chapter

6

Site Specific Analysis

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6.1 Introduction

The third approach to addressing safety in the corridor is site specific analysis. In the CSA process, the pre-field review data analysis guided the approach to the field review and assessment. The analysis of a five-year period (2010-2014) of crash data led to the identification of 25 site specific locations due to their crash history and severity, see Figures 6.1 and 6.2. The site specific locations were chosen based on their potential to show reduced average crash frequency or severity. Once the locations were identified, field reviews were conducted in accordance with standard Road Safety Audit (RSA) practices of evaluation and documentation. In addition, a directional video recording of the corridors through the driver's perspective was generated. The 25 locations are listed in Table 6.1.

Table 6.1.
U.S. Route 13 Segment Locations.

1.	North of Jonathans Landing Lane
2.	Stone Road
3.	Eyrehall Drive
4.	Captain Howe Lane
5.	Near Sylvan Scene Drive
6.	Bayford Road
7.	South of West Street
8.	Dogwood Drive
9.	North of Dogwood Drive
10.	Chesapeake Square Shopping Center
11.	Taylor Road
12.	Daugherty Road
13.	Courthouse Avenue
14.	Mary N Smith Road / Front Street
15.	Evans Road
16.	Parksley Road
17.	South of Whites Neck Road
18.	Nelsonia Road
19.	Groton Town Road
20.	Hallwood Road
21.	Temperanceville Road
22.	New Temperanceville Road
23.	Chincoteague Road
24.	East of U.S. Route 13
25.	Bridge Crossing Wire Narrows

The 25 site specific locations are discussed in full detail on the following pages. For each site, the following information is included:

- Location of site along corridor;
- Aerial photo of location with crash locations shown;
- Description of existing conditions;
- Crash data;
- Key safety concerns;
- Recommended countermeasures and implementation plan for short-term, mid-term and long-term conditions;
- Summarized cost estimate using the templates as shown in Appendix A and other recommended countermeasures listed.
- Crash mitigation summary for recommended improvements; and
- Renderings of proposed geometric changes if recommended.

Additional details for the cost estimate can be found in Appendix E.

The recommendations are a result of the application of the Templates with the addition of site specific countermeasures. The recommendations are presented in three levels of implementation based on anticipated funding and potential completion. Generally, Tier 1 and Short-Term include countermeasures that are anticipated to be implemented quickly, possibly during maintenance using VDOT crews; Tier 2 and Mid-Term include countermeasures that would require more time to be implemented due to design or funding; and Tier 3 and Long-Term include countermeasures that would require longer lead time due to funding, property acquisition, public hearing, and/or longer construction time.

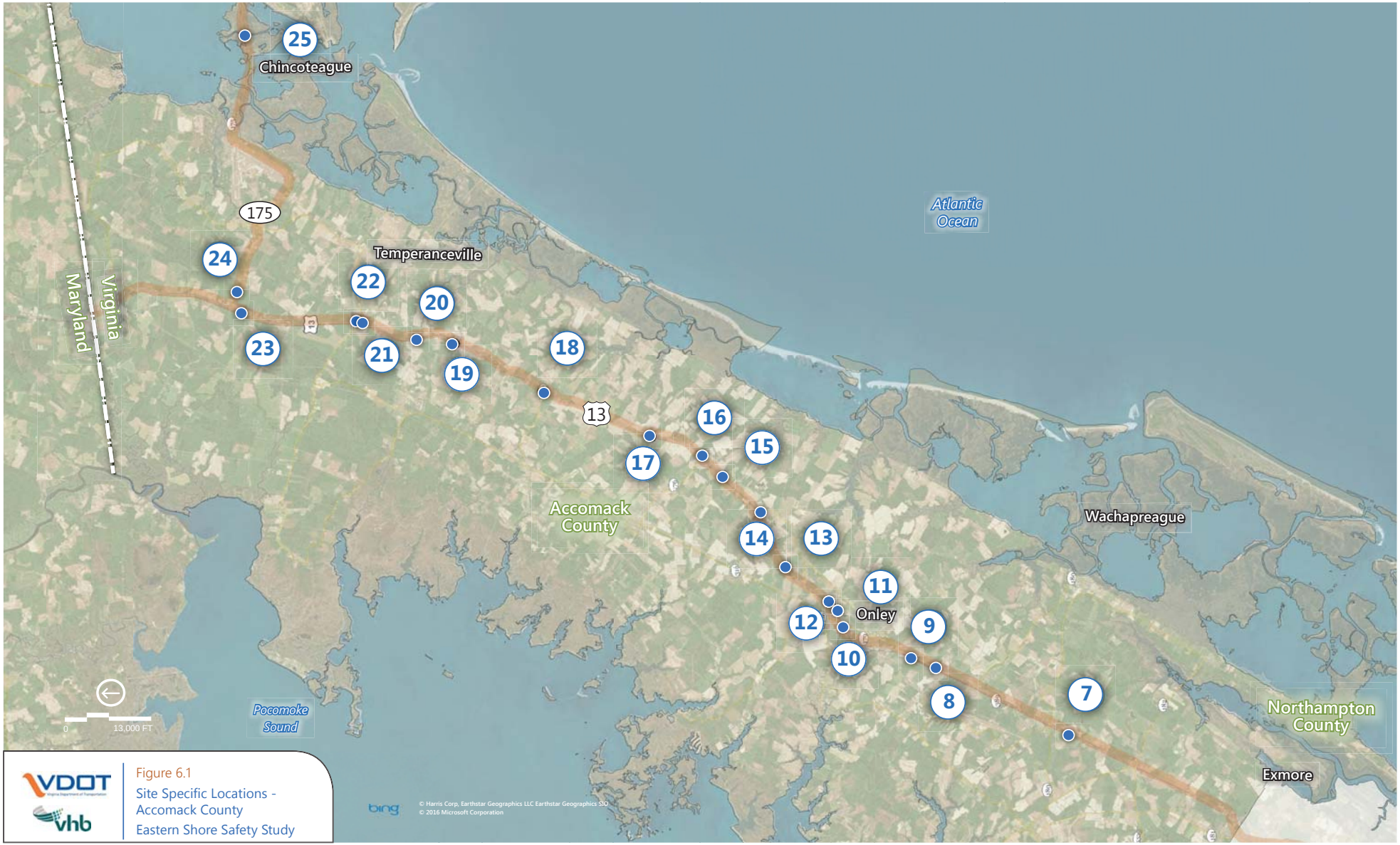
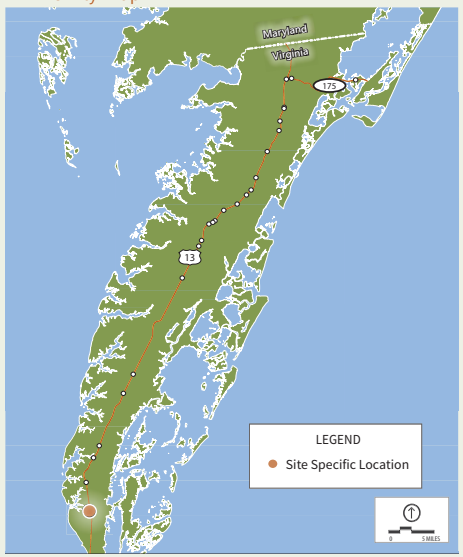


Figure 6.1
Site Specific Locations - Accomack County
Eastern Shore Safety Study

Figure 6.2
Site Specific Locations - Northampton County
Eastern Shore Safety Study

site specific location #1

Vicinity Map



Crash Sites

6.2 Site Specific Location #1 North of Jonathans Landing Lane (MP 76.13)

6.2.1 Existing Conditions

This location is approximately a third of a mile north of Arlington Road (Route 644) and a tenth of a mile north of Jonathans Landing Lane, and is in close proximity to a crossover on a four-lane divided section of U.S. Route 13. There are no intersecting roadways and no turn lanes present at the crossover.

The surrounding area is a mix of open fields and woods with some houses and field access. Outside shoulders are present for both north and southbound directions, and there are limited median shoulders present in either direction. Median and shoulder rumble strips are present in both north and southbound directions. There is no on-street parking or lighting. During the field review high truck traffic and vehicular speeds were observed.

6.2.2 Crash Data

Four crashes occurred during the five-year study period. The crashes were roadway departure crashes with one resulting in fatality, one resulting in non-incapacitating injury, and two in property damage only. Half of the crashes occurred during nighttime conditions and half were roadway departures into the median.

6.2.3 Key Safety Concerns

- Lack of positive guidance for drivers.
- Lack of recovery space for vehicles to stay on the road or recover from driving off the road.

6.2.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve positive guidance and warning through post mounted delineators along the roadside and at the median crossover, reflectorized sign posts, and wider 6-inch edge line and center line pavement markings.
- Implement safety edge during scheduled paving to provide an additional method for vehicles to recover from roadway departure crashes.

Long-Term:

- Widen outside shoulders to be at least eight feet wide and median shoulders to be four feet wide to provide additional space for vehicles that drive outside the travel lanes.
- Construct turn lanes with 200 feet of storage and 200 feet of taper at crossover.

Table 6.2. Location #1 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Widen paved shoulder from 3 ft to 8 ft	0.71 (29% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.3. Location #1 Cost Estimate.

	Item	Location #1
Tier 1	Signage	$5,585
	Pavement Markings	$8,882
	Signal	
	Other	$166
	TOTAL	$14,633
Tier 2	Signage	
	Pavement Markings	
	Signal	
	Other	$500
	TOTAL	$500
Tier 3	Signage	$2,345
	Pavement Markings	
	Signal	
	Other	$105,077
	TOTAL	$107,422

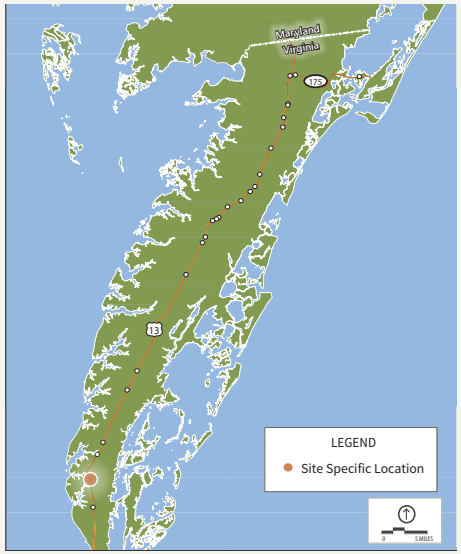
Note: See Templates in Appendix A for applicable items.

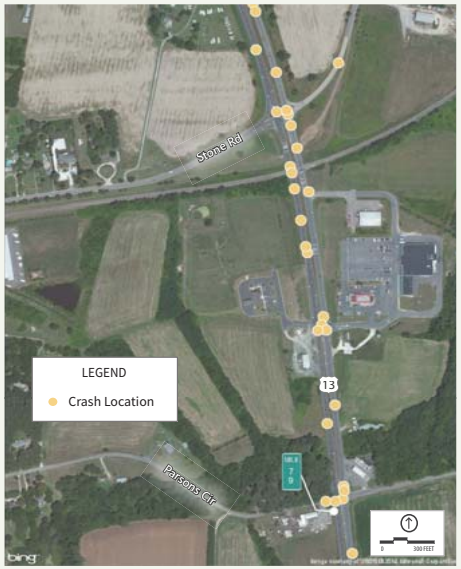
Facing east, a view of the median crossover on U.S. Route 13

U.S. Southbound Route 13

site specific location #2

Vicinity Map





Crash Sites

6.3 Site Specific Location #2 Stone Road (MP 79.18 – 79.43)

6.3.1 Existing Conditions

Location #2 is a segment from the Food Lion shopping center, north to Stone Road (Route 184). U.S. Route 13 and Stone Road is a four-legged, signalized intersection just north of a railroad crossing. There is a 120-foot northbound left turn lane with a 60-foot taper and a 120-foot northbound right turn lane with a 60-foot taper. Additionally, there is a 130-foot southbound left turn lane with a 60-foot taper and 325-foot southbound right slip lane with a 150-foot taper. Stone Road is a two-lane paved roadway. The outside shoulders are six (6) feet in the northbound and southbound directions.

U.S. Route 13 is four lanes with a grass median. At the shopping center there are right and left turn lanes in the north and southbound directions, two eastbound lanes entering the shopping center and one westbound/outbound lane. The southbound left turn lane has 185 feet of storage and 140 feet of taper and the southbound right turn lane has 200 feet of storage and 185 feet of taper. The northbound left turn lane has 210 feet of storage and 150 feet of taper and the northbound right turn lane has 220 feet of storage and 110 feet of taper. VDOT standard is 200/200 feet turn lane/taper. There is also a retail center located on the western side of the intersection with several access points, including one located at the median crossover for the shopping center entrance.

6.3.2 Crash Data

Twenty-six (26) crashes occurred within this quarter-mile segment during the five-year study period. Sixty (60) percent of the crashes were intersection related with 30 percent angle crashes and 30 percent rear end crashes. Fifteen (15) percent were deer crashes. The one pedestrian crash resulted in fatality. Half of the crashes resulted in injuries and half in property damage only. Four (4) of the crashes occurred at the shopping center driveway – all with injuries. Slightly less than half of the crashes occurred during nighttime conditions, and 60 percent occurred in the northbound direction.

