



Rhode Island Strategically Targeted Affordable Roadway Solutions

Aquidneck Island 2010-2011



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IN CONJUNCTION WITH



Aquidneck Island
Transportation Study
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Acknowledgments



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Representatives from the city/towns:

- Town of Portsmouth
- Town of Middletown
- City of Newport



Federal, State, and Local Agencies:

- Rhode Island Department of Transportation (RIDOT)
- Rhode Island Statewide Planning Program (RISPP)
- Federal Highway Administration (FHWA)
- Aquidneck Island Planning Commission (AIPC)





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1

Study Process and Framework

This chapter presents the process and framework for the RI*STARS pilot program on Aquidneck Island. The study background, process, and objective, are presented in this chapter.

1.1 Study Background

The Rhode Island Department of Transportation (RIDOT) has embarked on a “new” initiative focused on delivering low-cost and high benefit safety and mobility improvements. Traditionally, the transportation planning process has focused on long-term, high cost capital improvements for the transportation system. With today’s safety, mobility, and funding challenges, it is imperative for State DOTs to continue to identify innovative ways to improve and refine business practices. A significant challenge that DOTs face is the lack of revenues needed to implement large-scale highway improvements. As a result, RIDOT has identified the need to focus more heavily on identifying and rapidly implementing low cost, high benefit roadway improvements aimed at efficiency, capacity, and safety.

The new initiative is called RI*STARS (Strategically Targeted Affordable Roadway Solutions), which involves partnerships between transportation planners, traffic engineers, safety engineers and operations staff. It borrows from a federal program in the 1970’s called TOPICS (Targeted Operational Projects to Improve Capacity and Safety) and Virginia Department of Transportation’s similarly named V-STARS program. Through this program RIDOT will identify critical safety and congestion locations. RIDOT will work with our local partners to develop a detailed improvement plan for selected locations with the focus on delivering low-cost and high benefit safety and mobility improvements.

The goal of the RI*STARS Program is to identify roadway improvements on the freeway, secondary, and local roadway systems that:

- Are relatively low in cost – from a few thousand dollars to \$2,000,000 maximum for a project
- Address existing mobility and safety problem areas



- Require minimal preliminary engineering and right-of-way
- Can be implemented quickly (The goal is 3 to 36 months from identifying location to completing construction.)

Because of the significant amount of data available from the Aquidneck Island Transportation Study (AITS), the RIDOT started the RI*STARS program with a “pilot project” on Aquidneck Island. As part of the AITS, critical data such as traffic volumes, crash data, roadway geometry, and signal timings were already compiled.

1.2 RI*STARS Process Overview

The RI*STARS Program Direction Document developed by the RIDOT provides an overview of the general process for the program. The following describes the specific process that was followed for the Aquidneck Island pilot program.



1.2.1 Network Screening

The RI*STARS Team (highway/traffic engineering on-call consultant and RIDOT staff) developed a list of candidate locations based on the following data that was compiled as part of the AITS:

- Crash Frequency Data
- Crash Severity Data
- Top Bottleneck Locations (as identified via online surveys)
- Engineering Judgment
- Solicitation of Input from Municipalities
- Congestion Mapping
- Other Online/Email Surveys

The signalized intersections identified were then ranked based on the following (where appropriate data was available):

- 50% weight given to total crash rank (which was average ranking of crash rate (not total number of crashes) and Severity index)
- 50% weight given to delay rank (based on average delay during worst case peak hour from capacity analysis)

From there, the top 30 signalized intersections with the highest crash frequency/severity/delay ranking were identified. Also, based on the crash rates and severity indexes alone (no traffic data was available), the top 20 unsignalized intersections with the highest crash frequency/severity were identified.



1.2.2 Identification of Detailed Study Locations

Once the network screening was completed, the RI*STARS Team conducted a preliminary assessment of the 50 candidate locations to identify the top locations with the greatest safety and/or congestion concerns. Some projects that were already in the design process or were already/in construction were dropped from further consideration.

Resulting from this detailed review, 17 locations, consisting of 26 signalized and 2 unsignalized intersections, were identified for further study as part of the RI*STARS process. The recommended list of locations to be part as part of the Aquidneck Island RI*STARS pilot program include the following corridors and intersections:

Newport

1. Admiral Kalbfus Road, between JT Connell Highway Rotary and Malbone Road
2. America's Cup Avenue at West Marlborough Street
3. America's Cup Avenue from Thames Street South to Memorial Boulevard
4. Memorial Boulevard at Bellevue Avenue
5. Memorial Boulevard at Rhode Island Avenue

Middletown

1. West Main Road, between Coddington Highway and Smythe Street
2. West Main Road/Broadway at Admiral Kalbfus Road/Miantonomi Avenue
3. West Main Road at Forest Avenue
4. East Main Road at Aquidneck Avenue
5. East Main Road at Turner Road
6. Aquidneck Avenue at Green End Avenue

Portsmouth

1. Mount Hope Bridge at Boyds Lane/Bristol Ferry Road
2. West Main Road/Sprague Street at Turnpike Avenue/Bristol Ferry Road
3. West Main Road Stringham Road
4. West Main Road at Union Street/Redwood Road
5. East Main Road at Turnpike Avenue
6. East Main Road at Stubtoe Lane/Fairview Lane

The general locations of the study intersections are shown in **Figure 1-1**.



1.2.3 Data Collection

The RI*STARS Team compiled and reviewed the following data from the AITS for the identified RI*STARS locations:

- Segmental link AADT
- Turning movement counts
- Signal timing and phasing (AM, PM)
- SYNCHRO signal optimization files
- Latest 3 years of crash data
- Aerial photography of locations
- GIS mapping
- Inventory of corridor characteristics including lane widths, shoulder widths, and turn bay lengths, and number and locations of access points
- Documentation of ongoing citizen or elected officials concerns with corridors



1.2.4 Crash Data Analysis

The RI*STARS Team analyzed the available crash data provided by RIDOT to identify crash trends at each location. Crash data and rates have been summarized including such elements as type of collision, weather, time of day, day of week, and the number of property damage only, injury, and fatal crashes documented during the 3 year crash analysis period. A collision density map, as shown in **Figure 1-2**, illustrates the number of reported crashes that occurred between 2006 and 2008 at each of the study locations.

Collision diagrams have also been produced depicting the location of the crash relative to the study location, the type of collision, and the number of crashes occurring at a particular location. These collision diagrams were used by the RI*STARS team to identify any crash trend that may occur at a study location. The collision diagrams are located in the Appendix.



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Figure 1-1

Study Area Locations



Insert Fig 1-1



Source: RIDOT 2006 - 2008 Crash Database



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Figure 1-2

Study Area Locations
 Total Number of Crashes
 2006-2008



Insert Fig 1-2



1.2.5 Traffic Operation Analysis

The RI*STARS Team reviewed the existing traffic operations analyses of the study locations from the AITS. Various measures of effectiveness (MOEs) were used to determine the performance of the intersections, including:

- Level of Service
- Delay (second per vehicle)
- Queue Lengths (when appropriate)



1.2.6 Road Safety Assessment (RSA)



The RI*STARS Team conducted a Road Safety Assessment (RSA) for each of the study locations identified. RSAs are a valuable tool used by transportation agencies to evaluate road safety issues contributing to these injuries and deaths and to identify opportunities for improvement. The Federal Highway Administration (FHWA) defines an RSA as

“A formal safety performance evaluation of an existing or future road or intersection by an independent, multidisciplinary team”.

RSAs are a valuable tool for transportation agencies to evaluate road safety issues contributing to injuries and deaths and to identify opportunities for improvement. RSAs are also an effective tool for proactively improving roadway and roadside safety for all road users, motorized and non-motorized. A RSA also helps identify and mitigate localized, reoccurring congestion along segments of a roadway and at intersections. As such, the RSA process may be employed on any type of facility and during any stage of the project development process, including system planning, project development and design, construction, and on existing facilities open to traffic. The success of RSAs has led to the FHWA including the RSA process as one of its “Nine Proven Crash Countermeasures”.

Some element of safety is considered on every project. However, sometimes conditions merit a more detailed safety review. An example is downtown Newport’s unique, multimodal characteristic that creates a more complex dynamic that is critically assessed during an RSA. RSAs examine these conditions in detail by pulling together a multidisciplinary team that looks at the issues from different perspectives – perspectives which are often not a part of a traditional safety review.

RSAs also consider safety from a human factors point of view which aims to answer the following questions:



- How and why are people reacting to the roadway conditions?
- What do people sense and how do they react to those senses?
- What are the associated risks with those elements?

The multidisciplinary team approach helps to answer these questions. Interactions between all road users (e.g., pedestrians and motor vehicles, commuter traffic and recreational vehicle traffic, bicycles and motor vehicles, etc.) are investigated to determine potential risk and to identify programs and measures to help reduce those risks and create safer environments for all road users. An RSA typically follows a formal 8 step process, as listed below and illustrated in **Figure 1-3**.

1. Identify RSA project (design-stage) or existing road (in-service).
2. Select an independent, multi-disciplinary RSA team.
3. Conduct a start-up meeting to review project information and drawings.
4. Perform field reviews in various conditions.
5. Conduct the RSA analysis and prepare preliminary findings presentation.
6. Present preliminary RSA findings to project owner/design team.
7. Prepare formal response.
8. Incorporate findings into the project when appropriate.

Figure 1-3 RSA 8 Step Process



Source: [FHWA](#)



Additional information about RSAs, including resources, training opportunities, and contacts can be found on the FHWA website: <http://safety.fhwa.dot.gov/rsa/>.

The RSA team reviewed all the available traffic and crash data prior to observing field operations. The RSA team then conducted a field review of the study locations during the AM or PM peak hour, depending on which time period presents the worst case conditions. A review of some of the locations were needed to be performed multiple times at different time periods. A nighttime review of the corridor / location was also conducted.

The RI*STARS Team documented the findings from the RSA for corridor level issues and intersection or site specific issues. The findings are used to aid in identifying the deficiencies of the study locations and to aid in the development of appropriate countermeasures. The findings from the RSA are included in Chapter's 2, 3, and 4 for Newport, Middletown, and Portsmouth, respectively.



1.2.7 Identify Deficiencies and Develop Countermeasures

The RI*STARS Team used the results from the crash data analyses, existing operational analyses, and the RSAs to identify study location deficiencies and to develop a list of potential countermeasures for consideration. The list of potential improvements focuses on enhancing the safety and operations of the study locations and incorporates context sensitive design principles. As shown in Chapter 5, a matrix broken down by municipality has been developed for all study locations and include the following:

- Location
- Proposed Countermeasure and Description
- Implementation Mechanism (RIDOT Maintenance, Construction Contracts, etc)

For safety improvements, the RI*STARS Team used Crash Reduction Factors (CRF) to estimate the percentage of crash reduction that might be expected after implementing a given countermeasure. For those countermeasures that do not have specific CRFs, a brief narrative on the proposed improvement and its anticipated affect has been provided.



1.2.8 Evaluation of Selected Alternatives

Once the RI*STARS team developed countermeasures for the identified deficiencies, planning level order-of-magnitude construction cost estimates were developed for the recommended improvements. These estimates of expected project cost and crash reduction benefits were used in evaluating proposed improvements. The method of Benefit-to-Cost Ratio (B/C) was used to evaluate the economic feasibility and effectiveness of the proposed safety improvements at each location. Any location with a B/C Ratio greater than 1.0 generally is considered economically sound for implementation; however, the B/C Ratio is not the sole criteria on which to base implementation. The decision to proceed with the proposed improvements will be made by RIDOT, based on consideration of the B/C Ratio and anticipated improvements to operations and safety, as documented in this report.



1.2.9 Documentation

The RI*STARS team has developed this report for the evaluated study locations. This report documents the process used (described in this section), the data and results from the analysis performed, the findings of the RSAs, and an overview of the potential of improvements and their respective benefits and costs.



1.2.10 Implementation of Recommended Improvements

Improvements at the study locations will be implemented through various mechanisms. Initially, a review of all upcoming RIDOT construction contracts will be performed and any improvements that can be incorporated as part of these contracts will be identified. Next, any improvements that can be implemented by RIDOT Maintenance or Traffic Engineering staff will be identified. Any remaining improvements will be implemented through two Design-Bid-Build contracts. There are also some recommendations that require further study. RIDOT will be responsible for advancing the study of these recommendations if feasible.



1.2.11 Evaluation of Program

Once proposed improvement measures have been implemented, the locations will be evaluated to determine the effectiveness of the safety and/or congestion improvements implemented under this RI*STARS pilot program. An initial cursory evaluation will be performed after 1 year.



For the evaluation of safety improvements, locations will be analyzed utilizing 3 years of pre-improvement crash data (as documented in this report) and 3 years of post implementation crash data (to be collected by the RIDOT). Crash data during the construction period will be eliminated from consideration. Targeted crash evaluation, such as for head-on or angle crashes, will also be performed. For the evaluation of congestion improvements, Level of Service and calculated vehicle delays before improvements will be compared to the same values after improvements by RIDOT.



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2

City of Newport Road Safety Assessments

The recommended list of locations for the City of Newport to be included for the Road Safety Assessments as part of the Aquidneck Island RI*STARS pilot program include the following corridors and intersections:

1. Admiral Kalbfus Road from JT Connell Highway (Newport Rotary) to Malbone Road/Girard Avenue:
 - Admiral Kalbfus Road at the JT Connell Highway Rotary
 - Admiral Kalbfus Road at RK Towne Center/Pell Bridge On-Ramp
 - Admiral Kalbfus Road at Halsey Street
 - Admiral Kalbfus Road at Pell Bridge Off-Ramp/Newport Grand
 - Admiral Kalbfus Boulevard at Malbone Road/Girard Avenue
2. America's Cup Avenue at West Marlborough Street.
3. America's Cup Avenue from Thames Street South to Memorial Boulevard.
 - America's Cup Avenue at Thames Street South
 - America's Cup Avenue at Market Square/Bowens Warf
 - America's Cup Avenue at Midblock Crosswalk/Bannisters Wharf
 - America's Cup Avenue at Memorial Boulevard/Thames Street
4. Memorial Boulevard at Bellevue Avenue.
5. Memorial Boulevard at Rhode Island Avenue.

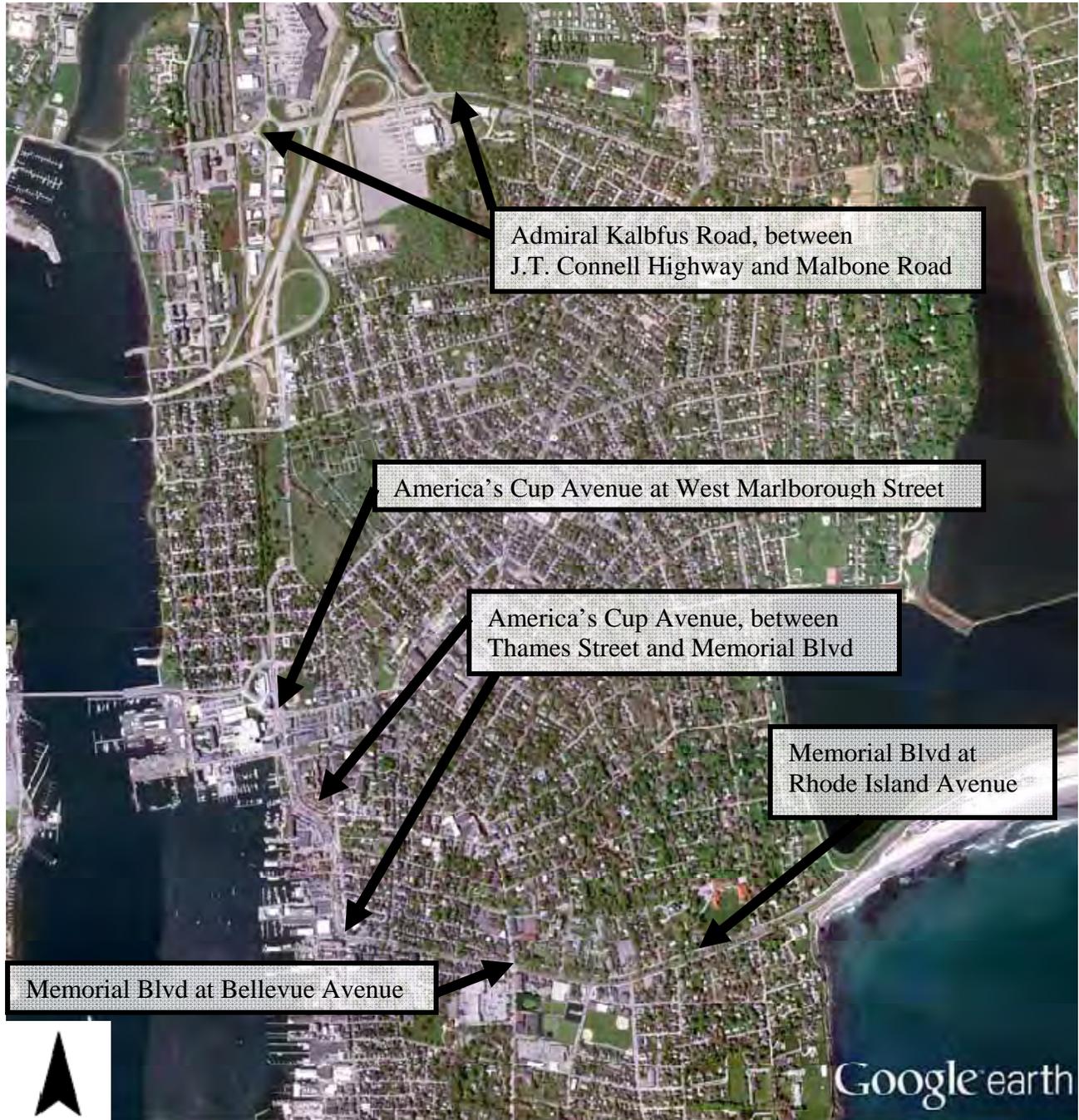
A map showing the general location of the project study area is shown in **Figure 2-1**.



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Figure 2-1 RSA Study Area – City of Newport



Source: Google Earth



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The interdisciplinary RSA Team for the Newport assessment consisted of engineers and officials from the City of Newport Department of Public Services, RIDOT, the Rhode Island Statewide Planning Program, and FHWA. Representatives from Vanasse Hangen Brustlin (VHB) facilitated the RSA. The members of the RSA team are as follows:

- Francis Marinaccio, DPS Engineering Division – City of Newport
- Tom Bushell, Traffic Engineer – RIDOT
- Anita Marshall, Highway Engineering – RIDOT
- Kristen Capaldi, Highway Engineering – RIDOT
- Michael Moan, Transportation Principal Planner – RISPP
- Jacinda Russell, Safety & Operations Engineer – FHWA
- Dan Nabors, Safety Engineer – VHB
- Robert Clinton, Traffic Engineer – VHB

2.1 Admiral Kalbfus Road



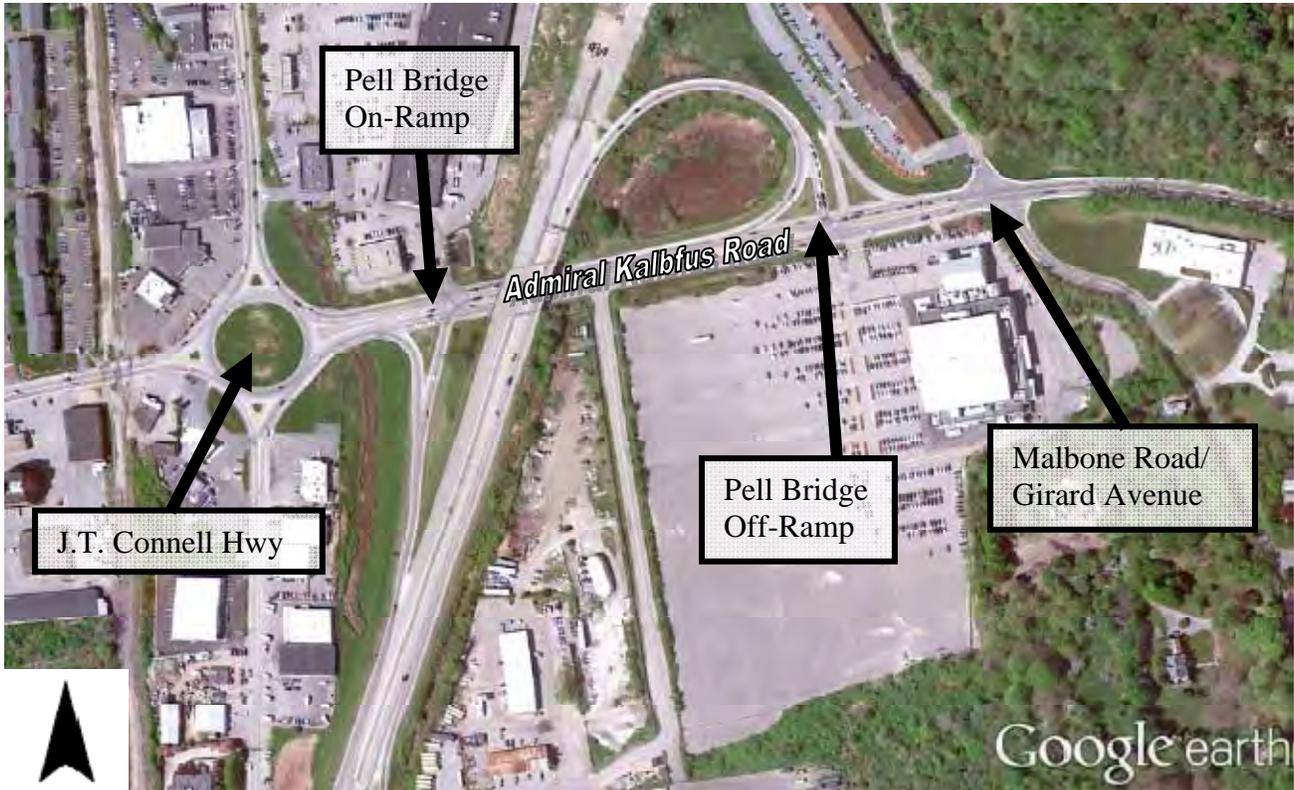
2.1.1 Existing Conditions

Admiral Kalbfus Road from JT Connell Highway (Newport Rotary) to Malbone Road/Girard Avenue is a primary route for vehicles traveling to/from Aquidneck Island by way of the Pell Bridge. Admiral Kalbfus Road is also a primary route that connects the Navy Base and JT Connell Highway to the west with West Main Road to the east. The RK Towne Center, Newport Grand and Best Western are all located along this corridor.

The corridor is a four-lane, mostly divided roadway, having two through lanes in each direction and exclusive turn lanes at the RK Towne Center/Pell Bridge On-Ramp and Halsey Street intersections. To the west of the JT Connell Highway and east of Malbone Street/Girard Avenue, it transitions to two lanes (one lane in each direction). The posted speed limit is 25 mph. The RSAs were performed at the intersections as shown in **Figure 2-2** and as discussed in the following section.



Figure 2-2 Admiral Kalbfus Road Study Area Corridor and Intersections



Admiral Kalbfus Road at the JT Connell Highway (Newport Rotary) is currently a rotary with Admiral Kalbfus Road as the eastbound/westbound approaches and JT Connell Highway as the northbound/southbound approaches. The Admiral Kalbfus Road westbound approach consists of two lanes and all other approaches consist of one lane.

Admiral Kalbfus Road at RK Towne Center/Pell Bridge On-Ramp is a signalized intersection consisting of one exclusive left-turn lane, one through lane, and a shared through lane with a channelized right-turn on-ramp to the Pell Bridge/Downtown Connector on the eastbound approach; one exclusive left-turn lane, one through lane, and a shared through/right-turn lane on the westbound approach; and one multipurpose (left-turn/through/right-turn) lane on the southbound approach. The south leg of the intersection is one-way away from the intersection.

Admiral Kalbfus Road at Halsey Street is an unsignalized T-intersection consisting of one shared left-turn/right-turn lane on the northbound approach; one through lane and one shared through/right-turn lane on the eastbound approach; and one exclusive left-turn lane and two through lanes on the westbound approach.



Admiral Kalbfus Road at Pell Bridge Off-Ramp/Newport Grand is a signalized intersection consisting of one through lane and one shared through/right-turn lane on the eastbound approach; one shared left-turn/through lane and one through lane on the westbound approach; one left-turn lane, one shared left-turn/through lane, and a channelized right-turn lane on the southbound approach; and one left-turn lane, one shared left-turn/right-turn lane and one right-turn lane on the northbound approach (Newport Grand driveway). The center lane on the northbound approach out of the Newport Grand driveway is delineated as a shared left-turn/right-turn lane. There are also no striped pedestrian crosswalks and there are no handicapped ramps.

This intersection has the highest number of crashes on Aquidneck Island, with 216 crashes over the past three years, including 169 rear-end collisions.

Admiral Kalbfus Boulevard at Malbone Road/Girard Avenue is a four way unsignalized intersection controlled by stop signs on the Girard Avenue and Malbone Road northbound/southbound approaches. The Admiral Kalbfus Road eastbound approach consists of a shared left-turn/through lane and a shared through/right-turn lane; however the roadway tapers through the intersection to one lane on the eastbound departure. All other approaches consist of one multipurpose (left-turn/through/right-turn) lane. The Admiral Kalbfus Road westbound departure widens to two lanes. Malbone Street is slightly offset to the east from Girard Avenue. The vertical alignment of Admiral Kalbfus Road consists of an uphill grade from west to east.



2.1.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 2-1** and is presented in vehicles per day (vpd):

Table 2-1 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
Admiral Kalbfus Road	21,200	East of JT Connell Highway

The overall delays and critical approaches/movements are listed below for the three major intersections with the study area corridor. The Admiral Kalbfus Road at Pell Bridge Off-Ramp/Newport Grand intersection experiences the highest delays and queues during the morning peak hour, as vehicles enter Newport via the Pell Bridge.



During the evening peak hour, the Admiral Kalbfus Road intersections with JT Connell Highway (Newport Rotary) and the Pell Bridge On-Ramp/RK Centre experience the higher delay, as vehicles are leaving Newport via the Pell Bridge. The overall intersection delay is presented in **Table 2-2**.

Table 2-2 Calculated Intersection Delay

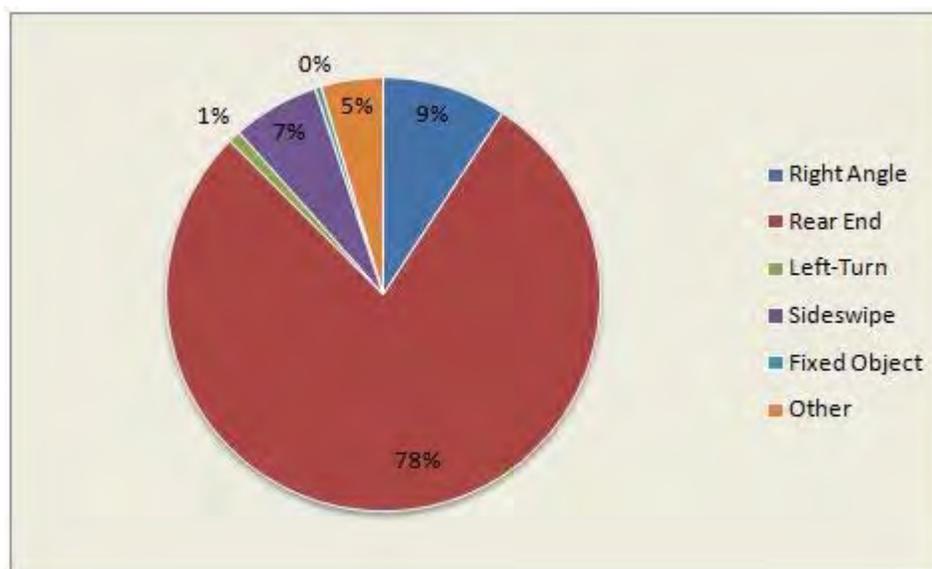
Subject Intersection – Admiral Kalbfus Road at	Intersection Delay (sec)	General Location of Issues
JT Connell Highway	34.3	Westbound Approach
Pell Bridge On-Ramp/RK Towne Center	24.1	Westbound Left-Turn Lane
Pell Bridge Off-Ramp/Newport Grand	21.8	Southbound Approach



2.1.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 216 crashes were reported along Admiral Kalbfus Road between JT Connell Highway and Malbone Road, with the majority (78%) being rear-end-type collisions. **Figure 2-3** illustrates the breakdown of the crashes by collision type.

Figure 2-3 Collision Types



The majority (57%/96) of the rear-end crashes occurred on the off-ramp from the Pell Bridge onto Admiral Kalbfus Road westbound. As previously mentioned, the



geometry of the Pell Bridge Off-Ramp, onto westbound Admiral Kalbfus Road, is such a large radius that vehicles travel fast and do not slow down when entering Admiral Kalbfus Road westbound. The large radii also results in vehicles entering Admiral Kalbfus Road westbound traffic from the Pell Bridge Off-Ramp at a sharp angle without a merge lane.

At the Admiral Kalbfus Road/JT Connell Highway (Newport Rotary), there were numerous rear-end and sideswipe type crashes reported. This is the result of the poorly delineated rotary, in which it is unclear to the motorists if it consists of one-lane or two-lanes.



2.1.4 Proposed Improvements

Currently on RIDOT's Transportation Improvement Program is the Pell Bridge Access Improvements project. Numerous alternatives have been developed over the past 10 years. As part of the Aquidneck Island Transportation Study (AITS), an additional concept has been developed as shown below. This concept, as shown in **Figure 2-4**, involves the removal and relocation of the Pell Bridge Ramps. Modern roundabouts are also proposed at the Admiral Kabfus Road intersections with JT Connell Highway and Halsey Street.

Figure 2-4 Proposed Conceptual Improvements – Admiral Kalbfus Road Corridor



Source: Aquidneck Island Transportation Study



2.1.5 Assessment Findings

2.1.5.1 Safety Benefits of Existing Roadway Features

Based on a review of existing site conditions, there are several positive characteristics of the roadway network when considered in terms of roadway safety:

Access management east of the Newport Rotary – All access to individual parcels east of the traffic circle is provided via intersecting streets or signalized intersections.

2.1.5.2 Safety Benefits of Conceptual Roadway Improvements

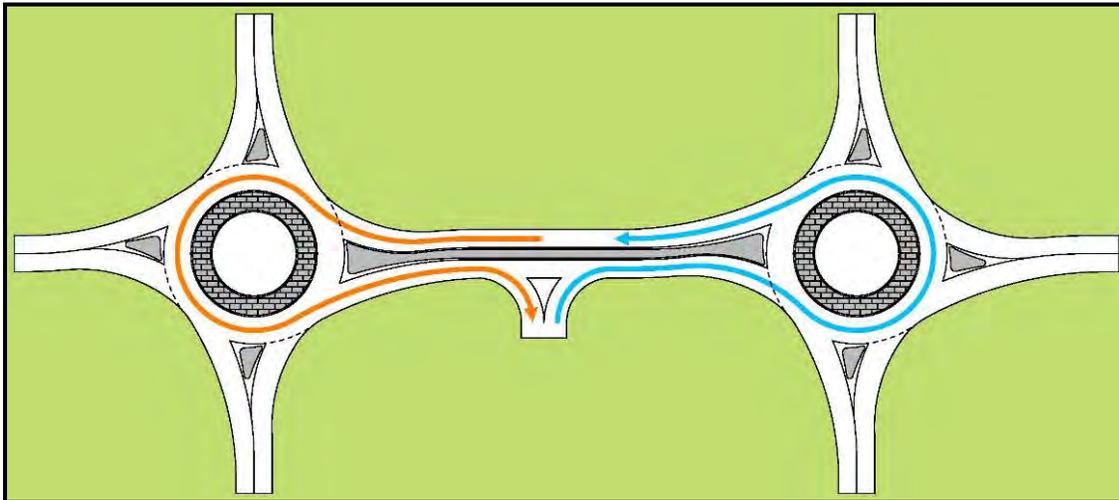
The proposed roundabouts as part of the conceptual plan were preferred by the RSA Team over the traditional signalized intersections due to a number of design features that would enhance safety within the study area:

- **Elimination of left turns at intersections** – By directing all traffic at these two intersections – both the through and turning traffic – to merge into the circular roadway, stopped turning vehicles are removed from the through lanes and the occurrence of unexpected stopped vehicles within the roadway are greatly reduced. This creates a “Dog-Bone” configuration, in which all left-turning movements can be removed between adjacent roundabouts, as shown in **Figure 2-5** below.
- **Natural traffic-calming effect** – A key element in modern roundabout design is to provide horizontal deflection in the approach legs so that entering traffic is naturally encouraged to decrease its speed. The opposite effect on approach speeds may be observed at traditional signalized intersections, where drivers may be inclined to *increase* their speeds near an intersection when a green or yellow light is within view.
- **Decreased intersection delay** – A general benefit of roundabouts is a reduction in both intersection delay and in the number of vehicles that must come to a stop at the intersection. More efficient traffic flow at the intersections should increase driver satisfaction and potentially decrease impatient and aggressive driver behavior within the corridor. A reduction in delay and vehicle idling has also been observed to have significant environmental benefits, as well.



- **Aesthetic appeal** – The latest conceptual plan for the Admiral Kalbfus Road corridor consists of installing two roundabouts that can be designed to include landscaping features to introduce a gateway experience for vehicles entering Aquidneck Island by way of the Pell Bridge.

Figure 2-5 Sample “Dog-Bone” Configuration



2.1.6 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Tables 2-3 thru 2-6** and **Figures 2-6 thru 2-10**, while **Table 2-7** lists the suggestions on the preliminary conceptual designs.



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Table 2-3 Summary of Safety Issues and Suggestions for Existing Facilities for Admiral Kalbfus at JT Connell Highway (Newport Rotary)

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Speed approaching, entering, and within the Newport Rotary</p> <p>- There are no posted speed limit signs on the approaches to the rotary. The existing geometry of the rotary (large radius, poor deflection on the approaches) results in higher speeds entering, within, and exiting.</p>	 <p><i>Photo shows the wide entering approach to the rotary with poor deflection, entering from JT Connell Hwy from the north. As a result, drivers enter the rotary at higher speeds than with modern roundabouts.</i></p>	<ul style="list-style-type: none"> - Install speed limit signs on all approaches to the rotary. Use portable speed feedback signs to alert motorists of their travel speeds. Increase police enforcement of speed limits. - Consider retrofitting the existing rotary with modern roundabout features using striping and signage. 	<ul style="list-style-type: none"> - Increase police enforcement of speed limits. 	<ul style="list-style-type: none"> - If the rotary is retrofitted to a modern roundabout or a new modern roundabout is constructed, educate or remind drivers about the basic principles of roundabout functionality. 	<ul style="list-style-type: none"> - Consider retrofitting the existing rotary with modern roundabout features using striping and signage. 	<ul style="list-style-type: none"> - Consider constructing a new modern roundabout to replace the existing rotary.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Poorly delineated rotary</p> <p>- The rotary is poorly delineated and sometimes operates as two lanes.</p>	 <p><i>Photo shows the confusion motorists find when driving the rotary due to wide lanes with no delineation.</i></p>	<ul style="list-style-type: none"> - Re-stripe the existing pavement to clearly delineate the rotary. Relocate the yield lines (shark teeth) to the correct location, closer to the entrance point of the rotary. - Consider retrofitting the existing rotary with modern roundabout features using striping and signage. 		<ul style="list-style-type: none"> - If a new modern roundabout is constructed, educate or remind drivers about the basic principles of roundabout functionality. 	<ul style="list-style-type: none"> - Consider retrofitting the existing rotary with modern roundabout features using striping and signage. 	<ul style="list-style-type: none"> - Consider constructing a new modern roundabout to replace the existing rotary.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Access points to adjacent properties are inside and too close to the rotary</p> <p>- There are access driveways inside of the rotary and too close to the approaches/ departures to the rotary.</p>	 <p><i>Photo shows a vehicle exiting a driveway close to the rotary departure, causing potential conflicts.</i></p>				<p>– Extend splitter islands on all approaches to the rotary to make adjacent access points right-in, right-out only.</p> <p>Intermediate – Consider closing the Shell gas station driveway located along the rotary for the southwest parcel. The parcel has two other driveways that can be accessed from both Training Station Road and JT Connell Highway.</p>	<p>– Consider constructing a new modern roundabout to replace the existing rotary and modifying/relocating access driveways.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Queues from traffic signals extending into the rotary</p> <p>- There are traffic signals at adjacent intersections to the north, west, and east of the rotary that have queues that extend into the rotary during peak hour traffic conditions.</p>	 <p><i>Photo shows vehicle queues extending into the rotary, caused by the Pell Bridge On-Ramp intersection.</i></p>	<p>- Optimize the traffic signal timings at adjacent signals to minimize the queues that extend into the rotary.</p>				<p>- Increase capacity by adding lanes on the departure of the rotary and at adjacent signalized intersections to increase capacity and consider construction of alternate routes such as the Halsey Street extension to reduce volume of traffic traveling through the study area.</p>
5	<p>No delineated crosswalks</p> <p>- There are currently no delineated pedestrian crosswalks on the approaches to the rotary; therefore, pedestrians were observed crossing in undesirable locations.</p>	 <p><i>Photo illustrates a pedestrian crossing the rotary with no delineated crosswalks.</i></p>				<p>- Delineate crosswalks on all approaches including the installation of ADA compliant ramps.</p>	<p>- Consider constructing a new modern roundabout to replace the existing rotary and incorporating delineated crosswalks and ADA compliant ramps.</p>



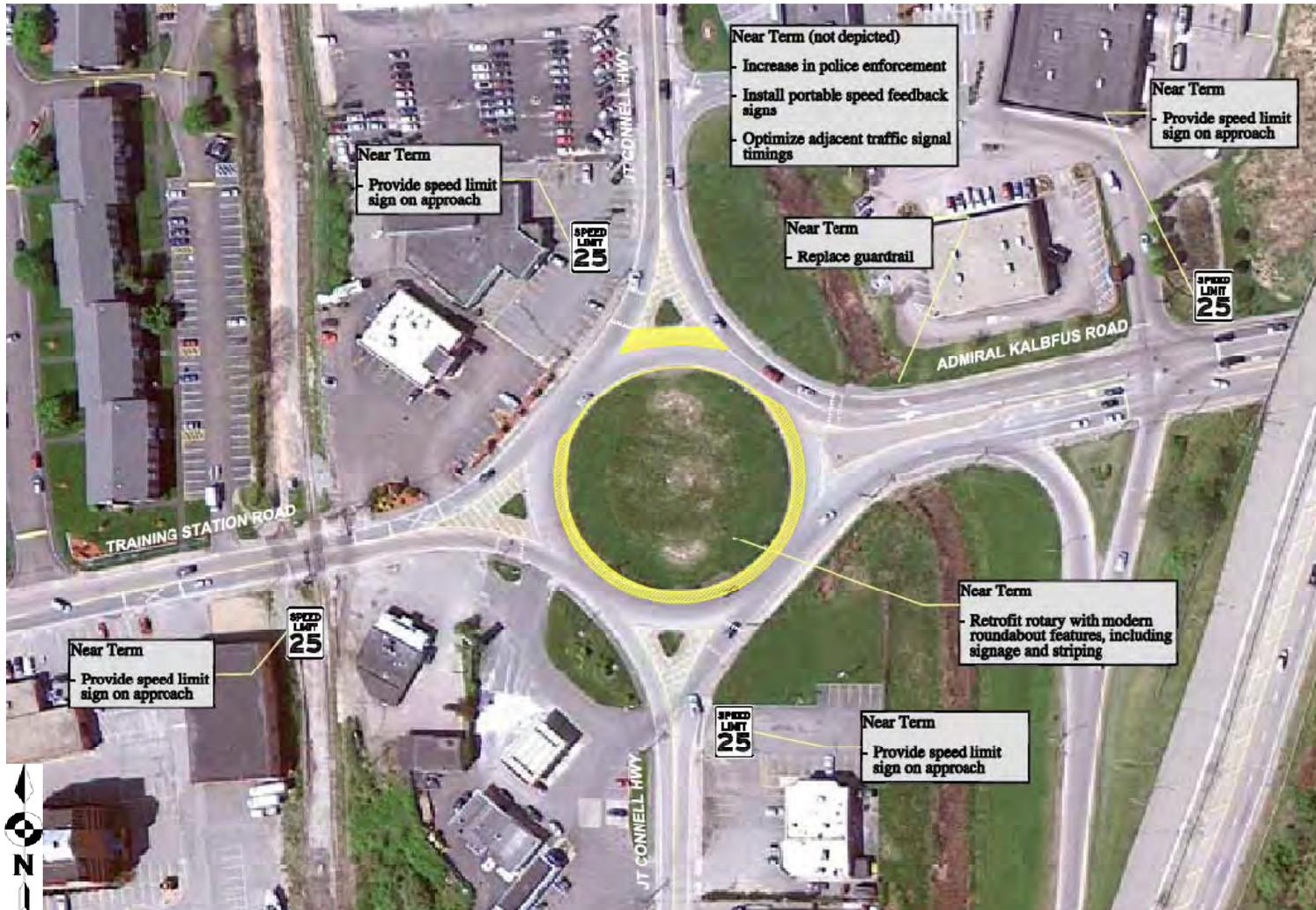
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Replace old/substandard guardrail on east leg of rotary</p> <p>– There is guardrail adjacent to the rotary that is old and does not meet current standards.</p>	 <p><i>Photo illustrates the non-standard guardrail on the east leg of the rotary.</i></p>	<p>– Replace old guardrail with guardrail that meets current standards.</p>				



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Figure 2-6 Admiral Kalbfus Road/JT Connell Highway Near-Term Conceptual Improvements/Recommendations



Source: Google Earth



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Figure 2-7 Admiral Kalbfus Road/JT Connell Highway Intermediate/Long-Term Conceptual Improvements/Recommendations



Source: Google Earth



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Table 2-4 Summary of Safety Issues and Suggestions for Existing Facilities for Admiral Kalbfus at Pell Bridge On-Ramp/RK Towne Center

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Queue lengths in the westbound left-turn lane, southbound approach, and eastbound approach</p> <p>- The queues in the westbound left-turn lane extend to the Halsey Street intersection impacting traffic accessing/ egressing Halsey Street. Queue lengths on the southbound approach are very long during peak periods resulting in long delays and congestion within the plaza. The queue lengths on the eastbound approach often extend into the rotary.</p>	 <p><i>Photo shows vehicle queues from the westbound left-turn lane extending beyond left-turn pocket.</i></p>	<p>- Optimize traffic signal timings to minimize queues.</p>			<p>- Consider extension of westbound left-turn lane onto Pell Bridge On-Ramp at the intersection to increase capacity and optimize traffic signal timings to minimize queues.</p>	<p>- Consider construction of alternate routes such as the Halsey Street extension to increase capacity in the area and redistribute traffic.</p> <p>- Eliminate left-turns with the conversion of the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Queue lengths and rear-end crashes at the merge onto the Pell Bridge On-Ramp</p> <p>-The queue lengths on the eastbound approach often extend into the rotary primarily as a result of the congestion at the merge onto the Pell Bridge On-Ramp. Eastbound vehicles turning right onto the Pell Bridge On-Ramp are required to yield to vehicles entering the On-Ramp from Admiral Kalbfus Road westbound and RK Towne Center approaches. There are some crashes resulting from vehicles not yielding at this location.</p>	 <p><i>Photo shows the merge between westbound and eastbound traffic destined to the Pell Bridge.</i></p>	<p>- Consider restriping the merge as two lanes with a lane drop tapering down to one lane.</p>			<p>- Consider widening the Pell Bridge On-Ramp to accommodate two lanes.</p>	<p>- Eliminate the movement with the conversion of the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.</p>



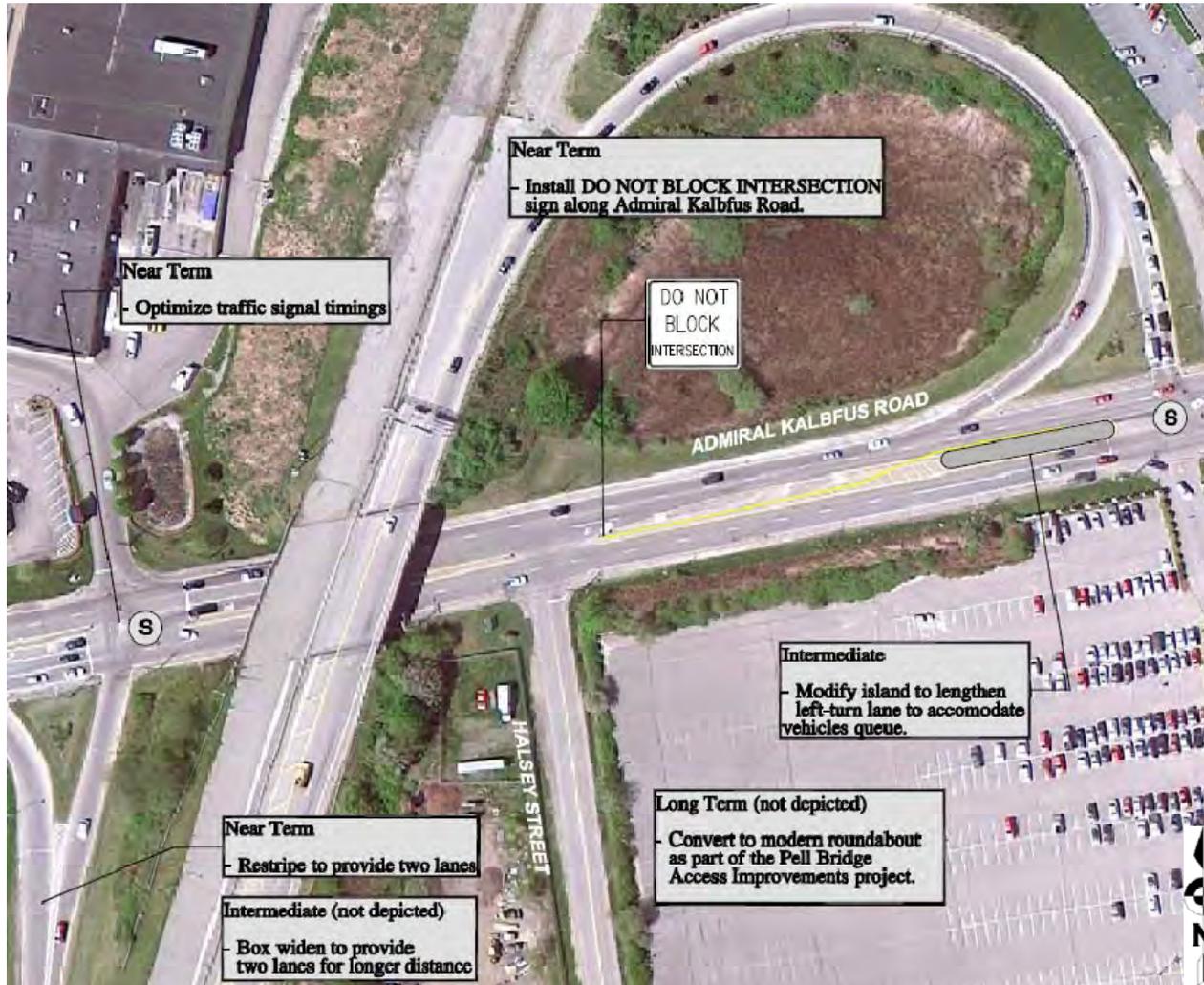
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Westbound left-turn lane at the Pell Bridge On-Ramp extends through the Halsey Street intersection</p> <p>- The westbound left-turn lane is often used by vehicles that are turning left onto the Pell Bridge On-Ramp which can result in crashes if vehicles turning left out of Halsey Street attempt to turn in front of them. There are also periods when the westbound left-turn queues at the RK Towne Center/Pell Bridge traffic signal extend to the Halsey Street intersection impacting access/egress.</p>	 <p><i>Photo shows vehicle queues from the westbound left-turn lane extending into the Halsey Street intersection, causing conflicts for exiting vehicles.</i></p>	<p>- Optimize the signal timings at the RK Towne Center/Pell Bridge traffic signal.</p> <p>- Install a DO NOT BLOCK INTERSECTION sign along Admiral Kalbfus Road to provide left-turning vehicles from Halsey Street a gap in traffic.</p>			<p>- Convert intersection to right-in/right-out. This will have impacts to the properties along Halsey Street and coordination is necessary to determine if feasible.</p> <p>- Modify island on westbound approach to extend the length of the left turn lane.</p>	<p>- Convert the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.</p>



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Figure 2-8 Admiral Kalbfus Road/Pell Bridge On-Ramp/RK Towne Center Conceptual Improvements/Recommendations



Source: Google Earth



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Table 2-5 Summary of Safety Issues and Suggestions for Existing Facilities Admiral Kalbfus at Pell Bridge Off-Ramp/Newport Grand

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Angled geometry of Pell Bridge Off-Ramp right-turn yield</p> <p>- The geometry of the Pell Bridge Off-Ramp right-turn is a large radius loop-ramp intersecting westbound Admiral Kalbfus Road at an acute angle with no merge area. This results in a variety of driver behaviors ranging from speeding up to stopping to merge with the westbound traffic. Numerous rear-end collisions occur on this ramp because the geometry and signing elicits non-uniform responses from motorists.</p>	  <p><i>Top photo shows a motorist looking "hard" left for a gap in traffic, while the bottom photo shows a motorist looking straight on the Pell Bridge Off-Ramp to Admiral Kalbfus Road westbound. These varying behaviors contribute to rear-end crashes on this approach</i></p>	<p>- Add pavement markings (No Merge Area), advance yield signs on both sides of the road, and a redundant yield sign across from the existing yield signs.</p>			<p>- Realign the Pell Bridge Off-Ramp right-turn to provide a smaller radius and bring it in closer to the signalized intersection and determine if dual right-turns are needed.</p>	<p>- Eliminate the movement with the conversion of the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Bushes in island obstruct sight distance of Pell Bridge Off-Ramp right-turning vehicles</p> <p>- There are bushes in the median that obstruct the sight distance of vehicles heading westbound from the Pell Bridge Off-Ramp.</p>	 <p><i>Photo shows the bushes limiting the sight distance for vehicles looking left on the Pell Bridge Off-Ramp to Admiral Kalbfus Road westbound.</i></p>	<ul style="list-style-type: none"> - Trim bushes to improve sight distance - Consider retrofitting the existing rotary with modern roundabout features using striping and signage. 			<ul style="list-style-type: none"> - Realign the Pell Bridge Off-Ramp right-turn to provide a smaller radius and bring it in closer to the signalized intersection. 	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Lack of left-turn storage lane on westbound approach</p> <p>- Left-turning vehicles from westbound Admiral Kalbfus Road into Newport Grand may block westbound through vehicles because there is not a left-turn pocket. This is likely to occur at critical peak traffic periods when left-turning vehicles are blocked by opposing eastbound traffic and westbound traffic is also its heaviest.</p>	 <p><i>Photo illustrates the left-turn movement into Newport Grand. The absence of a left-turn pocket may cause left-turning vehicles to delay westbound vehicles seeking to continue through the intersection.</i></p>	<p>- Consider programming a Time Of Day pattern to allow additional time to Newport Grand related movements during its peak period. Verification of the controller capabilities needs to be address to determine if this is possible.</p>			<p>- Remove island and install westbound left-turn lane. This may require new signal equipment.</p>	<p>- With the conversion of the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor, all left-turn will be made at the roundabout, so no left-turn pocket will be required.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Northbound Lane use out of Newport Grand</p> <p>- The center lane on the northbound approach out of the Newport Grand driveway is delineated as a shared left-turn/right-turn lane; however it is difficult for two vehicles to make right turns simultaneously. Also, the northbound departure is a dead end road and no vehicles are allowed, but there are no signs or barrier restricting this movement.</p>	 <p><i>Photo shows the Newport Grand northbound approach, with the dual left-turn/right-turn movements.</i></p>	<p>- Restripe Newport Grand Driveway with white lane lines and pavement markings consisting of two left-turn lanes and a right-turn lane. Add guide stripes ("Cat tracks") to delineate the dual left turn movement out of Newport Grand.</p> <p>- Install object markers and concrete barrier to help identify the restricted movement and restrict access to the dead-end road.</p>				<p>- Remove pavement and landscape dead-end road.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
5	<p>Lack of marked crosswalks and ADA compliant ramps</p> <p>- Marked crosswalks and ADA compliant ramps are missing at this intersection. There are also pedestrians that walk down Halsey Street where there are no sidewalks.</p>	 <p><i>Photo illustrates a pedestrian walking along the north side of Admiral Kalbfus. The pedestrian was observed to walk up the Pell Bridge off-ramp to find a suitable location to cross the ramp.</i></p>	<p>- The context of the road is one which supports several modes due to the surrounding land uses. Emphasis of this environment through the use of pavement markings may enhance the safety and comfort of pedestrians. Consider marking crosswalks and installing ADA compliant ramps for pedestrians walking parallel to Admiral Kalbfus.</p>				<p>- Create pedestrian crossings as part of the conversion of the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>There is a lack of delineation for the dual-left movement onto Admiral Kalbfus Road</p> <p>- There are insufficient pavement markings and signage to notify and guide the driver for the dual left-turn.</p>	 <p><i>Photo shows the Pell-Bridge Off-Ramp approach. There is a lack of adequate markings and signage for the dual-left-turn movement.</i></p>	<ul style="list-style-type: none"> - Install supplemental lane use signs for the off-ramp approach - Install pavement parking that delineate the dual left-turn movement. 				<ul style="list-style-type: none"> - Eliminate the movement with the conversion of the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.



