Jefferson County, MO

COUNTY ROAD SAFETY PLAN

June 25, 2021

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Resolution Number R21-0801

Table of Contents

Table of Figures

Table of Tables

Table of Photos

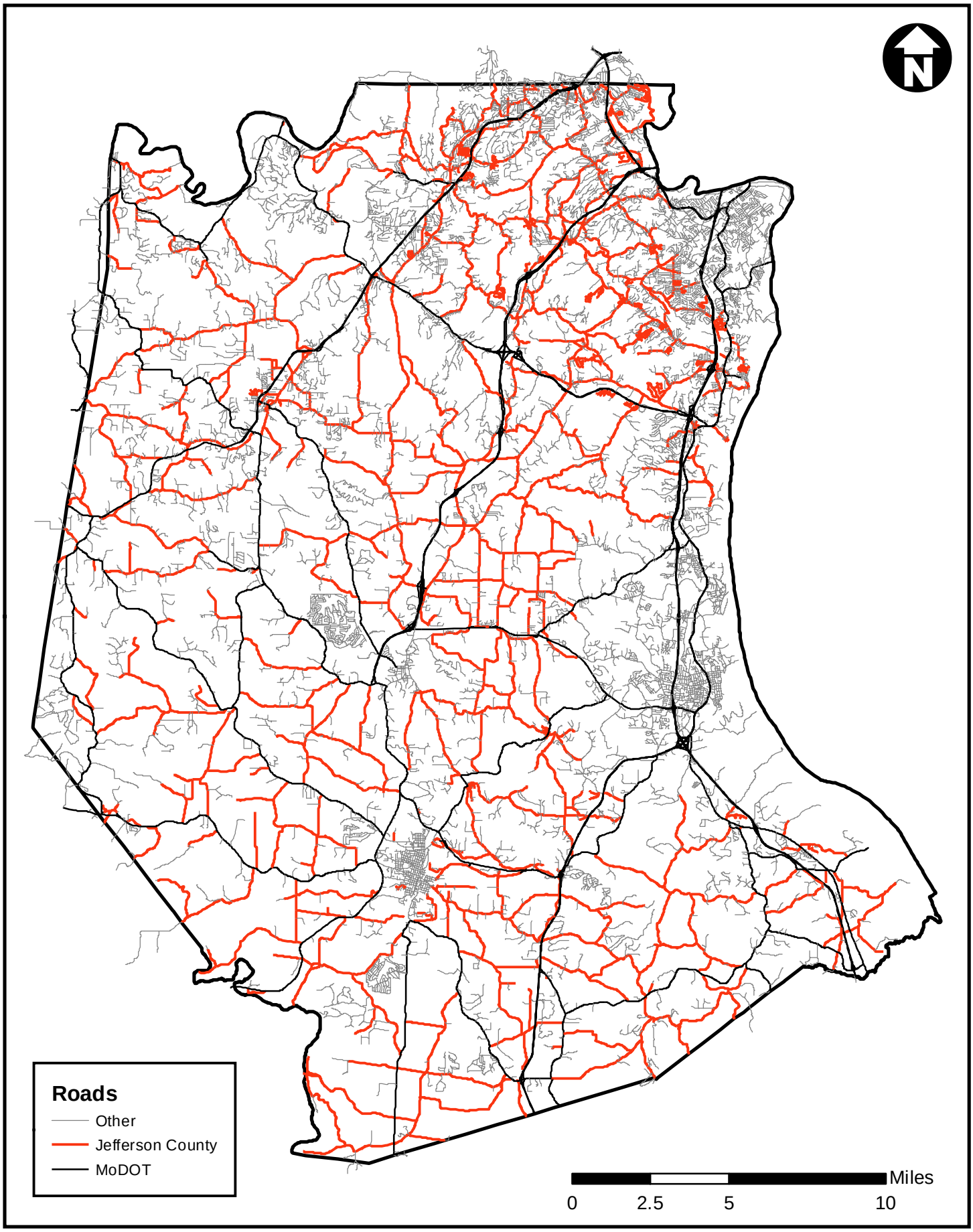
List of Appendices

Introduction

This report presents the Jefferson County Road Safety Plan including the crash history, study methodology and recommended countermeasures to reduce crashes in Jefferson County, Missouri. Jefferson County lies in the east-central portion of Missouri as part of the St. Louis Region and maintains almost 700 miles of County owned roadway. Figure 1 shows the county boundary and highlights the county roadway system. This study evaluated crash data on these roadways from July 1, 2014- June 30, 2019, to determine overrepresented crash types and identify high crash areas on the County roadway network. Specific countermeasures to lower the crash frequency and severity on these roadways have been identified. An important aspect of this safety plan is the identification of low-cost countermeasures, which can be applied widely on these corridors and others in a systemic manner to address the most crashes on Jefferson County roadways.

This safety study seeks to provide safety solutions on both a project specific and county-wide level. In the process of analyzing crash data and developing countermeasures for high crash areas, common themes emerged that can be applied on a wider level. This report contains strategies on how to address safety issues commonly seen in Jefferson County, such as roadside fixed objects and changes in horizontal alignment. These strategies could be used to inform future policy and address safety concerns systematically.

FIGURE 1: JEFFERSON COUNTY ROADWAYS



Jefferson County Road Safety Study

JEFFERSON COUNTY ROAD MAP

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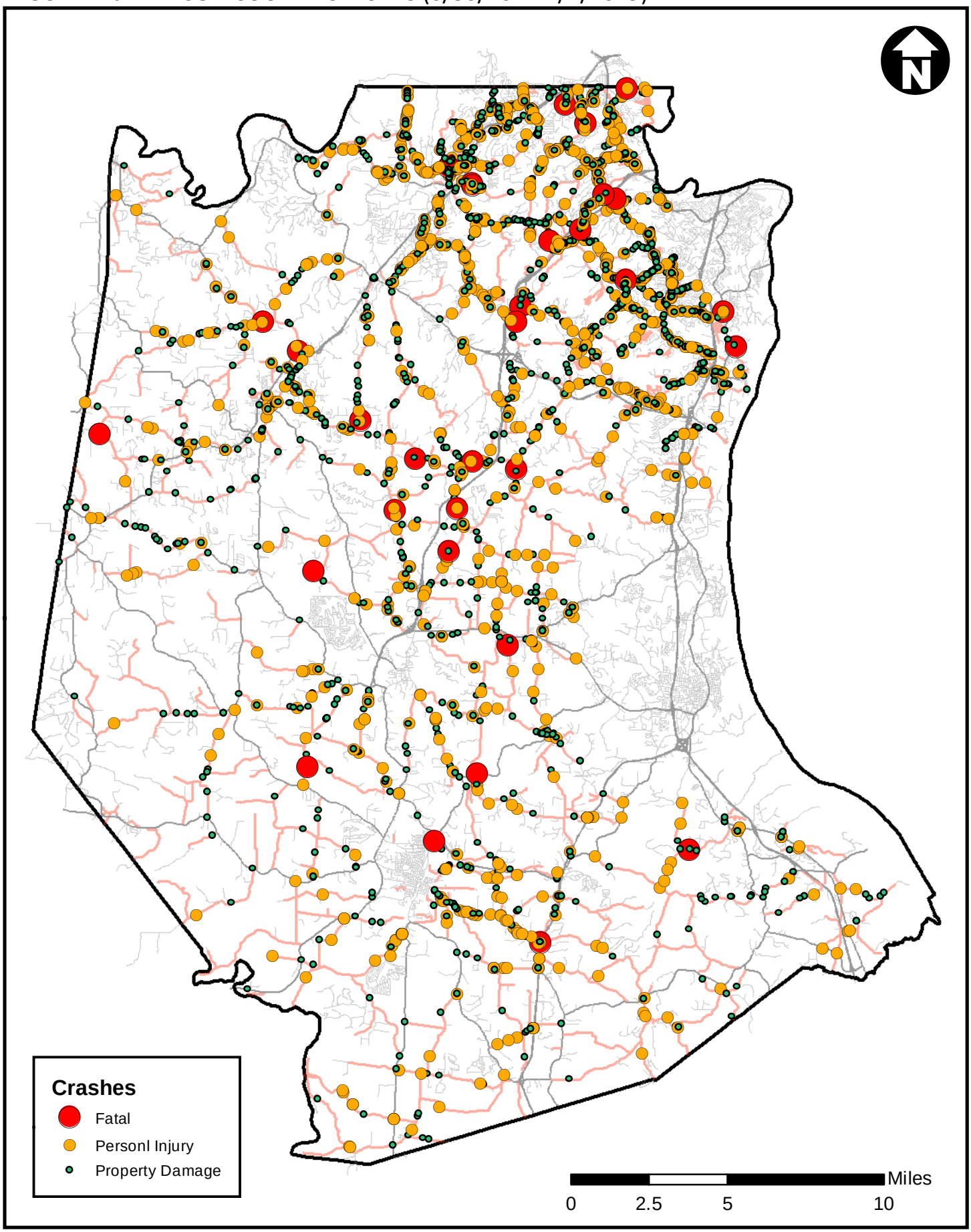
Countywide Crash Analysis

Crash data for the entire study area was provided by Jefferson County in a Geographic Information System (GIS) shapefile with location data for each crash. The crash data was derived from the Missouri crash database, which is compiled every year from the local and state police crash records. During this 5-year period, a total of 3,510 crashes occurred on the county roadway system resulting in 1,018 injury crashes and 32 fatal crashes. Figure 2 shows all crashes and severity on the County Road system.

The crash data files contain the following information required to identify and analyze the crash records:

- Crash ID
- Day and time of crash
- Latitude /Longitude
- Light condition
- Roadway condition (wet, dry)
- Crash severity (PDO, Injury, Fatal)

FIGURE 2: JEFFERSON COUNTY CRASHES (6/30/2014-7/1/2019)



Jefferson County Road Safety Study

JEFFERSON COUNTY CRASH MAP

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The primary crash types within the dataset were fixed object crashes representing 46 percent of all crashes on County roadways and resulting in 1,617 overall crashes, 539 injuries, and 20 fatal crashes (Figure 3). This crash type is significantly overrepresented when compared to the statewide average as reported by the MO State highway Patrol Statistical Analysis Center which shows fixed object crashes only accounted for 19 percent of total crashes and 34 percent of fatalities statewide. It should be noted that within the original crash dataset a large portion of vehicle crashes were coded simply as "Motor Vehicle in Transport" and did not provide specific crash types.

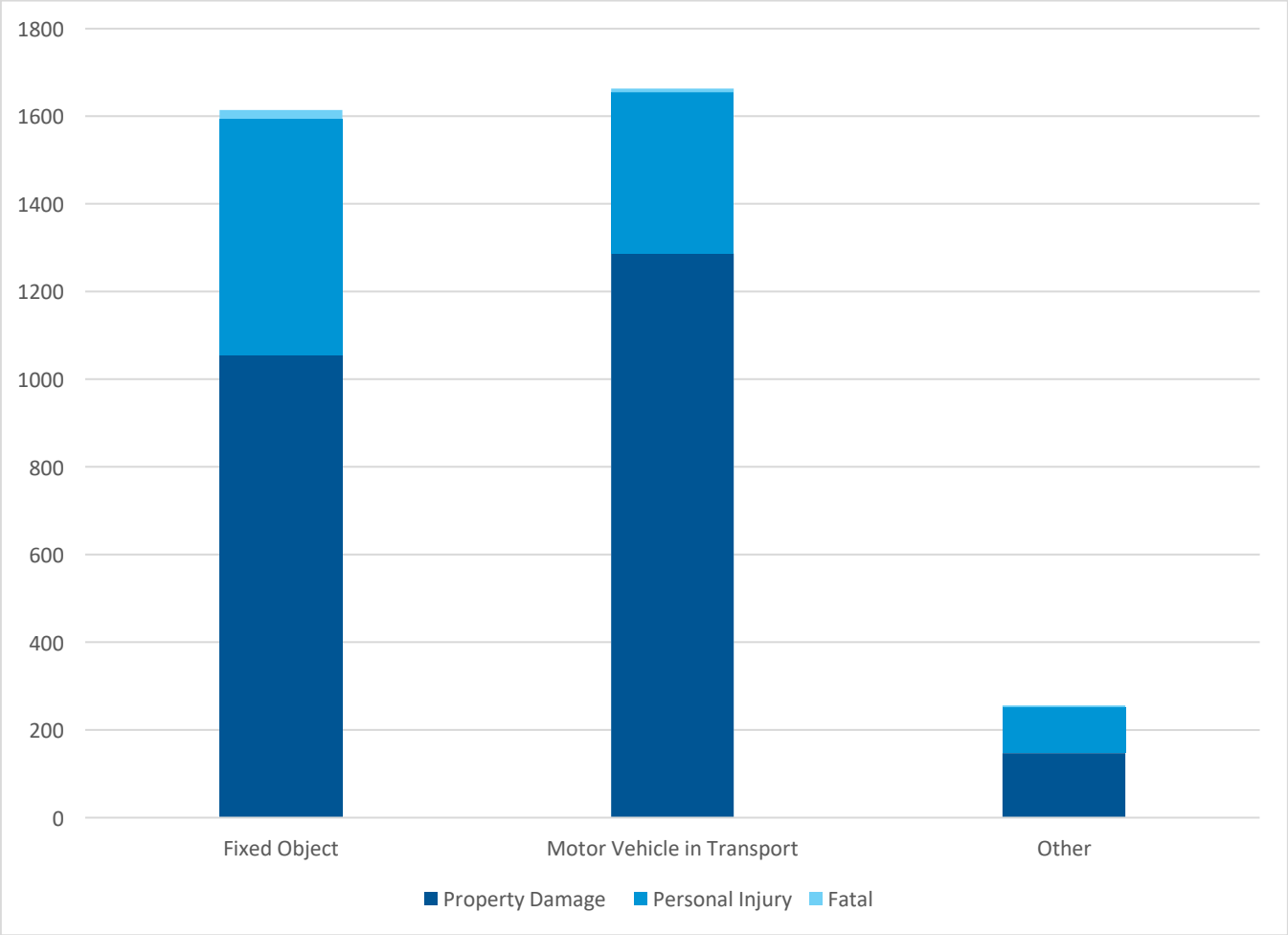


FIGURE 3: CRASH FREQUENCY AND SEVERITY

When examining light condition, daylight crashes were shown to represent 67.7 percent of all crashes, but only 28.1 percent of fatal crashes on the County-maintained roadways. 71.9 percent of fatalities occurred during dark unlighted conditions. Similar trends are maintained when evaluating single vehicle crashes, such as fixed object crashes, and light conditions with 41.8 percent of single vehicle crashes occurring during dark conditions, compared to 19.5 percent of multiple vehicle crashes. Figure 4 shows the distribution of all crashes by light conditions and Figure 5 shows fatal crashes by light conditions.

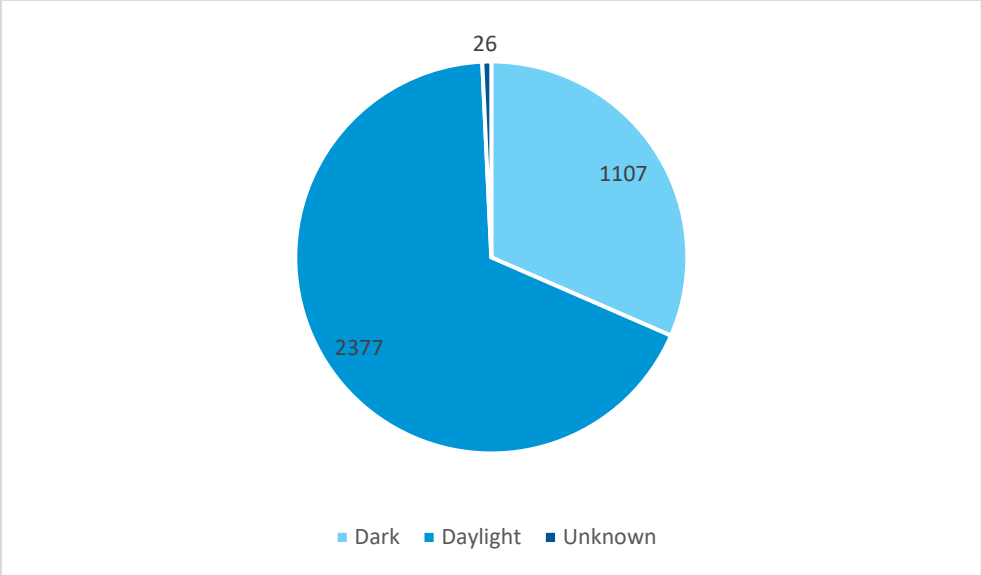


FIGURE 4: ALL CRASHES BY LIGHT CONDITION

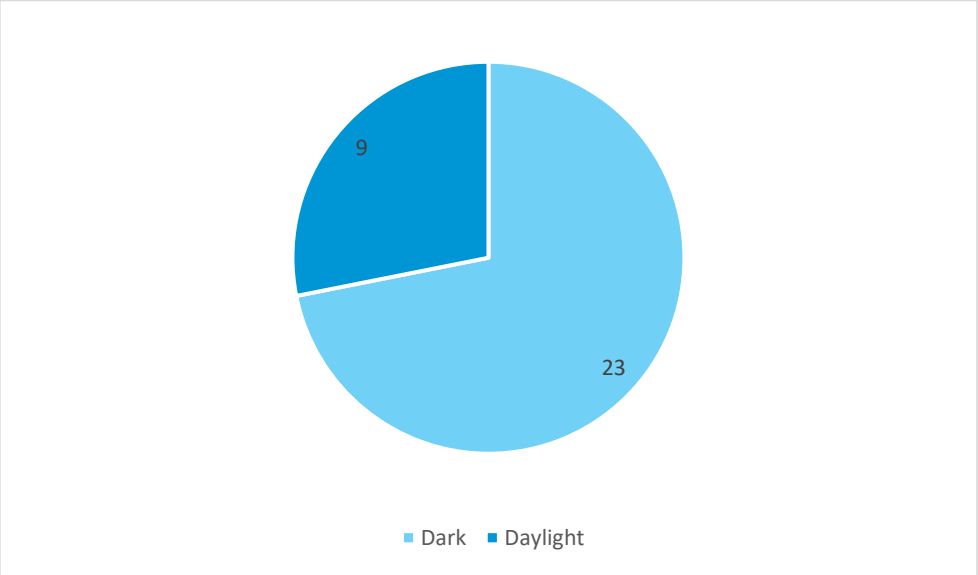


FIGURE 5: FATAL CRASHES BY LIGHT CONDITION

The crash analysis presented here can assist in identifying emphasis crash types, and subsequently, potential mitigation measures to implement on the county's roadway system. The high number of single vehicle fixed object crashes identified indicates there is a significant need to keep errant vehicles on the roadway and minimize the crash impact for vehicles that leave the roadway. This can be achieved through improved signing to identify horizontal changes in the roadway and to warn of hazards and by removing, relocating and/or redesigning fixed objects on the roadside.

Priority Locations for Safety Improvements

Priority Location Selection

After the initial crash analysis, priority locations, including both roadway segments and intersections, were identified with the goal to identifying roadways overrepresented in crash frequency and crash severity. An Equivalent Property Damage Only (EPDO), which uses a weighted rating technique based on crash severity, was used to targeting areas with frequent severe crashes. The EPDO formula used in this analysis assigns a weight of 10 to crashes resulting in a fatality, 5 for crashes resulting in an injury, and 1 to crashes resulting in property damage only. Roadway segments were divided into equal 1-mile segments, and appropriate influence areas around intersections were established. Spatial analysis was used to match crash data to each segment and intersection, and each were then ranked based on their EPDO values. The top segments and intersections were combined into one project list. Adjacent segments and overlapping intersections and segments were then combined to make 37 contiguous projects with an EPDO greater than 25. A threshold of 25 was chosen for project creation because crash patterns become less apparent with fewer data points, making countermeasure identification less effective. The combined project list was compared to a list of recent and ongoing safety projects in Jefferson County to eliminate overlap between the countermeasures suggested here and those improvements that are already in progress, resulting in a total of 20 priority locations that have the potential to be future safety projects.

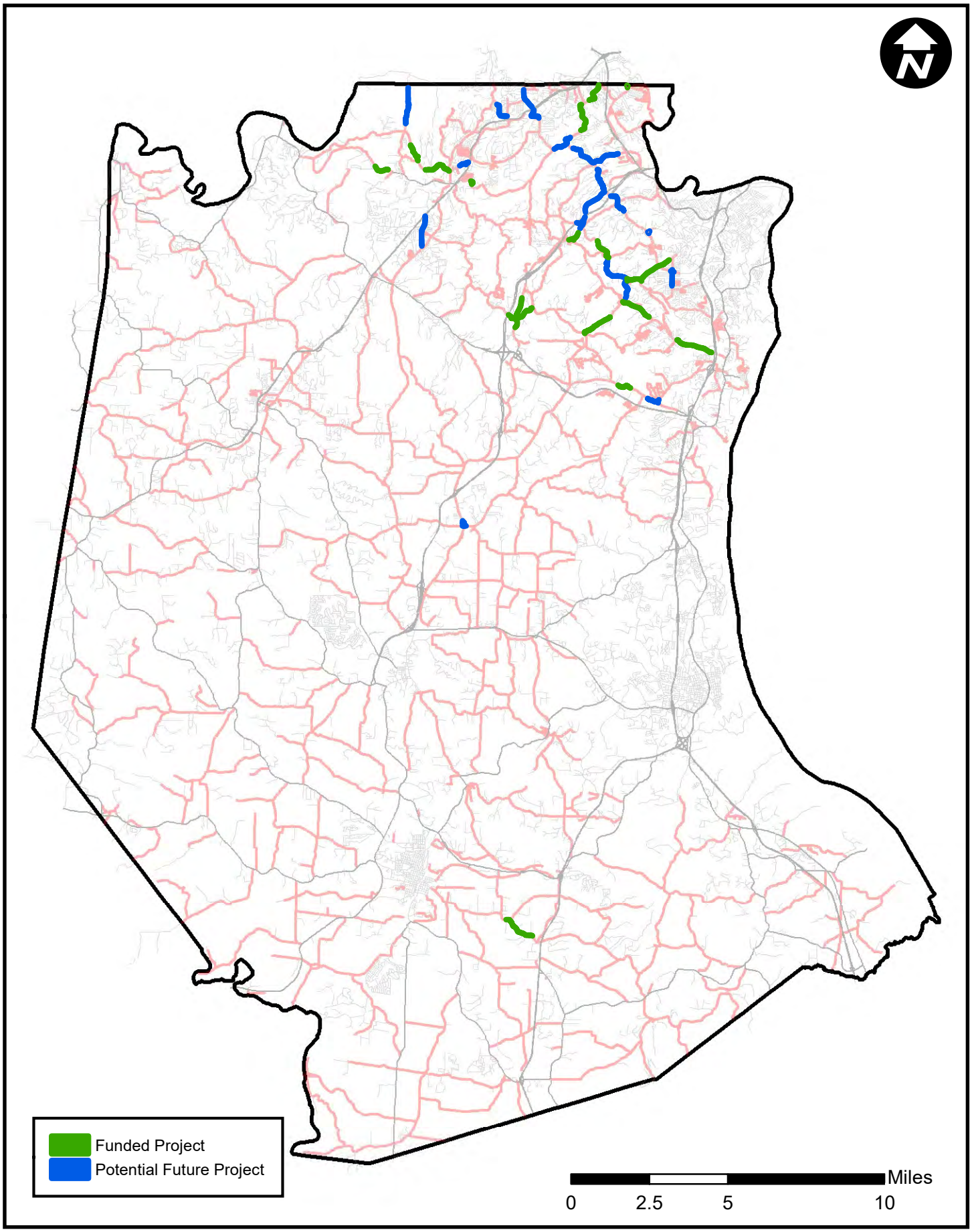
An EPDO based ranking was utilized to focus resources on those areas with more severe crash patterns and thus help reduce instances of fatalities and serious injuries. *Even though the final list of 37 only represents approximately 28 miles (4%) of total roadway within the county's 700 roadway mileage, the top 37 locations represent 976 total crashes or 27.8 percent of all county crashes including 277 injuries and 10 fatalities.* Similarly, the 20 priority locations within the list that are not associated with ongoing safety efforts represent just 14 miles (2%) of county-maintained roadway but experienced 518 crashes (14.8% of total) during the study period, including 155 injuries and 4 fatalities. Appendix A contains a more detailed description of how the data analysis was performed as well as an extended project list derived from that analysis.

Table 1 lists each of the 37 priority locations ranked by EPDO, and Figure 6 shows the location of each of these selected roadways within the county. The 20 locations with no recent or ongoing safety work have been assigned a priority number, while those projects that have already received funding are listed as such. As can be seen from Figure 6, the majority of priority locations are located within the northeastern portion of the county closer to the St. Louis Metro Area. This is reflective of the increased population within these areas and increasing development which is outpacing roadway improvements within northeastern Jefferson County.

TABLE 1: PRIORITY PROJECT LOCATIONS RANKED BY EPDO

Priority	Location	Fatal	Injury	PDO	EPDO
1	Romaine Creek from Konert to Caleb	0	19	18	113
Funded	Seckman from Elephant Walk to Outer Rd	0	13	48	113
Funded	Old State Route 21 and West Four Ridge	2	12	23	103
Funded	Saline Rd from Willow Bend to Hermitage	1	12	16	86
2	Konert from Breezy Oak to Konert Valley	0	14	16	86
Funded	Old Lemay between E Rock Creek and Spring Forest	0	10	30	80
3	Old State Rte 21 from Lonedell to Ench Forest	1	10	19	79
4	Old Sugar Creek from Sugar Creek to Anise	0	7	38	73
5	Miller and Vogel	0	7	38	73
6	East Rock Creek from Ehlers to Old Lemay	1	9	15	70
Funded	Seckmen from Old Lemay Ferry and Mastadon	0	6	37	67
7	Old State Rte 21 from SR21 past Rock Creek	1	7	15	60
Funded	East Rock Creek and Gary	0	11	4	59
8	Brennan from Eagle to Little Brennan	0	6	28	58
Funded	Old Lemay Ferry from Miller to Brenda	0	4	37	57
9	Gravois from Terrace to Roseglyn	0	8	17	57
Funded	Flucom Orchard Park to Kimberly	0	9	12	57
10	Antire from Brookside to Laurel	0	9	11	56
11	Old Hwy M and Old Antonia	0	9	10	55
12	Deihl/Saline from Old Sugar Creek to Walnut	0	9	10	55
13	High Ridge and Capetown Village	0	9	9	54
Funded	Antire Rd from Pere Cliff to Williams Creek	0	7	17	52
14	Lonedell from Valley to Jean	1	4	21	51
Funded	Twin River from Osage to Byrnes Mill	0	8	10	50
Funded	Old Lemay between Frisco Hill and Regency Woods	0	5	23	48
Funded	Old Hwy M from Glenstone to Chasteen	0	6	18	48
15	Saline from Chancellor to Romaine Creek	0	7	13	48
16	New Sugar Creek from Coil to Sugar Creek	0	6	16	46
Funded	Saline Road from Sunpark Spur to Silver Maple Drive	0	5	18	43
17	Miller from Vogel to Corral Estates	0	5	18	43
Funded	Hunning Rd and Cinphany Ln	2	3	7	42
18	Old State Route 21 and Glade Chapel/Goldman	0	5	11	36
Funded	Old SR 21 and Lion's Den	0	4	15	35
19	Old Lemay Ferry from East Rock to Lions Den	0	2	24	34
Funded	Old Route 141 and Samarra Estates Drive	1	3	6	31
Funded	Antire and Crestview	0	4	9	29
20	Lonedell and Tomahawk	0	3	12	27

FIGURE 6: PRIORITY PROJECT LOCATIONS



Jefferson County Road Safety Study

JEFFERSON CO. SAFETY PROJECTS

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Crash Analysis for Countermeasure Identification

Individual crash reports were reviewed for all crashes within the high crash corridors and intersections to identify specific crash types, injury severity, pavement condition and vehicle direction to assist in the crash and roadway audit review for individual projects. Figure 7 shows a distribution of crash types within the 20 priority locations that are not associated with recent or ongoing safety projects. Consistent with county-wide analysis, fixed-object crashes are the most frequent within the priority project locations. The additional information obtained from the crash report review indicates that rear end crashes (front to rear) and angle are the most common multiple vehicle crash types. Head-on (front to front) and opposite direction sideswipe are also prevalent which may be indicative of passing vehicles on narrow roadways.

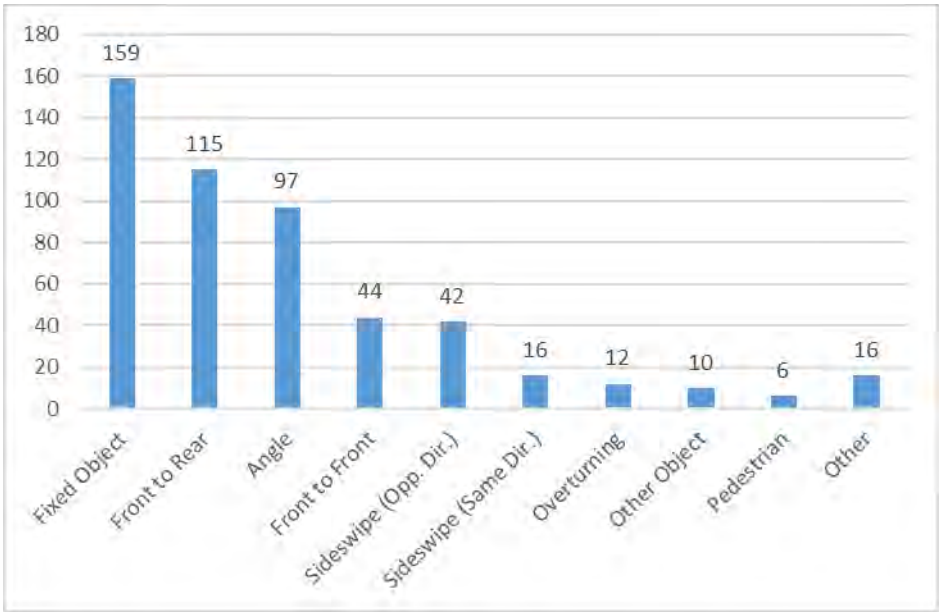


FIGURE 7: PRIORITY LOCATION CRASH TYPES

Pavement condition was also reviewed from the crash reports to identify if wet weather played a significant role in crash patterns. Out of the 518 crashes within the priority project locations, 144 (28%) occurred on wet pavement. This is significantly higher than the statewide wet pavement rate for Missouri of 16% as reported by the MO State Highway Patrol Statistical Analysis Center. In addition to the high incidence within these locations, the road safety reviews sought to identify concentrations of wet pavement crashes within the corridors so that appropriate countermeasures such as improved drainage and/or high friction surface treatments could be identified.

Countermeasures

Specific countermeasures have been developed for the 20 priority project locations identified in the data analysis phase based on crash history, google earth imagery, and in-person observation. These specific countermeasures can be found in Appendix B, and concept layouts of the suggested countermeasures for each priority project location can be found in Appendix C. In developing these site-specific countermeasures and conducting field observations, several recurring safety concerns emerged that could be addressed countywide. The following sections highlight these recurring safety concerns and potential countermeasures that can be applied to sites beyond the priority project locations.

Fixed Objects

Fixed object crashes were a common theme among the top project locations in Jefferson County, especially in locations with little to no shoulder present. Those fixed objects most often observed in the field and referenced in crash reports included trees, utility poles, large rocks, drainage structures, and embankments. A proper clear zone free of obstructions (as determined by the AASHTO Roadside Design Guide) is obviously the most preferable solution, but the topography and Right of Way limitations along Jefferson County roadways are prohibitive to achieving such clear zones. At a minimum, it is recommended that fixed objects be removed or relocated if they are within two feet of the edge of traveled way. Such a policy would eliminate those fixed objects that are directly adjacent to the roadway and difficult for errant drivers to avoid.

The most common fixed object crashes in Jefferson County involve trees. With the majority of County roads being in forested areas, the most cost-effective countermeasures for avoiding fixed object crashes would be those that keep motorists on the roadway, such as rumble strips and curve signing. For low volume roadways within the County with limited pavement markings, edge line pavement markings would be an incremental countermeasure to address keeping motorist on the roadway. In locations where trees or other fixed objects cannot be removed and the probability of a crash remains high, guardrail may be necessary to reduce crash severity.

PHOTO 1: FIXED OBJECTS AT MINOR STREET INTERSECTION WITH COUNTY ROADWAY

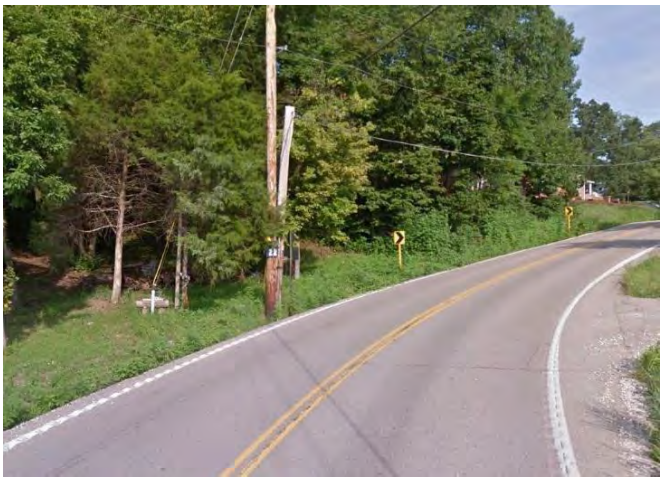


PHOTO 2: UTILITY POLE PLACED ON OUTSIDE OF HORIZONTAL CURVE

Photo 1 and Photo 2 show examples of decorative rocks and utility poles placed directly adjacent roadways without shoulders. Decorative rocks should be removed and relocated outside of the clear zone to reduce the likelihood of vehicles striking them. Per the AASHTO Roadside Design Guide, utility poles in high conflict areas, like at intersections or on the outside of horizontal curves should be relocated or protected with guardrail wherever possible. For utility poles

that are simply close to the edge of pavement, object markers should be placed to alert drivers to their presence, especially at night.

Photo 3 shows an example of a large culvert with concrete headwalls directly adjacent to the roadway, especially on the right side. These culverts are generally already marked with object markers, but in cases like that shown below it may be best to extend the culvert so that the headwalls are outside the clear zone. For culverts that run parallel to the roadway, such as those under intersection driveways, the Roadside Design Guide recommends keeping driveway embankments as flat as possible to avoid vehicles getting trapped. Where a traversable slope is not possible, drainage structures may be outfitted with grated openings to prevent a wheel from jamming into the pipe.

PHOTO 3: CULVERT HEADWALLS ADJACENT TO ROADWAY

Steep Foreslopes, Edge Drop-Off, and Embankments

Due to the topography of the area, Jefferson County roads feature a high density of horizontal and vertical curves, many of which have steep foreslopes leading down into ditches or ravines that are not traversable (Photo 4). Since most of these areas with steep sideslopes have no shoulders, the likelihood of recovery if a vehicle leaves the roadway is low. Similarly, there are many instances of pavement edge drop-offs in Jefferson County, as seen in Photo 5. As with fixed objects, the most cost-effective method of preventing these types of crashes is to keep vehicles on the roadway to begin with using tools like signing, striping, and rumble strips.

Ideally, all roadways would have wide, unobstructed clear zones with shoulders and recoverable slopes, but with the topography of the area this is just not possible for most Jefferson County roads. MoDOT guidance encourages at least a 2 ft. wide shoulder along minor roadways. The Engineering Policy Guide (EPG) states that although wide, continuous shoulders are preferred, narrow and/or intermittent shoulders are still preferable to nothing at all. In areas with steep foreslopes and edge drop- offs where the likelihood of a crash is high, like along a horizontal curve, building up a flat shoulder allows motorists space to recover if they leave the roadway rather than trapping their wheels off the edge of pavement.

Embankments and rock bluffs close to the roadway also present a hazard to drivers that leave the roadway. Photo 6 shows an example of an embankment on the inside of a curve that both acts as a fixed object and limits curve sight distance. Regrading sideslopes to provide shoulders or limit edge drop-offs also presents the opportunity to improve roadside drainage, which is an issue in many of these same areas.

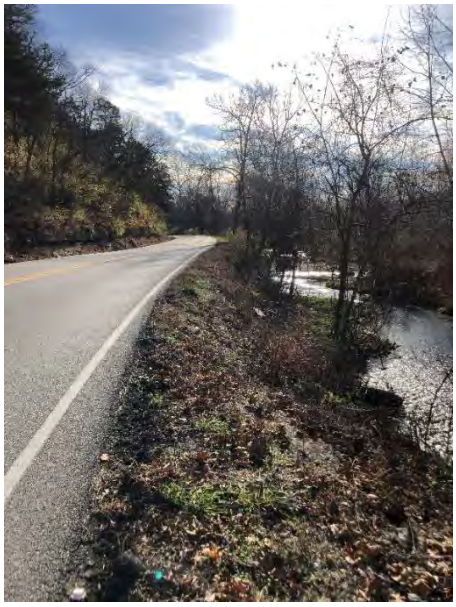


PHOTO 4: STEEP SIDE SLOPE LEADING DOWN TO CREEK

PHOTO 5: EDGE DROP OFF ON OUTSIDE OF CURVE

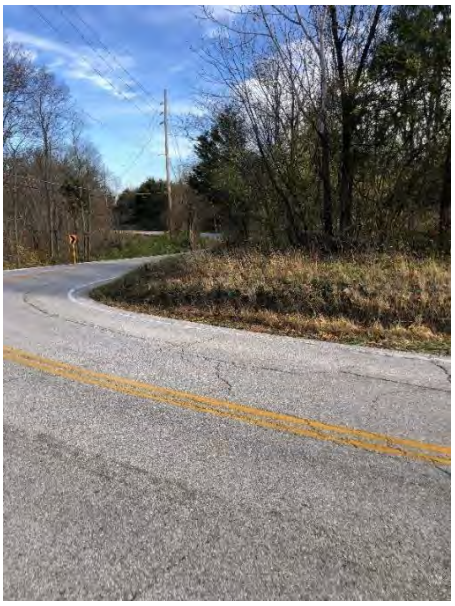


PHOTO 6: EMBANKMENT ON INSIDE OF CURVE

Sight Distance Restrictions

Objects such as vegetation, large signs, and fences that obstruct intersection or curve sight distance should be trimmed back or relocated wherever possible. Photo 7 and Photo 8 show examples of trees and brush blocking intersection and curve sight distance, respectively.

PHOTO 7: VEGETATION BLOCKING INTERSECTION SIGHT DISTANCE

PHOTO 8: VEGETATION BLOCKING SIGHT DISTANCE ON INSIDE OF CURVE

Vegetation at intersections should be trimmed back to ensure that proper sight triangles are available. Along the inside of curves, especially those with high crash instances, trees and brush should be trimmed back as much as possible to allow drivers a greater stopping sight distance to react to elements such as stopped traffic and animals.

The AASHTO Policy on Geometric Design of Highways and Streets (Green Book) provides direction on sight distance triangles for stop controlled minor approaches of intersections as shown in Figure 7 and Table 2 below.

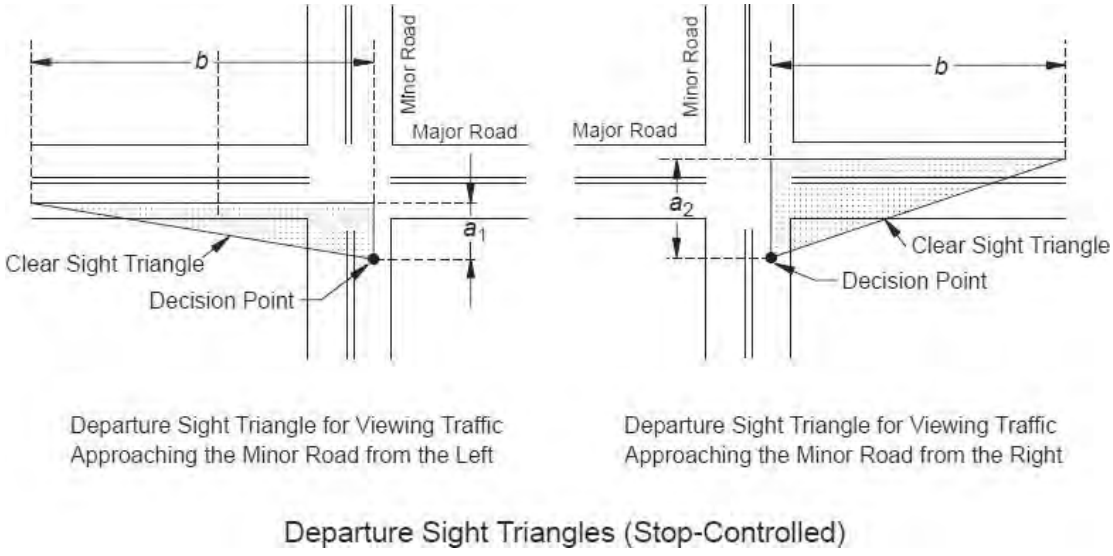


FIGURE 8: SIGHT TRIANGLE GUIDANCE (GREEN BOOK FIGURE 9-17)

TABLE 2: SIGHT TRIANGLE GUIDANCE (GREEN BOOK TABLE 9-4)

U.S. Customary		Metric	
Design Speed (mph)	Length of Leg (ft)	Design Speed (km/h)	Length of Leg (m)
15	70	20	20
20	90	30	25
25	115	40	35
30	140	50	45
35	165	60	55
40	195	70	65
45	220	80	75
50	245	90	90
55	285	100	105
60	325	110	120
65	365	120	135
70	405	130	150
75	445		
80	485		

Drainage and Wet Weather Crashes

Wet weather-related crashes were prevalent in Jefferson County during the study period, especially in areas with sharp horizontal curves and rolling hills. Inadequate drainage leads to water ponding on the roadway, which is detrimental both to safety and long-term pavement condition. Culverts are recommended under driveways and side streets where a ditch is present, and existing culverts and inlets should be regularly cleared of debris to ensure proper operation. Additionally, drainage should be evaluated along horizontal curves with high instances of crashes on wet pavement. A ditch may be required on the inside of the curve if not already present.

On curves where drainage and curve signing is adequate but crashes on wet pavement persist, High Friction Surface Treatment (HFST) should be considered to increase traction and help vehicles stay on the road during wet and dry weather. While visiting potential project locations, several horizontal curves were observed to have inadequate or reverse superelevation. If other countermeasures have been exhausted and curve related crashes at these locations continue, a long-term solution would be to mill the curve pavement and build up the superelevation with new asphalt (instances where this may be appropriate are called out in Appendix B). Proper superelevation provides greater traction to vehicles and reduces instances of vehicles leaving the roadway.

Curve Signing

Many of the project locations identified in this study contain one or more horizontal curves with high crash frequency. While some curve signing is present on the priority roadways, especially the use of chevrons around curves, it is inconsistent within the county and only meets the minimum requirements of the Manual on Uniform Traffic Control Devices (MUTCD). The MUTCD provides guidance for the use of horizontal alignment warning signs on roadways based on the speed differential between prevailing speed on the roadway and the horizontal curve's advisory speed. These warning signs are required on arterial and collector roadways with more than 1,000 AADT but may be used on other roadways based on engineering judgment. It is recommended that all roadways within the priority locations that have been identified as having crashes associated with curves be evaluated to determine appropriate advisory speeds and signed appropriately.

The MUTCD provides for three placements of signing to address horizontal alignment issues. These include 1) in advance of the horizontal curve, 2) at the beginning of the horizontal curve and 3) guidance throughout the horizontal curve.

Advanced sign placement includes the Turn, Curve, Reverse Turn, Reverse Curve and Winding Road Signs, shown in Figure 9 below. Advisory speed plaques are recommended by the MUTCD in conjunction with these signs when the advisory speed is 5 mph or less than the prevailing speed on the roadway.

FIGURE 9: HORIZONTAL ALIGNMENT SIGNS

The MUTCD allows for these signs to be repeated as supplemental signs at beginning of curvature. Additionally, a combination turn or curve sign with advisory speed is also permitted at the beginning of the curve as shown in Figure 10. **It is proposed that Jefferson County adopt the use of these supplemental signs at locations where reverse turn/curve or winding road signs are utilized.**

FIGURE 10: HORIZONTAL ALIGNMENT SIGNS WITH ADVISORY SPEEDS

Finally, directional guidance signs including the chevron and large arrow board are recommended by the MUTCD to provide additional guidance through the curve.

FIGURE 11: LARGE ARROW SIGN AND CHEVRONS

Figure 12 shows a conceptual sign layout for Saline Road based on the guidance from the MUTCD and the proposed practice resulting from the safety study. All Horizontal Alignment Warning signs should follow guidance for placement, location and spacing as specified in Chapter 2 of the MUTCD.

FIGURE 12: CONCEPTUAL SIGNING LAYOUT USING SUPPLEMENTAL HORIZONTAL ALIGNMENT SIGNS

Side Street Traffic Control

Through site visits, it was observed that many minor, residential side streets have inadequate traffic control, meaning a lack of stop signs or stop lines. On those minor road approaches that did have stop signs, many appeared weathered and/or undersized. The Manual on Uniform Traffic Control Devices (MUTCD) Section 2B has clear guidance on the implementation of stop signs. Notably, stop signs should be installed at intersections where sight distance is poor and/or crash records indicate a pattern of drivers failing to yield. Within the priority locations, existing stop signs should be upgraded to new, appropriately sized (30" x 30") signs where the existing stop sign is too small or is weathered to the point of being faded or no longer retroreflective, such as the one seen in Photo 9.

PHOTO 9: WEATHERED STOP SIGN IN NEED OF REPLACEMENT

Beyond those identified within the priority locations, it is recommended that the county, develop a plan to replace inadequate stop signs on county roads.

In addition to signing, pavement markings, specifically painted stop lines, can be effective in delineating the intended stopping point of vehicles at intersections and indicating the presence of the intersection. While pavement markings can present additional maintenance requirements, they are recommended for installation at

1) Wide or skewed access points and intersections within curves (See Photo 10) which increase driver uncertainty as to the intended stop location, and;
2) At intersections or on corridors with a documented intersection crash history.