6.3.3 Key Safety Concerns

- Buses stop unexpectedly at the railroad crossing that is adjacent to the traffic signal. Some of the rear end crashes were associated with buses stopping at the tracks.
- Nighttime crashes.

6.3.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve positive guidance and warning through post mounted delineators along the roadside and at the median crossover, reflectorized sign posts, and wider 6-inch edge line and center line pavement markings.
- Implement safety edge during scheduled paving to provide an additional method for vehicles to recover from roadway departure crashes.
- Install retroreflective tape on backplates or install retroreflective backplates to enhance signal conspicuity.
- Add a placard to the railroad track warning sign to watch for stopped vehicles.
- Evaluate truck turning radius at the southeast corner of the shopping center entrance and U.S. Route 13 to determine if it is possible to convert the two inbound lanes to one inbound lane and two outbound lanes, one for left-turning and one for right-turning vehicles.

Mid-Term:

- Conduct a signal warrant analysis to determine if signalization is a potential measure in reducing the angle crashes at the entrance to the Food Lion Shopping Center. Signalizing the entrance would provide dedicated movements for vehicles turning into and out of the shopping center if warranted. This cost is included in Tier 3, line "other".

Long-Term:

- Widen outside shoulders to be at least eight feet wide and median shoulders to be four feet wide to provide additional space for vehicles that drive outside the travel lanes.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.
- Consider adding intersection lighting at the shopping center and Stone Road to improve nighttime visibility.

Table 6.4. Location #2 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install retroreflective backplates	0.85 (15% reduction)	All Crashes - all severities	CMF Clearinghouse
Widen paved shoulder from 3 ft to 8 ft	0.71 (29% reduction)	All Crashes - all severities	CMF Clearinghouse
Directional medians to allow left-turns and u-turns	0.77 (23% reduction)	All Crashes - all severities	CMF Clearinghouse
Intersection lighting	0.881 - 0.92 (8 - 11.9% reduction)	Nighttime crashes - all severities	CMF Clearinghouse

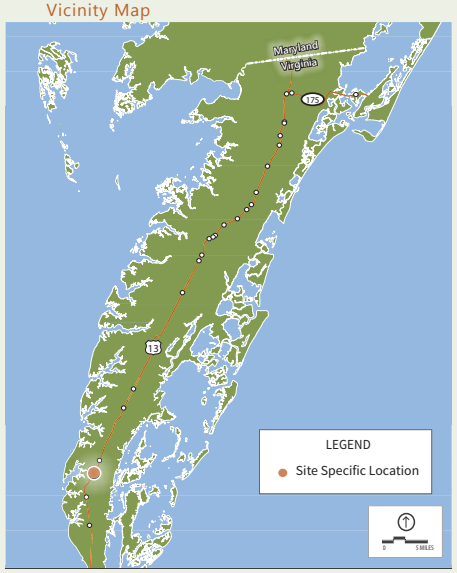
Table 6.5. Location #2 Cost Estimate.

	Item	Location #2
Tier 1	Signage	$71,167
	Pavement Markings	$31,039
	Signal	$792
	Other	$332
	TOTAL	$103,329
Tier 2	Signage	$24,275
	Pavement Markings	$1,663
	Signal	
	Other	$1,320
	TOTAL	$27,258
Tier 3	Signage	$22,420
	Pavement Markings	$417
	Signal	
	Other	$1,047,027
	TOTAL	$1,069,864

Note: See Templates in Appendix A for applicable items.

site specific location #3

Vicinity Map



Crash Sites

6.4 Site Specific Location #3 Eyrehall Drive (MP 82.40)

6.4.1 Existing Conditions

This location is a U.S. Route 13 corridor segment located near the stop controlled intersections of Eyrehall Drive and Cobbs Station Road (Route 636). The segment extends approximately 1,500 feet to the south and 2,000 feet to the north of Cobbs Station Road. The surrounding area type is agricultural and forest.

The intersections of Eyrehall Drive and Cobbs Station Road are offset T-intersections under stop control. Eyrehall Drive is a private driveway for several residences. This gravel road has an unpaved apron, and the approach has a steep downhill grade forcing vehicles to enter slowly. Cobbs Station Road is a paved local road. Edge line extensions are provided along U.S. Route 13 at Cobbs Station Road.

The only turn lane present at this location is a short, 155-foot southbound left turn lane with a 60-foot taper. Outside shoulders are present; however, median shoulders are narrow in both north and southbound directions. North and southbound median and shoulder rumble strips are present. During field review, drivers were heard driving over the rumble strips. Also, tire tracks were visible on and crossing the rumble strips. There was gravel on U.S. Route 13 from Eyrehall Drive.

6.4.2 Crash Data

Twenty (20) crashes occurred at this location including one fatal crash. Thirty-five (35) percent resulted in injuries. Half of the crashes involved deer, 30 percent were roadway departure crashes, and 20 percent were rear end crashes. Approximately half of the crashes occurred during dark or dawn conditions.

6.4.3 Key Safety Concerns

- Minimal positive guidance to drivers.
- Unpaved apron at intersecting road/driveway.
- Nighttime deer crashes.
- Offset intersections encourage drivers on Eyrehall Drive to travel against traffic towards the north to access the median crossover.
- Street signs are difficult to see from U.S. Route 13 due to the travel speeds.

6.4.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve positive guidance and warning through intersection warning signs, post mounted delineators, wider 6-inch pavement markings, dynamic speed warning signs, and deer warning signs.
- Pave driveway and road apron onto U.S. Route 13.
- Install 12-inch street name signs to conform to MUTCD recommendation.

Long-Term:

- Due to the alignment of the offset intersection, modify median access to provide channelization and restrict access to left turns from U.S. Route 13 south and Cobbs Station Road.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.6. Location #3 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Install dynamic speed feedback sign	0.93-0.95 (5-7% reduction)	All Crashes - all severities	CMF Clearinghouse
Directional medians to allow left-turns and u-turns	0.77 (23% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.7. Location #3 Cost Estimate.

	Item	Location #3
Tier 1	Signage	$28,302
	Pavement Markings	$30,717
	Signal	
	Other	$166
	TOTAL	$59,185
Tier 2	Signage	$2,657
	Pavement Markings	$185
	Signal	
	Other	
	TOTAL	$2,842
Tier 3	Signage	$11,694
	Pavement Markings	$417
	Signal	
	Other	$366,478
	TOTAL	$378,589

Note: See Templates in Appendix A for applicable items.

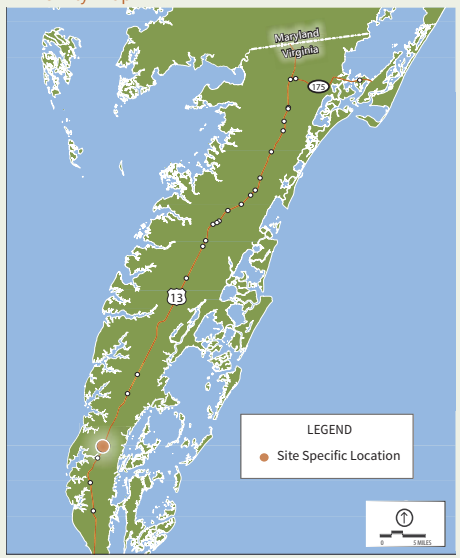
Looking north from Eyrehall Drive

Looking south from Cobbs Station Road

Figure 6.3
Concept Plan -
Site Specific Location #3
Eastern Shore Safety Study

site specific location #4

Vicinity Map



Crash Sites

6.5 Site Specific Location #4 Captain Howe Lane (MP 84.14)

6.5.1 Existing Conditions

This location is at the unsignalized, four-legged intersection of U.S. Route 13, Captain Howe Lane, and Eastville Commons. Captain Howe Lane is a paved local road, and Eastville Commons is an unused roadway leading to a vacant property.

A 235-foot left turn lane with a 45-foot taper is present in the northbound direction in addition to a 195-foot southbound left turn lane with a 150-foot taper. There is a 195-foot northbound right turn lane with 120 feet of taper provided at Eastville Commons; however, the turn lane is designated with arrows placed outside of the edge line. A southbound right turn lane is not present at this location.

Shoulder and median rumble strips are present in both directions. Outside and median shoulders are present in both directions; however, the median shoulders are narrow. Edge line extensions are provided for Captain Howe Lane along U.S. Route 13.

Waves of traffic were observed in the southbound direction due to upstream traffic signals providing gaps for traffic to enter from the side streets. However, northbound traffic is more evenly spread out making it difficult to find an acceptable gap. Waste management trucks use Courthouse Road/Indian Walk Lane to the north for dump access.

6.5.2 Crash Data

Seven (7) crashes occurred in the vicinity of Captain Howe Lane. Fifty-seven (57) percent of the crashes resulted in injury, including one fatal crash. Fifty-seven (57) percent of the crashes were intersection related crashes: angle, head-on, and rear end crashes. The remaining crashes were roadway departure and deer related crashes.

6.5.3 Key Safety Concerns

- Grade change in median at paving joint causes an uneven transition for drivers and traps debris which could cause drivers to lose traction.
- Lack of right turn lanes in southbound direction limit southbound drivers' ability to slow down before turning onto Captain Howe Lane. Additionally, the northbound right turn lane is not adequately marked.
- Street signs are difficult to see from U.S. Route 13 due to the travel speeds; a single stop sign was placed on the median island on Captain Howe Lane and no stop sign on the right side of the intersection. These signs are not MUTCD compliant.

6.5.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve positive guidance and warning through intersection warning signs, post mounted delineators, and wider 6-inch pavement markings.
- Smooth median crossover to prevent debris build-up.
- Install 12-inch street name signs, a right-hand stop sign on Captain Howe Lane, and MUTCD complaint median signage.

Mid-Term:

- Investigate potential to add right turn lane in southbound direction and if the Eastville Commons property is developed, improve right turn lane pavement markings.

Long-Term:

- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.8. Location #4 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Provide a right-turn lane on one major road approach	0.86 - 0.92 (8 - 14% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.9. Location #4 Cost Estimate.

	Item	Location #4
Tier 1	Signage	$22,717
	Pavement Markings	$8,215
	Signal	
	Other	$166
	TOTAL	$31,098
Tier 2	Signage	$2,657
	Pavement Markings	$554
	Signal	
	Other	
	TOTAL	$3,211
Tier 3	Signage	$9,349
	Pavement Markings	$417
	Signal	
	Other	$113,376
	TOTAL	$123,142

Note: See Templates in Appendix A for applicable items.

Looking south from Eastville Commons

Looking east at intersection of U.S. Route 13 and Captain Howe Lane

Figure 6.4
Concept Plan -
Site Specific Location #4
Eastern Shore Safety Study

site specific location #5

Vicinity Map

Crash Sites

6.6 Site Specific Location #5 Near Sylvan Scene Drive (MP 90.50 – 90.99)

6.6.1 Existing Conditions

This location is a U.S. Route 13 corridor segment extending from approximately 550 feet south to 1,800 feet north of Sylvan Scene Drive (Route 625). The intersection of Sylvan Scene Drive is a four-legged, two-way stop controlled intersection with a 115-foot northbound left turn lane with 60-foot taper. Additionally, there is a 115-foot southbound left turn lane with a 55-foot taper and a 240-foot southbound right turn lane with a 40-foot taper. Sylvan Scene Drive is a two-lane paved road.

Outside and median shoulders are present in both the north and southbound directions with rumble strips; however, the median shoulders are narrow. Vehicles park along the corridor to the north of Sylvan Scene Drive to access their homes on the eastern side of the railroad track.

6.6.2 Crash Data

There were 13 crashes within this half mile segment in the vicinity of the Sylvan Scene Drive intersection. Eighty-five (85) percent of the crashes were roadway departure or deer-related crashes. One fatal, rear end crash occurred in the northbound direction involving a parked car on the side of the road, and one angle crash occurred at the intersection of Sylvan Scene Drive.

Forty-six (46) percent of the crashes resulted in fatality or injury and 85 percent of the crashes occurred under dark conditions. The direction of travel was fairly evenly split with 54 percent occurring in the southbound direction and 46 percent occurring in the northbound direction.

6.6.3 Key Safety Concerns

- Parked vehicles on shoulder. There is a lack of expectancy for drivers on U.S. Route 13 as vehicles were not observed parking along the roadway on other parts of the corridor. These vehicles serve as fixed objects within the clear zone. Furthermore, these vehicles are parked in the grass requiring them to enter U.S. Route 13 at relatively slow speeds compared to the vehicles already traveling at higher speeds on U.S. Route 13.
- Lack of positive guidance for drivers, particularly at night. Difficult for vehicles to recover if they drive off the road due to narrow median shoulders.
- Nighttime crashes.