Figure 2-9 Admiral Kalbfus Road at Pell Bridge Off-Ramp/Newport Grand "Near" Term Conceptual Improvements/Recommendations



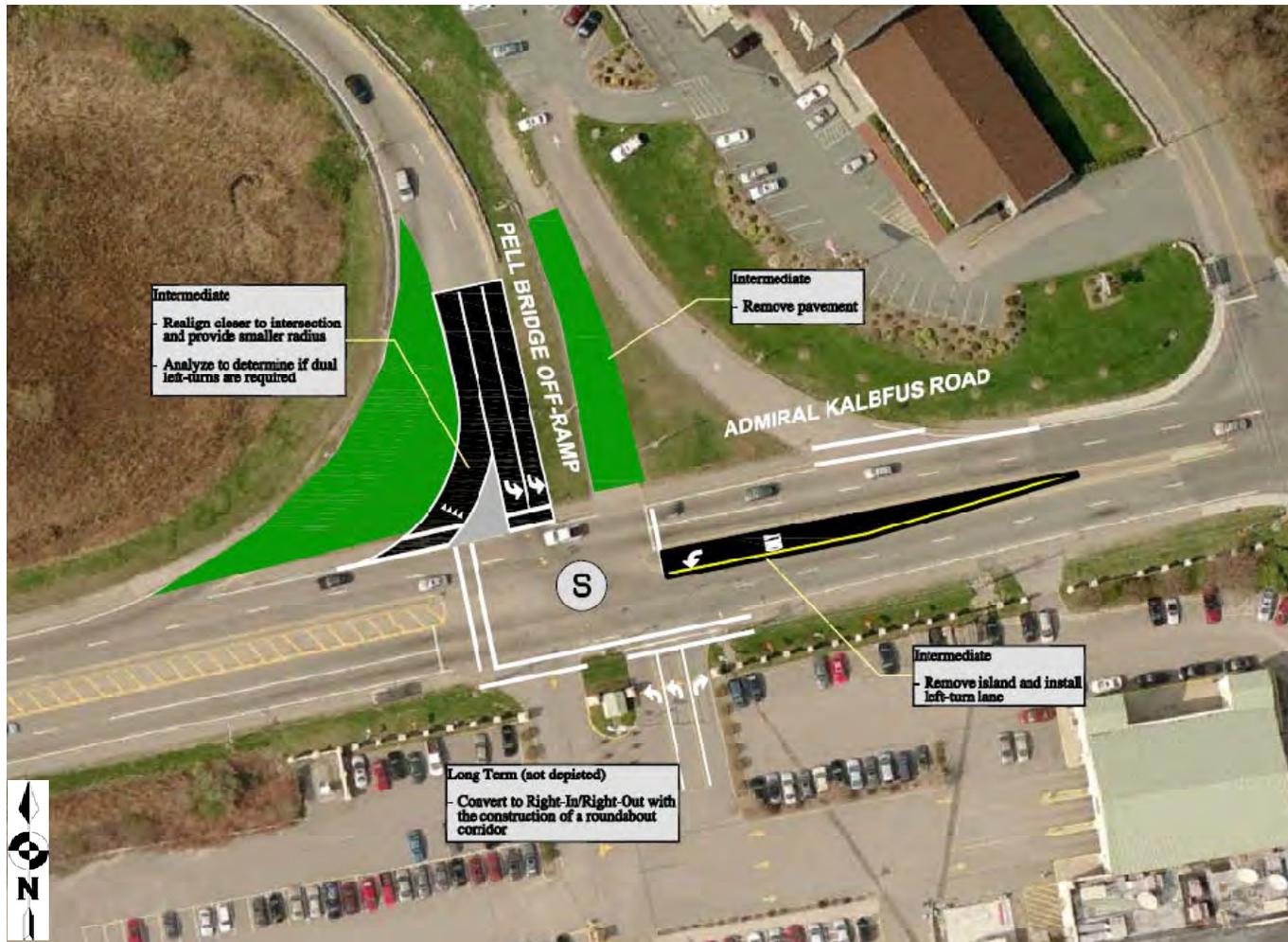
Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Figure 2-10 Admiral Kalbfus Road at Pell Bridge Off-Ramp/Newport Grand “Intermediate/Long” Term Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Table 2-6 Summary of Safety Issues and Suggestions for Existing Facilities Admiral Kalbfus Road at Malbone Road/Girard Avenue

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Heavy traffic volumes and turning movements to/from Malbone Road/Girard Avenue</p> <p>- The traffic entering/exiting Malbone Road/Girard Avenue experience delays during peak periods.</p>	 <p><i>Photo illustrates the heavy traffic volumes experienced at the intersection, looking eastbound toward the intersection</i></p>	<p>- Perform turning movement counts during the summer months and perform capacity analysis.</p>				<p>- Perform a traffic signal warrant analysis to determine if installation of a traffic signal can be justified or if installation of a roundabout would be beneficial.</p>
2	<p>Eastbound two lane approach tapers to one lane through the intersection</p> <p>- The roadway traveling eastbound tapers through the intersection from two lanes to one lane increasing the number of conflict points at the intersection.</p>	 <p><i>Photo shows the taper along Admiral Kalbfus Road from 2 lanes to 1 lane through the Malbone Road/Girard Road intersection.</i></p>					<p>- Consider reconstructing the eastbound departure to accommodate two lanes that taper to one lane.</p> <p>- Convert the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Large radii on all corners</p> <p>- There are large radii on all corners creating a wide open intersection. This makes it difficult for pedestrians and motorists to cross the intersection. Motorists were observed to wait far in advance of the stop bar on the minor street approaches to squeeze through a gap in traffic. The large radii also results in high turning speeds which may increase risk to pedestrians crossing.</p>	 <p><i>Photo shows the large radius along all four corners of the intersection, leading to high turning speeds and longer pedestrian crossings.</i></p>				<p>- Reconstruct small corner radii.</p>	<p>- Convert the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>ADA ramps are located around the corners on Malbone Road and Girard Avenue</p> <p>- The ADA ramps on the northbound and southbound approaches are set back from the intersection at locations motorists may not be expecting to find pedestrians crossing. Furthermore, the locations of the ramps are at locations where turning vehicles are typically accelerating, thus, potentially reducing motorist yielding to pedestrians.</p>	 <p><i>Photo illustrates the existing ADA ramps located south of the intersection, along Malbone Road, which are designed to serve pedestrians walking along Admiral Kalbfus Road.</i></p>	<p>- Install TURNING VEHICLES YIELD TO PEDESTRIANS on the Admiral Kalbfus Road approaches to the intersection to warn drivers of the crossings beyond the immediate intersection.</p>			<p>- Reduce turning radii, which will shorten the pedestrian crossings and relocate the ADA ramps and pedestrian crossings at the intersection.</p>	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
5	<p>High travel speeds on the eastbound and westbound approaches</p> <p>- Travel speeds on the eastbound approach are higher than the 25 mph posted speed limit due to vehicles racing from the Pell Bridge Off-Ramp/Newport Grand to the merge through the Girard Avenue/Malbone Road intersection. On the westbound approach, there is a significant down slope resulting in vehicles traveling higher than the 25 mph legal speed limit.</p>	 <p><i>Photo illustrates the down slope on westbound Admiral Kalbfus Road, leading to high speeds.</i></p>	<p>- Install 25 MPH speed limit signs on the eastbound and westbound approaches. Use portable speed feedback signs to alert motorists of their speeds.</p>	<p>- Increase police enforcement of speed limit. The only posted speed limits are located on the intersection departures.</p>			<p>- Convert the intersection to a modern roundabout as part of the Admiral Kalbfus Road roundabout corridor.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Restricted sight distance on side streets</p> <p>- In addition to the horizontal curvature, there is also a vertical upgrade on the east side of the intersection that impacts the sight distance of vehicles particularly on the northbound approach.</p>	 <p><i>Photo illustrates the restricted sight distance for vehicles exiting Malbone Road looking east.</i></p>					<p>- Consider geometric improvements and/or consider installation of a traffic signal or roundabout.</p>
7	<p>Heavy vehicle restriction sign poorly located</p> <p>- There is a sign restricting heavy vehicles from traveling south on Malbone Street that is located too far around the corner and south of the intersection to notify heavy vehicles before they turn.</p>	 <p><i>Photo illustrates the location of the heavy vehicle restriction sign on Malbone Street.</i></p>	<p>- Consider relocating the signs restricting heavy vehicles from traveling south on Malbone Street.</p>				



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Figure 2-11 Admiral Kalbfus Road at Girard Avenue/Malbone Road “Near” Term Conceptual Improvements/Recommendations



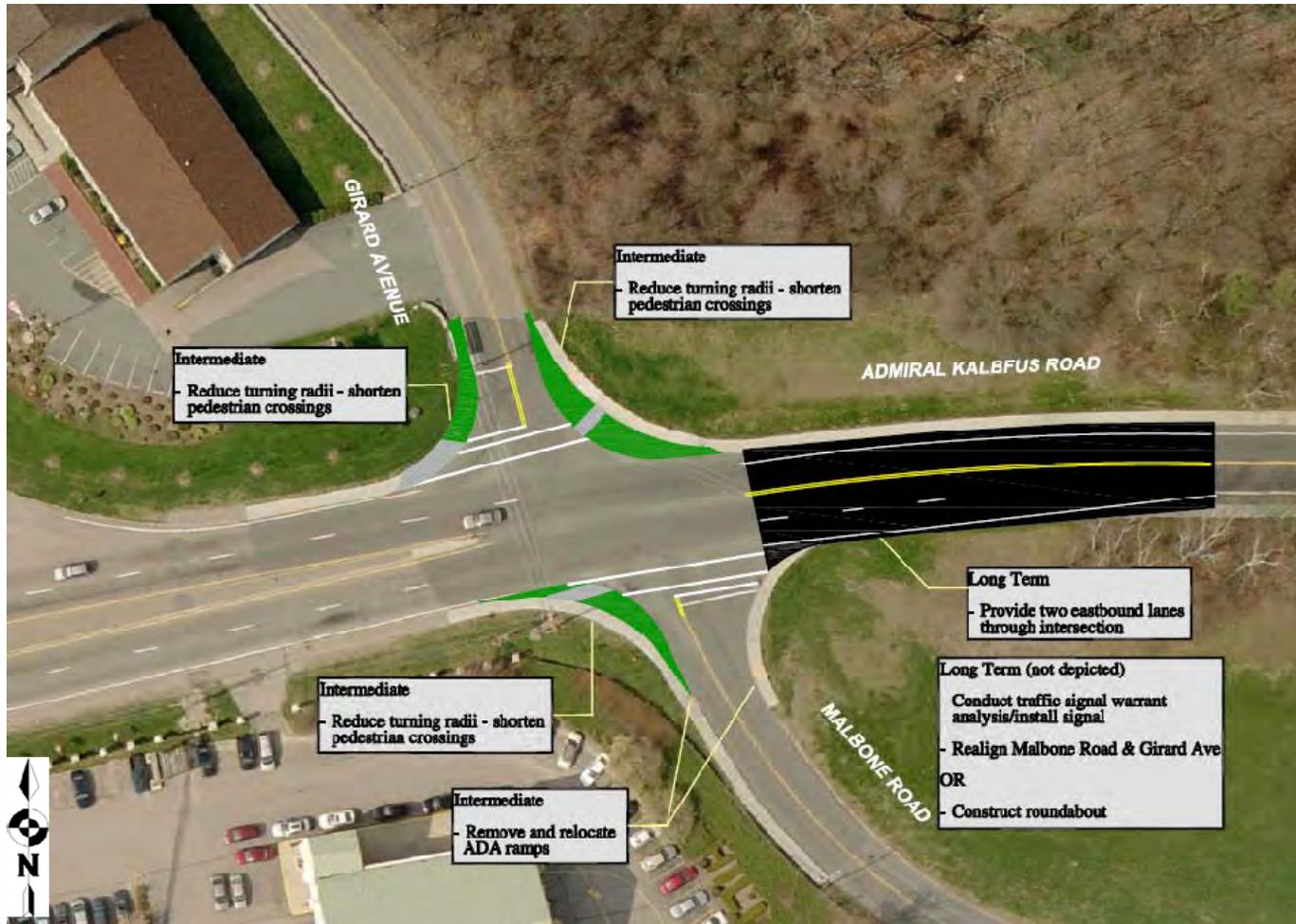
Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Figure 2-12 Admiral Kalbfus Road at Girard Avenue/Malbome Road “Intermediate/Long” Term Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Table 2-7 Summary of Suggestions for Conceptual Improvements

SUGGESTIONS ON THE CONCEPTUAL DESIGN OF ADMIRAL KALBFUS ROAD	
<p>Consider adding a third roundabout at the Malbone Road/Girard Avenue intersection. Placing roundabouts at JT Connell and Malbone will create a "roundabout corridor" which will improve the traffic operations and safety for a longer segment. It was suggested that Admiral Kalbfus Road may be an ideal site for conversion to a roundabout corridor, which can provide good access management and speed management. It should be noted that the roundabout at Malbone Road is independent of the Pell Bridge interchange project.</p>	
<p>Incorporate lighting into the overall roundabout design to improve night-time visibility and driver awareness of the roundabout conditions.</p>	
<p>Emphasize deflection in the horizontal geometry of the approach legs to enhance the reduction in speed for oncoming vehicles.</p>	



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2.2 America's Cup Avenue



2.2.1 Existing Conditions

America's Cup Avenue is a primary route for tourists, providing access to hotels, restaurants, shops and Newport Harbor. Vehicular, pedestrian, and bicyclist traffic volumes in this corridor are seasonal with the highest volumes occurring during the summer months due to tourism. The sidewalk is generally in good condition consisting of a wide concrete walkway lined with a brick walk located between the curb and the concrete walk. The RSAs were performed at the intersections as shown in **Figure 2-13** and as discussed in the following section.

America's Cup Avenue at West Marlborough Street is a signalized intersection consisting of one exclusive left-turn lane, two through lanes, and a right-turn lane on the northbound approach; one exclusive left-turn, one through lane, and a shared through/right-turn lane on the southbound approach; one shared left-turn/through lane and one right turn lane on the eastbound approach and one multipurpose (left-turn/through/right-turn) lane on the westbound approach. Although the northbound right-turn is signed "No Right Turn on Red" many vehicles continue to turn on red. There are many pedestrians at this intersection during the peak tourist season associated with the Public Parking, Transportation and Visitors Center, Marriott Hotel, and Cardines Memorial Field (baseball field).

America's Cup Avenue at Thames Street Southbound is a signalized T-intersection consisting of two through lanes on the America's Cup Avenue northbound and southbound approaches and a left-turn lane and a channelized right-turn lane (under Yield control) on the Thames Street approach. The Thames Street right-turn movement is such a large radius that vehicles travel fast and do not slow down when entering America's Cup Avenue northbound. It was also observed that the traffic signal experiences an all-red phase (operating under one controller with the signal at Market Square).



Figure 2-13 America's Cup Avenue Study Area Corridor and Intersections



Source: Google Earth

America's Cup Avenue at Thames Street Northbound/Bowens Wharf is a signalized intersection consisting of a shared left-turn/through lane and a through lane on the America's Cup Avenue northbound approach; a through lane and a shared through/right-turn lane on the America's Cup Avenue southbound



approach; one multipurpose lane from Thames Street northbound; and one shared left-turn/right-turn lane on the Market Square eastbound approach.

America’s Cup Avenue at Bannisters Wharf/Pedestrian Crossing is a right-in/right-out unsignalized T-intersection. The median on America’s Cup Avenue prohibits vehicles from turning left into and out of West Pelham Street. There is a pedestrian crossing on the north side of the intersection.

America’s Cup Avenue at Thames Street/Memorial Boulevard is a T-intersection located on a curve. Southbound America’s Cup Avenue curves to the east turning into Memorial Boulevard. The America’s Cup Avenue southbound approach consists of one through lane curving to the left onto Memorial Boulevard and one right turn lane onto Thames Street southbound. The Memorial Boulevard westbound approach consists of one left-turn lane onto Thames Street southbound and two through lanes curving to the right onto America’s Cup Avenue northbound, south of the intersection. Thames Street is one-way southbound away from the intersection. Just north of the intersection, there is a southbound “u-turn” movement from an exclusive left-turn lane on America’s Cup Avenue southbound onto Thames Street northbound that is a signalized movement operating under the same controller. There is also a signalized “jug handle” located on the southeast corner of the intersection that allows vehicles traveling westbound on Memorial Boulevard to make u-turns. The signalized “jug handle” is located across the street from the U.S. Post Office driveway that is also signalized.



2.2.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT’s are summarized below in **Table 2-8** and are presented in vehicles per day (vpd):

Table 2-8 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
America’s Cup Avenue	10,400	West of Farewell Street

The overall delays and critical approaches/movements are listed below for the four signalized intersections with the study area corridor. The America’s Cup Avenue at Thames Street/Memorial Boulevard experiences the highest delays and queues throughout most of the day. Heavy pedestrian movements along Thames Street cause right-turning vehicles to yield, creating long queues and delays along



America’s Cup Avenue southbound. Also, vehicles yielding to pedestrians in the midblock crossing near Bannister’s Wharf often (during peak tourist season) queue into the Market Square/Thames Street signals. The overall intersection delay is shown below in **Table 2-9**.

Table 2-9 Calculated Intersection Delay

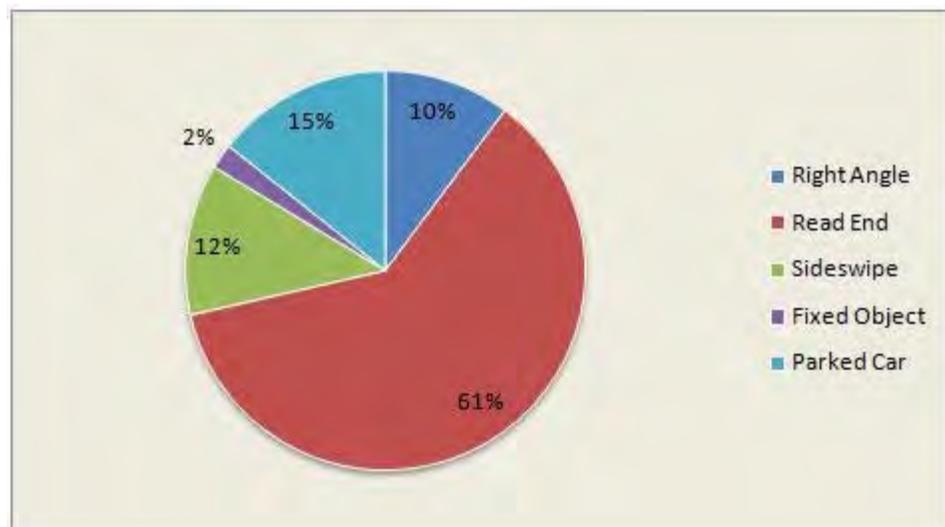
Subject Intersection – America’s Cup Avenue at	Intersection Delay (sec)	General Location of High Delays
West Marlborough Street	21.8	West Marlborough St/Marriot Driveway
Thames Street South	23.5	Thames Street Left-Turn
Market Square/Thames Street North	21.3	Thames Street North
Thames Street/Memorial Boulevard	34.2	America’s Cup to Thames Street South



2.2.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 50 crashes were reported along America’s Cup Avenue, at West Marlborough Street and between Market Square and Memorial Boulevard/Thames Street, with the majority (61%) being rear-end-type collisions. **Figure 2-14** illustrates the breakdown of crashes by collision type.

Figure 2-14 Collision Types





The majority of the rear-end crashes occurred at signalized intersection approaches. There were also two vehicle-pedestrian related crashes, in which one was a fatality at Bannister's Wharf. Other types of crashes were from vehicles conflicting with parked vehicles. At the West Marlborough Street intersection, seven crashes were from foul balls from the baseball field hitting vehicles parked adjacent to and traveling through the intersection.



2.2.4 Safety Benefits of Existing Roadway Features

Based on a review of existing site conditions, there are several positive characteristics of the roadway network when considered in terms of roadway safety:

- The corridor is well-lighted at night-time
- The midblock pedestrian crossing at Bannister's Wharf effectively accommodates pedestrian desire lines



2.2.5 Identified Safety Issues and Suggestions for Improvement

Despite the existing safety benefits noted, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to mitigate the safety concerns. The existing safety issues are summarized in **Tables 2-10 thru 2-15** and **Figures 2-15 thru 2-20**.



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Table 2-10 Summary of Safety Issues and Suggestions for Existing Facilities America's Cup Avenue at West Marlborough Street

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Long pedestrian crossings and pedestrian clearance times appear to be too short</p> <ul style="list-style-type: none"> - Crosswalks are skewed, increasing the crossing distance. As a result, pedestrian clearance times appear to be too short. 	 <p><i>Photo depicts the long pedestrian crossing on the north side of the intersection.</i></p>	<ul style="list-style-type: none"> - Check pedestrian clearance timings and change programmed timings to meet required minimum clearance times per MUTCD standards. - Perform capacity analysis to determine if the number of lanes at this intersection can be reduced. 			<ul style="list-style-type: none"> - Install new wheelchair ramps on the northeast corner and restripe crosswalks to reduce the crossing lengths. - Consider reducing the radii on all corners and bumping out the curb line on the southeast corner. 	<ul style="list-style-type: none"> - Reduce the number of lanes at the intersection if warranted.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Minimal pedestrian refuge area on the southeast corner and no crosswalk on south leg of intersection</p> <p>- There is little refuge area for pedestrians on the southeast corner of the intersection adjacent to the fire station and there is no marked crosswalk on the south leg of the intersection.</p>	 <p><i>Photo shows pedestrians crossing the south leg of the intersection, where no marked crosswalk exists.</i></p>	<p>- Perform capacity analysis to determine of the number of lanes at this intersection can be reduced.</p>			<p>- Consider bumping out the curb line on the southeast corner.</p>	<p>- Reduce the number of lanes at the intersection if warranted.</p>
3	<p>No pedestrian pushbuttons or pedestrian signal heads on the West Marlborough Street leg</p> <p>- No pedestrian pushbuttons or pedestrian signal heads currently exist on the West Marlborough Street east leg of the intersection.</p>	 <p><i>Photo illustrates the lack of pedestrian signal heads on the West Marlborough Street leg of the intersection.</i></p>				<p>- Install new pedestrian pushbuttons and pedestrian signal heads with countdown timers on the West .Marlborough Street east leg of the intersection.</p>	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Foul balls from baseball field sometimes strike vehicles</p> <p>- Based on the crash data and discussions with the fire department, foul balls from the baseball field sometimes hit vehicles parked near and traveling through the intersection.</p>	 <p><i>Photo shows the Cardines Memorial Field, where foul balls sometimes strike vehicles.</i></p>				Intermediate – Install a better backstop/netting that is possibly curved to prevent foul balls from leaving the park.	
5	<p>Narrow (3 foot wide) sidewalk adjacent to the fire station</p> <p>- There is only a 3 foot wide sidewalk in front of the fire station adjacent to the northbound approach.</p>	 <p><i>Photo shows the narrow sidewalk adjacent to the fire station, with pedestrian activity in this area.</i></p>	– Delineate crosswalks on all approaches including the installation of ADA compliant ramps.			– Consider widening sidewalk adjacent to the fire station to at least 5 feet.	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Lack of compliance to “NO RIGHT TURN ON RED” sign on northbound approach</p> <p>- Although the northbound right-turn is signed “No Right Turn on Red” many vehicles continue to turn on red.</p>	 <p><i>Photo shows vehicles from West Marlborough Street turning right on red onto America’s Cup Avenue. There is a “NO RIGHT TURN ON RED” posted on this approach.</i></p>		<p>– Increase police enforcement of no right-turn on red.</p>		<p>– Consider bumping out the curb line on the southeast corner.</p>	
7	<p>Fire pre-emption doesn’t meet needs of fire department</p> <p>– Based on conversations with the fire department, a new fire pre-empt is needed.</p>	 <p><i>Photo shows the existing pre-empt unit in the fire station.</i></p>				<p>– Consider installing a new fire pre-emption.</p>	



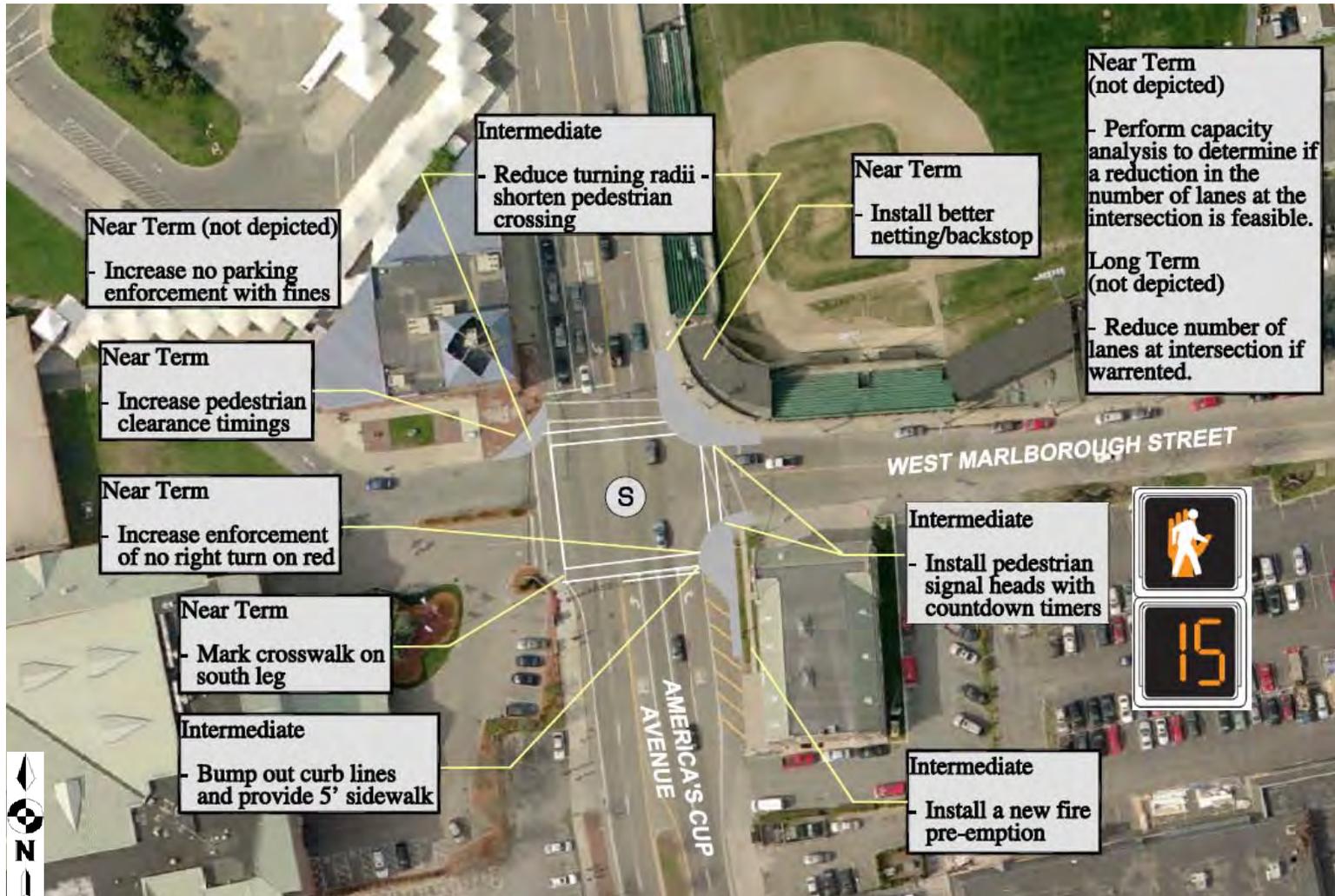
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
8	<p>Trucks park on southbound approach</p> <p>-Based on conversations with the City and observations in the field, there are trucks that park on the southbound approach blocking the right lane.</p>	 <p><i>Photo illustrates heavy vehicles parking along America's Cup Avenue, partially blocking the right travel lane.</i></p>	<p>- Consider replacing existing signs with new signs that include fines. This would require an ordinance.</p>	<p>- If new signs are installed, enforcement of No Parking restrictions will be important.</p>			



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Figure 2-15 America's Cup Avenue at West Marlborough Street Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Table 2-11 Summary of Safety Issues and Suggestions for Existing Facilities America’s Cup Avenue from Thames Street South to Memorial Blvd.

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>ADA issues</p> <p>- There are ADA issues along this corridor that restrict access for pedestrians with mobility limitations.</p>	 <p><i>Photo shows the stairs on the east side of the pedestrian crosswalk. There are other features along this corridor that are not ADA accessible</i></p>				<p>- Consider installing ADA-compliant ramps with detectable warning systems and marked crosswalks at all pedestrian crossings.</p>	<p>- Consider installing ADA-compliant ramps where stairs currently exist at locations along the corridor.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Outdated signs that do not meet MUTCD standards and small text on way-finding signs</p> <p>- There are outdated signs along the corridor that do not meet current MUTCD standards. The existing way-finding signs have small text sizes and are difficult to read.</p>	 <p><i>Photo shows sample of outdated signage along the corridor, which is not in compliance with MUTCD standards.</i></p>	<p>- Consider removing and replacing outdated signs along the corridor that do not meet current MUTCD standards.</p>			<p>- Consider installing new way-finding signs with larger text size that are easier to read.</p>	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Pedestrian countdown timers</p> <p>- There are no pedestrian countdown timers along the corridor.</p>	 <p><i>Photo shows typical pedestrian signal head along America's Cup Avenue corridor.</i></p>				<p>- Consider installing new countdown timers along the entire corridor as required by RIDOT policy and MUTCD standards.</p>	
4	<p>Trucks park on southbound lanes</p> <p>-Based on conversations with the City, there are trucks that park along America's Cup Avenue southbound.</p>	 <p><i>Photo illustrates delivery vehicles parking along America's Cup Avenue, partially blocking the right travel lane.</i></p>	<p>- Consider replacing existing signs with new signs that include fines. This may require an ordinance.</p>	<p>- If new signs are installed, enforcement of No Parking restrictions will be important.</p>			



Table 2-12 Summary of Safety Issues and Suggestions for Existing Facilities America's Cup Avenue at Thames Street South

			SPECIFIC NEAR TERM IMPROVEMENTS (1-6 MONTHS)			POTENTIAL INTERMEDIATE IMPROVEMENTS (6 MONTHS - 2 YEARS)	POTENTIAL LONG TERM IMPROVEMENTS (2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>No crosswalks or ADA ramps</p> <p>- There are no crosswalks across America's Cup Avenue between Market Square and Long Warf (approximately ¼ mile); therefore many pedestrians were observed crossing at the Thames Street southbound intersection (80 feet wide) where there are currently no pedestrian accommodations.</p>	 <p><i>Photo depicts a heavily used pedestrian crossing with no marked crosswalks, ADA compliant ramps, or pedestrian signal heads</i></p>	<p>- Install marked crosswalks with pedestrian signal heads and ADA ramps on the north leg of the intersection.</p>			<p>- Consider installing marked crosswalks and ADA ramps on the east leg and channelized right turn movement.</p>	



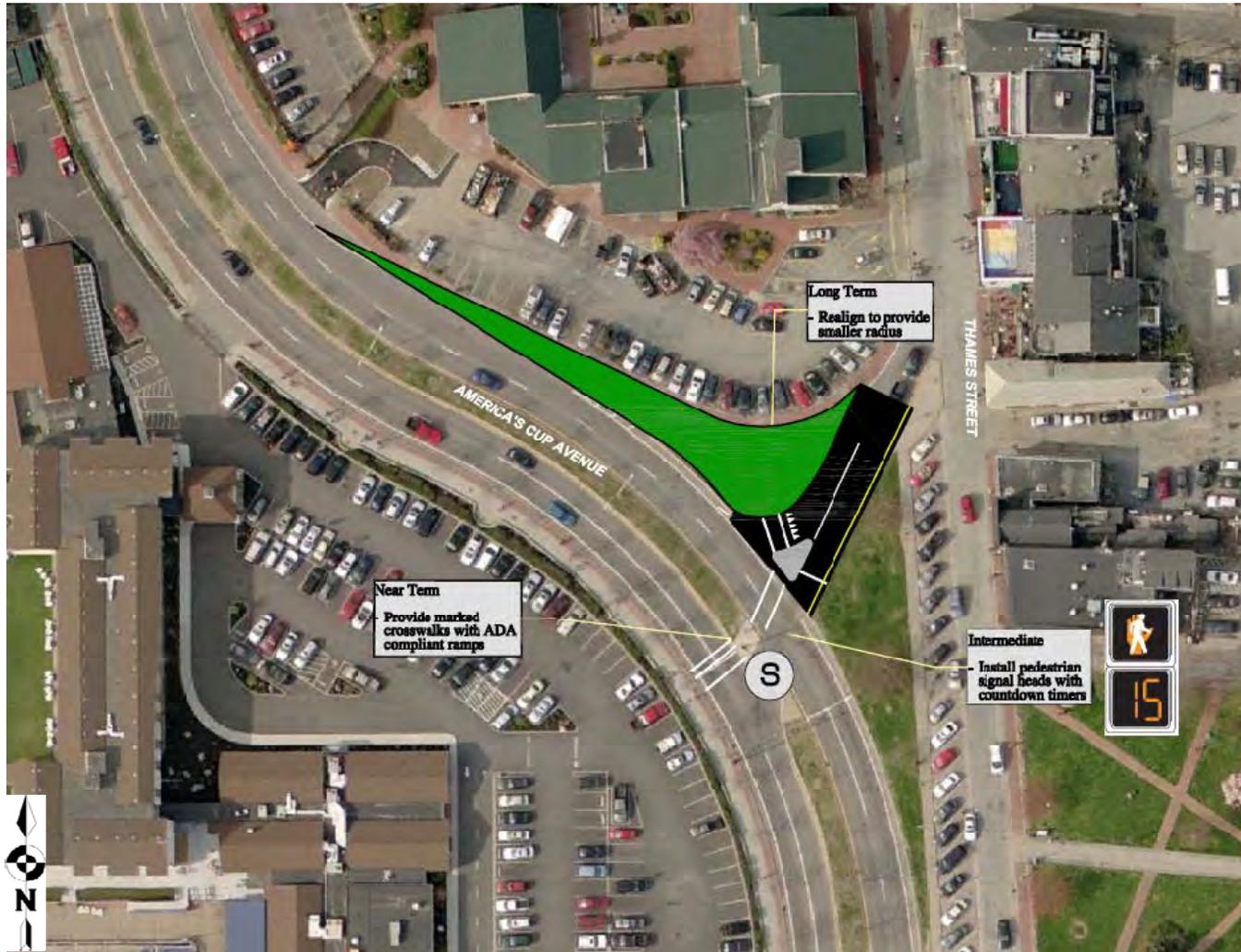
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Large radius and skewed angle of Thames Street right-turn movement</p> <p>- The Thames Street right-turn movement is such a large radius that vehicles travel fast and do not slow down when merging onto America's Cup Avenue northbound. The large radius results in vehicles entering America's Cup Avenue northbound at a sharp angle with a short merge area.</p>	 <p><i>Photo illustrates the sharp radius for the Thames Street northbound movement to America's Cup Avenue northbound.</i></p>	<p>- Consider removing and replacing outdated signs along the corridor that do not meet current MUTCD standards.</p>				<p>- Consider realigning the right-turn to provide a smaller radius.</p>



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Figure 2-16 America's Cup Avenue at Thames Street South Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Table 2-13 Summary of Safety Issues and Suggestions for Existing Facilities America's Cup Avenue at Market Square/Bowens Wharf

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Lack of ADA compliant pedestrian accommodations on the east side of the intersection</p> <p>- There are pedestrian and ADA access issues that should be addressed on the east side of the intersection to provide access to/from the east side of Thames Street.</p>	 <p><i>Photo shows no pedestrian accommodations on the east side on the intersection. There are no delineated crosswalks, ADA compliant ramps, or pedestrian signal heads.</i></p>				- Install ADA ramps.	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Lack of connectivity for pedestrians</p> <p>- The predominate desire line for pedestrians crossing America's Cup Avenue and Thames Street is to cross through queuing traffic.</p>	 <p><i>Photo shows pedestrians crossing Thames Street between stopped vehicles.</i></p>				<p>- Install marked crosswalks and accessible facilities to accommodate pedestrian desire lines and reduce conflicts between motorists and pedestrians. This may require the relocation of the utility cabinet on the island.</p>	



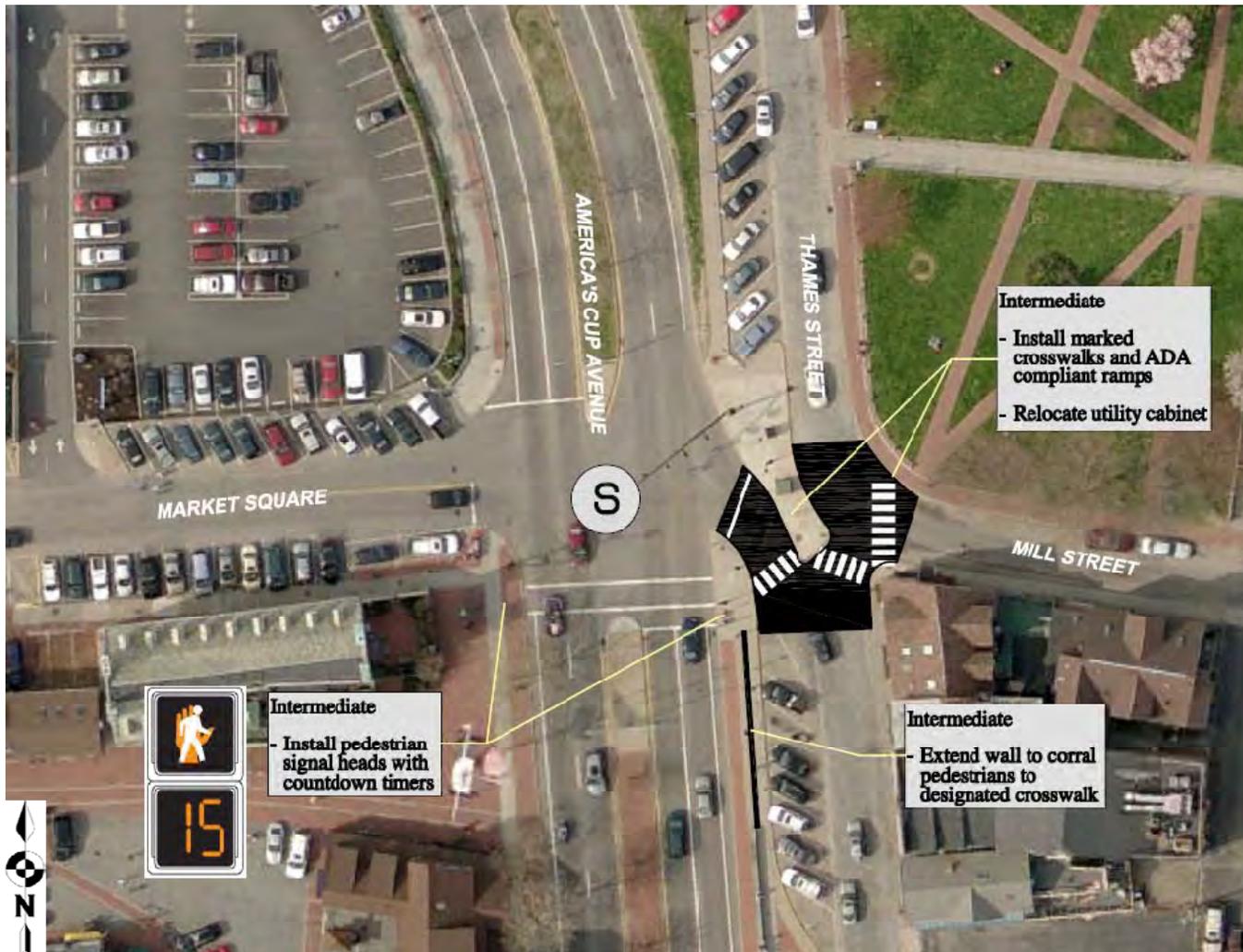
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Pedestrians cross south leg of intersection outside of crosswalk</p> <p>- The wall on the east side of the roadway ends approximately 75 feet south of the intersection resulting in pedestrians crossing on the south leg of the intersection and not at the pedestrian crossing.</p>	 <p><i>Photo shows the end of the wall along the east side of America's Cup Avenue between Memorial Blvd and Market Square. Pedestrians often cross at the terminus of the wall rather than the upstream crosswalk</i></p>				<p>- Extend the wall to corral pedestrians to the designated crosswalk at the intersection.</p>	



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Figure 2-17 America's Cup Avenue at Market Square/Bowens Wharf Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Table 2-14 Summary of Safety Issues and Suggestions for Existing Facilities America's Cup Avenue at Bannisters Wharf

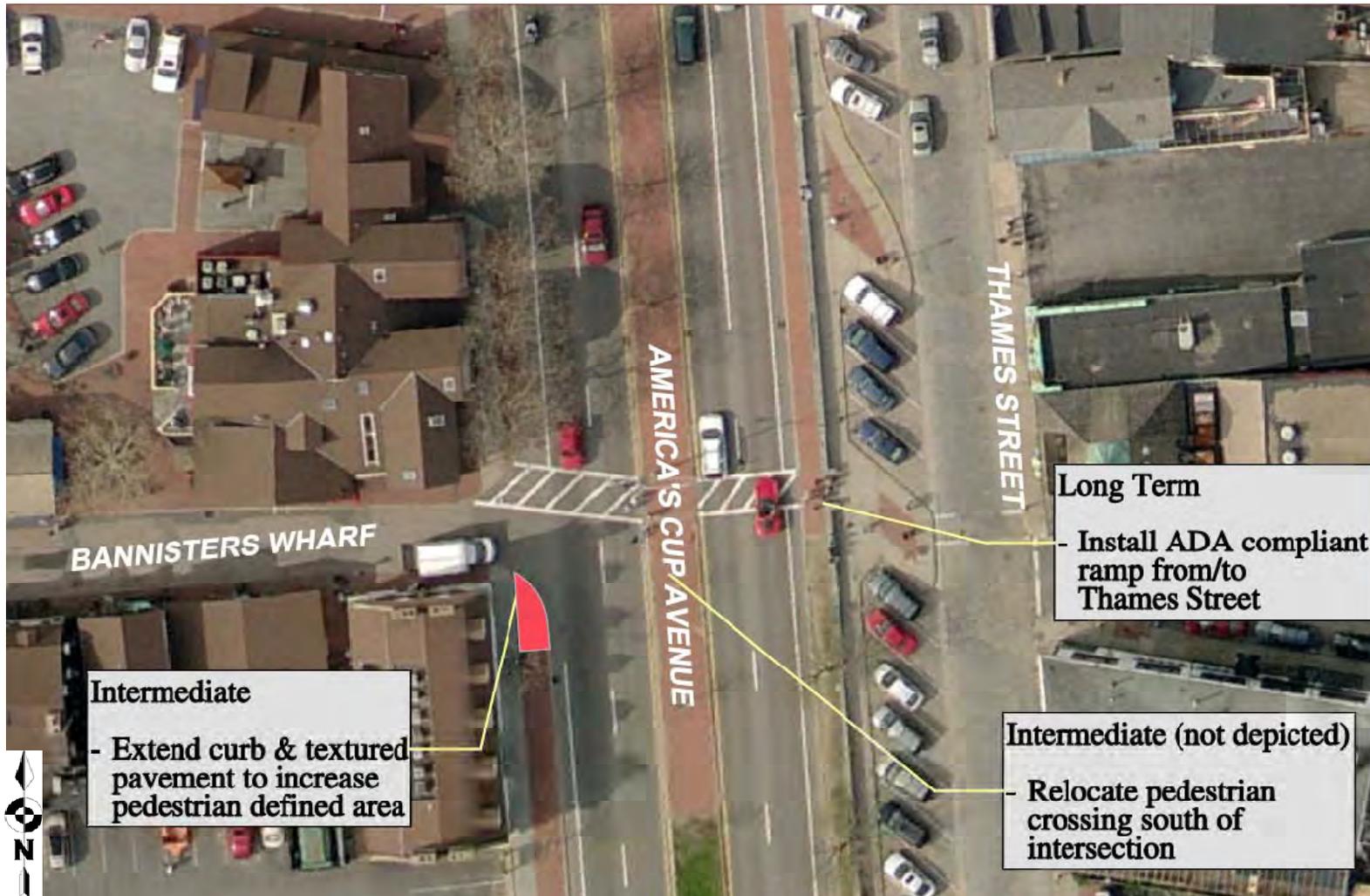
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Poor sight distance on west side of road at crosswalk due to trees lining the roadway</p> <p>- There are trees along the west side of America's Cup Avenue that obstruct the sight distance of pedestrians attempting to cross the roadway.</p>	 <p><i>Photo illustrates the view of vehicles/pedestrian looking north out of Bannister's Wharf. There is limited sight distance due to the row of trees in the sidewalk</i></p>				<p>- Consider relocating the crosswalk to the south leg of the West Pelham Street intersection. This would improve the sight distance looking north at the crosswalk. The crosswalk would not line up with the stairs on the east side of the road; therefore, some type of channelization should be considered.</p>	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Stairs on east side of pedestrian crosswalk are not handicap accessible</p> <p>- There are ADA issues on the east side of the road where there are currently stairs leading to Thames Street.</p>	 <p><i>Photo shows the stairs on the east side of the pedestrian crosswalk. The stairs are not ADA accessible.</i></p>					<p>- Consider installing a ramp that is ADA compliant on the east side of the roadway.</p>
3	<p>Continuity of pedestrian zones</p> <p>- The waiting area for pedestrians on the southwest corner is not clearly defined which could contribute to conflicts between pedestrians and vehicles. This condition is exacerbated by the limited sight distance around the building corner and the trees to the north that are in the sight triangle for vehicles exiting the side street.</p>	 <p><i>Photo showing limited waiting area and sight distance for pedestrians on the southwest corner of the intersection.</i></p>				<p>- Extend textured pavement to corner to increase pedestrian defined areas and increase visibility of pedestrians for vehicles turning out of the side street.</p>	



Figure 2-18 America's Cup Avenue at Bannisters Wharf Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Table 2-15 Summary of Safety Issues and Suggestions for Existing Facilities America's Cup Avenue at Memorial Boulevard/Thames Street

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Lack of pedestrian crosswalks</p> <p>- There is only one delineated crosswalk on the west leg of the wide intersection. This intersection is one of the busiest for both vehicles AND pedestrians</p>	  <p><i>Photos show pedestrians crossing where no crosswalks exist.</i></p>				<ul style="list-style-type: none"> - Stripe crosswalks and install pedestrian signal heads with countdown timers. - Install landscaping/hardscaping to deter pedestrian from crossing at unauthorized areas. - Add pedestrian signal heads and exclusive pedestrian phase. 	<ul style="list-style-type: none"> - Remove the "Jug-Handle" and convert to a pedestrian refuge area. This will shorten pedestrian crossings, and extend the left-turn lane storage from Memorial Boulevard onto Thames Street southbound. However, this concept would restrict access to the Post-Office to right-in/right-out. Coordination will be necessary to determine if this concept is feasible.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Broken pedestrian equipment</p> <p>- The pedestrian pushbutton on the southwest corner is broken</p>	 <p><i>Photo shows a broken pedestrian push button located on the southwest corner of the intersection.</i></p>	- Replace the pedestrian pushbutton on the southwest corner.				



