

ROAD SAFETY AUDIT

West Elm Street
High Crash Locations between West St and Warren Ave
City of Brockton

November 30, 2012

Prepared For:
MassDOT Highway Division



Prepared By:
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ENGINEERING SUCCESS **TOGETHER**

Table of Contents

Project Data	1
Background	2
Project Description	2
Audit Observations	11
Potential Safety Enhancements	17
Summary of Road Safety Audit	22

List of Appendices

- Appendix A. RSA Meeting Agenda
- Appendix B. RSA Audit Team Contact List
- Appendix C. Detailed Crash Data
- Appendix D. Traffic Volume Information

List of Figures

Figure 1. Location Map	3
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List of Tables

Table 1. Participating Audit Team Members	1
Table 2. Estimated Time Frame and Costs Breakdown	17
Table 3. Potential Safety Enhancement Summary	23

Project Data

A Road Safety Audit for High Crash Locations along West Elm Street between West Street and Warren Avenue in the City of Brockton was held on October 19, 2012 at the Plymouth County Registry of Deeds Brockton Satellite Office in Brockton, MA. As indicated in Table 1, the audit team consisted of representatives from State, Regional and Local agencies and included a cross-section of engineering, planning, emergency response and legislative expertise.

Table 1. Participating Audit Team Members

Audit Team Member	Agency/Affiliation
Bonnie Polin	MassDOT Highway Division – Safety Section
Charles Kilmer	Old Colony Planning Council (OCPC)
Ray Guarino	OCPC
Bill McNulty	OCPC
Alex Duggan	MassDOT Highway Division – District 5
Thomas Rebello	MassDOT Highway Division – District 5
George Riddell	Brockton Area Transit (BAT)
Fred Keylor	H.W. Moore
Jocelyn Dewire	MassDOT Highway Division – Project Management
Jacques Borges	City of Brockton – City Engineer
Craig Young	City of Brockton – Highway Superintendent
Mike Thoreson	City of Brockton – Commissioner of Public Works
Jeffrey Gillpatrick	Brockton Fire Department
Mike Power	Senator Tom Kennedy's Office
Greg Lucas	BETA Group, Inc.
Justin Curewitz	BETA Group, Inc.

Background

The Federal Highway Administration defines a Road Safety Audit (RSA) as *the formal safety examination* of an existing or future road or intersection by an *independent, multidisciplinary team*. The purpose of an RSA is to *identify potential safety issues and possible opportunities for safety improvements* considering all roadway users. A Road Safety Audit was scheduled for High Crash Locations along West Elm Street between West Street and Warren Avenue in Brockton, focusing on five intersections along West Elm Street: Moraine Street, Ash Street, Belmont Avenue, Newbury Street and Warren Avenue. All five intersections have been identified as high crash locations within the Old Colony Planning Council (OCPC) region, and an RSA is required by MassDOT design guidelines for high crash locations. The intersections at Ash Street, Newbury Street and Warren Avenue are on MassDOT's Top 200 list of High Crash Intersections from 2008 to 2010. West Elm Street between West Street and Warren Avenue is scheduled to be reconstructed in 2014 by the MassDOT Highway Division. The project includes four of the five study intersections; it does not include the intersection of West Elm Street and Warren Avenue. The RSA is intended to identify potential short and long term safety improvements that can be made at the intersections, which can then be implemented through general maintenance for short term low cost improvements or incorporated into the planned reconstruction project to the greatest extent practicable.

Project Description

West Elm Street, shown in Figure 1, is an Urban Collector providing east-west access through the City of Brockton west of the downtown area of the City. West Elm Street serves as an alternative to both Pleasant Street (Route 27) and Belmont Street (Route 123), and traffic along West Elm Street consists of both locally-generated traffic and through traffic from Route 24 bound for the downtown area. It was noted that traffic from Route 24 follows Pleasant Street (Route 27) to West Street, then turns onto West Elm Street. West Elm Street is under City of Brockton jurisdiction, as are all intersecting side streets within the study area.

The five intersections included in the audit are discussed in detail below.

West Elm Street/Moraine Street

West Elm Street and Moraine Street form a 4-legged unsignalized intersection, with Moraine Street under STOP control. Moraine Street serves as a cut-through between Pleasant Street to the north and Belmont Street to the south. Land use in the area is primarily residential.

West Elm Street and Moraine Street each provide a single general purpose lane in each direction at the intersection. Moraine Street has an offset alignment at West Elm Street.



West Elm Street at Moraine Street



**Road Safety Audit
West Elm Street
Brockton, MA**

Figure 1
Location Map

Pavement markings at the intersection consist of a double yellow centerline and white edge lines for West Elm Street and painted stop bars with STOP word markings for Moraine Street. No centerline or edge line markings are provided on Moraine Street. A wide shoulder/parking lane is provided along the north side of West Elm Street from Ash Street past Moraine Street to West Street; it was noted that this parking lane is wider than the travel lane and may appear to be a second travel lane for drivers unfamiliar with the area. Stop signs are provided on both sides of Moraine Street on both the northbound and southbound approaches. On-street parking is allowed along West Elm Street in the vicinity of Moraine Street; it is unclear if parking is allowed along Moraine Street, although no signage is present indicating parking restrictions. It should be noted that No Parking signage is sporadic and in poor condition along the entirety of West Elm Street, and that the absence of signing is not a clear indicator that no City ordinance exists restricting parking in any specific area.

No marked crosswalks are provided at the intersection. Continuous sidewalks are provided on both sides of West Elm Street throughout the study corridor, and are separated from the edge of roadway by a grass strip with mature trees in the vicinity of Moraine Street. Paved sidewalks are provided on both sides of Moraine Street south of West Elm Street; no sidewalks are provided north of West Elm Street, although there is a worn gravel path for pedestrian use along the east side of Moraine Street. Handicap ramps are provided at the intersection despite the lack of marked crosswalks, but are generally in poor condition and do not meet ADA and MassDOT guidelines.

Crash data provided by the Brockton Police Department and summarized by MassDOT show 28 crashes occurred between January 2008 and December 2010. Seven crashes were listed as incidents only, where a crash report was not prepared. The remaining 21 crashes are mapped on the collision diagram included in Appendix C. The prevalent crash type were angle crashes, comprising 86% of total crashes. Ten angle crashes occurred between an eastbound through vehicle and a southbound vehicle, perhaps the result of visibility restrictions created by hedges along both the northwest and northeast corners of the intersection. Three additional angle crashes occurred between a westbound through vehicle and a northbound vehicle. A summary of crash data and a collision diagram are included in the Appendix.

West Elm Street/Ash Street

West Elm Street and Ash Street form a 4-legged unsignalized intersection, with Ash Street under STOP control. Ash Street serves as a cut-through between Pleasant Street to the north and Belmont Street to the south. Land use in the area is primarily residential.

West Elm Street and Ash Street each provide a single general purpose lane in each direction at the intersection. Pavement markings at the intersection consist of a double yellow centerline and white edge lines for West Elm Street and double yellow center lines and painted stop bars with STOP word markings for Ash Street. The wide parking lane along West Elm Street begins at Ash Street. Stop signs are provided on



West Elm Street at Ash Street

both sides of Ash Street on both the northbound and southbound approaches, although the right side Stop sign for the southbound approach is set back approximately 10 feet from the stop line. On-street parking is allowed along both sides of West Elm Street west of Ash Street, accommodated on the north side within the aforementioned wide shoulder. No Parking signs are sporadically posted on both sides of West Elm Street east of Ash Street. It is unclear if parking is allowed along Ash Street, although no signage is present indicating parking restrictions.

Crosswalks are provided across all four legs of the intersection, with apex style handicap ramps on all four corners that do not appear to meet current ADA and MassDOT guidelines. Continuous sidewalks are provided on both sides of West Elm Street, and are separated from the edge of roadway by a grass strip on both sides of West Elm Street west of Ash Street and on the north side of West Elm Street east of Ash Street. Continuous sidewalks are also provided on both sides of Ash Street.

Crash data provided by the Brockton Police Department and summarized by MassDOT show 64 crashes occurred between January 2008 and December 2010. Seventeen crashes were listed as incidents only, where a crash report was not prepared. The remaining 47 crashes at the intersection are mapped on the collision diagram included in Appendix C. The prevalent crash type were angle crashes, comprising 91% of mapped crashes. Twenty-four crashes occurred involving vehicles departing Ash Street southbound: twelve with a westbound through vehicle, eleven with an eastbound through vehicle, and one with an eastbound left turning vehicle. One crash was noted involving a southbound left turning vehicle and a westbound through vehicle, and three involving an eastbound left turning vehicle and a westbound through vehicle. Visibility for drivers looking right from Ash Street southbound is impacted by a stone wall, vegetation and mature trees on the northwest corner. Visibility for drivers looking left from Ash Street southbound is impacted by both the geometry of the intersection and a mature tree in the front yard of the home on the northeast corner. West Elm Street widens at Ash Street, so a vehicle stopped at the southbound stop line is farther away from the edge line of West Elm Street on the east side of the intersection than on the west side, where West Elm Street is wider. This forces vehicles to creep forward to be able to see approaching westbound traffic and may cause drivers to cross when they do not have clear lines of sight.

Similar visibility restrictions exist for Ash Street northbound due to hedges on the southeast corner of the intersection. The collision diagram shows fifteen crashes involving vehicles departing Ash Street northbound: seven with an eastbound through vehicle, six with a westbound through vehicle, one with a northbound left turning vehicle and an eastbound through vehicle, and one with a northbound right turning vehicle and an eastbound through vehicle. One crash at the intersection involved a pedestrian who was struck by an eastbound vehicle while in the crosswalk on the west leg of the intersection. A summary of crash data and a collision diagram are included in the Appendix.

The intersection ranks 41st on MassDOT's statewide list of Top Crash Intersections from 2008 to 2010. The MassDOT ranking is based on the number and severity of crashes in MassDOT's database which can be georeferenced to a cluster area around the intersection. This cluster area experienced 54 crashes in the three year period, with 24 of the 54 crashes involving an injury. The variance in crash totals may be the result of local crash reports not being submitted to the statewide system, or the difference in areas due to the automated nature of the geocoding process. The ranking is based on a weighted system which calculates the Equivalent Property Damage Only (EPDO) rating of the intersection. Fatal crashes are

weighted 10 times and injury crashes are weighted 5 times. There were no fatal crashes at the intersection in the period.

West Elm Street/Belmont Avenue

West Elm Street and Belmont Avenue form a 4-legged unsignalized intersection, with Belmont Avenue under STOP control. Belmont Avenue serves as a cut-through between Pleasant Street to the north and Belmont Street to the south. Land use in the area is primarily residential, except for the Universalist Unitarian Church on the northwest corner of the intersection.

West Elm Street and Belmont Avenue each provide a single general purpose lane in each direction at the intersection. Pavement markings at the intersection consist of a double yellow centerline and white edge lines for West Elm Street and double yellow center lines and painted stop bars with STOP word markings for Belmont Avenue. Stop signs are provided on both sides of Belmont Avenue on both the northbound and southbound approaches, although the right side Stop sign for the northbound approach is set back approximately 15 feet from the stop line. On-street parking is restricted along West Elm Street in the vicinity of Belmont Avenue. It is unclear if parking is allowed along Belmont Avenue, although no signage is present indicating parking restrictions.



West Elm Street at Belmont Avenue

No marked crosswalks are provided at the intersection. Continuous sidewalks are provided on both sides of West Elm Street throughout the study corridor. Continuous sidewalks separated from the edge of roadway by a grass strip are provided on both sides of Belmont Avenue south of West Elm Street, and a continuous sidewalk is provided on the west side of Belmont Avenue north of the intersection. Apex-style handicap ramps are provided at the intersection despite the lack of marked crosswalks, but are generally in poor condition and do not meet ADA and MassDOT guidelines.

Crash data provided by the Brockton Police Department and summarized by MassDOT show 25 crashes occurred between January 2008 and December 2010. Three crashes were listed as incidents only, where a crash report was not prepared. The remaining 22 crashes at the intersection are mapped on the collision diagram included in Appendix C. The prevalent crash type were angle crashes, comprising 77% of mapped crashes. Eleven crashes occurred involving vehicles departing Belmont Avenue southbound: six with a westbound through vehicle and five with an eastbound through vehicle. Five crashes involved vehicles departing Belmont Avenue northbound: three with a westbound through vehicle and two with an eastbound through vehicle. Four rear-end crashes occurred at the intersection, three in the westbound direction and one in the eastbound direction. A number of the descriptions in the summary included in Appendix C describe inattention, solar glare and “not seeing any oncoming traffic.” Visibility for drivers departing Belmont Street southbound is impacted by shrubs and a decorative pillar on the northeast

corner. The uphill grade of the southbound approach may also impact a driver's sightlines. A summary of crash data and a collision diagram are included in the Appendix.

West Elm Street/Newbury Street

West Elm Street and Newbury Street form a 4-legged unsignalized intersection, with Newbury Street under STOP control. Newbury Street serves as a cut-through between Pleasant Street to the north and Belmont Street to the south. Land use in the area is primarily residential, with some institutional and government land uses in the vicinity. A four-story apartment building is located on the northeast corner of the intersection, with the Plymouth County Registry of Deeds immediately to the east. New Life Christian Church is on the southwest corner, and a parking area for the Brockton War Memorial Building is located on the southeast corner. The War Memorial Building is adjacent to the parking area east of the intersection.

West Elm Street and Newbury Street each provide a single general purpose lane in each direction at the intersection. Newbury Street has an offset alignment at West Elm Street. Pavement markings at the intersection consist of a double yellow centerline and white edge lines for West Elm Street. Crosswalks are set back on all four approaches, and the Newbury Street approaches have two stop lines – a stop line with STOP word marking before the crosswalk, and a stop line adjacent to the stop sign after the crosswalk. This creates a confusing scenario for approaching motorists. A double yellow centerline is provided on the northbound Newbury Street approach but is missing from the southbound approach. Stop signs are provided on both sides of Newbury Street on both the northbound and southbound approaches, but are set back from the stop line in both directions. Stop signs on the southbound approach are set approximately five feet in advance of the stop line, while signs on the northbound approach are approximately fifteen feet in advance of the stop line. On-street parking is restricted along the north side of West Elm Street in the vicinity of Newbury Street and from Newbury Street to Warren Avenue. On-street parking is restricted on the south side of West Elm Street west of Newbury Street, with sporadic signage restricting parking east of Newbury Street to Warren Avenue. It is unclear if parking is allowed along Newbury Street, although no signage is present indicating parking restrictions.



West Elm Street at Newbury Street

As previously mentioned, crosswalks are provided across all four legs of the intersection, with separate ramps for each crosswalk on all four corners. All ramps are concrete and appear to be in good condition. Continuous sidewalks are provided along both sides of both intersecting streets.

Crash data provided by the Brockton Police Department and summarized by MassDOT show 47 crashes occurred at the intersection between January 2008 and December 2010. Three crashes were listed as incidents only, where a crash report was not prepared. The remaining 44 crashes are mapped on the

collision diagram included in Appendix C. The prevalent crash type were angle crashes, comprising 75% of mapped crashes. Twenty-three crashes occurred involving vehicles departing Newbury Street northbound: eleven with an eastbound through vehicle, nine with a westbound through vehicle, one with a westbound left turning vehicle, one between a northbound left turning vehicle and an eastbound through vehicle, and one between a northbound right turning vehicle and an eastbound through vehicle. Eleven crashes involved vehicles departing Newbury Street southbound: seven with an eastbound through vehicle and four with a westbound through vehicle. Three crashes occurred between an eastbound left turning vehicle and a westbound through vehicle, while two occurred between a westbound left turning vehicle and an eastbound through vehicle. Visibility for the Newbury Street southbound approach is impacted by shrubs and an uphill grade in the property on the northwest corner and by a mature tree in the front yard of the home on the northeast corner. The crash history may also be the result of confusion stemming from the dual stop bars. Crash descriptions in the summary included in Appendix C describe stop sign violations, solar glare and “not seeing any oncoming traffic.” One crash at the intersection involved a 95 year old pedestrian, it is unknown if the pedestrian was in the crosswalk. A summary of crash data and a collision diagram are included in the Appendix.

The intersection ranks 77th on MassDOT’s statewide list of Top Crash Intersections from 2008 to 2010. The MassDOT ranking is based on the number and severity of crashes in MassDOT’s database which can be georeferenced to a cluster area around the intersection. This cluster area experienced 43 crashes in the three year period, with 21 of the 43 crashes involving an injury. The variance in crash totals may be the result of local crash reports not being submitted to the statewide system, or the difference in areas due to the automated nature of the geocoding process. The ranking is based on a weighted system which calculates the Equivalent Property Damage Only (EPDO) rating of the intersection. Fatal crashes are weighted 10 times and injury crashes are weighted 5 times. There were no fatal crashes at the intersection in the period.

West Elm Street/Warren Avenue

West Elm Street and Warren Avenue form a 4-legged intersection under traffic signal control. Warren Avenue is one-way southbound through the intersection, while West Elm Street is two-way west of the intersection and one-way eastbound east of the intersection. Warren Avenue is an Urban Minor Arterial that carries Route 123 westbound, a National Highway System roadway, through the intersection. Land use is varied in the area, with the Brockton Assembly of God church on the southwest corner, a Caribbean restaurant (#76 Warren Avenue) on the southeast corner, a law office on the northeast corner, and the BB Russell Alternative School, a Brockton public school, on the northwest corner. Operations at the intersection are also impacted by the Boys and Girls Club, which is adjacent to the Assembly of God Church on the west side of Warren Avenue south of West Elm Street.



West Elm Street at Warren Avenue

West Elm Street provides a single general purpose lane in each direction west of the intersection. East of the intersection, West Elm Street provides a wide, undefined lane eastbound with an adjacent parking lane on the right side. The roadway appears wide enough for two lanes of operation and ultimately is striped as two lanes at its approach to Main Street approximately 750 feet east of Warren Avenue. Warren Avenue southbound provides a three lane approach, with an exclusive right turn lane to West Elm Street westbound, a southbound through lane, and a shared lane for southbound through vehicles and left turning vehicles. Warren Avenue departing the intersection is striped as two through lanes, with a wide unmarked right shoulder that is noted to be used for parking maneuvers for pickup and drop-off of children at the Boys and Girls Club. The traffic signal provides basic three-phase operation, with a phase for West Elm Street eastbound, a phase for Warren Avenue, and an exclusive phase for pedestrians.

Pavement markings at the intersection consist of a double yellow centerline, white edge lines and a painted stop bar for West Elm Street west of Warren Avenue. West Elm Street east of Warren Avenue has no markings except for the parking lane. The Warren Avenue southbound approach has arrow markings for each lane, but no ONLY word markings for the exclusive right turn lane. The lanes on this approach appear to be approximately ten feet in width, and no edge line markings are provided. Warren Avenue departing the intersection has a single broken white lane line separating the two travel lanes. On-street parking is restricted along both sides of West Elm Street in the vicinity of Warren Avenue, and is restricted along the Warren Avenue southbound approach.

Ladder-type crosswalks are provided across all four approaches. Apex-style handicap ramps are provided on all four corners, but may not meet current ADA and MassDOT guidelines. Continuous sidewalks are provided on both sides of both intersecting streets. Pedestrian pushbuttons and pedestrian signals are provided on all corners, although it was noted that a pushbutton on the northeast corner was not working on the day of the audit.

Crash data provided by the Brockton Police Department and summarized by MassDOT show 42 crashes occurred at the intersection between January 2008 and December 2010. Ten crashes were listed as incidents only, where a crash report was not prepared. The remaining 32 crashes are mapped on the collision diagram included in Appendix C. The prevalent crash type were angle crashes, comprising 53% of mapped crashes. Twelve angle crashes involved an eastbound through vehicle and a southbound through vehicle. The crash summary typically attributes these crashes to red light running. Worth noting is the fact that eleven of the twelve crashes involved injury, perhaps reflecting higher vehicle speeds at the time of impact. Another prevalent crash type at the intersection is angle crashes involving left turning vehicles from Warren Avenue southbound. Seven of these type of crash involve a left turning vehicle and a through vehicle, with the assumption that a vehicle made a left turn from the middle lane, which is intended as a through lane only. One additional crash involved two vehicles turning left at the same time.

Rear-end crashes were also a factor in the crash history of the intersection. Two rear-end crashes occurred on the Warren Avenue approach, while four occurred on the departure side of Warren Avenue. The vehicle struck in each of these four crashes was stopped for queued traffic, stopped to turn into the Caribbean restaurant on the southeast corner of the intersection, or stopped for a vehicle turning into the restaurant. One crash involving a pedestrian occurred at the intersection, but it was noted that the pedestrian was walking between stopped vehicles in traffic. A summary of crash data and a collision diagram are included in the Appendix.

The intersection ranks 101st on MassDOT's statewide list of Top Crash Intersections from 2008 to 2010. The MassDOT ranking is based on the number and severity of crashes in MassDOT's database which can be georeferenced to a cluster area around the intersection. This cluster area experienced 35 crashes in the three year period, with 21 of the 35 crashes involving an injury. The variance in crash totals may be the result of local crash reports not being submitted to the statewide system, or the difference in areas due to the automated nature of the geocoding process. The ranking is based on a weighted system which calculates the Equivalent Property Damage Only (EPDO) rating of the intersection. Fatal crashes are weighted 10 times and injury crashes are weighted 5 times. There were no fatal crashes at the intersection in the period.

West Elm Street

Bus operations along the corridor impact operations and generate pedestrian traffic, punctuating the need for safe crossings. Brockton Area Transit (BAT) operates a route with fixed stops along West Elm Street, and school buses stop along the corridor to pick up and drop off children. Schoolchildren are known to walk along West Elm Street at various points throughout the morning peak traffic periods, generated by West Middle School at the intersection of West Elm Street and West Street, Arnone Elementary School at the corner of Newbury Street and Belmont Street, and the BB Russell Alternative School at West Elm Street and Warren Avenue.

Average Daily Traffic (ADT), speed and turning movement count information was provided and is included in Appendix D. West Elm Street carries a 2009 ADT of 17,100 vehicles per day (vpd) west of Ash Street, and 10,700 vpd east of Newbury Street. 85th percentile speeds were also recorded along the corridor. The 85th percentile speed is defined as the speed at which 85 percent of the traffic is traveling at or below. Speeds generally decrease slightly traveling eastbound, from 39 mph approaching Ash Street to 35 mph approaching Newbury Street. It was suggested that vehicle speeds are at their highest midway between West Street and Warren Street because there is no traffic signal or other traffic control measure along West Elm Street to slow traffic, and that high speeds lead to the high percentage of crashes resulting in injury.