6.6.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Incorporating safety edge to provide an additional method for vehicles to recover from roadway departure crashes.
- Prohibit parking on grassy shoulder.
- Provide additional recovery area for drivers by widening median shoulders to four feet and incorporating safety edge.

Long-Term:

- Install roadway lighting if positive guidance does not reduce nighttime crashes.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.10. Location #5 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Corridor lighting	0.73 (27% reduction)	All Crashes - severe and minor injury	CMF Clearinghouse

Table 6.11. Location #5 Cost Estimate.

	Item	Location #5
Tier 1	Signage	$49,448
	Pavement Markings	$24,267
	Signal	
	Other	$332
	TOTAL	$74,046
Tier 2	Signage	$6,218
	Pavement Markings	$515
	Signal	
	Other	$1,320
	TOTAL	$8,053
Tier 3	Signage	$15,374
	Pavement Markings	$832
	Signal	
	Other	$94,993
	TOTAL	$111,199

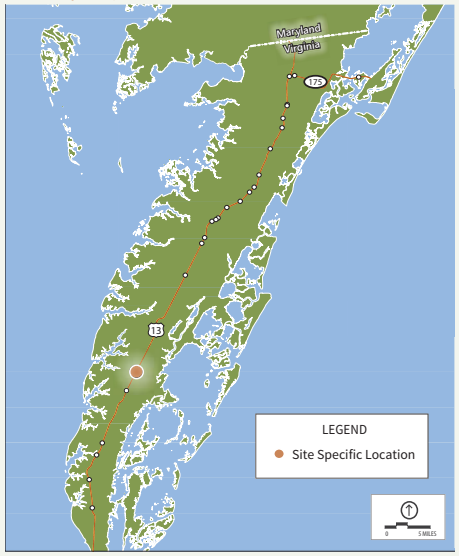
Note: See Templates in Appendix A for applicable items.

Looking north from westbound approach at Sylvan Scene Drive

Vehicles parked on the eastern side of the northbound travel lane on U.S. Route 13

site specific location #6

Vicinity Map



Crash Sites

6.7 Site Specific Location #6 Bayford Road (MP 93.28 – 94.04)

6.7.1 Existing Conditions

This location encompasses a stretch of U.S. Route 13 in the vicinity of Bayford Road (Route 617) extending from approximately 1,000 feet north to almost 3,000 feet south of the intersection. The area is a mix of fields and forests with some residential areas. During the field review, the RSA team viewed agricultural trucks entering and exiting from the western side of Bayford Road.

A 225-foot northbound left turn lane with a 195-foot taper and a 170-foot southbound left turn lane with 220-foot taper are present at the intersection with Bayford Road. A 170-foot southbound right turn lane with a 115-foot taper is also present at this location. Intersection warning signs are present in both north and southbound direction.

6.7.2 Crash Data

There were 22 crashes on this three-quarters of a mile segment. Seventy-three (73) percent of the crashes were roadway departure and deer-related crashes. One of the roadway departure crashes resulted in fatality. Half of the crashes occurred during dark, dawn, or dusk conditions. Eighty-six (86) percent of the crashes occurred on dry pavement. The roadway is level and half of the drivers were cited for exceeding the speed limit or failing to maintain proper control of the vehicle.

6.7.3 Key Safety Concerns

- Difficult for vehicles, particularly trucks, to turn from Bayford Road onto U.S. Route 13 due to necessary turning radii and high speeds on U.S. Route 13.

6.7.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Incorporating safety edge to provide an additional method for vehicles to recover from roadway departure crashes.

Mid-Term:

- Widen outside shoulders to be at least eight feet wide and median shoulders to be four feet wide to provide additional space for vehicles that drive outside the travel lanes.

Long-Term:

- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.12. Location #6 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Widen paved shoulder from 3 ft to 8 ft	0.71 (29% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.13. Location #6 Cost Estimate.

	Item	Location #6
Tier 1	Signage	$49,448
	Pavement Markings	$37,748
	Signal	
	Other	$332
	TOTAL	$87,528
Tier 2	Signage	$6,218
	Pavement Markings	$554
	Signal	
	Other	$660
	TOTAL	$7,432
Tier 3	Signage	$15,374
	Pavement Markings	$832
	Signal	
	Other	$79,071
	TOTAL	$95,277

Note: See Templates in Appendix A for applicable items.

Looking northbound from the median at Bayford Road

Bus entering onto U.S. Route 13 from Bayford Road

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site specific location #7

Vicinity Map

Crash Sites

6.8 Site Specific Location #7 South of West Street (MP 106.14)

6.8.1 Existing Conditions

This location is approximately 1,700 feet south of West Street/Keller Pond Road (VA 620). The area is predominantly comprised of fields with some wooded portions.

Outside shoulders with rumble strips are present in both north and southbound directions. There are narrow median shoulders and a median rumble strip in the northbound direction but no median shoulders or rumble strip/stripe in the southbound direction.

6.8.2 Crash Data

Six (6) crashes occurred at this location including a fatal roadway departure crash. Five other crashes occurred within 2,500 feet of the intersection. Sixty-seven (67) percent of the crashes were roadway departure. Four (4) of the crashes were in the southbound direction and two (2) in the northbound direction. Four of the six crashes occurred during daylight.

6.8.3 Key Safety Concerns

- Lack of positive guidance.
- Lack of warning/recovery space in the median, particularly in the southbound direction.
- Deep ditch on roadside within clear zone.

6.8.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve positive guidance through post mounted delineators and replace pavement markings with wider 6-inch pavement markings.

Mid-Term:

- Widen/add median shoulders to four feet and add rumble strips. If shoulders are not possible then incorporate rumble stripes in the southbound direction.
- Review ditches to see if the depth and slope can be reduced. If not, widen shoulder and add guardrail or pipe ditch to eliminate hazard within clear zone.

Table 6.14. Location #7 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Install shoulder rumble strips	0.73-0.83 (17-27% reduction)	Run-off-the-road crashes - all severities	CMF Clearinghouse

Table 6.15. Location #7 Cost Estimate.

	Item	Location #7
Tier 1	Signage	$5,585
	Pavement Markings	$4,798
	Signal	
	Other	$166
	TOTAL	$10,549
Tier 2	Signage	
	Pavement Markings	
	Signal	
	Other	$660
	TOTAL	$660
Tier 3	Signage	$2,345
	Pavement Markings	
	Signal	
	Other	$117,913
	TOTAL	$120,258

Note: See Templates in Appendix A for applicable items.

Looking north from the western side of U.S. Route 13

site specific location #8

Vicinity Map

Crash Sites

6.9 Site Specific Location #8 Dogwood Drive (MP 110.31)

6.9.1 Existing Conditions

Site Specific Location #8 is at the intersection of U.S. Route 13 with Dogwood and Phillips Drives (Route 639) in Accomack County. This is an unsignalized intersection, and U.S. Route 13 has a posted speed of 55 mph. There is a 125-foot northbound left turn lane, a 100-foot southbound left turn lane and a 125-foot southbound right turn lane at this intersection.

Dogwood and Phillips Drives are two-lane rural local roads. Dogwood Drive intersects on the west side of the U.S. Route 13, and Phillips Drive intersects on the east side.

Texaco Town Road is a frontage road that runs parallel to U.S. Route 13 on the east side. It terminates at Phillips Drive approximately 90 feet from the U.S. Route 13 intersection. In addition to Texaco Town Road, there is a deep ditch and railroad tracks running parallel to U.S. Route 13 on the east side of the road at this location.

Directly adjacent to U.S. Route 13 on the west side of the intersection are the Virginia State Police Area Office and Tammy and Johnny's Restaurant. Both buildings have access from U.S. Route 13 as well as from Dogwood Drive.

6.9.2 Crash Data

There were 23 crashes reported within the vicinity of the intersection. These crashes included one fatal crash and the remainder of crashes were split between injury and property damage only. Forty-eight (48) percent of crashes were roadway departure crashes and 30 percent were angle crashes. Fifty-seven (57) percent of the crashes occurred during daylight with one-third of all crashes occurring in the afternoon between the hours of noon and 5 pm.

6.9.3 Key Safety Concerns

- High number of conflict points due the numerous intersections and driveways within the intersection footprint.
- Wide access points/driveway entrances that reduce driver expectancy
- High travel speeds on U.S. Route 13 lead to difficulty for drivers entering U.S. Route 13 to identify sufficient gaps to enter traffic flow and/or drivers to slow down adequately to safely enter driveways or intersecting roads due to insufficient turn lane and taper lengths
  - Increased potential for higher severity crashes
- Limited auxiliary lanes
  - Short southbound right turn lane
  - No northbound right turn lane
  - Insufficient space for drivers to slow down before turning onto intersecting streets or parking lot entrances.
- U-turn prohibition due to narrow median and speeds.
  - Signage is present but vehicles still conduct maneuver.
- Unclear signage
  - Some of the signs or sign posts are bent/damaged.
  - Street signs are difficult to see traveling at speed on U.S. Route 13.

6.9.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Repair or replace damaged signs and sign posts.
- Install 12-inch street name signs to conform to MUTCD recommendation.
- Improve intersection expectancy and visibility through advance intersection warning signs, flashing/dynamic warning beacons on warning signs or at intersection, reflective strips on signs posts, reflective post mounted delineators on intersection approaches and median.

Long-Term:

- Reduce the entrance width and consolidate entrances at Tammy and Johnny's Restaurant through use of curbing, landscaping, etc., to close access points and reduce the number of conflict points.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.
- The installation of a northbound right turn lane is recommended; however, it is not feasible to construct the turn lane due to the limited space and elevation change between the existing travel lanes and the railroad tracks. The mainline would require a significant shift or elevation adjustment to add in the right turn lane.

Table 6.16. Location #8 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Add dynamic intersection warning signs	0.814-0.918 (18.6%-8.2% reduction)	All Crashes - all severities	CMF Clearinghouse
Corridor Access Management	0.77 - 0.95 (5 - 23% reduction)	All Crashes - all severities	FHWA Proven Countermeasures
Directional Medians to allow left-turns and u-turns	0.77 (23% reduction)	All Crashes - all severities	CMF Clearinghouse
Intersection lighting	0.881 - 0.92 (8 - 11.9% reduction)	Nighttime crashes - all severities	CMF Clearinghouse

Table 6.17. Location #8 Cost Estimate.

	Item	Location #8
Tier 1	Signage	$43,862
	Pavement Markings	$9,527
	Signal	
	Other	$166
	TOTAL	$53,555
Tier 2	Signage	$6,218
	Pavement Markings	$554
	Signal	
	Other	$660
	TOTAL	$7,432
Tier 3	Signage	$13,029
	Pavement Markings	$832
	Signal	
	Other	$74,337
	TOTAL	$88,198

Note: See Templates in Appendix A for applicable items.

Looking south from Tammy and Johnny's restaurant

Looking north from southwest quadrant of intersection

Figure 6.5
Concept Plan -
Site Specific Location #8
Eastern Shore Safety Study

site specific location #9

Vicinity Map

Crash Sites

6.10 Site Specific Location #9 North of Dogwood Drive (MP 110.95)

6.10.1 Existing Conditions

This location approximately 3,375 feet north of Dogwood Drive, just south of Nandua High School and is in an area with residential and retail land uses.

In the southbound direction there is an outside shoulder with rumble strip and a narrow median shoulder with a narrow rumble strip. Tire tracks were on the southbound shoulder and off the road on the northbound grass and gravel roadside.

A gravel access road provides access from the residential area to the east, over the railroad tracks, and onto U.S. Route 13. The apron was not paved and gravel was in the roadway. Also, vehicles were observed using this access and did not have room to accelerate when entering U.S. Route 13.

6.10.2 Crash Data

Eight (8) crashes occurred in this area including one fatal crash involving a pedestrian. Of the eight crashes, half resulted in fatality or injury. Thirty-eight (38) percent were roadway departure crashes with one of each of the following crash types: deer-related, fixed object in road, pedestrian, rear end, and train. Approximately half of the crashes occurred during dark conditions.

6.10.3 Key Safety Concerns

- Lack of positive guidance.
- Lack of warning/recovery space on both the outside and median, particularly in the northbound direction.
- Lack of space to slow down to make turns off of U.S. Route 13 or onto U.S. Route 13.
- Deep ditches on roadside within clear zone, particularly adjacent to the railroad tracks.
- Unpaved access from eastern side of corridor.
- Lack of dedicated pedestrian space or crossing measures. Due to the proximity of the school, businesses including an ice cream shop on the western side of U.S. Route 13 and the residential area on the eastern side of U.S. Route 13, pedestrian activity should be investigated to determine if dedicated facilities or crossing measures are necessary.

6.10.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Pave the apron of the access road on the eastern side of U.S. Route 13.
- Review ditches to see if the depth and slope can be reduced. If not, widen shoulder and add guardrail or pipe ditch to eliminate hazard within clear zone.

Mid-Term:

- Widen/add median shoulders to four feet with rumble strips. If shoulders are not possible then incorporate rumble stripes in the southbound direction.