At 'T' intersections, especially in unlit areas, the presence of the intersection may be even more difficult to discern for some drivers. In addition to the risk associated with entering the intersection, fixed object crashes if a driver proceeds through a 'T' intersection are also common. A Two Direction Large Arrow signs (W1-7; see figure) is another low-cost method to reinforce stop control at T-intersections. It is proposed that Jefferson County adopt the use of the Two Direction Large Arrow sign at all 'T' intersections on rural roads as shown in Figure 13.

PHOTO 10: WIDE ACCESS POINT

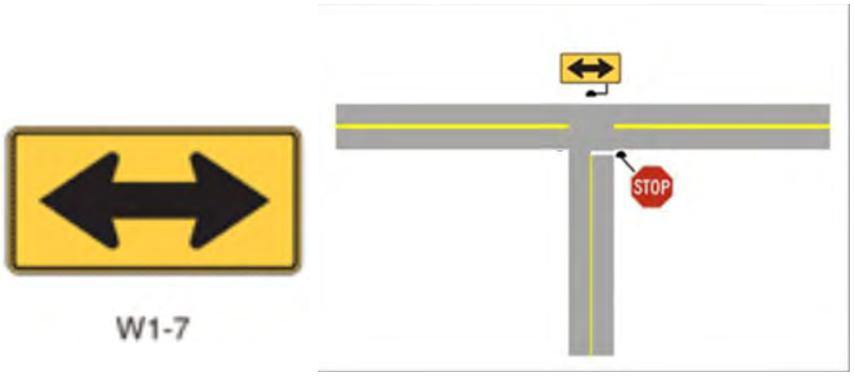


FIGURE 13: LARGE ARROW SIGN PLACEMENT AT T-INTERSECTIONS

In cases where vegetation is partially or fully blocking existing signs of any kind, that vegetation should be trimmed back. In cases where other sight distance limitations exist that block signs from view, such as horizontal or vertical curves, advance traffic control signs should be utilized, such as stop ahead signing (W3-1). For intersections with persistent crash history or demonstrated high frequency and high severity of crashes, dual mounted signing may be used as shown the figure below.

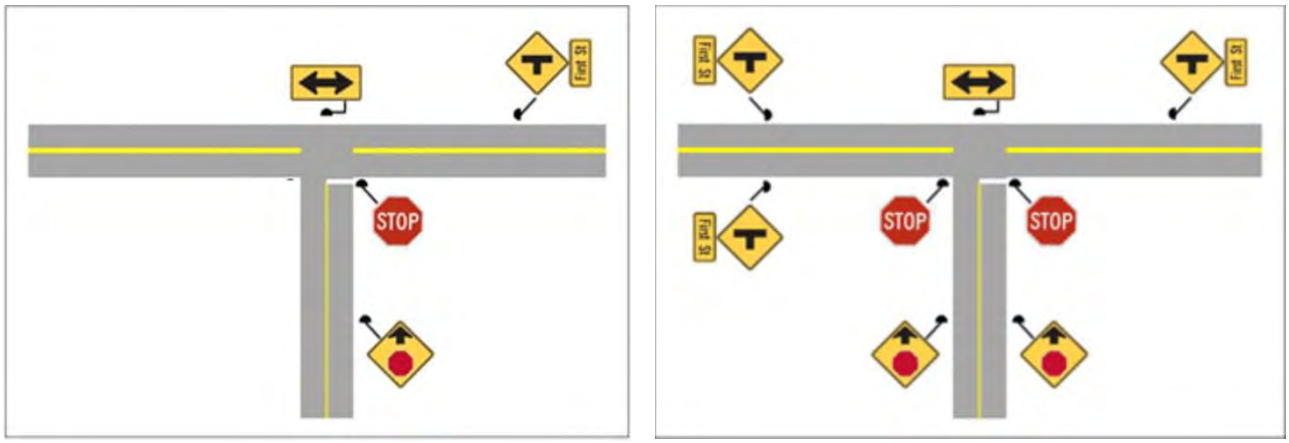


FIGURE 14: IMPROVEMENT PROGRESSIONS AT A T-INTERSECTION

Longitudinal Pavement Markings

Longitudinal striping was observed to be consistent throughout the more trafficked corridors in Jefferson County, but this is not always the case on less busy, more rural roadways. The MUTCD offers some guidance on the installation of yellow center line and white edge line pavement markings, but it does not offer a definitive policy for roadways less than 20 feet in width. Based on MUTCD guidance and research into policies implemented by other states, particularly Kentucky, the following policy is recommended for determining when to install edge line and center line pavement markings:

Roadways less than sixteen feet in width:

Right edge line pavement markings should be installed on two-lane, two-way roadways with a traveled way width less than sixteen (16) feet. Centerlines shall not be installed on roadways with a traveled way width less than sixteen (16) feet.

Roadways greater than or equal to 16 feet but less than 20 feet in width:

For two-lane, two-way highways with a traveled way width that is greater than or equal to sixteen (16) feet but less than twenty (20) feet, roadways shall be striped with either edge lines or centerlines. These roadways shall be striped with edge lines unless the ADT of the roadway exceeds 2,000 vehicles per day, in which case centerlines should be installed. Engineering judgment may also be used to determine the appropriate striping pattern for roadway between 16 and 20 feet.

Roadways greater than 20 feet in width:

For two-lane, two-way highways with a traveled way width of twenty (20) feet or greater, right edge line pavement markings and centerline striping shall be installed.

Edge line striping may be excluded, based on engineering judgment, in areas where the edge of the pavement is delineated by physical objects such as curbs, parking spaces, or other markings. Edge line striping should be installed on roadways with curb and gutter when the posted speed limit is 45 mph or greater.

Benefit-Cost Analysis

Once appropriate countermeasures and conceptual layouts were developed for each priority project location, a benefit-cost analysis was performed using the safety calculator provided by the East-West Gateway Council of Governments (EWG). Inputs required for this analysis included conceptual cost estimates, which were developed by CMT for each project based on the layouts seen in Appendix C and can be found along with the safety calculator outputs in Appendix D.

Table 3 below provides the list of the 20 potential project locations ranked by their corresponding benefit-cost ratio. Note that projects 4 and 7 each have an alternate cost estimate and therefore have multiple benefit-cost ratio entries. See Appendix B and the associated cost estimates in Appendix D for details.

TABLE 3: PRIORITY PROJECT LOCATIONS RANKED BY BENEFIT COST RATIO

EPDO Priority	Location	EPDO Value	Concept Cost Estimate	Benefit-Cost Ratio
7a	Old State Rte 21 from SR21 past Rock Creek	60	$21,200	64.7
14	Lonedell from Valley to Jean	51	$125,300	31.3
9	Gravois from Terrace to Roseglyn	57	$24,800	17.9
7b	Old State Rte 21 from SR21 past Rock Creek	60	$72,400	15.5
3	Old State Rte 21 from Lonedell to Ench Forest	79	$86,700	11.7
6	East Rock Creek from Ehlers to Old Lemay	70	$226,600	11.6
5	Miller and Vogel	73	$26,600	10.5
1	Romaine Creek from Konert to Caleb	113	$163,600	8.1
13	High Ridge and Capetown Village	54	$20,000	7.9
11	Old Hwy M and Old Antonia	55	$70,700	5.7
12	Deihl/Saline from Old Sugar Creek to Walnut	55	$80,900	5.2
10	Antire from Brookside to Laurel	56	$107,100	5.0
8	Brennan from Eagle to Little Brennan	58	$100,100	4.9
4b	Old Sugar Creek from Sugar Creek to Anise	73	$78,900	3.8
15	Saline from Chancellor to Romaine Creek	48	$28,700	3.8
16	New Sugar Creek from Coil to Sugar Creek	46	$30,700	3.0
18	Old State Route 21 and Glade Chapel/Goldman	36	$24,400	2.9
4a	Old Sugar Creek from Sugar Creek to Anise	73	$127,300	2.7
2	Konert from Breezy Oak to Konert Valley	86	$252,500	2.5
17	Miller from Vogel to Corral Estates	43	$33,800	1.5
19	Old Lemay Ferry from East Rock to Lions Den	34	$24,400	1.1
20	Lonedell and Tomahawk	27	$32,600	0.9

Conclusions & Recommendations

This safety study identifies implementable countermeasures at a specific, project-based level and at the county-wide level. Those locations identified specifically as potential safety project locations should be prioritized for countermeasure implementation, as they represent almost 15 percent of the crashes that occurred during the study period. At the county-wide level, it is recommended that county-maintained roads be evaluated for the safety concerns detailed previously, and that new construction projects take them into account. Horizontal curves in particular should be inventoried to identify segments with the greatest potential for applying those safety countermeasures suggested here.

Beyond evaluating and implementing low-cost countermeasures, there are roadways within Jefferson County that would benefit from more comprehensive improvements, such as horizontal or vertical alignment changes, additional lanes, shoulders, or superelevation correction. Some of these long-term solutions have been identified in Appendix B, but many of the priority areas identified in this report could be considered for larger projects, especially if low- cost countermeasures are not effective in reducing crash rates. These larger projects could be submitted to East West Gateway Council of Governments (EWG) for Surface Transportation Program – Suballocated (STP-S) funding.

This safety study should be shared with local agencies to communicate safety concerns and potential improvements for locally owned and maintained roadways. Distracted driving, impaired driving, and speeding are elements that may be addressed by coordinating with local law enforcement agencies. Developing law enforcement and education strategies, such as speed feedback signs and awareness programs, may help address these types of crashes, which are scattered throughout Jefferson County but more concentrated in areas with roadway safety concerns.

APPENDIX A:

GIS DATA ANALYSIS DETAILS AND PROJECT LIST DEVELOPMENT

Data Collection

GIS data including crash and roadway information was provided to CMT by Jefferson County for the purposes of identifying County maintained intersections and roadway segments that may benefit from the implementation of safety countermeasures. A list of recent (within the last five years) and ongoing roadway projects within Jefferson County was assembled by CMT for the purposes of comparison to the top intersections and segments identified in this analysis. The list of projects was assembled using past and present Jefferson County bid information and TIP applications provided by the County. Only those projects that may have an impact on roadway safety were considered.

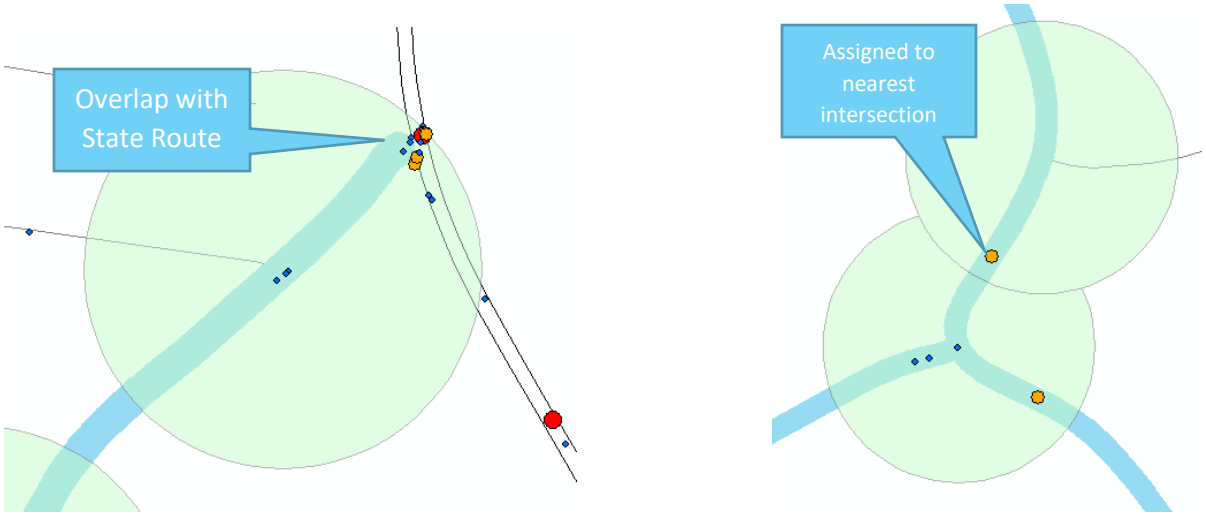
Crash Data Processing

Five years of crash data between the dates of 6/30/2014 and 7/01/2019 were considered as part of this analysis, as 2019 crash data beyond that end date was not yet complete at the time of analysis. Further, crashes listed as type “Animal” and “Parked Motor Vehicle” were not considered.

Out of the 21,179 crashes being considered as part of the safety analysis, 764 (3.6%) were unmapped in the GIS files. Four of those unmapped crashes were fatal, with only one occurring on a County maintained roadway. This relevant fatal crash was subsequently mapped based on its attached roadway information. The remaining unmapped PDO and injury crashes were left as such since the time required to map them would not result in a substantial increase in analysis quality.

Intersection Analysis

An intersection file was created using the provided roadway shapefile, which included information about the maintainer of each segment. Intersections considered include only those with at least one leg maintained by Jefferson County and no state-maintained components. A 300-foot buffer was placed around each eligible intersection point to denote the influence area of that intersection. Any crashes that fall within the influence area are attributed to the corresponding intersection. In some cases, if an intersection is close enough to a State maintained route, it would count crashes from the State route within its influence area. To remedy this, any crashes associated with a state route were subtracted from the intersection’s counts. Similarly, some crashes fall within the influence area of multiple, closely spaced intersections. In these cases, any crashes within the overlap were assigned to the nearest intersection, as not to be counted twice.



The equivalent property damage only (EPDO) value of each intersection was calculated by assigning a value to each severity of crash and taking the sum of the crashes within the influence area. For the purposes of this

analysis, each fatal crash was assigned a value of 10, each injury crash a value of 5, and each PDO crash a value of 1. With the EPDO calculated for each eligible intersection, they were sorted by EPDO to obtain a preliminary list of high priority intersections.

Segment Analysis

Roadway segments were created by dividing continuous County maintained roadways from the provided GIS roadway information into segments no longer than one mile. Once created, a 25-foot buffer was placed along each segment to ensure that any crashes along the segment would be counted. Like the intersections, the crashes within each eligible segment buffer were attributed to that segment and adjusted as necessary to account for nearby State maintained routes. The EPDO of each segment was calculated in the same manner as with the intersections.

Project List Creation

With both an intersection and segment list created, these lists were then compared to each other to determine overlap. In many cases, the segments identified by the crash analysis contain priority intersections and would thus be considered one combined "project." In a limited number of these overlap cases, segments were excluded from the list if there were very few or no crashes outside of the included intersection influence area. A few segments were also combined with adjacent segments or shifted to cover high EPDO areas.

This comparison resulted in a single list containing 37 projects with EPDO values greater than 25. A threshold of 25 was chosen for project creation because crash patterns become less apparent with fewer data points, making countermeasure identification less effective. The combined list was then compared to a list of past and current projects within Jefferson County to determine if any of the top areas identified by the analysis have recently undergone safety improvements or have planned safety improvements for the near future. Seventeen project areas were excluded from consideration based on this information (they can be seen in Table 3), leaving 20 potential safety project areas.

Tables have been provided below that includes the top 20 project areas as well as other project areas to consider with lower EPDO values. With the top priority locations identified, Jefferson County provided CMT with crash reports for those crashes within potential project areas. These crash reports were necessary for countermeasure identification, as the initial GIS dataset did not include specific crash types, such as right angle or rear end, which is critical information for determining the most effective countermeasures at a given location.

Project Lists

Table 1 below lists the top 20 project areas to be considered for safety countermeasure implementation. Appendix B details the existing conditions, crash history, and suggested countermeasures for each of these locations.

TABLE 1: TOP 20 PROJECT LOCATIONS FOR COUNTERMEASURE IMPLEMENTATION

Priority	Location	Fatal	Injury	PDO	EPDO Value
1	Romaine Creek from Konert to Caleb	0	19	18	113
2	Konert from Breezy Oak to Konert Valley	0	14	16	86
3	Old State Rte 21 from Lonedell to Ench Forest	1	10	19	79
4	Old Sugar Creek from Sugar Creek to Anise	0	7	38	73
5	Miller and Vogel	0	7	38	73
6	East Rock Creek from Ehlers to Old Lemay	1	9	15	70
7	Old State Rte 21 from SR21 past Rock Creek	1	7	15	60
8	Brennan from Eagle to Little Brennan	0	6	28	58
9	Gravois from Terrace to Roseglyn	0	8	17	57
10	Antire from Brookside to Laurel	0	9	11	56
11	Old Hwy M and Old Antonia	0	9	10	55
12	Deihl/Saline from Old Sugar Creek to Walnut	0	9	10	55
13	High Ridge and Capetown Village	0	9	9	54
14	Lonedell from Valley to Jean	1	4	21	51
15	Saline from Chancellor to Romaine Creek	0	7	13	48
16	New Sugar Creek from Coil to Sugar Creek	0	6	16	46
17	Miller from Vogel to Corral Estates	0	5	18	43
18	Old State Route 21 and Glade Chapel/Goldman	0	5	11	36
19	Old Lemay Ferry from East Rock to Lions Den	0	2	24	34
20	Lonedell and Tomahawk	0	3	12	27

Beyond the list of top project locations, there were several other "hot spots" identified that warrant further observation – mainly individual curves and intersections. These are considered lower priority than those listed in Table 1, but may benefit from many of the same low-cost countermeasures mentioned in this report and Appendix B. See Table 2 below. Keep in mind that locations with fewer crash data points can be skewed by a small number of more severe incidents.

TABLE 2: ADDITIONAL POTENTIAL PROJECT LOCATIONS TO CONSIDER

Location	Fatal	Injury	PDO	EPDO
West Four Ridge from Matts Manor to Sparrow	0	4	4	24
Dulin Creek from Vinmill to Saxony	0	3	9	24
Lynch Road (Curve near 4225 Lynch Rd)	0	4	3	23
Jarvis and Sandy Valley	0	4	3	23
Cedar Hill from Local Hillsboro to White Oak Drive	0	3	7	22
Miller and Warren	0	2	12	22
Victoria Glade and Hillsboro-Victoria	0	4	1	21
Upper Plattin (Reverse curve north of Frissel)	0	2	9	19
West Four Ridge from Old State Rte 21 to Forest Lane	0	3	4	19
Old State Rte 21 and Valley View	1	1	3	18
Ems from Tower Rd to east of Ems Crossing	0	3	3	18
West Rock Creek from West Swaller to Kreidheider	0	1	10	15

Table 3 lists several locations identified as having high EPDO values but also recent, current, or upcoming safety improvements. For this reason, it is suggested that Table 3 be considered a "watch list" to determine if these safety improvements will prove effective in reducing crashes. If after several years of implementation there is no reduction in crash rates, these sites should be evaluated for further safety countermeasures.

TABLE 3: WATCH LIST LOCATIONS

Location	Fatal	Injury	PDO	EPDO	Reason for Removal from Main List
Seckman from Elephant Walk to Outer Rd	0	13	48	113	Current Safety Projects STP-7202(604) andSTP-5461(612)
Old State Route 21 and West Four Ridge	2	12	23	103	Current Project STP-5462 (608)
Saline Rd from Willow Bend to Hermitage	1	12	16	86	Current Safety Project, TIP application ID 7113F-23
Old Lemay between E Rock Creek and Spring Forest	0	10	30	80	Current Projects STP-5461(609) and STP-5461(610)
Seckmen from Old Lemay Ferry and Mastadon	0	6	37	67	Current Projects STP-7202(602) at intersection and by school
East Rock Creek and Gary	0	11	4	59	Current Safety Project STP-5403 (677)
Flucom Orchard Park to Kimberly	0	9	12	57	2021 TIP application recommended for funding by EWG
Old Lemay Ferry from Miller to Brenda	0	4	37	57	Current Safety Project, TIP application ID 7113B-23
Antire Rd from Pere Cliff to Williams Creek	0	7	17	52	Current Safety Project, TIP application ID 7113D-22
Twin River from Osage to Byrnes Mill	0	8	10	50	2021 TIP application recommended for funding by EWG
Old Hwy M from Glenstone to Chasteen	0	6	18	48	2021 TIP application recommended for funding by EWG
Old Lemay between Frisco Hill and Regency Woods	0	5	23	48	Current Safety Project STP-6451 (611)
Saline Road from Sunpark Spur to Silver Maple Drive	0	5	18	43	2016 improvements
Hunning Rd and Cinphany Ln	2	3	7	42	Current Safety Project STP-5403 (696)
Old SR 21 and Lion's Den	0	4	15	35	Current Project STP-5462 (607)
Old Route 141 and Samarra Estates Drive	1	3	6	31	2016 lane realignment to address sight distance issue
Antire and Crestview	0	4	9	29	Current Safety Project, TIP application ID 7113D-22

APPENDIX B:

CRASH ANALYSIS AND POTENTIAL COUNTERMEASURES BY PRIORITY PROJECT LOCATION

Notes

1. Some crashes are reported at the same location, causing crash indicators to appear on top of each other or block others from view in the crash diagrams. Be aware that one crash marker may represent several crashes with different characteristics.
2. Site photos presented in this appendix are a mix of those collected by CMT in the field and images taken from Google Street View. Site visits were conducted for the top 10 Priority Project Locations and several others with outdated Street View Images to verify field conditions.
3. The countermeasures given in this appendix are suggestions that may be subject to updated field conditions, right of way restrictions, and further engineering investigation.
4. Several project locations have further suggestions in the countermeasures section for long-term solutions. These may be considered as higher cost alternatives to implement up front or as the next step if low-cost countermeasures are ineffective in reducing crash rates. Priority project locations that include additional long-term suggestions:
    - Priority Location 2 (shoulders along curves)
    - Priority Location 4 (curve realignment)
    - Priority Location 6 (potential for a larger project with shoulders, curve realignment, and drainage work)
    - Priority Location 9 (potential for a larger project that includes roadway widening for a TWLTL)
    - Priority Location 10 (potential for a larger project that includes shoulder installation)
    - Priority Location 12 (curve realignment)
    - Priority Location 14 (curve realignment with shoulders)
    - Priority Location 15 (evaluating side streets for the addition of dedicated turn lanes)
5. Pavement condition was generally not considered as part of this analysis, but if the corridors detailed here are determined to be in need of resurfacing or surface treatment, that effort would be beneficial in increasing safety (in conjunction with the suggested countermeasures) because of the resulting increase in pavement friction.

Priority Location #1: Romaine Creek Road from Konert Road to Caleb Crossing

Existing Conditions

Romaine Creek Road is generally a two-lane road in the study segment marked with white edge lines and a double yellow centerline. The lane width on Romaine Creek Road is approximately 11 feet. The topography of the area is rolling hills while the roadway is winding passing through a forested area. Several multifamily and single-family housing developments access the roadway. The posted speed limit is 30 mph. Horizontal alignment signs are provided in the study segment.

Crash Patterns

Thirty-seven crashes occurred on this roadway segment including 18 injury crashes (5 severe injury crashes, 9 minor injury crashes, & 4 possible injury crashes). The primary crash type was fixed object crashes (12) followed by rear end crashes (11). In this roadway segment, 12 of 37 crashes (32 percent) occurred on wet or snow-covered pavement conditions, which is significantly above the statewide average of 16 percent. Four of five crashes near Arrowhead Hills Drive are fixed/other object during dark conditions. Five crashes in immediate area of curve near Old Haven Drive - 2 fixed objects, 2 front to rear, and 1 front to front). In the roadway segment east of Sugar Creek Court, there were 19 total crashes (6 fixed object, 2 front to front, 7 front to rear, 1 other object, 1 overturning, 1 pedestrian, 1 sideswipe-opposite; 1 snow/6 wet, 1 dark-lighted/7 dark-unlighted), all in the vicinity of dense access points in the area.

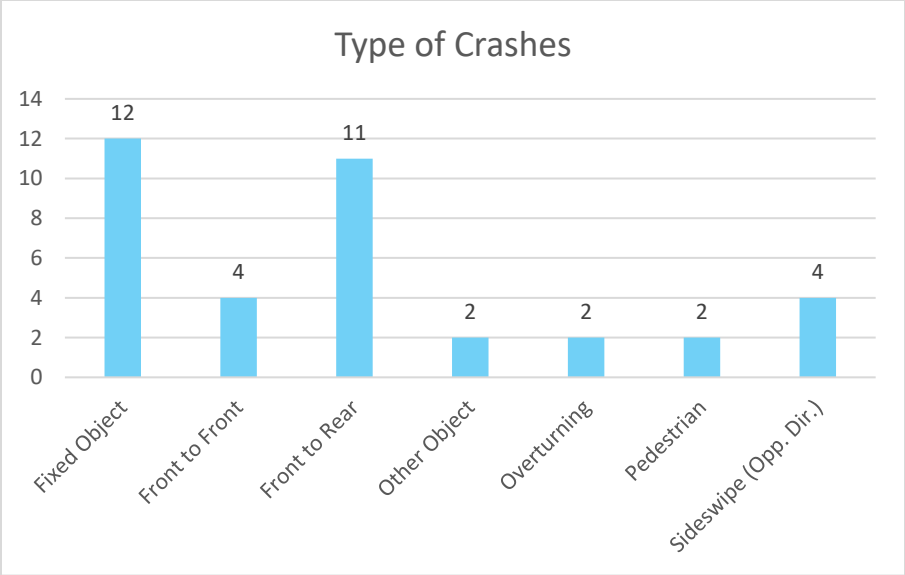
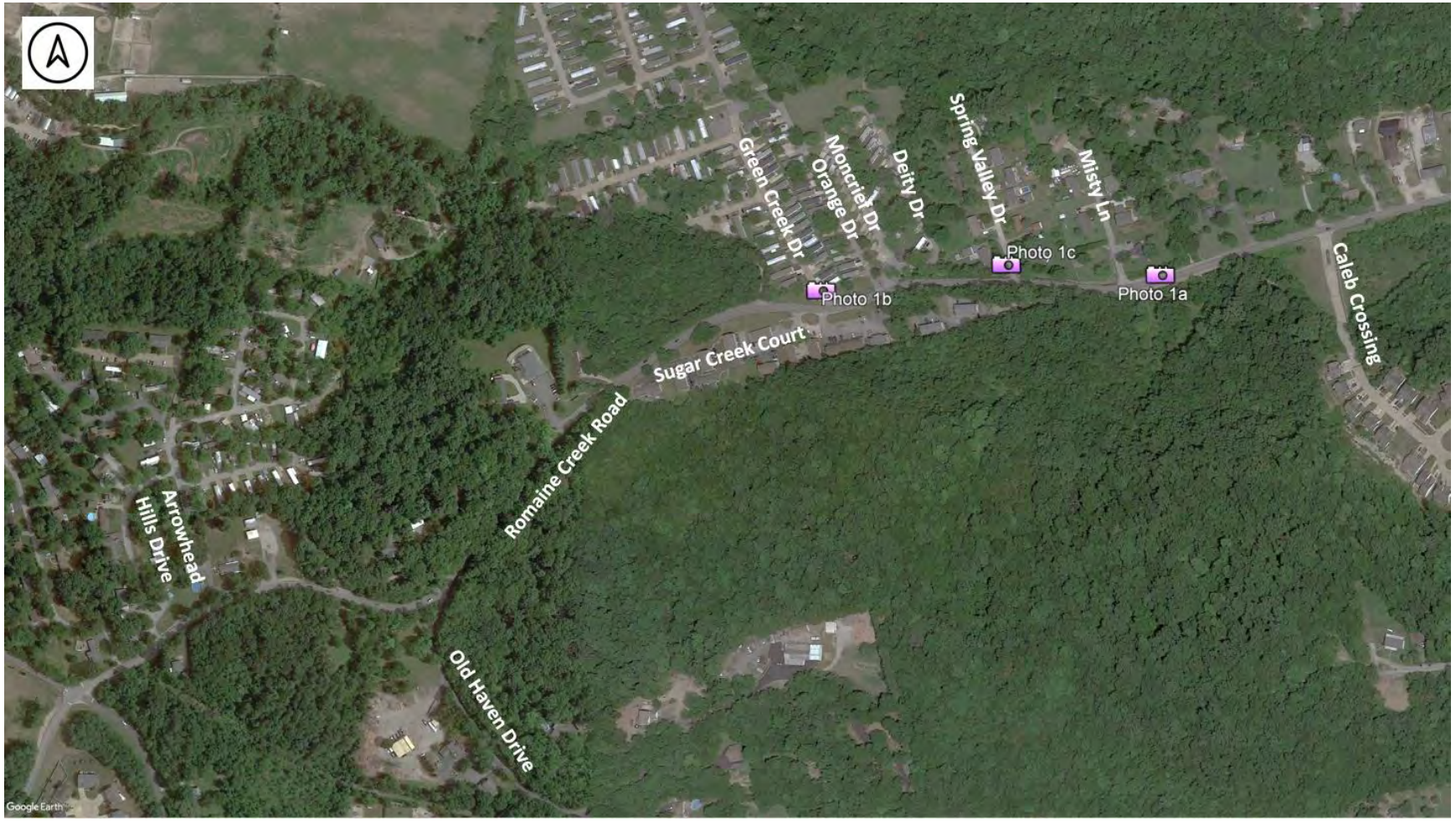
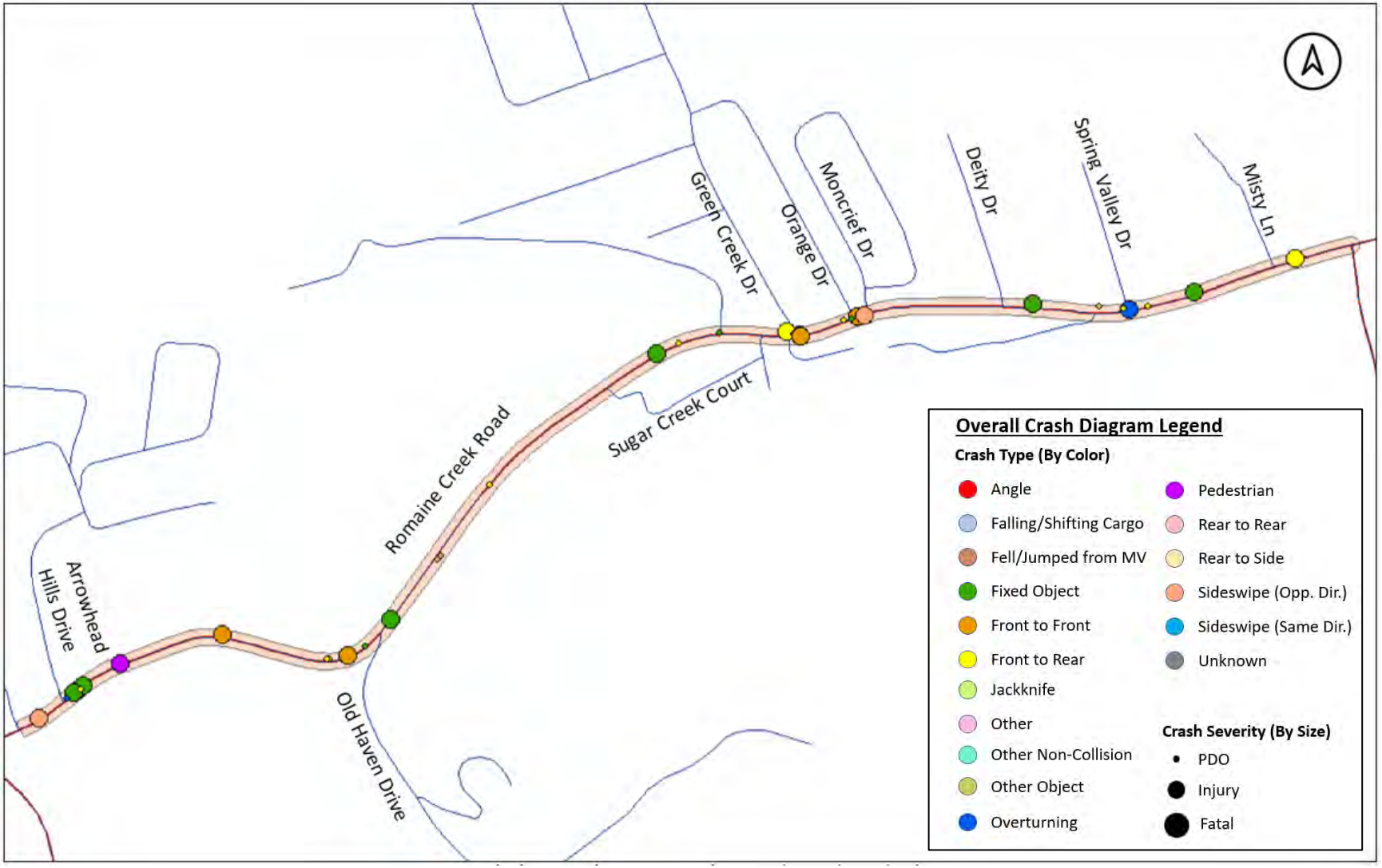


FIGURE 1: PRIORITY LOCATION 1 CRASHES BY TYPE

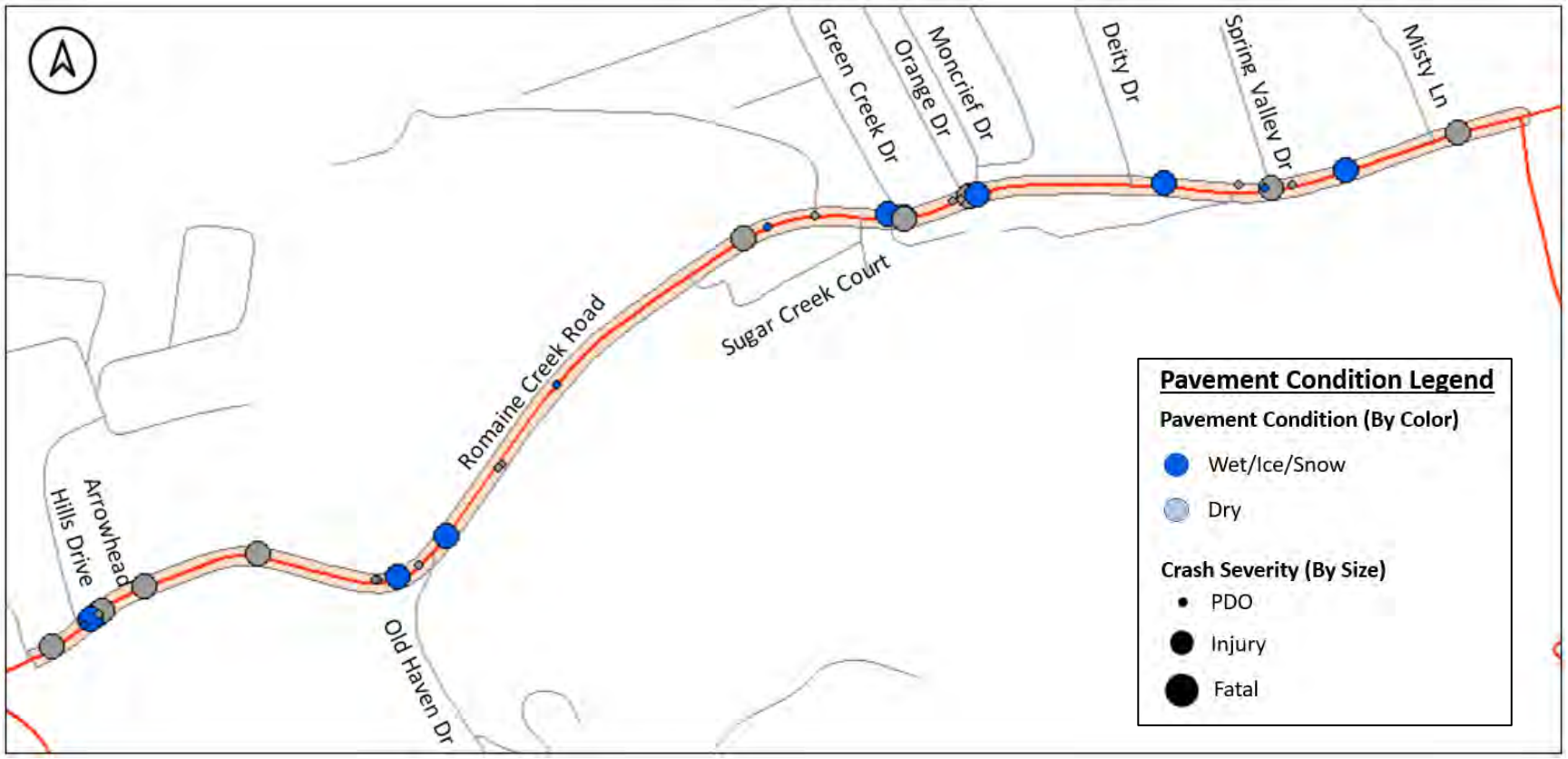
AERIAL 1: ROMAINE CREEK ROAD FROM KONERT ROAD TO CALEB CROSSING



CRASH DIAGRAM 1A: PRIORITY LOCATION 1 OVERALL



CRASH DIAGRAM 1B: PRIORITY LOCATION 1 BY PAVEMENT CONDITION



Contributing Factors

As identified above, wet pavement crashes were significantly overrepresented during the study period. The site visit identified standing water on the shoulder near Spring Valley Drive, though it had not rained in several days at the time (**Photo 1a**). Ditches are not present on much of the roadway, which in conjunction with the relatively flat vertical alignment, can cause ponding.

PHOTO 1 A: STANDING WATER ON SHOULDER

There are a few crashes concentrated at the tight curve around Old Haven Drive. The outside of this curve has no shoulder and a steep drop off that contributed to at least one of the fixed object crashes at this location.

The intersection of Green Creek Drive with Romaine Creek Road is the site of a cluster of intersection related crashes. The stop sign at this location looks weathered, there is no stop line, and there are fences on either side of the entrance that restrict sight distance. There is a culvert, pictured in **Photo 1b**, on the west side of the entrance that poses a hazard as a fixed object and was hit at least once during the crash study period. Other clusters of intersection related crashes Orange Drive, Moncrief Drive, and Spring Valley Drive. None of these locations have stop signs or stop lines present. Deity Drive is similar to Green Creek Drive in that it has a culvert with a sharp drop off just to the west of the intersection. This location, shown in **Photo 1c**, also has a utility pole that is very close to the road that has been hit at least once during the crash study period.

PHOTO 1 B: CULVERT AT GREEN CREEK DRIVE

Several driveway culverts in this area also either serve as edge drop off hazards, fixed object hazards, or both.

PHOTO 1 C: CULVERT AND UTILITY POLE AT DEITY DRIVE

Countermeasures

Potential countermeasures for this segment of Romaine Creek Road include the following:

1. Review roadway during rain event to determine impact of drainage conditions on roadway safety.
2. Improve drainage along the corridor, by providing a) ditching where necessary, b) roadside slope maintenance and c) culverts under side streets and driveways. Limited cross drains may also be considered to move water from the high side of the roadway to the creek.
3. Replace culverts that pose hazards as fixed objects with extended pipe and/or traversable inlets. Where feasible wider radius returns should be provided, especially at Green Creek Drive and Deity Drive.
4. Replace/install stop signs at all intersections and install stop lines where appropriate.
5. Add arrow signs across from T-intersections along the segment.
6. Delineate utility poles and fixed objects along the roadway. Consider relocating the utility pole at Deity Drive.
7. Update curve signing on Romaine Creek Road to meet MUTCD standards. Install chevrons for EB Romaine Creek Road along the curve at Spring Valley Drive.
8. Fences, trees, and signs on either side of the intersections should be evaluated for relocation or removal based on their sight distance impacts.

Priority Location #2: Konert Road from Breezy Oak Lane to Konert Valley Drive

Existing Conditions

Konert Road is generally a two-lane road in the study segment provided with white edge lines and a double yellow centerline. There are edge line rumble strips present throughout the segment. The lane width of Konert Road is approximately 11 feet. The topography of the area is rolling hills while the roadway is winding passing through a forested area. The posted speed limit is 30 mph. Horizontal alignment signs are present in the study segment. Several single-family residential neighborhoods connect to Konert Road within the study section.

Crash Patterns

Overall, there were 30 crashes on this segment. This includes 13 injury crashes (1 severe, 7 minor, & 5 injury possible) and 17 PDO crashes. Eight crashes occurred in the curve near Breezy Oak Lane (2 angle, 2 fixed object, 1 front to front, 1 overturning, 2 sideswipe opposite; 6 of these 8 crashes occurred on wet pavement conditions and 2 occurred during dark-unlighted conditions), nine crashes happened in the curve near Willow Glen Park (2 angle, 3 fixed object, 2 front to front, 2 sideswipe opposite; 5 during wet pavement conditions and 4 during dark conditions), eight crashes took place in the curve near Konert Valley Drive (2 angle, 2 fixed object, 3 front to front, 1 pedestrian; 6 during wet conditions and 3 during dark conditions). 19 of 30 crashes in this segment occurred on wet pavement conditions.

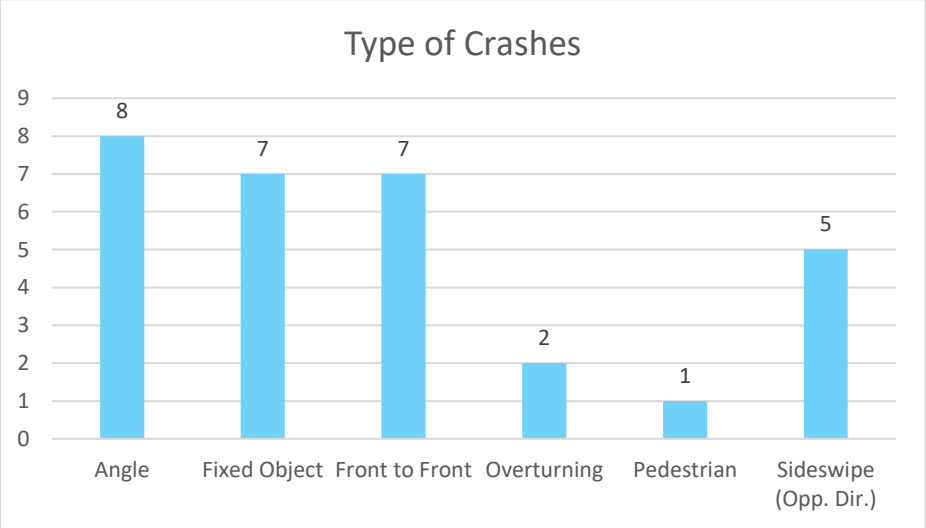
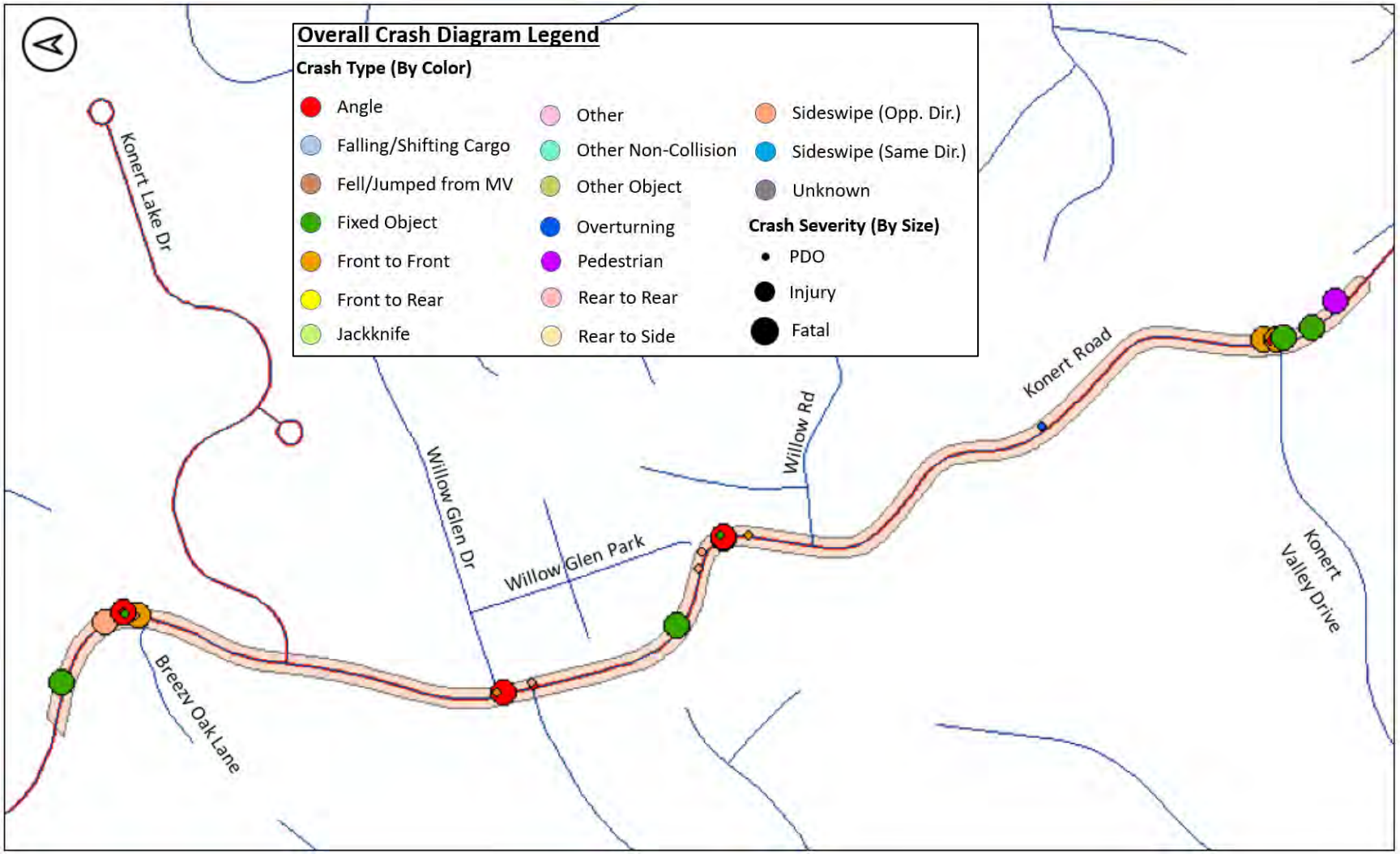


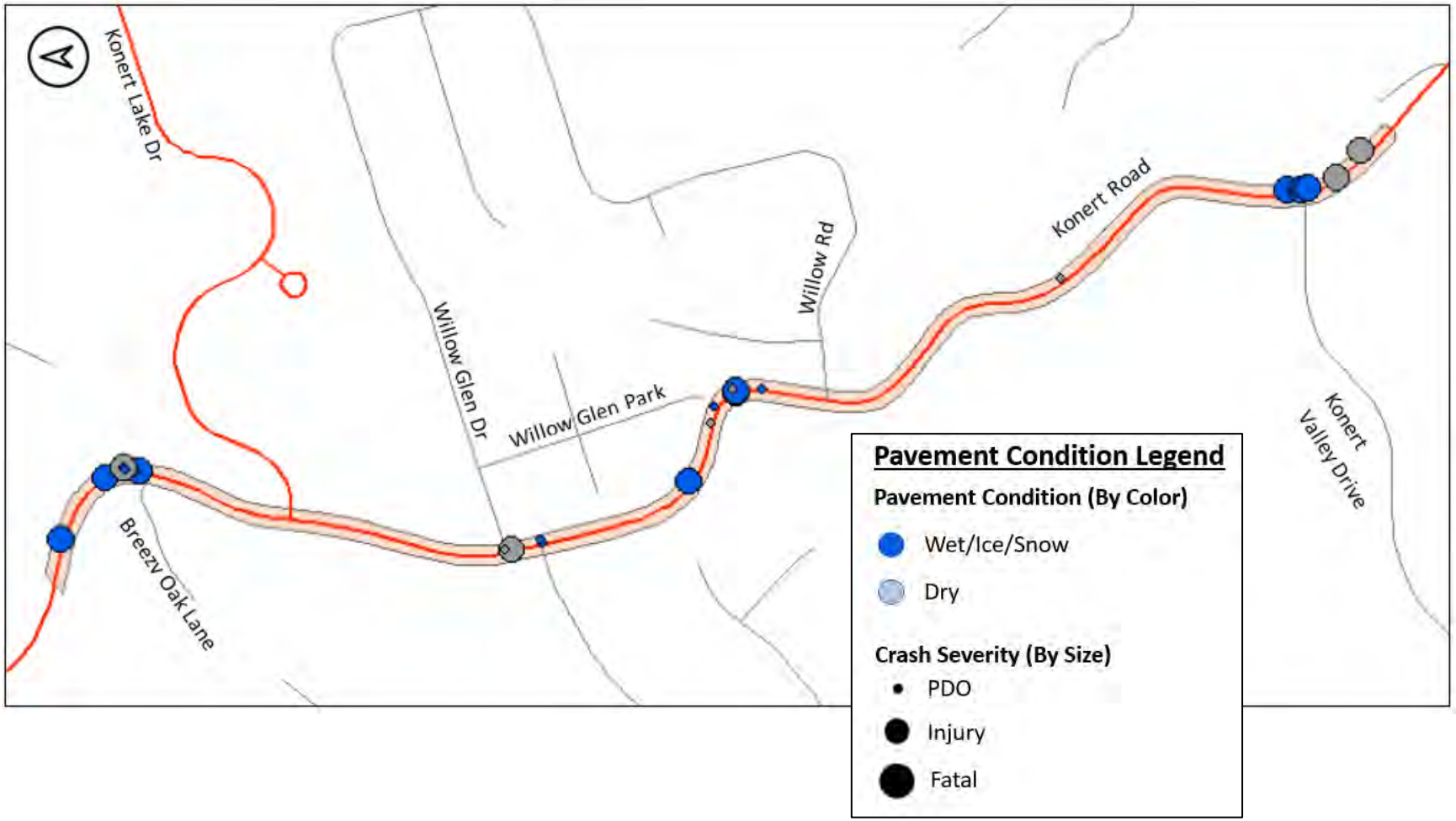
FIGURE 2: PRIORITY LOCATION 2 CRASHES BY TYPE

AERIAL 2: KONERT ROAD FROM BREEZY OAK LANE TO KONERT VALLEY DRIVE

CRASH DIAGRAM 2A: PRIORITY LOCATION 2 OVERALL



CRASH DIAGRAM 2B: PRIORITY LOCATION 2 CRASHES BY PAVEMENT CONDITION



Contributing Factors

The crashes along this segment are concentrated at three horizontal curves at Breezy Oak Lane, Willow Glen Park, and Konert Valley Drive, the majority of which were the result of drivers failing to navigate those curves on wet pavement.

