SITE ANALYSIS AND JUSTIFICATION

JACKSON COUNTY

TASK 3 AND 4 REPORT SUPPLEMENT-2

Prepared for

The Florida Department of Transportation

FDOT Contract BDV32-945-001

Prepared by

University of Florida

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Background

The Transportation Safety Center (TSC) at the University of Florida (UF) has been engaged by the Florida Department of Transportation (FDOT) to provide technical assistance to small Florida counties to address highway safety problems. The TSC has provided such assistance to Jackson County. This report documents the safety study for Jackson County roads and provides recommendations for certain safety improvements.

Purpose and Scope of Study

The intent of this study is to identify highway safety problems, recommend feasible countermeasures and provide documentation needed to support requests for funding. The document is intended to provide conceptual descriptions and preliminary cost estimates for the suggested countermeasures.

Process

The study followed the process identified in the pilot study conducted by TSC in Union County and generally follows the principals of FHWA's Road Safety Audit process. The study kickoff meeting was conducted on August 16, 2018, at the Jackson County Administration Offices. Participants included representatives of the TSC, FDOT District 3 Safety Office, Jackson County Engineering and Public Works Departments, and other members of the Community Traffic Safety Team for Jackson County. TSC provided an overview of the study process and presented crash data for the county road system. Using the crash data and local knowledge of problems, the County Engineer, together with FDOT and TSC representatives, selected study sites.

On August 16 and 17, 2019, the TSC, Jackson County Engineering and Public Works Departments, and FDOT District 3 Safety Office conducted field reviews of the selected sites. A subsequent site visit was also conducted by the TSC and County Engineer on December 5, 2018, to obtain additional information.

Recommendations were developed based on brief site visits, analysis of crash data, and information obtained from available records and photography. **More detailed information will be required for development of construction plans and final cost estimates. Additional information 5/be needed, including surveys, detailed inventories of signs and other road features, and engineering analysis as required by MUTCD for selection and installation of signs.**

For the five-year period, there were 26 fatal crashes on county roads in Jackson County. The countermeasures recommended by this study would provide safety improvements in areas affected by nine of these crashes.

Summary of Recommendations

Table 1 summarizes the recommended countermeasures. These recommendations cover similar work at multiple locations and can be efficiently combined into one or two projects.

Table 1. Summary of recommended improvements

Project	Countermeasures	Estimated Cost (dollars)
Various curves countywide	• Upgrade signing (warnings and chevrons) • Upgrade pavement markings (RPMs)	624,000
CR-217 from Sneads to CR-164	• Upgrade curve signing • Upgrade pavement markings (audible lane lines and RPMs)	372,000
CR-278 at CR-167	• Upgrade curve markings on CR-167 • Consider advisory speed on CR-167 • Upgrade intersection warnings on CR-278	23,000
Total		1,019,000

Hurricane Michael

Shortly after the initial field study was conducted, Hurricane Michael struck the area, causing major damage to both private properties and the infrastructure. In addition to the extensive debris on the roads, many signs were damaged or removed, and the county's sign shop was destroyed. Since then, Jackson County has worked to restore critical signs on the road system, but as of the last site visit, restoration had not been completed. As a result, signs that 5/have been in place at the time of the field study 5/no longer be functional. The recommendations contained in this report assume that for the sites identified, all signs need to be replaced or added.

Crashes in Jackson County

The primary data source used for this analysis was Signal Four Analytics (https://s4.geoplan.ufl.edu). Both FDOT Crash portal and Signal4 Analytics receive raw crash data from DHSMV, Signal4 was adopted since it offers a robust visualization tool. Except as noted, analysis of general trends was based on the five-year period from 2013 through 2017. For the analysis of some individual crash sites, the team considered crashes outside this period.

The records show that 86.3% of the serious and fatal crashes occurred on roads outside the city limits. Most were also on major county roads. This study concentrated on the major rural county roads, although where special concerns were raised, the team did examine some local roads. Since the primary focus of the initiative is to address safety problems on roads under the jurisdiction of local government, issues on the state highway system were not addressed, except in instances where the county voiced a concern about intersections between local roads and state highways.

Figure 1 Shows the locations of crashes (by severity) on the local road system in Jackson County for the 10-year period from 2008 to 2017. These crashes were scattered throughout the county, clearly concentrated on the major county roads. Less severe crashes were concentrated in Marianna.

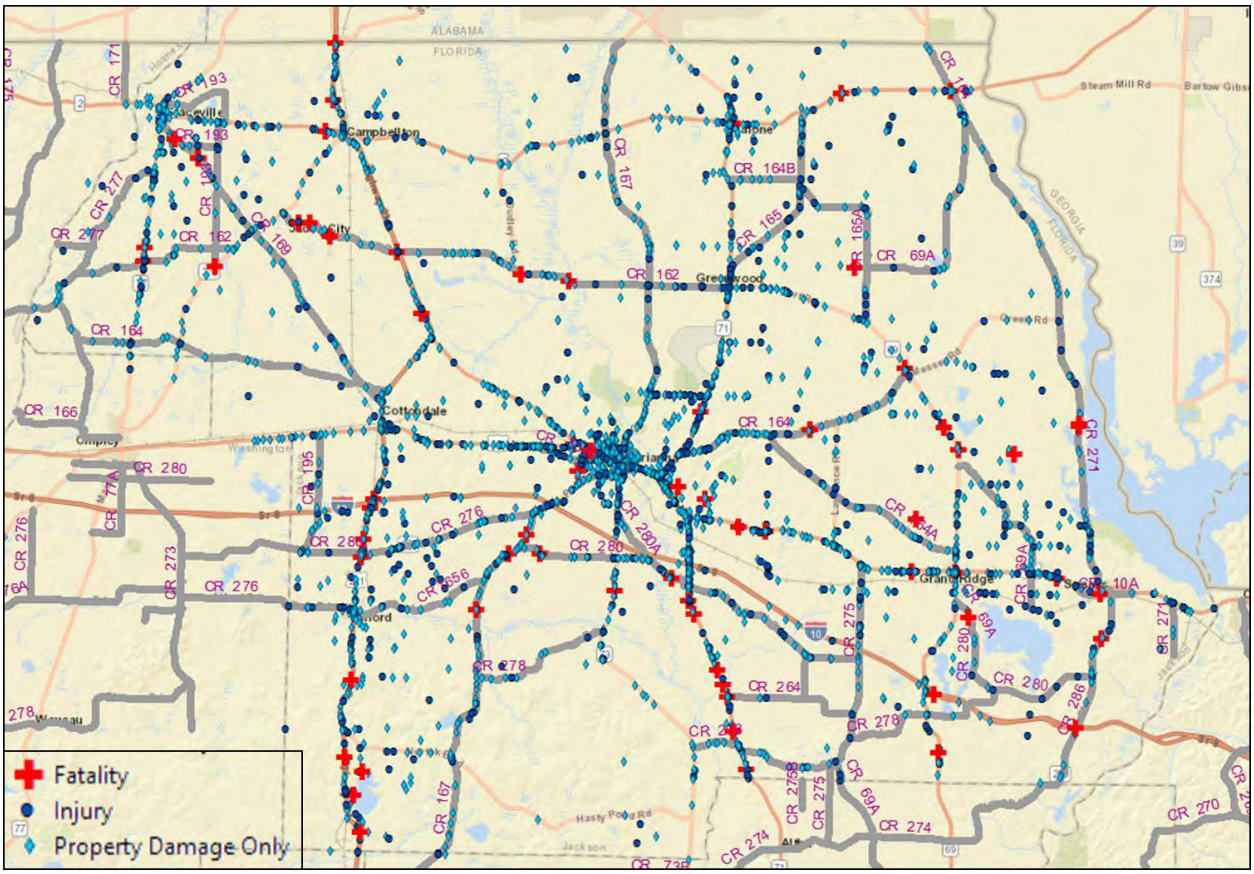

Figure 1. Locations of crashes on local roads in Jackson County (2013–2017)

Strategic Highway Safety Plan (SHSP) Focus Areas

Of the emphasis areas from the Florida Strategic Highway Safety Plan, the following areas are most relevant to this study:

- Lane departure crashes
- Intersection crashes
- Vulnerable road users: bicycles and pedestrians

Lane Departure Crashes

As shown in Figure 2, crash types typical of lane departures crashes (off-road, head-on, sideswipe, or rollover) are the most common. Seventy percent (70%) of the fatal lane departure crashes in 2013–2017 involved curves, so the field review concentrated on curves at the study sites.

Figure 2. Distribution of crash types on local roads (2013–2017)

Intersection Crashes

Crash types associated with intersections were less frequent (23%) and tended to be less severe, but the study sites did include certain intersections.

Bicycle and Pedestrian Crashes

Bicycle and pedestrian crashes account for a relatively small fraction of the total number of crashes on local roads in Jackson County. There were 10 pedestrian crashes and eight bicycle crashes during the period 2013–2017. Only one bicycle crash was fatal and involved a bicyclist travelling on a major county road in the dark without lighting (Figure 3).

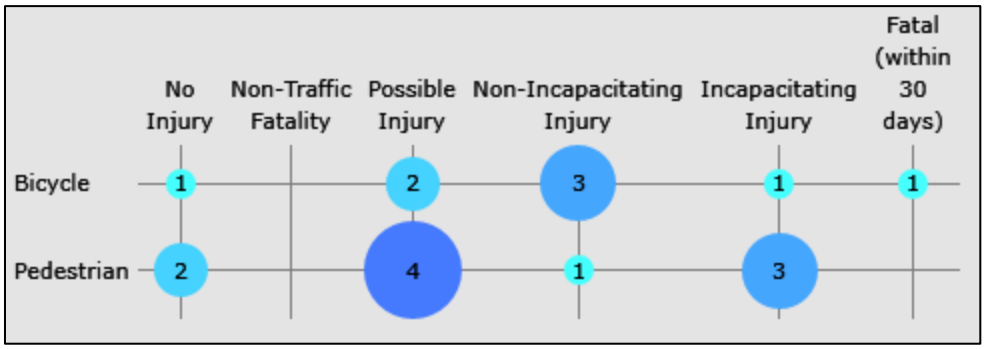

Figure 3. Severity of bicycle and pedestrian crashes

Two of the pedestrian crashes and four of the bicycle crashes were at intersections on US-90. Other crashes were scattered throughout the county (Figure 4). It did not appear that there were effective low-cost solutions that would significantly mitigate the pedestrian or bicycle crashes on the county road system.

