

ROAD SAFETY AUDIT

Route 3A from Evans Street to Abigail Adams State Park

Town of Weymouth

October 12, 2016

Prepared For:
MassDOT



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Background

This Road Safety Audit (RSA) was conducted as part of MassDOT's roadway reconstruction project for Route 3A (Bridge Street) in Weymouth. The purpose of the RSA was to identify and discuss existing safety issues and potential improvements from different road users. Both long term improvements that can be implemented as part of the Route 3A project and short term improvements that can be implemented before MassDOT's Route 3A reconstruction project begins were discussed.

There were 161 reported crashes along the corridor from 2013 through 2015. Approximately 77% of the crashes were property damage only. Approximately 70% of the crashes were rear-end or angle-type collisions.

The safety audit team was composed of representatives from MassDOT Highway Safety, MassDOT District 6, Weymouth Police Department, Weymouth Fire Department, Town of Weymouth Planning Department, and Green International Affiliates, Inc. (Green).

Project Data

The RSA for Route 3A in Weymouth was conducted on Wednesday September 7, 2016. The RSA agenda is provided in Appendix A. Table 1 lists all members of the audit team, and the RSA Audit Team Sign-in sheet is included in Appendix B. The RSA began with Green International Affiliates, Inc. (Green) giving a brief presentation of the existing conditions and crash data history to facilitate the start of the discussion. The audit team then walked along the Route 3A corridor and observed the intersections of Route 3A at Sea Street, Route 3A at North Street, and Route 3A at Green Street/Neck Street, and identified observed safety issues. Next, the audit team reconvened to summarize the safety concerns identified in the field and discussed potential improvements to address these safety concerns.

Table 1: Participating Audit Team Members

Audit Team Member	Agency/Affiliation
Bill Scully	Green International Affiliates, Inc.
Wing Wong	Green International Affiliates, Inc.
Sergio Musto	Green International Affiliates, Inc.
Lisa Schletzbaum	MassDOT Highway Safety
Kush Bhagat	MassDOT Highway Safety
Jennifer Inzana	MassDOT Highway Safety
Courtney Dwyer	MassDOT District 6 Bicycle and Pedestrian Coordinator
Amitai Lipton	MassDOT District 6 Traffic
Zach Veaner	MassDOT District 6
Robert Luongo	Weymouth Planning & Community Development
Owen MacDonald	Weymouth Traffic Engineer
Brendan Fogarty	Weymouth Police Department
Justin Myers	Weymouth Fire Department

Project Location and Description

This RSA evaluates safety issues for the Route 3A (Bridge Street) corridor reconstruction project in Weymouth, MA. The project limits along Route 3A (Bridge Street) extend from the intersection with Evans Street to 300 feet east of the driveway for Abigail Adams State Park for an approximate length of 1.4 miles. The RSA focused on the following intersections as well as the segments along Route 3A (Bridge Street) between these intersections:

- Bridge Street at Sea Street (signalized)
- Bridge Street at North Street (signalized)

- Bridge Street at Green Street / Neck Street (signalized)

Background research was performed for the above intersections as well as the following three intersections, and the roadway segments between these intersection and to the project limits:

- Bridge Street at Birchbrow Avenue (signalized)
- Bridge Street at the primary Riverway Plaza drive (signalized)
- Bridge Street at the drives to Abigail Adams Park and Riverway Plaza (signalized)

Additionally, the intersection of Bridge Street at Evans Street was reviewed, although this intersection is proposed to be reconstructed as part of the ongoing Fore River Bridge Replacement project, MassDOT project No. 604382.

Local crash data was collected and organized into a collision map and collision diagrams. Because existing roadway volumes had not been collected yet, 2010 ADT data for MassDOT count station #8050 on the Fore River Bridge were used in the calculations of crash rates, as well as turning movement count data for North Street from MassDOT Project #604382. The count data and the corresponding crash rates will be updated as it becomes available. Appendix C provides the collision map, collision diagrams, and MassDOT crash rate worksheets for each intersection and roadway segment.

Existing Roadway and Intersection Descriptions

Route 3A (Bridge Street)

Route 3A (Bridge Street) provides access to Route 53 in Quincy and I-93 in Boston to the west, and to Route 228 in Hingham to the east. Bridge Street is a four lane, two-way road and is classified as an Urban Principal Arterial roadway, and is under MassDOT jurisdiction. The roadway carries traffic in the east-west direction. The posted speed limit on Bridge Street varies from 30-35 miles per hour. Bridge Street is approximately 50 feet wide between Evans Street and Sea Street, with four 11-12 -foot-wide lanes and two- to three-foot shoulders. The cross-section of Bridge Street is narrower between Sea Street and Neck Street/Green Street, providing four 10-foot travel lanes and no shoulders. East of the intersection with Neck Street/Green Street, travel lanes on Bridge Street are 12 feet wide, 2-foot shoulders are marked, and there is a raised median island or concrete median barriers separating the two directions of travel. At each intersection, each approach of Bridge Street has two travel lanes from which turns are permitted; unless otherwise noted in the following intersection descriptions, no separate turn lanes are provided on Bridge Street except at Riverway Plaza. The project location is shown in Figure 1.

Land use adjacent to Bridge Street is commercial, residential, and recreational. There are frequent curb cuts for driveways and side streets along Bridge Street. There are numerous retail and residential properties located within the study area, with Riverway Plaza being the largest. Each intersecting street is owned and maintained by the Town of Weymouth. Evans Street, North Street south of Bridge Street, and Green Street are classified as Urban Minor Arterials; Sea Street, North Street north of Bridge Street, and Neck Street are classified as an Urban Collectors.



Figure 1
Project Location
Route 3A
Weymouth, MA

North Street and Green Street provide direct access to the part of Weymouth south of the peninsula, while all of the other side streets west of Green/Neck Street primarily serve residential traffic or lead to streets that ultimately connect to North Street and Green Street.

Sidewalks are present along both sides of Bridge Street between Evans Street and the primary Riverway Plaza drive, and present along the north side of Bridge Street east of the primary plaza drive. There are multiple curb cuts that interrupt the sidewalk along the corridor. Wheelchair ramps with detectable warning panels were constructed in the summer of 2016 as part of a separate project along both sides of Bridge Street. Along the project corridor the only marked crosswalks are present at the signalized intersections.

There are no bicycle lanes or markings along the Bridge Street corridor. Shoulders are nonexistent between Sea Street and Green/Neck Street and are narrow (less than three feet wide) west of Riverview Plaza, and there are multiple non-bicycle-safe catch basin grates along the corridor.

Bridge Street at Birchbrow Avenue (Signalized)

Birchbrow Avenue meets Bridge Street at a signalized three-legged intersection with Bridge Street as the main thoroughfare providing the east-west movements and Birchbrow Avenue serving as the north leg. Lane widths are 11-12 feet on Bridge Street and 12 feet on Birchbrow Avenue. Sidewalk is present along both sides of Bridge Street. There are crosswalks across Bridge Street east of Birchbrow Avenue and across Birchbrow Avenue at the intersection with Bridge Street. Pedestrian signal heads and pushbuttons are provided at each crosswalk. The signals operate with two vehicular phases and a pushbutton-actuated exclusive pedestrian phase. Bus stops for MBTA bus routes 220, 221, and 222 are located immediately to the east of this intersection in both directions.

Bridge Street at Sea Street (Signalized)

At this skewed, four-legged intersection, Bridge Street forms the east and west legs while Sea Street forms the northwest and southeast legs. The south leg of Sea Street has a splitter island between the northbound and southbound lanes and another island to provide a channelized right turn. The channelized turn operates under yield control although no signage or signals are present. The lanes on Bridge Street are 11-12 feet wide west of Sea Street and 10 feet wide east of Sea Street. Lane widths on Sea Street are approximately 20 feet at the intersection. Street parking is allowed on the southbound lane of Sea Street north of the intersection. In the southwest corner of the intersection is open greenspace and a driveway entrance for condominiums; the drive is accessed on the southbound side of Sea Street immediately south of the intersection. A building with small businesses with storefronts is located in the northwest corner. Wood fence and vegetation wrap around the northeast corner, and a church occupies the southeast corner. Crosswalks are present across each leg of the intersection.

Five- to eight-foot-wide sidewalk is present along each corner of the intersection and crosswalks with pedestrian pushbuttons are present across each leg, although there are no pushbuttons at the channelized right-turn island. Wheelchair ramps with detectable warning panels were reconstructed in the summer of 2016. The signals operate with two vehicular phases and a pushbutton-actuated exclusive pedestrian phase.

No turns are permitted on red for the westbound approach of Bridge Street. The Sea Street traffic movements have concurrent green times, as do both Bridge Street approaches. Pedestrian signal heads and push buttons are located at each corner of the intersection. The push button in the northeast corner faces the grass and is located above the grass behind the sidewalk.

Bridge Street at North Street (Signalized)

North Street intersects Bridge Street about 1,450 feet east of Sea Street at this four-legged signalized intersection. North Street forms the north and south legs, and Bridge Street forms the east and west legs. The lanes on Bridge Street are each 10 feet wide at this intersection. North Street has one lane at each approach, approximately 13-14 feet wide. A car dealer occupies the southwest corner of the intersection, a drive-through dry-cleaner is in the northwestern corner, small offices occupy the house in the southeast corner, and a parking lot for townhouses is in the northeast corner. A bus stop for MBTA routes 220 and 221 are located at this intersection.

Sidewalk is present along each corner of the intersection, at five to nine feet wide, and crosswalks with pedestrian pushbuttons are present across each leg. Wheelchair ramps with detectable warning panels were reconstructed in the summer of 2016. The signals operate with two vehicular phases and a pushbutton-actuated exclusive pedestrian phase.

Congestion from the Green Street/Neck Street intersection was observed to back up to the North Street intersection before noon, although this could be the result of a lane closure on Bridge Street east of Green Street.

Bridge Street at Green Street/Neck Street (Signalized)

Bridge Street meets Green Street and Neck Street at a four-way intersection with Bridge Street as the main thoroughfare. Bridge Street forms the east and west legs, Green Street forms the south leg, and Neck Street forms the north leg. The Bridge Street westbound approach has a channelized right turn approximately 200 feet east of the signalized intersection. Between the channelized right slip lane and Neck Street is a bus pullout area with a bus shelter, for MBTA bus routes 220 and 221. Sidewalks are present along each side of each intersection leg. Crosswalks with pedestrian signal heads and push buttons are present across each leg.

Both Bridge Street approaches provide two travel lanes. No turns are permitted in the westbound direction downstream of the channelized turn. The Neck Street and Green Street approaches each have a left-only lane and a through/right lane. Protected left-turn signal phases are provided for the Bridge Street eastbound approach and the Neck Street southbound approach. Right turns on red are prohibited from Neck Street and Green Street. There is an exclusive pedestrian phase, with push button actuation. Bicycle detection is present on each approach. This signal is coordinated with the signals at the Riverview Plaza driveways and at Abigail Adams Park.

Bridge Street at Riverway Plaza drive (Signalized)

The western driveway to Riverway Plaza and a small drive between two car dealerships form a four-way intersection with Bridge Street. The Bridge Street westbound approach provides an exclusive left-turn

lane in addition to the two travel lanes. The Riverway Plaza Drive northbound approach provides an exclusive left-turn lane and a shared through/right-turn lane. The car dealership drive is unmarked. There is one crosswalk across the east leg, with pedestrian signal heads but no refuge for pedestrians making the approximately 86-foot crossing. No sidewalk is provided along the south side of Bridge Street. There are bus stops along MBTA bus route 220 in both directions immediately west of the intersection.

