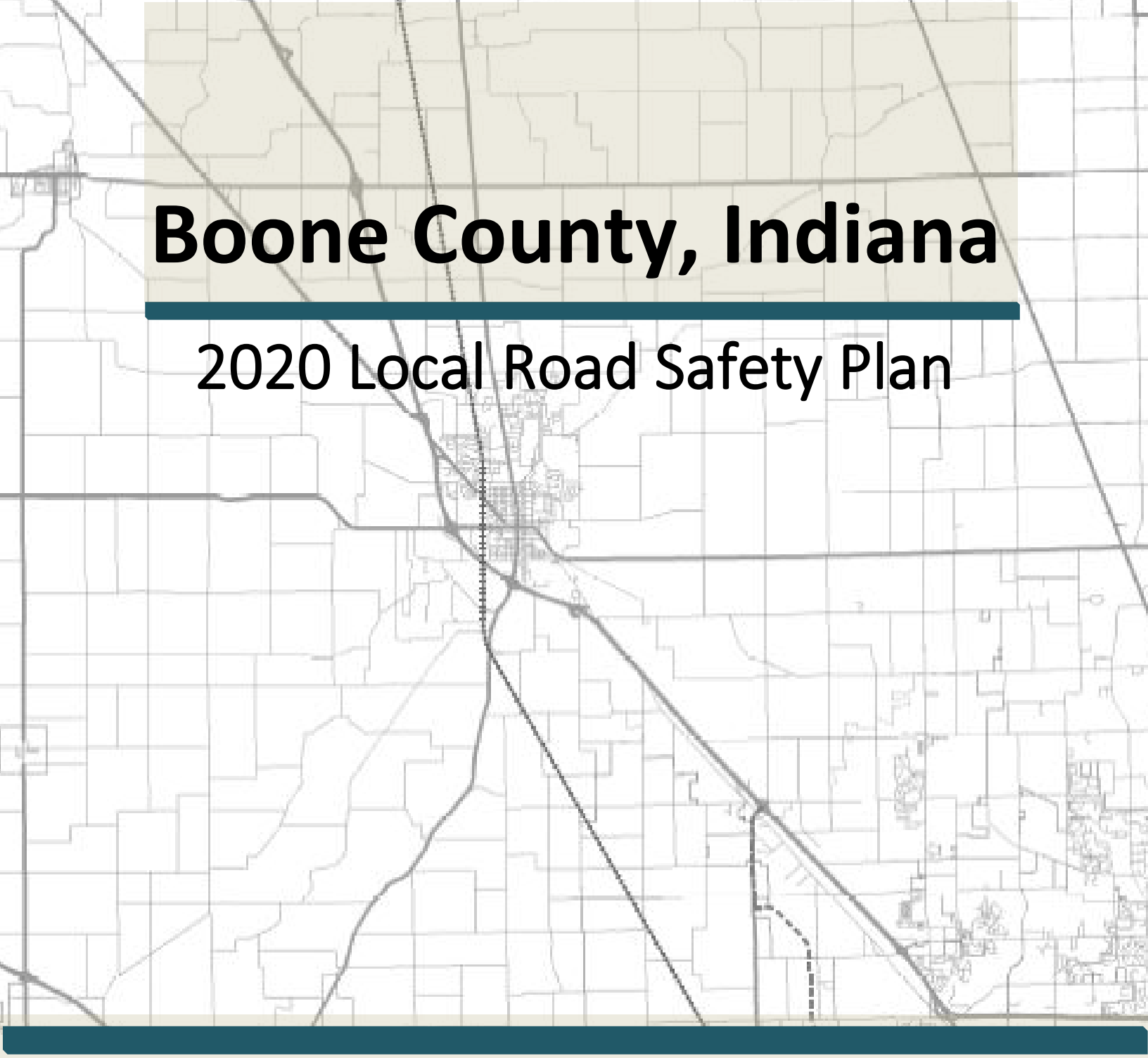


Boone County, Indiana

2020 Local Road Safety Plan

BOONE COUNTY
Highway Department

THE BOONE COUNTY LOCAL ROAD SAFETY PLAN IS
APPROVED ON THIS 21ST DAY OF SEPTEMBER BY:

THE BOONE COUNTY HIGHWAY DEPARTMENT:

BY: _____ 9-21-20
Craig Parks, County Engineer — Date

THE BOONE COUNTY BOARD OF COMMISSIONERS:

BY: _____ 9-21-20
Donnie Lawson, President — Date

BY: _____ 9/21/20
Tom Santelli, Member — Date

BY: _____ 09/21/20
Jeff Wolfe, Member — Date

AUDITOR ATTEST:

BY: _____ 9/21/2020
Debbie Crum — Date

ALL PREVIOUS LOCAL ROAD SAFETY PLANS ARE HEREBY REPEALED AND REPLACED WITH THIS LOCAL ROAD SAFETY PLAN EFFECTIVE ON THIS 21ST DAY OF SEPTEMBER, 2020

BOONE COUNTY
Highway Department

Boone County Local Road Safety Plan

INTRODUCTION

Boone County is committed to improving transportation safety in order to reduce the risk of death and serious injury that result from incidents on our transportation systems. This plan tells the story of transportation safety needs and outlines strategies to address those needs in our County. Implementation of the plan will improve transportation safety for the county, its people, and its visitors.

The intent of this plan is to:

- Increase awareness of road safety and risks through education and enforcement
- Achieve a reduction in severe crashes
- Develop lasting partnerships for addressing road safety
- Develop support for grant funding applications to address road safety
- Prioritize needed road safety investments
- Evaluate existing and develop new processes within our Highway Department to identify shortcomings and improve the safety of our transportation system

This plan is part of Federal Highway Administration's Local Road Safety Plan Pilot 2.0. It was developed by the Boone County Highway Department with data analysis assistance from the Indiana Local Technical Assistance Program (INLTAP) and consulting assistance from HWC Engineering.

DEFINITIONS

INLTAP: Indiana Local Technical Assistance Program offers technical and training assistance for street departments, highway departments and local elected officials in the state.

INDOT: The acronym for the Indiana Department of Transportation.

FHWA: Federal Highway Administration which is an agency within the U.S. Department of Transportation. This agency supports state and local governments in the design, construction, and maintenance of the nation's highway system (Federal-Aid Highway Program) and various federally and tribally owned lands.

MUTCD: Manual on Uniform Traffic Control Devices is a technical manual published by the FHWA that defines standards for traffic control devices on all public roadways, highways and bikeways. The 2011 Indiana MUTCD is based on the 2009 National MUTCD.

AADT: Annual Average Daily Traffic is the total traffic volume passing a point or segment of a road in both directions for one year divided by the number of days in a year.

PLAN PURPOSE

The scope of this plan is to provide general information, safety enhancement techniques, evaluation procedures and general guidance for making decisions relative to improving roadway safety in Boone County. Safety is ultimately a site-specific issue, so each recommendation made in this document will need to be carefully implemented to address the unique conditions at each site including topography, sight distance, right-of-way availability, roadway geometry, drainage conditions, environmental constraints and existing utility conflicts. Budget limitations will also be a key factor that influences the scope of what may be addressed.

This plan used three independent methods of identifying infrastructure, procedural or process improvements. Specifically, it recommends systemic, systematic and "hot spot" improvements. Systemic improvements are prevention measures implemented to address roadway segments with similar characteristics as those with higher crash rates. Systematic (or system-wide) improvements are prevention measures that are applied to the entire roadway network within Boone County, regardless the crash data. In contrast, hot spots are specific locations that already have a high frequency of crashes or were identified by stakeholders as concerns.

The intent of this plan is not just to implement engineering solutions. It is intended to outline a holistic approach to roadway safety that also addresses enforcement, education, encouragement and emergency response.

VISION AND MISSION

Vision

To help all users of Boone County's transportation system to reach their destination safely.

Mission

Eliminate fatal and serious injuries resulting from traffic crashes, making decisions based on their ability to reach zero deaths on Boone County's transportation system.

SAFETY PARTNERS

In addition to the Boone County Highway Department, multiple partners came together to provide input on the development this local road safety plan.

- Boone County Board of Commissioners
- Boone County Sheriff's Office
- Boone County Council
- Transportation Offices of Lebanon, Western Boone and Zionsville School Systems
- Boone County Area Plan Commission Office
- The Indianapolis Metropolitan Planning Organization
- Indiana Local Technical Assistance Program
- The Indiana Department of Transportation
- City of Lebanon Engineering Department
- Town of Whitestown Public Works Department
- Town of Zionsville Street Department
- Lebanon Police Department
- Lebanon Fire Department
- Zionsville Police Department
- Zionsville Fire Department

PROCESS

The planning process involved the following steps:

- *Data Analysis:* INLTAP provided data analysis as part of this planning effort. The results of the analysis were reviewed with Boone County Highway Department staff.
- *Stakeholder Input Meeting:* A planning meeting was held on August 20, 2019. Stakeholders included the entities listed under Safety Partners.
- *Goals and Recommendations:* A planning meeting was held with Boone County Highway Department staff, INLTAP and HWC Engineering to review draft goals.
- *Draft Plan:* A rough draft of the plan was developed and circulated for review by the Boone County Highway Department and HWC.
- *Stakeholder Presentation:* A follow up presentation was made to the Safety Partners to update them on the status of the draft plan and recommendations.
- *Final Plan:* All input was incorporated into the plan and a final plan was issued.

EXISTING EFFORTS

The Boone County Highway Department's recent efforts to establish a safe and reliable transportation network include the following:

- 2017 Thoroughfare Plan Update included an initial analysis of intersections with a high crash rate.
- Utilized the INLTAP Helpers Program to analyze and perform safety audits for individual crash sites.
- Purchased equipment and had staff licensed to spray for vegetation control along road shoulders and sightlines.
- Began installing stop bars at several stop condition locations.
- Updated inventory and condition rating of traffic signage.
- Provided roadway safety training to office and field staff to promote a safety culture.
- Established requirements for dedication of easements.
- PASER ratings are updated annually and used to determine projects for the county's roadway preservation program.

STAKEHOLDER INPUT

Stakeholders, consisting of the Safety Partners on page 4, met two times throughout this process as well as provided input on the process and draft of this document. Conversations with stakeholders can be summed up into the following points:

- *Safety at railroad crossings:* Includes clear sight distances and installation of crossing arms.
- *Identified hot spots and priority corridors (see figure 7):* These areas have factors that are currently, or will be areas where safety improvements are needed. Shoulder widths, stop conditions, clear signage and allowable right-of-way are all areas of potential improvement.
- *Improve safety culture throughout the county:* Work towards Zero Deaths Resolution and improve education and enforcement of road safety within the Boone County Highway Department and Boone County municipalities.
- *Reduce distracted driving:* County and local law enforcement agencies are limited in their capabilities in enforcing distracted driving. There needs to be pressure to amend local and state laws to decrease distracted driving, which is a main cause of crashes in Boone County.
- *Increased data gathering and sharing:* While there is collaboration amongst community stakeholders, there needs to be increased transparency amongst the many safety partners and their departments. Having a central data collection database that can share and easily analyze traffic studies, crash reports, etc. can help overall communication amongst the many moving parts of the county.
- *Collaboration with local, regional and state agencies*: The county should work and be transparent with INDOT, CSX, FHA and county municipalities to help achieve county-wide transportation initiatives. Areas of growth within the county need special attention and enhanced collaboration as developments impact the transportation network.