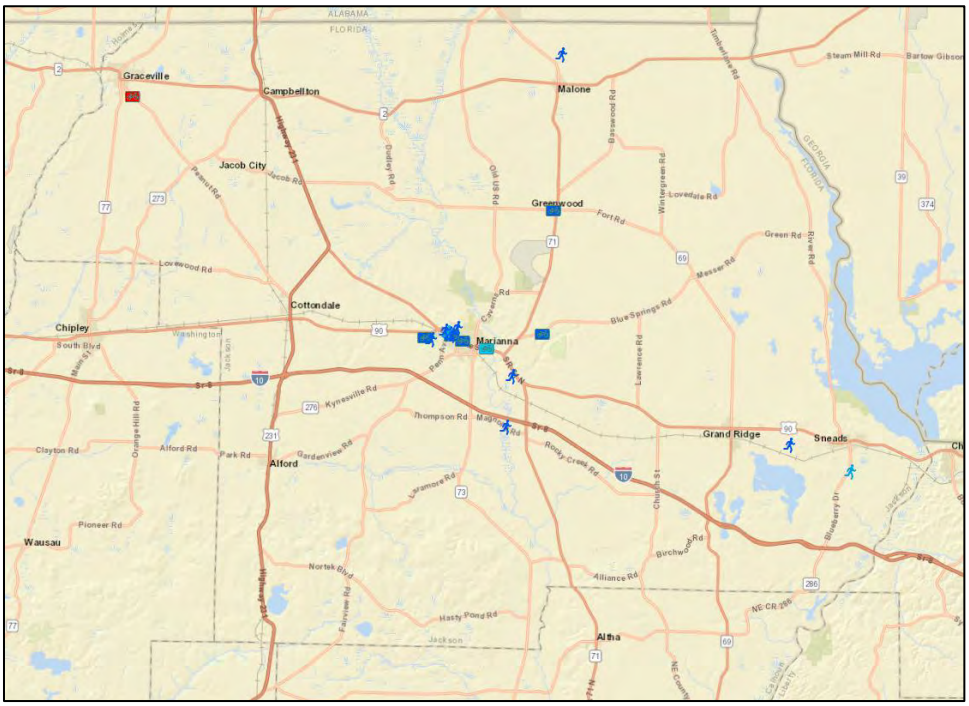

Figure 4. Locations of Bicycle and Pedestrian Crashes

Study Sites

Figure 5 shows the study sites. Over the five-year period from 2013 to 2017, nine fatal crashes had occurred at these sites. Since the data showed that lane departures accounted for most serious crashes, the study concentrated on identifying potential countermeasures for this type of crash, with an emphasis on curves. Recommended improvements primarily called for upgrading signs and pavement markings

The sites identified by this study were selected based on historical crash data, but conditions like those identified at these sites were noted at other locations throughout the county. Jackson County staff should be aware of these conditions and should be prepared to apply similar countermeasures at other locations as similar conditions are identified.

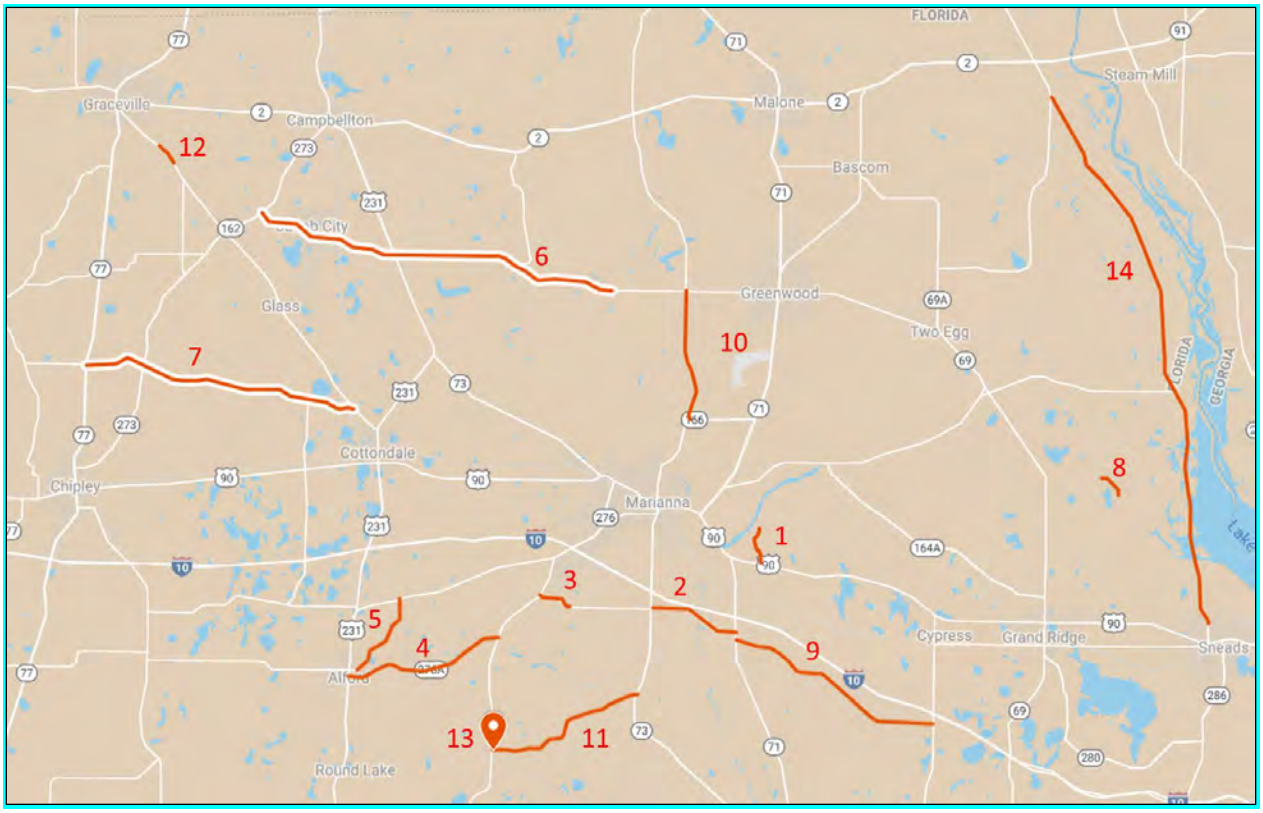

Figure 5. Study sites

Countermeasure Overview

Warning signs and chevrons can be effective in improving guidance through a curve where the driver does not have a long distance view or clear view of the pavement ahead. This is especially important for visual traps where the view is obstructed by a hill or sharp curve. This type of countermeasure is effective for both day and non-daylight conditions.

Raised pavement markers are especially effective for guidance of vehicles at night. While centerline RPMs are present on most major roads in Jackson county. RPMs applied to the edge-line for curves can be especially useful for longer sections of roadway where the addition of the RPMs can signal a change in the road condition ahead.

The countermeasures recommended in this report are intended to enhance road safety at locations where crash records suggest that there are risk factors that the design standards 5/not completely address. The focus of the recommended countermeasures is to improve communication with the driver about changes in road alignment or conflicts with other vehicles.

The primary focus of these recommendations is on upgrading curve markings and warnings. The following definition apply wherever used in the following recommendations:

- **Upgrading warnings, chevrons, and RPMs in curves** refers to:
    - Installing or replacing chevrons in accordance with guidance in MUTCD 2C.09, including spacing based on curve radius as shown in Table 2C-6.
    - Installing or replacing curve warning signs refers to use of the applicable Horizontal Alignment Warning Signs as shown in MUTCD Figure 2C-1.
    - Installing “bright sticks” on all the above sign supports.
        - “Bright sticks” refers to the retroreflective strips on the sign support for enhanced conspicuity in accordance with MUTCD Section 2A.21. The intent of this recommendation in this report is to install “bright sticks” on all supports for warnings about alignment changes, intersections, chevrons, and STOP, YIELD, or DO NOT ENTER signs, in accordance with MUTCD 2A.21.

- **Upgrading RPMS in curves** refers to:
    - Installing raised pavement markings along each edge-line of the curve extending for a distance of at least 450 ft in each direction for roads with speeds of 50 mph or greater and 350 ft for roads with 45 mph or less. MUTCD recommends using RPMs on edge-lines only if the benefits outweigh the impact on bicycles. In the corridors reviewed in this study, crash data indicate a clear advantage in improving delineation of the pavement edge.
    - Unless the centerline RPMs have been recently installed, they should also be replaced to the same limits.

Site Review

Various Curves Countywide

Analysis of the crashes showed that 70.5% of incapacitating injury and fatal crashes on local and county roads were lane departures on curves, mostly in rural areas. This review has concentrated on addressing the lane departures in the curves in the following corridors:

1. Indian Springs Road – North (N) of US 90
2. CR 280 - SR 73 to SR 71
3. CR 280 - CR 167 to Bart Road
4. CR 1656 - US 231 to CR 167
5. Holly Timber Road - US 231 to CR 276
6. CR 162 - SR 273 to Chipola River
7. CR 164 - SR 77 to CR 169
8. Salem Church Road - Sandridge Church Road to Gilley Road
9. CR 280 – SR 71 to CR 275
10. CR 167 – CR 166 to CR 162
11. 11- CR 278 - CR 167 to SR 73
12. CR 169 Adjacent to Treetop Rd
13. Intersection at CR 167 and CR 278
14. CR 271 – Sneads City limits to CR 164

Site description

These sites all have similar characteristics, and for the purposes of this analysis, the curves on these roads are all grouped together. Surrounding areas are mostly forests or other agricultural activity, with occasional small residential communities and some scattered residences in the agricultural areas. One of the roads, Indian Springs Rd, is the central access to a low-density residential subdivision, but the character of the road is like the residential segments of the other roads in this group.

Roads are all two lanes with frequent curves. Lanes are generally standard widths with satisfactory pavement surfaces. Shoulders are generally narrow with limited recovery area for errant vehicles. Most shoulders are unpaved, but in some cases, pavement has been added along the inside edge of the curve.

Speed limits are generally 45 to 55 mph except for short distances in residential areas. Major intersections are widely separated with occasional driveways and access roads serving the rural area. Pavements are marked with thermoplastic center- and edge-lines. Most segments had centerline RPMs.

Most of the significant curves examined had warning signs, but chevrons were limited. The impact of Hurricane Michael on these signs is not clear, but for the purpose of cost estimates, it is assumed that curve warnings and chevrons do not exist.

Crashes

A review of the crash data (134 crashes) showed that 56% of the lane departure crashes in the curves within these corridors were in curves with a radius of less than 1,500 ft. Approximately 48% of these crashes occurred during non-daylight hours.

Other crashes included collisions or evasive maneuvers associated with animals and usually minor crashes at scattered intersections. Twenty-three percent of the crashes were animal related.

Countermeasures

Based on the analysis of the crashes within the subject corridors, two levels of countermeasures are recommended based on the curve radius and crash history.

Curves with radius less than 1,500 ft and curves with one or more lane departure crashes in last five years:

- Upgrade warnings, chevrons, and RPMs in curves.

Other curves:

- Add Horizontal Alignment Sign (curve or other as appropriate) in accordance with MUTCD Section 2C.07.
- For the purpose of estimating the cost of this installation, this treatment was recommended for other curves with a radius of less than 2,500 ft.

The following discussion provides more detailed description of the conditions and crash experience at each of these locations.

1. *Indian Springs Road – North of US-90*

Indian Springs Rd serves as access to the Indian Springs subdivision. The speed limit through this area is 25 mph with advisory speed of 15 mph on some curves, but reported speeds are higher. Figure 7 shows the condition of this segment on 12/5, 2018. Curve warning signs and pavement markings are limited.

Figure 6. Indian Springs Rd

Figure 7. Indian Springs Rd curve, existing condition

Crashes

As shown in Table 2 for the five-year period of this analysis, there were five lane departure crashes in the curves, including one fatal crash. The fatality occurred in non-daylight hours. Three of these crashes, including the fatal and injury crashes, occurred at curve 1-1 (Figure 6). Following the fatal crash, chevrons were installed at the crash site in one direction only.

Table 2. Crashes on Indian Spring Road (sorted N to S)

Location	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
Curve 1-1	83793666	10/13/2014	Daylight	Rollover	N	PDO	Wet
Curve 1-1	81993940	10/2/2014	Dark - Not Lighted	Rollover	S	Fatality	Dry
Curve 1-1	85121794	6/12/2015	Daylight	Off-Road	S	Injury	Dry
Curve 1-4	85371130	3/22/2017	Daylight	Off-Road	N	PDO	Dry
Curve 1-4	85449455	12/28/2016	Dusk	Animal	N	PDO	Dry
Curve 1-4	84562430	3/8/2015	Daylight	Off-Road	N	PDO	Dry

Recommendations:

- Upgrade warnings, chevrons, and RPMs at Curves 1-1 and 1-4.
- Add curve warning signs on Curves 1-2 and 1-3.