The pedestrian-activated phase is concurrent with that of the plaza drive, but if the plaza drive phase is not activated the pedestrian phase becomes exclusive. The car dealership drive has signal heads and loop detectors, but because one of the adjacent dealerships is empty and access to the other dealer is gated, this phase was not observed to be activated in the field. Left turns are not permitted from the eastbound approach (e.g. into the car dealer drive). Bicycle detection is present on each approach. This signal is coordinated with the signals at North Street/Green Street and at Abigail Adams Park.

Bridge Street at Abigail Adams Park (Signalized)

Bridge Street intersects the Abigail Adams Park Driveway and an eastbound jughandle to form a four-legged signalized intersection. The eastbound jughandle accommodates Bridge Street Eastbound left-turns and U-turns, and also provides access to a secondary driveway for Riverway Plaza. Sidewalk is present along the north side of Bridge Street. Bridge Street provides two 12-20 -foot-wide lanes in each direction, whereas the jughandle northbound approach is approximately 25 feet wide and the Abigail Adams Park Driveway southbound approach is approximately 20 feet wide. There are no lane markings on the northbound jughandle and the southbound Abigail Adams Park Driveway approaches. Bicycle detection is present on each approach. This signal is coordinated with the signals at North Street/Green Street and at the primary Riverway Plaza drive.

Audit Observations and Potential Safety Enhancements

In conducting the Route 3A Road Safety Audit, existing safety issues and possible corrective actions were identified based on audit team discussions and field observations on Wednesday, September 7, 2016. The safety issues that were identified include:

- Faded pavement markings
- Intersection geometry deficiencies
- Non-ADA compliant sidewalks
- Lack of bicycle facilities
- Narrow roadway widths
- Poor access management
- Substandard signal equipment and phasing
- Poor/insufficient signage and wayfinding
- Substandard transit connections
- Poor geometry at channelized island at Route 3A / Neck Street
- Illegal parking

Many of these issues can or need to be addressed by long term solutions, but some short term improvements were also identified. The following paragraphs describe the issues and possible actions. The identified issues by the RSA team have some similarities and commonalities and consequently, were grouped into major categories.

Safety Issue #1. Faded Pavement Markings

Observations

Crosswalks and stop bars at all intersections are very faded, and the ends of crosswalks do not always match to the wheelchair ramp openings. Lane line and double yellow centerline markings are also faded throughout the corridor, which could lead to driver confusion, and unintended lane encroachment which are potential safety deficiencies.

Crosswalks and other pavement markings at the North Street intersection are especially faded, which may be a contributing factor in the three pedestrian crashes along the corridor. The STOP bar locations on the North Street southbound approach may also need to be reviewed as they are located unnecessarily far away from the crosswalk.

Enhancements:

Restripe all pavement markings within the project limits. Realign crosswalks that currently lead away from wheelchair ramp openings. At the southbound approach of the North Street intersection, relocate the STOP bar location to be four feet from the crosswalk per the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD). This crosswalk should also be realigned and be widened.



Image 1: This crosswalk across North Street does not align with the wheelchair ramps.

Safety Issue #2. Intersection Geometry Deficiencies

Observations:

At the Sea Street intersection, the vehicles turning left onto Sea Street from the Route 3A approaches appear to conflict head-on due to the skewed intersection layout.

At the North Street intersection, the northeast curb radius is too tight, requiring vehicles to almost stop to turn. This movement was observed in the field to have nearly caused a rear-end crash.

Because Green Street and Neck Street are somewhat offset (by approximately 20-30 feet) from each other, the approach and receiving lanes are not aligned, which could lead to sideswipe crashes in the middle of the intersection as drivers align themselves to the receiving lanes.

Enhancement:

At the Route 3A/Sea Street intersection, slightly realign the Sea Street approaches to eliminate conflicting left-turn movements from Route 3A.

At the Route 3A/North Street intersection, increase the curb radius at the northeast corner.

At the Route 3A / Green Street / Neck Street intersection, determine if it is possible to create a more straight alignment traveling northbound or southbound along the side streets.

Safety Issue #3 Non-ADA Compliant Sidewalks (Corridor Wide)

Observations:

Route 3A sidewalks have issues mostly at narrow roadway areas and at some crosswalk locations. Sidewalk along the north side of Route 3A between Sea Street and North Street has overgrown vegetation extending nearly out to the roadway which could force pedestrians into the roadway to bypass this segment of the sidewalk. Sidewalk widths are also reduced by the presence of utility poles.

Sidewalk grading issues were also observed. The majority of the sidewalk cross-slopes appear to exceed the maximum ADA allowable cross-slope of 2 percent. Wheelchair ramps were observed at a few locations to have lips between the ramp opening and edge of roadway (such as at Blackstone Street). This is not in accordance with ADA standards, which require a flush transition. Corner ramps such as those along the north side of the North Street intersection were observed to open toward one crosswalk but have raised curb at the end of the crosswalk in the perpendicular direction.



Image 2: Some recently-installed wheelchair ramps have a lip between the edge of roadway and the ramp entrance, which is not in accordance with ADA standards requiring a flush transition.



Image 3: Sidewalk between Sea Street and North Street is narrow with overhanging vegetation.

Enhancements:

Trim overgrown vegetation along sidewalks to provide adequate clearance width. Reconstruct existing sidewalks to be concrete and meet ADA and AAB standards. Reconstruct ADA-compliant curb ramps so that the ramp opens properly at each crosswalk end.

Safety Issue #4 Lack of Bicycle Facilities (Corridor Wide)

Observations:

There are no bicycle lanes along the Route 3A corridor and shoulders are narrow or non-existent to accommodate bicycles. The only bicycle accommodations that are currently provided in the study area are actuation loops at the Neck Street / Green Street, Riverway Plaza, and Abigail Adams State Park traffic signals. Bicyclists were observed riding on the sidewalk along the north side of Route 3A.

Enhancements:

Provide a continuous bicycle lane or wide bicycle-accommodating shoulder in each direction along the entire length of Route 3A, if feasible. Consider providing alternative bicycle routes if a bicycle lane cannot be added along portions of Route 3A due to site constraints. Add bicycle detection to the traffic signals at the Birchbrow Street, Sea Street, and North Street intersections on all approaches and provide appropriate signage and pavement markings to indicate where bicyclists are to wait. Encouraging slower travel speeds (see comments on speed limits) along the corridor will improve the safety of bicycling along the corridor, as well.

Safety Issue #5 Narrow Roadway Widths

Observations:

Shoulders are narrow (less than three feet wide) throughout the corridor west of Sea Street and are nonexistent between Sea Street and Green Street / Neck Street. Wider shoulders would benefit both bicyclists and law enforcement, since the parked vehicles partially block the right travel lane and essentially block the usage of the right lane. Travel lane widths are approximately ten feet between Sea Street and Green Street / Neck Street. It was observed that the narrow lane widths force buses and large trucks to encroach into adjacent travel lanes as these vehicles were trying to gain clearance from the utility poles and signs located within the adjacent sidewalk. This may be a factor in the 14 sideswipe crashes that occurred along the corridor.

Enhancement:

Increase roadway widths on Route 3A, especially between and including the intersections at Sea Street and Green Street / Neck Street. The expanded roadway cross section would require widening the shoulders to 5 feet (also to accommodate bike lanes, see the previous issue) and widen travel lanes to be 11 feet to comply with the MassDOT Complete Streets Policy and standards.

Safety Issue #6: Poor Access Management

Observations:

Driveway openings are excessively wide, poorly defined, and densely spaced on Route 3A. This results in numerous vehicular conflict points along the corridor. The presence of these conflict points results in an increased risk of angle and rear-end collisions. Excluding signalized intersections, there were 18 reported angle collisions and 18 reported rear-end collisions in 2013-2015 within the project limits. Curb cuts near the North Street intersection, among other locations, were also noted to be excessively wide – the curb cuts at the dry cleaners are approximately 50 feet wide, and the westernmost curb cut is shared as a driveway opening for several houses. Drivers also turn left out of driveways onto Route 3A, which requires them to cross in front of two opposing lanes of traffic. This is especially a concern between the Dunkin' Donuts and the Citgo gas station along the south side of Bridge Street between Green Street / Neck Street and Riverway Plaza, where Bridge Street is not physically divided. At the Green Street intersection, there is also concern that traffic could be stopped when drivers from the Route 3A eastbound

direction cross Green Street to access the southern Dunkin' Donuts driveway while there are vehicle queues stacked at the Green Street approach. This condition was observed during the RSA.

Enhancement:

Consolidate driveways where possible. At businesses or small plazas that currently have two driveways, discuss with property owners the possibility of eliminating a curb cut or alternatively converting the driveways to a one-way traffic pattern. This will reduce the number of conflict points along Route 3A. Discuss with property owners the possibility of closing curb cuts and/or providing internal connections between adjacent properties. Narrow the width of curb cuts, especially near the intersections.

Another option to help reduce conflict points along Route 3A is to restrict left turns from curb cuts to prevent drivers crossing opposing lanes of traffic on a four-lane roadway.

In the longer term, it is anticipated that changing zoning to encourage mixed-use or 'smart-growth' mixtures of residences and businesses will help limit the number of curb cuts needed along Route 3A.

Shift the Dunkin' Donuts driveway along Green Street further south of the intersection with Bridge Street or add Do Not Block Intersection markings at this driveway entrance. Considering that traffic from the westbound direction of Route 3A (via the jughandle) and Neck Street can turn right into the Dunkin' Donuts' Bridge Street driveway, it might also be advantageous to prohibit left turns into the Dunkin' Donuts driveway from Green Street.



Image 4: The entrance curb cut to the dry cleaners' at the North Street intersection is approximately 50 feet wide and the pavement at the driveway entrance is in poor condition.

Safety Issue #7: Substandard Signal Equipment and Phasing

Observations at Sea Street / Route 3A Intersection:

A pedestrian push button in the northeast corner is missing. See the general corridor comments for more observations about pedestrian signal equipment.

The signal system does not have preemption equipment.

Observations at North Street / Route 3A Intersection:

On the Route 3A westbound approach, a single signal head is mounted over the crosswalk of the west intersection leg and does not have the minimum separation distance of 40 feet (per standards of the latest edition of the MUTCD) between the stop bar and the signal heads. This creates a visibility issue since the signal head for the westbound approach is too high for drivers stopped near the STOP bar to see on this approach. A second signal head for the westbound approach is mounted on the southeast corner of the intersection and it is located outside of the MUTCD recommended cone of vision. The improper signal head locations may be a factor in the five red light running crashes and the nine rear-end crashes reported at this intersection from 2013-2015.

Route 3A left-turning vehicles have difficulty making these turning movements due to the lack of gaps in traffic. The crash data shows that 12 of the 46 reported angle crashes from 2013-2015 at this intersection involved left-turning westbound vehicles, and that there were four times as many reported crashes involving left turns from the westbound movement than crashes involving left turns from the eastbound movement. The Route 3A approaches have concurrent phases and there is no protected phase for this movement/approach.

During the time of observation, an inductive loop for the North Street southbound approach is believed to have been activated when a driver turning from Route 3A onto North Street drove over part of the loop, causing a false call to be made for the North Street approach and increasing overall intersection delay.

The signal system does not have preemption equipment.

The clearance timing interval was observed to be short/substandard.

