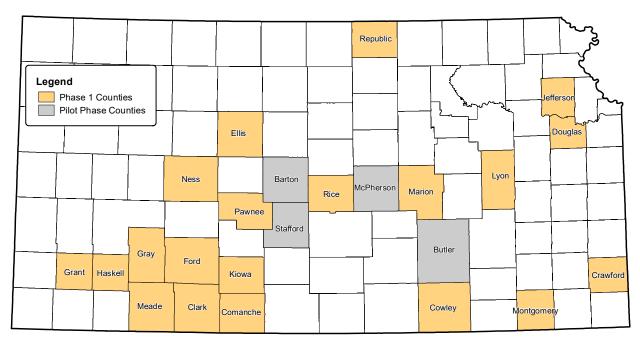


Figure 1 – Location of LRSP Counties

### 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 LRSP Pilot Phase, and 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 technical memorandum and includes a list of the approved LRSP Pilot Phase safety countermeasures.
- Section 3 includes additional countermeasures to be considered as part of Phase 1 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 LRSP Pilot Phase 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** provides a discussion of CMFs and how they are used in predictive crash analysis. The following section 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.

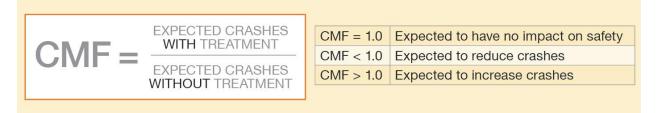


Figure 2 - CMF Calculation

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 a rural site. **Figure 3** is a sample calculation of the CMF method with one CMF being applied to a particular site for a single year.







10.1 crashes / year x 0.91 (CMF) =

9.2 crashes / year: a reduction of 0.9 total crashes per year and a CRF of 9%

### Figure 3 – CMF Method Sample Calculation

A Crash Reduction Factor (CRF) is similar to a CMF but stated in different terms. A CRF is defined as a percentage of crash reduction that might be expected after the implementation of a given countermeasure at a specific site. **Figure 4** shows how a CRF is calculated in relationship to a CMF.

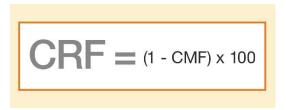


Figure 4 - CRF Calculation

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 (<a href="http://www.cmfclearinghouse.org">http://www.cmfclearinghouse.org</a>).
- 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, due to the amount of data and peer review that is required; however, preliminary studies show safety benefits as result of these countermeasures.







### 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
- Surface type (paved or unpaved)
- Roadway width
- Shoulder width
- Access density

- Presence of pavement markings
- Lane departure crash rate
- Edge condition
- Roadside assessment

### 2.2.2. Approved Segment Countermeasures

**Table 1** lists segment countermeasures approved in the LRSP Pilot Phase, CMFs, and planning-level estimated costs. 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 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 rear-end and run-off-road crashes). The costs included in the table are high-level estimates prepared as part of the LRSP Pilot Phase 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 turning movements, 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 R	Countermeasures where Risk Factor Data for Recommendations has been Collected				
Install/Upgrade Guardrail	0.53 – 0.56 New Guardrail along Embankment	\$35/foot	Х	Х	
Delineate Roadside Hazards with Retroreflective Markers	CMF not defined	\$100/each	Х	Х	
Remove/Relocate Fixed Objects in Clear Zone (e.g. tree, utility pole, culvert headwall, substandard guardrail)	FHWA Proven Countermeasure	\$1,000/each	X	×	
Centerline Rumble Strips	0.55 – 0.91	\$2,000/mile	Х		
Install 4" Retroreflective Centerline	0.76 when installed in combination with edgelines	\$2,100/mile	Х		
Install 6" Retroreflective Edgeline	0.64 - 0.88	\$4,200/mile	Х		
Edgeline Rumble Strips	0.61 – 0.67	\$5,000/mile	Х		
Post-Mounted Delineators	0.55 when installed in combination with edgelines and centerlines	\$5,000/mile	×	Х	
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	CMF not defined	\$5,000/mile	×		
Install 18-inch Aggregate Shoulder Treatment	CMF not defined	\$15,000/mile	Х		
Clear and Grub	0.78	\$30,000/mile	Х	Х	
Flattening and Widening Foreslopes (excludes culvert extension costs)	0.58 – 0.90	\$75,000/mile	х	Х	
2' Paved Shoulder with Safety Edge (includes earthwork)	0.75 – 0.99 "Pave Shoulder" 0.77 – 0.96 "Safety Edge"	\$150,000/mile	Х		
Countermeasures for a Segment that also has Curves					
Retroreflective Strips on Curve Signage	CMF not defined	\$100/curve	Х	Х	
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 – \$3,500/curve	Х	Х	







Safety Countermeasure	Crash Modification Factor (CMF) **	Estimated Cost	Paved	Unpaved
Transverse Rumble Strips Prior to Curve	0.66 Install Transverse Rumble Strips as Traffic Calming Device	\$3,000/curve	×	
Install High Friction Surface Treatment (HFST)	0.48 – 0.76	\$20,000/curve	Х	
Countermeasures for Speci	fic Locations where Addition	al Data/Informat	ion is Ne	eded
On-Pavement Markings for Speed Control	CMF not defined	\$1,000 – \$3,000/each	Х	
Speed Activated Flashers on Chevron Signs	CMF not defined	\$4,000/each	Х	Х
Superelevation Correction on Curves	CMF not defined	\$20,000/curve	Х	Х
Remove/Relocate/Combine Driveways	CMF not defined	\$20,000 – \$40,000/each	Х	Х
Conduct Road Safety Audit/Assessment (RSA) *	CMF varies based on recommendations	\$20,000 – \$40,000/each	Х	Х
Pave Roadway	CMF not defined	\$850,000/mile		X

<sup>\*</sup> Countermeasure recommended on segments with high crash rates

### 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
- Distance from previous stop sign (along the LRSP routes)
- Location on a curve
- Skew
- Sight distance
- Proximity of driveway or another intersection
- Fatal or serious injury crash history
- Intersection control

### 2.3.2. Approved Intersection Countermeasures

Table 2 lists intersection countermeasures approved in the LRSP Pilot Phase, CMFs, and estimated costs. The countermeasures were selected based on the approved risk factors for intersections. Some of the countermeasures will require additional information from the county.

091841008 2019-08-01 KDOT LRSP Tech Memo Countermeasures.docx Page 6

<sup>\*\*</sup> 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.







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 F	Risk Factor Data for Recomme	endations has be	en Colle	ected
Retroreflective Strips on Stop Sign Posts	CMF not defined	\$100/ intersection	Х	X
Install Second Stop Sign and Stop Ahead Signs	CMF not defined	\$1,200/leg	Х	Х
Transverse Rumble Strips on paved, Stop-Controlled Approaches	0.79	\$1,500/leg	Х	
Upgrade Signs and Pavement Markings	0.4 – 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"	\$2,200/leg	X	X (signs only)
Install Beacon on Stop Signs	0.42 - 0.87	\$2,500/sign	Х	Х
Install Stop Signs with LED Flashing Lights	CMF not defined	\$2,500/sign	Х	Х
Install Beacon on Intersection Warning Sign	CMF not defined	\$2,500/sign	Х	Х
Clear and Grub	0.78	\$2,500/leg	Х	X
Intersection Lighting (one luminaire)	0.62	\$5,500/each	Х	Х
Realign Intersection Approaches to Reduce or Eliminate Skew	CMF varies based on original skew angle 0.57 Change from 45 degrees to 90 0.6 Change from 60 degrees to 90 0.67 Change from 75 degrees to 90	\$300,000/ paved leg \$100,000/ unpaved leg	X	X







Safety Countermeasure	Crash Modification Factor (CMF) **	Estimated Cost	Paved	Unpaved
Countermeasures for Speci	fic Locations where Additiona	al Data/Informati	on is Ne	eded *
Removal of Unwarranted Stop Signs on Major Approach	CMF not defined	\$500/leg	Х	Х
Convert Two-Way Stop to All- Way Stop (if MUTCD warrants are met)	0.52 – 1.12	\$1,200/leg	Х	X
Install Intersection Conflict Warning System	0.52 – 0.91	\$40,000/each	Х	Х
Provide Left-Turn Lanes at Intersection	0.42 – 0.52	\$150,000/leg	Х	
Provide Right-Turn Lanes at Intersection	0.74 – 0.92	\$150,000/leg	Х	
Install Traffic Signal (if MUTCD warrants are met)	0.56	\$250,000/ each	Х	
Convert Offset T-Intersection to Four-Legged Intersection	CMF not defined	\$300,000/ each paved \$50,000/each unpaved	X	Х
Convert Stop-Control to Roundabout	0.18 – 0.42	\$1,500,000 – \$2,000,000/ each	Х	

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

### 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.

F-12

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

<sup>\*\*</sup> 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.







### 2.4.2. Approved Curve Countermeasures

**Table 3** lists curve countermeasures approved in the LRSP Pilot Phase, CMFs, and estimated costs. 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, 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 I	Risk Factor Data for Recom	mendations has be	een Colle	cted
Install/Upgrade Guardrail	0.53 – 0.56 New Guardrail along Embankment	\$35/foot	х	Х
Retroreflective Strips on Curve Signage	CMF not defined	\$100/curve	Х	Х
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 — \$3,500/curve	X	X
Centerline Rumble Strips	0.55 – 0.91	\$2,000/mile	Х	
Install 4" Retroreflective Centerline	0.76 when installed in combination with edgelines	\$2,100/mile	х	
Clear and Grub	0.78	\$2,500/curve	Х	Х
Transverse Rumble Strips Prior to Curve	0.66 Install Transverse Rumble Strips as Traffic Calming Device	\$3,000/curve	Х	
Install 6" Retroreflective Edgeline	0.64 - 0.88	\$4,200/mile	X	
Edgeline Rumble Strips	0.61 – 0.67	\$5,000/mile	Х	
Post-Mounted Delineators	0.55 when installed in combination with edgelines and centerlines	\$5,000/mile	х	Х
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	CMF not defined	\$5,000/mile	Х	
Install 18-inch Aggregate Shoulder Treatment	CMF not defined	\$15,000/mile	Х	







Safety Countermeasure	Crash Modification Factor (CMF) *	Estimated Cost	Paved	Unpaved
Install High Friction Surface Treatment (HFST)	0.48 – 0.76	\$20,000/curve	Х	
Pave 2' Outside Shoulder with Safety Edge (includes earthwork)	0.75 – 0.99 "Pave Shoulder" 0.77 – 0.96 "Safety Edge"	\$150,000/mile	Х	
Countermeasures for Spec	ific Locations where Addit	ional Data/Informat	ion is Ne	eded
On-Pavement Markings for Speed Control	CMF not defined	\$1,000 – \$3,000/each	Х	
Speed Activated Flashers on Chevron Signs	CMF not defined	\$4,000/each	Х	Х
Superelevation Correction on Curves	CMF not defined	\$20,000/curve	Х	Х

<sup>\*</sup> 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

With continuing research in transportation safety, it is necessary to review national best practices and recommended safety countermeasures. The following sections include additional safety countermeasures for KDOT and the Phase 1 counties to consider including recommendations where site location data/information would be needed.

While some of the previously noted countermeasures can be applied to unpaved roadways, there are additional countermeasures that could be considered specific to unpaved roadways. 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.

Table 4, Table 5, and Table 6 have two columns indicating the applicability of each countermeasure to paved or unpaved roadways, or both.







### 3.1. **Segments**

**Table 4 – Additional Segment Countermeasures** 

Safety Countermeasure	Crash Modification Factor (CMF) *	Estimated Cost	Paved	Unpaved
Install Guardrail Reflectors	CMF not defined	< \$1/foot (negligible)	Х	Х
Reshape/Repair Roadway Surface and Apply Dust Suppressants	CMF not defined	\$1,000 — \$5,000/mile		X
Install a Dynamic Speed Feedback Sign	0.93 – 0.95	\$4,000/sign	Х	Х
Upgrade Roadway Surface (e.g., millings, well-graded rock mix with adequate binder)	CMF not defined	\$8,000/mile		Х
Improve/Increase Roadway Width (to meet standards)	CMF not defined	\$20,000 – \$30,000/mile	Х	Х

<sup>\*</sup> 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.

### 3.2. Intersections

Table 5 - Additional Intersection Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF) *	Estimated Cost	Paved	Unpaved
Install Raised Pavement Markers (150'-300' on Intersection Approach)	0.87	\$500/leg	×	
Reshape Intersection for Control Type	CMF not defined	\$2,500/each		Х
Install a Dynamic Speed Feedback Sign on Intersection Warning Sign	0.93 – 0.95	\$4,000/sign	×	Х
Provide Bypass Lane on Shoulder at T-intersection	CMF not defined	\$50,000/each	Х	
Install a Restricted Crossing U-Turn (RCUT) Intersection	0.46 - 0.65	\$250,000/each	×	

<sup>\*</sup> 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.







### 3.3. Curves

Table 6 - Additional Curve Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF) *	Estimated Cost	Paved	Unpaved
Install In-Lane Curve Warning Pavement Markings	0.62	\$1,000/each	Х	
Install Guardrail Reflectors	CMF not defined	\$100/curve	Х	Х
Install Raised Pavement Markers (150'-300' in advance of and along curve)	0.87	\$1,000/curve	х	
Install a Dynamic Speed Feedback Sign on Curve Warning Sign	0.93 – 0.95	\$4,000/sign	х	Х
Reshape/Repair Roadway Surface and Apply Dust Suppressants	CMF not defined	\$1,000 — \$5,000/mile		Х

<sup>\*</sup> 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.

### 3.4. Unpaved Roadways

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: <a href="https://www.fhwa.dot.gov/construction/pubs/ots15002.pdf">https://www.fhwa.dot.gov/construction/pubs/ots15002.pdf</a>. 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.



### Kimley » Horn



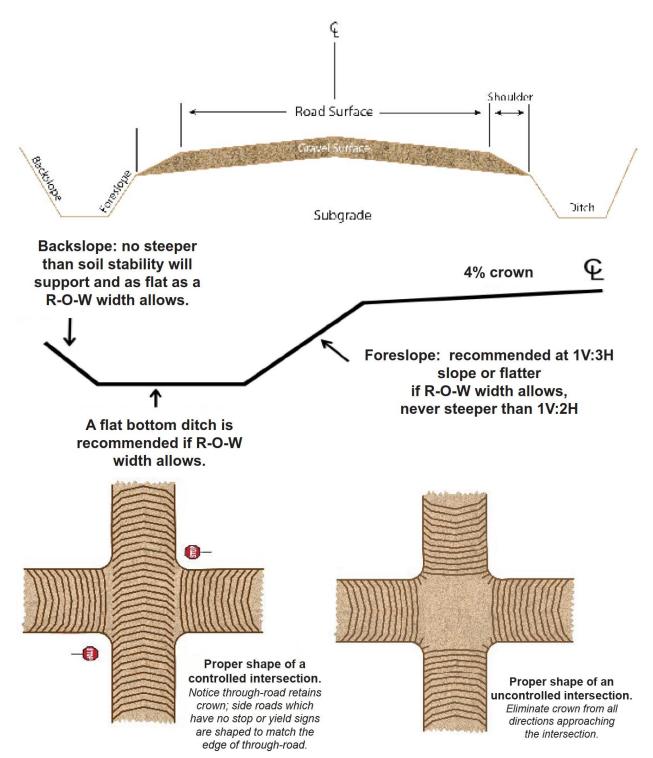


Figure 5 – Unpaved Roadway Proper Shape Guidance (Gravel Roads Construction & Maintenance Guide, FHWA, 2015)







### 4. **NEXT STEPS**

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

After the workshops are conducted, a systemic analysis will be conducted for the Phase 1 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**

2400 Pershing Road Suite 400 Kansas City, MO 64108 T 816-329-8600 F 816-329-8601

www.transystems.com

ATTENDEE	Brice Goebel (Marion County)
	Jim Stanek (TranSystems)
	David Church (WSP)
	Terry Coder (WSP)
	See Attached Attendance Sheet for
	additional attendees

DATE:	November 1, 2019		
FROM:	Jim Stanek		
JOB NAME:	KDOT Local Road Safety Plans		
JOB NO:	P101160157		
RE:	Marion County LRSP		
	Safety Workshop		

CC:	Meeting attendees			

### **MINUTES:**

The Marion County Local Road Safety Plan (LRSP) Safety Workshop was held at the Marion City Building (208 East Santa Fe, Marion, KS) on August 14, 2019, from approximately 9:00 to 11:20 a.m. TranSystems provided a PowerPoint presentation, presentation handout and maps of the 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:

### **General Items**

- I. Jim noted that LRSPs are being championed by KDOT. KDOT contacts within the Bureau of Local Projects are Bill Legge and Nelda Buckley.
- 2. As part of the 5E's of Safety discussion, the S.A.F.E. Program (Seatbelts Are For Everyone) was discussed. An attendee, Matt Voth with Marion County Fire District #2, requested that we send him information about that program. This was completed by David Church as a follow-up to the meeting.

### **LRSP Routes**

Participants were given approximately 15 minutes to review the supplied county map and give feedback on specific locations of concern. Below are the specific locations mentioned or discussed:

- 1. Nighthawk and 190th: The intersection is a major concern because drivers on Nighthawk often run through the stop signs. The county has attempted to reduce the stop sign violations by placing flashing beacons on the signs; however, the issue is still occurring. It was noted that 190th (Old 56) carries the highest traffic volumes along the county's roads.
- 2. 90th at Chisholm Trail: A concern was expressed about the transition between paved and unpaved surfaces along 90th at this intersection. Drivers can lose control transitioning from the paved to the unpaved surface.
- 3. Diamond at 370th: This has the same concern as noted for 90th at Chisholm Trail. Diamond is paved in Dickinson County and is unpaved in Marion County.
- 4. 90th and Falcon: Trees and other obstructions reduce the sight lines at this intersection.
- 5. Nighthawk and US-50 (on west side of Peabody): The intersection was noted as a concern even though this is on KDOT's system and not part of the LRSP project. The county is working with KDOT to address sight line concerns, high vehicle speeds and a pattern of crashes involving southbound and westbound traffic.
- 6. Kanza Road between 240th and 270th: This segment of road goes over the Marion Reservoir and has a winding horizontal alignment. Concerns along the segment include the existing curves, guardrail and foliage which can impact driver sight lines. Obstructions associated with guardrail were considered of most concern.
- 7. Ist/360th and D Streets near Quail Creek Road (in Ramona): The county road crosses the railroad tracks on a winding horizontal alignment. When drivers are travelling westbound, they are immediately met with a three-leg intersection (D Street) which has a large channelizing island. The curve impacts sight lines for drivers on D Street.
- 8. 290th (Main Street) at US-56/77 in Lincolnville: The intersection was noted as a concern even though this is on KDOT's system and not part of the LRSP project. There are sight line concerns for east/west traffic attempting to enter or cross the highway.
- 9. Railroad crossing on K-15 (in Durham): The location was noted as a concern even though this is on KDOT's system and not part of the LRSP project. Participants expressed a concern about the timing of the gate arm descent prior to the arrival of a train. A number of school bus drivers have noted having difficulty stopping in time and would like the gate arms to drop sooner.
- 10. Pawnee and 210th: The intersection has some unusual geometry and signage that confuses drivers. When stopping northbound, drivers have an option to turn right onto a gravel road or follow the curve left on the paved road towards the Marion Reservoir. Realignment options have been considered as a potential improvement for this intersection.
- 11. Sunflower and 180th: Participants noted concerns with sight distance due to crops and trees near the intersection.
- 12. Old Mill Road between 50th and 60th: There is a narrow box/bridge on this segment.
- 13. 290th between Mustang and Nighthawk: There is a narrow box/bridge on this segment.
- 14. Kent Becker, Marion County Commissioner, noted that farmers are growing more corn and there is a lot of agricultural encroachment onto the right of way, particularly at intersection corners, which impacts sight lines. The county would like to reclaim some of the right of way to increase sight distance for drivers. They have policies in place, but these lack "teeth". Matt Voth (also a farmer) mentioned that this can be an education issue for the farmers. Randy West mentioned that different counties are working on preserving the right of way due to similar sight distance issues.

The participants were encouraged to notify Jim Stanek (TranSystems) or Brice Goebel (Marion County) about other locations of concern, if they identified any others after the meeting.

### Crash Data

Some items noted in the discussion of the crash data:

1. Findings for Marion County are excluded to crashes along the LRSP routes rather than all county roads.

- 2. The Crash Location Heat map (Exhibit 3D) has been included to show the 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".
- 3. A list of high crash locations will be developed as part of the project and provided to Brice Goebel for the County's use.
- 4. There was a discussion about drivers under the influence of drugs and how that can affect their behavior. Randy West noted that he attended a safety meeting with law enforcement and they explained that drivers under the influence have trouble seeing certain colors (e.g., red and blue). This can lead to frequent stop sign violations by these drivers.
- 5. Kent Becker mentioned that a number of run-off-road crashes are likely due to texting; however, it is difficult to determine without a driver's statement.

### **Potential Safety Countermeasures**

Countermeasures for the LRSP segments, intersections and curves were identified. Participants were given approximately 15 minutes to review these and give feedback on specific countermeasures that are either of interest or concern. The feedback received and subsequent discussion is summarized below:

- 1. Comments on edgeline and centerline rumble strips were generally less favorable, primarily due to the potential for pavement damage. Brice noted he has heard/seen many drivers hitting these types of rumble strips for long periods of time which is surprising.
- 2. Overall, the county liked the idea of clearing and grubbing given the concerns expressed with agricultural and foliage encroachment onto the right of way. Marion County passed an ordinance recently to establish guidelines to address agricultural encroachment. Even so, it can be difficult to monitor and regulate the landowners cleaning up their land that borders county roads. The recent flooding and rain has worsened conditions, and the county generally doesn't have the resources to fix concerns in a timely manner.
- 3. Removing or relocating fixed objects was considered a positive treatment. This could include some of the larger and more decorative rock/stone mailboxes along some of their roads, although there was some uncertainty regarding who has the authority to coordinate the removal or relocation with the property owner. An alternate treatment could be the use of retroreflective markers or strips so drivers can see them better at night.
- 4. An aggregate shoulder treatment could be useful, but only where there is some mild shoulder available. The county generally doesn't have much useful shoulders along their roads. Even their busiest stretch of road, 190th (Old 56), doesn't have much shoulder width.
- 5. While the paved shoulder with safety edge treatment was considered positive, it would likely not be very practical for them since they tend to use rock patching and/or cold mix asphalt when patching the roadway. Hot mix asphalt is too expensive to use.
- 6. Use of 6-inch edge lines may be beneficial for the county because there are limited locations with shoulders. This was considered a positive treatment for keeping more drivers on the road.
- 7. Intersection lighting was considered positive.
- 8. Transverse rumble strips on stop-controlled approaches was considered a positive treatment, but not likely feasible for the county given their typical pavements (chip seal or cold mix asphalt). Milled in rumble strips work best for more long-term use. Joe Palic noted that KDOT's practice is to use 3/8-inch depth for these. Again, this is likely not practical for many of the county's roads.
- 9. There was positive feedback about adding flags, beacons, LEDs or even strobe lights to signs to potentially alert drivers. The participants also noted they liked the idea of speed monitor message boards in select areas known for higher vehicle speeds.
- 10. The use of warning signs and possibly delineators along curves were considered positive treatments. The county noted that they follow MUTCD standards regarding signing for their curves, even though they generally don't have that many curves.

