



Union County Site Analysis and Justification - CR229, CR241, CR18

*Safety Project Development Capacity for Small Communities
in Coordination with Local Technical Assistance Program (LTAP) Center*



October 2013

Prepared by:

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REPORT

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1. INTRODUCTION

1.1 SCOPE AND PURPOSE

The Florida Department of Transportation has recognized that there is an urgent need to assist small communities in Florida in their efforts to improve highway safety. With increased emphasis on safety at the national level, federal funds are available for safety improvements on all public roads, but federal guidance requires the programming of safety funds to be data driven. In many cases the smaller communities in Florida do not have sufficient technical resources to conduct the required analysis.

FDOT has engaged the LTAP Center at University of Florida to help develop a program to assist these small communities. This effort includes developing a template for conducting field studies and preparing the required analysis and documentation. To develop this template, LTAP has worked with Union County to conduct a pilot study as a basis for this template.

This report documents the findings from the pilot study and the associated analysis.

1.2 STUDY SITES

In selecting sites for the study, the team looked for roads where crashes could be mitigated with low cost improvements. Since one of the objectives was to provide a template for future use by others, it was also important to select sites that could provide meaningful examples of how to perform analyses.

The team examined crash information from two sources: the FDOT Safety Portal and Signal Four Analytics. The team also discussed the crash problems with Union County, and visited several locations before selecting the test sites.

From FDOT's All Roads Crash Analysis (ARCA,) on the Safety Portal two potential sites were identified:

CR 796 is shown as a High Risk Rural Road in 2010. Further examination of this road indicated that improvements to this road have been made recently. It did not appear to be a good example for a case study and it was eliminated.

CR 241 at CR 18 is shown as a High Crash Segment in 2010. Field visits confirmed that this site met the criteria for this study.

Signal Four Analytics was used to produce maps showing locations of fatalities, clusters of crashes, and sites where there appeared to be an unusual concentration of night time crashes. Crash data for the period from 2006 through 2011 were used for the analysis. From this information and discussions with Union County representatives, road segments on CR 229 and CR 241/18 were selected for the pilot study. Figure 1 shows the approximate location of these sites. For the purpose of analysis and development of proposed countermeasures, these road segments were divided into five separate study sites:

- CR 229 Area
 - CR 229 (south) from Bradford County Line to SR 121
 - CR 229 (north) from SR 121 to Baker County Line
- CR 241/CR 18 Area
 - Intersection of CR 18 at CR 241
 - CR 241 from Alachua County Line to CR 238
 - CR 18 from Columbia County Line to SR 121

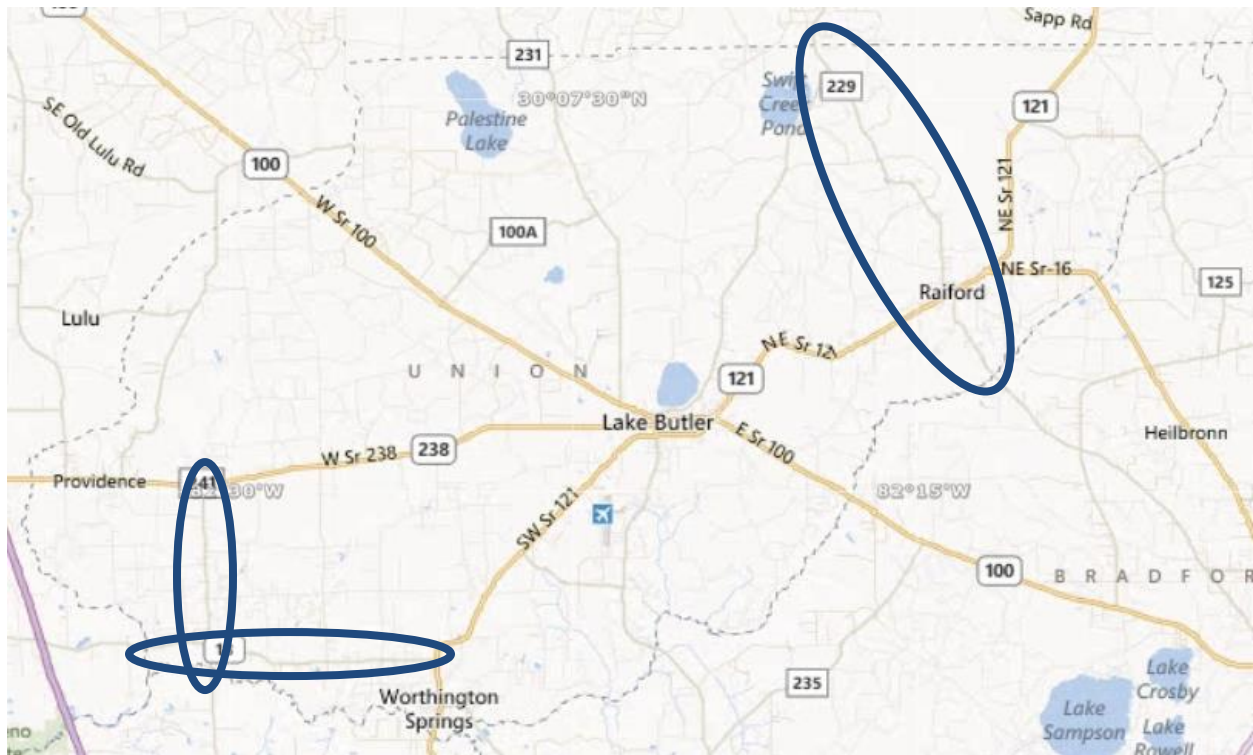


Figure 1. Sites for pilot study in Union County

2. STUDY METHODOLOGY

2.1 STUDY TEAM

The analysis was conducted generally following the principles of the FHWA Road Safety Audit Guidelines. The study team included various members of UF's research team. From the County, the participants were the County Commission Chairman, Road Superintendent, and a representative of the County Emergency Management office. The Road Superintendent represented the County during the field reviews.

Field studies were conducted during both daylight and nighttime conditions.

2.2 DATA SOURCES AND APPROACH TO DATA COLLECTION

Crash records for the period from 2006 through 2012 were used for this analysis. The crash sites were identified and plotted on maps prior to the field study and helped guide the team in investigating the problem areas.

To the extent practical, the team used data obtained from public sources. Although much of the photography contained in this report was obtained from Google's Street View, conditions were verified by field observation. A hand held GPS unit was used to collect some data.

Estimates and approximate locations of features like signs, guardrails, and culverts were considered adequate for estimating costs, but more detailed survey work will be required to obtain the information necessary to develop construction plans and quantities.

2.3 BENEFIT-COST (B/C) ANALYSIS SUMMARY

Benefit/cost analysis was performed in accordance with the specifications described by the Florida Department of Transportation in State Safety Office Bulletin 10-01, regarding "Benefit/Cost Analysis, Roadside Safety Analysis Program, and Discount (Interest) Rate." Crash costs and the interest rate used in analysis also come from this document (<http://www.dot.state.fl.us/rddesign/updates/files/RDB10-09.pdf>).

Crash modification factors used in analysis primarily originate from the FHWA Crash Modification Factor Clearinghouse (<http://www.cmfclearinghouse.org/>).

Countermeasure costs are based on statewide averages of 2011 unit costs (<http://www.dot.state.fl.us/specificationsoffice/estimates/historicalcostinformation/AnnualSWAve/AnnualStatewideAverage11.xls>.)

Quantities used in estimating countermeasure costs are shown in Appendix B – Basis of Cost Estimates.

Table 1 provides a summary of potential countermeasures for each site, along with their estimated costs and B/C ratio. In this summary and in the detailed discussions of each site, Level 1 countermeasures generally refer to low cost improvements that can be implemented quickly. These improvements generally have a higher benefit/cost ratio. Level 2 usually refers

to more extensive improvements that will take longer to plan and implement. Level 2 improvements usually include the Level 1 work.

Table 1. Summary of implementation scenarios

Site	Level 1 Countermeasures	Level 1 Estimated Cost	Level 1 B/C Ratio	Level 1 Net Present Value	Additional Level 2 Countermeasures	Level 2 Estimated Cost	Level 2 B/C Ratio	Level 2 Net Present Value
CR 229 (S Curve South of SR 121)	Upgrade signs and markings, enhance warning signs, chevrons, additional stop sign	\$60,653	19.215	\$210,749	Widen pavement with additional markings, move ditch, remove guardrails	\$581,670	6.778	\$229,163
CR 229 (Intersection at NE 125th Way and NE 228th Place)	Upgrade signs and markings, enhance advanced warning signs, additional stop sign, transverse rumble strips, new guardrail and mitered culvert end	\$22,842	37.728	\$116,507	N/A	\$22,842	37.728	\$116,507
CR 229 (SR 121 to Baker County Line)	Upgrade signs and markings, enhance advance warning signs and chevrons at curves, upgrade T-intersection end treatments, upgrade and install guardrail	\$217,366	4.741	\$139,807	Widen pavement	\$2,975,000	1.636	\$121,066
CR 241 - CR 18 Intersection	Advanced warning signs, trim vegetation, additional and larger stop signs, retroreflective sign posts, transverse rumble strips, edge lines, center lines, RPMs, update signs	\$19,144	41.506	\$190,928	Overhead flashing beacon, intersection lighting	\$83,791	20.291	\$208,025
CR 241 (Alachua County Line to CR 241A)	Edge lines, RPMs, warning signs, T-intersection end treatments, update signs, new guardrail	\$182,442	1.885	\$17,563	Widen pavement	\$1,124,186	1.976	\$70,224
CR 18 (CR 241 to Columbia County Line)	Upgrade signs and markings, upgrade T-intersection end treatments, upgrade and install guardrail	\$61,249	7.572	\$54,325	Widen pavement	\$612,500	2.424	\$55,828
CR 18 (CR 241 to SR 121)	Upgrade signs and markings, remove vegetation at intersections, upgrade T-intersection end treatments, upgrade and install guardrail	\$264,101	4.912	\$138,760	Widen pavement	\$3,125,000	2.247	\$249,369

2.4 DESCRIPTION OF COUNTERMEASURE SCENARIOS

To simplify discussion of options, some countermeasures have been grouped together. The following descriptions identify more completely the intent of these countermeasure groups.

2.4.1 Upgrade signs and pavement markings

- This item refers to upgrading critical signs to current MUTCD standards for sign type, placement, size, and condition, including object markers, chevrons, advisory speeds and advanced warnings where appropriate. For some sites, additional enhancements are suggested and these are addressed in the descriptions for each site.
- Intersection treatments refer to signs and pavement markings on the intersecting road.
Note: Union County's street naming practice is to designate certain driveways that serve multiple residences as named streets. Additional coordination with Union County is needed to determine the threshold for which the intersection treatments are required.
- Pavement marking refers to placement of centerlines and edge lines. This also includes placement of Raised Pavement Markers (RPMs) on the centerline. Cost estimates used for the B/C analysis are based on costs and expected life of thermoplastic markings. Painted lines may be appropriate under low traffic conditions or where emergency or temporary striping is needed, but arrangements should be made for follow-up applications if paint is used for lane lines.
Note: Union County has expressed a concern that when RPMS are placed outside double stripes for a centerline on narrow pavement, it encourages drivers to move closer to the edge and effectively reduces lane width. This should be considered when specifying the placement of RPMs on narrow pavements.

2.4.2 Enhanced conspicuity or other special signing or marking treatments

- A variety of additional treatments may be recommended to address certain problems. In some cases, merely upgrading to minimum standards is not enough to solve a problem, and use of retro reflective strips on sign posts or other devices to call attention to signs or roadway features is appropriate. These issues are described in the detailed discussion of each site.

2.4.3 Guardrail

- Guardrail upgrade refers to all work required to meet current standards, including rails, posts, end treatments, delineators, etc. This also includes extension or installation of new guardrail as required along steep slopes or obstacles within the clear zone.
- In some instances, culverts may be extended or slopes flattened as an alternative to installing guardrail. For the purposes of this analysis, B/C calculations are based on the use of guardrail, recognizing that further evaluation may indicate an alternate is preferred.

2.4.4 Widen and pave shoulders

- This treatment would involve widening the pavement to a minimum of 26' and striping to provide lane widths of at least 11' with paved shoulders of 2' with a safety edge. This may also involve additional grading of the unpaved portion of the shoulder as required to meet Florida Greenbook standards.

Note: Design exceptions may be required where right of way, environmental issues, or other constraints make it impractical to completely conform to the standards.

This work would also include other improvements such as culvert end treatments, vegetation removal within the clear zone, removal or shielding of other fixed obstacles, and other work as required to meet *Florida Greenbook* standards (unless otherwise approved by design exception).

3. CR 229 AREA

The areas north and south of SR 121 were reviewed separately. The study for the site south of SR 121 included a brief review of the entire road from Bradford County Line to SR 121, but since the reported crashes for the study period were concentrated in the rural area between NE 233rd Court and Norman Lane, the field review concentrated on this section.

CR 229 north of SR 121 was considered a separate site, with special emphasis on the intersection/curve at NE 125th Way and NE 228th Place.

3.1 FIELD REVIEWS

- Initial daylight review – conducted afternoon of 11-13-2012

Review team: John Goodknight, team leader; Soowoong Noh, UF; Phillip Haas, UF; Shelton Arnold, Union County Road Superintendent

- Follow up nighttime review – conducted after 6 pm 11-13-2012

Review team: John Goodknight, team leader; Soowoong Noh, UF; Phillip Haas, UF; Shelton Arnold, Union County Road Superintendent

3.2 CR 229 - FROM NE 233RD COURT TO NORMAN LANE (UNION CO.)

3.2.1 Site Description

Land along this section of the road (approximately .9 miles) is largely undeveloped and rural in nature. Two residential driveways connect directly to CR 229, and two other roads intersect within this section. Areas to the north and south are developed as low density residential properties.



Figure 2. Location of study site – CR 229 south of SR 121

3.2.2 Analysis of Problems

3.2.2.1 From Crash Records

For the period from 2006 through 2012, crash data show significant patterns:

- Five of six recorded crashes occurred during non-daylight hours, suggesting that visibility of roadway is a significant factor.
- Three crashes occurred at the CR 793 intersection. All crashes at this location occurred at night and involved southbound vehicles that failed to negotiate the curve and exited the road to the right.
- Crashes in the tangent sections involved lane departures. All three of these crashes resulted in rollovers with injuries or a fatality.

3.2.2.2 Field Observations

➤ Pavement:

Pavement of this two-lane road is narrow (approximately 19.5'). Pavement surface is somewhat irregular, but does not exhibit significant distress.