Table 6.18. Location #9 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Widen shoulder (paved) (from 2 to 4 ft)	0.89 (11% reduction)	All Crashes - all severities	CMF Clearinghouse
Install median guardrail	0.22 (78% reduction)	Cross median - all severities	CMF Clearinghouse

Table 6.19. Location #9 Cost Estimate.

	Item	Location #9
Tier 1	Signage	$28,302
	Pavement Markings	$15,302
	Signal	
	Other	$332
	TOTAL	$43,936
Tier 2	Signage	$2,657
	Pavement Markings	$370
	Signal	
	Other	$1,320
	TOTAL	$4,347
Tier 3	Signage	$11,694
	Pavement Markings	$417
	Signal	
	Other	$36,327
	TOTAL	$48,438

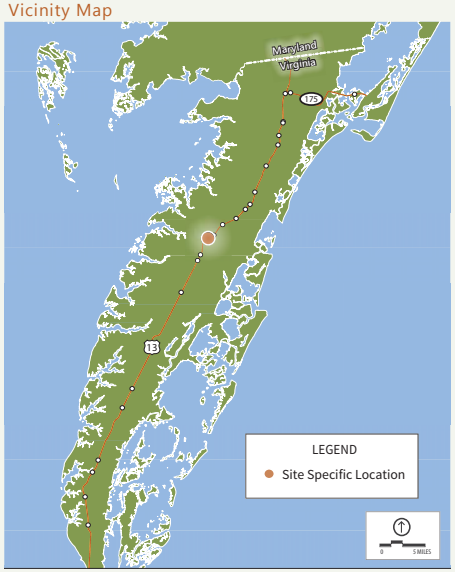
Note: See Templates in Appendix A for applicable items.

Looking north from the western side of U.S. Route 13

Gravel access road on eastern side of U.S. Route 13

site specific location #10

Vicinity Map



Crash Sites

6.11 Site Specific Location #10 Chesapeake Square Shopping Center (MP 113.04)

6.11.1 Existing Conditions

This site is located at the northern signal for Chesapeake Square Shopping Center (near Pizza Hut). This is a four-legged, signalized intersection. There is a 240-foot northbound left turn lane with a 160-foot taper and a 170-foot northbound right turn lane with an 80-foot taper. Additionally, there is a 205-foot southbound left turn lane with a 175-foot taper and a 200-foot southbound right turn lane with a 135-foot taper.

This intersection is located on a horizontal and vertical curve. There are no additional signals in close proximity to the north; however, there are signals directly to the south. Pedestrians were observed walking along U.S. Route 13 to access the shopping centers, although no pedestrian accommodations were present.

Speed reduction warning signs are double posted north of the intersection for southbound vehicles. Speed reduces to 45 mph prior to the intersection.

Field observations noted long queues on the southbound approach. The northwest corner of the section was worn away from southbound vehicles driving over the corner which could potentially be due to high vehicle speeds or inadequate turning radius for large trucks.

6.11.2 Crash Data

There were ten (10) crashes at this intersection; over half of the crashes resulted in injury. Six (6) of the crashes were rear end crashes and four (4) were angle crashes. Seventy-five (75) percent of the angle crashes were a result of red-light running. All of the crashes occurred during the day.

6.11.3 Key Safety Concerns

- No intersection warning.
- Horizontal and vertical curvature reduces intersection sight distance for southbound vehicles.
- Lack of facilities for pedestrians.
- Red-light running.
- Drivers encroaching on intersection corner damaging curb and potentially encroaching on pedestrians at signal.

6.11.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Add dynamic intersection warning and signal ahead signs in the southbound direction.
- Install retroreflective tape on backplates or install retroreflective backplates to enhance day and nighttime signal conspicuity.
- Review signal timing to minimize queuing.
- Increase targeted signal enforcement to discourage red-light running.
- Review intersection radii and reconstruct intersection corner as necessary.

Mid-Term:

- Review pedestrian activity to determine if dedicated pedestrian facilities and crossing measures should be provided.

Long-Term:

- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.20. Location #10 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Add dynamic intersection warning signs	0.814-0.918 (18.6%-8.2% reduction)	All Crashes - all severities	CMF Clearinghouse
Install retroreflective backplates	0.85 (15% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.21. Location #10 Cost Estimate.

	Item	Location #10
Tier 1	Signage	$29,114
	Pavement Markings	$9,375
	Signal	$950
	Other	$79,366
	TOTAL	$118,804
Tier 2	Signage	$10,534
	Pavement Markings	$1,188
	Signal	
	Other	$660
	TOTAL	$12,382
Tier 3	Signage	$7,441
	Pavement Markings	
	Signal	
	Other	$65,376
	TOTAL	$72,817

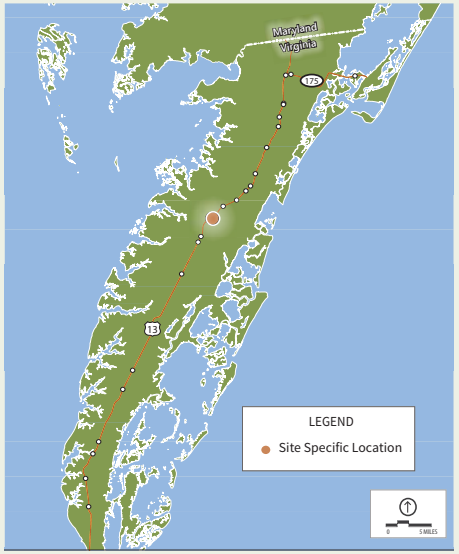
Note: See Templates in Appendix A for applicable items.

Looking north from the eastbound approach at Chesapeake Square Shopping Center

Vehicles queuing on the southbound approach of U.S. Route 13 at Chesapeake Square Shopping Center

site specific location #11

Vicinity Map



Crash Sites

6.12 Site Specific Location #11 Taylor Road (MP 113.69)

6.12.1 Existing Conditions

This location is the unsignalized four-legged intersection of Taylor Road (VA 650) and U.S. Route 13, and is located just south of site specific location #12 (intersection of Daugherty Road and U.S. Route 13). At this location, U.S. Route 13 is median divided. The intersection is located on a horizontal curve in a primarily wooded area. There is a 130-foot northbound left turn lane with a 75-foot taper and a 165-foot northbound right turn lane with a 140-foot taper. Additionally, there is a 120-foot southbound left turn lane with a 90-foot taper and a 135-foot southbound right turn lane with a 95-foot taper.

Due to the horizontal curve and trees, the Taylor Road intersection is difficult to see for southbound drivers. The northbound approach is downhill allowing drivers to increase speed through the intersection.

At Taylor Road, the street name signs were obscured by other signage. Stop signs on the side streets were also placed in the median island rather than on the right hand side of the road.

6.12.2 Crash Data

There were 12 crashes at Taylor Road with 33 percent of those crashes resulting in fatality or injury. Over half of the crashes were intersection–type crashes (33 percent angle and 24 percent rear end crashes). Other crash types included deer-related (24 percent) and roadway departure (19 percent) crashes.

Fifty-eight (58) percent of the crashes occurred in daylight.

6.12.3 Key Safety Concerns

- No intersection warning.
- Lack of intersection expectancy due to lack of intersection warning along with horizontal curvature and trees reducing intersection sight distance in the southbound direction.
- Observed high travel speeds.
- Street and stop sign placement is not MUTCD compliant.

6.12.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Install 12-inch street name signs to conform with MUTCD recommendations and revise placement to ensure they are visible from U.S. Route 13. Add stop signs on the right side of the street on Taylor Road, and add intersection warning signs on U.S. Route 13.

Mid-Term:

- Consider extending speed reduction zone from the south to north of Daugherty Road.

Long-Term:

- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.22. Location #11 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Replace a direct left turn with a right-turn/u-turn (RCUT)	0.8 (20% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.23. Location #11 Cost Estimate.

	Item	Location #11
Tier 1	Signage	$43,862
	Pavement Markings	$9,969
	Signal	
	Other	$166
	TOTAL	$53,997
Tier 2	Signage	$6,218
	Pavement Markings	$739
	Signal	
	Other	$660
	TOTAL	$7,617
Tier 3	Signage	$13,029
	Pavement Markings	$832
	Signal	
	Other	$86,376
	TOTAL	$100,237

Note: See Templates in Appendix A for applicable items.

Looking south on U.S. Route 13 from the westbound approach at Taylor Road

Looking north on U.S. Route 13 from eastbound approach at Taylor Road

Figure 6.6
Concept Plan -
Site Specific Location #11
Eastern Shore Safety Study

site specific location #12

Vicinity Map

Crash Sites

6.13 Site Specific Location #12 Daugherty Road (MP 113.99)

6.13.1 Existing Conditions

This location is the unsignalized four-legged intersection of U.S. Route 13 and Daugherty Road (VA 648). The northbound direction has a 140-foot left turn lane with a 70-foot taper and a 185-foot left turn lane with a 155-foot taper. The southbound has a 130-foot left turn lane with an 85-foot taper and a 125-foot left turn lane with 120-foot taper.

An intersection warning sign with dynamic flashing beacons were added recently in both the north and southbound directions based on recommendation in the 2002 report. The detection loops are placed on both east and west Daugherty Road approaches.

Retail spaces are located on the northwestern, southwestern, and southeastern corners of the intersection. Large, double posted stop signs have been placed on both east and westbound approaches of Daugherty Road. Many vehicles were viewed stopping in the median waiting for an acceptable gap in traffic.

6.13.2 Crash Data

Fourteen (14) crashes occurred in the vicinity of the Daugherty Road intersection. Seventy-nine (79) percent of the crashes resulted in fatality or injury, and 71 percent of those occurred in the northbound direction. Most of the crashes were intersection-type crashes: 86 percent angle crashes and seven (7) percent rear end crashes. Of all of the crashes in the intersection, 64 percent of the total crashes occurred during daylight conditions; 73 percent of fatal and injury crashes also occurred during the daylight.

Dynamic intersection warning signs were installed in recent years. The effectiveness of the signs is inconclusive without more recent crash data availability; however, it is anticipated that a reduction in angle crashes can be expected since the installation of the signs.

6.13.3 Key Safety Concerns

- Insufficient turn lane and taper lengths.
- Horizontal curvature reduces intersection sight distance for southbound vehicles.
- Observed high travel speeds.
- Lack of median crossover delineation.
- Access management of adjacent properties, particularly those properties on the southwestern and southeastern corners. These properties have multiple consecutive entrances on U.S. Route 13 and Daugherty Road. There are eight (8) driveway accesses south of the intersection: three (3) on U.S. Route 13 southbound and five (5) on U.S. Route 13 northbound, and one north of the intersection on the southbound approach.

6.13.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Provide additional positive guidance and median delineation through pavement markings to allow drivers to visually see the boundaries.
- Investigate pedestrian activity in the area, particularly as related to the schools and bus stop locations and consider providing dedicated and separate pedestrian facilities and crossing measures installed if a signal is installed.

Mid-Term:

- Conduct a signal warrant analysis to determine if signalization is the best measure in reducing the angle crashes.

Long-Term:

- Install a Restricted Crossing U-Turn (RCUT) intersection by modifying median access so that vehicles can only turn right from Daugherty Road with an available subsequent u-turn opportunity. Access for emergency responders that currently use this intersection can use an alternative route to the north to avoid the u-turn. Response time should be confirmed as a part of advancement of this recommendation.
- Implement access management measures on the properties adjacent to the intersection to consolidate access points onto U.S. Route 13.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.24. Location #12 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Directional Medians to allow left-turns and u-turns (RCUT)	0.77 (23% reduction)	All Crashes - all severities	CMF Clearinghouse
Corridor Access Management	0.77 - 0.95 (5 - 23% reduction)	All Crashes - all severities	FHWA Proven Countermeasures

Table 6.25. Location #12 Cost Estimate.

	Item	Location #12
Tier 1	Signage	$43,862
	Pavement Markings	$10,115
	Signal	
	Other	$166
	TOTAL	$54,143
Tier 2	Signage	$6,218
	Pavement Markings	$739
	Signal	
	Other	$660
	TOTAL	$7,617
Tier 3	Signage	$13,029
	Pavement Markings	$832
	Signal	
	Other	$298,691
	TOTAL	$312,552

Note: See Templates in Appendix A for applicable items.

Vehicle traveling southbound on U.S. Route 13 approaching Daugherty Road

Vehicle turning right on U.S. Route 13 from westbound approach at Daugherty Road

Figure 6.7
Concept Plan -
Site Specific Location #12
Eastern Shore Safety Study

site specific location #13

Vicinity Map

Crash Sites

6.14 Site Specific Location #13 Courthouse Avenue (MP 115.94)

6.14.1 Existing Conditions

This location includes the signalized intersection at U.S. Route 13, Courthouse Avenue and Accomac Road, and the portion of U.S. Route 13 extending roughly 2,500 feet to the south. Courthouse Avenue and Accomac Road are two-lane paved roads.

The northbound direction has a 130-foot left turn lane with a 70-foot taper and a 145-foot right turn lane with a 145-foot taper. Additionally, the southbound direction has a 140-foot left turn lane with a 60-foot taper and a 140-foot right turn lane with a 90-foot taper.