### **Conclusion**

As part of the Next Steps discussion, Jim explained how Marion County can benefit from their LRSP by using information in the report to apply for safety improvement funds (HRRR funding) through KDOT for safety improvements at their top safety project locations. Earlier in the presentation it was noted that by having a completed LRSP, a county will get extra points added to their application score. Previous KDOT guidance has indicated that the funds need to be used for a systemic improvement rather than a maintenance project.

Reports from the four LRSP Pilot counties were available for the participants to review. Jim noted that three of the four counties were able to obtain High Risk Rural Road (HRRR) funding for improvement projects by using the information provided within their report.

The participants were encouraged to contact Jim Stanek (TranSystems) or Brice Goebel (Marion County) if they have any additional comments about the information that was presented. Brice also asked the Fire Department and School District to talk with their staff about the LRSP and get their feedback to Jim Stanek.

The meeting concluded at approximately 11:20 a.m.

### Tran Systems

LRSP Workshop - Marion County Marion City Building 208 East Santa Fe, Marion, KS 66861

EXPERIENCE | Transportation

Date

100	Date:	8/14/2019			
#	First	Name Last	Agency	Phone Number	E-Mail
-	James	Stanek	TranSystems	816-329-8632	jjstanek@transystems.com
2	DAVID	Church	WSP	785-633-4285	churche wsp. com
3	Terry	Coder	WSP	785 478-6031	terry.coder QWSP. com
4	Desse	Hann	Marion Co. RAB	620-381-4485	hammanarioncoks, 1et
5	Math	Voth	Mon FO#2	620 747 2245	
6	Brice	Gerbel	MN CO R+B	620-381-0661	bgoebel@morroncoks.net
7	Joe	Palic	KDOT	620-382-3717	ice, Police Ks.gov
8	Randy	West	KDOT	785-823-3754	
9	Kaven	Gassen	USD#410	620-877-0502	
10	Nanette	Forsberg	USD#397	785-466-6262	transportation@459397
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Marion County Local Road Safety Plan (LRSP)

Safety Workshop

Wednesday, August 14, 2019

Department of Transportation

ansas

9:00 AM - 12:00 PM

Marion City Building 208 East Santa Fe

Marion, KS 66861

MARION COUNTY ROAD & BRIDGE DEPT.



Kimley » Horn

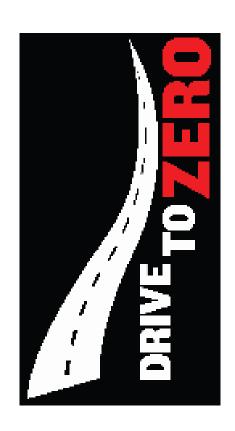




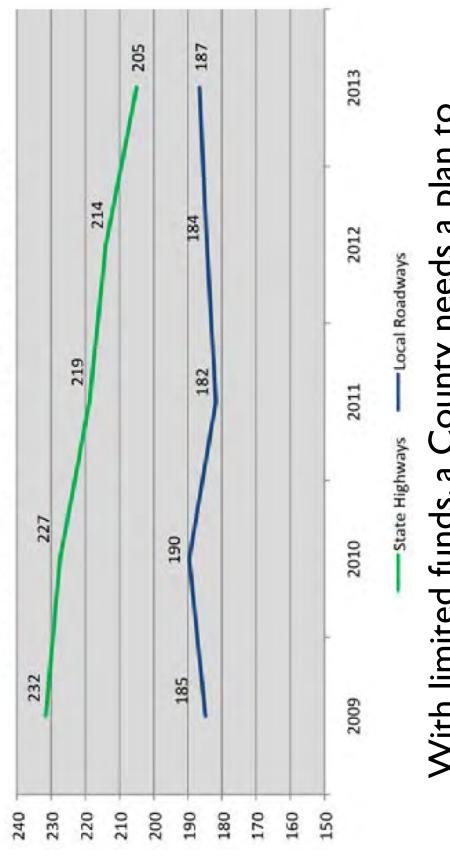
### Agenda

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

- 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



Five Year Average Fatalities by System (2009-2013)



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

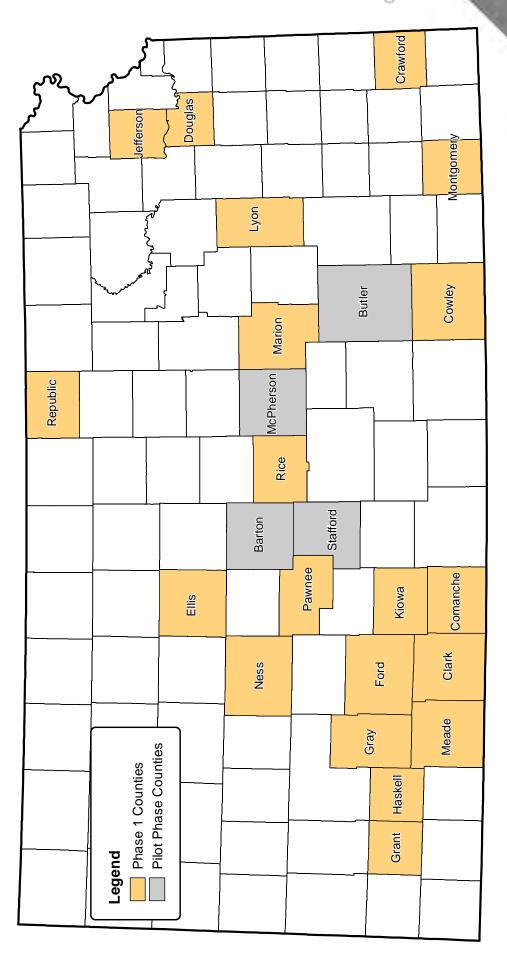
- Identify locations where systemic safety improvements can be implemented
- Proactive approach with a broader view of risk
- Less reliant on "hot spot" analysis

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

funds through High Risk Rural Roads (HRRR) Program Advantageous for the County in securing future safety

Safety Plan **Local Road Document** Develop Identify **Projects** Safety Countermeasures **Develop Safety** Strategies Data Collection **Crash Analysis** 

Monthly Conference Calls and Safety Workshop

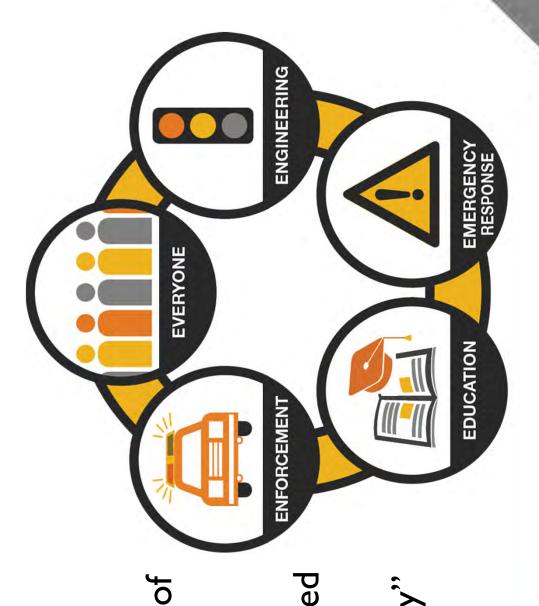


### 5E's of Safety

"Driver" factorscited in anestimated 94% ofcrashes

Multidisciplinary approach is needed

Perpetuate a "Culture of Safety"











### Your LRSP Routes

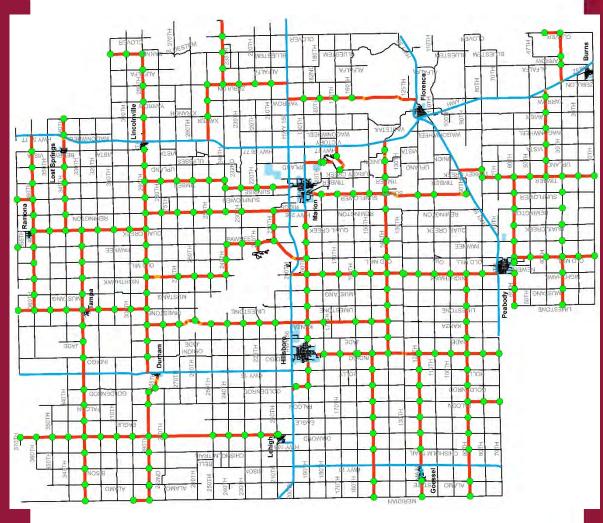


segments - Paved: 170 miles (58%)

Unpaved:125 miles (42%)

272 intersections

52 curves



### Your LRSP Routes

Workshop Feedback Opportunity:

Where are your specific locations of concern?

Segments

Intersections

– Curves

#### Overview of Crash Data

Five years of data reviewed (reported crashes only)

Pilot Phase: 2011 – 2015

- Phase 1: 2013 - 2017

KABCO Injury Severity Scale (National Safety

Council, 1990)

K, killed

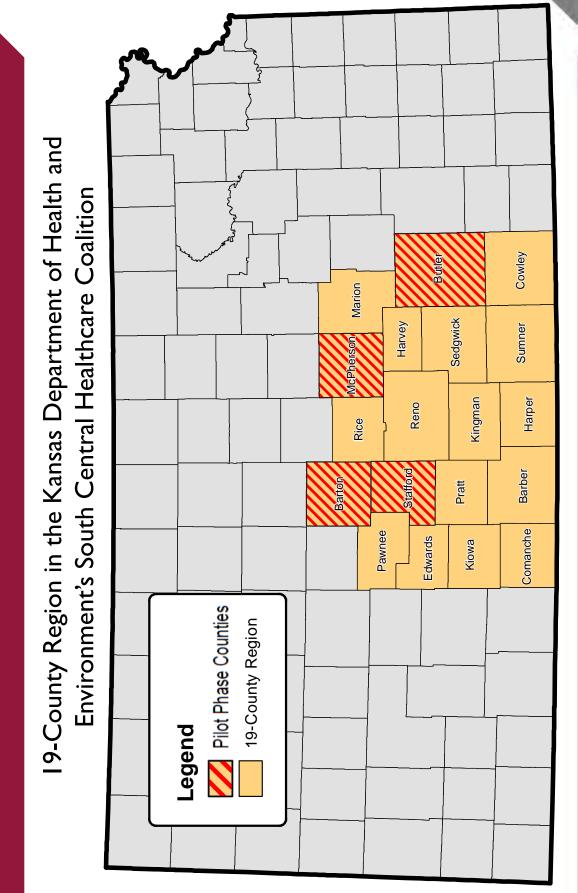
- A, disabling injury

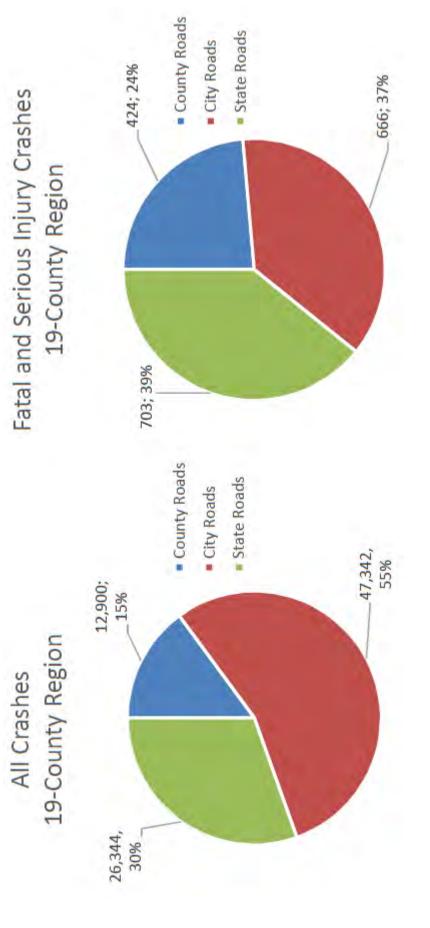
- B, evident injury

- C, possible injury

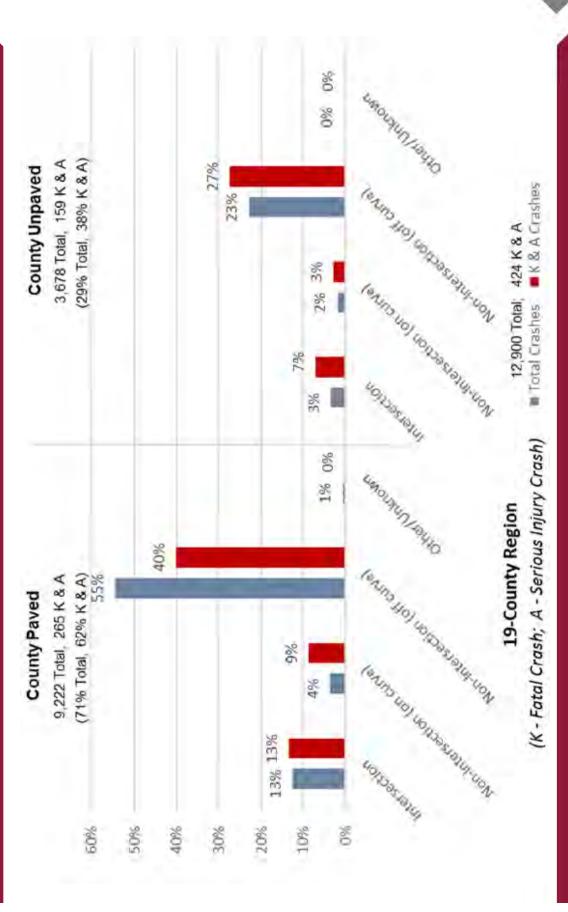
O, no apparent injury

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



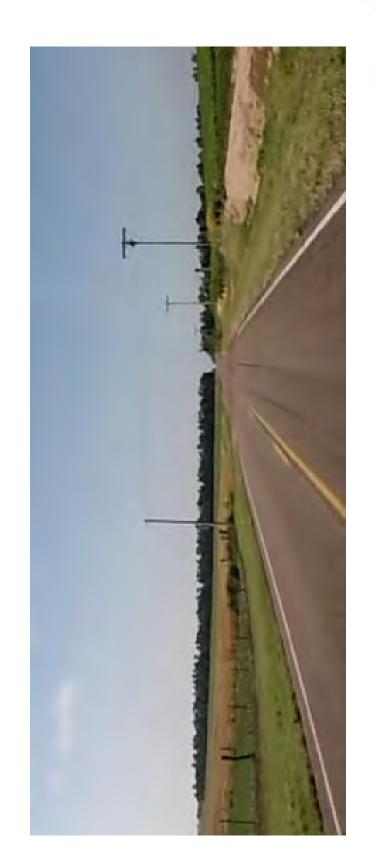


Crashes within the 19-County South Central Healthcare Coalition (2011-2015) 1,793 resulted in a fatal or serious injury 86,586 total crashes



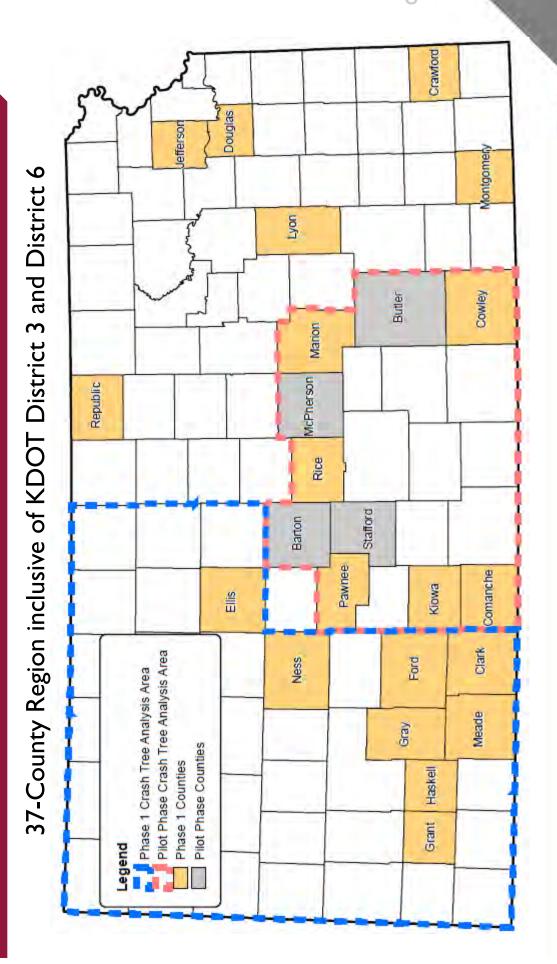
Crashes on straight roadway segments (paved or unpaved) are most common:

- 78% of all crashes, with 67% of the K+A crashes

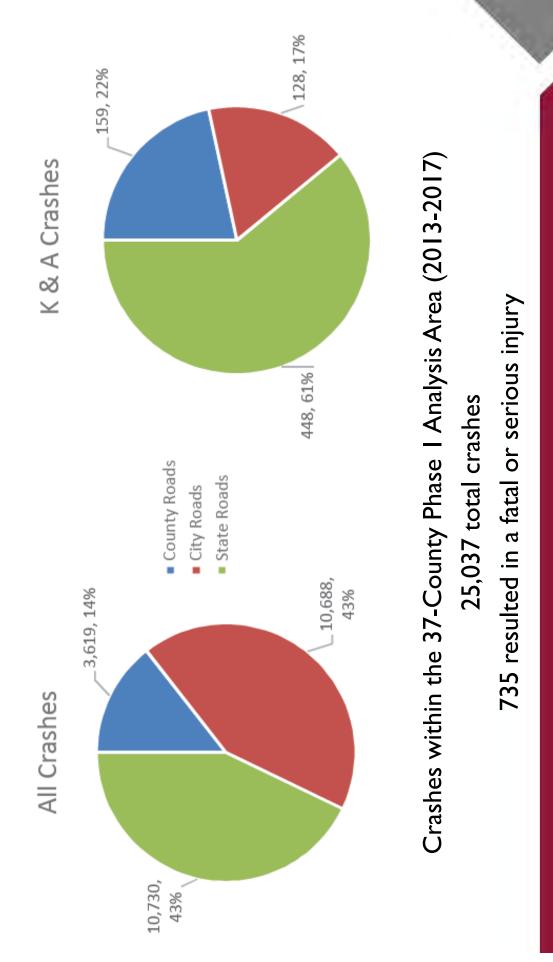


- Crashes on straight roadway segments:
- Many involved running off road (right or left), animal collisions (hitting or swerving to avoid), or crossing
- Many coded as "non-collision" meaning the vehicle did not collide with another vehicle or object
- Crashes at intersections were primarily angle or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