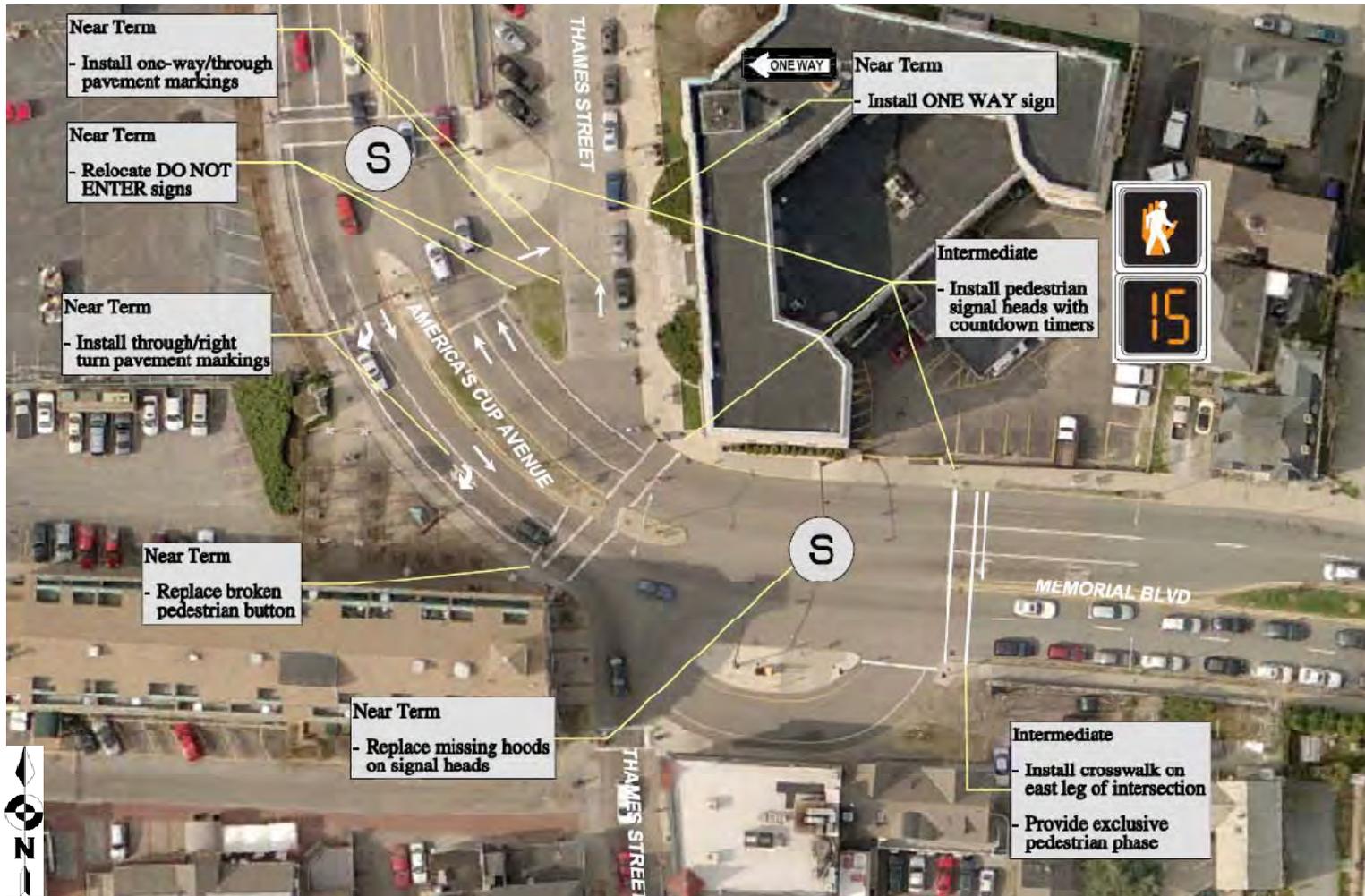
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Missing hoods on traffic signal heads</p> <p>- There are no hoods on the traffic signal heads on America's Cup Avenue at the U-turn.</p>	 <p><i>Photo shows the existing traffic signal heads with missing hoods</i></p>	<p>- Replace missing hoods or replace entire signal heads.</p>				
4	<p>Signs poorly located resulting in driver confusion</p> <p>- The "DO NOT ENTER" sign located at the entrance to the Thames Street northbound from the southbound America's Cup Avenue U-turn movement was observed to cause some confusion with motorists.</p>	 <p><i>Photo shows the "DO NOT ENTER" signs located at the Thames Street northbound entrance from America's Cup Avenue southbound. This can cause confusion for vehicles making this movement.</i></p>	<p>- Improve signage to help guide vehicles through one-way Thames Street. See Figure 3-7 for details on sign type and location.</p>				



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Figure 2-19 America's Cup Avenue at Memorial Blvd/Thames Street "Near/Intermediate" Term Conceptual Improvements/Recommendations



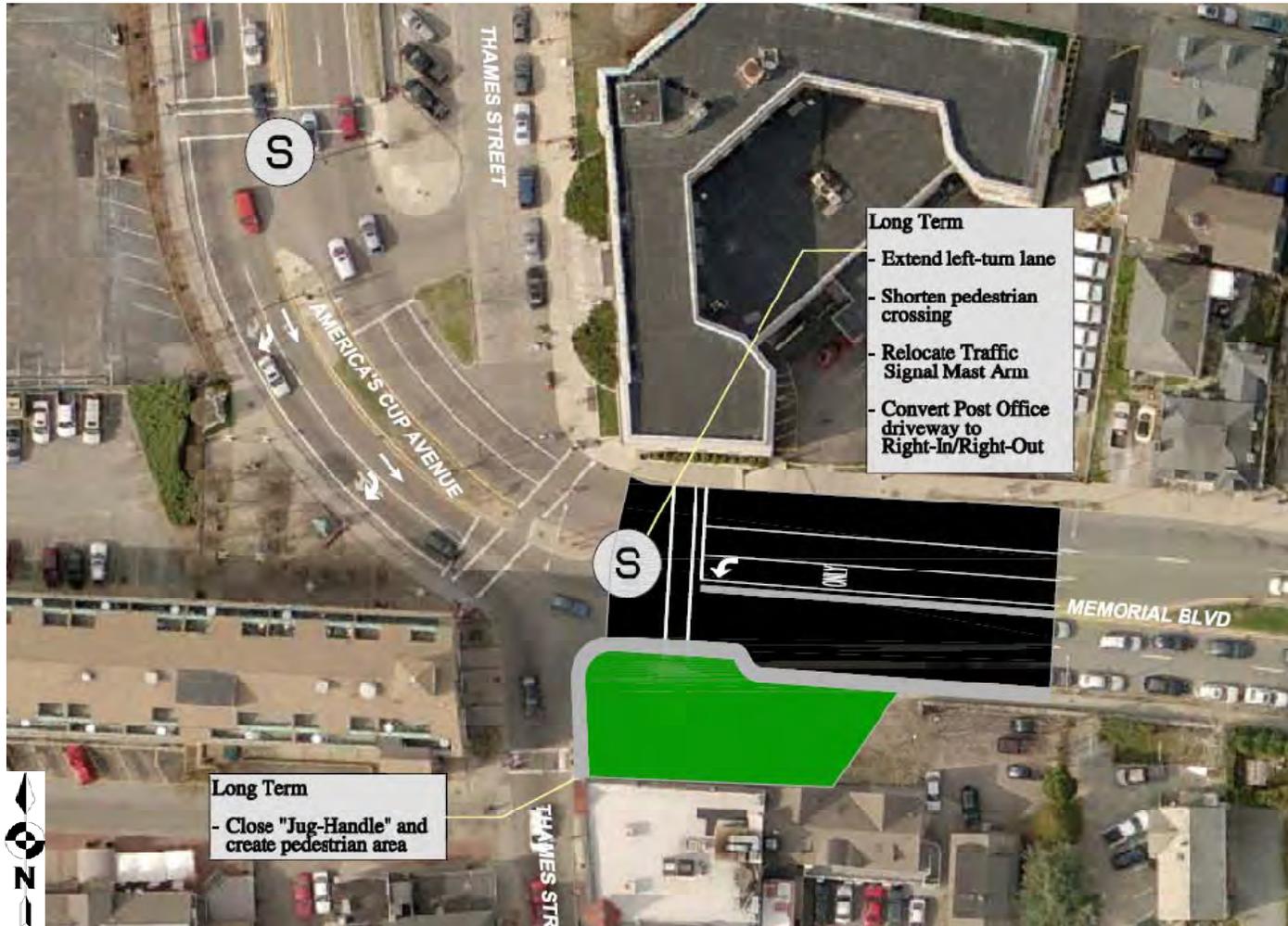
Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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Figure 2-20 America's Cup Avenue at Memorial Blvd/Thames Street "Long" Term Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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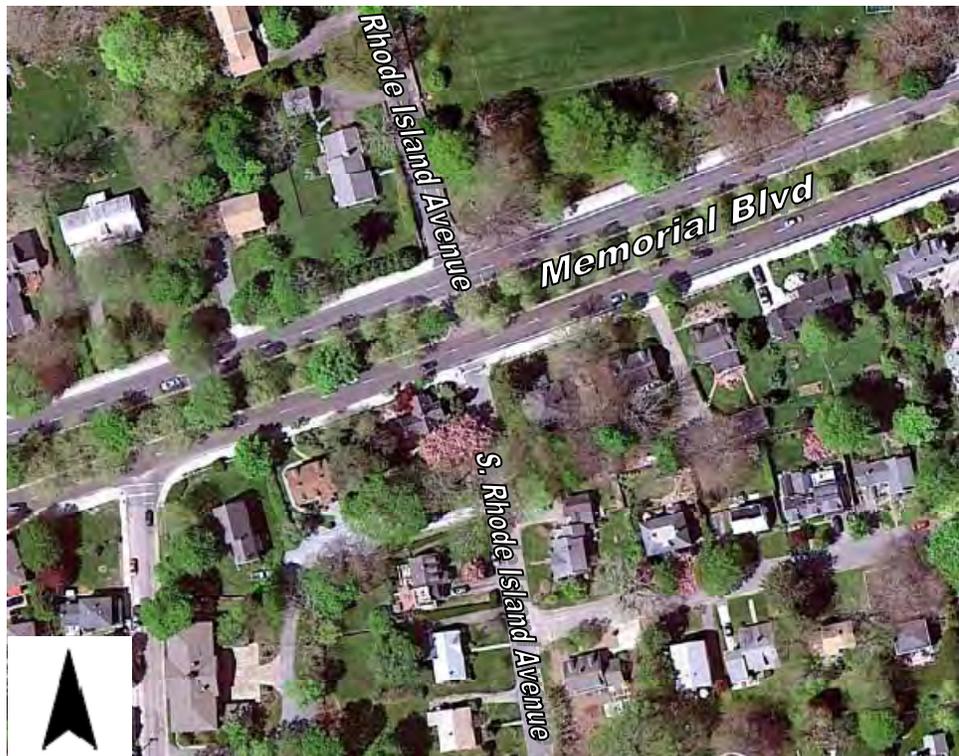
2.3 Memorial Boulevard at Rhode Island Avenue



2.3.1 Existing Conditions

Memorial Boulevard is a primary route connecting Downtown Newport to Newport's Mansions and Easton's Beach. The roadway consists of two lanes in each direction for most of its length with some areas consisting of one travel lane with on-street parking. The pavement width on Memorial Boulevard within the study area is approximately 28 feet wide. This wide roadway width and straight alignment results in vehicles traveling at 40 to 45 mph. The speed limit is not posted; therefore the legal speed limit on roadways that are not posted in Newport is 25 mph. There is a median along most of the roadway ranging from a few feet to 40 feet wide. An RSA was performed at the intersection as shown in **Figure 2-21** and as discussed in the following section.

Figure 2-21 Memorial Boulevard at Rhode Island Avenue Intersection



Source: Google Earth



Memorial Boulevard at Rhode Island Avenue is an unsignalized intersection consisting of one shared left-turn/through lane and one shared through/right-turn lane on the Memorial Boulevard eastbound/westbound approaches and one multipurpose (left-turn/through/right-turn) lane on the Rhode Island Avenue northbound/southbound approaches. The northbound and southbound approaches are controlled by stop signs. There is a 35+ foot wide median lined with two rows of trees in the center of Memorial Boulevard.

There are marked crosswalks across the Rhode Island Avenue northbound/southbound approaches; however there are no crosswalks across Memorial Boulevard. The pavement markings on Memorial Boulevard are not consistent. The outside/right lane on Memorial Boulevard eastbound/westbound is 15 feet wide on the west side of the intersection and 12 feet wide with a 3 foot shoulder east of the intersection.



2.3.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT's are summarized below in **Table 2-16** and are presented in vehicles per day (vpd):

Table 2-16 Daily Traffic Volumes

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
Memorial Boulevard	22,400	East of Rhode Island Avenue

There was no traffic volume data available for the unsignalized intersection of Memorial Boulevard with Rhode Island Avenue.



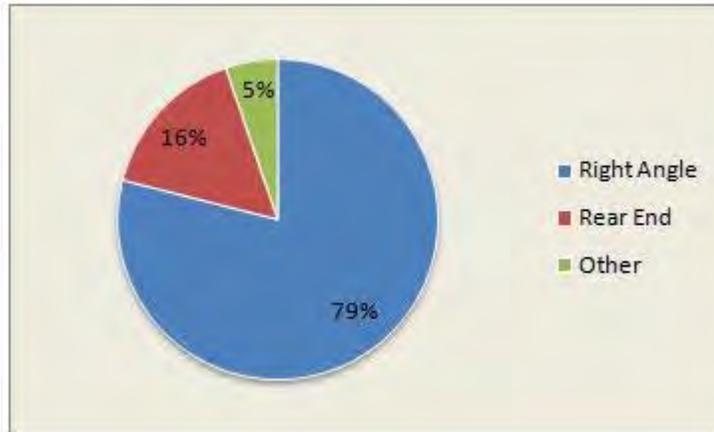
2.3.4 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, 19 crashes were reported at the Memorial Boulevard intersections with Rhode Island Avenue. **Figures 2-22** illustrates the breakdown of the crashes by collision type.



The majority of collisions (79%) at the Memorial Boulevard intersections with Rhode Island Avenue were angle related collisions, typical of unsignalized intersections with heavy turning movements. There were also two vehicle- bicycle collisions.

Figure 2-22 Collision Type – Memorial Blvd/Rhode Island Avenue



2.3.5 Identified Safety Issues and Suggestions for Improvement

The RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to mitigate the safety concerns. The RSA team noted that some of the issues and suggestions for improvements at this intersection may be applicable to other unsignalized intersections along Memorial Boulevard. The existing safety issues are summarized in **Table 2-17** and **Figure 2-23**.



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Table 2-17 Summary of Safety Issues and Suggestions for Existing Facilities Memorial Boulevard at Rhode Island Avenue

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>High travel speeds along Memorial Boulevard</p> <p>- The Memorial Blvd eastbound and westbound approaches are approximately 28 feet wide. This wide width and straight alignment results in vehicles traveling at 40 to 45 mph. The speed limit is not posted; therefore the legal speed limit in Newport is 25 mph. There is also a large speed differential between vehicles traveling through the intersection and turning vehicles which was identified as a safety concern in the field.</p>	 <p><i>Photo depicts the wide travel lanes along Memorial Boulevard.</i></p>	<ul style="list-style-type: none"> - Consider installing speed limit signs. - Consider restriping Memorial Boulevard as the following cross-section: a one foot offset from the median, two 11 foot travel lanes and a 5 foot shoulder. The narrower travel lanes may help reduce speeds and the 5 foot shoulder will provide better accommodations for bicycles. 	<ul style="list-style-type: none"> - Increase police patrols and enforcement of speed limit. 			



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Queue spill back in median blocks other movements</p> <p>- Vehicles queued in the median often extend into and block the eastbound/westbound through lanes. These queues also block vehicles traveling in the other direction crossing the median.</p>	 <p><i>Photo illustrates vehicle queues from the median extending into the Memorial Boulevard travel lane.</i></p>	<p>- Consider installing intersection warning signs in advance of the intersection.</p>				<p>- Consider removing a few trees on each of the approaches to develop a short left turn pocket on the eastbound/westbound approaches.</p>
3	<p>Narrow width of median opening</p> <p>- The width of the opening in the median is only 25± feet wide..</p>	 <p><i>Photo illustrates vehicle taking up the entire median opening.</i></p>				<p>- Consider widening the median opening.</p>	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>U-turns traveling on wrong side of roadway</p> <p>- Some U-turning traffic was observed traveling on the left side of the roadway as they passed through the opening in the median which is undelineated. This resulted in vehicle conflicts and queues.</p>	 <p><i>Photo shows a vehicle on the wrong side of the median opening while making a turn onto Memorial Boulevard southbound.</i></p>	<p>- Consider striping a double yellow centerline in the median and stop bar.</p>				
5	<p>Sight distance of vehicles in median obstructed by eastbound/westbound vehicles slowing to make left-turns</p> <p>- The sight distance of vehicles in the median is also obstructed by eastbound/westbound vehicles that are slowing to turn left.</p>	 <p><i>Photo shows the limited sight distance vehicles making a turn into Rhode Island Avenue from Memorial Boulevard southbound have.</i></p>	<p>- Consider installing intersection ahead signs on Memorial Boulevard eastbound/westbound approaches to alert motorists of entering traffic.</p>				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Drivers' attention diverted</p> <p>- Drivers on the Rhode Island Avenue northbound and southbound approaches looking left for a gap in traffic sometimes do not see pedestrians crossing from the right.</p>	 <p><i>Photo shows the direction a driver would be looking when looking for a gap in the Memorial Boulevard traffic. The drivers sometimes don't look for pedestrians attempting to cross from their right.</i></p>	<p>- Consider adding signs on the Rhode Island Avenue approaches alerting drivers to look both ways for pedestrians crossing.</p>				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
7	<p>No delineated crosswalks on Memorial Boulevard eastbound or westbound approaches</p> <p>- There are striped crosswalks across the Rhode Island Avenue northbound/southbound approaches; however, there are no crosswalks across Memorial Boulevard.</p>	 <p><i>Photo illustrates the lack of delineated crosswalks across Memorial Boulevard.</i></p>				<p>- Consider performing a study during the summer months to determine the most appropriate locations for pedestrians to cross Memorial Boulevard along the corridor. Also consider performing traffic counts during the summer to see if signalization of the intersection is warranted.</p>	
8	<p>Vehicles stop in crosswalks</p> <p>- Vehicles often stop in the crosswalks because the sight distance is limited due to walls and vegetation.</p>	 <p><i>Photo shows a vehicle stopped in the crosswalk on the Rhode Island Avenue leg.</i></p>	<p>- Trim vegetation.</p>				



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Figure 2-23 Memorial Blvd at Rhode Island Avenue Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008).



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2.4 Memorial Boulevard at Bellevue Avenue



2.4.1 Existing Conditions

Memorial Boulevard is a primary route connecting Downtown Newport to Newport's Mansions and Easton's Beach. The roadway consists of two lanes in each direction for most of its length with some areas consisting of one travel lane with on-street parking. The pavement width on Memorial Boulevard within the study area is approximately 28 feet wide. This wide roadway width and straight alignment results in vehicles traveling at 40 to 45 mph. The speed limit is not posted; therefore the legal speed limit on roadways that are not posted in Newport is 25 mph. There is a median along most of the roadway ranging from a few feet to 40 feet wide. An RSA was performed at the intersections as shown in **Figure 2-24** and as discussed in the following section.

Figure 2-24 Memorial Boulevard at Bellevue Avenue Intersection



Source: Google Earth



Memorial Boulevard at Bellevue Avenue is a signalized intersection consisting of a left-turn lane, one through lane and a shared through/right-turn lane on the eastbound approach; a left-turn lane, one through lane and an exclusive right-turn lane on the westbound approach; a left-turn lane and a shared through/right-turn lane on the northbound approach; and a left-turn lane and a shared through lane with a channelized right-turn on the southbound approach. The pavement markings are faded and generally in poor condition and the street name signs are not visible.

The northbound and southbound left-turn movements are permissive movements (not protected with a left-turn arrows and phases). Bicycles were observed traveling through the intersection randomly and in unexpected locations both on street and on the sidewalk.



2.4.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT's are summarized below in **Table 2-18** and are presented in vehicles per day (vpd):

Table 2-18 Daily Traffic Volumes

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
Memorial Boulevard	22,400	East of Rhode Island Avenue

The overall delay and problem approaches/movements are listed below for the Memorial Boulevard/Bellevue Avenue intersection. The intersection overall operates with acceptable calculated delays. As previously mentioned, conflicts occur on the northbound and southbound left-turn movements, due to permissive movements and heavy pedestrian activity especially during peak tourist periods. These conflicts result in actual delays that are much larger than the calculated delays. The overall intersection delays are shown below in **Table 2-19**.

Table 2-19 Calculated Intersection Delay

Subject Intersection	Intersection Delay (sec)	General Location of Issues
Memorial Boulevard at Bellevue Avenue	16.5	North/South Left-Turns

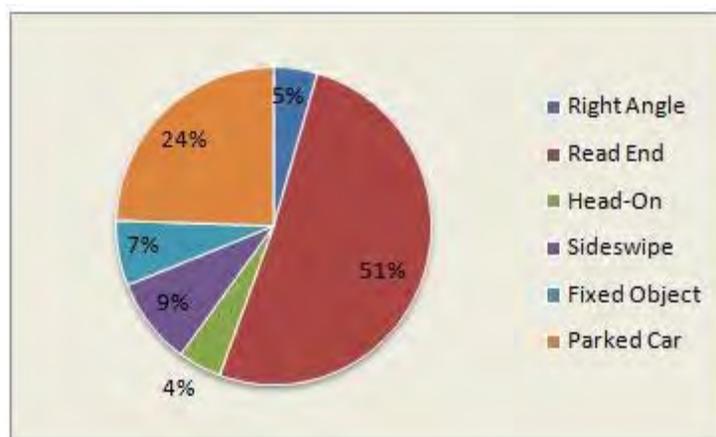


2.4.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, 47 crashes were reported at the Memorial Boulevard intersection with Bellevue Avenue. **Figure 2-25** illustrates the breakdown of the crashes by collision type.

The majority of the collisions at the Memorial Boulevard intersection with Bellevue Avenue were rear-end related collisions (51%). Another type of reoccurring accident at this intersection was from vehicles sideswiping parked vehicles along Memorial Boulevard.

Figure 2-25 Collision Type – Memorial Blvd/Bellevue Ave



2.4.4 Proposed Designs

A study has been performed by the State Traffic Commission determining that the protected left-turn movements are feasible on the Bellevue Avenue approaches to the Memorial Boulevard intersection. This project is currently scheduled on the RIDOT TIP.



2.4.5 Assessment Findings

2.4.5.1 Safety Benefits of Existing Roadway Features

Based on a review of existing site conditions, there are several positive characteristics of the roadway network when considered in terms of roadway safety:

- There is currently a landscaped area between the curb and the sidewalk along the north side of the Memorial Boulevard westbound approach to Bellevue Avenue. This pedestrian walkway leads to a seasonal farmers market, located on the east side of the intersection.

2.4.5.2 Safety Benefits of Traffic Signal Improvements

Protected Left-Turn Movements on Bellevue Avenue:

- Implementation of left-turn phasing on the northbound/southbound approaches to the intersection will improve the safety at this intersection.



2.4.6 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to mitigate the safety concerns. The existing safety issues are summarized in **Table 2-20** and **Figure 2-26**.



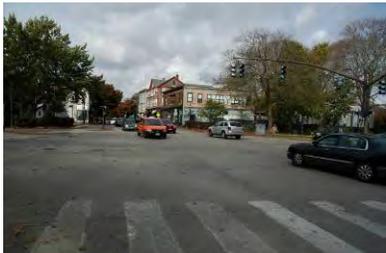
Table 2-20 Summary of Safety Issues and Suggestions for Existing Facilities Memorial Boulevard at Bellevue Avenue

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Large corner radii</p> <p>- There are large radii on the northwest and southwest corners resulting in high turning speeds.</p>	 <p><i>Photo illustrates the large radii on the southwest corner of the intersection, causing turning vehicles to make high speed turns.</i></p>	<p>- Restripe around curves and consider installing textured pavement to reduce curve radii as a temporary solution.</p>			<p>- Revise curb line to reduce the radii and consider installing bump-outs to reduce pedestrian crossing widths. Consider eliminating the island on the northwest corner and reducing the corner radius.</p>	
2	<p>Existing pedestrian clearance times are too short</p> <p>- There are also long skewed crosswalks and the pedestrian clearance times appear to be too short.</p>	 <p><i>Photo illustrates the long crosswalk on the west leg of the intersection. The center refuge island is small and can't accommodate many pedestrians at one time.</i></p>	<p>- Recalculate and revise the pedestrian clearance times in the controller.</p>				

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Pedestrian buttons are broken and poorly located</p> <p>- The pedestrian pushbuttons are poorly located; for example, the button on the southeast corner is located on the wrong side of the pole. The pedestrian pushbutton on the island located on the northwest corner is broken.</p>	 <p><i>Photo shows a pedestrian push button located on the opposite side from the wheelchair ramp.</i></p>	<p>- Replace broken pedestrian buttons and relocate pedestrian buttons that are poorly located.</p>				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Pedestrians cross outside of crosswalks/against signal and bicycles travel at unexpected locations</p> <p>- The crosswalks are skewed increasing the pedestrian crossing distance. Pedestrians were observed crossing outside of the crosswalks and against the traffic signal. Bicycles were observed traveling through the intersection randomly and in unexpected locations both on street and on the sidewalk.</p>	 <p><i>Photo shows pedestrians crossing against the traffic signal, in which the walking is not allowed.</i></p>	<p>- Restripe the crosswalks and consider adding signage or landscaping features to corral pedestrians to designated crossing locations. Consider implementing designated bike accommodation.</p>			<p>- Revise curb line to reduce the radii and consider installing bump-outs to reduce pedestrian crossing widths. Consider eliminating the island on the northwest corner and reducing the corner radius.</p>	
5	<p>Vehicles parked too close to intersection</p> <p>- Vehicles were observed parking too close to the intersection blocking the right lane and blocking sight distance. Some</p>		<p>- Consider installing additional No Parking signs.</p>			<p>- Consider installing bump-outs that would clearly define where parking is allowed. Consider widening the roadway to provide adequate room for</p>	

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	vehicles blocked crosswalks and access close to the intersections. It was also noted that several of the crashes at this intersection involved sideswipes to parked vehicles.	<i>Photo shows vehicles parking along Memorial Boulevard, in close proximity to the intersection.</i>				through vehicles to get around parked vehicles.	
6	Poorly lighted intersection - At night the intersection is dimly lighted, especially on the east side of the intersection..	 <i>Photo shows the intersection during the night, in which there is a lack of lighting.</i>	- Replace old guardrail with guardrail that meets current standards.			- Install additional street lighting. Any new street lighting must conform to the existing decorative lighting in the neighborhood.	
7	Faded pavement markings and eastbound alignment jogs through intersection - The pavement markings are faded and generally in poor condition and the street name signs are not	 <i>Photo shows the lack of travel</i>	- Install new pavement markings including "cat tracks" through the intersection on Memorial Boulevard eastbound through				

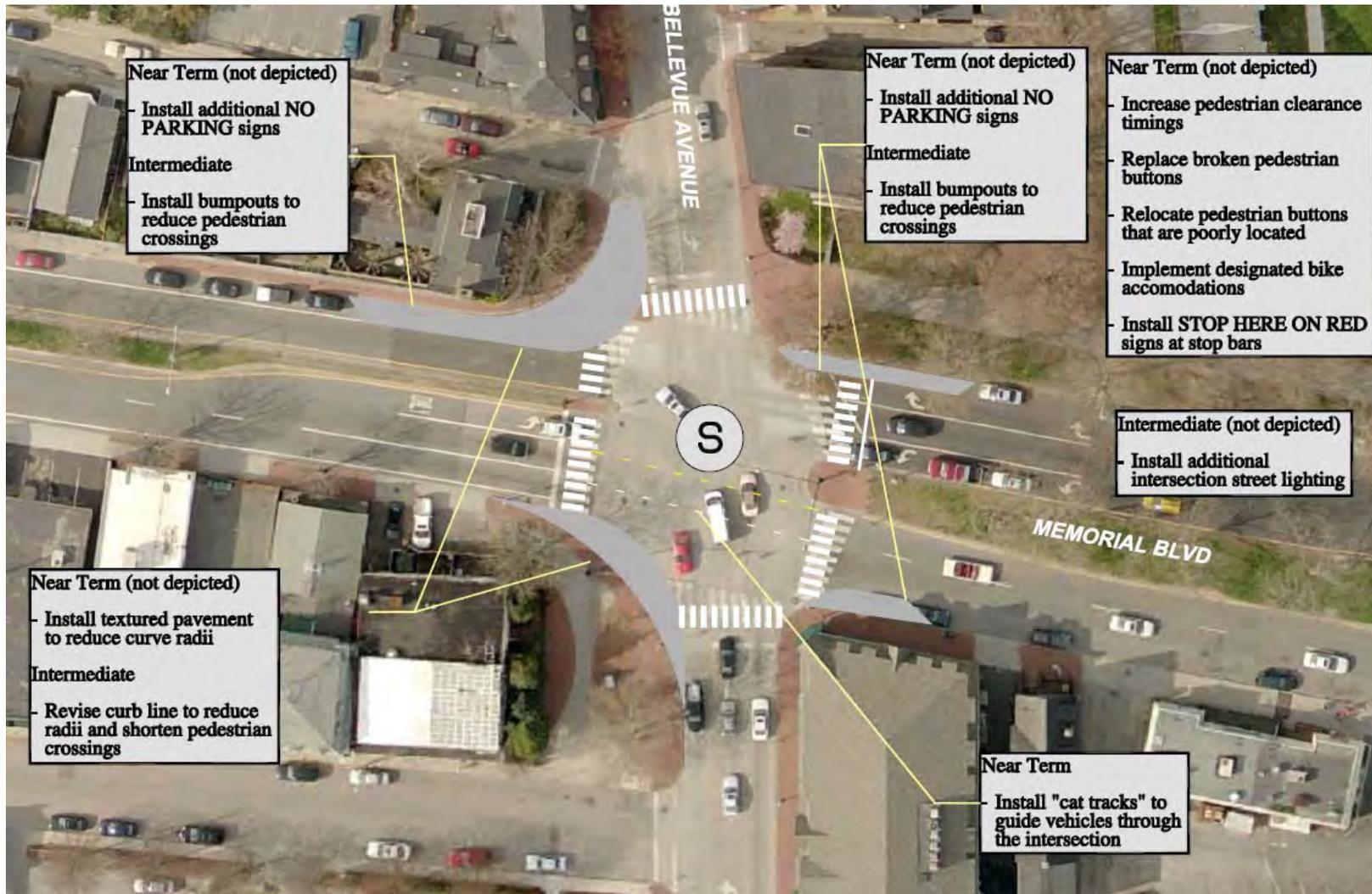


			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	visible. There is a jog in the eastbound through traffic and there is a history of vehicles ending up in the median	<i>delineation within the intersection. The Bellevue Avenue northbound through movement also experiences a slight jog on the northbound departure.</i>	the intersection.				
8	Yield Ahead sign inappropriate and in a poor location - There is a Yield Ahead sign located on the northwest corner of the intersection. This is not the correct location or the appropriate sign type.	 <i>Photo depicts poorly located "YIELD AHEAD" sign, which is not the appropriate sign for this location.</i>	- Remove Yield Ahead sign and install a new Yield sign adjacent to the yield line.				
9	Vehicles stop in crosswalks - Vehicles were observed stopping in the crosswalks.		- Consider installing Stop Here on Red signs.				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
		<i>Photo shows a vehicle stopped in the crosswalk on the west leg of the intersection, waiting to make a left-turn onto Bellevue Avenue southbound.</i>					

Figure 2-26 Memorial Blvd at Bellevue Avenue Conceptual Improvements/Recommendations



Source: Rhode Island E911 Uniform Emergency Telephone System, Pictometry International Corporation, 2008. Pictometric Licensed Images (Spring 2008)



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3

Town of Middletown Road Safety Assessments

The resulting recommended list of locations for the Town of Middletown to be included for the Road Safety Assessments as part of the Aquidneck Island RI*STARS pilot program include the following corridors and intersections:

1. Two Mile Corner (West Main Road, between Coddington Highway and Smythe Street)
2. One Mile Corner (West Main Road/Broadway at Admiral Kalbfus Road/Miantonomi Avenue)
3. West Main Road at Forest Avenue
4. East Main Road at Turner Road
5. East Main Road at Aquidneck Avenue
6. Aquidneck Avenue at Green End Avenue

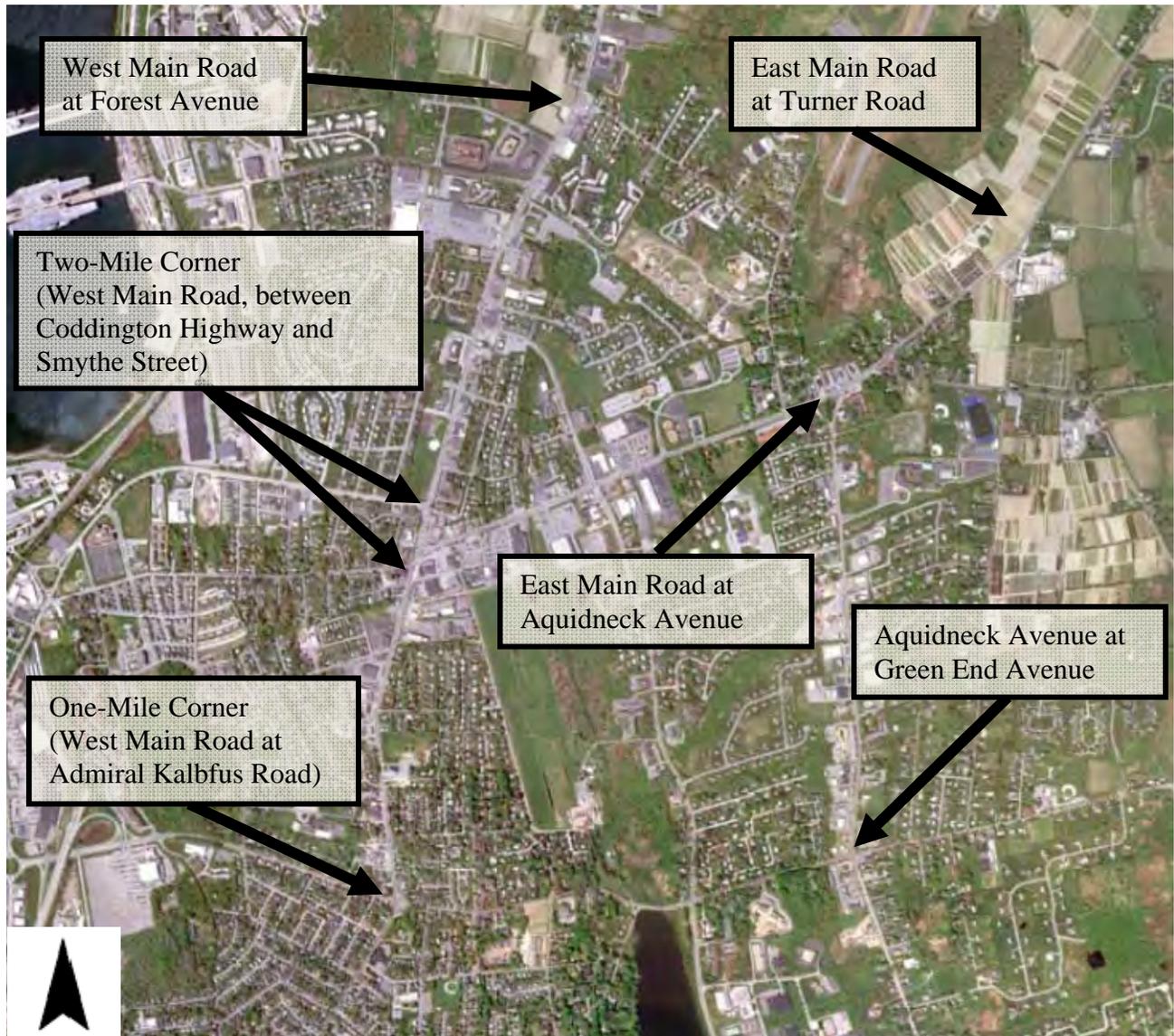
A map showing the general location of the project study area is shown in **Figure 3-1**.



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Figure 3-1 RSA Study Area



Source: Google Earth



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3.1 Road Safety Assessment Interdisciplinary Team

The interdisciplinary RSA Team for the Town of Middletown assessment consisted of representatives from RIDOT Highway and Traffic, the Rhode Island Statewide Planning Program, the Middletown Police Department, and FHWA. Representatives from Vanasse Hangen Brustlin facilitated the RSA. The members of the RSA team are as follows:



- Anita Marshall, Highway Engineer – RIDOT
- Tom Bushell, Traffic Engineer – RIDOT
- Kristen Capaldi, Highway Engineer – RIDOT
- Michael Moan, Transportation Principal Planner – RISPP
- Jacinda Russell, Safety & Operations Engineer – FHWA
- Sgt. Tim Beck – Middletown Police
- Dan Nabors, Safety Engineer – VHB
- Peter Pavao, Traffic Engineer – VHB





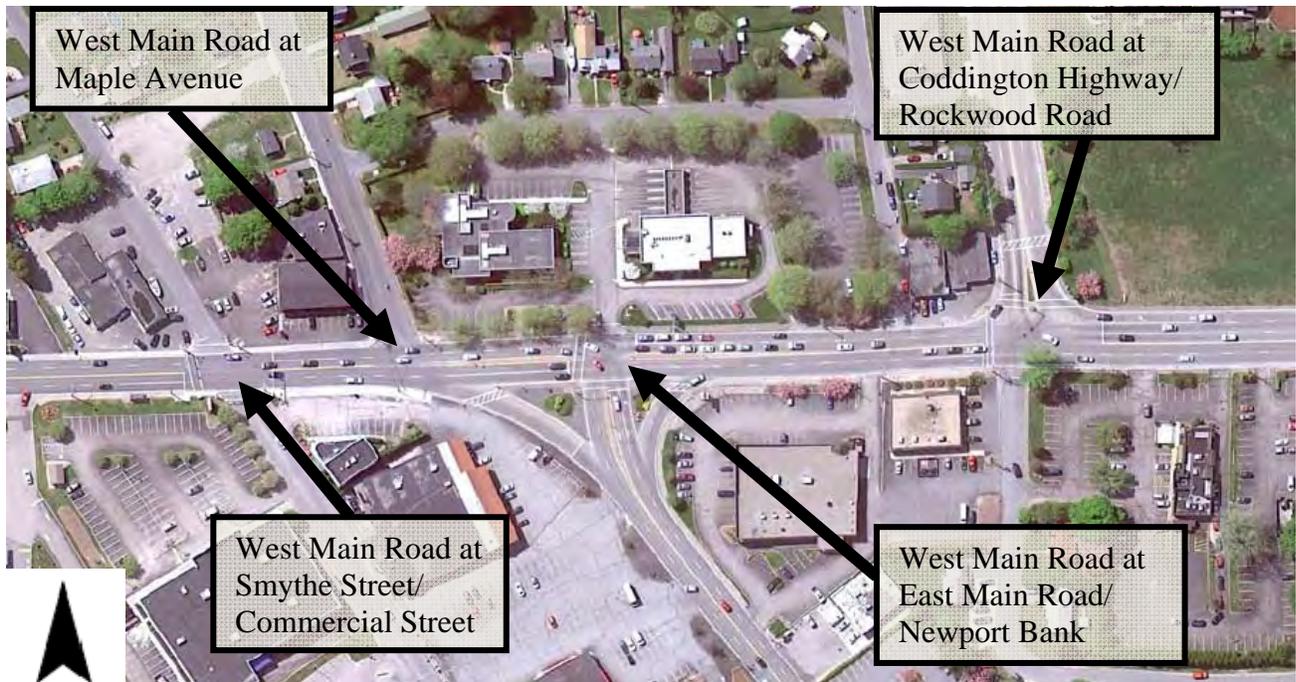
3.2 Two-Mile Corner Area



3.2.1 Existing Conditions

The area known as **Two-Mile Corner**, including **West Main Road between Smythe Street and Coddington Highway** is a primary corridor for vehicles traveling between Middletown/Portsmouth and Newport. The corridor is a four-lane, undivided roadway, having two through lanes in each direction. The posted speed limit is 25 mph. The RSAs were performed at the intersections as shown in **Figure 3-2** and as discussed in the following section.