DATA ANALYSIS

Introduction

Data for the project was collected by INLTAP from the ARIES database. This data was merged with other available data including pavement condition, roadway geometrics, location, speed limit and roadway surface. This data includes 988 crashes over the five-year period from 2013 to 2017. It is limited to roadways within Boone County's jurisdiction, which excludes municipal and INDOT roadways.

Data analysis was performed by INLTAP to identify systemic risk factors. Crash data was analyzed to see if there was an overrepresentation of crashes relative to that criteria. A summary of this analysis is provided on the following pages.

Crash Summary

A summary of crash data is provided in Table 1 below. The most common crash characteristic is roadway departure, which was cited in 59 percent of crashes. More information on roadway departures can be found on page 13.

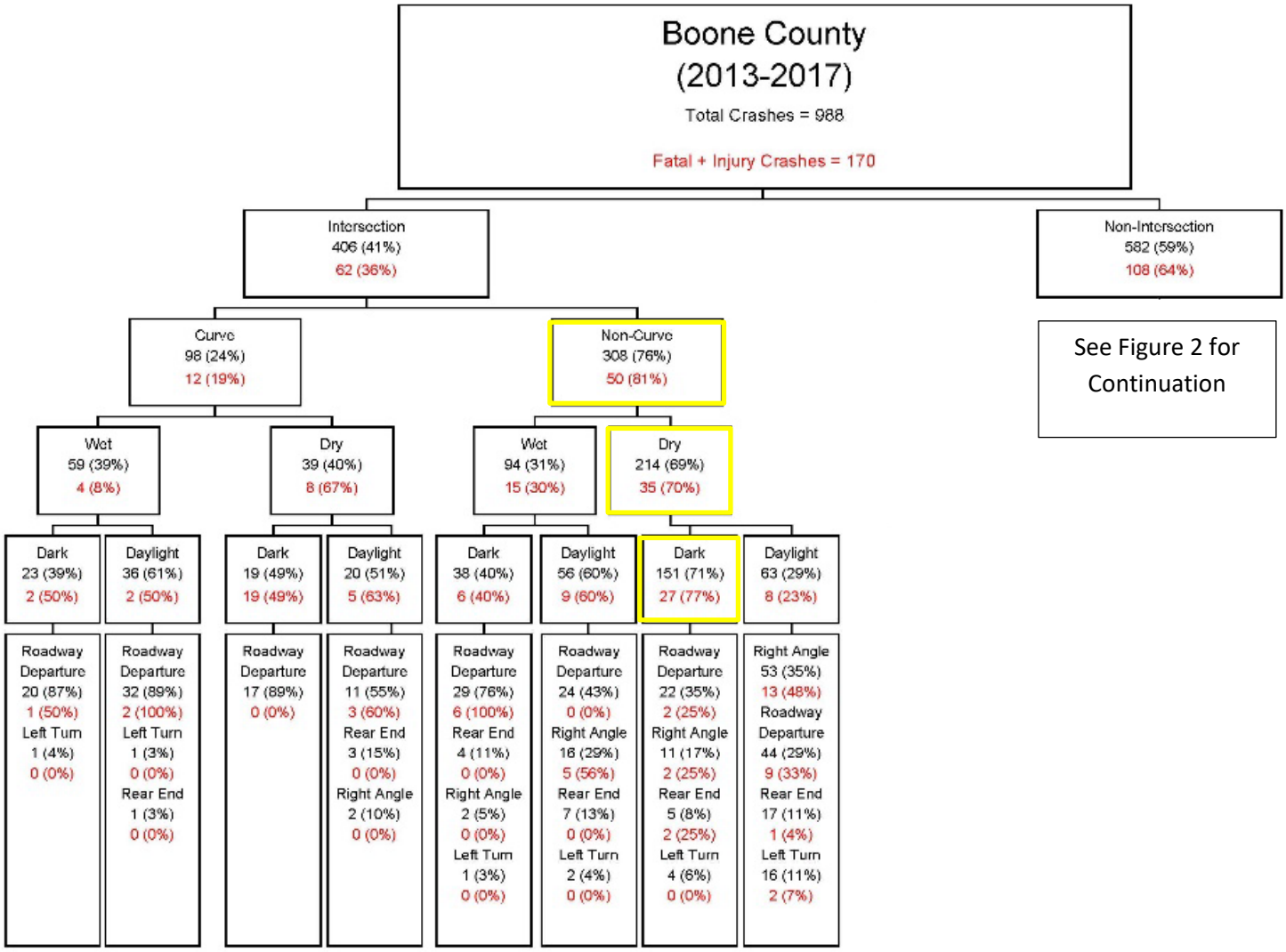
Table 1: Boone County 2013-2017 Overall Crash Summary

	Total Crashes	% Crashes	Number of Crashes per Year				
			2013	2014	2015	2016	2017
Total Crashes	**988**	-	156	186	214	218	214
Fatal Crashes	**4**	0.4%	0	1	2	1	0
Injury Crashes	**166**	17%	23	30	42	33	38
Roadway Departure Crashes	**581**	59%	101	124	123	123	110
Animal Crashes	**95**	10%	17	8	19	20	31
Angle/Left-Turn Crashes	**133**	13%	24	22	19	35	33
Rear-End Crashes	**68**	7%	8	11	17	18	14
Dark Roadway Crashes	**418**	42%	74	71	96	93	84
Wet Roadway Crashes	**367**	37%	58	71	67	89	82
Horizontal Curve Crashes	**228**	23%	33	33	50	63	49
Intersection Crashes	**406**	41%	69	74	95	85	83
Gravel Roadway Crashes	**80**	8%	14	16	21	13	16

Crash Tree – Intersection Crashes

A crash tree is used to isolate the various conditions associated with crashes. This first crash tree breaks down crashes by intersection and non-intersection crashes, and then by various contributing factors. For intersection crashes, this breakdown reveals that most occurred on straight roadway segments during dry weather, with darkness as a contributing factor. Since this does not identify curve conditions or wet pavement as a significant contributing factor, intersection visibility is most likely a contributing factor in intersection crashes. This plan recommends improvements to stop controlled intersections to address this (See Emphasis Area 2).

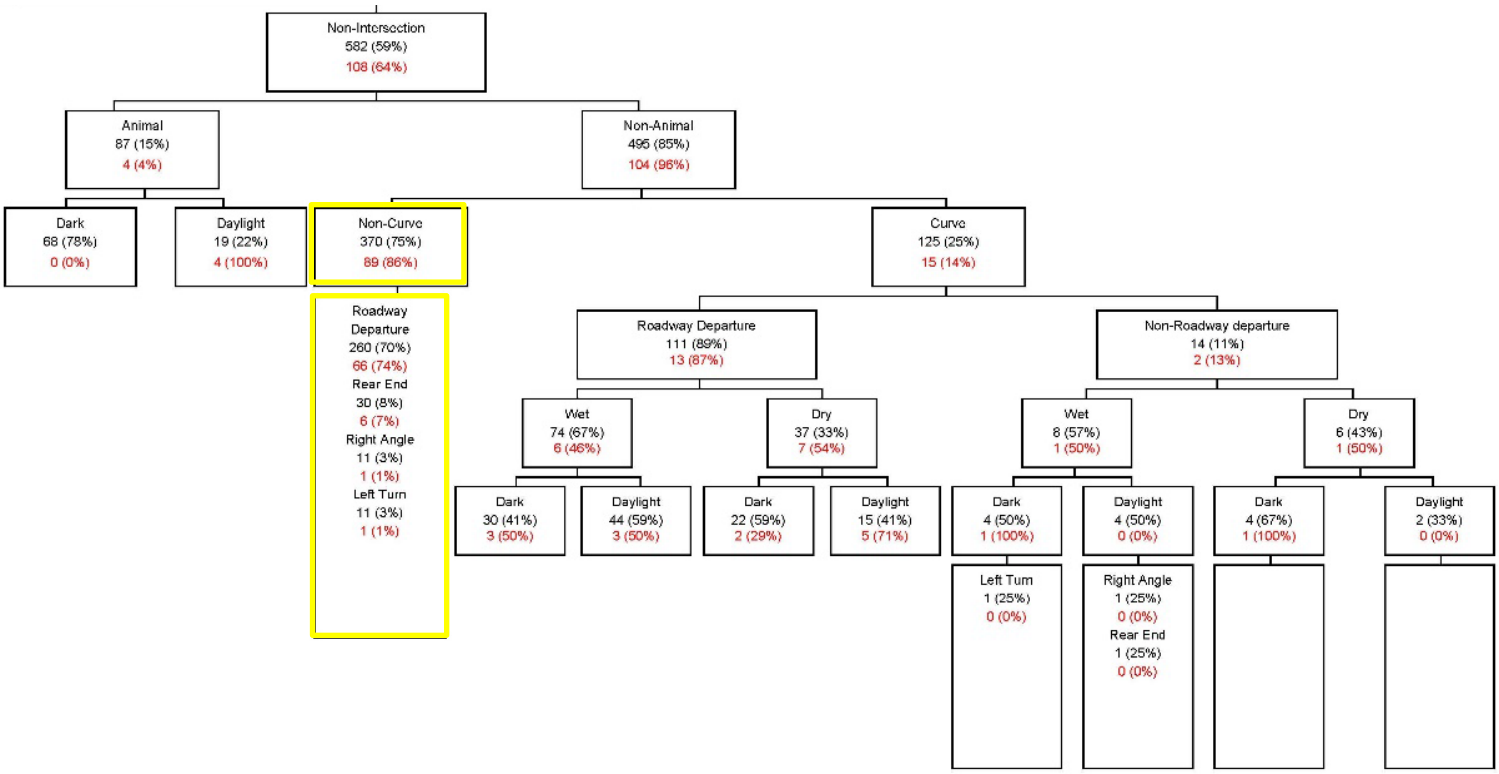
Figure 1: Intersection Crash Tree



Crash Tree – Non-Intersection Crashes

This crash tree includes all non-intersection crashes. Of the 988 total crashes between 2013-2017, majority of the crashes occur at non-intersection segments. Of these non-intersection segments, most occurred on straight sections of roadways and involved roadway departures. Roadway departures at non-intersection conditions could be the result of several factors, including inadequate pavement markings, distracted driving or shoulder conditions (not allowing for recovery before going off the road).