Turning movement count information from 2009 shows through volumes along West Elm Street increasing traveling westbound and varying traveling eastbound in the AM peak period. In the PM peak period, through volumes on West Elm Street generally increase traveling westbound and decrease traveling eastbound. A complete turning movement summary is included in the Appendix.

Audit Observations

Following a brief introduction to the RSA process and a summary of existing geometry, crash, volume and speed information, the audit participants were asked to discuss safety issues at the five study intersections and along the West Elm Street corridor. Audit participants then visited each of the intersections as a group, at which time they offered observations on safety issues. A summary of those major safety considerations is as follows:

All Locations & West Elm Street Corridor

A number of safety issues discussed are common to all locations or relate to the corridor.

- **Visibility** – Visibility restrictions created by vegetation, walls, slopes and roadway geometry exist at all locations except Warren Avenue. Specific visibility restrictions by location are discussed separately below.
- **Speeding** – Speed along the corridor is a concern amongst audit participants. It was suggested that speeds are highest at the midpoint between West Street and Warren Avenue due to the lack of traffic control devices to stop traffic along the West Elm Street corridor. Speeding along West Elm Street may be a factor in angle crashes involving side street vehicles, who do not properly judge the approach speed of oncoming vehicles. It was also suggested that high speeds lead to the high percentage of crashes resulting in injury.
- **Distracted Driving** – Distracted driving was noted as a factor in crashes at the study intersections by audit participants and in the crash summaries provided.
- **Impaired Driving** – While not cited in crash report narratives, impaired driving was noted as a factor in crashes by audit participants familiar with the area.
- **Cut-Through Traffic** – It was noted that vehicles use intersecting side streets along West Elm Street as a cut-through from Pleasant Street (Route 27) to Belmont Street (Route 123), or to access West Elm Street as an alternative east-west route.
- **Stop Sign Running** – Stop sign running was noted as a concern from side streets at all unsignalized intersections.
- **On-Street Parking** – The majority of West Elm Street within the study area and all intersecting side streets do not provide adequate shoulder width to allow on street parking. Vehicles traveling along the roadway must encroach the oncoming travel lane to pass a parked car.
- **Signage** – Existing No Parking signage along the corridor is faded, missing or obstructed by foliage. Other signs (including stop signs) are faded and do not meet current retroreflectivity standards. Trees obstruct both advance and direct visibility of stop signs on some approaches.



Faded No Parking Sign

- Overgrowth – Vegetation overgrowth along the sidewalk and tree roots impacting the sidewalk surface were cited as a safety concern along the entire corridor.
- Bicycle Accommodation – The lack of bicycle accommodation along the corridor was noted as a safety concern.
- Solar Glare – Solar glare was cited as a factor in several crash reports along the corridor. The direct east-west alignment of West Elm Street has eastbound drivers facing the rising sun in the morning, and westbound drivers facing the setting sun in the evening.
- Buses – Operation of both BAT buses and school buses along the corridor was discussed as a safety concern, especially related to pedestrian accommodations and available pavement width.
- Street Lighting – It was noted that lighting along West Elm Street is inconsistent and that some existing lights are not functioning and are in need of replacement bulbs or fixtures.



Vegetation encroaching on existing sidewalk

West Elm Street/Moraine Street

- Visibility – Hedges along both the northwest and northeast corners of the intersection block visibility for vehicles departing Moraine Street southbound. This is a likely factor in angle crashes involving southbound vehicles.



Moraine Street looking east on West Elm Street



Wide shoulder on West Elm Street (looking from Ash Street)

- Wide Shoulder – The wide shoulder/parking lane west of Ash Street past Moraine Street to West Street may create confusion for drivers unfamiliar with the area who may think that it designates a second travel lane.
- Pedestrian Accommodations – The lack of crosswalks was cited as a safety concern, as well as the non-compliant handicap ramps.

- Skewed Approaches – The Moraine Street legs of the intersection are skewed and do not clearly line up with each other, which may cause conflicts between crossing vehicles if they do not correct for the offset alignment.
- Pavement Markings – Although not discussed at the audit, the lack of a double yellow center line on Moraine Street is a safety concern, especially given the offset alignment of the Moraine Street approaches.



Skewed Moraine Street approaches

West Elm Street/Ash Street

- Visibility – Hedges, a stone wall and mature trees on the northwest corner and a mature tree on the northeast corner block visibility for vehicles departing Ash Street southbound. Hedges on the southeast corner are also a concern for Ash Street northbound vehicles. The variance in width of West Elm Street on each side of Ash Street exacerbates visibility concerns for Ash Street southbound. Visibility concerns are a likely factor in angle crashes at the intersection.
- Stop Sign – The Stop sign for the Ash Street northbound approach is set back approximately 10 feet from the stop line, which may cause confusion over where it is appropriate to stop.



Ash Street looking west on West Elm Street

- Pedestrian Accommodations – Non-compliant handicap ramps were noted as a concern for wheelchair bound pedestrians.

West Elm Street/Belmont Avenue

- Visibility – Shrubs and a decorative pillar on the northeast corner create visibility restrictions for vehicle departing Belmont Avenue southbound. This is a likely factor in angle crashes involving southbound vehicles.
- Uphill Grade – The uphill grade of the Belmont Street southbound approach was noted as a safety concern, as it exacerbates existing visibility concerns and may create problems with braking and pavement



Belmont Avenue looking east on West Elm Street

friction due to the older pavement surface, especially during wet, snowy or icy conditions.

- Utility Poles – Utility poles along West Elm Street are aligned such that they create a sight obstruction for vehicles looking east from Belmont Avenue southbound.
- Pedestrian Accommodations – The lack of crosswalks was cited as a safety concern, as well as the non-compliant handicap ramps.

West Elm Street/Newbury Street

- Crosswalks – Existing crosswalks are setback from the intersection corners on all four approaches. The setback crosswalks on the Newbury Street approaches have a stop line both before and after the crosswalk, which may create confusion over where it is appropriate to stop. The setback crosswalks on West Elm Street are in an unexpected position and may surprise a driver who has turned from the side street, not expecting to encounter a pedestrian in a crosswalk at that location. This may have been a factor in the single pedestrian crash at the intersection.



Dual Stop lines and set back Stop signs on Newbury Street southbound approach

- Pedestrian Accommodations – In addition to crosswalk concerns, the lack of compliant handicap ramps were noted as a safety concern.
- Stop Sign – Stop signs are not aligned with the stop bar on either Newbury Street approach. The stop signs on the southbound approach are set approximately five feet in advance of the stop line, while signs on the northbound approach are approximately fifteen feet in advance of the stop line.
- Skewed Approaches – The Newbury Street legs of the intersection are skewed and do not clearly line up with each other, which may cause conflicts between crossing vehicles if they do not correct for the offset alignment.
- Pavement Markings – Although not discussed at the audit, the lack of a double yellow center line on the north leg of Newbury Street is a safety concern, especially given the offset alignment of the Newbury Street approaches.



Skewed Newbury Street approaches

- Visibility – Shrubs and an uphill grade on the northwest corner and a mature tree on the northeast corner create visibility restrictions for vehicles departing Newbury Street southbound. This is a likely factor in angle crashes involving southbound vehicles. The horizontal alignment of West Elm Street and the presence of a crest vertical curve were also cited as a potential visibility restriction.
- Turning Traffic/Pedestrian Activity – Land uses near Goddard Road generate a significant amount of turning traffic and pedestrian activity between Newbury Street and Warren Avenue. A senior housing high-rise apartment building is located on the northwest corner of the intersection of West Elm Street and Goddard Road, with the BB Russell Alternative School occupying the block between Goddard Road and Warren Avenue.



**Newbury Street looking east on
West Elm Street**

West Elm Street/Warren Avenue

- Lane Control Signage – The lack of lane control signage on both Warren Avenue and Frederick Douglass Avenue was noted as a potential factor in crashes at the intersection. Frederick Douglass Avenue intersects Warren Avenue approximately 1,100 feet north of West Elm Street and has a dual left turn lane to Warren Avenue. Lack of advance indication of lane control on both the left and right sides is a likely factor in the number of angle crashes involving turning vehicles on Warren Avenue, who may assume that the dual left from Frederick Douglass Avenue extends to the Warren Avenue approach at West Elm Street. The lack of signs is especially of concern during peak periods, when queued traffic likely blocks visibility of the existing lane markings.
- Signal Timing – Audit participants suggested that existing signal timing at the intersection should be adjusted based on current demand, and that the yellow and all red clearance time may not be sufficient. The number of angle crashes and red light running at the intersection may be the result of inadequate clearance times, or may be the result of driver frustration over traffic congestion.
- #76 Warren Avenue – Turns into the Caribbean restaurant at 76 Warren Avenue on the southeast corner of the intersection were a factor in rear-end crashes occurring on Warren Avenue departing the signalized intersection. It was noted that the driveway is designed for one-way flow, with vehicles entering on Warren Avenue and exiting on West Elm Street.



**Lack of lane control signage on
Warren Avenue approach**

- Boys & Girls Club – It was noted that parents stop along the right side of Warren Avenue south of West Elm Street to drop off and pick up children at the Boys & Girls Club, and that this impacts traffic along this approach. This may also be a factor in rear-end crashes on Warren Avenue.
- Pedestrian Pushbutton – The pedestrian pushbutton on the northeast corner was not working on the day of the audit. Fire department personnel present at the audit noted this and stated that it will be repaired.
- Turning Radius – The tight corner radius on the northwest corner makes it difficult for large vehicles such as fire trucks and buses to make the right turn from Warren Avenue to West Elm Street.



**Warren Avenue departing
West Elm Street**

Potential Safety Enhancements

After the site visit, audit participants returned to the meeting location to discuss the safety issues and consider improvements. Audit participants were encouraged to consider both short and long term improvements for each issue. Each improvement considered has been categorized as short-term, mid-term, or long-term based on the definitions shown in Table 2. Additionally, a cost category has been assigned to each improvement based on the parameters set forth in Table 2.

Table 2. Estimated Time Frame and Costs Breakdown

Time Frame		Costs	
Short-term	<1 year	Low	<\$10,000
Mid-term	1–3 years	Medium	\$10,000–\$50,000
Long-term	>3 years	High	>\$50,000

The following improvements were suggested by audit participants to improve safety issues at high crash locations along West Elm Street.

All Locations & West Elm Street Corridor

- Increase enforcement for speeding and stop sign running along the corridor. Additional enforcement is a short-term improvement with no cost, except for the cost of potential reduced enforcement elsewhere. It should also be noted that proposed traffic signals at Ash Street and Newbury Street will provide interruptions in traffic flow along the corridor between West Street and Warren Avenue.
- Consider reducing lane widths currently proposed for the planned reconstruction project. The project currently proposes 14-foot lane widths, which would further encourage speeding. The project should consider reducing lane widths and potentially narrowing the overall roadway width to provide 11-foot lanes with shoulders appropriate for bicycle accommodation. This is a mid-term improvement.
- Consider City-wide programs to educate drivers regarding distracted and impaired driving. is a short-term improvement with an on-going cost.
- Consider signal timing strategies to reduce cut-through traffic. Signal timings implemented as part of the proposed reconstruction project can be designed to discourage cut-through traffic along Ash Street and Newbury Street. The presence of signals interrupting traffic flow along both West Elm Street and the intersecting side streets will change driver behavior related to cut-through traffic.
- Consider traffic calming measures to reduce cut-through traffic. This is a long-term improvement that should be considered by the City only after evaluation of new traffic patterns resulting from the signalization of West Elm Street at both Ash Street and Newbury Street.
- Upgrade No Parking signage, and determine where parking restrictions are appropriate. Existing signs are faded or obstructed. The City should determine where no parking restrictions are appropriate and place signs accordingly. This is a short-term, low cost improvement.

- Trim overgrowth along sidewalks. Shrubs and trees overhanging existing sidewalks should be trimmed as a short-term, low cost improvement.
- Replace sidewalks and handicap ramps. It was noted that sidewalks and handicap ramps will be reconstructed as part of proposed improvements. Existing sidewalks are in poor condition, with heavy cracking and upheaval from tree roots in some areas. This is a mid-term, high cost improvement.
- Provide bicycle accommodation along West Elm Street. A 4-foot shoulder is proposed along the length of the planned reconstruction project. The project may also consider this in conjunction with recommendations regarding reduced lane widths to provide a 5-foot bicycle lane, or a reduced overall pavement width. This is a mid-term improvement with a cost assumed to be included in the overall cost of the project. In conjunction with this improvement, the City should determine if the existing roadway width can be reconfigured to provide a minimum 4-foot shoulder from the eastern project limit to Warren Avenue, which would provide continuous bicycle accommodation from West Street to Warren Avenue.
- Provide retroreflective backplates on proposed traffic signals at Ash Street and Newbury Street. Backplates will increase visibility of signal indications for approaching vehicles, which is especially important on an east-west corridor such as West Elm Street where solar glare occurs. This is a mid-term improvement with a cost assumed to be included in the overall cost of the project.
- Provide emergency pre-emption equipment at both proposed traffic signals. Though not discussed at the audit as an existing deficiency, this will provide priority to emergency vehicles and improve response times. This is a mid-term improvement with a cost assumed to be included in the overall cost of the project.
- Consider cutouts for BAT bus stops to avoid buses blocking the travel lane. This is a mid-term improvement that should be considered to the greatest extent practicable in the planned reconstruction project.
- Investigate street lighting along West Elm Street. It was suggested that existing fixtures be replaced or updated to improve lighting along the corridor. The location of lights should also be reviewed to ensure that lighting is focused on intersections and both existing and proposed crosswalk locations. This is a mid-term, high cost improvement.
- Rehabilitate pavement. Pavement will be rehabilitated along the corridor as part of planned improvements. The appropriate method of pavement rehabilitation should be determined based on the results of subsurface exploration. This is a mid-term, high cost improvement.

West Elm Street/Moraine Street

- Trim hedges on the northwest and northeast corners of the intersection. Existing vegetation blocks visibility for vehicles departing Moraine Street southbound. It was noted by City of Brockton personnel that City ordinances limit the height of hedges and roadside object to 3 ½ feet for a distance 25 feet from the back of the sidewalk. The City should enforce this ordinance at this location as a short-term measure.

- Modify pavement markings to clarify that the wide shoulder between Ash Street and West Street is a shoulder/parking lane rather than a travel lane. A tapered marking starting at the curb line departing Ash Street would clarify that this area is a shoulder. This is a short-term, low cost improvement. It was noted that the proposed improvements introduce proper pavement marking tapers for this wider shoulder as a mid-term improvement.
- Apply a double yellow centerline on Moraine Street. This is a short-term, low cost improvement.
- Limited right-of-way is available for geometric modifications that would correct the skewed alignment of the Moraine Street approaches. It was noted that this could be accomplished by eliminating a sidewalk, but decided that pedestrian connectivity is too important in the area to consider such a modification.
- Provide crosswalks at the intersection. It was noted that proposed improvements include crosswalks across both intersecting streets at this location. This is a mid-term improvement with a cost assumed to be included in the overall cost of the project.

West Elm Street/Ash Street

- Install a traffic signal at the intersection. Although not specifically discussed as an audit team recommendation, the proposed traffic signal included in the proposed improvements will help address many safety concerns presented by the audit team.
- Trim hedges and a tree on the northwest corner, a tree on a northeast corner and hedges on the southeast corner of the intersection. Existing vegetation blocks visibility for vehicles departing Ash Street. The City should enforce the previously described ordinance at this location as a short-term measure.
- Reset the stop sign for the Ash Street northbound approach to coincide with the painted stop line. This is a short-term, low cost improvement.

West Elm Street/Belmont Avenue

- Trim hedges and verify height of a decorative pillar on the northeast corner of the intersection. Existing vegetation blocks visibility for vehicles departing Belmont Street. The City should enforce the previously described ordinance at this location as a short-term measure.
- The uphill grade was noted as a safety concern, but further discussion amongst audit participants determined that modifications to the roadway grade are impractical at this location. Improvements to the pavement surface will benefit braking and friction for Belmont Street vehicles.
- Review utility pole alignment along West Elm Street. It was noted that utility poles, as presently aligned, create a sight obstruction for vehicles looking east from Belmont Avenue southbound. This potential sight obstruction should be reviewed to determine if pole relocation is feasible as part of the proposed improvements as a mid-term measure.

- Provide crosswalks at the intersection. It was noted that proposed improvements include crosswalks across both intersecting streets at this location. This is a mid-term improvement with a cost assumed to be included in the overall cost of the project.

West Elm Street/Newbury Street

- Install a traffic signal at the intersection. Although not specifically discussed as an audit team recommendation, the proposed traffic signal included in the proposed improvements will help address many safety concerns presented by the audit team.
- Realign crosswalks so that they are closer to the intersection corners, in concurrence with MassDOT design standards. This is a mid-term improvement that will be implemented as part of planned improvements. This improvement will also require reconstruction of handicap ramps at the intersection.
- Reset the stop signs on both Newbury Street approaches to coincide with the painted stop line. This is a short-term, low cost improvement.
- Limited right-of-way is available for geometric modifications that would correct the skewed alignment of the Newbury Street approaches. It was noted that this could be accomplished by eliminating a sidewalk, but decided that pedestrian connectivity is too important in the area to consider such a modification.
- Apply a double yellow centerline on the north leg of Newbury Street. This is a short-term, low cost improvement.
- Trim hedges on the northwest corner and a tree on the northeast corner of the intersection. Existing vegetation blocks visibility for vehicles departing Newbury Street southbound. The City should enforce the previously described ordinance at this location as a short-term measure.
- Determine feasibility of an eastbound turning lane at Goddard Road. It was noted that there is a significant amount of turning traffic due to elderly housing and the BB Russell Alternative School. This turning volume should be quantified to determine if a turning lane is justified, then available right of way should be reviewed to determine if addition of a lane is geometrically feasible. This is a mid-term improvement that should be considered with the design proposed improvements.
- Determine if pedestrian crossings are needed across West Elm Street at Goddard Road. Pedestrian crossing patterns should be observed to determine if a crosswalk across West Elm Street at Goddard Road should be incorporated into the proposed improvements.

West Elm Street/Warren Avenue

- Install lane usage signage. It was suggested that lane control signage is needed on both Warren Avenue and Frederick Douglass Avenue. It is recommended that R3-8 series graphical signs be provided on Warren Avenue. Signage is recommended on both sides of Warren Avenue so that drivers turning left from Frederick Douglass Avenue are aware that left turns at West Elm are only allowed from the left lane on Warren Avenue. This is a short-term, low cost improvement.

- Study signal timing at the intersection. Current year traffic volume information should be collected and analyzed to determine if signal timing changes are appropriate at the intersection. This is a short-term, low cost improvement.
- Study signal clearance times. The existing yellow and all red clearance times should be determined from the existing traffic signal controller and compared to minimum requirements calculated based on the Institute of Transportation Engineers (ITE) methodology. If existing clearance times are insufficient, clearance times should be increased accordingly. This is a short-term, low cost improvement.
- Control parking along Warren Avenue during peak pickup and drop-off times at the Boys & Girls Club. The City should determine what parking restrictions are appropriate, and implement them with signage and enforcement. This is a short-term, low cost improvement.
- Repair the pedestrian pushbutton on the northeast corner of the intersection. Fire department personnel present at the audit noted this, and the button was repaired on October 23rd.
- Widen corner radius on the northwest corner of the intersection. This is a short-term, medium cost improvement that would improve access for large vehicles such as fire trucks and buses. Widening the corner radius would require modifications to the sidewalk, which would impact the short granite retaining wall and a mature tree at the back of sidewalk, and may require property acquisition.

Summary of Road Safety Audit

Table 3 summarizes potential recommendations discussed by the audit team. The recommendations are categorized based on the potential safety payoff, as well as by time frame and cost. The safety payoff is a qualitative judgment of the effectiveness of the potential safety improvements. Each recommendation has a responsibility assigned to it stating whether MassDOT or the City of Brockton would be responsible for implementing the recommended improvement. The term “Project” refers to improvements that are assumed to be included or could reasonably be accommodated as part of planned improvements.