PHOTO 2 A: STEEP SLOPE ON OUTSIDE OF NORTHERNMOST CURVE

There is a cluster of 8 crashes on the northernmost curve of this segment near Breezy Oak Lane, 6 of which occurred on wet pavement. This is a sharp horizontal curve along a crest vertical curve with no shoulders and a drop off on the outside, as can be seen in **Photo 2a**. There are shoulder rumbles here, but it seems that drivers are failing to negotiate the curve and either leaving the road or crossing the centerline as a result.

The sharp curve on Konert Road between Willow Glen Park and Willow Rd is the site of 9 crashes during the study period, 5 of which occurred on wet pavement and 8 of which involved drivers failing to negotiate the tight curve. As can be seen in **Photo 2b**, Willow Glen Park has been blocked off by concrete blocks in this location, likely to prevent intersection related crashes. Sediment buildup can be seen on the outside of this curve, suggesting a drainage issue here.

PHOTO 2 B: CONCRETE BLOCKS AND SEDIMENT BUILD UP AT WILLOW GLEN PARK

The southernmost curve of this segment near Konert Valley Drive is the site of 7 crashes, 5 of which occurred on wet pavement and all of which involved drivers failing to negotiate the curve. This curve is on a hill, has no shoulders, and has sections with a steep drop off on both sides of Konert Road, shown in **Photo 2c**.

PHOTO 2 C: CURVE NEAR KONERT VALLEY DRIVE

Countermeasures

Potential countermeasures for Konert Road from Breezy Oak Lane to Konert Valley Drive include the following:

1. Improve drainage at the three high crash locations noted above. Recommendations include improved ditching on low side of roadway and regrading the shoulder to ensure water can move away from the roadway. On sections with steep backslopes, ditching and cross drains should constructed/improved where feasible. If ditching is infeasible, it is recommended that curb and gutter be installed with catch basins and cross drains.
2. Install guardrail on the outside of the northernmost curve of this segment near Breezy Oak lane to reduce the severity of crashes in the area. Also consider the application of High Friction Surface Treatment (HFST) at this location to assist drivers in navigating the curve without losing traction during wet weather events.
3. Utilize the extra space on the outside of the curve at Willow Glen Park to implement curve widening and improve drainage in that location. Widening both lanes at this location would give drivers more space to navigate the curve without leaving the roadway or crossing the centerline. The area should be graded as part of the widening process to improve drainage and prevent wet weather crashes.
4. Remove the additional pavement at Willow Glen park and place end of roadway object (OM4) markers to replace the concrete blocks at that location.
5. Install guardrail on the outside of the curve starting south of Konert Valley Drive to reduce the severity of crashes in the area. Also consider the application of HFST at this location.

An additional long-term countermeasure would be to construct 4-5’ shoulders through critical horizontal curve areas to provide a recoverable space for drivers who fail to negotiate the curves. Roadway realignment may also be an option, but impacts to adjacent properties may be prohibitive.

Priority Location #3: Old State Route 21 from Lonedell Road to Enchanted Forest Drive

Existing Conditions

Old State Route 21 Road from Lonedell Road to Enchanted Forest Drive is generally a two-lane road in the study segment provided with an 8-foot shoulder, white edge lines, and a double yellow centerline. Old State Route 21 has approximately 13-foot lanes. The road has a high design speed, being generally flat with gentle curves. The posted speed limit is 50 mph. Edge line and center line rumble strips are present along the segment.

Crash Patterns

This segment had 30 crashes including 1 fatal crash, 10 injury crashes (3 severe, 3 minor, and 4 injury possible), and 19 PDO crashes. 11 crashes occurred near Enchanted Forest Drive (1 angle, 2 fixed object, 1 front to front, 5 front to rear, 1 sideswipe-opposite, and 1 sideswipe-same; all on dry pavement 3 of 9 during dark/unlighted conditions), 4 front to rear collisions (1 on wet pavement all during daylight) happened near the intersection with Riebold Drive, and there were 9 crashes in the area of the gentle curve near Hidden Hollow Drive (2 angle, 1 fixed object, 2 front to front, 2 front to rear, 1 other object (1 wet and 1 dark-unlighted).

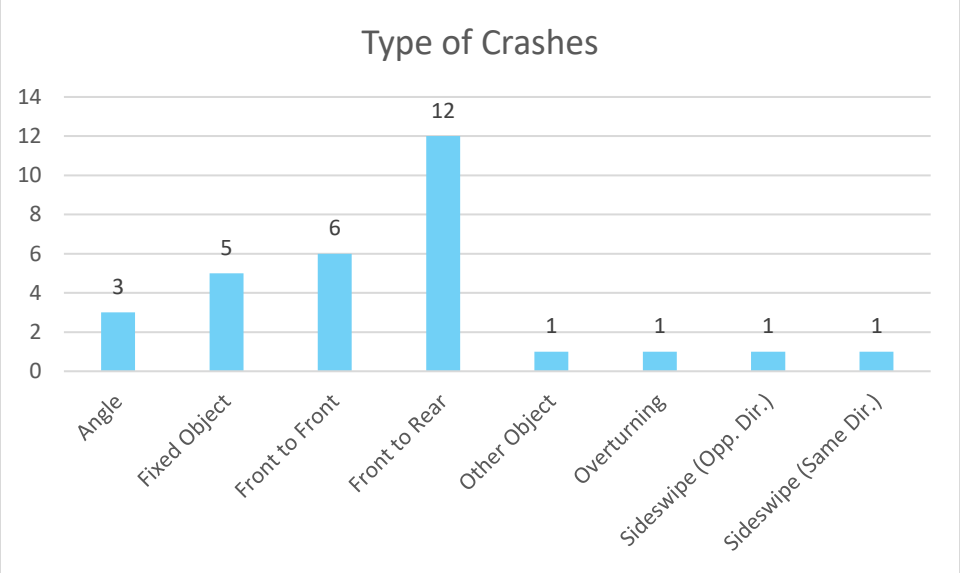
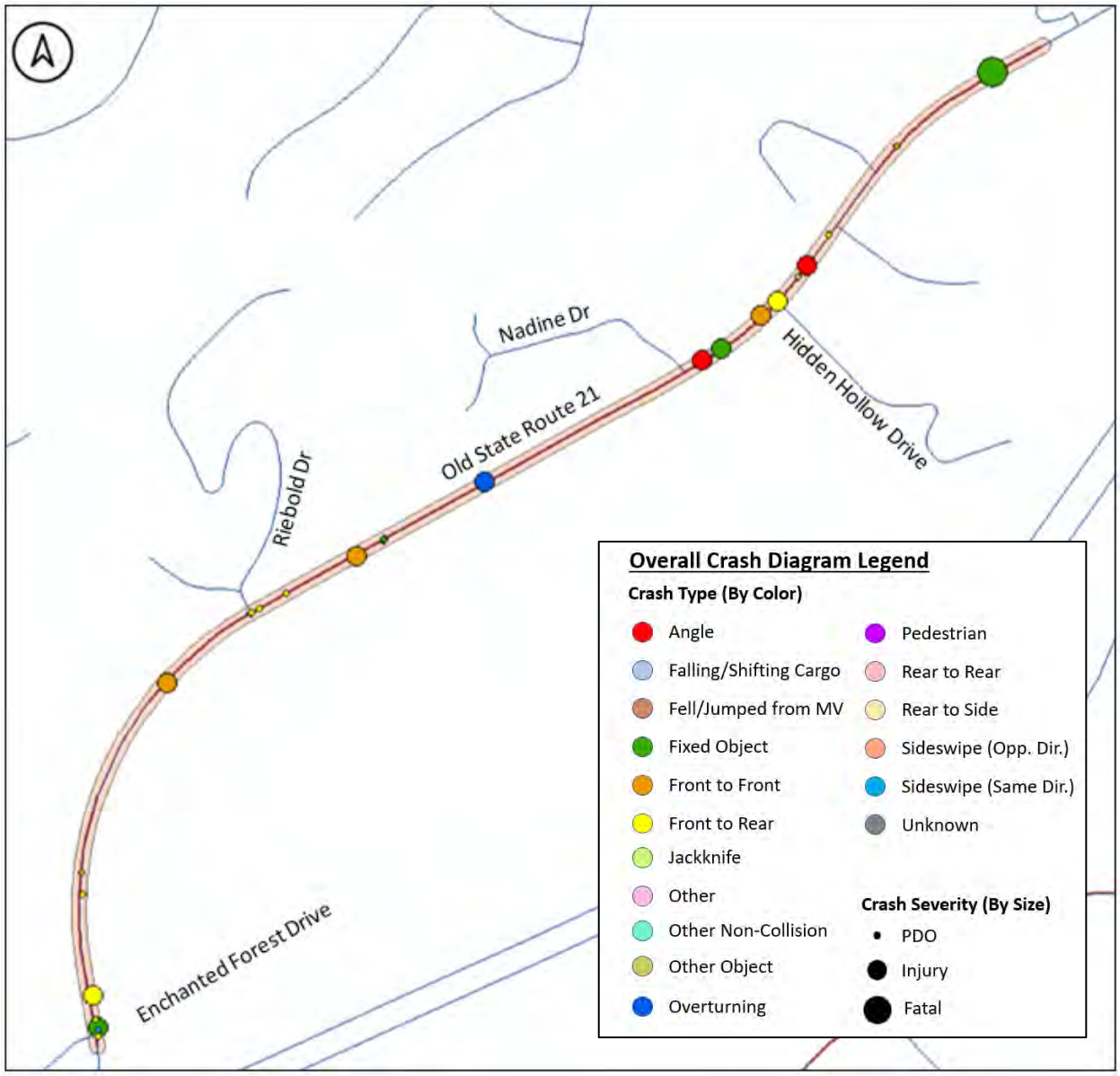


FIGURE 3: PRIORITY LOCATION 3 CRASHES BY TYPE

AERIAL 3: OLD STATE ROUTE 21 FROM LONEDELL ROAD TO ENCHANTED FOREST DRIVE

CRASH DIAGRAM 3: PRIORITY LOCATION 3 OVERALL



Contributing Factors

There is a cluster of 9 crashes concentrated near Enchanted Forest Drive, most of which were access related with vehicles turning in and out of Enchanted Forest Drive. The remaining crashes along this segment are fairly spread out and do not follow a particular pattern. There are some other access related crashes involving vehicles exiting and entering various businesses and driveways along the segment, but the remaining incidents had no obvious roadway related contributing factors. Old Missouri 21 begins at the uncontrolled terminus of the SR 21 off-ramp near Lonedell which may contribute to high speeds along the roadway. Distracted driving seems to be an issue along this segment, and there were three crashes involving motorcycles in the northern portion of the segment during the study period.

Countermeasures

To address the access related crashes along this segment, a continuous two-way left turn lane (TWLTL) may be considered between Enchanted Forest Drive and Riebold Drive. This added lane would be implemented by changing the typical section to include two 11-foot travel lanes, one 11-foot TWLTL, and 4’ shoulders. Using only the existing 42-footwide pavement would result in narrower shoulders than are currently present but run off the road crashes were not prevalent in this study area and the change would be addressing the primary safety concern along the segment. If roadway departures are still a concern, the existing shoulders could be widened.

Priority Location #4: Old Sugar Creek Road from Sugar Creek Center to Anise Lane

Existing Conditions

Old Sugar Creek Road is generally a two-lane road in the study segment with white edge lines and a double yellow centerline. The road widens to a 5-lane segment with a two way left turn lane within 550 feet of the signalized intersection with MO Route 30. The lane width of Old Sugar Creek Road is approximately 11 feet. The topography of the area is moderate hills and there are two sharp horizontal curves within the study area. There is an all way stop controlled intersection with Valley Drive/Hill Drive. The posted speed limit is 30 mph.

Crash Patterns

This project area experienced 45 crashes during the study time frame with 7 injury crashes (1 severe, 4 minor, 2 injury possible), and 38 PDO crashes. Eighteen (18) of these crashes occurred on the approach to MO Route 30 (8 angle crashes, 1 front to front crash, 1 front to rear crash, 2 other crashes, 6 sideswipe-same crashes; 2 on wet pavement, 5 during dark conditions), 17 crashes took place near Wilderness Lane (7 angle crashes, 2 fixed object crashes, 2 front to front crashes, 3 front to rear crashes, 3 sideswipe-opposite crashes; 10 crashes on wet pavement, 1 on snow, 3 during dark conditions); and 7 crashes happened near the AWSC intersection with Hill Drive (1 angle, 3 fixed object, 1 front to front, 2 front to rear; 3 on wet pavement and 4 during dark lighting conditions). Crash Diagram 4A shows the study area crash locations by type and severity, while Crash Diagram 4B details pavement condition.

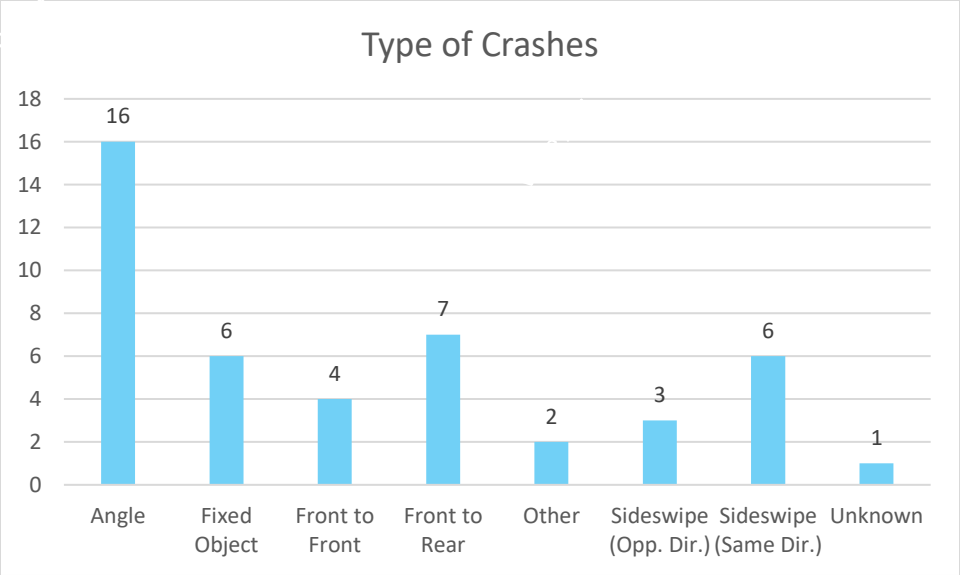
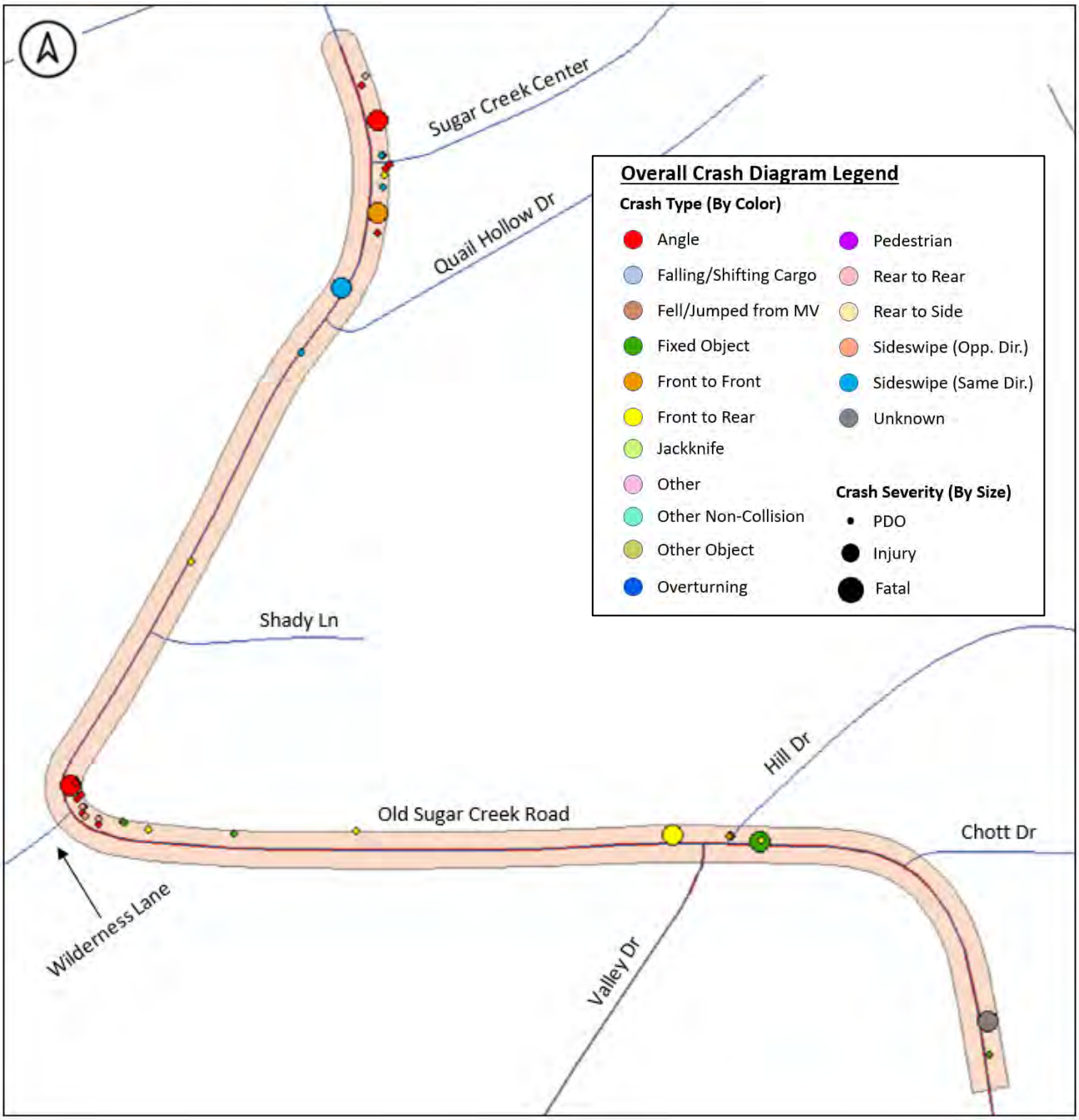


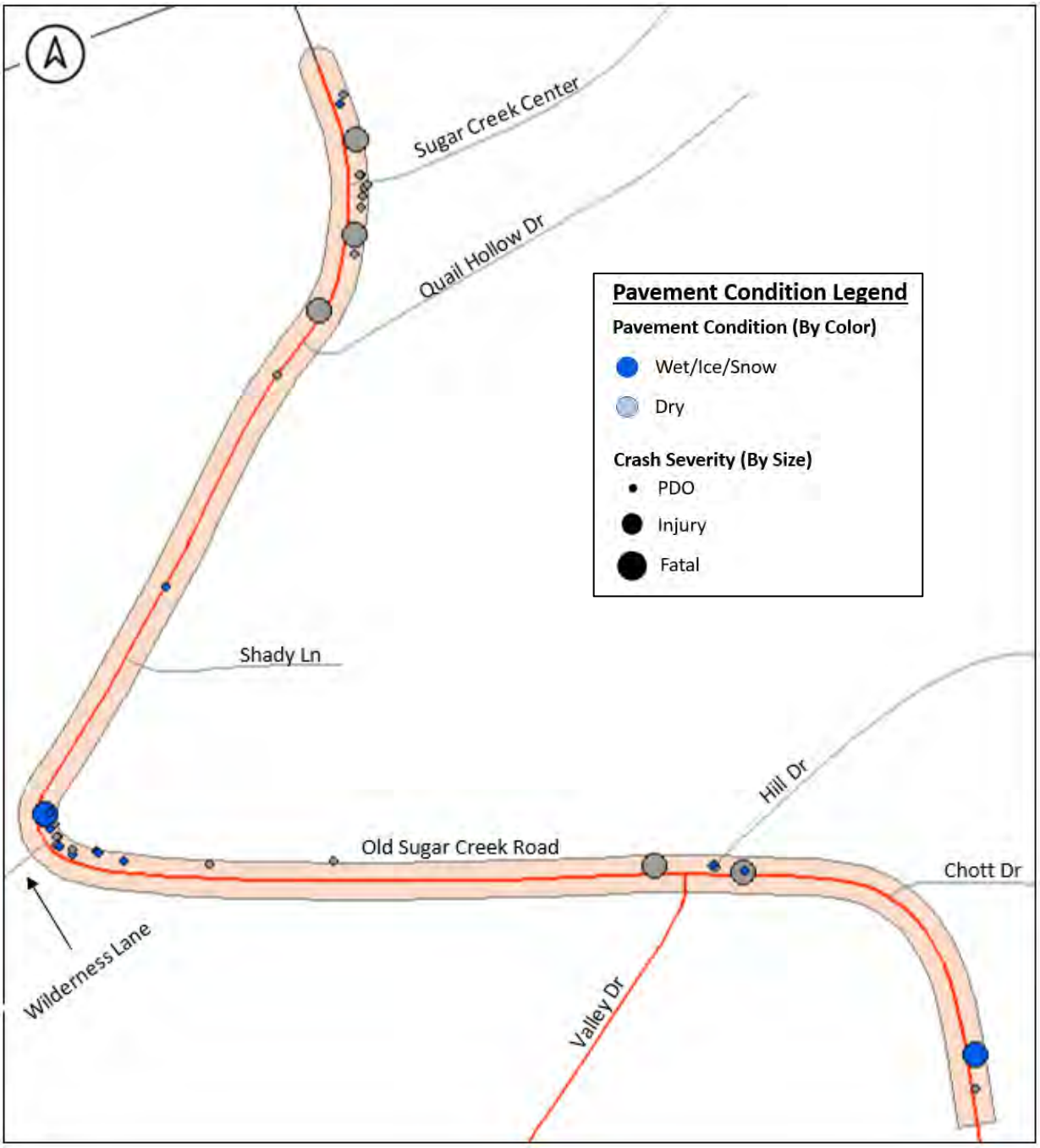
FIGURE 4: PRIORITY LOCATION 4 CRASHES BY TYPE

AERIAL 4A: OLD SUGAR CREEK ROAD FROM SUGAR CREEK CENTER TO ANISE LANE

CRASH DIAGRAM 4A: PRIORITY LOCATION 4 OVERALL



CRASH DIAGRAM 4B: PRIORITY LOCATION 4 CRASHES BY PAVEMENT CONDITION



Contributing Factors

As Old Sugarcreek Road approaches MO 30, the roadway widens from a 2-lane roadway to a 5-lane roadway. In addition, several access points are present on the approach, leading to a gas station in the southeast quadrant of the intersection and a McDonald's in the NE quadrant. This location had the highest frequency of crashes during the study period with 18 crashes, including 8 angle crashes and 8 sideswipe crashes. The primary contributing factor to these crashes is likely the uncontrolled access within the functional area of the MO 30 intersection. Additionally, a southbound lane drop shown in the aerial below is the location of 6 same direction side swipe crashes, which may be attributable to unclear signing/striping of the lane drop, resulting driver confusion. Currently, a "Right Lane Must Turn Right" and "Right Lane Ends" signs are present with a single right turn arrow marking.

AERIAL 4B: SOUTH LEG OF OLD SUGARCREEK ROAD AT MO 30

The intersection of Wilderness Lane with Old Sugarcreek Road occurs at a 120-degree curve and is the second highest crash location on the corridor with 17 crashes. The majority of those crashes (10) occurred during wet weather. Water runoff in this location surface drains from the north in a shallow ditch on the west side of the roadway. No underdrains are present at driveways along the corridor, including at the intersection with Wilderness Lane, which requires water to run over the roadway surface. The curve is a low point in the roadway, with a flat grade approaching the creek to the east which can significantly increase the potential for ponding on the roadway. An area inlet is present at the southeast corner of the intersection with Wilderness lane but is raised above much of the roadway. Moreover, construction up the hill from Wilderness Lane was underway at the time of the site visit, which will increase water discharge directly to this area.

AERIAL 4C: SOUTH LEG OF OLD SUGARCREEK ROAD AT MO 30

There is a cluster of crashes at this location (2 head-on and 3 sideswipe opposite direction), which involve vehicles crossing over the centerline. There is curve widening present on the outside, however, the roadway was not striped to utilize the full width of available pavement, increasing the sharpness of the curve. Additionally, vegetation is present immediately adjacent to the roadway on the inside of the curve, which significantly impacts sight distance.

Photo 4a shows the intersection of Valley Dr/Hill Dr with Old Sugar Creek Rd looking east. This intersection is signed as an all way stop. There are no stop lines and only one stop ahead sign on the westbound approach prior to the curve. There is a cluster of 7 crashes at this intersection including instances of vehicles running off the road as well as rear end and front to front.

PHOTO 4 A: INTERSECTION OF VALLEY DRIVE/HILL DRIVE WITH OLD SUGAR CREEK ROAD

Countermeasures

Potential countermeasures for Old Sugar Creek Road from Sugar Creek Center to Anise Lane include the following:

1. Delineate the right turn lane drop on Old Sugar Creek Road with a 6" dotted white lane line to improve identification of the upcoming lane drop. Install additional right turn arrows to provide advance warning of the lane drop.
2. Convert the access points to the gas station and McDonald's that are closest to MO 30 to right-in/right-out access points by installing raised delineators such as quick curb or tubular markers. Access to these parcels can still be maintained through further access points at Sugar Creek Center Drive.
3. Evaluate drainage at the intersection of Wilderness Lane and Old Sugar Creek Road. There is an excess of wet weather crashes on the curve that may be mitigated by improved drainage. An inlet could be added at the end of the northwest gutter section and connected to an existing area inlet at the intersection.
4. Widen the inside of the curve at Wilderness Lane and restripe the curve to provide wider lanes and a smoother transition. Widening the inside of the curve at Wilderness Lane would require right of way acquisition from one property owner and impact one utility pole. An alternative would be to forgo widening and restripe by utilizing the existing widening present on the outside of the curve. This alternative would be less expensive and less impactful to the adjacent property but would result in a slightly smaller curve radius than widening on the inside (a difference of around 10'). In either case the wider lanes are expected to be beneficial in reducing crash instances. The ultimate solution to addressing the curve crashes at Wilderness Lane would involve realigning the curve entirely so that it is not so sharp, but this may be infeasible due to potential property impacts.
5. Clear vegetation on the inside of the curve near Wilderness Lane to improve visibility. If drivers can better see the severity of the curve or the presence of other vehicles at the intersection, they will be able to reduce their speed sooner.
6. Replace the existing signs and add stop lines on all four legs of the intersection at Valley Drive/Hill Drive to better alert drivers to the AWSC condition.
7. Implement advance warning signs (Stop Ahead) in both directions on Old Sugar Creek Road to warn drivers exiting the curves on either side of the intersection of the upcoming stop. The current advance warning sign in the westbound direction is prior to the curve, so another closer to the intersection may be beneficial.

As there are two options for addressing the Wilderness Lane curve, concept layouts and cost estimates have been developed for both alternate 4a (widening on the inside of the curve) and alternative 4b (utilizing the existing widening on the outside of the curve). All other elements remain the same between the two alternates.

Priority Location #5: Intersection of Miller Road and Vogel Road

Existing Conditions

Miller Road is generally a two-lane road, but a northbound right turn lane is added at the intersection with Vogel Road. Vogel Road transitions from a five-lane roadway (east of Miller Road) to a three-lane roadway (west of Miller Road) at the signalized intersection with Miller Road. Both roads are provided with pavement markings including edge lines, lane lines, and centerlines. Eastbound Vogel Road has a shared right/through lane and a left turn only lane. Westbound Vogel Road has a right turn only lane, a through only lane, and a left turn only lane. The lane widths on Vogel Road are approximately 12 feet and the lane widths on Miller Road are approximately 11 feet. The topography of the area is rolling hills while the roadways are generally tangential. The posted speed limit on Miller Road is 30 mph and the posted speed limit on Vogel Road is 40 mph. Advance signal ahead warning signs are provided on both Miller Road approaches to traffic signal at Vogel Road. Lighting was added to this intersection in late 2019.

Note that this intersection is directly north of a separate priority segment to be addressed subsequently. The two areas were split into distinct projects due to the differences in crash patterns and thus the suggested countermeasures.

Crash Patterns

At the intersection of Miller and Vogel, there were 45 crashes (7 personal injury and 38 PDO). The primary crash types at the intersection are rear end crashes (26) and angle crashes (11). Seven crashes occurred on wet/ice/snow covered pavement and fourteen crashes occurred during dark lighting conditions.

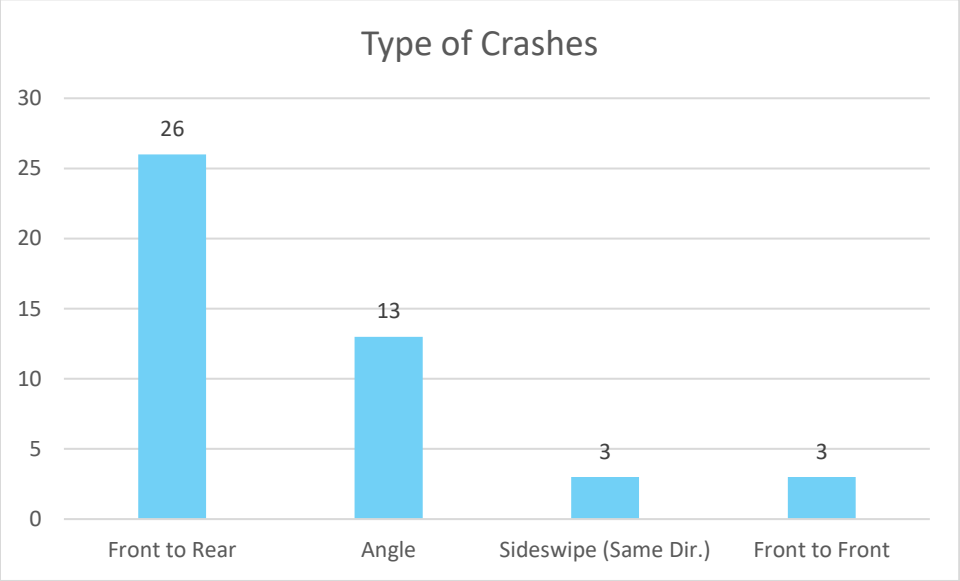
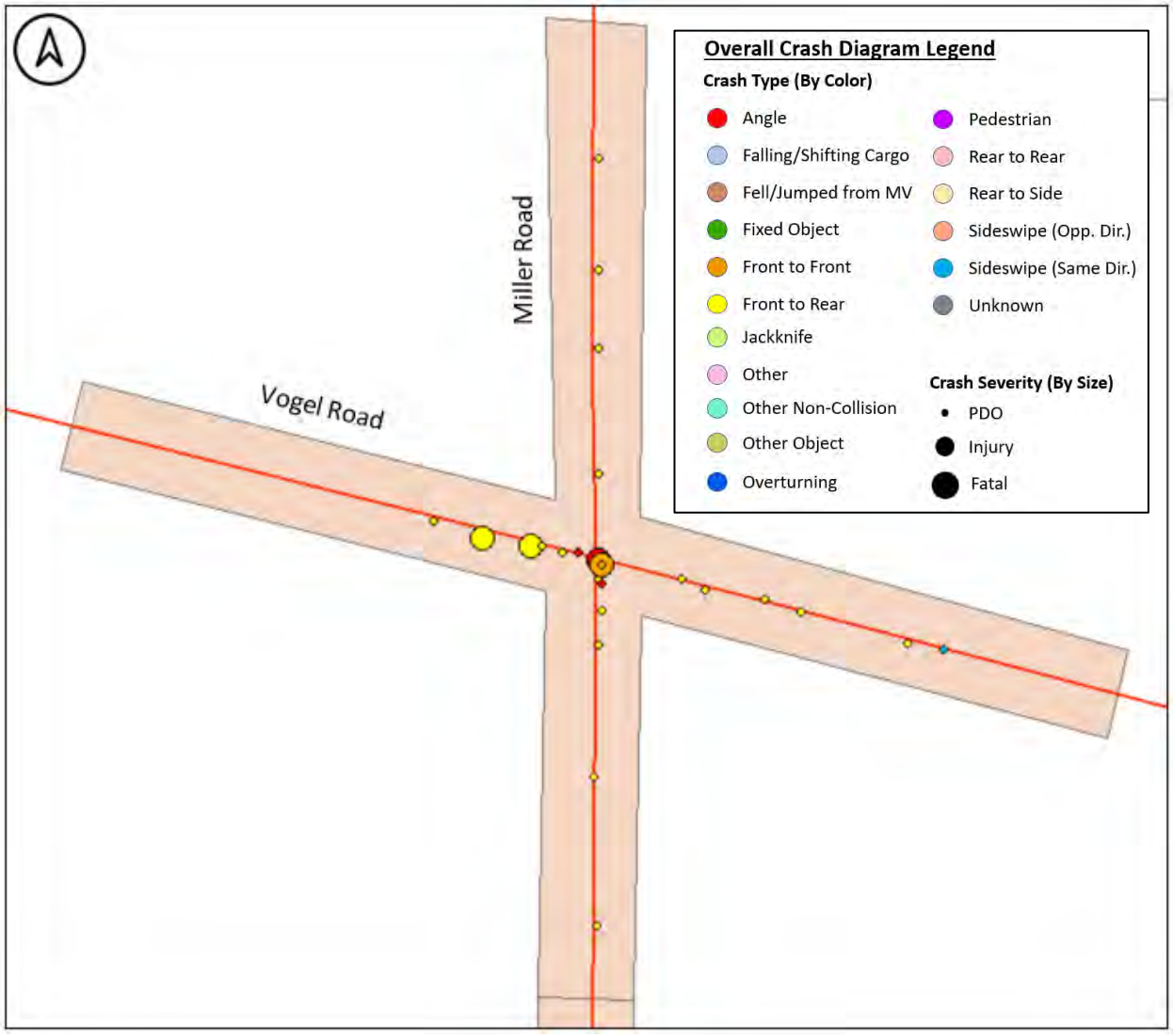


FIGURE 5: LOCATION 5 CRASHES BY TYPE

AERIAL 5: MILLER ROAD AND VOGEL ROAD

CRASH DIAGRAM 5: PRIORITY LOCATION 5 INTERSECTION CRASHES



Contributing Factors

The primary crash pattern at the intersection is rear end crashes primarily on Vogel Road. On Vogel Road, higher speeds are likely contributing to the pattern of rear end crashes as faster moving vehicles come up behind those stopped at the signal. The intersection of Miller Road and Vogel Road is also positioned within a sag curve on the Miller Road northbound approach, which creates a visual trap where the signal heads and vehicle queues may be blocked from view. An example of this visual trap on the northbound approach can be seen in **Photo 5a**. More advance signing and reflective backplates can help enhance the visibility of the signal and warn drivers to slow down.

PHOTO 5A: VISUAL TRAP BLOCKING VIEW OF INTERSECTION

The traffic signal at Vogel Road utilizes protected/permissive left turn phasing on the Vogel Road approaches and permissive only phasing on the Miller Road approaches. This permissive phasing structure may contribute to a pattern of angle crashes as left-turning vehicles with a permissive solid green indication or flashing yellow indication turn in front of opposing vehicles traveling through the intersection.

Countermeasures

Potential countermeasures for the intersection of Miller Road and Vogel Road include the following:

1. Install advanced signal signs (MUTCD sign W3-3) on all approaches to the signalized intersection to warn drivers of the upcoming signal and mitigate rear end crashes.
2. Install reflective strips on signal head backplates to create visual contrast, especially at night.
3. Consider performing a traffic timing study at this intersection to identify any timing related issues, especially as it pertains to left turn phasing and yellow and all-red clearance times.
4. Add a supplemental signal head for the westbound approach to the existing near side mast arm pole to make it easier for vehicles in the westbound right turn lane to see the signal indication.
5. Replace mast arm mounted street signs. These signs are currently difficult to read due their size and age.

Priority Location #6: East Rock Creek Road from Ehlers Ridge Lane to Old Lemay Ferry Road

Existing Conditions

East Rock Creek Road is generally a two-lane road in the study segment provided with white edge lines and a double yellow centerline. There are edge line rumble strips present throughout the segment. The lane width of East Rock Creek Road is approximately 10.5 feet wide. The topography of the area is rolling hills while the roadway is winding. This section of roadway provides access to several commercial/light industrial areas and single-family home developments. The posted speed limit is 30 mph. Some horizontal alignment signs are present in the study segment.

Crash Patterns

This segment has 25 crashes, including 1 fatal crash, 9 injury crashes (4 severe, 3 minor, & 2 injury possible), and 15 PDO crashes. There were 11 crashes near the curve and intersection with Ehlers Ridge Lane (2 angle, 2 fixed object, 1 front to front, 1 other object, 5 sideswipe-opposite crashes; 6 wet crashes, only 1 dark conditions crash). Of the 25 crashes on the corridor 10 are fixed object crashes, 2 front to front crashes, 1 other object crash, 2 overturning crashes, & 6 sideswipe-opposite crashes. 14 crashes were during wet pavement conditions.

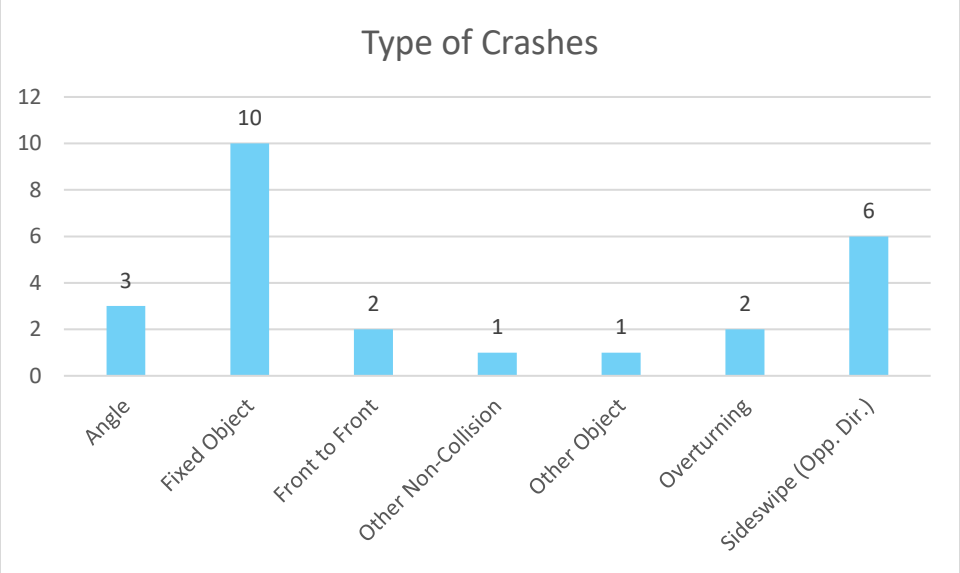
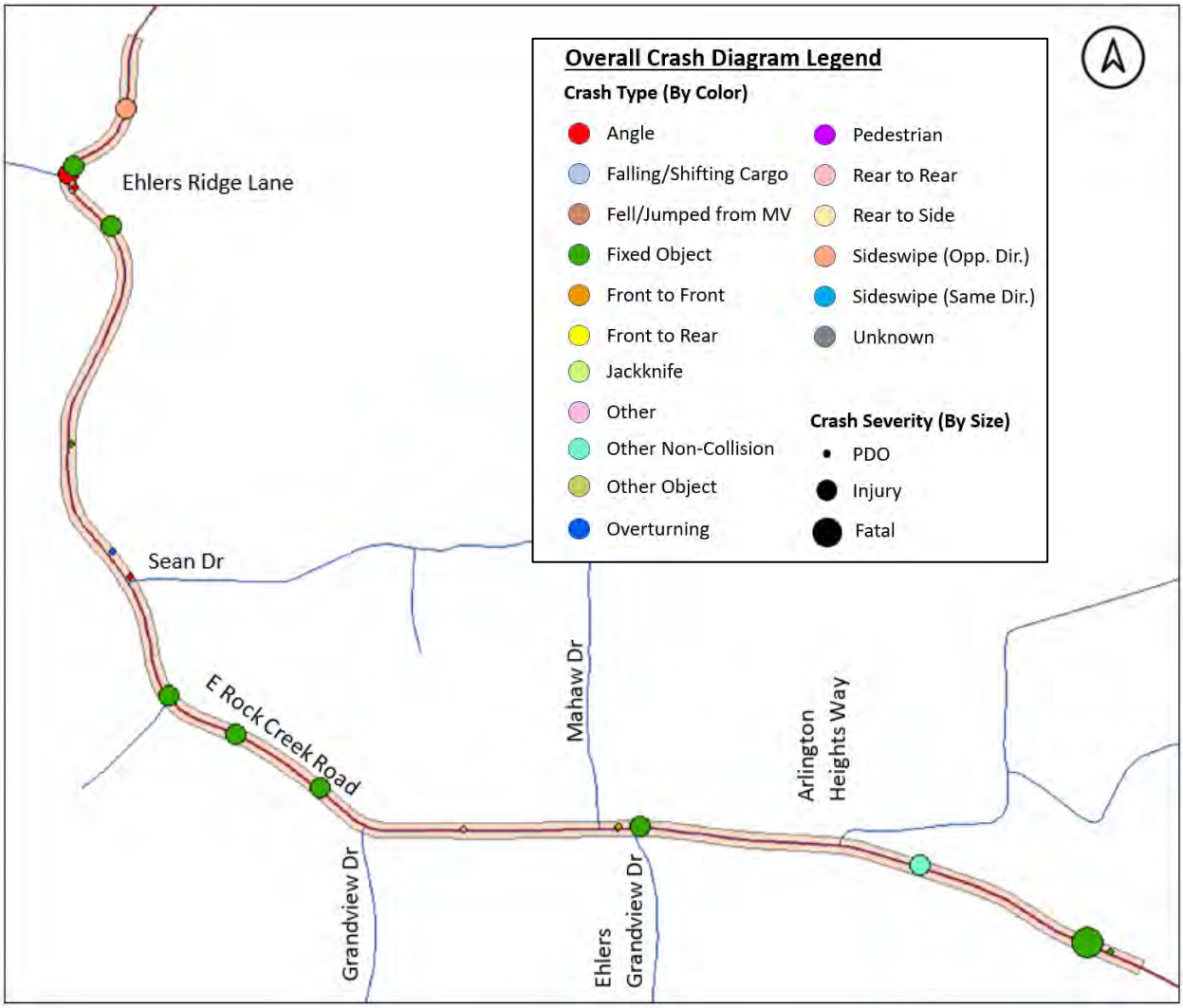


FIGURE 6: PRIORITY LOCATION 6 CRASHES BY TYPE

AERIAL 6: EAST ROCK CREEK ROAD FROM EHLERS RIDGE LANE TO OLD LEMAY FERRY ROAD

CRASH DIAGRAM 6A: PRIORITY LOCATION 6 OVERALL



CRASH DIAGRAM 6B: PRIORITY LOCATION 6 CRASHES BY PAVEMENT CONDITION

Contributing Factors

All of the crashes near Ehlers Ridge Lane involved vehicles not negotiating the sharp curve there and either leaving the roadway to strike a fixed object or crossing the centerline to strike another vehicle. **Photo 6a** shows the view of this curve looking north, where Ehlers Ridge Lane, a private drive, is on the left. The embankment on the inside of the curve limits sight distance and acts as a fixed object. Additionally, the embankment does not allow for ditching on the inside of the curve and water will sheet flow over the roadway. There is a flat, perhaps even reverse superelevation present on this curve where the roadway slopes towards Ehlers Ridge Lane rather than to the inside of the curve. This lack of superelevation likely contributes to a drainage issue here, leading to several wet weather crashes when combined with the sharp curve.