Figure 3-2 Two-Mile Corner Study Area Corridor and Intersections



Source: Google Earth

West Main Road at Smythe Street/Commercial Street is a skewed, four-way signalized intersection consisting of a shared left-turn/through lane and a shared through/right-turn lane on the West Main Road northbound and southbound approaches; and one multipurpose (left-turn/through/right-turn) lane on the Smythe Street eastbound and Commercial Street westbound approaches. There are sidewalks along West Main Road and there are marked crosswalks on the south,



east, and west legs of the intersection marked with standard pavement markings. There are numerous access points located in the vicinity of the intersection; some of which are wide, undelineated, and are used by motorists to bypass the traffic signal.

West Main Road at Maple Avenue is an three-way, unsignalized intersection consisting of a shared left-turn/through lane on the West Main Road northbound approach, a through lane and a shared through/right-turn lane on the West Main Road southbound approach, and one shared left-turn/right-turn lane on the Maple Avenue eastbound approach. There are sidewalks along West Main Road and there are no marked crosswalks at the intersection. A wide channelized right-turn lane on northbound West Main Road heading to East Main Road begins just east of Maple Avenue. This unusual geometry may contribute to driver confusion.

West Main Road at East Main Road/Bank Newport, is a four-way signalized intersection consisting of a shared left-turn/through lane, a through lane, and a channelized right-turn lane on the West Main Road northbound approach, a shared left-turn/through lane and a shared through/right-turn lane and southbound approaches; a left-turn lane, a shared left-turn/through lane, and a channelized right-turn lane on the East Main Road westbound approach, and one multipurpose (left-turn/through/right-turn) lane on the Bank Newport eastbound approach. There are sidewalks along West Main Road and there are marked crosswalks on the south, east, and west legs of the intersection as well at the northbound and westbound channelized right-turn lanes. The channelized right-turn lanes consist of large radii that lead to high vehicle speeds. There is also a lack of pedestrian crossings within the pedestrian sight line, as some of the crossings require pedestrians go out of their line of sight to cross the intersection.

West Main Road at Coddington Highway/Rockwood Road is a four-way, signalized intersection consisting of a shared left-turn/through lane and a shared through /right-turn lane on the West Main Road northbound approach, a shared left-turn/through lane, a through lane, and a right-turn lane on the West Main Road southbound approach; a left-turn lane and a multipurpose (left-turn/through/right-turn) lane on the Coddington Highway eastbound approach, and one multipurpose (left-turn/through/right-turn) lane on the Rockwood Road westbound approach. The Rockwood Road approach is also aligned across from the Coddintgon Highway eastbound approach, causing vehicles from Rockwood Road to shift right to continue straight on Coddington Highway. There are sidewalks along West Main Road and the north side of Coddington Highway near the intersection, and there are marked crosswalks on the south and west legs of the intersection. There is also a marked crosswalk approximately 76 feet west of the intersection. There are access points with wide, undelineated driveways on the south corners of the intersection as well.



3.2.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 3-1** and is presented in vehicles per day (vpd):

Table 3-1 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
West Main Road	32,200	North of Coddington Highway
Coddington Highway	18,600	West of West Main Road

The overall delays and critical approaches/movements are listed below for the three major intersections within the study area corridor. The West Main Road at Coddington Highway/Rockwood Road intersection experiences the highest delays and queues during the evening peak hour, as commuters leaving the Newport area (including the US Navy) seeking to go north travel through this intersection. Also, the lack of exclusive left-turn lanes along this corridor cause additional queues and delays for along West Main Road. The overall intersection delay is presented in **Table 3-2**.

Table 3-2 Calculated Intersection Delay

Subject Intersection – West Main Road at	Intersection Delay (sec)	General Location of Delays
Smythe Street/Commercial Street	9.7	Northbound Approach
East Main Road/Bank Newport	27.5	Southbound Left-Turn Lane
Coddington Highway/Rockwood Road	21.1	Eastbound Approach

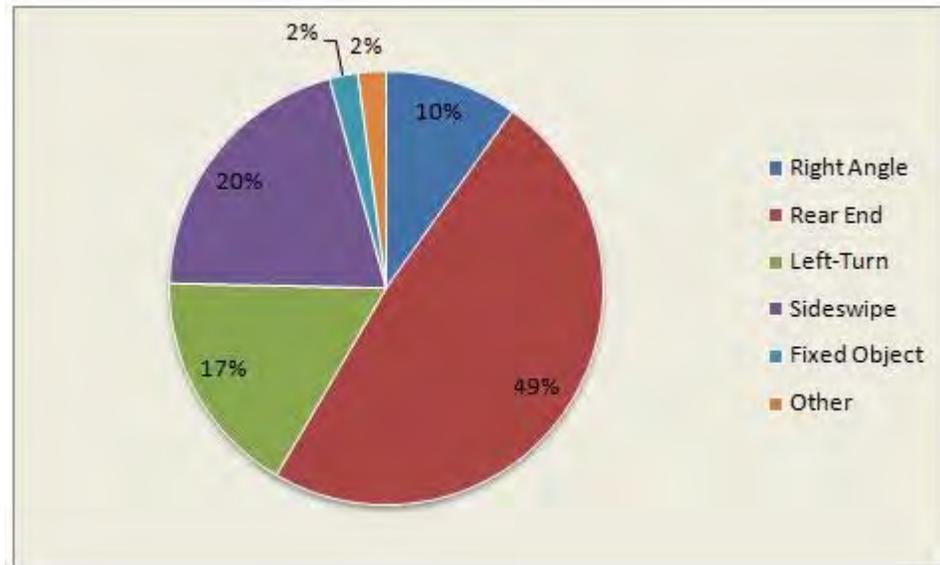


3.2.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 142 crashes were reported along West Main Road, between Smythe Street and Coddington Highway, with rear-end collisions being the most prevalent (49%). This corridor has the second highest number of crashes on Aquidneck Island. **Figure 3-3** illustrates the breakdown of the crashes by collision type.



Figure 3-3 Vehicle Crash Type – Two Mile Corner



The next two highest crash types are Sideswipes (20%) and Left-Turn (17%) crashes. Also, 17% of the crashes related to unsignalized driveways and side streets within this corridor.



3.2.4 Proposed Improvements

Reconstruction of Two-Mile Corner is a RIDOT project currently at the 75% design stage. This project includes the West Main Road intersections with Coddington Highway and East Main Road. The proposed improvements currently consist of geometric improvements including the addition of exclusive left turn lanes and reduction/elimination of channelized right-turns. Other improvements include new sidewalks and traffic signal equipment.

As part of the Aquidneck Island Transportation Study (AITS), an alternative concept has been developed, replacing the 4-way signalized intersections with two lane roundabouts. The two roundabouts alternative would improve access management, as left-turns would be restricted on the side streets/driveways between the two intersections. Left-turns would be made by making a right-turn out of the driveway and using the roundabout to execute a u-turn. RIDOT and the Town of Middletown evaluated the roundabout alternative to determine its feasibility and potential impacts. It was determined that due to public input and potential impacts, the roundabout alternative would not be carried forward. The Roundabout and Signalized Concepts are illustrated in **Figures 3-5 and 3-6**, respectively.



3.2.5 Assessment Findings

3.2.5.1 Safety Benefits of Proposed Designs

Because both design concepts were proposed at the time of the assessment, the RSA team evaluated both concepts to determine the potential safety benefits. The following is a list of the potential safety benefits from both design concepts.

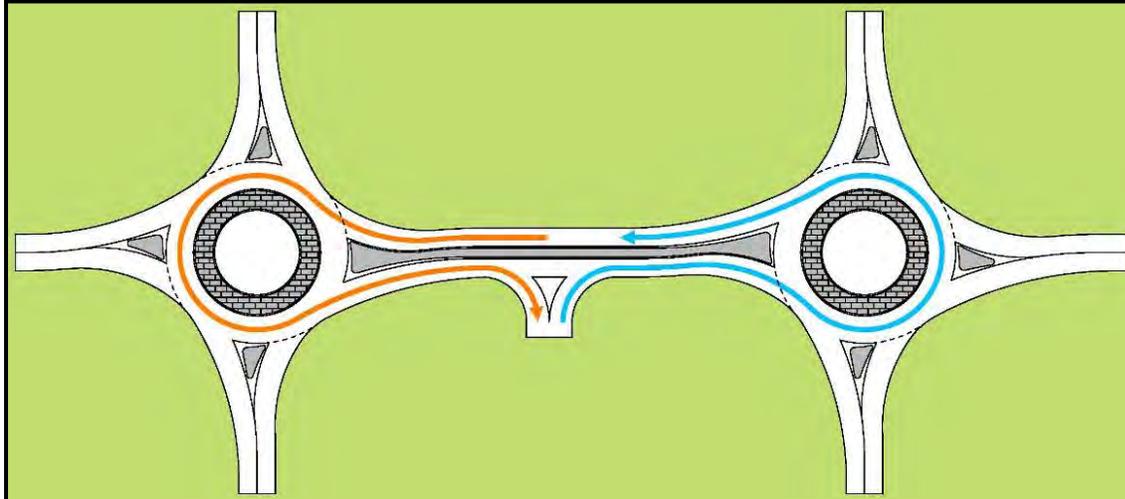
Roundabout Concept

Elimination of left-turns at intersections – By directing all traffic at these two intersections – both the through and turning traffic – to merge into the circular roadway, stopped turning vehicles are removed from the through lanes and the occurrence of unexpected stopped vehicles within the roadway are greatly reduced. This creates a “Dog-Bone” configuration, in which all left-turning movements can be removed between adjacent roundabouts by using the roundabouts to execute u-turns, as shown in **Figure 3-4**.

- ▶ **Natural traffic-calming effect** – A key element in modern roundabout design is to provide horizontal deflection on the approach legs so that motorists entering the roundabout are naturally encouraged to decrease their speed. The opposite effect on approach speeds may be observed at traditional signalized intersections, where drivers may be inclined to *increase* their speeds near an intersection when a green or yellow light is within view.
- ▶ **Decreased intersection delay** – A general benefit of roundabouts is a reduction in both intersection delay and in the number of vehicles that must stop at the intersection. More efficient traffic flow at the intersections should increase driver satisfaction and potentially decrease impatient and aggressive driver behavior within the corridor. A reduction in delay and vehicle idling has also been observed to have significant environmental benefits, as well.
- ▶ **Aesthetic appeal** – The latest conceptual plan for the Two-Mile Corner corridor consists of installing two roundabouts that can be designed to include landscaping features to introduce a gateway experience for vehicles entering this historic part of Middletown.



Figure 3-4 Sample "Dog-Bone" Configuration



Signalized Concept

- **Installation of exclusive left turns lanes at intersections** – The addition of exclusive left-turn lanes at the signalized intersections will help remove left-turning vehicles from the through lanes at the two intersection, increasing mobility and safety within the corridor.
- **Enhancing pedestrian accommodations** – The project includes enhanced pedestrian accommodations such as new sidewalks along the study roadways and new pedestrian signal equipment at the signalized intersections.
- **Elimination of the channelized right-turn** – The concept eliminates the channelized right-turn from East Main Road to West Main Road north, keeping the pedestrian crossing the East Main Road leg of the intersection at the signalized crossing.



3.2.6 Identified Safety Issues and Suggestions for Improvement

The RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Table 3-3** while **Figures 3-5 and 3-6** lists the suggestions on the preliminary conceptual designs. Because the Reconstruction of Two-Mile Corner RIDOT project is currently at the 75% design stage and is schedule to be complete



within 2-3 years, all suggestions are meant to be implemented as part of either the Roundabout or Signalized design concepts.



Table 3-3 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the Two Mile Corner area

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Poorly located crosswalk on Coddington Highway</p> <p>–The crosswalk on Coddington Highway is located west of the intersection where the vehicle queue often extends to and beyond, creating the following issues: Vehicles often block the crosswalk Sight distance of pedestrians crossing is often limited by queuing traffic.</p> <p>Expectancy of pedestrians crossing may be particularly low, which is especially critical for westbound traffic.</p>	 <p><i>The crosswalk is located on the approach to the intersection There is a crosswalk at the signalized intersection, located 50 east of this crosswalk.</i></p>	<p>– Remove crosswalk</p>			<p>– Remove ramps</p>	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Poor delineation of vehicle paths</p> <ul style="list-style-type: none"> - The dual left-turn movement from Coddington Highway to West Main Road is not delineated. - The dual left-turn movement from East Main Road onto West Main Road is not delineated. - There is no delineation on side street approaches. The side streets were observed to be mistaken for one-way streets due to the lack of a centerline. 	 <p><i>There is a lack of delineation for vehicles making the dual left-turning movement from Coddington Highway onto West Main Road.</i></p>	<ul style="list-style-type: none"> - Mark the dual left-turning movement with dashed white pavement markings (cat tracks). - Mark white edge lines and yellow center lines on all side street approaches for 100 feet from the intersection, at a minimum. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Sidewalk obstructions</p> <ul style="list-style-type: none"> – Some of the existing sidewalks are not ADA compliant, including narrow width, ramp slope exceeding minimums, and missing detectable warning systems. – There are numerous objects located in the sidewalks, forming obstructions that provide less than the ADA minimum width. – There are signs in the sidewalk that do not meet minimum installation heights. 	 <p><i>There are signs, guys, and utility poles in the sidewalk along West Main Road, creating choke points less than 32”.</i></p>  <p><i>This sign, located within the sidewalk, does not have the minimum height clearance from the ground.</i></p>	<ul style="list-style-type: none"> – Relocate signs, guy wires, etc to maintain minimum widths along the sidewalk. – Modify signs to meet minimum height clearances. 			<ul style="list-style-type: none"> – Relocate ADA ramp on southeast corner of the West Main Road/Smythe Street intersection. 	<ul style="list-style-type: none"> – Provide new sidewalks and ADA ramps as part of the “Reconstruction of Two-Mile Corner” project (either the signalized or roundabout design concept)



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Lack of delineation between sidewalk, driveways, and the roadway</p> <ul style="list-style-type: none"> - The curbing along the west side of West Main Rd, adjacent to Bank Newport, is broken and missing in some places. Sidewalks are not smooth and are not visually delineated from roadway, which may present issues to pedestrians with low-visibility. - There are wide open access points with little to no delineation. - Vehicles were observed cutting through driveways to access side streets. Examples include Commercial Street onto West Main Road and West Main Road onto Hart Street. 	 <p><i>The sidewalk adjacent to Bank Newport has broken and missing curb.</i></p>  <p><i>Access point, such as the one on the southwest corner of Coddington Highway and West Main Road, lack and pavement marking or curbing delineation. This created no indication or buffer for pedestrians walking along this area.</i></p>				<ul style="list-style-type: none"> - Repave sidewalks with smooth material to differentiate sidewalk from roadway - Install new curbing along the sidewalks. - Provide minimum driveway openings by installing curbing. 	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
5	<p>Steep slope adjacent to sidewalk</p> <p>– There is a steep drop-off along West main Road, adjacent to Walgreens.</p>	 <p><i>There is a steep drop-off along the east side of West Main Road.</i></p>				<p>– Provide a railing, fence, barrier, etc to protect pedestrians from falling down the drop-off.</p>	
6	<p>Left-turns from Maple Avenue onto West Main Road conflict with through movements</p> <p>– Vehicles along West Main Rd in right lane stop to let left-turning vehicles from Maple Avenue go, and then vehicles in left lane have limited sight distance to see this vehicle crossing. This also created additional delay along West Main Rd..</p>	 <p><i>Maple Avenue is a highly used cut-through roadway, connecting to JT Connell Highway.</i></p>	<p>– Perform analysis to determine if a restriction for left-turning movements is feasible.</p> <p>– Limit eastbound Maple Ave vehicles to right-turns only. Install NO LEFT TURN signs.</p> <p>– Consider applying times to restrict left-turns.</p>	<p>– Enforce the NO LEFT TURN restriction.</p>			<p>– Convert intersection to right-in/right-out through installation channelization.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
7	<p>Lack of clear lane use</p> <ul style="list-style-type: none"> - The signage/stripping that denotes the lane usage at intersection is inconsistent. Two examples are East Main Road approach to West Main Road and Coddington Highway approach to West Main Road. - There are no speed limit signs in the area 	 <p><i>The lane use signage (left side) and pavement markings conflict with each other.</i></p>	<ul style="list-style-type: none"> - Install consistent lane use signing and pavement markings - Install speed limit signage 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
8	<p>High speeds along channelized right-turns</p> <ul style="list-style-type: none"> – Vehicles travel at high speeds along the channelized right-turn from West Main Road onto East Main Road. This channel has a wide radius that likely encourages higher speeds. – Typically motorists traveling at high speeds are less likely to yield. Motorists were observed not yielding at the merge with East Main Road. – There is a pedestrian crossing along this ramp. There has been a reported pedestrian crash that has occurred at this location. – The shrubs located on the island limit sight distance between merging vehicles from West Main Road north and south onto East Main Road. 	 <p><i>Vehicles fail to yield and travel at high speeds around the channelized right-turn ramp from West Main Road onto East Main Road.</i></p>	<ul style="list-style-type: none"> – Install larger, florescent yellow YIELD signs and pavement markings at the crosswalk to enhance visibility. – Stripe the channelized ramp/install delineators to reduce the lane width – Trim shrubs to increase sight distance. 	<ul style="list-style-type: none"> – Monitor and enforce the YIELD condition. 			<ul style="list-style-type: none"> – Reconstruct channelized right-turn ramp to provide smaller radius with correlating slower speeds OR – Convert signalized intersections to roundabout.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
9	<p>Potentially confusing alignment for Rockwood Road approach to West Main Road</p> <ul style="list-style-type: none"> – Vehicles exiting Rockwood Avenue are aligned across from Coddington Highway eastbound vehicles. – The signal phase in which the Rockwood Road approach is green runs concurrent with the Coddington Highway green signal phase. Vehicles on the Rockwood Road approach were observed to wait on green until the Coddington Highway approach cleared the vehicle queue. 	 <p><i>Vehicles on the Rockwood Rd westbound approach are aligned directly across the Coddington Hwy eastbound approaching traffic.</i></p>  <p><i>Some vehicles on the Rockwood Rd approach wait until the Coddington Hwy vehicles clear, causing frustration for other vehicles, such as this truck</i></p>	<ul style="list-style-type: none"> – Consider revising signal phasing to provide the Coddington Highway eastbound approach and the Rockwood Road westbound approach with separate phases or implement lead/lag in the phasing to provide the Coddington Highway approach with the advance. – Install enhanced signage and pavement markings that help guide Rockwood Road vehicles to the Coddington Highway departure lanes. 				<ul style="list-style-type: none"> – If feasible, realign the Rockwood Road westbound approach OR – Convert signalized intersections to roundabout.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
10	<p>Outdated traffic signal equipment</p> <ul style="list-style-type: none"> - The LEFT-TURN arrow signal heads are not bright enough to see during certain times of the day. - The traffic signal pole equipment is located in undesirable locations. -Some of the pedestrian signal equipment is not working properly. - The traffic signal heads on east and west approaches may be difficult for motorists to see due to the effects of backlighting and sun glare. 	 <p><i>Some vehicles on the Rockwood Road approach wait</i></p>	<ul style="list-style-type: none"> - Replace traffic signal heads as necessary with visible LED illuminations. 			<ul style="list-style-type: none"> - Replace pedestrian signal head as necessary, including countdown timers. 	<ul style="list-style-type: none"> - Replace traffic signal equipment OR - Convert signalized intersections to roundabout.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
11	<p>Lack of delineated paths serving pedestrian desire lines.</p> <ul style="list-style-type: none"> The following West Main Road intersections legs are lacking pedestrian signal equipment and/or marked crossings: Coddington Highway north leg, East Main Road north leg, and Smythe Street north leg. The accessible ramp on Smythe Street south leg (east side) is located adjacent to the signal cabinet, leaving no room for a level landing area. 	 <p><i>Pedestrian crossing West Main Road, north of Smythe Street intersection.</i></p>	<ul style="list-style-type: none"> Mark and install pedestrian signal equipment at all crosswalks on all approaches to signalized intersections, as appropriate. 				<ul style="list-style-type: none"> Convert signalized intersections to roundabout. Relocate accessible ramp on Smythe Street south leg (east side)



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
12	Lack of sign conspicuity – The “Smythe Street” street name sign is located too far from the intersection to be effective.	 <p><i>Street name sign is located too far from the intersection.</i></p>	– Relocate sign to mast arm.				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
13	<p>Lack of left-turn lanes & exclusive left-turn phasing</p> <ul style="list-style-type: none"> – Left-turning vehicles “sneak” during red interval – Motorists wishing to take a left-turn on Commercial Street from West Main Road have a difficult time making the movement due to the lack of gaps in the heavy northbound movement. – Motorists wishing to make a left-turn block the through movement along West Main Road. – The lack of protected left-turn phasing cause additional conflicts as vehicles must make a left-turn against two lanes of opposing through traffic. 	 <p><i>A vehicle turning left onto Commercial Street finds a gap in traffic only after West Main Road corridor has the red light. This movement conflicts with side street traffic that has the green light.</i></p>				<ul style="list-style-type: none"> – Consider providing advance northbound left-turn movement onto Commercial Street from West Main Road. 	<ul style="list-style-type: none"> – Replace traffic signal equipment to include left-turn phasing and widen roadway to provide left-turn lanes at the East Main Road and Coddington Highway intersections with West Main Road OR – Convert signalized intersections to roundabouts. This will eliminate the left-turn/through vehicle conflict.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
14	<p>Vehicle conflicts at access points close to intersection</p> <ul style="list-style-type: none"> – Access points are located too close to the intersection, creating conflicts with vehicles exiting the intersection at high speeds. – Motorists traveling on the right-turn channelized ramp to East Main Road are looking left to merge. They may not see vehicles trying to exit this driveway. 	 <p><i>Vehicles exiting the Rite-Aid driveway located close to the East Main/West Main Road intersection conflicted with vehicles turning from West Main Road, including the channelized right-turn lane.</i></p>					<ul style="list-style-type: none"> – Consider closing/relocating this access point. This should be done under either proposed design concept; signalized intersections or roundabouts.
15	<p>Pedestrian push-button signage confusing</p> <ul style="list-style-type: none"> – Some of the signage for instructions on how to cross is confusing as the direction they are installed does not coincide with the crossing the button 		<ul style="list-style-type: none"> – Relocate signage to coincide with correct pedestrian crossing path. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	responds to.	<i>The push button signage can be confusing to pedestrians on which button activated which crossing.</i>					



Figure 3-5 Suggested Recommendations to the Proposed Two-Mile Corner Roundabout Design Concept



Source: Aquidneck Island Transportation Study, Google Earth



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Figure 3-6 Suggested Recommendations to the Proposed Two-Mile Corner Signalized Design Concept



Source: Aquidneck Island Transportation Study, Google Earth



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3.3 West Main Road/Broadway at Admiral Kalbfus Road/ Miantonomi Avenue



3.3.1 Existing Conditions

The intersection of West Main Road, Broadway, Admiral Kalbfus Road, and Miantonomi Avenue, also known as One-Mile Corner, is a four-way, signalized intersection on the jurisdictional boundary between the City of Newport and the Town of Middletown. Crashes are investigated and documented by the Town of Middletown for the West Main Road and Miantonomi Avenue legs of the intersection. The City of Newport is responsible for crashes that occur on the Broadway and Admiral Kalbfus Road legs of the intersection. Crashes that occur in the intersections are the responsibility of the Town of Middletown as well.

The intersection is positioned on a horizontal curve and consists of a shared left-turn/through lane and a shared through/right-turn lane on the Broadway northbound approach, a shared left-turn/through lane and a shared through/right-turn lane on the West Main Road southbound approach; a left-turn lane and a shared through/right-turn lane on the Admiral Kalbfus Road eastbound approach, and one multipurpose (left-turn/through/right-turn) lane on the Miantonomi Avenue westbound approach. The southbound receiving lanes change from two lanes to one lane immediately departing from the intersection. There are sidewalks on all approaching roadway to the intersection and there are marked crosswalks on the north, east, and west legs of the intersection marked with standard pavement markings. There are wide, undelimited access driveways on the east corners. Some vehicles were observed to use these wide driveways to by-pass the traffic signal during congested times. The RSAs was performed at the intersection as shown in **Figure 3-9** and as discussed in the following section.



Figure 3-9 One Mile Corner Study Area Intersection



Source: Google Earth

3.3.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 3-4** and is presented in vehicles per day (vpd):

Table 3-4 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
Admiral Kalbfus Road	21,200	East of JT Connell Highway
West Main Road	25,700	North of Admiral Kalbfus Road

The overall delays and critical approaches/movements are listed below for the intersection. The intersection experiences the highest delays and queues during the



evening peak hour, with long delays and queues on the West Main Road southbound approach. On the Admiral Kalbfus Road eastbound approach, the vehicles queues extend beyond the left-turn storage bay. The overall intersection delay is presented in **Table 3-5**.

Table 3-5 Calculated Intersection Delay

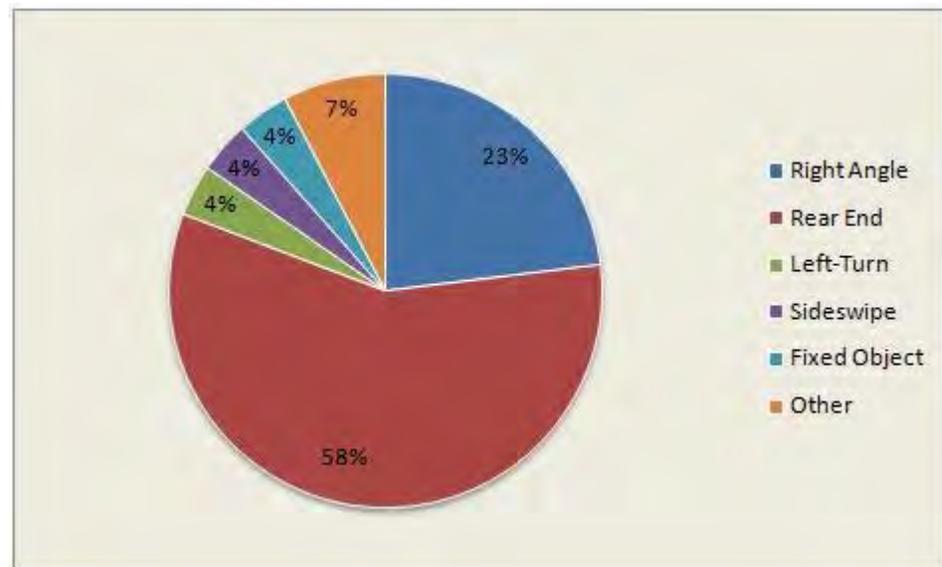
Subject Intersection	Intersection Delay (sec)	General Location of Delay
West Main Road/Broadway at Admiral Kalbfus Road/ Miantonomi Avenue	34.4	Southbound Approach Eastbound Left-Turn Movement



3.3.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 26 crashes were reported at this intersection, with the majority (58%) being rear-end-type collisions. **Figure 3-10** illustrates the breakdown of the crashes by collision type.

Figure 3-10 Vehicle Crash Type – One Mile Corner



The majority (85%) of the crashes occurred in daylight conditions. Also, the second highest crash type is right angle (23%)



3.3.4 Assessment Findings

The intersection has recently been reconstructed within the past 10 years. Based on a review of existing site conditions, there are several positive characteristics of the roadway network when considered in terms of roadway safety:

- There are working pedestrian signal heads at the crossings.
- The pavement is also in good condition.



3.3.5 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Table 3-6** and **Figure 3-11**.



Table 3-6 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the One Mile Corner area

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Southbound right lane merges immediately after the intersection.</p> <ul style="list-style-type: none"> - There is a lack of pavement markings to delineate the two through lanes on the Broadway southbound departure. - The Lane Ends sign is located within the lane drop & merge area. 	 <p><i>The Lane Ends sign is located with the merge area.</i></p>	<ul style="list-style-type: none"> - Install pavement markings to delineate the two through lanes and the taper from two lanes to one lane. - Relocate the Lane Ends sign (W4-2R) to the beginning of the lane drop. 				
2	<p>Lack of lighting on the west leg of the intersection.</p> <ul style="list-style-type: none"> - There is inadequate lighting on the north and southwest corners of the intersection. 	 <p><i>There is a lack of lighting on the northwest and south west corners of the intersection.</i></p>				<ul style="list-style-type: none"> - Install lighting on the northwest and southwest corners of the intersection. 	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Poor and inadequate destination, guide, and lane use signing at this intersection.</p> <ul style="list-style-type: none"> - The One-Mile corner area is traveled by numerous out-of-towners/tourists as it provides a direct connection between the Pell Bridge and Middletown/Portsmouth. - The Route 114/Route 138 trailblazing signage is blocked by vegetation. This is the only wayfinding signage on the approach. - Route 138 cardinal direction is signed both EAST and NORTH in this area, causing additional confusion to unfamiliar motorists. 	 <p><i>The trailblazing signage on the eastbound approach from Pell Bridge is partially obstructed by vegetation. There is also a lack of adequate wayfinding signage on the approach.</i></p>	<ul style="list-style-type: none"> - Install wayfinding signage for this area. - Trim vegetation that blocks signage OR - Relocate signage - Install street name signage on mast arms (if structural feasible) - Provide consistent signing for Route 138. - Install supplemental LEFT LANE MUST TURN LEFT sign on eastbound approach to intersection. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Inadequate ADA facilities</p> <ul style="list-style-type: none"> - The northeast corner of the intersection is missing an ADA ramp for the pedestrian crossing West Main Road. - The ADA ramp on the northwest corner is missing a detectable warning system. 	 <p><i>The crosswalk along the north leg of the intersection is missing an ADA ramp.</i></p>	<ul style="list-style-type: none"> - Install detectable warning systems where missing/upgrade needed. 			<ul style="list-style-type: none"> - Construct ADA ramp. 	
5	<p>Eastbound left-turns extend beyond storage bay</p> <ul style="list-style-type: none"> - The Admiral Kalbfus Road eastbound approach left-turn queues often extend beyond the storage lane, blocking access to the through/right-turn lane. 	 <p><i>Left-turning vehicles spill beyond the storage lane, blocking motorists wishing to go through/right at the intersection.</i></p>	<ul style="list-style-type: none"> - Restripe the approach to provide a longer eastbound left-turn lane. 				<ul style="list-style-type: none"> - Widen the approach to provide a longer eastbound left-turn lane.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Wide access points</p> <ul style="list-style-type: none"> - The business on the northeast corner of the intersection has a wide access point. - Vehicles from parking spaces at business back out into traffic. - During peak times, vehicles were observed to cut through this access point to bypass the signal. 	 <p><i>The driveway along Miantonomi Avenue near the intersection with West Main Road is wide open and poorly delineated.</i></p>		<ul style="list-style-type: none"> - Work with the business on the corner to discourage cut-through vehicles. 			<ul style="list-style-type: none"> - Provide curbing to delineate driveway and provide smaller, more manageable access point.



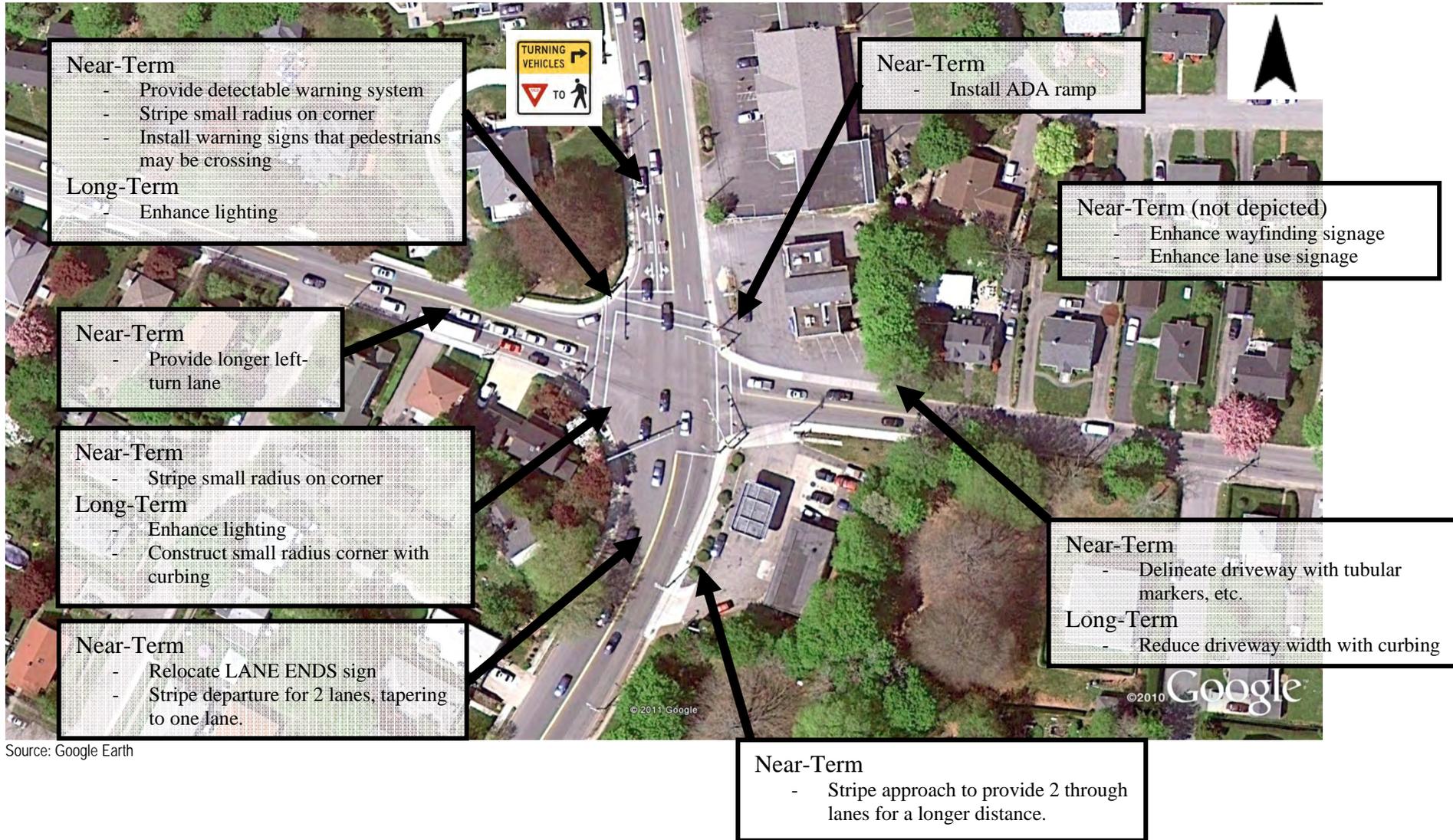
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
7	<p>High speeds right-turn movements</p> <ul style="list-style-type: none"> – The large radii on the northwest and southwest corners of the intersection allow vehicles to make high-speed right-turns. These higher speed turns may not be appropriate for the context as a pedestrian/bicycle friendly tourist destination. – The large corner radius accommodates large trucks. However, the ADA ramp and sidewalk is cracked and appears to be driven over numerous times. 	 <p><i>Vehicles making high-speed right-turn movements. There is limited sight-distance for pedestrian crossing the east leg of the intersection.</i></p>	<ul style="list-style-type: none"> – Provide a smaller radius on the northwest corner through cross hatch striping. This will delineate a slower path for most vehicles while providing an apron for large trucks. – Install TURNING TRAFFIC YIELD TO PEDESTRIANS signs on the southbound approach. – Move STOP BAR on the eastbound approach back to provide a clear movement for large trucks without encroaching on ADA ramp. 				<ul style="list-style-type: none"> – Provide a tighter radius through curbing on the southwest corner. This should be design to accommodate large trucks marking the right-turn movement onto Broadway southbound.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
8	<p>Northbound approach queues extend beyond two lane storage</p> <p>– The Broadway northbound approach is often congested in the evening peak period. The two lanes on storage are insufficient during this period.</p>	 <p><i>The two northbound lanes at the Broadway northbound approach to the intersection provides insufficient storage during the evening peak period.</i></p>	<p>– Restripe the Broadway northbound approach to extend the two northbound lanes for a longer distance. This may require elimination of some on-street parking on Broadway.</p>				
9	<p>Pedestrian push-button signage confusing</p> <p>– Some of the signage for instructions on how to cross is confusing as the direction they are installed does not coincide with the crossing the button responds to.</p>	 <p><i>The push button signage can be confusing to pedestrians on which button activated which crossing.</i></p>	<p>– Relocate signage to coincide with correct pedestrian crossing path.</p>				



Figure 3-11 Suggested Recommendations to the One-Mile Corner Intersection



Source: Google Earth



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3.4 West Main Road at Forest Avenue



3.4.1 Existing Conditions

The intersection of West Main Road and Forest Avenue is a three-way, signalized intersection that has recently been reconstructed as part of the West Main Road 1R Reconstruction project. This project included new signal equipment, pavement, and sidewalks upgrades.

The intersection consists of a through lane and a shared through/right-turn lane on the West Main Road northbound approach, a shared left-turn/through lane and a through lane on the West Main Road southbound approach and one multipurpose (left-turn/through/right-turn) lane on the Forest Avenue westbound approach. There are sidewalks along West Main Road and there are marked crosswalks with pedestrian signal countdown timers on the north and west legs of the intersection. There is a service station in the southeast quadrant with 2 access points. The RSAs was performed at the intersection as shown in **Figure 3-12** and as discussed in the following section.



Figure 3-12 West Main Road/Forest Avenue Intersection



Source: Google Earth



3.4.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 3-7** and is presented in vehicles per day (vpd):

Table 3-7 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
West Main Road	32,200	North of Coddington Highway

The overall delays and critical approaches/movements for the West Main Road at Forest Avenue intersection is presented in **Table 3-8**.



Table 3-8 Calculated Intersection Delay

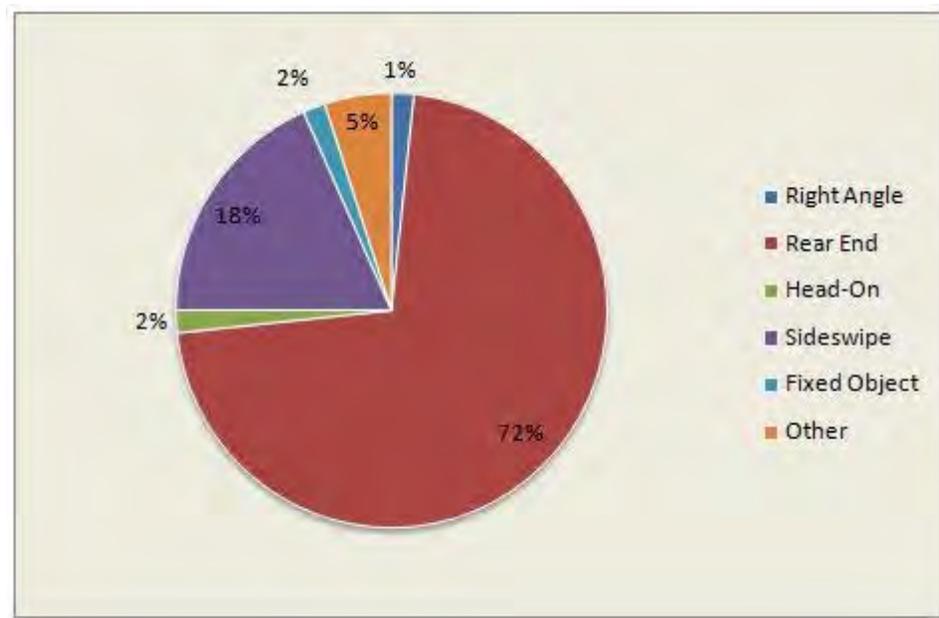
Subject Intersection	Intersection Delay (sec)	General Location of Delay
West Main Road at Forest Avenue	21.1	Westbound Approach



3.4.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 60 crashes were reported at this intersection, with the majority (72%) being rear-end-type collisions. **Figure 3-13** illustrates the breakdown of the crashes by collision type.

Figure 3-13 Vehicle Crash Type – West Main Road at Forest Avenue



The large percentage of rear-end crashes are typical of a signalized intersection, especially without an exclusive left-turn lane.



3.4.4 Assessment Findings

The intersection has recently been reconstructed within the past year. As part of this reconstruction, there are several positive characteristics of the roadway network when considered in terms of roadway safety:



- New signal equipment and enhanced pedestrian facilities such as sidewalks, crosswalks, and pedestrian signal head with countdown timers was installed.
- The pavement was overlaid as well.



3.4.5 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Table 3-9** and **Figure 3-14**.



Table 3-9 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the West Main Road/Forest Avenue intersection

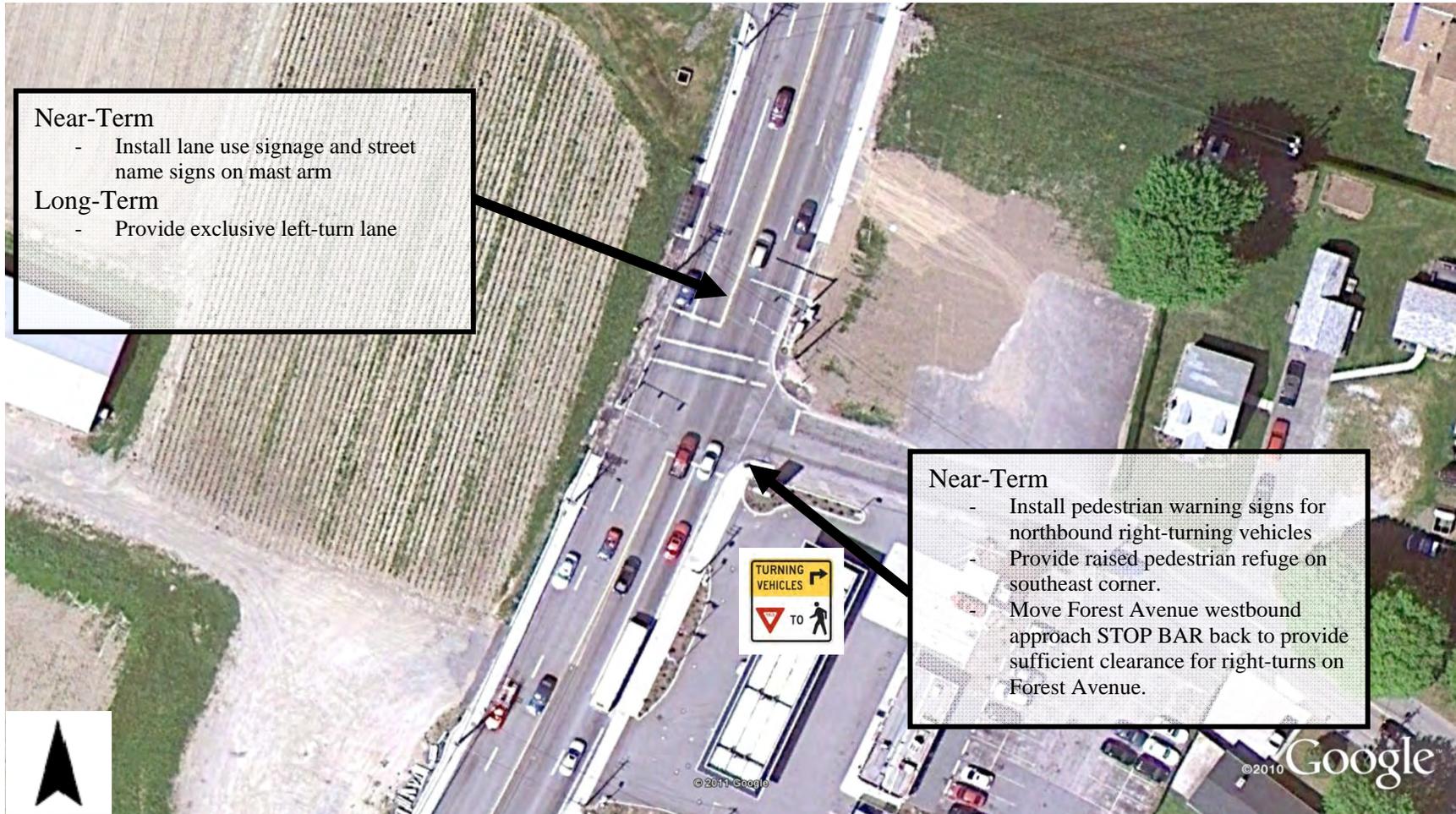
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Sidewalk in southwest corner flush with roadway</p> <ul style="list-style-type: none"> - The ADA ramp and sidewalk on the southeast corner of the intersection is flush with the roadway. - Right-turning vehicles encroach on the sidewalk. - Gas station driveway close to signal 	 <p><i>Right-turning vehicles encroaching on the ADA ramp.</i></p>  <p><i>The ADA ramp and sidewalk have numerous tire marks from being run over by right-turning vehicles.</i></p>	<ul style="list-style-type: none"> - Install raised pedestrian refuge area on southeast corner. - Move Forest Avenue STOP BAR back to provide sufficient room for vehicle to make right-turning movement without encroaching onto sidewalk. - Install TURNING TRAFFIC YIELD TO PEDESTRIANS" signs on the southbound approach. - Restrict left-turn in/out at the driveway on the southeast corner. 			<ul style="list-style-type: none"> - Increase curve radius to move back curb to provide additional waiting space for pedestrians. This may require minor ROW takings. 	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Lack of left-turn lanes & exclusive left-turn phasing</p> <ul style="list-style-type: none"> – Motorists wishing to make a left-turn block the through movement along West Main Road. – The lack of protected left-turn phasing may cause additional conflicts as vehicles must make a left-turn against two lanes of opposing through traffic. 	 <p><i>Vehicle waiting in left-lane swerving into the right-lane to go around vehicle waiting to make left-turn movement. The high number of sideswipes at this intersection may be caused by maneuvers like the one shown.</i></p>	<ul style="list-style-type: none"> – Install advance lane use signage for southbound traffic and supplement with pavement markings. – Install street name signs and lane use signage on mast arm, if feasible. 				<ul style="list-style-type: none"> – Install exclusive left-turn lane on West Main Road southbound approach.



Figure 3-14 Suggested Recommendations at the West Main Road at Forest Avenue Intersection



Source: Google Earth



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3.5 East Main Road at Aquidneck Avenue



3.5.1 Existing Conditions

The intersection of East Main Road and Aquidneck Avenue is a major junction in Middletown, where vehicles travel to/from Aquidneck Avenue and East Main Road northbound. Aquidneck Avenue is the main corridor from this area leading to the Middletown and Newport beaches and is designated Scenic Route 138A. This intersection has been reconstructed within the past 10 years as part of the East Main Road Reconstruction project. As part of this project new signal equipment, pavement, and sidewalks upgrades were provided.