2. *CR-280 from SR-73 to SR-71*

As shown in Figure 8, CR-280 is surrounded with forest and agricultural areas with some scattered residences in the agricultural areas. The speed limit on this road is 45 mph. As shown in Figure 8, this segment has two curves with radii of approximately 1,900 ft (Curve 2-1) and 1,600 ft (Curve 2-2). Chipola River passes through this segment between of these two curves.

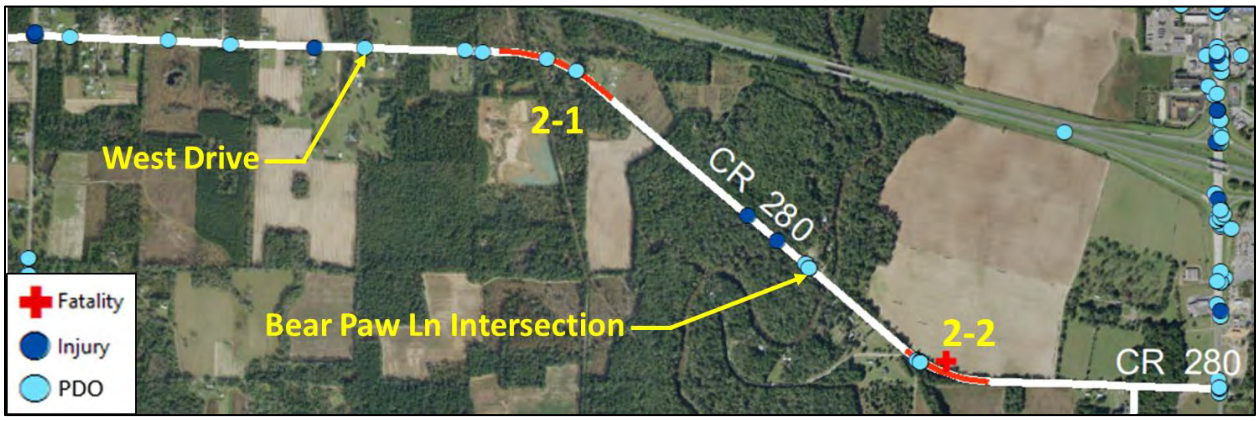

Figure 8. CR-280 from SR-73 to SR-71

Figure 9 shows the condition of CR-280 on 12/5, 2018. This road has center- and edge-line pavement markings and centerline RPMs.

Figure 9. CR-280 from SR-73 to SR-71 (Curve 2-2, looking west)

Crashes

Figure 10 shows that this segment experienced one fatal crash, six injury crashes, and 13 PDO crashes. Four injury crashes and five PDO crashes were due to lane departures. Crashes on this segment were concentrated in the two curves and at the intersection with Bear Paw Lane, as shown in Figure 8 and Table 3. There were two PDO crashes and one injury lane departure crash on Curve 2-1, and the injury occurred in non-daylight condition. Curve 2-2 experienced two PDO crashes, one injury crash, and one fatal crash. All four were lane departure crashes. The two crashes involving injury and fatality both occurred during non-daylight hours.

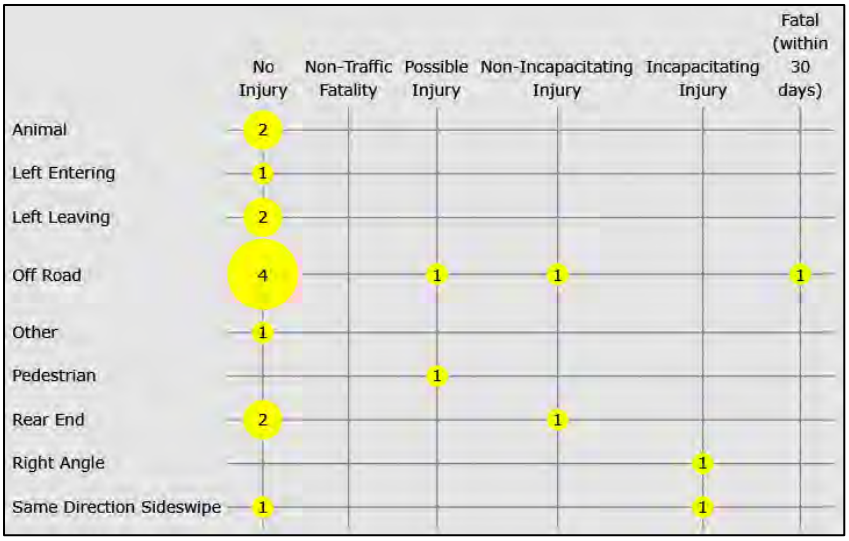

Figure 10. Crash type vs. severity on CR-280 from SR-73 to SR-71

One crash in the vicinity of West Drive was related to water on the road, but other crashes were unrelated to the roadway characteristics. No low-cost measures are identified to mitigate these.

Table 3. Crashes on CR-280 from SR-73 to SR-71 (sorted W to E)

Location	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
	85186470	1/9/2016	Dark - Not Lighted	Animal	W	PDO	Dry
	83835003	11/21/2014	Dark - Not Lighted	Animal	W	PDO	Dry
	85306064	4/25/2016	Daylight	Rear End	E	PDO	Wet
	83327396	11/2/2013	Daylight	Right Angle	NW	Injury	Dry
	85512514	9/7/2017	Daylight	Left-Entering	W	PDO	Dry
West Dr	83697546	7/19/2014	Daylight	Off-Road	W	PDO	Wet
	83730614	1/24/2014	Daylight	Same Direction Sideswipe	W	PDO	Dry
Curve 2-1	83219487	7/31/2013	Daylight	Off-Road	W	PDO	Wet
	85365145	9/4/2016	Daylight	Off-Road	E	PDO	Wet
	83690373	8/2/2014	Dark - Not Lighted	Off-Road	E	Injury	Dry
	83179379	4/2/2013	Daylight	Off-Road	W	Injury	Dry
	85371375	11/21/2016	Daylight	Pedestrian	E	Injury	Dry
Bear Paw Ln	85306081	5/15/2016	Daylight	Left-Leaving	S	PDO	Dry
	85471197	5/5/2017	Daylight	Rear End	W	PDO	Dry
	85497242	6/10/2017	Daylight	Rear End	E	Injury	Dry
	85521383	8/6/2017	Daylight	Left-Leaving	W	PDO	Dry
Curve 2-2	85147590	10/31/2015	Dark - Not Lighted	Off-Road	E	PDO	Dry
	85304660	11/9/2016	Daylight	Same Direction Sideswipe	W	Injury	Dry
	85187365	4/26/2016	Daylight	Other	W	PDO	Dry
	83328262	1/26/2014	Dusk	Off-Road	E	Fatality	Dry

Recommendations

- Upgrade warnings, chevrons, and RPMs on Curves 2-1 and 2-2.
- Install intersection warning signs at Bear Paw Lane.
    - CR-280 was recently reconstructed, but presence of these warning signs following the hurricane should be verified.

3 CR-280 from CR-167 to Bart Road

Figure 11 shows that this two-lane highway is surrounded by a mixture of agricultural and forested areas. The speed limit on this road is 45 mph with the advisory speed of 25 mph on the Curves 3-2 and 3-3. There are three curves on this segment, with the approximate radii of less than 1,500 ft. There is a hill to the east (E) of Curve 3-3 that restricts the sight distance. Chevrons were in place for portions of Curves 3-2 and 3-3, but these installations did not appear to completely cover the affected areas.

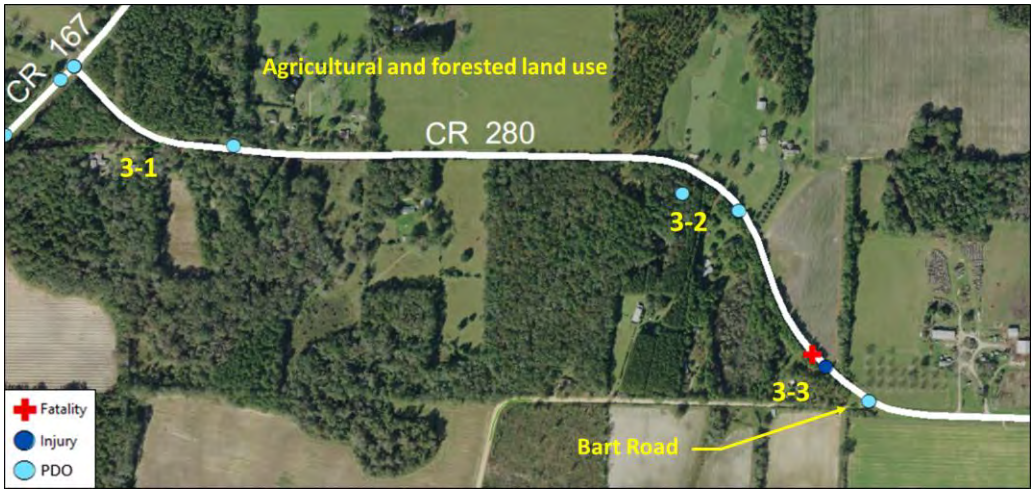

Figure 11. CR-280 from CR-167 to Bart Rd

Crashes

As shown in Table 4, eight lane departure crashes occurred at these three curves. Five of the lane departure crashes occurred in non-daylight conditions. The most severe is Curve 3-3, with fatal and injury crashes, both in non-daylight conditions. Figure 12 shows the crash type versus the severity.

Figure 12. Crash type vs. severity on CR-280 from CR-167 to Bart Rd

The crash at the intersection with Fairview Rd (CR-167) involved a driver error, and no countermeasures were identified to address that condition.

Table 4. Crashes on CR-280 from CR-167 to Bart Rd (sorted W to E)

Location	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
CR-167	85187749	10/5/2015	Daylight	Left-Entering	W	PDO	Dry
	83834995	11/13/2014	Dark - Not Lighted	Left-Leaving	W	Injury	Dry
	84544416	9/26/2015	Dark - Not Lighted	Animal	W	PDO	Dry
	85290680	**4/16/2016**	**Dark - Not Lighted**	**Off-Road**	**E**	**PDO**	**Dry**
	85188233	10/12/2015	Dark - Not Lighted	Animal	W	PDO	Dry
	83292976	9/1/2013	Daylight	Single Vehicle	N	PDO	Dry
Curve 3-1	85558379	9/23/2017	Dawn	Single Vehicle	W	PDO	Dry
Curve 3-2	85440517	2/5/2017	Dark - Not Lighted	Off-Road	W	PDO	Dry
	84541630	12/21/2014	Daylight	Off-Road	W	PDO	Wet
Curve 3-3	85327752	10/23/2016	Dark - Not Lighted	Rollover	W	Fatality	Dry
	85290717	7/21/2016	Dark - Not Lighted	Off-Road	W	Injury	Dry
	84890080	7/6/2015	Daylight	Off-Road	W	PDO	Dry
	84545631	5/15/2015	Dark - Not Lighted	Off-Road (Animal)	E	PDO	Dry

Recommendations

- Upgrade warnings and chevrons at Curves 3-1, 3-2, and 3-3.
- **Install Internally Illuminated RPMs (IIRMPs) on center- and edge-line on Curves 3-1, 3-2, and 3-3 with 20-ft spacing.**

4. CR-1656 from US-231 to CR-167

Little Dry Creek crosses CR-1656 near the W end of this two-lane highway segment (Figure 13). This crossing and associated guardrail are within the limit of Curve 4-1. In the area of Curve 4-2, the shoulders are narrow and roadside swales are deep. This segment is surrounded with forested and farm areas with scattered residents.