Observations at Green Street / Neck Street / Route 3A Intersection:

The signal heads for the Route 3A westbound approach display green arrows, but they should be green balls since there are opposing left-turn movements from the Route 3A eastbound approach permitted during the same phase.

There are two sign mounting brackets on the southeast corner mast arm. The signs that were once installed on these brackets are missing (review of old Google Streetview photos shows that a “left turn yield on green” sign was mounted on this arm for the Neck Street approach). The “No Turn on Red” mounted over/for the eastbound Route 3A movement is partially blocked by one of the signal heads facing the Neck Street approach.

The signal system does not have preemption equipment.

Observations Along Corridor:

The signalized intersections within the project limits lack pedestrian signal heads with countdown timers, and do not provide accessible features. Many of the pedestrian push buttons are missing, not ADA/AAB compliant, and/or are incorrectly installed.

The signal systems do not have preemption equipment.

Existing signal systems are not coordinated.

Most of the signal heads along the corridor do not have backplates. Some of the backplates for the signal heads at the Green Street/Neck Street intersection and (as observed during prior field review conducted in May 2016) the Birchbrow Avenue intersection are damaged. The reduced visibility of the signal heads may be a contributing factor in the eight red light running crashes reported along the corridor from 2013-2015.

Enhancement:

At the North Street / Route 3A intersection, the yellow and all-red clearance times should be checked and updated to current MassDOT standards. Providing an advance protected left turn phase for the westbound traffic on Route 3A will help left-turning movements on this approach. Adjust the location of the vehicle signal heads at this intersection to meet the standards of the latest edition of the MUTCD. Review and adjust loop detector settings (short delay timing) to avoid unnecessary false calls.



Image 5: This mast arm at North Street has a signal head for the westbound approach too close (almost above) the stop line, a pedestrian signal head without a countdown, and a pushbutton facing the wrong way.

At the Green Street / Neck Street / Route 3A intersection, replace the signal heads for the westbound direction to have circular green indications. Remove the sign mounting brackets that are no longer necessary. Check the mountings for the remaining mast arm-mounted signage, and relocate as needed to avoid visibility blockage.

For corridor wide improvements, pedestrian signal equipment compliant with the latest edition of the MUTCD should be installed for all crosswalks at the signalized intersections, with accessible pedestrian features per current MassDOT policy.

Traffic signals should be coordinated within the corridor in a closed loop system to improve overall traffic operations.

Backplates should be installed or re-installed on the traffic signal heads as necessary throughout the corridor.

Safety Issue #8: Poor/Insufficient Signage and Wayfinding

Observations:

Although Route 3A is a busy corridor located in close proximity to several beaches and state parks. However, there are no wayfinding signs along Route 3A within the project limits to guide drivers to these destinations. Route marker signs are absent, and speed limit signs in either travel direction are provided at only one location within the project corridor. Aside from a variable message sign on the Hingham side of the Back River Bridge that alerts motorists to divert to Green Street or North Street during closures of the Fore River Bridge, there is no other signage that alerts drivers of the Fore River Bridge closure in advance of boat crossings.

Most of the street name signs are located too far back from Route 3A and are difficult to see for drivers on Route 3A as the signs are blocked by vegetation, buildings, utility poles, etc. Other regulatory and warning signs within the project limits are difficult to read as the sign panels are old and faded. This may cause vehicles to shift lanes suddenly.

Enhancement:

Install wayfinding signage for beaches, state parks, and state boat ramps along the corridor. Add route marker and speed limit reinforcement signs along the corridor. Install solar-powered speed display signs for traffic calming. Install additional real-time display signs alerting drivers to (scheduled) bridge closures.

Trim vegetation around street name signs and relocate, if necessary, to more visible locations. The installation of advanced street name signage is also recommended along approaches to major intersections. Install overhead street name signs on the mast arms at the signalized intersections.

Replace old and faded regulatory and warning signs throughout the corridor to meet the standards of the latest edition of the MUTCD.

Safety Issue #9: Substandard Transit Connections

Observations:

There are only three bus shelters along the project corridor. Bus stop signs located at multiple locations are faded and are barely visible. The existing bus stops are not accessible. There are bus stop locations along the corridor that are not near crosswalks, such as the bus stop on the north side of Bridge Street east of Blackstone Rd, and the bus stop at St. Jerome Parish on the north side of Bridge Street. It was mentioned that pedestrians were known to cross Bridge Street at unmarked locations that are not expected by motorists in order to walk to/from bus stops.

During the morning and afternoon there are many vehicle trips for student drop-offs and pick-ups at the St. Jerome Elementary School, which adds to the amount of turning traffic at the Green Street / Neck Street intersection when school is in session.

Enhancement:

Install additional bus shelters along the corridor and install the bus shelters near existing crosswalks, and upgrade stops to be accessible. Replace the existing faded bus stop/route signage.

For the private St. Jerome Elementary School, consider providing school buses to help reduce the number of trips entering and exiting the school and overall vehicle trips. The primary student pick-up/drop-off location for St. Jerome Elementary School is off of Lovell Street at the rear of the St. Jerome property. Pick-ups and drop-offs on Bridge Street could be prohibited to enhance access management.

Safety Issue #10: Poor Geometry at Channelized Island at Route 3A / Neck Street

Observations:

There were several issues noted with the turn lane between the westbound Route 3A movement and Neck Street. Trees and shrubs within the island have grown to be at the approximate driver's eye height, restricting sight distances for vehicles exiting the channelized lane.

Sight distance for drivers turning left onto Neck Street is restricted by the horizontal curve on Neck Street located just north of the channelized island. It is difficult to see oncoming traffic from Neck Street until a vehicle has entered this horizontal curve. There were three crashes involving vehicles turning left from the channelized turning lane onto Neck Street.

The geometry of the island where it intersects Neck Street has a sharp skewed angle that favors right turn movements and the angle does not encourage the left turn movements.

Vehicle queues from the southbound approach of Neck Street were observed to extend to the end of the channelized island resulting in the blocking of left turning vehicles from merging onto Neck Street from the channelized westbound lane.

The STOP sign on the left side of the channelized lane is obstructed by tree branches and this sign is not visible until the driver is near the stop bar. There is no advance signage informing westbound drivers on

Route 3A that left turns are prohibited at the Neck Street/Green Street intersection and that drivers intending to make a left turn movement must use the channelized lane.

Enhancement:

Trim trees and shrubs in the vicinity of the channelized island to eliminate sight restrictions.

Realign the channelized lane/island to approach Neck Street closer to a 90-degree angle to help improve overall sight distance and left turn movements.

Improve signal operations to control queue length such that the queue on Neck Street would not block left turn vehicles from the channelized lane.

Clear vegetation near the STOP sign location to eliminate the sight distance restriction. Install advance signage informing westbound drivers on Route 3A that left turns are prohibited at the intersection and that drivers intending on making a left turn movement must use the channelized lane.

Safety Issue #11: Illegal Parking

Observations:

Parking in the right lane on the westbound approach of Route 3A was observed adjacent to the shops immediately west of Sea Street (between Bridge-Wey Tailors and Cleaners and Fore River Holistic Therapy and Skin Care). As a result, westbound traffic must merge into the left lane immediately after

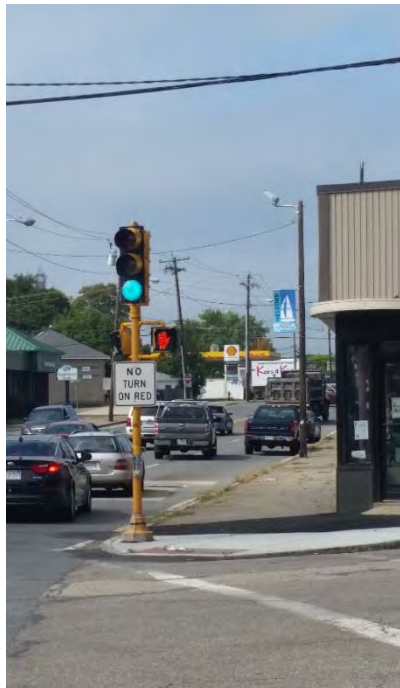


Image 6: Illegal parking (see pick-up truck) on the westbound right lane west of Sea Street restricts vehicle flow on Route 3A.

crossing the Sea Street intersection. Vehicles unexpectedly changing lanes to avoid the parked vehicles may cause sideswipe crashes. There is no known regulation record allowing parking on Route 3A in this area. There is a narrow (approximately one-foot-wide) shoulder present on Route 3A at this location. There is a gravel parking lot behind these shops off of Sea Street.

Enhancement:

Install “No Parking” signs at this area and provide enforcement of this rule.

Summary of Road Safety Audit

Based on the audit team members review of observations and discussions, issues and possible solutions were identified that could help reduce safety risks along the Route 3A corridor.

Table 2 defines estimated safety payout, time frame, cost, and responsibility. The issues and possible solutions from the previous sections are summarized in Table 3.

Safety Payoff: the enhancement could reduce the number of crashes along the corridor by a low (<30%), medium (30% - 70%), or high (>70%).

Time frame: the enhancement can be completed within a time frame of short-term (<1 year), mid-term (1-3 years), or long-term (>3 years).

Cost: cost is estimated to be within one of three categories of cost of low (\$10,000), medium (\$10,001-\$50,000) or high (>\$50,000).

Responsibility: which entity or organization will be responsible for completing the work.

Table 2: Estimated Time Frame and Costs Breakdown

Time Frame		Costs	
Short-Term	<1 Year	Low	<\$10,000
Mid-Term	1-3 Years	Medium	\$10,001-\$50,000
Long-Term	>3 Years	High	>\$50,000

Table 3: Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Faded Pavement Markings	Restripe all existing crosswalks.	low	Short-term	medium	MassDOT
Faded Pavement Markings	Restripe all existing lane lines and shoulder lines.	medium	Short-term	medium	MassDOT
Faded Pavement Markings	Review STOP bar locations at the Route 3A / North Street intersection and restripe as necessary.	medium	Short-term	low	MassDOT
Intersection Geometry Deficiencies	Consider slightly realigning the Sea Street approaches at the Route 3A / Sea Street intersection.	medium	Long-term	high	MassDOT
Intersection Geometry Deficiencies	Increase the curb radius on the northeast corner at the Route 3A / North Street intersection.	medium	Mid-term	medium	MassDOT
Intersection Geometry Deficiencies	Review and realign Green Street and Neck Street alignments at Route 3A.	medium	Long-term	high	MassDOT
Non ADA-compliant sidewalks / Maintenance Items	Trim vegetation along and over sidewalks.	medium	Short-term	low	MassDOT
Non ADA-compliant sidewalks	Reconstruct sidewalk and wheelchair ramps to be fully ADA/MAAB-compliant and open properly at crosswalks.	low	Long-term	high	MassDOT
Lack of Bicycle Facilities, Narrow Roadway Widths	Provide a continuous bicycle lane, or a shoulder wide enough to accommodate bicyclists, along both sides of the entire Route 3A corridor. Roadway widening would be needed west of Green Street / Neck Street.	medium	Long-term	high	MassDOT