➤ Shoulders and Pavement edge drop-offs:

Shoulders are generally narrow and provide limited recovery area. Pavement edge drop-offs are prevalent throughout the area. Figure 3 shows the extent of these drop-offs.



This aerial photograph shows the locations of pavement edge drop-offs as marked using a hand held gps device. The drop-offs were recorded while driving along the road in each direction of travel. Marks were recorded for each 25' of shoulder where the surface of the shoulder was estimated to be 3" or more below the pavement surface.

Figure 3. Pavement edge drop-offs on CR 229 (south)



Figure 4. Typical shoulder conditions on CR 229 (south)

➤ **Signage:**

Signs are minimal and some do not meet current MUTCD requirements. Curves are not delineated with chevrons or other markers. The curve at the CR 793 intersection is especially difficult to detect at night for southbound drivers. Speed limit through this area is 40 mph, but a preliminary check with the ball-bank indicator showed that the speed at the CR 793 curve/intersection should be lowered, either by reducing the speed limit or by posting a lower advisory speed. A speed study will be needed if the speed limit is lowered. The stop sign at the CR 793 intersection with CR 229 (northbound approach from CR 793) was partially obscured by the vegetation at the intersection at the time of the study.

➤ **Pavement markings:**

Centerline markings on CR 229 and the intersecting roads are deteriorated. None of the roads in the study area have edge line markings or raised pavement markers.

➤ **Clear zone encroachments:**

- **Culverts:** One culvert crosses CR 229 within the study area. Ends of this culvert are within the limits of the clear zone, and should be extended. The culvert at the intersection with CR 793 is within the clear zone for CR 793 (NE 227th Avenue). Culverts at NE 233rd Lane and at the various driveways all have blunt ends, but are small in diameter.



Figure 5. Culvert crossing (CR 229 south)



Figure 6. Culvert at CR 793 Intersection



Figure 7. Culvert at NE 233rd Lane Intersection

- **Guardrail:** A guardrail along the west side of CR 793 (NE 227th Avenue) at the intersection with CR 229 shows evidence of a crash (Figure 6. Culvert at CR 793 Intersection). This guardrail could be eliminated by extending a culvert and flattening the slope of the shoulder; however, the guardrail now supports delineators that mark the outside of the curve of CR793. Removing the guardrail would require placement of alternate markings delineating the curve for northbound vehicles as they approach the intersection.
- **OTHER:** Right of way throughout the corridor is approximately 50 feet. Much of this right of way is clear, but trees encroach into the clear zone at some locations, especially on the east side of the road in the vicinity of NE 233rd Lane.



Figure 8. Trees within right of way

3.2.2.3 Emphasis Areas for Countermeasures

- Enhance the visibility of roadway through the curves with a combination of signs and pavement markings.
- Reduce speeds to be consistent with the curvature of the road.
- Reduce the frequency and severity of lane departures by providing wider pavement (lanes and shoulders) and delineation of pavement edge.
- Remove obstacles within clear zone.

Table 2. Potential Countermeasures for CR 229 (south)

<i>Level</i>	Countermeasure	Estimated Cost	Benefit /Cost
1.	<ul style="list-style-type: none"> • Upgrade signs and pavement markings for the entire road segment between Bradford County Line and SR 121. • Enhance signing and marking for two curves between NE 233rd Ln and NE 231st CT: <ul style="list-style-type: none"> • Lower speeds through the area of “s” curves using either advisory speeds or lower speed limit (will require engineering study). • Install chevrons and other signs to delineate “s” curves consistent with MUTCD 2C-2. Add “bright sticks” for enhanced conspicuity for chevron posts. • Place additional stop sign on left side of CR 793 at intersection (vegetation on right side of road may restrict visibility of sign at times). 	\$60,653	19.21
2.	<p>Widen lanes and add paved shoulders through “s” curves- (south of NE 233rd Ln to north of NE 231st CT), including:</p> <ul style="list-style-type: none"> ○ Overlay existing pavement ○ Extend culverts and add mitered end sections as appropriate 	\$581,670	6.78

	<ul style="list-style-type: none"> ○ Place additional RPMs on outside southbound shoulder of curve at intersection with CR 793. These RPMs should be placed in a chevron pattern consistent with MUTCD Section 3B.24. (Because CR 793 intersects CR 229 in the curve, chevrons alone may not be adequate to delineate the curve. The additional markings will significantly enhance communication to the driver). ○ Remove guardrail at intersection with CR 793: <ul style="list-style-type: none"> ○ Extend culvert, relocate ditch and regrade shoulder. ○ Replace delineators installed on guardrail with post mounted delineators. ○ Add paved shoulder on west side of CR 793 at intersection. ○ Add RPMs on shoulder of CR 793 to enhance night time delineation at intersection. ○ Remove trees within clear zone. 		
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➤ **Factors affecting implementation**

Right of way	Right of way in this corridor is nominally 50'. It appears that all improvements can be implemented within existing right of way.
Environmental impacts	Potential permit issues involving culvert crossings and shoulder widening. These appear minimal but will require further investigation.
Utilities	No significant conflicts are apparent, but will require standard utility coordination.
Community impacts	None anticipated. Rumble strips are not included in these scenarios. If these are considered, the impact on residences should be evaluated.

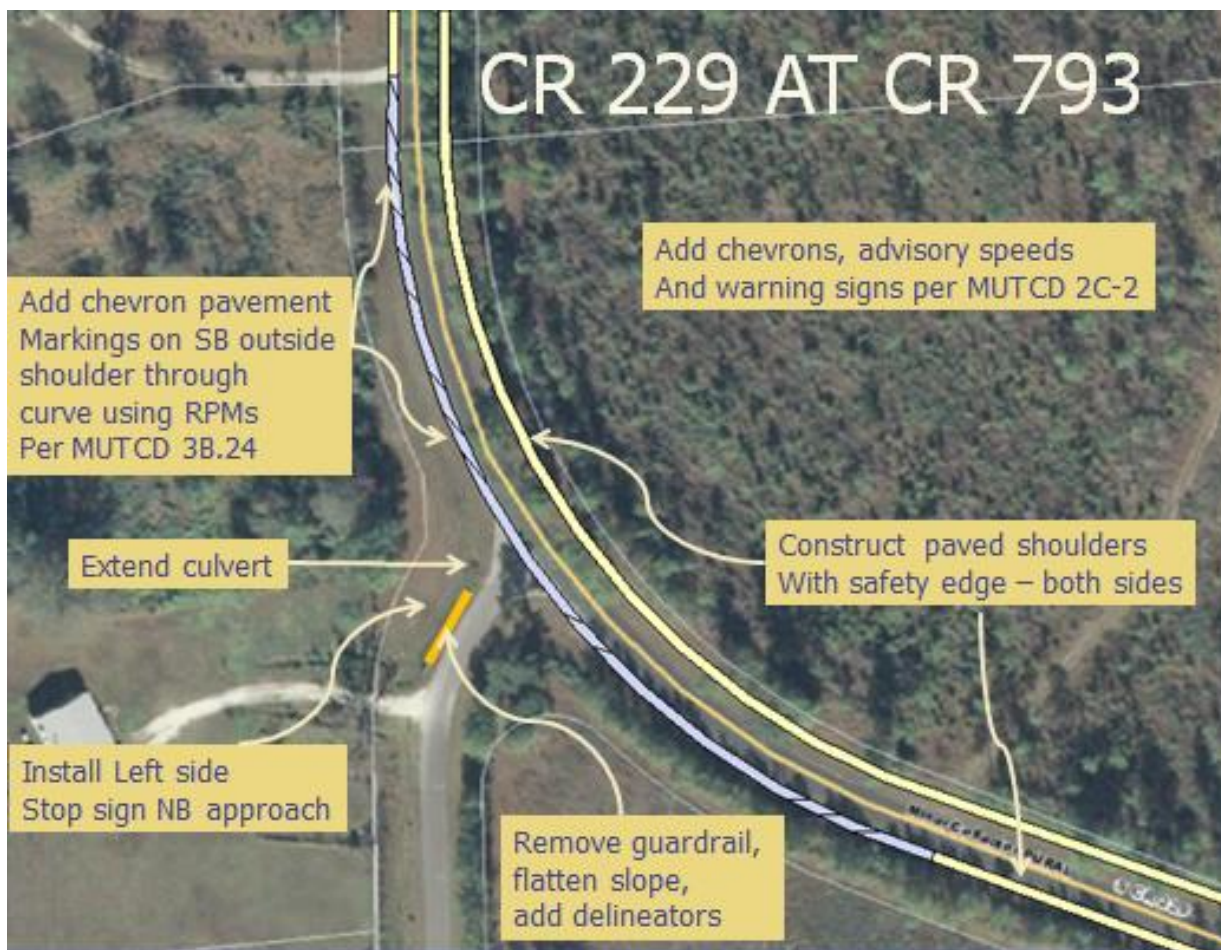


Figure 9. Suggested improvements at CR 229 intersection with CR 793

3.3 CR 229 – SR 121 TO BAKER COUNTY LINE

3.3.1 Site Description

The review covered the entire section between SR 121 and CR 229 (approximately 6 ½ miles). The intersection/curve at NE 228th Place is addressed separately. The area between SR 121 and NE 228th Place is largely residential and speeds on the road are relatively low. North of this intersection there is a short transition (approximately 1 ½ miles) from residential to rural, and the remainder of the road is rural with occasional intersections or driveways.

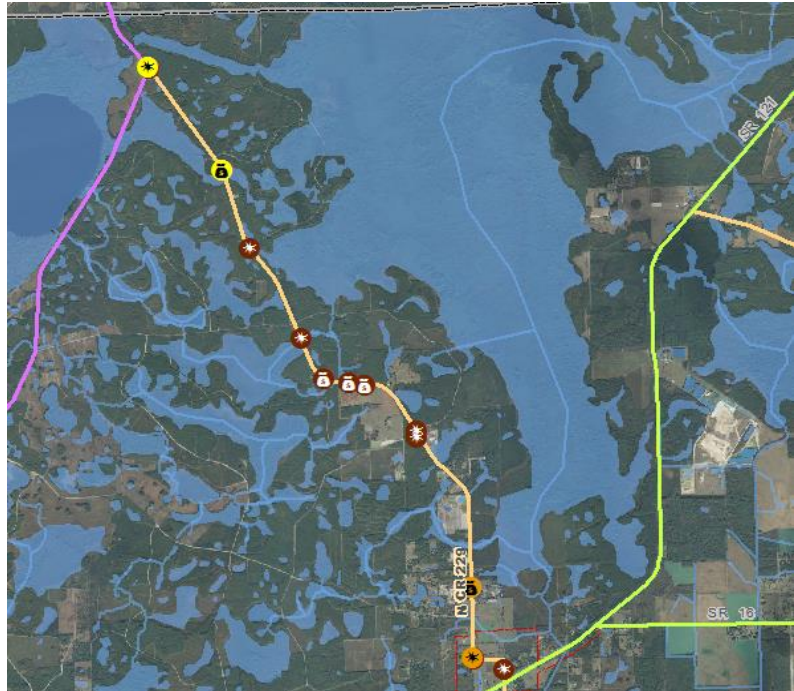


Figure 10. CR 229 north of SR 121 showing crash locations

3.3.2 Analysis of Problems

3.3.2.1 From Crash Records

Most crashes in this corridor occurred during non-daylight hours. Most involved lane departures. Five of the eight lane departures north of NE 125th Way resulted in overturning vehicles.

One crash with a serious injury occurred when a vehicle approaching from an intersecting road failed to stop at the intersection. Three of the crashes occurred at the curve in the vicinity of NE 215th Road.

A crash involving a pedestrian just north of SR 121 was not included in this analysis. In this crash, it appeared that the causes were improper actions by the pedestrian and /or driver, and road conditions did not appear to be a contributing factor.

3.3.2.2 Field Observations

➤ Pavement and shoulders:

The pavement is narrow, but it does not show significant signs of distress. Pavement edge drop-offs are extensive (See Figure 11). Shoulders are generally flat and clear through most of the corridor, but there are a few locations where the presence of a roadside ditch would make recovery difficult. Since the lane departure crashes occur mostly at night, it would appear that the problem is associated more with lack of lane delineation than with condition of the shoulder; however, improving the recovery area could be expected to reduce the severity of the lane departure crashes.

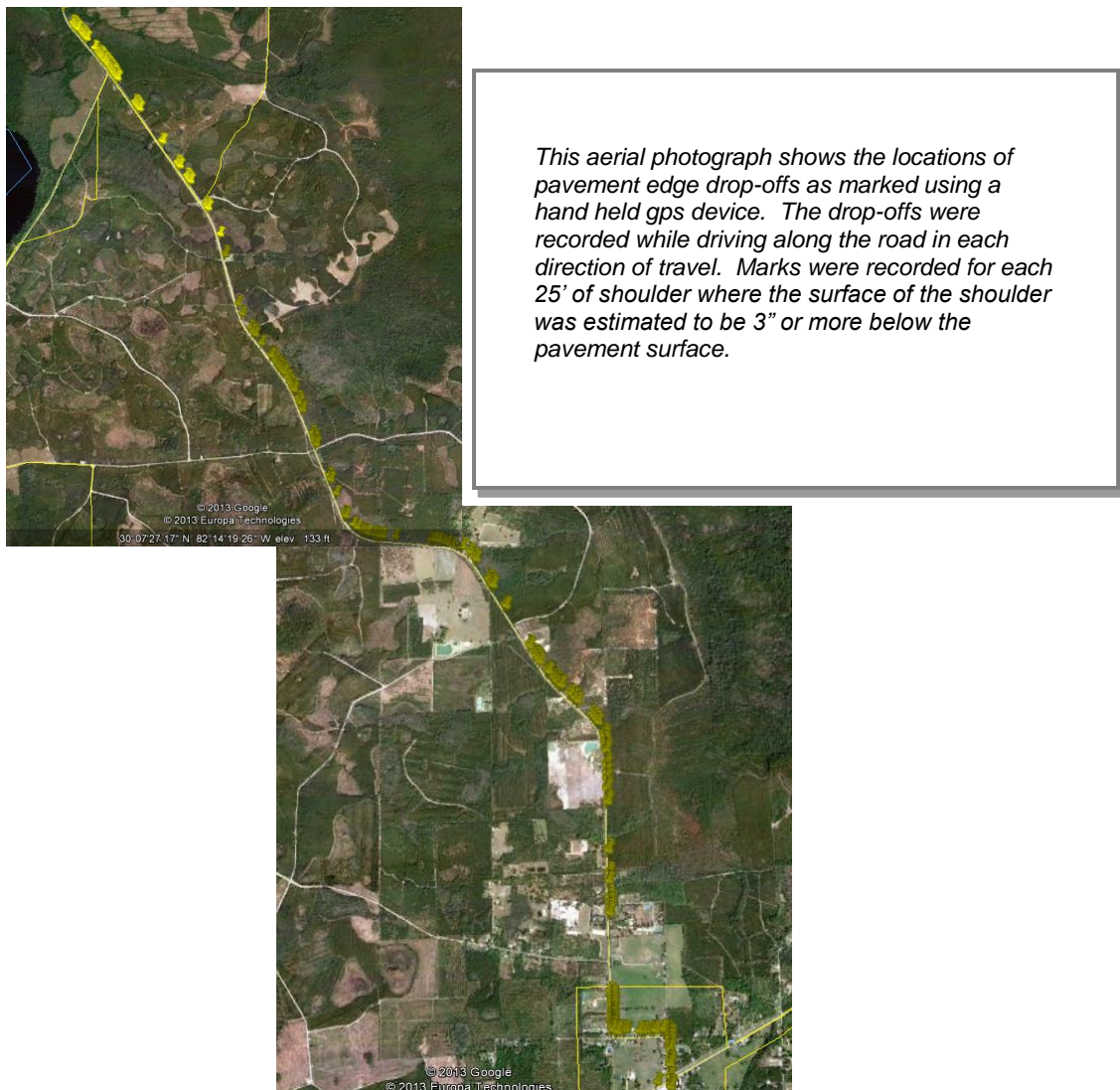


Figure 11. Pavement edge drop-offs (CR 229 north of SR 121)

➤ Signage

Warning signs designating curves are generally visible, but are small and placed well in advance of the curves. At one location, shadows from overhanging vegetation made daytime visibility of a curve warning sign difficult. One serious injury crash occurred at a “T” intersection (NE 148th Trail) where the only warning is a small stop sign.