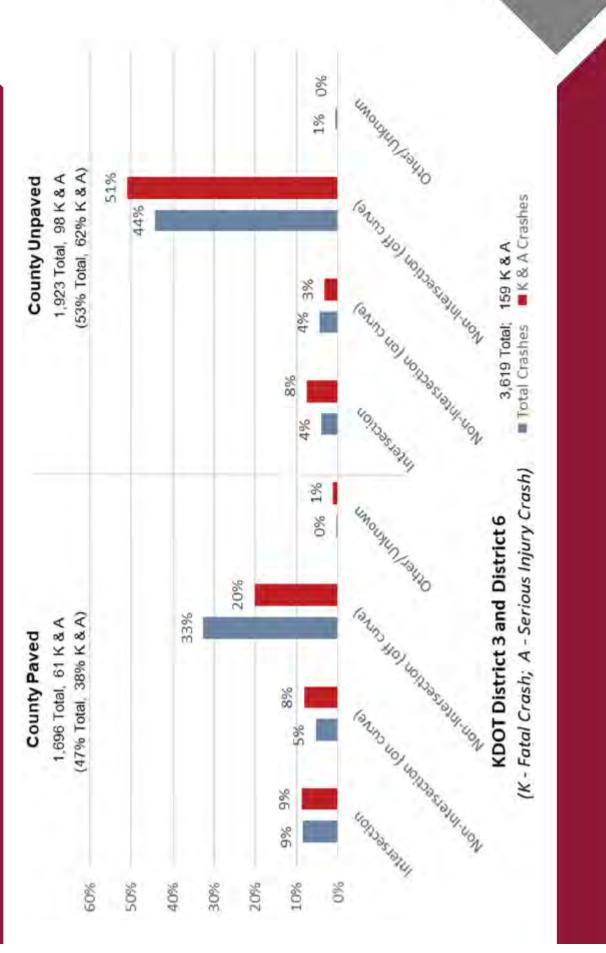
#### Crash Data: LRSP Phase I



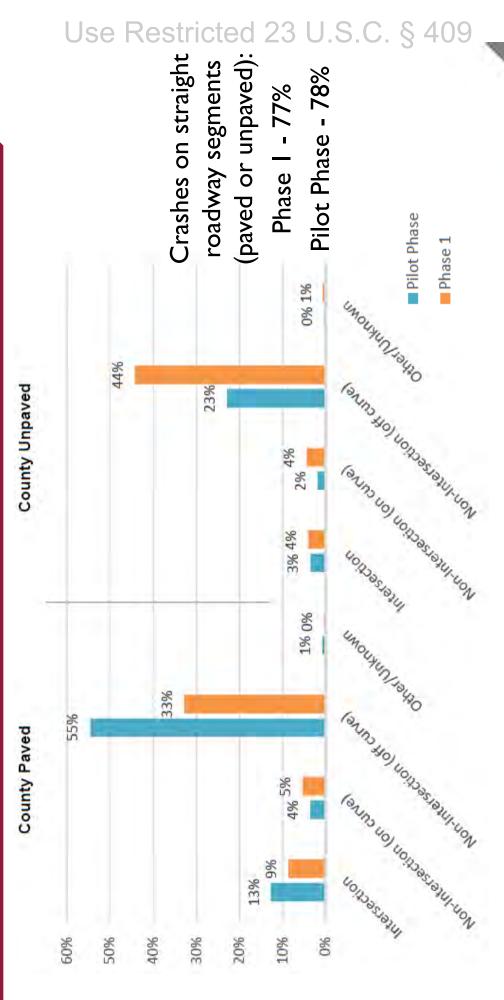
#### Crash Data: LRSP Phase



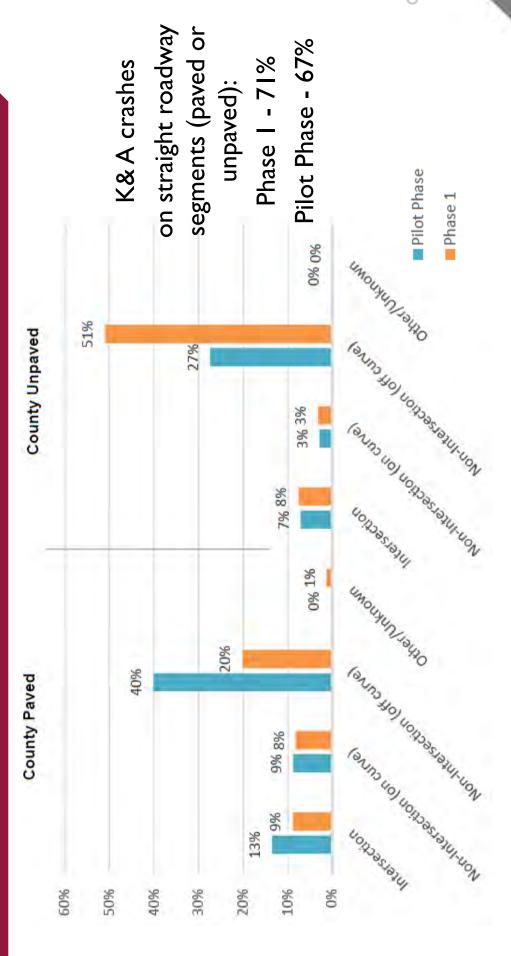
#### Crash Data: LRSP Phase I



## Crash Data: Phase I vs. Pilot Phase

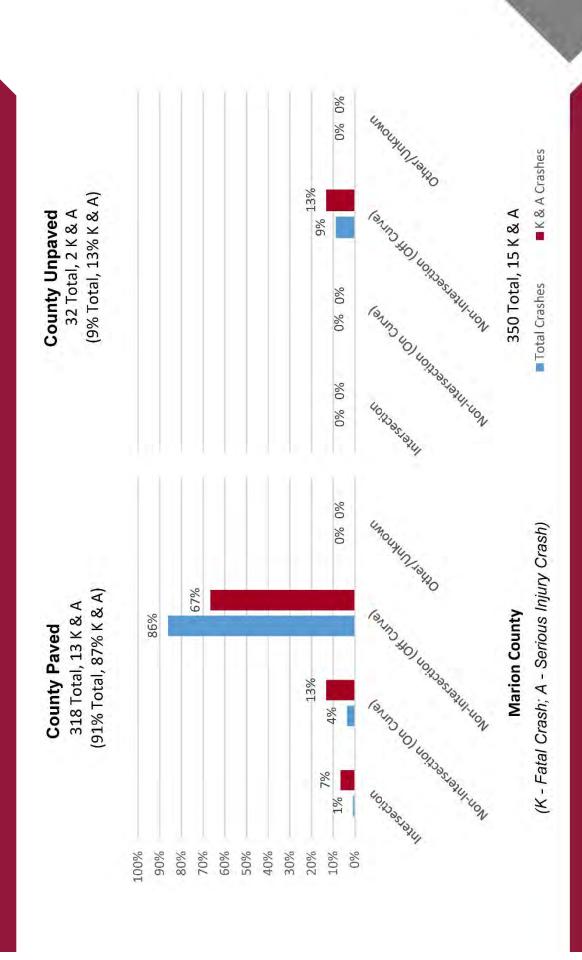


## Crash Data: Phase I vs. Pilot Phase



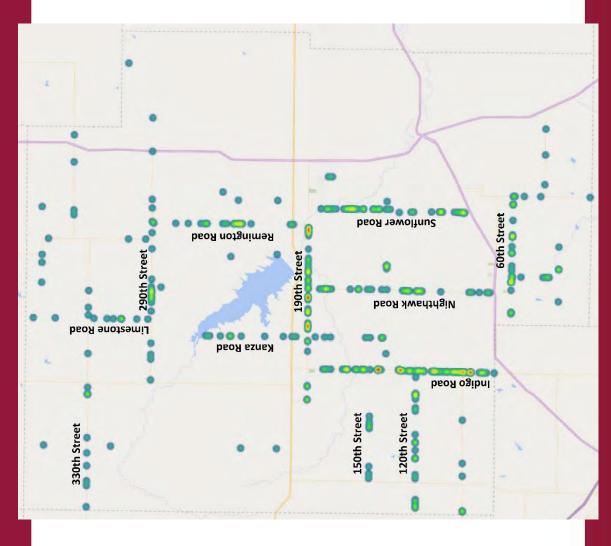
K&A Crashes by Roadway Type (Phase I and Pilot Phase)

#### Crash Data: Your LRSP Routes



#### Crash Data: Your LRSP Routes

Crash Location Heat Map Total Crashes



# 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

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 Runn	Running the intersection, sight visibility
Proximity of driveway or another intersection Confli	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
- potential systemic safety improvements, if available Examine the Crash Modification Factor (CMF) of
- The CMF Method is found in Part D of the Highway Safety Manual (HSM)



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

# Potential Segment Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost Paved		Unpaved
Install 6" Retroreflective Edgeline	0.64 - 0.88	\$4,200/mile	X	
Install 4" Retroreflective Centerline	0.76 when installed in combination with edgelines	\$2,100/mile	X	
Edgeline Rumble Strips	0.61 - 0.67	\$5,000/mile	X	
Centerline Rumble Strips	0.55 - 0.91	\$2,000/mile	X	
Install a Dynamic Speed Feedback Sign	0.93 - 0.95	\$4,000/sign	×	×

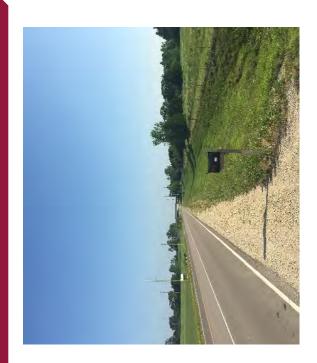
#### Ranges indicate potential crash modification results based on:

- differing research
- crash types
- volume levels

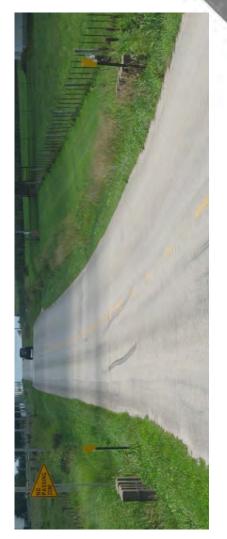


# Potential Segment Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Delineate Roadside Hazards with Retroreflective Markers	CMF not defined	\$100/each	X	×
Remove/Relocate Fixed Objects in Clear Zone (e.g. tree, utility pole, culvert headwall, substandard guardrail)	FHWA Proven Countermeasure	\$1,000/each	×	×
Post-Mounted Delineators	0.55 when installed in combination with edgelines and centerlines	\$5,000/mile	×	×
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	CMF not defined	\$5,000/mile	×	
Reshape/Repair Roadway Surface and Apply Dust Suppressants	CMF not defined	\$1,000 – \$5,000/mile		×
Upgrade Roadway Surface (e.g., millings, well-graded rock mix with adequate binder)	CMF not defined	\$8,000/mile		×
Install 18-inch Aggregate Shoulder Treatment	CMF not defined	\$15,000/mile	×	
Clear and Grub	0.78	\$30,000/mile	×	×









# Potential Segment Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Improve/Increase Roadway Width (to meet standards)	CMF not defined	\$20,000 – \$30,000/mile	×	×
Install/Upgrade Guardrail	0.53 – 0.56 New Guardrail along Embankment	\$35/foot	×	×
Install Guardrail Reflectors	CMF not defined	< \$1/foot (negligible)	X	×
Flattening and Widening Foreslopes (excludes culvert extension costs)	0.58 – 0.90	\$75,000/mile	×	×
2' Paved Shoulder with Safety Edge (includes earthwork)	0.75 – 0.99 "Pave Shoulder" 0.77 – 0.96 "Safety Edge"	\$150,000/mile	×	
Remove/Relocate/Combine Driveways	CMF not defined	\$20,000 – \$40,000/each	×	×
Conduct Road Safety Audit/Assessment (RSA) *	CMF varies based on recommendations	\$20,000 – \$40,000/each	X	×
Pave Roadway	CMF not defined	\$850,000/mile		×

<sup>\*</sup> Countermeasure recommended on segments with high crash rates



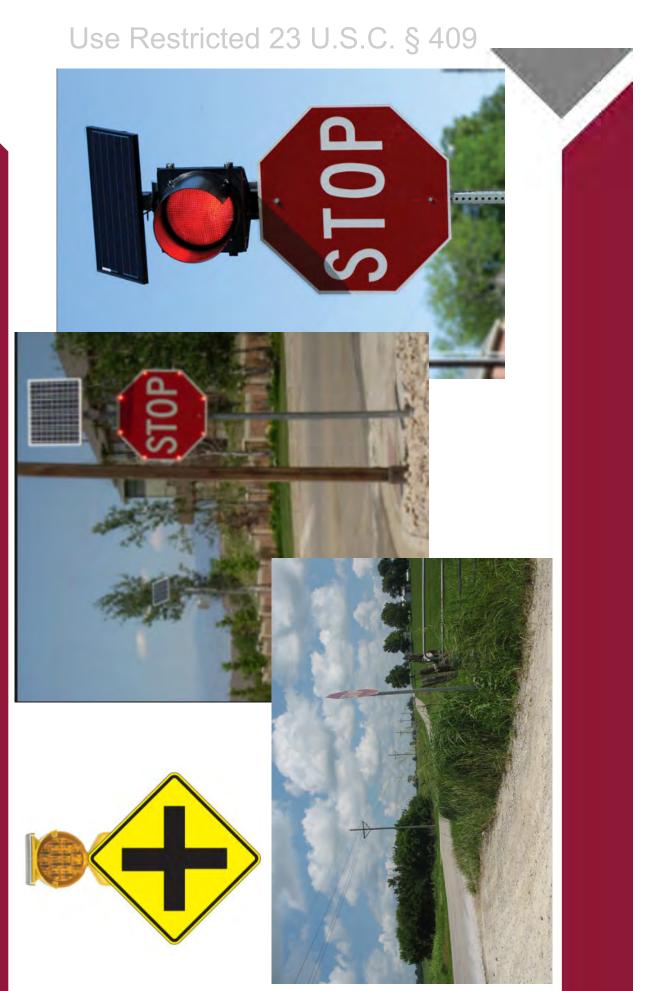
# Potential Intersection Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Intersection Lighting (one luminaire)	0.62	\$5,500/each	X	X
Upgrade Signs and Pavement Markings	0.4 – 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"	\$2,200/leg	×	X (signs only)
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	×	
Install Second Stop Sign and Stop Ahead Signs	CMF not defined	\$1,200/leg	X	×
Transverse Rumble Strips on paved, Stop-Controlled Approaches	0.79	\$1,500/leg	×	



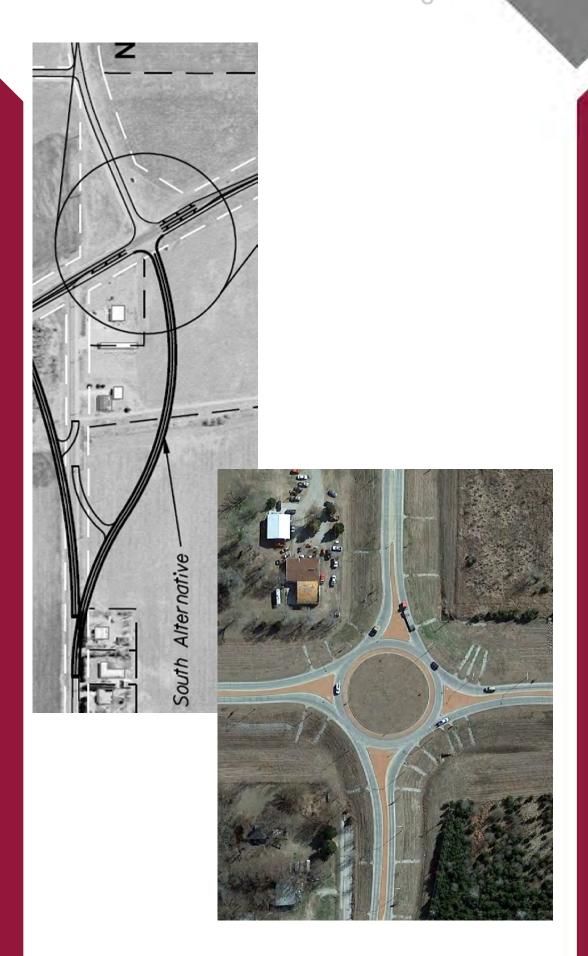
# Potential Intersection Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Install Beacon on Stop Signs	0.42 – 0.87	\$2,500/sign	X	×
Install Stop Signs with LED Flashing Lights	CMF not defined	\$2,500/sign	X	×
Install Beacon on Intersection Warning Sign	CMF not defined	\$2,500/sign	X	×
Install a Dynamic Speed Feedback Sign on Intersection Warning Sign	0.93 – 0.95	\$4,000/sign	X	×
Clear and Grub	0.78	\$2,500/leg	×	×
Reshape Intersection for Control Type	CMF not defined	\$2,500/each		×
Realign Intersection Approaches to Reduce or Eliminate Skew	CMF varies based on original skew angle 0.57 Change from 45 degrees to 90 0.6 Change from 60 degrees to 90 0.67 Change from 75 degrees to 90	\$300,000/ paved leg \$100,000/ unpaved leg	×	×



# 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	×
Convert Two-Way Stop to All-Way Stop (if MUTCD warrants are met)	0.52 – 1.12	\$1,200/leg	×	×
Install Intersection Conflict Warning System	0.52 - 0.91	\$40,000/each	×	×
Provide Bypass Lane on Shoulder at T-intersection	CMF not defined	\$50,000/each	×	
Provide Left-Turn Lanes at Intersection	0.42 – 0.52	\$150,000/leg	X	
Provide Right-Turn Lanes at Intersection	0.74 – 0.92	\$150,000/leg	×	
Install Traffic Signal (if MUTCD warrants are met)	0.56	\$250,000/ each	X	
Install a Restricted Crossing U-Turn (RCUT) Intersection	0.46 – 0.65	\$250,000/ each	×	
Convert Offset T-Intersection to Four-Legged Intersection	CMF not defined	\$300,000/ each paved \$50,000/ each unpaved	×	×
Convert Stop-Control to Roundabout	0.18 – 0.42	\$1,500,000 – \$2,000,000/ each	×	
* An Intersection Control Evaluation (ICE) is recommended for intersection control changes (estimated cost of \$7 500 – \$20 000/each)	nded for infersection control change	S to tsop patential set	7 500 - 52	(42e9/000 0

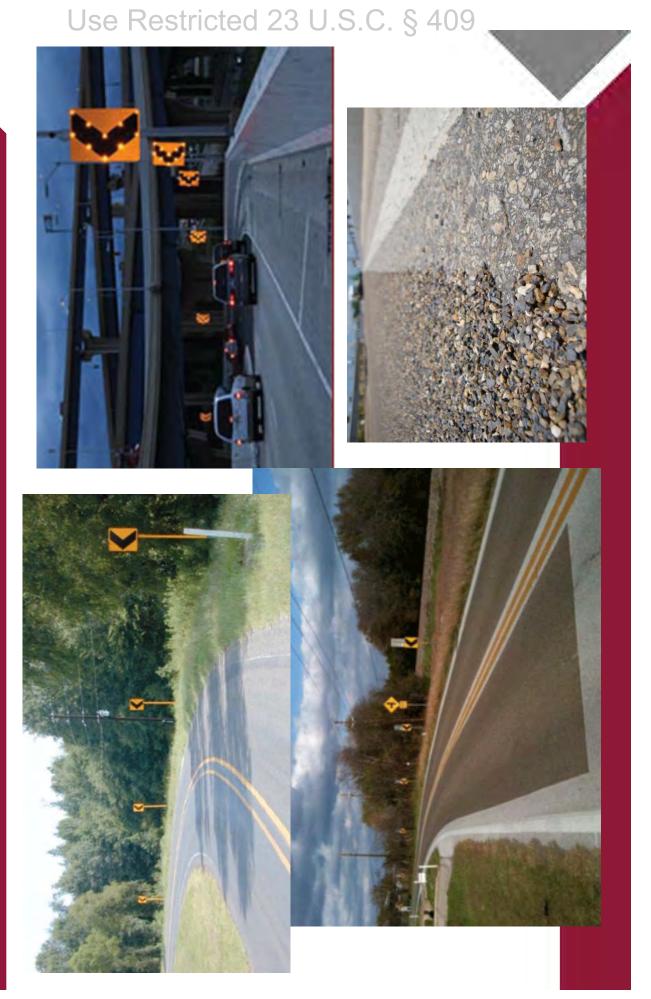


### Potential Curve Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Install 6" Retroreflective Edgeline	0.64 - 0.88	\$4,200/mile	×	
Install 4" Retroreflective Centerline	0.76 when installed in combination with edgelines	\$2,100/mile	X	
Install In-Lane Curve Warning Pavement Markings	0.62	\$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 – \$3,500/curve	×	×
Retroreflective Strips on Curve Signage	CMF not defined	\$100/curve	X	×
Install a Dynamic Speed Feedback Sign on Curve Warning Sign	0.93 - 0.95	\$4,000/sign	X	×
Edgeline Rumble Strips	0.61 – 0.67	\$5,000/mile	X	
Centerline Rumble Strips	0.55 - 0.91	\$2,000/mile	X	
Post-Mounted Delineators	0.55 when installed in combination with edgelines and centerlines	\$5,000/mile	×	×

### Potential Curve Countermeasures

Safety Countermeasure	Crash Modification Factor (CMF)	Estimated Cost	Paved	Unpaved
Clear and Grub	0.78	\$2,500/curve	×	×
Transverse Rumble Strips Prior to Curve	0.66 Install Transverse Rumble Strips as Traffic Calming Device	\$3,000/curve	X	
Install/Upgrade Guardrail	0.53 – 0.56 New Guardrail along Embankment	\$35/foot	×	×
Install Guardrail Reflectors	CMF not defined	\$100/curve	X	X
Install High Friction Surface Treatment (HFST)	0.48 – 0.76	\$20,000/curve	X	
Pave 2' Outside Shoulder with Safety Edge (includes earthwork)	0.75 – 0.99 "Pave Shoulder" 0.77 – 0.96 "Safety Edge"	\$150,000/mile	×	
Reshape/Repair Roadway Surface and Apply Dust Suppressants	CMF not defined	\$1,000 – \$5,000/mile		×
On-Pavement Markings for Speed Control	CMF not defined	\$1,000 – \$3,000/each	X	
Speed Activated Flashers on Chevron Signs	CMF not defined	\$4,000/each	X	×
Superelevation Correction on Curves	CMF not defined	\$20,000/curve	×	×



## 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









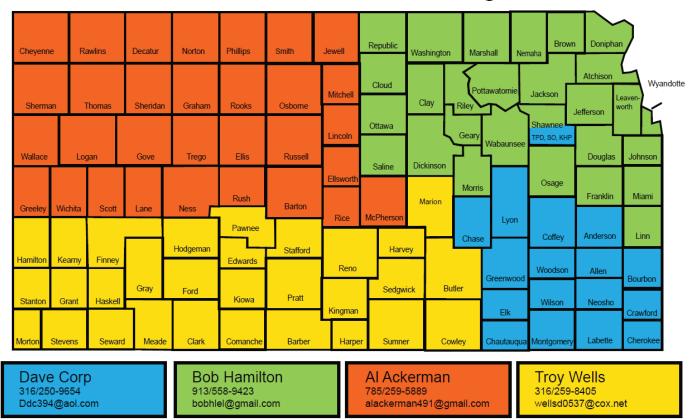
# **APPENDIX H SAFETY RESOURCES**

# Safety Resources

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

KDOT's Law Enforcement Liaison Program Page <a href="https://www.ksdot.org/bureaus/burTrafficSaf/lel/lawEnL.asp">https://www.ksdot.org/bureaus/burTrafficSaf/lel/lawEnL.asp</a>

# Law Enforcement Liaison Regions



Kansas Traffic Safety Resource Office <a href="https://www.ktsro.org/">https://www.ktsro.org/</a>

Vision Zero Webpage <a href="http://visionzeronetwork.org/">http://visionzeronetwork.org/</a>

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

Kansas DUI Impact Center https://ksdui.org KDOT Crash Record Request https://kdotapp.ksdot.org/CrashRecords/AcceptTerms.aspx

ITE Vision Zero Page <a href="http://www.ite.org/visionzero/">http://www.ite.org/visionzero/</a>

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

MADD State Statistics <a href="https://www.madd.org/state-statistics">https://www.madd.org/state-statistics</a>









# **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 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, 3<sup>rd</sup> Floor West Topeka, Kansas 66603-3745 785-296-3861

# Prepared by:





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# TECHNICAL MEMORANDUM - RISK FACTOR RANKING AND COUNTERMEASURE SELECTION

**FOR** 

# KDOT LOCAL ROAD SAFETY PLANS (LRSPS) – PHASE 1

**KDOT PROJECT NO: 106 C-4790-02** 

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# **LIST OF ACRONYMS**

**ADT** Average Daily Traffic

CMF **Crash Modification Factor** 

**FHWA** Federal Highway Administration

**HFST High-Friction Surface Treatment** 

Kansas Department of Transportation **KDOT** 

Local Road Safety Plan **LRSP** 

**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 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). **Figure 1** shows the location of the Phase 1 LRSP counties and the Pilot Phase counties.

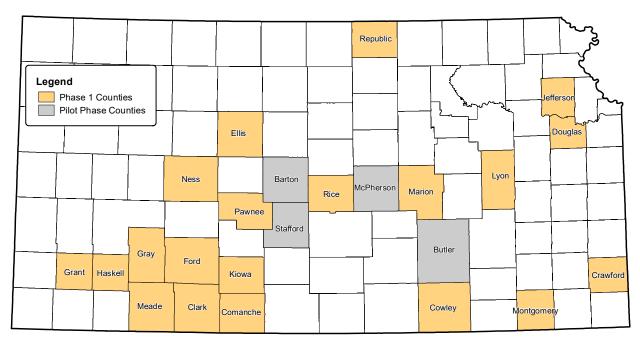


Figure 1 – Location of LRSP Counties

# 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 approved in previous technical memos. 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 Pilot Phase of the LRSP project and reviewed as part of the Phase 1 project. **Table 2** includes the risk factor scoring criteria for segments, **Table 3** for intersections, and **Table 4** for curves.

# 2.1. LRSP Phase 1 Scoring Modifications

Some minor clarifications and modifications are recommended to these tables as detailed in the following sections. The proposed modifications maintain the same maximum number of risk factor score points (24) as were included in the LRSP Pilot project.