The intersection is located on the northern end of a horizontal curve in an area that is wooded to the west with retail locations to the east.

There are outside shoulders with rumble strips and minimal median shoulders in both the north and southbound directions.

6.14.2 Crash Data

There were 20 crashes at this location. Thirty (30) percent of the crashes resulted in fatality and injury. Thirty-five (35) percent of the crashes occurred at the Courthouse Avenue intersection and were comprised of angle and rear end crashes. One roadway departure fatal crash occurred in the northbound direction, approximately 2,000 feet south of the intersection.

6.14.3 Key Safety Concerns

- Horizontal curve and wooded area prior to intersection on northbound approach limits intersection visibility and expectancy.
- Observed high travel speeds on U.S. Route 13.
- Lack of recovery area along median and positive guidance.

6.14.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Provide additional positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Provide additional intersection warning through measures such as next signal ahead and intersection warning signs, particularly in the northbound direction.
- Install retroreflective tape on backplates or install retroreflective backplates to enhance day and nighttime signal conspicuity.
- Incorporate safety edge to provide an additional method for vehicles to recover from roadway departure crashes.

Long-Term:

- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.26. Location #13 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Install retroreflective backplates	0.85 (15% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.27. Location #13 Cost Estimate.

	Item	Location #13
Tier 1	Signage	$34,699
	Pavement Markings	$25,848
	Signal	$792
	Other	$332
	TOTAL	$61,671
Tier 2	Signage	$10,534
	Pavement Markings	$739
	Signal	
	Other	$1,320
	TOTAL	$12,593
Tier 3	Signage	$9,785
	Pavement Markings	
	Signal	
	Other	$186,289
	TOTAL	$196,074

Note: See Templates in Appendix A for applicable items.

Looking south on U.S. Route 13 from the westbound approach on Courthouse Avenue

site specific location #14

Vicinity Map

Crash Sites

6.15 Site Specific Location #14 Mary N Smith Road/Front Street (MP 117.23 – 117.61)

6.15.1 Existing Conditions

This location includes an approximately 2,000-foot corridor segment extending approximately 1,000 feet to the south and 1,000 feet to the north of the unsignalized intersection at U.S. Route 13 and Mary N Smith Road (Route 663). This segment also includes the intersection of Front Street/U.S. 13 Business and U.S. Route 13.

The intersection of U.S. Route 13 and Mary N Smith Road is a two-way stop controlled unsignalized intersection. There is a 250-foot northbound left turn lane with a 170-foot taper and a 155-foot northbound right turn lane with 140-foot taper. Additionally, there is a 210-foot southbound left turn lane with 170-foot taper and a 195-foot southbound right turn lane with a 180-foot taper.

The intersection of Front Street and U.S. Route 13 is a yield controlled, skewed intersection that provides northbound access onto U.S. Route 13. There are outside shoulders with rumble strips and minimal median shoulders in both the north and southbound directions. Rumble strips are present in the northbound direction. The intersections are located on a horizontal curve, just north of a large Purdue factory. During the field observation it was noted that work-shift pedestrians access the Purdue factory at various times of the day from the residential community on U.S. Route 13 south of Mary N Smith Road.

6.15.2 Crash Data

There were 17 crashes in this segment with over 50 percent of the crashes resulting in fatality and injury. Thirty-five (35) percent of the crashes were rear end and 30 percent were roadway departure. Sixty (60) percent of the crashes occurred during dark conditions. One fatal pedestrian crash occurred approximately 1,000 feet south of the Mary N Smith Road intersection.

6.15.3 Key Safety Concerns

- Horizontal curves and skewed intersections limits intersection sight distance.
- Lack of intersection warning.
- Nighttime crashes.
- Lack of recovery space along the median, particularly in the southbound direction on the inside of the curve.
- Lack of pedestrian accommodations.

6.15.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Provide additional positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Provide intersection warning signs.
- Incorporate safety edge to provide an additional method for vehicles to recover from roadway departure crashes.
- Investigate pedestrian activity and routes and investigate potential countermeasures, such as separate and dedicated space and enhanced crossings, if necessary.

Mid-Term:

- Provide improved recovery area along median by widening shoulder to four feet and installing rumble strips/stripes in the southbound direction.

Long-Term:

- Consider adding intersection lighting, particularly at the intersection of Front Street.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.28. Location #14 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install shoulder rumble strips	0.73-0.83 (17-27% reduction)	Run-off-the-road crashes - all severities	CMF Clearinghouse
Intersection lighting	0.881 - 0.92 (8 - 11.9% reduction)	Nighttime crashes - all severities	CMF Clearinghouse

Table 6.29. Location #14 Cost Estimate.

	Item	Location #14
Tier 1	Signage	$71,511
	Pavement Markings	$28,606
	Signal	
	Other	$830
	TOTAL	$100,947
Tier 2	Signage	$15,841
	Pavement Markings	$739
	Signal	
	Other	$3,300
	TOTAL	$19,880
Tier 3	Signage	$30,957
	Pavement Markings	$2,083
	Signal	
	Other	$194,865
	TOTAL	$227,905

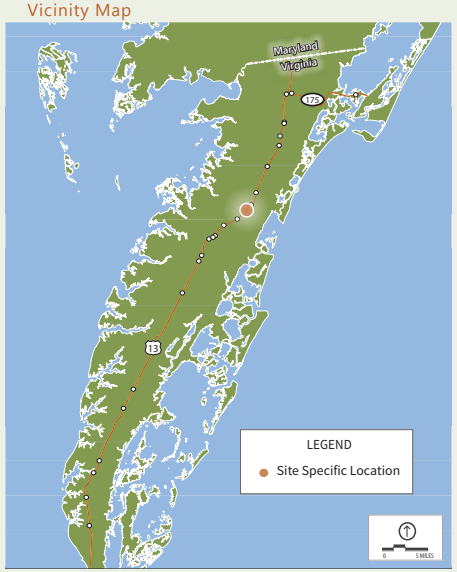
Note: See Templates in Appendix A for applicable items.

Northbound right turn lane onto Front Street from U.S. Route 13

Looking north from the southeast corner of the intersection

site specific location #15

Vicinity Map



Crash Sites

6.16 Site Specific Location #15 Evans Road (MP 118.83)

6.16.1 Existing Conditions

This location is at the unsignalized intersection of Evans Road and Johnson Road (Route 661).

The northbound direction has a 275-foot left turn lane with a 105-foot taper and a 185-foot right turn lane with a 140-foot taper. Additionally, the southbound direction only has a 130-foot left turn lane with a 140-foot taper.

The intersection is located along a horizontal curve and is bordered by fields, trees, and some residential access points. There are curve warning signs in the southbound direction.

Outside shoulders are present with rumble strips in both the north and southbound directions. There is a minimal median shoulder with narrow rumble strips in the northbound direction and no median shoulder in the southbound direction. Steep roadside ditches are present with driveway culverts, particularly in the southbound direction south of the intersection.

6.16.2 Crash Data

Thirteen (13) crashes occurred in the vicinity of the intersection. Thirty (30) percent resulted in fatal or injury crashes. The fatal injury crash was a roadway departure crash which occurred roughly 500 feet south of the intersection in the southbound direction. Over 60 percent of the crashes were roadway departure, 30 percent were deer-related, and there was one angle crash. Over half of the crashes occurred during dark conditions.

6.16.3 Key Safety Concerns

- Horizontal curvature.
- Nighttime crashes.
- Lack of recovery space along the median, particularly in the southbound direction.
- Stop sign installed too low on westbound approach on Johnson Road.
- Unmarked roadside hazards within clear zones.

6.16.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Provide additional positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Incorporate safety edge to provide an additional method for vehicles to recover from roadway departure crashes.
- Install Johnson Road stop sign at appropriate height.
- Mark steep ditches and culverts with object markers.
- Review ditches to see if the depth and slope can be reduced. If not, widen shoulder and add guardrail or pipe ditch to eliminate hazard within clear zone.

Mid-Term:

- Provide improved recovery area along median by widening shoulder to four feet and installing rumble strips/stripes in the southbound direction.

Long-Term:

- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.30. Location #15 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install median guardrail	0.22 (78% reduction)	Cross median - all severities	
Install shoulder rumble strips	0.73-0.83 (17-27% reduction)	Run-off-the-road crashes - all severities	CMF Clearinghouse

Table 6.31. Location #15 Cost Estimate.

	Item	Location #15
Tier 1	Signage	$53,727
	Pavement Markings	$9,837
	Signal	
	Other	$166
	TOTAL	$63,731
Tier 2	Signage	$19,603
	Pavement Markings	$554
	Signal	
	Other	$660
	TOTAL	$20,817
Tier 3	Signage	$15,374
	Pavement Markings	$1,664
	Signal	
	Other	$150,850
	TOTAL	$167,888

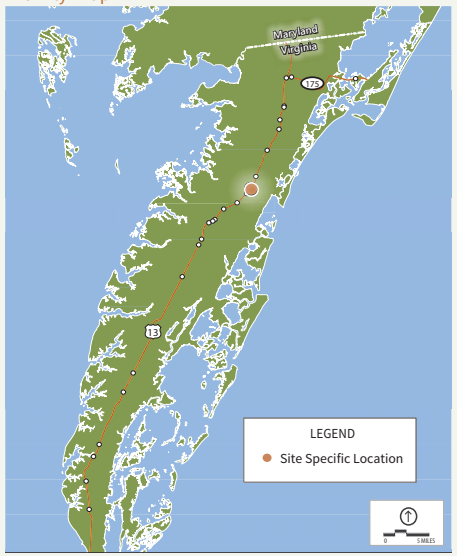
Note: See Templates in Appendix A for applicable items.

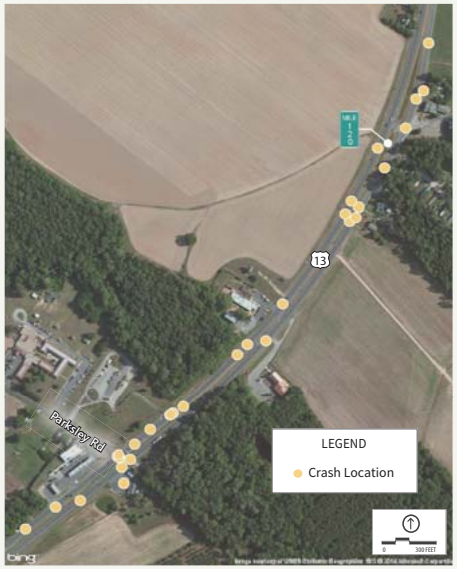
Raised pavement markers are present on U.S. Route 13 at the intersection of Evans Road

Looking south on U.S. Route 13 from westbound approach on Johnson Road

site specific location #16

Vicinity Map





Crash Sites

6.17 Site Specific Location #16 Parksley Road (MP 119.55)

6.17.1 Existing Conditions

This location is at the signalized intersection of Parksley Road (Route 176) and U.S. Route 13. Parksley Road is a wide two-lane paved roadway; however, pavement markings have been installed to define and narrow the travel lanes.

At this intersection there is a 190-foot northbound left turn lane with a 50-foot taper, a 210-foot southbound left turn lane with a 130-foot taper, and a 275-foot southbound right turn lane with a 175-foot taper. At the time of the field review the southbound lanes were recently paved and the pavement markings were only partially replaced.

A gas station and convenience store are located at the southwest corner of the intersection, and a seasonal farm stand is located east of the intersection.

Recent signal improvements were evident, including new mast arms with street name signs, pedestrian pushbuttons, curb/landing area on the eastern side of the intersection, high visibility pavement markings, and accessible ramps.

Double posted dynamic warning signs are present north of the intersection. Comments from law enforcement were that the northbound left turn bays were too short, particularly in the summer when traffic volumes are higher.

It was evident that trucks encroach on the southwest corner pedestrian space and run over the ramp when making a right turn from the eastbound approach. The field review team noted that trucks were barely making the turn and were very close to driving into the grassy median. The RSA team also witnessed southbound right turning trucks barely making the turn without encroaching into the eastbound through lane.

6.17.2 Crash Data

There were 17 crashes in the vicinity of the intersection with roughly 65 percent resulting in injuries. The majority of the crashes were angle crashes (47 percent) followed by rear end crashes (29 percent). There was one pedestrian crash. Over 70 percent of the crashes occurred during the day.

Five of the eight angle crashes involved drivers running red lights. Three of the angle crashes appear to involve drivers turning right on red and failing to yield to oncoming traffic.

6.17.3 Key Safety Concerns

- Inadequate intersection radii.
- Red-light running.
- Difficult for drivers to judge acceptable gaps to turn right on red.
- Intersection expectancy and high speeds on U.S. Route 13.
- Lack of connected/continuous pedestrian space.

6.17.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Analyze necessary truck turning radii, particularly at southwest corner.
- Increase targeted enforcement for red-light running.
- Restrict right turns on red for eastbound approach.
- Install intersection warning signs in the northbound direction and next signal signs in both north and southbound directions.
- Install retroreflective tape on backplates or install retroreflective backplates to enhance day and nighttime signal conspicuity.
- Investigate pedestrian activity to determine if dedicated pedestrian facilities are necessary.