This sign is posted well in advance of the curve (approximately 600'). There are no chevrons, edge lines, or other markers to delineate the curve.

Moving the sign closer to the curve, delineating with chevrons and edge markings, and adding an advanced warning sign would help drivers identify the curve, especially at night.

Figure 12. Typical curve warning sign (CR 229)



The intersection at NE 148th Trail was the site of a serious injury crash involving a vehicle that failed to stop.

Increasing the size of the stop sign, adding a double arrow and stop bar would improve communication to the driver about the stop condition.

Figure 13. End of road signage (NE 148th Trail and CR 229)

➤ Pavement markings

Pavement markings are worn, but the centerline is still visible at night. Absence of an edge line makes it difficult to see the pavement edge.

➤ Clear zone issues (guardrail and culverts)

Guardrail installations are obsolete, although no involvement was reported with any of the crashes reviewed.



Figure 14. Typical guardrail installation (CR 229)

3.3.2.3 Emphasis Areas for Countermeasures

- Improve night time visibility of the pavement edge, especially through the curves.
- Upgrade end of road signage and markings at intersections.
- Improve recovery area:
 - Replace obsolete guardrail and extend guardrail to cover unprotected areas.
 - Widen pavement and add paved shoulders to correct drop-offs, especially through curve.

Table 3. Potential Countermeasures for CR 229 (North of SR 121)

<i>Level</i>	<i>Countermeasure</i>	<i>Estimated Cost</i>	<i>Benefit/Cost</i>
1.	<ul style="list-style-type: none"> • Upgrade signs and pavement markings (especially important to improve delineation of curves). • Add supplemental warning signs and chevrons at each curve – (MUTCD Figure 2C-2). Use enhanced conspicuity treatments for curve at NE 215th Rd. • Add/upgrade end of road treatment at “T” intersections. • Upgrade guardrail installations and/or extend culverts to eliminate clear zone conflicts. 	\$217,366	4.74
2.	<ul style="list-style-type: none"> • All Level 1 improvements. • Widen pavement and add paved shoulders. 	\$2,975,000	1.64

➤ **Factors affecting implementation**

Right of way	Right of way in this corridor is nominally 50'. It appears that all improvements can be implemented within existing right of way.
Environmental impacts	Extending culverts and widening pavement may involve some minor wetland impacts. These appear minimal but will require further investigation.
Utilities	No significant conflicts are apparent, but will require standard coordination with utility companies.
Community impacts	None anticipated. Rumble strips are not included in these scenarios. If these are considered, the impact on residences should be evaluated.

3.4 CR 229 – INTERSECTION AT NE 125TH WAY AND NE 228TH PLACE

3.4.1 Site Description

CR 229 makes a 90 degree turn at this intersection. The CR 229 movements (north and east legs) are through movements. The west and south legs are controlled by stop signs.

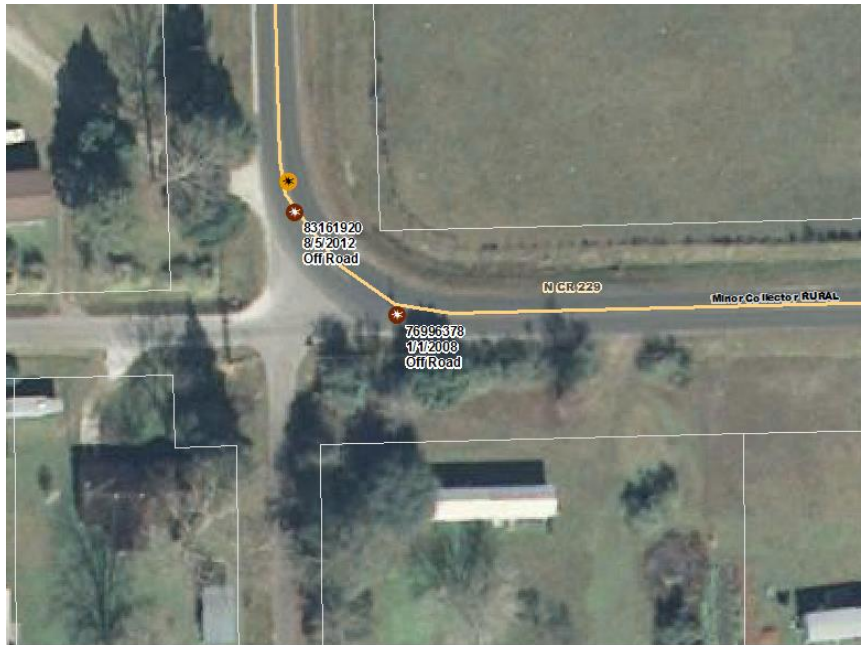


Figure 15. CR 229 at intersection of NE 228th Place and NE 125th Way

3.4.2 Analysis of Problems

3.4.2.1 From Crash Records

Crashes involved southbound to eastbound vehicles that failed to negotiate the turn. All recorded crashes occurred in non-daylight hours, and resulted in minor injuries.

Vehicles that failed to negotiate the curve struck guardrail, ditch, or other fixed object on south side of CR 229.

3.4.2.2 Field Observations

➤ Pavement and shoulder conditions

The conditions at this location do not appear to be a serious concern, although there is erosion of the shoulder on the inside of the curve. Roadside ditches on the west and south sides of CR 229 pose potential problems. A guardrail along the south edge of CR 229 does not completely shield a ditch and power pole. The end of the culvert under the west leg of the intersection has a vertical end exposed to southbound traffic.



Figure 16. Southbound view of guardrail and exposed culvert end at NE 228th PL/NE 125th Way

Southbound vehicles approach the intersection/curve from a long rural section of the road where speeds are higher. Although advanced warnings are in place, inattention by the driver could easily result in a driver's failure to slow down adequately to make the left turn. Speed appears to be a major factor contributing to the crashes at this location.

➤ Signs and markings

Generally, upgrading signs and markings could improve delineation of the intersection (Figure 16 and Figure 17). There is no turn sign delineating the west to north movement. A stop sign on northbound leg of intersection is partially obstructed by vegetation. An advanced warning sign ("Dangerous Intersection") is in place on the southbound approach to the intersection.

The centerline pavement markings are worn, and there are no pavement edge markings.



Figure 17. Westbound view showing lack of signage delineating turn at NE 228th Place/NE 125th Way

3.4.2.3 Emphasis Areas for Countermeasures

- Improve delineation of changes in road alignment – especially for southbound nighttime traffic. Upgrade signs on other approaches.
- Increase protection provided by guardrail along the south side of the road.

Table 4. Potential Countermeasures for CR 229 at NE 125th Way and NE 228th Place

<i>Level</i>	<i>Countermeasure</i>	<i>Estimated Cost</i>	<i>Benefit/Cost</i>
1.	<ul style="list-style-type: none">• Upgrade signs delineating turn for SB/EB traffic – including upgrade of advanced warning signs.• Add chevrons for southbound and westbound approaches.• Install sign delineating turn for WB/NB traffic – including advanced warning signs• Replace “Dangerous Intersection “ sign with alternate treatment for enhanced conspicuity.• Add left side stop sign for north bound 228th Place where vegetation obscures signs during growing season.• Refresh pavement markings and add RPMs and edge lines. (Since approach speed for southbound vehicles is an apparent problem, add speed reduction markings as described in MUTCD Section 3B.22.)• Upgrade and extend guardrail on south side of CR 229 to shield fixed objects and ditch.• Add mitered end sections to culvert under west leg of intersection.	\$22,842	37.73

➤ **Factors affecting implementation**

Right of way	It appears that all improvements can be implemented within existing right of way.
Environmental impacts	These appear minimal.
Utilities	No significant conflicts are apparent, but will require standard coordination with utility companies.
Community impacts	None anticipated.

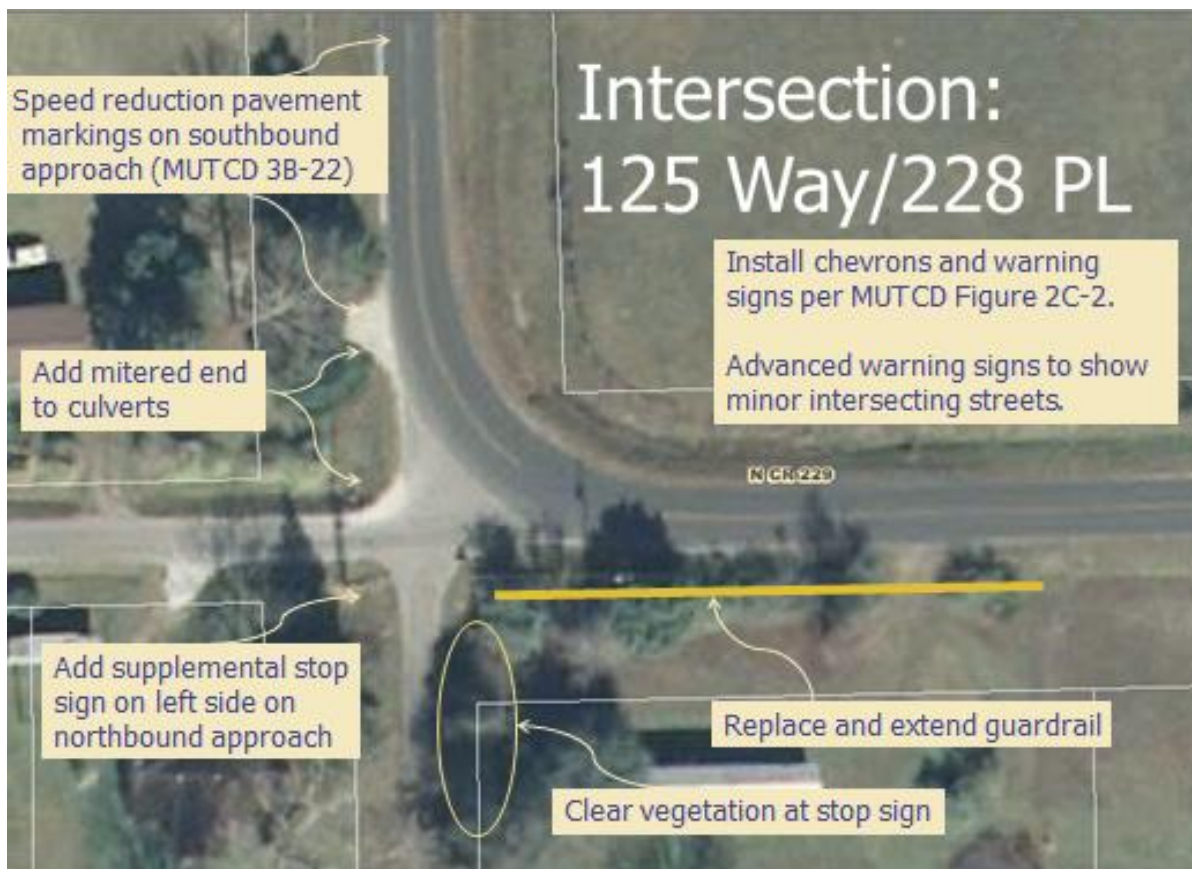


Figure 18. Suggested improvements for CR 229 at NE 228th PL/NE 125th Way

Figure 3B-28. Example of the Application of Speed Reduction Markings

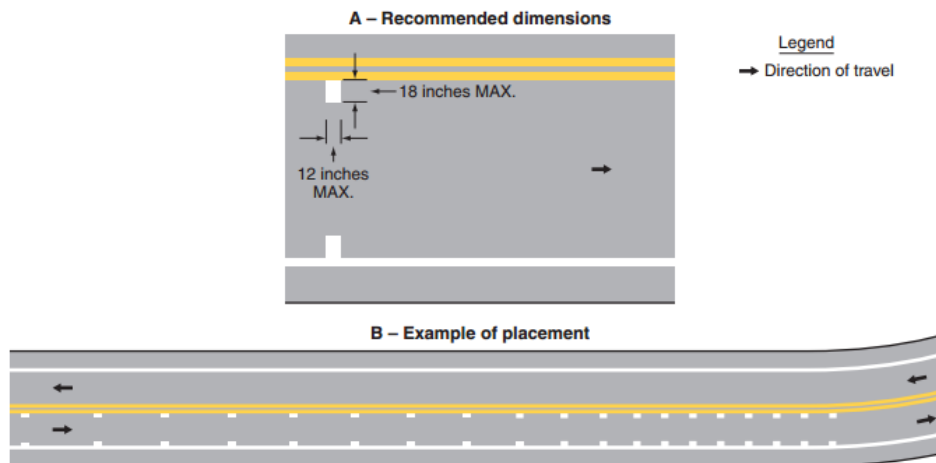


Figure 19. Speed reduction markings for southbound approach

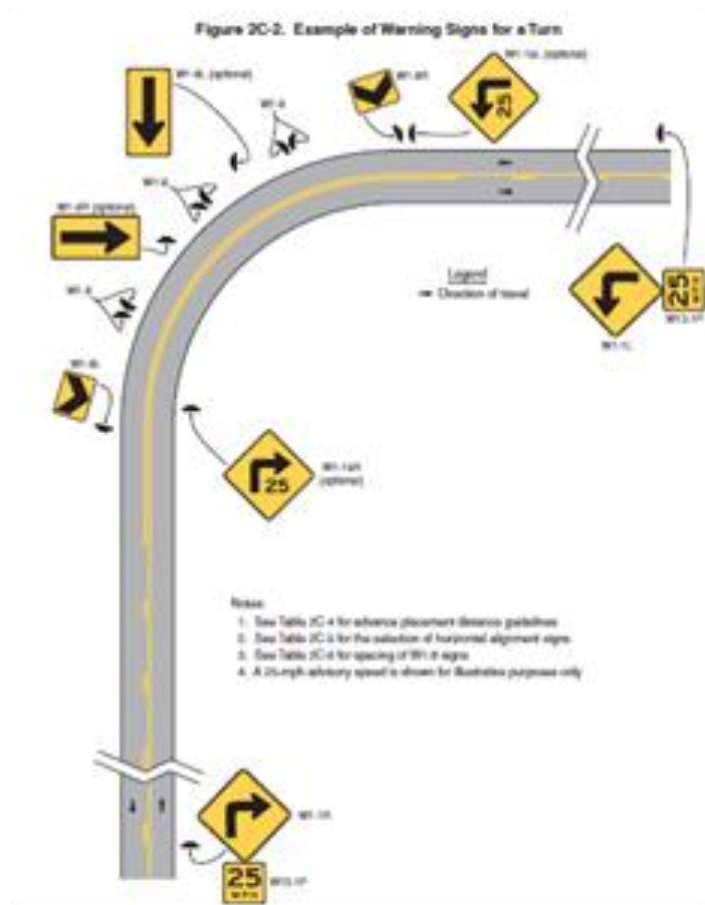


Figure 20. Signs for curve (modify curve/turn signs to reflect minor intersecting streets)