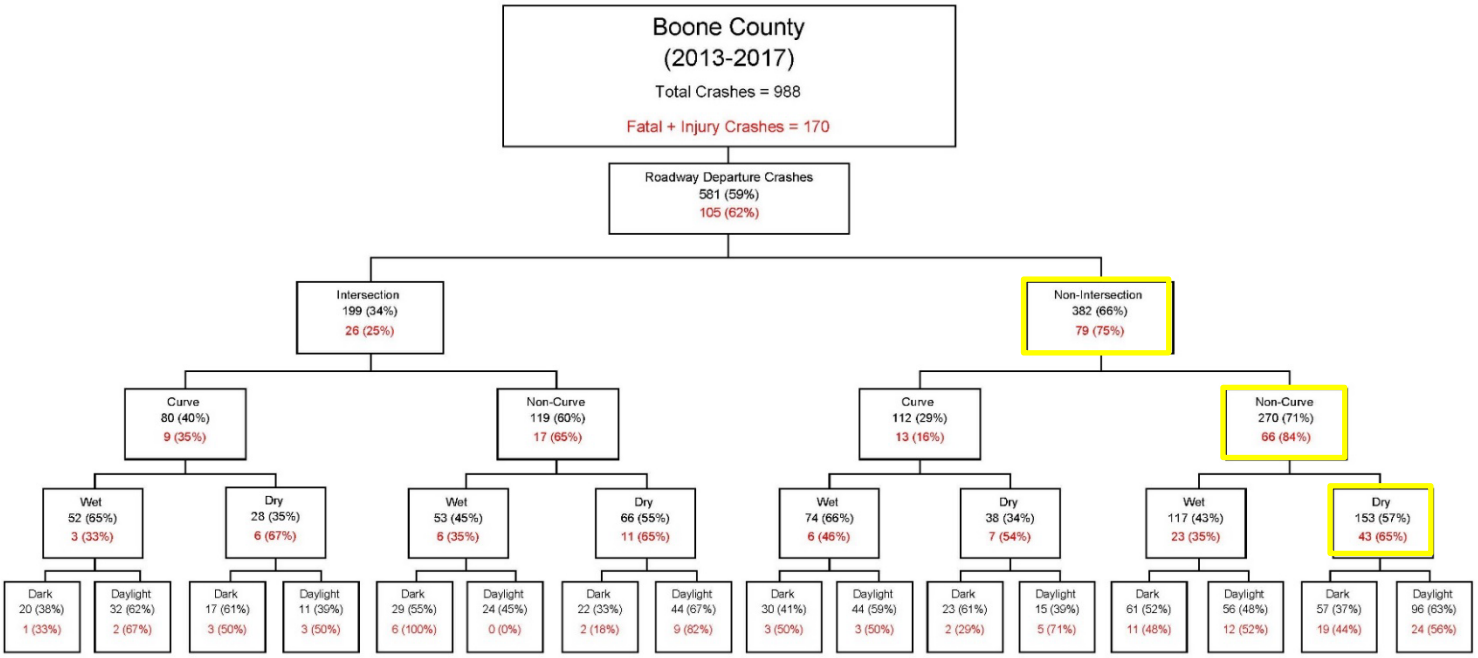
Figure 2: Non-Intersection Crash Tree



Roadway Departure Crash Tree

This third crash tree (Figure 3) breaks down roadway departure crashes. This was analyzed since 59% of crashes involved roadway departures, and since roadway departures were identified as the most common element of non-intersection crashes. The analysis concludes that the majority of these crashes occurred along straight road segments in daytime and dry conditions. This could indicate the need for better lane identification/visibility. It could also indicate that distracted driving is a contributing factor. To address these issues, the plan recommends an emphasis improving pavement markings (See Emphasis Area 1) and identifying methods to reduce distracted driving (See Emphasis Area 4).

Figure 3: Roadway Departure Crash Tree



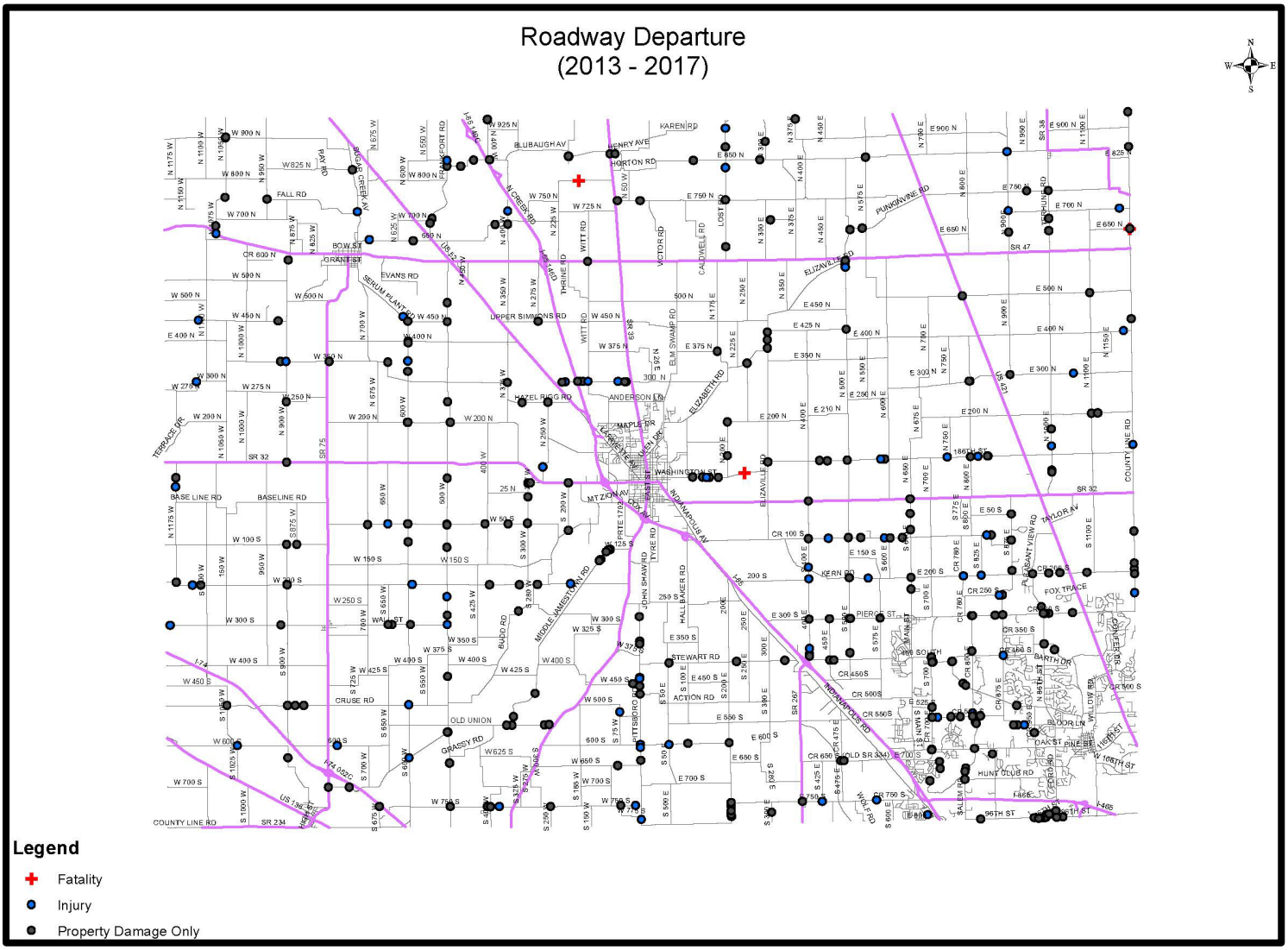
Roadway Departure Crash Distribution

As roadway departure crashes were evaluated, the distribution of crashes was reviewed to determine if they were concentrated in any particular location. There was specific concern that the roadway departure crashes could be more prevalent in high growth areas of the county.

As shown in Figure 4, roadway departure crashes are evenly distributed across the county. While the graphic does show some additional concentration in the southeast portion of the county where there has been growth, it is not significant enough to be defined as a contributing factor.

One noticeable concentration of roadway departure crashes is in the southeast corner of the county at 96th Street and Ford Road and 96th and Moore Road. Improvements have already been completed at 96th and Moore Road.

Figure 4: Roadway Departure Crash Distribution Map



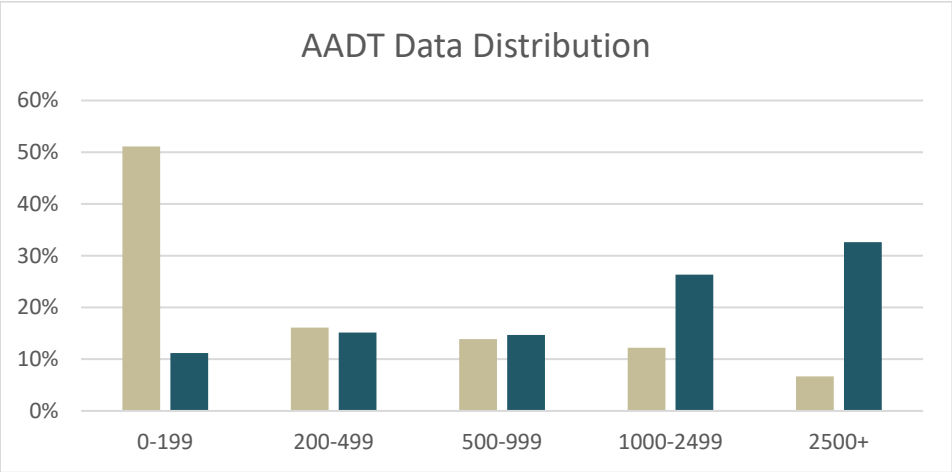
Systemic Analysis

Next, a systemic analysis was performed to identify connections between roadway characteristics and crash data. For each roadway characteristic, crash data was tabulated and analyzed to determine if the characteristic resulted in a disproportionately high number of crashes. These characteristics were then identified as risk factors. From this analysis, the clearest connections between roadway characteristics and crash data are related to the following risk factors:

- Higher volume roads (AADT greater than 1,000)
- Somewhat narrow roads (20 to 22 feet in width)
- Poor pavement condition (PASER rating of less than 5)
- Located in growth areas (Specifically in Center, Eagle and Worth Townships)

Table 2 on page 15, is a summary of roadways with these and similar risk factors. This table is mapped out in Figure 5.

Traffic Volume

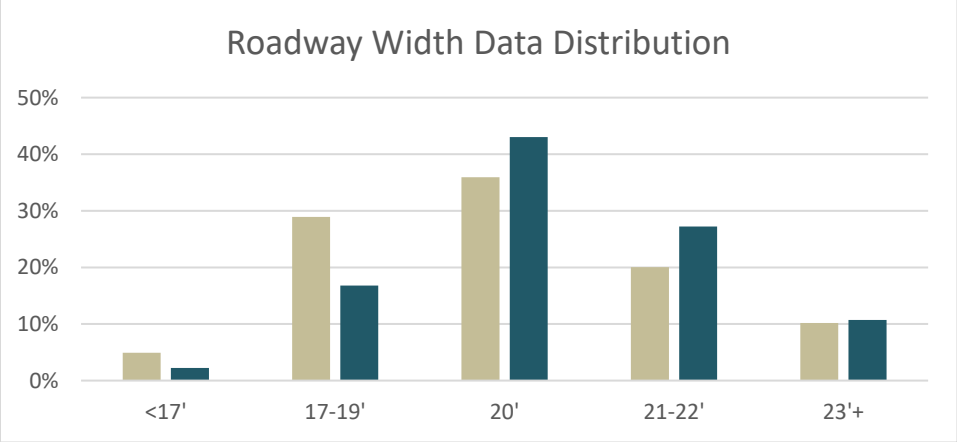


- The number of crashes on low-volume roads (less than 1,000 AADT) is disproportionately low, meaning it is not likely a risk factor for crashes.
- The number of crashes on higher-volume roads (over 1,000 AADT) is disproportionally high. This indicates that high volume roads are a risk factor for crashes.