Long-Term:

- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.32. Location #16 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Add dynamic intersection warning signs	0.814-0.918 (18.6%-8.2% reduction)	All Crashes - all severities	CMF Clearinghouse
Install retroreflective backplates	0.85 (15% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.33. Location #16 Cost Estimate.

	Item	Location #16
Tier 1	Signage	$12,129
	Pavement Markings	$9,557
	Signal	$634
	Other	$166
	TOTAL	$22,486
Tier 2	Signage	$2,771
	Pavement Markings	$554
	Signal	
	Other	$660
	TOTAL	$3,985
Tier 3	Signage	$11,670
	Pavement Markings	$417
	Signal	
	Other	$44,376
	TOTAL	$56,463

Note: See Templates in Appendix A for applicable items.

Eastbound approach on Parksley Road

U.S. Route 13/Parksley Road intersection from southwest corner

site specific location #17

Vicinity Map

Crash Sites

6.18 Site Specific Location #17 South of Whites Neck Road (MP 120.90 – 121.30)

6.18.1 Existing Conditions

This location is an approximately 2,000-foot corridor segment extending from Johnson Wharton Lane to the south to Whites Neck Road (Route 677) to the north. This section of the corridor is located on a horizontal curve that is median divided. The area-type is generally agricultural; however, there are numerous driveway access points and a business located at the Whites Neck Road intersection with wide open accesses into the parking lot.

A 130-foot northbound left turn lane with a 65-foot taper and a 140-foot southbound left turn lane with an 80-foot taper are present at the intersection of U.S. Route 13 and Whites Neck Road. The northbound right turn lane at Whites Neck Road and entrance to the restaurant on the southeast corner of the intersection blend together. It can be difficult for drivers to decipher where vehicles should turn onto Whites Neck Road.

North and southbound outside shoulders with rumble strips and narrow median shoulders with rumble strips were present. There were steep roadside drop-offs within the clear zone that were not visible due to high grass. Object markers were placed in the ditch but were low and hidden by the grass. Mowing operations were occurring along the corridor throughout the field review, so this area may have been trimmed. Large signs, vegetation, and horizontal curve limits sight distance to the south from the Whites Neck Road intersection.

A law enforcement officer commented that he felt the rumble strips in the area have helped to reduce crashes, but speeds were still a concern.

6.18.2 Crash Data

There were eight (8) crashes on this segment. Thirty-eight (38) percent resulted in injury or fatality. There was one fatal, angle crash that occurred approximately 950 feet south of the Whites Neck Road intersection. Forty (40) percent of crashes were angle type crashes and 40 percent were animal-related. There was also one rear end and one roadway departure crash. All but one of the crashes occurred during dark conditions.

6.18.3 Key Safety Concerns

- Nighttime crashes.
- High speeds.
- Intersection expectancy and high speeds on U.S. Route 13.
- Access management at Whites Neck Road.
- Roadside conditions and ability for drivers to recover.

6.18.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Provide additional positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Incorporate safety edge to provide an additional method for vehicles to recover from roadway departure crashes.
- Schedule mowing operations to be conducted regularly and at intervals that ensure grass does not obscure roadside hazards and signs.
- Place roadside object marker signs at appropriate height, so that they are visible to drivers.
- Review ditches to see if the depth and slope can be reduced. If not, widen shoulder and add guardrail or pipe ditch to eliminate hazard within clear zone.
- Conduct targeted speed enforcement, particularly during the nighttime when most of the crashes occurred.
- Install intersection warning signs for both Johnson Wharton Lane and Whites Neck Road.

Mid-Term:

- Provide improved recovery area along median by widening shoulder to four feet.
- Consider implementing street lighting.

Long-Term:

- Implement access management measures at Whites Neck Road by defining the parking lot and limiting access onto U.S. Route 13 to specific entry and exit points.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.34. Location #17 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install median guardrail	0.22 (78% reduction)	Cross median - all severities	CMF Clearinghouse
Corridor lighting	0.73 (27% reduction)	All Crashes - severe and minor injury	CMF Clearinghouse
Corridor Access Management	0.77 - 0.95 (5 - 23% reduction)	All Crashes - all severities	FHWA Proven Countermeasures

Table 6.35. Location #17 Cost Estimate.

	Item	Location #17
Tier 1	Signage	$58,374
	Pavement Markings	$23,014
	Signal	
	Other	$498
	TOTAL	$81,885
Tier 2	Signage	$8,521
	Pavement Markings	$185
	Signal	
	Other	$1,980
	TOTAL	$10,686
Tier 3	Signage	$26,238
	Pavement Markings	$834
	Signal	
	Other	$347,065
	TOTAL	$374,137

Note: See Templates in Appendix A for applicable items.

Tall grass grows along eastern side and center median of U.S. Route 13

Looking south from the median on U.S. Route 13

Figure 6.8
Concept Plan -
Site Specific Location #17
Eastern Shore Safety Study

site specific location #18

Vicinity Map

Crash Sites

6.19 Site Specific Location #18 Nelsonia Road (MP 124.23)

6.19.1 Existing Conditions

This location is at the four-legged, signalized intersection of U.S. Route 13 and Nelsonia Road (Route 187). Nelsonia Road is a two-lane paved road. The intersection is located on a curve in a more urbanized area with residential housing and businesses. There are three businesses at the southeast, northeast, and northwest corners of the intersection.

This intersection is undivided with left turn lanes in the north and southbound directions. In the northbound direction the left turn lane is 250 feet leading into the two-way left-turn lane while the southbound left turn lane is 250 feet also leading into the two-way left-turn lane. Some southbound drivers will pass through the intersection and turn left across the two northbound lanes to access the Royal Farms gas station instead of turning left at the signal and making a right into the gas station.

There are fixed objects such as poles and mailboxes close to the roadway. Curb and sidewalk are present at the intersection but no crosswalks or pedestrian signal enhancements. During field review, pedestrians were observed walking on the shoulder.

The hillside at Royal Farms limits sight distance for the westbound intersection approach. Street signs were less visible to drivers as they were post mounted rather than mast arm mounted. Drivers were observed cutting through the Sunoco parking lot on the northeastern corner of the intersection to avoid the traffic signal. Heavy truck traffic and high vehicle speeds were also observed on U.S. Route 13. It was also noted that many westbound approach drivers turning north onto U.S. Route 13 look left before entering the roadway on their green signal indicating hesitation regarding drivers obeying the traffic signal. Northbound trucks traveling at high speeds may not see the signal as they come around curve to the intersection.

6.19.2 Crash Data

There were 27 crashes at this intersection. Forty-one (41) percent of those resulted in fatality or injury. The most predominant crash types were intersection type crashes: 48 percent angle and 30 percent rear end. Over 80 percent of the crashes occurred during the day. Of the 13 angle crashes, three of those involved red-light running and eight (8) may be attributed to drivers misjudging gaps.

6.19.3 Key Safety Concerns

- Reduced intersection sight distance due to horizontal curve.
- Limited sight distance for westbound approach due to vertical grade at Royal Farms.
- Red-light running.
- Cut through traffic on adjacent properties.
- Intersection expectancy and high speeds on U.S. Route 13.
- Access management due to the numerous driveways on intersection approaches and wide open access on the northwest corner.
- Lack of continuous pedestrian space and crossing measures.

6.19.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Restrict right turn on red for westbound approach.
- Conduct targeted speeding and signal enforcement in the vicinity of the intersection.
- Install intersection warning signs and next signal ahead warning signs in both the north and southbound directions and replace post mounted with mast arm mounted street name signs.
- Install retroreflective tape on backplates or install retroreflective backplates to enhance day and nighttime signal conspicuity.
- Investigate pedestrian activity to determine if sidewalks should be extended and crossing measures installed at the intersection.

Long-Term:

- Implement access management measures at the northwest corner of the intersection to better define access points. Consider installing narrow raised concrete medians to prevent left turns from U.S. Route 13 onto corner businesses as those can be accessed from Nelsonia Road.
- Construct right turn lanes with 200 feet of storage and a 200-foot taper.

Table 6.36. Location #18 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install retroreflective backplates	0.85 (15% reduction)	All Crashes - all severities	CMF Clearinghouse
Corridor Access Management	0.77 - 0.95 (5 - 23% reduction)	All Crashes - all severities	FHWA Proven Countermeasures
Provide a right-turn lane on one major road approach	0.86 - 0.92 (8 - 14% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.37. Location #18 Cost Estimate.

	Item	Location #18
Tier 1	Signage	$29,114
	Pavement Markings	$11,728
	Signal	$792
	Other	$79,366
	TOTAL	$121,000
Tier 2	Signage	$10,534
	Pavement Markings	$370
	Signal	
	Other	$660
	TOTAL	$11,564
Tier 3	Signage	$7,441
	Pavement Markings	$832
	Signal	
	Other	$114,589
	TOTAL	$122,862

Note: See Templates in Appendix A for applicable items.

Vehicles traveling north on U.S. Route 13

Traffic signals for vehicles traveling southbound on U.S. Route 13

Figure 6.9
Concept Plan -
Site Specific Location #18
Eastern Shore Safety Study

site specific location #19

Vicinity Map

Crash Sites

6.20 Site Specific Location #19 Groton Town Road (MP 126.74 – 127.33)

6.20.1 Existing Conditions

This corridor segment is roughly 3,100 feet extending from approximately 1,100 feet north of the Groton Town Road (Route 691) intersection to 2,000 feet south of the intersection. The Groton Town Road intersection is a signalized, undivided three-legged intersection with a 205-foot right turn lane with a 100-foot taper in the southbound direction and a 375-foot left turn lane leading into the two-way left-turn lane in the northbound direction. Groton Town Road is a two-lane paved road. This location is surrounded by forest and fields with a bank at the southwest corner, an elementary school in the northwest corner, and an industrial facility to the northeast corner of the intersection.

South of Groton Town Road, U.S. Route 13 has four travel lanes and a two-way left-turn lane. There are shoulders and rumble strips in both the north and southbound directions. North of Groton Town Road, U.S. Route 13 is median divided with outside shoulders and rumble strips and narrow median shoulders and rumble strips in both the north and southbound directions. There is a steep ditch along the northwest quadrant of the intersection within the clear zone and indicated by object marker signs. Street signs are post mounted rather than mast arm mounted.

There are no dedicated pedestrian facilities or pedestrian signal enhancements in the vicinity of the school or at the signal. The field review team observed a young pedestrian walking from the school in the northwest corner headed north by walking on the grass and roadway shoulder. The field review also noted StarTRANSIT orange line buses stopping in the bank parking lot to pick-up and drop-off passengers.

6.20.2 Crash Data

There were 18 crashes on this segment; 28 percent resulted in fatality or injury. Forty-four (44) percent of the crashes were angle crashes, one of which resulted in a fatality. Twenty-eight (28) percent were deer-related. Two of the crashes involved pedestrians, one at the Groton Town Road intersection and one approximately 800 feet to the south of the same intersection.

6.20.3 Key Safety Concerns

- Post rather than mast arm mounted street name signs.
- Lack of continuous pedestrian space and crossing measures.
- Lack of recovery space for drivers along median.
- Lack of positive guidance.
- Access management: between Davis Drive and Groton Town Road there are minimal access points, but a two-way left-turn lane is present for the entire corridor segment increasing the amount of potential conflict points and the potential for head-on crashes.

6.20.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Provide additional positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Replace post mounted street name signs with mast arm mounted signs.
- Install safety edge to provide an additional method for vehicles to recover from roadway departure crashes.
- Install retroreflective tape on backplates or install retroreflective backplates to enhance day and nighttime signal conspicuity.
- Investigate pedestrian activity in the area, particularly as related to the schools and bus stop locations and consider providing dedicated and separate pedestrian facilities and crossing measures installed at the signal.

Mid-Term:

- Provide improved recovery area along median by widening shoulder to four feet and installing rumble strips/stripes in the southbound direction.
- Review ditches to see if the depth and slope can be reduced. If not, widen shoulder and add guardrail or pipe ditch to eliminate hazard within clear zone.

Long-Term:

- Implement access management measures by converting the two-way left-turn lane between Groton Town Road and Davis Drive into a grass median with crossovers and turn lanes at necessary locations. Add an east bound right-turn lane on Groton Town Road and close driveway closest to intersection.
- Lengthen substandard turn lane to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.38. Location #19 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install retroreflective backplates	0.85 (15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install median guardrail	0.22 (78% reduction)	Cross median - all severities	CMF Clearinghouse
Corridor Access Management	0.77 - 0.95 (5 - 23% reduction)	All Crashes - all severities	FHWA Proven Countermeasures

Table 6.39. Location #19 Cost Estimate.