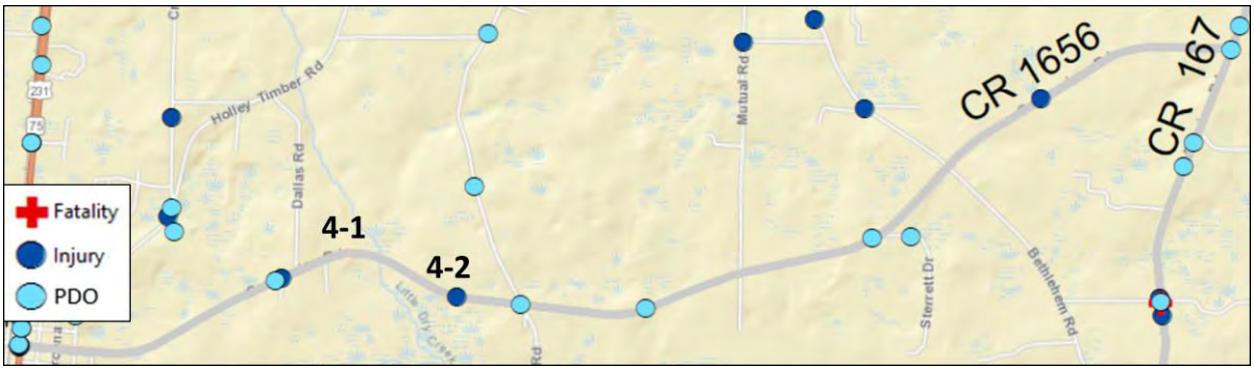

Figure 13. CR-1656 from US-231 to CR-167

This road has center- and edge-line pavement marking, and centerline RPMs as shown in Figure 14

Figure 14. Existing condition of CR-1656 (on 12/5, 2018).

Crashes

Table 5 shows the crashes on CR-1656. One injury crash was reported at each of the two Curves 4-1 and 4-2. The crash at Curve 4-2 was nighttime. Other crashes in the corridor were minor and involved animals, driver error, or other issues for which low-cost safety improvements were not available.

Table 5. Crashes on CR-1656 from US-231 to CR-167 (W to E)

Location	HSMV Number	Date	Light condition	Crash type	Direction	Severity	Surface Condtion
	85373531	12/10/2016	Dark - Not Lighted	Opposing Sideswipe	EW	PDO	Dry
Curve 4-1	84863594	4/21/2015	Daylight	Off-Road	E	Injury	Dry
Curve 4-2	83217832	3/30/2013	Dark - Not Lighted	Off-Road	E	Injury	Dry
	85185338	3/10/2016	Dark - Not Lighted	Off-Road	S	PDO	Dry
	85127673	10/5/2015	Daylight	Same Direction Sideswipe	W	PDO	Dry
	85563971	10/20/2017	Daylight	Rear End	W	PDO	Dry
	85188270	1/15/2016	Daylight	Animal	E	Injury	Wet
	85160499	8/27/2015	Daylight	Off-Road	E	PDO	Dry

Recommendations

Upgrade warnings, chevrons, and RPMs at Curves 4-1 and 4-2.

> *Note: Pavement condition at the time of the field review showed some distress and had been crack sealed. Pavement condition should be reevaluated before installing pavement markings.*

5. Holley Timber Road from US-231 to CR-276

As shown in Figure 15, Holly Timber Rd is a minor road in an area of mixed development including scattered residential, agricultural, and some commercial or industrial activity. The road includes five curves, with radii less than 1,500 ft.

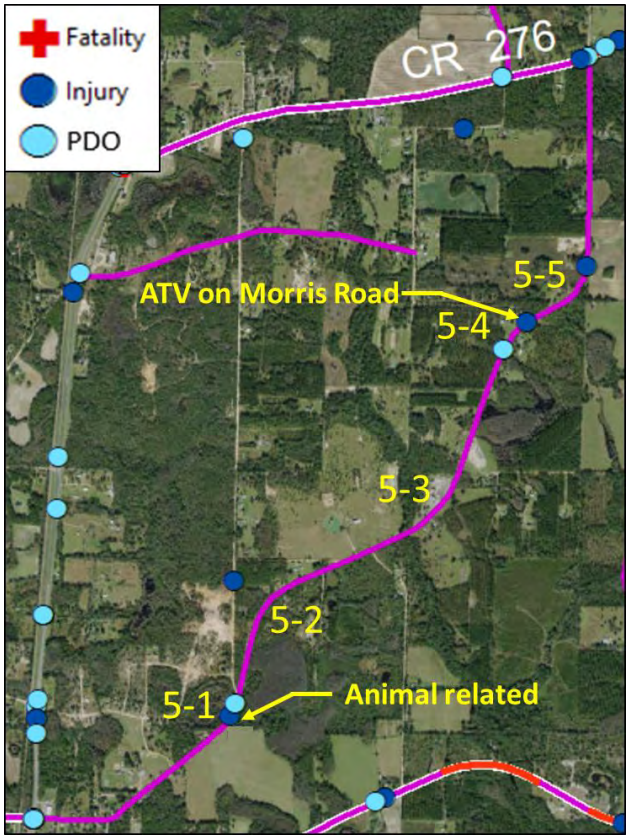

Figure 15. Holley Timber Road from US-231 to CR-276

Figure 16 shows the existing condition of this segment. The edge-line pavement markings were barely visible.

Figure 16. Existing condition of Holley Timber Road from US-231 to CR-276 (12/ 5, 2018)

Crashes

Figure 15 shows three injury crashes and two PDO crashes on three of the curves. Of the six, one PDO was animal related. Another crash plotted on Holley Timber Rd involved an all-terrain vehicle (ATV) on an adjoining facility.

Table 6. Crashes on Holley Timber Rd from US-231 to CR-276 (N to S)

Location	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
Curve 5-5	83660054	12/9/2013	Daylight	Off-Road	N	Injury	Wet
Morris Road	87138437	12/25/2017	Daylight	Rollover	E	Injury	Dry
Curve 5-4	84544395	5/31/2015	Dark - Not Lighted	Off-Road	N	PDO	Dry
Curve 5-1	84863931	4/7/2015	Daylight	Off-Road	S	PDO	Dry
Curve 5-1	83195489	7/13/2013	Dark - Not Lighted	Animal	E	Injury	Dry

Recommendations

- Upgrade warnings, chevrons, and RPMs on all five curves.

  A repaving project is scheduled for this road. The suggested countermeasures need to be coordinated with the repaving project.

6. CR-162 from SR-273 to Chipola River

Between SR-273 and US-231, CR-162 passes through the small town of Jacob City. Much of the area is agricultural with a small residential area. Between US-231 and the Chipola River, the surrounding area is mostly agricultural. The road includes several curves with radii of less than 1,500 ft, which are numbered from 6-1 to 6-10 in Figure 17. The speed limit in the area of Jacob City is 45 and 35 mph. Elsewhere, it is 55 mph.

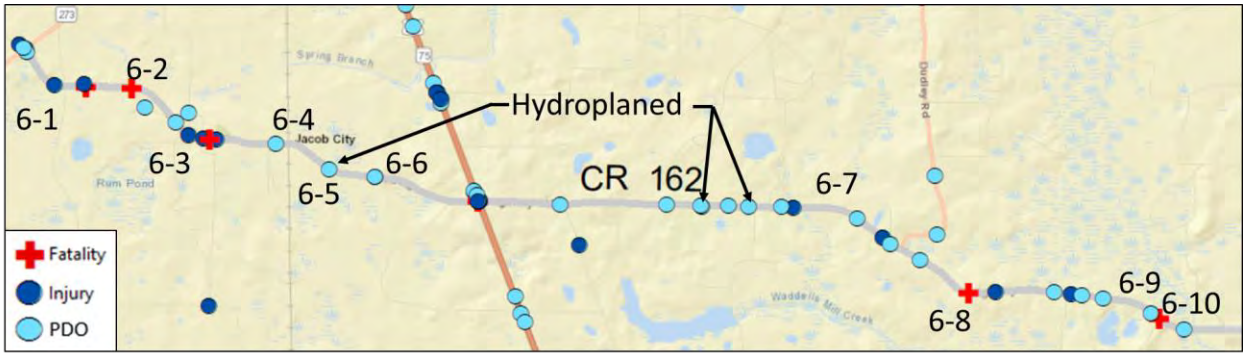

Figure 17. CR-162 from SR-273 to Chipola River

In the Jacob City area, fire hydrants have been installed within the right of way. Bollards have been placed around the hydrants in Curve 6-2, presumably to protect them from errant vehicles. These hydrants and bollards pose a risk to vehicles that leave the roadway and can be especially problematic when they are located on the outside shoulder of a curve, as shown in Figure 18.

Figure 18. Hydrant and bollards on outside of curve in Jacob City (on Curve 6-2)

This road has center- and edge-line pavement marking, along with centerline RPMs as shown in Figure 19. The curve signage on this road is limited.

Figure 19. Existing condition of CR-162 from SR-273 to Chipola River

Crashes

As shown in Table 7, of the 34 total crashes in the corridor, 18 were lane departures, and 13 were animal related. Table 7 does not include crashes at SR-273 and SR-231 intersections. About 59% of the crashes occurred in non-daylight hours. Four of five fatal crashes occurred at curves. Nine of the 18 lane departure crashes occurred at Curves 6-1 to 6-10. Four of the crashes occurred at locations where water was on road and vehicles. (Figure 17.) Figure 20 shows the crash type versus crash severity on CR-162.

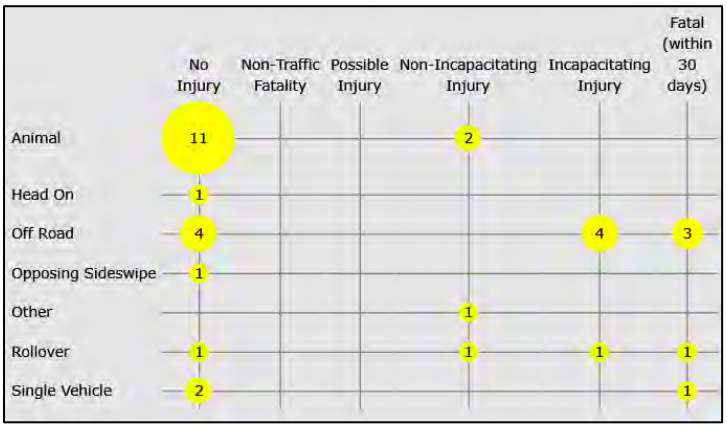

Figure 20. Crash type vs. severity on CR-162

Recommendations

- Upgrade chevrons, warnings signs, and RPMs on curves designated as 6-1 through 6-10.
- Add **Internally Illuminated RPMs (IIRMPs) on center- and edge-line on Curve 6-3.**
- Add object markers at the fire hydrants in Curve 6-2 and at any other locations where bollards have been installed in the right of way to shield the hydrants.

  The county plans a repaving project on the E side of SR-231. The suggested countermeasures should be coordinated with this project.