Table 3 (continued): Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Lack of Bicycle Facilities	Install bicycle detection at the Birchbrow Avenue, Sea Street, and North Street intersections. Provide appropriate signage and pavement markings to indicate where bicyclists are to wait.	low	Mid-term	medium	MassDOT
Narrow Roadway Widths	Widen lanes on Route 3A to be 11 feet wide throughout the corridor. Involves road widening between and including Sea Street and Green Street / Neck Street.	high	Long-term	high	MassDOT
Poor Access Management	Consolidate driveways where possible, especially west of North Street. Coordinate with business owners on removing curb cuts, shifting driveways to one-way flows, and/or providing internal connections with adjacent properties.	medium	Long-term	high	MassDOT / property owners
Poor Access Management	Narrow curb cut widths.	medium	Mid-term	high	MassDOT / property owners
Poor Access Management	Restrict left turns from curb cuts along the Route 3A corridor.	high	Short-term	low	MassDOT / property owners
Poor Access Management	Along Route 3A change zoning to encourage mixed-use or 'smart-growth' mixtures of residences and businesses	high	Long-term	n/a	Town of Weymouth
Poor Access Management	Shift Dunkin' Donuts driveway on Green Street south and add Do Not Block Intersection pavement markings at driveway entrance.	low	Mid-term	medium	MassDOT / Town of Weymouth / Dunkin' Donuts

Table 3 (continued): Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Substandard Signal Equipment and Phasing	Check yellow and all-red clearance timings at all approaches to the Route 3A / North Street intersection and update to current MassDOT standards.	medium	Short-term	low	MassDOT
Substandard Signal Equipment and Phasing	Provide an advance phase for westbound Route 3A traffic at the North Street intersection for left-turning westbound traffic.	medium	Short-term	low	MassDOT
Substandard Signal Equipment and Phasing	Review and adjust loop detector settings (short delay timing) at the Route 3A / North Street intersection.	low	Short-term	low	MassDOT
Substandard Signal Equipment and Phasing	Review and adjust locations of signal heads at the Route 3A / North Street intersection.	low	Mid-term	medium	MassDOT
Substandard Signal Equipment and Phasing	Replace the signal heads for the westbound direction to have circular green indications on the westbound Route 3A approach at Green Street / Neck Street.	low	Short-term	low	MassDOT
Substandard Signal Equipment and Phasing / Poor/Insufficient Signage and Wayfinding	At the Route 3A / Green Street / Neck Street intersection, remove the sign mounting brackets that are no longer necessary. Check the mountings for the remaining mast arm-mounted signage, and relocate as needed to avoid visibility blockage.	low	Short-term	low	MassDOT
Substandard Signal Equipment and Phasing	Install 2009 MUTCD compliant countdown pedestrian signals at all crosswalks at all six project signalized intersections.	low	Mid-Term	high	MassDOT

Table 3 (continued): Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Substandard Signal Equipment and Phasing	Coordinate the traffic signals within the project limits in a closed loop system to improve overall traffic operations.	low	Mid-term	medium	MassDOT
Substandard Signal Equipment and Phasing	Install optical emergency vehicle detection and pre-emption at all signalized intersections along the corridor within project limits.	low	Short-term	medium	MassDOT
Poor/Insufficient Signage and Wayfinding	Add route marker and speed limit signage.	low	Short-term	low	MassDOT
Poor/Insufficient Signage and Wayfinding	Determine locations and need for solar-powered speed display signs.	medium	Short-term	medium	MassDOT
Poor/Insufficient Signage and Wayfinding	Install additional wayfinding signage for beaches, state parks, and state boat ramps along the corridor.	low	Short-term	low	MassDOT
Poor/Insufficient Signage and Wayfinding	Consider installing real-time (Fore River) bridge closure display signs.	low	Short-term	medium	MassDOT
Poor/Insufficient Signage and Wayfinding	Trim vegetation around and relocate street name signs as necessary to more highly visible locations.	low	Short-term	low	MassDOT
Poor/Insufficient Signage and Wayfinding	Install additional advance street name signage for major intersections along the corridor.	low	Short-term	low	MassDOT
Poor/Insufficient Signage and Wayfinding	Install overhead street-name signage at signalized intersections.	low	Short-term	low	MassDOT
Poor/Insufficient Signage and Wayfinding	Replace existing faded roadway signage along the corridor.	low	Short-term	medium	MassDOT
Substandard Transit Connections	Install additional bus shelters along the corridor.	low	Mid-term	high	MassDOT / MBTA

Table 3 (continued): Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Substandard Transit Connections	Upgrade stops to be made more handicapped-accessible.	low	Mid-term	high	MassDOT / MBTA
Substandard Transit Connections	Replace the existing faded bus stop/route signage.	low	Short-term	low	MassDOT / MBTA
Substandard Transit Connections	Consider purchasing/funding school buses to reduce the number of trips entering and exiting St. Jerome Elementary school	medium	Short-term	medium	Town of Weymouth / St. Jerome Parish
Poor Geometry at Channelized Island at Route 3A / Neck Street	Trim trees and shrubs in vicinity of the channelized turn.	low	Short-term	low	MassDOT / Town of Weymouth
Poor Geometry at Channelized Island at Route 3A / Neck Street	Realign the channelized lane/island to approach Neck Street closer to a 90-degree angle.	medium	Long-term	high	MassDOT / Town of Weymouth
Poor Geometry at Channelized Island at Route 3A / Neck Street	Consider installing crosshatch Do Not Block Intersection markings on Neck Street in vicinity of the exit from the turn lane.	medium	Short-term	low	MassDOT / Town of Weymouth
Poor Geometry at Channelized Island at Route 3A / Neck Street	Position STOP signs to be more visible to drivers on the turn lane.	low	Short-term	low	MassDOT / Town of Weymouth
Poor Geometry at Channelized Island at Route 3A / Neck Street / Improve Signage and Wayfinding	Install advance signage telling westbound-turning drivers to use the channelized turn lane leading to Neck Street.	low	Short-term	low	MassDOT / Town of Weymouth
Illegal Parking	Install No Parking signs along Route 3A between Bridge-Wey Tailors and Cleaners and Fore River Holistic Therapy and Skin Care, and increase enforcement	medium	Short-term	low	MassDOT / Town of Weymouth / property owners

Appendix A. RSA Meeting Agenda

Agenda

Road Safety Audit

Meeting Location: Weymouth
Mary McElroy Meeting Room, McCulloch Building
September 7, 2016
9:00 AM – 12:00 PM

Type of meeting: Route 3A, Bridge Street – Road Safety Audit
Attendees: Invited Participants to Comprise a Multidisciplinary Team
Please bring: Thoughts and Enthusiasm!!

9:00 AM Welcome and Introductions

9:15 AM Review of Site Specific Material

- Crash Summaries – provided in advance
- Existing Geometries and Conditions

10:00 AM Visit the Site

- Drive to LOCATION
- As a group, review site & identify areas for improvement

11:30 AM Post Visit Discussion / Completion of RSA

- Discuss observations and finalize findings
- Discuss potential improvements and finalize recommendations

12:00 PM Adjourn for the Day – but the RSA has not ended

Instructions for Participants:

- Before attending the RSA on DATE, participants are encouraged to drive through the project area and complete/consider elements on the RSA Prompt List (enclosed) with a focus on safety.
- All participants will be actively involved in the process throughout. Participants are encouraged to come with thoughts and ideas, but are reminded that the synergy that develops and respect for others' opinions are key elements to the success of the overall RSA process.
- After the RSA meeting, participants will be asked to comment and respond to the document materials to assure it is reflective of the RSA completed by the multidisciplinary team.

Appendix B. RSA Audit Team Contact List

Participating Audit Team Members

Date: September 7, 2014

Location: Weymouth, MA

Audit Team Members	Agency/Affiliation	Email Address	Phone Number
Bill Scully	Green International Affiliates, Inc.	bscully@greenintl.com	(978) 923-0400
Wing Wong	Green International Affiliates, Inc.	wwong@greenintl.com	(978) 923-0400
Sergio Musto	Green International Affiliates, Inc.	smusto@greenintl.com	(978) 923-0400
Lisa Schletzbaum	MassDOT Highway Safety	lischletzbaum@state.ma.us	(857) 368-9634
Kush Bhagat	MassDOT Highway Safety	kush.bhagat@state.ma.us	(857) 368-9652
Jennifer Inzana	MassDOT Highway Safety	jennifer.inzana@state.ma.us	(857) 368-9644
Courtney Dwyer	MassDOT District 6 Bicycle and Pedestrian Coordinator	courtney.dwyer@state.ma.us	(857) 368-6165
Amitai Lipton	MassDOT District 6 Traffic	amitai.lipton@state.ma.us	(857) 368-6313
Zach Veaner	MassDOT District 6	zachary.veaner@state.ma.us	(857) 368-6163
Robert Luongo	Weymouth Planning & Community Development	rluongo@weymouth.ma.us	(781) 340-5015
Owen MacDonald	Weymouth Traffic Engineer	omacdonald@weymouth.ma.us	(781) 340-5015
Brendan Fogarty	Weymouth Police Department	bfogarty@weymouth.ma.us	(781) 953-4073
Justin Myers	Weymouth Fire Department	jmyers@weymouth.ma.us	(781) 340-5000

Meeting Sign In Sheet

PROJECT: Weymouth Route 3A
MEETING TOPIC: Road Safety Audit
DATE: 9/1/16 TIME: 9:00 am
PLACE: _____

[illegible]

Appendix C. Detailed Crash Data

SEGMENT CRASH RATE WORKSHEET

CITY/TOWN : Weymouth COUNT DATE : 9/14/16 - 9/15/16

DISTRICT : 6

~ SEGMENT DATA ~

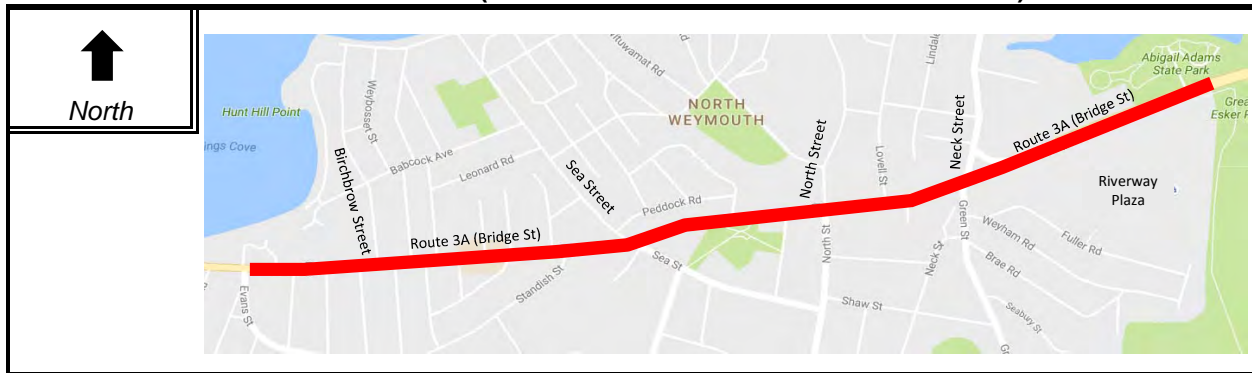
ROADWAY NAME: Route 3A

START POINT: Evans Street

END POINT: 300 Feet East of Abigail Adams State Park Driveway

FUNCTIONAL CLASSIFICATION OF ROADWAY: Urban Principal Arterial

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES (L): **1.4**

AVERAGE DAILY TRAFFIC VOLUME (V): **27,107**

TOTAL # OF CRASHES:

161

OF
YEARS :

3

AVERAGE # OF
CRASHES PER YEAR (A) :

53.67

CRASH RATE
CALCULATION :