The four-way, signalized intersection consists of a shared left-turn/through lane and a shared through/right-turn lane on the East Main Road eastbound and westbound approaches. The Aquidneck Avenue northbound approach consists of a left-turn lane and a shared through/right-turn lane and approaches the intersection on a horizontal curve and intersects at a slight skew. The southbound driveway approach consists of a shared left-turn/through lane and a right-turn lane. Four other heavily used driveways are located in the vicinity of the intersection. The posted speed limit is 25 mph. The RSAs were performed at the intersections as shown in **Figure 3-15** and as discussed in the following section.



Figure 3-15 East Main Road/Aquidneck Avenue Intersection



Source: Google Earth

3.5.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 3-10** and is presented in vehicles per day (vpd):

Table 3-10 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
East Main Road	19,000	South of Portsmouth Town Line
Aquidneck Avenue	11,800	Between East Main Road & Green End Avenue

The overall delay and critical approaches/movements are listed below for this intersection. The East Main Road westbound left-turn movement onto Aquidneck



Avenue southbound experiences the highest delays and queues during the morning peak hour, as vehicles enter Middletown/Newport. During the evening peak hour, the Aquidneck Avenue northbound right-turn movement experiences the higher delay, as vehicles are leaving Middletown/Newport. The overall intersection delay is presented in **Table 3-11**.

Table 3-11 Calculated Intersection Delay

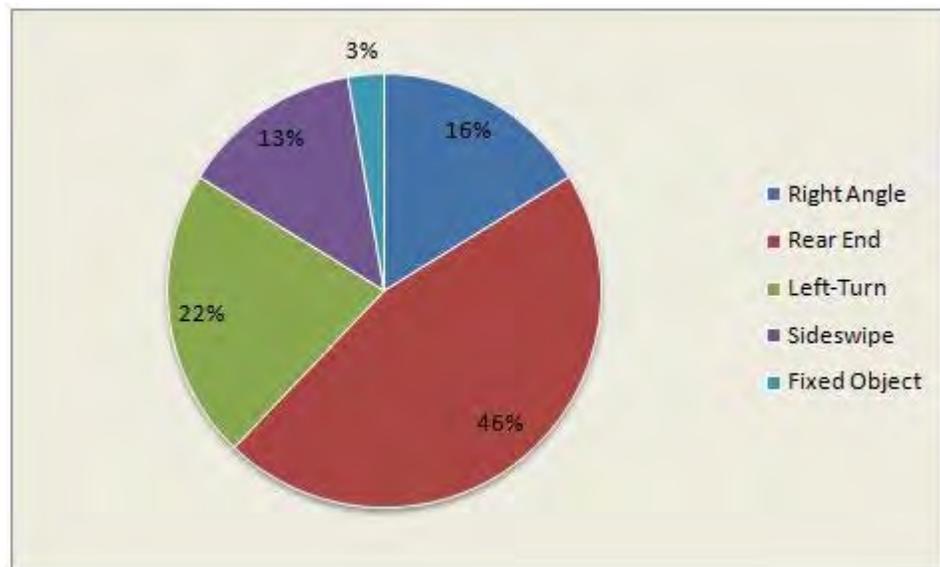
Subject Intersection	Intersection Delay (sec)	General Location of Delay
East Main Road at Aquidneck Avenue	18.4	Northbound Right-Turn Movement



3.5.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 37 crashes were reported at this intersection, with the most prevalent (46%) being rear-end-type collisions. **Figure 3-16** illustrates the breakdown of the crashes by collision type.

Figure 3-16 Vehicle Crash Type – East Main Road at Aquidneck Avenue



In addition to the rear-end crashes, which are typical of a signalized intersection, left-turn, right angle, and sideswipe crashes comprised 22%, 16%, and 13% of the crashes, respectively. A total of 16% the total number of crashes were attributed to the driveways along the north side of East Main Road (Bank, Dunkin Donuts).



3.5.4 Assessment Findings

The intersection has been reconstructed within the past 10 years. As part of this reconstruction, there are several positive characteristics of the roadway network when considered in terms of roadway safety:

- New signal equipment and enhanced pedestrian facilities such as sidewalks, crosswalks, and pedestrian signal head with countdown timers were installed.
- The pavement was overlaid as well.



3.5.5 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Table 3-12** and **Figure 3-17**.



Table 3-12 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the East Main Road at Aquidneck Avenue Intersection

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Multiple access points near intersection.</p> <ul style="list-style-type: none"> – On the westbound approach, there are multiple access points close to each other and near the intersection. – Left-turning vehicles waiting to access driveways along East Main Road cause delay for through vehicles. – Vehicles along East Main Road in left lane stop to let left-turning vehicles from into driveway, and then vehicles in right lane have limited sight distance to see this vehicle crossing. – Eastbound vehicles pass the signalized entrance to the Bank/Shopping Center and enter via the unsignalized drive to the east. 	 <p><i>Vehicles turning left into bank driveway. Vehicles drive past signal and try to sneak in between the westbound queue.</i></p>	<ul style="list-style-type: none"> – Convert unsignalized Bank driveway to Right-In/Right-Out access only. 				<ul style="list-style-type: none"> – Install median along East Main Road, between Aquidneck Avenue and Wyatt Road. – Connect the driveways for Dunkin Donuts and the Bank/Plaza with frontage roads and consolidate access points along East Main Road.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Conflicts with left-turning vehicles</p> <ul style="list-style-type: none"> – Motorists wishing to make a left-turn block the through movement along East Main Road. – The lack of protected left-turn phasing causes additional conflicts as vehicles must make a left-turn against two lanes of opposing through traffic. 		<ul style="list-style-type: none"> – Install advance lane use signage warning westbound vehicles of heavy left-turn movement. – Install lane use signage on mast arm, if feasible. 				<ul style="list-style-type: none"> – Install exclusive left-turn lane on East Main Road approaches.



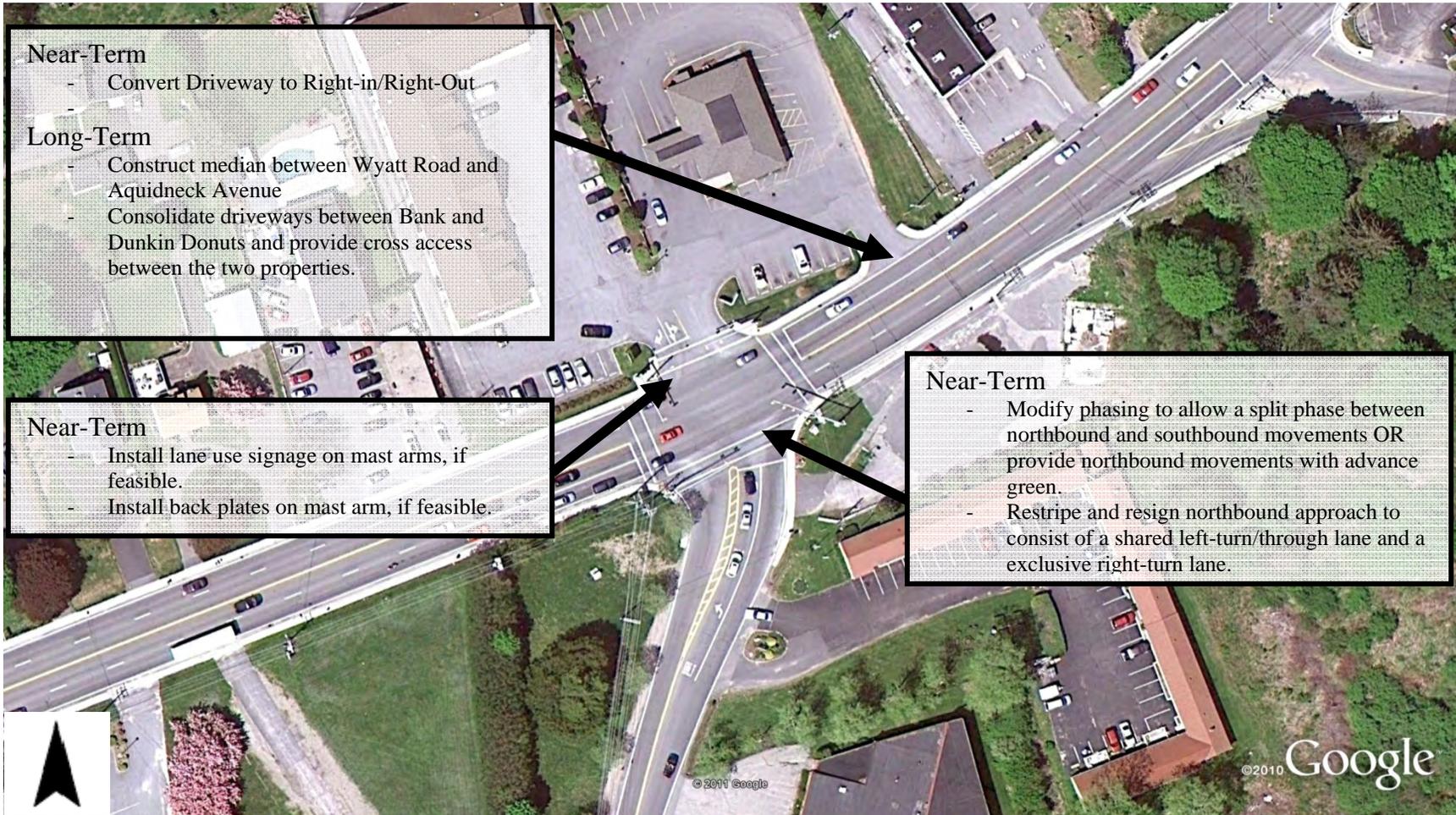
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Numerous crashes between Aquidneck Avenue northbound and driveway southbound movements</p> <ul style="list-style-type: none"> – There were several crashes that include angle collisions between northbound and southbound movement. – The northbound through movement, shared with the right-turn lane, is caused a skewed angle for vehicles going through intersection. 		<ul style="list-style-type: none"> – Reconfigure signal timings to provide split phasing or give advance green phase to northbound approach. This may help avoid most conflicts. – Restripe/Resign northbound approach to a left-turn/through movement and a exclusive right-turn lane 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Sun glare causes limited visibility during peak period.</p> <p>– The eastbound and westbound approaches experienced sun glare during the morning and evening peak periods, respectively.</p>		<p>– Add back plates to the traffic signal heads, if feasible.</p>				



Figure 3-17 Suggested Recommendations at the East Main Road at Aquidneck Avenue Intersection



Source: Google Earth



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3.6 East Main Road at Turner Road



3.6.1 Existing Conditions

The East Main Road at Turner Road intersection is a skewed, three-way unsignalized intersection. East Main Road curves from a north-south corridor to an east-west corridor in the area of this intersection.

The intersection consists of a through lane and a shared through/right-turn lane on the East Main Road eastbound approach, a shared left-turn/through lane on the East Main Road southbound approach, and one multipurpose (left-turn/through/right-turn) lane on the Turner Road northbound approach. The land use in the area is mostly farm, with a small business and a gas station at the intersection corners. There is inadequate delineation for the gas station access driveways. The posted speed limit is 35 mph. The RSAs were performed at the intersections as shown in **Figure 3-18** and as discussed in the following section.



Figure 3-18 East Main Road/Turner Road Intersection



Source: Google Earth

3.6.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 3-13** and is presented in vehicles per day (vpd):

Table 3-13 Daily Traffic Volume

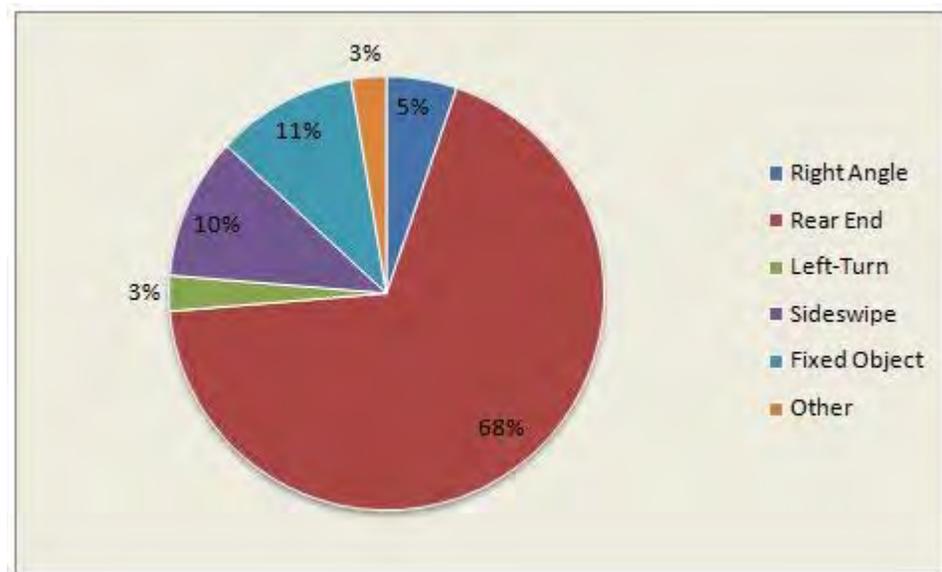
Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
East Main Road	19,000	South of Portsmouth Town Line



3.6.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 38 crashes were reported at this intersection with the majority (68%) being rear-end collisions. **Figure 3-19** illustrates the breakdown of the crashes by collision type.

Figure 3-19 Vehicle Crash Type – East Main Road at Turner Road



Of the 38 rear-ends crashes, 24 (63%) occurred on the Turner Road northbound approach. Also, all five crashes that involved a fixed object occurred in nighttime conditions.



3.6.4 Assessment Findings

Based on a review of existing site conditions, there are several positive characteristics of the roadway network when considered in terms of roadway safety:

Intersection Lighting – It appeared that the intersection was adequately lit during a nighttime field visit.

Low Speeds – As part of the field review, speed shots were performed along East main Road, adjacent to Turner Road. It was determined that during the team’s



observations, the majority of vehicles traveled within the posted speed limit of 35 mph.



3.6.5 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Table 3-14** and **Figure 3-20**.



Table 3-14 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the East Main Road at Turner Road intersection

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>The Turner Road approach to the intersection is skewed.</p> <ul style="list-style-type: none"> - The northbound approach to the intersection is at a skewed angle, requiring drivers exiting Turner Road to look "hard" left for a gap in traffic. - Because the northbound vehicles must look "hard" left, once they see a gap, they proceed without looking forward. This may have been a contributing factor in the majority of rear-end crashes at this intersection. 	 <p><i>Vehicles exiting Turner Road must look left at a less than desirable angle to determine a safe gap in traffic to proceed.</i></p>	<ul style="list-style-type: none"> - Restripe to realign northbound approach to create an intersection closer to a 90 degree angle. - Restrict intersection to rights-out only, if feasible. Conduct traffic counts to determine if lefts are low enough to be rerouted via another route. 			<ul style="list-style-type: none"> - Install curbing to realign northbound approach to create an intersection closer to a 90 degree angle. 	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Lack of delineation between roadway and access points</p> <ul style="list-style-type: none"> – There is no delineation between East Main Road, Turner Road, and the properties located adjacent to this intersection. – The lack of delineation permits vehicles exiting the gas station to enter the intersection at undesirable locations. 	 <p><i>Photo illustrated the lack of delineation between Turner Road and the property to the east.</i></p>  <p><i>Photo shows a vehicle exiting the gas station and waiting in the queue on wrong side of road.</i></p>	<ul style="list-style-type: none"> – Install tubular delineators to help define access points 			<ul style="list-style-type: none"> – Install curbing delineators to help define access points and roadway edge. 	



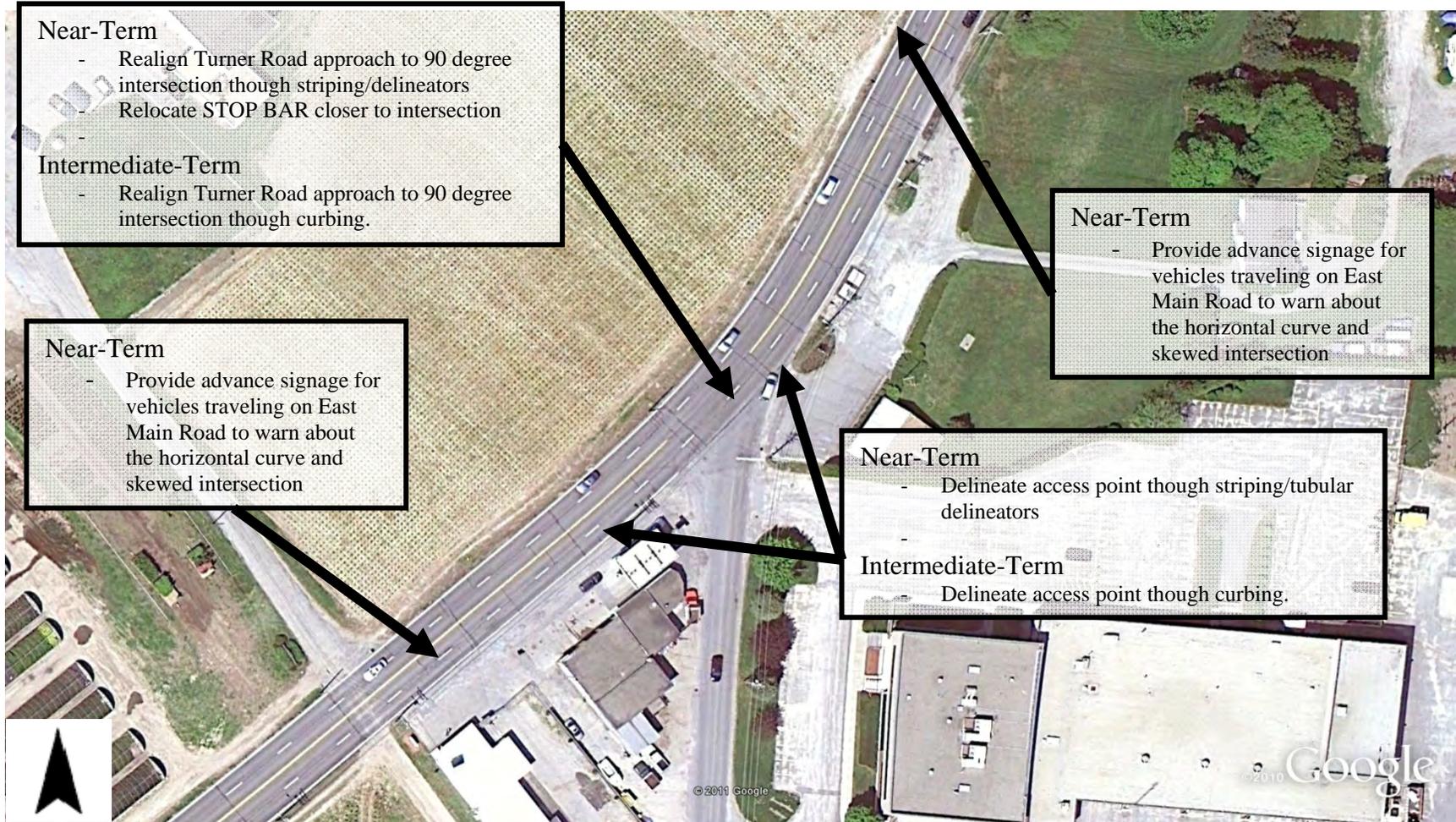
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Stop Bar on Turner Road northbound approach too far back from intersection.</p> <p>– The STOP BAR is located too far back and is not adhered to.</p>	 <p><i>Photo illustrates view from vehicle when stopped at STOP BAR.</i></p>	<p>– Move STOP BAR closer to East Main Road.</p>				
4	<p>Horizontal curve on major arterial</p> <p>– East Main Road changes direction in this area, going from a north-south corridor to an east-west corridor.</p> <p>– There is a lack of signage warning drivers of this change in direction.</p>	 <p><i>There is a lack of guidance for motorists around the horizontal curve/intersection.</i></p>	<p>– Install advance warning signs/chevrons on the East Main Road approaches to the intersection/horizontal curve.</p> <p>– Install object markers on utility poles, curbing, etc.</p>			<p>– Install recessed reflectorized pavement markers around the horizontal curve.</p>	



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Figure 3-20 Suggested Recommendations at the East Main Road at Turner Road Intersection



Source: Google Earth



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3.7 Aquidneck Avenue at Green End Avenue



3.7.1 Existing Conditions

The intersection of Aquidneck Avenue and Green End Avenue is identified as a High-hazard intersection based on RIDOT. It has been investigated as part of the RIDOT High-Hazard program and a proposed design has been developed.

The four-way, skewed signalized intersection consists of a shared left-turn/through lane and a right-turn lane on the Aquidneck Avenue northbound approach, a shared left-turn/through lane and a shared through/right-turn lane on the Aquidneck Avenue southbound approach, and one multipurpose (left-turn/through/right-turn) lane on the Green End Avenue eastbound and westbound approaches. The posted speed limit is 25 mph. The RSAs were performed at the intersections as shown in **Figure 3-21** and as discussed in the following section.



Figure 3-21 Aquidneck Avenue at Green End Avenue Intersection



Source: Google Earth



3.7.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 3-15** and is presented in vehicles per day (vpd):

Table 3-15 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
Aquidneck Avenue	11,800	North of Green End Avenue
Green End Avenue	18,700	West of Aquidneck Avenue

The overall delays and critical approaches/movements are listed below for the three major intersections with the study area corridor. The Green End Avenue eastbound



approach operates overcapacity with long delays and queues during the evening peak period. The overall intersection delay is presented in **Table 3-16**.

Table 3-16 Calculated Intersection Delay

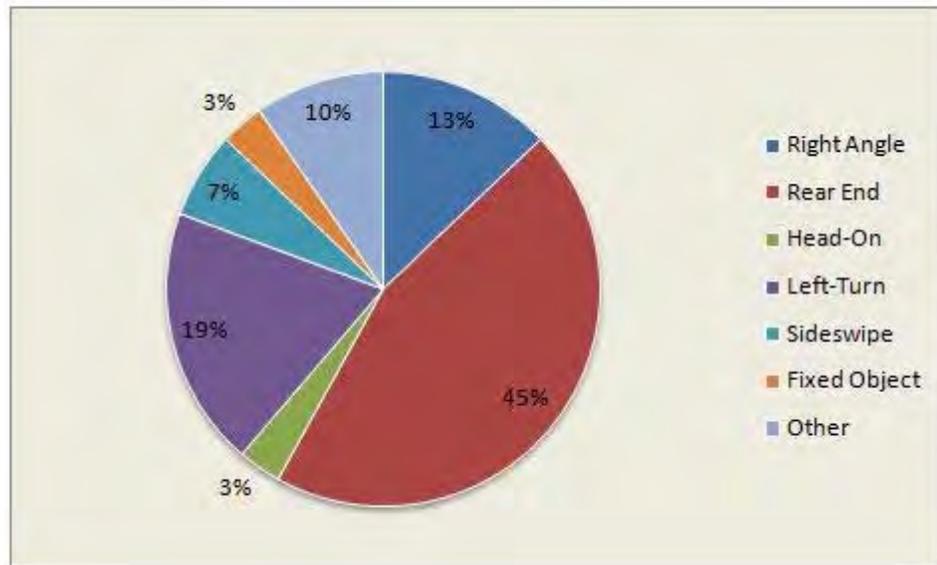
Subject Intersection	Intersection Delay (sec)	General Location of Delay
Aquidneck Avenue at Green End Avenue	47.5	Eastbound Approach



3.7.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 31 crashes were reported at the intersection, with the most predominant (45%) being rear-end collisions. **Figure 3-22** illustrates the breakdown of the crashes by collision type.

Figure 3-22 Vehicle Crash Type – Aquidneck Avenue at Green End Avenue



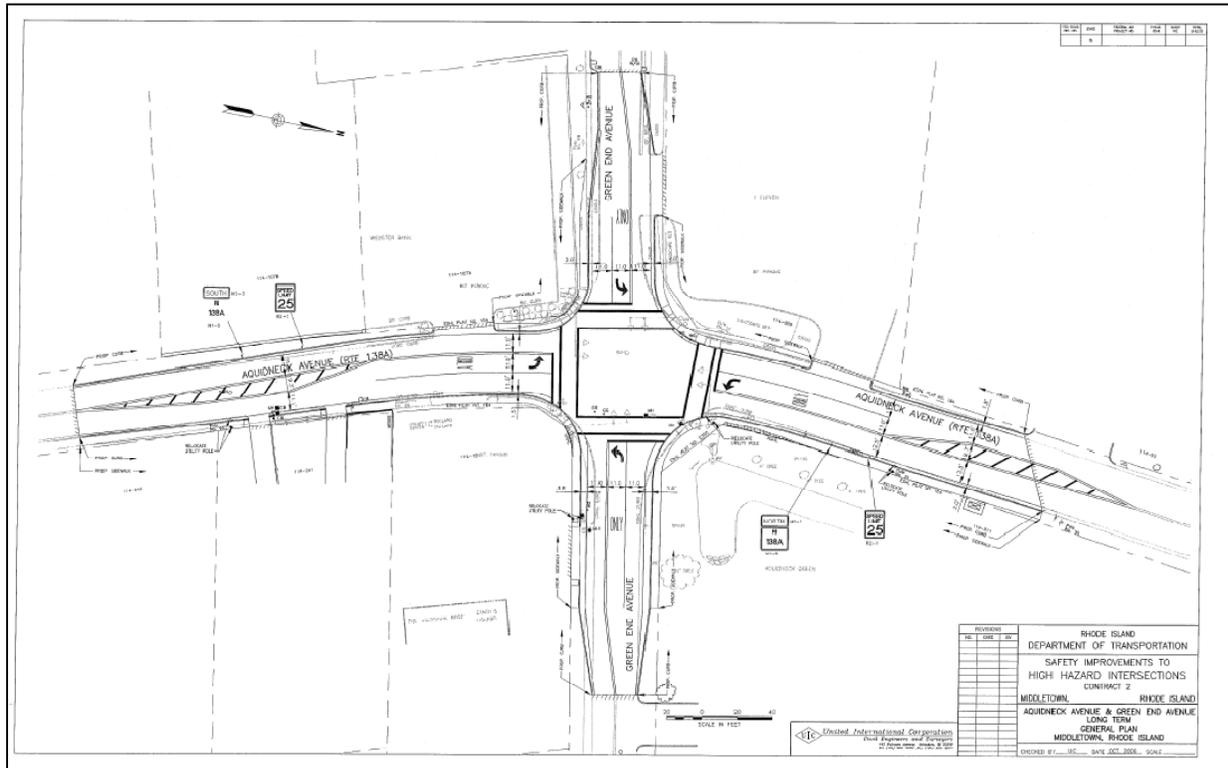
Six (20%) of the total number of crashes occurred at the 7-11 driveway, north of the intersection. Supplemental crash data was available from the RIDOT High-Hazard project. From this report, it was determined that 88 crashes occurred between 2003-2005.



3.7.4 Proposed Improvements

As part of the RIDOT High-Hazard improvement project, a design concept was developed for the Aquidneck Avenue at Green End Avenue intersection. As part of the design concept, exclusive left-turn lanes and enhanced pedestrian facilities including new sidewalk and crosswalks are propose to be installed on all approaches to the intersection. New traffic signal equipment, pavement, and signing are also included. The design concept is illustrated in **Figure 3-23**.

Figure 3-23 Proposed Long-Term Improvements



Source: RIDOT



3.7.5 Assessment Findings

The RSA team evaluated the design concept proposed by the RIDOT's High Hazard project in terms of safety benefits. The following is a list of the potential safety benefits from the design concept.



- **Installation of exclusive left turns lanes** – The addition of exclusive left-turn lanes at the signalized intersection will help remove left-turning vehicles from the through lanes at the two intersection, increasing mobility along the corridor.
- **Enhancing pedestrian accommodations** – The project includes enhanced pedestrian accommodations such as new sidewalks along the approach roadways and new pedestrian signal equipment and crosswalks at the intersection.



3.7.6 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Table 3-17 and Figure 3-24**.



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Table 3-17 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the Aquidneck Avenue at Green End Avenue Intersection

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>The Aquidneck Avenue approaches are skewed.</p> <ul style="list-style-type: none"> The southbound approach to the intersection is at a skewed angle, causing the left-most lane, consisting of a shared left-thru lane, to line up with the opposing southbound approach. 	 <p><i>The southbound approach to the intersection /through lane lines up across from the southbound approach.</i></p>	<ul style="list-style-type: none"> Reconfigure northbound approach to consist of a left-turn lane and a shared thru/right-turn lane. 				<ul style="list-style-type: none"> Construct proposed design concept from High-Hazard report, which better aligns the Aquidneck Avenue northbound and southbound approaches.
2	<p>Signage not MUTCD compliant.</p> <ul style="list-style-type: none"> There is some signage at the intersection that does not conform to MUTCD standards. 	 <p><i>The RT 138 trailblazing sign is not compliant with the MUTCD.</i></p>	<ul style="list-style-type: none"> Install MUTCD compliant signage. Install enhanced way finding signage. 				<ul style="list-style-type: none"> Incorporate enhanced way finding signage as part of the proposed design concept from High-Hazard report.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>High number of crashes at the 7-11 north driveway.</p> <p>– There were several crashes that involved vehicles entering/exiting 7-11 driveway off Aquidneck Avenue.</p>	 <p><i>Left-turning accepts small gap in traffic to enter Aquidneck Avenue.</i></p>	<p>– Sign driveway as right-in/right-out only OR</p> <p>– Restrict lefts-in from Aquidneck Avenue northbound.</p> <p>– Consider left-turn restrictions at other driveways near the intersection.</p>	<p>– Enforce driveway restrictions</p>		<p>– Convert driveway to right-in/right-out only by constructing island/curbing.</p>	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Inadequate pedestrian accommodations</p> <p>– There are no crosswalks or pedestrian signals at the intersection, despite sidewalks on the south, east, and west legs of the intersection.</p>	 <p><i>The sidewalk on the Green End Avenue eastbound approach is narrow and in poor condition.</i></p>  <p><i>Several pedestrians were observed crossing Green End Avenue west leg, from the 7-11 store to the Polo Center.</i></p>			<p>– Encourage employees/visitors of the Polo Center to cross at the intersection, once crosswalks and pedestrian signal heads are installed.</p>	<p>– Upgrade existing sidewalks to ADA standards.</p> <p>– Connect sidewalks on all approaches to the intersection.</p>	<p>– Incorporate pedestrian signal heads with countdown timers and ADA ramps as part of the proposed design concept from High-Hazard report.</p>



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
5	<p>Lack of lane use signage on Aquidneck Avenue southbound approach.</p> <ul style="list-style-type: none"> - The lack of any lane use signage/markings on southbound approach cause vehicles in both through lanes to continue through intersection. - There is only one receiving lane on southbound departure, causing vehicles to merge in the intersection. 	 <p><i>Vehicles from both southbound lanes continue through the intersection, causing vehicles in right lane to merge in the intersection.</i></p>	<ul style="list-style-type: none"> - Install lane use signage/markings to indicate left-turn lane and shared through/right-turn lane. 				<ul style="list-style-type: none"> - Incorporate lane usage as proposed design concept from High-Hazard report.



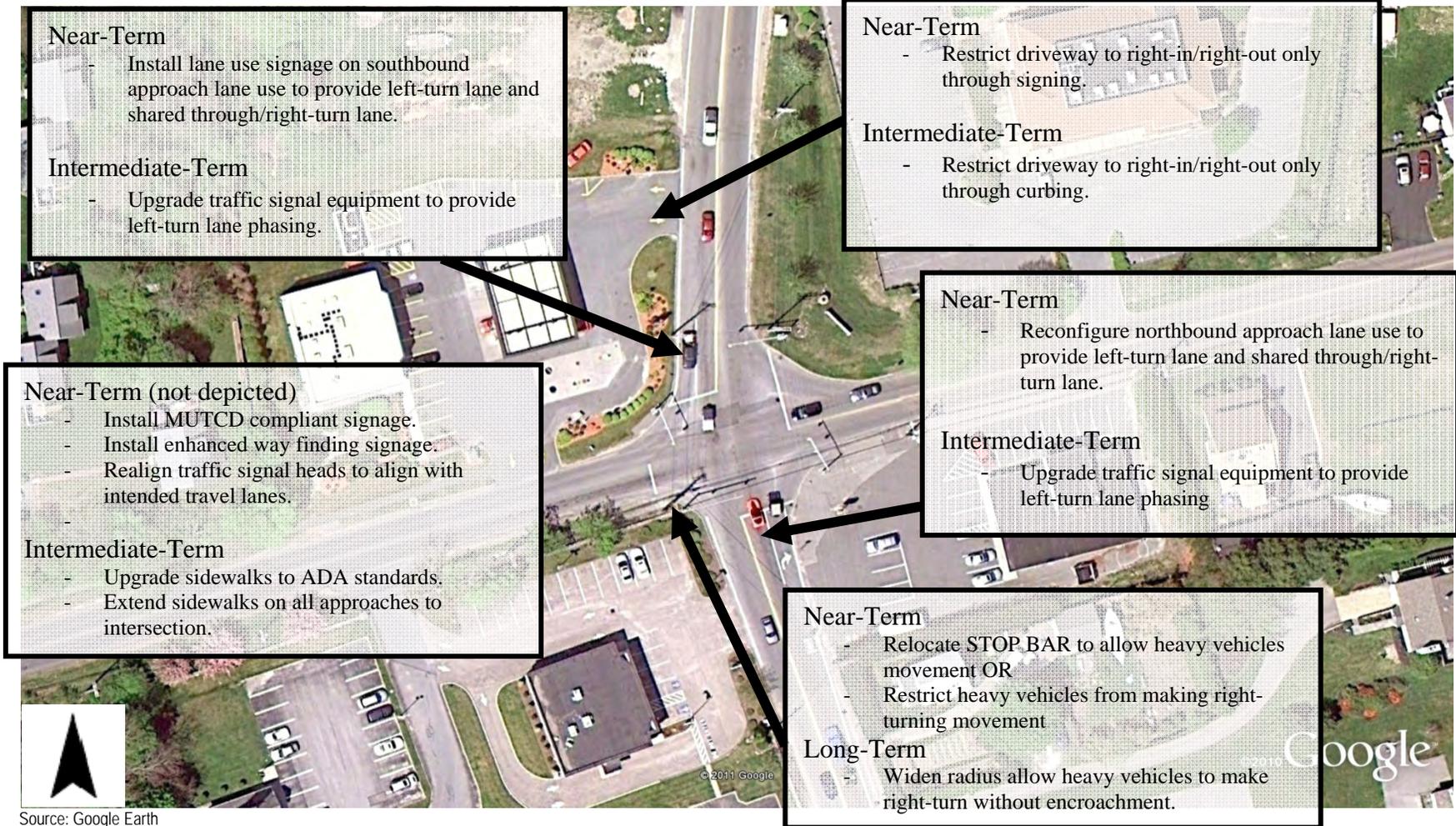
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Eastbound right-turn difficult for heavy vehicles to make.</p> <ul style="list-style-type: none"> - The tight radius on the southwest corner of the intersection causes heavy vehicles to encroach onto oncoming lanes. 	 <p><i>Heavy vehicles marking right-turn movement from Green End Avenue onto Aquidneck Avenue southbound causes conflicts through intersection.</i></p>	<ul style="list-style-type: none"> - Relocate northbound STOP BAR back to allow right-turn movement. - Restrict trucks from making this movement. Create a truck route via Valley Road. 	<ul style="list-style-type: none"> - Enforce the heavy vehicle restriction at this intersection. 			<ul style="list-style-type: none"> - Incorporate wider radius as part of the proposed design concept from High-Hazard report. This should be done only if heavy vehicle movement restriction is not feasible.
8	<p>Traffic signal heads not lined up with approaches.</p> <ul style="list-style-type: none"> - The traffic signal heads on multiple approaches are skewed and do not line up with the intended lanes of travel. 	 <p><i>The traffic signal heads on the Green End Avenue westbound approach are skewed.</i></p>	<ul style="list-style-type: none"> - Realign the traffic signal heads to align with the intended travel lanes. 				<ul style="list-style-type: none"> - Install new traffic signal equipment as part of the proposed design concept from High-Hazard report.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
9	<p>Lack of left-turn lanes.</p> <ul style="list-style-type: none"> – There are no exclusive left-turn lanes or phasing at this intersection. – Six (19%) of the crashes were left-turn crashes. 	 <p><i>Vehicles often make left-turn movements during the yellow and red phases due to the lack of an acceptable gap in opposing traffic.</i></p>	<ul style="list-style-type: none"> – Restripe/resign the northbound approach to provide an exclusive left-turn lane. – Sign the southbound approach to provide an exclusive left-turn lane. 			<ul style="list-style-type: none"> – Incorporate exclusive left-turn phasing through existing traffic signal upgrades. 	<ul style="list-style-type: none"> – Incorporate exclusive left-turn lanes and phasing as part of the proposed design concept from High-Hazard report.



Figure 3-24 Suggested Recommendations at the Aquidneck Avenue at Green End Avenue Intersection





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4

Town of Portsmouth Road Safety Assessments

The resulting recommended list of locations for the Town of Portsmouth to be included for the Road Safety Assessments as part of the Aquidneck Island RI*STARS pilot program include the following corridors and intersections:

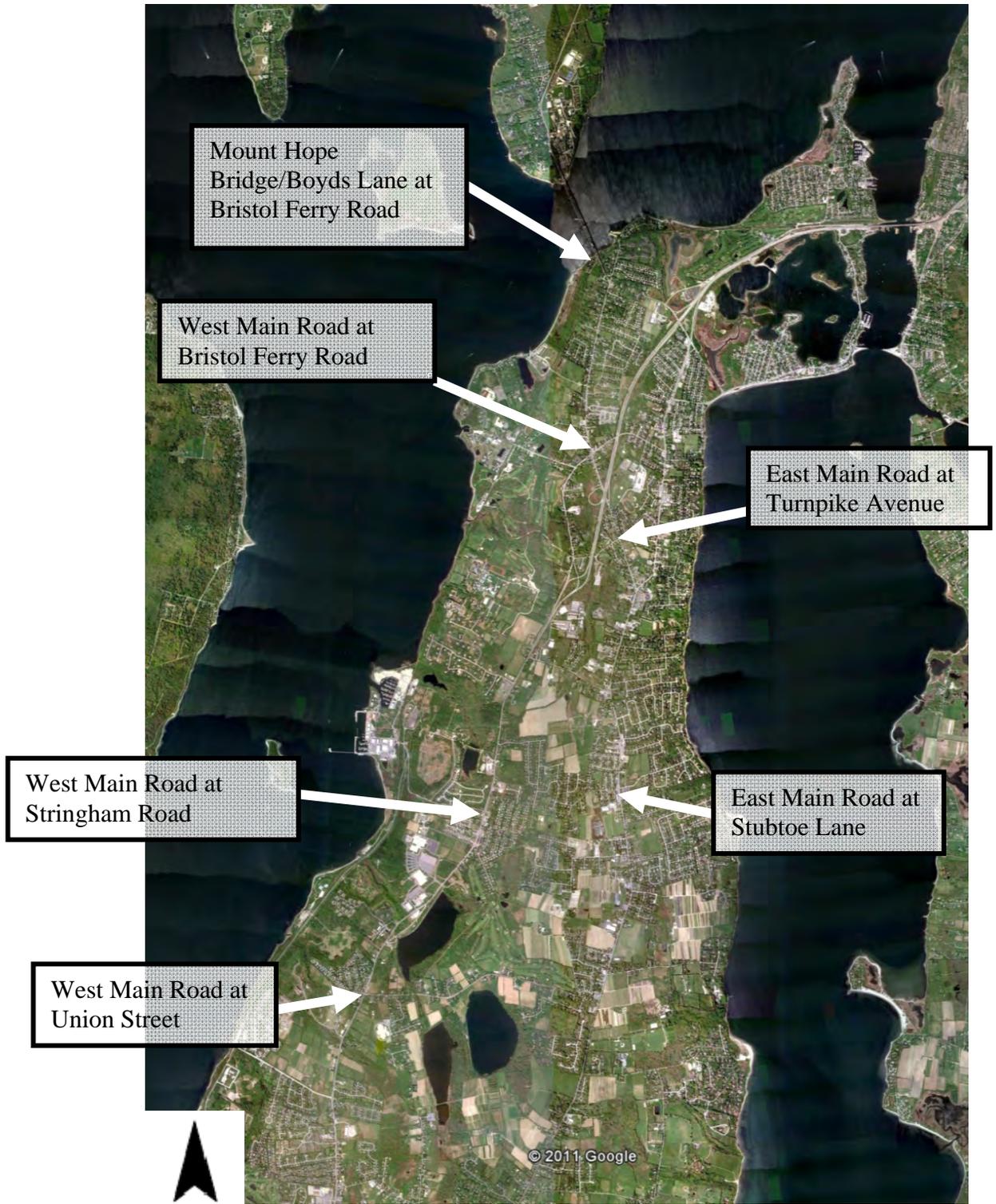
1. Mount Hope Bridge at Boyds Lane/Bristol Ferry Road.
2. West Main Road/Sprague Street at Bristol Ferry Road/Turnpike Avenue.
3. West Main Road at Stringham Road/Dunkin Donuts.
4. West Main Road at Union Street/Redwood Road.
5. East Main Road at Turnpike Avenue/Clements Market.
6. East Main Road at Stubtoe Lane/Fairview Lane.

A map showing the general location of the project study area is shown in **Figure 4-1**.



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Figure 4-1 RSA Study Area



Source: Google Earth



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4.1 Road Safety Assessment Interdisciplinary Team

The interdisciplinary RSA Team for the Town of Portsmouth assessment consisted of representatives from RIDOT Highway and Traffic, the Portsmouth Police Department, and the Federal Highway Administration (FHWA). Representatives from Vanasse Hangen Brustlin facilitated the RSA. The members of the RSA team are as follows:



- Anita Marshall, Highway Engineer – RIDOT
- Kate Wilson, Highway Engineer – RIDOT
- Sean Raymond, Traffic Engineer – RIDOT
- Kristen Capaldi, Highway Engineer – RIDOT
- Jacinda Russell, Safety & Operations Engineer – FHWA
- Colonel Lance Hebert – Portsmouth Police
- Frank Gross, Safety Engineer – VHB
- Peter Pavao, Traffic Engineer – VHB





4.2 Mount Hope Bridge/Boyd's Lane at Bristol Ferry Road



4.2.1 Existing Conditions

The Mount Hope Bridge intersects with Bristol Ferry Road and Boyd's Lane and is controlled by a five-leg signalized intersection. Mussel Bed Shoal Road intersects from the west to form the fifth leg of the intersection. Left-turn movements are only allowed from Bristol Ferry Road onto Mount Hope Bridge. All other vehicles wishing to make left-turns are required to do so via the access road that runs under the bridge and connects Mussel Bed Shoal Road and Bristol Ferry Road (north of intersection).

The Bristol Ferry Road northbound approach consists of a left-turn lane and a shared through/right-turn lane. The Bristol Ferry Road southbound approach consists of a channelized right-turn lane only onto Mount Hope Bridge. The Mount Hope Bridge south/eastbound approach consists of a through lane onto Boyd's Lane and a right-turn lane that serves access to Bristol Ferry Road and Mussel Bed Shoal Road. The right lane only provides storage for approximately 50 feet from the bridge abutment to the intersection. The Boyd's Lane westbound approach consists of a shared through/right-turn lane. The Mussel Bed Shoal Road eastbound approach consists of a shared through/right-turn lane.

There are median islands on the Bristol Ferry Road northbound, Mount Hope Bridge south/west, and Boyd's Lane westbound approaches to the intersection. There are sidewalks on the Bristol Ferry Road approach and there are no marked crosswalks at the intersection. The posted speed limit is between 25-35 mph on the intersection roadways. The RSAs were performed at the intersections as shown in **Figure 4-2** and as discussed in the following section.



Figure 4-2 Mount Hope Bridge at Boyds Lane/Bristol Ferry Road Study Area Intersection



Source: Google Earth



4.2.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 4-1** and is presented in vehicles per day (vpd):

Table 4-1 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
Mount Hope Bridge	17,800	Between Bristol and Portsmouth
Bristol Ferry Road	12,500	South of Boyds Lane

The overall delays and critical approaches/movements are listed below for the three major intersections with the study area corridor. The intersection experiences the highest delays and queues on the Mount Hope Bridge approach in the morning peak hour as vehicles enter the Island. During the evening peak hour the Bristol Ferry



Road northbound and Boyds Lane westbound approaches experience the highest delay, as commuters leave the Island. The overall intersection delay is presented in **Table 4-2**.

Table 4-2 Calculated Intersection Delay

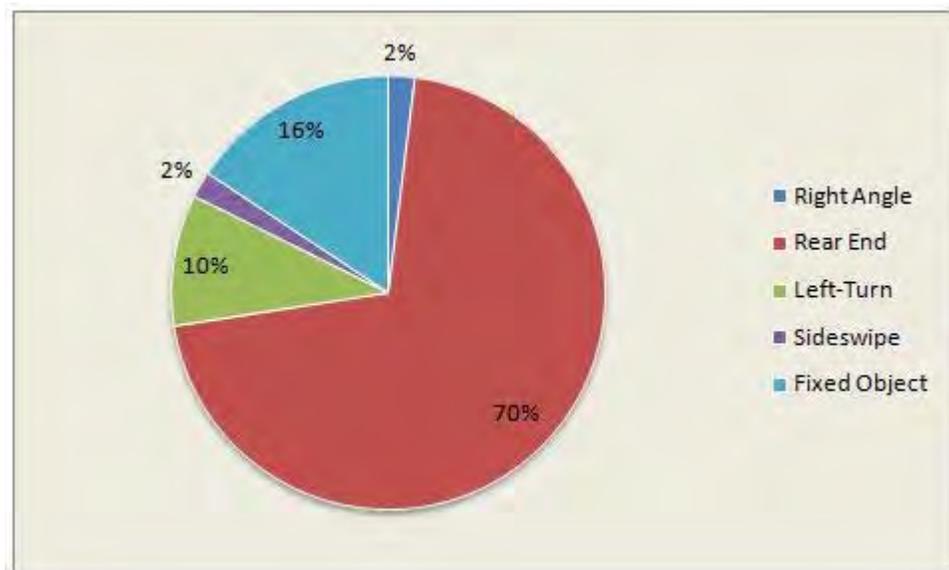
Subject Intersection	Intersection Delay (sec)	General Location of Delay
Mount Hope Bridge at Boyds Lane/Bristol Ferry Road	33.1	Northbound, Westbound, and South/eastbound approaches



4.2.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, over 50 crashes were reported with the majority (70%) being rear-end-type collisions. Of the 51 crashes reported, 7 (14%) resulted in an injury. **Figure 4-3** illustrates the breakdown of the crashes by collision type.