Table 7. Crashes on CR-162 (sorted from W to E)

Location	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
Curve 6-1	**83725972**	**8/26/2014**	**Daylight**	**Off-Road**	**E**	**Injury**	**Dry**
	83307470	9/ 18/2013	Daylight	Animal	E	Injury	Dry
Curve 6-1	**81993949**	**3/16/2015**	**Dark - Not Lighted**	**Off-Road**	**E**	**Fatality**	**Dry**
Curve 6-2	**84479717**	**10/24/2014**	**Dark - Not Lighted**	**Off-Road**	**E**	**Fatality**	**Dry**
	84860918	6/13/2015	Dark - Not Lighted	Opposing Sideswipe	EW	PDO	Dry
Curve 6-3	**83740683**	**10/19/2014**	**Daylight**	**Other**	**E**	**Injury**	**Dry**
Curve 6-3	**85373527**	**12/2/2016**	**Dark - Not Lighted**	**Off-Road**	**E**	**Injury**	**Dry**
	85471925	6/16/2017	Dark - Lighted	Single Vehicle	W	Fatality	Dry
Jackson Rd	83678069	9/14/2013	Daylight	Rollover	S	Injury	Dry
	83239220	12/29/2013	Dark - Not Lighted	Animal	W	PDO	Dry
Curve 6-5, hydroplaned	83307460	8/18/2013	Daylight	Off-Road	E	PDO	Wet
	81999361	10/23/2017	Daylight	Animal	E	PDO	Wet
	85456552	2/1/2017	Dark - Not Lighted	Animal	W	PDO	Dry
Curve 6-6	82898584	2/5/2013	Dark - Not Lighted	Animal	E	PDO	Wet
Curve 6-6	85151661	2/9/2016	Daylight	Animal	W	PDO	Dry
hydroplaned	83161248	8/17/2013	Daylight	Off-Road	W	PDO	Wet
hydroplaned	83681831	5/15/2014	Dark - Not Lighted	Single Vehicle	W	PDO	Wet
	85521183	9/25/2017	Daylight	Animal	E	PDO	Dry
hydroplaned	83697527	5/5/2014	Daylight	Single Vehicle	W	PDO	Water
	83307488	11/14/2013	Dawn	Animal	E	PDO	Dry
Curve 6-7	**85563179**	**12/ 7/2017**	**Dark - Not Lighted**	**Off-Road**	**W**	**Injury**	**Wet**
Curve 6-7	83316660	5/30/2016	Daylight	Rollover	W	PDO	Dry
	85558393	10/12/2017	Daylight	Animal	E	Injury	Dry
	83817214	10/2/2014	Dark - Not Lighted	Head-On	EW	PDO	Dry
	83748841	6/22/2014	Dawn	Off-Road	E	PDO	Dry
Curve 6-8	**83328296**	**2/1/2016**	**Dawn**	**Rollover**	**W**	**Fatality**	**Dry**
	83834919	12/12/2014	Dark - Not Lighted	Rollover	W	Injury	Dry
	83305299	9/29/2013	Dark - Not Lighted	Animal	E	PDO	Dry
	85440548	6/3/2017	Daylight	Off-Road	W	Injury	Dry
	84891518	8/20/2015	Dark - Not Lighted	Animal	E	PDO	Dry
	81993173	12/18/2015	Dusk	Animal	W	PDO	Dry
	85290688	4/27/2016	Dawn	Animal	E	PDO	Dry
Curve 6-10	**85440510**	**1/9/2017**	**Daylight**	**Off-Road**	**W**	**Fatality**	**Dry**
Curve 6-10	**84891548**	**11/9/2015**	**Dawn**	**Off-Road**	**E**	**PDO**	**Wet**

7. CR-164 from SR-77 to CR-169

The area along CR-164 is predominantly agricultural with scattered residential activity. The speed limit is posted at 55 mph, with one advisory speed reduction to 45 mph at Curve 7-2. Pavement is marked with center- and edge-lines and centerline RPMs.

Figure 21. CR-164 from SR-77 to CR-169

Crashes

Seven crashes were reported during the analysis period as shown in Table 8. Of the 7, one was in an adjoining cemetery and one was animal related, and one lane departure was due to fatigued driver. These three are highlighted in the Table 8. The other four crashes were lane departures that occurred at the curves. One of these curve-related crashes was nighttime. In addition, a memorial marker located in Curve 7-2 indicates that a fatal crash had occurred previously at this location.

Table 8. Crashes on CR-164 from SR-77 to CR-169 (W to E sorted)

Location	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
Curve 7-2	85386846	11/15/2016	Unknown	Rollover	W	PDO	Dry
Curve 7-2	85493558	10/12/2017	Dark - Not Lighted	Off-Road	W	PDO	Dry
Curve 7-3	83307439	6/4/2013	Daylight	Single Vehicle	W	PDO	Dry
	82012378	1/22/2015	Daylight	Animal	E	PDO	Dry
	85187357	3/5/2016	Dark - Not Lighted	Off-Road	W	PDO	Dry
Cemetery	85562851	10/15/2017	Dark - Not Lighted	Off-Road	E	PDO	Dry
Curve 7-4	85558374	8/26/2017	Daylight	Rollover	W	Injury	Dry

Countermeasures

- Upgrade warnings, chevrons, and RPMs at Curves 7-1, 7-2, 7-3, and 7-4.
- Add curve warning signs at Curves 7-5 and 7-6.

Intersections for Referral to FDOT

There were two sites identified as a concern that are intersections between county roads and state roads. These sites are identified here with suggestions for evaluation by FDOT.

CR-164 at SR-77

This is a two-way stop-controlled intersection, with-CR 164 as the minor approach. As shown in Figure 22 and Figure 23, trees along SR-77 in the NE of the intersection restrict visibility for westbound (WB) vehicles approaching the intersection.

Figure 22. Trees along SR-77 at CR-164

Figure 23. Visual obstruction at intersection of CR-164 and SR-77

It is recommended that FDOT review this condition and remove any trees in the SR-77 right of way that 5/be obstructing visibility.

CR-164 at SR-273

This is a two-way stop-controlled intersection, with CR-164 as the minor approach. There is a visual obstruction at this intersection due to a hill on SR-273 south of the intersection, as shown in Figure 24. It is suggested that FDOT consider installing an Intersection Conflict Warning System (ICWS).

Figure 24. Visual obstruction due to hill at intersection of CR-164 and SR-273

8. Salem Church Road from Sandridge Church Road to Gilley Road

Salem Church Rd connects Sandridge Church Rd with Howell Rd through an area of mixed land use, primarily agricultural with scattered residential properties along the road. Salem Church Rd has been recently reconstructed with standard lanes, pavement markings, and warning signs. There are two curves with radii of less than 1,500 ft at the north end of the road. None of the curves are marked with chevrons.

Figure 25. Salem Church Rd

Crashes

One fatal crash was recorded between the two curves. Although the crash report did not indicate that the vehicle was in the curve, the proximity to the curve and the fact that the reported speed was 55 mph suggest that the driver 5/have to lost control on Curve 8-1. A more recent crash (not included in the initial analysis period) has occurred at Curve 8-1.

There were 2 other crashes at Curve 8-1 that were minor PDOs and could not be mitigated by available countermeasures.

Recommendation

- Upgrade warnings, chevrons, and RPMs on Curves 8-1 and 8-2.

9. CR-280 from SR-71 to CR-275

This two-lane highway is surrounded by a mixed land use, primarily agricultural and forest, with scattered residential properties along the road. As shown in Figure 26, where three creeks pass under CR-280, there are guardrails on the roadside. One of the guardrails is located on Curve 9-3. There are four curves with approximate radii of less than 1,500 ft as shown in Figure 26. The speed limit on this road is 55 mph.

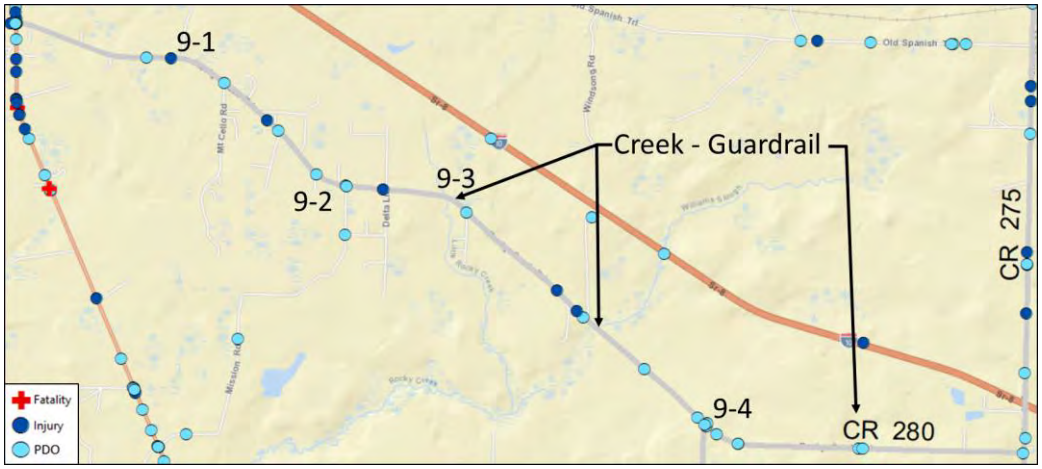

Figure 26. CR-280 from SR-71 to CR-275

Crashes

As shown in Table 9, 23 crashes were reported on this segment. Eleven of the 23 occurred in non-daylight condition. Thirteen of the crashes were lane departure crashes, of which six occurred in Curves 9-1 to 9-4. In four crashes on this segment, the vehicle hit the guardrail. Figure 27 shows the crash type versus severity. Six PDO crashes were animal related. Of the seven injury crashes, one was incapacitating injury, two were non-incapacitating injury, and the rest were possible injuries. In summary, the six lane departure crashes on curves are addressed by the proposed countermeasures. The rest were mostly minor PDO crashes and involved animals, driver error, or other issues for which low-cost safety improvements were not available.

Figure 27. Crashes on CR-280 from SR-71 to CR-275

Table 9. Crash types vs. severity on CR-280 from SR-71 to CR-275

Location/Description	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
Driver's fault	83835714	12/31/2014	Daylight	Single Vehicle	W	PDO	Dry
Curve 9-1	**85187106**	**3/18/2016**	**Dawn**	**Off-Road**	**W**	**Injury**	**Wet**
	83671858	9/28/2013	Daylight	Off-Road	W	PDO	Dry
	83830660	11/22/2014	Dark - Not Lighted	Off-Road	E	Injury	Dry
	83662461	9/2/2013	Daylight	Other	W	PDO	Dry
Curve 9-2	84880669	1/24/2016	Dark - Not Lighted	Animal	W	PDO	Dry
Curve 9-2 (intersection)	85338033	6/15/2016	Daylight	Right Angle	NE	PDO	Dry
Curve 9-2	**85456595**	**6/12/2017**	**Daylight**	**Off-Road**	**E**	**PDO**	**Dry**
Curve 9-3 Guardrail	**83811389**	**10/30/2015**	**Daylight**	**Off-Road**	**W**	**Injury**	**Dry**
Curve 9-3	**85185314**	**7/14/2016**	**Daylight**	**Off-Road**	**W**	**PDO**	**Dry**
Driveway	85151652	1/17/2016	Daylight	Rollover	N	Injury	Dry
Guardrail	83728992	4/19/2014	Daylight	Off-Road	E	Injury	Wet
	83748835	5/29/2014	Dawn	Animal	E	PDO	Dry
	85185371	7/13/2016	Dark - Not Lighted	Animal	W	PDO	Dry
Tree on road	85407512	3/1/2017	Daylight	Single Vehicle	E	PDO	Dry
Curve 9-4	85371373	11/8/2016	Dark - Not Lighted	Animal	E	PDO	Dry
Curve 9-4	85563183	12/15/2017	Dark - Not Lighted	Animal	W	PDO	Dry
Curve 9-4	**83830821**	**12/15/2014**	**Dawn**	**Off-Road**	**W**	**PDO**	**Dry**
Curve 9-4 (Intersection)	85309548	5/14/2016	Dark - Not Lighted	Off-Road	E	PDO	Dry
Curve 9-4	**85295602**	**6/24/2016**	**Dark - Not Lighted**	**Off-Road**	**W**	**PDO**	**Dry**
Guardrail	85562857	11/1/2017	Daylight	Single Vehicle	E	Injury	Dry
	84860947	9/5/2015	Dark - Not Lighted	Animal	E	PDO	Dry
Guardrail	83292964	7/30/2013	Daylight	Off-Road	E	PDO	Dry

Recommendation

- Upgrade warnings, chevrons, and RPMs on Curves 9-1 to 9-4.