# 2.1.1. Unpaved Roads

The tables have been revised to including the text "or unpaved road" in the scoring criteria of shoulder width that receive 0 points, and presence of pavement markings for 0 points.

# 2.1.2. Intersection Control

The intersection control risk factor scoring was reversed to include a risk factor point where the intersection control was identified as stop-controlled (as opposed to the yield/uncontrolled control), as more crashes (and fatal and serious injury crashes) are associated with stop-controlled intersections based on the crash analysis conducted as part of this study.

Based on the crash data provided as part of the LRSP Phase 1 project, there were a total of 241 intersection crashes within the 20 counties along LRSP routes. **Table 1** includes a breakdown of the intersection crashes showing a crash rate 40% higher for stop-controlled intersection, consistent with assessing risk factor points for stop-controlled intersections as opposed to yield or uncontrolled intersections. Two of the crashes occurred at a signalized intersection and are not included in the table.

Table 1 – Crash Analysis by Intersection Control Type

	<b>Stop Control</b>	Yield/Uncontrolled
Number of Intersections	3,975	727
Number of Intersection Crashes	221	18
Crashes per Intersection	0.56	0.25
Average Daily Entering Vehicles	483	300
Average Number of Crashes per million entering vehicles	115.1	82.5

# 2.1.3. Access Density

Based on the characteristics of access points along the LRSP routes, many of which are low-volume field access points, the access density risk factor score total was reduced from 3 to 2, to give access density less weight in risk factor scoring for segments, intersections, and curves.







# 2.1.4. Crash Experience

To provide more weight to locations where priority crash types have occurred in the past, the risk factor scores were adjusted from 2 to 3 for the maximum number of points for segments and curves.

#### 2.1.5. Intersection Skew

The maximum risk factor score for an intersection based on skew was increased from 2 to 3 points. This change was made to increase the impact to the score of having a significant skew on at least one leg of the intersection, targeting associated priority crash types.

# 2.1.6. Edge Condition and Roadside Assessment

To further help identify segments and curves with risk factors that could contribute to run-off-road crashes, the scoring criteria for edge condition and roadside assessment were modified to include a score of 0 where a rating of 2.75 to 3 was recorded. This range allows for less risk factor points to be applied where conditions are generally good with minimal apparent edge drop-offs or roadside hazards.

Use Restricted 23 U.S.C. § 409







# Table 2 - Segment Risk Factor Scoring Criteria

Risk Factor	Measurement	Points	Max Points Available
		0: ADT within 0%-14.3% percentile range	
		1: ADT within 14.3%-28.6% percentile range	
	Average roadway	2: ADT within 28.6%-42.9% percentile range	
Volume	segment volume per	3: ADT within 42.9%-57.1% percentile range	6
	county (ADT)	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 of	0: Bottom third of the access density Crash Modification Factor (CMF)*	
density	intersections and	1: Middle third of the access density CMF*	2
	driveways per mile	2: Top third of the access density CMF*	
		0: Rating of 2.75–3	
Edge	Observed condition	1: Top third of remaining ratings	0
condition	rating	2: Middle third of remaining ratings	3
		3: Bottom third of remaining ratings	
		0: Rating of 2.75–3	
Roadside	Observed condition	1: Top third of remaining ratings	
assessment	rating	2: Middle third of remaining ratings	3
		3: Bottom third of remaining ratings	
Roadway	10/1-141- 1 f 4	0: Roadway width greater than or equal to 22 feet	0
width	Width in feet	2: Roadway width less than 22 feet	2
	Width in feet of	0: 4-foot shoulder and greater, or unpaved road	
Shoulder width	recoverable area prior	1: 2-foot shoulder to 4-foot shoulder	2
Widti	to a ditch or fill slope	2: less than 2-foot shoulder	
		0: Bottom fourth of roadway departure crash rates along the roadway segments	
Lane departure	Lane departure	Second lowest fourth of roadway departure crash rates along the roadway segments	3
crash rate	crashes per MVMT	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	Observed presence of	0: Both centerline and edgeline present, or unpaved road	
pavement markings	markings	1: Centerline or edgeline present	2
markings		2: Neither centerline or edgeline present	
Surface	Dayed or uppered	0: Paved	4
type	Paved or unpaved	1: Unpaved	1

<sup>\*</sup> Access Density CMF Equation as presented in the Highway Safety Manual (Equation 13-7).







# Table 3 - Intersection Risk Factor Scoring Criteria

Risk Factor	Measurement	Points	Max Points Available
		0: ADT within 0%-14.3% percentile range	
	Average Daily	1: ADT within 14.3%-28.6% percentile range	
	Traffic (ADT) on all	2: ADT within 28.6%-42.9% percentile range	
Volume	approaches per intersection with a	3: ADT within 42.9%-57.1% percentile range	6
	paved approach	4: ADT within 57.1%-71.4% percentile range	
	per county	5: ADT within 71.4%-85.7% percentile range	
		6: ADT within 85.7%-100% percentile range	
	Number of	0: None	
Access density	driveways or intersections within	1: 1 or 2 Access Points	2
,	500 feet of the intersection	2: More than 2 Access Points	
Sight distance	Based on field	0: Adequate	3
Signit distance	observations	3: Limited	<b>o</b>
Horizontal	Intersection on a	0: No	3
curvature	curve	3: Yes	<b>o</b>
Crock experience	Fatal or serious	0: None	3
Crash experience	injury crashes	3: 1 or more	3
		0: 1.5 miles or less	
Distance from previous stop sign	Based on field data collection	2: 1.5 miles to less than 5 miles	3
1 3		3: 5 miles or more	
Skewed approach	Degrees	0: 75 degree to 90-degree intersection approaches	3
		3: 75 degree or less intersection approach	
Intersection	Observed control	0: Yield/None	1
control	type	1: Stop	







# Table 4 – Curve Risk Factor Scoring Criteria

Risk Factor	Measurement	Points	Max Points Available
		0: ADT within 0%-14.3% percentile range	
		1: ADT within 14.3%-28.6% percentile range	
	Average curve	2: ADT within 28.6%-42.9% percentile range	
Volume	volume per	3: ADT within 42.9%-57.1% percentile range	6
	county	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	
		0: Top fourth of curve radii	
Curve radius	Radius of curve	1: Second highest fourth of curve radii	3
Curve radius	in feet per county	2: Second lowest fourth of curve radii	3
		3: Bottom fourth of curve radii	
	Intersections or	0: None	
Access density	driveways within 500 feet of the	1: 1 or 2 Access Points	2
	curve	2: More than 2 Access Points	
	Width in feet of recoverable	0: 4-foot shoulder and greater, or unpaved road	
Shoulder width	area prior to a	1: 2-foot shoulder to 4-foot shoulder	2
	slope	2: less than 2-foot shoulder	
		0: Rating of 3	
Edge condition	Observed condition rating	1: Rating of 2	2
	contained the containing	2: Rating of 1	
		0: Rating of 3	
Roadside assessment	Observed condition rating	1: Rating of 2	2
	contained the containing	2: Rating of 1	
Cuparalovation	Presence of	0: Yes	2
Superelevation	superelevation	2: No	۷
Crash experience	Fatal or serious	0: None	3
Crash experience	injury crashes	3: 1 or more	3
Presence of	Observed	0: Present	2
warning signs	presence	2: Not present	







# 3. Project Selection Threshold Tables

Countermeasure project selection threshold tables were developed during the Pilot Phase of the LRSP project and reviewed as part of the Phase 1 project. **Table 5**, **Table 6**, and **Table 7** include the threshold tables for segments, intersections, and curves respectively.

# 3.1. LRSP Phase 1 Threshold Modifications

Based on the findings of the LRSP Pilot Phase 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 the LRSP Pilot Phase were updated to match the language, updated CMFs, and costs approved in the Phase 1 Countermeasures tech memo, which included various minor modifications.

# 3.1.2. Revised Countermeasures

The intersection countermeasure: "Review and Install/Upgrade Intersection Warning Sign" was removed, as the installation of intersection warning signs are included in the countermeasure "Upgrade Signs and Pavement Markings".

# 3.1.3. Thresholds

Where some countermeasures did not have an identified threshold in the LRSP Pilot Phase, one was added in the Phase 1 tables. These modifications included adding the thresholds "based upon video review" and "all" for various countermeasures.

The thresholds for improving edge rut conditions on segments and curves were modified from requiring an aggregate shoulder to including all "unpaved" shoulders, as the countermeasure can be effectively deployed without an existing aggregate shoulder.







Table 5 - Segment Countermeasure Project Selection Thresholds

Safety Countermeasure	CMF	Cost	Short-Term Long-Term	Long-Term	Threshold
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.64 - 0.88	\$4,200/mile	×		All
Install 4" Retroreflective Centerline	92'0	\$2,100/mile	×		All
Delineate Roadside Hazards with Retroreflective Markers	not defined	\$100/each	×		All (10 markers per mile)
Clear and Grub (Both Sides of Road)	82'0	\$30,000/mile	×		All
Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations (Both Sides of Road)	not defined	\$5,000/mile	×		Edge Condition < 2 and unpaved shoulder
Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible on Both Sides of Road)	0.61 - 0.67	\$5,000/mile	×		ADT > 400 and 11' lanes
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	0.55 - 0.91	\$2,000/mile	×		ADT > 400 and 11' lanes
Install Post-Mounted Delineators	0.55	\$5,000/mile	×		Roadside Assessment < 2
Review and Upgrade Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet the Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	96.0 - 65.0	\$1,000/curve	×		On all curves within the segment that currently have signage
Install Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet the Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	96.0 - 65.0	\$3,500/curve	×		On all curves within the segment that do not have signage
Retroreflective Strips on Curve Signage	not defined	\$100/curve	×		On all curve signage within the segment
Remove/Relocate Fixed Objects in Clear Zone (e.g. tree, utility pole, culvert headwall, substandard guardrail)	FHWA proven Countermeasure	\$1,000/each		×	All (based upon video review)
Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	not defined	\$15,000/mile		×	No existing aggregate shoulder and edge condition < 2
Pave 2' Shoulder with Safety Edge (Both Sides of Road – Includes Earthwork)	66.0 - 27.0	\$150,000/mile		×	ADT > 400
Install Edgeline Rumble Strips (Both Sides of Road)	0.61 - 0.67	\$5,000/mile		×	ADT > 400 and 11' lanes
Install Centerline Rumble Strips	0.55 - 0.91	\$2,000/mile		X	ADT > 400 and 11' lanes
Instal//Upgrade Guardrail	0.53 - 0.56	\$35/foot		X	All (based upon video review)
Flattening and Widening Foreslopes (Excludes Culvert Extension Costs)	0.58 - 0.90	\$75,000/mile		X	All
Install High Friction Surface Treatment (HFST) on Curves	0.48 - 0.76	\$20,000/curve		×	All curves with ADT > 400 and no superelevation





# Table 6 - Intersection Countermeasure Project Selection Thresholds

Safety Countermeasure	CMF	Cost	Short-Term Long-Term	Long-Term	Threshold
Retroreflective Strips on Stop Sign Posts	not defined	\$100/intersection	×	IIA	
Clear and Grub	0.78	\$2,500/leg	×	All	
Review Pavement Condition/Type and Install Transverse Rumble Strips on Paved, Stop- Controlled Approaches	0.79	\$1,500/leg	×	All	
Upgrade Signs and Pavement Markings	0.4-0.91	\$2,200/leg	×	IIA	
Install Second Stop Sign and Stop Ahead Signs	not defined	\$1,500/leg	×	Mi	Minor ADT > 400
Install Beacon on Stop Signs or Stop Sign with LED Flashing Lights	0.42-0.87	\$2,500/sign	×	Ma	Major ADT> 800 and Minor ADT > 400
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	not defined	\$2,500/sign	×	Lin	imited sight distance and Minor ADT > 400
Intersection Lighting (One Luminaire)	0.62	\$5,500/each		X M	Major ADT >800 and Minor ADT > 400
Realign Intersection Approaches to Reduce or Eliminate Skew	0.57-0.67	\$300,000/leg		X Ske	Skew < 75 degrees

# Table 7 - Curve Countermeasure Project Selection Thresholds

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	n Threshold	On all curves that currently have signage	On all curves that do not have signage	All	All	All	All	Edge Condition < 2 and unpaved shoulder	ADT > 400 and 11' lanes	ADT > 400 and 11' lanes	Roadside Assessment < 2	No existing aggregate shoulder and edge condition < 2	ADT > 400	ADT > 400 and 11' lanes	ADT > 400 and 11' lanes	All (based upon video review)	ADT > 400 and no superelevation
	Long-Term											×	×	×	×	×	×
spiolisal	Short-Term	×	×	×	×	×	×	×	×	×	×						
able / = curve countenneasure Project Selection Thresholds	Cost	\$1,000/curve	\$3,500/curve	\$100/curve	\$4,200/mile	\$2,100/mile	\$2,500/curve	\$5,000/mile	\$5,000/mile	\$2,000/mile	\$5,000/mile	\$15,000/mile	\$150,000/mile	\$5,000/mile	\$2,000/mile	\$35/foot	\$20,000/curve
vurve countermeasur	CMF	0.59 - 0.96	0.59 - 0.96	not defined	0.64 - 0.88	92.0	0.78	not defined	0.61 - 0.67	0.55 - 0.91	0.55	not defined	0.75 - 0.99	0.61 - 0.67	0.55 - 0.91	0.53 - 0.56	0.48 - 0.76
	Safety Countermeasure	Review and Upgrade Curve Signage (Waming signs, Speed Advisory plaques, Chevrons) to meet the Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	Install Curve Signage (Warning signs, Speed Advisory plaques, Chevrons) to meet the Manual on Uniform Traffic Control Devices (MUTCD) and KDOT Standards	Retroreflective Strips on Curve Signage	Install 6" Retroreflective Edgeline (Both Sides of Road)	Install 4" Retroreflective Centerline	Clear and Grub	Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations	Review Pavement Condition/Type and Install Edgeline Rumble Strips (If Feasible on Both Sides of Road)	Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	Install Post-Mounted Delineators	Install 18-inch Aggregate Shoulder Treatment (With Transition to Earth)	Pave 2' Outside Shoulder with Safety Edge (Both Sides of Road – Includes Earthwork)	Install Edgeline Rumble Strips (Both Sides of Road)	Install Centerline Rumble Strips	Install/Upgrade Guardrail	Install High Friction Surface Treatment (HFST)

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# 4. NEXT STEPS

Upon approval from KDOT of these risk factor scoring criteria and countermeasure project selection threshold tables, the next steps include a systemic analysis that will be conducted for the 20 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.

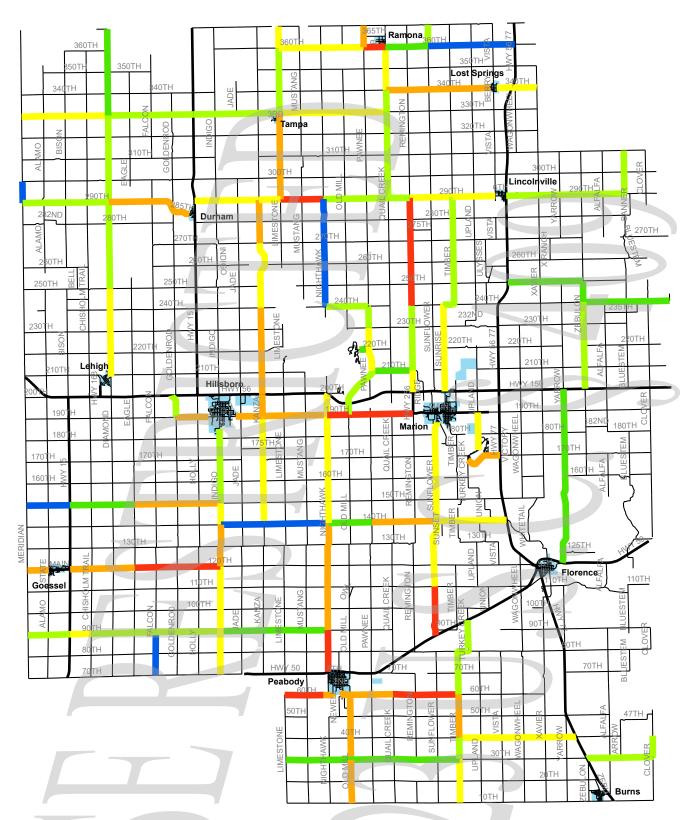








# **APPENDIX J** LRSP SEGMENT RISK FACTOR SCORES

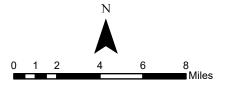


# **Marion County LRSP Segment Risk Factor Scores**

# Total Score 17; 18 14; 15; 16 11; 12; 13 8; 9; 10 5; 6; 7

**3**; 4

Legend



Surface Type	Score	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pavement Markings	Score	2	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	2	0	0	0	0	0	0	2	0	0	2	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	
Lane Departure	Score	ဗ	3	က	3	2	2	3	8	3	2	2	3	3	2	0	3	2	8	0	က	2	က	2	0	3	2	2	3	0	2	0	0	ဗ	ဗ	2	0	2	0	0	3	0	3	3	3	2	
Shoulder Width	Score	2	2	2	2	2	1	1	2	7	2	2	2	2	2	2	7	2	2	2	2	2	2	2	2	2	7	7	2	7	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	
Roadway/ Pavement	Score	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Roadside Assessment	Score	8	3	က	3	3	3	3	3	3	1	3	3	3	3	3	3	1	1	1	3	3	1	æ	æ	1	0	0	8	1	0	8	3	1	8	0	3	0	1	8	c	3	1	1	3	0	
Edge Condition A	Score	8	3	e	3	3	3	3	3	3	3	3	3	3	3	3	3	m	3	8	3	0	æ	33	æ	3	3	8	3	1	3	3	3	3	3	8	3	3	3	3	3	0	3	3	3	m	
Access Density	Score	2	2	2	1	2	2	1	1	2	2	2	0	2	2	2	1	1	2	1	0	2	2	0	2	2	1	2	0	2	0	2	1	1	0	1	1	1	2	0	1	2	0	0	1	1	
ADT	score	က	5	2	9	2	9	9	2	4	9	4	3	က	3	3	3	9	4	4	4	9	4	2	2	4	2	2	ဗ	4	2	2	2	4	4	2	2	2	2	9	-	9	4	4	1	4	
Total	score	18	18	18	18	17	17	17	17	17	16	16	16	16	15	15	15	15	15	15	15	15	15	15	15	15	15	14	14	14	14	14	14	14	14	13	13	13	13	13	13	13	13	13	13	12	
Length	(III)	1.80	1.94	2.00	2.29	3.97	2.98	1.01	1.99	3.04	1.25	2.00	0.50	1.04	4.84	3.00	4.00	3.00	1.49	4.03	0.51	1.93	4.01	3.01	2.01	1.00	4.00	3.01	1.00	2.00	1.01	1.72	2.99	1.99	2.01	5.01	3.26	1.99	2.99	1.01	2.43	3.01	3.99	1.01	2.03	4.02	
ОТ		0.25 MILE WEST OF NIGHTHAWK	HWY 50	240TH	HWY 50	INDIGO	REMINGTON (K-256)	OLD MILL	NIGHTHAWK	TIMBER	KANZA	QUAIL CREEK	SLOCUST	QUAIL CREEK	N WASHINGTON	SUNFLOWER	OÐIQNI	NIGHTHAWK	WEST OF HILLSBORO	PARK AVE	OFD WIFE	120TH	290TH	30TH	10TH	370TH	US HWY 56	EAGLE	ALAMO	270TH	190TH	HWY 77	90TH	120ТН	40TH	140TH	ULYSSES	TIMBER	KANZA	LIMESTONE	L AMH	90ТН	150ТН	140TH	10TH	DIAMOND	
From		LIMESTONE	90TH	290TH	110TH	EAGLE	OLD MILL	NIGHTHAWK	LIMESTONE	QUAIL CREEK	PRAIRIE	OLD MILL	0.25 MILE WEST OF NIGHTHAWK	PAWNEE	QUAIL CREEK	PAWNEE	EAGLE	KANZA	GOLDENROD	DIAMOND	S MAPLE	140TH	330TH	H109	30TH	360TH	240TH	HWY 15	MERIDIAN	290TH	US HWY 56	TURKEY CREEK	120TH	140TH	H109	190TH	SUNFLOWER	REMINGTON	HWY 15	KANZA	WAGONWHEEL	120ТН	190ТН	150TH	30TH	MERIDIAN	
Segment Name		60TH	NIGHTHAWK	REMINGTON	SUNFLOWER	120TH	190TH	190TH	290TH	H109	190ТН	60TH	60ТН	360ТН	340TH	140TH	150TH	190TH	190TH	290ТН	60ТН	INDIGO	LIMESTONE	OLD MILL	OLD MILL	PAWNEE	KANZA	120ТН	120ТН	KANZA	KANZA	LAKESHORE	NIGHTHAWK	NIGHTHAWK	TIMBER	KANZA	140TH	290ТН	290TH	290TH	40TH	INDIGO	NIGHTHAWK	NIGHTHAWK	TIMBER	330TH	
TSID		51	88	100	103	1	12	16	56	46	15	20	52	46	40	2	6	13	14	53	23	73	80	06	95	95	118	2	3	75	77	78	83	82	109	74	9	23	25	32	48	71	84	88	107	36	