Segment Data

Crash Data

Roadway Width



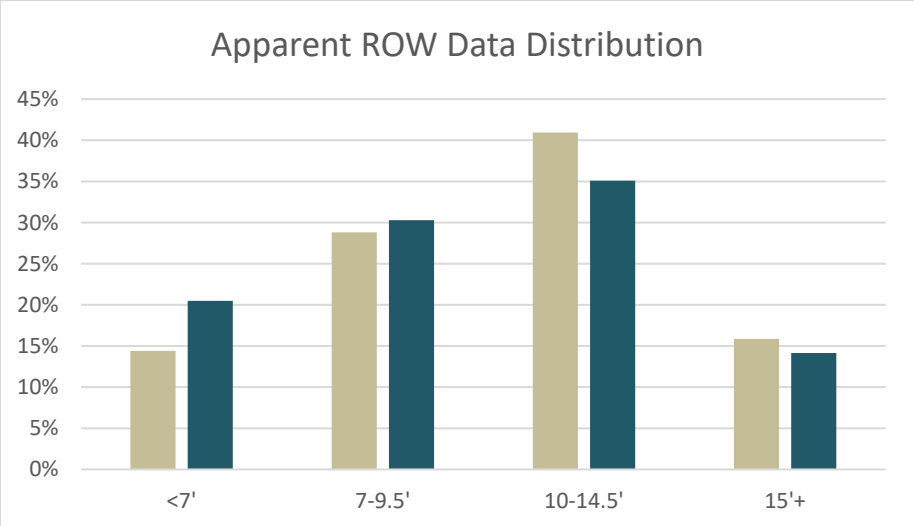
Data Summary

- The number of crashes on narrow roads (19 feet wide or less) is disproportionately low, while wider roads (20 feet wide or more) have a disproportionally high number of crashes. This indicates that wider roadways are a risk factor for crashes, likely because wider roads can induce higher speeds than the road is intended for.

Segment Data

Crash Data

Right-of-Way Width Beyond Edge of Pavement



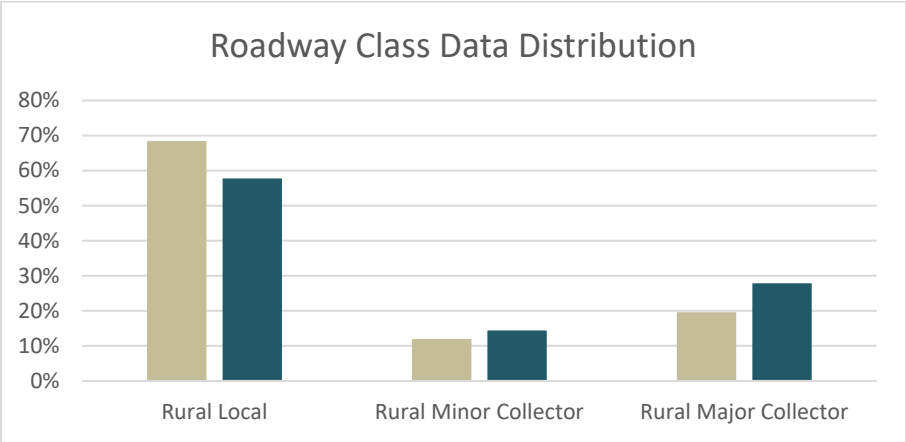
Data Summary

- Data indicates a somewhat disproportionally high rate of crash where the right-of-way width beyo the edge of pavement is 9.5 feet o less. This means narrow right-of-w areas are a contributing risk factor crashes.

Segment Data

Crash Data

Roadway Classification



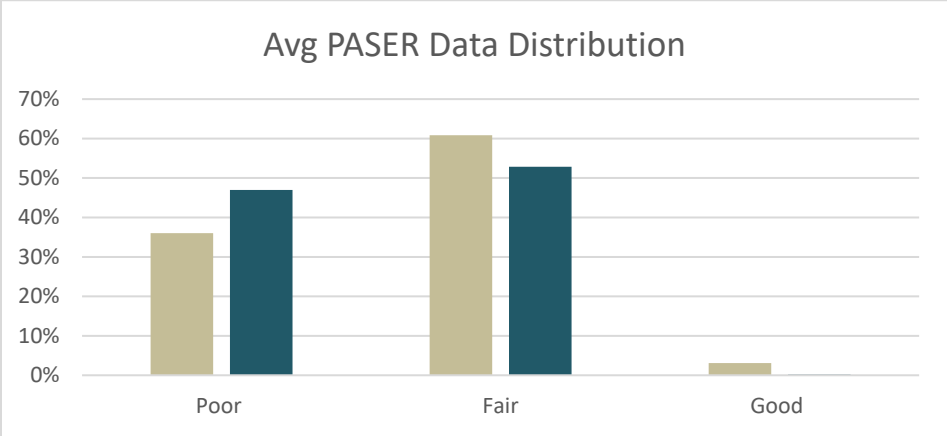
Data Summary

- The rate of crashes on collector roadways is disproportionately high. This indicates that crashes are more likely on higher classification roadways.

Segment Data

Crash Data

Pavement Condition



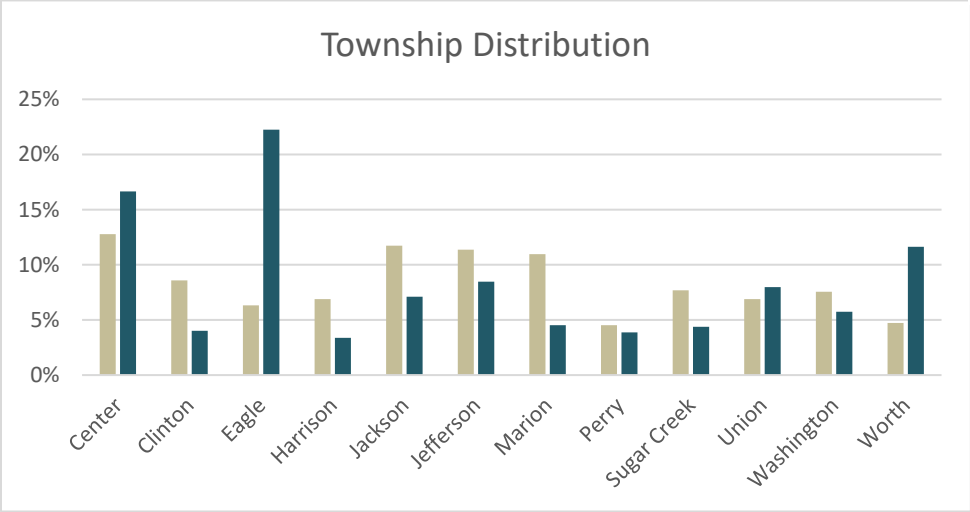
Data Summary

- Pavement in poor condition (corresponding to a PASER rating less than 5) has a disproportionately high number of crashes. This indicates that poor roadway conditions are a risk factor for crashes.

Segment Data

Crash Data

Location



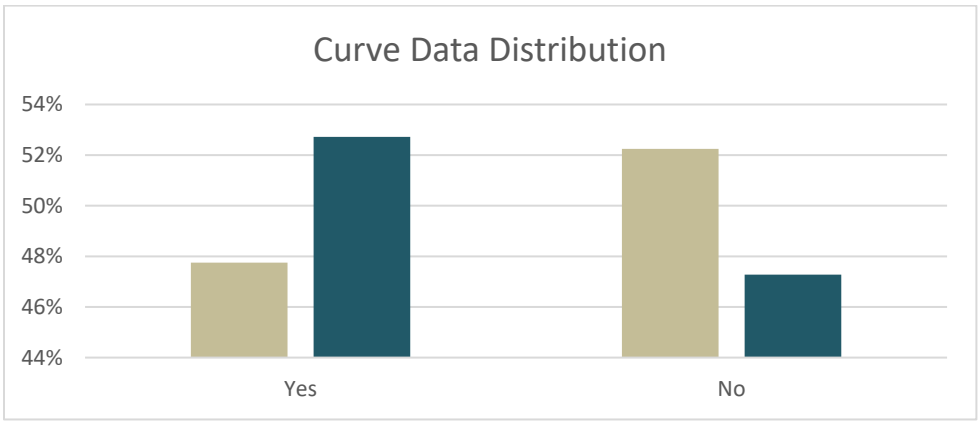
Data Summary

- There are a disproportionately high number of crashes in Center, Eagle and Worth Townships. These high growth portions of the county have a higher risk of crashes.

Segment Data

Crash Data

Curves



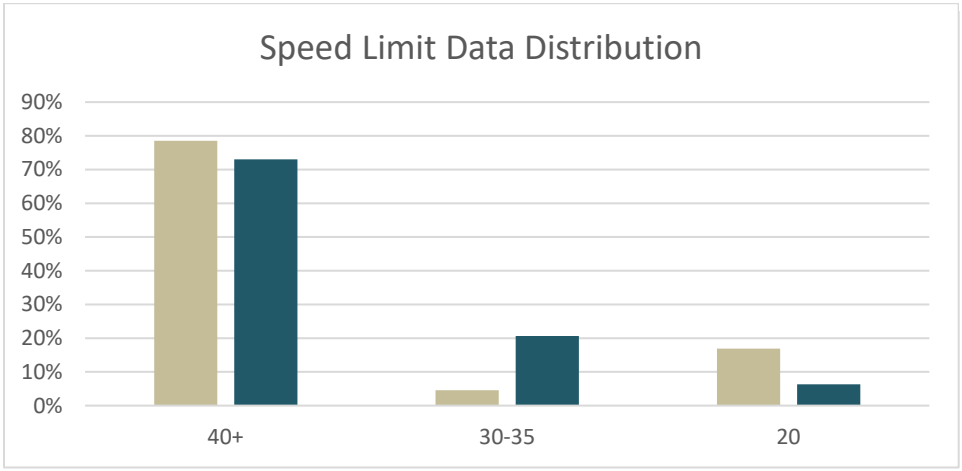
Data Summary

- There are a disproportionally high number of crashes on roadway segments with curves. This means that roadways with curves are a risk factor for crashes.