  Jackson County and FDOT are developing a project to pave the shoulders on this road. Implementing the curve countermeasures should be coordinated with this project.

10. CR-167 from CR-166 to CR-162

As shown in Figure 28, this road segment is in a mixed area of farm and forest with scattered residentials. This road is crossed by a creek to the north of Curve 10-2. The speed limit on most of this two-lane highway is 55 mph, except on Curve 10-1, where it is 35 mph. This road has standard pavement markings on center- and edge-line with centerline RPMs.

Figure 28. CR-167 from CR-166 to CR-162

Crashes

This segment experienced four injury crashes and six PDO crashes, as shown in Figure 29 and Table 10. On each of the Curves 10-1 and 10-2, two injury crashes and two PDO lane departure crashes occurred. Other crashes were mostly due to driver error or other factors for which low-cost safety improvements were not available. Figure 29 shows the crash type versus severity. Half of the crashes occurred in non-daylight condition.

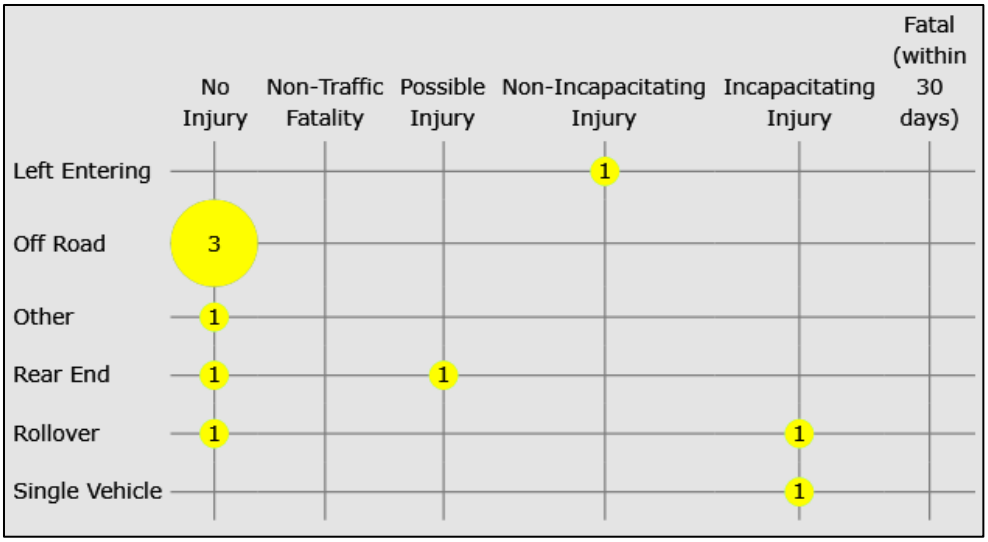

Figure 29. Crash type vs. severity on CR-167 from CR-166 to CR-162

Table 10. Crashes on CR-167 from CR-166 to CR-162

Location/ description	HSMV number	Date (M/D/Y)	Light condition	Crash type	Direction	Severity	Surface condition
	83740667	9/15/2014	Daylight	Rear End	N	Injury	Dry
	85421460	1/17/2017	Dark - Not Lighted	Rear End	N	PDO	Dry
	85456592	6/7/2017	Daylight	Other	N	PDO	Dry
	85180064	12/15/2015	Dawn	Off-Road	S	PDO	Dry
Curve 10-2	**84895355**	**9/17/2015**	**Dark - Not Lighted**	**Off-Road**	**N**	**PDO**	**Dry**
Curve 10-2	**85488548**	**11/2/2017**	**Daylight**	**Single Vehicle**	**N**	**Injury**	**Dry**
Intersection	85449682	8/22/2017	Dark - Not Lighted	Rollover	E	PDO	Wet
Curve 10-1	**85243321**	**7/30/2016**	**Daylight**	**Off-Road**	**S**	**PDO**	**Dry**
Intersection	83179375	3/28/2013	Daylight	Left-Entering	N	Injury	Dry
Curve 10-1	**84541654**	**1/17/2015**	**Dark - Not Lighted**	**Rollover**	**S**	**Injury**	**Dry**

Recommendation

- Upgrade warnings, chevrons, and RPMs on Curves 10-1 and 10-2.

11. CR-278 from CR-167 to SR-73

This segment connects CR-167 to SR-73 through forested and agriculture lands with scattered residential areas, as shown in Figure 30. The terrain is mildly rolling. This road includes six curves with radius about 1,500 ft, numbered as 11-1 to 11-6 in Figure 30. This road has center- and edge-line pavement markings with centerline RPMs.

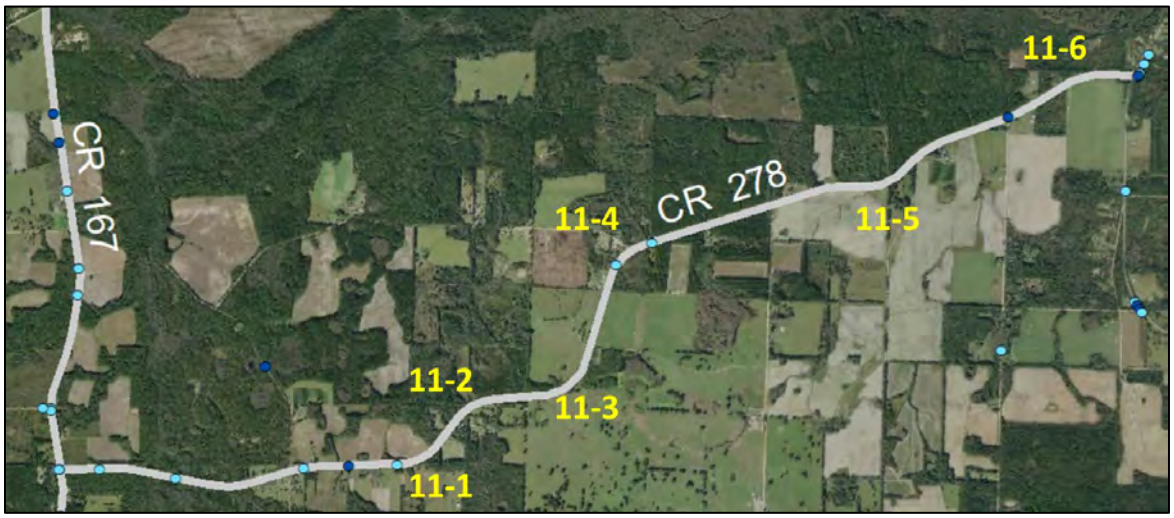

Figure 30. CR-278 from CR-167 to SR-73

Crashes

This section experienced two injury crashes and six PDO crashes during the analysis period. Figure 31 shows the crash type versus the severity. Six of the eight crashes were animal related. In this figure, one off-road crash and one single-vehicle crash were actually animal related. The non-animal-related crashes were one PDO off-road crash and one injury rear-end crash. The rear-end crash was due to a vehicle turning left to Medlock Ln. After Jan. 1, 2018, two injury crashes and one fatal lane departure crash occurred on these curves. The crashes between 2013 and 2017 are in Table 11. The lane departure crash on curve is shown in bold text.

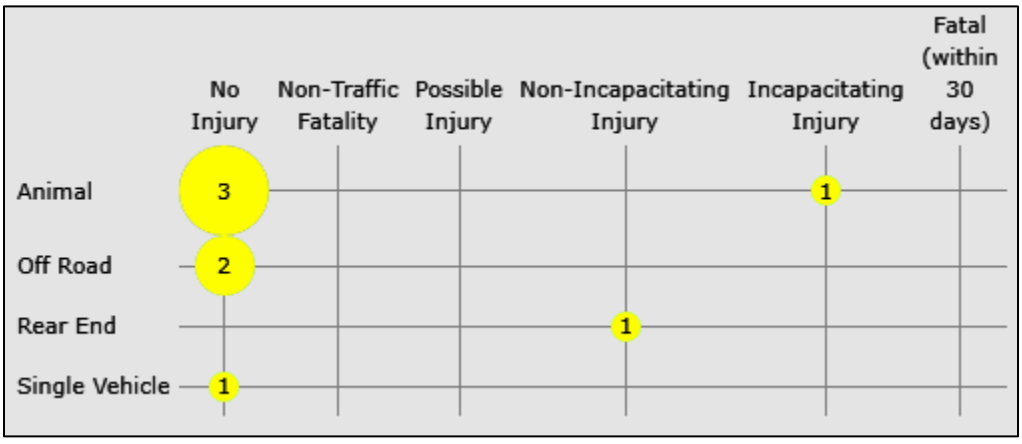

Figure 31. Crash type vs. severity on CR-278 from CR-167 to SR-73

Table 11. Crashes on CR-278 from CR-167 to SR-73

Location/ Description	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
	83195571	2/1/2013	Dark - Not Lighted	Animal	N	PDO	Dry
	85421472	4/14/2017	Daylight	Single Vehicle	W	PDO	Dry
	83654128	11/1/2013	Dark - Not Lighted	Animal	W	PDO	Wet
	85160516	10/21/2015	Daylight	Rear End	W	Injury	Dry
	83830769	6/6/2014	Dark - Not Lighted	Off-Road	W	PDO	Wet
	83830686	**3/14/2015**	**Dark - Not Lighted**	**Off-Road**	**S**	**PDO**	**Wet**
	83835243	1/8/2015	Dark - Not Lighted	Animal	E	PDO	Dry
	83752274	3/1/2014	Daylight	Animal	W	Injury	Dry

Recommendation

- Upgrade warnings, chevrons, and RPMs on Curves 11-1 to 11-6.

12. CR-169 adjacent to Treetop Road

This curve is located south of Treetop Rd as shown in Figure 32. There are multiple culverts on the east side of the curve. These culverts increase the risk to the vehicles leaving the road.

Figure 32. CR-169 adjacent to Treetop Rd

Crashes

Table 12 shows that this site experienced one fatal crash and two injury crashes occurred. One of the three was a rear-end crash due to a turning vehicle (grayed out in the table), while the rest were curve-related lane departure crashes.

Table 12. Crashes on CR-169 adjacent to Treetop Rd

Location/ description	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
	84544389	5/3/2015	Dark - Not Lighted	Off-Road	N	Injury	Dry
	85186445	10/17/2015	Daylight	Left-Entering	S	Injury	Dry
	85447272	2/22/2017	Dark - Not Lighted	Off-Road	N	Fatality	Dry

Recommendation

- Upgrade warnings, chevrons, and RPMs on the curve.

Benefit- Cost Analysis

In preparing the benefit-cost analyses for the improvements in Sites 1–12, the costs and benefits were aggregated because the recommended countermeasures and the risk factors are similar at the various sites. Results of this aggregate analysis are shown in Table 13. The details of cost calculations are in Table 18.