Figure 4-3 Vehicle Crash Type – Mount Hope Bridge at Boyds Lane/Bristol Ferry Road





4.2.4 Proposed Improvements

The Mount Hope Bridge/Bristol Ferry Road intersection improvement project is a RIDOT project currently at the 90% design stage. This project includes the new signal equipment (using existing mast arms), marked crosswalks on certain legs, additional signage, pavement resurfacing, and enhanced marking of the center islands.

As part of the Aquidneck Island Transportation Study (AITS), an alternative concept has been developed, reconfiguring the existing intersection with a smaller intersection footprint, and changing the through movement from Mount Hope Bridge to Boyds Lane to a left-turn movement. This Alternative Signalized Concept is illustrated in **Figure 4-4**.

Figure 4-4 Alternative Signalized Concept



Source: Aquidneck Island Transportation Study



4.2.5 Assessment Findings

Based on a review of existing site conditions, the following items were defined as positive characteristics of the roadway network.

- Left-turning movements are restricted for all approaches. This restriction eliminates all potential left-turning conflicts that a conventional intersection is susceptible to.
- As part of the Bristol Ferry Road reconstruction project, the sidewalks along Bristol Ferry Road have recently been upgraded.



4.2.6 Safety Benefits of Proposed Designs

Because both the RIDOT design concept at 90% as well as the concept from the Aquidneck Island Transportation Study were proposed at the time of the assessment, the RSA team evaluated both concepts in terms of safety benefits. The following is a list of the potential safety benefits from both design concepts.

4.2.6.1 RIDOT 90% Design Concept

- **Enhanced wayfinding and lane use signage at the intersection** – The addition of enhanced wayfinding signage and lane use signage will help unfamiliar motorists navigate through this unconventional intersection.
- **Enhancing pedestrian accommodations** – The project includes enhanced pedestrian accommodations such as new sidewalks along the study roadways and new pedestrian signal equipment at the signalized intersections.
- **Installation of object markers** – The installation of object markers on the center islands should enhance visibility of these islands.



4.2.7 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct



or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Table 4-3** and **Figure 4-5**.

Because the Mount Hope Bridge/Bristol Ferry Road intersection improvement project is currently at the 90% design stage and is scheduled to be completed within 2-3 years, all suggestions are meant to be implemented as part of either this project or the Alternate Signalized Concept as proposed by the Aquidneck Island Transportation Study.



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Table 4-3 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the Mount Hope Bridge at Boyds Lane/Bristol Ferry Road Intersection

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>General confusion and lack of delineation at intersection.</p> <p>The configuration, signing, and geometry of the intersection are confusing, particularly related to the indirect left-turn movements. To further compound the issue, there is a lack of delineation and guidance through intersection. The RSA team noted the following specific issues:</p> <ul style="list-style-type: none"> - There is limited guidance to get to 114 south from Boyds Lane. - The 'no left-turn' sign is not visible from the westbound thru lane. 	 <p><i>Photo shows the southbound approach. Thru movements are not permitted from this approach. Instead, drivers must turn right prior to the intersection, go under the bridge, and then make a right back onto 114 south.</i></p> 	<ul style="list-style-type: none"> - Add lane designation on mast arms (if possible). - Improve signing and adjust way-finding signs as appropriate, particularly for guidance to 114 south and turn restrictions. - Convert green ball into canted arrow to the upper left for thru vehicles from Mount Hope Bridge onto Boyds Lane. The destination arrows should be converted in the same manner. 			<ul style="list-style-type: none"> - There are plans to install new signage (large MUTCD compliant) and lighting, rehab curbs, enhance curb islands, and pull back the guardrail in the southeast quadrant as part of an upcoming project 	<ul style="list-style-type: none"> - Consider AITS concept drawing to allow more space for right-turn lane from the Mount Hope Bridge.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	<ul style="list-style-type: none"> - The 'keep right' arrow signs have a white background (non-compliant and blends with snow). - The northbound 'To 114' sign (prior to intersection) should be '114 North'. - North of the intersection, the sign for 114 is too close to the intersection and may confuse drivers looking for 114 North. - The Channelizing islands are not well delineated. - The guardrail in the southeast quadrant is painted white and blends with the sidewalk (and the ground during snow). 	<p><i>Photo shows the numerous channelizing islands at and within the intersection.</i></p>	<ul style="list-style-type: none"> - Replace current 'keep right' arrow with a yellow background. - Consider eliminating mid-intersection channelizing islands where possible and properly delineating those that remain with appropriate signing and potentially paint the curb with reflective paint. - Delineate the guardrail with reflective tape or reflectors. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Diver behavior issues.</p> <ul style="list-style-type: none"> – The RSA team observed high speeds in the eastbound direction from the Mount Hope Bridge. There is a downgrade coming off the bridge that induces speeding. – High speeds contributed to several crashes at the intersection and there were several guardrail hits directly across from the bridge approach. The guardrail was replaced 3 times in 2011 (Jan-Mar). – The 30 mph speed limit sign on the Mount Hope Bridge (traveling west) may be mounted too low. – There is also some indication that alcohol may be a contributing factor, 	 <p><i>Photo shows the downgrade from the bridge.</i></p>	<ul style="list-style-type: none"> – Consider speed feedback signs on the Mount Hope Bridge in the eastbound direction. This may be an intermediate measure for permanent signs. – Consider installing a 'signal ahead' sign/flasher on the Mount Hope Bridge in the eastbound direction. – Consider installing transverse speed bars (pavement markings) on the Mount Hope Bridge in the eastbound direction. 	<ul style="list-style-type: none"> – Target speeding in conjunction with education. There is also potential for DUI checkpoints. 	<ul style="list-style-type: none"> – Target speeding and DUI in conjunction with enforcement campaign. Specifically, there is the potential to work with bars and restaurants (maybe the university) in Bristol. 		



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	particularly in the nighttime crashes.	 <p><i>Photo shows the damaged guardrail on the southeast corner.</i></p>	<ul style="list-style-type: none"> - Visually narrow the lanes using a pavement stamp. - Adjust height of speed limit sign. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Unsecured signal heads.</p> <ul style="list-style-type: none"> - The signal heads twist when the wind blows, making it difficult to determine whether the light is green or red. 	 <p><i>Photo shows the unsecured signal heads, which are starting to twist from the wind.</i></p>	<ul style="list-style-type: none"> - Tighten or secure signal heads to prevent twisting in the wind. - Add backplates to signals. 				
4	<p>Sight distance issues.</p> <ul style="list-style-type: none"> - There is poor sight distance to the signal on the westbound approach (Boyd's Lane). Signs and a tree obstruct drivers' view to the signal. A supplemental signal has been installed, but is not 		<ul style="list-style-type: none"> - Relocate sign to improve sight distance to signal on westbound approach (this will be moved as part of upcoming project). - Consider 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	visible at the current location.	<i>Photo shows where a sign and tree obstruct the line of sight to the signal heads from the westbound approach. This issue is accentuated when the tree is in bloom.</i>	installing a 'signal ahead' warning sign on Boyds Lane.				
5	Roadside hazards. – There are several fixed objects in close proximity to the roadway along the east side of the northbound approach.	 <i>Photo shows several utility poles in close proximity to the roadway.</i>	– There is the potential to relocate utility lines and eliminate at least three utility poles.			– There are plans to eliminate redundant utility poles as part of an upcoming project (Kate Wilson).	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Pedestrian and ADA issues.</p> <ul style="list-style-type: none"> – There are no pedestrian crossings on any of the intersection approaches and there are also obstructions along the sidewalk. – The location of the planned crosswalk on the southern leg is a concern due to high speeds from right-turn vehicles and limited sight distance. – No refuge islands. 	 <p><i>Photo shows several fixed objects obstructing the sidewalk.</i></p>	<ul style="list-style-type: none"> – Consider revising the plans to move the crosswalk on the southern leg and/or improve sight distance. – Reduce vehicle speeds through engineering, education, and enforcement strategies described previously. 			<ul style="list-style-type: none"> – There are plans to install pedestrian refuge islands on Bristol Ferry Road, new pedestrian heads and push-buttons, and reinforce/improve the sidewalk through an upcoming project (Kate Wilson). 	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
7	<p>Pavement issues.</p> <ul style="list-style-type: none"> – The pavement is “shoving” on the northbound approach. <p>There were also several wet-weather crashes.</p>	 <p><i>Photo shows pavement shoving on the northbound approach.</i></p>				<ul style="list-style-type: none"> – There are plans to improve the pavement by white topping to address shoving (Kate Wilson) 	<ul style="list-style-type: none"> – Consider improving pavement friction.
8	<p>Capacity issues.</p> <p>The RSA team identified several capacity-related issues including:</p> <ul style="list-style-type: none"> – Eastbound vehicles queue and block the right-turn lane (AM and PM peak). – The green phase for the northbound approach 	 <p><i>Photo shows the queues in the PM peak along the eastbound approach.</i></p>	<ul style="list-style-type: none"> – Replace the controller in cabinet to allow more efficient timing at different peaks. 			<ul style="list-style-type: none"> – Consider impacts of tolling on safety and capacity. – There are plans to improve the northbound right-turn storage lane by roadway widening and tightening the radius for 	



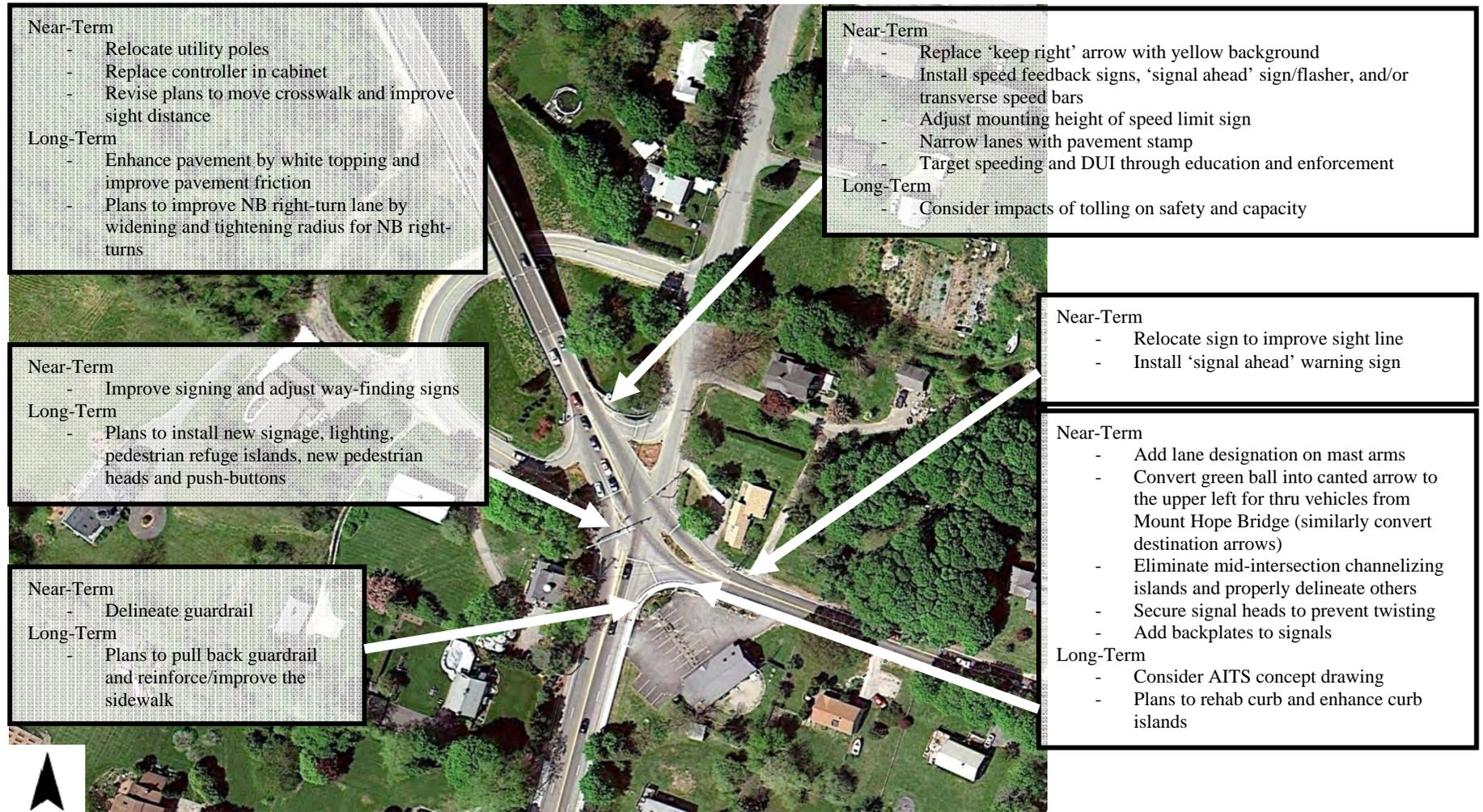
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	<p>seemed too long for the demand in the AM peak.</p> <ul style="list-style-type: none"> - Older style controller that is not capable of different timing plans by time-of-day. - There are no apparent issues on Boyds Lane and Bristol Ferry Road (queues cleared during each cycle). 	 <p><i>Photo shows how the eastbound queue blocks the right-turn lane to 114 south. Note the right-turn arrow is green, but cannot be used.</i></p>				northbound right-turns as part of an upcoming project (Kate Wilson).	



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Figure 4-5 Suggested Recommendations at the Mount Hope Bridge at Boyds Lane/Bristol Ferry Road Intersection



Source: Google Earth



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4.3 West Main Road/Sprague Street at Bristol Ferry Road/Turnpike Avenue



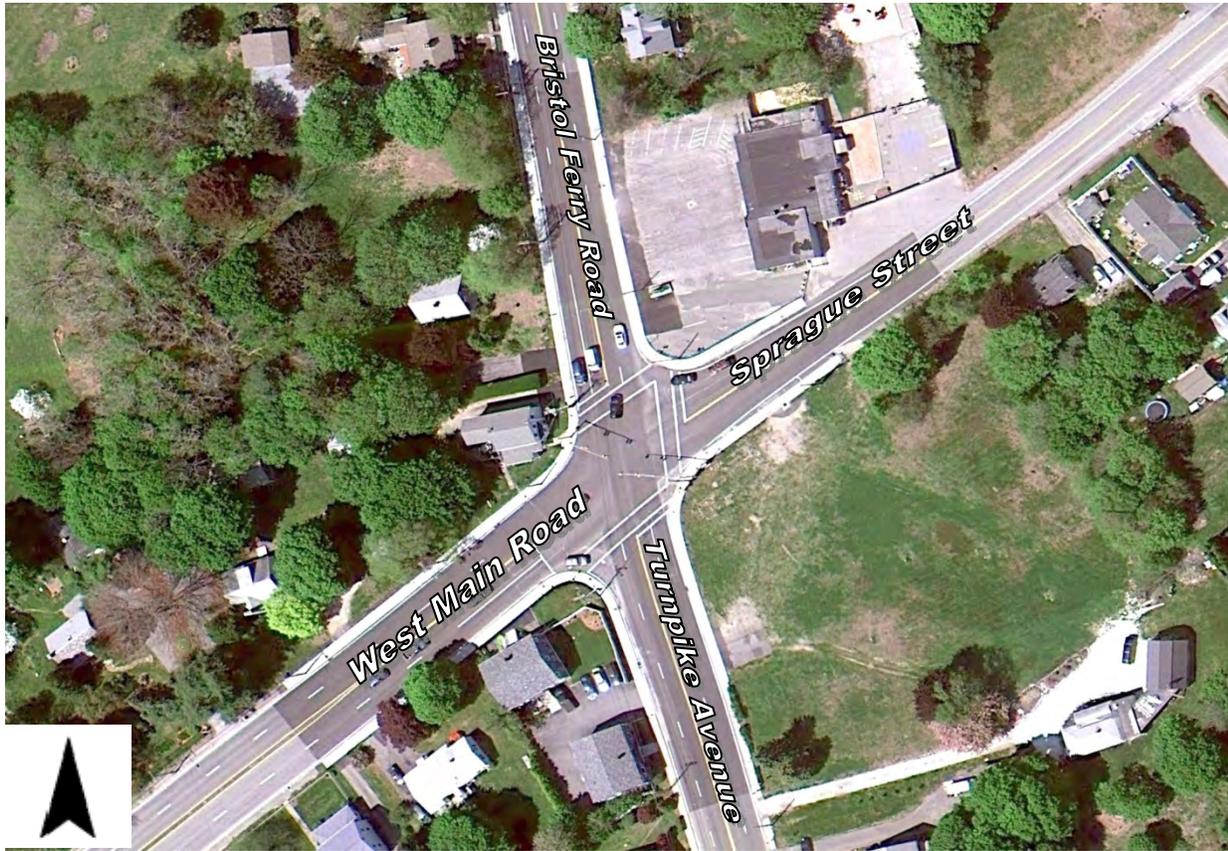
4.3.1 Existing Conditions

The intersection of West Main Road, Sprague Street, Bristol Ferry Road, and Turnpike Avenue is a 4-leg signalized intersection that has recently been reconstructed by the RIDOT. The intersection consists of a shared left-turn/through lane and a shared through/right-turn lane on the Bristol Ferry Road southbound and Turnpike Avenue northbound approaches. The West Main Road eastbound approach consists of a left-turn lane and one multipurpose (left-turn/through/right-turn) lane. The Sprague Street westbound approach consists of two lanes. There was no lane use indicated during the field review, but the approaches operated as a shared left-turn/through lane and a right-turn lane.

There are sidewalks on all approaches and marked crosswalks with pedestrian signal accommodations on the north, south, and east legs on the intersection. The posted speed limit is between 25-40 mph on the intersection roadways. The RSA was performed at the intersection as shown in **Figure 4-6** and as discussed in the following section.



Figure 4-6 West Main Road/Sprague Street at Bristol Ferry Road/Turnpike Avenue Study Area Intersection



Source: Google Earth



4.3.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 4-4** and is presented in vehicles per day (vpd):

Table 4-4 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
Bristol Ferry Road	21,200	South of Boyds Lane
West Main Road	25,700	South of Bristol Ferry Road
Turnpike Avenue	33,700	West of East Main Road



The overall delays and critical approaches/movements are listed below for the intersection. The intersection operates at overall acceptable levels during both peak periods. The overall intersection delay is presented in **Table 4-5**.

Table 4-5 Calculated Intersection Delay

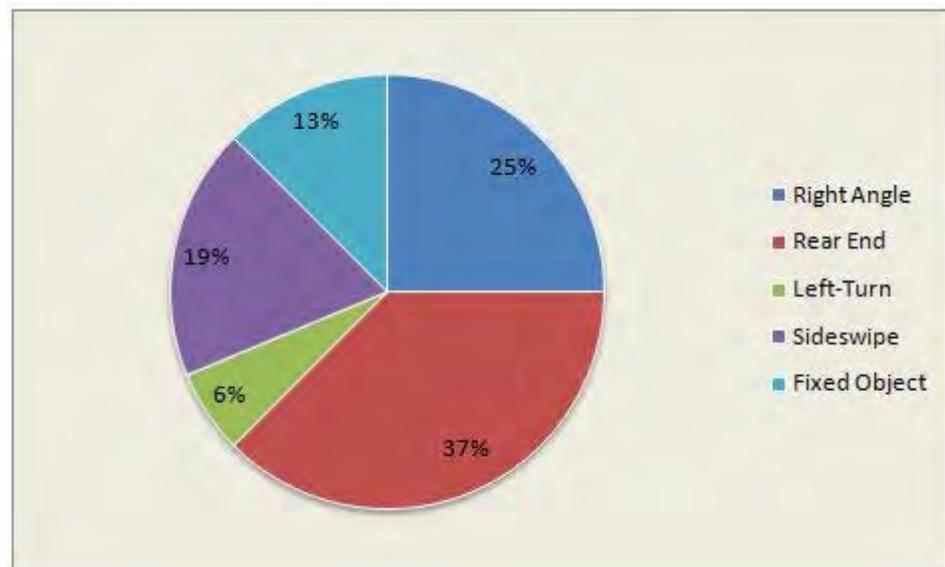
Subject Intersection	Intersection Delay (sec)	General Location of Delay
West Main Road/Sprague Street at Bristol Ferry Road/ Turnpike Avenue	18.0	Northbound Left-Turn Movement



4.3.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, 16 crashes were reported at this intersection, with the majority (37%) being rear-end-type collisions. Of the 16 crashes report, 2 (13%) resulted in an injury. It should be noted that the crash data reviewed occurred before the intersection was reconstructed. **Figure 4-7** illustrates the breakdown of the crashes by collision type.

Figure 4-7 Vehicle Crash Type – West Main Road/Sprague Street at Bristol Ferry Road/Turnpike Avenue





4.3.4 Assessment Findings

Based on a review of existing site conditions, there are several positive characteristics of the roadway network:

- **Intersection recently reconstructed**– The intersection has recently been reconstructed within the past 2 years. There are working pedestrian signal heads at the crossings and the pavement is also in good condition.
- **Audible crossing system installed** – Because there is a deaf pedestrian within the area of the intersection, an audible crossing system has been installed.
- **Driveways located away from intersection** – The business on the northeast corner of the intersection has one driveway on Bristol Ferry Road and one on Sprague Street. Both driveways are located far away from the intersection.



4.3.5 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Tables 4-6** and **Figure 4-8**.



Table 4-6 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at West Main Road/Sprague and Bristol Ferry Road/Turnpike Avenue

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Pedestrian and ADA issues.</p> <p>The RSA team noted several pedestrian and ADA-related issues, including:</p> <ul style="list-style-type: none"> – Wheelchair ramp is not ADA compliant (too steep). – Inconspicuous crosswalks. – Guide wire is placed in the sidewalk, obstructing the path. – The sidewalk was dug-up and the concrete was replaced with asphalt in the northeast quadrant (more of an aesthetics issue). – There is no crosswalk across West Main Road, but this is a wide cross-section with high speeds for the right-turn movement. – There is a blind pedestrian that lives in the vicinity. 	 <p><i>Photo shows the relatively steep ramp and obstructions on the sidewalk.</i></p>  <p><i>Photo shows the lack of a crosswalk on West Main Road.</i></p>	<ul style="list-style-type: none"> – Address ADA concerns. – Consider enhancing visibility of crosswalks (piano key style). 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Driver behavior issues.</p> <p>The RSA team noted several driver behavior issues, including:</p> <ul style="list-style-type: none"> – Drivers stopping in the crosswalk. – Right-turn drivers are not yielding to pedestrians (green light comes up at same time as walk signal). – Right-turning drivers are not stopping on red (rolling stops). – Drivers turning right on red against signing 	 <p><i>Photo shows a vehicle stopped in the crosswalk to turn right on red.</i></p>	<ul style="list-style-type: none"> – Consider implementing a leading pedestrian interval. 				
3	<p>Maintenance issues.</p> <ul style="list-style-type: none"> – A signal head is missing a louver. – Door to signal pole is missing. 	 <p><i>Photo shows the missing door on the signal pole.</i></p>	<ul style="list-style-type: none"> – Replace louver on signal head. – Replace door on signal pole. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	<p>Signing issues.</p> <ul style="list-style-type: none"> – A guide sign to 114 north is placed in the northwest quadrant (facing south). There is not a similar guide sign in the northeast quadrant. – There is a need for better destination signs to bridges on the northbound approach. – The “To 114” sign on the southeast corner should read “114 south”. – There is a need for a ‘No Turn on Red’ sign on Bristol Ferry Road. – The existing ‘No Turn on Red’ sign on the northwest corner is not MUTCD compliant. 	 <p><i>Photo shows the noncompliant NO TURN ON RED sign on the northwest corner.</i></p>	<ul style="list-style-type: none"> – Improve way-finding signs. Specifically, install guide sign to 114 north in northeast quadrant, install destination signs to bridges on northbound approach, and change “To 114” sign to “114 south” on southeast corner. – Install street name signs on mast arms (if feasible). – Install a ‘No Turn on Red’ sign on Bristol Ferry Road. – Upgrade ‘No Turn on Red’ sign to comply with MUTCD. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
5	<p>Operational issues.</p> <ul style="list-style-type: none"> – There are two receiving lanes on Turnpike Avenue. This is an unnecessary configuration and creates the potential for merging issues. – The split phase provides a protected left-turn for the northbound approach, but the left-turn lane only receives a green ball (not left arrow). This is confusing to unfamiliar drivers (may not know that they have a protected phase). – Some signals do not have backplates. 	 <p><i>Photo shows the two receiving lanes on Turnpike Avenue and immediate merge down to one lane.</i></p>	<ul style="list-style-type: none"> – Consider restriping receiving lanes on Turnpike Avenue as one receiving lane. – Potential to add signal head with left-turn arrow (or additional bulb with arrow on existing signal head) to better communicate protected left. Check shop drawings for load capacity. – Consider signing dual left to let drivers know there is a protected left on green ball. – Potential to retime as protected only (remove split phasing). Note that changing the phasing to protected- 				



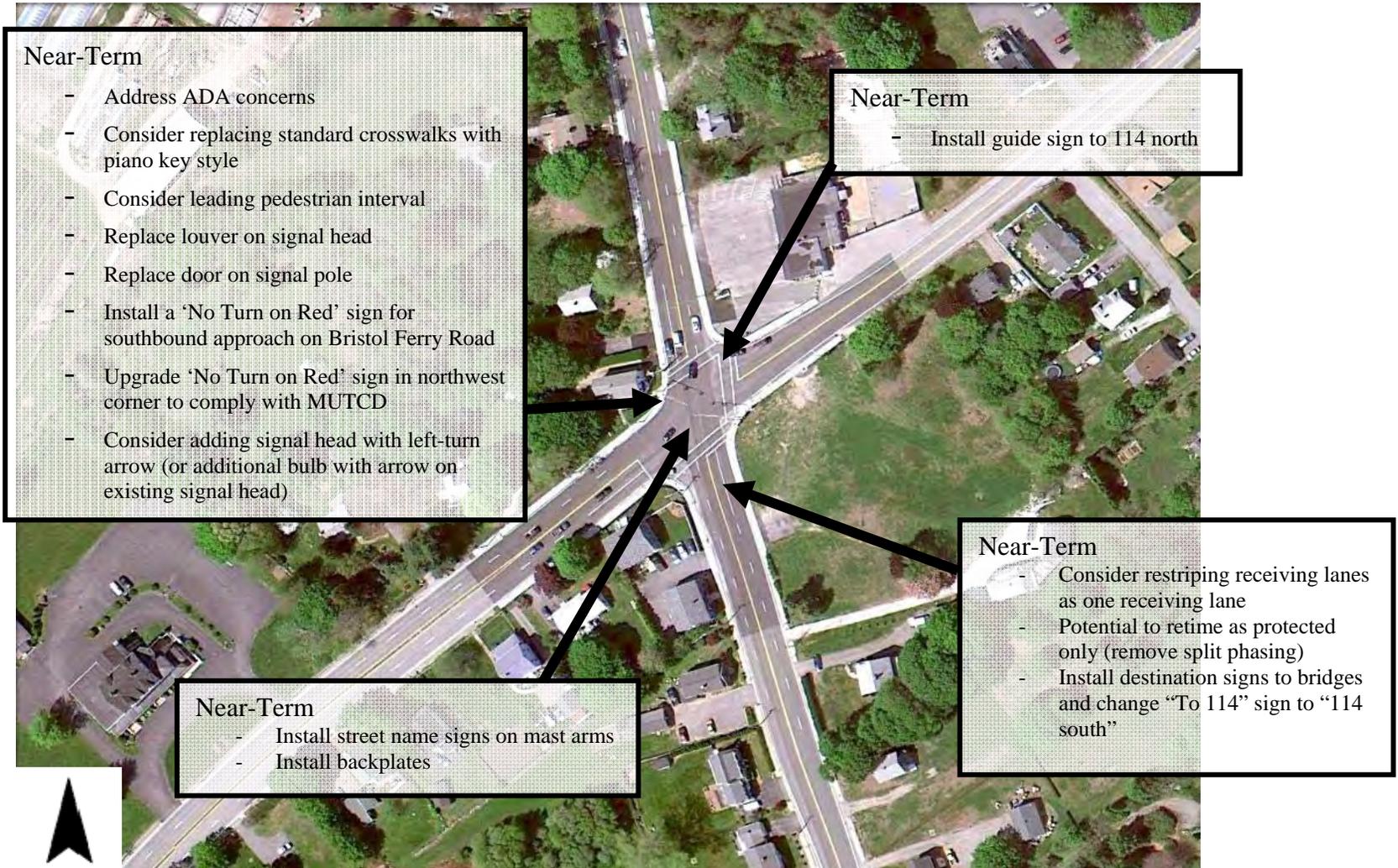
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
			permissive would likely increase left-turn crashes. – Install back plates on all signal heads that don't currently have them.				



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Figure 4-8 Suggested Recommendations at the West Main Road/Sprague Street at Bristol Ferry Road/Turnpike Avenue Intersection



Source: Google Earth



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4.4 West Main Road at Stringham Road



4.4.1 Existing Conditions

Stringham Road intersects West Main Road from the west to form a four-leg signalized intersection. Stringham Road is primarily used by employees of the US Navy and Melville businesses that originate from the north. The intersection is part of the RIDOT's West Main Road 1R Phase 3 project. As part of this project, upgraded signal equipment and new pavement is proposed.

The Dunkin Donuts driveway serves as the east leg to the intersection. The West Main Road northbound approach consists of a left-turn lane, a through lane, and a shared through/right-turn lane. The West Main Road southbound approach consists of a left-turn lane, two through lanes, and a right-turn lane. The Stringham Road eastbound approach consists of a left-turn lane and one multipurpose (left-turn/through/right-turn) lane. The Dunkin Donuts westbound approach consists of a left-turn lane and a shared through/right-turn lane.

There are sidewalks on the Stringham Road approach and the west side of the West Main Road northbound approach. There are marked crosswalks with pedestrian signal equipment on the south and west legs of the intersection. The posted speed limit is between 25-45 mph on the intersection roadways.

The RSAs was performed at the intersection as shown in **Figure 4-9** and as discussed in the following section.



Figure 4-9 West Main Road at Stringham Road/Dunkin Donuts Intersection



Source: Google Earth



4.4.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 4-7** and is presented in vehicles per day (vpd):

Table 4-7 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
West Main Road	21,200	North of Corys Lane
Stringham Road	6,600	West of West Main Road

The overall delays and critical approaches/movements are listed below for the intersection. The intersection experiences the highest delay during the evening peak



period, in which the eastbound approach operates with high delay and long queues. This is primarily caused by the US Navy and Melville employees.

As part of the AITS, most of the US Navy land along Stringham Road and Burma Road is being sold by the Navy and will be available for redevelopment. The study projected that with the growth from the proposed redevelopments, this intersection will operate with higher delay and longer queues than existing conditions if no improvements are made. The RSA team took this into consideration when developing recommendations. The overall intersection delay is presented in **Table 4-8**.

Table 4-8 Calculated Intersection Delay

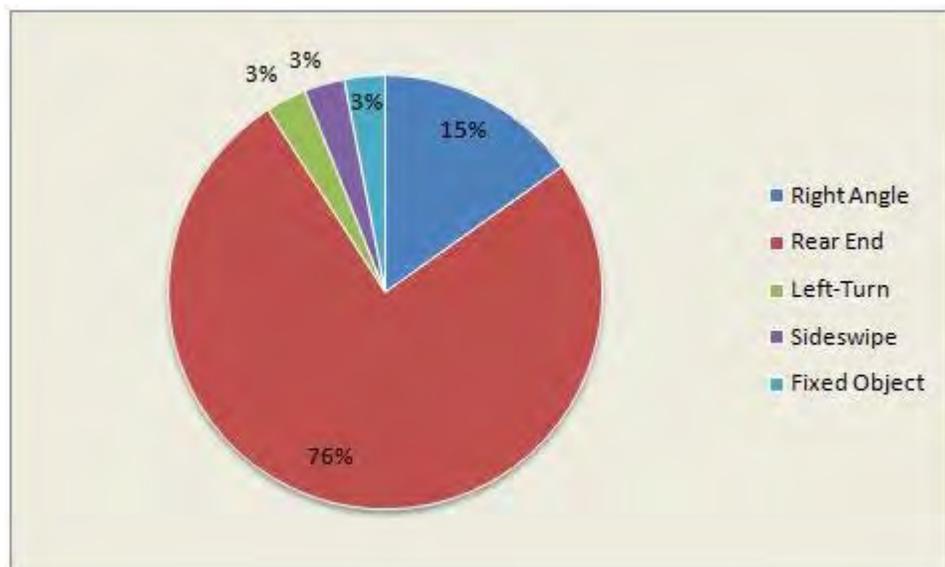
Subject Intersection	Intersection Delay (sec)	General Location of Delay
West Main Road at Stringham Road/Dunkin Donuts	45.0	Eastbound approach



4.4.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, 33 crashes were reported at this intersection, with the majority (76%) being rear-end-type collisions. Of the 31 crashes report, 3 (9%) resulted in an injury. **Figure 4-10** illustrates the breakdown of the crashes by collision type.

Figure 4-10 Vehicle Crash Type – West Main Road at Stringham Road/ Dunkin Donuts





4.4.4 Proposed Improvements

RIDOT's West Main Road 1R Phase 3 project is currently at the 90% design stage. This project includes the new signal equipment and pavement resurfacing. Because this project is still at the 90% design stage, any proposed recommendations from this assessment can be incorporated into the design.



4.4.5 Assessment Findings

Based on a review of existing site conditions, there are several positive characteristics of the roadway network:

- ▶ **Left-turn lanes on the West Main Road approaches** – Both the northbound and southbound approaches to the intersection have exclusive left-turns lanes with protected movements.

The following is a list of the potential safety benefits from the design concept.

- ▶ **Enhanced traffic and pedestrian signal equipment** – The project will upgrade the traffic and pedestrian signal equipment to the latest State and MUTCD standards.



4.4.6 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Tables 4-9** and **Figure 4-11**.



Table 4-9 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the West Main Road at Stringham Road/Dunkin Donuts Intersection

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Operational issues.</p> <ul style="list-style-type: none"> - Dunkin Donuts indicated the detector loop is not being tripped unless vehicles pull beyond the stop bar. The RSA team verified that the loop works correctly if vehicles are aligned properly, but the loop could be extended further back into the parking lot to ensure proper detection. - Internal conflicts create a trap in the Dunkin Donuts parking lot. The queue spills out onto West Main Road. - There is a concentrated peak in the PM from Stringham Road. The RSA team observed several long queues, which occasionally led to double cycling. There is the potential for a large development in the vicinity and capacity concerns would need to be addressed if this occurs. 	 <p><i>Photo shows the internal conflicts in the Dunkin Donuts parking lot.</i></p>  <p><i>Photo shows the lengthy queues that build-up in the PM peak along Stringham Road.</i></p>	<ul style="list-style-type: none"> - Potential to extend loop (back into parking lot) for Dunkin Donuts parking lot to improve detection. - Potential to eliminate southern parking spaces in Dunkin Donuts parking lot and have patrons park in back lot and use sidewalk. 				<ul style="list-style-type: none"> - Potential to extend dual lefts from Stringham Road. Could make developers improve this in the future.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Pedestrian and ADA issues.</p> <p>The RSA team noted pedestrian and ADA-related issues, including:</p> <ul style="list-style-type: none"> – There is a crosswalk with pedestrian heads across the north side of West Main Road, but no pedestrian ramps. – There is a crosswalk across Stringham Road, but no pedestrian signal. 	 <p><i>Photo shows the crosswalk across the north leg of West Main Road and the lack of a receiving ramp.</i></p>				<ul style="list-style-type: none"> – Pedestrian heads will be addressed in Phase 3. – Consider adding pedestrian ramp on southeast corner in Phase 3 (currently does not show in the plans). 	
3	<p>Access management issues.</p> <ul style="list-style-type: none"> – The northern-most access to the Mobil station is in close proximity to the intersection. Southbound vehicles turning left into the Mobil station travel the wrong way in the left-turn lane for the intersection. – The left-turn lane on the northbound approach is too long. There is the potential to use the additional space for a southbound left-turn lane into the southern-most driveway of the gas station. 	 <p><i>Photo shows the close proximity of the gas station driveway to the intersection.</i></p>	<ul style="list-style-type: none"> – Potential to make northern-most driveway from gas station a right-out only. Work with owner of gas station to incorporate right-turn arrow from driveway, no left-turn sign from driveway, and 'No Left-Turn' sign/'Do Not Enter' sign facing East Main Road. 			<ul style="list-style-type: none"> – In Phase 3, create southbound left-turn lane into Mobil station. This may require some space from the shoulder. 	



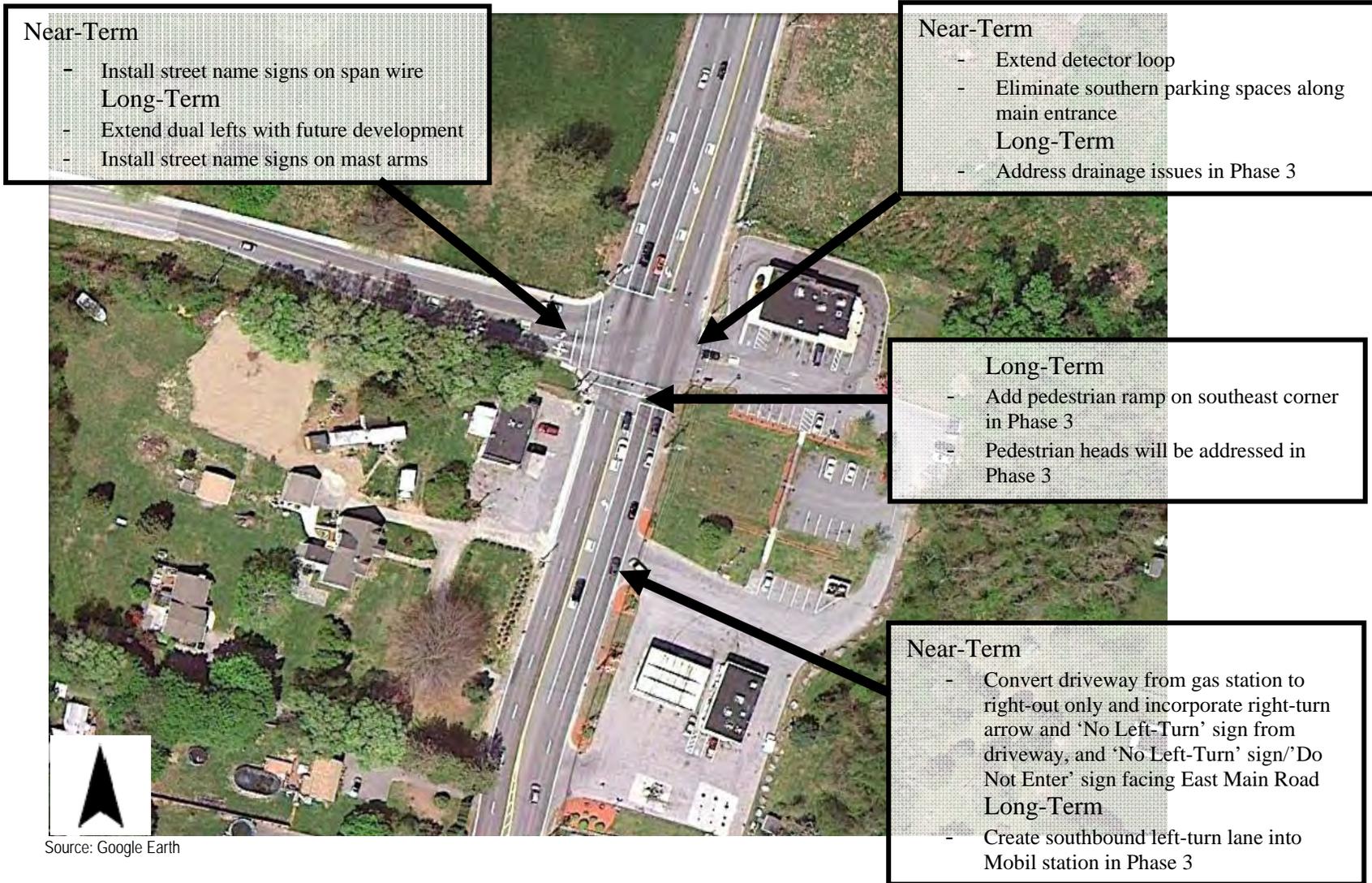
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
4	Drainage issues. – The RSA team noted drainage issues in the southeast quadrant. Specifically, there was standing water in the travel lane.	 <p><i>Photo shows the drainage issue along the southeast corner where water is covering a portion of the travel lane.</i></p>				– Potential to address drainage issues through upcoming project (Phase 3).	
5	Limited guidance. – There is a lack of street name signs at the intersection.	 <p><i>Photo shows the lack of overhead street name signs. The only sign is circled in red on the left side of the photo.</i></p>	– Check shop drawings to determine potential to add street name signs on span wire.				– Install street name signs on mast arms.



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Figure 4-11 Suggested Recommendations at the West Main Road at Stringham Road/Dunklin Donuts Intersection



Source: Google Earth



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4.5 West Main Road at Union Street/ Redwood Road



4.5.1 Existing Conditions

Union Street and Redwood Road intersect West Main Road from the east and west respectively to form a four-leg signalized intersection. Union Street is a major east-west cut-through on the Island and connects to East Main Road. Redwood Road serves as the access point for a neighborhood. The intersection is part of the RIDOT's West Main Road 1R Phase 2 project. As part of this project, upgraded signal equipment, the addition of a left-turn lane, and new pavement is proposed.

The West Main Road northbound and southbound approaches consist of a shared left-turn/through lane and a shared through/right-turn lane. The Union Street westbound approach consists of a short left-turn lane and a shared through/right-turn lane. The Redwood Road eastbound approach consists of one multipurpose (left-turn/through/right-turn) lane.

There are sidewalks on the south side of Union Street and on the west side of West Main Road. There are marked crosswalks with pedestrian signal equipment on the south and west legs of the intersection. The posted speed limit is between 25-35 mph on the intersection roadways.

The RSAs was performed at the intersection as shown in **Figure 4-12** and as discussed in the following section.



Figure 4-12 West Main Road at Union Street/Redwood Road Intersection



Source: Google Earth

4.5.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 4-10** and is presented in vehicles per day (vpd):

Table 4-10 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
West Main Road	21,200	Near Union Street

The overall delays and critical approaches/movements are listed below for the three major intersections within the study area corridor. The intersection operates at



overall acceptable levels during both peak periods. The overall intersection delay is presented in **Table 4-11**.

Table 4-11 Calculated Intersection Delay

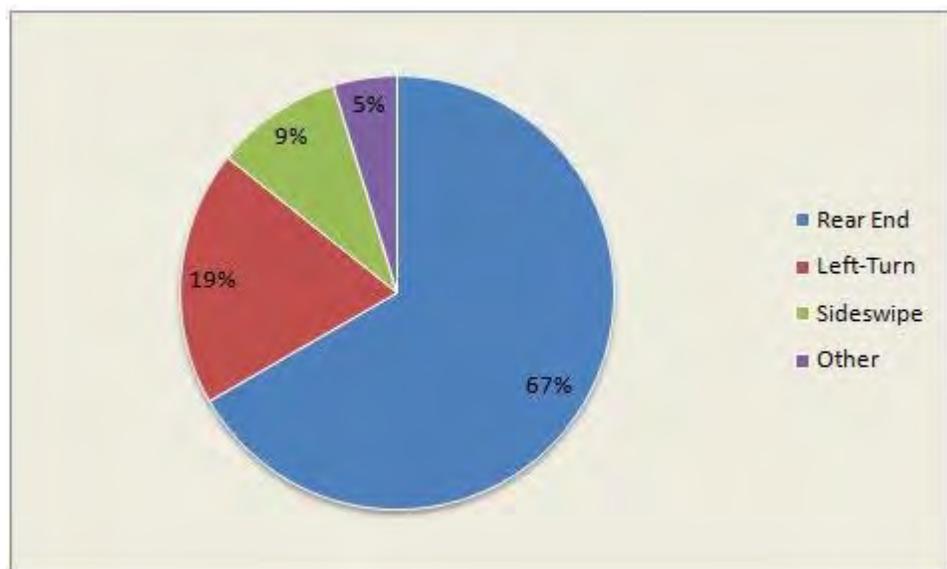
Subject Intersection	Intersection Delay (sec)	General Location of Delay
West Main Road at Union Street/Redwood Road	11.8	Southbound Movement



4.5.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, 21 crashes were reported at the intersection, with the majority (67%) being rear-end-type collisions. Of the 16 crashes report, 3 (14%) resulted in an injury. There was also a fatality at this intersection that involves a right-angle crash. **Figure 4-13** illustrates the breakdown of the crashes by collision type.

Figure 4-13 Vehicle Crash Type – West Main Road at Union Street/Redwood Road





4.5.4 Proposed Improvements

RIDOT's West Main Road 1R Phase 2 project is currently at the 10% design stage. This project includes the new signal equipment, the addition of a left-turn lanes onto Union Street and Redwood Road, and pavement resurfacing. Because this project is still at the 10% design stage, any proposed recommendations from this assessment can be incorporated into the design.



4.5.5 Assessment Findings

Based on a review of existing site conditions, there are several positive characteristics of the roadway network:

- **Left-turn advance on West Main Road southbound approach** – The advance provides a short protected movement for southbound vehicles making a left-turn on Union Street.
- **Object markers present** – There were reflective object markers mounted on the utility poles near the intersection.

The following is a list of the potential safety benefits from the design concept.

- **Enhanced traffic and pedestrian signal equipment** – The project will upgrade the traffic and pedestrian signal equipment to the latest State and MUTCD standards.
- **Addition of left-turn lane and protected phasing** – The addition of the exclusive left-turn lane with protected phasing will allow vehicles to wait to make a left without blocking West Main Road through traffic.



4.5.6 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Tables 4-12** and **Figure 4-14**.