Curve signing should be reevaluated throughout the segment to ensure drivers are aware of upcoming changes in horizontal alignment, as the current signing is inconsistent. There is a sharp drop off on the west side of East Rock Creek Road that is present between Ehlers Ridge Lane and Grandview Drive. Guardrail should be considered along this section to reduce crash severity, particularly for curves with a sharp drop off downstream of the curve.

All three of the crashes between Sean Drive and Grandview Drive occurred during wet weather. There is no ditch on the east side of East Rock Creek Road in that section, which could be leading to water not draining properly off the driving surface.

At the very end of this project segment, there are concrete culverts under private driveways that have been the site of at least one crash during the study period. One of these culverts is shown in **Photo 6b**. They should at least be delineated with object markers if not replaced with a safer alternative.

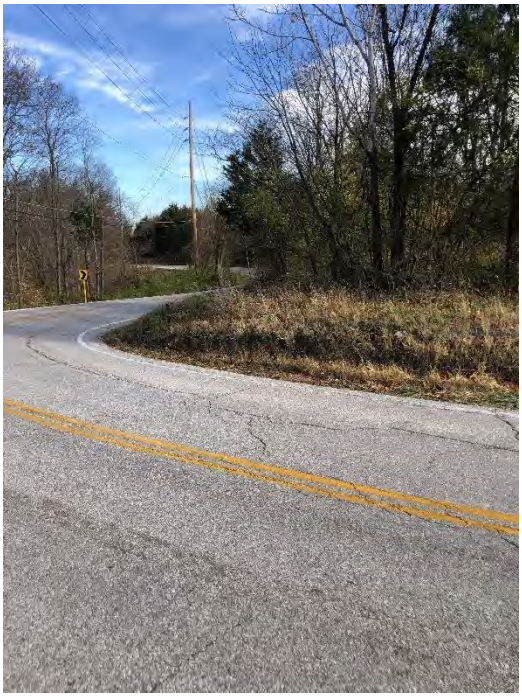


PHOTO 6 A: CURVE AT EHLERS RIDGE LANE

PHOTO 6 B: CULVERT UNDER 3010 E ROCK CREEK ROAD

Countermeasures

Potential countermeasures for East Rock Creek Road from Ehlers Ridge Lane to Old Lemay Ferry Road include the following:

1. Address the curve at Ehlers Ridge Lane to mitigate curve related crashes at this location. Short term countermeasures would include cutting back the slope and vegetation on the inside of the curve to provide better sight distance around the curve, as well as milling out this curve and repaving to correct or improve the flat superelevation in this location. Curve widening may also be considered. The long-term solution here would be to flatten the horizontal alignment by realigning East Rock Creek Road at this location.
2. Drainage along East Rock Creek Road should be improved through the construction of ditches and cross-drains where applicable, especially in the areas identified as having concentrations of wet weather crashes. Specifically, provide a ditch on the east side of East Rock Creek Road between Sean Drive and Grandview Drive to facilitate drainage and mitigate wet weather crashes in this area.
3. Consider guardrail on the high side of curves between Ehlers Ridge Lane and Grandview Drive that have a sharp drop off to reduce crash severity for vehicles that leave the road in these locations.
4. Delineate the culverts under the private driveways for 3004 and 3010 East Rock Creek Road with object markers.
5. Evaluate curve signing throughout this segment for consistency and add signs where necessary.

The addition of 4-5’ shoulders with edge line rumble strips would be beneficial throughout this segment as a long-term solution for reducing run off the road crashes. These could be constructed in conjunction with curve realignment at Ehlers Ridge Lane and drainage improvements throughout, including the replacement of the fixed object culverts at the south end of the project.

Priority Location #7: Old Route 21 at Rock Creek Rd

Existing Conditions

Old Route 21 from MO Route 21 to beyond Rock Creek Road is generally a two-lane road in the study segment provided with a double yellow centerline and white edge lines. Rock Creek Road is also generally a two-lane road with a double yellow centerline and white edge lines. At the signalized intersection of Old Route 21 & E/W Rock Creek Road, the northbound, eastbound, and westbound approaches each have a through/right lane and left only lane. Southbound Old Route 21 has a left only lane, a through only lane, and a right only lane. Right turns on red are prohibited from the Rock Creek Road approaches. The lanes on Old Route 21 are generally 12 feet wide. The lanes on E Rock Creek Road are approximately 10.5 feet wide and the lanes on W Rock Creek Road are approximately 11.5 feet wide. The topography of the area is best described as rolling hills. Old Route 21 is generally tangential on a down slope going from north to south while both approaches of Rock Creek Road are winding. The posted speed limit on Old Route 21 is 35 mph and is 30 mph on Rock Creek Road. Horizontal alignment signs are present on the East and West Rock Creek Road. Advance signal ahead signs with flashing beacons are provided on Old Route 21 prior to the intersection with E/W Rock Creek Road. Commercial developments surround the intersection with a BP gas station of the northwest quadrant of the intersection and a small strip mall on the eastern side of the intersection.

Crash Patterns

Overall, there were 23 crashes including 1 fatal crash, 7 injury crashes (3 severe, 1 minor, 3 injury possible), and 15 PDO crashes. Five crashes occurred on wet/ice/snow covered pavement and five crashes occurred during dark lighting conditions. There were 11 crashes at the intersection of Old State Route 21 and East/West Rock Creek Road (3 angle, 1 front to front, 5 front to rear, 1 overturning, 1 rear to side; 1 crash on snow, 1 on ice, all daylight). There were 9 crashes on Old State Route 21 north of East/West Rock Creek Road (3 angle crashes, 2 front to front, 4 front to rear; 3 wet crashes, 3 dark condition crashes). 1 fatal pedestrian crash occurred on Old State Route 21 south of the signalized intersection during dark lighting conditions.

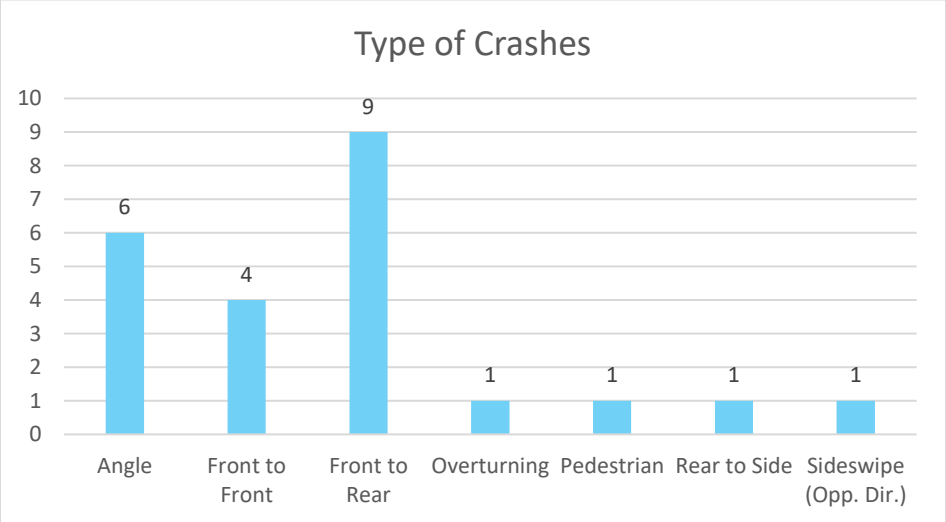
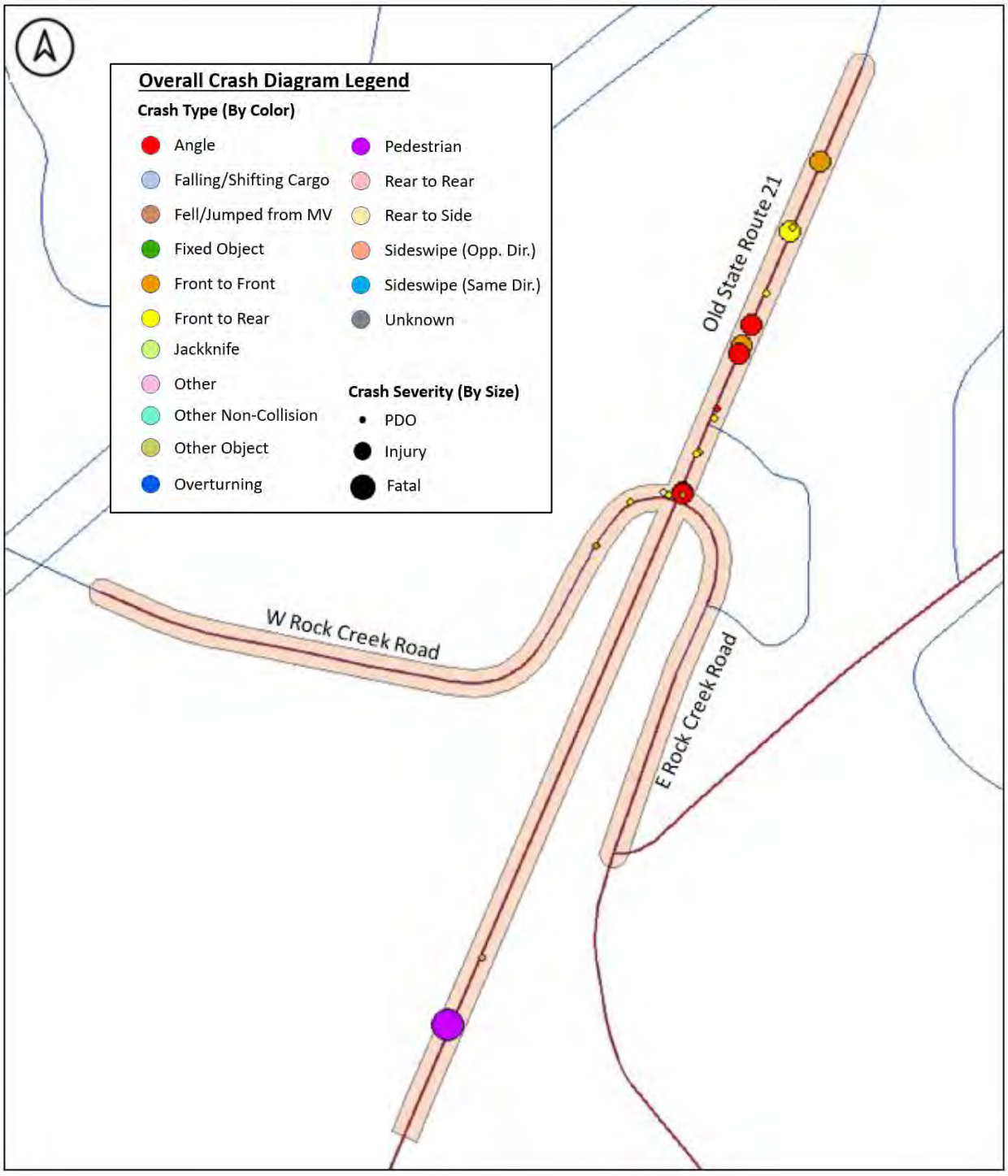


FIGURE 7: PRIORITY LOCATION 7 CRASHES BY TYPE

AERIAL 7A: OLD ROUTE 21 FROM MO ROUTE 21 PAST ROCK CREEK RD

AERIAL 7B: INTERSECTION VIEW

CRASH DIAGRAM 7: PRIORITY LOCATION 7OVERALL



Contributing Factors

PHOTO 7 A: GAS STATION ENTRANCE CLOSE TO INTERSECTION

Based on the crash analysis, the main issue at this intersection seems to be with vehicles entering and exiting the gas station located in the northwest quadrant of this intersection. The gas station has three full-access entrances. Two of the entrances are on Old State Route 21, the closer of which is only 30 feet behind the southbound stop line, and the third entrance is on the W Rock Creek Road leg and is even with the stop line on that approach. The majority of the crashes on Old State Route 21 near this intersection are access related; caused by drivers turning left in and out of the driveway closest to the intersection in particular. **Photo 7a** shows the proximity of the entrance nearest to the intersection along Old State Route 21.

Other crashes in this study area do not reveal additional roadway safety concerns, as they largely consisted of distracted driving and mechanical failure related incidents.

Countermeasures

To address the access related crashes at this intersection, the gas station entrance closest to the intersection along Old State Route 21 should be closed, or at least converted to right-in/right-out (RIRO) only access to prevent hazardous left turns. This could be accomplished by installing signage and a channelizing island at this location. A similar RIRO treatment could be considered for the gas station driveway on W Rock Creek Road.

If changing the existing access configuration of the property is infeasible, an alternative solution could be to relocate the two driveways closest to the intersection further away, while having them remain full access entrances. The safety benefit of this solution would be smaller than the first since left turns would be permitted but relocating those driveways further from the signalized intersection would still be beneficial.

In all cases, the entrance closest to the intersection along Old State Route 21 is the most critical, as it is the site of the majority of crashes at this priority location. As there are two options for addressing access related crashes, concept layouts and cost estimates have been developed for both alternate 7a (closing closest entrance) and alternative 7b (relocating entrances).

Priority Location #8: Brennan Road from Eagle Drive to Little Brennan Road

Existing Conditions

Old Brennan Road is generally a two-lane road in the study segment provided with a double yellow centerline and white edge lines. The lanes on Brennan Road are approximately 11 feet wide. The topography of the area is rolling hills while the roadway is winding. The posted speed limit is 30 mph. Horizontal alignment signs are present in the study segment. The roadway provides access to several residential developments in the area and commercial development at the southern end of the study area. A school zone is marked on Brennan Road in the study area approaching the intersection with Little Brennan Road.

Crash Patterns

In this segment, there were 34 crashes including 6 injury crashes (3 minor, 3 injury possible), and 28 PDO crashes. Fourteen of 34 crashes occurred on wet (13) or snow (1) covered pavement, representing 41 percent of total crashes. Seven crashes took place in the curve near Brennan Woods Drive (4 fixed object, 1 overturning, sideswipe-opposite; 4 wet crashes, 2 dark-unlighted), 4 crashes happened in the curve just west of Atkinson Road (2 fixed object, 1 front to front, 1 sideswipe opposite; 2 on wet pavement, 1 on snow, 3 during dark conditions), 5 crashes occurred near or in intersection with Atkinson Road (3 angle, 1 fixed object, 1 other object; 1 wet and 2 dark conditions). Finally, there are 11 crashes on the approach to Little Brennan Road (5 angle, 4 fixed object, 1 front to front, 1 front to rear; 3 wet crashes 2 dark crashes).

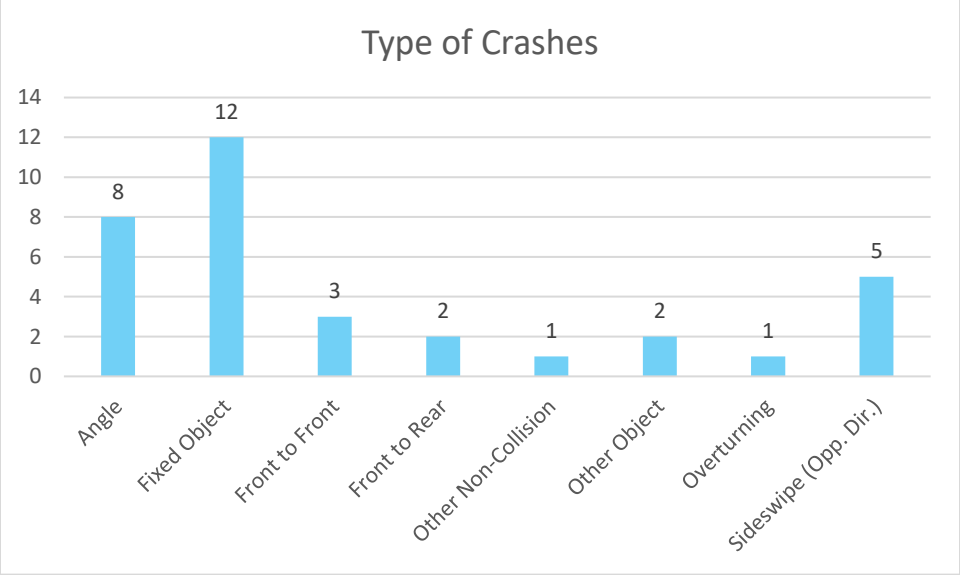
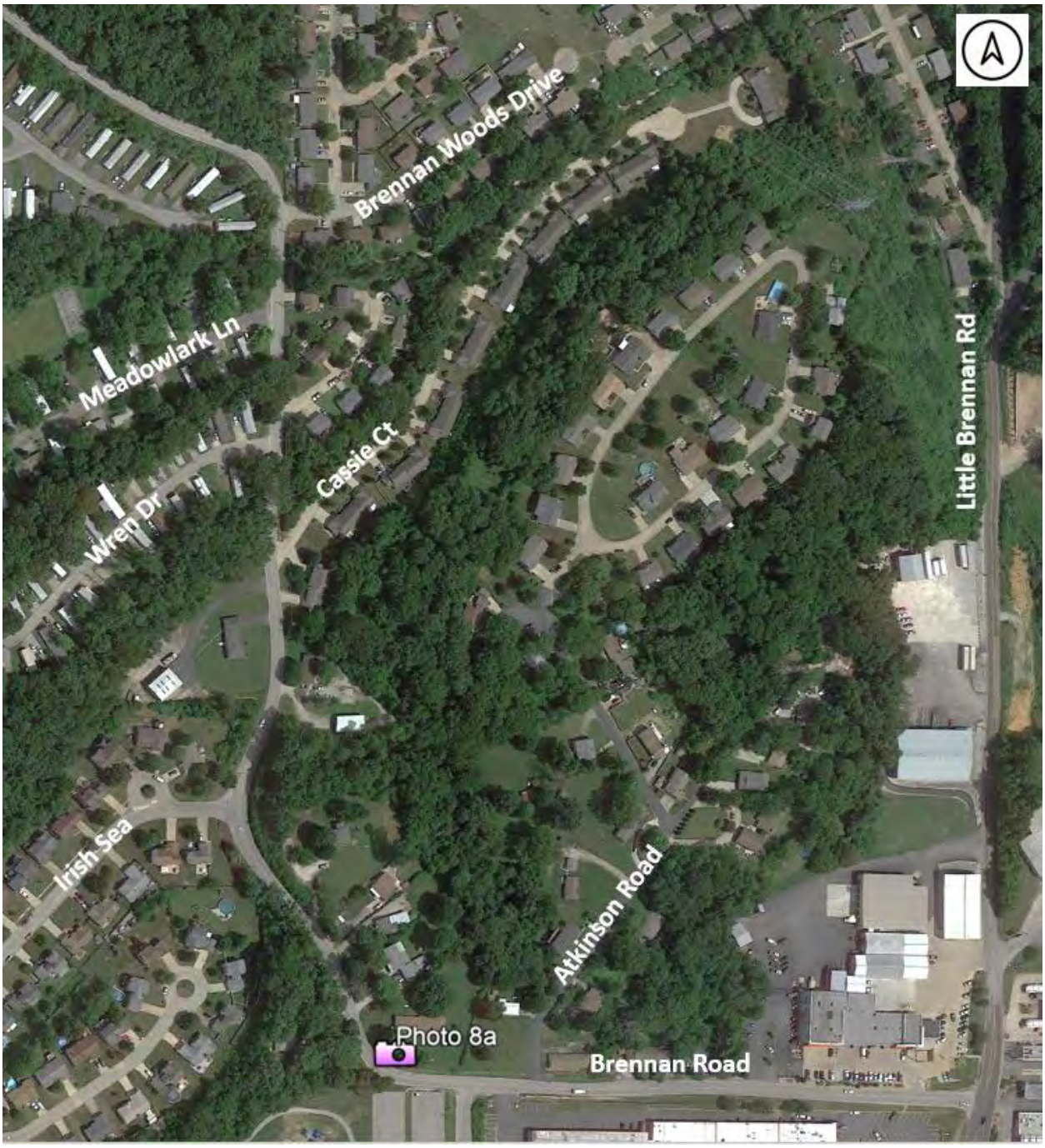
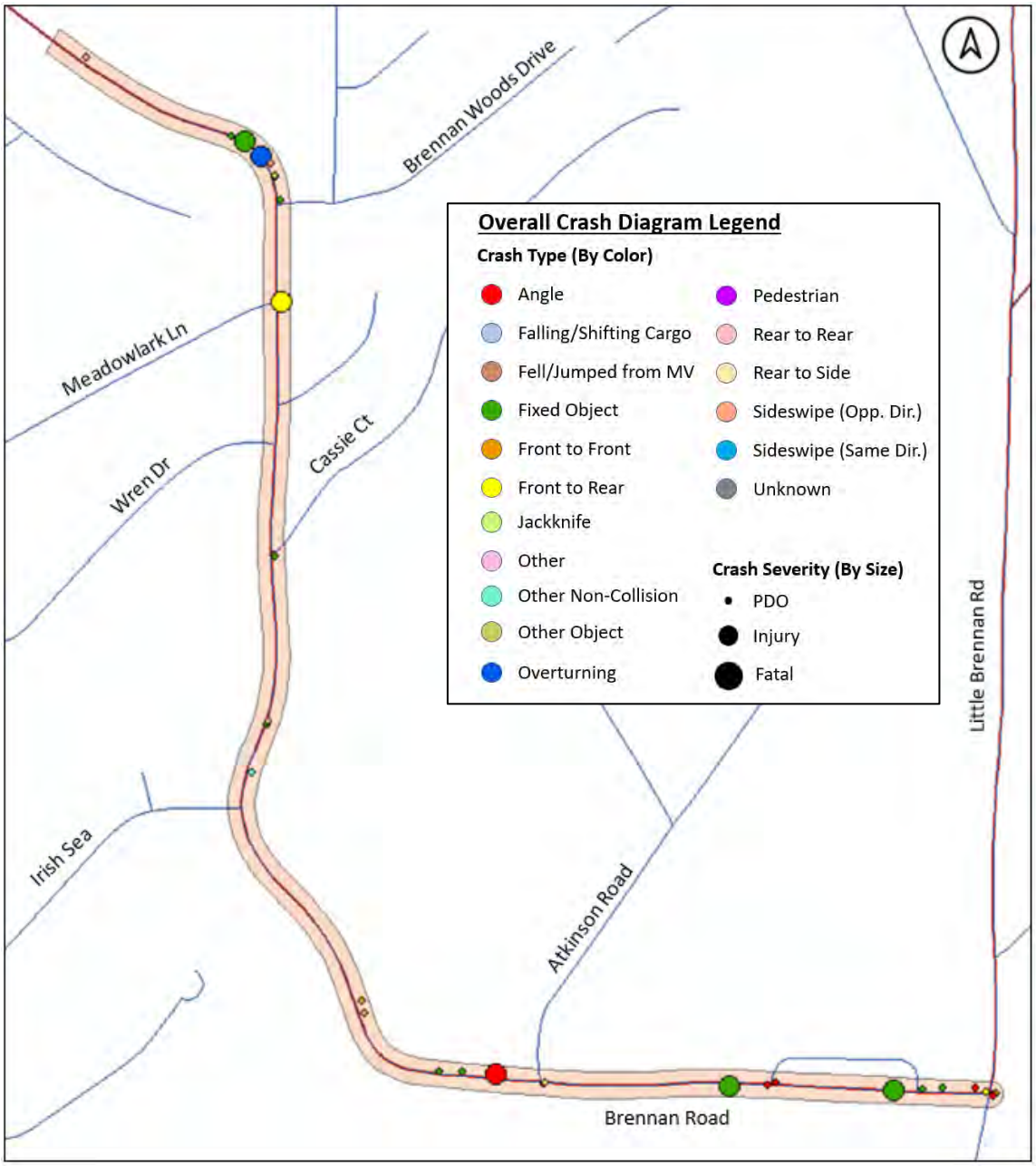


FIGURE 8: PRIORITY LOCATION 8 CRASHES BY TYPE

AERIAL 8: BRENNAN ROAD FROM EAGLE DRIVE TO LITTLE BRENNAN ROAD



CRASH DIAGRAM 8A: PRIORITY LOCATION 8 OVERALL



CRASH DIAGRAM 8B: PRIORITY LOCATION 8 BY PAVEMENT CONDITION

Contributing Factors

The seven crashes that occurred on the curve near Brennan Woods Drive were a mix of vehicles not negotiating the curve and leaving the roadway and vehicles crossing the centerline to strike another vehicle. There are already advance curve warning signs and chevrons at this location. The embankment on the east side of the roadway limits available ditching and drainage, which increases the probability of sheet flow on the roadway surface. Additionally, no underdrain is present at Brennan Woods Drive which likely increases water on the roadway.

Most of the residential side streets along this segment of Brennan Road do not have stop signs present. Vegetation blocking intersection sight distance is a concern as well, particularly at Cassie Court, Wren Drive, and Pecan Court. There were several fixed object crashes involving utility poles, especially north of Irish Sea. Object markers are used appropriately on this segment for culverts and sharp drop offs, but utility poles near the roadway should also be considered.

Photo 8a shows the sharp curve just west of Atkinson Road near Brennan Woods Elementary School. Currently there are only large arrow sign signs present with no advance warning signs or chevrons. Wet weather crashes seem to be an issue between this curve and Little Brennan Road, largely due to vehicles either losing control on the curve or sliding due to the vertical alignment in this area. High Friction Surface Treatment (HFST) should be considered at this location to increase pavement friction.

PHOTO 8 A: SHARP CURVE WEST OF ATKINSON RD, LOOKING WEST

Countermeasures

Potential countermeasures for Brennan Road from Eagle Drive to Little Brennan Road include the following:

1. Improve drainage along Brennan Road, especially near the curve at Brennan Woods Drive.
2. Clear vegetation and trees from areas where they restrict sight distance, particularly on the inside of curves and at Cassie Court, Wren Drive, and Pecan Drive.
3. Install stop signs at residential side streets that do not currently have them to reinforce stop control at those locations.
4. Add advance horizontal alignment warning signs and chevrons to the sharp curve near Brennan Woods Elementary School.
5. Consider HFST between Brennan Woods Elementary School and Little Brennan Road to increase traction during wet weather events.

Priority Location #9: Gravois Road from Terrace Drive to Roseglyn Lane

Existing Conditions

Gravois Road is generally a two-lane road in the study segment provided with a double yellow centerline and white edge lines. The lanes on Gravois Road are approximately 12 feet wide. The topography of the area is gentle hills while the roadway is tangential with gentle curves. Single Family homes and some commercial uses line the roadway with direct access. The posted speed limit is 45 mph. No horizontal alignment signs are present on Gravois Road in the study area.

Crash Patterns

Overall, there were 25 crashes in this roadway segment including 8 injury crashes (2 severe, 5 minor, 1 injury possible), and 17 POD crashes. 11 of 25 crashes occurred during dark lighting conditions. Four crashes occurred in the curve near Terrace Drive (1 angle, 1 fixed object, 1 other, 1 sideswipe opposite; 1 snow and 1 wet, 3 dark conditions), 7 crashes happened near Meadowlark Lane/ Quiet Hollow Lane (1 angle, 2 fixed object, 2 front to year, 2 other object crashes; 3 dark conditions), 8 more crashes happened near the curve at Bush Road (1 angle, 4 fixed object, 1 front to front, 2 front to rear), and 4 crashes happened in the area of Pine Grove Manor (1 fixed object, 3 front to rear; 3 dark unlighted conditions).

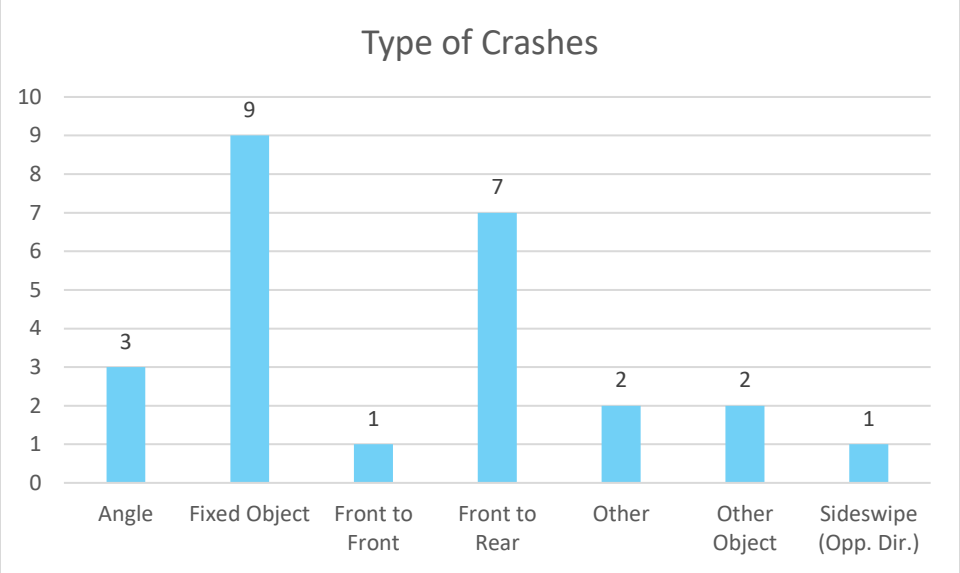
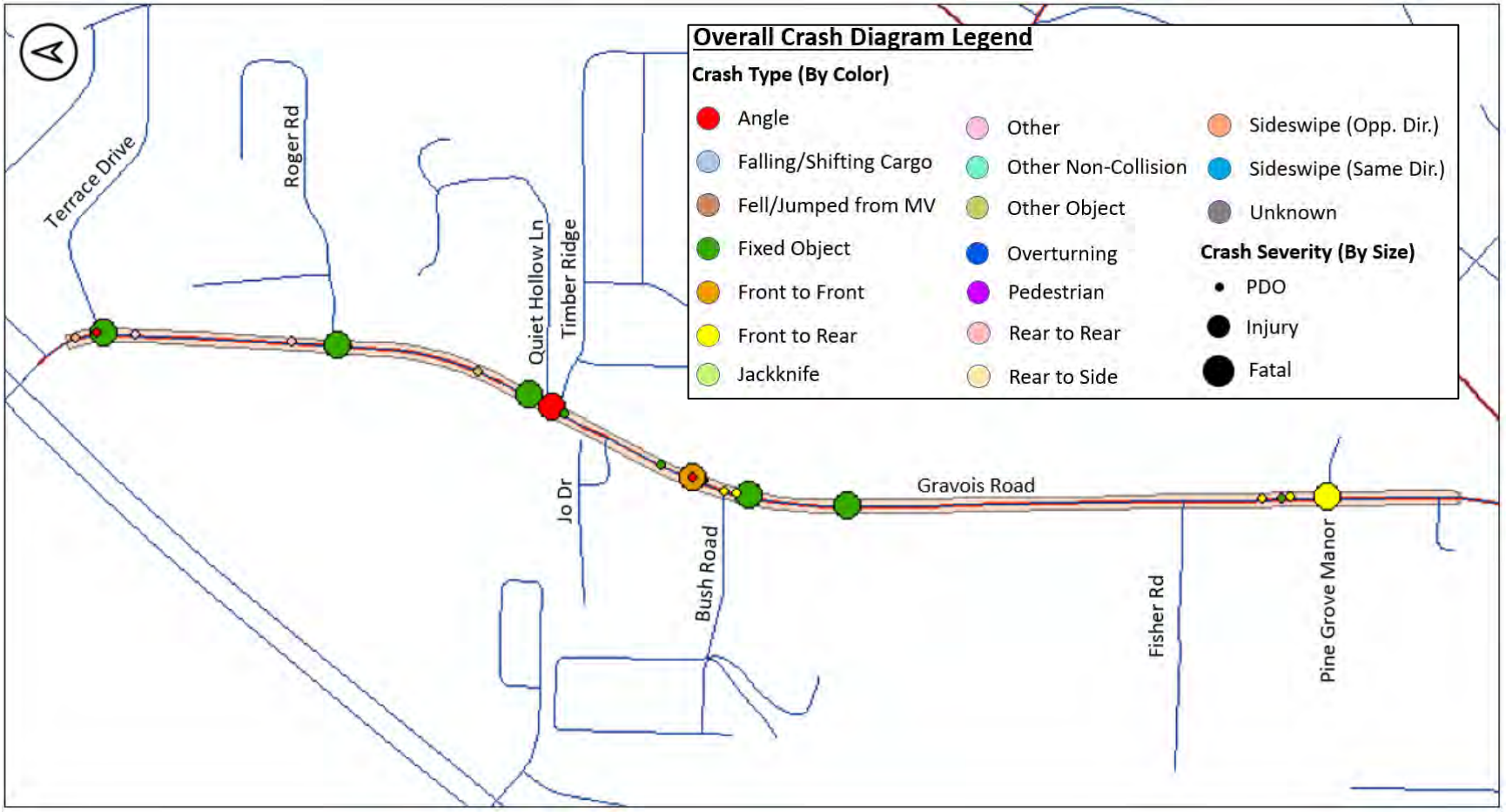


FIGURE 9: PRIORITY LOCATION 9 CRASHES BY TYPE

AERIAL 9: GRAVOIS ROAD FROM TERRACE DRIVE TO ROSEGLYN LANE

CRASH DIAGRAM 9: PRIORITY LOCATION 9 OVERALL



Contributing Factors

The majority of crashes along this segment were either rear end crashes or run off the road (fixed object) crashes. The rear end crashes mostly stem from vehicles slowing to turn left into a driveway or side street. Several fixed object crashes were also due to vehicles swerving to avoid stopped vehicles. As can be seen in the aerial view, there is a high concentration of driveways south of Quiet Hollow Drive. The long-term solution would be to implement a two way left turn lane (TWLTL) along this segment of Gravois to provide refuge for left turning vehicles while allowing through traffic to pass.

There were several cases of inattentiveness and drivers falling asleep that may be addressed by installing edge line rumble strips throughout the segment. As mentioned previously, 11 out of the 25 crashes occurred during dark conditions. Installing lighting along the corridor may be beneficial in mitigating nighttime crashes.

Countermeasures

Potential countermeasures for Gravois Road from Terrace Drive to Roseglyn Lane include the following:

1. Install dusk to dawn lighting along the segment to address high instances of nighttime crashes.
2. Install edge line rumble strips along the segment to warn drivers before they depart the roadway, though noise levels may be a consideration in this residential area.
3. Install a horizontal alignment warning sign south of the intersection of Gravois Rd and Missouri Route 30.
4. Ensure vegetation throughout the segment is maintained so that it does not block intersection or curve sight distance.

As mentioned previously, the ultimate solution for addressing multiple-vehicle crashes along this segment is to install a TWLTL. The additional lane would require widening of the roadway as the existing pavement is not wide enough to support a third lane as well as adequate shoulders.

Priority Location #10: Antire Road from Brookside Drive to Laurel Road

Existing Conditions

The segment of Antire Road between Brookside Drive to Laurel Road is generally a two-lane road in the study segment provided with a double yellow centerline and white edge lines. The lanes on Antire Road are approximately 10 to 10.5 feet wide. The topography of the area consists of rolling hills while the roadway is winding. The posted speed limit is 40 mph. Some horizontal alignment signs are present in the study area and advance intersection signs are present prior to Brookside Drive.

Crash Patterns

Twenty (20) crashes occurred on this segment: 1 fell/jumped from a moving vehicle, 11 fixed objects, 1 front to front, 4 front to rear, 1 other non-collision, 1 overturning, and 1 pedestrian crash. Of the 20 crashes, three occurred on wet pavement and four in dark lighting conditions crashes. There were nine injury crashes (2 severe, 5 minor, & 2 injury possible). Five crashes (4 fixed object, 1 front to rear, 1 fell/jumped from MV; 2 wet crashes, 1 dark) occurred in the curve south of Antire Valley Estates Lane. There were eight crashes on the northern end around Brookside Dr (3 fixed object, 1 front to front, 2 front to rear, 1 other non-collision, 1 overturning; 2 dark conditions).

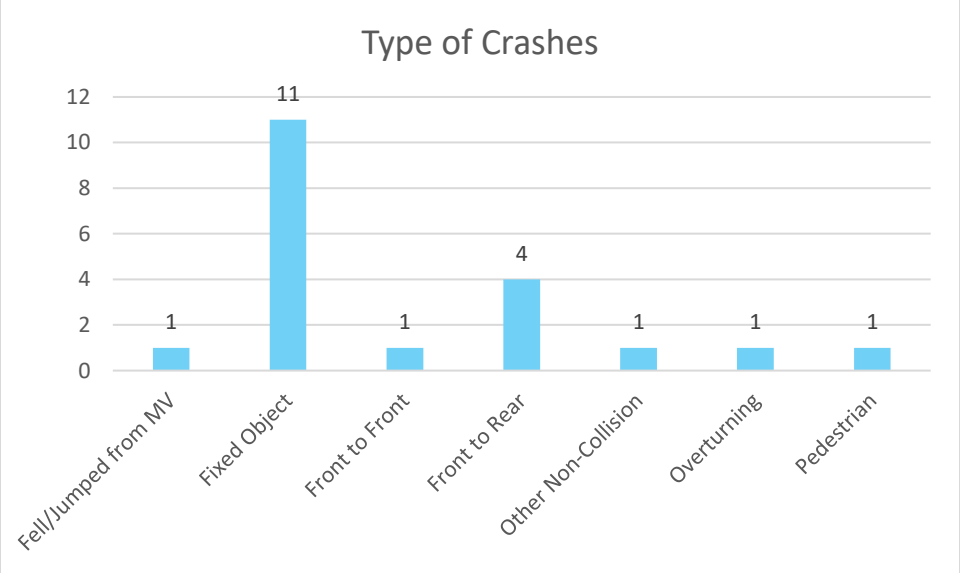
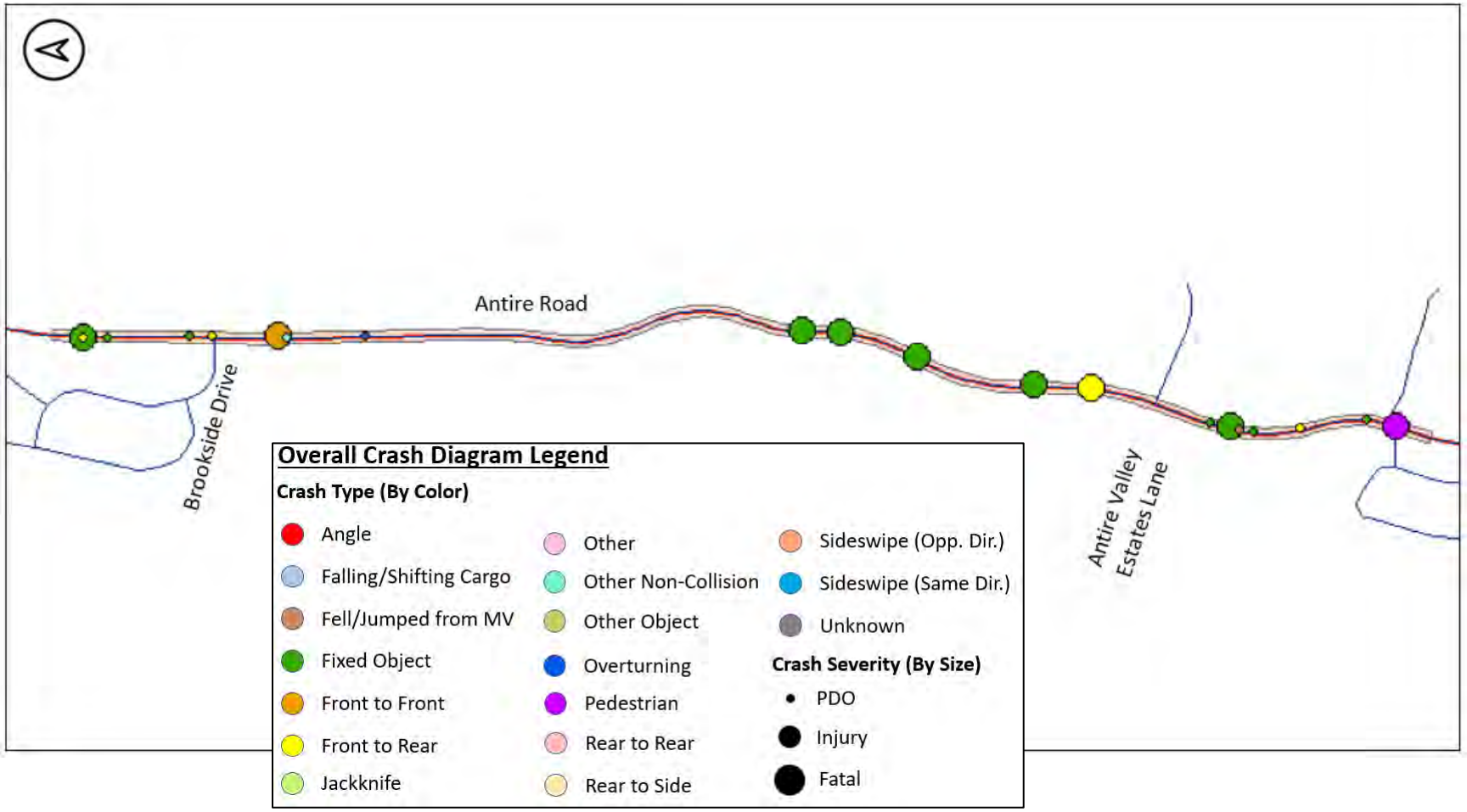


FIGURE 10: PRIORITY LOCATION 10 CRASHES BY TYPE

AERIAL 10: ANTIRE ROAD FROM BROOKSIDE DRIVE TO LAUREL ROAD

CRASH DIAGRAM 10: PRIORITY LOCATION 10 OVERALL



Contributing Factors

According to the crash reports in this area, the main safety concern seems to be the sharp drop off along Antire Road, particularly on the west side of Antire. With no shoulders, vehicles are left with no room to recover if they leave the roadway, leading to fixed object crashes where vehicles strike trees, utility poles, and concrete culverts adjacent to the roadway. The steep roadside slope can be seen in **Photo 10a. Photo 10b** shows various roadside fixed objects directly adjacent to the traveled way, including trees, utility poles, and culverts. Only the culverts are delineated with object markers.

PHOTO 10 A: SHARP ROADSIDE SLOPE ON WEST SIDE OF ANTIRE ROAD

PHOTO 10 B: ROADSIDE FIXED OBJECTS

The main factor that contributes to vehicles leaving the roadway is failing to negotiate the series of curves present in the study area. There are no chevrons on these curves within the study area, and the winding road signs present do not have advisory speeds.

Countermeasures

Potential countermeasures for Antire Road from Brookside Drive to Laurel Road include the following:

1. Add an advisory speed to the existing curve signs and add chevrons to the critical curves within the study area to enhance curve visibility. Supplemental curve signs with advisory speed may be considered on significant curves.
2. Delineate utility poles that are close to the roadway with object markers.
3. Remove trees directly adjacent to the roadway to eliminate some of the fixed objects in the study area.
4. Address run off the road (fixed object) crashes caused by the sharp drop off and lack of shoulders. This could be accomplished by installing edge line rumble strips throughout the segment to warn drivers before they depart the roadway, as well as guardrail along hazardous sections to reduce the severity of such crashes. Long term, the addition of shoulders along Antire Road would most effectively address the crashes in this area by providing a warning and space for vehicles to recover before leaving the roadway.

Priority Location #11: Old Highway M and Old Antonia Road

Existing Conditions

Old Highway M Road and Old Antonia Road are two-lane roads in the study segment provided with a double yellow centerlines and white edge lines. At the intersection of Old Highway M Road and Old Antonia Road, only Old Antonia Road is stop controlled. The lanes on Old Highway M Road are generally 11 feet wide and the lanes on Old Antonia Road are also about 11 feet wide. The topography of the area generally consists of rolling hills and the roads are winding. The posted speed limit on Old Highway M Road is 45 mph and the speed limit on Old Antonia Road is 30 mph. A stop ahead sign is present on Old Antonia Road prior to Old Highway M. Advance intersection signs are present on Old Highway M Road prior to Old Antonia Road. There are several segments of guardrail along Old Highway M on the outside of the curves in the study area. There are edge line rumble strips present along Old Antonia Road but none on Old Highway M.

Crash Patterns

In the study area including the intersection of Old Highway M Road & Old Antonia Road, there were 19 total crashes. There were nine minor injury crashes and ten PDO crashes at this intersection. One crash occurred on wet pavement and six crashes occurred during dark lighting conditions. In the immediate influence area of the intersection, there were 13 crashes (2 angle, 10 fixed object, 1 front to rear; 1 wet, 4 dark-unlighted/1 dark-lighted). The other six crashes occurred to the west of the intersection (5 fixed object, 1 sideswipe (opposite); all during dry pavement conditions and only 1 dark-unlighted crash).