3.87

RATE =

$$\frac{(A * 1,000,000)}{(L * V * 365)}$$

Comments : _____

Project Title & Date: Weymouth Route 3A (Bridge Street) Functional Design Report, Sept. 2016



LEGEND

● APPROXIMATE CRASH LOCATION

11 (XX) CRASH NUMBER (CRASH TYPE)

CRASH REPORT DATA

NUMBER	TYPE OF COLLISION	VEHICLES INVOLVED	ROADWAY CONDITION	LIGHT CONDITION	SEVERITY	DATE	DIRECTION
1	AC	2	DRY	DAYLIGHT	PD	2/18/2013	S/W
2	CP	1	DRY	DARK (LIT)	PI	10/22/2013	E
3	RE	2	DRY	DAYLIGHT	PD	5/16/2014	W
4	OC	2	DRY	DAYLIGHT	PD	11/1/2013	W
5	SS	2	WET	DAYLIGHT	PD	3/7/2013	W
6	RE	2	DRY	DAYLIGHT	PD	6/2/2014	E
7	AC	3	DRY	DAYLIGHT	PD	1/14/2015	W
8	AC	3	DRY	DAYLIGHT	PI	2/6/2015	W/E
9	SS	2	DRY	DAYLIGHT	PI	9/16/2015	W/E
10	SS	2	DRY	DAYLIGHT	PD	11/19/2013	W/E
11	RE	2	DRY	DAYLIGHT	PD	10/25/2014	W
12	RE	3	DRY	DAYLIGHT	PI	6/7/2014	W
13	AC	2	DRY	DAYLIGHT	PD	2/21/2015	S/W
14	RE	2	DRY	DAYLIGHT	PD	8/11/2013	W
15	RE	3	DRY	DAYLIGHT	PI	4/11/2014	E

NUMBER	TYPE OF COLLISION	VEHICLES INVOLVED	ROADWAY CONDITION	LIGHT CONDITION	SEVERITY	DATE	DIRECTION
16	AC	2	DRY	DAYLIGHT	PI	6/26/2015	N/E
17	HO	2	SNOW	DAYLIGHT	PD	2/14/2015	N/S
18	SS	2	WET	UNKNOWN	PD	11/12/2015	W
19	RE	2	DRY	DAYLIGHT	PI	12/12/2015	E
20	AC	2	WET	DARK (LIT)	PI	2/12/2013	E
21	AC	2	DRY	DAYLIGHT	PD	9/5/2014	W
22	RE	2	WET	DAYLIGHT	PD	8/9/2013	W
23	SS	3	WET	DAYLIGHT	PI	3/12/2013	W
24	SS	2	DRY	DAYLIGHT	PD	6/11/2013	W
25	SS	2	DRY	DARK (LIT)	PI	11/5/2014	E
26	AC	2	DRY	DAYLIGHT	PD	3/9/2015	W/E
27	SS	2	DRY	DAYLIGHT	PD	11/15/2014	E
28	AC	1	DRY	DARK (LIT)	PD	11/15/2013	N/W
29	CO	1	DRY	DAYLIGHT	PI	7/28/2014	W
30	RE	2	DRY	DAYLIGHT	PI	5/15/2015	E

NUMBER	TYPE OF COLLISION	VEHICLES INVOLVED	ROADWAY CONDITION	LIGHT CONDITION	SEVERITY	DATE	DIRECTION
31	RE	2	DRY	DAYLIGHT	PI	11/5/2014	E
32	CO	1	DRY	DARK (LIT)	PD	5/13/2015	E
33	RE	2	DRY	DARK (LIT)	PD	6/26/2013	E
34	AC	2	DRY	DAYLIGHT	PD	1/1/2014	W/E
35	AC	2	WET	DUSK	PI	12/23/2015	N/E
36	RE	2	DRY	DAYLIGHT	PD	3/15/2014	E
37	AC	2	DRY	DAYLIGHT	PI	10/4/2015	W/E
38	SS	2	DRY	DAYLIGHT	PD	11/9/2013	W

LEGEND


- SS = SIDESWIPE
RE = REAR END
AC = ANGLE CRASH
CO = COLLISION WITH OBJECT
CP = COLLISION WITH PEDESTRIAN
HO = HEAD-ON COLLISION
OC = OUT OF CONTROL VEHICLE

PD = PROPERTY DAMAGE ONLY
PI = PERSONAL INJURY

COLLISION MAP
ROUTE 3A BRIDGE STREET

2013–2015 WEYMOUTH, MA

SHEET 1 OF 3

 GREEN INTERNATIONAL AFFILIATES, INC.
CONSULTING ENGINEERS

WESTFORD, MASSACHUSETTS



CRASH REPORT DATA

NUMBER	TYPE OF COLLISION	VEHICLES INVOLVED	ROADWAY CONDITION	LIGHT CONDITION	SEVERITY	DATE	DIRECTION
39	CO	1	DRY	DARK (LIT)	PD	10/12/2013	W
40	CP	1	WET	DARK (LIT)	PI	12/6/2014	W
41	HO	4	DRY	DAYLIGHT	PI	2/10/2014	W/E
42	CO	1	DRY	DARK (LIT)	PD	11/28/2013	W
43	RE	2	DRY	DAYLIGHT	PI	5/5/2015	W
44	AC	2	WET	DARK (LIT)	PI	3/30/2014	S/W
45	SS	2	DRY	DARK (LIT)	PD	1/23/2013	E
46	RE	4	DRY	DAYLIGHT	PD	7/3/2013	E
47	CP	1	WET	DARK (LIT)	PI	12/6/2013	W
48	RE	2	DRY	DAYLIGHT	PD	9/1/2015	E
49	SS	2	DRY	DAYLIGHT	PD	7/21/2015	W
50	RE	2	DRY	DAYLIGHT	PD	8/28/2013	E
51	RE	2	DRY	DARK (LIT)	PD	5/13/2015	E
52	RE	2	DRY	DARK (LIT)	PD	10/2/2014	E
53	RE	2	DRY	DAYLIGHT	PD	3/21/2013	E

NUMBER	TYPE OF COLLISION	VEHICLES INVOLVED	ROADWAY CONDITION	LIGHT CONDITION	SEVERITY	DATE	DIRECTION
54	AC	2	WET	DAYLIGHT	PD	3/14/2015	E
55	AC	3	DRY	DAYLIGHT	PD	4/29/2013	N/E
56	RE	2	DRY	DARK (LIT)	PD	6/4/2013	E
57	RE	2	DRY	DAYLIGHT	PI	1/13/2014	W
58	AC	2	WET	DAYLIGHT	PD	4/24/2013	W
59	AC	2	DRY	DAYLIGHT	PD	10/31/2014	N/E
60	AC	2	WET	DAYLIGHT	PD	3/15/2015	N/E

LEGEND


SS = SIDESWIPE
RE = REAR END
AC = ANGLE CRASH
CO = COLLISION WITH OBJECT
CP = COLLISION WITH PEDESTRIAN
HO = HEAD-ON COLLISION
OC = OUT OF CONTROL VEHICLE

PD = PROPERTY DAMAGE ONLY
PI = PERSONAL INJURY

COLLISION MAP
ROUTE 3A BRIDGE STREET

2013–2015 WEYMOUTH, MA

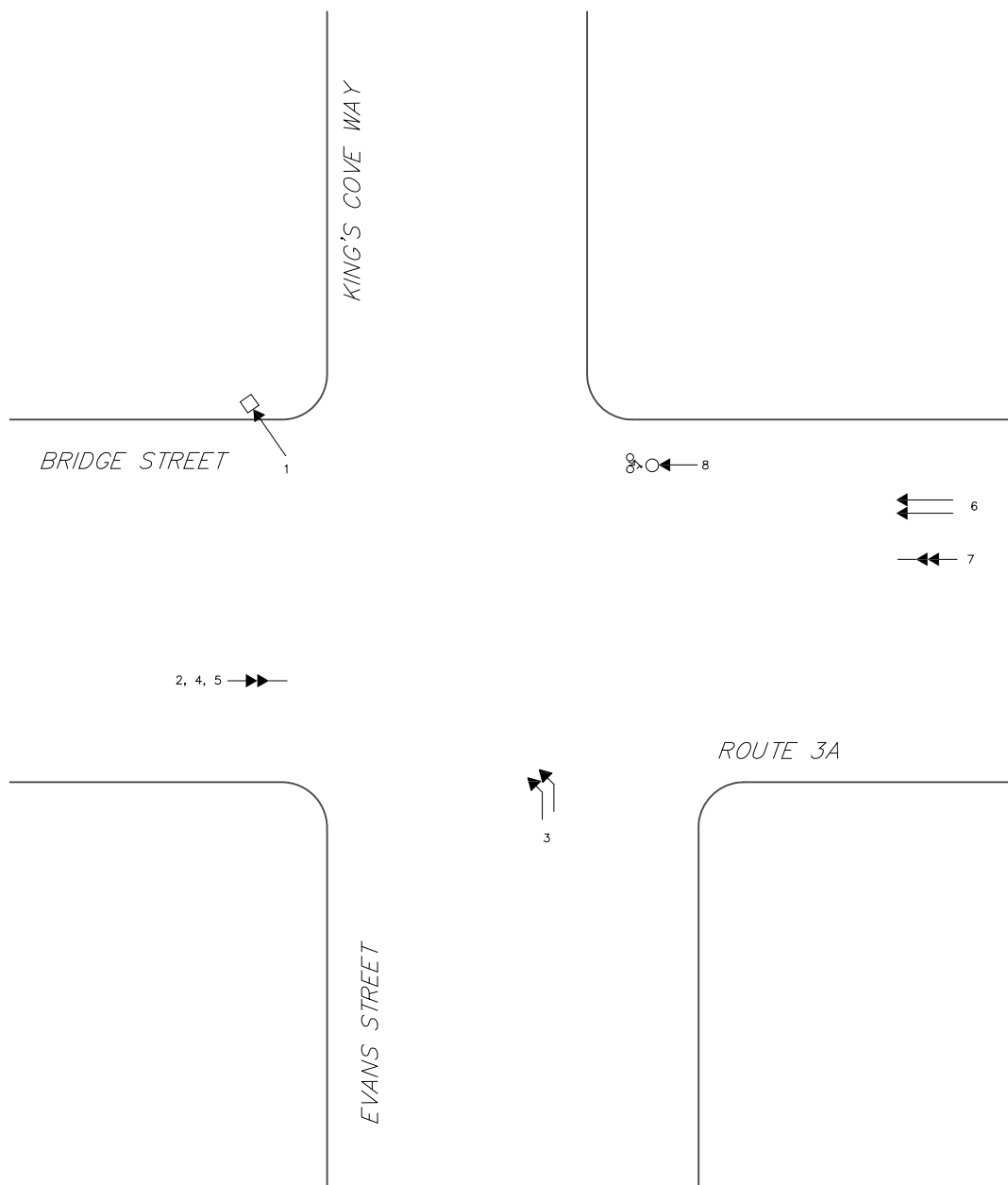
SHEET 2 OF 3

 GREEN INTERNATIONAL AFFILIATES, INC.
CONSULTING ENGINEERS
WESTFORD, MASSACHUSETTS



COLLISION MAP
ROUTE 3A BRIDGE STREET
2013–2015 WEYMOUTH, MA

SHEET 3 OF 3



2013-2015

	DATE	TIME	W	PD	I	F	L	R	V
1	3/8/2013	6:55 AM	F	YES			1	3	
2	9/13/2013	8:43 AM	TU	YES			1	1	5
3	11/6/2013	8:54 AM	F	YES			1	1	6
4	12/14/2013	1:25 AM	SA	YES			3	1	
5	3/7/2014	6:06 PM	F	YES			3	1	5
6	5/10/2015	11:04 AM	SU	YES			1	1	6
7	11/25/2015	4:44 PM	W	YES			1	1	
8	12/23/2015	7:47 PM	W	YES	1		3	2	4