Table 4-12 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the West Main Road at Union Street/Redwood Road Intersection

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Operational issues.</p> <ul style="list-style-type: none"> – There are currently no left-turn lanes on West Main Road. Drivers make turns from the through lanes. – Dilemma zone loops are in place, but may not be functioning properly. The RSA team noted that the loops appear to be damaged. 	 <p><i>Photo shows the lack of left-turn lanes on West Main Road and a vehicle stopped in the thru lane waiting to turn left.</i></p>  <p><i>Photo shows the potentially broken dilemma zone detector loops on the northbound approach of West Main Road.</i></p>	<ul style="list-style-type: none"> – Check functionality of dilemma zone loops. Properly functioning loops will help address red light running. 				<ul style="list-style-type: none"> – Left-turn lanes will be added on both major approaches.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
2	<p>Driver behavior issues.</p> <ul style="list-style-type: none"> – The law enforcement team member indicated red light running is an issue on the northbound approach. This was confirmed during the PM peak field review. – There was also an indication of speeding in the northbound direction. This was confirmed by car following during the field review. The high speeds along West Main Road create a concern for vehicles turning right-on-red from Union Street. 	 <p><i>Photo shows a vehicle running the red light traveling northbound.</i></p>	<ul style="list-style-type: none"> – Perform a speed study to determine the adequacy of the yellow and all red time (currently 4 sec yellow and 1.5 sec all red). Also confirm or reject speeding issue. – Consider speed feedback signs (mobile unit). – Potential to add 'No Right on Red' sign for Union Street. 	<ul style="list-style-type: none"> – Consider localized enforcement to address speeding issues if speeding is confirmed. 			<ul style="list-style-type: none"> – Consider intersection as candidate for red light running camera.
3	<p>Signage issues.</p> <ul style="list-style-type: none"> – The 'Yield to Pedestrian' signs at the intersection are not MUTCD compliant. The sign on Redwood Avenue is not located in a good place to be visible. – The street name signs are too small for the relatively high posted speed on West Main Road. – There are unnecessary pedestrian warning signs on West Main Road (not necessary at a signalized intersection). These signs increase visual clutter. 	 <p><i>Photo shows the non-compliant and inconspicuous 'Yield to Pedestrian' sign on Redwood Avenue.</i></p>	<ul style="list-style-type: none"> – Increase size of street name signs. – Relocate 'Yield to Pedestrian' sign on Redwood to be more conspicuous. – Remove unnecessary pedestrian warning sign. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
		 <p><i>Photo shows the unnecessary pedestrian warning sign on the northbound approach on West Main Road.</i></p>					
4	<p>Pedestrian and ADA issues.</p> <p>The RSA team noted pedestrian and ADA-related issues, including:</p> <ul style="list-style-type: none"> - The sidewalk on the southeast corner is insufficient. - The southeast corner lacks a pedestrian ramp. - There is a non-compliant pedestrian ramp on the southwest corner. 	 <p><i>Photo shows the sidewalk on the southeast corner. The sidewalk is insufficient.</i></p>					<ul style="list-style-type: none"> - Crosswalk should be shown on the plans for the southern leg. - Update pedestrian equipment and pedestrian heads. Relocate equipment behind sidewalk. - Install accessible ramps



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
		 <p><i>Photo shows the lack of a pedestrian ramp on the southeast corner.</i></p>					
5	<p>Geometric issues.</p> <ul style="list-style-type: none"> - The alignment of Union Street is skewed and the signal heads are not aligned with the left-turn lane. 	 <p><i>Photo shows the westbound approach on Union Street. The signal heads are not aligned properly, particularly with the left-turn lane.</i></p>					<ul style="list-style-type: none"> - Consider realigning Union Street to better align with Redwood Avenue, particularly if the northeast quadrant is developed in the future. - Need to update plans to show the westbound left-turn lane and shared thru-right lane. - Add supplemental head on signal pole in southwest quadrant facing Union Street.



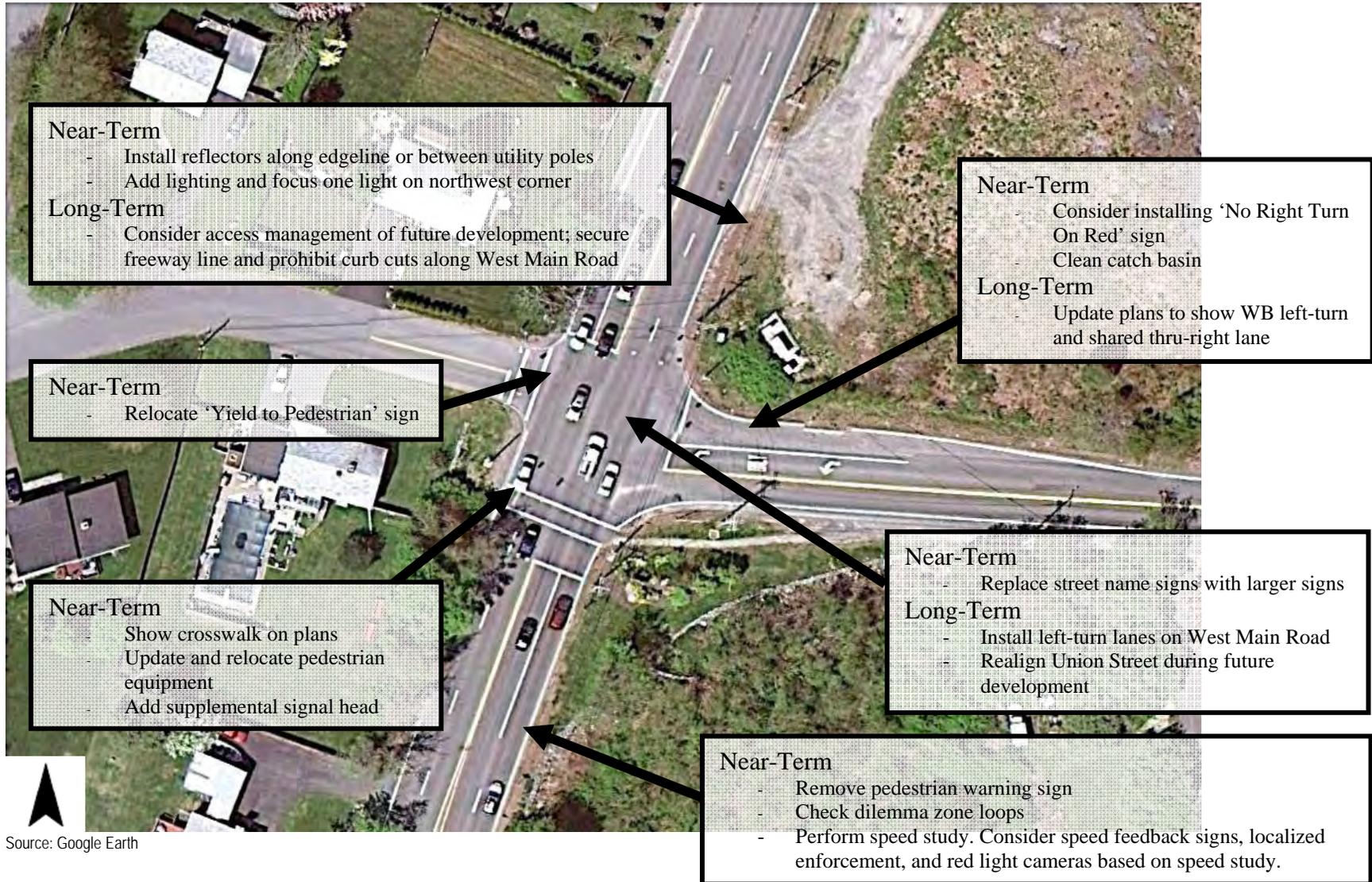
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Drainage issues.</p> <ul style="list-style-type: none"> – There is a plugged catch basin along Union Street. 	 <p><i>Photo shows the plugged catch basin along Union Street.</i></p>	<ul style="list-style-type: none"> – Notify maintenance to clean catch basin on Union Street. 				
7	<p>Delineation issues.</p> <ul style="list-style-type: none"> – There is a lack of lighting on the north side of West Main Road. There is some lighting at the intersection, but the northeast corner of the intersection is poorly lit. – The edge of the roadway is not well delineated along West Main Road. Reflectors are installed on utility poles, but consider installing other reflectors along edgeline or in between utility poles to enhance guidance. 	 <p><i>Photo shows the continuous lighting further north of the intersection and the delineators on the utility poles.</i></p>	<ul style="list-style-type: none"> – Consider adding lighting along the north side of West Main Road to fill-in gap. – Consider focusing one of the lights in the northeast corner of intersection. – Consider installing reflectors along the edgeline or in between utility poles on the roadside. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
8	<p>Access management issues.</p> <ul style="list-style-type: none"> – There is the potential to develop the northeast quadrant of the intersection in the future. 	 <p><i>Aerial shows the undeveloped northeast corner.</i></p>					<ul style="list-style-type: none"> – Need to consider management of access and secure freeway line. – Try to prohibit curb cuts along West Main Road.



Figure 4-14 Suggested Recommendations at the West Main Road at Union Street/Redwood Road Intersection



Source: Google Earth



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4.6 East Main Road at Turnpike Avenue



4.6.1 Existing Conditions

East Main Road and Turnpike Avenue intersect to form a four-leg signalized intersection. The driveway for Clements Market serves as the east leg of the intersection. Turnpike Avenue Street provides a connection to Route 24 and to the Mount Hope Bridge. The intersection is part of the RIDOT's Reconstruction of East Main Road project, which is currently at the 30% design stage. As part of this project, the intersection is proposed to be reconstructed to a roundabout, along with two other roundabouts along East Main Road south of this intersection. RIDOT's Statewide ADA Compliance project along East Main Road also includes a portion of the intersection. This project is currently at PS&E design stage and includes upgrades to sidewalks, signing, and roadway restriping.

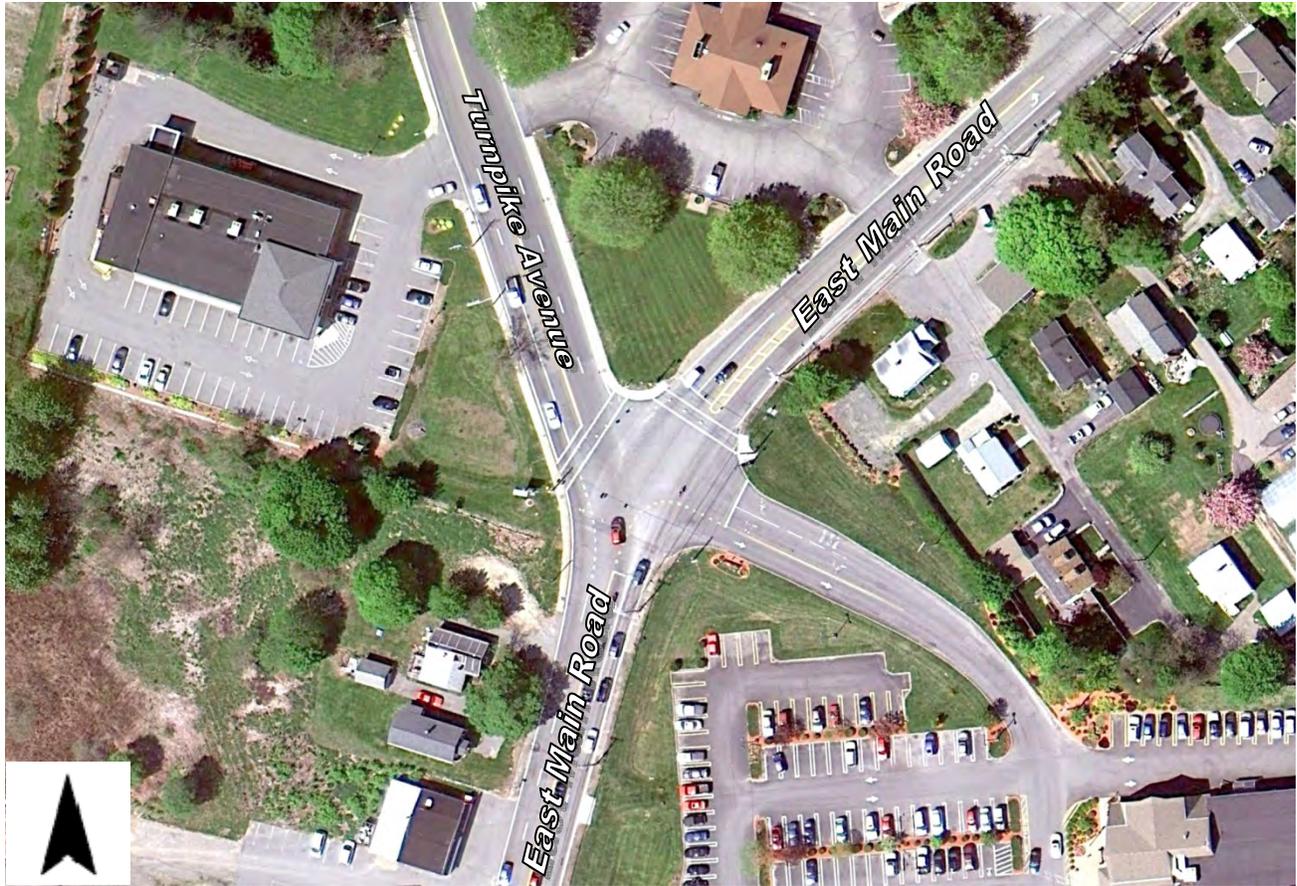
The East Main Road northbound approach consists of a left-turn lane and a shared through/right-turn lane. The East Main Road southbound approach consists of a shared left-turn/through lane and a shared through/right-turn lane. The Turnpike Avenue eastbound approach consists of a multipurpose (left-turn/through/right-turn) lane and an exclusive right-turn lane. The Clements Market westbound approach consists of a shared left-turn/through lane and a right-turn lane.

There are sidewalks on the east side of East Main Road south of the intersection, along the west side of East Main Road north of the intersection, and along Turnpike Avenue. There are marked crosswalks with pedestrian signal equipment on the north and west legs of the intersection. The posted speed limit is between 25-30 mph on the intersection roadways.

The RSAs was performed at the intersection as shown in **Figure 4-15** and as discussed in the following section.



Figure 4-15 East Main Road at Turnpike Avenue/Clements Market Intersection



Source: Google Earth

4.6.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 4-13** and is presented in vehicles per day (vpd):

Table 4-13 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
East Main Road	15,000	North of Turnpike Avenue
East Main Road	24,800	South of Turnpike Avenue
Turnpike Avenue	33,700	West of East Main Road



The overall delays and critical approaches/movements are listed below for the intersections. The highest delay occurs during the evening peak period, when the East Main Road northbound left-turn movement is over-capacity, experiencing high delay and long queues. The overall intersection delay is presented in **Table 4-14**.

Table 4-14 Calculated Intersection Delay

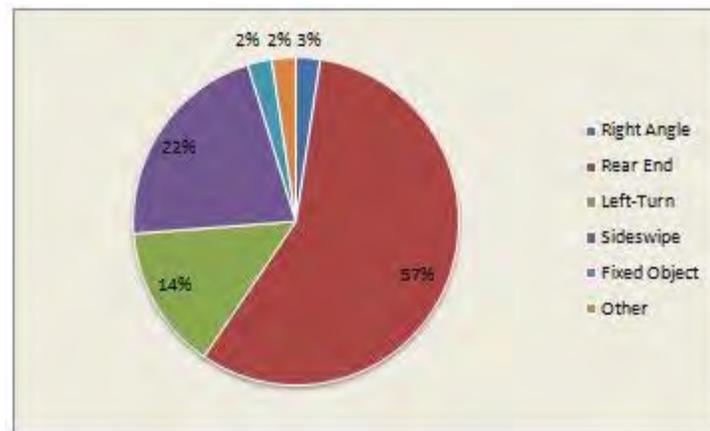
Subject Intersection	Intersection Delay (sec)	General Location of Issues
East Main Road at Turnpike Avenue/Clements Market	97.3	Northbound Left-Turn Movement



4.6.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, 42 crashes were reported at the intersection, with the majority (57%) being rear-end-type collisions. Of the 16 crashes report, 3 (7%) resulted in an injury. **Figure 4-16** illustrates the breakdown of the crashes by collision type.

Figure 4-16 Vehicle Crash Type – East Main Road at Turnpike Avenue/ Clements Market



4.6.4 Proposed Improvements

The intersection is part of 2 RIDOT projects. The Reconstruction of East Main Road project, which is currently at the 30% design stage, involves the intersection to be reconstructed to a roundabout, along with two other roundabouts along East Main



Road south of this intersection. The 10% design plans are shown in **Figure 4-17**. RIDOT's Statewide ADA Compliance project is currently at PS&E design stage and includes upgrades to sidewalks, signing, and roadway restriping. Because both projects are still at the preliminary design stages, any proposed recommendations from this assessment can be incorporated into these designs.



4.6.5 Assessment Findings

Based on a review of existing site conditions, there are several positive characteristics of the roadway network:

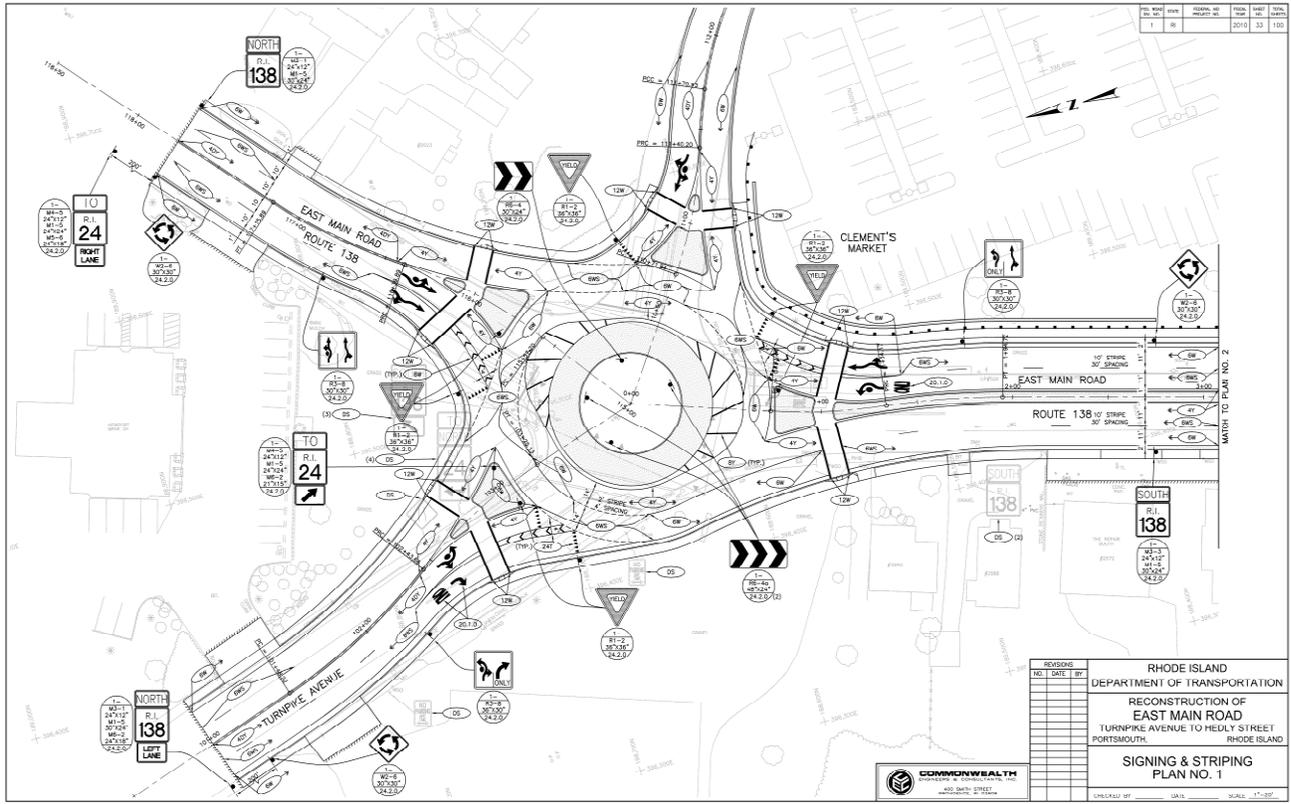
- **Good lighting at the intersection** – During a nighttime observation, the RSA team noticed that the lighting at the intersection seemed sufficient.

Because both the Reconstruction of East Main Road and the Statewide ADA Compliance projects were proposed at the time of the assessment, the RSA team evaluated both concepts in terms of safety benefits. The following is a list of the potential safety benefits from both design concepts.



Figure 4-17 Proposed Roundabout Concept

Reconstruction of East Main Road Project



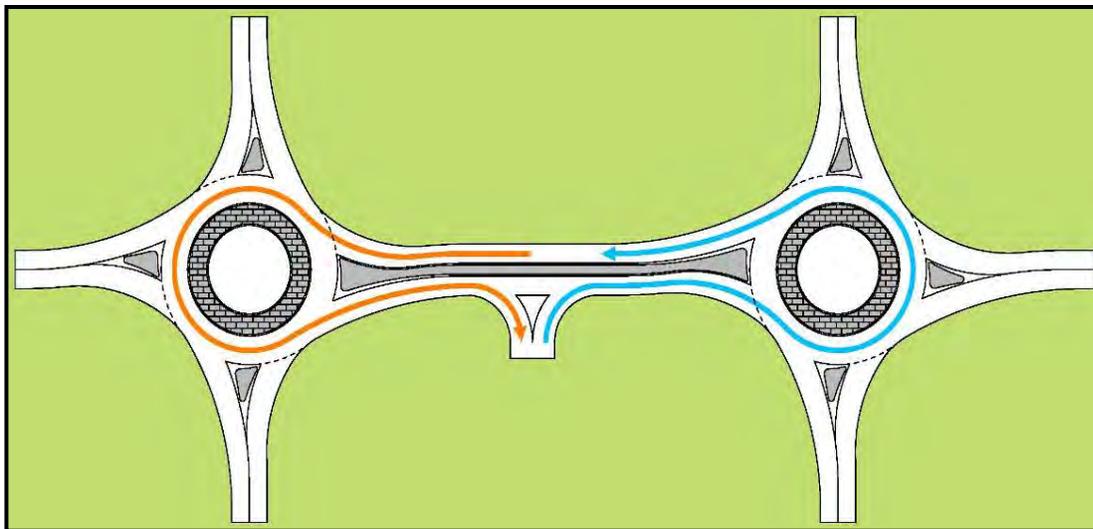
Source: RIDOT

- **Elimination of left turns at intersections** – By directing all traffic at these two intersections – both the through and turning traffic – to merge into the circular roadway, stopped turning vehicles are removed from the through lanes and the occurrence of unexpected stopped vehicles within the roadway are greatly reduced. This creates a “Dog-Bone” configuration, in which all left-turning movements can be removed between adjacent roundabouts, as shown in **Figure 4-18**.
- **Natural traffic-calming effect** – A key element in modern roundabout design is to provide horizontal deflection in the approach legs so that entering traffic is naturally encouraged to decrease its speed. The opposite effect on approach speeds may be observed at traditional signalized intersections, where drivers may be inclined to *increase* their speeds near an intersection when a green or yellow light is within view.
- **Decreased intersection delay** – A general benefit of roundabouts is a reduction in both intersection delay and in the number of vehicles that must come to a stop

at the intersection. More efficient traffic flow at the intersections should increase driver satisfaction and potentially decrease impatient and aggressive driver behavior within the corridor. A reduction in delay and vehicle idling has also been observed to have significant environmental benefits, as well.

- **Aesthetic appeal** – The latest conceptual plan for the East Main Road corridor near the Portsmouth Town Center consists of installing three roundabouts that can be designed to include landscaping features to introduce a gateway experience for vehicles entering this historic part of Portsmouth.

Figure 4-18 Sample “Dog-Bone” Configuration



- **Enhancing pedestrian accommodations** – The project includes enhanced pedestrian accommodations such as new sidewalks along the east side of East Main Road.



4.6.6 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Table 4-15** and **Figures 4-19 and 4-20**.



Table 4-15 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the East Main Road at Turnpike Avenue/Clements Market Intersection

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>General lack of guidance through intersection.</p> <p>There is a general lack of guidance for drivers through the intersection. General issues include faded pavement markings and limited lighting. Another specific issue is the narrow stop bar on the northbound approach.</p>	 <p><i>Photo shows the general lack of guidance (no lane designation signs or pavement markings) at the intersection.</i></p>	<ul style="list-style-type: none"> – Restripe pavement markings and make sure they comply with MUTCD. – Add pavement arrows to designate lane use. 				
2	<p>Driver behavior issues.</p> <p>The RSA team noted several safety concerns related to driver behavior, including the following:</p> <ul style="list-style-type: none"> – Northbound drivers are making a left-turn from the right lane, which is a shared through-right. – Northbound left-turning drivers cut the turn and drive in southbound receiving lane. – Lanes on northbound approaches are narrow, between 9 and 10 feet wide. 	 <p><i>Photo shows a northbound left-turning vehicle cutting the turn and encroaching on the southbound receiving lane.</i></p>	<ul style="list-style-type: none"> – Designate lane use by adding pavement arrows. – Add skip marks to provide better guidance for dual turning vehicles. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
3	<p>Intersection skew.</p> <ul style="list-style-type: none"> – Due to the skew of the intersection, it is difficult to make the left-turn from Clement's Market onto East Main Road. Specifically, the skew creates an optical illusion, making it difficult to determine where vehicles are positioned on the opposing approach (Turnpike Avenue). – The RSA team noted several near misses for southbound left-turns into Clement's Market. Several crashes were also reported for left-turns into Clement's Market from East Main Road. 	 <p>Photo shows the drivers view looking from Clement's Market toward Turnpike Avenue. It is difficult to determine if the vehicles are in the near or far lane of the opposing approach.</p>	<ul style="list-style-type: none"> – Pull northbound left-turn lane back (allow more room for westbound left-turns and eastbound right-turns). 				
4	<p>Signal-related issues.</p> <p>The RSA team noted signal-related issues, including:</p> <ul style="list-style-type: none"> – Alignment of signal heads: the northbound signal heads lead you into the opposing lanes. – Short phase length: the northbound left-turn phase is too short at night and during the first part of the AM peak. The team 		<ul style="list-style-type: none"> – Move signal heads if possible. – Provide thru arrow and skip marks to guide drivers. – Adjust signal timing to provide more time for northbound left-turn phase, particularly in the AM peak. 				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	observed several drivers running the red light to turn left. Capacity did not appear to be an issue, but team members noted that it may be worse in the summer.	<i>Photo shows how the northbound signal heads appear to lead drivers into the opposing southbound lanes.</i>					
5	<p>ADA issues.</p> <p>The RSA team noted the following ADA issues:</p> <ul style="list-style-type: none"> – Obstructions in the sidewalk. – Poor sidewalk condition and lack of sidewalks in some locations. – Lack of curb ramps. – Wheelchair ramp is too steep. – Missing pedestrian heads and crosswalks: Clement's Market creates a draw from nearby elderly housing facilities. – Concrete pad is existing for bus shelter, but bus shelter is missing. 	 <p><i>Photo shows the gaps in the sidewalk and lack of crosswalk at the entrance to Clement's Market.</i></p>	<ul style="list-style-type: none"> – Potential to add crosswalk across Clement's Market driveway (would also require pedestrian signal head). – Fix deficient wheelchair ramp. – Make call to Lamar to install bus shelter. 			<ul style="list-style-type: none"> – Wheelchair ramps will be improved under upcoming project. 	<ul style="list-style-type: none"> – Future plans for a roundabout at this location. There is the potential to extend the sidewalk along East Main Road (from north down to Clement's Market and from bus shelter to corner of intersection) as part of this project.



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Drainage issues.</p> <p>There is an unprotected catch basin (no grate) and the cracked curb allows water in under the sidewalk.</p>	 <p><i>Photo shows the unprotected catch basin and deteriorating curb.</i></p>				<p>– Catch basins will be improved under upcoming project.</p>	
7	<p>Narrow lanes.</p> <p>– The receiving lanes for left-turns from Clement's Market and dual right-turns from Turnpike Avenue are relatively tight. This issue is accentuated by the placement of the northbound stop bar, which is relatively close to the intersection.</p> <p>– There are also several fixed objects and a steep embankment in the southeast quadrant that are in close proximity to the roadway. Narrow lanes don't provide much room for recovery. There are post-mounted delineators to delineate the embankment in the southeast quadrant, but no protection.</p>	 <p><i>Photo shows several vehicles turning into the southbound receiving lanes, which is a difficult maneuver with the narrow lanes.</i></p>	<p>– Pull northbound left-turn lane back (allow more room for westbound left-turns and eastbound right-turns).</p> <p>– Install context-friendly guardrail in southeast quadrant.</p>				



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
8	<p>Dual receiving lanes on Turnpike Avenue.</p> <p>There are two receiving lanes on Turnpike Avenue, which creates a weaving issue within a short distance.</p>	 <p><i>Photo shows the dual receiving lanes on Turnpike Avenue and vehicles attempting to merge as one receiving lane is dropped.</i></p>	<p>– Restripe departure to one acceptance lane with shoulder.</p>				



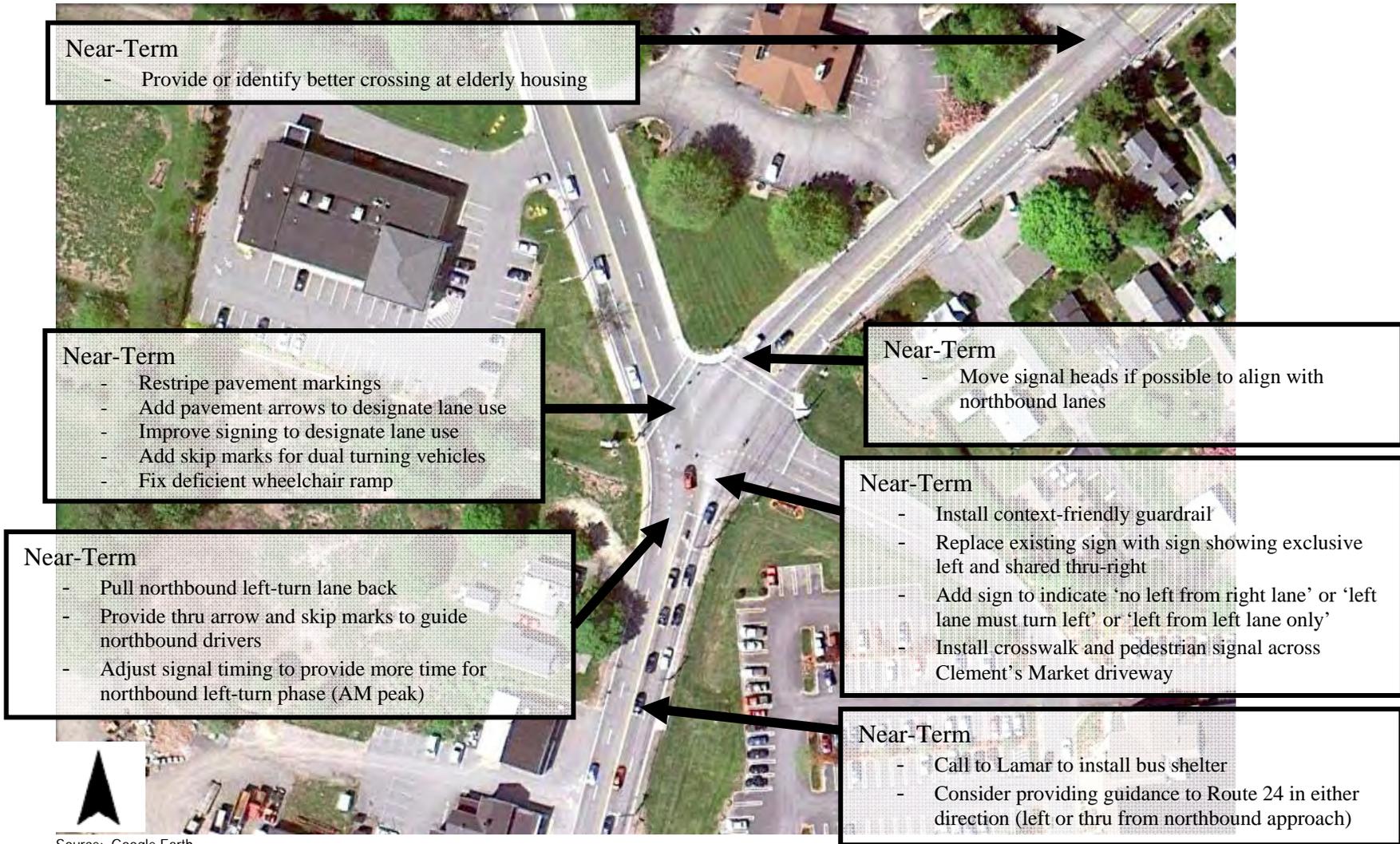
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
9	<p>Signing issues.</p> <ul style="list-style-type: none"> - The northbound lane use sign shows a left-turn and thru only. This approach functions as a left-turn and a shared thru-right. - There are multiple route options to Route 24, but limited signing. 	 <p><i>Photo shows the lane use sign for the northbound approach that indicates an exclusive left and thru only.</i></p>	<ul style="list-style-type: none"> - Improve signing to designate lane use. - Consider replacing existing sign with sign showing exclusive left and shared thru-right. - Could add sign to indicate 'no left from right lane' or 'left lane must turn left' or 'left from left lane only'. - Consider providing guidance to Route 24 in either direction (left or thru from northbound approach). One route would use "alternate" as the designation. Guidance should be provided prior to intersection. 				



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Figure 4-19 Suggested Near-Term Recommendations at the East Main Road at Turnpike Avenue/Clements Market Intersection



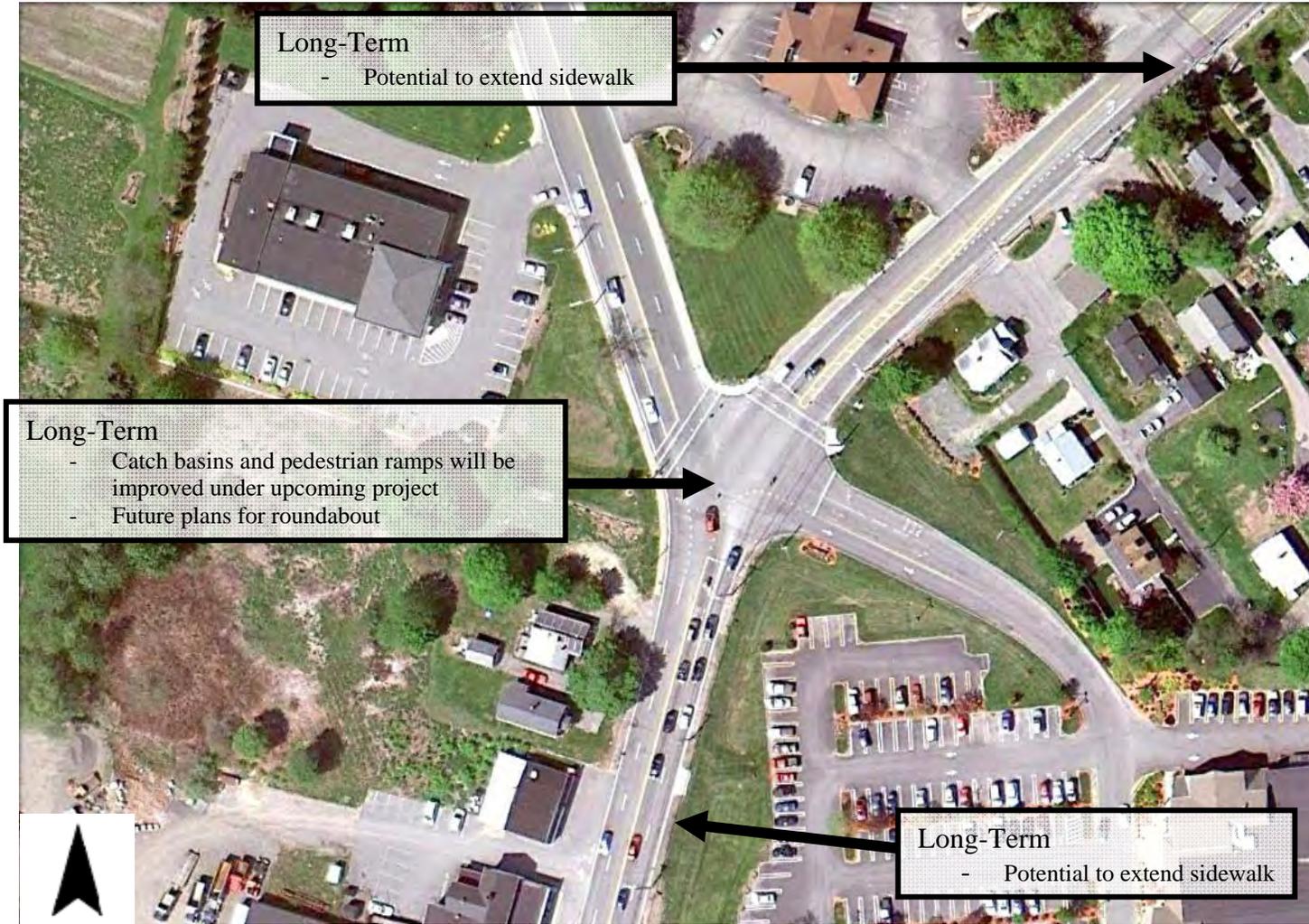
Source: Google Earth



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Figure 4-20 Suggested Long-Term Recommendations at the East Main Road at Turnpike Avenue/Clements Market Intersection



Source: Google Earth



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4.7 East Main Road at Stubtoe Lane/ Fairview Lane



4.7.1 Existing Conditions

Stubtoe Lane and Fairview Lane intersect West Main Road from the west and east respectively to form a four-leg signalized intersection. Stubtoe Lane and Fairview Lane are offset from each other at the intersection with East Main Road. The intersection is part of the RIDOT's High-Hazard project. As part of this project, upgraded signal equipment, the addition of left-turn lanes, and new pavement is proposed.

The East Main Road northbound and southbound approaches consist of a shared left-turn/through lane and a shared through/right-turn lane. The Stubtoe Lane eastbound approach consists of a left-turn lane and a right-turn lane pocket. The Fairview Lane westbound approach consists of a left-turn lane and a right-turn lane.

There are sidewalks on the Stubtoe Lane eastbound approach. There are no marked crosswalks or ADA ramps at the intersection; however, there is pedestrian signal equipment to cross East Main Road between Stubtoe Lane and Fairview Lane. The posted speed limit is between 25-35 mph on the intersection roadways.

The RSAs was performed at the intersection as shown in **Figure 4-21** and as discussed in the following section.



Figure 4-21 East Main Road at Stubtoe Lane/Fairview Lane Intersection



Source: Google Earth



4.7.2 Traffic Data

The average annual daily traffic (AADT) volumes for the study roadways were recorded in August 2009 as part of the Aquidneck Island Transportation Study. The AADT is summarized below in **Table 4-16** and is presented in vehicles per day (vpd):

Table 4-16 Daily Traffic Volume

Subject Roadway	2009 AADT (vpd)	General Location of Traffic Counts
East Main Road	21,200	North of McCorrie Lane



The overall delays and critical approaches/movements are listed below for the intersection. The intersection operates at overall acceptable levels. However, there is wasted green time at this intersection due to the advance left-turn movement coupled with the lack of exclusive left-turn lanes. The overall intersection delay is presented in **Table 4-17**.

Table 4-17 Calculated Intersection Delay

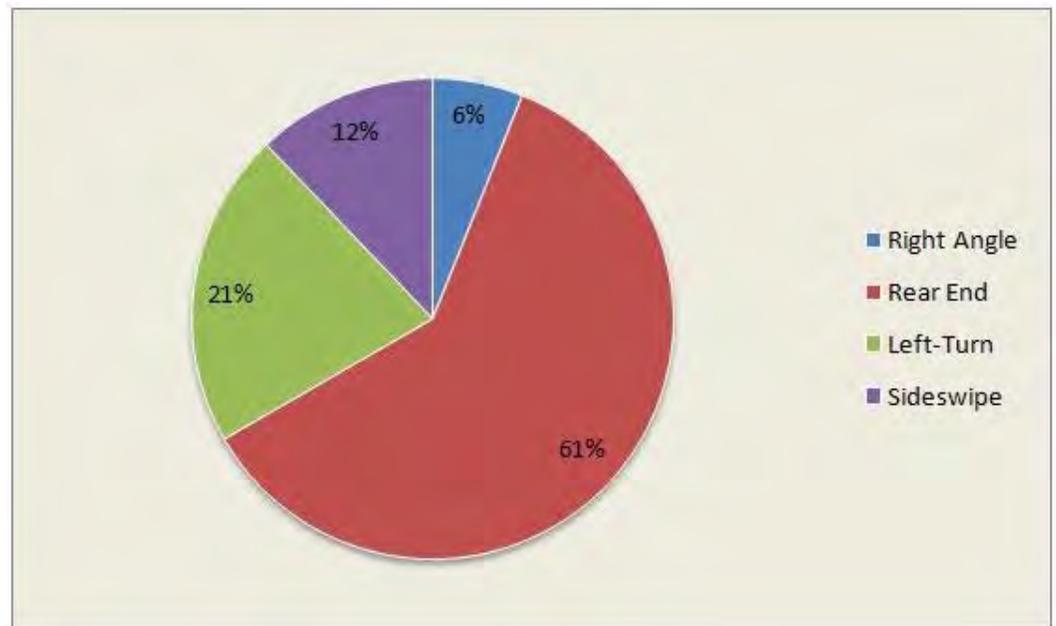
Subject Intersection	Intersection Delay (sec)	General Location of Issues
East Main Road at Stubtoe Lane/Fairview Lane	12.9	Northbound/Southbound Left-Turn Movement



4.7.3 Crash Analysis

Crash data for the study area was provided by RIDOT for the three-year period between January 1, 2006 and December 31, 2008. During that time, 33 crashes were reported at the intersection, with the majority (61%) being rear-end-type collisions. Of the 33 crashes report, 4 (12%) resulted in an injury. **Figure 4-22** illustrates the breakdown of the crashes by collision type.

Figure 4-22 Vehicle Crash Type – East Main Road at Stubtoe Lane/ Fairview Lane





- **Installation of exclusive left turns lanes** – The addition of exclusive left-turn lanes at the signalized intersection will help remove left-turning vehicles from the through lanes at the two intersections, increasing mobility along the corridor.
- **Enhanced Alignment** – The concept better aligns the Stubtoe Lane and Fairview Lane approaches.
- **Enhancing pedestrian accommodations** – The project includes enhanced pedestrian accommodations such as new sidewalks along the approach roadways and new pedestrian signal equipment and crosswalks at the intersection.



4.7.6 Identified Safety Issues and Suggestions for Improvement

Despite the safety benefits noted for the existing and planned conditions, the RSA Team identified several safety issues within the study area. The Team prioritized these issues in order of perceived importance and developed suggestions to correct or mitigate the safety concerns. The existing safety issues and suggestions are summarized in **Tables 4-18** and **Figure 4-24**.



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Table 4-18 Summary of Safety/Efficiency Issues and Suggestions for Existing Facilities at the East Main Road at Stubtoe Lane/Fairview Lane intersection

			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
1	<p>Operational issues.</p> <p>The RSA team noted operational-related issues, including:</p> <ul style="list-style-type: none"> – There is protected left-turn phasing, but there are no left-turn lanes on the mainline. – There is wasted time when the protected left arrow comes on and no one is turning left. – At night, the northbound green maxes out and recalls to the southbound thru and protected left movement. 	 <p><i>Photo shows the protected left from the mainline and lack of left-turn lanes. The protected green arrow is on, but the first vehicle in the queue is not turning left and blocking others from making the turn.</i></p>	<ul style="list-style-type: none"> – Retime signal to gain efficiency. Specifically, address the northbound green maxing out during nighttime cycle. 			<ul style="list-style-type: none"> – Investigate the potential for permissive phasing. This may require skip marks to provide guidance. 	<ul style="list-style-type: none"> – Install left-turn lanes.
2	<p>Pedestrian and ADA issues.</p> <p>The RSA team noted several pedestrian and ADA-related issues, including:</p> <ul style="list-style-type: none"> – A lack of continuity and connectivity of sidewalks. There are limited sidewalks at the corners of intersection, but limited sidewalks beyond the corner. – The sidewalk up Stub Toe Lane 		<ul style="list-style-type: none"> – Consider removing the sidewalk along Stub Toe Lane as it does not meet ADA standards and may be a liability. – According to FHWA Report FHWA-HRT-04-100 (page 54), the midblock crosswalk (near the church) alone is insufficient (multi-lane, undivided, ADT > 				<ul style="list-style-type: none"> – Consider extending sidewalk on future plans in front of church. Work with Town to determine need. – Pedestrian ramps, pedestrian signals, and crosswalks will be addressed in future plan. – There is the potential to create a median



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
	<p>is too steep for ADA.</p> <ul style="list-style-type: none"> – Antiquated wheelchair ramps are not ADA-compliant. – There are no crosswalks at the intersection. – Pedestrian signals are present to cross East Main Road, but there is no accepting ramp for eastbound pedestrians. – The push-button on the northwest corner is inaccessible. – The midblock crosswalk near the church (south of the intersection) leads into a driveway and is not accessible (no ramp on east side). 	<p><i>Photo shows an inaccessible push-button. The button is installed on the backside of the pedestal and is not reachable from the sidewalk.</i></p>  <p><i>Photo shows the pedestrian signal crossing West Main Street, but the lack of a crosswalk and pedestrian ramp.</i></p>	<p>15,000 vpd). Consider using other treatments or other crossing improvements to supplement the marked crossing if it is to remain.</p> <ul style="list-style-type: none"> – Consider realignment of midblock crosswalk near church to terminate at curb rather than the driveway. – If parking is available on the church side of the road, consider restricting parking across the road. 				<p>refuge across Stub Toe Lane as the current plans show a painted median.</p> <ul style="list-style-type: none"> – Consider lighting and other pedestrian improvements such as rapid rectangular flashing beacons (RRFB) to supplement the crosswalk near the church. Coordinate these efforts with the church.
3	<p>Access management issues.</p> <ul style="list-style-type: none"> – There are three driveways to the gas station and three additional driveways to Castro's. The number of access points creates a greater opportunity for conflicts. – It is difficult to access gas station driveways for northbound drivers turning left. 	 <p><i>Photo shows a driveway to the gas station that is in</i></p>	<ul style="list-style-type: none"> – Potential to make driveway from gas station as right-out only (work with owner of gas station) – Incorporate right-turn arrow from gas station driveway, no left-turn sign from driveway, and no left-turn sign/do not enter sign facing East Main Road. 			<ul style="list-style-type: none"> – Consider closing one driveway as part of future project. 	<ul style="list-style-type: none"> – Consider creating a left-turn lane into the gas station for northbound drivers. This could involve shortening the southbound left-turn lane to create the necessary space.