Table 3. Potential Safety Enhancement Summary

Safety Issue	Safety Enhancement	Responsibility	Safety Payoff	Time Frame	Cost
All Locations					
Speeding, Stop Sign Running	Increase enforcement for speeding and stop sign running along the corridor.	City	High	Short-term	Use of police resources
Speeding	Consider reducing lane widths currently proposed for the planned reconstruction project.	Project	High	Mid-term	*
Distracted Driving, Impaired Driving	Consider City-wide programs to educate drivers regarding distracted and impaired driving.	City	High	Short-term	On-going
Cut-Through Traffic	Consider signal timing strategies to reduce cut-through traffic.	Project	Medium	Mid-term	*
Cut-Through Traffic	Consider traffic calming measures to reduce cut-through traffic. (This improvement should be considered only after evaluation of traffic pattern changes following the reconstruction of West Elm Street)	City	Medium	Long-term	TBD
On-Street Parking, Signage	Upgrade No Parking signage, and determine where parking restrictions are appropriate.	City	Medium	Short-term	\$5,000
Overgrowth	Trim overgrowth along sidewalks.	City	Medium	Short-term	\$5,000
Pedestrian Accommodations	Replace sidewalks and handicap ramps at all locations.	Project	Medium	Mid-term	**
Bicycle Accommodation	Provide bicycle accommodation along West Elm Street. (The City should review if the existing roadway width can accommodate a 4 foot shoulder outside the project limits)	Project/City	Medium	Mid-term	**
Solar Glare	Provide backplates on proposed traffic signals at Ash Street and Newbury Street.	Project	Medium	Mid-term	**
	Provide emergency pre-emption equipment at proposed traffic signals.	Project	Medium	Mid-term	**
Buses	Consider cutouts for BAT bus stops to avoid buses blocking the travel lane	Project	Medium	Mid-term	**
Street Lighting	Investigate street lighting along West Elm Street. Location of lights should be reviewed to ensure that lighting is focused on intersections and crosswalk locations.	City/Project	Medium	Mid-term	TBD

Table 3. Potential Safety Enhancement Summary

Safety Issue	Safety Enhancement	Responsibility	Safety Payoff	Time Frame	Cost
Pavement, Uphill Grade	Rehabilitate pavement along the corridor.	Project	Medium	Mid-term	**
West Elm Street/Moraine Street					
Visibility	Trim hedges on the northwest and northeast corners of the intersection. The City ordinance limiting height to 3 ½ feet should be enforced.	City	High	Short-term	\$2,500
Wide Shoulder/ Pavement Markings	Modify pavement markings to clarify that the wide shoulder between Ash Street and West Street is a shoulder/parking lane. This can be accomplished by application of a tapered marking starting at the curb line.	City	Medium	Short-term	\$2,000
Pavement Markings, Skewed Approaches	Apply a double yellow centerline on Moraine Street.	City	Medium	Short-term	\$2,000
Pedestrian Accommodations	Provide crosswalks at the intersection.	Project	Medium	Mid-term	**
West Elm Street/Ash Street					
Visibility	Trim hedges and a tree on the northwest corner, a tree on the northeast corner and hedges on the southeast corner. The City ordinance limiting height to 3 ½ feet should be enforced.	City	High	Short-term	\$2,500
Stop Sign	Reset the stop sign for the Ash Street northbound approach to coincide with the painted stop line.	City	Medium	Short-term	\$250
West Elm Street/Belmont Avenue					
Visibility	Trim hedges and verify height of a decorative pillar on the northeast corner. The City ordinance limiting height to 3 ½ feet should be enforced.	City	High	Short-term	\$2,500
Utility Poles	Review utility pole alignment along West Elm Street.	Project	Medium	Mid-term	*
Pedestrian Accommodations	Provide crosswalks at the intersection.	Project	Medium	Mid-term	**

Table 3. Potential Safety Enhancement Summary

Safety Issue	Safety Enhancement	Responsibility	Safety Payoff	Time Frame	Cost
West Elm Street/Newbury Street					
Crosswalks, Pedestrian Accommodations	Realign crosswalks so they are closer to the intersection corners, in concurrence with MassDOT design standards. This improvement will also require reconstruction of ramps.	Project	High	Mid-term	**
Stop Sign	Reset the stop signs for both Newbury Street approaches to coincide with the painted stop line.	City	Medium	Short-term	\$1,000
Pavement Markings, Skewed Approaches	Apply a double yellow centerline on the north leg of Newbury Street.	City	Medium	Short-term	\$2,000
Visibility	Trim hedges on the northwest corner and a tree on the northeast corner. The City ordinance limiting height to 3 ½ feet should be enforced.	City	High	Short-term	\$2,500
Turning Traffic	Determine feasibility of an eastbound turning lane at Goddard Road.	Project	Medium	Mid-term	*
Pedestrian Activity	Determine if pedestrian crossings are needed across West Elm Street at Goddard Road.	Project	Medium	Mid-term	*
West Elm Street/Warren Avenue					
Lane Control Signage	Install lane usage signage on the left and right side of both Warren Avenue and Frederick Douglass Avenue.	City	High	Short-term	\$2,000
Signal Timing	Study signal timing at the intersection.	City	Medium	Short-term	TBD
Signal Timing	Study existing clearance times and make changes, if appropriate.	City	High	Short-term	\$2,000
Boys & Girls Club	Control parking along Warren Avenue during peak pickup and drop-off times at the Boys & Girls Club. The City should determine what parking restrictions are appropriate.	City	High	Short-term	TBD
Pedestrian Pushbutton	Repair the pedestrian pushbutton on the northeast corner of the intersection.	City	Medium	Short-term	\$1,000
Corner Radius	Widen corner radius on the northwest corner of the intersection.	City	Medium	Short-term	\$25,000

* These improvements were not part of the proposed project as described and should be included in the next submission. All other “Project” safety enhancements are assumed to already be included in the proposed improvements.

** Improvements to be incorporated into the proposed project are assumed to be included as part of the overall project cost.

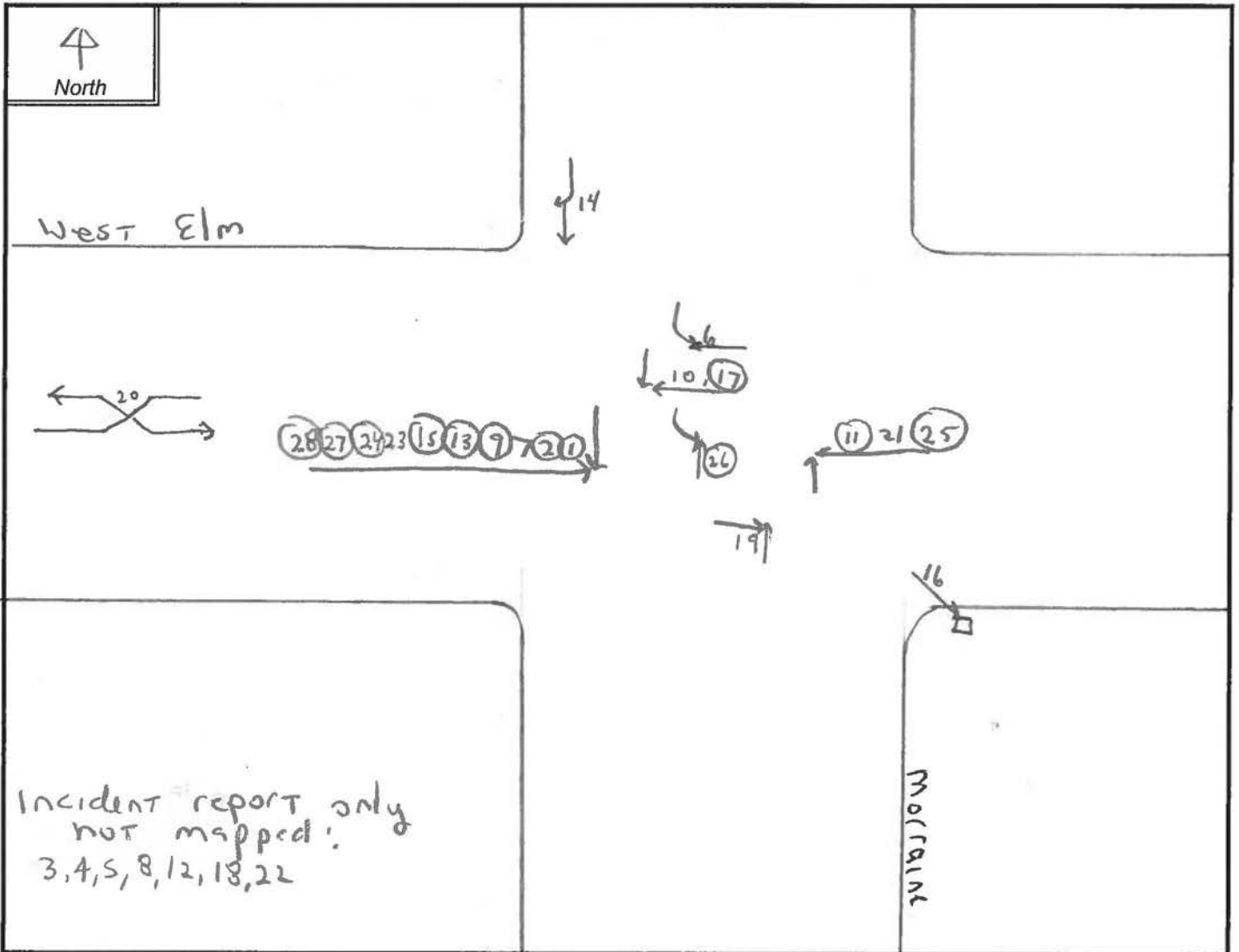
Appendix A. RSA Meeting Agenda

Appendix B. RSA Audit Team Contact List

Appendix C. Detailed Crash Data

COLLISION DIAGRAM

CITY/TOWN: Brockton DATE PREPARED: 9-27-12
 REGION: OCPC PREPARED BY: BSP
 ROADWAY NAMES: West Elm St / MORRIS
 TIME PERIOD ANALYZED: 1/1/2008 - 12/31/2010
 SOURCE OF CRASH REPORTS: Brockton Police



SYMBOLS	TYPES OF CRASH	SEVERITY
Moving Vehicle Backing Vehicle Non-Involved Vehicle Pedestrian Parked Vehicle Fixed Object Bicycle Animal	Head On Angle Turning Move Rear End Sideswipe Out of Control	Injury Accident Fatal Accident

EPDO = 76

Crash Data Summary Table

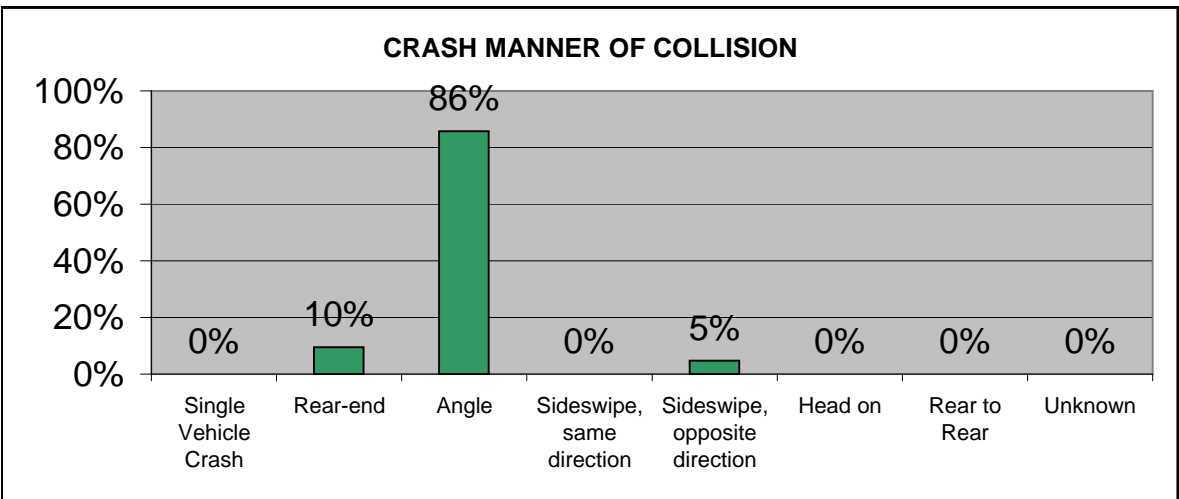
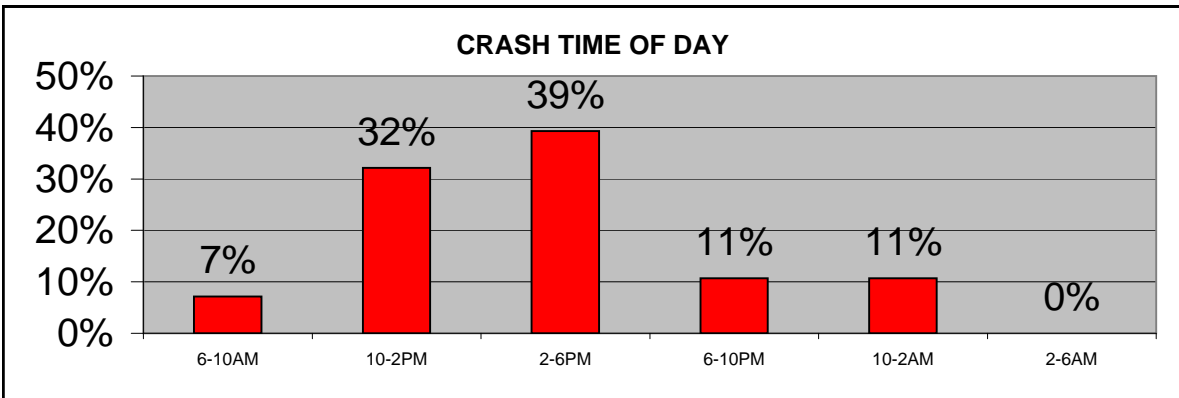
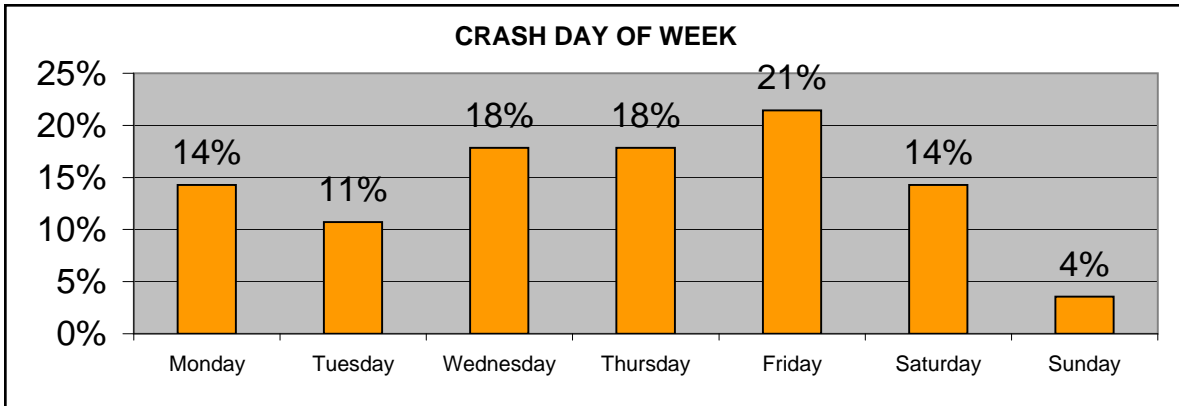
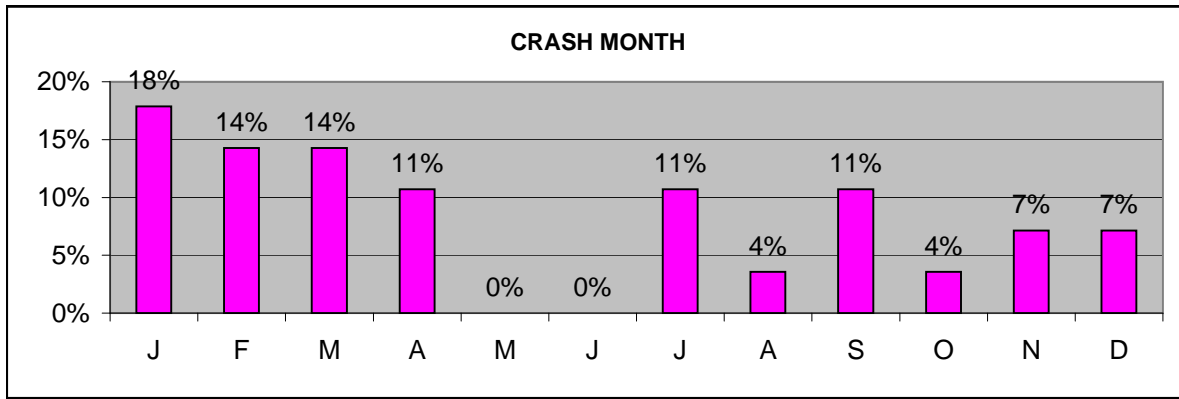
Intersection of West Elm Street and Moraine Street; Brockton, MA

January 1, 2008 - December 31, 2010

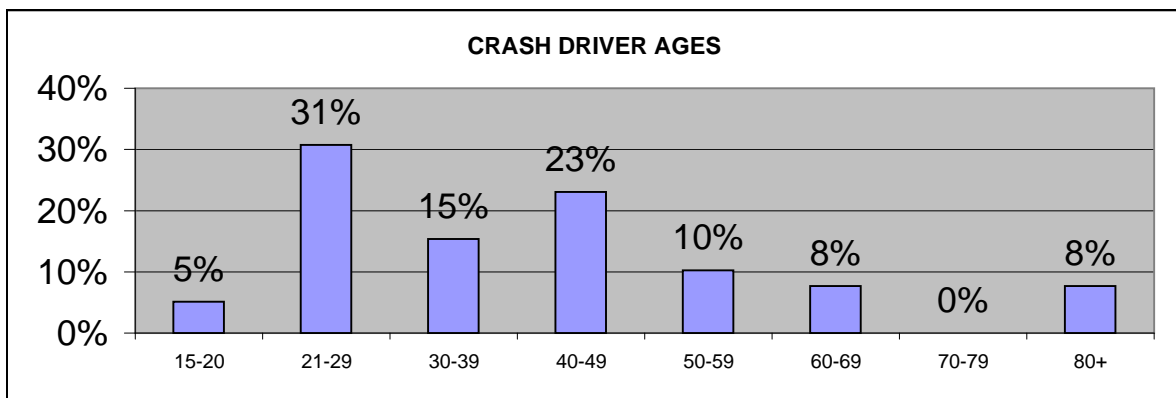
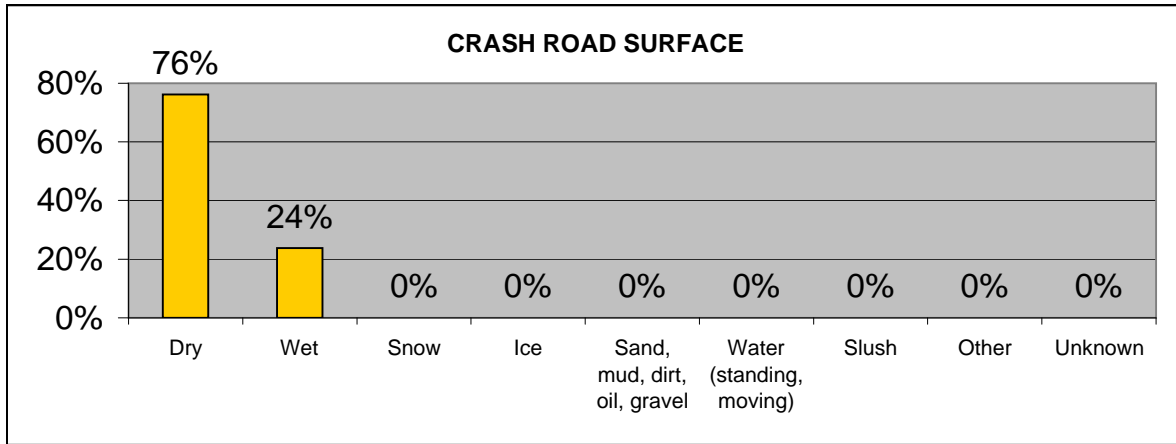
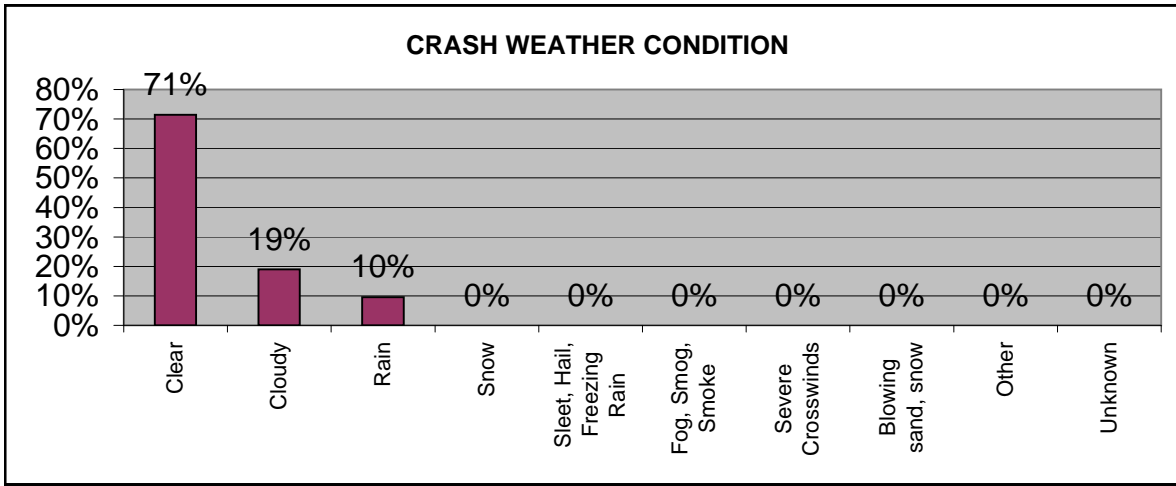
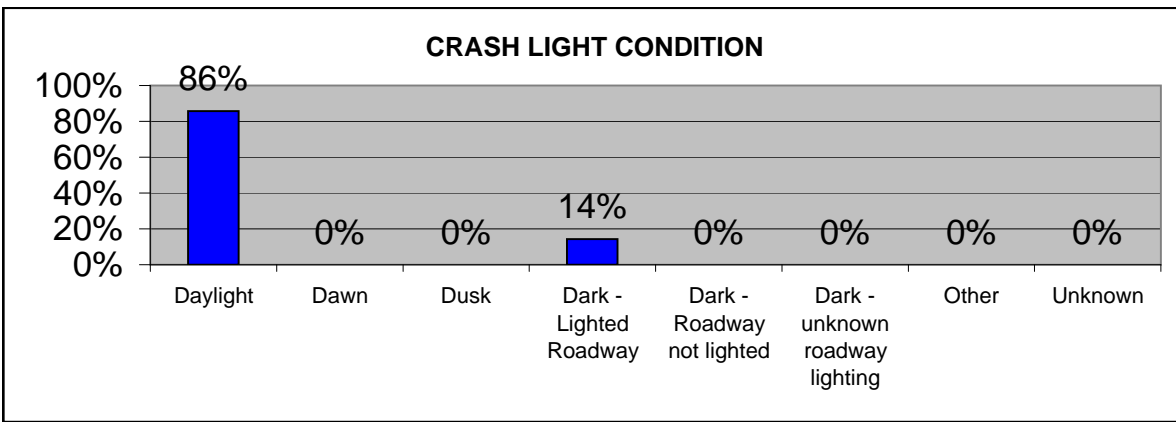
#	Crash Date <i>m/d/y</i>	Time of Day	Manner of Collision <i>Type</i>	Light Condition <i>Type</i>	Weather Condition <i>Type</i>	Road Surface <i>Type</i>	Driver Contributing Code <i>Type</i>	Ages				Comments
								D1	D2	D3	D4	
1	1/24/08	11:50 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	54	90			
2	2/26/08	3:51 PM	Angle	Daylight	Cloudy	Dry	Failed to yield to right of way	44	27			
3	3/4/08	7:31 AM										Incident Report
4	4/5/08	12:19 AM										Incident Report
5	7/31/08	4:25 PM										Incident Report
6	8/20/08	4:04 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	20	24			other vehicles stopped but West Elm vehicle crossed double yellow center to go around stopped vehicle and struck SB left turning vehicle
7	9/3/08	10:28 PM	Angle	Dark - lighted roadway	Clear	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	16	45			
8	9/20/08	10:24 AM										Incident Report
9	1/29/09	12:08 PM	Angle	Daylight	Clear	Wet	Failed to yield to right of way	64	31			
10	2/4/09	4:21 PM	Angle	Daylight	Clear	Dry	Other improper action	Unk	83			
11	2/18/09	8:10 AM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	68	Unk			Operator did not stop for stop sign
12	2/26/09	4:21 PM										Incident Report
13	3/15/09	6:10 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	24	31			
14	3/20/09	1:20 PM	Rear-end	Daylight	Clear	Dry	No Improper Driving	22	48			
15	3/30/09	1:42 PM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	57	18			
16	4/11/09	12:28 PM	Rear-end	Daylight	Rain	Wet	Exceeded authorized speed limit	44				Operator claims he swerved to avoid hitting another vehicle and hit utility pole
17	7/17/09	4:50 PM	Angle	Daylight	Clear	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	25	22			
18	9/21/09	8:27 PM										Incident Report
19	10/16/09	3:40 PM	Angle	Daylight	Cloudy	Wet	No Improper Driving	37	54			Operator 1 claims that foot slid off brake pedal and vehicle slid on slippery surface
20	11/4/09	8:44 PM	Sideswipe, opposite direction	Dark - lighted roadway	Cloudy	Dry	Unknown	35	22			unknown reasons, drivers hit each other just west of intersection
21	11/12/09	4:25 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	29	41			hit vehicle was then pushed into two parked cars on West Elm, on north side just west of intersection
22	12/1/09	2:13 PM										Incident Report
23	1/4/10	10:51 AM	Angle	Daylight	Cloudy	Wet	Failed to yield to right of way	58	31			one driver unlicensed and other car unregistered
24	1/9/10	11:34 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	20	46			Vehicle 1 did not see Vehicle 2
25	1/11/10	2:02 PM	Angle	Daylight	Clear	Dry	Other improper action	64	44			
26	4/2/10	3:14 PM	Angle	Daylight	Clear	Dry	Made an improper turn	81	24			
27	7/30/10	1:00 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	41	44			
28	12/3/10	11:20 PM	Angle	Dark - lighted roadway	Clear	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	38	22			Vehicle 1 failed to stop at stop sign

Summary based on Crash Reports obtained from the Brockton Police Department and the RMV.