4. CR 241 / CR 18 AREA

This study area includes County Road 18 from Columbia County line to SR 121 and CR 241 from the Santa Fe River bridge to CR 241A. CR 241 at the intersection with CR 18 is identified in FDOT's *All Roads Crash Analysis (ARCA)* as a High Crash Location.

Note: Several crashes were reported at the intersection of CR 18 and SR 121. This intersection includes a State Highway and was not included in this pilot study for local roads. Crashes on the CR 18 approach to SR 121 were also excluded from the analysis for CR 18.

4.1 FIELD REVIEWS

- Initial daylight review – conducted afternoon of October 16, 2012

Review team: John Goodknight, team leader; Soowoong Noh, UF; Ilir Bejlari, UF, Srinivasan Sivaramakrishnan, UF; Shelton Arnold, Union County Road Superintendent

- Follow up nighttime review – conducted after 6 pm November 13, 2012.

Review team: John Goodknight, team leader; Soowoong Noh, UF; Phillip Haas, UF; Shelton Arnold, Union County Road Superintendent

4.2 INTERSECTION – CR 241 AT CR 18

4.2.1 Site Description

The intersection of CR 241 and CR 18 operates as a four-way stop controlled by stop signs. The intersection is at the top of a hill. The speed limit on all approaches is 50 mph. The nearest intersection in any direction with a stop condition is approximately four miles away.



Figure 21. Topography of intersection CR 241/18 (vertical scale exaggerated)

4.2.2 Analysis of Problems

4.2.2.1 From Crash Records

Of five crashes reported, three involved vehicles failing to stop at the intersection. One of these three resulted in a fatality and multiple injuries (One vehicle was fleeing law enforcement and driving without lights.) Three of the five crashes occurred during non-daylight hours.

4.2.2.2 Field Observations

Visibility of the intersection and stop signs is restricted and may have been a contributing factor in the three most serious crashes. The intersection is situated on a small “plateau” at the top of the hill and the roadway surface is hidden from view on all four approaches by the vertical curvature of the road (Figure 21 and Figure 22).

Although stop signs and advanced warning signs are in place, the stop signs are partially obscured by the roadway grade. At the time of the field investigation, some of the signs were partially obscured by vegetation, but this has been subsequently trimmed by Union County crews. Union County does not have a bucket truck and has difficulty trimming trees that overhang the road or the clear zone. This can create a serious problem where overhanging limbs create a canopy that limits visibility of the intersection or signs. Trees should also be reviewed to determine whether clear zone encroachment requires removal.

Rumble strips provide an audible warning but are not differentiated by color from the pavement so they do not provide a visual warning at night. Since the initial field investigation, the centerline and stop bars have been repainted.



Figure 22. Advanced intersection warning (westbound approach to CR 18/241 intersection)

The electric utility facility in the southeast quadrant of the intersection is lighted, but does not provide any illumination for the road. Some concern has been expressed that the lighting of this facility may distract drivers at night.

4.2.2.3 Emphasis Areas for Countermeasures

- Improve visibility of the intersection and stop signs, concentrating on both identifying the location of the crossroad and providing advanced warning to drivers. Since the

pavement of the crossing road cannot be seen by drivers approaching the intersection from any direction until they are close to the intersection, this means that signs, markings, and other traffic control devices must be especially effective in communicating conditions to drivers.

Table 5. Potential Countermeasures for Intersection at CR 241 and CR 18

<i>Level</i>	<i>Countermeasure</i>	<i>Estimated Cost</i>	<i>Benefit/Cost</i>
1.	<ul style="list-style-type: none"> • Upgrade signs and pavement markings. • Install stop signs and advanced warnings signs on both sides of road – each approach. • Install retro reflective strips on sign posts for enhanced conspicuity as described in MUTCD (Section 2A.15). • Replace or augment asphalt rumble strips with retro reflective material to provide increased nighttime visibility. 	\$19,144	41.51
2.	<ul style="list-style-type: none"> • All level 1 improvements. • Install overhead flashing signal; if conflicts with power lines prohibit overhead signal use flashers on advanced warning signs. • Install flashers on advanced warning signs as a temporary measure until overhead flasher can be installed. • Install luminaires on signal poles (if overhead flasher is feasible) 	\$83,791	20.29

➤ **Factors affecting implementation**

Right of way	It appears that all improvements can be implemented within existing right of way.
Environmental impacts	None anticipated.
Utilities	Overhead power lines cross the three approaches at the intersection. Initial observations suggest that there may be sufficient space to allow installation of signal poles, but this needs to be evaluated further to determine whether there is a conflict. If there is a conflict that cannot be resolved, flashers should be installed on the advanced warning signs.
Community impacts	Removal of trees may cause some adverse community reaction.
Other considerations:	Union County has indicated that they are prepared to commit to maintenance of the flasher.

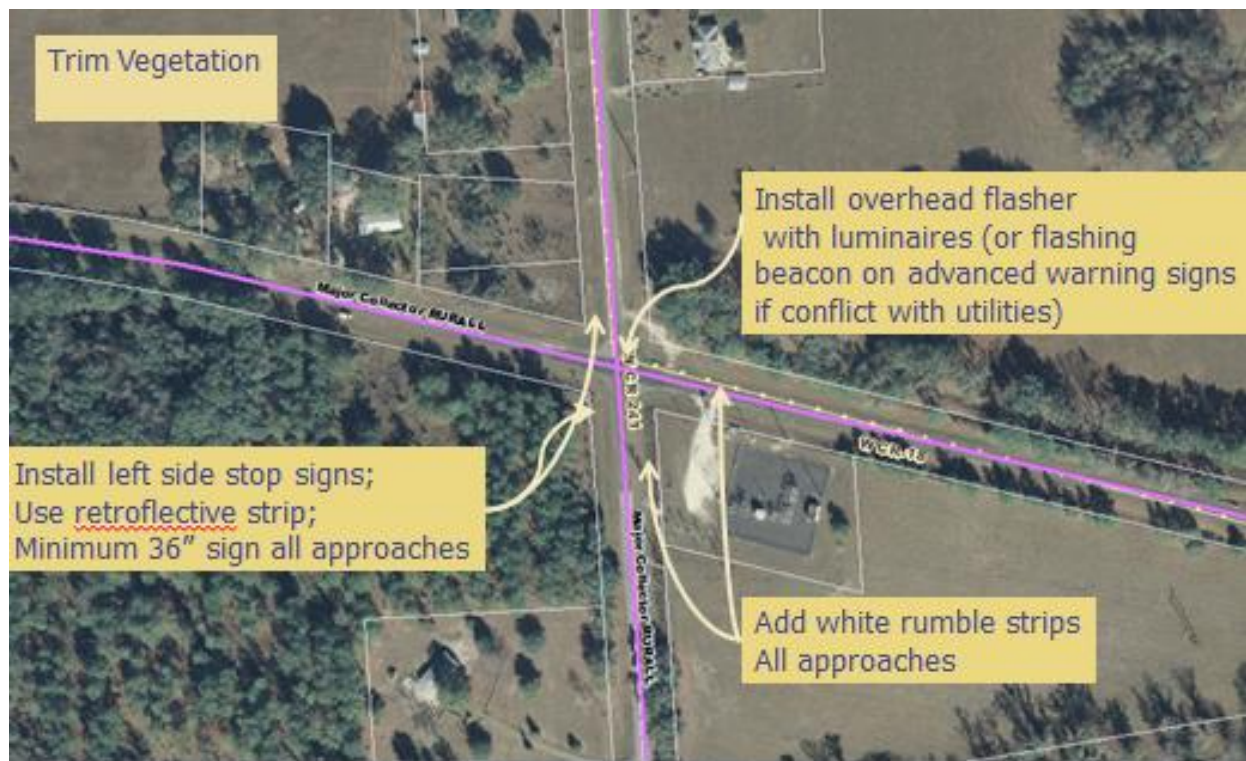


Figure 23. Suggested improvements for intersection at CR 241 and CR 18

4.3 CR 241 – ALACHUA COUNTY LINE TO CR 18

4.3.1 Site Description

CR 241 in this area approaches the bridge to Santa Fe River on a high fill section. In this area, shoulders are narrow and slopes are steep. An old guardrail was installed through most (but not all) of the area with steep slopes.

4.3.2 Analysis of Problems

4.3.2.1 From Crash Records

Two crashes occurred in this area. Both occurred at night and involved vehicles striking the guardrail. In one case the vehicle first struck the guardrail on the bridge. In the other, the vehicle lost control, travelled across the oncoming lane and struck the guardrail

4.3.2.2 Field Observations

➤ Pavement and shoulders:

Pavement is cracked extensively, and appears to be near the end of its economic life. Shoulders have some drop-offs, but it is unclear whether this condition contributed to the crashes.

➤ Guardrail

Although the guardrail appears to have prevented both of these crashes from becoming catastrophic, the guardrail installation is obsolete, in seriously deteriorated condition, and has gaps where critical protection is not provided. In its present condition it cannot provide the level of protection needed at this location.



Figure 24. Guardrail at CR 241 approach to Santa Fe River Bridge

4.3.2.3 Emphasis Areas for Countermeasures

- Upgrade guardrail.
- Improve shoulders. Pavement is deteriorated and any widening or shoulder paving should also be accompanied by restoration of the existing pavement.

4.4 CR 241 – CR 18 TO CR 238

4.4.1 Site Description

CR 241 through this area is straight with only minor grade changes. South of CR 241A the land use is mixed between rural and low density residential. There are occasional driveways and intersections with minor roads. North of CR 241A, the area is more residential in character. For the study period, there were no crashes reported that appeared to be related to the road conditions, so the detailed investigation concentrated on the area south of CR 241A.

4.4.2 Analysis of Problems

4.4.2.1 From Crash Records

Five crashes, including a fatality, were reported in the segment south of CR 241A. Four of these were at night. All five were lane departures, including an opposing direction sideswipe. One of the crashes was on an intersecting road at the approach to CR 241. Three involved loss of control on the right shoulder. Three vehicles struck fixed objects after losing control. The fatal crash involved a vehicle that first entered the right shoulder, crossed the opposing lane, and then struck a tree.

4.4.2.2 Field Observations

➤ Pavement and shoulders

Pavement is narrow (less than 20'). Through much of the area the shoulders are relatively clear; however, there are areas where the shoulder slopes are steep.

➤ Signage

Most signs are in place, though some require upgrade to conform to MUTCD standards. In one area the road is subject to chronic flooding. Union County has indicated there is a need to install signs to warn motorists of the potential for roadway flooding.

➤ Pavement markings

The centerline was badly worn at the time of the initial field review, but has been restriped. There are no edge lines or centerline RPMs.

➤ Clear zone conditions

There is at least one culvert crossing without standard end treatments or guardrail protection (Figure 25). Driveway culverts generally do not have mitered end sections.



Figure 25. Culvert crossing with headwall in clear zone (CR 241 north of CR 18)

4.4.2.3 Emphasis Areas for Countermeasures

- Improve delineation of pavement edges and fixed objects with particular attention to night time visibility.
- Improve intersection signage and markings.
- Improve recovery area. This would include shoulder paving, installation or upgrade of guardrail, and elimination or mitigation of fixed objects (especially culvert ends) within the clear zone.

Table 6. Potential Countermeasures for CR 241

<i>Level</i>	<i>Countermeasure</i>	<i>Estimated Cost</i>	<i>Benefit/Cost</i>
1.	<ul style="list-style-type: none"> • Upgrade signs and pavement markings (Alachua County Line to CR 238). • Upgrade end of road treatments at “T” intersections. (Alachua County Line to CR 238). • Add signs designating areas where road is subject to flooding • Replace and add guardrail: <ul style="list-style-type: none"> ○ The main area of concern is the high fill section at the approach to the Santa Fe River Bridge. ○ Sites north of CR 18 need new installations. 	\$182,442	1.88

➤ **Factors affecting implementation**

Right of way	It appears that all improvements can be implemented within existing right of way, however, if extensive work on the slopes is required, additional rights of way or easements may be required.
Environmental impacts	Potential permit issues involving culvert crossings and shoulder widening. These appear minimal but will require further investigation.
Utilities	No significant conflicts are apparent, but will require standard coordination with utility companies.
Community impacts	None anticipated.

4.5 CR 18 – COLUMBIA COUNTY LINE TO CR 241

4.5.1 Site Description

This segment of the road includes several curves and modest hills with dense vegetation. There are several intersections and driveways along this section. These factors tend to limit visibility of roadway features to a short distance.