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	Surface	Type	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	0	0	1	0	1	1	1	1	1	0	1	0	1	1	0
	Pavement	Markings Score	2	0	0	0	2	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Lane	Crash Rate Score	0	2	2	2	0	0	0	2	0	0	0	0	3	2	8	0	2	0	2	2	0	0	2	0	0	2	0	0	0	0	0	0	2	0	3	3	3	0	3	2	0	0	3	0	0
	Shoulder	Width	7	0	2	2	2	7	7	0	7	2	2	2	0	2	0	2	2	2	2	2	0	7	0	2	0	2	2	0	0	0	2	2	0	2	0	0	0	0	0	2	0	2	0	0	2
	Roadway/ Pavement	Width	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Roadside	Assessment Score	0	3	3	0	0	1	3	3	0	1	0	3	3	0	1	0	0	0	0	0	3	1	1	0	3	1	3	3	3	3	1	0	1	3	3	3	1	3	0	0	8	8	0	3	0
		Condition A Score	3	3	æ	0	3	3	3	3	3	3	3	3	3	0	3	0	3	1	1	1	3	1	ъ	33	3	1	3	3	3	3	3	0	3	3	3	3	1	3	0	3	3	3	0	3	0
		Density (	2	0	1	2	0	7	2	2	1	0	1	1	1	1	1	7	1	7	0	2	7	1	2	0	1	0	0	1	1	1	0	2	1	0	0	0	2	0	2	0	1	0	1	0	1
	ADT	Score	3	3	1	9	5	4	2	1	2	2	3	2	0	9	2	2	3	9	9	4	1	2	1	2	2	4	2	2	2	2	4	9	2	2	0	0	1	2	3	2	1	1	3	1	2
	Total	Score	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	11	11	11	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	6	6	6	6	6	8	8	∞
	l enoth	(mi)	0.73	3.95	3.01	1.01	3.15	0.99	1.01	4.02	1.99	4.97	1.14	1.00	4.09	2.01	1.01	2.02	2.00	4.60	3.09	1.75	0.47	3.01	5.48	1.00	3.05	3.95	1.93	3.00	2.00	1.00	1.07	3.43	2.99	3.00	0.98	2.00	1.99	0.97	0.97	4.00	1.99	0.98	1.92	4.00	4.01
-		٥	US HWY 77	PAWNEE	WAGONWHEEL	150TH	240TH	190TH	HWY 56	HWY 56	VISTA	QUAIL CREEK	XAVIER	CHISOLM TRAIL	210TH	70TH	360TH	210TH	340TH	E. FOREST	110TH	LAKESHORE	TIMBER	QUAIL CREEK	BLUESTEM	REMINGTON	CLOVER	HWY 15	K15	INDIGO	EAGLE	FALCON	190TH	BLAIRWOOD	330TH	210TH	360TH	240TH	290TH	30TH	230ТН	290TH	60TH	30TH	PAWNEE	DIAMOND	LIMESTONE
		From	MAIN	LIMESTONE	TIMBER	140TH	270TH	HWY 56	210TH	240TH	TIMBER	LIMESTONE	US HWY 77	K15	250TH	90ТН	370TH	230ТН	360TH	140TH	140TH	HWY 256	SUNRISE	NIGHTHAWK	HWY 56	QUAIL CREEK	HWY 77	DIAMOND	MERIDIAN	FALCON	CHISHOLM TRAIL	EAGLE	HWY 56	150TH	360TH	240TH	370TH	290TH	310TH	40TH	240TH	330TH	80TH	40TH	NIGHTHAWK	MERIDIAN	HWY 15
		Segment Name	340TH	Э80ТН	40TH	INDIGO	KANZA	NIGHTHAWK	REMINGTON	SUNRISE	Z90TH	330TH	340TH	90TH	DIAMOND	ODIGNI	TIMESTONE	PAWNEE	QUAIL CREEK	SUNFLOWER	SUNFLOWER	UPLAND	240TH	290TH	290TH	290TH	30TH	330TH	90TH	90TH	90TH	90TH	GOLDENROD	INDIGO	LIMESTONE	REMINGTON	SUNFLOWER	TIMBER	BLUESTEM	CLOVER	PAWNEE	QUAIL CREEK	TIMBER	TIMBER	240TH	290TH	330ТН
		TSID	42	45	47	72	26	87	101	106	31	37	41	09	99	70	81	93	96	104	105	113	21	24	28	30	34	39	55	26	28	59	89	69	79	66	102	108	61	62	94	6	110	111	20	27	38

						_				_				_		_						_		_				$\overline{}$
Surface Type Score	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Pavement Markings Score	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Lane Departure Crash Rate	0	0	0	2	0	0	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	2	0	0
Shoulder Width Score	0	•	0	0	2	0	0	0	7	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Roadway/ Pavement Width	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
Roadside Issessment Score	e	8	8	0	0	33	3	3	1	1	3	1	1	3	1	0	3	1	3	0	1	0	0	3	0	0	0	0
Edge Roadside Condition Assessment Score Score	m	3	3	0	3	3	3	1	0	3	3	3	1	3	1	0	1	0	1	3	3	3	3	0	1	0	0	0
Access Density (	0	0	0	1	0	0	1	7	1	2	0	1	1	0	0	2	1	0	0	0	0	0	0	0	0	0	1	0
ADT Score	1	-	1	2	3	٢	0	0	3	0	0	1	1	0	0	0	0	3	0	1	0	0	0	0	0	1	1	2
Total Score	80	8	∞	<b>∞</b>	00	8	8	7	7	7	7	7	7	7	9	9	9	2	2	2	2	4	4	4	4	4	3	3
Length (mi)	0.48	4.01	4.01	2.46	1.00	1.43	4.02	1.98	2.99	1.88	4.05	3.49	5.04	0.98	2.01	0.46	4.02	3.01	4.99	4.00	4.11	3.00	2.00	4.03	1.00	4.99	2.01	2.00
ō.	TURKEY CREEK	290TH	250TH	190TH	330TH	HWY 50	HWY 150	SUNFLOWER	EAGLE	REMINGTON	CHASE	ZEBULON	TIMBER	240TH	PAWNEE	COTTONWOOD POINT	160ТН	OFD WIFF	NIGHTHAWK	330ТН	120ТН	NIGHTHAWK	KANZA	HWY 56	290ТН	240TH	K-15	70TH
From	TIMBER	330TH	290TH	210TH	340TH	Н108	240TH	QUAIL CREEK	K-15	STRASSBURG	NOTION	95 AMH	סרם שורד	250TH	MIGHTHAWK	PAWNEE	95 AMH	LIMESTONE	OSIGNI	H107E	H1091	KANZA	OSIGNI	SUNFLOWER	300TH	290ТН	MERIDAN	H106
Segment Name	80TH	DIAMOND	DIAMOND	OLD MILL	QUAIL CREEK	TURKEY CREEK	NOTINEZ	H1098	150TH	210TH	240TH	250TH	30ТН	SEBULON	140TH	220TH	YARROW	нтоє	нт06	DIAMOND	YARROW	140TH	140TH	H109E	MERIDIAN	NIGHTHAWK	150TH	FALCON
TSID	54	64	65	91	86	112	116	44	10	17	19	22	32	117	7	18	114	33	22	63	115	4	∞	43	82	98	11	29









# **APPENDIX K** LRSP Intersection Risk Factor Scores

TSID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score		Distance from Previous STOP Score	Skewed Approach Score	Intersection Control Score
147	NIGHTHAWK & 190TH	17	6	1	3	0	3	3	0	1
178	PAWNEE & 210TH	15	5	1	3	0	0	2	3	1
297	UPLAND & LAKESHORE	15	6	2	3	0	0	0	3	1
70	INDIGO & 140TH	14	6	1	3	0	0	3	0	1
137	NEEDLE & 60TH	14	4	0	3	3	0	0	3	1
173	OLDMILL & 60TH	14	6	1	3	0	0	3	0	1
61	GOLDENROD & GOLDENROD EXTENSION	13	3	0	3	3	0	0	3	1
80	INDIGO & 90TH	13	6	0	3	0	0	3	0	1
153	NIGHTHAWK & 290TH	13	5	1	3	0	0	3	0	1
166	OLD MILL & 30TH	13	5	1	3	0	0	3	0	1
198	QUAILCREEK & 290TH	13	6	0	3	0	0	3	0	1
230	SUNFLOWER & 90TH	13	6	0	3	0	0	0	3	1
243	TIMBER & 290TH	13	6	0	3	0	0	3	0	1
13	BLUESTEM & 290TH	12	2	0	3	3	0	0	3	1
56	GOLDENROD & 190TH	12	5	0	0	3	0	0	3	1
161	OLD HWY 77 & HIGHLAND	12	6	2	0	3	0	0	0	1
62	HOLLY & 120TH	11	4	0	3	0	0	0	3	1
68	INDIGO & 120TH	11	4	0	3	0	0	3	0	1
69	INDIGO & 130TH	11	6	1	3	0	0	0	0	1
71	INDIGO & 150TH	11	6	1	0	0	0	3	0	1
73	INDIGO & 160TH (S)	11	6	1	3	0	0	0	0	1
82	JADE & 190TH	11	6	1	3	0	0	0	0	1
92	KANZA & 190TH	11	6	1	0	0	0	3	0	1
177	PAWNEE & 190TH	11	6	1	3	0	0	0	0	1
185	PAWNEE & 360TH	11	5	0	0	3	0	2	0	1
189	QUAILCREEK & 190TH	11	6	1	3	0	0	0	0	1
191	QUAILCREEK & 300TH	11	6	1	3	0	0	0	0	1
215	S STATE & 120TH	11	6	1	3	0	0	0	0	1
239	TIMBER & 240TH	11	1	0	3	3	0	0	3	1
288	360TH & D ST	11	1	0	3	3	0	0	3	1
16	CHISHOLM TRAIL & 120TH	10	5	1	3	0	0	0	0	1
22	CLOVER & 30TH	10	0	0	3	3	0	0	3	1
66	INDIGO & 100TH	10	6	0	3	0	0	0	0	1
72	INDIGO & 160TH (N)	10	6	0	3	0	0	0	0	1
78	INDIGO & 70TH	10	6	0	3	0	0	0	0	1
79	INDIGO & 80TH	10	6	0	3	0	0	0	0	1
91	KANZA & 180TH	10	5	1	3	0	0	0	0	1
101	KANZA & 290TH	10	6	0	0	0	0	3	0	1
112	LIMESTONE & 330TH	10	5	1	0	0	0	3	0	1
122	MERIDIAN & 120TH	10	6	0	3	0	0	0	0	1
138	NIGHTHAWK & 100TH	10	5	1	3	0	0	0	0	1
140	NIGHTHAWK & 120TH	10	5	1	3	0	0	0	0	1
170	OLD MILL & 50TH	10	5	1	3	0	0	0	0	1
209	REMINGTON & 290TH	10	6	0	0	0	0	3	0	1
217	SUNFLOWER & 120TH	10	6	0	3	0	0	0	0	1
218	SUNFLOWER & 140TH	10	6	0	0	0	0	3	0	1
219	SUNFLOWER & 150TH	10	6	0	3	0	0	0	0	1
220	SUNFLOWER & 160TH	10	6	0	3	0	0	0	0	1
222	SUNFLOWER & 180TH	10	6	0	3	0	0	0	0	1
24	DIAMOND & 120TH	9	5	0	3	0	0	0	0	1
36	DIAMOND & 330TH	9	5	0	0	0	0	3	0	1
43	EAGLE & 120TH	9	5	0	3	0	0	0	0	1
53	FALCON & 90TH	9	2	0	3	0	0	3	0	1
127	MERIDIAN & 90TH	9	5	0	3	0	0	0	0	1
142	NIGHTHAWK & 140TH	9	5	0	0	0	0	3	0	1
159	NIGHTHAWK & 90TH	9	5	0	0	0	0	3	0	1
164	OLD MILL & 20TH	9	5	0	3	0	0	0	0	1

TSID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score	Experience Score	Distance from Previous STOP Score	Skewed Approach Score	Intersection Control Score
171	OLDMILL & 10TH	9	5	0	3	0	0	0	0	1
195	QUAILCREEK & 330TH	9	5	0	0	0	0	3	0	1
196	QUAILCREEK & 360TH	9	2	0	3	0	0	3	0	1
256	UPLAND & 180TH	9	5	0	3	0	0	0	0	1
285	ZEBULON & 250TH	9	2	0_	3	0	0	3	0	1
300	190TH & PRARIE POINT	9	6	2	0	0	0	0	0	1
301	NIGHTHAWK & 194TH TER (N)	9	6	2	0	0	0	0	0	1
303	OLD HWY 77 & FOREST	9	6	2	0	0	0	0	0	1
305	OLD MILL & NORWOOD	9	5	0	3	0	0	0	0	1
54	GOLDENROD & 120TH	8	4	0	3	0	0	0	0	1
74	INDIGO & 170TH	8	6	1	0	0	0	0	0	1
75	INDIGO & 180TH	8	6	1	0	0	0	0	0	1
108	LIMESTONE & 290TH	8	5	0	0	0	0	2	0	1
132	MUSTANG & 330TH	8	4	0	3	0	0	0	0	1
134	MUSTANG & 60TH	8	4	0	3	0	0	0	0	1
143	NIGHTHAWK & 150TH	8	4	0	3	0	0	0	0	1
144	NIGHTHAWK & 160TH	8	4	0	3	0	0	0	0	1
146	NIGHTHAWK & 180TH	8	4	0	3	0	0	0	0	1
157	NIGHTHAWK & 60TH	8	4	0	3	0	0	0	0	1
160	NORWOOD & 60TH	8	4	0	3	0	0	0	0	1
187	PAWNEE & 60TH	8	4	0	3	0	0	0	0	1
197	QUAILCREEK & 60TH	8	4	0	3	0	0	0	0	1
199	QUAILCREEK & 340TH	8	5	0	0	0	0	3	0	0
202	REMINGTON & 210TH	8	2	0	3	0	0	2	0	1
203	REMINGTON & 230TH	8	4	0	3	0	0	0	0	1
206	REMINGTON & 260TH	8	4	0	3	0	0	0	0	1
207	REMINGTON & 270TH	8	4	0	3	0	0	0	0	1
208	REMINGTON & 280TH	8	4	0	3	0	0	0	0	1
213	REMINGTON & 60TH	8	4	0	3	0	0	0	0	1
214	RIDGEWAY DR & 170TH	8	5	0	3	0	0	0	0	0
249	TIMBER & 60TH	8	1	0	3	0	0	3	0	1
251	TIMBER & 80TH	8	1	0	0	3	0	0	3	1
253	TURKEY CREEK & 80TH	8	1	0	0	3	0	0	3	1
255	ULYSSES & 140TH	8	2	0	3	0	0	2	0	1
284	ZEBULON & 240TH	8	1	0	3	0	0	3	0	1
295	PAWNEE & 211TH	8	5	2	0	0	0	0	0	1
296	PAWNEE & 213TH	8	5	2	0	0	0	0	0	1
298	UPLAND & PRARIE	8	6	2	0	0	0	0	0	0
302	NIGHTHAWK & 194TH TER (S)	8	6	1	0	0	0	0	0	1
304	INDIGO & WILLOW GLEN	8	6	1	0	0	0	0	0	1
19	CHISHOLM TRAIL & 330TH	7	3	0	3	0	0	0	0	1
25	DIAMOND & 150TH	7	3	0	3	0	0	0	0	1
49	FALCON & 290TH	7	3	0	3	0	0	0	0	1
55	GOLDENROD & 395TH	7	3	0	3	0	0	0	0	1
57	GOLDENROD & 285TH	7	3	0	0	3	0	0	0	1
58	GOLDENROD & 290TH	7	3	0	0	3	0	0	0	1
67	INDIGO & 110TH	7	6	0	0	0	0	0	0	1
104	LIMESTONE & 30TH	7	6	0	0	0	0	0	0	1
107	LIMESTONE & 190TH	7	0	0	3	0	0	0		1
116	LIMESTONE & 370TH	7	3	0	0	0	0	0	3	1
154	LIMESTONE & E 2ND NIGHTHAWK & 30TH	7	3	0	3	0	0	0	0	1
163	OLD MILL & 190TH	7	6	0	0	0	0	0	0	1
		7	3	0	3	0	0	-	0	1
179 193	PAWNEE & 220TH  QUAILCREEK & 310TH	7	3	0	3	0	0	0	0	1
193	QUAILCREEK & 310TH  QUAILCREEK & 320TH	7	3	0	3	0	0	0	0	1
211	REMINGTON & 340TH	7	3	0	3	0	0	0	0	1
Z11	INLIMINGTON & 34010	, , , , , , , , , , , , , , , , , , ,	٠	L	J	U	U	U	U	'

TSID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score		Distance from Previous STOP Score	Skewed Approach Score	Intersection Control Score
216	SUNFLOWER & 110TH	_ 7	6	0	0	0	0	0	0	1
221	SUNFLOWER & 170TH	7	6	0	0	0	0	0	0	1
226	SUNFLOWER & 360TH (E)	7	0	0	3	0	0	3	0	1
245	TIMBER & 340TH	7	3	0	3	0	0	0	0	1
254	TURKEY CREEK & LAKESIDE DR	7	1	0	3	0	0	0	3	0
8	ALFALFA & 30TH	6	2	0	3	0	0	0	0	1
18	CHISHOLM TRAIL & 290TH	6	2	0	3	0	0	0	0	1
20	CHISHOLM TRAIL & 90TH	6	2	0	3	0	0	0	0	1
47	FALCON & 120TH	6	5	0	0	0	0	0	0	1
60	GOLDENROD & 90TH	6	5	0	0	0	0	0	0	1
86	KANZA & 140TH	6	2	0	0	0	0	3	0	1
87	KANZA & 150TH	6	2	0	3	0	0	0	0	1
93	KANZA & 210TH	6	5	0	0	0	0	0	0	1
102	KANZA & 330TH	6	5	0	0	0	0	0	0	1
113	LIMESTONE & 340TH	6	2	0	3	0	0	0	0	1
125	MERIDIAN & 300TH	6	5	0	0	0	0	0	0	1
130	MUSTANG & 290TH	6	5	0	0	0	0	0	0	1
139	NIGHTHAWK & 110TH	6	5	0	0	0	0	0	0	1
141	NIGHTHAWK & 130TH	6	5	0	0	0	0	0	0	1
148	NIGHTHAWK & 240TH	6	2	0	0	3	0	0	0	1
155	NIGHTHAWK & 330TH	6	5	0	0	0	0	0	0	1
158	NIGHTHAWK & 80TH	6	5	0	0	0	0	0	0	1
165	OLD MILL & 290TH	6	5	0	0	0	0	0	0	1
169	OLD MILL & 40TH	6	5	0	0	0	0	0	0	1
181	PAWNEE & 240TH	6	2	0	0	3	0	0	0	1
182	PAWNEE & 290TH	6	5	0	0	0	0	0	0	1
223	SUNFLOWER & 290TH	6	5	0	0	0	0	0	0	1
231	SUNRISE & 210TH	6	2	0	3	0	0	0	0	1
233	SUNRISE & 230TH	6	2	0	- 3	0	0	0	0	1
257	UPLAND & 290TH	6	5	0	0	0	0	0	0	1
261	UPLAND & GILHAM	6	6	0	0	0	0	0	0	0
262	UPLAND AND 140TH	6	2	0	3	0	0	0	0	1
263	VISTA & 290TH	6	5	0	0	0	0	0	0	1
5	ALAMO & 90TH	5	4	0 _	0	0	0	0	0	1
14	BLUESTEM & 300TH	5	1	0	3	0	0	0	0	1
15	BLUESTEM & 310TH	5	1	0	3	0	0	0	0	1
32	DIAMOND & 290TH	5	2	0_	0	0	0	2	0	1
45	EAGLE & 330TH	5	4	0	0	0	0	0	0	1
48	FALCON & 150TH	5	4	0	0	0	0	0	0	1
50	FALCON & 330TH	5	4	0	0	0	0	0	0	1
59	GOLDENROD & 330TH	5	4	0	0	0	0	0	0	1
76	INDIGO & 290TH	5	4	0	0	0	0	0	0	1
77	INDIGO & 330TH	5	4	0	0	0	0	0	0	1
81	JADE & 140TH	5	1	0	3	0	0	0	0	1
83	JADE & 290TH	5	4	0	0	0	0	0	0	1
84	JADE & 330TH	5	4	0	0	0	0	0	0	1
89	KANZA & 170TH	5	4	0	0	0	0	0	0	1
90	KANZA & 175TH	5	4	0	0	0	0	0	0	1
94	KANZA & 220TH	5	4	0	0	0	0	0	0	1
95	KANZA & 230TH	5	4	0	0	0	0	0	0	1
96	KANZA & 240TH	5	4	0	0	0	0	0	0	1
105	LIMESTONE & 60TH	5	4	0	0	0	0	0	0	1
145	NIGHTHAWK & 170TH	5	4	0	0	0	0	0	0	1
167	OLD MILL & 330TH	5	4	0	0	0	0	0	0	1
184	PAWNEE & 330TH	5	4	0	0	0	0	0	0	1
186	PAWNEE & 370TH	5	4	0	0	0	0	0	0	1
204	REMINGTON & 240TH	5	4	0	0	0	0	0	0	1

TSID	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
205	REMINGTON & 250TH	_ 5	4	0	0	0	0	0	0	1
224	SUNFLOWER & 30TH	5	1	0	3	0	0	0	0	1
229	SUNFLOWER & 60TH	5	4	0	0	0	0	0	0	1
234	SUNRISE & 240TH	5	1	0	0	0	0	0	3	1
236	TIMBER & 10TH	5	1	0	3	0	0	0	0	1
238	TIMBER & 20TH	5	1	0	3	0	0	0	0	1
244	TIMBER & 30TH	5	1	0	0	0	0	3	0	1
247	TIMBER & 40TH	5	1	0	0	0	0	3	0	1
265	VISTA & 40TH	5	1	0	3	0	0	0	0	1
267	WAGONWHEEL & 40TH	5	1	0	3	0	0	0	0	1
269	XAVIER & 250TH	5	1	0	3	0	0	0	0	1
278	YARROW & 250TH	5	1	0	3	0	0	0	0	1
279	YARROW & 290TH	5	1	0	3	0	0	0	0	1
280	YARROW & 40TH	5	1	0	3	0	0	0	0	1
294	REMINGTON & 275TH	5	4	0	0	0	0	0	0	1
4	ALAMO & 330TH	4	3	0	0	0	0	0	0	1
11	BISON & 330TH	4	3	0	0	0	0	0	0	1
17	CHISHOLM TRAIL & 150TH	4	3	0	0	0	0	0	0	1
29	DIAMOND & 240TH	4	0	0	3	0	0	0	0	1
39	DIAMOND & 360TH	4	1	0	3	0	0	0	0	0
42	DIAMOND & E MAIN	4	0	0	0	0	0	0	3	1
52	FALCON & 80TH	4	0	0	3	0	0	0	0	1
64	HOLY & 150TH	4	3	0	0	0	0	0	0	1
65	HOLY & 190TH	4	3	0	0	0	0	0	0	1
88	KANZA & 160TH	4	3	0	0	0	0	0	0	1
97	KANZA & 250TH	4	3	0	0	0	0	0	0	1
98	KANZA & 260TH	4	3	0	0	0	0	0	0	1
99	KANZA & 270TH	4	3	0	0	0	0	0	0	1
100	KANZA & 280TH	4	3	0	0	0	0	0	0	1
103	KANZA & 90TH	4	0	0	3	0	0	0	0	1
109	LIMESTONE & 300TH	4	3	0	0	0	0	0	0	1
110	LIMESTONE & 310TH	4	3	0	0	0	0	0	0	1
111	LIMESTONE & 320TH	4	3	0	0	0	0	0	0	1
117	LIMESTONE & 90TH	4	0	0	3	0	0	0	0	1
119	LIMESTONE & E 3RD	4	3	0	0	0	0	0	0	1
121	LIMESTONE & E 5TH	4	3	0	0	0	0	0	0	1
126	MERIDIAN & 330TH	4	3	0	0	0	0	0	0	1
128	MUSTANG & 140TH	4	0	0	3	0	0	0	0	1
131	MUSTANG & 30TH N MAIN STREET & 340TH	4	3	0	0	0	0	0	0	1
136 162	OLD MILL & 140TH	4	0	0	3	0	0	0	0	1
176	PAWNEE & 140TH	4	3	0	0	0	0	0	0	1
180	PAWNEE & 230TH	4	3	0	0	0	0	0	0	1
188	QUAIL CREEK & 140TH	4	3	0	0	0	0	0	0	1
200	QUAILCREEK & 350TH	4	3	0	0	0	0	0	0	1
212	REMINGTON & 360TH	4	0	0	3	0	0	0	0	1
225	SUNFLOWER & 340TH	4	3	0	0	0	0	0	0	1
227	SUNFLOWER & 360TH (W)	4	0	0	0	0	0	0	3	1
258	UPLAND & 340TH	4	3	0	0	0	0	0	0	1
259	UPLAND & 360TH	4	0	0	3	0	0	0	0	1
264	VISTA & 360TH	4	0	0	3	0	0	0	0	1
266	WAGONWHEEL & 340TH	4	3	0	0	0	0	0	0	1
271	XAVIER & 340TH	4	3	0	0	0	0	0	0	1
273	YARROW & 125TH	4	0	0	3	0	0	0	0	1
274	YARROW & 160TH	4	0	0	3	0	0	0	0	1
283	ZEBULON & 230	4	0	0	3	0	0	0	0	1
289	PAWNEE & 365TH	4	3	0	0	0	0	0	0	1
289	PAVVINEE & 3051H	4	3	U	U	U	U	U	U	1