Crash Data Summary Tables and Charts
 Intersection West Elm and Moraine; Brockton, MA

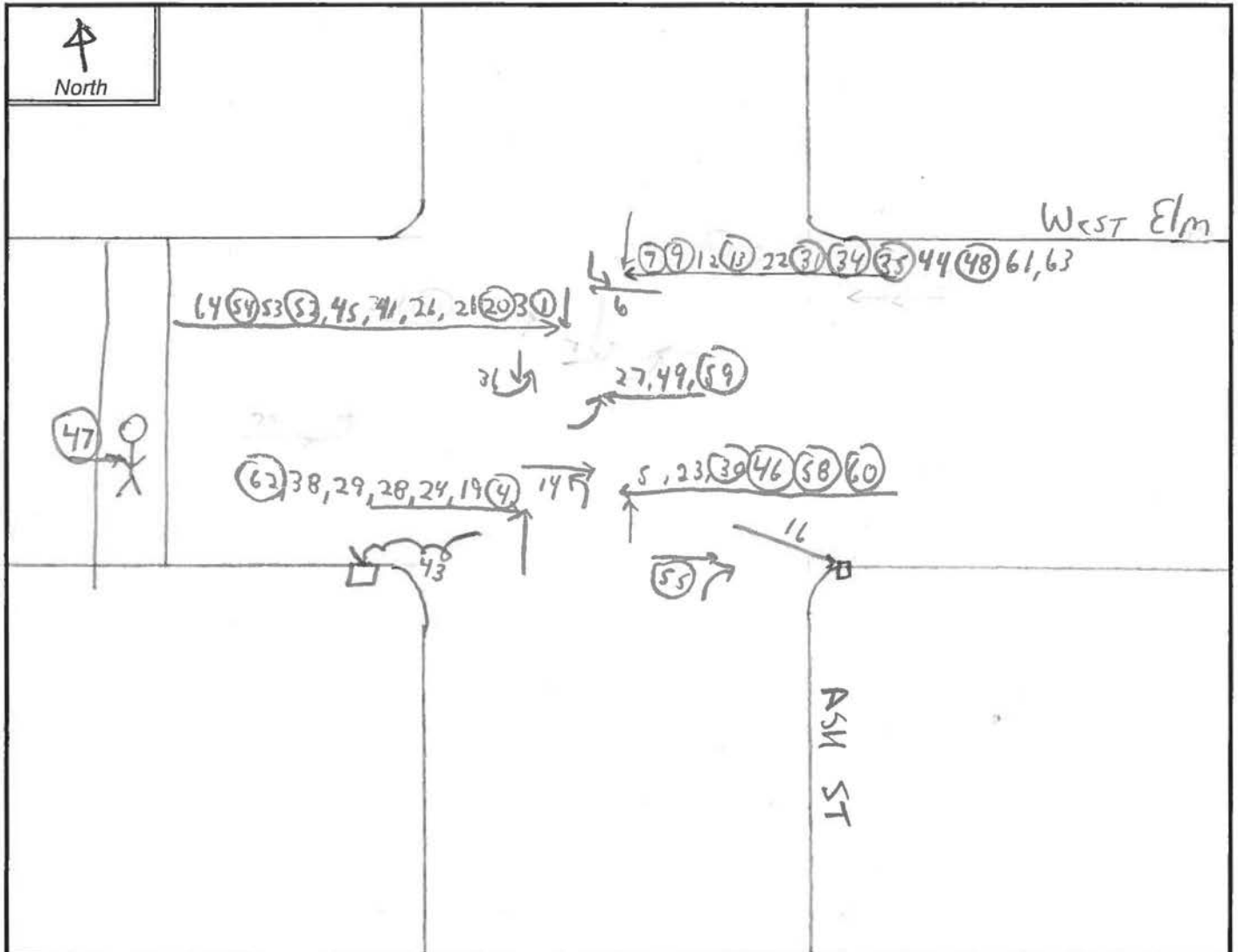


Crash Data Summary Tables and Charts
 Intersection West Elm and Morraine; Brockton, MA



COLLISION DIAGRAM

CITY/TOWN : Brockton DATE PREPARED: 9-27-12
 REGION: OCPC PREPARED BY: BSP
 ROADWAY NAMES: West Elm St - Ash St
 TIME PERIOD ANALYZED: 1/1/2008 - 12/31/2010
 SOURCE OF CRASH REPORTS: Brockton Police



SYMBOLS	TYPES OF CRASH	SEVERITY
Moving Vehicle Backing Vehicle Non-Involved Vehicle Pedestrian Parked Vehicle Fixed Object Bicycle Animal	Head On Angle Turning Move Rear End Sideswipe Out of Control	Injury Accident Fatal Accident

Crash Data Summary Table

Intersection of West Elm Street and Ash Street; Brockton, MA
January 1, 2008 - December 31, 2010

#	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Ages				Comments
									D1	D2	D3	D4	
	m/d/y			Type	Type	Type	Type	Type					
1	1/24/08	Thursday	2:46 PM	Angle	Daylight	Cloudy	Dry	Failed to yield to right of way	23	46			Vehicle 1 failed to stop at stop sign
2	2/15/08	Friday	12:50 PM										Incident report
3	2/27/08	Wednesday	12:09 PM	Angle	Daylight	Cloudy	Dry	Failed to yield to right of way	32	78			
4	2/29/08	Friday	11:04 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	26	28			
5	3/13/08	Thursday	2:50 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	24	77			
6	3/19/08	Wednesday	4:33 PM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	48	43			
7	4/9/08	Wednesday	3:20 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	90	22			
8	4/14/08	Monday	2:10 PM										Incident report
9	4/30/08	Wednesday	2:22 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	38	37			
10	5/3/08	Saturday	12:03 AM										Incident report
11	5/3/08	Saturday	12:35 AM										Incident report
12	5/9/08	Friday	9:54 AM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	27	17			
13	5/17/08	Saturday	8:47 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	22	47			Driver on west Elm traveling approx. 35 - 40 mph
14	5/19/08	Monday	1:54 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	20	22			
15	7/12/08	Saturday	8:35 PM										Incident report
16	7/27/08	Sunday	6:28 PM	Sideswipe, same direction	Daylight	Rain	Wet	No Improper Driving	40				Police cruiser traveling on West Elm responding to call with lights and sirens swerved to avoid vehicle driving NB on Ash Street and hit curb
17	8/16/08	Saturday	4:36 PM										Incident report
18	10/5/08	Sunday	4:27 PM										Incident report
19	10/12/08	Sunday	8:08 PM	Angle	Dark - lighted roadway	Clear	Dry	Disregarded traffic signs, signals, road markings	17	22			
20	10/15/08	Wednesday	12:20 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	56	31	28		
21	10/31/08	Friday	8:14 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	45	74			Operator 2 did not see Vehicle 1
22	12/1/08	Monday	4:04 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	82	38	24		Vehicle 2 failed to stop at stop sign, struck Vehicle 1 which then struck Vehicle 3.
23	12/22/08	Monday	12:06 PM	Angle	Daylight	Clear	Wet	Disregarded traffic signs, signals, road markings	44	22			Driver believed it was a four-way stop
24	1/12/09	Monday	9:27 AM	Angle	Daylight	Cloudy	Wet	Failed to yield to right of way	28	21			Vehicle 2 stopped to far forward causing Vehicle 1 to strike it
25	1/30/09	Friday	10:15 AM										Incident report
26	2/26/09	Thursday	11:35 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	19	53			Driver claims not to have sen vehicle on West Elm
27	4/28/09	Tuesday	11:33 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	38	52	72		
28	7/7/09	Tuesday	9:18 PM	Angle	Dark - lighted roadway	Rain	Wet	Disregarded traffic signs, signals, road markings	18	28	22		Vehicle 1 failed to yield to right of way. Vehicle 2 struck Vehicle 1 and then struck Vehicle 3.
29	7/16/09	Thursday	4:15 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	62	27			Operator disregarded stop sign
30	7/29/09	Wednesday	5:10 PM	Angle	Daylight	Cloudy	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	66	52	34		
31	8/3/09	Monday	9:59 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	31	23			Vehicle 2 failed to yield to right of way
32	9/4/09	Friday	8:10 AM	Angle	Daylight	Clear	Dry	Other improper action	35	21			Operator failed to stop at stop sign
33	9/11/09	Friday	6:39 PM										Incident report
34	9/22/09	Tuesday	3:02 PM	Angle	Daylight	Cloudy	Dry	Unknown	17	42	59		Witness stated vehicle WB on West Elm was speeding
35	9/26/09	Saturday	4:47 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	54	27	45		Vehicle 1 failed to stop at stop sign. Vehicle 2 struck Vehicle 1 and then struck Vehicle 3.
36	10/18/09	Sunday	9:01 AM	Angle	Daylight	Rain	Wet	No Improper Driving	31	41			
37	11/15/09	Sunday	3:10 PM										Incident report - hit & run crash
38	11/24/09	Tuesday	5:24 PM	Angle	Dark - lighted roadway	Rain	Wet	Other improper action	31	31			Vehicle 2 misunderstood Vehicle 1's emergency flashers as a turn signal and pulled out
39	11/29/09	Sunday	9:29 AM										incident report
40	12/8/09	Tuesday	9:09 AM										Incident report
41	12/18/09	Friday	5:19 PM	Angle	Dark - lighted roadway	Clear	Dry	Failure to keep in proper lane or running off road	45	20			Unknown EB vehicle stopped and waived Vehicle 2 SB from stop sign. Vehicle 1 passed unknown vehicle EB on right and struck Vehicle 2
42	12/26/09	Saturday	10:37 AM										Incident report
43	1/2/10	Saturday	3:34 PM	Single Vehicle Crash	Daylight	Snow	Snow	Driving too fast for conditions	52				Vehicle attempted to turn left but instead slid on ice into tree
44	1/12/10	Tuesday	12:57 PM	Angle	Daylight	Cloudy	Dry	Failed to yield to right of way	41	25			Operator 1 (at stop sign) did not see Vehicle 2 and said that Vehicle 2 may have been speeding
45	1/24/10	Sunday	12:50 AM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	22	18			
46	1/24/10	Sunday	11:43 AM	Angle	Daylight	Clear	Dry	No Improper Driving	56	53			
47	1/26/10	Tuesday	4:52 PM	Single Vehicle Crash	Daylight	Clear	Dry	Unknown	unk	16			EB driver hit pedestrian (D2) in crosswalk and then fled
48	1/30/10	Saturday	3:50 PM	Angle	Dusk	Cloudy	Dry	Disregarded traffic signs, signals, road markings	24	40			
49	2/15/10	Monday	10:26 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	21	24			
50	3/8/10	Monday	4:20 PM										Incident report - hit & run crash
51	3/13/10	Saturday	1:49 PM										Incident report
52	3/20/10	Saturday	12:35 PM	Angle	Daylight	Clear	Dry	Inattention	63	40			

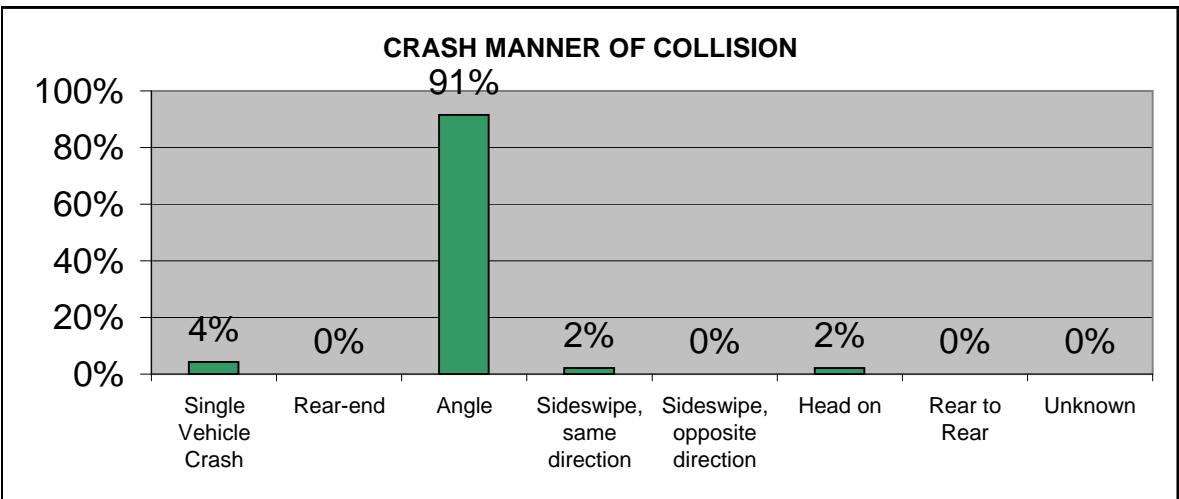
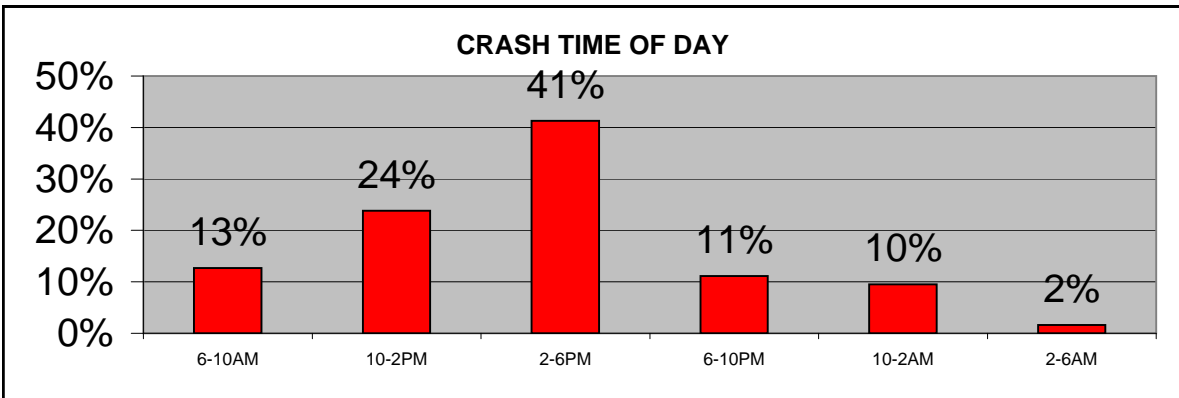
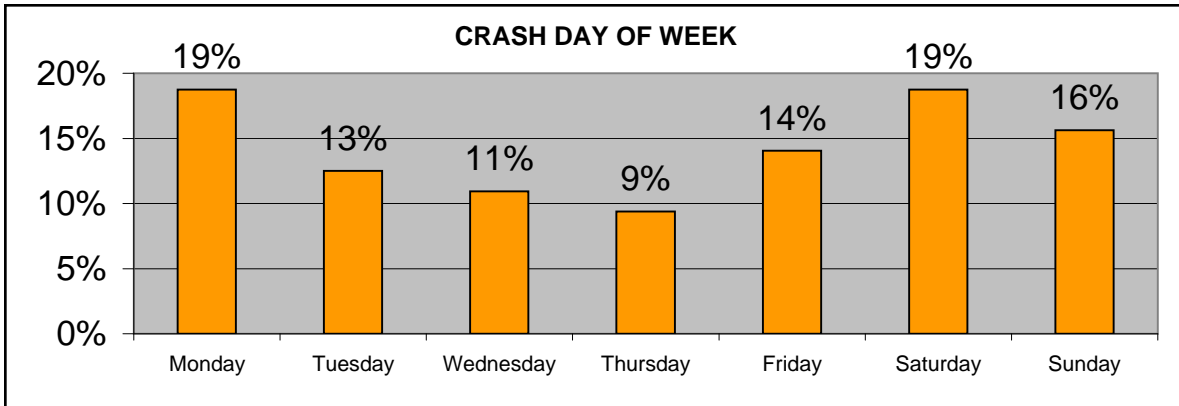
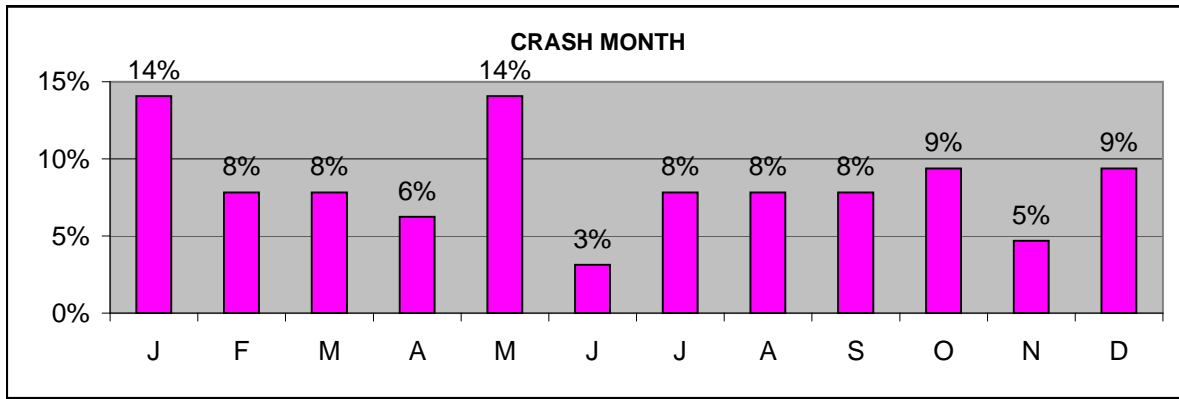
Crash Data Summary Table

Intersection of West Elm Street and Ash Street; Brockton, MA
January 1, 2008 - December 31, 2010