Table 13. Benefit-cost summary for Sites 1-12

Annual Benefit in crash reduction cost	*Annualized cost*	*Total Cost*	*B/C Ratio*	*NPV*
$1,751,327	***$169,381***	***$887,916***	***12.73***	***$8,711,364***

13. Intersection at CR-167 and CR-278

Site Description

This site is a T-intersection between CR-167 and CR-278, controlled by a stop sign on CR-278. The surrounding area is largely forested, with scattered residential development along CR-167 as shown in Figure 33. Both roads are two lanes with no turning lanes at the intersection. Posted speed limits on both CR-278 and CR-167 are 55 mph.

Figure 33. CR-278 at CR-167

The south leg of the intersection includes both a horizontal and vertical curve. This limits the distance at which vehicles approaching from the S and E can see each other and shortens the time available for either driver to react to approaching traffic, as shown in Figure 34.

Figure 34. Restricted sight distance between vehicles approaching from S and E

The CR-278 approach is on an uphill grade with the crest of the hill at a short distance from the intersection. The CR-278 approach is marked with a double arrow and object markers, and there are rumble strips on the WB lane, but the view of the pavement at the intersection is hidden by the crest of the hill as shown in Figure 35.

Figure 35. CR-278 approach to CR-167 intersection (top); intersection of CR-278 and CR-167 (bottom)

Crashes

Table 14 shows the crashes at this intersection from 2013 through 2017. During the five-year analysis period, two of the crashes involved WB vehicles that failed to stop and collided with fixed objects on the west side of CR-167. Since the field study was conducted, there was another crash with injury involving a WB vehicle that failed to stop at the intersection. This crash and one of the earlier crashes both occurred when visibility was restricted by fog or smoke.

Table 14. Crashes at CR-167 and CR-278 Intersection

Location	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface condition
Intersection	85470688	8/18/2017	Daylight	Animal	W	PDO	Dry
	85221158	4/23/2016	Daylight	Right/Through	W	PDO	Dry
	84890111	11/3/2015	Daylight	Off-Road	W	PDO	Dry
	84528426	12/22/2014	Dark - Not Lighted	Single Vehicle	W	PDO	Wet
Curve to south of intersection	85456555	2/7/2017	Daylight	Off-Road	N	PDO	Wet
	85563151	9/3/2017	Dark - Not Lighted	Off-Road	N	PDO	Dry
	83660039	10/24/2013	Dawn	Animal	N	PDO	Dry

One crash was a collision between a WB and NB vehicle. The WB driver reported he did not see the NB vehicle before entering the intersection.

The curve to the south of the intersection experienced two curve-related lane departure crashes and one animal-related crash.

Emphasis Areas for Countermeasures

- Improve visual cues for WB drivers on CR-278 that a stop-controlled intersection is located just beyond the crest of the vertical curve. This is especially important during periods of restricted visibility.
- Inform the drivers on SB and NB about the presence of vehicles at intersection's WB approach.
- Upgrade warnings for NB drivers about the curve and intersection.
- Increase the time available for NB and WB drivers to detect and react to each other.

Recommendations

The following countermeasures are suggested for this intersection (Figure 36):

- Upgrade signing at the intersection to include flashing LED large stop signs on both left and right sides of the CR-278 approach.
- Add an advanced stop warning sign on CR-278 with a flashing beacon.
- Increase mounting height of end-of-road signage for the CR-278 approach.
- Add warning signs on the CR-167 approaches to show the curve and intersection.
- Add chevrons on the S leg of the curve.
- Consider posting a reduced advisory speed for NB traffic through the curve and intersection. This would require action by Jackson County.
- Add Intersection Conflict Warning System (ICWS) with displays on CR-167 to be activated when vehicles approach from CR-278.

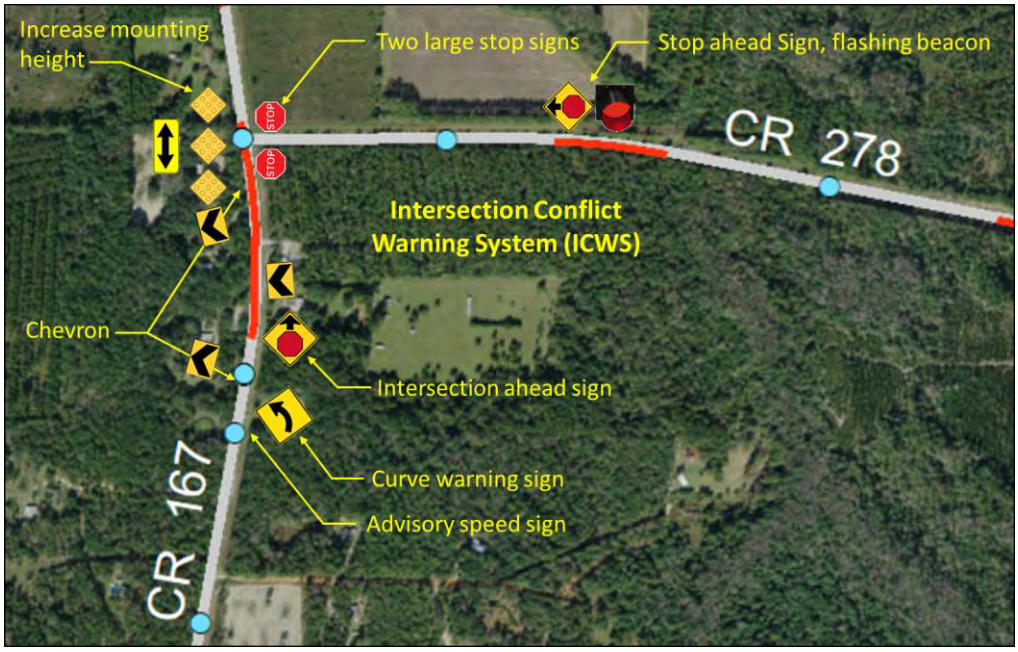

Figure 36. Countermeasures for the intersection of CR-278 and CR-167

Benefit-Cost analysis

Table 15 shows the benefit-cost summary of this intersection. The total cost is about $83,000, with the benefit-to-cost (BC) ratio of 10.34. The details of cost calculations are in Table 19.

Table 15. Benefit-cost summary for the intersection at CR-167 and CR-278

Annual Benefit in crash reduction cost	Annualized cost	Total Cost	B/C Ratio	NPV
$164,465	$13,505	$91,658	12.2	$640,510

14. CR-271 from Sneads City Limits to CR-164

Site Description

The subject road passes through an area that is mostly agricultural (Figure 37). There is a small residential community at the south end of the corridor and a few scattered residences to the north. The road runs parallel to Chattahoochee River and Lake Seminole. There are occasional driveways, mostly serving agricultural access. With the lake to the east, there are no significant four-leg intersections. Two state parks along Lake Seminole have access from CR-271.

The road is two lanes with a curvilinear alignment. A portion of the lake extends across the road at two locations. In these two areas, which have culverts/bridges, guardrail has been installed.

The road was repaved and upgraded within the last 10 years. Pavement shows no significant distress, and thermoplastic centerline and edge-line are functional. RPMs were not installed on this road. There are a limited number of warning signs, and no chevrons were observed at the curves during the field study.

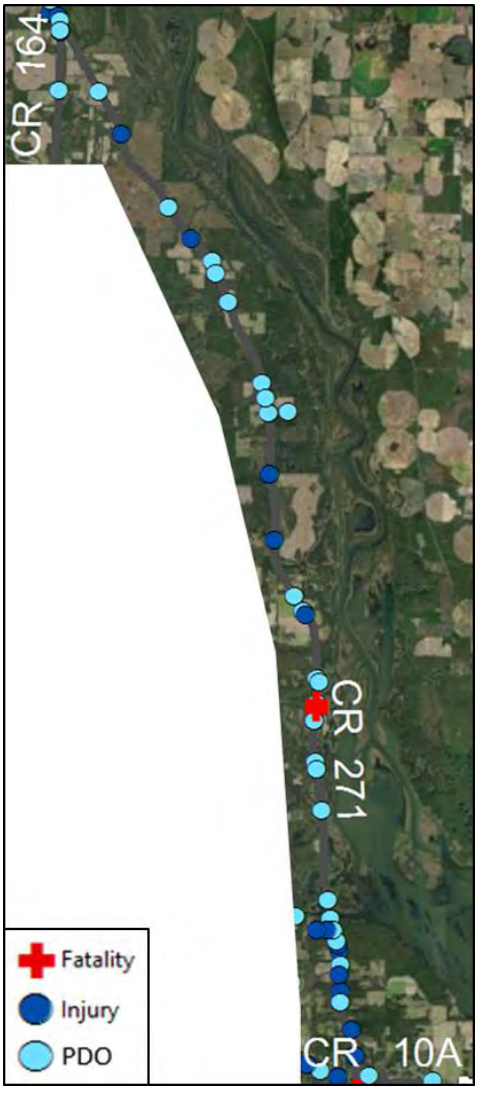

Figure 37. CR 271 from Sneads city limits to CR-164

Crashes

For the period 2013–2017, there were 43 crashes in this segment. Twenty of these crashes involved animals on the road, and 14 were mostly minor crashes involving conditions for which low-cost countermeasures are not available.

Nine of the crashes were lane departures, including one fatal crash and three with injuries. Five of the lane departure crashes (55%) occurred in non-daylight hours, and six (67%) were affected by curves. These lane departure crashes are summarized in Table 16.

Table 16. Lane departure crashes on CR-271 (sorted N to S)

Location/ description	HSMV number	Date	Light condition	Crash type	Direction	Severity	Surface conditions
Curve	85445804	8/14/2017	Daylight	Single Vehicle	S	Injury	Dry
Straight	83316626	8/1/2015	Daylight	Off-Road	N	PDO	Dry
Curve	83328251	10/11/2013	Daylight	Off-Road	S	Fatality	Dry
Straight segment	84890084	7/21/2015	Dark - Not Lighted	Rollover	N	PDO	Dry
Curve	85180085	2/13/2016	Daylight	Rollover	S	PDO	Dry
Curve	85476214	2/12/2017	Daylight	Off-Road	S	PDO	Dry
Curve	85188254	12/15/2015	Dark - Not Lighted	Off-Road	N	Injury	Dry
Curve	83681784	9/19/2013	Dusk	Rollover	S	Injury	Dry
Curve	83830771	6/13/2014	Dark - Not Lighted	Off-Road	S	Injury	Dry
Straight	85304642	8/23/2016	Dark - Not Lighted	Off-Road	S	PDO	Wet

Recommendations

Upgrade pavement marking and signing for the entire corridor, including

Corridor-wide

- Audible pavement markings along both centerline and edge-line (except in areas near residences)
- RPMs along centerline for entire length of the corridor

Curves with radius less than 1,500 ft

- RPMs along the edge-line at curves 1, 2, 3, 5, 6, 7, 8, 12, and 13 in Figure 38.
- Chevrons and curve warning signs at curves 1, 2, 3, 5, 6, 7, 8, 12, and 13 in Figure 38.

Other curves

- Curve warning signs at curves 4, 9, 10, and 11 in Figure 38.