TSID	Intersection Name	Total Score	Volume Score	Access Density Score	Sight Distance Score	Horizontal Curvature Score		Distance from Previous STOP Score	Skewed Approach Score	Intersection Control Score
1	ALAMO & 150TH	3	2	0	0	0	0	0	0	1
2	ALAMO & 290TH (E)	3	2	0	0	0	0	0	0	1
3	ALAMO & 290TH (W)	3	2	0	0	0	0	0	0	1
9	ARROW & 30TH	3	2	0	0	0	0	0	0	1
10	BISON & 290TH	3	2	0	0	0	0	0	0	1
114	LIMESTONE & 350TH	3	2	0	0	0	0	0	0	1
120	LIMESTONE & E 4TH	3	3	0	0	0	0	0	0	0
124	MERIDIAN & 290TH	3	2	0	0	0	0	0	0	1
149	NIGHTHAWK & 250TH	3	2	0	0	0	0	0	0	1
172	OLDMILL & 240TH	3	2	0	0	0	0	0	0	1
174	PALM & 140TH	3	2	0	0	0	0	0	0	1
175	PARK & 285TH	3	3	0	0	0	0	0	0	0
183	PAWNEE & 30TH	3	2	0	0	0	0	0	0	1
201	REMINGTON & 140TH	3	3	0	0	0	0	0	0	0
232	SUNRISE & 220TH	3	2	0	0	0	0	0	0	1
235	SUNSET & 140TH	3	2	0	0	0	0	0	0	1
237	TIMBER & 140TH	3	2	0	0	0	0	0	0	1
242	TIMBER & 270TH	3	0	0	3	0	0	0	0	0
260	UPLAND & 40TH	3	2	0	0	0	0	0	0	1
268	WASHINGTON & 340TH	3	3	0	0	0	0	0	0	0
270	XAVIER & 290TH	3	2	0	0	0	0	0	0	1
275	YARROW & 170TH	3	2	0	0	0	0	0	0	1
290	330TH & LINCOLN	3	2	0	0	0	0	0	0	1
291	330TH & MAIN	3	2	0	0	0	0	0	0	1
292	330TH & ROOSEVELT	3	2	0	0	0	0	0	0	1
293	330TH & COLUMBUS	3	2	0	0	0	0	0	0	1
37	DIAMOND & 340TH	2	1	0	0	0	0	0	0	1
38	DIAMOND & 350TH	2	1	0	0	0	0	0	0	1
41	DIAMOND & 90TH	2	1	0	0	0	0	0	0	1
46	EAGLE & 90TH	2	1	0	0	0	0	0	0	1
63	HOLLY & 90TH	2	1	0	0	0	0	0	0	1
106	LIMESTONE & 140TH	2	1	0	0	0	0	0	0	1
115	LIMESTONE & 360TH	2	0	0	0	0	0	2	0	0
150	NIGHTHAWK & 260TH	2	1	0 _	0	0	0	0	0	1
151	NIGHTHAWK & 270TH	2	1	0	0	0	0	0	0	1
152	NIGHTHAWK & 280TH	2	1	0	0	0	0	0	0	1
192	QUAILCREEK & 30TH	_ 2	1	0	0	0	0	0	0	1
210	REMINGTON & 30TH	2	1	0	0	0	0	0	0	1
272	XAVIER & 40TH	2	1	0	0	0	0	0	0	1
276	YARROW & 180TH	2	1	0	0	0	0	0	0	1
286	ZEBULON & 290TH	2	1	0	0	0	0	0	0	1
287	360TH & B ST	2	1	0	0	0	0	0	0	1
6	ALFALFA & 240TH	1	0	0	0	0	0	0	0	1
7	ALFALFA & 290TH	1	0	0	0	0	0	0	0	1
12	BLUESTEM & 240TH	1	0	0	0	0	0	0	0	1
21	CLOVER & 240TH	1	0	0	0	0	0	0	0	1
26	DIAMOND & 210TH	1	0	0	0	0	0	0	0	1
27	DIAMOND & 220TH	1	0	0	0	0	0	0	0	1
30	DIAMOND & 250TH	1	0	0	0	0	0	0	0	1
33	DIAMOND & 300TH	1	0	0	0	0	0	0	0	1
35	DIAMOND & 320TH	1	0	0	0	0	0	0	0	1
40	DIAMOND & 370TH	1	1	0	0	0	0	0	0	0
44	EAGLE & 150TH	1	0	0	0	0	0	0	0	1
51	FALCON & 70TH	1	0	0	0	0	0	0	0	1
85	JADE & 90TH	1	0	0	0	0	0	0	0	1
123	MERIDIAN & 150TH	1	0	0	0	0	0	0	0	1
129	MUSTANG & 190TH	1	0	0	0	0	0	0	0	1
				•						

TSID	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
133	MUSTANG & 360TH	1	0	0	0	0	0	0	0	1
135	MUSTANG & 90TH	1	0	0	0	0	0	0	0	1
156	NIGHTHAWK & 360TH	1	0	0	0	0	0	0	0	1
168	OLD MILL & 360TH	1	0	0	0	0	0	0	0	1
228	SUNFLOWER & 370TH	1	0	0	0	0	0	0	0	1
240	TIMBER & 250TH	1	0	0	0	0	0	0	0	1
241	TIMBER & 260TH	1	0	0	0	0	0	0	0	1
246	TIMBER & 360TH	1	0	0	0	0	0	0	0	1
248	TIMBER & 50TH	1	1	0	0	0	0	0	0	0
250	TIMBER & 70TH	1	1	0	0	0	0	0	0	0
277	YARROW & 190TH	1	0	0	0	0	0	0	0	1
281	ZEBULON & 210	1	0	0	0	0	0	0	0	1
282	ZEBULON & 220	1	0	0	0	0	0	0	0	1
23	CLOVER & 40TH	0	0	0	0	0	0	0	0	0
28	DIAMOND & 230TH	0	0	0	0	0	0	0	0	0
31	DIAMOND & 280TH	0	0	0	0	0	0	0	0	0
34	DIAMOND & 310TH	0	0	0	0	0	0	0	0	0
190	QUAILCREEK & 210TH	0	0	0	0	0	0	0	0	0
252	TMBER & 280TH	0	0	0	0	0	0	0	0	0











# **APPENDIX L** LRSP CURVE RISK FACTOR SCORES

22 NODIGO 0.07M S OF 1.07H 16 6 0 2 2 2 0 1 2 0 3 45 SUNFLOWER G 37 N N OF 9011 16 5 1 1 1 2 0 0 3 46 SUNFLOWER G 37 N N OF 9011 16 5 1 1 1 2 1 1 1 2 0 0 3 47 SUNFLOWER F 0.07 N S OF 9010 17 1 1 1 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	TSID	Location or Intersection	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
45   SUNFLOWER 0.37 M N OF 90PH   16		NUDICO O CELLO DE 100EU	4.0									
17								_			_	
14   SUNFLOWER 0 9M SOF 180TH				_								
43   SUNPLOWER 0.99 M S OF 180TH   14   6   2   2   2   2   0   0   2   0   0   0											_	_
18				_								
7												_
41 SUNFLOWER & DOT HOUSE AS STATE AND STATE AN			_									
41											_	
31												-
42   SUNFLOWER & HIGHLAND   13   6   2   1   2   0   0   2   0   0			_	_								
30												
13			_					_			_	
16												
S					-		_					
40   SUNFLOWER & 180TH   12   6   0   2   2   2   0   0   2   0   0												
44   SUNFLOWER 0.21 M S OF 180TH   12		( )			_							
32												
33					-			_	_		_	_
SUNFLOWER 0.10M N OF 90TH												
S8												
37 PAWNEE 0.25 M N OF 213TH 12 5 0 2 2 1 0 2 0 0 GOLDENROD 8 190TH 11 3 2 1 2 1 0 2 0 0 0 6 290TH 8 GOLDEN ROD (W) 11 3 1 2 2 1 0 2 0 0 0 24 KANZA 0.38M N OF 280TH 11 4 1 1 2 1 0 2 0 0 0 25 KANZA 8.280TH 11 4 1 1 2 1 0 2 0 0 0 29 LAKESHORE DR 0.42 M E OF TURKEY 11 2 2 1 2 1 1 2 0 0 0 20 LAKESHORE DR 0.42 M E OF TURKEY 11 2 2 1 2 1 1 2 0 0 0 21 LAKESHORE DR 0.30M E OF TURKEY 11 2 2 1 2 1 1 2 0 0 0 22 LAKESHORE DR 0.04 M E OF TURKEY 11 2 2 1 2 1 1 2 0 0 0 23 LAKESHORE DR 0.05 M E OF TURKEY 11 2 2 1 2 1 1 2 0 0 0 21 GOLDEN ROD JUST S OF HWY 56 11 3 1 1 2 1 1 2 0 0 0 23 KANZA 0.27M S OF 270TH 10 1 3 2 0 1 1 2 0 0 0 26 KANZA 0.58M N OF 250TH 10 4 0 1 2 1 0 2 0 0 0 26 KANZA 0.58M N OF 250TH 10 4 0 1 2 1 0 2 0 0 0 27 LIMBER 8.80TH 10 1 3 2 0 1 1 2 0 0 0 28 LIMBER 8.80TH 10 1 3 2 0 1 1 2 0 0 0 29 LIMBER 8.80TH 10 1 3 2 0 1 1 2 0 0 0 20 COLD MILL 0.17M N OF HWY 56 10 1 3 2 0 1 1 2 0 0 0 21 1 1 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					-							-
20  GOLDENROD & 190TH											_	_
6 290TH & GOLDEN ROD (W) 11 3 1 2 2 1 0 2 0 0 0 2 4 KANZA 0.38M N OF 260TH 11 4 1 1 2 1 0 2 0 0 0 0 2 0 0 0 0 0 0 0 0 0						1	1					
24 KANZA 0.38M N OF 260TH 11 4 1 1 2 1 0 2 0 0 0 2 0 0 0 2 0 0 0 2 0 0 0 2 0 0 0 0 2 0							1		_		_	_
25 KANZA & 260TH 11 4 1 1 2 1 0 2 0 0 0 2 0 0 0 2 1 LAKESHORE DR 0.42 ME OF TURKEY 11 2 2 1 2 1 1 1 2 0 0 0 0 0 0 0 0 0 0												
29 LAKESHORE DR 0.42 M E OF TURKEY 11 2 2 1 2 1 1 2 0 0 0 2 7 LAKESHORE DR 0.30M E OF TURKEY CREEK 11 2 2 1 2 1 1 2 0 0 0 0 2 2 0 0 0 2 3 40TH & HWY 56 H		1112 1 11							_			
27 LAKESHORE DR 0.30M E OF TURKEY CREEK 11 2 1 2 1 1 2 0 0 0 2 1 0 0 1 1 2 1 1 2 0 0 0 0												
28 LAKESHORE DR 0.10M W OF RIDGEWAY DR 11 2 2 1 2 1 1 2 0 0 0 2 1 GOLDEN ROD JUST S OF HWY 56 11 3 1 1 2 1 1 2 0 0 0 0 2 3 KANZA 0.27M S OF 270TH 10 4 0 1 2 1 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0							V	1		-	_	
Columbia C												
TIMBER & 80TH	_										_	
23						1						
26					_							_
48												
49												-
1         140TH 0.30M E OF UPLAND         10         1         1         2         2         1         1         2         0         0           36         OLDMILL 0.17M N OF HWY 56         10         5         0         1         2         0         0         2         0         0           12         360TH 8.N D ST (E)         9         0         3         2         0         1         1         2         0         0           15         360TH 8.D ST (E)         9         0         3         2         0         1         1         2         0         0           15         360TH 0.01M E OF N D ST         9         0         3         2         0         1         1         2         0         0           11         340TH 0.13M W OF N D ST         9         2         1         2         0         1         1         2         0         0           8         30TH 8.C LOVER         9         1         3         1         0         1         1         2         0         0           19         BLUESTEM & 290TH         9         0         3         2         0         0 </td <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>					-							
36											_	_
12   360TH & N D ST (E)												
15         360TH 0.01M E OF N D ST         9         0         3         2         0         1         1         2         0         0           11         340TH 0.13M W OF HWY 56         9         2         1         2         0         1         1         2         0         0           9         340TH & HWY 56 (W)         9         2         1         2         0         1         1         2         0         0           8         30TH & CLOVER         9         1         3         1         0         1         1         2         0         0           19         BLUESTEM & 290TH         9         0         3         2         0         1         1         2         0         0           35         OLD MILL & 210TH         9         5         0         2         0         0         0         2         0         0           51         TURKEY & 80TH         8         1         3         1         0         0         1         2         0         0           46         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         <						1					_	
11         340TH 0.13M W OF HWY 56         9         2         1         2         0         1         1         2         0         0           9         340TH & HWY 56 (W)         9         2         1         2         0         1         1         2         0         0           8         30TH & CLOVER         9         1         3         1         0         1         1         2         0         0           19         BLUESTEM & 290TH         9         0         3         2         0         1         1         2         0         0           35         OLD MILL & 210TH         9         5         0         2         0         0         0         2         0         0           51         TURKEY & 80TH         8         1         3         1         0         0         1         2         0         0           56         ZEBULLON & 30TH         8         0         2         2         0         1         1         2         0         0           46         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         0 <td></td> <td></td> <td>_</td> <td></td> <td>-</td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td>			_		-		-					
9         340TH & HWY 56 (W)         9         2         1         2         0         1         1         2         0         0           8         30TH & CLOVER         9         1         3         1         0         1         1         2         0         0           19         BLUESTEM & 290TH         9         0         3         2         0         1         1         2         0         0           35         OLD MILL & 210TH         9         5         0         2         0         0         0         2         0         0           51         TURKEY & 80TH         8         1         3         1         0         0         1         2         0         0           56         ZEBULLON & 30TH         8         0         2         2         0         1         1         2         0         0           47         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         0         0         0         0           46         SUNFLOWER 1.2M N OF 140TH         8         5         0         1         2         0         0 </td <td></td> <td>_</td> <td></td>											_	
8         30TH & CLOVER         9         1         3         1         0         1         1         2         0         0           19         BLUESTEM & 290TH         9         0         3         2         0         1         1         2         0         0           35         OLD MILL & 210TH         9         5         0         2         0         0         0         2         0         0           51         TURKEY & 80TH         8         1         3         1         0         0         1         2         0         0           56         ZEBULLON & 30TH         8         0         2         2         0         1         1         2         0         0           47         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         0         0         0         0           46         SUNFLOWER 0.43 M S OF 140TH         8         5         0         1         2         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>												
19         BLUESTEM & 290TH         9         0         3         2         0         1         1         2         0         0           35         OLD MILL & 210TH         9         5         0         2         0         0         0         2         0         0           51         TURKEY & 80TH         8         1         3         1         0         0         1         2         0         0           56         ZEBULLON & 30TH         8         0         2         2         0         1         1         2         0         0           47         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         0         0         0         0           46         SUNFLOWER 0.43 M S OF 140TH         8         5         0         1         2         0	_		-				_					
35         OLD MILL & 210TH         9         5         0         2         0         0         0         2         0         0           51         TURKEY & 80TH         8         1         3         1         0         0         1         2         0         0           56         ZEBULLON & 30TH         8         0         2         2         0         1         1         2         0         0           47         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         0         0         0         0           46         SUNFLOWER 0.43 M S OF 140TH         8         5         0         1         2         0         0         0         0         0           46         SUNFLOWER 0.43 M S OF 140TH         8         5         0         1         2         0												
51         TURKEY & 80TH         8         1         3         1         0         0         1         2         0         0           56         ZEBULLON & 30TH         8         0         2         2         0         1         1         2         0         0           47         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         0         0         0         0           46         SUNFLOWER 0.43 M S OF 140TH         8         5         0         1         2         0 <td></td> <td>-</td> <td></td>											-	
56         ZEBULLON & 30TH         8         0         2         2         0         1         1         2         0         0           47         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         0         0         0         0           46         SUNFLOWER 0.43 M S OF 140TH         8         5         0         1         2         0 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>												
47         SUNFLOWER 1.2M N OF 120TH         8         5         0         1         2         0         0         0         0         0           46         SUNFLOWER 0.43 M S OF 140TH         8         5         0         1         2         0         0         0         0         0           10         340TH & HWY 56 (E)         8         2         0         2         0         1         1         2         0         0           3         240TH & PAWNEE         7         2         1         2         0         0         0         2         0         0           2         240TH & NIGHTHAWK         7         2         1         2         0         0         0         2         0         0           52         YARROW 0.42 M N OF 125TH         7         0         2         1         0         1         1         2         0         0           54         YARROW 0.67 M S OF 160TH         7         0         2         1         0         1         1         2         0         0           55         YARROW 0.66 M N OF 125TH         6         0         1         1         0											-	
46       SUNFLOWER 0.43 M S OF 140TH       8       5       0       1       2       0       0       0       0       0         10       340TH & HWY 56 (E)       8       2       0       2       0       1       1       2       0       0         3       240TH & PAWNEE       7       2       1       2       0       0       0       2       0       0         2       240TH & NIGHTHAWK       7       2       1       2       0       0       0       2       0       0         52       YARROW 0.42 M N OF 125TH       7       0       2       1       0       1       1       2       0       0         54       YARROW 0.67 M S OF 160TH       7       0       2       1       0       1       1       2       0       0         55       YARROW 0.76 M S OF 160TH       7       0       2       1       0       1       1       2       0       0         53       YARROW 0.66 M N OF 125TH       6       0       1       1       0       1       1       2       0       0												
10     340TH & HWY 56 (E)     8     2     0     2     0     1     1     2     0     0       3     240TH & PAWNEE     7     2     1     2     0     0     0     2     0     0       2     240TH & NIGHTHAWK     7     2     1     2     0     0     0     2     0     0       52     YARROW 0.42 M N OF 125TH     7     0     2     1     0     1     1     2     0     0       54     YARROW 0.67 M S OF 160TH     7     0     2     1     0     1     1     2     0     0       55     YARROW 0.76 M S OF 160TH     7     0     2     1     0     1     1     2     0     0       53     YARROW 0.66 M N OF 125TH     6     0     1     1     0     1     1     2     0     0			_						_		_	
3     240TH & PAWNEE     7     2     1     2     0     0     0     2     0     0       2     240TH & NIGHTHAWK     7     2     1     2     0     0     0     2     0     0       52     YARROW 0.42 M N OF 125TH     7     0     2     1     0     1     1     2     0     0       54     YARROW 0.67 M S OF 160TH     7     0     2     1     0     1     1     2     0     0       55     YARROW 0.76 M S OF 160TH     7     0     2     1     0     1     1     2     0     0       53     YARROW 0.66 M N OF 125TH     6     0     1     1     0     1     1     2     0     0												
2     240TH & NIGHTHAWK     7     2     1     2     0     0     0     2     0     0       52     YARROW 0.42 M N OF 125TH     7     0     2     1     0     1     1     2     0     0       54     YARROW 0.67 M S OF 160TH     7     0     2     1     0     1     1     2     0     0       55     YARROW 0.76 M S OF 160TH     7     0     2     1     0     1     1     2     0     0       53     YARROW 0.66 M N OF 125TH     6     0     1     1     0     1     1     2     0     0											_	
52     YARROW 0.42 M N OF 125TH     7     0     2     1     0     1     1     2     0     0       54     YARROW 0.67 M S OF 160TH     7     0     2     1     0     1     1     2     0     0       55     YARROW 0.76 M S OF 160TH     7     0     2     1     0     1     1     2     0     0       53     YARROW 0.66 M N OF 125TH     6     0     1     1     0     1     1     2     0     0												
54         YARROW 0.67 M S OF 160TH         7         0         2         1         0         1         1         2         0         0           55         YARROW 0.76 M S OF 160TH         7         0         2         1         0         1         1         2         0         0           53         YARROW 0.66 M N OF 125TH         6         0         1         1         0         1         1         2         0         0									_		_	
55         YARROW 0.76 M S OF 160TH         7         0         2         1         0         1         1         2         0         0           53         YARROW 0.66 M N OF 125TH         6         0         1         1         0         1         1         2         0         0												
53 YARROW 0.66 M N OF 125TH 6 0 1 1 0 1 1 2 0 0											_	
1 34 L NICHTERWYN U IZWIN UFZOUTE   4	34	NIGHTHAWK 0.12M N OF 280TH	4	1	0	1	0	0	0	2	0	0