4.5.2 Analysis of Problems

4.5.2.1 From Crash Records

All three reported crashes resulted in injury. Two occurred at night, and one involved an effort to evade an oncoming vehicle driving without lights. Two occurred at the intersection with CR 791.

4.5.2.2 Field Observations

➤ Pavement and shoulders

Pavement width is approximately 20 feet, with no significant distress noted. Pavement edge drop-offs are extensive throughout this section.

For the areas along CR 18, there are several locations where the recovery area involves steep slopes and/or trees are in close proximity to the travel lane.



Figure 26. Drop-offs (CR 18 west of CR 241)

➤ Signage and pavement markings

Upgrade of signs is needed to conform to MUTCD. Pavement markings are worn and there are no edge lines or RPM.

➤ **Clear zone conditions**

The approach to the bridge at the Columbia County line has a long fill with steep slopes. A short guardrail at the bridge does not extend far enough to provide full protection and end treatments are not consistent with current standards.

Trees in some areas appear to encroach into the clear zone and may also restrict visibility of some signs.



Figure 27. Unprotected slopes on approach to bridge at Columbia County Line

4.5.2.3 Emphasis Areas for Corrections

- Enhance communications with the driver through improved signs and markings. Curvilinear alignment of the road requires more attention to advanced warning signs. End of road treatment at “T” intersections should be improved with both signage and pavement markings.
- Improve recovery area by eliminating clear zone encroachments and pavement edge drop-offs

Table 7. Potential Countermeasures for CR 18 – Columbia County Line to CR 241

<i>Level</i>	<i>Countermeasure</i>	<i>Estimated Cost</i>	<i>Benefit/Cost</i>
1.	Upgrade signs and markings; Upgrade/ install guardrail <ul style="list-style-type: none"> • Signing and pavement markings <ul style="list-style-type: none"> ○ Upgrade signs and pavement markings ○ Upgrade intersection treatments ○ Remove vegetation, as required, to give adequate visibility at intersections. • Upgrade / install guardrail 	\$61,249	7.57
2.	<ul style="list-style-type: none"> • Level 2 improvements • Widen pavement and add paved shoulders 	\$612,500	2.42

➤ **Factors affecting implementation**

Right of way	Right of way in this corridor is nominally 50'. Signs, marking, and guardrail can all be installed within existing right of way. Additional easements or right of way may be required for shoulder work in areas where the road is in a fill section.
Environmental impacts	The road is close to the Santa Fe River and its tributaries. Extending culverts and widening pavement may involve impacts on wetlands or streams, and permits may be required.
Utilities	Some utilities are located in this corridor. Coordination with utility companies will be required for most improvements.
Community impacts	Removal of trees may raise concerns from the community.

4.6 CR 18 – CR 241 TO SR 121

4.6.1 Site Description

Land use along this section of the road ranges from primarily agriculture at the west end to residential at the east. There are numerous driveways and intersecting streets.

4.6.2 Analysis of Problems

4.6.2.1 From Crash Records

For this section of CR 18, the crashes are summarized as follows:

<i>Crash type</i>	<i>Total</i>	<i>Non-daylight</i>	<i>% Non- daylight</i>
Lane departure to shoulder	5	1	20
Struck Animals	4	4	100
Failure to stop at intersection	3	2	67
Sideswipe	3	2	67
Improper passing	2	1	50
Collision with debris	1	0	0

Of these crash types it appears that countermeasures may be available to mitigate two types: lane departures and failure to stop at intersections. Improved recovery areas could provide some mitigation for the other types of crashes.

Most of the lane departure crashes occurred during daylight hours. Under these conditions the white limerock used for shoulder repair is generally visible and delineates the pavement edge. It is doubtful that adding edge lines would be very effective in reducing the lane departures under these conditions. Instead, it appears that elimination of the drop-offs by widening and adding a safety edge would be more effective.

4.6.2.2 Field Observations

➤ Pavement and shoulder conditions:

Pavement is narrow (approximately 20') and there are numerous locations where the shoulder is narrow and slopes are steep. Pavement edge drop-offs are a chronic problem. The graphic in Figure 28 indicate that most of the crashes occurred in areas with significant drop-offs.

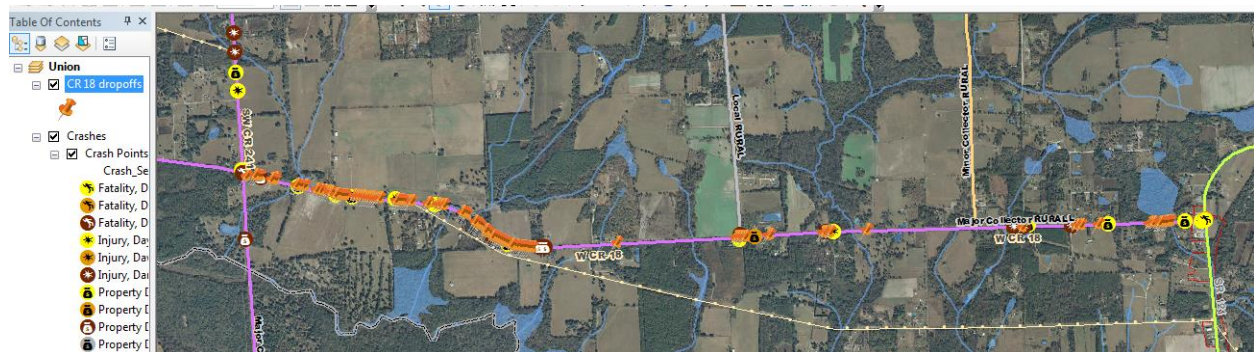


Figure 28. Drop-offs and crash sites (CR 18 from CR 241 to SR 121)

➤ Guardrail and culverts

Shoulders are generally narrow at culvert crossings and there are exposed headwalls or vertical drop-offs within the clear zone. Culverts at driveways and intersections do not usually include mitered end sections. Few locations have guardrail, and these installations generally do not meet current standards.



Figure 29. Culvert crossing and steep shoulder slope (CR 18 east of CR 241) without guardrail



Figure 30. Guardrail installation without end treatments (CR 18 east of CR 241)

These conditions combine to create a roadside environment in which errant vehicles have difficulty making a safe recovery. In fact, of the five reported lane departure crashes, four resulted in overturning vehicles, and the fifth struck a culvert resulting in an incapacitating injury. Since 80% of these crashes occurred during daylight, it is doubtful that lower cost measures like edge marking would provide a significant reduction in crashes.

➤ Intersections

Three of the crashes involved vehicles entering CR 18 from intersecting roads (CR 239 and SW 111 Lane). Two of these three were at night. In one case, the investigating officer identified vegetation that obstructed the vision between the vehicle approaching the intersection and oncoming traffic.



Figure 31. Restricted sight distance at intersection (CR 239 and SW 111 Lane)

4.6.2.3 Emphasis Areas for Countermeasures

➤ For the lane departure crashes:

- Replace obsolete or substandard guardrail with appropriate installations; add guardrail where needed.
- Eliminate or shield non-conforming features within the clear zone (culvert ends, steep slopes, trees).
- Eliminate or reduce pavement edge drop-offs (paved shoulders):
The most severe problem with pavement edge drop-offs and the highest incidence of crashes occurs between CR 241 and SW 95th Lane (Figure 28). (The alignment of the road has two significant curves, but the existing slopes and right of way would appear to make shoulder construction in this area less costly and simpler than in other segments of the corridor.)

➤ For intersections:

- Ensure that appropriate signs and pavement markings are in place. For “T” intersections, give special attention to end of road markings and advanced warnings.
- Check sight distance and remove vegetation where appropriate.

Table 8. Potential Countermeasures for CR 18 – CR 241 to SR 121

<i>Level</i>	<i>Countermeasure</i>	<i>Estimated Cost</i>	<i>Benefit/Cost</i>
1.	<ul style="list-style-type: none"> • Signing and pavement markings: <ul style="list-style-type: none"> ○ Upgrade signs and pavement markings. ○ Upgrade intersection treatments. ○ Remove vegetation, as required, to give adequate visibility at intersections. • Upgrade and install new guardrail. 	\$264,101	4.91
2.	<ul style="list-style-type: none"> • All Level 1 improvements. • Widen pavement and add paved shoulders. 	\$3,125,000	2.25

➤ **Factors affecting implementation**

Right of way	Right of way in this corridor is nominally 50'. Signs, marking, and guardrail can all be installed within existing right of way. Additional easements or right of way may be required for shoulder work in areas where the road is in a fill section.
Environmental impacts	The road is close to the Santa Fe River and its tributaries. Extending culverts and widening pavement may involve impacts on wetlands or streams, and permits may be required.
Utilities	Some utilities are located in this corridor. Coordination with utility companies will be required for most improvements.
Community impacts	Removal of trees for sight distance improvement at intersections may raise concerns from the community.

5. OPTIONS FOR IMPLEMENTATION

Table 9 identifies options for implementing various countermeasures. Most can be implemented within existing right of way and require only simple plans or drawing. While the Local Agency Program (LAP) is the typical method used by FDOT for implementing federally funded construction projects on local road systems, Union County is not certified to perform LAP projects. Based on the understanding that the County will not be certified for this work in the near future, the options presented here are based on the assumption that FDOT will directly handle any contracting that would usually be done by the local agency through a LAP agreement.

Table 9. Options for implementing safety improvements in Union County

<i>Improvement type</i>	<i>Implementation method</i>	<i>Issues</i>
Sign installation	Furnish signs to Union County for installation by County crews	<ul style="list-style-type: none"> • Union County has indicated a willingness to provide labor with County funds if sign materials can be furnished by FDOT/FHWA. • Additional review and drawings/sketches showing sign installation details are needed. Where lowering speeds is indicated, additional studies are needed to set speed limits or advisory speeds. • Follow up inspection or documentation of completed installations may be needed. • Additional training for County sign personnel may be needed- especially with respect to use and interpretation of MUTCD. Such training would have long term benefits in reducing the reliance on outside technical support.
	Contract administered by FDOT	<ul style="list-style-type: none"> • Will require preparation of plans and contract documents. • This type of work would be a good candidate for a unit price or design-build push button contract. • If other work such as shoulder paving is included, sign upgrades may be incorporated into such contracts; however, the urgency of some sign work (such as installation of advisory speeds, chevrons, etc.) May require immediate attention even if signs will be replaced or relocated during subsequent construction.

Table 10. Options for implementing safety improvements in Union County (continued)

<i>Improvement type</i>	<i>Implementation method</i>	<i>Issues</i>
Pavement markings	Perform work with FDOT crew	<ul style="list-style-type: none"> • Union County's striping capability is limited to a hand liner capable of applying paint only. • For areas where conditions indicate a need for immediate attention, FDOT striping crews may be able to apply "temporary" striping on an emergency basis.
	Contract administered by FDOT	<ul style="list-style-type: none"> • Preparation of plans/sketches is required. • This would be a good candidate for a district wide or state wide pavement marking contract if such a contract can be developed to qualify for federal funds. This could be a variation of the "design-build push button" concept. • For areas where widening is planned, a further evaluation of the site should be made to determine whether conditions warrant immediate installation of "temporary" markings until the major project can be implemented.
Guardrail	Contract administered by FDOT	<ul style="list-style-type: none"> • Union County does not have capability to install or perform major repairs to guardrail. • Most guardrail installations will require some engineering design. • This work would appear to be a good candidate for a design-build push button contract. • In areas where pavement widening or shoulder paving is planned, this work may be incorporated into the paving contract.
Widening, shoulder paving, signal installation, etc.	Contract administered by FDOT	<ul style="list-style-type: none"> • This work will vary in complexity from site to site. For some sites, a design-build push button contract may be appropriate. • In cases involving more complex designs or environmental issues, separate plans and contracts may be required. • Funds available to the County through the Small County Programs may also be used in combination with HSIP funds for this type of work.