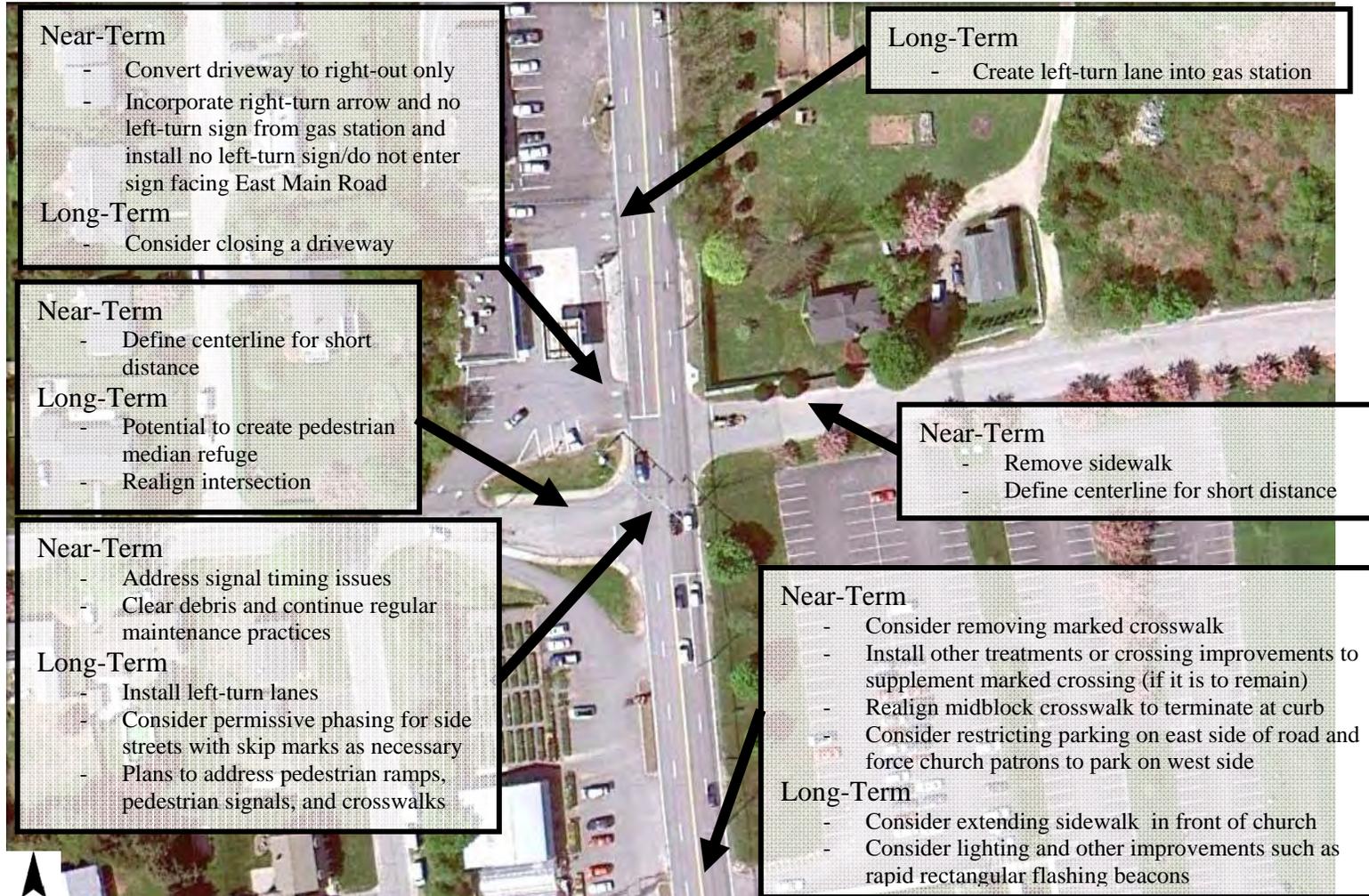
			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
		<i>close proximity to the intersection. A vehicle exiting the driveway actually enters the road between the stop line and the signal.</i>					
4	<p>Geometric issues.</p> <ul style="list-style-type: none"> – There is a severe grade on Stub Toe Lane and the team noted that several vehicles bottomed-out. The team also observed vehicles stopping further from the stop bar on Stub Toe Lane to provide a smoother thru movement (less severe change in grade when they travel diagonal to Fairview Lane). – The offset alignment of the intersection creates a need for the split phase. 	 <p><i>Photo shows the offset geometry of the intersection as viewed from Fairview Lane.</i></p>					– Consider realigning the intersection.
5	<p>Limited guidance at intersection.</p> <ul style="list-style-type: none"> – There is a lack of delineation on Stub Toe Lane and Fairview Lane, which may be a particular issue at night. – Segment lighting is present along West Main Road, but there is no formal intersection lighting. This issue was not apparent in the crash data, but should be monitored. 	 <p><i>Photo shows the lack of delineation on the side streets.</i></p>	– Define centerline on the side streets for a short distance.			– Monitor nighttime crashes and consider formal intersection lighting if nighttime crashes become an issue.	



			SPECIFIC NEAR TERM IMPROVEMENTS			POTENTIAL INTERMEDIATE IMPROVEMENTS	POTENTIAL LONG TERM IMPROVEMENTS
			(1-6 MONTHS)			(6 MONTHS - 2 YEARS)	(2 OR MORE YEARS)
NO.	ISSUES/CONCERNS	EXAMPLE OF ISSUES	ENGINEERING	ENFORCEMENT	EDUCATION & ENCOURAGEMENT	ENGINEERING	ENGINEERING
6	<p>Maintenance issues.</p> <p>– There is debris in road, particularly along the west side of West Main Road. The loose debris reduces surface friction and increases the potential for skidding.</p>	 <p><i>Photo shows the accumulated debris along the west side of the intersection.</i></p>	<p>– Clear debris from the road and continue regular maintenance practices.</p>				



Figure 4-24 Suggested Recommendations at the East Main Road at Stubtoe Lane/Fairview Lane Intersection



Source: Google Earth



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Identification, Implementation, and Evaluation of Recommendations

This chapter summarizes the identified recommended improvements for the study locations, describes the implementation plan for each recommendation, and evaluates specific recommendations based on the safety benefit, cost, and operational benefit.

5.1 Identification of Recommended Improvements

The RI*STARS Team used the results from the crash data analyses, existing operational analyses, and RSAs to identify study location deficiencies and to develop a list of potential countermeasures for consideration. They also considered the RIDOT/FHWA endorsed systemic crash countermeasures, current Manual on Uniform Traffic Control Devices (MUTCD) guidelines, and other RIDOT studies recommended improvements when developing countermeasures. The RI*STARS team reviewed all this potential countermeasure and developed a refined list of potential improvements that focus on enhancing the safety and operations of the study locations as well as incorporates context sensitive design principles. These recommendations are summarized below.

5.1.1 RI*STARS Road Safety Assessments



RI*STARS RSA team during field review

At each of the study locations, crash and traffic operational data was reviewed and analyzed, field visits were conducted during critical time periods (peak hours, nighttime), and numerous issues were identified. Countermeasures were determined by the RI*STARS team and were categorized into short-term, intermediate, and long-term engineering improvements, education methods, and

enforcement solutions. A detailed description of each issue and recommended improvement are listed in Chapters 2 (Newport), 3 (Middletown), and 4 (Portsmouth).



5.1.2 Systemic Crash Countermeasures

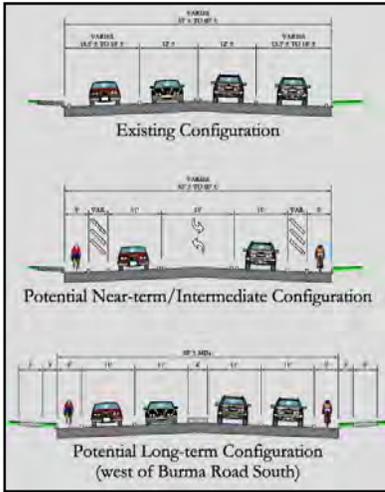


"Piano Key" style crosswalks are systemically recommended

As listed in RIDOT "To All Consultants" letter (TAC 0187), RIDOT and FHWA will be systemically implementing crash countermeasures on all state maintained highways as they target crash types and high crash locations. These crash countermeasures are based on the "9 Proven Crash Countermeasures" identified by FHWA as well as other safety features. Although they were not formally recommended as part of the RSAs, these safety countermeasures were considered at the study locations using a systemic approach. The following countermeasures were identified by the RI*STARS team as appropriate improvements for the study locations, where appropriate:

- ▶ Yellow Change and Red Clearance Interval Timing - The yellow change intervals and all-red clearance intervals for the signalized intersections were calculated using the formula in the ITE Traffic Control Devices Handbook based on assumed travel speeds and approach grades.
- ▶ Continental "Piano Key" Design Marked Crosswalks - All marked crosswalks at the study locations were reviewed and were applicable, piano key crosswalks were recommended.
- ▶ Shared Lane Markings - On study location roadways which are identified as a "suitable" or "most-suitable" bike routes, shared lane markings were considered and recommended.
- ▶ Medians and Pedestrian Refuge Areas - The team considered the application of median/pedestrian refuge areas at all study locations, especially those with high pedestrian use.

5.1.3 Other Recommended Improvements



Coddington Highway proposed "Road Diet"

Other countermeasures/improvements identified were also considered by the RI*STARS team, including:

- Coddington Highway Road Diet – One of the recommendations from the Defense Highway/Burma Road Corridor Road Safety Assessment conducted in August 2009 by the FHWA was the implementation of a road diet along Coddington Highway. The report is included in the Appendix.
- Pedestrian Intervals and Signal Phasing – The 2009 edition of the Manual on Uniform Traffic Control Devices (MUTCD) includes a new methodology for calculating pedestrian signal walk and clearance times. For all study locations where pedestrian signals are present, new timings were calculated.

5.2 Implementation of Recommended Improvements

Once the RI*STARS team reviewed all countermeasures and developed a list of recommendations, the team developed a list of implementation mechanisms to be used for the identified recommendations. The recommended improvements from the RI*STARS RSAs and their respective implementation mechanisms are listed by municipality in **Tables 5-1 thru 5-3**. **Table 5-4** lists the recommended improvements from RIDOT/FHWA endorsed systemic crash countermeasures, current Manual on Uniform Traffic Control Devices (MUTCD) guidelines, and other RIDOT studies. A brief summary of the implementation mechanisms are listed below.



5.2.1 RIDOT Traffic Engineering Section



RIDOT Traffic Engineering staff will implement new signal timings in the field

The calculation of the yellow, red and pedestrian interval signal timings will be developed by on-call design consultant (VHB). The implementation of all the signal timings will be performed by RIDOT in-house staff.



5.2.2 Upcoming Construction Projects



RIDOT's Pell Bridge Ramps Access Improvements project

Where feasible, the RI*STARS recommended improvements will be implemented by adding the work to upcoming RIDOT construction or paving projects. The following were identified as upcoming projects where some of the recommended improvements could be incorporated. Included are the current design stage and the anticipated start of construction for each project.

- Reconstruction of Two-Mile Corner –Under final design, project to advertise in 2013
- ADA Enhancements to Bristol Ferry Road (Route 114) – Under final design, construction to start by Fall 2012
- West Main Road 1R – Phase 2 – Under 30% design, construction to Start by 2013
- West Main Road 1R – Phase 3 – Under final design, construction to start by Fall 2012
- Pell Bridge Ramps Access Improvements – 30% design to start in 2013
- High Hazards Program –Newport County – Under 30% design, construction to start in 2013



5.2.3 RI*STARS Design Contracts

When the recommended improvements could not be added to upcoming projects, the construction will be performed through two traditional Design-Bid-Build construction contracts. Contract #1 will consist of improvements that involve no permitting and are not considered “controversial”. Contract #2 will consist of minor widening and other improvements that may require permitting or are deemed “controversial”



5.2.4 Other Implementation Mechanisms/Methods



Silted catch basin, causing ponding in roadway

Some of the recommended improvements can be performed by the RIDOT maintenance section. Such improvements involve cleaning and flushing of drainage structures.

- **Additional Study** – Some recommendations require further studies to determine their feasibility. Such recommendations include determining feasibility of certain intersections for red-light-running candidates.
- **RIDOT Maintenance** – Some of the recommended improvements can be performed by the RIDOT maintenance section. Such improvements involve cleaning and flushing of drainage structures.
- **Enforcement** – Enforcement strategies, such as speed feedback trailers, and increased enforcement, are some of the recommended improvements. RIDOT and Island officials will coordinate this with the local police department.



Portable Speed Feedback sign



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Table 5-1 Implementation Plan – Newport Locations

RSA LOCATION #	TOWN/CITY	INTERSECTION/CORRIDOR	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM
1	Newport	Admiral Kalbfus Road corridor, between JT Connell Highway and Malbone Road/Girard Avenue	• Optimize signal timings (including yellow and red clearance intervals)	RIDOT Traffic Engineering
			• Retrofit rotary to modern roundabout with signing, striping, and splitter island modifications	RI*STARS Contract 1
			• Striping upgrades (provide 2 lanes on Pell Bridge On-Ramp and)	
			• Signing and striping upgrades (Provide merge/yield warning signage and pavement markings on Pell Bridge Off-Ramp, stripe guide tracks, and install lane use and guide signage)	RIDOT Maintenance
			• Trim vegetation on channeled island at Pell Bridge off-ramp	Newport Police
			• Implement portable speed feedback signs	Pell Bridge Ramps Project
2	Newport	America's Cup Avenue at West Marlborough Street	• Convert all intersections to modern roundabouts	RIDOT Traffic Engineering
			• Optimize signal timings (including yellow, red, and pedestrian intervals)	Newport DPW
			• Install NO PARKING signs with fines adjacent to Gateway Center	
			• Coordinate with baseball field to provide better netting	RI*STARS Contract 1
			• Install new fire pre-emption equipment	
• Signing and striping upgrades ("Piano Key" crosswalks, regulatory and other signage)				
• Install detectable warning systems as needed (on concrete sidewalks)	RI*STARS Contract 2			
• Install pedestrian signal equipment for westbound leg of intersection				
• Install pedestrian countdown timers				
• Install pedestrian refuge area in median				
3	Newport	America's Cup Avenue corridor , between Thames Street/ Bowens Wharf and Memorial Blvd	• Optimize signal timings (including yellow, red, and pedestrian intervals)	RIDOT Traffic Engineering
			• Replace missing signal head hoods at America's Cup Ave/Memorial Blvd	RIDOT Maintenance
			• Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning, and other signage)	RI*STARS Contract 1
			• Install accessible ramps and detectable warning systems as needed	
			• Install additional pedestrian crossing with pedestrian signals	RI*STARS Contract 2
• Install pedestrian countdown timers				
• Reconfigure channelized right-turn movement from Thames Street onto America's Cup Avenue				
• Install landscaping/hardscaping to deter pedestrian crossings at unauthorized areas				
• Reconfigure jug handle at America's Cup Avenue/Memorial Blvd intersection to provide pedestrian area and crossing on east leg				
4	Newport	Memorial Blvd at Bellevue Avenue	• Optimize signal timings (including yellow, red, and pedestrian intervals)	RIDOT Traffic Engineering
			• Conduct study to determine where additional street lighting is feasible	Newport DPW
			• Signing and striping upgrades (improved striping through intersection, guide, regulatory, warning and other signage)	RI*STARS Contract 1
			• Install detectable warning systems as needed	
			• Install pedestrian countdown timers and replace broken pushbuttons	RI*STARS Contract 2
• Add left-turn phases for Bellevue Avenue northbound approach				
• Eliminate southbound channelized right turn and install curb bump outs				
• Provide ADA minimum clearance on northwest corner of intersection				
5	Newport	Memorial Boulevard at Rhode Island Avenue	• Trim vegetation along Memorial Blvd at side streets	RIDOT Maintenance
			• Signing upgrades (speed limit signs on Memorial Blvd, advance intersection ahead warning signs, and signs warning turning vehicles of pedestrian movements)	RI*STARS Contract 1
			• Install double yellow centerlines and stop bars in median areas	



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Table 5-2 Implementation Plan – Middletown Locations

RSA LOCATION #	TOWN/CITY	INTERSECTION	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM
6	Middletown	West Main Road corridor, between Coddington Hwy/ Rockwood Road and Smythe Street/ Commercial Street	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Add protected movement for Rockwood Rd approach (separate split phase) Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Install accessible ramps and detectable warning systems as needed Install pedestrian countdown timers Install exclusive left-turn lanes on West Main Road at East Main Rd & Coddington Hwy Convert Maple Ave to Right-in/Right-out Provide West Main Road southbound advance left-turn movement Relocate obstructions in sidewalk (guy wires, signs) 	Two-Mile Corner Project
7	Middletown	West Main Road/ Broadway at Admiral Kalbfus Road/ Miantonomi Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Relocate pedestrian crossing signs to coincide with correct crossing Trim vegetation on eastbound approach to increase visibility of signs 	RIDOT Maintenance
			<ul style="list-style-type: none"> Work with business owners on northeast corner to discourage vehicles that cut-thru driveway to avoid signal 	Middletown Police
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, extend eastbound left-turn lane, and to provide 2 lanes for a short distance on southbound departure) Install accessible ramps and detectable warning systems as needed Install pedestrian countdown timers 	RI*STARS Contract 1
8	Middletown	West Main Road at Forest Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) Conduct study to add left-turn lanes in a future project (recently reconstructed under 1R project in 2010) 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Provide refuge for pedestrians on southeast corner Relocate stop bar further back on westbound approach Install signs restricting left-turns into/out of gas station driveway (closest to signal on West Main Road) 	RI*STARS Contract 2
9	Middletown	East Main Road at Aquidneck Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) Consider median island/consolidation of driveways when intersection is reconstructed 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, and restripe northbound lane use to provide right-turn only lane) Install Pedestrian Countdown timers 	RI*STARS Contract 1
			<ul style="list-style-type: none"> Convert unsignalized bank driveway to right-in/right-out Adjust phasing to provide advance left-turn for northbound approach 	RI*STARS Contract 2
10	Middletown	East Main Road at Turner Road	<ul style="list-style-type: none"> Conduct study to determine feasibility of restricting left-turning movement from Turner Road onto East Main Road 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Signing and striping upgrades (guide, regulatory, warning and other signage, edge line guide striping through intersection curve, and delineation) 	RI*STARS Contract 1
			<ul style="list-style-type: none"> Install curbing to delineate intersection from access points Reconfigure skewed intersection to 90 degree angle 	RI*STARS Contract 2
11	Middletown	Aquidneck Avenue at Green End Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red intervals) 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Realign traffic signal heads with intended travel lanes 	RIDOT Maintenance
			<ul style="list-style-type: none"> Consider restricting heavy vehicles from this intersection 	Middletown DPW
			<ul style="list-style-type: none"> Signing and striping upgrades (guide, regulatory, warning and other signage, and reconfigure lane use to provide left-turn lanes on the Aquidneck Avenue approaches) 	RI*STARS Contract 1
			<ul style="list-style-type: none"> Provide left-turn lanes on Green End Avenue approaches (widen pavement) Provide pedestrian facilities (including sidewalks and pedestrian signal equipment) Restrict left-turns into driveway near intersection (through signing) 	RI*STARS Contract 2
			<ul style="list-style-type: none"> Replace Traffic Signal Equipment (provide exclusive left-turn phasing) 	Statewide High Hazard Intersection/Ramps – Newport County



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Table 5-3 Implementation Plan – Portsmouth Locations

RSA LOCATION #	TOWN/CITY	INTERSECTION	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM
12	Portsmouth	Mount Hope Bridge at Boyds Lane/ Bristol Ferry Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red intervals) Consider alternate intersection configuration in future reconstruction project 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Traffic signal upgrades (tighten signal heads, new controller) Provide pedestrian facilities Provide delineation on guardrail/medians/islands Provide speed reduction on bridge (coordinate with RITBA) 	ADA Improvements to Bristol Ferry Road
13	Portsmouth	West Main Road/ Sprague Street at Turnpike Avenue/ Bristol Ferry Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Replace traffic signal head hoods Replace access panel on mast arm 	RIDOT Maintenance
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, lane drop striping, and guide, regulatory, warning and other signage) Install supplemental left-turn arrows on West Main Road northbound approach 	RI*STARS Contract 1
14	Portsmouth	West Main Road at Stringham Road/ Dunkin Donuts Drive	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) Consider extending left-turn lanes on Stringham Road as development occurs in the area 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Install accessible ramps and detectable warning systems as needed Restrict left-turns into and out of driveway immediately south of intersection Install vehicle detection for Dunkin Donut s driveway to capture vehicles not pulling up to stop bar 	West Main Road 1R - Contract 3
15	Portsmouth	West Main Road at Union Street/Redwood Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) . Check functionality of dilemma zone equipment. Consider intersection as a red-light running candidate Consider access management techniques when reviewing access to future development on northeast corner Consider implementation of freeway line along West Main Road in immediate area 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Clean catch basins at intersection 	RIDOT Maintenance
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, larger street name signage, and "No Right Turn On Red") 	RI*STARS Contract 1
			<ul style="list-style-type: none"> Install left-turn lanes on West Main Road Upgrade traffic signal equipment (including exclusive left-turn phasing on West Main Road), add supplemental traffic signal head for Union Street 	West Main Road 1R - Contract 2
16	Portsmouth	East Main Road at Turnpike Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Realign traffic signal heads with intended travel lanes 	RIDOT Maintenance
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, restripe to provide one departure lane on Turnpike Avenue northbound , lane use arrows, and restripe markings through intersection) Install detectable warning systems as needed (on concrete sidewalks) 	RI*STARS Contract 1
			<ul style="list-style-type: none"> Install accessible ramps and detectable warning systems as needed Add signalized pedestrian crossing on east leg Install context-sensitive guardrail on southeast corner 	RI*STARS Contract 2
			<ul style="list-style-type: none"> Replace signal with modern roundabout 	East Main Road Reconstruction
17	Portsmouth	East Main Road at Stubtoe Lane/Fairview Lane	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red clearance intervals) Conduct study to demine feasibility of the midblock crosswalk at the church/monitor nighttime crashes at intersection to determine if lighting in an issues 	RIDOT Traffic Engineering
			<ul style="list-style-type: none"> Clear debris and sand intersection 	RIDOT Maintenance
			<ul style="list-style-type: none"> Provide left-turn lanes on East Main Road approaches and realign skewed intersection Restrict left-turns into driveway near intersection (through signing) Provide pedestrian facilities, including al pedestrian refuge area on west leg 	Statewide High Hazard Intersection/Ramps – Newport County



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Table 5-4 Implementation Plan – Other Locations

ADDITIONAL LOCATION #	TOWN/CITY	INTERSECTION	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM
1	Middletown	Coddington Hwy, between Girard Avenue and West Main Road	• Implement road diet with two-way left-turn lane	RI*STARS Contract 1
			• Install bike lanes along shoulder	RI*STARS Contract 2
2	Newport	America's Cup Avenue corridor	• Conduct study to determine if a road diet is warranted	RIDOT Traffic Engineering
			• Signing and striping upgrades ("Piano Key" crosswalks, regulatory and other signage)	RI*STARS Contract 1
			• Install detectable warning systems as needed (on concrete sidewalks)	
		• Install pedestrian countdown timers	RI*STARS Contract 2	
		• Install pedestrian refuge area in median		
		• Install bike lanes along shoulder		
3	Newport	Memorial Blvd, between Spring Street and Old Beach Road	• Install detectable warning systems as needed (on brick sidewalks)	
			• Conduct study to determine feasible locations to cross pedestrians along Memorial Blvd	RIDOT Traffic Engineering
			• Signing upgrades (speed limit signs on Memorial Blvd, advance intersection ahead warning signs, and signs warning turning vehicles of pedestrian movements)	RI*STARS Contract 1
		• Install double yellow centerlines and stop bars in median areas	RI*STARS Contract 2	
		• Restripe travel lanes/parking bays		
4	Middletown/ Newport	Route 138 Designation	• Consider relocating Route 138 designation from A. Kalbfus Road to J.T. Connell Hwy/Coddington Hwy upon completion of the Pell Bridge Ramps project.	RIDOT Traffic Engineering
			• Signing upgrades to provide consistency in Route 138's cardinal direction. Route 138 shall be an east-west route between Pell Bridge and the West Main Road/A. Kalbfus Road intersection. Route 138 shall be a north-south route between the West Main Road/A. Kalbfus Road intersection to Route 24.	All Future Projects



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5.3 Benefit/Cost Analysis

To determine the relative economic feasibility and effectiveness of the identified potential safety improvements at the study locations, benefit to cost ratios were developed certain recommendation at the 17 locations reviewed by the RI*STARS RSA team.

The estimated total annual construction/maintenance cost estimate, total annual safety benefit cost, and the calculated benefit-cost (B/C) ratio for each of the implementation methods are presented in **Tables 5-5 thru 5-7, by municipality**. The recommended improvements ranked by the safety benefit/cost ratio and by the total safety benefit, as presented in **Table 5-8**.

The preliminary construction cost estimate, estimated annual reduction in crashes and the calculated present value (in 2010 dollars) of the benefit over the life cycle of the improvements for each of the implementation methods are include in the Appendix.

5.4 Transportation Capacity Analysis

To determine the traffic operational benefits from the recommended improvements, capacity analyses were conducted for the intersections during the most problematic time periods. The recommended improvements that result in a traffic operational benefits range from optimized signal timings, lengthening of turning bays, and additional capacity enhancements from minor widening to full reconstruction of intersections. **Tables 5-5 thru 5-7** list the operation impact resulting from the recommended improvements. The capacity analyses for the impacted intersections are included in the Appendix.



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Table 5-5 Implementation Plan and Evaluation Results – Newport Locations

INT #	TOWN/CITY	INTERSECTION/CORRIDOR	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM	TOTAL ANNUAL COST	TOTAL ANNUAL SAFETY BENEFIT	SAFETY BENEFIT/COST RATIO (B/C)	INTERSECTION DELAY IMPACT
1	Newport	Admiral Kalbfus Road corridor, between JT Connell Highway and Malbone Road/Girard Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red clearance intervals) 	RIDOT Traffic Engineering	\$700	\$26,650	37.03	Westbound left-turn lane vehicle queues onto Pell-Bridge On-Ramp projected to not extend beyond storage bay.
			<ul style="list-style-type: none"> Retrofit rotary to modern roundabout with signing, striping, and splitter island modifications Signing and striping upgrades (Provide merge/yield warning signage and pavement markings on Pell Bridge Off-Ramp, provide 2 lanes on Pell Bridge On-Ramp, stripe guide tracks, and install lane use and guide signage) 	RI*STARS Contract 1	\$6,200	\$327,100	52.71	J.T. Connell Hwy/A.Kalbfus Rd retrofitted rotary projected to operate with approximately 15 seconds less delay. The eastbound vehicle queues are projected to reduce by approximately 85% during the PM peak period.
			<ul style="list-style-type: none"> Convert all intersections to modern roundabouts 	Pell Bridge Ramps Project	\$1,459,650	\$570,650	0.39	Roundabouts along the corridor projected to operate at acceptable levels of service during both peak periods.
2	Newport	America's Cup Avenue at West Marlborough Street	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$12,700	17.86	
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, regulatory and other signage) Install detectable warning systems as needed (on concrete sidewalks) Install pedestrian signal equipment for west leg of intersection Install pedestrian countdown timers 	RI*STARS Contract 1	\$1,685	\$35,575	21.11	
			<ul style="list-style-type: none"> Install pedestrian refuge area in median Install detectable warning systems as needed (on brick sidewalks) 	RI*STARS Contract 2	\$1,140	\$22,350	19.61	
3	Newport	America's Cup Avenue corridor, between Thames Street/ Bowens Wharf and Memorial Blvd	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$19,400	27.30	
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning, and other signage) Install accessible ramps and detectable warning systems as needed (on concrete sidewalks) Install additional pedestrian crossing with pedestrian signals Install pedestrian countdown timers 	RI*STARS Contract 1	\$7,150	\$54,350	7.60	
			<ul style="list-style-type: none"> Reconfigure channelized right-turn movement from Thames Street onto America's Cup Avenue Install landscaping/hardscaping to deter pedestrian crossings at unauthorized areas Reconfigure jug handle at America's Cup Avenue/Memorial Blvd intersection to provide pedestrian area and crossing on east leg 	RI*STARS Contract 2	\$4,700	\$4,500	0.95	
4	Newport	Memorial Blvd at Bellevue Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$15,450	21.74	
			<ul style="list-style-type: none"> Signing and striping upgrades (improved striping through intersection, "Piano Key" crosswalks, guide, regulatory, warning and other signage) Install pedestrian countdown timers and replace broken pushbuttons Add left-turn phases for Bellevue Avenue approaches 	RI*STARS Contract 1	\$3,300	\$76,350	23.22	Slight increase in delay from addition of left-turn phases
			<ul style="list-style-type: none"> Eliminate southbound channelized right turn and install curb bump outs Provide ADA minimum clearance on northwest corner of intersection Install detectable warning systems as needed (on brick sidewalks) 	RI*STARS Contract 2	N/A	N/A	N/A	
5	Newport	Memorial Boulevard at Rhode Island Avenue	<ul style="list-style-type: none"> Signing upgrades (speed limit signs on Memorial Blvd, advance intersection ahead warning signs, and signs warning turning vehicles of pedestrian movements) Install double yellow centerlines and stop bars in median areas 	RI*STARS Contract 1	\$450	\$93,050	218.98	

N/A – Recommended improvements were made based on the potential for specific crashes as identified by the RSA team. The countermeasures for these specific recommendations do not address any reported crashes that occurs between 2006 and 2008.



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Table 5-6 Implementation Plan and Evaluation Results – Middletown Locations

INT #	TOWN/CITY	INTERSECTION	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM	TOTAL ANNUAL COST	TOTAL ANNUAL SAFETY BENEFIT	SAFETY BENEFIT/COST RATIO (B/C)	INTERSECTION DELAY IMPACT
6	Middletown	West Main Road corridor, between Coddington Hwy/ Rockwood Road and Smythe Street/ Commercial Street	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$61,400	86.33	
			<ul style="list-style-type: none"> Add protected movement for Rockwood Rd approach (separate split phase) Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Install accessible ramps and detectable warning systems as needed Install pedestrian countdown timers Install exclusive left-turn lanes on West Main Road at East Main Rd & Coddington Hwy Convert Maple Ave to Right-in/Right-out Provide West Main Road southbound advance left-turn movement onto Smythe St 	Two-Mile Corner Project	\$587,150	\$230,450	0.39	<p>Providing a protected movement alone for Rockwood Road would increase intersection delay during PM peak period; however,</p> <p>Providing exclusive left-turn lanes on West Main Road will allow through movements to flow. Vehicle queues on West Main Road during the PM peak may extend beyond the storage bay, causing delay to through vehicles.</p>
7	Middletown	West Main Road/ Broadway at Admiral Kalbfus Road/ Miantonomi Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$9,050	12.73	Slight reduction in intersection delay (<10 seconds)
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, extend eastbound left-turn lane, and to provide 2 lanes for a short distance on southbound departure) Install accessible ramps and detectable warning systems as needed Install pedestrian countdown timers 	RI*STARS Contract 1	\$1,550	\$25,350	16.21	Eastbound left-turn vehicles projected not to extend beyond proposed storage bay.
8	Middletown	West Main Road at Forest Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$20,850	29.31	
			<ul style="list-style-type: none"> Provide refuge for pedestrians on southeast corner Install signs restricting left-turns into/out of gas station driveway (closest to signal on West Main Road) 	RI*STARS Contract 2	N/A	N/A	N/A	
9	Middletown	East Main Road at Aquidneck Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$12,300	17.30	Slight reduction in intersection delay (<10 seconds)
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, and restripe northbound lane use to provide right-turn only lane) Install Pedestrian Countdown timers 	RI*STARS Contract 1	\$550	\$12,300	22.95	
			<ul style="list-style-type: none"> Convert unsignalized bank driveway to right-in/right-out Adjust phasing to provide advance left-turn for northbound approach 	RI*STARS Contract 2	\$700	\$2,450	3.38	
10	Middletown	East Main Road at Turner Road	<ul style="list-style-type: none"> Signing and striping upgrades (guide, regulatory, warning and other signage, edge line guide tracks through intersection curve, and delineation) 	RI*STARS Contract 1	\$70	\$1,000	14.89	
			<ul style="list-style-type: none"> Install curbing to delineate intersection from access points Reconfigure skewed intersection to 90 degree angle 	RI*STARS Contract 2	\$1,300	\$36,350	28.25	
11	Middletown	Aquidneck Avenue at Green End Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red intervals) 	RIDOT Traffic Engineering	\$700	\$15,750	22.15	Slight reduction in intersection delay (<10 seconds)
			<ul style="list-style-type: none"> Signing and striping upgrades (guide, regulatory, warning and other signage, and reconfigure lane use to provide left-turn lanes on the Aquidneck Avenue approaches) 	RI*STARS Contract 1	\$1,200	\$40,600	33.95	Reduction in intersection delay; projected to operate under capacity compared to over capacity under existing conditions
			<ul style="list-style-type: none"> Provide left-turn lanes on Green End Avenue approaches (widen pavement) Restrict left-turns into driveway near intersection (through signing) 	RI*STARS Contract 2	\$6,900	\$2,650	0.38	Significant reduction in intersection delay (approximately 30 seconds)
			<ul style="list-style-type: none"> Replace Traffic Signal Equipment (provide exclusive left-turn phasing) Provide pedestrian facilities (including sidewalks and pedestrian signal equipment) 	Statewide High Hazard Intersection/Ramps – Newport County	\$13,700	\$31,500	2.30	Reduction in intersection delay (approximately 20 seconds) from existing conditions. Increase in delay from other improvements due to addition of protected left-turn phasing.

N/A – Recommended improvements were made based on the potential for specific crashes as identified by the RSA team. The countermeasures for these specific recommendations do not address any reported crashes that occurs between 2006 and 2008.



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Table 5-7 Implementation Plan and Evaluation Results – Portsmouth Locations

INT #	TOWN/CITY	INTERSECTION	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM	TOTAL ANNUAL COST	TOTAL ANNUAL SAFETY BENEFIT	SAFETY BENEFIT/COST RATIO (B/C)	INTERSECTION DELAY IMPACT
12	Portsmouth	Mount Hope Bridge at Boyds Lane/ Bristol Ferry Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red intervals) 	RIDOT Traffic Engineering	\$700	\$22,400	31.44	Slight reduction in intersection delay (<10 seconds)
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Traffic signal upgrades (tighten signal heads, new controller) Provide pedestrian facilities Provide delineation on guardrail/medians/islands Provide speed reduction on bridge (coordinate with RITBA) 	ADA Improvements to Bristol Ferry Road	\$13,700	\$94,800	6.93	Reduction in intersection delay during AM peak period (due to new signal equipment capable of Time-Of-Day programming)
13	Portsmouth	West Main Road/ Sprague Street at Turnpike Avenue/ Bristol Ferry Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$6,000	8.44	
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, lane drop striping, and guide, regulatory, warning and other signage) Install supplemental left-turn arrows on West Main Road northbound approach 	RI*STARS Contract 1	\$1,000	\$6,000	5.46	
14	Portsmouth	West Main Road at Stringham Road/ Dunkin Donuts Drive	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$9,700	13.59	
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Install accessible ramps and detectable warning systems as needed Restrict left-turns into and out of driveway immediately south of intersection 	West Main Road 1R - Contract 3	\$350	\$9,700	26.39	
15	Portsmouth	West Main Road at Union Street/Redwood Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$10,800	15.15	
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, larger street name signage, and "No Right Turn On Red") 	RI*STARS Contract 1	\$450	\$10,800	25.36	
			<ul style="list-style-type: none"> Install left-turn lanes on West Main Road Upgrade traffic signal equipment (including exclusive left-turn phasing on West Main Rd) 	West Main Road 1R - Contract 2	\$124,500	\$68,900	0.55	Vehicle queues on the southbound approach projected to be decreased during the PM peak period.
16	Portsmouth	East Main Road at Turnpike Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	\$700	\$10,700	15.02	Slight reduction in intersection delay (<10 seconds)
			<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, restripe to provide one departure lane on Turnpike Avenue northbound, lane use arrows, and restripe markings through intersection) Install detectable warning systems as needed (on concrete sidewalks) 	RI*STARS Contract 1	\$800	\$10,700	13.64	
			<ul style="list-style-type: none"> Install accessible ramps and detectable warning systems as needed Add signalized pedestrian crossing on east leg Install context-sensitive guardrail on southeast corner 	RI*STARS Contract 2	N/A	N/A	N/A	
			<ul style="list-style-type: none"> Replace signal with modern roundabout 	East Main Road Reconstruction	\$137,750	\$69,400	0.50	Reduction in intersection delay (approximately 30 seconds)
17	Portsmouth	East Main Road at Stubtoe Lane/Fairview Lane	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red clearance intervals) 	RIDOT Traffic Engineering	\$700	\$11,900	16.73	Slight reduction in intersection delay (<10 seconds)
			<ul style="list-style-type: none"> Provide left-turn lanes on East Main Road approaches Realign skewed intersection Provide pedestrian facilities Restrict left-turns into driveway near intersection (through signing) 	Statewide High Hazard Intersection/Ramps – Newport County	\$80,850	\$88,700	0.91	Slight reduction in intersection delay (<10 seconds)

N/A – Recommended improvements were made based on the potential for specific crashes as identified by the RSA team. The countermeasures for these specific recommendations do not address any reported crashes that occurs between 2006 and 2008.



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Table 5-8 Benefit/Cost Ratio and Annual Safety Benefit Ranking

BC RATIO RANK	INT #	TOWN/CITY	INTERSECTION/CORRIDOR	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM	B/C RATIO	ANNUAL SAFETY BENEFIT	ANNUAL SAFETY BENEFIT RANK
1	5	Newport	Memorial Boulevard at Rhode Island Avenue	<ul style="list-style-type: none"> Signing upgrades (speed limit signs on Memorial Blvd, advance intersection ahead warning signs, and signs warning turning vehicles of pedestrian movements) Install double yellow centerlines and stop bars in median areas 	RI*STARS Contract 1	218.98	\$93,050	5
2	6	Middletown	West Main Road corridor, between Coddington Hwy and Smythe Street	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	86.33	\$61,400	10
3	1	Newport	Admiral Kalbfus Road corridor, between JT Connell Highway and Malbone Road	<ul style="list-style-type: none"> Retrofit rotary to modern roundabout with signing, striping, and splitter island modifications Signing and striping upgrades (Provide merge/yield warning signage and pavement markings on Pell Bridge Off-Ramp, provide 2 lanes on Pell Bridge On-Ramp and, stripe guide tracks, and install lane use and guide signage) 	RI*STARS Contract 1	52.71	\$327,100	2
4	1	Newport	Admiral Kalbfus Road corridor, between JT Connell Highway and Malbone Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red clearance intervals) 	RIDOT Traffic Engineering	37.03	\$26,650	16
5	11	Middletown	Aquidneck Avenue at Green End Avenue	<ul style="list-style-type: none"> Signing and striping upgrades (guide, regulatory, warning and other signage, and reconfigure lane use to provide left-turn lanes on the Aquidneck Avenue approaches) 	RI*STARS Contract 1	33.95	\$40,600	12
6	12	Portsmouth	Mount Hope Bridge at Boyds Lane/Bristol Ferry Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red intervals) 	RIDOT Traffic Engineering	31.44	\$22,400	18
7	8	Middletown	West Main Road at Forest Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	29.31	\$20,850	20
8	10	Middletown	East Main Road at Turner Road	<ul style="list-style-type: none"> Install curbing to delineate intersection from access points Reconfigure skewed intersection to 90 degree angle 	RI*STARS Contract 2	28.55	\$36,350	13
9	3	Newport	America's Cup Avenue corridor, between Thames Street/Bowens Wharf and Memorial Blvd	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	27.30	\$19,400	21
10	14	Portsmouth	West Main Road at Stringham Road/Dunkin Donuts Drive	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Install accessible ramps and detectable warning systems as needed Restrict left-turns in driveway immediately south of intersection 	West Main Road 1R - Contract 3	26.39	\$9,700	33
11	15	Portsmouth	West Main Road at Union Street/Redwood Road	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, larger street name signage, and "No Right Turn On Red") 	RI*STARS Contract 1	25.36	\$10,800	29
12	4	Newport	Memorial Blvd at Bellevue Avenue	<ul style="list-style-type: none"> Signing and striping upgrades (improved striping through intersection, "Piano Key" crosswalks, guide, regulatory, warning and other signage) Install pedestrian countdown timers and replace broken pushbuttons Add left-turn phase for Bellevue Avenue approaches 	RI*STARS Contract 1	23.22	\$76,350	7
13	9	Middletown	East Main Road at Aquidneck Avenue	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, and reconfigure northbound lane use to provide right-turn only lane) Install Pedestrian Countdown timers 	RI*STARS Contract 1	22.95	\$12,300	26
14	11	Middletown	Aquidneck Avenue at Green End Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red intervals) 	RIDOT Traffic Engineering	22.15	\$15,750	22
15	4	Newport	Memorial Blvd at Bellevue Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	21.74	\$15,450	23
16	2	Newport	America's Cup Avenue at West Marlborough Street	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, regulatory and other signage) Install detectable warning systems as needed Install pedestrian signal equipment for west leg of intersection Install pedestrian countdown timers 	RI*STARS Contract 1	21.11	\$35,575	14
17	2	Newport	America's Cup Avenue at West Marlborough Street	<ul style="list-style-type: none"> Install pedestrian refuge area in median Install detectable warning systems as needed (on brick sidewalks) 	RI*STARS Contract 2	19.61	\$22,350	19
18	2	Newport	America's Cup Avenue at West Marlborough Street	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	17.86	\$12,700	24
19	9	Middletown	East Main Road at Aquidneck Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	17.30	\$12,300	25
20	17	Portsmouth	East Main Road at Stubtoe Lane/Fairview Lane	<ul style="list-style-type: none"> Optimize signal timings (including yellow and red clearance intervals) 	RIDOT Traffic Engineering	16.73	\$11,900	27



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Table 5-8 Benefit/Cost Ratio and Annual Safety Benefit Ranking Continued

BC RATIO RANK	INT #	TOWN/CITY	INTERSECTION/CORRIDOR	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM	B/C RATIO	ANNUAL SAFETY BENEFIT	ANNUAL SAFETY BENEFIT RANK
21	7	Middletown	West Main Road/Broadway at Admiral Kalbfus Road/Miantonomi Avenue	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, extend eastbound left-turn lane, and to provide 2 lanes for a short distance on southbound departure) Install accessible ramps and detectable warning systems as needed Install pedestrian countdown timers 	RI*STARS Contract 1	16.21	\$25,350	17
22	15	Portsmouth	West Main Road at Union Street/Redwood Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	15.15	\$10,800	28
23	16	Portsmouth	East Main Road at Turnpike Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	15.02	\$10,700	30
24	10	Middletown	East Main Road at Turner Road	<ul style="list-style-type: none"> Signing and striping upgrades (guide, regulatory, warning and other signage, edge skip striping through intersection curve, and delineation) 	RI*STARS Contract 1	14.89	\$1,000	40
25	16	Portsmouth	East Main Road at Turnpike Avenue	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage, restripe to provide one departure lane on Turnpike Avenue northbound, land use arrows, and restripe markings through intersection) Install detectable warning systems as needed 	RI*STARS Contract 1	13.64	\$10,700	31
26	14	Portsmouth	West Main Road at Stringham Road/Dunkin Donuts Drive	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	13.59	\$9,700	32
27	7	Middletown	West Main Road/Broadway at Admiral Kalbfus Road/Miantonomi Avenue	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	12.73	\$9,050	34
28	13	Portsmouth	West Main Road/Sprague Street at Turnpike Avenue/Bristol Ferry Road	<ul style="list-style-type: none"> Optimize signal timings (including yellow, red, and pedestrian intervals) 	RIDOT Traffic Engineering	8.44	\$6,000	35
29	3	Newport	America's Cup Avenue corridor, between Thames Street/Bowens Wharf and Memorial Blvd	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning, and other signage) Install accessible ramps and detectable warning systems as needed Install additional pedestrian crossing with pedestrian signals Install pedestrian countdown timers 	RI*STARS Contract 1	7.60	\$54,350	11
30	12	Portsmouth	Mount Hope Bridge at Boyds Lane/Bristol Ferry Road	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Traffic signal upgrades (tighten signal heads, new controller) Provide pedestrian facilities Provide delineation on guardrail/medians/islands Provide speed reduction on bridge (coordinate with RITBA) 	ADA Improvements to Bristol Ferry Road	6.93	\$94,800	4
31	13	Portsmouth	West Main Road/Sprague Street at Turnpike Avenue/Bristol Ferry Road	<ul style="list-style-type: none"> Signing and striping upgrades ("Piano Key" crosswalks, lane drop striping, and guide, regulatory, warning and other signage) Install supplemental left-turn arrows on West Main Road northbound approach 	RI*STARS Contract 1	5.46	\$6,000	36
32	9	Middletown	East Main Road at Aquidneck Avenue	<ul style="list-style-type: none"> Convert bank driveway to right-in/right-out Adjust phasing to provide advance green for northbound approach 	RI*STARS Contract 2	3.38	\$2,450	39
33	11	Middletown	Aquidneck Avenue at Green End Avenue	<ul style="list-style-type: none"> Replace Traffic Signal Equipment (including exclusive left-turn phasing) Provide pedestrian facilities (including sidewalks and pedestrian signal equipment) 	Statewide High Hazard Intersection/Ramps - Newport County	2.30	\$31,500	15
34	3	Newport	America's Cup Avenue corridor, between Thames Street/Bowens Wharf and Memorial Blvd	<ul style="list-style-type: none"> Reconfigure channelized right-turn movement from Thames Street onto America's Cup Avenue Install landscaping/hardscaping to deter pedestrian crossings at unauthorized areas Reconfigure jug handle at America's Cup Avenue/Memorial Blvd intersection to provide pedestrian area and crossing on east leg 	RI*STARS Contract 2	0.95	\$4,500	37
35	17	Portsmouth	East Main Road at Stubtoe Lane/Fairview Lane	<ul style="list-style-type: none"> Provide left-turn lanes on East Main Road approaches and realign skewed intersection Provide pedestrian facilities Restrict left-turns into driveway near intersection (through signing) 	Statewide High Hazard Intersection/Ramps - Newport County	0.91	\$88,700	6
36	15	Portsmouth	West Main Road at Union Street/Redwood Road	<ul style="list-style-type: none"> Install left-turn lanes on West Main Road Upgrade traffic signal equipment (including exclusive left-turn phasing) 	West Main Road 1R - Contract 2	0.55	\$68,900	9



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Table 5-8 Benefit/Cost Ratio and Annual Safety Benefit Ranking Continued

BC RATIO RANK	INT #	TOWN/CITY	INTERSECTION/CORRIDOR	RECOMMENDED IMPROVEMENTS	IMPLEMENTATION MECHANISM	B/C RATIO	ANNUAL SAFETY BENEFIT	ANNUAL SAFETY BENEFIT RANK
37	16	Portsmouth	East Main Road at Turnpike Avenue	<ul style="list-style-type: none"> Replace signal with modern roundabout 	East Main Road Reconstruction	0.50	\$69,400	8
38	1	Newport	Admiral Kalbfus Road corridor, between JT Connell Highway and Malbone Road	<ul style="list-style-type: none"> Convert all intersections to modern roundabouts 	Pell Bridge Ramps Project	0.39	\$570,650	1
39	6	Middletown	West Main Road corridor, between Coddington Hwy and Smythe Street	<ul style="list-style-type: none"> Add protected movement for Rockwood Rd approach Signing and striping upgrades ("Piano Key" crosswalks, guide, regulatory, warning and other signage) Install accessible ramps and detectable warning systems as needed Install pedestrian countdown timers Install exclusive left-turn lanes on West Main Road at East Main Rd & Coddington Hwy Convert Maple Ave to Right-in/Right-out Provide West Main Road southbound advance left-turn movement onto Smythe St 	Two-Mile Corner Project	0.39	\$230,450	3
40	11	Middletown	Aquidneck Avenue at Green End Avenue	<ul style="list-style-type: none"> Provide left-turn lanes on Green End Avenue approaches (widen pavement) Restrict left-turns into driveway near intersection (through signing) 	RI*STARS Contract 2	0.38	\$2,650	38



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