Segment Data

Crash Data

Speed



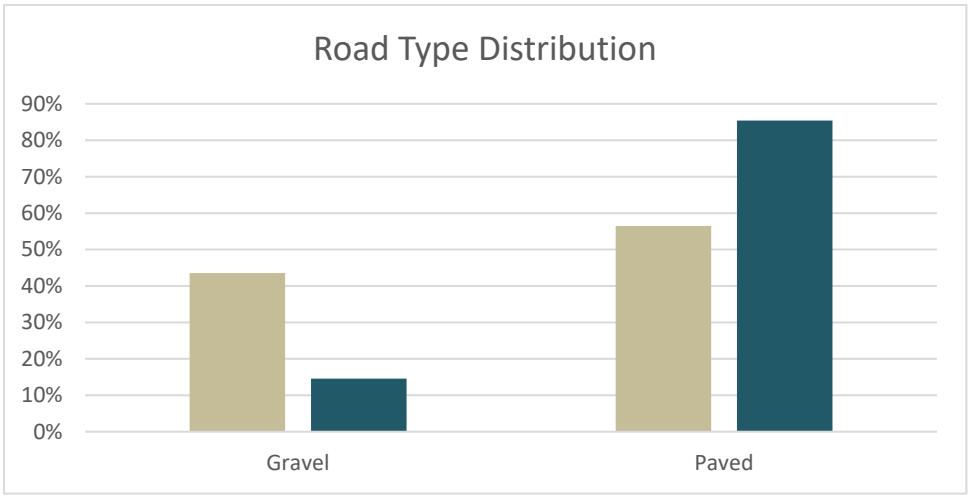
Data Summary

- The number of crashes on roads with a posted speed limit of 30 to 35 mph is disproportionately high. This indicates that roads with a 30 mph to 35 mph speed limit are a risk factor.

Segment Data

Crash Data

Pavement Type



Data Summary

- The rate of crashes on paved roads is disproportionately high compared to the rate on gravel roads. This indicates that paved roads are a higher risk factor for roadway crashes.

Segment Data

Crash Data

Priority Corridor- Based on Systemic Analysis

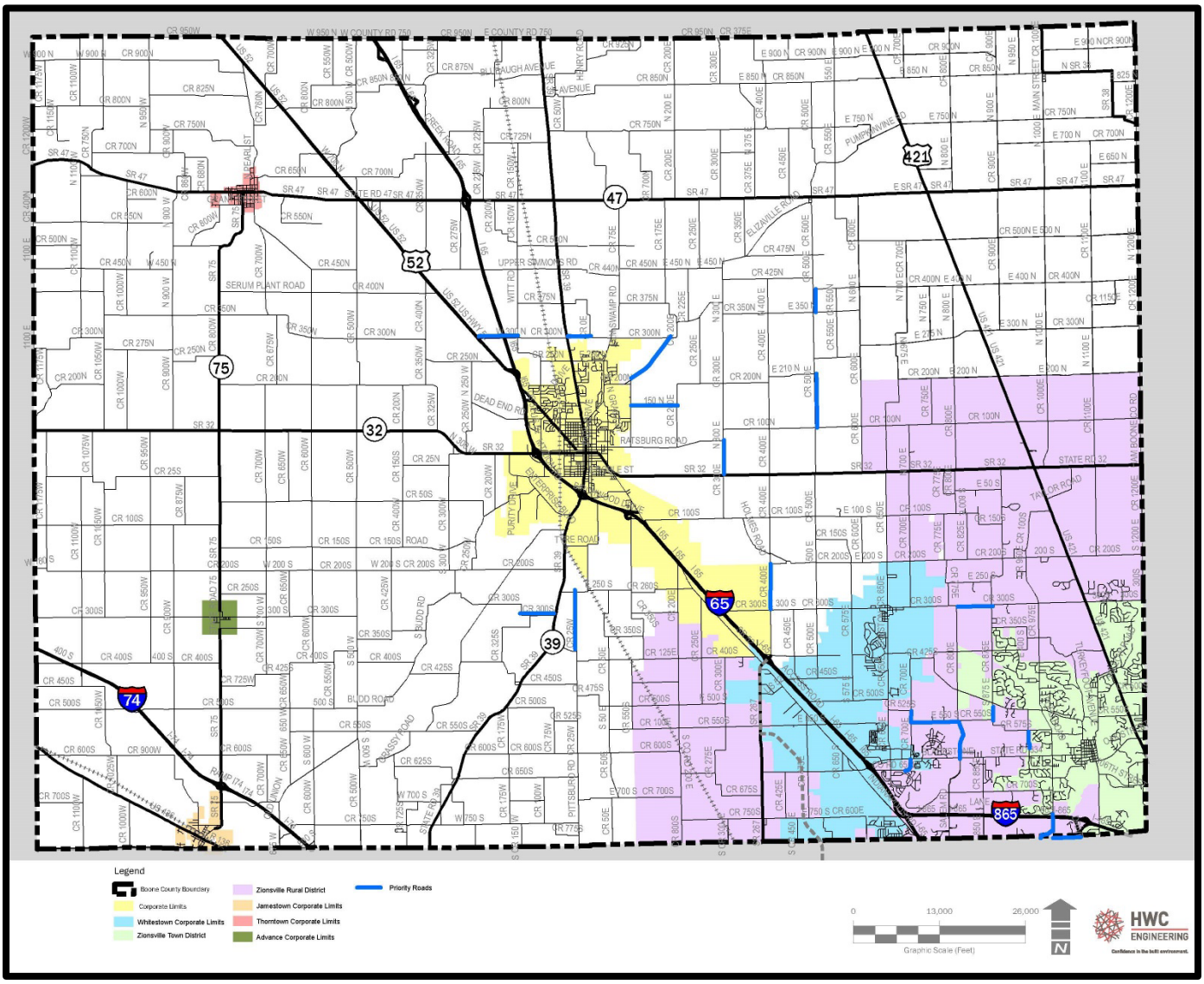
For the systemic analysis, roadway segments in the county with multiple risk factors were identified. These risk factors include higher volume roads, somewhat narrow roads, poor pavement condition and a location in growth areas.

The roadways in Table 2 represent corridors that have similar risk factors as roadways with higher crash rates, indicating that these roadways have the potential for future crashes. The goal would be to proactively implement countermeasures to reduce the risk of future crashes. Recommendations for implementation are provided in Emphasis Area 8. These roadways are mapped in Figure 5 on page 16.

Table 2 - Table of Priority Corridors Identified by Systemic Analysis

Priority Corridor	Location	Road Classification
C.R. 300 N	S.R. 39 to C.R. 25 E	Minor Arterial
C.R. 300 N	S.R. 52 to C.R. 150 W	Minor Arterial
C.R. 500 E	C.R. 100 N to C.R. 210 N	Minor Collector
C.R. 500 E	C.R. 350 N to C.R. 400 N	Minor Collector
C.R. 300 S	C.R. 875 E to C.R. 800 E	Major Arterial
C.R. 550 S	C.R. 700 E to C.R. 800 E	Local
96th /Ford Rd	Ford Rd. to Moore Rd.	Minor Arterial
Ford Rd	Irishmans Run Ln to 96th St	Minor Arterial
C.R. 800 E	C.R. 550 S to S.R. 334	Local
C.R. 600 S	C.R. 950 E to 900 E	Major Collector
C.R. 400 E	C.R. 200 S to Key Rd	Major Collector
C.R. 300 S	C.R. 150 W to S.R. 39	Major Collector
C.R. 25 W	C.R. 375 S to C.R. 250 S	Major Collector

Figure 5: Map of Priority Corridors Identified by Systemic Analysis



Hot Spots – Based on Crash Frequency

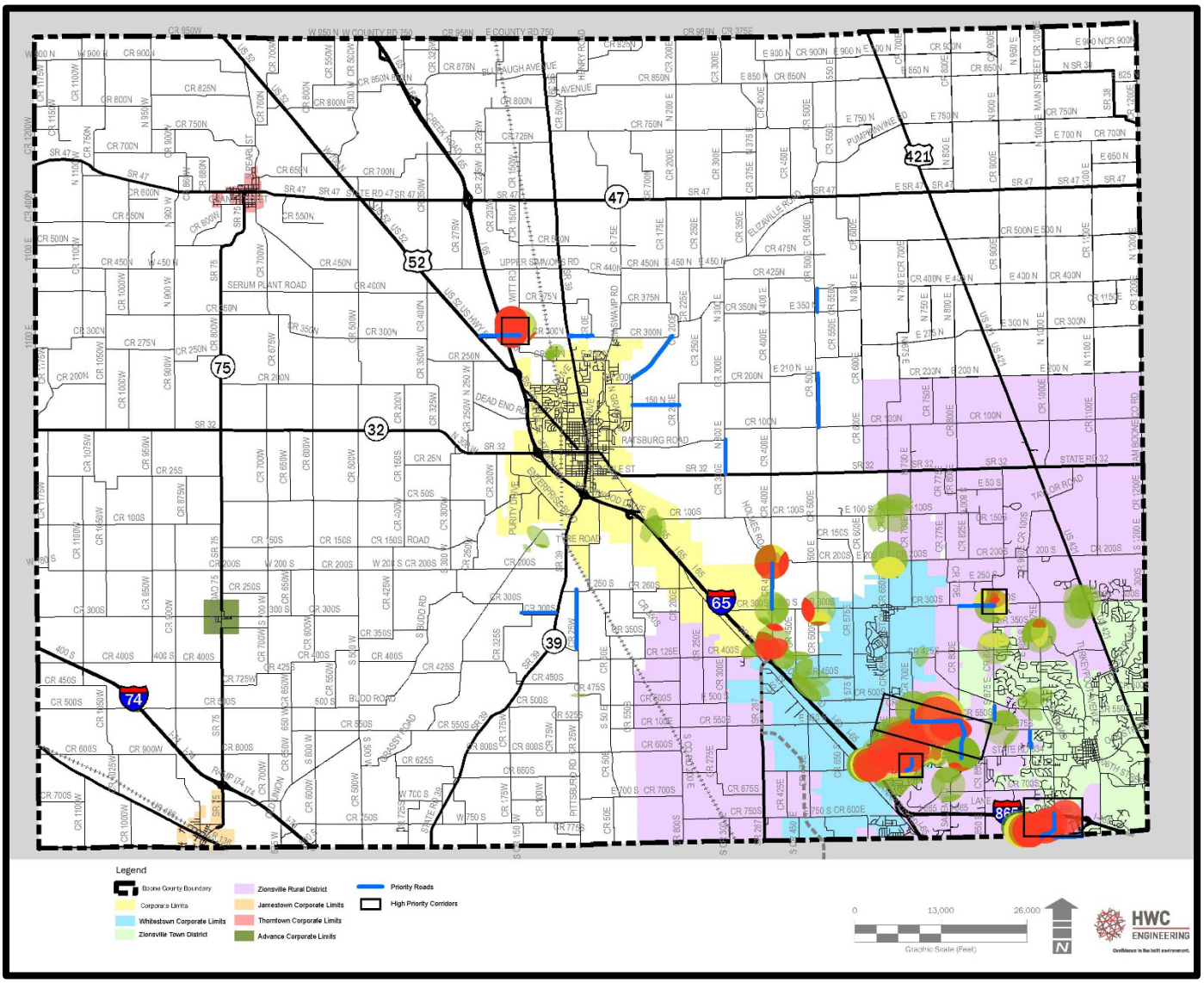
Hot Spot Locations were identified through analysis of crash frequency. Table 3 and map (Figure 6) depict the intersections with the greatest number of crashes. For these high crash intersections, red indicates the intersections with the most crashes within this group, yellow/orange are in the middle range, and green depicts the low end of the range. Figure 6 also includes the priority corridors identified by systemic analysis.