	Item	Location #19
Tier 1	Signage	$65,799
	Pavement Markings	**$38,577**
	Signal	$554
	Other	**$79,698**
	TOTAL	**$184,628**
Tier 2	**Signage**	**$68,596**
	Pavement Markings	$4,911
	Signal	
	Other	$1,980
	TOTAL	**$75,487**
Tier 3	Signage	$88,710
	Pavement Markings	**$417**
	Signal	
	Other	**$399,974**
	TOTAL	**$489,101**

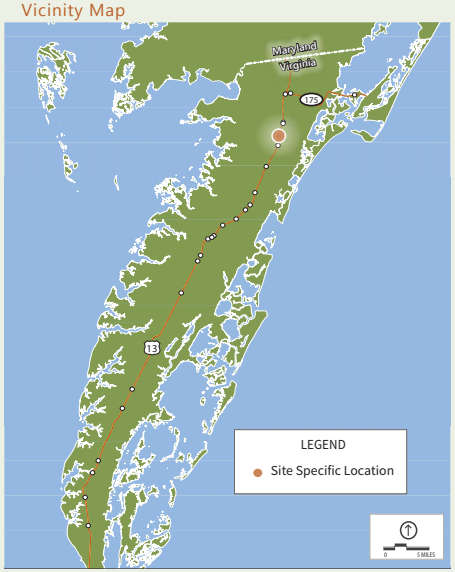
Note: See Templates in Appendix A for applicable items.

Vehicles stopped at the eastbound approach on Groton Town Road

Figure 6.10
Concept Plan -
Site Specific Location #19
Eastern Shore Safety Study

site specific location #20

Vicinity Map



Crash Sites

6.21 Site Specific Location #20 Hallwood Road (MP 128.23 - 128.37)

6.21.1 Existing Conditions

This location is an approximately 1,400-foot segment of U.S. Route 13 in the vicinity of Hallwood (Route 692) and Thorton Roads (Route 790). Hallwood Road and Thorton Road intersections are both three-legged, unsignalized intersections with median crossovers. At the Hallwood Road intersection there is a 210-foot southbound right turn lane with a 75-foot taper and a 115-foot northbound left turn lane with a 120-foot taper. A business is located at the northwest corner of the intersection.

At the Thorton Road intersection there is a 70' northbound right turn lane with a 65' taper and a 175' southbound left turn lane with a 175' taper. Thorton Road serves as the primary access for the Campbell Farms facility.

In between these intersections, U.S. Route 13 is a median divided roadway with outside shoulders and rumble strips and narrow median shoulders and rumble strips in both the north and southbound directions. There is a residential area on the western side and fields on the eastern side.

At the Hallwood Road intersection, vehicles in the southbound right turn lane obstruct the sight distance of drivers on the eastbound approach. There is a steep drop-off at the northwest corner of the Hallwood Road intersection.

6.11.2 Crash Data

There were 15 crashes in this quarter-mile segment. Forty-seven (47) percent of those resulted in fatality or injury. Sixty-seven (67) percent of the crashes were angle crashes and occurred during the day. Seventy (70) percent of the angle crashes involved vehicles disregarding stop signs or misjudging gaps after stopping at the stop sign. There were seven (7) angle crashes at the Hallwood Road intersection including one fatality. There were two (2) rear end crashes in the northbound direction, one prior to Thorton Road and one prior to Hallwood Road.

6.21.3 Key Safety Concerns

- Short northbound right turn lane at Thorton Road intersection. Trees obscure the intersection in northbound direction, and the intersection is located immediately after on-street market parking.
- Lack of expectancy at both Hallwood and Thorton Road intersections.
- Ability of drivers from side streets to judge acceptable gaps.
- Hallwood Road and U.S. Route 13 intersection is skewed limiting the northbound sight distance.
- At Hallwood Road the stop sign is posted in the median island. There is no right-side posted stop sign as recommended in the MUTCD.
- Wide open access to parking lot at the southwestern corner of the Hallwood Road intersection.

6.21.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Improve intersection expectancy and warning at both Hallwood Road and Thorton Road intersections. Install intersection warning signs in the northbound direction prior to Thorton Road intersection and southbound prior to Hallwood Road intersection. Due to the prevalence and severity of angle crashes, consider installing a dynamic warning sign at the Hallwood Road intersection.
- Trim vegetation on southeast corner of the Thorton Road intersection and eliminate parking for market within the right-of-way to allow for an extension of the northbound right turn lane.
- Use pavement markings to define available space in median crossover.
- Install a stop sign on the right side of the Hallwood Road intersection approach.
- Install 12-inch street name signs to conform to MUTCD recommendation.

Mid-Term:

- Review ditches to see if the depth and slope can be reduced. If not, widen shoulder and add guardrail or pipe ditch to eliminate hazard within clear zone.

Long-Term:

- Investigate geometric changes to improve sight distance and reduce conflict points at intersections. This could include realigning the Hallwood Road intersection to reduce/eliminate the skew and improve sight distance to the north. Another alternative is to modify the intersections from full access to a pair of restricted movement intersections so that drivers can only make right turns. In order to turn left, drivers would have to perform a subsequent u-turn 700 feet south at Thornton Road.
- Define parking lot access at the southwestern corner of the Hallwood Road intersection through use of curbing/landscaping.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.40. Location #20 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install median guardrail	0.22 (78% reduction)	Cross median - all severities	CMF Clearinghouse
Directional Medians to allow left-turns and u-turns	0.77 (23% reduction)	All Crashes - all severities	CMF Clearinghouse
Corridor Access Management	0.77 - 0.95 (5 - 23% reduction)	All Crashes - all severities	FHWA Proven Countermeasures

Table 6.41. Location #20 Cost Estimate.

	Item	Location #20
Tier 1	Signage	$51,019
	Pavement Markings	$17,302
	Signal	
	Other	$498
	TOTAL	$68,819
Tier 2	Signage	$5,314
	Pavement Markings	$740
	Signal	
	Other	$1,980
	TOTAL	$8,034
Tier 3	Signage	$21,043
	Pavement Markings	$834
	Signal	
	Other	$333,443
	TOTAL	$355,320

Note: See Templates in Appendix A for applicable items.

Vehicle traveling northbound on U.S. Route 13 approaching Thorton Road

Vehicle traveling southbound on U.S. Route 13 approaching Holland Road

Figure 6.11
Concept Plan -
Site Specific Location #20
Eastern Shore Safety Study

site specific location #21 & #22

Vicinity Map

Crash Sites

6.22 Site Specific Locations #21 and #22 Temperanceville Road (MP 129.64 – 130.47)

6.22.1 Existing Conditions

Location 21 is the intersection of Temperanceville Road and U.S. Route 13 and Location 22 is the intersection of New Temperanceville Road (Route 695) and U.S. Route 13. Due to their proximity, geometry, area type, and crash similarities, they are discussed together. The segment of U.S. Route 13 encompassed by these two locations extends from the beginning of the two-way left-turn lane, approximately 1,800 feet south of the Temperanceville Road intersection, to the beginning of the median divided roadway, approximately 2,000 feet to the north of the New Temperanceville Road intersection.

The Temperanceville Road intersection is a one-way stop controlled, three-legged intersection with a 140-foot southbound left turn lane with a 130-foot taper on U.S. Route 13. Temperanceville Road is a two-lane paved road with a gas station located on the northeastern corner of the intersection.

The New Temperanceville Road intersection is a two-way stop controlled, four-legged intersection. In the northbound direction, there is a 170-foot left turn lane with a 120-foot taper and a 425-foot right turn lane spanning the entire distance between Temperanceville Road and New Temperanceville Road. In the southbound direction there is a 190-foot left turn lane with a 95-foot taper and a 210-foot right turn lane with an 80-foot taper. New Temperanceville Road is on the eastern side of U.S. Route 13 and Saxis Road is on the west of the intersection. Both intersecting roads are two-lane paved roads. There is a business located on the southeastern corner of the intersection with two entrances onto U.S. Route 13; the northernmost entrance is located approximately 125 feet to the south of the intersection. It does not appear that this building is currently in use.

Approximately 1,800 feet south of the Temperanceville Road and U.S. Route 13 intersection, the concrete median transitions to a two-way left-turn lane. In between Temperanceville Road and New Temperanceville Road the two-way left-turn lane transitions to two left-turn lanes. North of New Temperanceville Road there is a southbound left turn lane preceded by a two-way left-turn lane that extends to approximately 2,000 feet north of the intersection before returning to a median divided roadway.

Throughout this roughly 3,800-foot corridor segment of U.S. Route 13, there is gutter pan located on both sides of the roadway. During a night field review, the RSA team noted the lack of positive roadside guidance for drivers unlike other parts of the corridor where edge line and raised pavement markers were present.

Narrow sidewalks are present throughout this portion of the corridor. Beginning at New Temperanceville Road and extending approximately 1,500 feet south of Temperanceville Road, the sidewalk is present along both sides of the road. The sidewalk is present along the eastern side of U.S. Route 13 from New Temperanceville Road to approximately 1,200 feet to the north of New Temperanceville Road. During the field review no pedestrians were viewed and a local resident noted that there is only the occasional pedestrian.

6.22.2 Crash Data

There were 38 crashes in the vicinity of the two intersections. Thirty-seven (37) percent resulted in fatality or injury. There were a total of three (3) fatal, angle crashes. Two fatal crashes occurred at the New Temperanceville Road (VA 695) and U.S. Route 13 intersection and one fatal crash occurred roughly 200 feet south of the Temperanceville Road and U.S. Route 13 intersection.

Fifty-five (55) percent of the crashes were angle crashes and 32 percent were roadway departure crashes. Of the 12 angle crashes, eight (8) involved drivers misjudging available gaps when turning from the side street, driveway, or making a left-turn off of U.S. Route 13. Six (6) of the angle crashes involved vehicles crossing the center line and hitting a vehicle in the opposite direction or losing control and hitting a vehicle traveling in the same direction. Five (5) of the angle crashes had incomplete narrative to determine the sequence of events; however, it was noted for all five of these that the driver did not have the right of way. Two (2) of the crashes involved vehicles turning right off of U.S. Route 13 when they were struck by another vehicle.

Of the 38 total crashes, 39 percent of those occurred during dark conditions. The majority of the crashes that occurred during dark periods were fixed object off road (53 percent) and 33 percent were angle crashes. In total, 67 percent of fixed object-off road crashes occurred during dark conditions.

6.22.3 Key Safety Concerns

- Lack of adequate gaps for vehicles attempting to turn onto U.S. Route 13 or drivers turning left off of U.S. Route 13 and on to a side street/driveway.
- Horizontal curve and high speeds reduce driver's ability to maintain control.
- Horizontal curve also limits intersection sight distance.
- Lack of positive roadside guidance.
- Pedestrian facilities with narrow sidewalk in poor condition. Ramps did not appear to meet ADA standards and no pedestrian crossing measures were present.
- Debris in gutter pan, within intersections/driveway entrances, and on sidewalk.
- Numerous conflict points due to number of lanes on U.S. Route 13 along with the proximity of intersections and driveway entrances.
- Eastbound approach at New Temperanceville Road intersection has a limited sight distance to the north due to horizontal curve.

6.22.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Investigate pedestrian activity to determine if the facilities need to be upgraded to meet ADA standards and to determine if crossing measures should be installed. Clear debris and trim vegetation growing over the sidewalk to provide additional width and a smoother surface.
- Consider measures to reduce speeds through the area through targeted enforcement or implementing a speed reduction zone throughout this section of the corridor. With the amount of closely spaced residential and retail driveways, intersections, and horizontal curve, reducing the speeds would allow drivers on U.S. Route 13 the ability to slow down and respond to vehicles turning off or onto U.S. Route 13. Slower speeds would also help drivers from driveways or side streets to better judge adequate gaps for entering or crossing U.S. Route 13.
- Trim/remove vegetation on the northeast corner of the New Temperanceville intersection to improve sight distance to the north.
- Install 12-inch street name signs at both intersections to conform to MUTCD recommendation.
- Clear debris from roadway gutter pan to help drivers maintain control.
- Provide enhanced roadside delineation through post mounted delineators to provide nighttime guidance to drivers.
- Provide additional intersection warning through intersection warning signs. Beacons could be added to the static warning signs to provide further enhancement or the warning signs could be dynamic and warn drivers when a vehicle is approaching a stop sign.

Mid-Term:

- Consider installation of high friction surface treatment through the horizontal curve.

Long-Term:

- Extending the concrete or grass median and providing turn lane pockets would reduce the number of potential conflict points and could help reduce the number of crossover and angle crashes. Additionally, closing Temperanceville Road would further reduce the number of potential conflict points.
- If the angle crashes are not reduced through the intersection warning and access management measures then investigate additional measures, such as the implementation of RCUTs, which could help to further reduce the number of conflict points, particularly as intersection sight distance is limited due to the horizontal curve.
- Lengthen remaining substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.42. Locations #21 & #22 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Add dynamic intersection warning signs	0.814-0.918 (18.6%-8.2% reduction)	All Crashes - all severities	CMF Clearinghouse
High friction surface treatment	0.67-1.27	All Crashes - all severities	CMF Clearinghouse
Directional Medians to allow left-turns and u-turns	0.77 (23% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.43. Locations #21 and #22 Cost Estimate.