6. APPENDICES

APPENDIX A – CRASH DATA

CR 229 - NE 228th PL to North County Line																																														
HS&M Report Number	Crash Date	Crash Time	Crash Severity	Crash Type	First Harmful Event	Light Cond	Weather Cond	Alcohol Related	Drug Related	Potential to correct	Potential to correct	Potential to correct	Potential to correct	Potential to correct	Potential to correct	Potential to correct																														
76976004	38830	2:45 AM	Injury	Off Road	Traffic Sign Support	Dark - Not Lighted	Clear	Y	N	1 Y	EB	4 N	Y	N		On intersecting road (NE 149th ST) exit right then crossed road to left ditch;overturned																														
76987267	39186	10:44 PM	Injury	Off Road	Ran into Water/Canal	Dark - Not Lighted	Cloudy	N	N	1	NB	2	Y	Y		exit left, then crossed to right in curve; overturned; fell asleep																														
76987405	39204	2:02 AM	Damage Only	Off Road	Ditch	Dark - Not Lighted	Clear	N	N	1 Y	WB	1 Y	Y	Y		Struck Deer; injury coding incorrect																														
76869193	39429	7:35 AM	Injury	Off Road	Ditch	Daylight	Clear	N	N	1 N	SB	1	N	N		Exited lane left, then right shoulder into ditch; distracted																														
77256712	40455	12:38 AM	Damage Only	Off Road	Ditch	Dark - Not Lighted	Clear	N	N	1 Y	WB	1 Y	N	N		exit right then crossed road to left ditch;overturned																														
77251363	39829	12:45 AM	Injury	Off Road	Ditch	Dark - Not Lighted	Clear	N	N	1 Y	SB	3 Y	Y	Y		exited to right to avoid deer; lost control; struck tree; overturned																														
76997234	39725	3:15 AM	Injury	Off Road	Tree (standing)	Dark - Not Lighted	Clear	N	N	1 Y	SB	3	Y	Y		collision with turning vehicle																														
77251807	39822	8:50 AM	Damage Only	Direction Sideswipe	Motor Vehicle in Transport	Daylight	Clear	N	N	2 N	SB	1	Y	N		On CR 238; exit left into ditch																														
82011193	40917	2:54 AM	Damage Only	Single Vehicle	Animal	Dark - Not Lighted	Fog, Smog, Smoke	N	N	1 ?	EB	2	N	N		report not available																														
82042638	40982	12:00 AM	Damage Only	Rollover	Overturn/Rollover	Dark - Not Lighted	Clear	N	N	1 Y		1	Y	Y																																
<table><tr><td></td><td>Number</td><td>Percent</td></tr><tr><td>Total Crashes</td><td>10</td><td></td></tr><tr><td>Fatal</td><td></td><td>0%</td></tr><tr><td>Injury</td><td>5</td><td>50%</td></tr><tr><td>PDO</td><td>5</td><td>50%</td></tr><tr><td>Daylight</td><td>2</td><td>20%</td></tr><tr><td>Dark/other</td><td>8</td><td>80%</td></tr><tr><td>Curve?</td><td>3</td><td>30%</td></tr><tr><td>Intersection?</td><td>2</td><td>20%</td></tr><tr><td>Overturn?</td><td>5</td><td>50%</td></tr></table>																		Number	Percent	Total Crashes	10		Fatal		0%	Injury	5	50%	PDO	5	50%	Daylight	2	20%	Dark/other	8	80%	Curve?	3	30%	Intersection?	2	20%	Overturn?	5	50%
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CR 229 - SR 121 to NE 228th PI																																														
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76996381	39455	7:10 PM	Injury	Pedestrian	Pedestrian	Dark - Not Lighted	Clear	N	N	1 N	EB	2 N	N	N		ped walking incorrectly; windshield cracked																														
76996378	39448	2:25 AM	Injury	Off Road	Guardrail Face	Dark - Not Lighted	Fog, Smog, Smoke	N	N	1 Y	SB	2 Y	Y	N		Failed to negotiate curve; excessive speed																														
83161920	41126	7:55 PM	Injury	Off Road	Ditch	Dark - Not Lighted	Cloudy	N	N	1 Y	SB	3 Y	Y	N		Failed to negotiate curve																														
82011139	40563	7:25 AM	Injury	Off Road	Pole/Light Support	Dawn	Fog, Smog, Smoke	N	N	1 Y	SB	2 Y	Y	N		Failed to negotiate curve																														
82034444	40710	2:15 AM	Damage Only	Off Road	Ditch	Dark - Lighted	Clear	N	N	1 Y		1				** Crash report not available**																														
<table><tr><td></td><td>Number</td><td>Percent</td></tr><tr><td>Total Crashes</td><td>5</td><td></td></tr><tr><td>Fatal</td><td></td><td>0%</td></tr><tr><td>Injury</td><td>4</td><td>80%</td></tr><tr><td>PDO</td><td>1</td><td>20%</td></tr><tr><td>Daylight</td><td>0</td><td>0%</td></tr><tr><td>Dark/other</td><td>5</td><td>100%</td></tr><tr><td>Curve?</td><td>3</td><td>60%</td></tr><tr><td>Intersection?</td><td>3</td><td>60%</td></tr><tr><td>Overturn?</td><td>0</td><td>0%</td></tr></table>																		Number	Percent	Total Crashes	5		Fatal		0%	Injury	4	80%	PDO	1	20%	Daylight	0	0%	Dark/other	5	100%	Curve?	3	60%	Intersection?	3	60%	Overturn?	0	0%
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HS&M Report Number	Crash Date	Crash Time	Crash Severity	Crash Type	First Harmful Event	Light Cond	Weather Cond	Alcohol Related	Drug Related	Potential to correct	Potential to correct	Potential to correct	Potential to correct	Potential to correct	Potential to correct	Potential to correct																														
77258926	1/24/2010	1:00 AM	Injury	Off Road	Ditch	Dark - Not Lighted	Clear	Y	N	1 Y	NB	2	Y	Y		exit left																														
82024158	12/23/2010	4:26 PM	Fatality	Rollover	Overturn/Rollover	Daylight	Clear	N	N	1 Y	NB	5	Y	Y		exit right; speeding																														
76998500	2/14/2009	11:15 PM	Injury	Off Road	Ditch	Dark - Not Lighted	Cloudy	N	N	1 Y	SB	2 Y	Y	Y		failed to negotiate curve																														
76995572	1/27/2008	10:35 PM	Property Damage Only	Off Road	Guardrail Face	Dark - Not Lighted	Clear	Y	N	1 Y	SB	1 Y	Y	Y		failed to negotiate curve; did not see curve in time																														
77253555	10/29/2009	6:50 AM	Property Damage Only	Parked Vehicle	Parked Motor Vehicle	Dawn	Fog, Smog, Smoke	N	N	2 Y	SB	1 Y	Y	Y		failed to negotiate curve																														
76982388	6/5/2006	1:40 AM	Injury	Rollover	Overturn/Rollover	Dark - Not Lighted	Clear	N	N	1 Y	SB	4	Y	Y		exit right; speeding																														
<table><tr><td></td><td>Number</td><td>Percent</td></tr><tr><td>Total Crashes</td><td>6</td><td></td></tr><tr><td>Fatal</td><td>1</td><td>17%</td></tr><tr><td>Injury</td><td>3</td><td>50%</td></tr><tr><td>PDO</td><td>2</td><td>33%</td></tr><tr><td>Daylight</td><td>1</td><td>17%</td></tr><tr><td>Dark/other</td><td>5</td><td>83%</td></tr><tr><td>Curve?</td><td>3</td><td>50%</td></tr><tr><td>Intersection?</td><td>3</td><td>50%</td></tr><tr><td>Overturn?</td><td>3</td><td>50%</td></tr></table>																		Number	Percent	Total Crashes	6		Fatal	1	17%	Injury	3	50%	PDO	2	33%	Daylight	1	17%	Dark/other	5	83%	Curve?	3	50%	Intersection?	3	50%	Overturn?	3	50%
	Number	Percent																																												
Total Crashes	6																																													
Fatal	1	17%																																												
Injury	3	50%																																												
PDO	2	33%																																												
Daylight	1	17%																																												
Dark/other	5	83%																																												
Curve?	3	50%																																												
Intersection?	3	50%																																												
Overturn?	3	50%																																												

CR 241 - north of CR 18																				
HSMV_Report_Number	Crash_Date	Crash_Time	Crash_Severity	Crash_Type	First_Harmful_Event	Light_Cond	Weather_Cond		Alcohol_Related		Drug_Related		Potential to correct		Dir of travel	Inj_Severity	Curve	Intersection	Overturn?	Comments
76977218	7/26/2006	11:05 AM	Injury	Off Road	Ditch	Daylight	Cloudy	N	N	1	Y	SB	3	N	N	N				Lost control on rt
76989051	3/6/2007	8:15 PM	Injury	Off Road	Tree (standing)	Dark - Not Lighted	Clear	N	N	1	Y	?	?	N	N	N				No report
76997592	4/12/2009	4:10 AM	Fatality	Single Vehicle		Dark - Not Lighted	Clear	Y	N	1	Y	NB	5	N	N	N				lost control on rt shoulder/crossed nb lane/struck tree
77261192	10/10/2010	8:15 PM	Property Damage Only	Opposing Sideswipe	Motor Vehicle in Transport	Dark - Not Lighted	Clear	N	N	2	?	NB	1	N	N	N				vehicle left scene
82038621	9/20/2011	9:35 PM	Injury	Off Road	Culvert	Dark - Not Lighted	Cloudy	N	N	1	Y	WB	3	N	Y	N				lost control on rt shoulder of intersecting
				<i>Number</i>	<i>Percent</i>															
Total Crashes				5																
Fatal				1	0.2															
Injury				4	0.8															
PDO				0	0															
Daylight				1	0.2															
Dark/other				4	0.8															
Curve?				0	0															
Intersection?				1	0.2															
Overturn?				0	0															

CR 18 - Columbia CL to CR 241

HSMV_Report_Number	Crash_Date	Crash_Time	Crash_Severity	Crash_Type	First_Harmful_Event	Type_of_Shoulder	Light_Cond	Weather_Cond	Alcohol_Related	Drug_Related	Potential_to_correct	Dir_of_travel	Inj_Severity	Curve	Intersection	Overturn?	Comments																																																																																																																																																																																				
77258949	5/28/2010	8:06 PM	Injury	Off Road	Tree (standing)	Paved	Dark - Not	Rain	Y	N	1	Y	SB	2	N	Y	N	failed to stop at intersection																																																																																																																																																																																			
76999528	8/31/2008	10:45 AM	Injury	Rear End	Motor Vehicle in Transport	Unpaved	Daylight	Cloudy	N	N	2	Y	WB	2	N	Y	N	Failed to stop for turning vehicle																																																																																																																																																																																			
82042637	3/13/2012	10:30 PM	Injury	Off Road	Tree (standing)	Unpaved	Dark - Not	Clear	N	N	2	Y	WB	4	N	N	N	evasive maneuver - avoid approaching vehicle no lights																																																																																																																																																																																			
<table><tr><td></td><td><i>Number</i></td><td><i>Percent</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Total Crashes</td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Fatal</td><td>0</td><td>0%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Injury</td><td>3</td><td>100%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>PDO</td><td></td><td>0%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Daylight</td><td>1</td><td>33%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Dark/other</td><td>2</td><td>67%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Curve?</td><td>0</td><td>0%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Intersection?</td><td>2</td><td>67%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Overturn?</td><td>0</td><td>0%</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>																			<i>Number</i>	<i>Percent</i>																Total Crashes	3																	Fatal	0	0%																Injury	3	100%																PDO		0%																Daylight	1	33%																Dark/other	2	67%																Curve?	0	0%																Intersection?	2	67%																Overturn?	0	0%															
	<i>Number</i>	<i>Percent</i>																																																																																																																																																																																																			
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CR 18 / CR 241 Intersection

HSMV_Report_Number	Crash_Date	Crash_Time	Crash_Severity	Crash_Type	First_Harmful_Event	Type_of_Shoulder	Light_Cond	Weather_Cond	Alcohol_Related	Drug_Related	Potential_to_correct	Dir_of_travel	Inj_Severity	Curve	Intersection?	Overturn?	Comments	
76982408	9/23/2006	2:00 PM	Injury	Rear End	Motor Vehicle in Transport	Unpaved	Daylight	Clear	N	N	2	Y	WB	2	N	Y		failed stop
77258185	7/2/2010	8:58 PM	Fatality	Left Leaving		Unpaved	Dark - Not Lighted	Cloudy	N	N	2	Y	SB	5	N	Y	Y	failed to stop;police pursuit' no lights
77258972	10/24/2010	6:41 AM	Property Damage Only	Right Angle	Motor Vehicle in Transport	Paved	Dark - Not Lighted	Clear	N	N	2	Y	WB	1	N	Y		failed to stop
76997225	7/22/2008	4:20 PM	Property Damage Only	Other	Motor Vehicle in Transport	Unpaved	Daylight	Clear	N	N	2	N	NB	1	N	N		stalled vehicle rolled back
82044930	2/18/2011	6:35 PM	Property Damage Only	Other	Thrown or Falling Object	Unpaved	Dark - Not Lighted	Clear	N	N	2	N	WB	1	N	N		object fell from trailer inot oncoming lane
			<i>Number</i>	<i>Percent</i>														
Total Crashes			5															
Fatal			1	20%														
Injury			1	20%														
PDO			3	60%														
Daylight			2	40%														
Dark/other			3	60%														
			0	0%														
Curve?																		
Intersection?			4	80%														
Overturn?			1	20%														

[illegible][illegible]

APPENDIX B – BASIS OF COST ESTIMATES

Countermeasure / Activity	Cost	Units	Lifespan	Item Number (from FDOT Average Unit Cost)
Remove vegetation	\$ 1,000.00	each location	1	N/A
Upgrade signs to meet MUTCD standards	\$ 3,909.50	mile	6	see group section below
Turn/sharp curve treatments MUTCD 2C-2	\$ 4,515.67	each location	6	see group section below
Warning sign	\$ 250.87	each	6	0700 20 11
Chevron	\$ 250.87	each	6	0700 20 11
Stop sign	\$ 250.87	each	6	0700 20 11
Curve warning sign with advisory speed plates	\$ 376.31	each	6	based on 0700 20 11
Remove single post sign	\$ 14.85	each	6	0700 20 60
T-intersection upgrade	\$ 1,106.68	each location	6	see group section below
Object marker sign	\$ 125.23	each	6	0705 10 3
Edgelines	\$ 0.66	feet	6	0711 11111
Centerlines	\$ 0.67	feet	6	0711 11211
RPMS	\$ 3.34	each	6	0706 3
Transverse rumble strips	\$ 3.09	feet	6	713102111
Stop bar (12" preformed tape)	\$ 7.35	feet	6	713101111
Retroreflective strip for sign post	\$ 70.00	each	6	N/A
Guardrail	\$ 15.08	feet	25	0536 1 1
Guardrail removal	\$ 1.29	feet	25	0536 73
Guardrail anchorage assembly	\$ 1,596.44	each	25	0536 85 22
Culvert with mitered end sections	\$ 2,262.90	each	25	0430173118 and 430982125
Overhead flashing signal	\$ 50,000.00	each	20	N/A
Luminaires on signal poles	\$ 358.68	each	6	0715 11111
Widen and pave shoulder (basic)	\$ 350,000.00	mile	25	see group section below
Widen and pave shoulder (with added work)	\$ 500,000.00	mile	25	see group section below
Signal maintenance	\$ 1,000.00	ea	1	N/A
Contingency and engineering	25.0%			
Interest rate	4.0%			

Group Costs						
Upgrade signs to meet MUTCD standards						
Assume that existings signs are all obsolete and require replacement to correct size, location, or condition						
Assume an average of 10 signs per mile						
Assume an average of 10 object markers per mile - use cost of type 3 markers						
Use average cost of signs as follows:						
	furnish and install single post sign < 12 sf			\$	250.87	
	remove existing single post sign			\$	14.85	
	total cost			\$	265.72	per sign
	install object markers			\$	125.23	per sign
	Cost per mile to upgrade existing signs			\$	3,909.50	per mile
"T" intersection upgrade						
Assume these signs are not included in upgrade of existing signs						
Intersection end treatments will consist of the following items:						
Most intersections have existing stop signs - (usually obsolete)						
Some locations have double arrows and advanced warning signs - but these may be obsolete						
Actual work required will vary from location to location, but these items represent the typical requirements for this treatment.						
	Add 2 intersection warning signs on main line	W2-2		\$	250.87	
	Add 1 Stop ahead warning on minor approach	W3-1		\$	250.87	
	Remove/Replace Double Arrow at end of road	W1-7		\$	265.72	
	Remove and replace stop sign			\$	265.72	
	Add Stop Bar (12" preformed tape	10' @\$7.35/ft)		\$	73.50	
	Cost per intersection to add "T" intersection treatments			\$	1,106.68	per intersection
Upgrade Guardrail						
Assume any existing guardrail will be removed and replaced						
Much existing guardrail does not extend far enough to meet need.						
For estimating purposes, use flared end treatment at all breaks in guardrail. Acutal design will may vary from this estimate.						
Paving under guardrail is not included in this estimate.						
Turn/sharp curve treatments MUTCD 2C-2						
Assumptions:						
Use signing layout per Figure 2C-2 MUTCD						
Actual layout to be adjusted to site conditions.						
Signs Required						
	Advanced warning with advisory plate	W1-1R and W13-1P		\$	376.31	2 752.62
	(use full cost of single post plus 1/2 of cost for additional face)					
	Warning sign at beginning of curve	W1-1aR		\$	250.87	2 501.74
	Turn signs	W1-6R		\$	250.87	2 501.74
	Chevrons	W1_8		\$	250.87	11 2759.57
	Total Signing cost for Curve/Turn					\$4,515.67
Widen and Resurface						
Basis of estimate:						
Cost estimate is based on total project cost per mile for similar projects on county roads in District 2.						
Data obtained from Work Program and projects selected based on descriptions in program.						
Projects sampled were in Baker, Bradford, Columbia, and Dixie Counties.						
	Cost range: (Widen or pave shoulders and resurface)				Approx \$340k to \$500k per mile	
	For basic projects with minimal extra work, use:			\$ 350,000.00	per mile	
	For projects with additionalwork, use:			\$ 500,000.00	per mile	
Assumptions:						
Completed cross section will have a minimum 2-11' travel lanes with 2' paved shoulder with safety edge.						
Work will include all other items necessary to meet standards (or design exception if appropriate), such as:						
	Guardrail upgrade, adjustment or addition if needed					
	cross culvert extensions and end sections					
	mitered end sections for roadside culverts					
	replace all signs to conform to MUTCD - including side road signing at intersections					
	addition of other signs identified under level 1					
	All recommended pavement markings including thermo striping and RPMs					
Pavement Markings						
Unless otherwise specified						
Centerline costs are based on a double yellow throughout the project length						
Edge line will be applied on both sides						
RPMs are placed on centerline at 2 per 40'						
Rumble strips to be formed from 6" preformed tape - over 11' lane (typical)						
Stop bars to be formed from 12" preformed tape -(lane width of side street typically 10')						