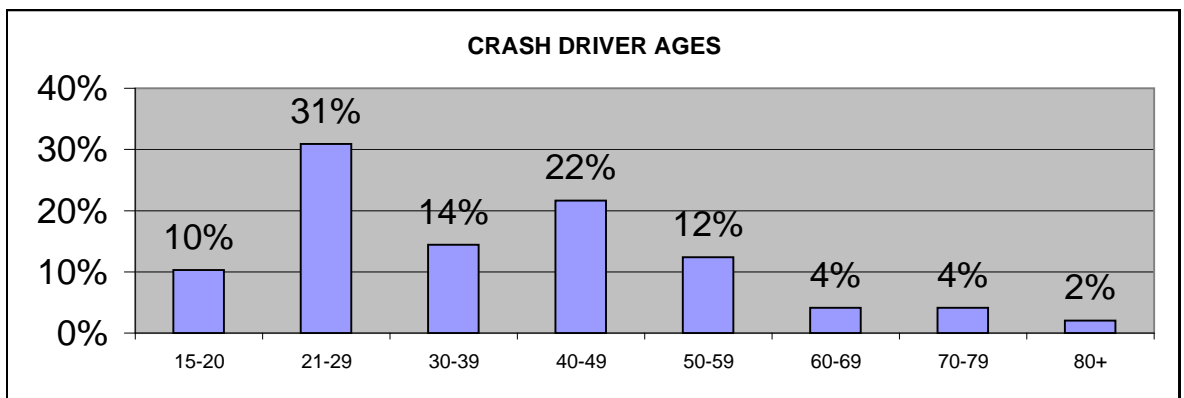
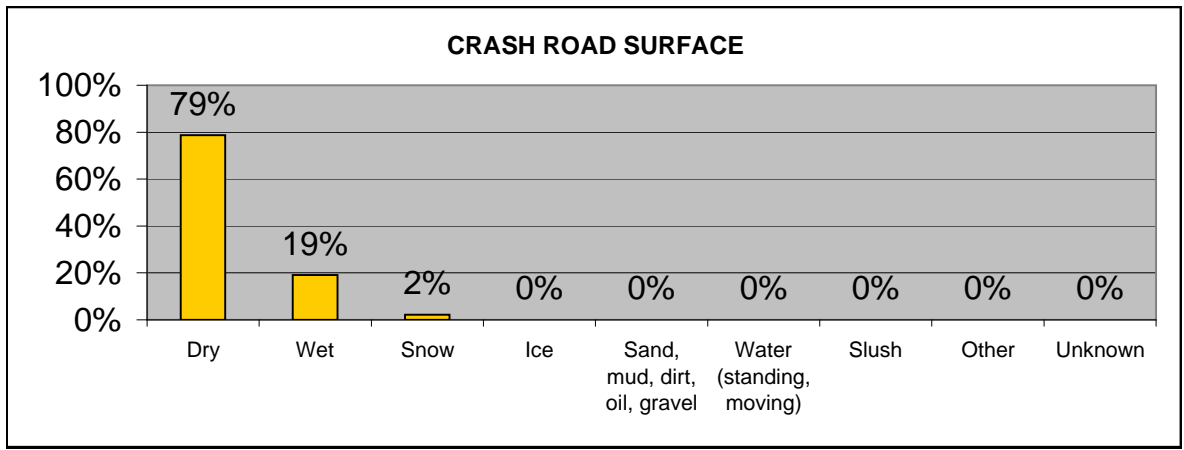
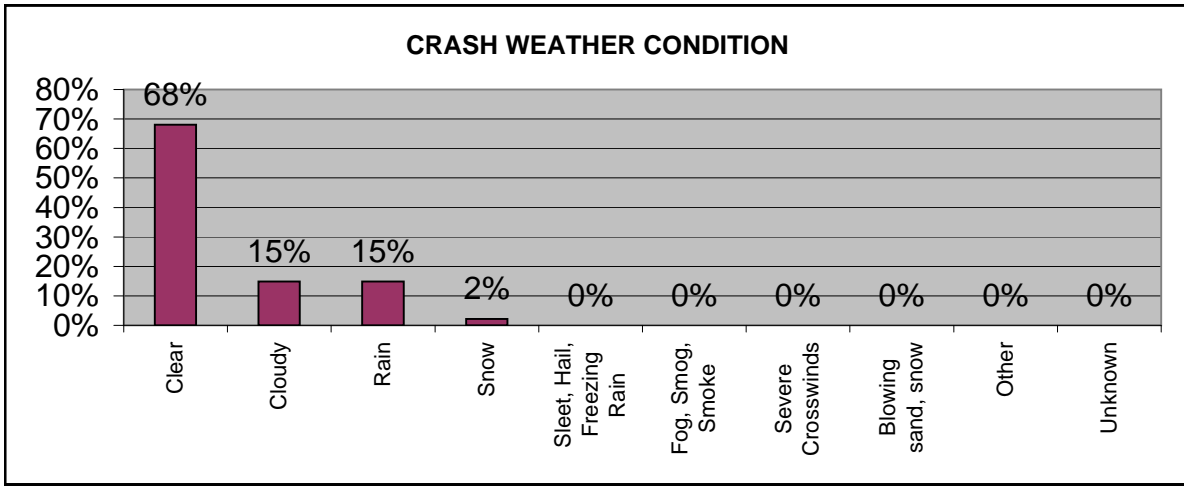
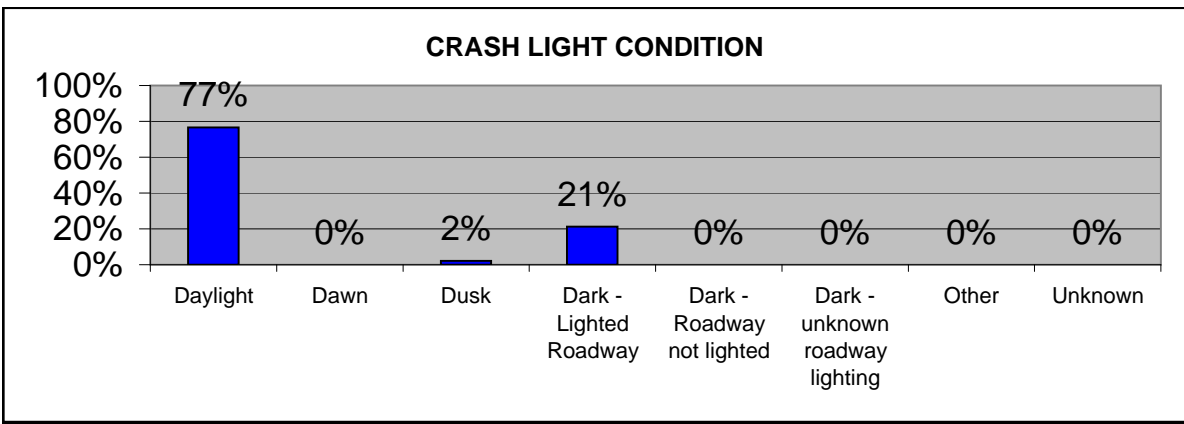
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	m/d/y								Type	Type	Type	Type		D1
53	5/8/10	Saturday	10:04 AM	Angle	Daylight	Rain	Wet	Failed to yield to right of way		47	30			
54	5/24/10	Monday	5:10 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	44	44				Vehicle 2 failed to yield to right of way
55	5/27/10	Thursday	2:07 PM	Angle	Daylight	Clear	Dry	Inattention	45	61				Vehicle 2 failed to yield to right of way
56	5/30/10	Sunday	11:45 AM											Incident report
57	6/15/10	Tuesday	7:39 PM											Incident report
58	6/30/10	Wednesday	3:25 PM	Angle	Daylight	Clear	Dry	Inattention	18	26				Vehicle 1 failed to stop at stop sign
59	8/9/10	Monday	2:46 PM	Head on	Daylight	Clear	Dry	Unknown	56	22				Vehicle 2 failed to stop at stop sign
60	8/13/10	Friday	4:52 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	46	41				NB driver claimed not to see stop sign
61	8/30/10	Monday	11:01 AM	Angle	Daylight	Clear	Dry	No Improper Driving	unk	23				Vehicle 1 failed to yield to right of way and fled the scene
62	9/2/10	Thursday	4:48 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	31	19				Vehicle 2 (at stop sign) thought that Vehicle 1 was letting him/her go
63	10/10/10	Sunday	2:40 AM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	18	49				Operator 1 thought intersection was a 4-way stop and that Vehicle 2 would stop
64	12/20/10	Monday	12:12 AM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	59	57				Vehicle 2 claims to have not seen any on coming traffic

Summary based on Crash Reports obtained from the Brockton Police Department and the RMV.

Crash Data Summary Tables and Charts
 Intersection West Elm Street and Ash Street; Brockton, MA

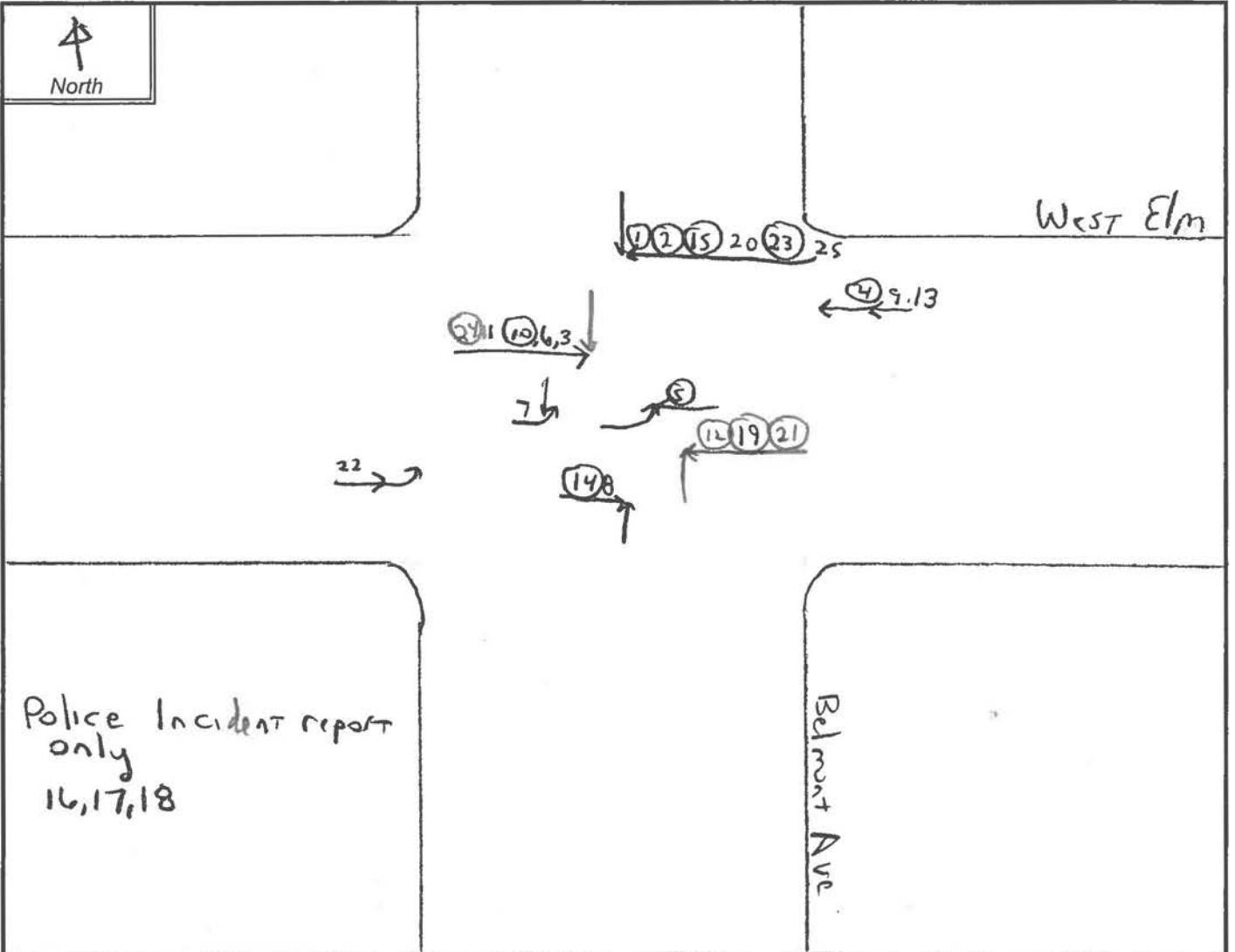


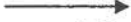















Crash Data Summary Tables and Charts
 Intersection West Elm Street and Ash Street; Brockton, MA



COLLISION DIAGRAM

CITY/TOWN: Brockton DATE PREPARED: 9-27-12
 REGION: OCPC PREPARED BY: BSP
 ROADWAY NAMES: West Elm St - Belmont Ave
 TIME PERIOD ANALYZED: 1/1/2008 - 12/31/2010
 SOURCE OF CRASH REPORTS: Brockton Police



SYMBOLS	TYPES OF CRASH	SEVERITY
 Moving Vehicle  Backing Vehicle  Non-Involved Vehicle  Pedestrian  Parked Vehicle  Fixed Object  Bicycle  Animal	 Head On  Angle  Turning Move  Rear End  Sideswipe  Out of Control	 Injury Accident  Fatal Accident

EPDO = 73

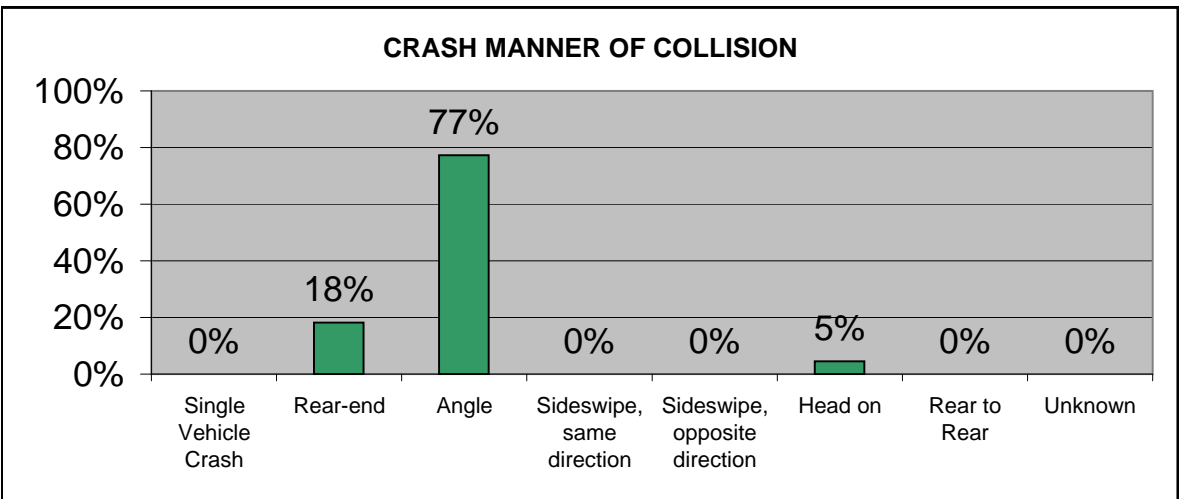
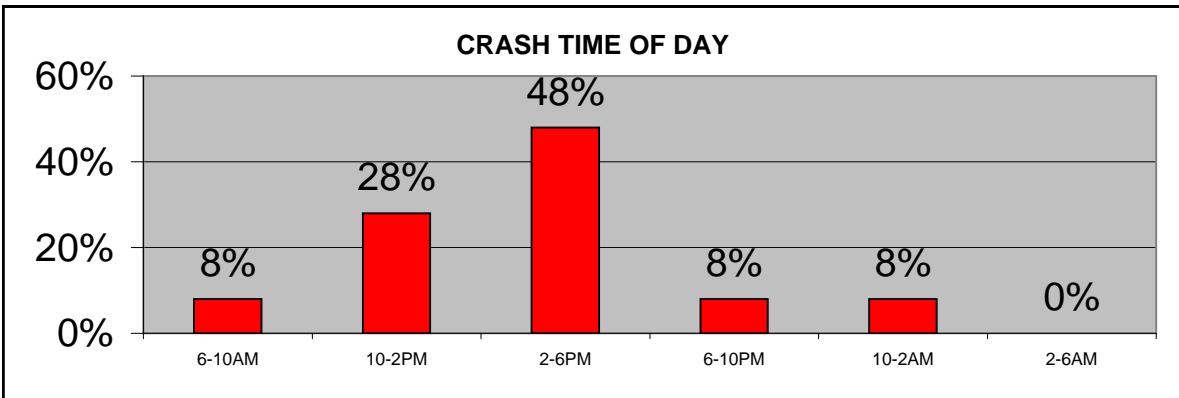
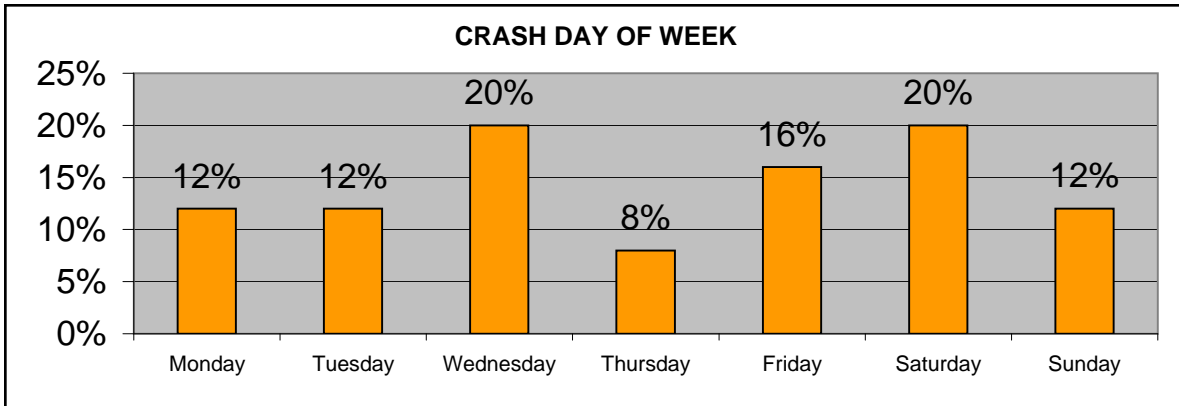
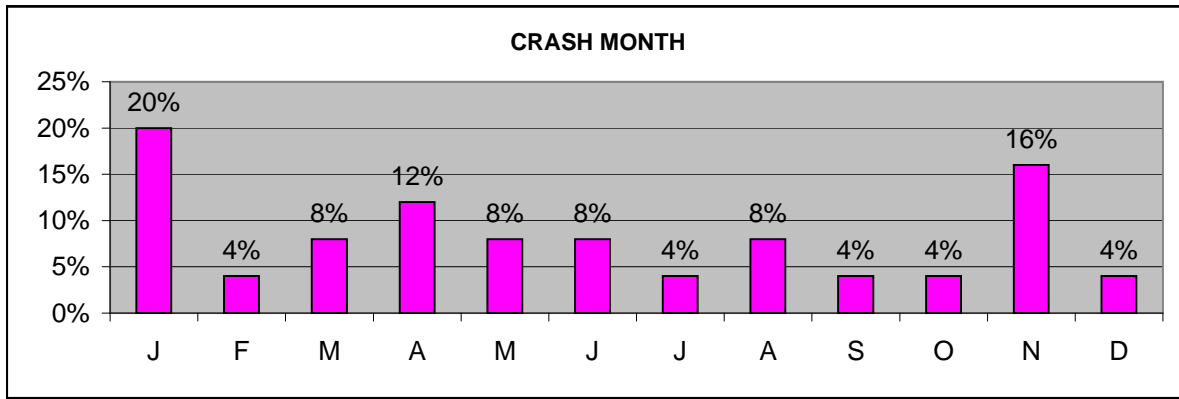
Crash Data Summary Table

Intersection of West Elm Street and Belmont Avenue; Brockton, MA
January 1, 2008 - December 31, 2010

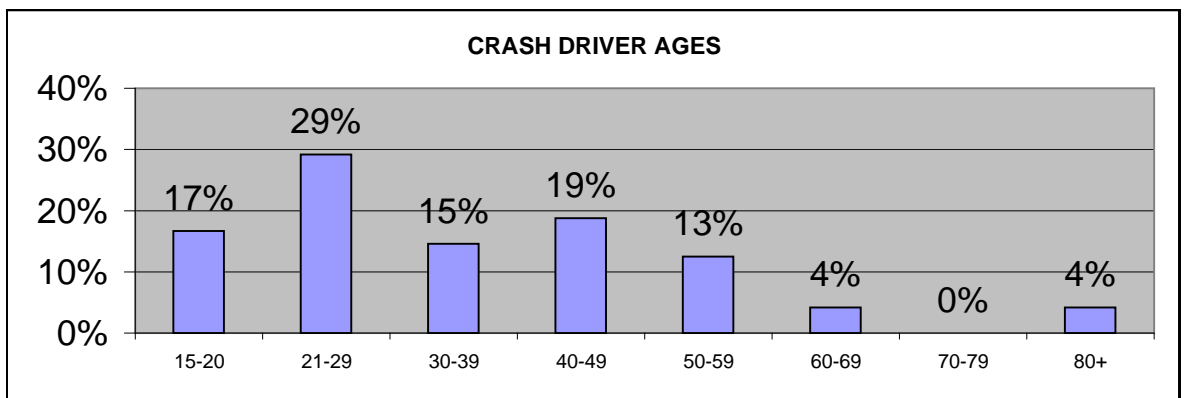
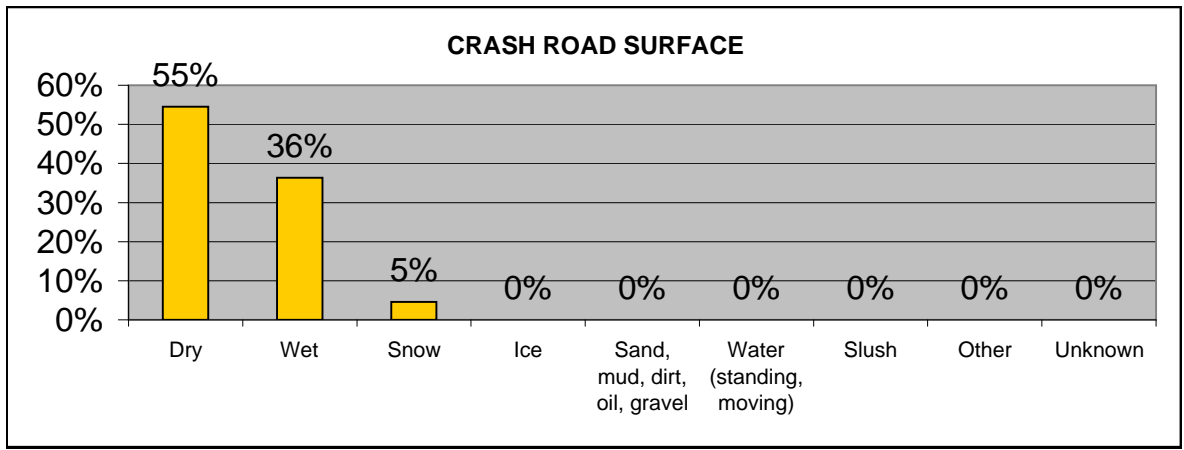
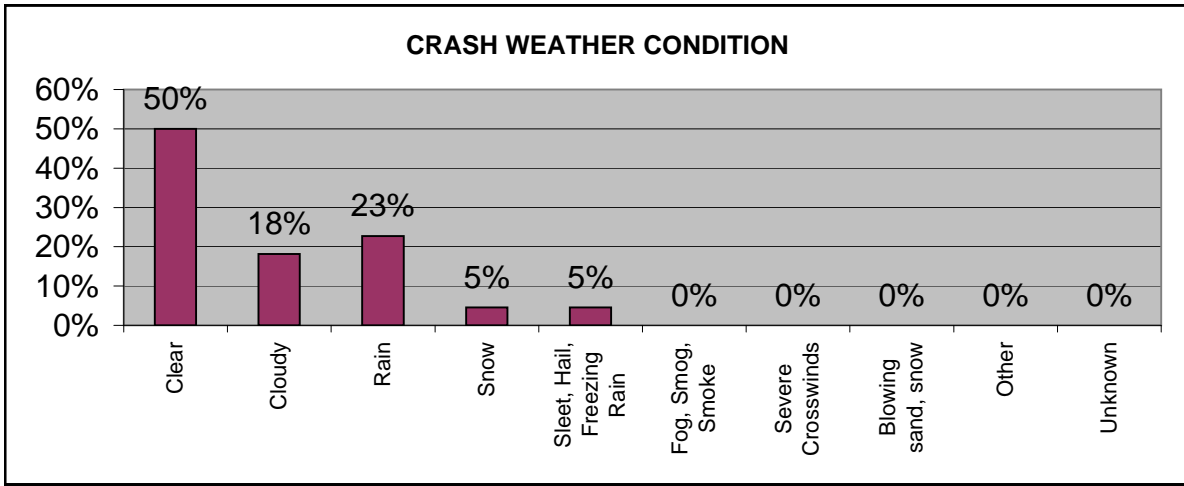
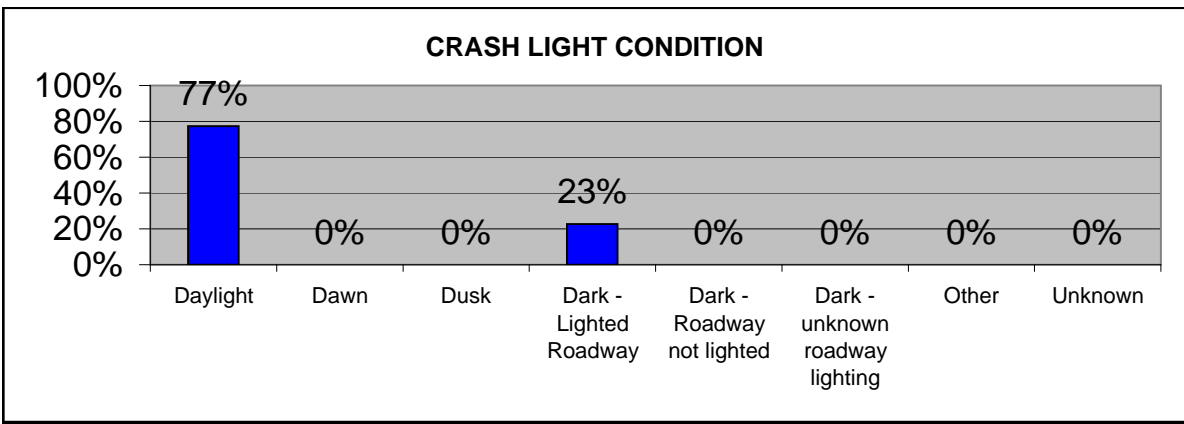
#	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Ages				Comments
	m/d/y								Type	Type	Type	Type	
1	1/16/08	Wednesday	10:04 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	25	19			Vehicle 2 claims to have not seen any on coming traffic
2	1/19/08	Saturday	12:50 PM	Angle	Daylight	Cloudy	Dry	Failed to yield to right of way	86	26			Vehicle 2 failed to yield for Vehicle 1
3	2/1/08	Friday	12:19 PM	Angle	Daylight	Sleet, Hail, Freezing Rain	Wet	Failed to yield to right of way	63	38			Vehicle 2 claims to have not seen any on coming traffic
4	5/20/08	Tuesday	2:49 PM	Rear-end	Daylight	Clear	Dry	Inattention	38	39	41		***No narrative or diagram provided
5	6/3/08	Tuesday	5:24 PM	Head on	Daylight	Clear	Dry	Failed to yield to right of way	68	19			Vehicle 2 failed to yield for Vehicle 1 (motorcycle) while making a left turn
6	12/11/08	Thursday	11:38 AM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	21	39	23		
7	1/4/09	Sunday	9:37 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	32	52			Operator 2 (at stop sign) "was a little blinded by the sun"
8	3/1/09	Sunday	10:20 PM	Angle	Dark - lighted roadway	Snow	Snow	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	25	45			Vehicle 1's brakes were not working properly
9	5/8/09	Friday	9:29 PM	Rear-end	Dark - lighted roadway	Clear	Dry	Followed too closely	19	31			
10	6/5/09	Friday	2:22 PM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	17	19			
11	7/14/09	Tuesday	4:10 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	43	29			Vehicle 2 failed to yield for Vehicle 1 (motorcycle)
12	8/29/09	Saturday	9:25 AM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	41	51			
13	9/2/09	Wednesday	3:22 PM	Rear-end	Daylight	Clear	Dry	Distracted	55	24			vehicle stopped for a school bus and was rear-ended by a driver who was looking up a phone number on his phone
14	10/19/09	Monday	5:19 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	22	45			
15	11/5/09	Thursday	5:09 PM	Angle	Dark - lighted roadway	Cloudy	Dry	Failed to yield to right of way	39	41	47	28	
16	11/25/09	Wednesday	5:26 PM										Incident Report
17	11/27/09	Friday	1:43 PM										Incident Report
18	1/9/10	Saturday	12:51 PM										Incident Report
19	1/25/10	Monday	3:44 PM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	54	21			
20	3/22/10	Monday	2:27 PM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	49	17			
21	4/3/10	Saturday	4:15 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	57	20			
22	4/4/10	Sunday	4:32 PM	Rear-end	Daylight	Clear	Unknown	Followed too closely	88	17			
23	4/10/10	Saturday	9:34 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	20	27			Vehicle 1 failed to stop at stop sign
24	8/25/10	Wednesday	11:28 PM	Angle	Dark - lighted roadway	Cloudy	Wet	Failed to yield to right of way	21	51			Operator 1 though he/she had enough space to proceed across intersection.
25	11/10/10	Wednesday	12:59 PM	Angle	Daylight	Cloudy	Wet	Failed to yield to right of way	19	42			Vehicle 2 claims to have not seen any on coming traffic