Recommendations for improvements at these locations are provided as part of Emphasis Area 8.

Table 3: Table of Hot Spots – Based on Crash Frequency

Hot Spot Locations
C.R. 300 N and C.R. 150 W
C.R. 400 E and C.R. 100 S
C.R. 100 S and C.R. 650 E
C.R. 650 E and C.R. 200 S
C.R. 300 S and C.R. 400 E
C.R. 300 S and C.R. 500 E
C.R. 300 S and C.R. 875 E
C.R. 300 S and C.R.975 E
C.R. 300 S and U.S. 421
C.R. 400 E and Albert S. White Drive
C.R. 550 S and C.R. 700 E
C.R. 550 S and C.R. 800 E
Ford Road and 96th Street

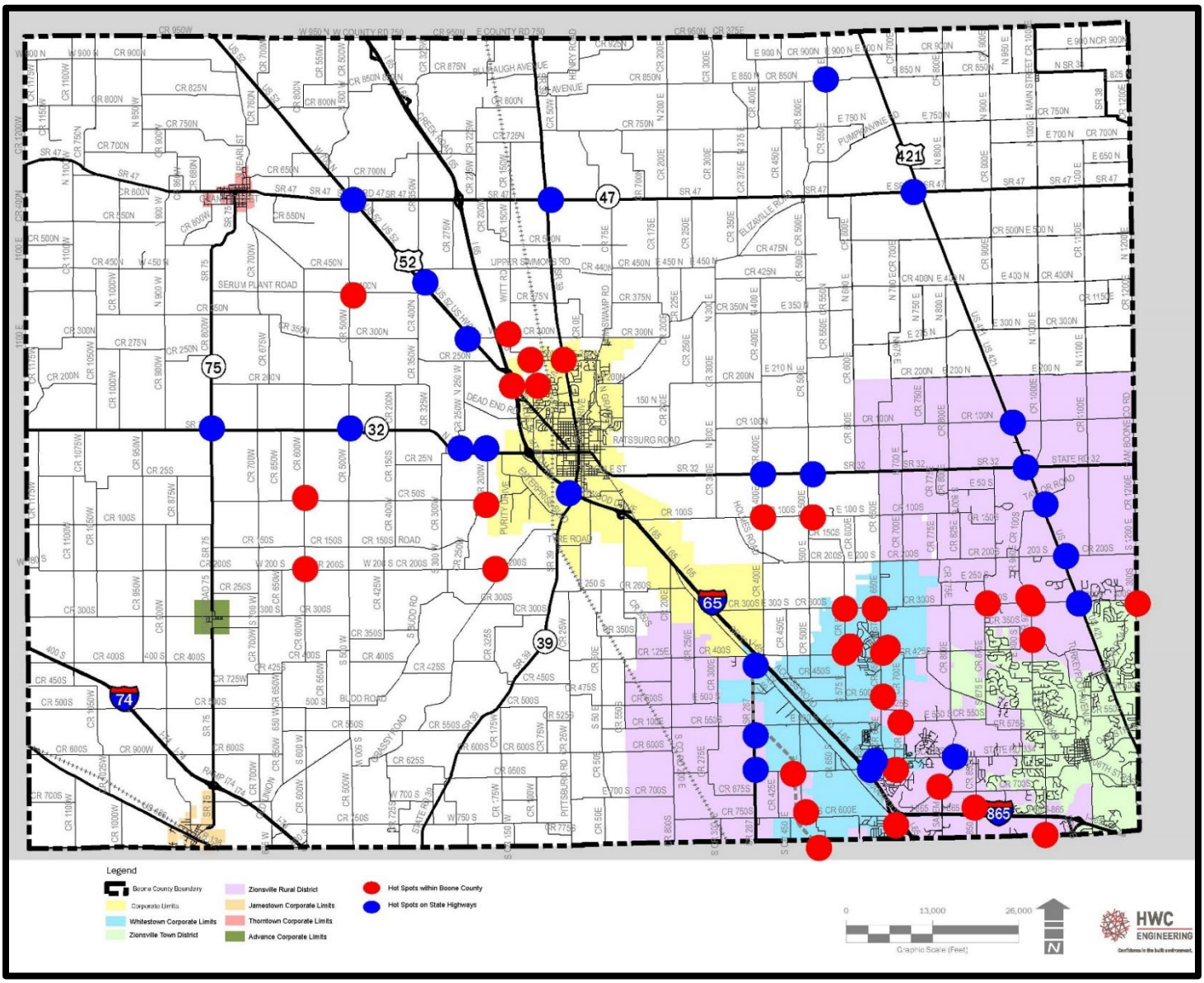
Figure 6: Map of Hot Spots – Based on Crash Frequency



Hot Spots – Based on Stakeholder Input

Input from community stakeholders also identified other locations in the county where they have concerns over roadway safety. These locations are shown in Figure 7 below. All locations identified by stakeholders were included, even if the location is on a state highway and not within Boone County's jurisdiction. Further analysis of each location should be completed by the Boone County Highway Department to assess site specific needs. Recommendations for improvements at these locations are summarized as part of Emphasis Area 8.

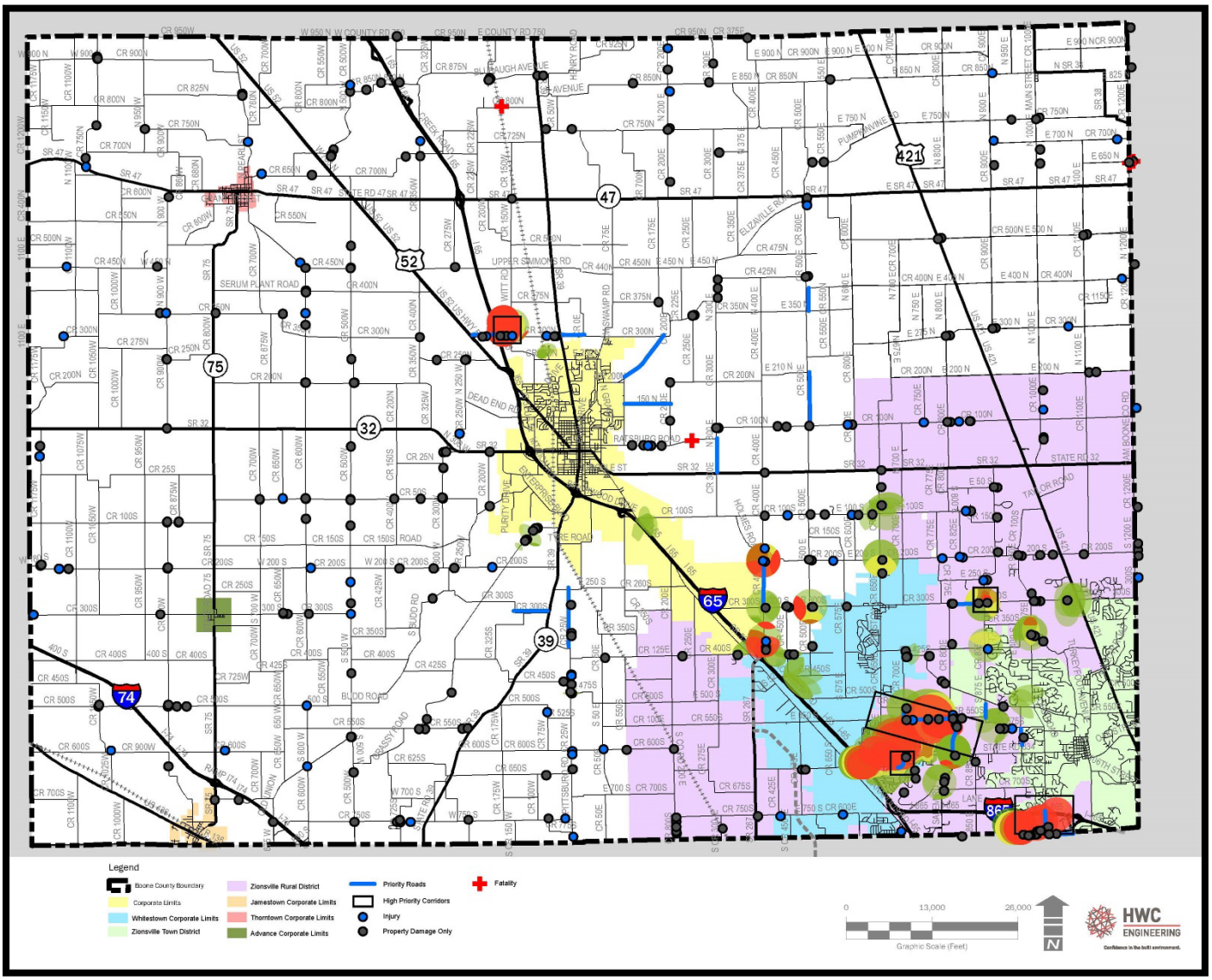
Figure 7: Stakeholder Identified Hot Spots



Combined Crash, Hot Spot and Priority Corridor Map

The following map was prepared to combine all crash data, hot spots and identified priority corridors on a single graphic.

Figure 8: Combined Crash, Hot Spot and Priority Corridor Map



EMPHASIS AREAS

Introduction

This three-part analysis process has identified a number of traffic safety concerns related to Boone County roadways. These concerns were identified through data analysis, and through input from community stakeholders.

The table below (Table 4) presents a summary of the primary safety concerns identified, an explanation of the source of those concerns, and a brief summary of recommended countermeasures to address each issue. Detailed recommendations and action steps for each area of emphasis is provided on the following pages.