APPENDIX C – CALCULATION OF BENEFIT/COST RATIOS

Site:	CR 229, S-Curve South of SR 121 - limits extended from SR 121 to CL for signs and markings														
Length:	0.9 miles	2.2													
	4752 feet	11616													
Countermeasure			Level 1							Level 2					
			unit	cost/unit	number	cost	annuity factor	annual cost		unit	cost/unit	number	cost	annuity factor	annual cost
Upgrade signs to MUTCD standards			mile	\$ 3,909.50	2.2	\$ 8,601	5.24	\$ 1,641			\$ 3,909.50	1.3	\$ 5,082	5.24	\$ 970
Pavement Markings															
Centerline			lf	\$ 0.67	23,232	\$ 15,456	5.24	\$ 2,948			\$ 0.67	6,864	\$ 4,567	5.24	\$ 871
Edge line			lf	\$ 0.66	23,232	\$ 15,368	5.24	\$ 2,932			\$ 0.66	6,864	\$ 4,541	5.24	\$ 866
RPMs			ea	\$ 3.34	581	\$ 1,940	5.24	\$ 370			\$ 3.34	343	\$ 1,146	5.24	\$ 219
Rumble Strips															
Upgrade "T" intersections															
Curve Treatments (MUTCD 2C-2)															
Advanced warning signs			ea	\$ 250.87	2	\$ 502	5.24	\$ 96			\$ 250.87		\$ -		
Curve warnings signs with advisory speed plates			ea	\$ 376.31	2	\$ 753	5.24	\$ 144			\$ 376.31		\$ -		
Chevrons			ea	\$ 250.87	20	\$ 5,017	5.24	\$ 957			\$ 250.87		\$ -		
Turn arrow			ea	\$ 250.87	1	\$ 251	5.24	\$ 48			\$ 250.87		\$ -		
Sign removal			ea	\$ 14.85	3	\$ 45	5.24	\$ 8			\$ 14.85		\$ -		
Guardrail															
Number of sites															
Removal											\$ 1.29		\$ -		
Install new											\$ 15.08		\$ -		
Anchorage assembly											\$ 1,596.44		\$ -		
Culvert extensions (with mitered end)											\$ 2,262.90		\$ -		
Widen and Resurface											\$ 500,000	0.9	\$ 450,000	15.62	\$ 28,805
Other															
Stop sign			ea	\$ 250.87	2	\$ 502	5.24	\$ 96			\$ 250.87		\$ -		
Stop sign removal			ea	\$ 14.85	1	\$ 15	5.24	\$ 3			\$ 14.85		\$ -		
Stop bar			lf	\$ 7.35	10	\$ 74	5.24	\$ 14			\$ 7.35		\$ -		
Subtotal						\$ 48,522		\$ 9,256					\$ 465,336		\$ 31,731
Engineering and contingencies				25%		\$ 12,131		\$ 2,314			25%		\$ 116,334		\$ 7,933
Total Cost						\$ 60,653		\$ 11,570					\$ 581,670		\$ 39,664

Crashes	
Study Period (years)	6
Total Crashes	6
K - fatality	1
A - incapacitating inj	1
B - non inc. inj	0
C - possible inj	2
O - PDO	2

Crash Costs	
2-Lane rural road	\$ 402,003
Total crash costs	\$ 2,412,018

Crash Modification Factors	
Level 1 Combined CMF	
CMF - Fatal	0.404586
CMF - Injury	0.404586
CMF - PDO	0.5317416
Level 2 Combined CMF	
CMF - Fatal	0.30975104
CMF - Injury	0.30975104
CMF - PDO	0.37434609

Benefit	
	Level 1
Crashes Reduced	3.3181728
Benefit	\$ 1,333,915
Benefit per year	\$ 222,319

Benefit/Cost Ratio	
	Level 1
Annual Benefit	\$ 222,319
Annual Cost	\$ 11,570
B/C Ratio	19.21

	Level 1
Net Present Value	\$ 210,749

	Level 2
Crashes Reduced	4.01230366
Benefit	\$ 1,612,958
Benefit per year	\$ 268,826

	Level 2
Annual Benefit	\$ 268,826
Annual Cost	\$ 39,664
B/C Ratio	6.78

	Level 2
Net Present Value	\$ 229,163

Note: Unit price for widen and resurface includes costs for regular pavement marking and signing shown in Level 1. Costs for Level 2 markings and signing reflect the additional work show as Level 2 improvements.

Site:	CR 229 Intersection with NE 125th Way and NE 228th Place						
Length:	0.25 miles						
	1320 feet						
Countermeasure	Level 1						
		unit	cost/unit	number	cost	annuity factor	annual cost
Upgrade signs to MUTCD standards		mile	\$ 3,909.50	0.25	\$ 977	5.24	\$ 186
Pavement Markings							
	Centerline	lf	\$ 0.67	2,640	\$ 1,756	5.24	\$ 335
	Edge line	lf	\$ 0.66	2,640	\$ 1,746	5.24	\$ 333
	RPMs	ea	\$ 3.34	66	\$ 220	5.24	\$ 42
	Rumble Strips	lf	\$ 3.09	200	\$ 618	5.24	\$ 118
Upgrade "T" intersections							
Curve Treatments (MUTCD 2C-2)							
	Advanced warning sign	ea	\$ 250.87	2	\$ 502	5.24	\$ 96
	Curve warning signs with advisory speed plates	ea	\$ 376.31	2	\$ 753	5.24	\$ 144
	Chevrons	ea	\$ 250.87	11	\$ 2,760	5.24	\$ 526
	Turn arrow signs	ea	\$ 250.87	2	\$ 502	5.24	\$ 96
	Sign removal	ea	\$ 14.85	2	\$ 30	5.24	\$ 6
Guardrail							
	Number of sites			1			
	Removal	lf	\$ 1.29	50	\$ 65	15.62	\$ 4
	Install new	lf	\$ 15.08	130	\$ 1,960	15.62	\$ 125
	Anchorage assembly	ea	\$ 1,596.44	2	\$ 3,193	15.62	\$ 204
Culvert extensions (with mitered end)		ea	\$ 2,262.90	1	\$ 2,263	15.62	\$ 145
Widen and Resurface							
Other							
	Stop sign	ea	\$ 250.87	3	\$ 753	5.24	\$ 144
	Stop sign removal	ea	\$ 14.85	2	\$ 30	5.24	\$ 6
	Stop bar	lf	\$ 7.35	20	\$ 147	5.24	\$ 28
Subtotal					\$ 18,274		\$ 2,538
Engineering and contingencies			25%		\$ 4,568		\$ 634
Total Cost					\$ 22,842		\$ 3,172
Crashes							
Study Period (years)	6						
Total Crashes	3						
K - fatality	0						
A - incapacitating inj	0						
B - non inc. inj	1						
C - possible inj	2						
O - PDO	0						
Crash Costs							
2-Lane rural road cost	\$ 402,003						
Total crash costs	\$1,206,009						
Crash Modification Factors							
Level 1 Combined CMF		Curve Edgelines		Curve Warning Signs		Curve Chevrons	
CMF - Fatal	0.404586	CMF - Fatal	0.741	CMF - Fatal	0.7	CMF - Fatal	0.78
CMF - Injury	0.404586	CMF - Injury	0.741	CMF - Injury	0.7	CMF - Injury	0.78
CMF - PDO	0.5317416	CMF - PDO	0.741	CMF - PDO	0.92	CMF - PDO	0.78
Benefit							
Level 1							
Crashes Reduced	1.786242						
Benefit	\$ 718,075						
Benefit per year	\$ 119,679						
Benefit/Cost Ratio							
Level 1							
Annual Benefit	\$ 119,679						
Annual Cost	\$ 3,172						
B/C Ratio	37.73						
Level 1		Level 2					
Net Present Value	\$ 116,507	\$ -					

Site:	CR 229 (north)	SR 121 to Baker County Line - except intersection at 125 Way & 228 Place													
Length:	6.8 miles														
	35904 feet														
		Level 1							Level 2						
Countermeasure		unit	cost/unit	number	cost	annuity factor	annual cost		unit	cost/unit	number	cost	annuity factor	annual cost	
Upgrade signs to MUTCD standards		mile	\$ 3,909.50	6.8	\$ 26,585	5.24	\$ 5,071			\$ 3,909.50		\$ -			
Pavement Markings															
Centerline		If	\$ 0.67	71,808	\$ 47,774	5.24	\$ 9,113			\$ 0.67		\$ -			
Edge line		If	\$ 0.66	71,808	\$ 47,501	5.24	\$ 9,061			\$ 0.66		\$ -			
RPMs		ea	\$ 3.34	1,795	\$ 5,996	5.24	\$ 1,144			\$ 3.34		\$ -			
Rumble Strips															
Upgrade "T" intersections		ea	\$ 1,106.68	6	\$ 6,640	5.24	\$ 1,267			\$ 1,106.68		\$ -			
Curve Treatments (MUTCD 2C-2)		ea	\$ 4,515.67	3	\$ 13,547	5.24	\$ 2,584			\$ 4,515.67		\$ -			
Guardrail															
Number of sites				2											
Removal		If	\$ 1.29	200	\$ 258	15.62	\$ 17			\$ 1.29		\$ -			
Install new		If	\$ 15.08	400	\$ 6,032	15.62	\$ 386			\$ 15.08		\$ -			
Anchorage assembly		ea	\$ 1,596.44	8	\$ 12,772	15.62	\$ 818			\$ 1,596.44		\$ -			
Culvert extensions (with mitered end)		ea	\$ 2,262.90	3	\$ 6,789	15.62	\$ 435			\$ 2,262.90		\$ -			
Widen and Resurface										\$ 350,000	6.8	\$ 2,380,000	15.62	\$ 152,348	
Subtotal					\$ 173,893		\$ 29,896					\$ 2,380,000		\$ 152,348	
Engineering and contingencies			25%		\$ 43,473		\$ 7,474			25%		\$ 595,000		\$ 38,087	
Total Cost					\$ 217,366		\$ 37,369					\$ 2,975,000		\$ 190,436	
Curve Crashes				Non-Curve Crashes											
Study Period (years)	6			Study Period	6										
Total Crashes	3			Total Crashes	7										
K - fatality	0			K	0										
A - incapacitating inj	0			A	1										
B - non inc. inj	1			B	1										
C - possible inj	0			C	1										
O - PDO	2			O	4										
Crash Costs															
2-Lane rural road	\$ 402,003														
Total crash costs	\$ 4,020,030														
Crash Modification Factors															
Level 1 Non-Curve Combined CMF	Update Signs to MUTCD	Edgelines	Lvl 1 Curve Comb. CMF	Curve Warning Sign	Curve Edgelines	Curve Chevrons									
CMF - Fatal	0.79815	CMF 0.85	CMF 0.939	CMF - Fatal 0.404586	CMF 0.7	CMF 0.741	CMF 0.78								
CMF - Injury	0.79815	CMF 0.85	CMF 0.939	CMF - Injury 0.404586	CMF 0.7	CMF 0.741	CMF 0.78								
CMF - PDO	0.87327	CMF 0.93	CMF 0.939	CMF - PDO 0.5317416	CMF 0.92	CMF 0.741	CMF 0.78								
Level 2 Non-Curve Combined CMF	Update Signs to MUTCD	Edgelines	Widen Lane	Widen Shoulder	Lvl 2 Curve Comb. CMF	Curve Warning Signs	Curve Pmnt Markings	Curve Chevrons							
CMF - Fatal	0.61106364	CMF 0.85	CMF 0.939	CMF 0.88	CMF 0.87	CMF - Fatal 0.309751	CMF 0.7	CMF 0.741	CMF 0.78						
CMF - Injury	0.61106364	CMF 0.85	CMF 0.939	CMF 0.88	CMF 0.87	CMF - Injury 0.309751	CMF 0.7	CMF 0.741	CMF 0.78						
CMF - PDO	0.61478208	CMF 0.93	CMF 0.939	CMF 0.88	CMF 0.8	CMF - PDO 0.3743461	CMF 0.92	CMF 0.741	CMF 0.78						
Crashed Reduced Curve	Level 1 1.5319308	Level 2 1.94155679													
Non-curve	1.11247	2.70768076													
Benefit			Level 1	Level 2											
Crashes Reduced	2.6444008	4.64923755													
Benefit	\$ 1,063,057	\$ 1,869,007													
Benefit per year	\$ 177,176	\$ 311,501													
Benefit/Cost Ratio			Level 1	Level 2											
Annual Benefit	\$ 177,176	\$ 311,501													
Annual Cost	\$ 37,369	\$ 190,436													
B/C Ratio	4.74	1.64													
Net Present Value	Level 1 \$ 139,807	Level 2 \$ 121,066													