	Item	Locations #21 & #22
Tier 1	Signage	$127,335
	Pavement Markings	$40,008
	Signal	
	Other	$12,958
	TOTAL	$180,301
Tier 2	Signage	$148,786
	Pavement Markings	$555
	Signal	
	Other	$1,980
	TOTAL	$151,321
Tier 3	Signage	$165,194
	Pavement Markings	$1,249
	Signal	
	Other	$287,230
	TOTAL	$453,673

Note: See Templates in Appendix A for applicable items.

Looking south on U.S. Route 13

Looking north on U.S. Route 13 at New Temperanceville Road

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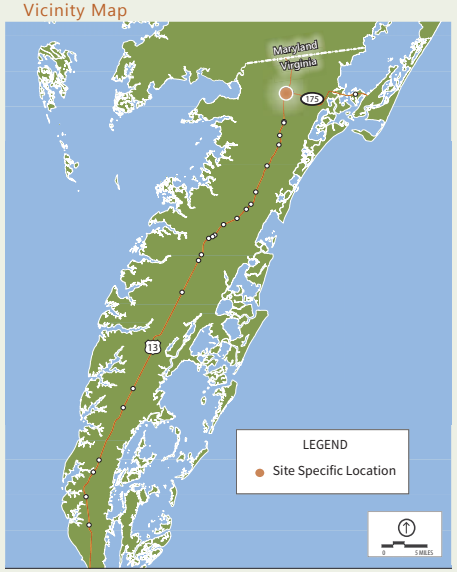
Figure 6.12
Concept Plan -
Site Specific Locations #21 & #22
Eastern Shore Safety Study

site specific location #23

Vicinity Map



Crash Sites

6.23 Site Specific Location #23 Chincoteague Road (MP 133.73)

6.23.1 Existing Conditions

This location is at the four-legged signalized intersection of U.S. Route 13 and Chincoteague Road (VA 175). At this location, U.S. Route 13 is median separated with a 200-foot northbound left turn lane with a 155-foot taper and a 230-foot northbound right turn lane with a 185-foot taper. Additionally, there is a 250-foot southbound left turn lane with a 125-foot taper. Route 175 is a two-lane undivided roadway with a westbound right and left turn lane. The area is primarily residential and retail. At the intersection there is a restaurant and bank on the northeast corner, a gas station and shopping center in the southeast corner, a gas station on the western side of the intersection, and a small shopping center on the southwestern corner of the intersection.

In the southbound direction there is an outside shoulder and a narrow median shoulder, both without rumble strips. In the northbound direction, there is an outside shoulder and a narrow median shoulder. Approaching the intersection, there are no shoulder or median rumble strips, but past the intersection there are median rumble strips. On the northbound approach there are also transverse rumble strips. On Route 175, there is minimal or no shoulder with no rumble strips/stripes.

6.23.2 Crash Data

Fifty-eight (58) crashes occurred In the vicinity of the intersection. Twenty-eight (28) percent of those crashes resulted in injury crashes. The primary crash types were rear end (47 percent) and angle crashes (31 percent). Seventy-eight (78) percent of the crashes occurred during the day.

Twelve of the 27 rear end crashes were related to the inability of drivers to stop for traffic stopped at the signal, and three of the crashes were related to vehicles slowing down to make a turn. The action of most of the remaining crashes were noted as "following too close". Forty (40) percent of the rear end crashes occurred on eastbound Route 175, heading away from the traffic signal.

Of the 18 angle crashes, eight (8) involved drivers misjudging gaps when making turns, five (5) crashes were from vehicles running the red light, and five (5) crashes involved drivers failing to maintain control or performing improper or unsafe lane changes. Angle crashes were most prevalent on U.S. Route 13 northbound; however, Route 175 eastbound and U.S. Route 13 southbound each had 30 percent of the angle crashes.

6.23.3 Key Safety Concerns

- Median crossover is sloped in a manner that prevents proper drainage, trapping debris and water in crossover.
- Access management: Many of the rear end crashes occurred eastbound on Route 175, past the traffic signal. Also many of the angle crashes occurred at access points near the intersection.
- Speed along Routes 13 and 175 and the speed differential between trucks and other vehicles. Drivers are not able to stop in time for stopped or turning vehicles, particularly slower moving trucks. Additionally, with higher speeds it is more difficult for drivers entering U.S. Route 13 and Route 175 to judge and find acceptable gaps in traffic.
- Lack of advance intersection warning.
- Street name mounted to signal pole versus mast arm.

6.23.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Revise slope to promote drainage at median crossover to improve vehicle traction.
- Implement targeted enforcement of speed on the intersection approaches so that drivers are better able to respond to stopped or slowing traffic and red light running enforcement at the signal.
- Install transverse rumble strips on the southbound U.S. Route 13 approach and static or dynamic intersection warning signs in both north and southbound approaches.
- Install retroreflective tape on backplates or install retroreflective backplates to enhance signal conspicuity.
- Move street name signs to mast arm rather than signal pole to enhance visibility.

Mid-Term:

- Consider installing lighting at the intersection and on the intersection approaches to improve nighttime visibility at the intersection and the adjacent driveways.

Long-Term:

- Evaluate methods to reduce, condense, and better define access points in the vicinity of the intersection to improve driver expectancy and reduce unexpected stopping due to drivers entering and exiting the roadway. The gas station on the southeastern corner of the intersection has wide open access. Through curb and landscaping strips, the access points could be defined and potentially moved away from the traffic signal. There are two additional access points to the east on Route 175 that could be combined. Similarly, there are access points less than 500 feet on the western side of the intersection. By minimizing and defining accesses onto Routes 13 and 175 the conflict points can be greatly reduced.
- Lengthen substandard turn lanes to provide 200 feet of storage and 200 feet of taper for an overall minimum length of 400 feet.

Table 6.44. Location #23 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install centerline & shoulder rumble strips	0.82 (18% reduction)	All Crashes - fatal, serious injury	CMF Clearinghouse
Curve warning signage	0.56 - 0.69 (31 - 44% reduction)	All Crashes - all severities	CMF Clearinghouse
Slope flattening	0.58-0.78 (22 - 42% reduction)	All Crashes - all severities	CMF Clearinghouse
Widen paved shoulder from 3 ft to 8 ft	0.71 (29% reduction)	All Crashes - all severities	CMF Clearinghouse
Install center line & shoulder rumble strips	0.82 (18% reduction)	All Crashes - fatal, serious injury	CMF Clearinghouse

Table 6.45. Location #23 Cost Estimate.

	Item	Location #23
Tier 1	Signage	$29,114
	Pavement Markings	**$10,126**
	Signal	$871
	Other	**$166**
	TOTAL	**$40,277**
Tier 2	**Signage**	**$10,534**
	Pavement Markings	$924
	Signal	
	Other	$660
	TOTAL	**$12,118**
Tier 3	Signage	$7,441
	Pavement Markings	**$417**
	Signal	
	Other	**$85,535**
	TOTAL	**$93,393**

Note: See Templates in Appendix A for applicable items.

Vehicles traveling northbound on U.S. Route 13

Vehicles stopped in the westbound approach at U.S. Route 13 and Chincoteague Road

Figure 6.13
Concept Plan -
Site Specific Location #23
Eastern Shore Safety Study

site specific location #24

Vicinity Map

Crash Sites

6.24 Site Specific Location #24 East of U.S. Route 13

6.24.1 Existing Conditions

This corridor segment is roughly 1,750 feet of Route 175 starting approximately 2,500 feet east of the U.S. Route 13 and Route 175 intersection.

The section of the corridor is a two-lane paved road with minimal to no shoulder and a passing lane in the westbound direction. The area is wooded with steep slopes on both sides of the road.

6.24.2 Crash Data

There were 11 crashes within this segment; four (4) crashes were deer-related, three (3) crashes were roadway departure, three (3) crashes were rear end, and one (1) fatal was a head-on crash. Thirty-six (36) percent resulted in fatal or injury crashes. Fifty-five (55) percent of the crashes occurred during dark conditions.

6.24.3 Key Safety Concerns

- Roadway departure crashes at the curve on the eastern side, near the edge of the woods.
- Limited sight distance at curve.
- During the field review a local homeowner noted that he witnessed two recent crashes involved drivers traveling west and misjudging the length of the horizontal curve. The homeowner also noted that many drivers are texting while driving.

6.24.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Provide additional positive guidance through post mounted delineators and wider 6-inch pavement markings.
- Implement safety edge to provide an additional method for vehicles to recover from roadway departure crashes.
- Install edge and center line rumble strips.
- Install curve warning signage in both the east and westbound directions.
- Use a ball bank test to determine if chevrons are appropriate.
- Improve sight distance by trimming/removing vegetation on the inside of the curve.

Mid-Term:

- Increase drivers' opportunity to stay on the road or to recover if they drive off the road. Methods include shoulder slope flattening, widening paved outside shoulder to eight feet, and application of center and edge line rumble strips.

Table 6.46. Location #24 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install wider edge lines (4 in to 6 in)	0.83 (17% reduction)	All Crashes - all severities	CMF Clearinghouse
Installation of safety edge treatment	0.85 - 1.00 (0 - 15% reduction)	All Crashes - all severities	CMF Clearinghouse
Install center line & shoulder rumble strips	0.82 (18% reduction)	All Crashes - fatal, serious injury	CMF Clearinghouse
Curve warning signage	0.56 - 0.69 (31 - 44% reduction)	All Crashes - all severities	CMF Clearinghouse
Slope flattening	0.58-0.78 (22 - 42% reduction)	All Crashes - all severities	CMF Clearinghouse
Widen paved shoulder from 3 ft to 8 ft	0.71 (29% reduction)	All Crashes - all severities	CMF Clearinghouse

Table 6.47. Location #24 Cost Estimate.

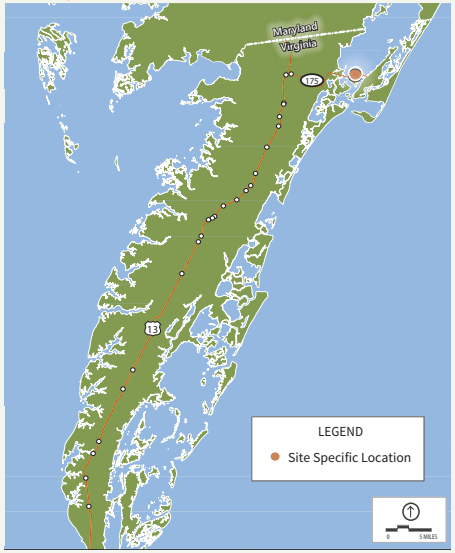
	Item	Location #24
Tier 1	Signage	$5,075
	Pavement Markings	
	Signal	
	Other	$166
	TOTAL	$5,241
Tier 2	Signage	$5,817
	Pavement Markings	
	Signal	
	Other	$660
	TOTAL	$6,477
Tier 3	Signage	$3,620
	Pavement Markings	$832
	Signal	
	Other	$8,477
	TOTAL	$12,929

Note: See Templates in Appendix A for applicable items.

Traveling westbound on Route 175

site specific location #25

Vicinity Map



Crash Sites

6.25 Site Specific Location #25 Bridge Crossing Wire Narrows

6.25.1 Existing Conditions

This location is a corridor segment of Route 175 located approximately 5,500 feet west of the intersection with Marsh Island Drive and extending roughly 1,000 feet to the west. This portion of the corridor is a two-lane paved road with shoulders in the east and westbound directions with a guardrail on the southern side of the roadway, and a passing zone for westbound drivers.

This section of the corridor is open and surrounded by water on both the north and south with a bridge to the east. During the field review it was noted that many drivers drove very closely to the vehicles ahead and were willing to perform passing maneuvers with limited available space due to vehicles traveling in opposite direction.

6.25.2 Crash Data

There were two (2) crashes at this location; one head-on fatal crash and one rear end incapacitating injury crash. Both occurred during the day. The rear end crash involved a vehicle passing in the westbound direction.

6.25.3 Key Safety Concerns

- Lack of positive guidance.
- Location of passing zone.
- Speed and aggressive driving.

6.25.4 Recommended Countermeasures and Implementation Plan

Short-Term:

- Install shoulder and center line rumble strips.
- Re-evaluate passing zones. Due to the water on both sides of the road, there is limited recovery space if other drivers conduct passing without having adequate space.
- Conduct targeted enforcement of aggressive driving. Also implement public educational campaigns about the risks associated with aggressive driving.

Table 6.48. Location #25 Recommended Countermeasures.

Countermeasure	CMF	Notes	Source
Install center line & shoulder rumble strips	0.82 (18% reduction)	All Crashes - fatal, serious injury	CMF Clearinghouse

Table 6.49. Location #25 Cost Estimate.

	Item	Location #25
Tier 1	Signage	
	Pavement Markings	$5,940
	Signal	
	Other	$166
	TOTAL	$6,106
Tier 2	Signage	
	Pavement Markings	$3,630
	Signal	
	Other	$660
	TOTAL	$4,290
Tier 3	Signage	
	Pavement Markings	$2,640
	Signal	
	Other	$2,376
	TOTAL	$5,016

Note: See Templates in Appendix A for applicable items.

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