Summary based on Crash Reports obtained from the Brockton Police Department and the RMV.

Crash Data Summary Tables and Charts
 Intersection West Elm St and Belmont Ave; Brockton, MA

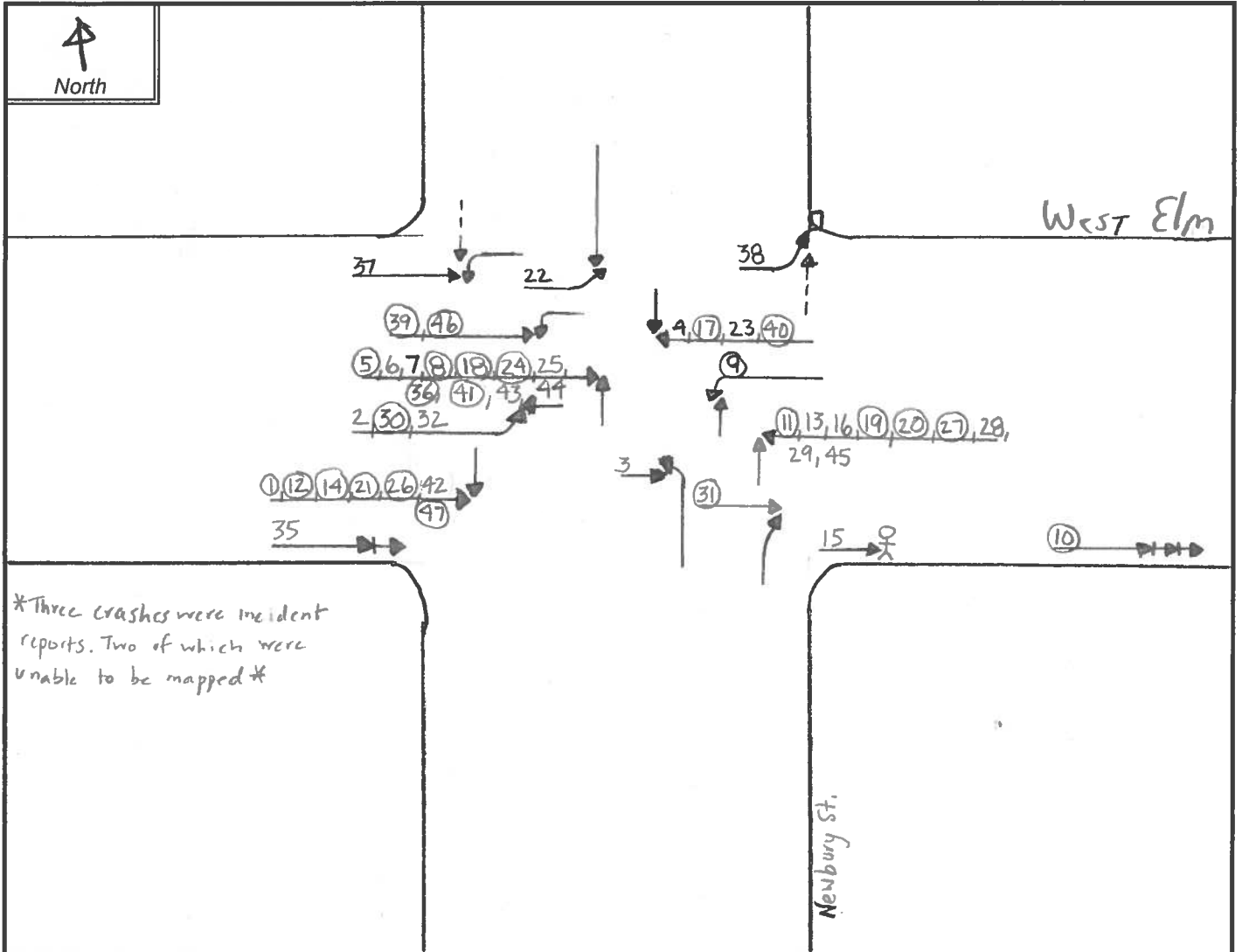


Crash Data Summary Tables and Charts
 Intersection West Elm St and Belmont Ave; Brockton, MA



COLLISION DIAGRAM

CITY/TOWN: Brockton DATE PREPARED: 9-27-12
 REGION: OCPC PREPARED BY: BSP
 ROADWAY NAMES: West Elm St / Newbury St.
 TIME PERIOD ANALYZED: 1/1/2008 - 12/31/2010
 SOURCE OF CRASH REPORTS: Brockton Police



SYMBOLS		TYPES OF CRASH		SEVERITY
	Moving Vehicle		Head On	
	Backing Vehicle		Angle	
	Non-Involved Vehicle		Turning Move	
	Pedestrian		Rear End	
	Parked Vehicle		Sideswipe	
	Fixed Object		Out of Control	
	Bicycle			
	Animal			

Crash Data Summary Table

Intersection of West Elm Street and Newbury Street; Brockton, MA

January 1, 2008 - December 31, 2010

#	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Ages				Comments
	m/d/y								D1	D2	D3	D4	
				Type	Type	Type	Type	Type					
1	1/9/08	Wednesday	7:43 AM	Angle	Daylight	Cloudy	Wet	Failed to yield to right of way	38	47	unk		Vehicle 1 failed to stop at stop sign. Vehicle 1 hit Vehicle 2 which then ran off road and hit a parked vehicle (Vehicle 3)
2	2/12/08	Tuesday	4:04 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	50	16	19		Vehicle 3 failed to yield to Vehicle 2. Vehicle 2 hit Vehicle 3 which then hit Vehicle 1.
3	2/24/08	Sunday	12:26 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	42	29			
4	3/4/08	Tuesday	3:42 PM	Angle	Dusk	Rain	Wet	Failed to yield to right of way	27	48			
5	4/10/08	Thursday	8:43 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	47	23			Vehicle 1 failed to yield for Vehicle 2. Operator 1 claims that Vehicle 2 did not have headlights on. Fire department claims that Vehicle 2's headlights were on when responding to scene
6	4/27/08	Sunday	10:21 AM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	29	51			Vehicle 2 failed to stop at stop sign
7	6/7/08	Saturday	12:38 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	48	43			Vehicle 1 failed to stop at stop sign
8	6/22/08	Sunday	8:59 PM	Angle	Dark - lighted roadway	Rain	Wet	Failed to yield to right of way	17	39			Vehicle 2 failed to yield for Vehicle 1
9	8/27/08	Wednesday	3:54 PM	Angle	Daylight	Clear	Dry	Made an improper turn	48	19			Vehicle 1 made contact with Vehicle 2 (which was stopped at stop sign) while making left turn
10	9/17/08	Wednesday	9:58 AM	Rear-end	Daylight	Clear	Dry	Followed too closely	48	58	62		Operator 1 claims that sun was in his/her eyes. Vehicle 1 rear-ended Vehicle 2 which then rear-ended Vehicle 3
11	10/1/08	Wednesday	6:11 PM	Angle	Dusk	Cloudy	Dry	Failed to yield to right of way	66	22	39		
12	10/31/08	Friday	10:38 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	65	44			Vehicle 1 failed to yield for Vehicle 2
13	10/31/08	Friday	3:30 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	30	49			Vehicle 1 stopped at stop sign then proceeded into Vehicle 2
14	11/15/08	Saturday	2:42 PM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	20	25			Vehicle 1 failed to yield for Vehicle 2
15	1/29/09	Thursday	11:46 AM	Head on	Daylight	Clear	Wet	No Improper Driving	24				Hit a 95 year old pedestrian
16	5/6/09	Wednesday	10:29 PM	Angle	Dark - lighted roadway	Clear	Dry	Disregarded traffic signs, signals, road markings	49	19			Vehicle 2 failed to stop at stop sign
17	5/12/09	Tuesday	4:18 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	24	62	67		Vehicle 1 failed to stop at stop sign, hit Vehicle 2 which then hit Vehicle 3
18	5/14/09	Thursday	2:33 PM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	28	25			Vehicle 1 stopped at stop sign then proceeded into Vehicle 2
19	5/24/09	Sunday	3:31 PM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	17	35			Crash occurred during a severe thunderstorm & visibility was poor
20	6/1/09	Monday	2:35 PM	Sideswipe, opposite direction	Daylight	Clear	Dry	Inattention	71	20			
21	6/6/09	Saturday	7:13 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	20	38			Vehicle 2 failed to yield for Vehicle 1
22	7/7/09	Tuesday	6:30 PM						45	unk			Incident Report
23	10/5/09	Monday	3:46 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	unk	43			Vehicle 2 (at stop sign) did not see Vehicle 1
24	10/13/09	Tuesday	9:06 AM	Angle	Daylight	Rain	Wet	No Improper Driving	37	38			
25	10/17/09	Saturday	1:50 PM	Angle	Daylight	Cloudy	Dry	Failed to yield to right of way	40	66			Vehicle 1 failed to stop at stop sign
26	11/14/09	Saturday	2:47 PM	Angle	Daylight	Rain	Wet	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	40	20			Vehicle did not stop at stop sign
27	11/24/09	Tuesday	4:32 PM	Angle	Dark - lighted roadway	Rain	Wet	Failed to yield to right of way	43	55			Vehicle did not stop at stop sign
28	1/8/10	Friday	3:32 PM	Angle	Dusk	Snow	Wet	Inattention	43	54			
29	1/12/10	Tuesday	1:50 PM	Angle	Daylight	Cloudy	Dry	Failed to yield to right of way	50	26			Vehicle 2 (at stop sign) did not see Vehicle 1
30	1/16/10	Saturday	5:44 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield to right of way	29	40	17		Vehicle 2 failed to yield while turning left. Vehicle 1 hit Vehicle 2 which then hit Vehicle 3.
31	2/13/10	Saturday	10:58 AM	Angle	Daylight	Clear	Dry	No Improper Driving	21	52			Vehicle mailed citation for not stopping at the stop sign
32	2/21/10	Sunday	1:48 PM	Sideswipe, opposite direction	Daylight	Clear	Dry	Distracted	29	47			
33	3/22/10	Monday	12:20 PM										Incident Report
34	3/23/10	Tuesday	1:41 PM										Incident Report
35	4/16/10	Friday	2:59 PM	Rear-end	Daylight	Rain	Wet	Operating defective equipment	22	60			
36	5/9/10	Sunday	9:32 AM	Sideswipe, opposite direction	Daylight	Clear	Dry	Inattention	23	35			Vehicle 2 (at stop sign) claims to have not been able to see any oncoming vehicles
37	5/13/10	Thursday	2:12 PM	Sideswipe, opposite direction	Daylight	Clear	Dry	Failed to yield to right of way	27	30	52		Vehicle swerved to avoid hitting a non-involved vehicle heading SB on Newbury St that unsafely proceeded into traffic
38	5/15/10	Saturday	1:37 AM	Single Vehicle Crash	Dark - lighted roadway	Clear	Wet	No Improper Driving	27				Vehicle swerved to avoid an unknown vehicle that did not stop at stop sign causing it to hit fire hydrant
39	5/19/10	Wednesday	8:27 AM	Angle	Daylight	Rain	Wet	Failed to yield to right of way	24	20	unk		Unknown vehicle hit Vehicle 2 which then hit Vehicle 1. Vehicle 2 failed to yield to unknown vehicle, unknown vehicle fled the scene
40	5/25/10	Tuesday	3:18 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	26	27			Vehicle may not have stopped at the stop sign
41	7/27/10	Tuesday	8:20 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	25	29			
42	9/12/10	Sunday	8:29 PM	Angle	Dark - lighted roadway	Clear	Dry	Disregarded traffic signs, signals, road markings	46	28			Vehicle 2 failed to stop at stop sign
43	9/15/10	Wednesday	3:57 PM	Sideswipe, opposite direction	Daylight	Clear	Dry	Inattention	33	52			

Crash Data Summary Table

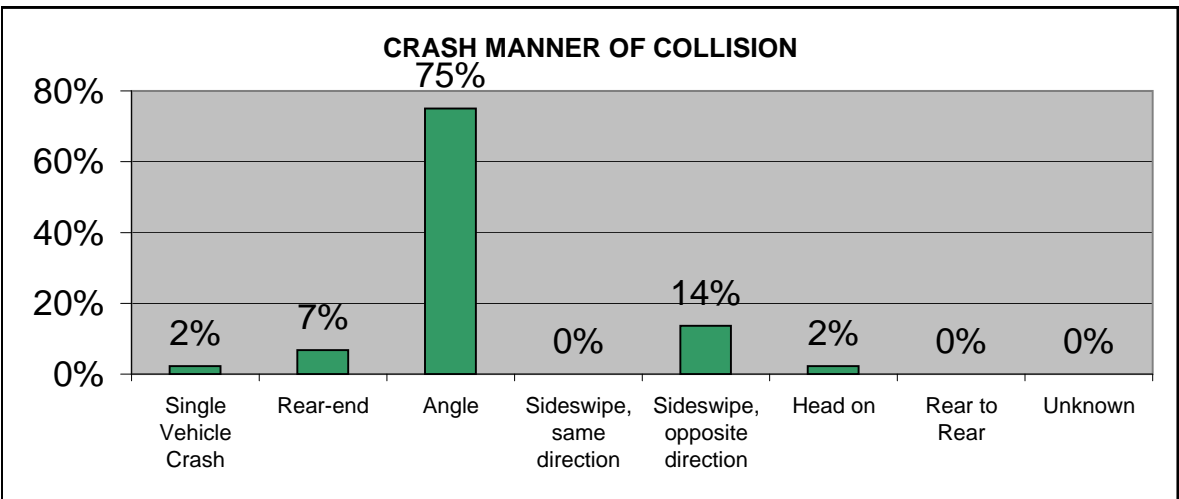
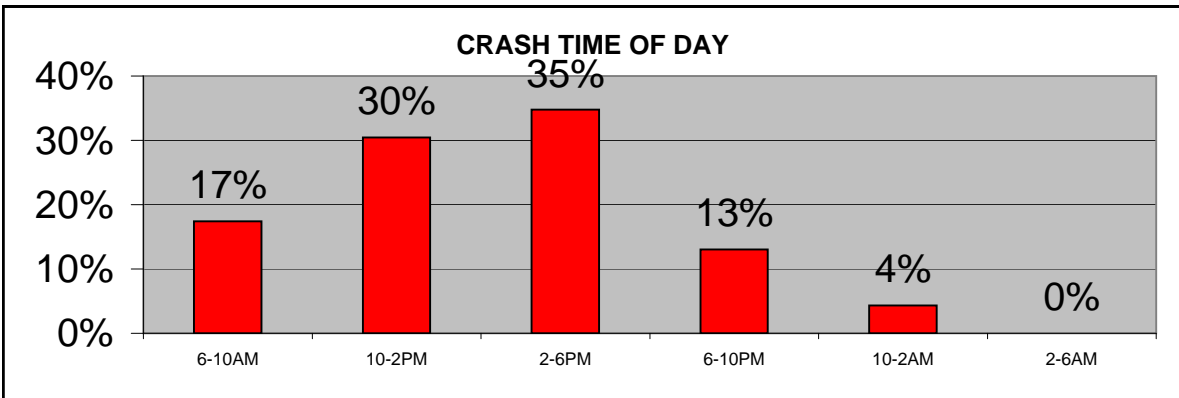
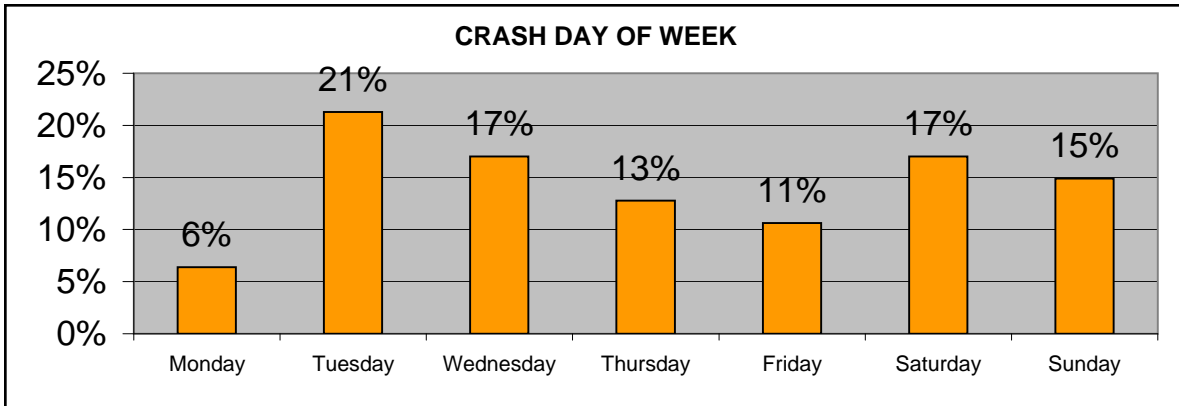
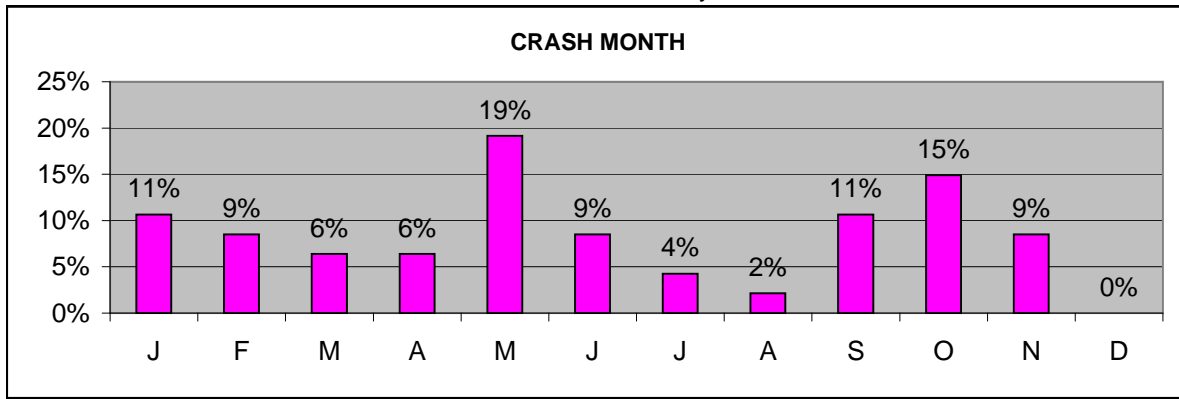
Intersection of West Elm Street and Newbury Street; Brockton, MA