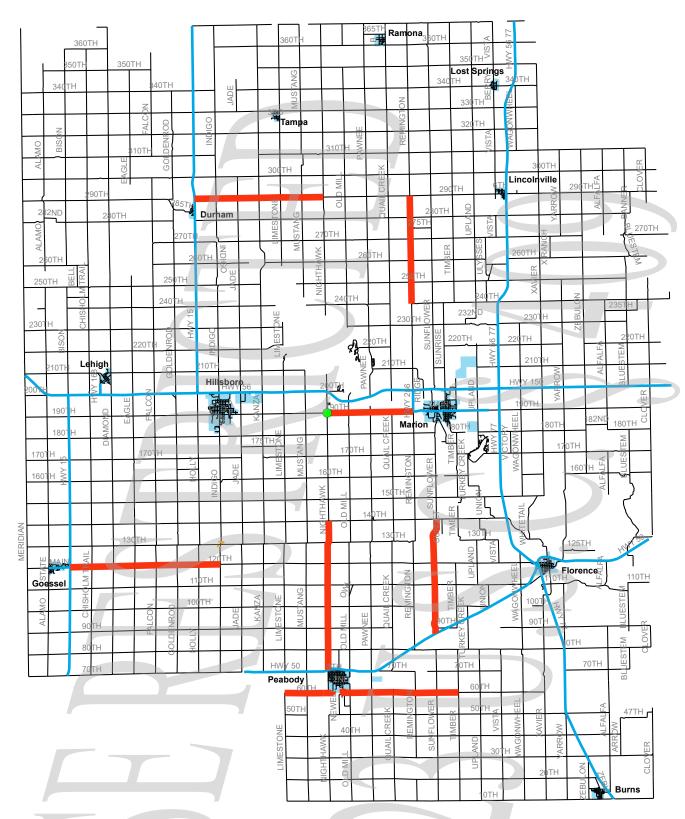




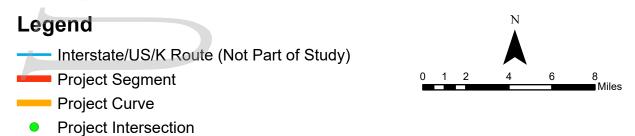




# **APPENDIX M** LRSP Project Locations and Project Sheets



# **Marion County LRSP Project Locations**



# Marion County Local Road Safety Plan

# Project Description for Roadway Segment Improvements

Risk Factor Score\*: 18

Project Name: 60th Street between Limestone Road and S Locust Street (Peabody Southwest City Limit)

Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net

Date: 2/28/20 Prepared By: AJW Checked By: MMO

**SEGMENT** 

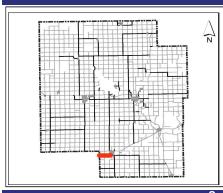
#### **Location Description**

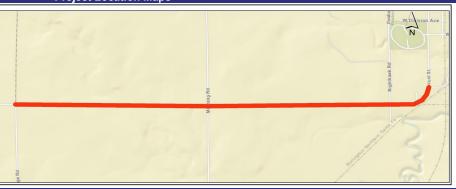
Road: 60th Street GPS ID: 51, 52

From: Limestone Road Length (miles): 2.3

To: S Locust Street (Peabody Southwest City Limit)

#### Project Location Maps





# **Segment Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score*				
Average Daily Traffic (ADT)	185	3				
Access Points per Mile	4.5	2				
Edge Condition	2.0	3				
Roadside Assessment	2.0	3				
Pavement Width (ft)	24.0	0				
Shoulder Width (ft)	0.0	2				
Lane Departure Crash Rate	3.3	3				
Presence of Pavement Markings	No	2				
Surface Type						
Total Risk Factor Score (24 i	18					

Other Informa	tion
Paved Shoulder	No
Shoulder Material	NONE
Speed Limit (mph)	55
Number of Lanes	2
Lane Width (ft)	12
Edgeline Rumble Strips	NOT PRESENT
Centerline Rumble Strips	NOT PRESENT
Curves	1
Curves with Warning Signs	1

\*Score from highest ranking segment used

#### Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit		Unit Price	Item Cost
Install 6" Retroreflective Edgeline (Both Sides of Road)	2.30	MILE	\$	4,200	\$ 9,657
Install 4" Retroreflective Centerline	2.30	MILE	\$	2,100	\$ 4,828
Delineate Roadside Hazards with Retroreflective Markers	23	EACH	\$	100	\$ 2,300
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.73	MILE	\$	30,000	\$ 21,750
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	0	MILE	\$	5,000	\$ -
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	\$ -
Retroreflective Strips on Curve Signage	1	CURVE	\$	100	\$ 100
	•	Short Term Imp	orove	ements Subtotal:	\$ 39,635

#### 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	0	FOOT	\$	35	\$ -
Flattening and Widening Foreslopes	2.30	MILE	\$	75,000	\$ 172,443
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	\$	20,000	\$ -
		Longer Term Im	prove	ements Subtotal:	\$ 176,443

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

Front Page









Marion County Local Road Safety Plan

Project Description for Roadway Segment Improvements

Risk Factor Score: 18

Project Name: 60th Street between Limestone Road and S Locust Street (Peabody Southwest City Limit)

Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net

Date: 2/28/20 Prepared By: AJW Checked By: MMO

**SEGMENT** 

51, 52

#### Opinion of Probable Cost (Additional Potential Improvements)

GPS ID:

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	Uı	nit 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	\$	20,000	\$	-
Speed Activated Flashers on Chevron Signs		CURVE	\$	4,000	\$	-
Speed Feedback Sign on Curve Warning Sign		EACH	\$	4,000	\$	-
Other: Extend Culverts	6	EACH	\$	15,000	\$	90,000
Other:						
Other:						
Other:						
	1.00			-	Φ.	00 000

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

Additio	nal Po	tential Imp	rovements Subtotal:	\$ 90,000
	Shor	t Term Imp	rovements Subtotal:	\$ 39,635
I	onge	r Term Imp	rovements Subtotal:	\$ 176,443
	_	Co	onstruction Subtotal:	\$ 306,078

10%	\$	30,610
5%	\$	15,462
20%	\$	61,849
n Cost	\$	414,000
	5% 20%	10% \$ 5% \$ 20% \$ n Cost \$

PE (Design)	12%	\$ 49,680
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 62,100
Estimated Project	t Total	\$ 526 000

#### Additional Project Benefits:

The improvements recommended along this segment can also have the benefit of positively impacting the following identified facility:

- Curve 18

#### Crash History Along this 2.3 Mile Roadway Segment

	2017	2016	2015	2014	2013
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	0	0	0	0	0
Number of Injuries	0	0	0	0	0
Number of Property Damage Only Crashes	0	0	0	5	0

#### **Opinion of Probable Construction Cost Disclaimer:**

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#### **Project Description Form Disclaimer:**

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End of Project Description Back Page









<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

# Marion County Local Road Safety Plan

# Project Description for Roadway Segment Improvements

Project Name: Nighthawk Road between 140th Street and US-50

Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net

Risk Factor Score\*: 18

Date: 2/28/20 Prepared By: AJW Checked By: MMO

GPS ID:



**SEGMENT** 

83, 85, 89

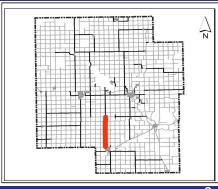
# **Location Description**

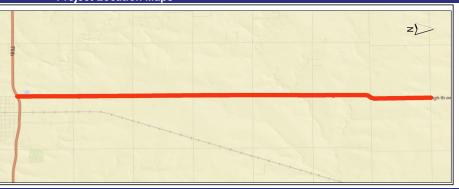
Road: Nighthawk Road

From: 140th Street To: US-50

Length (miles): 6.92

#### **Project Location Maps**





# **Segment Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score*					
Average Daily Traffic (ADT)	460	5					
Access Points per Mile	5.2	2					
Edge Condition	2.0	3					
Roadside Assessment	2.0	3					
Pavement Width (ft)	22.0	0					
Shoulder Width (ft)	1.0	2	1				
Lane Departure Crash Rate	1.8	3					
Presence of Pavement Markings	Yes	0	**				
Surface Type	PAVED	0					
Total Risk Factor Score (24 r	18						
*Score from highest ranking segment used							

Other Information					
Paved Shoulder	Yes				
Shoulder Material	ASPHALT				
Speed Limit (mph)	55				
Number of Lanes	2				
Lane Width (ft)	11				
Edgeline Rumble Strips	NOT PRESENT				
Centerline Rumble Strips	NOT PRESENT				
Curves	2				
Curves with Warning Signs	2				
**Edgeline and Centerline					

<sup>\*\*</sup>Edgeline and Centerline

#### Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	antity Unit Unit Price		Unit Price		Item Cost
Install 6" Retroreflective Edgeline (Both Sides of Road)	6.92	MILE	\$	4,200	\$	29,051
Install 4" Retroreflective Centerline	6.92	MILE	\$	2,100	\$	14,525
Delineate Roadside Hazards with Retroreflective Markers	70	EACH	\$	100	\$	7,000
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.32	MILE	\$	30,000	\$	9,600
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)	6.92	MILE	\$	5,000	\$	34,584
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	6.92	MILE	\$	2,000	\$	13,834
Post-Mounted Delineators	0	MILE	\$	5,000	\$	-
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	2	CURVE	\$	1,000	\$	2,000
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	\$	3,500	\$	-
Retroreflective Strips on Curve Signage	2	CURVE	\$	100	\$	200
Short Term Improvements Subtotal:						110,794

#### 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)	6.92	MILE	\$	150,000	\$	1,037,529
Install Edgeline Rumble Strips	6.92	MILE	\$	5,000	\$	34,584
Install Centerline Rumble Strips	6.92	MILE	\$	2,000	\$	13,834
Install/Upgrade Guardrail	182	FOOT	\$	80	\$	14,560
Flattening and Widening Foreslopes	6.92	MILE	\$	75,000	\$	518,765
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	\$	20,000	\$	-
Longer Term Improvements Subtotal:					\$	1,623,272

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









Marion County Local Road Safety Plan

Project Description for Roadway Segment Improvements

Project Name: Nighthawk Road between 140th Street and US-50 Prepared By: AJW

Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net



18

Date: 2/28/20

Checked By: MMO

**SEGMENT** 

GPS ID: 83, 85, 89

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	\$ 20,000	\$ -
Speed Activated Flashers on Chevron Signs		CURVE	\$ 4,000	\$ -
Speed Feedback Sign on Curve Warning Sign		EACH	\$ 4,000	\$ -
Other: Extend Culverts	12	EACH	\$ 15,000	\$ 180,000
Other:				
Other:				-
Other:				
				400 000

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

A	dditional Po	tential Imp	rovements	Subtotal:	\$ 180,000
	Shor	t Term Imp	rovements	Subtotal:	\$ 110,794
	Longe	r Term Imp	rovements	Subtotal:	\$ 1,623,272
		Ċ	netruction S	Subtotal:	\$ 1 914 066

**Risk Factor Score:** 

Mobilization: (% +/-)*	10%	\$ 75,000
Traffic Control: (% +/-)	5%	\$ 95,787
Contingency: (% +/-)	20%	\$ 383,147
Estimated Construction	on Cost	\$ 2,468,000

PE (Design)	12%	\$ 296,160
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 370,200
Estimated Project	t Total	\$ 3 135 000

#### Additional Project Benefits:

The improvements recommended along this segment can also have the benefit of positively impacting the following identified facility:

Curves 32, 33

### Crash History Along this 6.92 Mile Roadway Segment

	2017	2016	2015	2014	2013
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	2	0	0
Number of Injuries	0	1	3	0	0
Number of Property Damage Only Crashes	1	3	3	1	4

#### Opinion of Probable Construction Cost Disclaimer:

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Back Page **End of Project Description** 











<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

# Marion County Local Road Safety Plan

# Project Description for Roadway Segment Improvements

Risk Factor Score: 18

3 ||

GPS ID:

Project Name: Remington Road between 290th Street and 240th Street

Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net

Date: 2/28/20 Prepared By: AJW Checked By: MMO

**SEGMENT** 

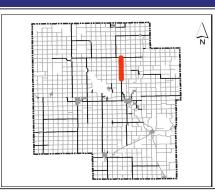
100

#### **Location Description**

Road: Remington Road

From: 290th Street To: 240th Street

Length (miles): 5.00





# **Segment Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score	1
Average Daily Traffic (ADT)	295	5	1
Access Points per Mile	5.0	2	1
Edge Condition	2.0	3	1
Roadside Assessment	2.0	3	1
Pavement Width (ft)	30.0	0	1
Shoulder Width (ft)	0.0	2	1
Lane Departure Crash Rate	1.9	3	1
Presence of Pavement Markings	Yes	0	*:
Surface Type	PAVED	0	1
Total Risk Factor Score (24)	18	1	

Other Information					
Paved Shoulder	No				
Shoulder Material	NONE				
Speed Limit (mph)	55				
Number of Lanes	2				
Lane Width (ft)	15				
Edgeline Rumble Strips	NOT PRESENT				
Centerline Rumble Strips	NOT PRESENT				
Curves	0				
Curves with Warning Signs	0				
**Edgaling and Contading					

<sup>\*\*</sup>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)	5.00	MILE	\$	4,200	\$	21,006	
Install 4" Retroreflective Centerline	5.00	MILE	\$	2,100	\$	10,503	
Delineate Roadside Hazards with Retroreflective Markers	51	EACH	\$	100	\$	5,100	
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.71	MILE	\$	30,000	\$	21,150	
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	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	\$	-	
Retroreflective Strips on Curve Signage	0	CURVE	\$	100	\$	-	
Short Term Improvements Subtotal:							

### **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	0	FOOT	\$	35	\$	-
Flattening and Widening Foreslopes	5.00	MILE	\$	75,000	\$	375,110
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	\$	20,000	\$	-
Longer Term Improvements Subtotal:						

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









Marion County Local Road Safety Plan

Project Description for Roadway Segment Improvements

Date: 2/28/20

18

**Risk Factor Score:** 

Project Name: Remington Road between 290th Street and 240th Street

Contact Name: Brice Goebel

Prepared By: AJW Checked By: MMO E-mail: bgoebel@marioncoks.net

**SEGMENT** 

GPS ID: 100

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.

Quantity	Unit		Unit Price		Item Cost
	EACH	\$	3,000	\$	
	EACH	\$	40,000	\$	-
	MILE	\$	850,000	\$	-
	EACH	\$	40,000	\$	-
	CURVE	\$	3,000	\$	-
	CURVE	\$	20,000	\$	-
	CURVE	\$	4,000	\$	-
	EACH	\$	4,000	\$	-
13	EACH	\$	15,000	\$	195,000
			-		-
					105.000
		EACH EACH MILE EACH CURVE CURVE CURVE EACH	EACH \$ EACH \$ MILE \$ EACH \$ CURVE \$ CURVE \$ CURVE \$ EACH \$	EACH \$ 3,000 EACH \$ 40,000 MILE \$ 850,000 EACH \$ 40,000 CURVE \$ 3,000 CURVE \$ 20,000 CURVE \$ 4,000 EACH \$ 4,000 EACH \$ 15,000	EACH \$ 3,000 \$ EACH \$ 40,000 \$ MILE \$ 850,000 \$ EACH \$ 40,000 \$ CURVE \$ 3,000 \$ CURVE \$ 20,000 \$ CURVE \$ 4,000 \$ EACH \$ 4,000 \$

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

Additional Potentia	al Imp	rovements Subtotal:	\$ 195,000
Short Terr	n Imp	rovements Subtotal:	\$ 57,759
Longer Terr	n Imp	rovements Subtotal:	\$ 379,110
	C	onstruction Subtotal:	\$ 631 870

Mobilization: (% +/-)*	10%	\$ 63,190
Traffic Control: (% +/-)	5%	\$ 31,788
Contingency: (% +/-)	20%	\$ 127,152
Estimated Construction	on Cost	\$ 854,000

PE (Design)	12%	\$ 102,480
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 128,100
Estimated Project	Total	\$ 1 085 000

# Crash History Along this 5 Mile Roadway Segment

	2017	2016	2015	2014	2013
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	1	0	0
Number of Disabling Injuries	0	0	1	0	0
Number of Injury Crashes	0	0	1	0	0
Number of Injuries	0	0	1	0	0
Number of Property Damage Only Crashes	1	1	3	1	0

#### Opinion of Probable Construction Cost Disclaimer:

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Back Page **End of Project Description** 









<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

# Marion County Local Road Safety Plan

# Project Description for Roadway Segment Improvements

Project Name: Sunflower Road between 140th Street and US-50

Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net

Risk Factor Score\*:

18

Date: 2/28/20 Prepared By: AJW Checked By: MMO

**SEGMENT** 

#### **Location Description**

Road: Sunflower Road

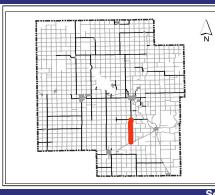
From: 140th Street To: US-50

Length (miles): 5.38

GPS ID:

103, 105







# **Segment Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score*	
Average Daily Traffic (ADT)	615	6	
Access Points per Mile	2.2	1	1
Edge Condition	2.0	3	
Roadside Assessment	2.0	3	
Pavement Width (ft)	24.0	0	
Shoulder Width (ft)	0.0	2	1
Lane Departure Crash Rate	3.1	3	
Presence of Pavement Markings	Yes	0	*:
Surface Type	PAVED	0	
Total Risk Factor Score (24 r	18		
*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)	12			
Edgeline Rumble Strips	NOT PRESENT			
Centerline Rumble Strips	NOT PRESENT			
Curves	5			
Curves with Warning Signs	5			
**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)	5.38	MILE	\$	4,200	\$ 22,591
Install 4" Retroreflective Centerline	5.38	MILE	\$	2,100	\$ 11,295
Delineate Roadside Hazards with Retroreflective Markers	54	EACH	\$	100	\$ 5,400
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.17	MILE	\$	30,000	\$ 5,100
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)	5.38	MILE	\$	5,000	\$ 26,894
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	5.38	MILE	\$	2,000	\$ 10,758
Post-Mounted Delineators	0	MILE	\$	5,000	\$ -
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	5	CURVE	\$	1,000	\$ 5,000
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	\$	3,500	\$ -
Retroreflective Strips on Curve Signage	5	CURVE	\$	100	\$ 500
		Short Term Imp	rove	ements Subtotal:	\$ 87,538

### **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)	5.38	MILE	\$	150,000	\$ 806,816
Install Edgeline Rumble Strips	5.38	MILE	\$	5,000	\$ 26,894
Install Centerline Rumble Strips	5.38	MILE	\$	2,000	\$ 10,758
Install/Upgrade Guardrail	241	FOOT	\$	80	\$ 19,280
Flattening and Widening Foreslopes	5.38	MILE	\$	75,000	\$ 403,408
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	\$	20,000	\$ -
		Longer Term Imp	rove	ements Subtotal:	\$ 1,271,155

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









Kimley » Horn

Marion County Local Road Safety Plan

Project Description for Roadway Segment Improvements

Project Name: Sunflower Road between 140th Street and US-50

Contact Name: Brice Goebel E-mail: bgoebel@marioncoks.net Date: 2/28/20

**Risk Factor Score:** 

Prepared By: AJW Checked By: MMO

18



**SEGMENT** 

#### Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 103, 105

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 39, 41, and 45	3	CURVE	\$	50,000	\$	150,000	
Speed Activated Flashers on Chevron Signs		CURVE	\$	4,000	\$	-	
Speed Feedback Sign on Curve Warning Sign		EACH	\$	4,000	\$	-	
Other: Extend Culverts	11	EACH	\$	15,000	\$	165,000	
Other: At grade railroad crossing .35 miles east of K-15							
Other:							
Other:						315,000	
Additional Patential Improvements Subtatal:							

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

Α	dditional Po	tential Imp	rovements S	Subtotal:	\$	315,000
	Shor	t Term Imp	rovements S	Subtotal:	\$	87,538
	Longe	r Term Imp	rovements S	Subtotal:	\$	1,271,155
		Ċ	netruction S	Subtotal:	¢	1 672 602

Mobilization: (% +/-)*	10%	\$ 75,000
Traffic Control: (% +/-)	5%	\$ 83,862
Contingency: (% +/-)	20%	\$ 335,446
Estimated Construction	n Cost	\$ 2,168,000

PE (Design)	12%	\$ 260,160
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 325,200
Estimated Project	t Total	\$ 2 754 000

#### Additional Project Benefits:

The improvements recommended along this segment can also have the benefit of positively impacting the following identified facility:

- Curves 39, 41, 45, 46, 47

### Crash History Along this 5.38 Mile Roadway Segment

	2017	2016	2015	2014	2013
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	1	0	0
Number of Disabling Injuries	0	0	6	0	0
Number of Injury Crashes	0	1	1	1	0
Number of Injuries	0	1	1	1	0
Number of Property Damage Only Crashes	1	3	2	3	2

#### **Opinion of Probable Construction Cost Disclaimer:**

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<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

# Marion County Local Road Safety Plan

# Project Description for Roadway Segment Improvements

Project Name: 290th Street between K-15 and Nighthawk Road

Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net



Date: 2/28/20

GPS ID:

Prepared By: AJW Checked By: MMO

**SEGMENT** 

25, 26, 32

#### **Location Description**

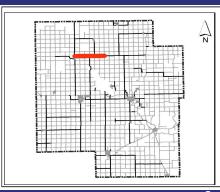
Road: 290th Street

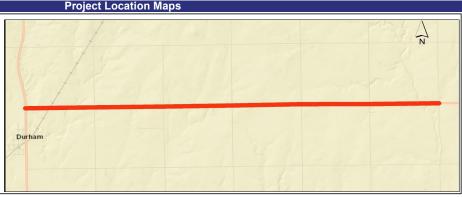
From: K-15

To: Nighthawk Road

Length (miles): 5.98

#### \_\_\_\_\_





# **Segment Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score*	
Average Daily Traffic (ADT)	535	5	
Access Points per Mile	2.0	1	1
Edge Condition	2.0	3	
Roadside Assessment	2.0	3	
Pavement Width (ft)	26.0	0	
Shoulder Width (ft)	1.0	2	1
Lane Departure Crash Rate	2.1	3	
Presence of Pavement Markings	Yes	0	**
Surface Type	PAVED	0	
Total Risk Factor Score (24 r	17		
*Score from highest ranking segment used	1	•	

Other Information					
Paved Shoulder	Yes				
Shoulder Material	ASPHALT				
Speed Limit (mph)	55				
Number of Lanes	2				
Lane Width (ft)	13				
Edgeline Rumble Strips	NOT PRESENT				
Centerline Rumble Strips	NOT PRESENT				
Curves	0				
Curves with Warning Signs	0				
**Edgeline and Centerline					

<sup>\*\*</sup>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)	5.98	MILE	\$ 4,200	\$ 25,121
Install 4" Retroreflective Centerline	5.98	MILE	\$ 2,100	\$ 12,560
Delineate Roadside Hazards with Retroreflective Markers	60	EACH	\$ 100	\$ 6,000
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.11	MILE	\$ 30,000	\$ 3,300
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)	5.98	MILE	\$ 5,000	\$ 29,906
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	5.98	MILE	\$ 2,000	\$ 11,962
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	\$ -
Retroreflective Strips on Curve Signage	0	CURVE	\$ 100	\$
		Short Term Imp	rovements Subtotal:	\$ 88.850

### **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)	5.98	MILE	\$	150,000	\$	897,177
Install Edgeline Rumble Strips	5.98	MILE	\$	5,000	\$	29,906
Install Centerline Rumble Strips	5.98	MILE	\$	2,000	\$	11,962
Install/Upgrade Guardrail	73	FOOT	\$	80	\$	5,840
Flattening and Widening Foreslopes	5.98	MILE	\$	75,000	\$	448,589
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	\$	20,000	\$	-
		Longer Term Imp	orove	ements Subtotal:	\$	1,397,474

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









Marion County Local Road Safety Plan

Project Description for Roadway Segment Improvements

Project Name: 290th Street between K-15 and Nighthawk Road Date: 2/28/20

Contact Name: Brice Goebel Prepared By: AJW E-mail: bgoebel@marioncoks.net Checked By: MMO