SYMBOLS

ANGLE	→	BICYCLE	🚲
BACKING	←←←	FIXED OBJECT	→
REAR END	→→→	PARKED VEHICLE	☒
SIDE SWIPE	→→→	FATALITY	●
HEAD ON	→→→	INJURY	○
TURNING MOVE	→→→	VEHICLE	→
OUT OF CONTROL	~	PEDESTRIAN	→

LIGHT CONDITIONS (L)

1. DAYLIGHT
2. DAWN OR DUSK
3. DARKNESS, LIT ROADWAY
4. DARKNESS, UNLIT ROADWAY
5. UNKNOWN

ROAD CONDITIONS (R)

1. DRY
2. WET
3. SNOW OR ICY
4. OTHER/ UNKNOWN

WEEKDAY (W)

M = MONDAY F = FRIDAY
 TU = TUESDAY SA = SATURDAY
 W = WEDNESDAY SU = SUNDAY
 TH = THURSDAY

VIOLATIONS CITED (V)

1. SPEED TOO FAST
2. FAILURE TO YIELD
3. RAN STOP SIGN
4. RAN TRAFFIC SIGNAL
5. FOLLOWING TOO CLOSE
6. IMPROPER PASSING
7. WRONG SIDE OF ROAD
8. IMPROPER TURNING
9. IMPROPER BACKING
10. HAD BEEN DRINKING
11. PEDESTRIAN VIOLATION
12. RECKLESS DRIVING
13. IMPROPER LIGHT OR BRAKES
14. OPERATING UNLICENSED

PD = PROPERTY DAMAGE
 I = INJURY
 F = FATALITY

COLLISION DIAGRAM

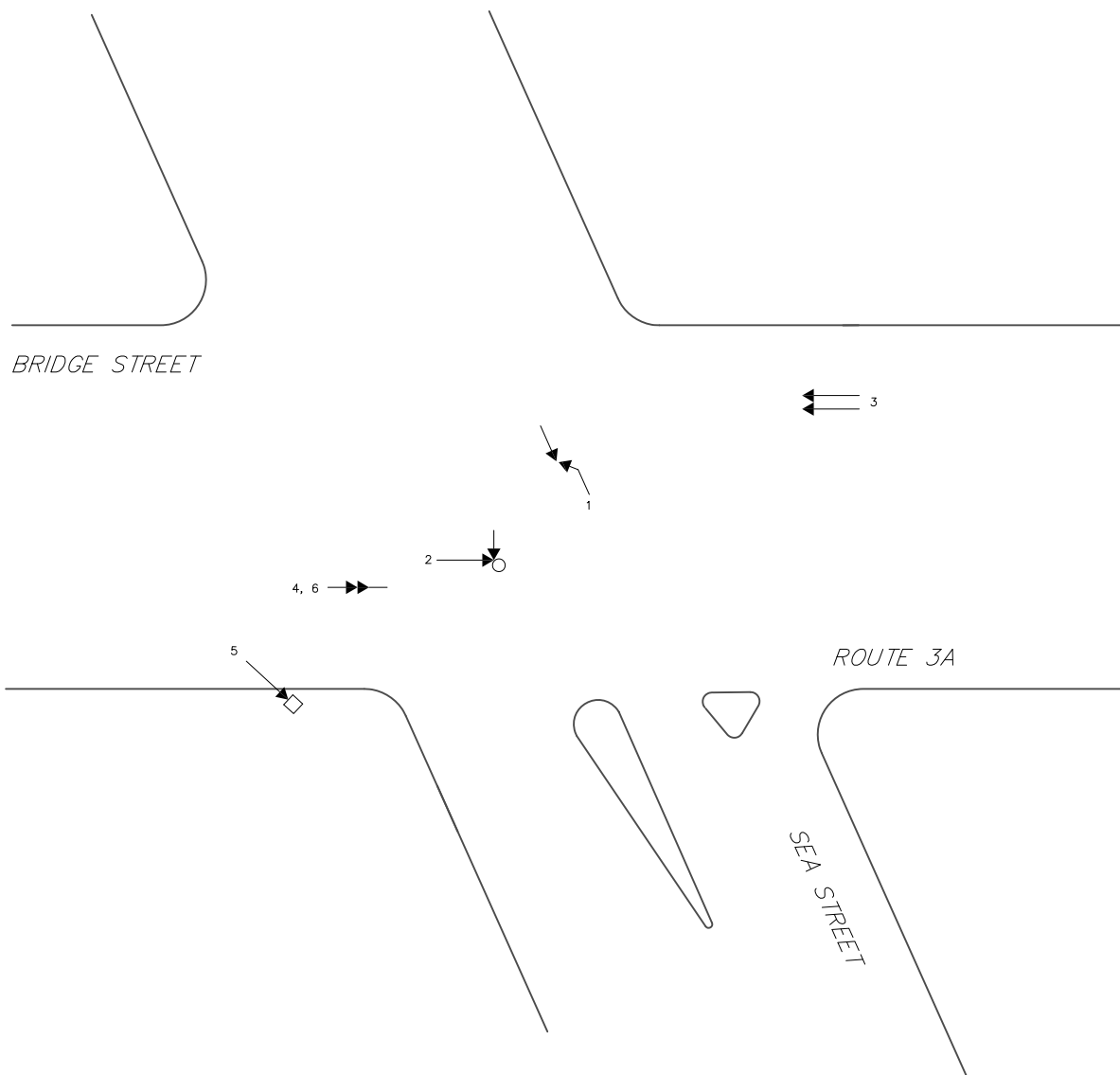
FUNCTIONAL DESIGN REPORT

WEYMOUTH BRIDGE ST
 INTERSECTION OF BRIDGE ST AND EVANS ST

WEYMOUTH, MA



GREEN INTERNATIONAL AFFILIATES, INC.
 CIVIL & STRUCTURAL ENGINEERS WESTFORD, MASSACHUSETTS



2013-2015

	DATE	TIME	W	PD	I	F	L	R	V
1	5/6/2013	8:43 AM	M	YES			1	1	2
2	12/13/2013	8:14 AM	F	YES	1		1	1	
3	5/7/2014	12:30 PM	W	YES			1	1	
4	5/17/2014	3:43 PM	SA	YES			1	1	5
5	6/26/2014	8:19 AM	TH	YES			1	2	
6	2/13/2015	11:46 PM	F	YES			3	1	5

SYMBOLS

ANGLE	→↘	BICYCLE	🚲
BACKING	→←←	FIXED OBJECT	→□
REAR END	→→→	PARKED VEHICLE	→☒
SIDE SWIPE	→→→	FATALITY	●
HEAD ON	→↔→	INJURY	○
TURNING MOVE	→↘↗	VEHICLE	→
OUT OF CONTROL	→~→	PEDESTRIAN	→👤

LIGHT CONDITIONS (L)

1. DAYLIGHT
2. DAWN OR DUSK
3. DARKNESS, LIT ROADWAY
4. DARKNESS, UNLIT ROADWAY
5. UNKNOWN

ROAD CONDITIONS (R)

1. DRY
2. WET
3. SNOW OR ICY
4. OTHER/ UNKNOWN

WEEDKAY (W)

M = MONDAY F = FRIDAY
TU = TUESDAY SA = SATURDAY
W = WEDNESDAY SU = SUNDAY
TH = THURSDAY

VIOLATIONS CITED (V)

1. SPEED TOO FAST
2. FAILURE TO YIELD
3. RAN STOP SIGN
4. RAN TRAFFIC SIGNAL
5. FOLLOWING TOO CLOSE
6. IMPROPER PASSING
7. WRONG SIDE OF ROAD
8. IMPROPER TURNING
9. IMPROPER BACKING
10. HAD BEEN DRINKING
11. PEDESTRIAN VIOLATION
12. RECKLESS DRIVING
13. IMPROPER LIGHT OR BRAKES
14. OPERATING UNLICENSED

PD = PROPERTY DAMAGE
I = INJURY
F = FATALITY

COLLISION DIAGRAM

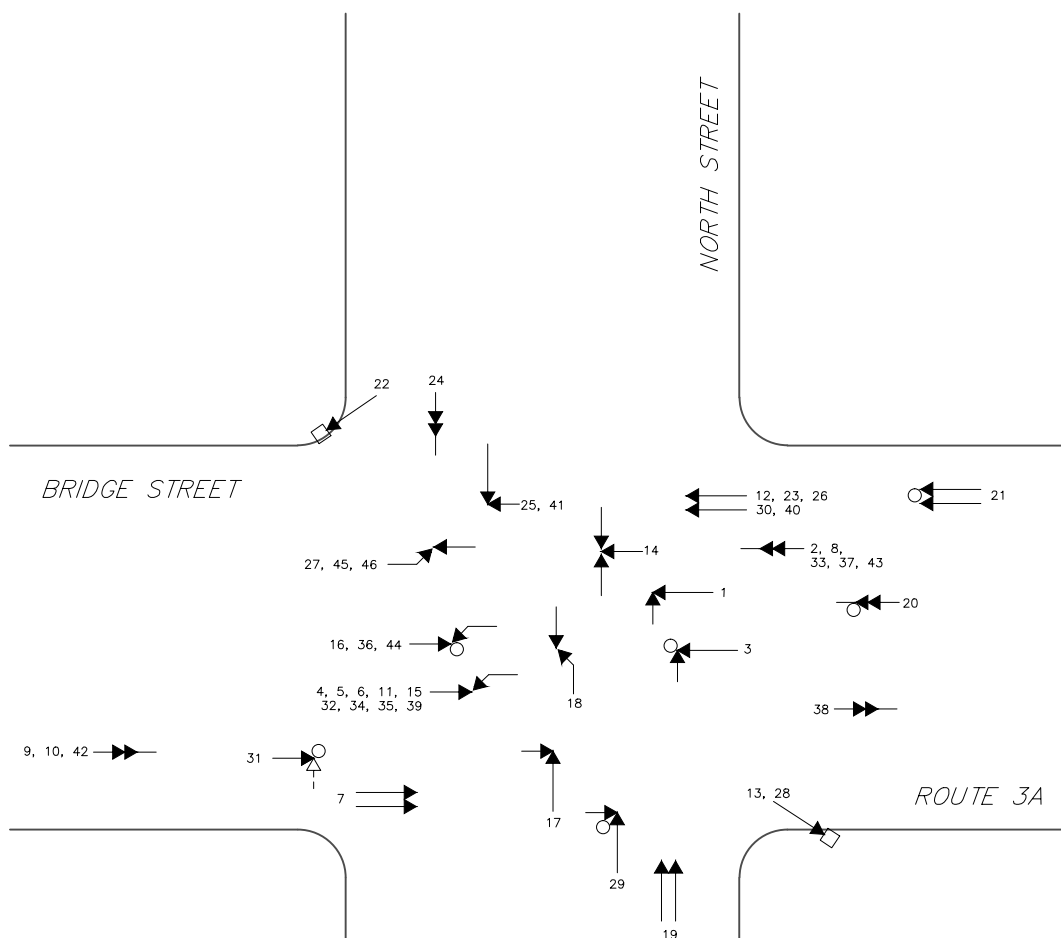
FUNCTIONAL DESIGN REPORT

WEYMOUTH BRIDGE ST
INTERSECTION OF BRIDGE ST AND SEA ST

WEYMOUTH, MA



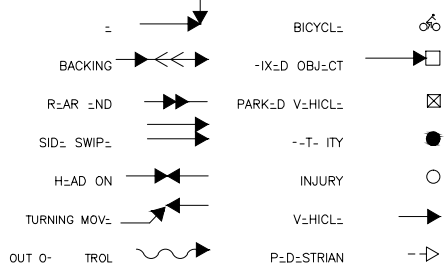
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL & STRUCTURAL ENGINEERS WESTFORD, MASSACHUSETTS