Site:	Intersection of CR 18 and CR 241													
Length:	500 includes 500 feet of each approach													
Countermeasure			Level 1					Level 2						
			unit	cost/unit	number	cost	annuity factor	annual cost	unit	cost/unit	number	cost	annuity factor	annual cost
Vegetation Removal			ea	\$ 1,000.00	1	\$ 1,000	0.96	\$ 1,040	ea	\$ 1,000.00	1	\$ 1,000	0.96	\$ 1,040
Upgrade signs to MUTCD standards			mile	\$ 3,909.50	0.38	\$ 1,481	5.24	\$ 282	mile	\$ 3,909.50	0	\$ 1,481	5.24	\$ 282
Pavement Markings														
	Centerline		lf	\$ 0.67	4,000	\$ 2,661	5.24	\$ 508	lf	\$ 0.67	4,000	\$ 2,661	5.24	\$ 508
	Edge line		lf	\$ 0.66	4,000	\$ 2,646	5.24	\$ 505	lf	\$ 0.66	4,000	\$ 2,646	5.24	\$ 505
	RPMs		ea	\$ 3.34	100	\$ 334	5.24	\$ 64	ea	\$ 3.34	100	\$ 334	5.24	\$ 64
	Rumble Strips		lf	\$ 3.09	800	\$ 2,471	5.24	\$ 471	lf	\$ 3.09	800	\$ 2,471	5.24	\$ 471
Upgrade "T" intersections														
Curve Treatments (MUTCD 2C-2)														
Guardrail														
	Number of sites													
	Removal													
	Install new													
	Anchorage assembly													
Culvert extensions (with mitered end)														
Widen and Resurface														
Other														
	Warning sign		ea	\$ 250.87	8	\$ 2,007	5.24	\$ 383	ea	\$ 250.87	8	\$ 2,007	5.24	\$ 383
	Warning sign removal		ea	\$ 14.85	4	\$ 59	5.24	\$ 11	ea	\$ 14.85	4	\$ 59	5.24	\$ 11
	Stop sign		ea	\$ 250.87	8	\$ 2,007	5.24	\$ 383	ea	\$ 250.87	8	\$ 2,007	5.24	\$ 383
	Stop sign removal		ea	\$ 14.85	4	\$ 59	5.24	\$ 11	ea	\$ 14.85	4	\$ 59	5.24	\$ 11
	Stop bar		lf	\$ 7.35	4	\$ 29	5.24	\$ 6	lf	\$ 7.35	4	\$ 29	5.24	\$ 6
	Retroreflective sign post		ea	\$ 70.00	8	\$ 560	5.24	\$ 107	ea	\$ 70.00	8	\$ 560	5.24	\$ 107
Signals														
	Overhead flashing signal								ea	\$50,000.00	1	\$ 50,000	13.59	\$ 3,679
	Luminaires on signal poles								ea	\$ 358.68	2	\$ 717	5.24	\$ 137
	Signal Maintenance								ea	\$ 1,000.00	1	\$ 1,000	0.96	\$ 1,040
Subtotal						\$ 15,315		\$ 3,771				\$ 67,033		\$ 8,627
Engineering and contingencies				25%		\$ 3,829		\$ 943		25%		\$ 16,758		\$ 2,157
Total Cost						\$ 19,144		\$ 4,714				\$ 83,791		\$ 10,783
Crashes														
Study Period (years)	6	Night Int. Crashes			Night Non-Int Crashes			Day Int. Crashes						
Total Crashes	5	Study Period	6	Study Period	6	Study Period	6	Study Period	6					
K - fatality	1	Total Crashes	2	Total Crashes	1	Total Crashes	1	Total Crashes	2					
A - incapacitating inj	0	K	1	K	0	K	0	K	0					
B - non inc. inj	1	A	0	A	0	A	0	A	0					
C - possible inj	0	B	0	B	0	B	0	B	0					
O - PDO	3	C	0	C	0	C	0	C	1					
		O	1	O	1	O	1	O	1					
Crash Costs														
2-Lane rural road cost	\$ 402,003													
Total crash costs	\$ 2,010,015													
Crash Modification Factors														
Level 1 Combined CMF		Int. Warning Signs		Double Stop Signs										
CMF - Fatal	0.27	CMF - Fatal	0.6	CMF - Fatal	0.45									
CMF - Injury	0.27	CMF - Injury	0.6	CMF - Injury	0.45									
CMF - PDO	0.27	CMF - PDO	0.6	CMF - PDO	0.45									
Level 2 Combined Day CMF		Int. Warning Signs		Double Stop Signs		Flashing Signal		Lighting		Lv 2 Comb. Night Int CMF		Lv 2 Comb. Night Non-Int CMF		
CMF - Fatal	0.2268	CMF - Fatal	0.6	CMF - Fatal	0.45	CMF - Fatal	0.84	CMF - Fatal	0.881	CMF - Fatal	0.1998108	CMF - Fatal	0.881	
CMF - Injury	0.2268	CMF - Injury	0.6	CMF - Injury	0.45	CMF - Injury	0.84	CMF - Injury	0.881	CMF - Injury	0.1998108	CMF - Injury	0.881	
CMF - PDO	0.2268	CMF - PDO	0.6	CMF - PDO	0.45	CMF - PDO	0.84	CMF - PDO	0.881	CMF - PDO	0.1998108	CMF - PDO	0.881	
Crashed Reduced	night int	day int	night non-int											
Level 1	1.46	1.46	0											
Level 2	1.6003784	1.5464	0.119											
Benefit														
Level 1	Level 2													
Crashes Reduced	2.92	3.2657784												
Benefit	\$ 1,173,849	\$ 1,312,853												
Benefit per year	\$ 195,641	\$ 218,809												
Benefit/Cost Ratio														
Level 1	Level 2													
Annual Benefit	\$ 195,641	\$ 218,809												
Annual Cost	\$ 4,714	\$ 10,783												
B/C Ratio	41.51	20.29												
Level 1	Level 2													
Net Present Value	\$ 190,928	\$ 208,025												

Site:	CR 241-north & south		CR 241A to Alachua County Line										
Length:	2.3 Miles	4.1											
	12144 feet	21648											
		Level 1						Level 2					
Countermeasure		unit	cost/unit	number	cost	annuity factor	annual cost	unit	cost/unit	number	cost	annuity factor	annual cost
Upgrade signs to MUTCD standards		mile	\$ 3,909.50	4.10	\$ 16,029	5.24	\$ 3,058	mile	\$ 3,909.50		\$ -		
Pavement Markings													
	Centerline	lf	\$ 0.67	0	\$ -	5.24	\$ -	lf	\$ 0.67		\$ -		
	Edge line	lf	\$ 0.66	43,296	\$ 28,640	5.24	\$ 5,463	lf	\$ 0.66		\$ -		
	RPMs	ea	\$ 3.34	1,082	\$ 3,615	5.24	\$ 690	ea	\$ 3.34		\$ -		
	Rumble Strips												
Upgrade "T" intersections		ea	\$ 1,106.68	3	\$ 3,320	5.24	\$ 633	ea	1106.68		\$ -		
Curve Treatments (MUTCD 2C-2)													
Guardrail													
	Number of sites			12						12			
	Removal	lf	\$ 1.29	1,120	\$ 1,445	15.62	\$ 92	lf	\$ 1.29	1,120	\$ 1,445	15.62	\$ 92
	Install new	lf	\$ 15.08	3,620	\$ 54,590	15.62	\$ 3,494	lf	\$ 15.08	3,620	\$ 54,590	15.62	\$ 3,494
	Anchorage assembly	ea	\$ 1,596.44	24	\$ 38,315	15.62	\$ 2,453	ea	\$ 1,596.44	24	\$ 38,315	15.62	\$ 2,453
Culvert extensions (with mitered end)													
Widen and Resurface								mile	\$ 350,000	2.30	\$ 805,000	15.62	\$ 51,530
Subtotal					\$ 145,953		\$ 15,884				\$ 899,349		\$ 57,569
Engineering and contingencies			25%		\$ 36,488		\$ 3,971		25%		\$ 224,837		\$ 14,392
Total Cost					\$ 182,442		\$ 19,855				\$ 1,124,186		\$ 71,961
South Crashes				North Crashes									
Study Period (years)	6			Study Period	6								
Total Crashes	2			Total Crashes	5								
K - fatality	0			K	1								
A - incapacitating inj	0			A	0								
B - non inc. inj	1			B	4								
C - possible inj	0			C	0								
O - PDO	1			O	0								
Crash Costs													
2-Lane rural road cost	\$402,003												
Total crash costs	\$804,006												
Crash Modification Factors													
Lvl 1 Non-Guardrail Comb CMF				Edgelines	Guardrail	Lvl 1 Guardrail Comb. CMF							
CMF - Fatal	0.939			CMF	0.939	CMF	0.93	CMF - Fatal	0.87327				
CMF - Injury	0.939			CMF	0.939	CMF	0.93	CMF - Injury	0.87327				
CMF - PDO	0.939			CMF	0.939	CMF	0.93	CMF - PDO	0.87327				
Lvl 2 Non-Guardrail Comb CMF				Edgelines	Widen Lane	Widen Shoulder	Guardrail	Lvl 2 Guardrail Comb. CMF					
CMF - Fatal	0.718898			CMF	0.939	CMF	0.88	CMF	0.87	CMF	0.93	CMF - Fatal	0.668575512
CMF - Injury	0.718898			CMF	0.939	CMF	0.88	CMF	0.87	CMF	0.93	CMF - Injury	0.668575512
CMF - PDO	0.661056			CMF	0.939	CMF	0.88	CMF	0.8	CMF	0.93	CMF - PDO	0.61478208
South Benefit				North Benefit									
	Level 1	Level 2				Level 1	Level 2						
Crashes Reduced	0.25346	0.716642			Crashes Red	0.305	1.405508						
Benefit	\$101,892	\$288,092			Benefit	\$122,611	\$ 565,018						
Benefit per year	\$ 16,982	\$ 48,015			Benefit per yr	\$ 20,435	\$ 94,170						
Benefit/Cost Ratio													
	Level 1	Level 2											
Annual Benefit	\$ 37,417	\$142,185											
Annual Cost	\$ 19,855	\$ 71,961											
B/C Ratio	1.88	1.98											
	Level 1	Level 2											
Net Present Value	\$ 17,563	\$ 70,224											

Site:	CR 18 (West)	Columbia County Line to CR 241													
Length:	1.4 miles														
	7392 feet														
		Level 1							Level 2						
Countermeasure		unit	cost/unit	number	cost	annuity factor	annual cost	unit	cost/unit	number	cost	annuity factor	annual cost		
Upgrade signs to MUTCD standards		mile	\$ 3,909.50	1.40	\$ 5,473	5.24	\$ 1,044		\$ 3,909.50		\$ -				
Pavement Markings															
	Centerline	lf	\$ 0.67	14,784	\$ 9,836	5.24	\$ 1,876		\$ 0.67		\$ -				
	Edge line	lf	\$ 0.66	14,784	\$ 9,780	5.24	\$ 1,866		\$ 0.66		\$ -				
	RPMs	ea	\$ 3.34	370	\$ 1,234	5.24	\$ 235		\$ 3.34		\$ -				
	Rumble Strips														
	Speed Red. Markings														
Upgrade "T" intersections		ea	\$ 1,106.68	1	\$ 1,107	5.24	\$ 211		\$ 1,106.68		\$ -				
Curve Treatments (MUTCD 2C-2)															
Guardrail															
	Number of sites			2											
	Removal	lf	\$ 1.29	80	\$ 103	15.62	\$ 7		\$ 1.29		\$ -				
	Install new	lf	\$ 15.08	1,000	\$ 15,080	15.62	\$ 965		\$ 15.08		\$ -				
	Anchorage assembly	ea	\$ 1,596.44	4	\$ 6,386	15.62	\$ 409		\$ 1,596.44		\$ -				
Culvert extensions (with mitered end)										\$ -		\$ -			
Widen and Resurface										\$ 350,000	1.40	\$ 490,000	15.62	\$ 31,366	
Subtotal						\$ 48,999		\$ 6,613					\$ 490,000	\$ 31,366	
Engineering and contingencies		25%				\$ 12,250		\$ 1,653	25%				\$ 122,500	\$ 7,841	
Total Cost						\$ 61,249		\$ 8,267					\$ 612,500	\$ 39,207	
Crashes			T-Int Crashes				Non T-Int Crashes								
Study Period (years)	6	Study Period				6	Study Period				6				
Total Crashes	3	Total Crashes				2	Total Crashes				1				
K - fatality	0	K				0	K				0				
A - incapacitating inj	1	A				0	A				1				
B - non inc inj	0	B				0	B				0				
C - possible inj	2	C				2	C				0				
O - PDO	0	O				0	O				0				
Crash Costs															
2-Lane rural road		\$ 402,003													
Total crash costs		\$1,206,009													
Crash Modification Factors															
Level 1 Non Int Combined CMF		Edgelines	Update T-Int signs		Level 1 Int Comb. CMF										
CMF - Fatal	0.939	CMF - Fatal	0.939	CMF - Fatal	0.6	CMF - Fatal	0.5634								
CMF - Injury	0.939	CMF - Injury	0.939	CMF - Injury	0.6	CMF - Injury	0.5634								
CMF - PDO	0.939	CMF - PDO	0.939	CMF - PDO	0.6	CMF - PDO	0.5634								
Level 2 Non Int Combined CMF		Edgelines	Widen Lane		Widen Shoulder		Update T-Int signs	Lv 2 Int Comb. CMF							
CMF - Fatal	0.7188984	CMF - Fatal	0.939	CMF - Fatal	0.88	CMF - Fatal	0.87	CMF - Fatal	0.6	CMF - Fatal	0.4313				
CMF - Injury	0.7188984	CMF - Injury	0.939	CMF - Injury	0.88	CMF - Injury	0.87	CMF - Injury	0.6	CMF - Injury	0.4313				
CMF - PDO	0.661056	CMF - PDO	0.939	CMF - PDO	0.88	CMF - PDO	0.8	CMF - PDO	0.6	CMF - PDO	0.3966				
Benefit				Crashes Red.	level 1	level 2									
	Level 1	Level 2			T-Int	0.8732	1.13732192								
Crashes Reduced	0.9342	1.4184235			Non T-Int	0.061	0.2811016								
Benefit	\$ 375,551	\$ 570,211													
Benefit per year	\$ 62,592	\$ 95,035													
Benefit/Cost Ratio															
	Level 1	Level 2													
Annual Benefit	\$ 62,592	\$ 95,035													
Annual Cost	\$ 8,267	\$ 39,207													
B/C Ratio	7.57	2.42													
	Level 1	Level 2													
Net Present Value	\$ 54,325	\$ 55,828													

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