**SEGMENT** 

#### Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 25, 26, 32

17

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	\$	20,000	\$	-
Speed Activated Flashers on Chevron Signs		CURVE	\$	4,000	\$	-
Speed Feedback Sign on Curve Warning Sign		EACH	\$	4,000	\$	-
Other: Extend Culverts	12	EACH	\$	15,000	\$	180,000
Other:						
Other:						
Other:						
Λ	dditional Da	tantial Imp	rov.	monte Subtotal:	Φ.	180 000

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

Additional Poter	ntial Imp	rovements Subtotal:	\$ 180,000
Short Te	erm Imp	rovements Subtotal:	\$ 88,850
Longer Te	erm Imp	rovements Subtotal:	\$ 1,397,474
	Co	instruction Subtotal:	\$ 1 666 323

**Risk Factor Score:** 

Mobilization: (% +/-)*	10%	\$ 75,000
Traffic Control: (% +/-)	5%	\$ 83,335
Contingency: (% +/-)	20%	\$ 333,341
Estimated Construction	on Cost	\$ 2,158,000

PE (Design)	12%	\$ 258,960
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 323,700
Estimated Project	t Total	\$ 2,741,000

Crash Histor	y Along t	this 5.98 Mile Roadway	y Segment
--------------	-----------	------------------------	-----------

	2017	2016	2015	2014	2013
Number of Fatal Crashes	0	0	0	1	0
Number of Fatalities	0	0	0	1	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	0	0	0
Number of Injuries	0	1	0	0	0
Number of Property Damage Only Crashes	2	3	1	1	2

#### **Opinion of Probable Construction Cost Disclaimer:**

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<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

# Marion County Local Road Safety Plan

# Project Description for Roadway Segment Improvements

Risk Factor Score\*: 17

Project Name: 190th Street between Nighthawk Road and Remington Road (K-256)

Contact Name: Brice Goebel E-mail: bgoebel@marioncoks.net

Date: 2/28/20 Prepared By: AJW Checked By: MMO

**SEGMENT** 

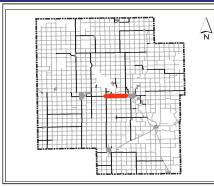
#### **Location Description**

Road: 190th Street GPS ID: 12, 16

From: Nighthawk Road

To: Remington Road (K-256) Length (miles): 3.98

# **Project Location Maps**





# **Segment Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score*
Average Daily Traffic (ADT)	1,075	6
Access Points per Mile	3.7	2
Edge Condition	2.0	3
Roadside Assessment	2.0	3
Pavement Width (ft)	26.0	0
Shoulder Width (ft)	2.0	1
Lane Departure Crash Rate	0.9	2
Presence of Pavement Markings	Yes	0
Surface Type	PAVED	0
Total Risk Factor Score (24 max)		17
*Score from highest ranking segment used		

Other Information					
Paved Shoulder	No				
Shoulder Material	GRAVEL				
Speed Limit (mph)	55				
Number of Lanes	2				
Lane Width (ft)	13				
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)	3.98	MILE	\$	4,200	\$ 16,720
Install 4" Retroreflective Centerline	3.98	MILE	\$	2,100	\$ 8,360
Delineate Roadside Hazards with Retroreflective Markers	40	EACH	\$	100	\$ 4,000
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.43	MILE	\$	30,000	\$ 12,750
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)	3.98	MILE	\$	5,000	\$ 19,904
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	3.98	MILE	\$	2,000	\$ 7,962
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	\$ -
Retroreflective Strips on Curve Signage	0	CURVE	\$	100	\$ -
		Short Term Imp	orove	ements Subtotal:	\$ 69,695

### **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)	3.98	MILE	\$	150,000	\$	597,129
Install Edgeline Rumble Strips	3.98	MILE	\$	5,000	\$	19,904
Install Centerline Rumble Strips	3.98	MILE	\$	2,000	\$	7,962
Install/Upgrade Guardrail	975	FOOT	\$	35	\$	34,125
Flattening and Widening Foreslopes	3.98	MILE	\$	75,000	\$	298,565
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	\$	20,000	\$	-
Longer Term Improvements Subtotal:						961,685

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









Marion County Local Road Safety Plan

Project Description for Roadway Segment Improvements

Risk Factor Score: 17

17

Date: 2/28/20

Project Name: 190th Street between Nighthawk Road and Remington Road (K-256)

Contact Name: Brice Goebel Prepared By: AJW
E-mail: bgoebel@marioncoks.net Checked By: MMO

SEGMENT

#### Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 12, 16

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	\$ 20,000	\$ -
Speed Activated Flashers on Chevron Signs		CURVE	\$ 4,000	\$ -
Speed Feedback Sign on Curve Warning Sign		EACH	\$ 4,000	\$ -
Other: Extend Culverts	6	EACH	\$ 15,000	\$ 90,000
Other:				
Other:				-
Other:				
				00 000

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

Add	ditional Po	tential Imp	rovements Subtotal:	\$ 90,000
	Short	t Term Imp	rovements Subtotal:	\$ 69,695
	Longer	r Term Imp	rovements Subtotal:	\$ 961,685
	_	Co	onstruction Subtotal:	\$ 1,121,380

Mobilization: (% +/-)*	10%	\$ 75,000
Traffic Control: (% +/-)	5%	\$ 56,124
Contingency: (% +/-)	20%	\$ 224,496
Estimated Construction	n Cost	\$ 1,477,000

PE (Design)	12%	\$ 177,240
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 221,550
Estimated Project	t Total	\$ 1 876 000

#### Additional Project Benefits:

The improvements recommended along this segment can also have the benefit of positively impacting the following identified facility:

- Intersection 147

### **Crash History Along this 3.98 Mile Roadway Segment**

	2017	2016	2015	2014	2013
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	1	0	0	0
Number of Disabling Injuries	0	1	0	0	0
Number of Injury Crashes	0	2	1	0	1
Number of Injuries	0	2	1	0	4
Number of Property Damage Only Crashes	2	2	3	3	3

#### **Opinion of Probable Construction Cost Disclaimer:**

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<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

#### Marion County Local Road Safety Plan

# Project Description for Roadway Segment Improvements

Risk Factor Score\*: 17

Project Name: 60th Street between S Maple Street (Peabody Southeast City Limit) and Timber Road

Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net

Date: 2/28/20 Prepared By: AJW Checked By: MMO

GPS ID:

**SEGMENT** 

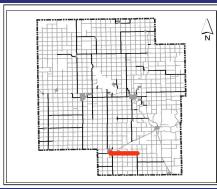
49, 50, 53

#### **Location Description**

Road: 60th Street

From: S Maple Street (Peabody Southeast City Limit) To: Timber Road Length (miles): 5.55

# **Project Location Maps**





# Segment Information and Systemic Ranking Summary

Systemic Ranking Summary	Value	Score*					
Average Daily Traffic (ADT)	245	4					
Access Points per Mile	4.6	2	1				
Edge Condition	2.0	3	]				
Roadside Assessment	2.0	3					
Pavement Width (ft)	24.0	0	1				
Shoulder Width (ft)	0.0	2	1				
Lane Departure Crash Rate	2.2	3					
Presence of Pavement Markings	Yes	0	*				
Surface Type	PAVED	0					
Total Risk Factor Score (24 r	17						
*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)	12					
Edgeline Rumble Strips	NOT PRESENT					
Centerline Rumble Strips	NOT PRESENT					
Curves	1					
Curves with Warning Signs	1					
**Edgeline and Centerline	•					

Item Description Quantity Unit Unit Price Item Cost Install 6" Retroreflective Edgeline (Both Sides of Road) 4 200 \$ 23 292 5 55 MII F Install 4" Retroreflective Centerline 5.55 MILE \$ 2,100 \$ 11,646 Delineate Roadside Hazards with Retroreflective Markers 56 **EACH** 100 5,600 Clear and Grub (15 Feet Off Edge of Road, If Applicable) 1.77 MILE 30,000 52,950 5,000 \$ Improve Edge Rut Conditions with Aggregate at Edge Drop-off Locations 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 MILE Post-Mounted Delineators 0 5,000 Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed) 1.000 1 CURVE \$ 1.000 | \$ 0 CURVE 3,500 Retroreflective Strips on Curve Signage CURVE 100 100 Short Term Improvements Subtotal: \$ 94,588

Opinion of Probable Cost (Short Term Improvements)

### **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	380	FOOT	\$	80	\$	30,400
Flattening and Widening Foreslopes	5.55	MILE	\$	75,000	\$	415,923
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	\$	20,000	\$	-
Longer Term Improvements Subtotal:						450,323

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









Marion County Local Road Safety Plan

Project Description for Roadway Segment Improvements

Risk Factor Score: 1

17

Date: 2/28/20

Project Name: 60th Street between S Maple Street (Peabody Southeast City Limit) and Timber Road

Contact Name: Brice Goebel E-mail: bgoebel@marioncoks.net

Prepared By: AJW Checked By: MMO

**SEGMENT** 

#### Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 49, 50, 53

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	Un	it 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	\$	20,000	\$ -
Speed Activated Flashers on Chevron Signs		CURVE	\$	4,000	\$ -
Speed Feedback Sign on Curve Warning Sign		EACH	\$	4,000	\$ -
Other: Extend Culverts	11	EACH	\$	15,000	\$ 165,000
Other:					
Other:					
Other:					

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

Α	dditional Po	tential Imp	rovements Subtotal:	\$	165,000
	Shor	t Term Imp	rovements Subtotal:	\$	94,588
	Longe	r Term Imp	rovements Subtotal:	\$	450,323
	_	Ċ	anatruction Subtatal:	0	700 010

Mobilization: (% +/-)*	10%	\$ 71,000
Traffic Control: (% +/-)	5%	\$ 35,618
Contingency: (% +/-)	20%	\$ 142,472
Estimated Construction	on Cost	\$ 959,000

PE (Design)	12%	\$ 115,080
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 143,850
Estimated Project	t Total	\$ 1,218,000

#### Additional Project Benefits:

The improvements recommended along this segment can also have the benefit of positively impacting the following identified facilities:

- Curve 17
- Intersection 137

# Crash History Along this 5.55 Mile Roadway Segment

	2017	2016	2015	2014	2013
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	1	1	1	1
Number of Injuries	2	1	1	1	4
Number of Property Damage Only Crashes	2	1	0	4	10

#### **Opinion of Probable Construction Cost Disclaimer:**

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#### **Project Description Form Disclaimer:**

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<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

# Marion County Local Road Safety Plan

# Project Description for Roadway Segment Improvements

Risk Factor Score\*: 17

GPS ID:

Project Name: 120th Street between K-15 and Indigo Road

Contact Name: Brice Goebel E-mail: bgoebel@marioncoks.net

Date: 2/28/20 Prepared By: AJW

Checked By: MMO

**SEGMENT** 

1, 2

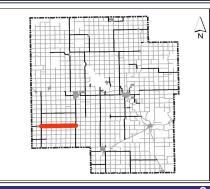
#### **Location Description**

Road: 120th Street

From: K-15

To: Indigo Road Length (miles): 6.98

# **Project Location Maps**





# **Segment Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score*	
Average Daily Traffic (ADT)	275	5	
Access Points per Mile	4.0	2	1
Edge Condition	2.0	3	
Roadside Assessment	2.0	3	
Pavement Width (ft)	24.0	0	
Shoulder Width (ft)	0.0	2	1
Lane Departure Crash Rate	1.0	2	
Presence of Pavement Markings	Yes	0	*:
Surface Type	PAVED	0	1
Total Risk Factor Score (24 r	17		
*Score from highest ranking segment used	1		_

Other Information				
Paved Shoulder	No			
Shoulder Material	NONE			
Speed Limit (mph)	55			
Number of Lanes	2			
Lane Width (ft)	12			
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)	6.98	MILE	\$ 4,200	\$ 29,319
Install 4" Retroreflective Centerline	6.98	MILE	\$ 2,100	\$ 14,660
Delineate Roadside Hazards with Retroreflective Markers	70	EACH	\$ 100	\$ 7,000
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	0.91	MILE	\$ 30,000	\$ 27,150
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)	6.98	MILE	\$ 5,000	\$ 34,904
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	6.98	MILE	\$ 2,000	\$ 13,962
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	\$
Retroreflective Strips on Curve Signage	0	CURVE	\$ 100	\$ -
		Short Term Imp	rovements Subtotal:	\$ 126.995

### **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)	6.98	MILE	\$	150,000	\$	1,047,119
Install Edgeline Rumble Strips	6.98	MILE	\$	5,000	\$	34,904
Install Centerline Rumble Strips	6.98	MILE	\$	2,000	\$	13,962
Install/Upgrade Guardrail	0	FOOT	\$	35	\$	
Flattening and Widening Foreslopes	6.98	MILE	\$	75,000	\$	523,559
Install High Friction Surface Treatment (HFST) on Curve	0	CURVE	\$	20,000	\$	-
Longer Term Improvements Subtotal:						1,623,543

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









Marion County Local Road Safety Plan

Project Description for Roadway Segment Improvements

**Risk Factor Score:** 

Project Name: 120th Street between K-15 and Indigo Road Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net

Date: 2/28/20 Prepared By: AJW Checked By: MMO

17

Checked By: MMO

# **SEGMENT**

#### Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 1, 2

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	Un	it 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	\$	20,000	\$ -
Speed Activated Flashers on Chevron Signs		CURVE	\$	4,000	\$ -
Speed Feedback Sign on Curve Warning Sign		EACH	\$	4,000	\$ -
Other: Extend Culverts	11	EACH	\$	15,000	\$ 165,000
Other:					
Other:					
Other:					

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

Additional P	otential Imp	rovements Subtotal:	\$ 165,000
Sho	rt Term Imp	rovements Subtotal:	\$ 126,995
Longe	r Term Imp	rovements Subtotal:	\$ 1,623,543
	C	onstruction Subtotal:	\$ 1,915,538

Mobilization: (% +/-)*	10%	\$ 75,000
Traffic Control: (% +/-)	5%	\$ 95,892
Contingency: (% +/-)	20%	\$ 383,570
Estimated Construction	on Cost	\$ 2,470,000

PE (Design)	12%	\$ 296,400
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 370,500
Estimated Project	t Total	\$ 3.137.000

### Crash History Along this 6.98 Mile Roadway Segment

	2017	2016	2015	2014	2013
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	1	0	0	0	0
Number of Injuries	1	0	0	0	0
Number of Property Damage Only Crashes	4	3	2	3	4

#### **Opinion of Probable Construction Cost Disclaimer:**

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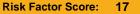
<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

#### **Marion County Local Road Safety Plan**

# **Project Description for Intersection Improvements**

Project Name: NIGHTHAWK & 190TH Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net



Date: 2/28/20 Prepared By: AJW Checked By: MMO

**INTERSECTION** 

### **Location Description**

Road: NIGHTHAWK GPS ID: 147 Road: 190TH

#### **Project Location Maps**







# **Intersection Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score
Average Daily Traffic (ADT)	1,320	6
Access Points within 500 feet	2	1
Sight Distance	LIMITED	3
Intersection Control	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 (2	17	

Other Information								
Major Road ADT	1,055							
Minor Road ADT	265							
Intersection Crash Rate (TMEV)	4.2							
Lighting	NOT PRESENT							
Flashing Beacon	PRESENT							
Transverse Rumble Strips	NOT PRESENT							
Number of Paved Approaches	4							

# **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	\$ 1,500	\$ 3,000	
Upgrade Signs and Pavement Markings	4	LEG	\$ 2,200	\$ 8,800	
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	\$ -	
Review and Install/Upgrade Intersection Warning Sign	2	LEG	\$ 1,200	\$ 2,400	
Install Solar-Powered Flashing Beacon on Intersection Warning Sign	0	LEG	\$ 2,500	\$ -	
Short Term Improvements Subtotal:					

# **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)	0	LEG	\$ 100,000	\$ -		
Longer Term Improvements Subtotal:						

Continued on back of this page.

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









**Marion County Local Road Safety Plan** 

**Project Description for Intersection Improvements** 

Project Name: NIGHTHAWK & 190TH Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net



Date: 2/28/20 Prepared By: AJW Checked By: MMO

INTERSECTION

#### **Opinion of Probable Cost (Additional Potential Improvements)**

GPS ID: 147

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

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	1	EACH	\$ 40,000	\$ 40,000
Provide Left-Turn Lanes at Intersection		LEG	\$ 150,000	\$ -
Provide Right-Turn Lanes at Intersection and Remove Sweeping Right Turns		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:				_

Short Term Improvements Subtotal: 24,300 Longer Term Improvements Subtotal: Construction Subtotal: 64,300

> Mobilization: (% +/-)\* 10% Traffic Control: (% +/-) 3,254 Contingency: (% +/-) 20% 13.016 Estimated Construction Cost 87.000

> > PE (Design) 12% 10,440 Utilities\*\* 40,000 ROW\* 40,000 CE (Inspection) 15% 13,050 Estimated Project Total 111,000

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	1	EACH	\$	40,000	\$	40,000
Provide Left-Turn Lanes at Intersection		LEG	\$	150,000	\$	-
Provide Right-Turn Lanes at Intersection and Remove Sweeping Right Turns		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:						40,000

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

# Crash History at this intersection

	2017	2016	2015	2014	2013
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	1	0	0
Number of Disabling Injuries	0	0	1	0	0
Number of Injury Crashes	0	0	0	0	0
Number of Injuries	0	0	0	1	0
Number of Property Damage Only Crashes	0	0	0	0	0

# Opinion of Probable Construction Cost Disclaimer:

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<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations

Marion County Local Road Safety Plan

Project Description for Curve Improvements

Risk Factor Score\*:

Project Name: Indigo Rd near 130th Rd Contact Name: Brice Goebel

E-mail: bgoebel@marioncoks.net

Date: 2/28/20 Prepared By: AJW Checked By: MMO

**CURVE** 

# **Location Description**

Road: Indigo Rd Length (feet): 1,475 Length (Miles): 0.28 Closest City: Hillsboro GPS ID: 22, 30

#### **Project Location Maps**







# **Curve Information and Systemic Ranking Summary**

Systemic Ranking Summary	Value	Score*
Average Daily Traffic (ADT)	1,273	6
Curve Radius (ft)	1,970	0
Access Points within 500 feet	4	2
Shoulder Width (ft)	1.0	2
Edge Condition	3.0	0
Roadside Assessment	2.0	1
Superelevation	NO	2
Fatal or Debilitating Injury Crashes	1	3
Presence of Warning Signs	PRESENT	0
Total Risk Factor Score (24 n	16	

Other Informa	tion
Paved Shoulder	Yes
Shoulder Material	ASPHALT
Speed Limit (mph)	Not Provided
Number of Lanes	2
Lane Width	11
Edgeline Rumble Strips	NOT PRESENT
Centerline Rumble Strips	NOT PRESENT

\*Score from highest ranking curve used

# Opinion of Probable Cost (Short Term Improvements)

Item Description	Quantity	Unit	Unit Price		Item Cost	
Review and Upgrade Curve Signage to Meet MUTCD and KDOT Standards	2	CURVE	\$ 1,000	\$	2,000	
Install Curve Signage to Meet MUTCD and KDOT Standards (If Needed)	0	CURVE	\$ 3,500	\$	-	
Retroreflective Strips on Curve Signage	2	CURVE	\$ 100	\$	200	
Install 6" Retroreflective Edgeline (Both Sides of Road)	0.28	MILE	\$ 4,200	\$	1,176	
Install 4" Retroreflective Centerline	0.28	MILE	\$ 2,100	\$	588	
Clear and Grub (15 Feet Off Edge of Road, If Applicable)	2	CURVE	\$ 2,500	\$	5,000	
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)	0.28	MILE	\$ 5,000	\$	1,400	
Review Pavement Condition/Type and Install Centerline Rumble Strips (If Feasible)	0.28	MILE	\$ 2,000	\$	560	
Post-Mounted Delineators	0	MILE	\$ 5,000	\$	-	
Short Term Improvements Subtotal:						

# Opinion of Probable Cost (Longer Term Improvements)

Item Description	Quantity	Unit		Unit Price		Item Cost
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)	0.28	MILE	\$	150,000	\$	42,000
Install Edgeline Rumble Strips	0.28	MILE	\$	5,000	\$	1,400
Install Centerline Rumble Strips	0.28	MILE	\$	2,000	\$	560
Install/Upgrade Guardrail	224	FOOT	\$	80	\$	17,920
Install High Friction Surface Treatment (HFST) on Curve	2	CURVE	\$	20,000	\$	40,000
Longer Term Improvements Subtotal:						101,880

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









Marion County Local Road Safety Plan

Project Name: Indigo Rd near 130th Rd

Contact Name: Brice Goebel

**Project Description for Curve Improvements** 

E-mail: bgoebel@marioncoks.net

**Risk Factor Score:** 

Date: 2/28/20 Prepared By: AJW Checked By: MMO



**CURVE** 

#### Opinion of Probable Cost (Additional Potential Improvements)

GPS ID: 22, 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	\$	-
Transverse Rumble Strips Prior to Curve		CURVE	\$	3,000	\$	-
Speed Activated Flashers on Chevron Signs		CURVE	69	4,000	\$	-
Speed Feedback Sign on Curve Warning Sign		EACH	69	4,000	\$	-
Superelevation Correction on Curves	2	CURVE	69	50,000	\$	100,000
Other: Reconstruct Curves with Intersection Tie-ins		MILE	\$	1,400,000	\$	-
Other: Reconstruct Culvert		EACH	\$	50,000	\$	-
Other:						
Other:						
Additional Potential Improvements Subtotal					4	100 000

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

1	dditional Po	tential Imp	rovements Subtotal:	\$ 100,000
	Shor	t Term Imp	rovements Subtotal:	\$ 10,924
	Longe	r Term Imp	rovements Subtotal:	\$ 101,880
		Ċ	onstruction Subtotal:	\$ 212.804

Mobilization: (% +/-)*	10%	\$ 21,290
Traffic Control: (% +/-)	5%	\$ 10,781
Contingency: (% +/-)	20%	\$ 43,125
Estimated Construction	n Cost	\$ 288,000

PE (Design)	12%	\$ 34,560
Utilities**		\$ -
ROW**		\$ -
CE (Inspection)	15%	\$ 43,200
Estimated Project	Total	\$ 366,000

#### Additional Project Benefits:

The improvements recommended along this segment can also have the benefit of positively impacting the following identified facility:

- Intersection 69

#### **Crash History Along this 0.28 Mile Curve**

	2017	2016	2015	2014	2013
Number of Fatal Crashes	0	0	0	0	0
Number of Fatalities	0	0	0	0	0
Number of Disabling Injury Crashes	0	0	1	0	0
Number of Disabling Injuries	0	0	1	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	1	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.

#### **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 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, 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 January 2020.











<sup>\*\*</sup>To be considered by county as they move forward with design of the recommendations