January 1, 2008 - December 31, 2010

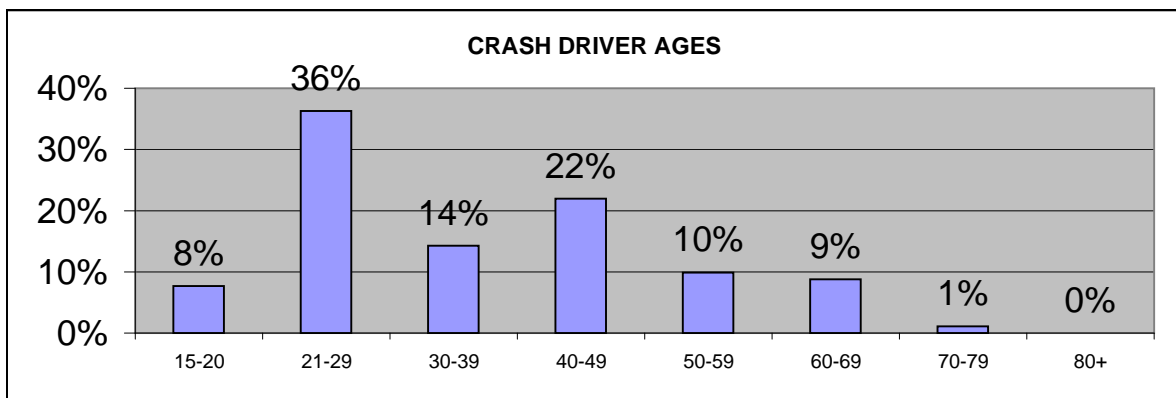
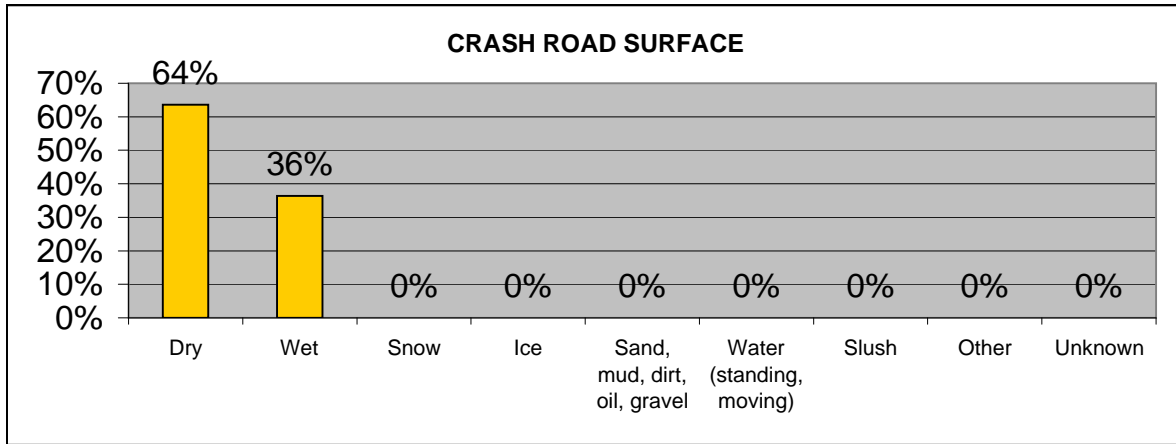
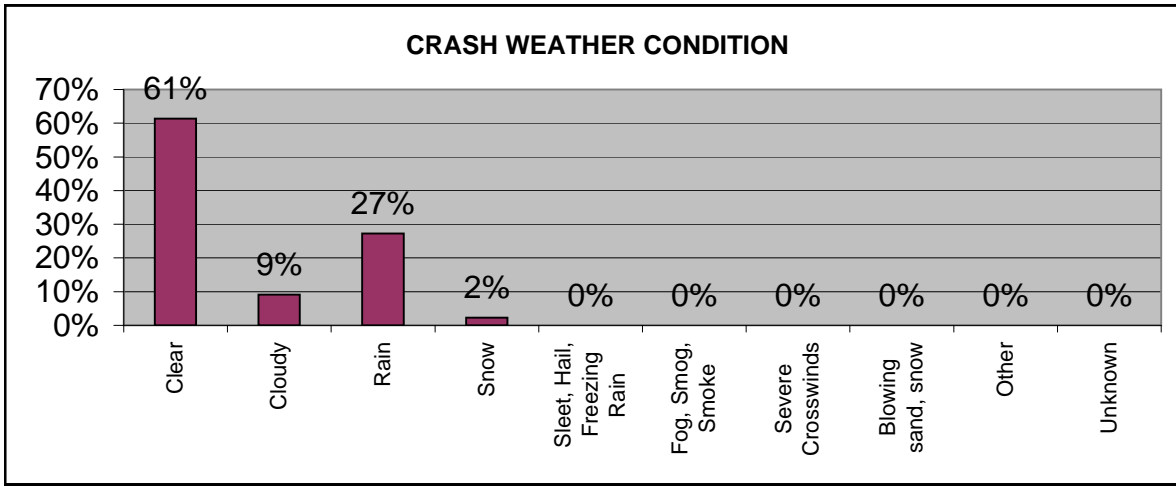
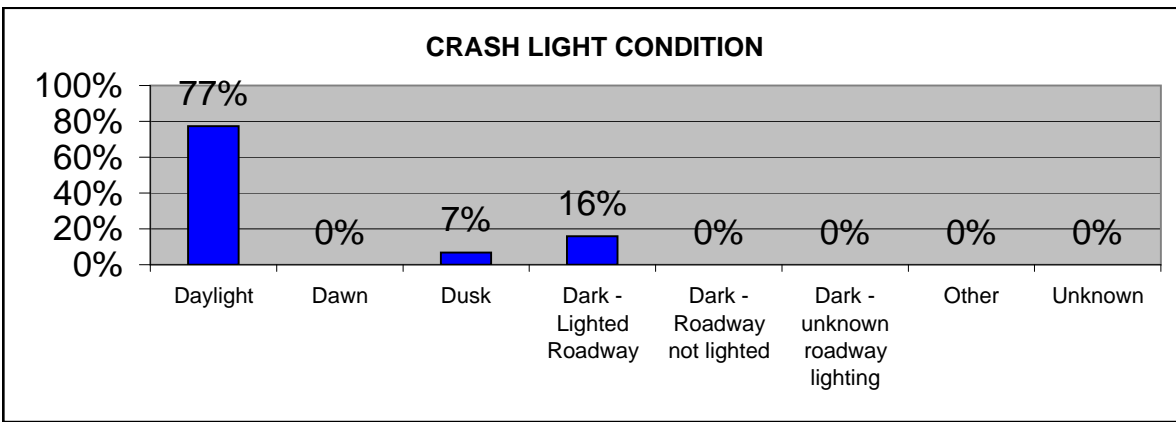
#	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Ages				Comments
	<i>m/d/y</i>								<i>Type</i>	<i>Type</i>	<i>Type</i>	<i>Type</i>	
44	9/16/10	Thursday	12:20 PM	Angle	Daylight	Clear	Dry	Inattention	36	22			Vehicle 2 (at stop sign) did not see any oncoming vehicles
45	9/22/10	Wednesday	8:52 AM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	32	unk			Operator 2 claims crossing guard waived him/her on from stop sign into Vehicle 1. Both crossing guard and Operator 1 deny Operator 2's claim
46	10/7/10	Thursday	7:32 AM	Rear-end	Daylight	Clear	Dry	Failed to yield to right of way	25	24			Vehicle 1 failed to yield while turning left. Operator 1 claims Vehicle 2 was speeding.
47	11/5/10	Friday	11:34 AM	Sideswipe, opposite direction	Daylight	Rain	Wet	Inattention	20	61			Vehicle 2 did not make a complete stop at stop sign

Summary based on Crash Reports obtained from the Brockton Police Department and the RMV.

Crash Data Summary Tables and Charts
 Intersection West Elm Street and Newbury Street; Brockton, MA

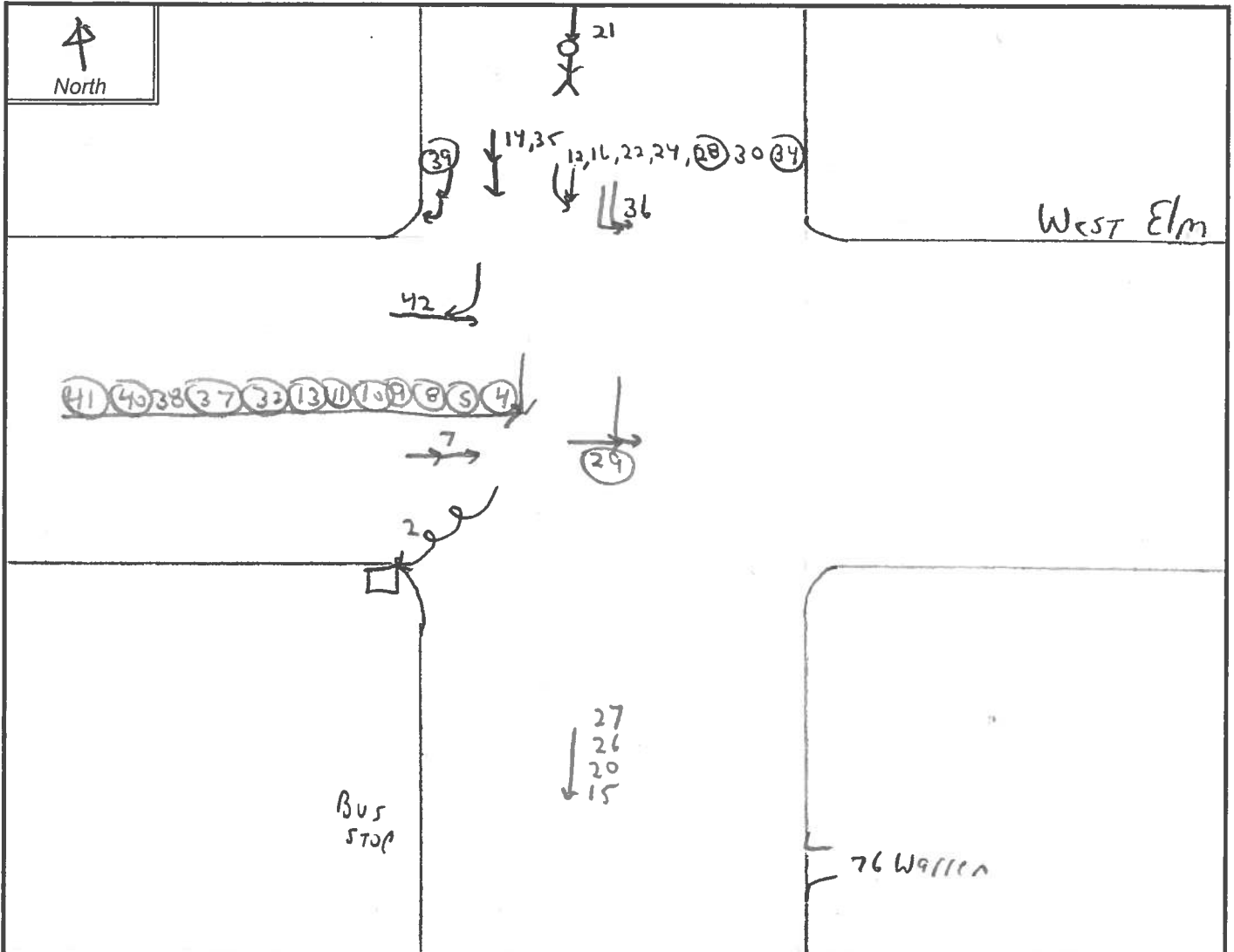
















Crash Data Summary Tables and Charts
 Intersection West Elm Street and Newbury Street; Brockton, MA



COLLISION DIAGRAM

CITY/TOWN: Brockton DATE PREPARED: 9-27-12
 REGION: OCPC PREPARED BY: BSP
 ROADWAY NAMES: West Elm St - Warren Ave
 TIME PERIOD ANALYZED: 1/1/2008 - 12/31/2010
 SOURCE OF CRASH REPORTS: Brockton Police



SYMBOLS		TYPES OF CRASH		SEVERITY
	Moving Vehicle		Head On	○ Injury Accident
	Backing Vehicle		Angle	
	Non-Involved Vehicle		Turning Move	○ Fatal Accident
	Pedestrian		Rear End	
	Parked Vehicle		Sideswipe	
	Fixed Object		Out of Control	
	Bicycle			
	Animal			

Crash Data Summary Table

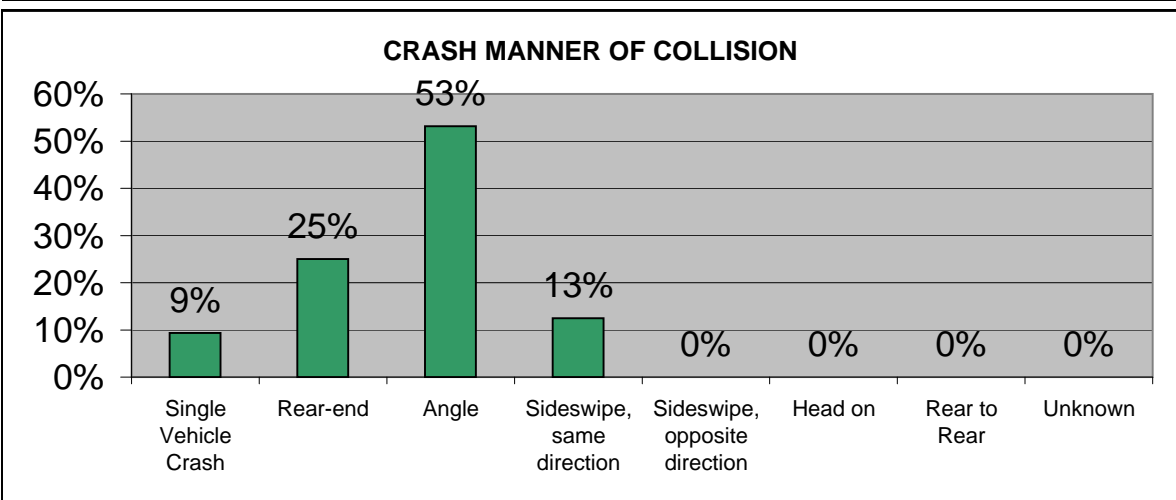
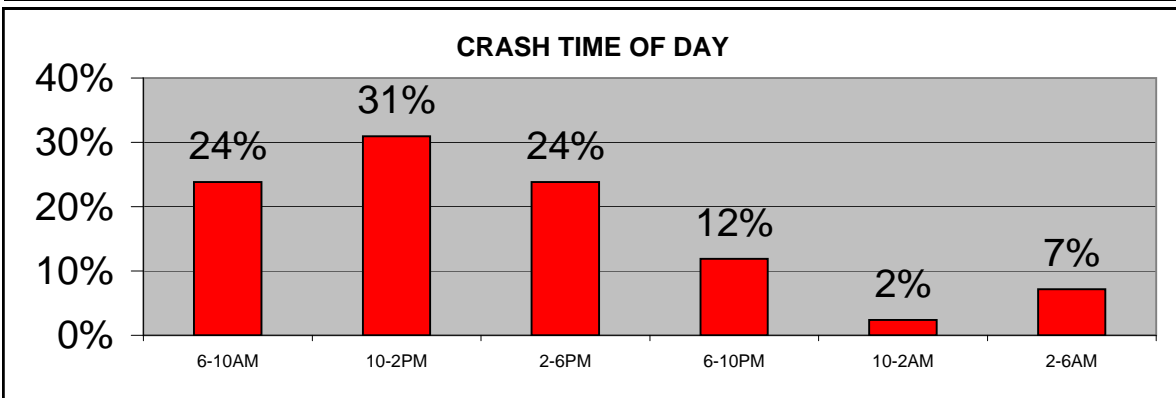
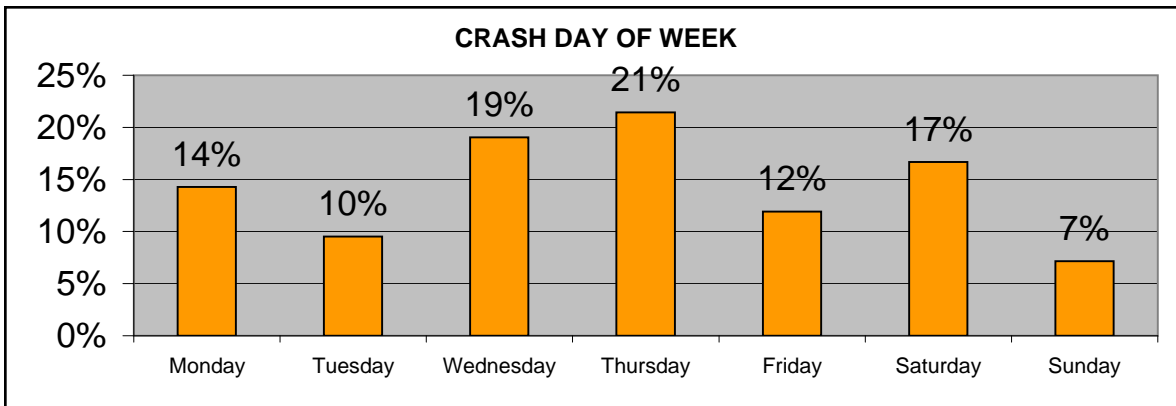
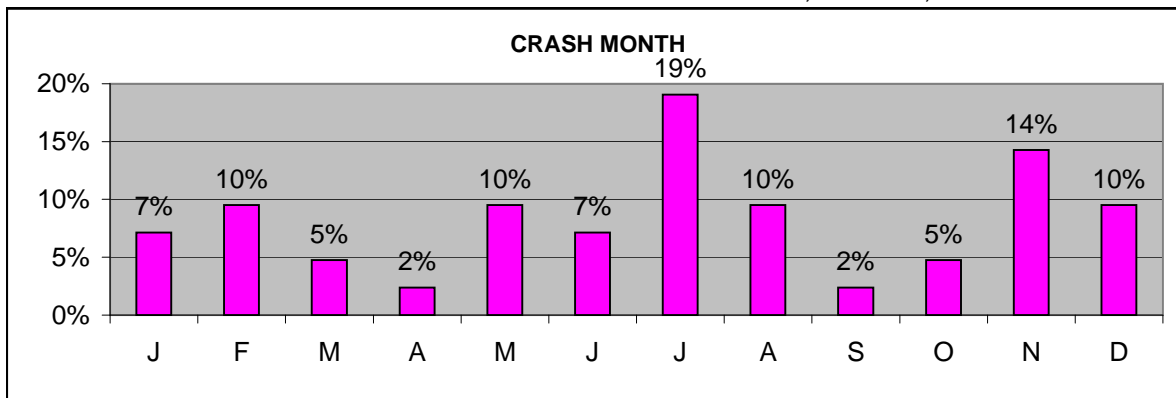
Intersection of West Elm Street and Warren Avenue; Brockton, MA