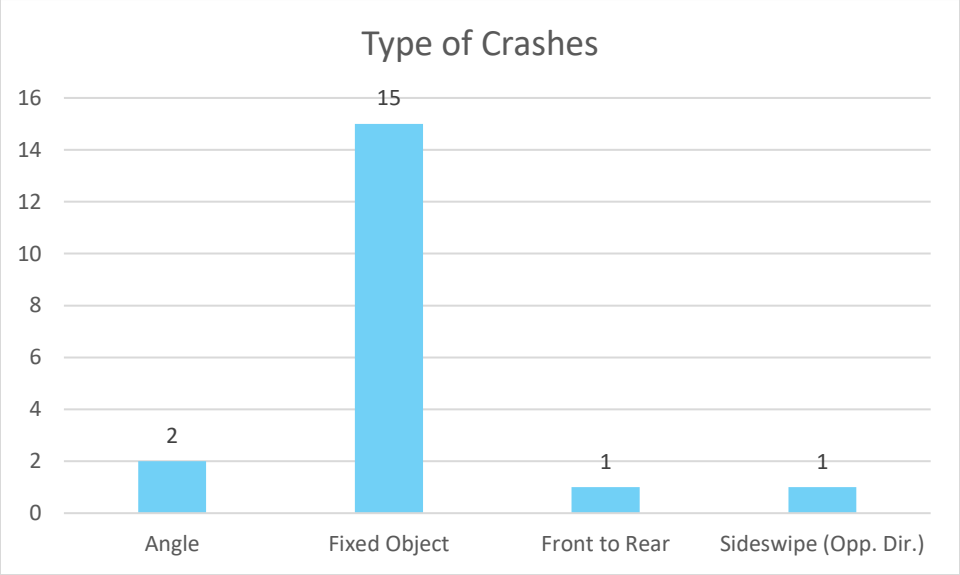
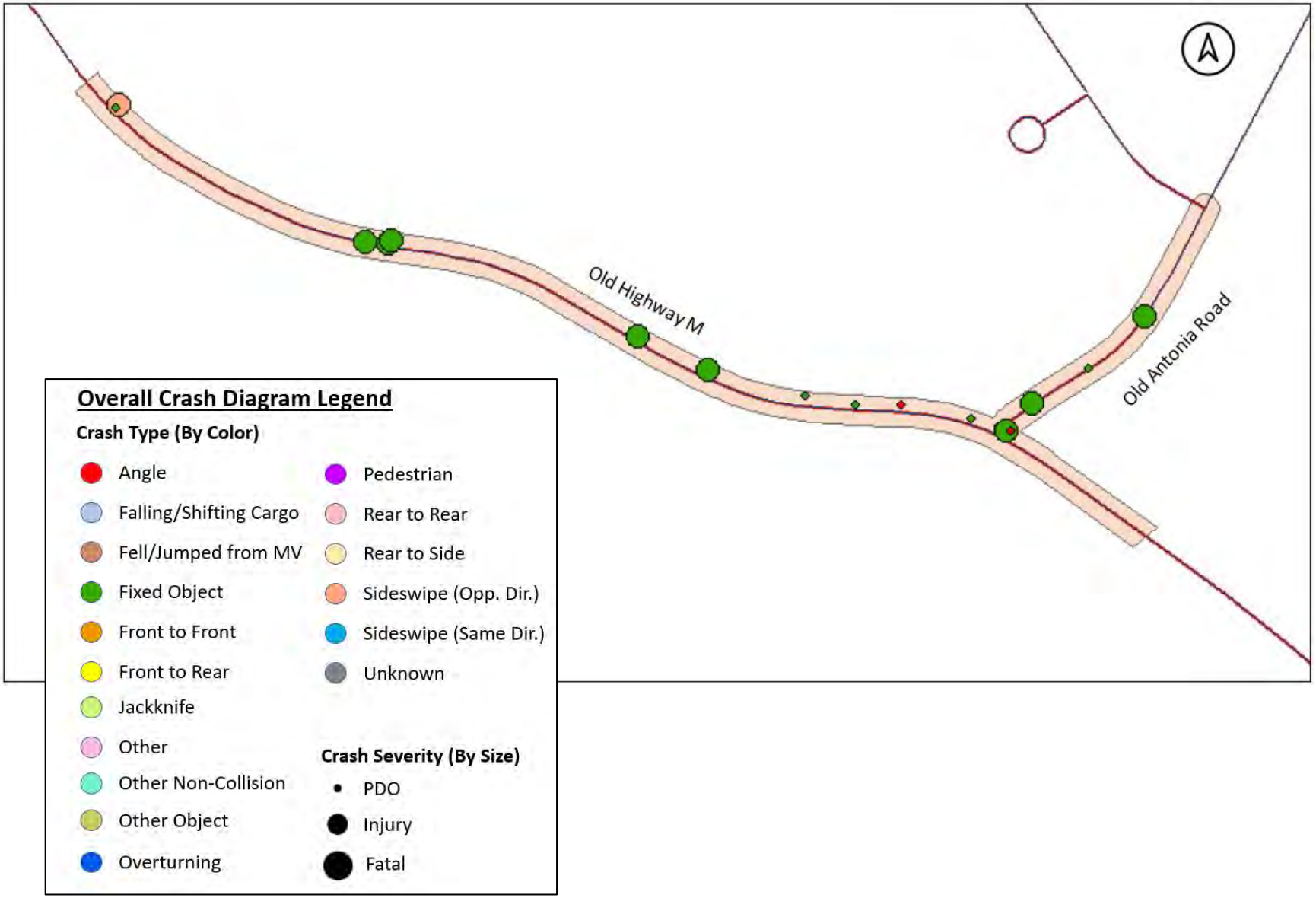


FIGURE 11: PRIORITY LOCATION 11 CRASHES BY TYPE

AERIAL 11: OLD HIGHWAY M AND OLD ANTONIA ROAD

CRASH DIAGRAM 11: PRIORITY LOCATION 11 OVERALL



Contributing Factors

For much of Old Highway M in the study area, there are no shoulders, and the roadway is flanked by guardrail on one side and a rock bluff on the other, as can be seen in **Photo 11a**. There are no horizontal alignment signs or chevrons within the study area to guide drivers through the curves and no edge line rumble strips along Old Highway M to warn drivers before they depart the roadway. There are winding road signs with a 35-mph advisory speed on Old Highway M outside of the study area.

PHOTO 11 A: OLD HIGHWAY M LOOKING EAST

At the intersection of Old Highway M and Old Antonia Road, there is a small section of guardrail protecting a culvert in the NW quadrant (shown in **Photo 11b**). This section should be replaced, outfitted with proper end treatments, and extended north along Old Antonia Road to further protect the steep slope leading to the creek and associated culvert.

PHOTO 11 B: NW QUADRANT OF OLD HIGHWAY M AND OLD ANTONIA ROAD

Countermeasures

Potential countermeasures for the intersection of Old Highway M and Old Antonia Road include the following:

1. Install edge line rumble strips along Old Highway M within the study area to help prevent roadway departures. These edge line rumble strips could also be extended on either side of the project area to increase protection and connect to neighboring projects (see Priority Location 17).
2. Install a double arrow sign across from the intersection of Old Antonia Road.
3. Install chevrons on the curves within the study area on both Old Highway M and Old Antonia Road.
4. Install supplemental horizontal alignment warning signs with advisory speeds for critical curves on both Old Highway M and Old Antonia Road.
5. Replace guardrail section at the intersection of Old Highway M and Old Antonia Road and extend the run along the west side of Old Antonia Road to protect the sharp drop off and culvert there.
6. Repaint the stop line at the intersection of Old Highway M and Old Antonia Road.

Priority Location #12: Diehl Road/Saline Road from Old Sugar Creek Road to Walnut Ridge

Existing Conditions

In this segment which includes sections of Diehl Road and Saline Road (the through roadway changes names at the intersection of Diehl Road and Saline Road), the road is generally a two-lane road in the study segment provided with a double yellow centerline and white edge lines. The intersection of Diehl Road and Saline Road is all way stop controlled. The lanes in the study segment are 10-11 feet wide. The topography of the area consists of rolling hills while the roadway is winding. The posted speed limit on both roads is 30 mph. Horizontal alignment signs are present in the study area.

Crash Patterns

In this segment, there were 19 total crashes including nine injury crashes (2 severe, 5 minor, 2 injury possible), and ten PDO crashes. Five crashes occurred on wet pavement, two crashes on snowy pavement, and twelve crashes occurred during dark lighting conditions. Ten fixed object crashes occurred between Old Sugar Creek Rd and Saline Rd (2 wet, 1 snow, 7 dry pavement; 6 dark-unlighted, 4 daylight). There were nine crashes between Saline Rd and Walnut Ridge (1 angle, 5 fixed object, 1 other non-collision, 1 overturning, 1 sideswipe-opposite; 3 wet, 1 snow, 6 dark-unlighted).

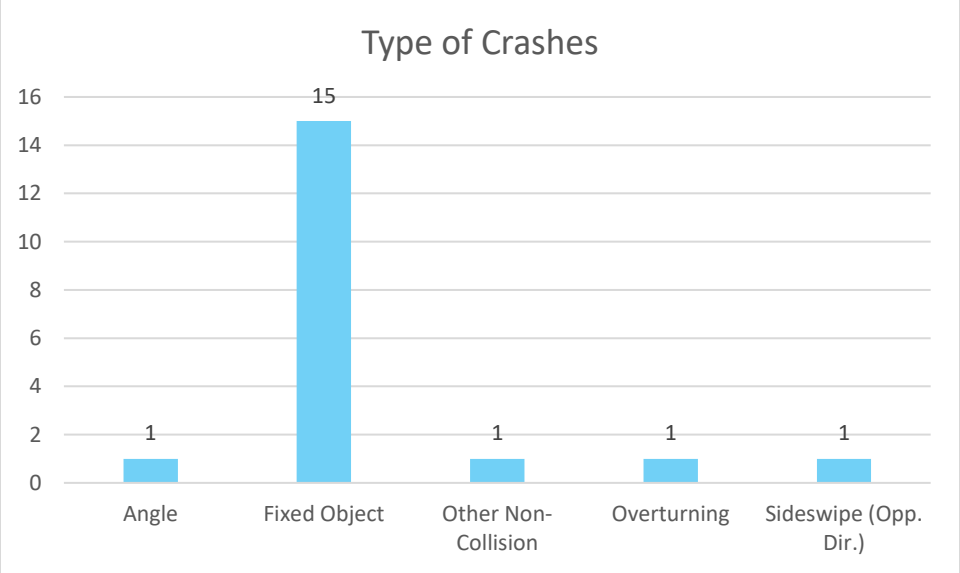
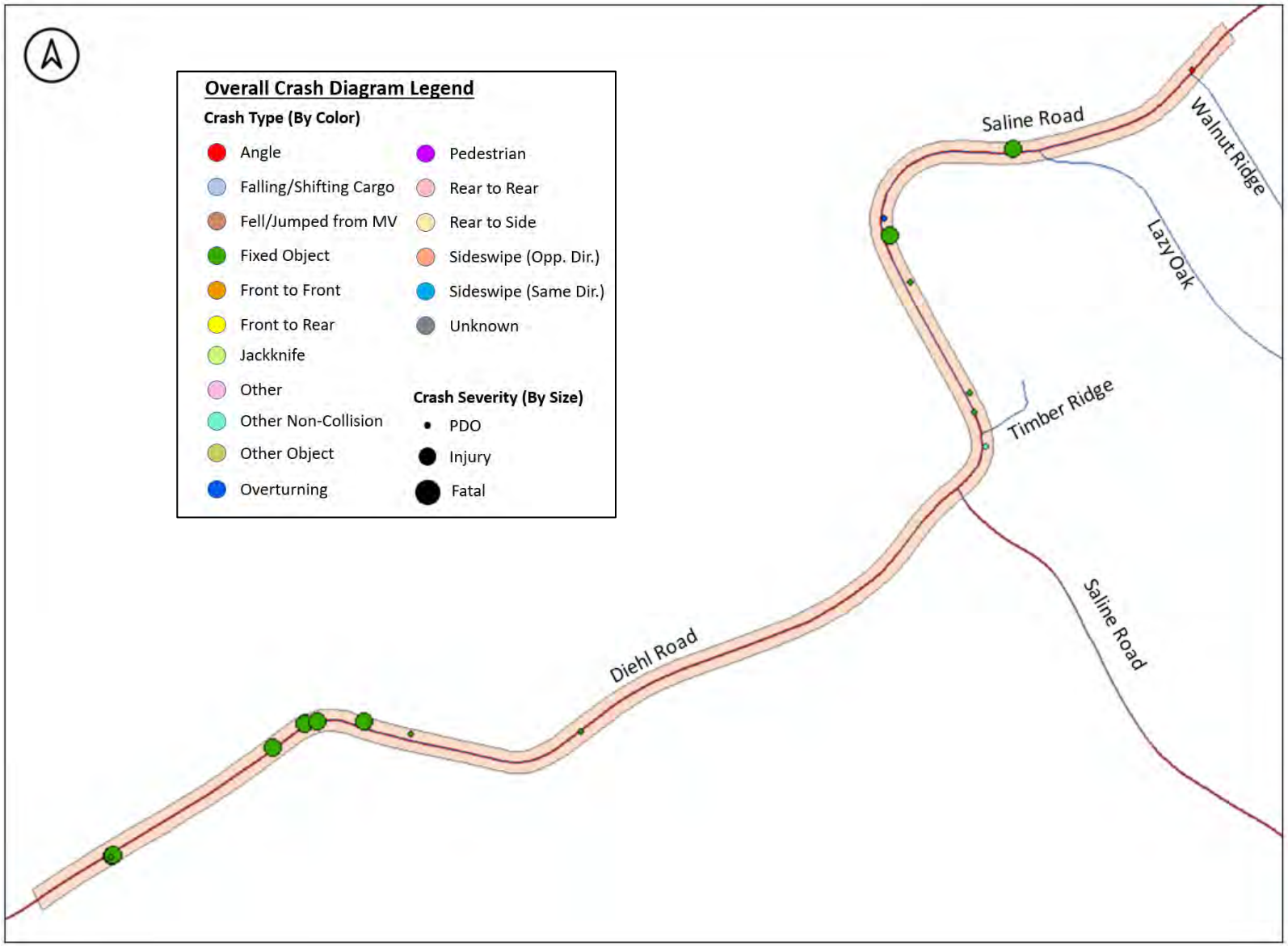


FIGURE 12: PRIORITY LOCATION 12 CRASHES BY TYPE

AERIAL 12: DIEHL ROAD/SALINE ROAD FROM OLD SUGAR CREEK ROAD TO WALNUT RIDGE

CRASH DIAGRAM 12: PRIORITY LOCATION 12 OVERALL



Contributing Factors

PHOTO 12 A:FIRST CURVE, ABOUT 1000' EAST OF OLD SUGAR CREEK ROAD

There are three clusters of crashes in this study area, located along the three sharpest curves. At the first curve (starting from the west, about 1000 feet east of Old Sugar Creek Road), there is an arrow sign and a couple of chevrons with inconsistent spacing and no advance horizontal alignment signs. As can be seen in **Photo 12a,** there are several trees in close proximity to the traveled way that act as fixed objects for vehicles that depart the roadway. Just east of this curve is a retaining wall associated with a drainage ditch (pictured in **Photo 12b**) that is unmarked and was associated with at least one crash in the study period.

PHOTO 12 B: CULVERT AND RETAINING WALL ALONG NORTH SIDE OF DIEHL ROAD

The second curve, just east of the intersection of Diehl Road and Saline Road, has only an arrow sign and no chevrons. During a site visit, vegetation was observed to be blocking the arrow sign at the curve, and the arrow sign at the intersection itself was observed to be weathered.

The third cluster of crashes occurred on the curve just west of Lazy Oak. This curve has chevrons and horizontal alignment signs, but there is an edge drop off and vegetation blocking sight lines on the inside of the curve (seen in **Photo 12c**).

PHOTO 12 C: CURVE JUST WEST OF LAZY OAK, LOOKING NORTH

Countermeasures

Potential countermeasures for Diehl Road/Saline Road from Old Sugar Creek Road to Walnut Ridge include the following:

1. Install edge line rumble strips along the curves at either end of the study area. Rumble strips could be applied throughout the segment, but as roadway departures are concentrated in these locations, rumble strips can be applied intermittently to save on both cost and noise levels.
2. Add horizontal alignment signs with advisory speeds to the westernmost curve in the study area. Replace/relocate the chevrons and arrow sign at that location to be consistent with MUTCD guidelines and better guide drivers; remove trees and other fixed objects directly adjacent to the roadway.
3. Delineate the retaining wall along the north side of Diehl Road with object markers and regularly clear the brush in that area so drivers can see the drop off.
4. At the intersection of Diehl Road and Saline Road, replace the arrow sign at the intersection and install chevrons on the curve directly east of the intersection.
5. Grade the inside of the curve just west of Lazy Oak to eliminate the sharp drop off and provide a ditch for improved drainage.
6. Cut back the brush along the curves in the study area to improve sight distance and visibility of curve signing.

If removing fixed objects and improving signage at the westernmost curve of this project segment is ineffective, roadway realignment to flatten the curve at this location should be considered.

Priority Location #13: High Ridge Boulevard and Capetown Village Road

Existing Conditions

The intersection of High Ridge Boulevard and Capetown Village Road/ Crossroads Place is a two way stop controlled intersection with Capetown Village Road and Crossroads Place being stop controlled. Capetown Village Road is a public street with a single lane approaching the intersection and is provided with 11-foot lanes marked with double yellow centerline and white edgelines. The speed limit on Capetown Village Road is 25 mph. Crossroads Place is a private drive without any pavement markings. High Ridge Boulevard transitions from five lanes to three lanes at the intersection with Capetown Village Road/Crossroads Place. The marked lanes on High Ridge Boulevard are 12 feet wide. The posted speed limit on High Ridge Boulevard is 35 mph. The topography of the area consists of gentle hills. High Ridge Boulevard has a large radius curve at the intersection while the approach of Capetown Village includes two sharp turns. No warning signs are present on the approaches to this intersection.

Crash Patterns

At this intersection, there were 18 total crashes including nine injury crashes (1 severe, 3 minor, & 5 injury possible) and nine PDO crashes. There were six angle crashes, two fixed object crashes, one front to front crash, six front to rear crashes, one other crash, and two sideswipe-opposite direction crashes. Of the total number of crashes, only one occurred on wet pavement and only two occurred during dark lighting conditions.

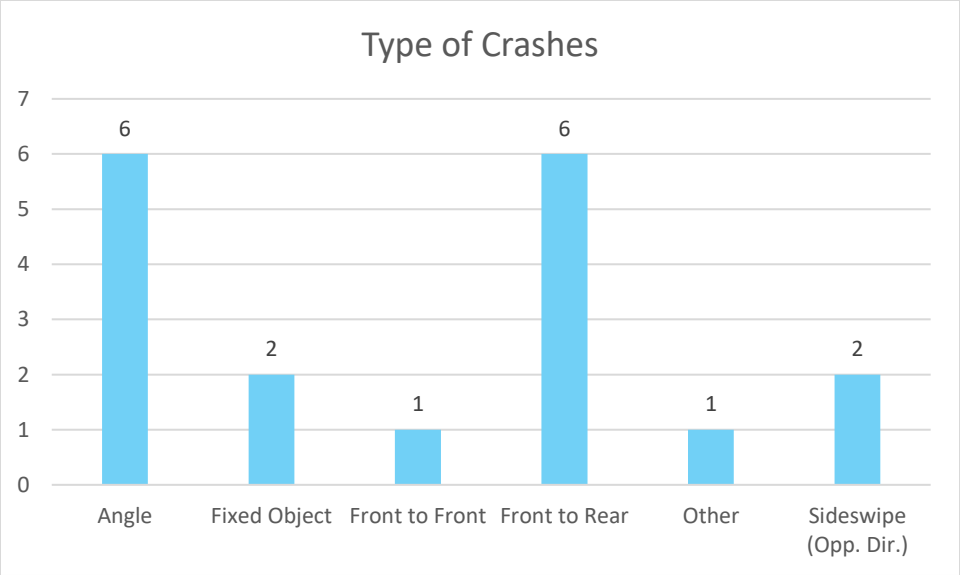
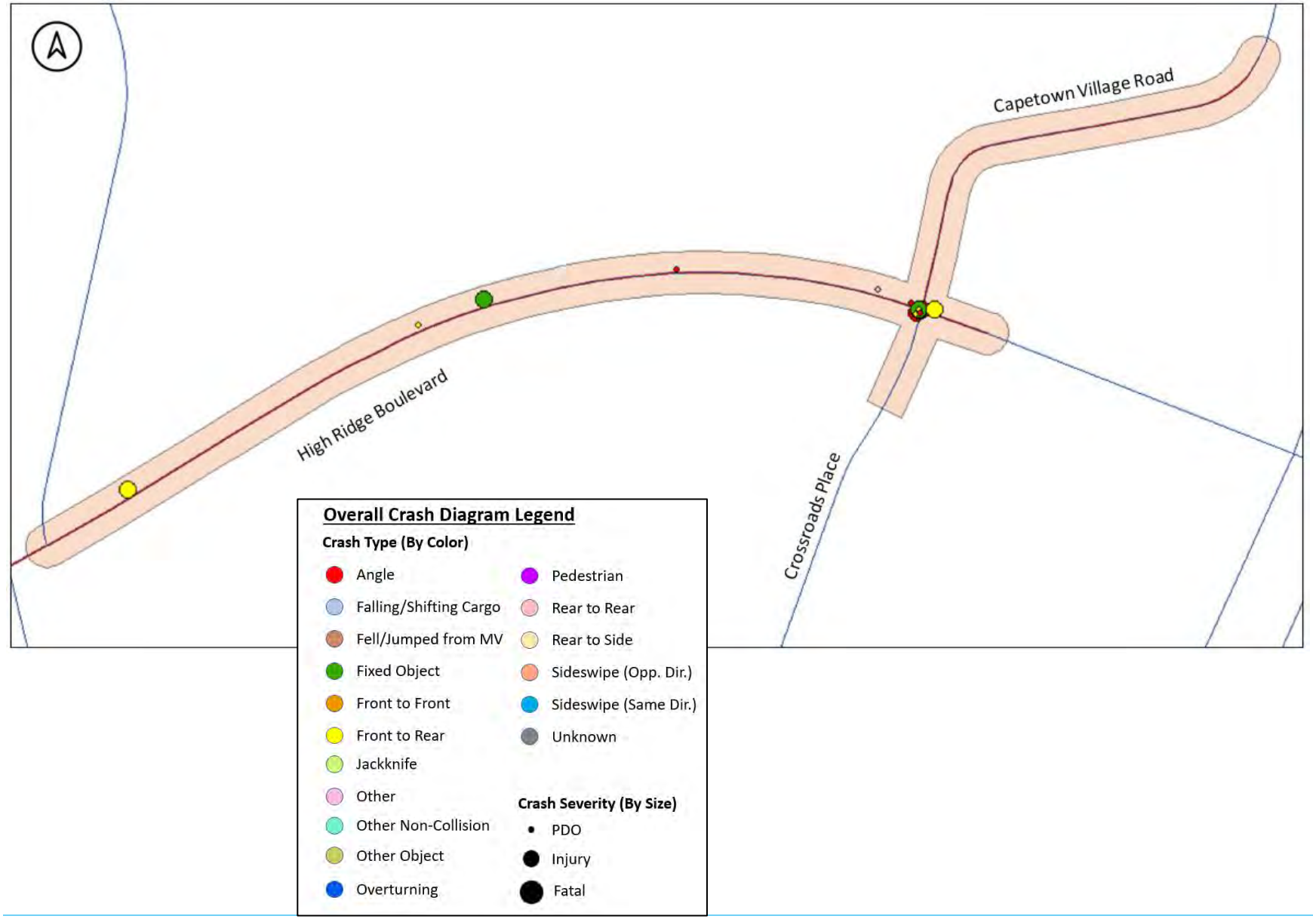


FIGURE 13: PRIORITY LOCATION 13 CRASHES BY TYPE

AERIAL 13: HIGH RIDGE BOULEVARD AND CAPETOWN VILLAGE ROAD

CRASH DIAGRAM 13: PRIORITY LOCATION 13 OVERALL



Contributing Factors

Crashes at the intersection of High Ridge Boulevard and Capetown Village Road are generally due to either left turning vehicles failing to yield or inattentive drivers in rear end situations. **Photo 13a** shows the northbound approach to the intersection (Crossroads Place).

PHOTO 13 A: NB INTERSECTION APPROACH, CROSSROADS PLACE

There is a small section of landscaping blocking sight distance in the SW quadrant of the intersection that was referenced as a factor in at least one crash report. The Crossroads Place features only a stop sign and no pavement markings. According to reports, several crashes involved vehicles taking right turns too wide or left turns too tight into Crossroads Place and hitting a vehicle waiting at the stop sign there. Given that the approach width is over 45 feet prior to the radius, there is space to delineate lanes, including a right turn lane. Marking out lanes on this approach may assist drivers in positioning themselves properly and separating opposing streams of traffic.

Countermeasures

Potential countermeasures for the intersection of High Ridge Road and Capetown Village Road include the following:

1. Install stop signs at the driveways just west of Capetown Village Road, particularly at the Fellowship Baptist Church entrance and Coachlight Plaza.
2. Reinforce the two-way stop control at Capetown Village Road/Crossroads Place by installing new, larger size stop signs with an added Cross Traffic Does Not Stop plaque (W4-4P) on the Capetown Village Road and Crossroads Place approaches.
3. Use pavement markings to delineate lanes and add a painted stop line on the Crossroads Place approach. Install double yellow centerline to the Shop ‘n Share/Walgreens access.
4. Remove the landscaping at the SW corner of the intersection to eliminate sight distance restrictions.
5. Remove guardrail north of Crossroads Place on High Ridge Road, as it does not appear to be warranted under the AASHTO Roadside Design guidance and is placed too low presenting a fixed object hazard and sight obstruction.

Priority Location #14: Lonedell Road from Valley Drive to Jean Drive

Existing Conditions

Lonedell Road is generally a two-lane road in the study segment and has a double yellow centerline and white edge lines. The lanes on Lonedell Road are approximately 10.5 feet wide. The topography of the area consists of gentle hills with a winding road. The posted speed limit is 30 mph. Some horizontal alignment signs are present in the study area and there are edge line rumble strips throughout the segment.

Crash Patterns

Overall, this segment had 26 crashes including one fatal crash, four injury crashes (3 minor, 1 injury possible), and 21 PDO crashes. Fourteen crashes occurred on wet pavement, one on icy pavement, and ten during dark conditions. In curve area near Great Oak Drive the crash breakdown was: 1 angle, 7 fixed object, 1 overturning, 3 sideswipe-opposite; 6 wet crashes, 1 ice/frost, 5 dark-unlighted). There were 3 crashes in area of intersection with Hillcrest Road (1 angle, 1 fixed object, 1 front to front; 2 dark-unlighted). In the winding road area south of Richard Drive there were 9 crashes: (2 angle, 3 fixed object, 2 front to front, 2 sideswipe-opposite; 7 wet crashes, 2 dark-unlighted).

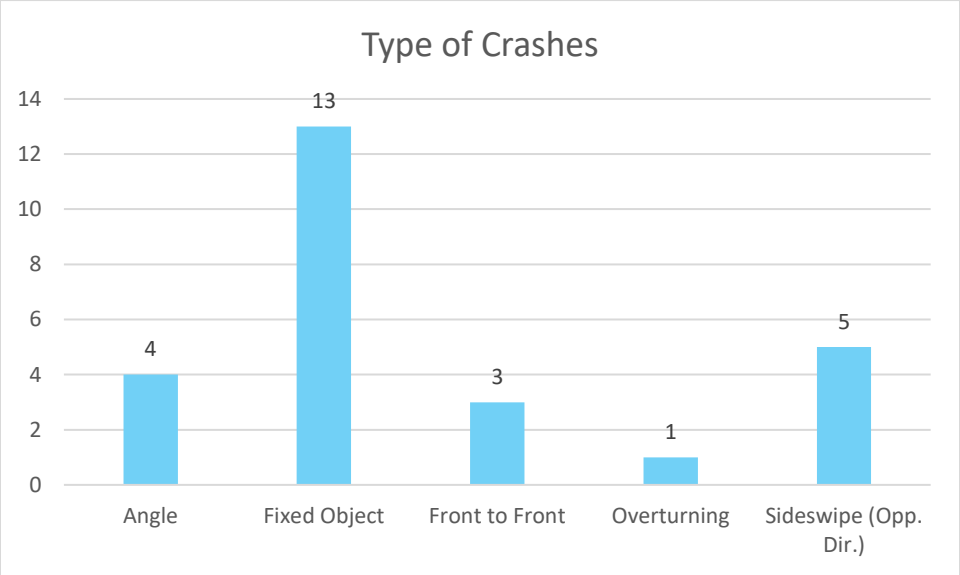
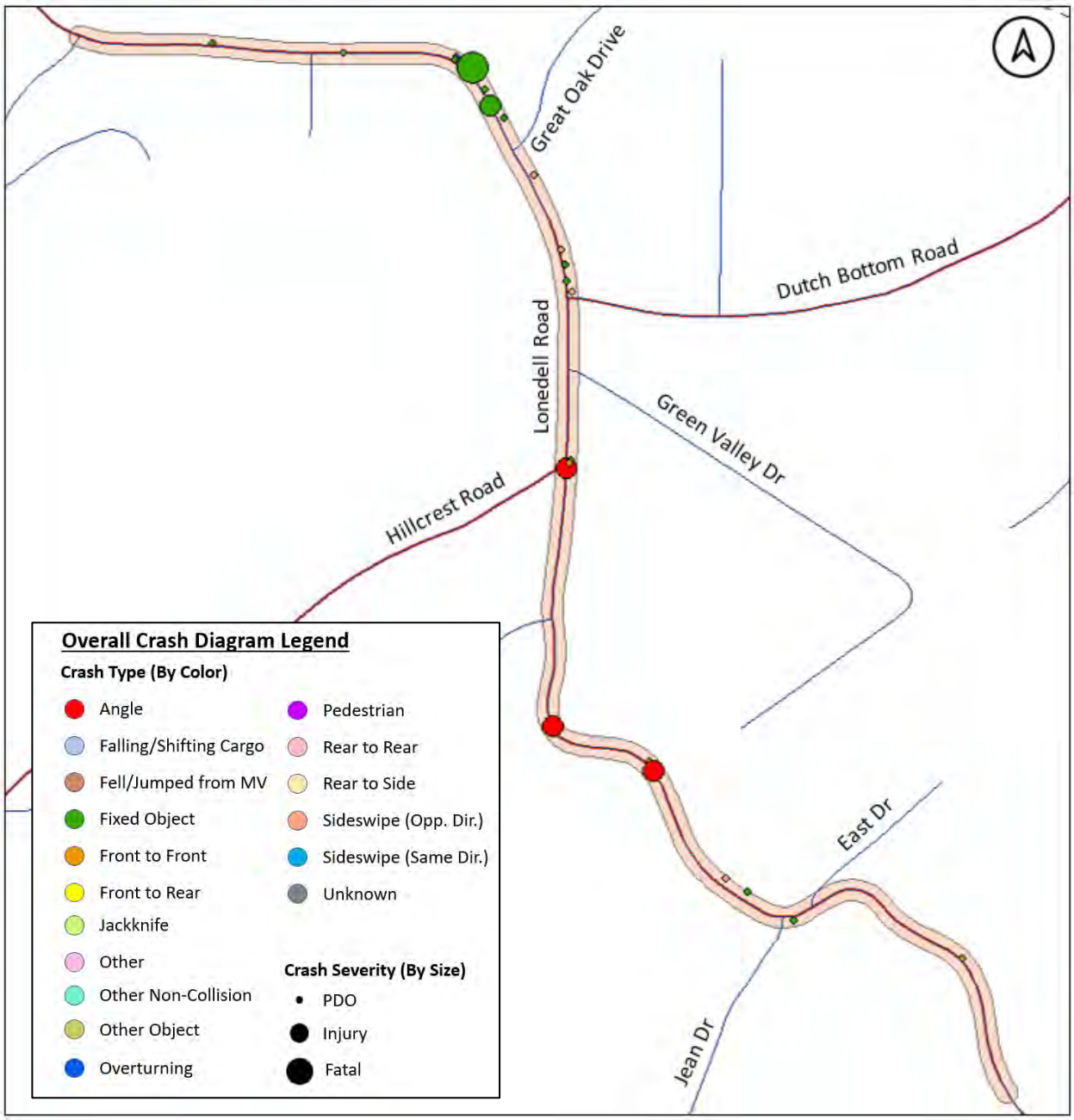


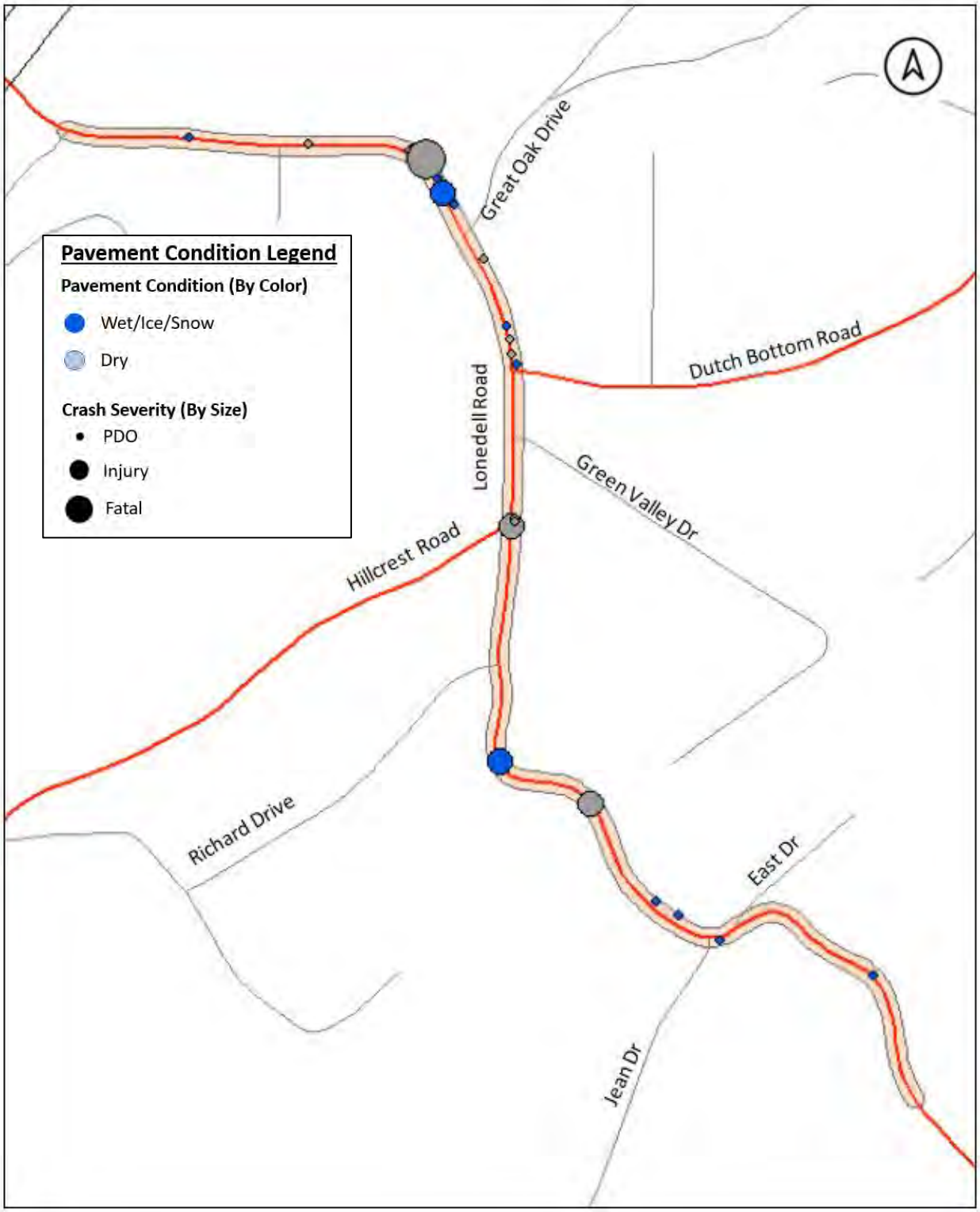
FIGURE 14: PRIORITY LOCATION 14 CRASHES BY TYPE

AERIAL 14: LONEDELL ROAD FROM VALLEY DRIVE TO JEAN DRIVE

CRASH DIAGRAM 14A: PRIORITY LOCATION 14 OVERALL



CRASH DIAGRAM 14B: PRIORITY LOCATION 14 CRASHES BY PAVEMENT CONDITIONS



Contributing Factors

At the curve just north of Great Oak Drive (pictured in **Photo 14a**) there is a cluster of fixed object crashes, most of which involve vehicles losing control and crossing the centerline. The utility pole located adjacent to the roadway on the outside of the curve was reported as being hit in at least three crash reports during the study period. The utility poles should be relocated. It is recommended that an outside shoulder and grading also be considered within this area to provide a recoverable roadside. High Friction Surface Treatment (HFST) should be considered at this location to provide additional traction and prevent loss of control. There is a small cluster of crashes near the intersection of Dutch Bottom Road, but upon reviewing crash reports, those crashes can largely be attributed to the curve near Great Oak Drive.

PHOTO 14 A: CURVE JUST NORTH OF GREAT OAK DRIVE

To address wet weather crashes throughout the segment, existing culverts and drainage structures in the area should be cleaned out to ensure proper operation. Driveway culverts are present throughout.

At the intersections of Dutch Bottom Road and Hillcrest Road with Lonedell Road, brush should be cleared at the corners to improve sight distance. At Hillcrest Road in particular, the embankment as well as the vegetation may be blocking sight distance (shown in **Photo 14b**). A stop line and Stop Ahead sign may be helpful in reinforcing the stop control at Hillcrest Drive.

PHOTO 14 B: HILLCREST DRIVE AND LONEDELL ROAD INTERSECTION

Photo 14c shows a limited sight distance caused by vertical and

horizontal alignment in the area of the reverse curves west of Jean Drive. There is a winding road sign present at this location, but no chevrons on the southern portion of the reverse curve. HFST should be considered through the reverse curve area between Richard Drive and Jean Drive to help vehicles maintain traction and avoid leaving the roadway.

PHOTO 14 C: LIMITED SIGHT DISTANCE AT REVERSE CURVES WEST OF JEAN DRIVE

Countermeasures

Potential countermeasures for Lonedell Road from Valley Drive to Jean Drive include the following:

1. Relocate the utility pole on the outside of the curve north of Great Oak Drive.
2. Install a shoulder on the outside of the curve to provide recovery space.
3. Clear out debris from existing culverts and drainage structures throughout the study area to ensure proper drainage and reduce wet weather-related crashes.
4. Cut back vegetation to improve intersection sight distance at Hillcrest Road and any other locations where overgrown. Consider cutting back the embankment slope at Hillcrest Road if possible to further improve sight distance.
5. Add a painted stop line and a Stop Ahead (W3-1) sign on the Hillcrest Road approach to Lonedell Road.
6. Add chevrons to the portion of the reverse curve west of Jean drive and clear vegetation on the inside of that same curve to improve visibility.
7. Consider HFST for the Great Oak Drive curve and the reverse curve area between Richard Drive and Jean Drive to help vehicles maintain traction and avoid leaving the roadway.

Roadway realignment resulting in a more gradual curve at the northernmost curve of this project segment may be considered as a higher cost solution (in conjunction with shoulders).

Priority Location #15: Saline Road from Chancellor Lane to Romaine Creek Road

Existing Conditions

Saline Road between Chancellor Lane and Romaine Creek Road is generally a two-lane road in the study segment and has a double yellow centerline and white edge lines. The lanes on Saline Road are approximately 11 feet wide. The topography of the area consists of rolling hills with a winding road. The posted speed limit is 30 mph. Horizontal curve warning signs are present on this roadway segment.

Crash Patterns

The total number of crashes in this segment was 20. There were seven injury crashes (2 severe, 5 minor) and 13 PDO crashes including four dark condition crashes and three wet pavement crashes.

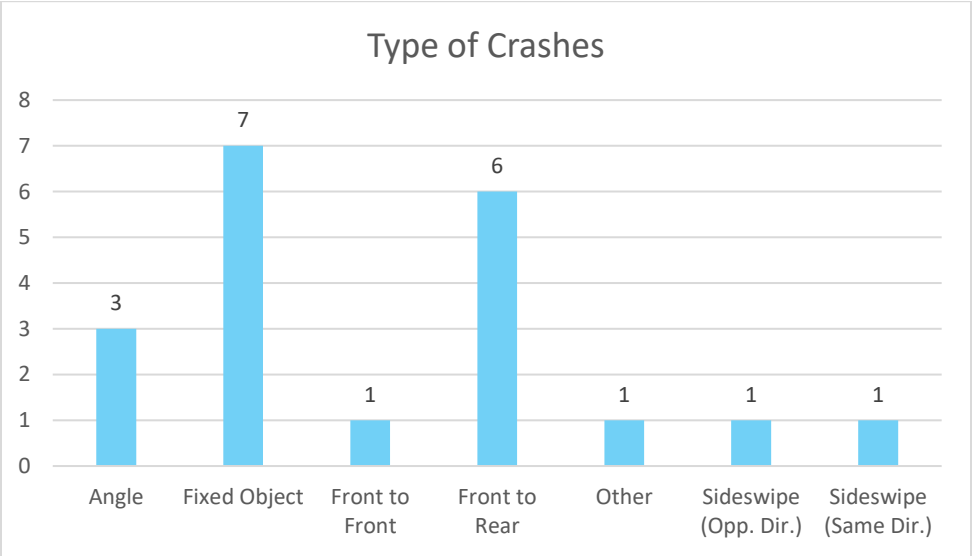
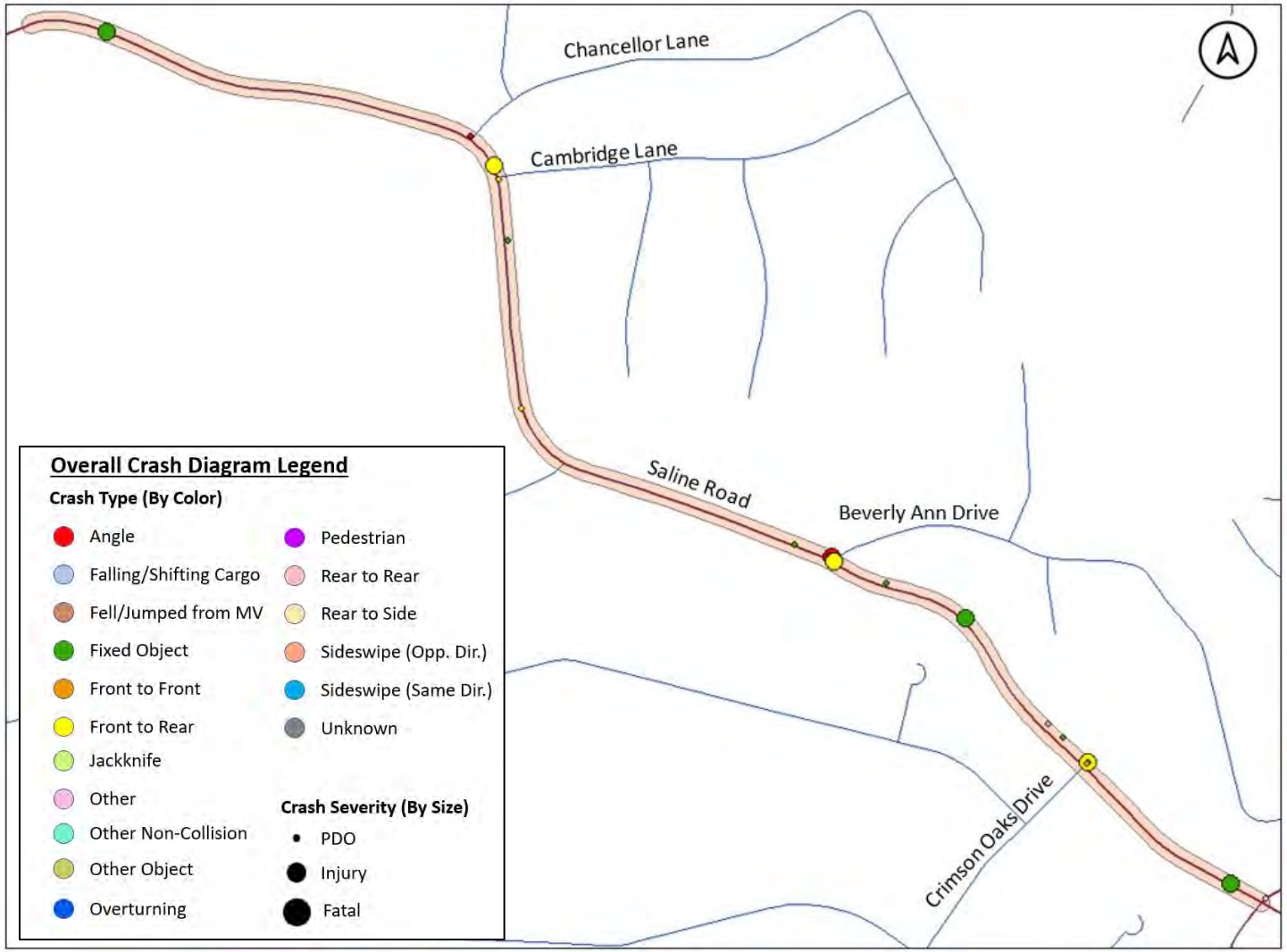


FIGURE 15: PRIORITY LOCATION 15 CRASHES BY TYPE

AERIAL 15: SALINE ROAD FROM CHANCELLOR LANE TO ROMAINE CREEK ROAD

CRASH DIAGRAM 15: PRIORITY LOCATION 15 OVERALL



Contributing Factors

The three main clusters of crashes reported along this segment of Saline Road were intersection related crashes at Cambridge Lane, Beverly Ann Drive, and Crimson Oaks Drive. None of those side streets have painted stop lines or arrow signs across from them. Beverly Ann Drive, shown in **Photo 15a**, has visual obstructions blocking sight lines that were referenced in at least two crash reports at that location. Both Beverly Ann Drive and Crimson Oak Drive have decorative rocks close to the roadway that act as fixed objects for vehicles that may leave the roadway.

PHOTO 15 A: VISUAL OBSTRUCTIONS AT BEVERLY ANN DRIVE, LOOKING EAST ON SALINE ROAD

On the curve between Beverly Ann Drive and Crimson Oaks Drive, there are chevrons leading into the curve from the east on the south side, but no chevrons on the outside of the main curve to the north. There are horizontal alignment signs with advisory speeds present.