Table 4: Table of Primary Safety Concerns

Safety Concern	Data Analysis/Stakeholder Support	Recommendations
There is a high frequency of roadway departure crashes on Boone County Roadways.	• 59% of Boone County crashes include roadway departures (Table 1) • Most roadway departure crashes were on straight road segments, in daylight and in dry conditions (Figure 2)	Address roadway departure crashes by improving shoulder conditions, and implementing striping and no-passing zones. (See Emphasis Area 1)
There is a high instance of intersection crashes that do not involve curve conditions, wet pavement, or darkness.	• 69% of intersection crashes were during dry conditions. (Figure 1) • Improving intersection safety and visibility was cited as a priority by stakeholders. (See page 5)	Improve safety at stop conditions through clearing intersection obstructions, installation of high visibility traffic control devices and site-specific engineering evaluations. (See Emphasis Area 2)
Most of Boone County's at-grade railroad crossings do not have lights or crossing arms.	• Boone County has 25 at-grade railroad crossings. • Boone county was awarded grant funding from INDOT to make needed improvements to approach visibility. • Improving the safety of at-grade railroad crossings was cited as a priority by stakeholders (See page 5).	Improve the safety of railroad crossings by adding advance signs and pavement markings, by working with railroads to improve sight distance at crossings, and by working toward the long-term goal of installing crossing arms and warning lights. (See Emphasis Area 3)
There is a high instance of crashes on straight roadway segments during daylight hours in dry conditions. Distracted driving is believed to be a contributing factor in this, and in the number of roadway departure crashes.	• 59% of crashes are on straight road segments (Figure 2) • 70% of non-intersection crashes involve roadway departure (Figure 2) • Distracted driving was cited by stakeholders as a key priority related to roadway departure crashes and in the number of crashes on straight road segments during daylight/dry conditions (See page 5).	Address distracted driving through local education and enforcement strategies. (See Emphasis Area 4)

Safety Concern	Data Analysis/Stakeholder Support	Recommendations
The Boone County Highway Department needs to take a stronger leadership role in the community on traffic safety.	• The Boone County Highway Department is the entity responsible for traffic safety. • Stakeholder input supported providing tools and resources to the Boone County Highway Department needed to emphasize safety. (See page 5).	Establish tools and resources to support the Boone County Highway Department's leadership role in traffic safety. (See Emphasis Area 5)
There is a disproportionately high number of crashes in growth areas within Center, Eagle and Worth Townships.	• Crash rates in Eagle and Worth Townships are more than double the expected rate (based on the length of roadways in those townships). Crash rates in Center township are also considerably higher than the expected rate. (See Township Distribution Chart on page 20).	Improve roadway safety in growth areas by enforcing speeds and implementing roadway improvements in support of growth (See Emphasis Area 6)
Roadway signs are a critical component of Boone County's overall traffic safety system, but the county does not have a program for the proactive assessment and replacement of aging signs.	• Maintenance and replacement of signs was cited by stakeholders as a key priority. (See page 5).	Develop and implement a county-wide signage replacement program. (See Emphasis Area 7)
Systemic analysis has identified corridors with risk factors similar to corridors with high crash rates. Proactive improvements to these corridors can reduce the risk of crashes.	• Systemic analysis has identified higher volume roads, somewhat narrow roads, poor pavement condition and location in a growth area as risk factors (See page 15). • Roadways having these risk factors are summarized in Table 2.	Implement projects to address risk factors in priority corridors. (See Emphasis Area 8)

EMPHASIS AREA 1: Reduce the number and severity of roadway departure crashes by improving shoulder conditions and implementing striping and no-passing zones.

The data collected reveals that 59 percent of all crashes on Boone County's transportation system have involved roadway departures. These roadway departures are also involved in 61 percent of injury crashes and 75 percent of fatal crashes in the county. Data indicates that most roadway departure crashes are occurring during dry conditions, in daylight hours and on straight roadway segments. This suggests that efforts to reduce roadway departures should be focused on lane delineation, and implementation of shoulder recovery areas.

Action 1.1: Implement centerline striping and no-passing zones on all paved roads in the county. The Boone County Highway Department has commissioned an evaluation of all rural roads to identify where vertical and horizontal road curvature and/or other obstructions allow for safe passing zones. Boone County will now be able to use the results to add centerline striping and no passing zones where needed for the entire county. The Manual on Uniform Traffic Control Devices (MUTCD) Section 3B-01 recommends centerline striping be installed on rural roads 18 feet wide or greater with an ADT of 3,000. Centerline striping can also be installed on roadways as narrow as 16 feet with engineering judgement. After Boone County implements a long-term striping program, procedures and protocols for centerline striping should be evaluated on an annual basis. Additionally, it is recommended to re-analyze passing and no-passing zones on the entire network every five years.

Action 1.2: Improve shoulder conditions on paved roads in the county. The benefit of shoulders and clear zones are they provide room for a driver to recover before there is a crash. The intent of this recommendation is to take steps to improve shoulder conditions and install clear zones. While this should ultimately be implemented system-wide, the initial priority should be to improve shoulders in the priority corridors identified in Emphasis Area 8. Generalized guidance for implementing this recommendation is as follows:

- *Low-volume, low-speed roads:* Install stone shoulders on a spot basis to eliminate drop-offs. Install stone shoulders at curve conditions.
- *Medium-volume, medium-speed roads:* Install stone shoulders for the full length of priority roadways. Remove obstructions whenever possible. Where lanes are narrow or there is not right-of-way for stone shoulders, conduct site specific engineering studies to evaluate alternatives for improving shoulder conditions.
- *High-volume, high-speed roads:* Conduct site specific engineering studies to evaluate alternatives for improving shoulder conditions.

Action 1.3: Install edge striping on paved roads 20 feet wide or greater. The MUTCD Section 3B.07 recommends edge striping be installed when the pavement width is 20 feet or greater and ADT exceeds 3,000. Edge striping can also be used with engineering judgement in other conditions, such as to minimize driving next to edge conditions with limited shoulder or recovery area. The priority for edge striping should be the corridors identified in Emphasis Area 8.

Action 1.4: Enforce right-of-way dedication requirements along rural roads. Local data indicates that there is a disproportionately high rate of crashes on roadways with a narrow right-of-way width. In these conditions, there is little room for shoulders or clear zones outside of the travel lanes. The county's current policy requires property owners to dedicate right-of-way adjacent to roadways when a drive permit or a change of property use is proposed. This provides the county with additional space to install shoulders, maintain clear zone requirements and make

other necessary improvements as recommended in Action 1.2. While this is especially important in growth areas, this policy provides value throughout the entire county.

EMPHASIS AREA 2: Improve safety at stop conditions.

Crashes at intersections represent 41 percent of the crashes in the county, making this a key priority. The need to improve safety at stop conditions was also emphasized by stakeholders during the planning process. Key recommendations include improving sight lines and increasing the visibility of traffic control devices. It is also recommended that an additional study be completed at existing 2-way stop locations with an effort to enhance safety at these locations. Additionally, it is recommended that Boone County emphasize high-visibly traffic control devices at intersections because of the frequency of intersection crashes during the night.

Action 2.1: Keep intersections free of obstructions that block sight lines, the view of emergency response vehicles and the view of traffic control devices. This includes prohibiting new obstructions from being installed, as well as removing existing obstructions. The county should also regularly inspect and clear vegetation around intersections, approaches, signage and other traffic control devices that aid in managing and directing traffic as well for clear intersections for emergency response vehicles.

Action 2.2: Install high-visibility traffic control devices at intersections with higher classification roadways. At intersections that include roadways classified as collectors or arterials, high-visibility traffic control devices should be installed, depending on the situation. This may include the addition of stop bars, spinners, LED enhanced signs, reflective advance warning signs, double stop signs, larger signs, flashers or related improvements. Advanced intersection signage should also be considered to warn drivers of upcoming stop conditions.

Action 2.3: Conduct supplemental research on two-way stop conditions in the county. The county should inventory and assess two-way stop conditions in the county, and establish best practices (such as the need for advanced warning devices). This planning effort should also include partnering with INDOT to assess and provide recommendations for two-way stop conditions where local roads intersect with state highways. While stop control at these intersections is INDOT's responsibility, Boone County could take steps to further improve intersection visibility by collaboration with INDOT to install advanced warning signage where deemed necessary.

EMPHASIS AREA 3: Improve the safety of railroad grade crossings.

Indicated as an area of focus by the steering committee and staff, most of the 25 at-grade railroad crossings within the Boone County Highway Department's jurisdiction lack lights or crossing arms and are only protected with signage. Short-term improvements should be made to improve visibility. Additional funding will be needed to implement medium-to-long term solutions that address approach conditions and crossing arms/lights.

Action 3.1: Improve the approach visibility of railroad crossings. Boone County has been awarded a grant to improve the approach visibility at railroad crossings. On gravel roads, advanced warning signs will be installed. On paved roads, advanced warning signs and pavement markings will be incorporated.

Action 3.2: Improve sight distance at railroad crossings. This will first include clearing vegetation on a regular basis to improve sight distance at railroad approaches. Where vegetation in the railroad right-of-way is impeding visibility, Boone County will need to coordinate with the railroad to address the concern. In some locations, regrading of the railroad approach should be considered to improve sight distance.

Action 3.3: Install crossing arms and warning lights at railroad crossings. The long-term goal should be to have full protection at all county railroad crossings, including crossing arms and warning lights. Since the installation of these systems is the responsibility of each individual railroad company, Boone County should partner with INDOT and the railroads to support the pursuit of funding for the installation of these protection systems.

EMPHASIS AREA 4: Reduce distracted driving related crashes.

Crash data shows a high number of roadway departure crashes on dry, straight roadways during daylight hours indicating distracted driving is a contributing factor. Distracted driving is any activity that involves taking your eyes off the road, hands off the wheel or taking your mind off of driving. Smart phone use while driving was cited as a key priority by law enforcement during stakeholder meetings. Their concern was that state statues, at the time of the stakeholder's meeting, only prohibited phone calls and texting while driving, but not social media use or other applications. This limits the enforcement actions that can be taken by local officers. A multi-pronged approach to distracted driving is needed to address these concerns.

Action 4.1: Enforce Indiana's new distracted driving laws. Early in the planning process, it was identified that additional local and/or state legislation was needed to prohibit distracted driving in all its forms. Since this plan began, Indiana has passed legislation that makes it unlawful to type, transmit or read e-mail or text messages on a communication device while driving in Indiana. This goes into effect July 1, 2020. The Boone County Sheriff's Department should develop a program to begin enforcement of this new legislation.

Action 4.2: Develop a local education and enforcement campaign to increase awareness of distracted driving. Boone County Highway Department should partner with the Boone County Sheriff, local schools, peer groups and others to develop and implement local education and enforcement campaigns to increase awareness of the state's new legislation, and the and dangers of distracted driving. Implementation of this program should begin in advance of the state's new distracted driving laws. These groups could also pursue grant funding to support this education and enforcement campaign.

EMPHASIS AREA 5: Build a culture of safety in the Boone County Highway Department and in the community.

The Boone County Highway Department should become the leading voice in the community on traffic safety. To accomplish this, it will take continuing training, investments in data collection/analysis and transparency on traffic safety progress.

Action 5.1: Develop a traffic and roadway data collection program for Boone County roadways. The Boone County Highway Department should develop methodologies to collect relevant traffic and roadway data. This should include identifying the data to be collected the frequency in which it needs to be updated. This should address frequency of traffic counts in both rural and growth areas of the county. Methodologies should also include roadway data such as ditch condition, pavement markings and other relevant information.

Action 5.2: Educate local officers and emergency response teams on the use of crash data and its role in traffic safety planning. There is a perception among many police officers that data entered in the crash database is only for insurance purposes. It is important to provide training to officers to show the how the data is used for planning and to educate them on how to accurately fill out the information in the database. Additionally, training should include how to utilize the data in reporting. Related to this, it is important for the Boone County Highway Department to partner with the Boone County Sheriff's office in accident investigations to identify potential transportation system needs that should be addressed.

Action 5.3: Add a data analyst position to the Boone County Highway Department for GIS data collection and analysis. Integration of GIS data related to the county's pavement rating system, signage inventory and traffic safety data is currently being utilized, but could be enhanced. The Boone County Highway Department has identified the need to collect and analyze additional data for safety planning, asset management and to support data-driven day-to day decision making. The Boone County Highway Department should request the addition of for a staff position to support these goals.

Action 5.4: Update the Local Road Safety Plan on a regular basis. As new crash data is available, it is recommended that the data be reviewed on an annual basis to assess performance. At a minimum, this would include updating Table 1. It is further recommended that this local road safety plan be updated every three to five years.