2013-2015

	DAT=	TIM=	W	PD	I	-	\	V		DAT=	TIM=	W	PD	I	-	\	V		D-T=	TIM=	W	PD	I	-	\	V				
1	1/14/2013	7:21 PM	SA	Y-S			3	1	4	16	12/21/2013	7:16 PM	S-	'-S	2		3	2	2	31	10/22/2014	1:37 PM	W		1		1	2		
2	2/10/2013	6:10 PM	-				3	2		17	12/23/2013	2:37 PM	M	Y-S			1	2	4	32	11/10/2014	7:55 PM	M	Y-S			3	1	2	
3	7/11/2013	11:24 -		Y-S	1		1	1		18	3/3/2014	5:33 PM	SU	Y-S			3	1		33	11/11/2014	8:39 AM	TU				1	1	5	
4	4/28/2013	10:41 -	-	Y-S			1	1		19	3/9/2014	10:32 AM	S-	'-S			1	1		34	11/25/2014	10:44 AM	TU					1	1	
5	6/15/2013	8:46 AM	-				1	1		20	4/25/2014	4:22 PM	-	'-S	2		1	1		35	11/26/2014	3:46 PM	W				1	2	2	
6	7/23/2013	2:25 PM	SA	Y-S			1	1		21	6/2/2014	3:49 PM	M		1		1	1	2	36	4/22/2015	6:40 PM	W				1	1	2	
7	6/28/2013	3:16 AM	TH	Y-S			3	2	4,5,6	22	6/20/2014	1:14 PM	TH	Y-S			1	1		37	4/26/2015	12:42 AM	SU				3	1	5	
8	7/11/2013	2:05 PM	W	Y-S			1	1	5	23	6/28/2014	1:07 PM	S-	'-S			1	1	2	38	4/29/2015	5:24 PM	W					1	1	
9	7/24/2013	4:58 PM	TU				1	1		24	7/14/2014	2:21 PM	SU	Y-S			1	1		39	5/20/2015	3:23 PM	W	Y-S				1	1	
10	7/27/2013	2:10 PM	-	'-S			1	1		25	8/12/2014	5:16 PM	TU				1	1		40	5/21/2015	5:22 PM	TH	Y-S					1	1
11	9/14/2013	7:43 PM	-				1	1		26	8/20/2014	9:43 -	-	'-S			1	1	4	41	6/18/2015	10:14 AM	TH					1	1	
12	9/20/2013	6:17 PM	TH				2	1	6	27	8/26/2014	5:46 PM	TU	Y-S			1	1		42	8/4/2015	2:16 PM	TU					1	1	
13	10/25/2013	3:12 AM	TH	Y-S			3	1		28	9/22/2014	12:20 PM	M	Y-S	1		1	1		43	8/26/2015	9:37 PM	W	Y-S				3	1	
14	11/10/2013	3:15 PM	SA	Y-S			1	2	4	29	10/13/2014	7:57 -	-	'-S			1	1		44	9/15/2015	4:51 PM	TU	Y-S	2			1	1	2
15	11/23/2013	6:19 PM	SA	Y-S			3	1	2	30	10/20/2014	6:05 PM	M	Y-S			2	1		45	9/22/2015	3:04 PM	TU	Y-S				1	1	
																			46	10/20/2015	5:35 PM	TU	Y-S				1	1	2	

SYMBOLS



LIGHT CONDITIONS (L)

1. DAYLIGHT
2. DAWN OR DUSK
3. DARKNESS, LIT ROAD
4. DARKNESS, UNLIT ROADWAY
5. UNKNOWN

ROAD CONDITIONS (R)

1. DRY
2. WET
3. SNOW OR ICY
4. OTHER/ UNKNOWN

WEEDKAY (W)

M = MONDAY - - - - -
TU = TUESDAY - - - - -
W = WEDNESDAY - - - - -
TH = THURSDAY - - - - -

VIOLATIONS CITED (V)

1. SPEED TOO FAST
2. ILLEGAL TURN
3. RED TOP SIGN
4. RED TRAIL SIGN
5. -ING TOO CLOSE
6. IMPROPER PASSING
7. WRONG SIDE OF ROAD
8. IMPROPER TURNING
9. IMPROPER BACKING
10. HAD ON DRINKING
11. P.D. STRIKE - IOL-TION
12. R.C.L. SS DRIVING
13. IMPROPER LIGHT OR BRAKES
14. OPERATING UNLICENSED

PD = PROPERTY DAMAGE
I = INJURY
- = -T- ITY

COLLISION DIAGRAM

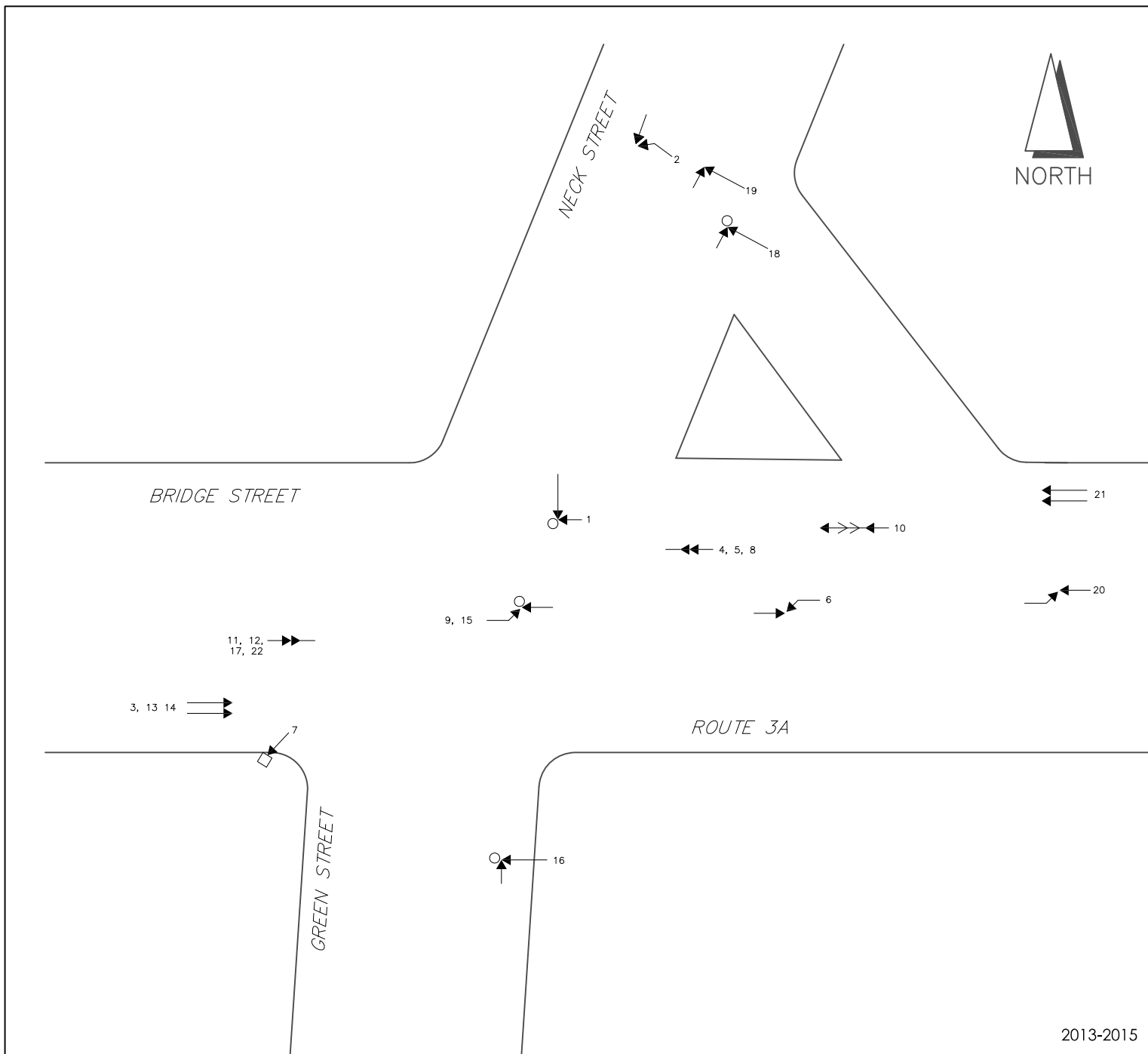
FUNCTIONAL DESIGN REPORT

WEYMOUTH BRIDGE ST
INTERSECTION OF BRIDGE ST AND NORTH ST

WEYMOUTH, MA



GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL & STRUCTURAL ENGINEERS WESTFORD, MASSACHUSETTS



2013-2015

	DATE	TIME	W	PD	I	F	L	R	V
1	3/19/2013	1:10 PM	TU	YES	1		1	2	4
2	5/6/2013	2:38 PM	M	YES			1	1	2
3	8/28/2013	8:42 AM	W	YES			1	1	6
4	9/15/2013	12:51 PM	SU				1	1	
5	9/22/2013	11:47 AM	SU	YES			1	1	5
6	12/29/2013	5:45 PM	SU	YES			3	2	8
7	2/5/2014	7:10 PM	W	YES			3	3	10
8	3/20/2014	11:58 AM	TH	YES			1	1	
9	4/26/2014	9:35 PM	SA	YES	2		3	1	
10	7/5/2014	7:54 AM	SA	YES			1	1	
11	8/6/2014	11:42 AM	W	YES			1	1	5
12	11/22/2014	10:39 AM	SA				1	1	

	DATE	TIME	W	PD	I	F	L	R	V
13	11/22/2014	2:36 PM	SA				1	1	
14	11/24/2014	2:05 PM	M				1	2	6
15	2/21/2015	7:51 PM	SA		1		3	2	2
16	5/16/2015	9:40 AM	SA	YES	2		1	1	
17	7/19/2015	7:17 PM	SU	YES			1	1	14
18	7/21/2015	6:26 PM	TU		2		1	1	2
19	7/24/2015	12:25 PM	F				1	1	
20	9/8/2015	3:56 PM	TU				1	1	2
21	10/28/2015	6:42 AM	W				1	1	6
22	10/31/2015	2:53 PM	SA				1	1	5

SYMBOLS

ANGLE	→	BICYCLE	🚲
BACKING	←←←	FIXED OBJECT	→
REAR END	→→→	PARKED VEHICLE	☒
SIDE SWIPE	→→→	FATALITY	●
HEAD ON	→→→	INJURY	○
TURNING MOVE	→→→	VEHICLE	→
OUT OF CONTROL	~→	PEDESTRIAN	→

LIGHT CONDITIONS (L)

1. DAYLIGHT
2. DAWN OR DUSK
3. DARKNESS, LIT ROADWAY
4. DARKNESS, UNLIT ROADWAY
5. UNKNOWN

ROAD CONDITIONS (R)