Countermeasures

Potential countermeasures for Saline Road from Chancellor Lane to Romaine Creek Road include the following:

1. Add a stop sign at Chancellor Lane.
2. Add painted stop lines at Cambridge Lane, Beverly Ann Drive, and Crimson Oaks Drive to reinforce stop control at those locations.
3. Install an arrow sign across from Cambridge Lane and Beverly Ann Drive.
4. Clear the vegetation blocking intersection sight distance at Beverly Ann Drive. Remove trees directly adjacent to the roadway at this location to reduce fixed object hazards.
5. Relocate the decorative rocks along Beverly Ann Drive and Crimson Oaks Drive to eliminate fixed objects along the roadway.
6. Install chevrons along the north side of the curve between Beverly Ann Drive and Crimson Oaks Drive.

Long term alternatives may include evaluating the intersections of Cambridge Lane, Beverly Ann Drive and Crimson Oaks drive for dedicated left turn lanes.

Priority Location #16: New Sugar Creek Road from Coil Road to Sugar Creek Square

Existing Conditions

New Sugar Creek Road is generally a three-lane road in the study segment provided with a two way left turn lane and white edge lines. The lanes on New Sugar Creek Road are approximately 11 feet wide. The topography of the area is gentle hills while the roadway is tangential with a gentle large radius curve. The posted speed limit is 40 mph. A few horizontal alignment signs are present in the study segment. Note that this project area is part of a current resurfacing project STP-5472(603), but that project does not include safety improvements as discussed here.

Crash Patterns

Crash data for this segment was sorted so that crashes associated with Gravois Road, a MODOT maintained roadway, were not included. Overall, on this segment there were 22 crashes, including six injury crashes (1 severe injury crash, 1 minor injury crash, 4 injury possible) and 16 PDO crashes. There was a crash pattern associated with Sugar Creek Square and Grandview Drive just north of Gravois and MO 30 (1 injury crash, 8 PDO). A small crash pattern was noted at Lark Industrial Drive (3 crashes – 2 front to rear and 1 fixed object) and another small crash pattern near Coil Rd (2 front to rear and 1 angle; 1 wet).

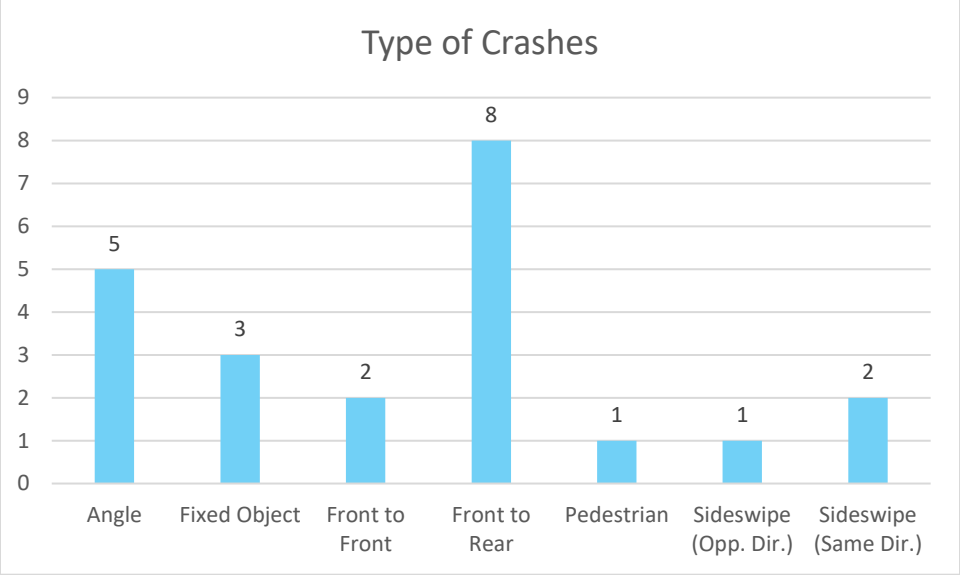


FIGURE 16: PRIORITY LOCATION 16 CRASHES BY TYPE

AERIAL 16: NEW SUGAR CREEK ROAD FROM COIL ROAD TO SUGAR CREEK SQUARE

CRASH DIAGRAM 16: PRIORITY LOCATION 16 OVERALL

Contributing Factors

Most of the side street stop signs along this segment are too small and/or weathered to the point of no longer meeting MUTCD standards, an example of which can be seen in **Photo 16a**. As most of the crashes in this area are access related, stop control on the side streets intersecting with New Sugar Creek Road should be updated to better get the attention of drivers.

PHOTO 16 A: WEATHERED STOP SIGN AT MILLER DRIVE

Crash reports referenced several instances of congestion related crashes and improper use of the two way left turn lane along this segment. Sight distance on side streets may also be an issue due to overgrown vegetation, which should be trimmed back.

Countermeasures

Potential countermeasures for New Sugar Creek Road from Coil Road and Sugar Creek Square include the following:

1. Upgrade existing weathered, undersized, and low-mounted stop signs at side streets along this segment to ensure the signs are noticeable day and night.
2. Add stop lines at the more trafficked intersecting side streets to establish the location where vehicles must stop. These stop lines would help mitigate crashes caused by vehicles stopping past the stop signs and "creeping" out onto New Sugar Creek Road
3. Install Two-Way Left Turn Only Signs (R3-9b) along the corridor.
4. Improve intersection sight distance along the segment by trimming back trees and other vegetation that may be blocking sight lines.
5. Add an arrow sign across from Grandview Drive.

Priority Location #17: Miller Road from Vogel Road to Corral Estates Drive

Existing Conditions

Miller Road is generally a two-lane road with 11-foot lanes in the study segment. The topography of the area is rolling hills while the roadway is tangential with a posted speed limit of 30 mph. Note that this segment is directly south of the intersection of Miller Road and Vogel Road, which is addressed above as a separate project due to the differences in the crash patterns of the two areas.

Crash Patterns

Along Miller Road south of the intersection at Vogel Road, there were 23 crashes (5 personal injury and 18 PDO). Ten (10) of these were fixed object crashes followed by 5 rear end crashes and 4 angle crashes. Four crashes occurred during wet/snow pavement conditions, and seven crashes occurred under dark lighting conditions.

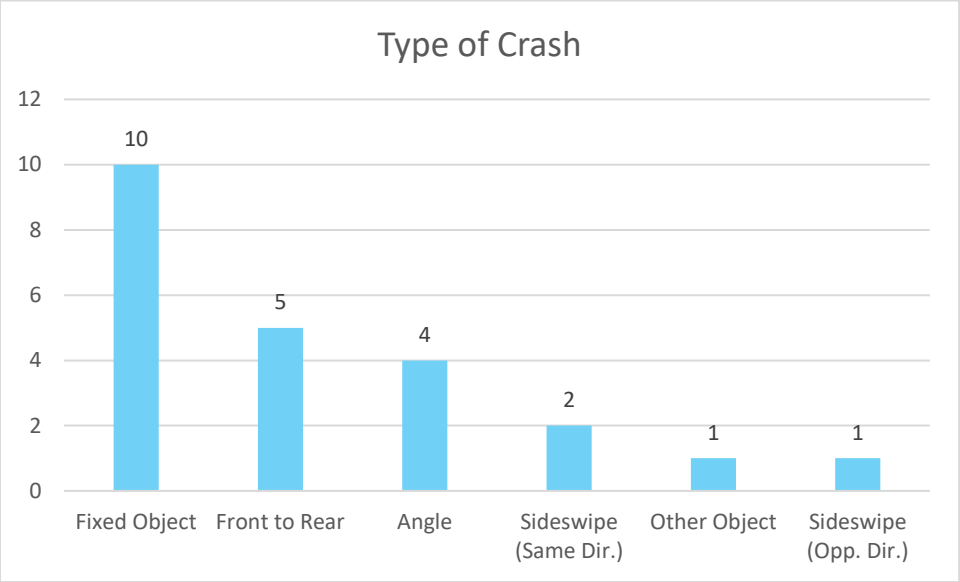
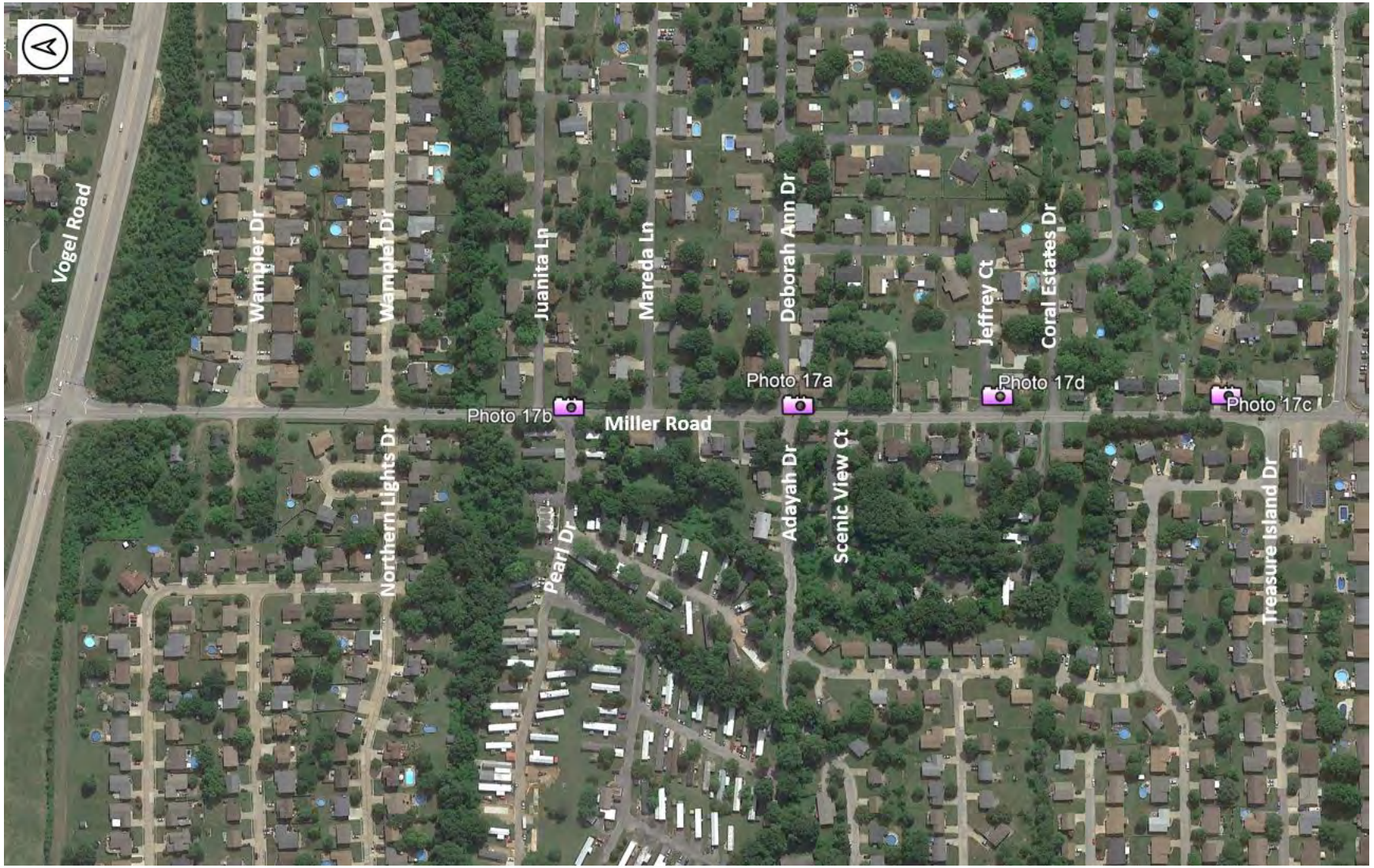


FIGURE 17: LOCATION 17 CRASHES BY TYPE

AERIAL 17: MILLER ROAD FROM VOGEL ROAD TO CORAL ESTATES DRIVE



CRASH DIAGRAM 17: PRIORITY LOCATION 17 OVERALL CRASHES

Contributing Factors

The segment of Miller Road south of the intersection with Vogel Road runs through a residential area with several stop-controlled side street intersections. Most of the side street stop signs along this segment are too small and/or not reflective and do not have corresponding stop lines, contributing to the angle crashes throughout the corridor. Additionally, sight distance restrictions are present from structures and fencing located throughout the corridor. **Photo 17a** and **Photo 17b** show examples of how sight distance is restricted by fences and signs, respectively.

PHOTO 17 A: FENCES LIMITING SIGHT DISTANCE

PHOTO 17 B: SIGN LIMITING SIGHT DISTANCE

Finally, fixed objects along the roadside should be addressed as there is a pattern of fixed object crashes in this segment. **Photo 17c** shows an example of a non-traversable drainage structure and **Photo 17d** shows decorative rocks and utility poles close to the roadway. Fixed objects like the decorative rocks should be removed wherever possible, and those that cannot be moved should be marked with object delineators.

PHOTO 17 C: NON-TRAVERSABLE DRAINAGE STRUCTURE

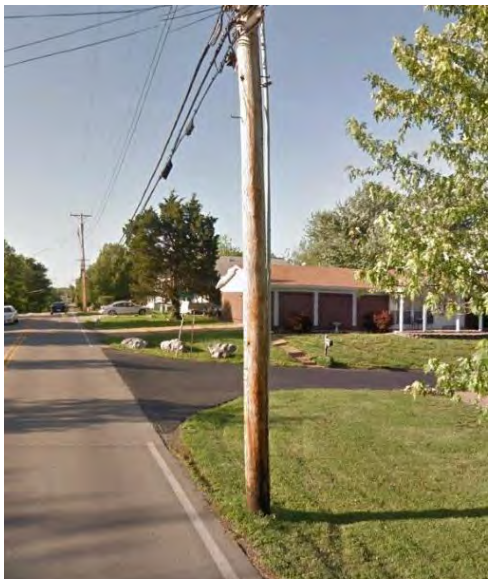


PHOTO 17 D: UTILITY POLE AND DECORATIVE ROCKS

Countermeasures

Potential countermeasures for the segment of Miller Road south of the Vogel intersection include the following:

1. Implement stop lines and updated stop signs at the side street intersections along this segment to mitigate access related crashes.
2. Remove decorative fixed objects, like decorative rocks, within right of way where possible to mitigate fixed object crashes.
3. Reconstruct and/or redesign non-traversable drainage structures with flush mounted catch basins along the roadway.
4. Delineate utility poles adjacent to the roadway with Type 3 Object Markers (MUTCD OM3).
5. Eliminate or move sight distance restrictions for side streets such as fences, signs, and vegetation where possible within the right of way.

These segment countermeasures could also be applied further south along Miller Road, where there are fewer crashes, but the crash patterns and safety concerns remain consistent with those identified here. A conceptual layout of these countermeasures can be found in Appendix C.

Priority Location #18: Old State Route 21 and Glade Chapel Road/Goldman Spur Road

Existing Conditions

The intersection of Old State Route 21 and Glade Chapel Road/Goldman Spur Road is a two way stop controlled intersection. The Glade Chapel Road and Goldman Spur Road approaches are stop controlled at the intersection with Old State Route 21. Glade Chapel Road is a public road that is not provided with pavement markings on the approach to Old State Route 21. The width of this road is about 25 feet wide and has a speed limit of 30 mph. Goldman Spur Road is a public road and is provided with a single lane approach with Old State Route 21 and has a double yellow centerline and white edgelines. The lane width on Goldman Spur Road is about 10.5 feet wide and the posted speed limit is 35 mph. Old State Route 21 is a two-lane highway segment with a posted speed limit of 50 mph near the intersection Old State Route 21 and Glade Chapel Road. The marked lanes on Old State Route 21 are approximately 10.5 feet wide. The topography of the area consists of gentle hills. Old State Route 21 has a gentle curve in the study area but the side streets have sharp turns on the approaches to the intersection. No advanced intersection warning signs are present on Old State Route 21. Horizontal alignment signs are present on Goldman Spur Road.

Note that this project area is part of a current roadway project STP-5403(684), which includes resurfacing and shoulder work, but that project does not include safety improvements for this intersection.

Crash Patterns

At this intersection, there were three angle, nine fixed object, two front to rear, and two other non-collision crashes totaling 16 crashes. One wet crash and four dark-unlighted crashes were also noted at this location. Of the total number of crashes, five crashes involved injuries (4 minor and 1 injury possible) while eleven crashes were property damage only.

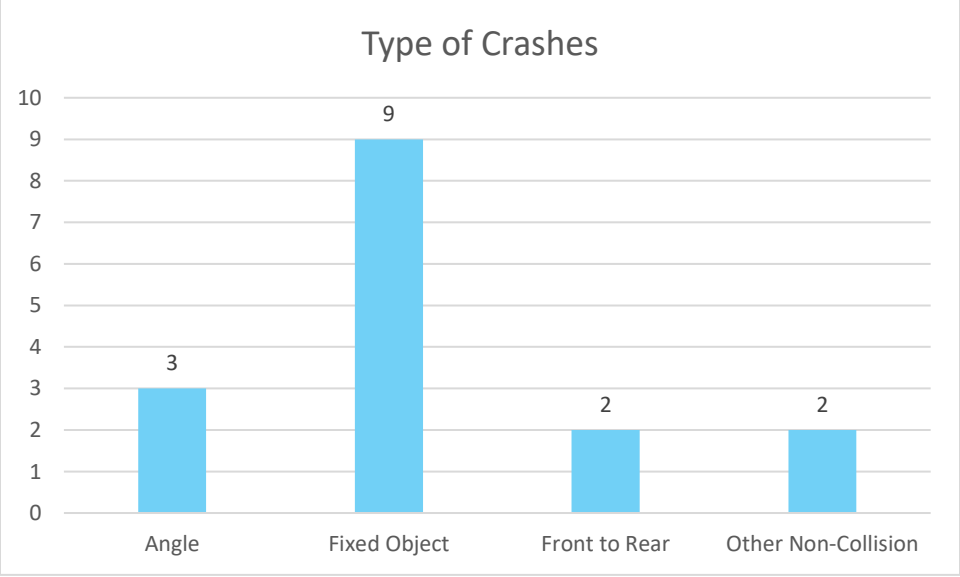
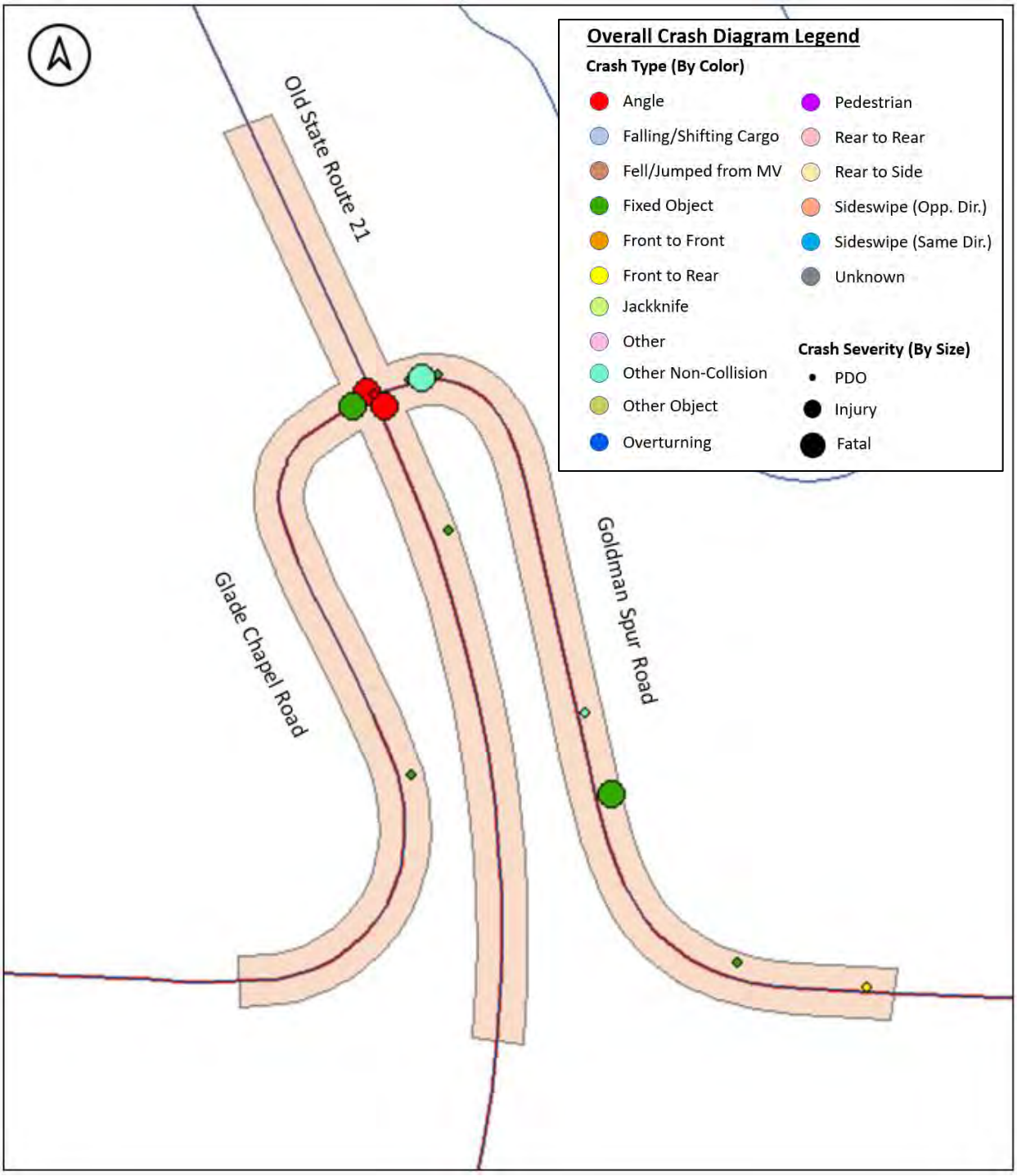


FIGURE 18: PRIORITY LOCATION 18 CRASHES BY TYPE

AERIAL 18: OLD STATE ROUTE 21 AND GLADE CHAPEL ROAD/GOLDMAN SPUR ROAD

CRASH DIAGRAM 18: PRIORITY LOCATION 18 OVERALL



Contributing Factors

The two main concerns at this intersection are stop control at Glade Chapel Road/Goldman Spur Road and navigating the curves on those approaches. Crashes at the intersection itself were largely caused by vehicles failing to yield to traffic on Old State Route 21 due to inattention or limited sight distance. **Photo 18a** shows the view from Glade Chapel Road looking south, where trees and brush limit sight distance. Painted stop lines and stop ahead warning signs on the Glade Chapel Road and Goldman Spur Road approaches may be helpful in reinforcing stop control at those locations. Further, due to the curve approach of Glade Chapel Road, the stop sign on that approach is not immediately obvious since drivers have to look to the right to see it. A second stop sign on the north side of the Glade Chapel Road approach is recommended as it would be within driver sightlines sooner.

PHOTO 18 A: GLADE CHAPEL ROAD APPROACH, LOOKING SOUTH

To address curve related crashes on the side street approaches, large arrow signs should be installed at the sharp curves directly adjacent to Old State Route 21, as well as horizontal alignment signs with advisory speeds prior to the curves. On Old State Route 21, an intersection ahead sign (W2-1) should be placed on the southbound approach to the intersection per MUTCD guidelines. An intersection ahead sign is currently present on the northbound approach, but it is almost 1500 feet in advance of the intersection. This existing W2-1 sign should be relocated closer to the intersection.

Countermeasures

Potential countermeasures for the intersection of Old State Route 21 and Glade Chapel Road/Goldman Spur Road include the following:

1. Clear trees and brush that are blocking intersection sight distance, particularly to the southwest of the intersection.
2. Add painted stop lines and dual mounted stop ahead (W3-1) signs to the Glade Chapel Road and Goldman Spur Road approaches to reinforce stop control at those locations.
3. Install an additional stop sign on the north side of the Glade Chapel Road approach to make the stop control condition more obvious to drivers coming around the curve.
4. Install large arrow signs and horizontal alignment warning signs with advisory speeds for the sharp curves leading into the intersection.
5. Install an intersection ahead sign (W2-1) on southbound Old State Route 21 and relocate the W2-1 sign on the northbound approach closer to the intersection.

Priority Location #19: Old Lemay Ferry Road from East Rock Creek Road to Lion's Den Road

Existing Conditions

Old Lemay Ferry Road between East Rock Creek Road to Lions Den Road is generally a two-lane road in the study segment and has a double yellow centerline and white edge lines. The lanes on Old Lemay Ferry Road are approximately 12 feet wide. The topography of the area consists of rolling hills with a winding road. The posted speed limit is 40 mph. Horizontal curve warning signs are present on this roadway segment. The intersection of Old Lemay Ferry Road with East Rock Creek Road is the site of a current Jefferson County project STP-5461(610) and is therefore omitted for the purposes of this analysis.

Crash Patterns

In this segment, there were 26 total crashes including two injury possible crashes and 24 PDO crashes. Nine crashes occurred on wet pavement and eight crashes occurred during dark lighting conditions (3 dark – lighted, and 5 dark-unlighted). There were seven crashes in area of the curve/intersection with Double Tree Drive (1 angle, 2 fixed object, 3 front to rear, 1 sideswipe-opposite; 2 wet and 1 dark-unlighted), five crashes near the intersection with Eli Avenue (1 angle, 2 fixed object, 1 front to rear, 1 other non-collision; 2 wet, 4 dark condition crashes), 13 crashes in southern section of segment (two reverse curves in this area) that included 3 angle crashes, 4 fixed object crashes, 3 front to rear, 1 other non-collision, 1 other object, 1 sideswipe-opposite (including 5 crashes on wet pavement and 2 during dark conditions).

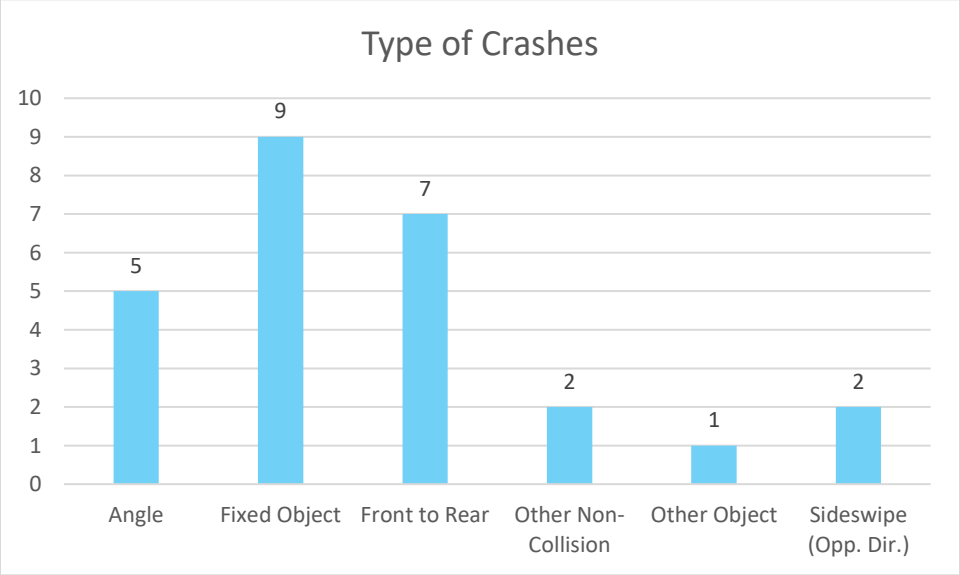
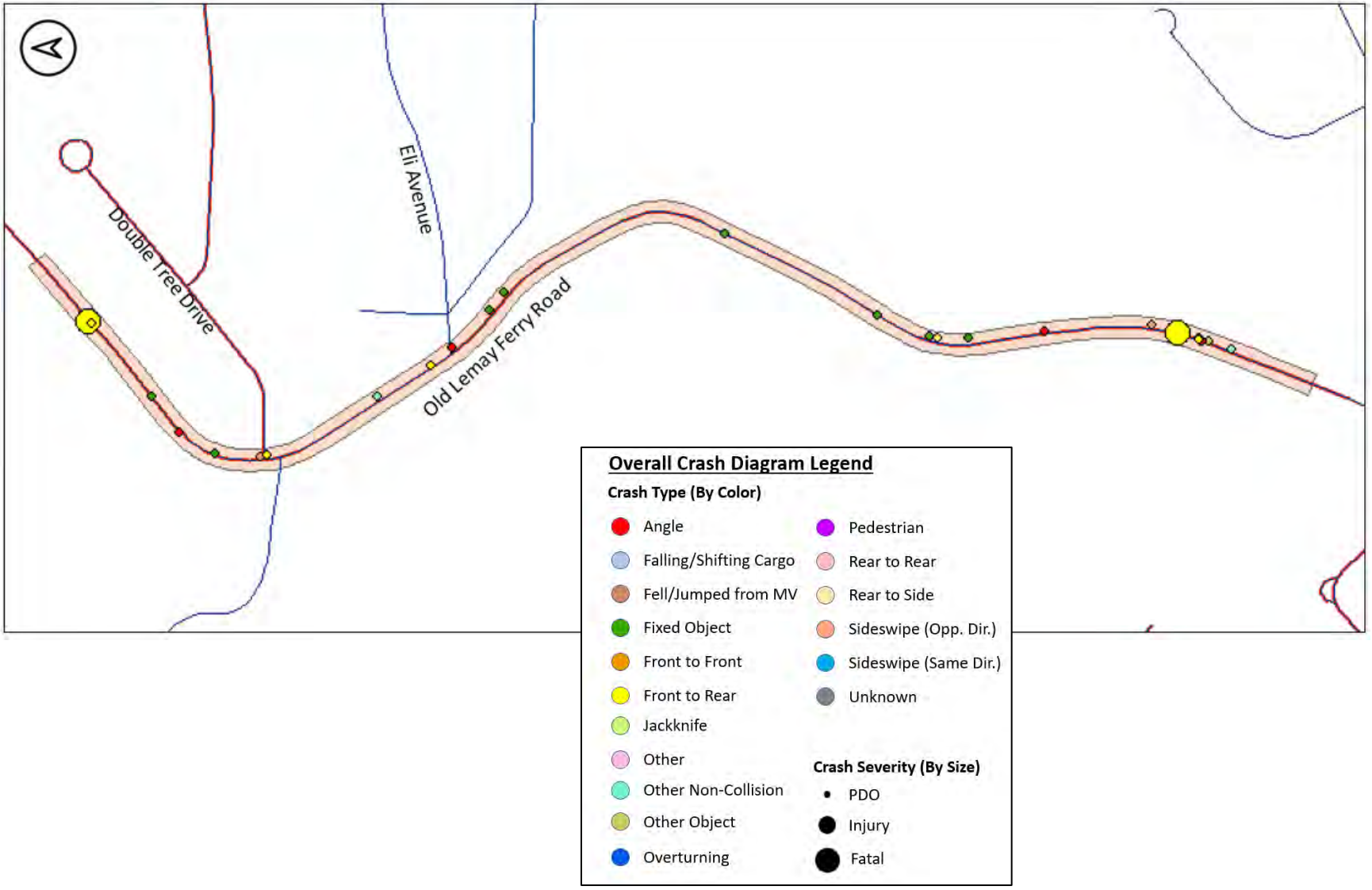


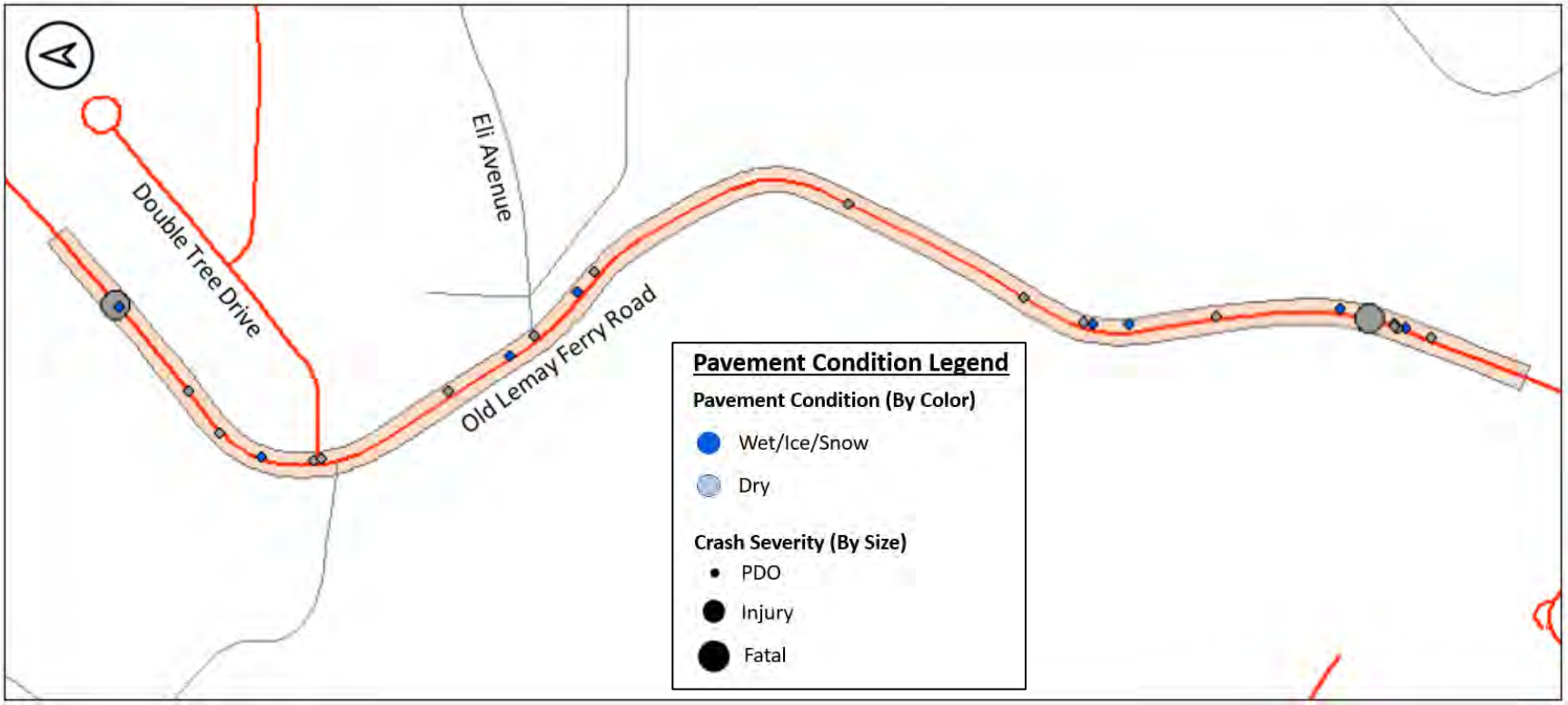
FIGURE 19: PRIORITY LOCATION 19 CRASHES BY TYPE

AERIAL 19: OLD LEMAY FERRY ROAD FROM EAST ROCK CREEK ROAD TO LION'S DEN ROAD

CRASH DIAGRAM 19A: PRIORITY LOCATION 19OVERALL



CRASH DIAGRAM 19B: PRIORITY LOCATION 19 CRASHES BY PAVEMENT CONDITIONS



Contributing Factors

The crashes in this study area were a mix of intersection related crashes at various side streets and driveways as well as curve related crashes. The intersection related crashes were more related to vehicles turning into side streets and driveways than coming out of them. There are segments of limited sight distance in the study area (example in **Photo 19a**) that, despite warning signs present, do not provide adequate stopping sight distance for vehicles coming up behind slower or stopped vehicles making a turn. Lowering the speed limit, or at least the advisory speeds, in the study area may be beneficial in preventing both intersection and curve related crashes.

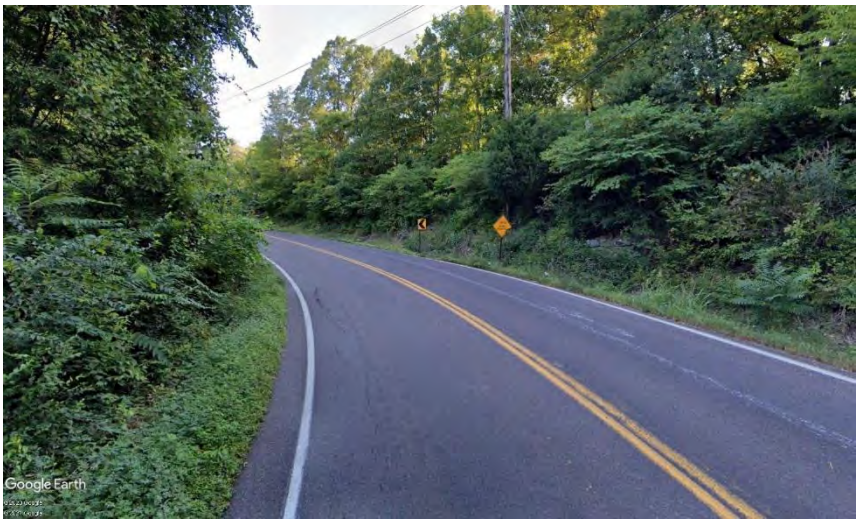


PHOTO 19 A: LIMITED SIGHT DISTANCE ON CURVE SOUTH OF ELI AVENUE

For curve related crashes, there were several instances of vehicles crossing the centerline due to inattentiveness rather than loss of control. In these cases, centerline rumble strips would help keep drivers in their lanes through curve sections. With nine curve related crashes occurring on wet pavement, drainage issues along the corridor should also be addressed.

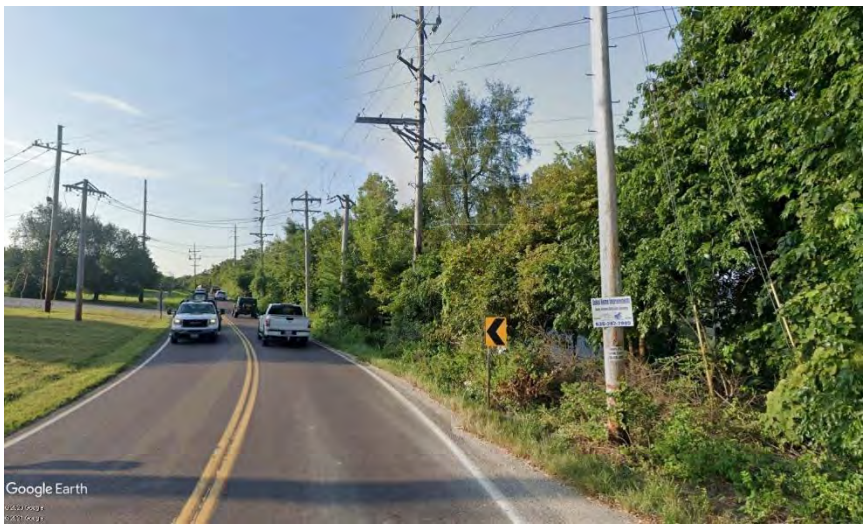


PHOTO 19 B: ROADSIDE UTILITY POLES

Photo 19b shows some of the of the utility poles that line the west side of Old Lemay Ferry Road. There were several crash reports referencing utility poles, none of which feature object markers, being hit.

Countermeasures

Potential countermeasures for Old Lemay Ferry Road from East Rock Creek Road to Lions Den Road include the following:

1. Consider lowering the speed limit, or at least the advisory speeds for congested areas along Old Lemay Ferry Road in the study area to address both intersection and curve related crashes.
2. Install centerline rumble strips through critical curve sections of the Old Lemay Ferry Road in the study area to deter centerline crossings.
3. Delineate utility poles in close proximity to the roadway with object markers.

Priority Location #20: Lonedell Road and Tomahawk Road

Existing Conditions

The intersection of Lonedell Road and Tomahawk Road is an all way stop controlled intersection. Each approach to the intersection consists of a single lane. The lane width on Tomahawk Drive is about 12 feet wide and the lane widths on Londell Drive are about 11 feet wide. Both roads are marked with double yellow centerlines and white edge lines. The topography of the area is rolling hills while the roadways are both winding. The posted speed limit on both roads is 30 mph. A fire station exists on Lonedell Drive at the intersection and obsolete word style advance fire station warning signs are provided on all three intersection approaches. A school is located on Tomahawk Drive near the intersection and is provided with school warning signs. A stop ahead warning sign is provided on westbound Lonedell Drive and edge rumble strips are provided throughout the study area.

Crash Patterns

There were 15 crashes at the intersection: four angle crashes, four fixed object crashes, two front to front crashes, two front to rear crashes, one sideswipe-opposite direction crash, and one sideswipe-same direction crash. Of the 15 crashes, there were also four wet pavement condition crashes and five dark lighting condition crashes (1 dark-lighted, 4 dark-unlighted). Of the 15 crashes at the intersection, there were three injury crashes (1 minor injury and 2 injury possible crashes) and 12 PDO crashes.

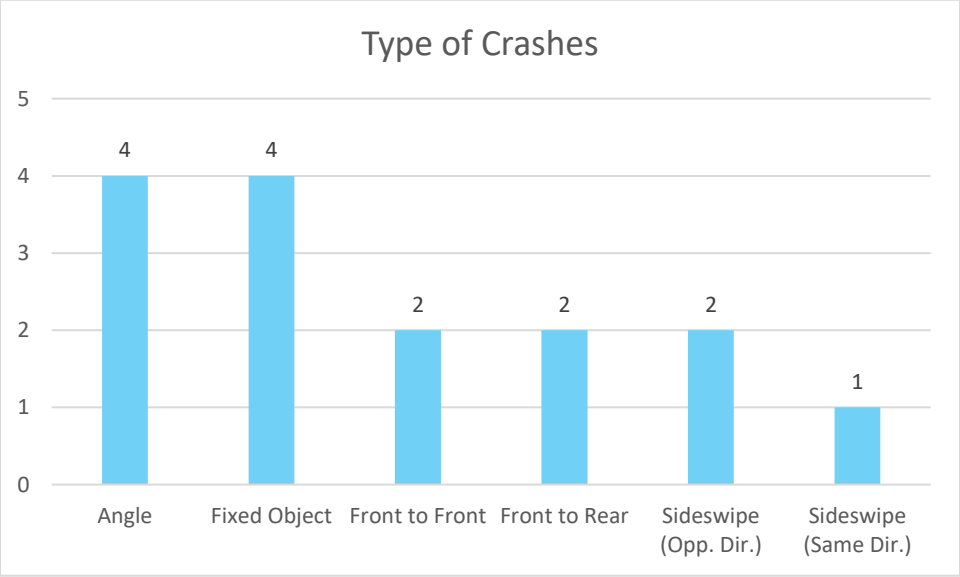
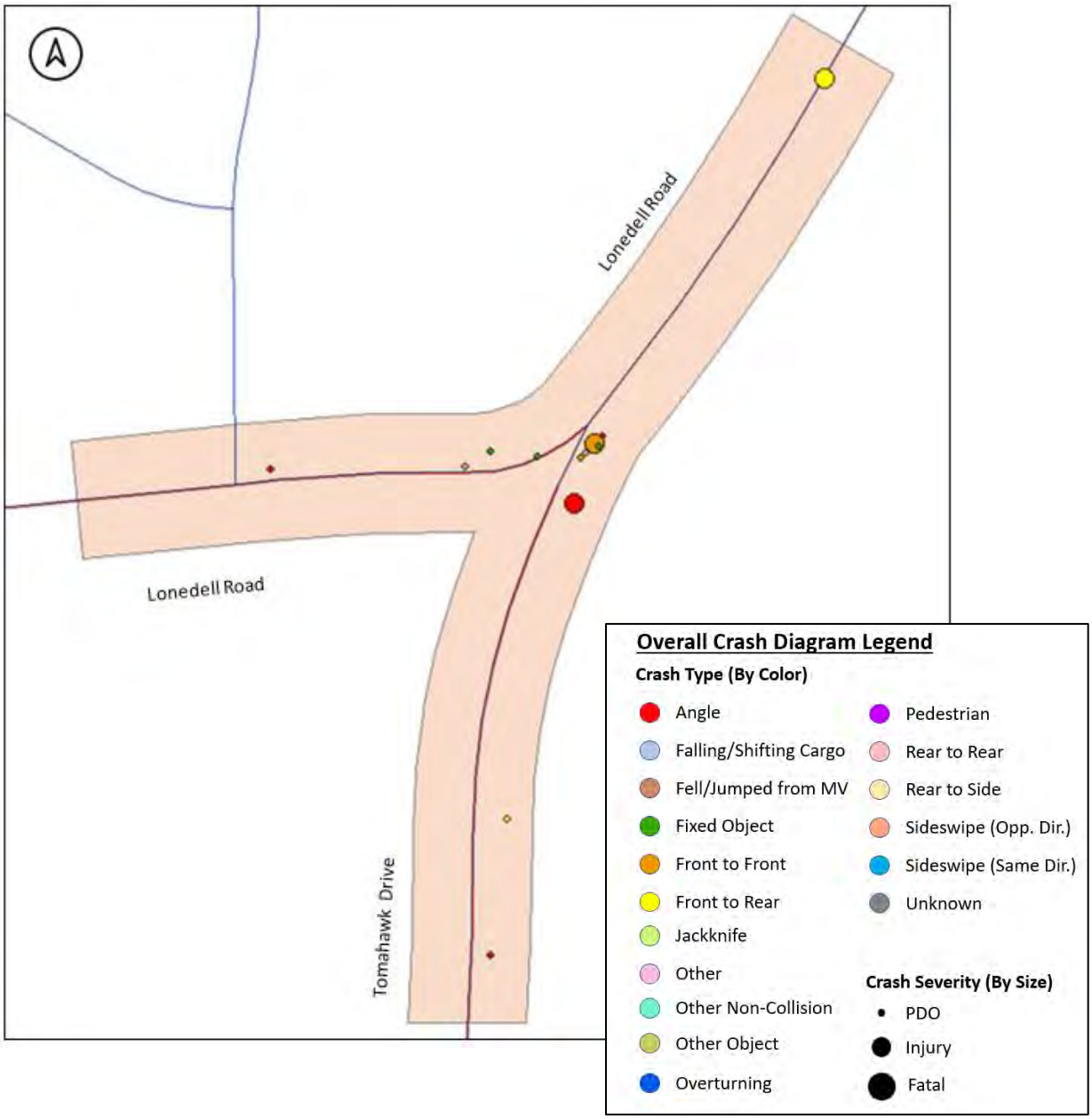


FIGURE 20: PRIORITY LOCATION 20 CRASHES BY TYPE

AERIAL 20: LONEDELL ROAD AND TOMAHAWK ROAD

CRASH DIAGRAM 20: PRIORITY LOCATION 20 OVERALL



Contributing Factors

Countermeasures at the intersection of Lonedell Road and Tomahawk drive should focus on reinforcing stop control and eliminating several safety concerns in the area. Stop ahead (W3-1) signs are recommended on the eastbound and northbound approaches to the intersection.