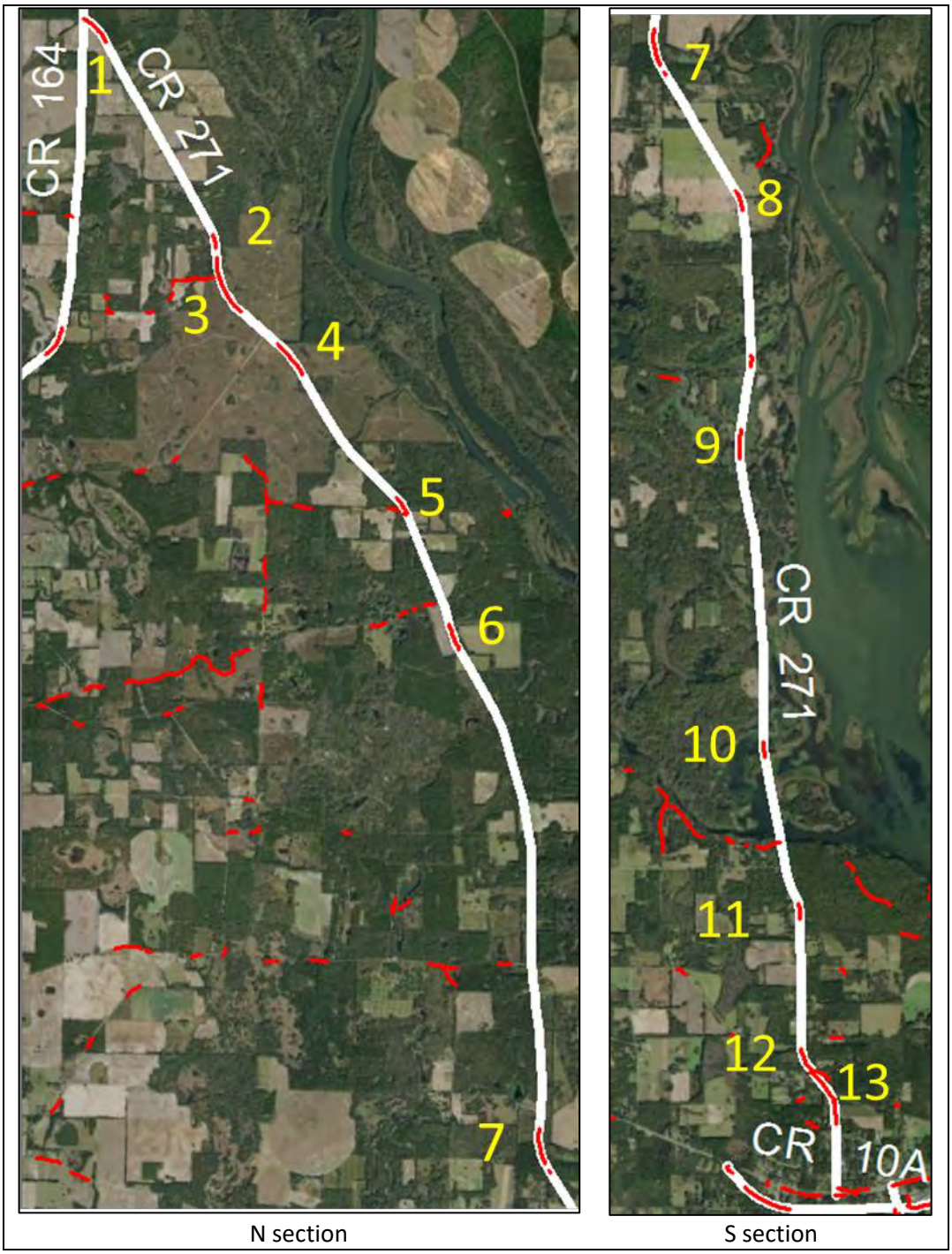

Figure 38. Curves on CR-271

Intersections

- Since the field study was conducted, Hurricane Michael damaged numerous signs throughout the county. The current status of the intersection signing in this corridor is unknown, but the signs at intersections identified in Figure 39 and Figure 40 should be checked. Signs should be installed at these locations as needed to conform to MUTCD standards.

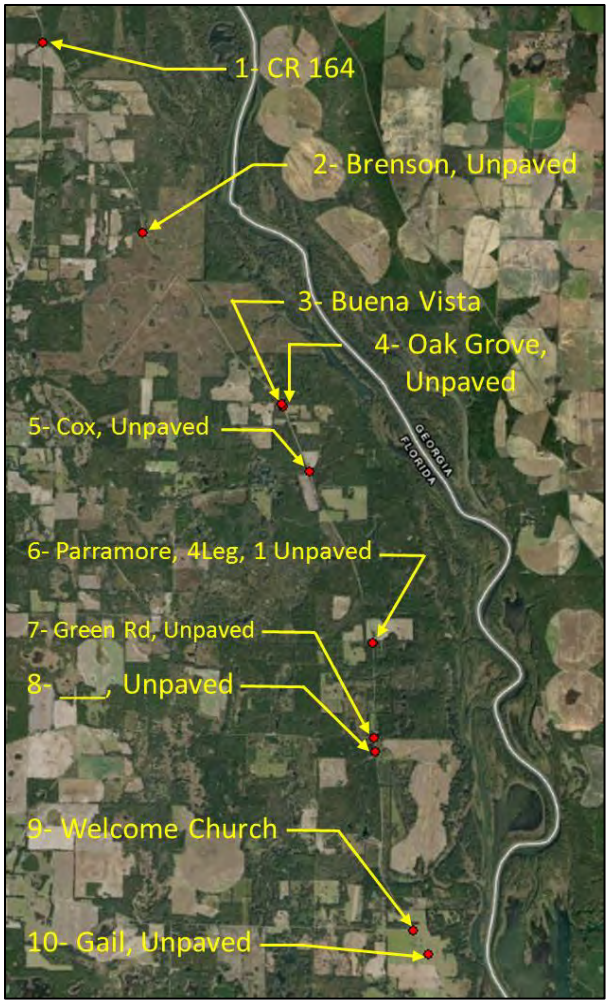

Figure 39. Intersections 1 to 10 on CR-271

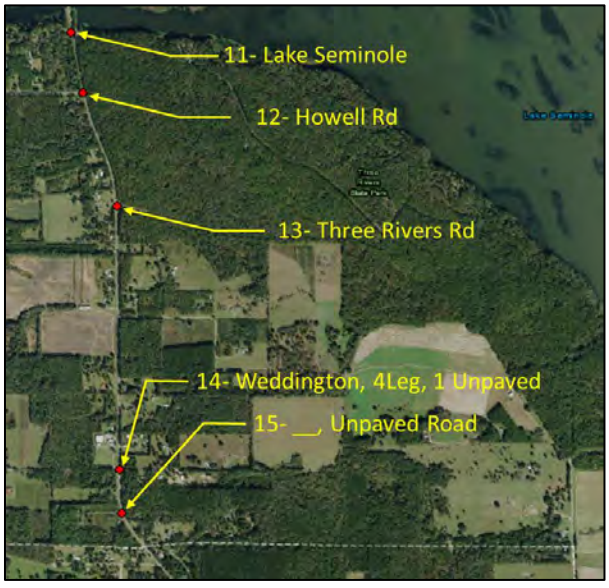

Figure 40. Intersections 11 to 15 on CR-271

Benefit-Cost Analysis

As shown in Table 17, the total cost for this segment is about $333,000, with the benefit-to-cost (BC) ratio of 4.72. The details of cost calculations are in Table 20.

Table 17. Benefit-cost summary for CR-271

Annual Benefit in crash reduction cost	Annualized cost	Total Cost	B/C Ratio	NPV
$301,674	$63,894	$334,938.51	4.7	$1,008,059

Appendix A Cost calculations

This section shows the detail of cost analysis and quantity of countermeasures including signs, RPMs, pavement markings, etc. The annualized costs were calculated by the following formula:

$$Annuity\ Factor\ =\ [1 - (1\ +\ r) - n]\ /\ r$$

$$Annualized\ costs\ =\ Total\ Cost\ \times\ Annuity\ Factor$$

where r is the annual interest rate (0.04) and n is the countermeasure life span reported by the FDOT Roadway Design office.

The yearly benefit of each project is calculated as follows:

$$Anualized\ benefit = Expected\ yearly\ reduction\ in\ crash\ \times Crash\ cost$$

Table 18 Cost analysis for sites 1 to 12

#	Countermeasures for Cost Calculations	Description	Quantity	FDOT Item	Unit	Unit Cost	Total Cost	Annualized Cost
1	Signs - Single Post Sign <12 SF	Chevrons Signing	734	0700 1 11	AS	$345.52	$253,612	$48,379
2	Signs - Single Post Sign <12 SF	Curve warning Signing	94	0700 1 11	AS	$345.52	$32,479	$6,196
3	Signs - Single Post Sign <12 SF	Advanced warning signs	2	0700 1 11	AS	$345.52	$691	$132
4	Retroreflective Sign Strip		830	0700 13 15	EA	$95.35	$79,141	$15,097
5	RPM - Retro-Reflective Pavement - markers		3771	0706 3	EA	$2.93	$11,049	$2,108
6	IIRPM		948	----	0	$170.00	$161,160	$30,743
					Subtotal		$538,131	
					Mobilization	10%	$53,813	
					MOT	10%	$53,813	
					CEI	30%	$161,439	
					Eng. & Contingencies	15%	$80,720	
					Total		**$887,916**	

Table 19 Cost analysis for Intersection of CR-278 and CR-167

#	Countermeasures for Cost Calculations	Description	Quantity	FDOT Item	Unit	Unit Cost	Total Cost	Annualized Cost
1	LED flashing stop sign (solar)	Combined Unsignalized Intersection Treatment 3Leg 3*22	2	----	EA	$2,000.00	$4,000	$763
2	Signs - Single Post Sign <12 SF		1	0700 1 11	AS	$345.52	$346	$66
3	Beacon, single		1	0654 2 11	AS	$6,506.43	$6,506	$1,241
4	ICWS 2*2 Minor	Install intersection conflict warning systems (ICWS) for two-lane at two-lane intersections	1	---	EA	$35,750.00	$35,750	$4,408
5	Retroreflective Sign Strip		6	0700 13 15	EA	$95.35	$572	$109
6	Signs - Single Post Sign <12 SF		3	0700 1 11	AS	$345.52	$1,037	$198
7	Signs - Single Post Sign <12 SF	Chevrons Signing	16	0700 1 11	AS	$345.52	$5,528	$1,055
8	Retroreflective Sign Strip		19	0700 13 15	EA	$95.35	$1,812	$346
					Subtotal	$55,551		
					Mobilization	10%	$5,555	
					MOT	10%	$5,555	
					CEI	30%	$16,665	
					Eng. & Contingencies	15%	$8,333	
					Total		**$91,658**	

Table 20 Cost analysis for CR-271 from Sneads City Limits to CR-164

#	Countermeasures for Cost Calculations	Description	Quantity	FDOT Item	Unit	Unit Cost	Total Cost	Annualized Cost
1	Signs - Single Post Sign <12 SF	Chevron	138	0700 1 11	AS	$345.52	$47,682	$9,096
2	Retroreflective Sign Strip	Bright stick	217	0700 13 15	EA	$95.35	$20,691	$3,947
3	RPM - Retro-Reflective Pavement - markers		2298	0706 3	EA	$2.93	$6,733	$1,284
4	RPM - Retro-Reflective Pavement - markers		729.6	0706 3	EA	$2.93	$2,138	$408
5	Solid Pavement Marking		69.6	0710 11101	GM	$929.03	$64,660	$12,335
6	Rumble Stripes Edge Line	Install rumble strips	34.8	0546 72 53	GM	$971.06	$33,793	$6,446
7	Signs - Single Post Sign <12 SF	Curve warning sign	26	0700 1 11	AS	$345.52	$8,984	$1,714
8	Signs - Single Post Sign <12 SF	Stop signs and end of road signage	53	0700 1 11	AS	$345.52	$18,313	$3,493
						Subtotal	$202,993	
						Mobilization	10%	$20,299
						MOT	10%	$20,299
						CEI	30%	$60,898
						Eng. & Contingencies	15%	$30,449
						Total		**$334,939**