1. DRY
2. WET
3. SNOW OR ICY
4. OTHER/ UNKNOWN

WEEKDAY (W)

M = MONDAY F = FRIDAY
 TU = TUESDAY SA = SATURDAY
 W = WEDNESDAY SU = SUNDAY
 TH = THURSDAY

VIOLATIONS CITED (V)

1. SPEED TOO FAST
2. FAILURE TO YIELD
3. RAN STOP SIGN
4. RAN TRAFFIC SIGNAL
5. FOLLOWING TOO CLOSE
6. IMPROPER PASSING
7. WRONG SIDE OF ROAD
8. IMPROPER TURNING
9. IMPROPER BACKING
10. HAD BEEN DRINKING
11. PEDESTRIAN VIOLATION
12. RECKLESS DRIVING
13. IMPROPER LIGHT OR BRAKES
14. OPERATING UNLICENSED

PD = PROPERTY DAMAGE
 I = INJURY
 F = FATALITY

COLLISION DIAGRAM

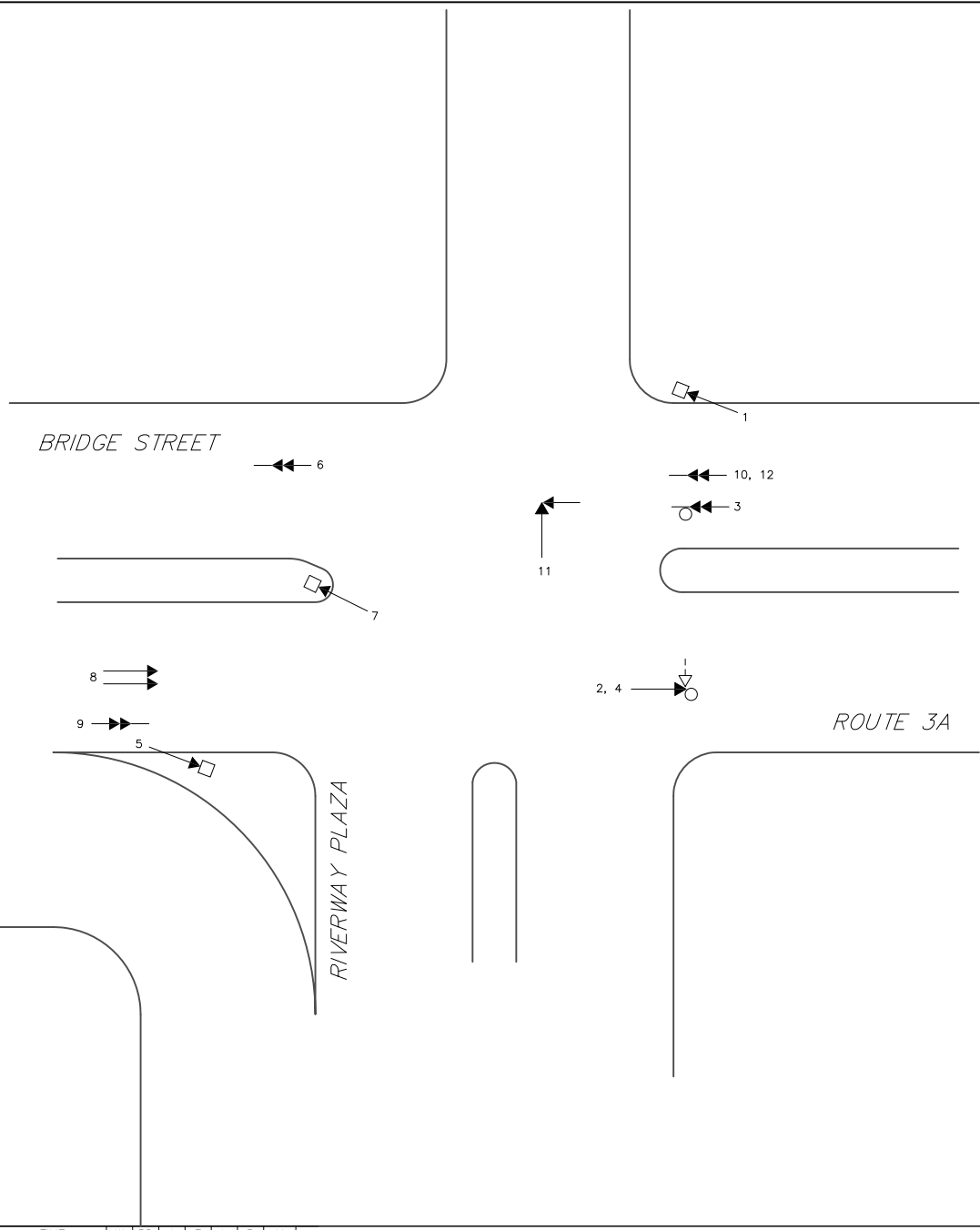
FUNCTIONAL DESIGN REPORT
 WEYMOUTH BRIDGE ST
 INTERSECTION OF BRIDGE ST AND
 NECK ST/GREEN ST
 WEYMOUTH, MA



GREEN INTERNATIONAL AFFILIATES, INC.
 CIVIL & STRUCTURAL ENGINEERS WESTFORD, MASSACHUSETTS



BRIDGE STREET



2013-2015

	DATE	TIME	W	PD	I	F	L	R	V
1	5/4/2013	5:10 PM	F	YES			1	1	6
2	7/1/2013	9:17 PM	SU	YES	YES		3	1	
3	7/15/2013	7:10 AM	SU	YES	YES		1	1	
4	10/5/2013	7:45 PM	SA	YES	YES		3	1	
5	3/22/2014	12:55 AM	SA	YES			3	1	
6	5/20/2014	5:22 PM	TU	YES			1	1	5
7	8/15/2014	10:57 PM	F	YES			3	1	
8	8/17/2014	7:47 AM	SU	YES			1	1	6
9	1/8/2015	8:22 AM	TH	YES			1	1	
10	3/4/2015	11:14 AM	W				1	2	2
11	3/21/2015	2:19 PM	SA	YES			1	1	4
12	7/5/2015	2:08 PM	SU	YES			1	1	14

SYMBOLS

ANGLE	→	BICYCLE	🚲
BACKING	←←←	FIXED OBJECT	▣
REAR END	→→→	PARKED VEHICLE	☒
SIDE SWIPE	→→→	FATALITY	●
HEAD ON	→→→	INJURY	○
TURNING MOVE	→→→	VEHICLE	→
OUT OF CONTROL	~→	PEDESTRIAN	-▷

LIGHT CONDITIONS (L)

1. DAYLIGHT
2. DAWN OR DUSK
3. DARKNESS, LIT ROADWAY
4. DARKNESS, UNLIT ROADWAY
5. UNKNOWN

ROAD CONDITIONS (R)

1. DRY
2. WET
3. SNOW OR ICY
4. OTHER/ UNKNOWN

WEEKDAY (W)

M = MONDAY F = FRIDAY
 TU = TUESDAY SA = SATURDAY
 W = WEDNESDAY SU = SUNDAY
 TH = THURSDAY

VIOLATIONS CITED (V)

1. SPEED TOO FAST
2. FAILURE TO YIELD
3. RAN STOP SIGN
4. RAN TRAFFIC SIGNAL
5. FOLLOWING TOO CLOSE
6. IMPROPER PASSING
7. WRONG SIDE OF ROAD
8. IMPROPER TURNING
9. IMPROPER BACKING
10. HAD BEEN DRINKING
11. PEDESTRIAN VIOLATION
12. RECKLESS DRIVING
13. IMPROPER LIGHT OR BRAKES
14. OPERATING UNLICENSED

PD = PROPERTY DAMAGE
 I = INJURY
 F = FATALITY

COLLISION DIAGRAM

FUNCTIONAL DESIGN REPORT
 WEYMOUTH BRIDGE ST
 INTERSECTION OF BRIDGE ST AND RIVERWAY
 PLAZA
 WEYMOUTH, MA



GREEN INTERNATIONAL AFFILIATES, INC.
 CIVIL & STRUCTURAL ENGINEERS WESTFORD, MASSACHUSETTS



ABIGAIL ADAMS STATE PARK

BRIDGE STREET

ROUTE 3A

RIVERWAY PLAZA

2013-2015

	DATE	TIME	W	PD	I	F	L	R	V
1	5/23/2014	10:58 AM	F	YES			1	1	5
2	7/3/2014	7:24 AM	TH				1	1	
3	9/28/2014	10:29 AM	SU	YES	1		1	1	
4	3/23/2015	9:04 AM	M				1	3	
5	7/2/2015	3:42 PM	TH	YES	1		1	1	
6	10/16/2015	7:41 PM	F				3	1	
7	12/19/2015	5:55 PM	SA	YES			3	1	

SYMBOLS

ANGLE	→	BICYCLE	→
BACKING	→←←	FIXED OBJECT	→
REAR END	→→	PARKED VEHICLE	→
SIDE SWIPE	→→	FATALITY	●
HEAD ON	→←	INJURY	○
TURNING MOVE	→↗	VEHICLE	→
OUT OF CONTROL	→	PEDESTRIAN	→

LIGHT CONDITIONS (L)

1. DAYLIGHT
2. DAWN OR DUSK
3. DARKNESS, LIT ROADWAY
4. DARKNESS, UNLIT ROADWAY
5. UNKNOWN

ROAD CONDITIONS (R)

1. DRY
2. WET
3. SNOW OR ICY
4. OTHER/ UNKNOWN

WEEDKAY (W)

M = MONDAY F = FRIDAY
TU = TUESDAY SA = SATURDAY
W = WEDNESDAY SU = SUNDAY
TH = THURSDAY

VIOLATIONS CITED (V)

1. SPEED TOO FAST
2. FAILURE TO YIELD
3. RAN STOP SIGN
4. RAN TRAFFIC SIGNAL
5. FOLLOWING TOO CLOSE
6. IMPROPER PASSING
7. WRONG SIDE OF ROAD
8. IMPROPER TURNING
9. IMPROPER BACKING
10. HAD BEEN DRINKING
11. PEDESTRIAN VIOLATION
12. RECKLESS DRIVING
13. IMPROPER LIGHT OR BRAKES
14. OPERATING UNLICENSED

PD = PROPERTY DAMAGE
I = INJURY
F = FATALITY

COLLISION DIAGRAM

FUNCTIONAL DESIGN REPORT
WEYMOUTH BRIDGE ST
INTERSECTION OF BRIDGE ST AND
ABIGAIL ADAMS STATE PARK
WEYMOUTH, MA



GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL & STRUCTURAL ENGINEERS WESTFORD, MASSACHUSETTS

Appendix D. Road Safety Audit References

Road Safety Audit References

Massachusetts Traffic Safety Toolbox, Massachusetts Highway Department,
www.mhd.state.ma.us/safetytoolbox.

Road Safety Audits, A Synthesis of Highway Practice. NCHRP Synthesis 336. Transportation Research Board, National Cooperative Highway Research Program, 2004.

Road Safety Audits. Institute of Transportation Engineers and U.S. Department of Transportation, Federal Highway Administration, www.roadwaysafetyaudits.org.

FHWA Road Safety Audit Guidelines. U.S. Department of Transportation, Federal Highway Administration, 2006.

Road Safety Audit, 2nd edition. Austroads, 2000.

Road Safety Audits. ITE Technical Council Committee 4S-7. Institute of Transportation Engineers, February 1995.