PHOTO 20 A: TAPER AT ELEMENTARY SCHOOL SOUTH OF INTERSECTION

Photo 20a, as well as the aerial view, shows the large taper present just south of the intersection at the entrance to the elementary school. This wide area of pavement lacks any lane markings to guide drivers through the taper. It is recommended that a dotted white pavement marking be applied to connect the Tomahawk Drive edge lines through the taper and driveway section so that drivers stay in their lane through that area.

PHOTO 20 B: UTILITY POLE AND CONCRETE SLOPE

Photo 20b shows the sharp drop off present along the northeast side of Tomahawk drive near the driveway for 2456 Lonedell Drive. There is a concrete slope and a utility pole positioned within a few feet of the roadway that should be either moved or delineated with an object marker.

Countermeasures

Potential countermeasures for the intersection of Lonedell Road and Tomahawk Drive include the following:

1. Install a stop ahead (W3-1) sign on the eastbound and northbound approaches to the intersection.
2. At the taper near the elementary school entrance, carry the Tomahawk Drive edge line through the taper with a white dotted line to separate the road and the large area of the taper.
3. Relocate stop lines at the intersection of Lonedell and Tomahawk closer together to reduce the size of the intersection. An alternative intersection design, such as a roundabout, could be considered as a long-term solution if low-cost countermeasures are ineffective.
4. If possible, relocate the utility pole and eliminate the concrete slope near the 2456 Lonedell Road Driveway. Delineate with object markers if not possible.
5. Clear brush from the NW quadrant of the intersection to both improve sight distance from the eastbound approach and improve visibility of the southbound stop sign.

APPENDIX C:

CONCEPTUAL LAYOUTS FOR COUNTERMEASURES

Several top project locations identified by this safety study have been selected to provide a conceptual level layout of the countermeasures suggested in Appendix B. The countermeasures given in Appendix B and shown here are suggestions that may be subject to updated field conditions, right of way restrictions, and further engineering investigation.

Notes about concept layouts:

- Items that are not called out may be assumed to be “Use in Place”
- Callouts for removal/delineation of fixed objects and intersection sight distance restrictions may not be comprehensive.
- It is recommended that areas with drainage issues be observed during a rain event to determine causes and evaluate appropriate solutions. Conceptual drainage countermeasures shown here are based on field observations and google earth imagery. Further information will be required for comprehensive drainage design.

SHEET 1 OF 2

PRIORITY LOCATION 1
ROMAINE CREEK RD FROM
KONERT RD TO CALEB CROSSING

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SCALE

0 100 200 300 400 500

GREEN CREEK DRIVE

ORANGE DRIVE

MONCRIEF DRIVE

DEITY DRIVE

SPRING VALLEY DRIVE

MISTY LANE

ROMAINE CREEK ROAD

CALEB CROSSING

SUGAR CREEK COURT

UTILITY POLE
(RELOC. OR PLACE
OBJECT MARKER)

OM3-R
12" x 36"
(UTILITY POLE)

OM3-R
12" x 36"
(UTILITY POLE)

R1-1
30" x 30"

STOP

R1-1
30" x 30"

STOP

W1-7
48" x 24"

WIDEN RADIUS RETURN,
EXTEND CULVERT UNDER
NEW PAVEMENT

CHEVRONS AT
80' SPACING

W1-8
18" x 24"

WIDEN RADIUS RETURN
EXTEND CULVERT UNDER
NEW PAVEMENT

NOTE: A MORE THOROUGH INVESTIGATION OF DRAINAGE
IS REQUIRED TO DETERMINE MORE SPECIFIC TREATMENTS

PRIORITY LOCATION 1
ROMAINE CREEK RD FROM
KONERT RD TO CALEB CROSSING

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 1 OF 2

PRIORITY LOCATION 2
KONERT RD FROM BREEZY OAK LN TO KONERT VALLEY DR

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES

PRIORITY LOCATION 2
KONERT RD FROM BREEZY
OAK LN TO KONERT VALLEY DR

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 1 OF 2

PRIORITY LOCATION 3
OLD STATE ROUTE 21 FROM
LONEDELL RD TO ENCHANTED
FOREST DR

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SCALE

0 100 200 300 400 500

NADINE DR

11′ WIDE TRAVEL LANES

11′ WIDE TWLTL

OLD STATE ROUTE 21

HIDDEN HOLLOW DR

R3-9B
24″ x 36″

CENTER LANE ONLY

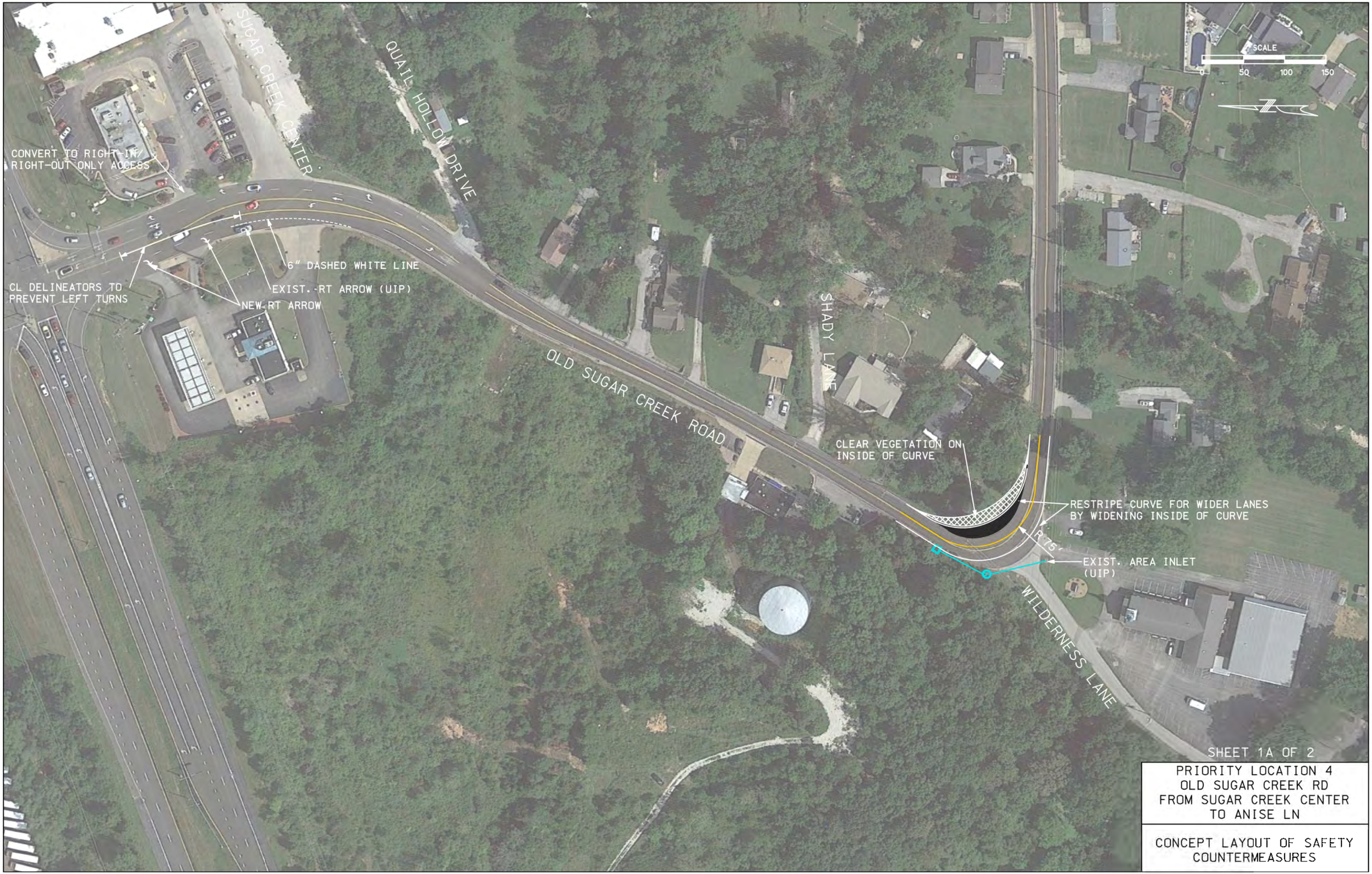
KONERT RD

TWLTL TRANSITIONS TO EXISTING INTERSECTION LT TURN LANE

SHEET 2 OF 2

PRIORITY LOCATION 3
OLD STATE ROUTE 21 FROM LONEDELL RD TO ENCHANTED FOREST DR

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES



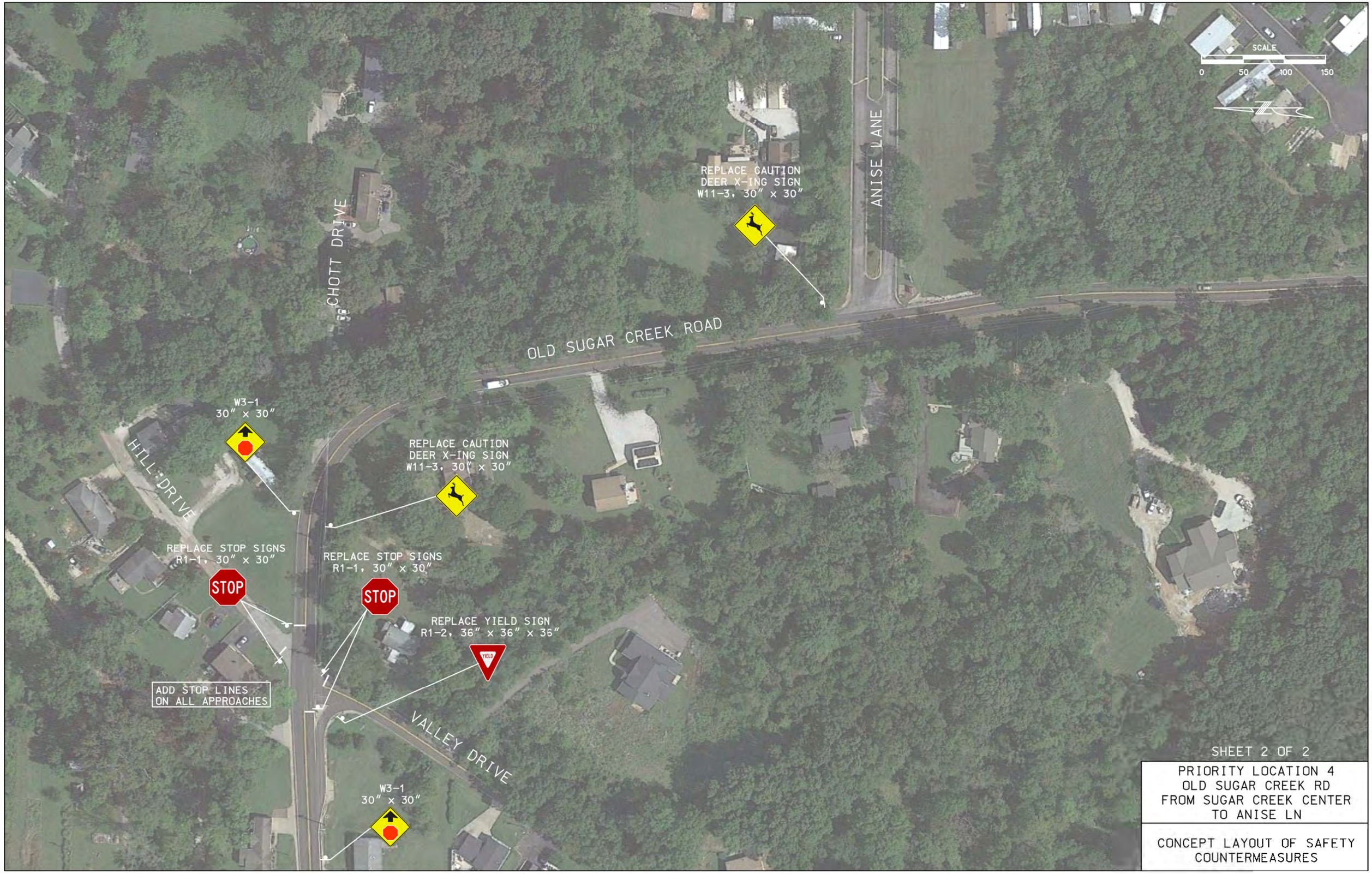
SHEET 1A OF 2

PRIORITY LOCATION 4
OLD SUGAR CREEK RD
FROM SUGAR CREEK CENTER
TO ANISE LN

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

PRIORITY LOCATION 4
OLD SUGAR CREEK RD
FROM SUGAR CREEK CENTER
TO ANISE LN

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES



SHEET 2 OF 2

PRIORITY LOCATION 4
OLD SUGAR CREEK RD
FROM SUGAR CREEK CENTER
TO ANISE LN

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

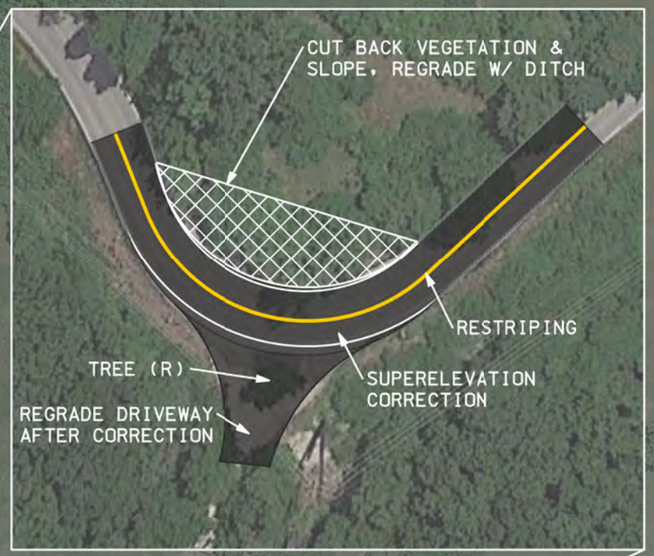
SHEET 1 OF 1

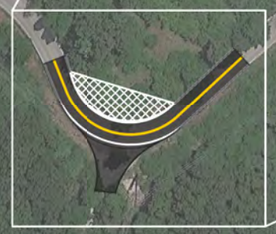
PRIORITY LOCATION 5
INTERSECTION OF MILLER RD
& VOGEL ROAD

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SCALE

0 100 200 300 400 500





CROSS DRAIN AT LOW POINT

GRANDVIEW DR

DITCHING

SEAN DRIVE

DRIVEWAY CULVERTS WHERE NEEDED

EAST ROCK CREEK RD

GUARDRAIL W/ PROPER END TREATMENTS

EHLERS RIDGE LANE

PRIORITY LOCATION 6
EAST ROCK CREEK RD FROM
EHLERS RIDGE LN TO
OLD LEMAY FERRY ROAD

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES

SHEET 2 OF 2

PRIORITY LOCATION 6
EAST ROCK CREEK RD FROM
EHLERS RIDGE LN TO
OLD LEMAY FERRY ROAD

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES

SHEET 1 OF 1

PRIORITY LOCATION 7A
OLD ROUTE 21 AT
ROCK CREEK RD

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SCALE
0 20 40 60

NEW CONCRETE ENTRANCE
(REMOVE LANDSCAPE WALL
WITHIN DRIVEWAY LIMITS)

FULL-ACCESS ENTRANCE
(UIP)

E ROCK CREEK RD

OLD STATE ROUTE 21

GRASS (REMOVE
EXIST. ENTRANCE)

CLOSE ENTRANCE BY
EXTENDING LANDSCAPE
WALL ACROSS DRIVEWAY
OR INSTALLING CONCRETE
MEDIAN

W ROCK CREEK RD

NEW CONCRETE ENTRANCE

RETAINING WALL

SHEET 1 OF 1

PRIORITY LOCATION 7B
OLD ROUTE 21 AT
ROCK CREEK RD

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 1 OF 1

PRIORITY LOCATION 8
BRENNAN RD FROM EAGLE DR TO LITTLE BRENNAN RD

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES

SHEET 1 OF 2

PRIORITY LOCATION 9
GRAVOIS RD FROM TERRACE DR
TO ROSEGLYN LANE

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 2 OF 2

PRIORITY LOCATION 9
GRAVOIS RD FROM TERRACE DR
TO ROSEGLYN LANE

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SCALE

0 100 200 300 400 500

NOTE: INSTALL EDGE LINE RUMBLE STRIPS THROUGHOUT PROJECT SEGMENT

ANTIRE ROAD

BROOKSIDE DRIVE

GUARDRAIL W/ PROPER END TREATMENTS

30 M.P.H.

W13-1P
18" x 18"
(ADD TO EXIST. W1-5 SIGN)

OM3-R
12" x 36"
(UTILITY POLE)

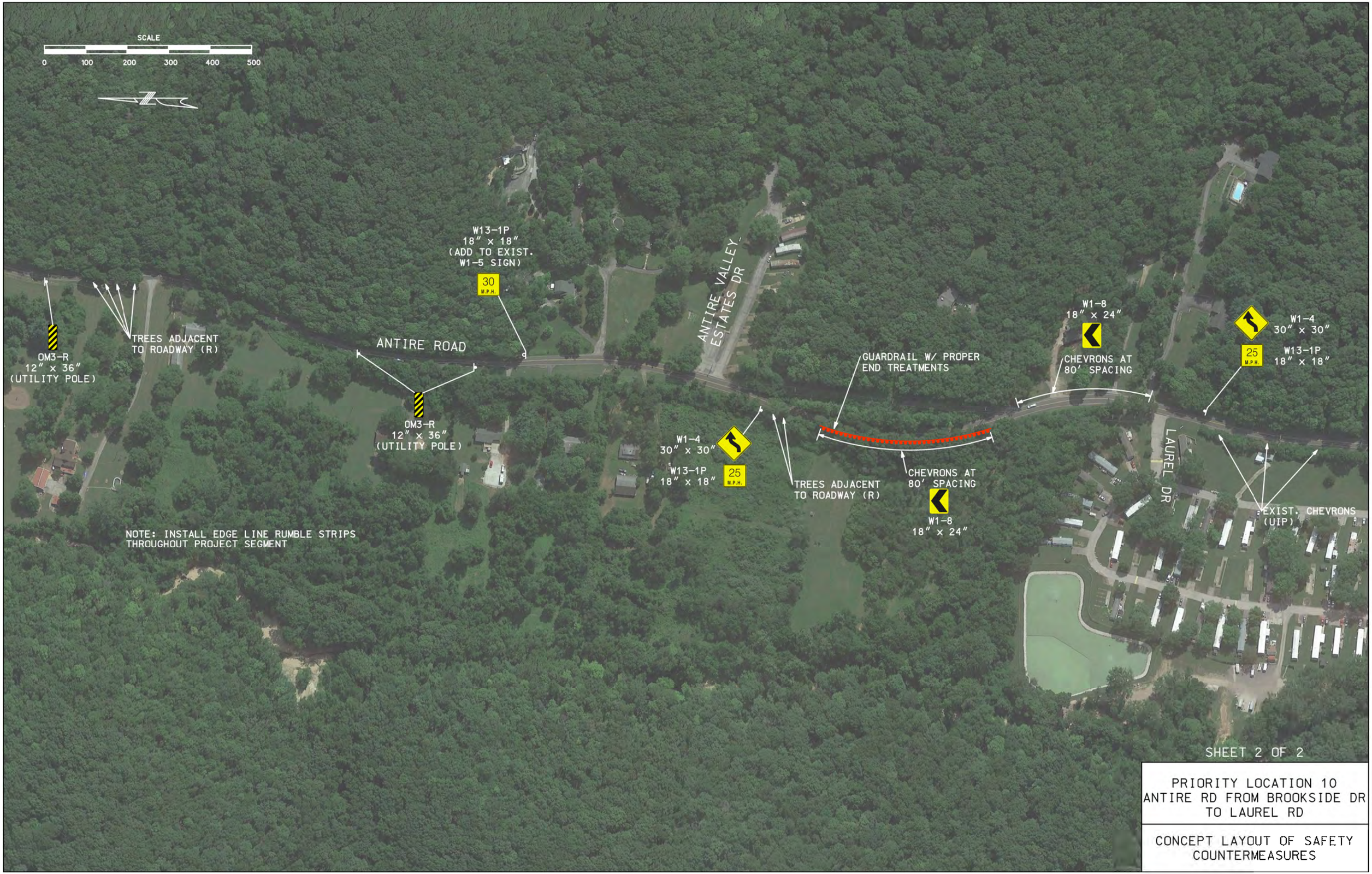
OM3-R
12" x 36"
(UTILITY POLE)

OM3-R
12" x 36"
(UTILITY POLE)

SHEET 1 OF 2

PRIORITY LOCATION 10
ANTIRE RD FROM BROOKSIDE DR TO LAUREL RD

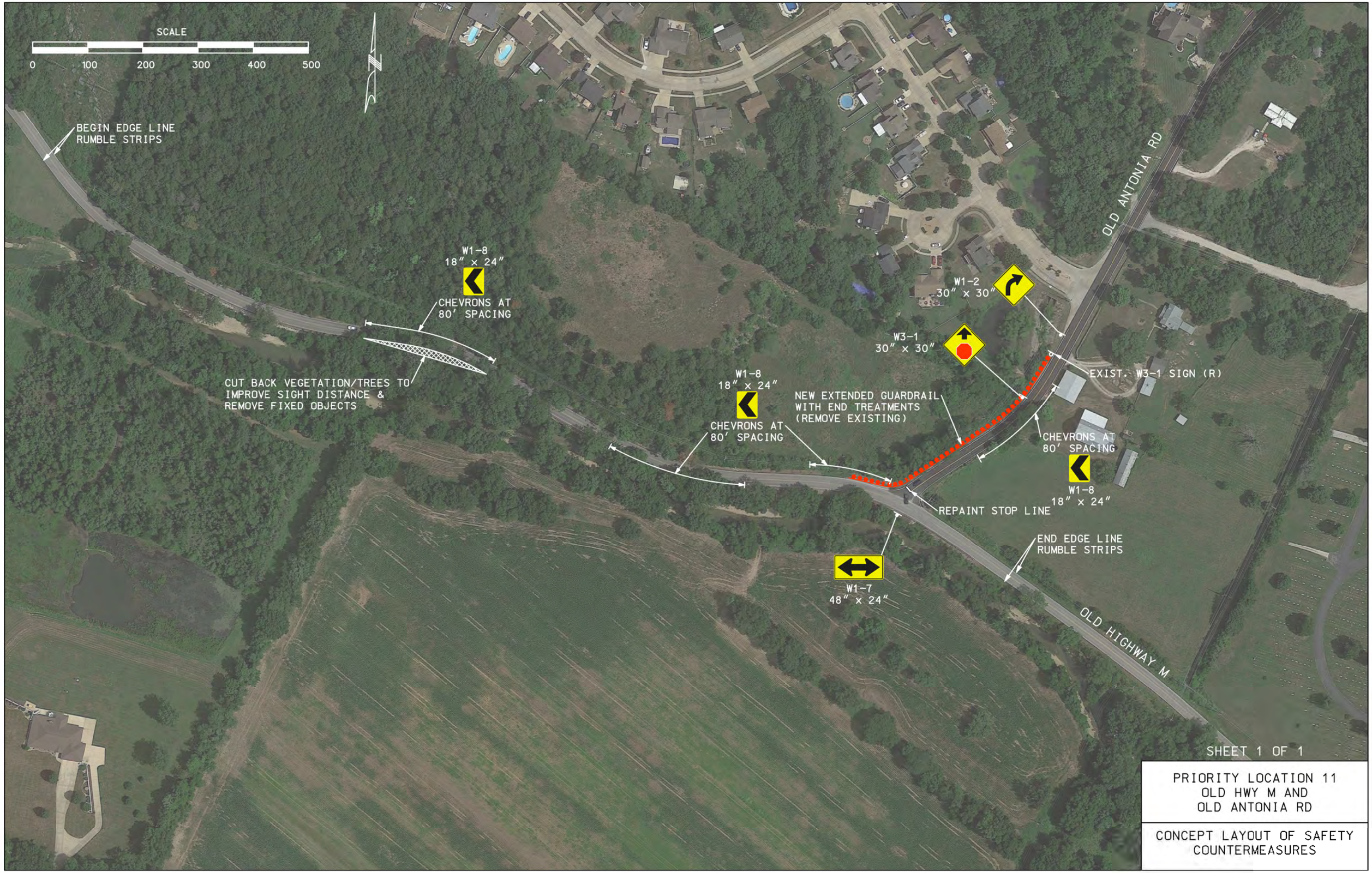
CONCEPT LAYOUT OF SAFETY COUNTERMEASURES



SHEET 2 OF 2

PRIORITY LOCATION 10
ANTIRE RD FROM BROOKSIDE DR
TO LAUREL RD

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES



SHEET 1 OF 1

PRIORITY LOCATION 11
OLD HWY M AND
OLD ANTONIA RD

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 1 OF 2

PRIORITY LOCATION 12
DIEHL RD/SALINE RD FROM
OLD SUGAR CREEK RD TO
WALNUT RIDGE

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SCALE
0 60 120 180

INSTALL EDGE LINE RUMBLE STRIPS ALONG CURVE

REGRADING TO ELIMINATE DROP OFF & ADD DITCH

SALINE ROAD

LAZY OAK

WALNUT RIDGE

W1-7
48" x 24"
(REPLACE EXISTING)

CUT BACK BRUSH FROM EXIST. SIGN (TYP.)

TIMBER RIDGE

CHEVRONS AT 40' SPACING

W1-8
18" x 24"

DIEHL ROAD

SALINE ROAD

SHEET 2 OF 2

PRIORITY LOCATION 12
DIEHL RD/SALINE RD FROM OLD SUGAR CREEK RD TO WALNUT RIDGE

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES

SHEET 1 OF 1

PRIORITY LOCATION 13
HIGH RIDGE AND
CAPETOWN VILLAGE

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 1 OF 2

PRIORITY LOCATION 14
LONEDELL RD FROM
VALLEY DR TO JEAN DR

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 2 OF 2

PRIORITY LOCATION 14
LONEDELL RD FROM
VALLEY DR TO JEAN DR

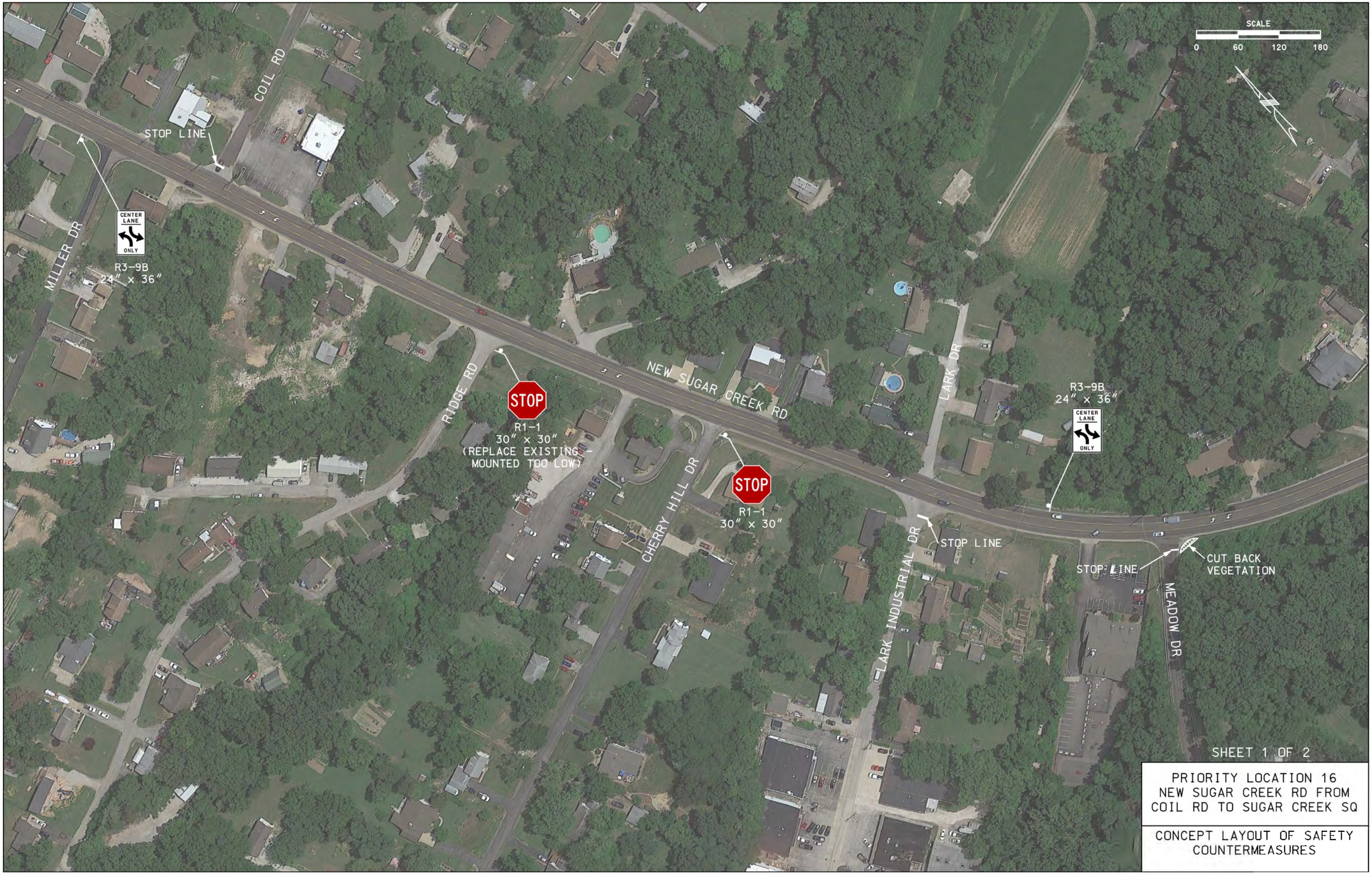
CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 1 OF 2

PRIORITY LOCATION 15
SALINE RD FROM CHANCELLOR LN TO ROMAINE CREEK RD

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES


SCALE
0
100
200
300
400
500
W1-8
18" x 24"
REMOVE TREES DIRECTLY ADJACENT TO ROADWAY
CHEVRONS AT 40' SPACING
BEVERLY ANN DR
CUT BACK TREES/ VEGETATION & RELOCATE ROCKS
STOP LINE
SALINE RD
EXIST. W1-3 SIGN (UIP)
W1-7
48" x 24"
EXIST. W1-3 SIGN (UIP)
RELOCATE ROCKS
SALINE RD
STOP LINE
CRIMSON OAKS DR
ROMAINE CREEK RD
SHEET 2 OF 2
PRIORITY LOCATION 15
SALINE RD FROM CHANCELLOR LN TO ROMAINE CREEK RD
CONCEPT LAYOUT OF SAFETY COUNTERMEASURES



SHEET 1 OF 2

PRIORITY LOCATION 16
NEW SUGAR CREEK RD FROM
COIL RD TO SUGAR CREEK SQ

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SCALE
0 60 120 180

R3-9B
24" x 36"
CENTER LANE
ONLY

R1-1
30" x 30"
(REPLACE EXISTING-
UNDERSIZED)

STOP

GRANDVIEW DR

CREST DR

OAKLEY LN

STOP LINE

ENSURE TREES ARE LIMBED UP HIGH
ENOUGH FOR SIGHT DISTANCE

STOP LINE

NEW SUGAR CREEK RD

STOP

R1-1
30" x 30"
(REPLACE EXISTING -
WEATHERED)

W1-7
48" x 24"

SUGAR CREEK SQUARE

MO 30

STOP LINE

CUT BACK
VEGETATION

CIRCLE DR

SHEET 2 OF 2

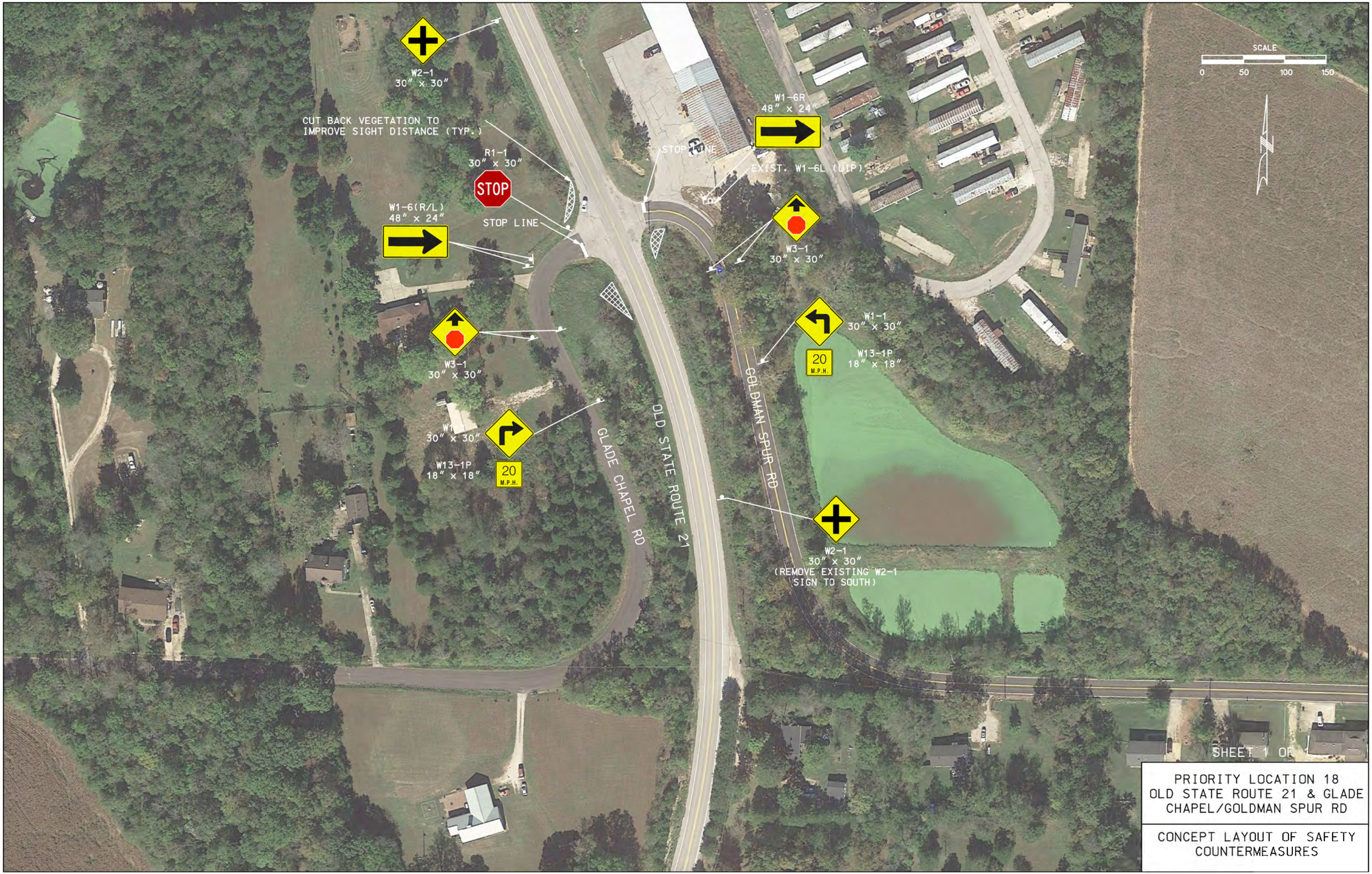
PRIORITY LOCATION 16
NEW SUGAR CREEK RD FROM
COIL RD TO SUGAR CREEK SQ

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

SHEET 1 OF 1

PRIORITY LOCATION 17
MILLER ROAD FROM VOGEL ROAD TO CORAL ESTATES DRIVE

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES



SHEET 1 OF

PRIORITY LOCATION 18
OLD STATE ROUTE 21 & GLADE CHAPEL/GOLDMAN SPUR RD

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES

SHEET 1 OF 2

PRIORITY LOCATION 19
OLD LEMAY FERRY RD FROM
EAST ROCK CREEK RD TO
LION'S DEN RD

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES

PRIORITY LOCATION 19
OLD LEMAY FERRY RD FROM
EAST ROCK CREEK RD TO
LION'S DEN RD

CONCEPT LAYOUT OF SAFETY COUNTERMEASURES

SHEET 1 OF 1

PRIORITY LOCATION 20
LONEDELL RD &
TOMAHAWK RD

CONCEPT LAYOUT OF SAFETY
COUNTERMEASURES

APPENDIX D:

CONCEPT COST ESTIMATES AND BENEFIT-COST ANALYSIS DETAILS

Benefit-Cost Analysis Inputs

To better understand the impacts of the priority projects laid out in previous sections, a benefit-cost analysis was performed to compare potential safety advantages to overall project costs.

Crashes

Crashes for each safety project were sorted into four categories: Fatal (K), Serious Injury (A), Minor Injury (B,C), and Property Damage Only (O). This information, including injury severity, was included in the GIS crash data provided by Jefferson County.

Project Information

Project type (segment or intersection), AADT, and project length were all required inputs for completing the analysis. AADT values were determined using the latest version of the County Road Traffic Count Map (10.5v 9.4.20) provided on the Jefferson County website.

Countermeasure Detail, Implementation and Cost

The final section of inputs involved information about the lifespan, maintenance, and effectiveness of the countermeasures being implemented, as well as the time to construction and total project cost. Per EWG guidance, even though most of the projects identified by this safety study involve more than one safety countermeasure, only one countermeasure is to be considered for the purposes of the benefit-cost analysis. Therefore, the Crash Modification Factor (CMF) and associated countermeasure lifespan utilized represents the primary countermeasure identified for each project location. Maintenance cost inputs were provided by Jefferson County. The tool includes a list of potential CMFs to complete the inputs, but there were several countermeasures suggested in this report that were not adequately represented in that list. In these cases, an appropriate CMF from the CMF Clearinghouse website was utilized and included in this appendix for reference.

Total project cost estimates were developed using the concept layouts in Appendix C. As with any concept level estimate, those included here would be subject to change during the engineering process as more information is available about existing conditions and required Right of Way acquisitions. Preliminary engineering and construction engineering costs for each individual project were estimated to be 15 percent of construction costs with a $4,000 minimum for those items. Actual engineering costs are likely to vary from this estimate, but a more conservative percentage was considered appropriate as smaller safety projects require more engineering effort when compared to their construction costs. However, if several safety projects were to be combined into one package, this approach could be helpful in reducing overall engineering costs. The concept level cost estimates and corresponding safety calculator outputs can be found in this appendix.

Results

Table 1 below provides the list of the 20 potential project locations ranked by their corresponding benefit-cost ratio. Note that projects 4 and 7 each have an alternate cost estimate and therefore have multiple benefit-cost ratio entries. See Appendix B and the associated cost estimates in this appendix for details.

TABLE 1: PRIORITY PROJECT LOCATIONS RANKED BY BENEFIT COST RATIO

EPDO Priority	Location	EPDO Value	Concept Cost Estimate	Benefit-Cost Ratio
7a	Old State Rte 21 from SR21 past Rock Creek	60	$21,200	64.7
14	Lonedell from Valley to Jean	51	$125,300	31.3
9	Gravois from Terrace to Roseglyn	57	$24,800	17.9
7b	Old State Rte 21 from SR21 past Rock Creek	60	$72,400	15.5
3	Old State Rte 21 from Lonedell to Ench Forest	79	$86,700	11.7
6	East Rock Creek from Ehlers to Old Lemay	70	$226,600	11.6
5	Miller and Vogel	73	$26,600	10.5
1	Romaine Creek from Konert to Caleb	113	$163,600	8.1
13	High Ridge and Capetown Village	54	$20,000	7.9
11	Old Hwy M and Old Antonia	55	$70,700	5.7
12	Deihl/Saline from Old Sugar Creek to Walnut	55	$80,900	5.2
10	Antire from Brookside to Laurel	56	$107,100	5.0
8	Brennan from Eagle to Little Brennan	58	$100,100	4.9
4b	Old Sugar Creek from Sugar Creek to Anise	73	$78,900	3.8
15	Saline from Chancellor to Romaine Creek	48	$28,700	3.8
16	New Sugar Creek from Coil to Sugar Creek	46	$30,700	3.0
18	Old State Route 21 and Glade Chapel/Goldman	36	$24,400	2.9
4a	Old Sugar Creek from Sugar Creek to Anise	73	$127,300	2.7
2	Konert from Breezy Oak to Konert Valley	86	$252,500	2.5
17	Miller from Vogel to Corral Estates	43	$33,800	1.5
19	Old Lemay Ferry from East Rock to Lions Den	34	$24,400	1.1
20	Lonedell and Tomahawk	27	$32,600	0.9

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Romaine Creek Road from Konert Road to Caleb Crossing
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$10,000.00	$10,000.00
CLEARING AND GRUBBING	0.1	ACRE	$8,000.00	$800.00
LINEAR GRADING, CLASS 2	4.0	STA	$1,500.00	$6,000.00
TYPE 5 AGGREGATE FOR BASE (4 IN. THICK)	38	SY	$10.00	$381.11
BITUMINOUS PAVEMENT - ENTRANCE	38	SY	$80.00	$3,048.89
DITCH LINER	270	LF	$30.00	$8,100.00
SIGN POST AND FOOTING	23	EA	$500.00	$11,500.00
SH-FLAT SHEET	69	SF	$27.00	$1,858.68
RELOCATE UTILITY POLE	1	EA	$10,000.00	$10,000.00
15" PIPE - GROUP A	62	LF	$75.00	$4,650.00
24" PIPE - GROUP A	20	LF	$110.00	$2,200.00
MISC. ADDITIONAL DRAINAGE	1	LS	$20,000.00	$20,000.00
SILT FENCE	500	LF	$5.00	$2,500.00
TEMPORARY TRAFFIC CONTROL	1	LS	$2,516.85	$2,516.85
MOBILIZATION	1	LS	$5,285.39	$5,285.39
			SUBTOTAL	**$88,840.92**

Construction Cost Total	**$88,840.92**
Contingency	**$17,768.18**
Preliminary Engineering	**$15,991.36**
Right-of-Way	**$25,000.00**
Construction Engineering/Inspection	**$15,991.36**
Project Total *	**$163,600.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Konert Road from Breezy Oak Lane to Konert Valley Drive
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$5,000.00	$5,000.00
CLEARING AND GRUBBING	0.1	ACRE	$8,000.00	$800.00
LINEAR GRADING, CLASS 2	8.5	STA	$1,500.00	$12,750.00
TYPE 5 AGGREGATE FOR BASE (4 IN. THICK)	178	SY	$10.00	$1,777.78
BITUMINOUS PAVEMENT - BASE	76	TON	$85.00	$6,485.50
BITUMINOUS PAVEMENT - BP-1	19	TON	$95.00	$1,805.00
HIGH FRICTION SURFACE TREATMENT	2,533	SY	$18.00	$45,594.00
DITCH LINER	650	LF	$30.00	$19,500.00
MGS GUARDRAIL	500	LF	$25.00	$12,500.00
MGS END ANCHOR	4	EA	$1,100.00	$4,400.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	2,360	LF	$1.00	$2,360.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	2,360	LF	$1.00	$2,360.00
SIGN POST AND FOOTING	4	EA	$500.00	$2,000.00
SH-FLAT SHEET	15	SF	$27.00	$405.00
MISC. ADDITIONAL DRAINAGE	1	LS	$15,000.00	$15,000.00
SILT FENCE	1,000	LF	$5.00	$5,000.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,569.85	$1,569.85
MOBILIZATION	1	LS	$3,296.69	$3,296.69
			SUBTOTAL	**$142,603.81**

Construction Cost Total	**$142,603.81**
Contingency	**$28,520.76**
Preliminary Engineering	**$25,668.69**
Right-of-Way	**$30,000.00**
Construction Engineering/Inspection	**$25,668.69**
Project Total *	**$252,500.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Old State Route 21 from Lonedell Road to Enchanted Forest Drive
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$22,000.00	$22,000.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	13,600	LF	$1.00	$13,600.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	10,880	LF	$1.00	$10,880.00
PREFORMED THERMOPLASTIC PAVEMENT MARKING, LEFT/RIGHT ARROW	14	EA	$300.00	$4,200.00
SIGN POST AND FOOTING	2	EA	$500.00	$1,000.00
SH-FLAT SHEET	12	SF	$27.00	$324.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,141.45	$1,141.45
MOBILIZATION	1	LS	$2,397.05	$2,397.05
			SUBTOTAL	**$55,542.50**

Construction Cost Total	**$55,542.50**
Contingency	**$11,108.50**
Preliminary Engineering	**$9,997.65**
Right-of-Way	**$0.00**
Construction Engineering/Inspection	**$9,997.65**
Project Total *	**$86,700.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Old Sugar Creek Road from Sugar Creek Center to Anise Lane (4a)
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$10,000.00	$10,000.00
CLEARING AND GRUBBING	0.1	ACRE	$8,000.00	$800.00
LINEAR GRADING, CLASS 2	0.3	STA	$1,500.00	$450.00
TYPE 5 AGGREGATE FOR BASE (4 IN. THICK)	136	SY	$10.00	$1,364.44
BITUMINOUS PAVEMENT - BASE	59	TON	$85.00	$5,015.00
BITUMINOUS PAVEMENT - BP-1	15	TON	$95.00	$1,425.00
6 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	73	LF	$1.00	$73.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	400	LF	$1.00	$400.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	215	LF	$1.00	$215.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	52	LF	$6.00	$312.00
PREFORMED THERMOPLASTIC PAVEMENT MARKING, LEFT/RIGHT ARROW	2	EA	$300.00	$600.00
6" CONCRETE MEDIAN STRIP	22	SY	$80.00	$1,777.78
TUBULAR MARKERS	32	EA	$70.00	$2,240.00
SIGN POST AND FOOTING	9	EA	$500.00	$4,500.00
SH-FLAT SHEET	59	SF	$27.00	$1,602.18
RELOCATE UTILITY POLE	1	EA	$10,000.00	$10,000.00
18" PIPE - GROUP A	125	LF	$85.00	$10,625.00
INLET	1	EA	$2,500.00	$2,500.00
MANHOLE	1	EA	$2,000.00	$2,000.00
SILT FENCE	200	LF	$5.00	$1,000.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,763.30	$1,763.30
MOBILIZATION	1	LS	$3,702.93	$3,702.93
			SUBTOTAL	**$62,365.63**