Action 5.5: Publish Annual Safety Reporting. Boone County Highway Department should include safety information in their annual report to create transparency and awareness of traffic safety issues as well as discuss safety countermeasures that have been implemented or are being considered.

Action 5.6: Toward Zero Deaths Resolution. The Boone County Highway Department should encourage the adoption of a local resolution promoting policies and practices to achieve the vision of a roadway system free of fatalities.

EMPHASIS AREA 6: Improve roadway safety in growth areas by enforcing speeds and implementing needed roadway improvements.

Data shows that roadways in Center, Eagle and Worth townships have a disproportionately high rate of crashes. These townships also reflect the high-growth areas of Boone County. The most probable explanation is that roadways originally constructed for lower volume rural use are seeing a significant increase in traffic volume as a result of development. In addition to traffic volume concerns, there is often little right-of-way available beyond the edge of pavement, which limits the range of countermeasures that can be implemented to address the increased traffic volume.

Action 6.1: Implement traffic calming strategies and enforce speed limits in high-growth areas. Traffic calming strategies should first include centerline and edge striping on roadways in growth areas, as indicated in Action 1.1. To promote traffic calming, roadways should utilize relatively narrow lane widths. If there is adequate right of way, stone shoulders should be installed. For example, where existing pavement exceeds 20 feet in width, or where traffic exceeds 1,000 vehicles per day, roadways could be striped for 10-foot lanes and paved shoulders.

The Boone County Highway Department should carefully assess resurfacing projects to determine if the work has a high probability of inducing higher speeds on the roadway. Traffic calming measures, such as striping, should be incorporated on resurfacing projects where higher induced speeds are likely.

Traffic calming measures should be complimented with a speed enforcement campaign by the Boone County's Sheriff's Department.

Action 6.2: Implement roadway improvements where traffic patterns have changed due to development. As development results in increased traffic volumes on rural roads, engineering judgement will need to be made regarding decisions to upgrade roadways. Guidance for such decisions in growth areas include:

- *Low-volume roads with limited impacts from development:* Install center and edge striping on pavement.
- *Medium-volume roads with subdivision entrances or indirect traffic impacts:* Install center and edge striping on pavement. Secure right-of-way or easements to allow shoulder improvements. Supplemental enhancements may also be needed based on engineering judgement.
- *High-volume roads:* Conduct engineering study to identify recommended improvements. This could include widening pavement, adding turn lanes, or installing a full curb and gutter.

Action 6.3: Maintain minimum pavement rating condition in growth areas. The analysis shows an increased risk of crashes when pavement is in poor condition. Within growth areas, the goal is to maintain all roads in fair condition or better (PASER rating of 5 or more). Before such roads are resurfaced, it is important to assess whether traffic calming strategies should be incorporated into the repaving project, as described in Action 6.1.

Action 6.4: Collaborate with municipalities in evaluating the impacts of development on Boone County's road network. Development projects within Boone County's cities and towns can have direct and indirect impacts on Boone County's roadway network. To proactively plan for these impacts, Boone County Highway Department should develop internal processes that improves strategic planning partnerships with Boone County cities and towns. This would provide the Highway Department an opportunity to be informed of pending development decisions. Partnerships could be as simple as communication regarding major developments, or could include participation in a Technical Advisory Committee process.

EMPHASIS AREA 7: Ensure Boone County signs are regularly assessed and maintained to meet the needs of roadway users.

Roadway signs are a critical component of the overall traffic safety program for the county. They communicate rules, warnings and directional information to roadway users. Boone County has developed and maintained a GIS-based sign inventory to track sign replacement/installations and identify deficiencies which is also required by the Indiana MUTCD (Manual on Uniform Traffic Control Devices) However, the county has not yet initiated a regular program that uses this data for the proactive assessment and replacement of aging signs.

Action 7.1: Develop and implement a county-wide sign replacement program. For this action, Boone County will utilize its existing sign inventory database to develop a data-driven, long-term annual sign replacement program.

EMPHASIS AREA 8: Implement projects to address priority corridors and spot conditions.

The systemic analysis identified a series of high priority corridors where proactive improvements should be implemented to address safety because they reflect the highest prevalence of risk factors. In some cases, crash data already supports improvements. In other areas, the prevalence of risk factors identifies that these areas have an increased likelihood of future crashes. In addition to the systemic analysis, this planning effort has identified other spot improvements that should be addressed.

Action 8.1: Implement improvements to address priority corridors. Recommended improvements are summarized in Table 5 below. While addressing each and every risk factor within these corridors may not be practical, one strategy would be to address a single risk factor everywhere it exists within these corridors. As an example, shoulder conditions could be improved over a two-year period for each of the roadways where it is noted as a risk factor.

Table 5: Priority Corridor Summary

Priority Corridor	Location
C.R. 300 N	S.R. 39 to C.R. 25 E
C.R. 300 N	S.R. 52 to C.R. 150 W
C.R. 500 E	C.R. 100 N to C.R. 210 N
C.R. 500 E	C.R. 350 N to C.R. 400 N
C.R. 300 S	C.R. 875 E to C.R. 800 E
C.R. 550 S	C.R. 700 E to C.R. 800 E
96th /Ford Rd	Ford Rd. to Moore Rd.
Ford Rd	Irishmans Run Ln to 96th St
C.R. 800 E	C.R. 550 S to S.R. 334
C.R. 600 S	C.R. 950 E to 900 E
C.R. 400 E	C.R. 200 S to Key Rd
C.R. 300 S	C.R. 150 W to S.R. 39
C.R. 25 W	C.R. 375 S to C.R. 250 S

Action 8.2: Implement improvements to address hot spots. Hot spots were established based on crash frequency. A site-specific engineering analysis for each location should be completed for each of these locations.

Table 6: Hot Spot Summary

Hot Spot Locations	
C.R. 300 N and C.R. 150 W	C.R. 300 S and C.R.975 E
C.R. 400 E and C.R. 100 S	C.R. 300 S and U.S. 421
C.R. 100 S and C.R. 650 E	C.R. 400 E and Albert S. White Drive
C.R. 650 E and C.R. 200 S	C.R. 550 S and C.R. 700 E
C.R. 300 S and C.R. 400 E	C.R. 550 S and C.R. 800 E
C.R. 300 S and C.R. 500 E	Ford Road and 96th Street
C.R. 300 S and C.R. 875 E	

Table 7: Implementation Table

Goal/Action	Responsible Party	Performance Measure/Timeframe
1-Reduce the number and severity of roadway departure crashes by improving shoulder conditions and implementing striping and no-passing zones		
Action 1.1: Implement centerline striping and no-passing zones on all paved roads in the county.	BCHD	• Finish Study – COMPLETE • Striping will be added to each roadway, bridge or resurfacing projects implemented by the county, beginning in 2020 for roadways with an AADT greater than 3,000.
Action 1.2: Improve shoulder conditions on paved roads in the county	BCHD	• See Emphasis Area 8
Action 1.3: Install edge striping on paved roads 20 feet wide or greater	BCHD	• See Emphasis Area 8
Action 1.4: Enforce right-of-way dedication requirements along rural county roads	BCHD/Commissioners/Area Plan Commission	• Zero variances from policy, measure annually in December.
2-Improve safety at stop conditions		
Action 2.1: Keep intersections free of obstructions that block sight lines and the view of traffic control devices.	BCHD	• Conduct annual audit of obstructions and quantify number of obstructions removed – Annually • Conduct regular inspections/trimming in summer months – Summer Months
Action 2.2: Install high visibility traffic control devices at intersections with higher classification roadways.	BCHD	• Identify target intersections – 2021 • Implement improvements on 5 intersections each year - Annually
Action 2.3: Conduct supplemental research on two-way stop conditions in the county.	BCHD	• Conduct research project - 2021
3-Improve the safety of railroad grade crossings		
Action 3.1: Improve the approach visibility of railroad crossings.	BCHD	• Apply for grant funding – COMPLETE • Complete installation of advanced warning signs and pavement markings – COMPLETE
Action 3.2: Improve sight distance at railroad crossings.	BCHD	• Complete assessment – 2022 • Remove vegetation and overgrowth • Strive to improve one crossing per year - Annually

Action 3.3: Install crossing arms and warning lights at railroad crossings.	CSX/INDOT	• Complete improvement project – 2021 • Boone County provide support to INDOT and CSX – Ongoing
4-Reduce distracted driving related crashes.		
Action 4.1: Enforce Indiana's new distracted driving laws.	Boone County Sheriff's office	• Introduce and adopt ordinance – 2020 • Enforce new state legislation
Action 4.2: Develop a local education and enforcement campaign to address and educate the public and public safety about distracted driving.	Boone County Sheriff and Safety Partners	• Develop campaign – 2021 • Implement campaign - 2022
5-Build a culture of safety in the Boone County Highway Department and in the community.		
Action 5.1: Develop a traffic and roadway data collection program for Boone County roadways.	BCHD	• Update 1/3 of traffic counts – Annually
Action 5.2: Educate local officers and emergency response teams on the use of crash data and its role in traffic safety planning.	Boone County Sheriff and BCHD	• Conduct training – Annually
Action 5.3: Add a data analyst position to the Boone County Highway Department for GIS data collection and analysis.	BCHD and Boone County Council	• Include in 2022 budget request – 2021 • Hire new employee – 2022
Action 5.4: Update the Local Road Safety Plan on a regular basis.	BCHD	• Review updated crash data – Annually • Update LRSP – 2023/2024
Action 5.5: Publish Annual Safety Reporting.	BCHD	• Update annually
Action 5.6: Work Toward Zero Deaths Resolution.	BCHD, Boone County Commissioners and Boone County Council	• Budget for priority corridor improvements – 2021 • Complete annual improvement projects – Starting in 2022
6-Improve roadway safety in growth areas by enforcing speeds and implementing needed roadway improvements.		
Action 6.1: Implement traffic calming strategies and enforce speed limits in high-growth areas	BCHD	• See Emphasis Area 8
Action 6.2: Implement roadway improvement prioritization based on traffic volumes and development conditions.	BCHD	• See Emphasis Area 8
Action 6.3: Maintain minimum pavement rating condition in growth areas.	BCHD	• Update Annually
Action 6.4: Collaborate with municipalities in evaluating the impacts of development on Boone County's road network.	BCHD and towns and cities within BC	• Annual on-going

7-Ensure Boone County signs are regularly assessed and maintained to meet the needs of roadway users		
Action 7.1: Develop and implement a county-wide sign replacement program	BCHD/Boone County Commissioners	• Budget for sign program – 2020 • Implement sign program – 2021
8-Implement projects to address priority corridors and spot conditions		
Action 8.1: Implement improvements to address priority corridors.	BCHD/Boone County Council	• Assessment of spot improvements - 2021 • Budget for spot improvements – 2022 • Complete annual improvement projects – Annually starting in 2023
Action 8.2: Implement improvements to address hot spots.	BCHD/Boone County Council	• Track improvements and update hot spots table.

** Performance Measures and timeframes depend on funding availability.