Construction Cost Total	**$62,365.63**
Contingency	**$12,473.13**
Preliminary Engineering	**$11,225.81**
Right-of-Way	**$30,000.00**
Construction Engineering/Inspection	**$11,225.81**
Project Total *	**$127,300.00**

Note: This estimate is for alternate 4a (widening on inside of Wilderness Lane curve)

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Old Sugar Creek Road from Sugar Creek Center to Anise Lane (4b)
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$6,000.00	$6,000.00
CLEARING AND GRUBBING	0.1	ACRE	$8,000.00	$800.00
6 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	73	LF	$1.00	$73.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	400	LF	$1.00	$400.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	215	LF	$1.00	$215.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	52	LF	$6.00	$312.00
PREFORMED THERMOPLASTIC PAVEMENT MARKING, LEFT/RIGHT ARROW	2	EA	$300.00	$600.00
6" CONCRETE MEDIAN STRIP	22	SY	$80.00	$1,777.78
TUBULAR MARKERS	32	EA	$70.00	$2,240.00
SIGN POST AND FOOTING	9	EA	$500.00	$4,500.00
SH-FLAT SHEET	59	SF	$27.00	$1,602.18
18" PIPE - GROUP A	125	LF	$85.00	$10,625.00
INLET	1	EA	$2,500.00	$2,500.00
MANHOLE	1	EA	$2,000.00	$2,000.00
SILT FENCE	200	LF	$5.00	$1,000.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$2,057.60	$2,057.60
			SUBTOTAL	**$37,702.56**

Construction Cost Total	**$37,702.56**
Contingency	**$7,540.51**
Preliminary Engineering	**$6,786.46**
Right-of-Way	**$20,000.00**
Construction Engineering/Inspection	**$6,786.46**
Project Total *	**$78,900.00**

Note: This estimate is for alternate 4b (utilizing existing widening on outside of Wilderness Lane curve)

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Intersection of Miller Road and Vogel Road
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$1,000.00	$1,000.00
SIGNAL HEAD, TYPE 3S	1	EA	$800.00	$800.00
REFLECTIVE TREATMENT FOR SIGNAL BACKPLATES	10	EA	$100.00	$1,000.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	45	LF	$6.00	$270.00
SH-FLAT SHEET - SIGNAL SIGN	15	SF	$33.00	$495.00
SIGNAL SIGN, MOUNTING HARDWARE	2	EA	$100.00	$200.00
SIGN POST AND FOOTING	7	EA	$500.00	$3,500.00
SH-FLAT SHEET	45	SF	$27.00	$1,213.92
SIGNAL TIMING STUDY	1	LS	$5,000.00	$5,000.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,000.00	$1,000.00
			SUBTOTAL	**$15,478.92**

Construction Cost Total	**$15,478.92**
Contingency	**$3,095.78**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$0.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$26,600.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	East Rock Creek Road from Ehlers Ridge Lane to Old Lemay Ferry Road
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$20,000.00	$20,000.00
CLEARING AND GRUBBING	0.4	ACRE	$8,000.00	$3,200.00
LINEAR GRADING, CLASS 2	12.0	STA	$1,500.00	$18,000.00
TYPE 5 AGGREGATE FOR BASE (4 IN. THICK)	168	SY	$10.00	$1,684.44
COLDMILLING BITUMINOUS PAVEMENT FOR REMOVAL OF SURFACING	650	SY	$5.00	$3,250.00
BITUMINOUS PAVEMENT - BP-1	85	TON	$80.00	$6,800.00
TACK COAT	65	GAL	$6.00	$390.00
BITUMINOUS PAVEMENT - ENTRANCE	168	SY	$80.00	$13,466.67
DITCH LINER	815	LF	$30.00	$24,450.00
MGS GUARDRAIL	440	LF	$25.00	$11,000.00
MGS END ANCHOR	4	EA	$1,100.00	$4,400.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	500	LF	$1.00	$500.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	500	LF	$1.00	$500.00
SIGN POST AND FOOTING	2	EA	$500.00	$1,000.00
SH-FLAT SHEET	6	SF	$27.00	$162.00
15" PIPE - GROUP A	70	LF	$75.00	$5,250.00
24" PIPE - GROUP A	30	LF	$110.00	$3,300.00
SILT FENCE	750	LF	$5.00	$3,750.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,577.75	$1,577.75
MOBILIZATION	1	LS	$3,313.28	$3,313.28
			SUBTOTAL	**$125,994.14**

Construction Cost Total	**$125,994.14**
Contingency	**$25,198.83**
Preliminary Engineering	**$22,678.94**
Right-of-Way	**$30,000.00**
Construction Engineering/Inspection	**$22,678.94**
Project Total *	**$226,600.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Old Route 21 at Rock Creek Road (7a)
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$1,000.00	$1,000.00
SIGN POST AND FOOTING	1	EA	$500.00	$500.00
SH-FLAT SHEET	4	SF	$27.00	$108.00
6" CONCRETE MEDIAN STRIP	45	SY	$80.00	$3,585.78
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,000.00	$1,000.00
			SUBTOTAL	**$7,193.78**

Construction Cost Total	**$7,193.78**
Contingency	**$1,438.76**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$4,500.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$21,200.00**

Note: This estimate is for alternate 7a (closing closest driveway)

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Old Route 21 at Rock Creek Road (7b)
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$5,000.00	$5,000.00
SMALL BLOCK WALL	245	SF	$40.00	$9,800.00
LINEAR GRADING, CLASS 2	1.0	STA	$1,500.00	$1,500.00
PAVED APPROACH. 8 IN.	250.7	SY	$70.00	$17,546.67
6" CONCRETE MEDIAN STRIP	20	SY	$80.00	$1,608.89
SODDING	174	SY	$18.00	$3,136.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,000.00	$1,000.00
			SUBTOTAL	**$40,591.56**

Construction Cost Total	**$40,591.56**
Contingency	**$8,118.31**
Preliminary Engineering	**$7,306.48**
Right-of-Way	**$9,000.00**
Construction Engineering/Inspection	**$7,306.48**
Project Total *	**$72,400.00**

Note: This estimate is for alternate 7b (relocating driveways)

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Brennan Road from Eagle Drive to Little Brennan Road
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$4,000.00	$4,000.00
CLEARING AND GRUBBING	0.10	ACRE	$8,000.00	$800.00
LINEAR GRADING, CLASS 2	2.3	STA	$1,500.00	$3,450.00
HIGH FRICTION SURFACE TREATMENT	1,500	SY	$18.00	$27,000.00
DITCH LINER	175	LF	$30.00	$5,250.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	1,070	LF	$1.00	$1,070.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	1,070	LF	$1.00	$1,070.00
SIGN POST AND FOOTING	11	EA	$500.00	$5,500.00
SH-FLAT SHEET	77	SF	$27.00	$2,074.68
15" PIPE - GROUP A	50	LF	$75.00	$3,750.00
SILT FENCE	250	LF	$5.00	$1,250.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,515.70	$1,515.70
			SUBTOTAL	**$57,730.38**

Construction Cost Total	**$57,730.38**
Contingency	**$11,546.08**
Preliminary Engineering	**$10,391.47**
Right-of-Way	**$10,000.00**
Construction Engineering/Inspection	**$10,391.47**
Project Total *	**$100,100.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Gravois Road from Terrace Drive to Roseglyn Lane
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$500.00	$500.00
CLEARING AND GRUBBING	0.10	ACRE	$8,000.00	$800.00
BITUMINOUS SHOULDER RUMBLE STRIP	9.7	STA	$20.00	$194.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	9,700	LF	$1.00	$9,700.00
SIGN POST AND FOOTING	1	EA	$500.00	$500.00
SH-FLAT SHEET	9	SF	$27.00	$229.50
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,000.00	$1,000.00
			SUBTOTAL	**$13,923.50**

Construction Cost Total	**$13,923.50**
Contingency	**$2,784.70**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$0.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$24,800.00**

Note: Installing Ameren dusk to dawn lights with 6' bracket arms on existing utility poles has no associated construction cost as long as secondary power is already present.

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Antire Road from Brookside Drive to Laurel Road
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$2,000.00	$2,000.00
CLEARING AND GRUBBING	0.10	ACRE	$8,000.00	$800.00
MGS GUARDRAIL	1,015	LF	$25.00	$25,375.00
MGS END ANCHOR	4	EA	$1,100.00	$4,400.00
BITUMINOUS SHOULDER RUMBLE STRIP	123	STA	$20.00	$2,460.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	12,280	LF	$1.00	$12,280.00
SIGN POST AND FOOTING	21	EA	$500.00	$10,500.00
SH-FLAT SHEET	103	SF	$27.00	$2,767.50
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,267.30	$1,267.30
			SUBTOTAL	**$62,849.80**

Construction Cost Total	**$62,849.80**
Contingency	**$12,569.96**
Preliminary Engineering	**$11,312.96**
Right-of-Way	**$9,000.00**
Construction Engineering/Inspection	**$11,312.96**
Project Total *	**$107,100.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Old Highway M and Old Antonia Road
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$2,000.00	$2,000.00
CLEARING AND GRUBBING	0.10	ACRE	$8,000.00	$800.00
LINEAR GRADING, CLASS 2	4.0	STA	$1,500.00	$6,000.00
MGS GUARDRAIL	460	LF	$25.00	$11,500.00
MGS END ANCHOR	2	EA	$1,100.00	$2,200.00
BITUMINOUS SHOULDER RUMBLE STRIP	39	STA	$20.00	$780.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	3,900	LF	$1.00	$3,900.00
SIGN POST AND FOOTING	18	EA	$500.00	$9,000.00
SH-FLAT SHEET	105	SF	$27.00	$2,835.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,417.30	$1,417.30
			SUBTOTAL	**$41,432.30**

Construction Cost Total	**$41,432.30**
Contingency	**$8,286.46**
Preliminary Engineering	**$7,457.81**
Right-of-Way	**$6,000.00**
Construction Engineering/Inspection	**$7,457.81**
Project Total *	**$70,700.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Diehl Road/Saline Road from Old Sugar Creek Road to Walnut Ridge
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$5,000.00	$5,000.00
CLEARING AND GRUBBING	0.25	ACRE	$8,000.00	$2,000.00
LINEAR GRADING, CLASS 2	3.5	STA	$1,500.00	$5,250.00
DITCH LINER	340	LF	$30.00	$10,200.00
BITUMINOUS SHOULDER RUMBLE STRIP	15.5	STA	$20.00	$310.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	1,550	LF	$1.00	$1,550.00
SIGN POST AND FOOTING	14	EA	$500.00	$7,000.00
SH-FLAT SHEET	77	SF	$27.00	$2,065.50
SILT FENCE	350	LF	$5.00	$1,750.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,608.30	$1,608.30
			SUBTOTAL	**$37,733.80**

Construction Cost Total	**$37,733.80**
Contingency	**$7,546.76**
Preliminary Engineering	**$6,792.08**
Right-of-Way	**$22,000.00**
Construction Engineering/Inspection	**$6,792.08**
Project Total *	**$80,900.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	High Ridge & Capetown Village
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$4,000.00	$4,000.00
CLEARING AND GRUBBING	0.05	ACRE	$8,000.00	$400.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	60	LF	$1.00	$60.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	180	LF	$1.00	$180.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	40	LF	$6.00	$240.00
SIGN POST AND FOOTING	4	EA	$500.00	$2,000.00
SH-FLAT SHEET	26	SF	$27.00	$712.26
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,353.50	$1,353.50
			SUBTOTAL	**$9,945.76**

Construction Cost Total	**$9,945.76**
Contingency	**$1,989.15**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$0.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$20,000.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Lonedell Road from Valley Drive to Jean Drive
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$2,000.00	$2,000.00
CLEARING AND GRUBBING	0.10	ACRE	$8,000.00	$800.00
LINEAR GRADING, CLASS 2	3.5	STA	$1,500.00	$5,250.00
TYPE 5 AGGREGATE FOR BASE (4 IN. THICK)	170	SY	$10.00	$1,700.00
TYPE A3 SHOULDER	170	SY	$40.00	$6,800.00
HIGH FRICTION SURFACE TREATMENT	1,840	SY	$18.00	$33,120.00
4 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	1,550	LF	$1.00	$1,550.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	1,550	LF	$1.00	$1,550.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	12	LF	$6.00	$72.00
SIGN POST AND FOOTING	7	EA	$500.00	$3,500.00
SH-FLAT SHEET	39	SF	$27.00	$1,059.75
RELOCATE UTILITY POLE	1	EA	$10,000.00	$10,000.00
SILT FENCE	350	LF	$5.00	$1,750.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,105.40	$1,105.40
MOBILIZATION	1	LS	$2,321.34	$2,321.34
			SUBTOTAL	**$72,578.49**

Construction Cost Total	**$72,578.49**
Contingency	**$14,515.70**
Preliminary Engineering	**$13,064.13**
Right-of-Way	**$12,000.00**
Construction Engineering/Inspection	**$13,064.13**
Project Total *	**$125,300.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Saline Road from Chancellor Lane to Romaine Creek Road
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$3,000.00	$3,000.00
CLEARING AND GRUBBING	0.05	ACRE	$8,000.00	$400.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	50	LF	$6.00	$300.00
SIGN POST AND FOOTING	11	EA	$500.00	$5,500.00
SH-FLAT SHEET	59	SF	$27.00	$1,605.42
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,253.30	$1,253.30
			SUBTOTAL	**$13,058.72**

Construction Cost Total	**$13,058.72**
Contingency	**$2,611.74**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$5,000.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$28,700.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	New Sugar Creek Road from Coil Road to Sugar Creek Square
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$1,000.00	$1,000.00
CLEARING AND GRUBBING	0.05	ACRE	$8,000.00	$400.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	102	LF	$6.00	$612.00
SIGN POST AND FOOTING	9	EA	$500.00	$4,500.00
SH-FLAT SHEET	74	SF	$27.00	$1,993.68
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,053.30	$1,053.30
			SUBTOTAL	**$10,558.98**

Construction Cost Total	**$10,558.98**
Contingency	**$2,111.80**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$10,000.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$30,700.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Miller Road from Vogel Road to Coral Estates Drive
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$4,000.00	$4,000.00
CLEARING AND GRUBBING	0.05	ACRE	$8,000.00	$400.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	92	LF	$6.00	$552.00
SIGN POST AND FOOTING	9	EA	$500.00	$4,500.00
SH-FLAT SHEET	49	SF	$27.00	$1,331.10
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,353.30	$1,353.30
			SUBTOTAL	**$13,136.40**

Construction Cost Total	**$13,136.40**
Contingency	**$2,627.28**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$10,000.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$33,800.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Old State Route 21 & Glade Chapel/Goldman Spur Rd
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
CLEARING AND GRUBBING	0.05	ACRE	$8,000.00	$400.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	28	LF	$6.00	$168.00
SIGN POST AND FOOTING	17	EA	$500.00	$8,500.00
SH-FLAT SHEET	95	SF	$27.00	$2,577.42
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,000.00	$1,000.00
			SUBTOTAL	**$13,645.42**

Construction Cost Total	**$13,645.42**
Contingency	**$2,729.08**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$0.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$24,400.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Old Lemay Ferry Road From East Rock Creek Road to Lion's Den Road
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
BITUMINOUS CENTERLINE RUMBLE STRIP	16.5	STA	$25.00	$412.50
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	3,300	LF	$1.00	$3,300.00
SIGN POST AND FOOTING	5	EA	$500.00	$2,500.00
SH-FLAT SHEET	17	SF	$27.00	$445.50
SPEED STUDY	1	LS	$5,000.00	$5,000.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$1,000.00	$1,000.00
			SUBTOTAL	**$13,658.00**

Construction Cost Total	**$13,658.00**
Contingency	**$2,731.60**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$0.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$24,400.00**

Estimate of Project Costs

Project Sponsor:	Jefferson County Department of Public Works
Project Title:	Lonedell Road and Tomahawk Road
Date:	6/7/2021

Roadway Items

Item	Quantity	Unit	Unit Price	Amount
REMOVAL OF IMPROVEMENTS	1	LS	$2,000.00	$2,000.00
CLEARING AND GRUBBING	0.05	ACRE	$8,000.00	$400.00
LINEAR GRADING, CLASS 2	0.5	STA	$1,500.00	$750.00
6 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	115	LF	$1.00	$115.00
4 IN. YELLOW STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	150	LF	$1.00	$150.00
24 IN. WHITE STANDARD WATERBORNE PAVEMENT MARKING PAINT, TYPE P BEADS	43	LF	$6.00	$258.00
SIGN POST AND FOOTING	5	EA	$500.00	$2,500.00
SH-FLAT SHEET	35	SF	$27.00	$941.76
RELOCATE UTILITY POLE	1	EA	$10,000.00	$10,000.00
TEMPORARY TRAFFIC CONTROL	1	LS	$1,000.00	$1,000.00
MOBILIZATION	1	LS	$2,303.50	$2,303.50
			SUBTOTAL	**$20,418.26**

Construction Cost Total	**$20,418.26**
Contingency	**$4,083.65**
Preliminary Engineering	**$4,000.00**
Right-of-Way	**$0.00**
Construction Engineering/Inspection	**$4,000.00**
Project Total *	**$32,600.00**

11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Romaine Creek from Konert to Caleb

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	5	*Input*
Minor Injury (B,C)	13	*Input*
Property Damage Only (O)	19	*Input*
Total	37	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	4,634	Number of vehicles (current)
Project Length	0.90	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	5	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.799	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$163,600	Dollars, include all phases of the project

Key:

Inputs

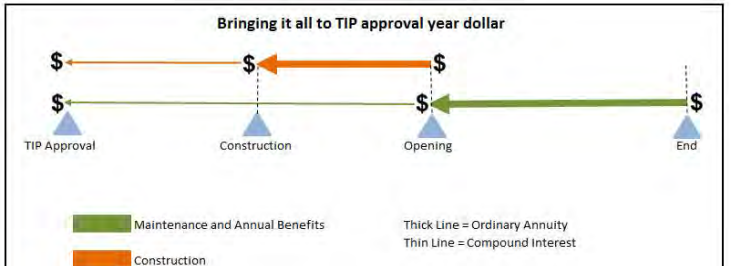
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	486.1
Fatality & Serious Injury Crash Rate	65.69
Benefit/Cost Ratio	8.1

CHECKS	
Annual Benefit	350,226
PVB	1,467,827
PVC	181,150
PVC Construction	149,717
PVC Maintenance	31,433
BCR	8.1



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Konert from Breezy Oak to Konert Valley

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	1	*Input*
Minor Injury (B,C)	12	*Input*
Property Damage Only (O)	17	*Input*
Total	30	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	2,678	Number of vehicles (current)
Project Length	0.70	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	5	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.799	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$252,500	Dollars, include all phases of the project

Key:

Inputs

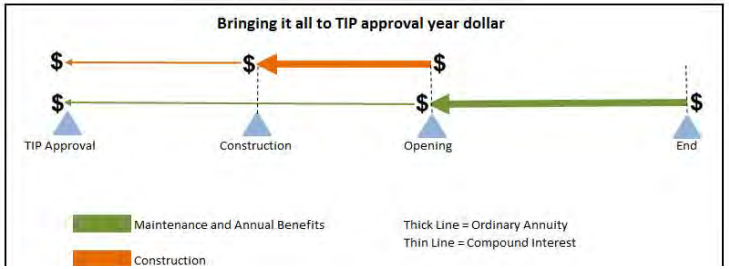
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	876.9
Fatality & Serious Injury Crash Rate	29.23
Benefit/Cost Ratio	2.5

CHECKS	
Annual Benefit	155,230
PVB	650,580
PVC	262,506
PVC Construction	231,073
PVC Maintenance	31,433
BCR	2.5



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old State Rte 21 from Lonedell to Enchanted Forest

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	1	*Input*
Serious Injury (A)	3	*Input*
Minor Injury (B,C)	7	*Input*
Property Damage Only (O)	19	*Input*
Total	30	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	9,720	Number of vehicles (current)
Project Length	1.00	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	1	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.640	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$86,700	Dollars, include all phases of the project

Key:

Inputs

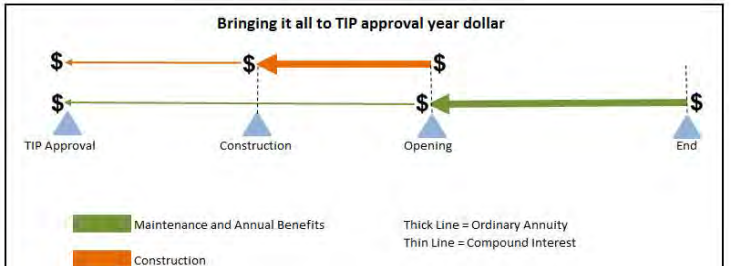
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	169.1
Fatality & Serious Injury Crash Rate	22.55
Benefit/Cost Ratio	11.7

CHECKS	
Annual Benefit	1,129,363
PVB	1,003,425
PVC	86,006
PVC Construction	79,343
PVC Maintenance	6,664
BCR	11.7



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old Sugar Creek from Sugar Creek to Anise (4a)

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	1	*Input*
Minor Injury (B,C)	6	*Input*
Property Damage Only (O)	38	*Input*
Total	45	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	8,818	Number of vehicles (current)
Project Length	0.50	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.850	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$127,300	Dollars, include all phases of the project

Key:

Inputs

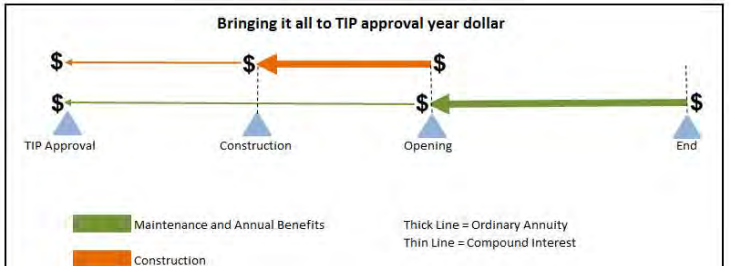
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	559.3
Fatality & Serious Injury Crash Rate	12.43
Benefit/Cost Ratio	2.7

CHECKS	
Annual Benefit	83,026
PVB	411,602
PVC	153,679
PVC Construction	116,498
PVC Maintenance	37,181
BCR	2.7



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old Sugar Creek from Sugar Creek to Anise (4b)

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	1	*Input*
Minor Injury (B,C)	6	*Input*
Property Damage Only (O)	38	*Input*
Total	45	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	8,818	Number of vehicles (current)
Project Length	0.50	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.850	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$78,900	Dollars, include all phases of the project

Key:

Inputs

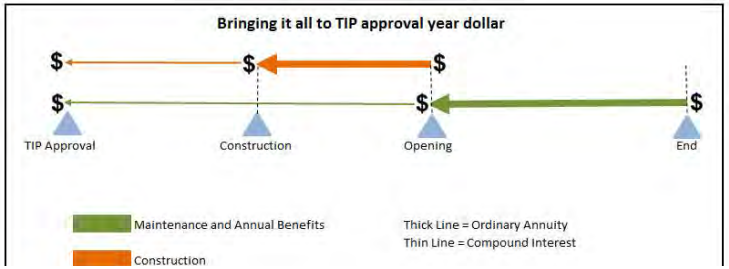
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	559.3
Fatality & Serious Injury Crash Rate	12.43
Benefit/Cost Ratio	3.8

CHECKS	
Annual Benefit	83,026
PVB	411,602
PVC	109,386
PVC Construction	72,205
PVC Maintenance	37,181
BCR	3.8



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Miller and Vogel

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	2	*Input*
Minor Injury (B,C)	5	*Input*
Property Damage Only (O)	38	*Input*
Total	45	
Project Type:		
Segment or Intersection	Intersection	Select from drop down list
Entering AADT	18,252	Number of vehicles (current)
	0.10	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	10	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.850	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$26,600	Dollars, include all phases of the project

Key:

Inputs

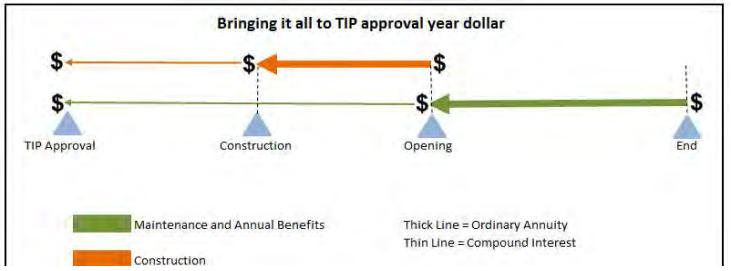
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	135.1
Fatality & Serious Injury Crash Rate	6.00
Benefit/Cost Ratio	10.5

CHECKS	
Annual Benefit	111,284
PVB	868,719
PVC	82,890
PVC Construction	24,343
PVC Maintenance	58,548
BCR	10.5



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: East Rock Creek from Ehlers to Old Lemay

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	1	*Input*
Serious Injury (A)	4	*Input*
Minor Injury (B,C)	5	*Input*
Property Damage Only (O)	15	*Input*
Total	25	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	1,232	Number of vehicles (current)
Project Length	1.10	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	5	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.799	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$226,600	Dollars, include all phases of the project

Key:

Inputs

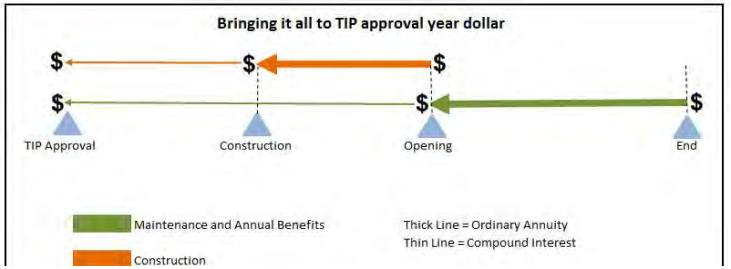
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	1,010.8
Fatality & Serious Injury Crash Rate	202.16
Benefit/Cost Ratio	11.6

CHECKS	
Annual Benefit	658,447
PVB	2,759,604
PVC	238,804
PVC Construction	207,371
PVC Maintenance	31,433
BCR	11.6



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old State Rte 21 from SR21 past Rock Creek (7a)

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	1	*Input*
Serious Injury (A)	3	*Input*
Minor Injury (B,C)	4	*Input*
Property Damage Only (O)	15	*Input*
Total	23	
Project Type:		
Segment or Intersection	Intersection	Select from drop down list
Entering AADT	9,804	Number of vehicles (current)
	0.20	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	15	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.800	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$21,200	Dollars, include all phases of the project

Key:

Inputs

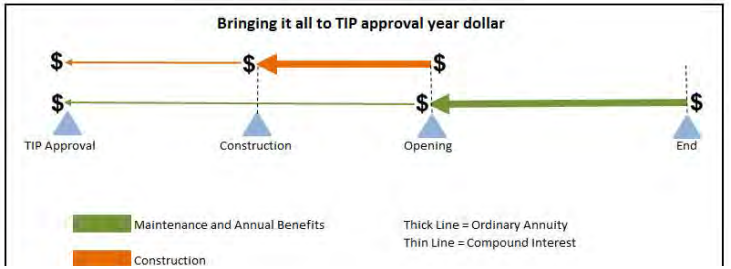
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	128.5
Fatality & Serious Injury Crash Rate	22.36
Benefit/Cost Ratio	64.7

CHECKS	
Annual Benefit	600,448
PVB	6,559,831
PVC	101,338
PVC Construction	19,401
PVC Maintenance	81,937
BCR	64.7



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old State Rte 21 from SR21 past Rock Creek (7b)

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	1	*Input*
Serious Injury (A)	3	*Input*
Minor Injury (B,C)	4	*Input*
Property Damage Only (O)	15	*Input*
Total	23	
Project Type:		
Segment or Intersection	Intersection	Select from drop down list
Entering AADT	9,804	Number of vehicles (current)
	0.20	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	15	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.930	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$72,400	Dollars, include all phases of the project

Key:

Inputs

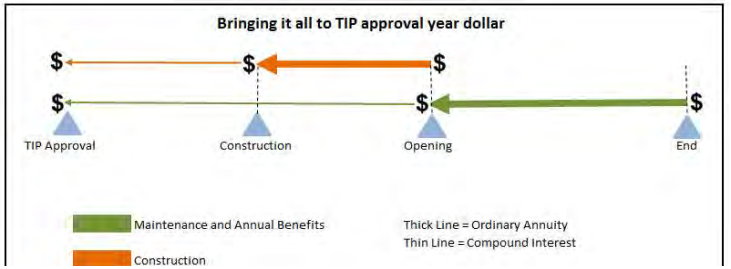
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	128.5
Fatality & Serious Injury Crash Rate	22.36
Benefit/Cost Ratio	15.5

CHECKS	
Annual Benefit	210,157
PVB	2,295,941
PVC	148,193
PVC Construction	66,256
PVC Maintenance	81,937
BCR	15.5



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Brennan from Eagle to Little Brennan

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	-	*Input*
Minor Injury (B,C)	6	*Input*
Property Damage Only (O)	28	*Input*
Total	34	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	3,346	Number of vehicles (current)
Project Length	0.70	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	5	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.529	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$100,100	Dollars, include all phases of the project

Key:

Inputs

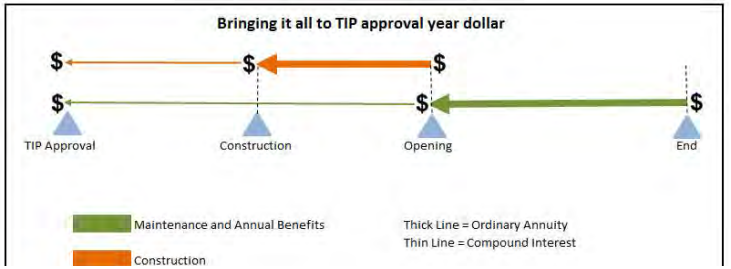
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	795.4
Fatality & Serious Injury Crash Rate	0.00
Benefit/Cost Ratio	4.9

CHECKS	
Annual Benefit	143,621
PVB	601,925
PVC	123,039
PVC Construction	91,606
PVC Maintenance	31,433
BCR	4.9



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Gravois Road from Terrace Drive to Roseglyn Lane

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	2	*Input*
Minor Injury (B,C)	6	*Input*
Property Damage Only (O)	17	*Input*
Total	25	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	4,538	Number of vehicles (current)
Project Length	0.90	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.710	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$24,800	Dollars, include all phases of the project

Key:

Inputs

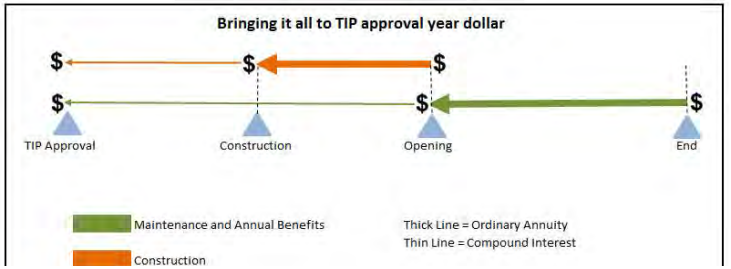
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	335.4
Fatality & Serious Injury Crash Rate	26.83
Benefit/Cost Ratio	17.9

CHECKS	
Annual Benefit	216,800
PVB	1,074,787
PVC	59,877
PVC Construction	22,696
PVC Maintenance	37,181
BCR	17.9



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Antire from Brookside to Laurel

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	2	*Input*
Minor Injury (B,C)	7	*Input*
Property Damage Only (O)	11	*Input*
Total	20	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	4,008	Number of vehicles (current)
Project Length	1.20	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	3	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.710	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$107,100	Dollars, include all phases of the project

Key:

Inputs

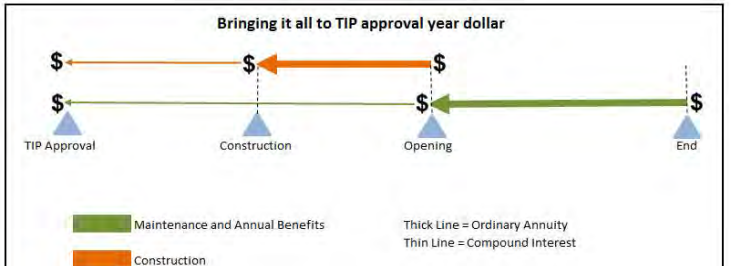
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	227.9
Fatality & Serious Injury Crash Rate	22.79
Benefit/Cost Ratio	5.0

CHECKS	
Annual Benefit	226,100
PVB	585,278
PVC	117,426
PVC Construction	98,012
PVC Maintenance	19,414
BCR	5.0



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old Hwy M and Old Antonia

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	-	*Input*
Minor Injury (B,C)	9	*Input*
Property Damage Only (O)	10	*Input*
Total	19	
Project Type:		
Segment or Intersection	Intersection	Select from drop down list
Entering AADT	6,905	Number of vehicles (current)
	0.40	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.710	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$70,700	Dollars, include all phases of the project

Key:

Inputs

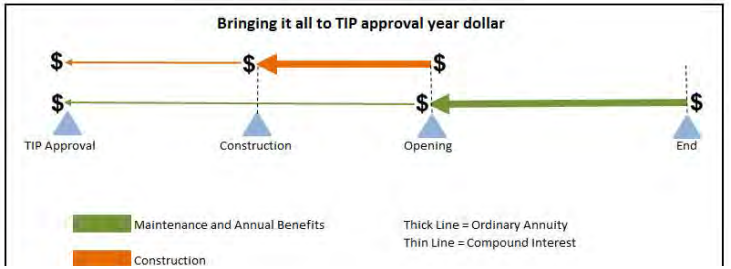
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	150.8
Fatality & Serious Injury Crash Rate	0.00
Benefit/Cost Ratio	5.7

CHECKS	
Annual Benefit	116,328
PVB	576,695
PVC	101,882
PVC Construction	64,701
PVC Maintenance	37,181
BCR	5.7



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Deihl/Saline from Old Sugar Creek to Walnut

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	2	*Input*
Minor Injury (B,C)	7	*Input*
Property Damage Only (O)	10	*Input*
Total	19	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	2,650	Number of vehicles (current)
Project Length	0.80	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.850	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$80,900	Dollars, include all phases of the project

Key:

Inputs

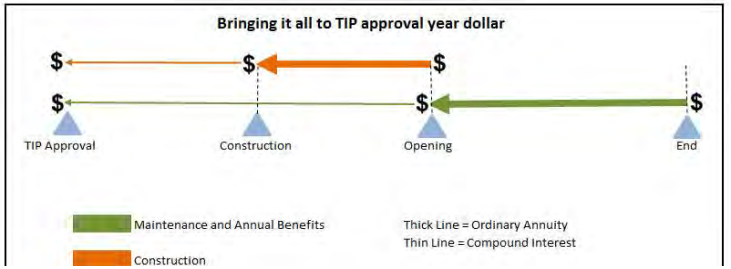
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	491.1
Fatality & Serious Injury Crash Rate	51.69
Benefit/Cost Ratio	5.2

CHECKS	
Annual Benefit	116,685
PVB	578,464
PVC	111,216
PVC Construction	74,035
PVC Maintenance	37,181
BCR	5.2



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: High Ridge and Capetown Village

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	1	*Input*
Minor Injury (B,C)	8	*Input*
Property Damage Only (O)	9	*Input*
Total	18	
Project Type:		
Segment or Intersection	Intersection	Select from drop down list
Entering AADT	5,866	Number of vehicles (current)
	0.10	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.850	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$20,000	Dollars, include all phases of the project

Key:

Inputs

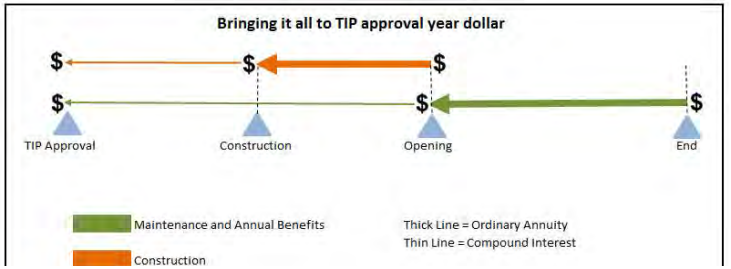
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	168.1
Fatality & Serious Injury Crash Rate	9.34
Benefit/Cost Ratio	7.9

CHECKS	
Annual Benefit	88,163
PVB	437,070
PVC	55,484
PVC Construction	18,303
PVC Maintenance	37,181
BCR	7.9



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Lonedell from Valley to Jean

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	1	*Input*
Serious Injury (A)	-	*Input*
Minor Injury (B,C)	4	*Input*
Property Damage Only (O)	21	*Input*
Total	26	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	1,748	Number of vehicles (current)
Project Length	0.80	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	5	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.529	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$125,300	Dollars, include all phases of the project

Key:

Inputs

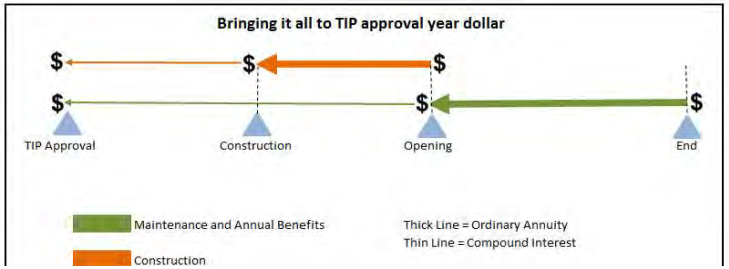
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	1,018.8
Fatality & Serious Injury Crash Rate	39.18
Benefit/Cost Ratio	31.3

CHECKS	
Annual Benefit	1,092,620
PVB	4,579,257
PVC	146,100
PVC Construction	114,667
PVC Maintenance	31,433
BCR	31.3



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Saline from Chancellor to Romaine Creek

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	-	*Input*
Minor Injury (B,C)	7	*Input*
Property Damage Only (O)	13	*Input*
Total	20	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	3,896	Number of vehicles (current)
Project Length	0.90	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.850	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$28,700	Dollars, include all phases of the project

Key:

Inputs

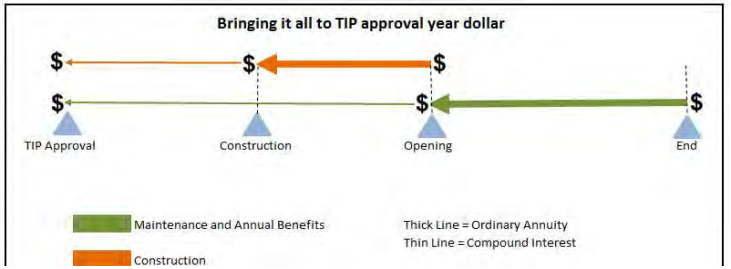
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	312.5
Fatality & Serious Injury Crash Rate	0.00
Benefit/Cost Ratio	3.8

CHECKS	
Annual Benefit	48,176
PVB	238,831
PVC	63,446
PVC Construction	26,265
PVC Maintenance	37,181
BCR	3.8



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: New Sugar Creek from Coil to Sugar Creek

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	1	*Input*
Minor Injury (B,C)	5	*Input*
Property Damage Only (O)	16	*Input*
Total	22	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	13,060	Number of vehicles (current)
Project Length	0.70	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.917	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$30,700	Dollars, include all phases of the project

Key:

Inputs

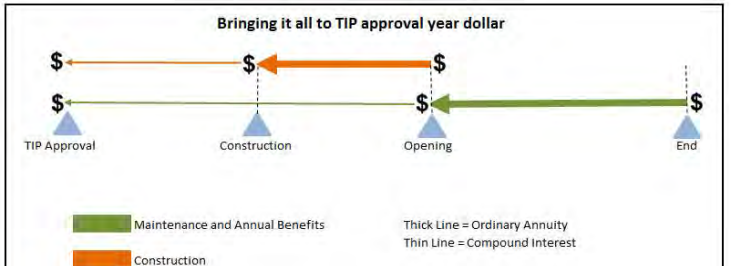
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	131.9
Fatality & Serious Injury Crash Rate	5.99
Benefit/Cost Ratio	3.0

CHECKS	
Annual Benefit	39,194
PVB	194,303
PVC	65,276
PVC Construction	28,095
PVC Maintenance	37,181
BCR	3.0



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Miller from Vogel to Corral Estates

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	-	*Input*
Minor Injury (B,C)	5	*Input*
Property Damage Only (O)	18	*Input*
Total	23	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	5,579	Number of vehicles (current)
Project Length	0.40	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.917	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$33,800	Dollars, include all phases of the project

Key:

Inputs

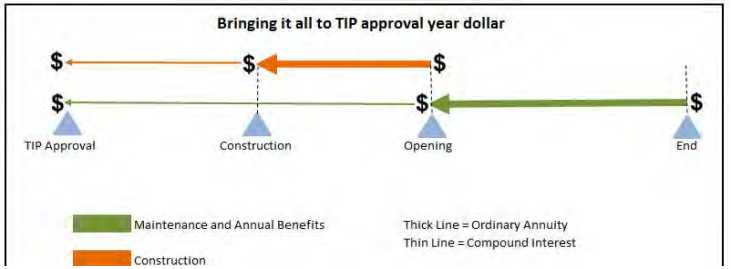
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	564.7
Fatality & Serious Injury Crash Rate	0.00
Benefit/Cost Ratio	1.5

CHECKS	
Annual Benefit	20,313
PVB	100,699
PVC	68,113
PVC Construction	30,932
PVC Maintenance	37,181
BCR	1.5



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old State Route 21 and Glade Chapel/Goldman

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	-	*Input*
Minor Injury (B,C)	5	*Input*
Property Damage Only (O)	11	*Input*
Total	16	
Project Type:		
Segment or Intersection	Intersection	Select from drop down list
Entering AADT	3,663	Number of vehicles (current)
	0.20	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.850	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$24,400	Dollars, include all phases of the project

Key:

Inputs

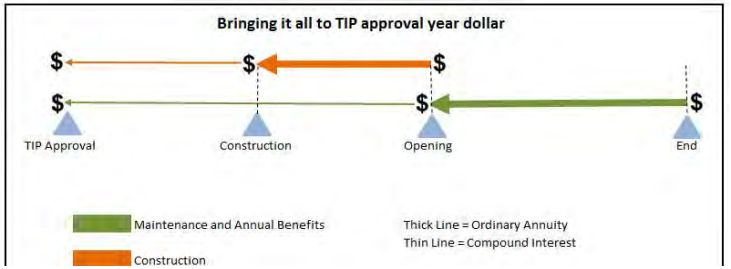
Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	239.3
Fatality & Serious Injury Crash Rate	0.00
Benefit/Cost Ratio	2.9

CHECKS	
Annual Benefit	34,863
PVB	172,835
PVC	59,511
PVC Construction	22,329
PVC Maintenance	37,181
BCR	2.9



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old Lemay Ferry from East Rock to Lions Den

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	-	*Input*
Minor Injury (B,C)	2	*Input*
Property Damage Only (O)	24	*Input*
Total	26	
Project Type:		
Segment or Intersection	Segment	Select from drop down list
Project Average Daily Traffic	7,014	Number of vehicles (current)
Project Length	0.60	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	3	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.860	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	24,400	Dollars, include all phases of the project

Key:

Inputs

Results

*Show projects with less than one year of construction as one year

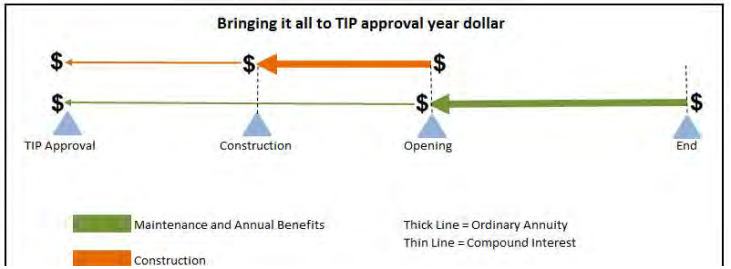
Clear Data

Outputs

	5 Year Crash Data (per 100 million miles)
Crash Rate	338.5
Fatality & Serious Injury Crash Rate	0.00
Benefit/Cost Ratio	1.1

CHECKS

Annual Benefit	17,840
PVB	46,180
PVC	41,744
PVC Construction	22,329
PVC Maintenance	19,414
BCR	1.1



11.06.20 Safety Calculator

Sponsoring Agency: Jefferson County Department of Public Works

Project Title: Old Lemay Ferry from East Rock to Lions Den

* When entering the data below, be sure to use the number of crashes and NOT the number of injuries/people involved. For example: If there was a crash that had one fatality and two minor injuries, sponsors would enter this as one fatal crash. The crash should be documented as the "highest" severity listed in the crash report.
* Sponsors should ONLY use crashes that happen WITHIN the project limits.

Benefit/Cost Ratio

	Value	Comment
Number of Crashes from 2014-2018:		
Fatal (K)	-	*Input*
Serious Injury (A)	-	*Input*
Minor Injury (B,C)	3	*Input*
Property Damage Only (O)	12	*Input*
Total	15	
Project Type:		
Segment or Intersection	Intersection	Select from drop down list
Entering AADT	2,860	Number of vehicles (current)
	0.10	in miles
Countermeasure Detail, Implementation, and Cost:		
Lifespan of Countermeasure	6	Years
Maintenance Cost of Countermeasure	$7,500	Annual dollars
CMF	0.917	One value only/Don't average multiple CMFs
Years To Construction Phase	2.0	Years
Duration of Construction Phase	1.0	Years, minimum of one year*
Total Project Cost	$32,600	Dollars, include all phases of the project

Key:

Inputs

Results

*Show projects with less than one year of construction as one year

Clear Data

Outputs	5 Year Crash Data (per 100 million miles)
Crash Rate	287.4
Fatality & Serious Injury Crash Rate	0.00
Benefit/Cost Ratio	0.9

CHECKS	
Annual Benefit	12,363
PVB	61,288
PVC	67,015
PVC Construction	29,834
PVC Maintenance	37,181
BCR	0.9