January 1, 2008 - January 1, 2011

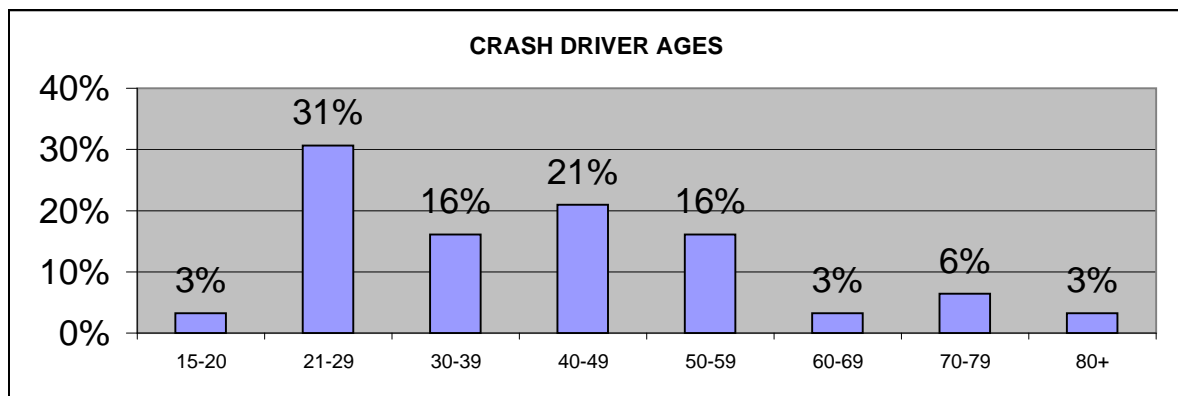
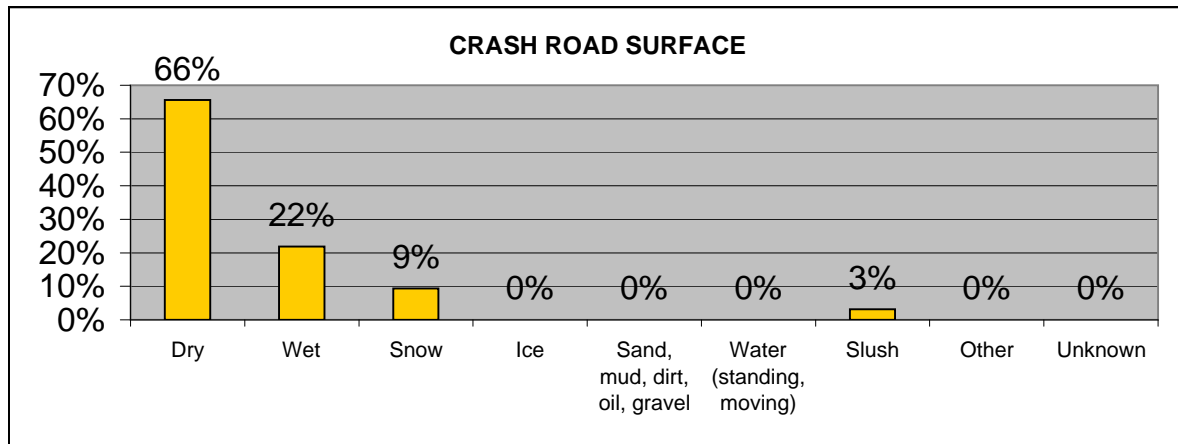
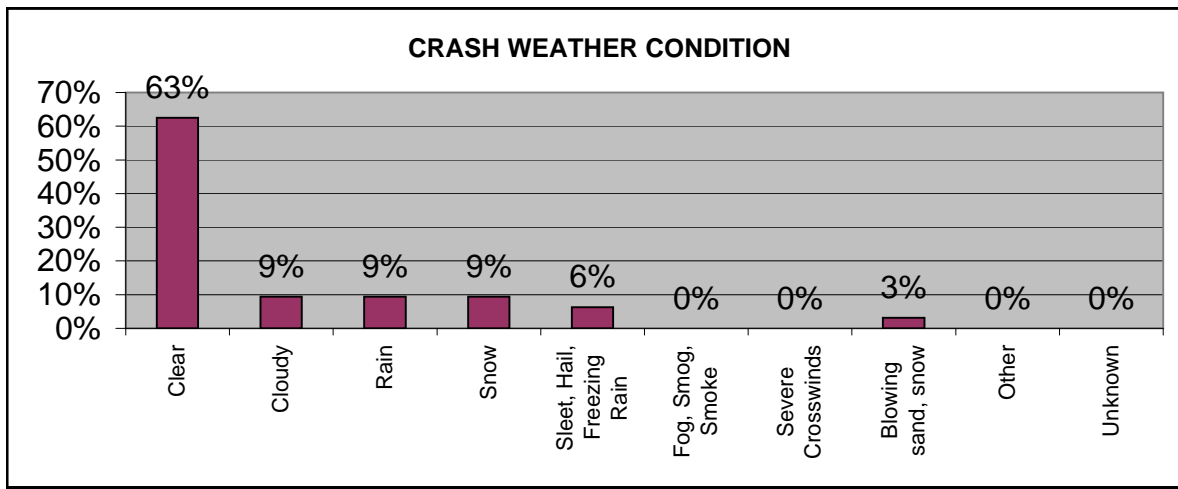
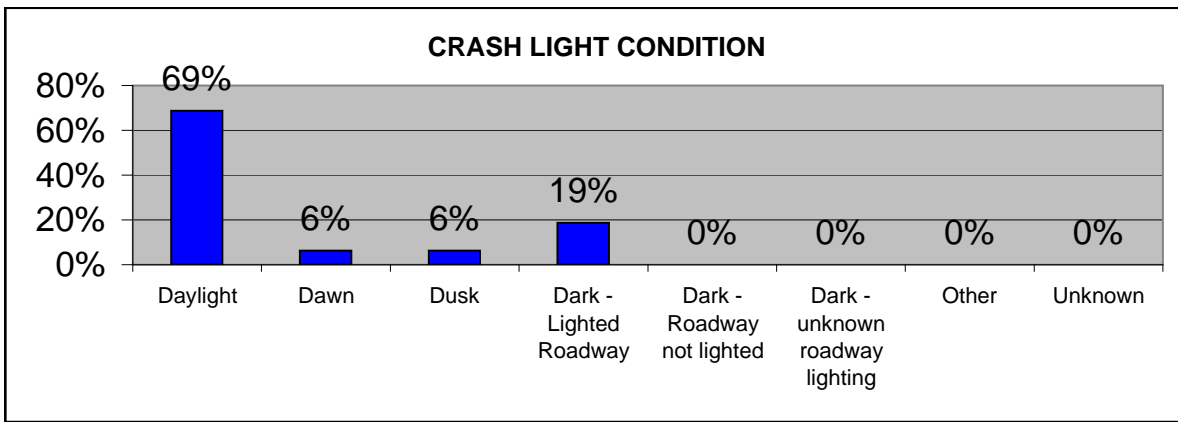
#	Crash Date m/d/y	Crash Day	Time of Day	Manner of Collision Type	Light Condition Type	Weather Condition Type	Road Surface Type	Driver Contributing Code Type	Ages				Comments	
									D1	D2	D3	D4		
1	2/22/08	Friday	10:00 AM											Incident report
2	7/3/08	Thursday	10:26 AM	Single Vehicle Crash	Daylight	Clear	Dry	Physical Impairment	57					Driver may have become ill & crashed into a traffic control pole
3	7/3/08	Thursday	10:36 AM											Incident report
4	7/21/08	Monday	6:10 AM	Angle	Dawn	Cloudy	Wet	Disregarded traffic signs, signals, road markings	23	61				Vehicle ran a red light on Warren according to witness
5	7/21/08	Monday	11:45 AM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	18	43				Vehicle ran a red light on Warren according to witness
6	9/16/08	Tuesday	7:28 AM											Incident report
7	10/23/08	Thursday	1:23 PM	Rear-end	Daylight	Clear	Dry	No Improper Driving	70	33				
8	11/9/08	Sunday	1:54 PM	Angle	Daylight	Clear	Dry	Unknown	43	46				Vehicle on Warren ran red light according to witness
9	11/14/08	Friday	8:11 AM	Angle	Daylight	Rain	Wet	Disregarded traffic signs, signals, road markings	56	50				Vehicle on Warren ran red light according to witness
10	11/15/08	Saturday	9:35 AM	Angle	Daylight	Rain	Wet	Other improper action	22	24				Vehicle on Warren ran red light according to witness
11	11/17/08	Monday	2:58 PM	Single Vehicle Crash	Dusk	Clear	Dry	No Improper Driving	54	23				Vehicle ran a red light, both operators claim to have had a green light
12	11/29/08	Saturday	12:23 PM	Sideswipe, same direction	Daylight	Clear	Dry	No Improper Driving	89	72				
13	12/17/08	Wednesday	7:18 AM	Angle	Dawn	Sleet, Hail, Freezing Rain	Slush	No Improper Driving	36	61				Vehicle ran a red light, both operators claim to have had a green light
14	2/3/09	Tuesday	6:15 PM	Rear-end	Dark - lighted roadway	Blowing Sand, Snow	Snow	No Improper Driving	41	52				driver claimed to have slid on snow
15	2/5/09	Thursday	11:05 AM	Rear-end	Daylight	Clear	Dry	No Improper Driving	39	48				Operator stopped short due to vehicle pulling out of parking lot at 76 Warren Avenue
16	2/7/09	Saturday	3:50 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	35	40				
17	4/28/09	Tuesday	2:05 PM											Incident report
18	5/2/09	Saturday	10:56 AM											Incident report - hit & run crash
19	5/5/09	Tuesday	9:25 AM											Incident report - BAT bus hit fire box
20	6/6/09	Saturday	9:05 PM	Rear-end	Dark - lighted roadway	Clear	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	35	22				Vehicle 2 was slowing to take a left turn south of West Elm when rear-ended by Vehicle 1
21	6/25/09	Thursday	4:28 PM	Single Vehicle Crash	Daylight	Clear	Dry	No Improper Driving	29					Hit a 46 year old pedestrian that was walking in between stopped vehicles in traffic
22	7/8/09	Wednesday	3:46 PM	Angle	Daylight	Cloudy	Dry	Failure to keep in proper lane or running off road	21	46				
23	8/5/09	Wednesday	9:14 AM											Incident report
24	8/26/09	Wednesday	12:24 PM	Angle	Daylight	Clear	Dry	Other improper action	30	35				
25	10/1/09	Thursday	1:35 PM											Incident report
26	11/2/09	Monday	5:34 PM	Rear-end	Dark - lighted roadway	Rain	Wet	Followed too closely	23	26				Vehicle 2 was stopped in traffic when rear-ended by Vehicle 1
27	12/9/09	Wednesday	5:50 AM	Rear-end	Daylight	Sleet, Hail, Freezing Rain	Snow	Followed too closely	56	44				Vehicle 1 slid on ice into Vehicle 2, a bus stopped at bus stop to pick up passengers
28	12/28/09	Monday	10:12 AM	Rear-end	Daylight	Cloudy	Wet	Made an improper turn	43	49				
29	1/1/10	Friday	5:14 AM	Angle	Dark - lighted roadway	Snow	Wet	Failed to yield to right of way	27	19				Vehicle made unsafe left on red
30	1/8/10	Friday	6:33 AM	Angle	Daylight	Clear	Dry	Unknown	32	46				Vehicle 2 (sanding truck actively sanding street) was straddling lanes and turned left. Vehicle 1, traveling at a high rate of speed, struck Vehicle 2
31	1/16/10	Saturday	12:30 PM											Incident report
32	3/4/10	Thursday	5:53 AM	Angle	Daylight	Snow	Wet	Unknown	23	32				Vehicle ran a red light, both operators claim to have had a green light
33	3/10/10	Wednesday	3:51 PM											incident report
34	5/13/10	Thursday	7:09 PM	Sideswipe, same direction	Daylight	Clear	Dry	Unknown	21	20				
35	5/15/10	Saturday	3:51 PM	Rear-end	Daylight	Clear	Dry	Inattention	20	45				
36	6/2/10	Wednesday	9:39 AM	Sideswipe, same direction	Daylight	Clear	Dry	Inattention	53	71				
37	7/7/10	Wednesday	7:25 PM	Angle	Dusk	Clear	Dry	Unknown	21	73				
38	7/18/10	Sunday	4:31 PM	Angle	Daylight	Clear	Dry	Failed to yield to right of way	58	42				Vehicle on Warren SB ran a red light
39	7/19/10	Monday	8:19 PM	Sideswipe, same direction	Dark - lighted roadway	Clear	Dry	Disregarded traffic signs, signals, road markings	53	28				Vehicle 1 suddenly changed lanes causing Vehicle 2 (motorcycle) to crash into the ground
40	8/27/10	Friday	5:01 PM	Angle	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	29	50				witness stated driver on West Elm ran red light
41	8/29/2010	Sunday	1:02 AM	Angle	Dark - lighted roadway	Clear	Dry	Physical Impairment	23	28				Vehicle 1 ran a red light and was OUI
42	12/23/10	Thursday	9:08 AM	Angle	Daylight	Snow	Snow	Physical Impairment	81	36				Vehicle turning right from warren crossed center line and struck EB vehicle

Summary based on Crash Reports obtained from the Brockton Police Department and the RMV.

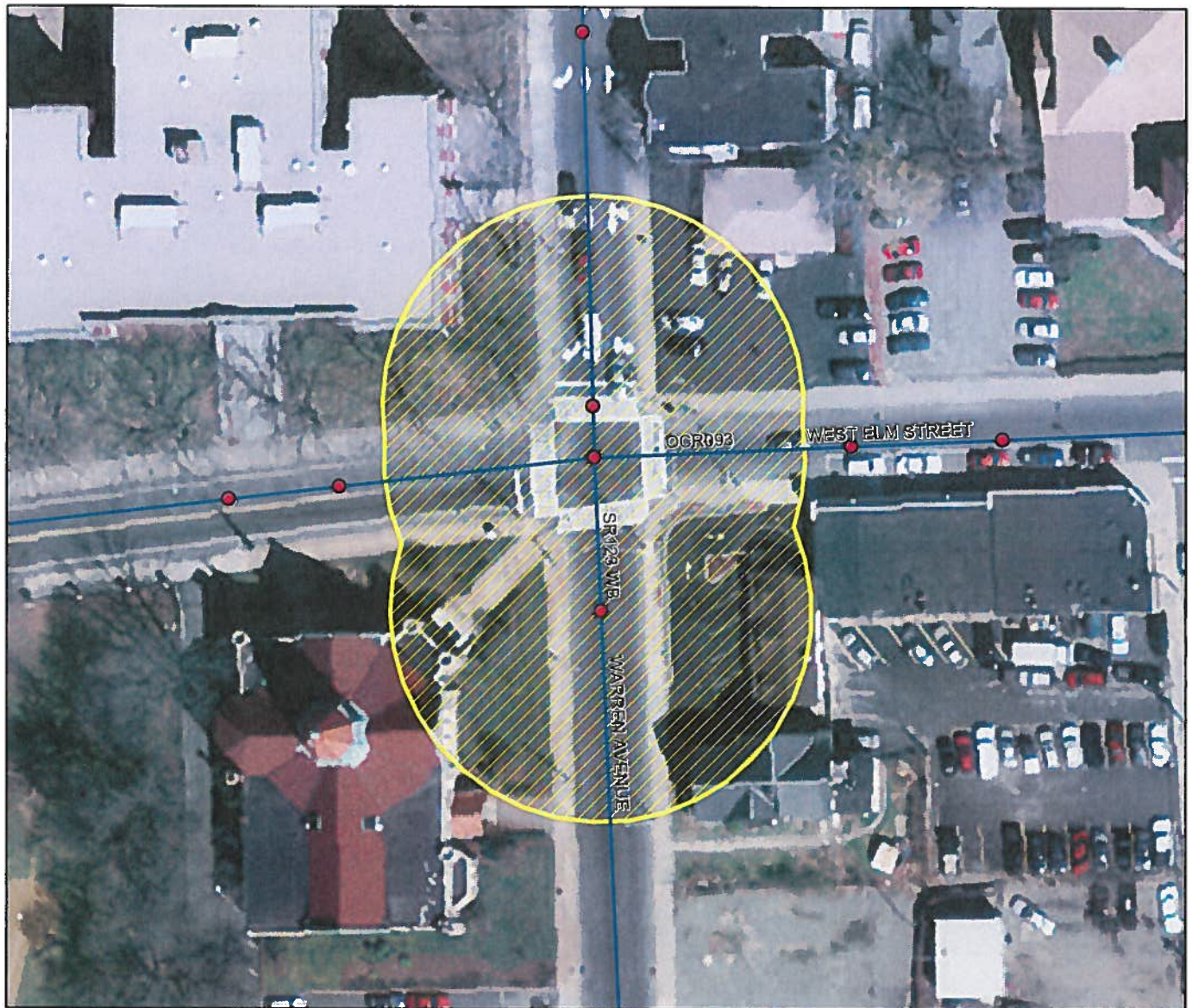
Crash Data Summary Tables and Charts
 Intersection of West Elm Street and Warren Avenue; Brockton, MA



Crash Data Summary Tables and Charts
 Intersection of West Elm Street and Warren Avenue; Brockton, MA



Top Crash Intersections 2008-2010



0 50 100 150 200 Feet



RANK
101

BROCKTON

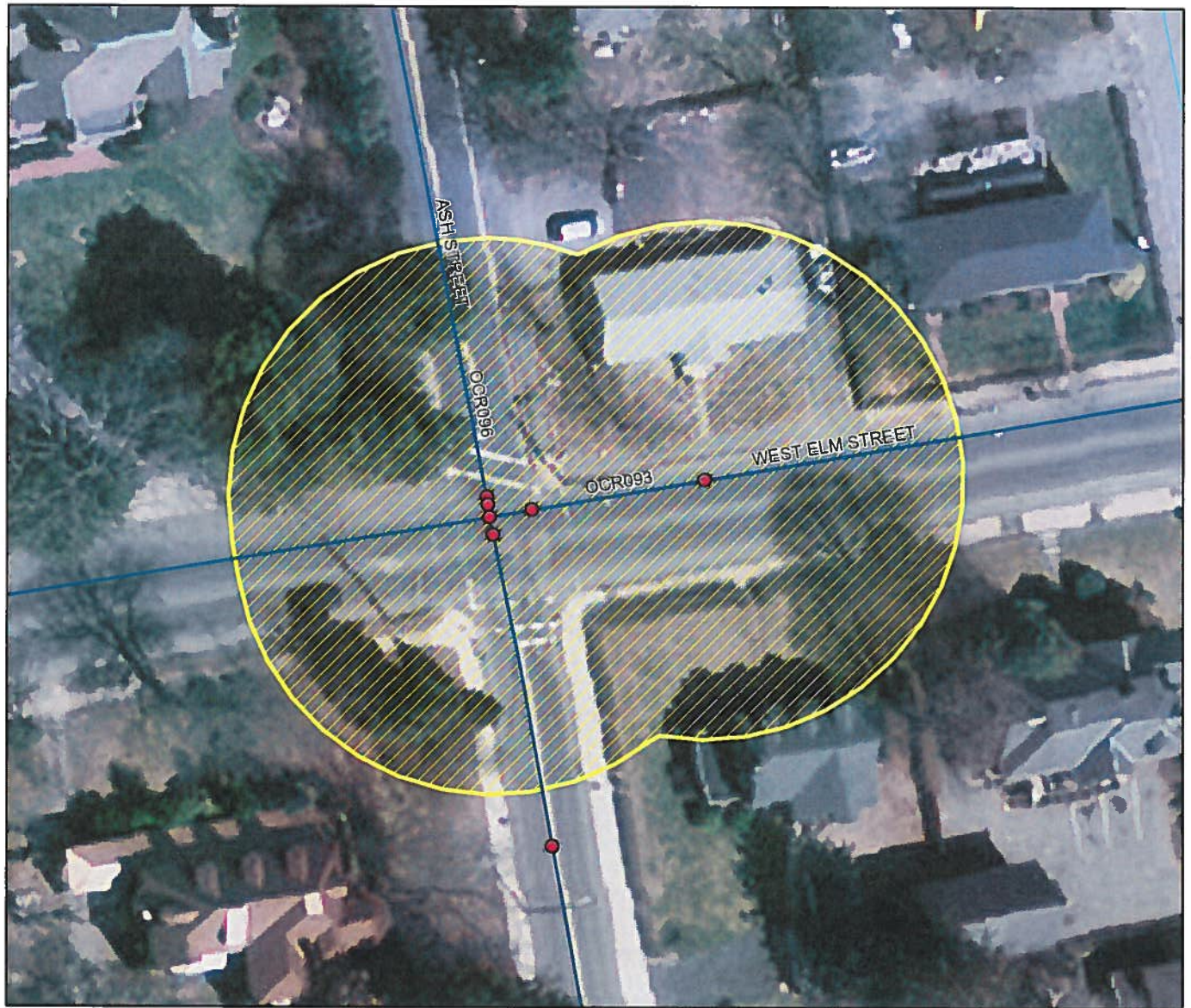
WARREN AVENUE ROUTE 123
WEST ELM STREET

MassDOT District 5
RPA OCPC
EPDO 119
Number of Fatal Crashes 0
Number of Injury Crashes 21
Number of Non-Injury Crashes 14
Total Crashes 35

Legend

- Crash Locations 2008-2010
- ~ Local Roads
- ~ All Functional Classification Except Local Roads
- Top Crash Intersections

Top Crash Intersections 2008-2010



0 42.5 85 127.5 170 Feet



RANK
41

BROCKTON

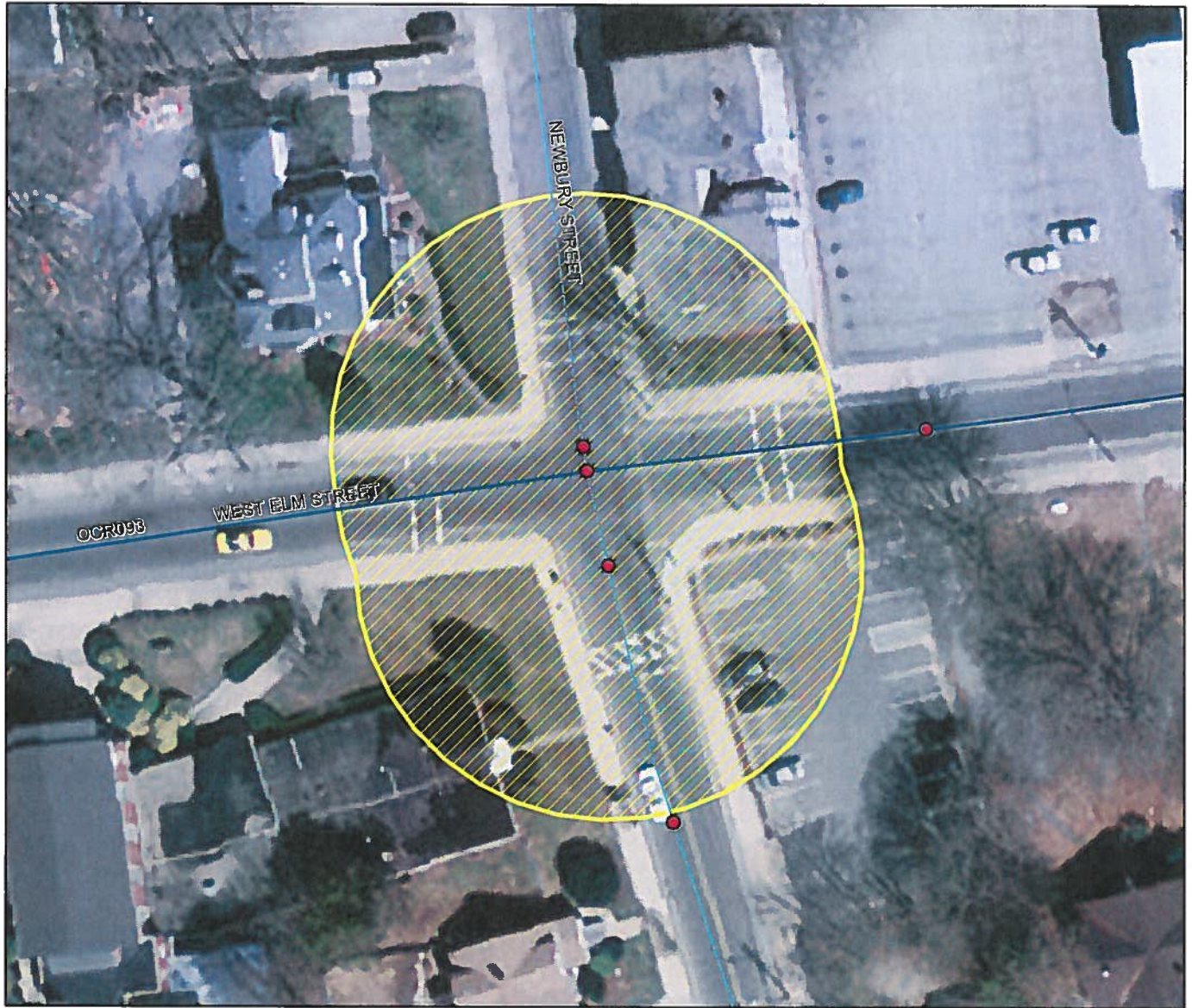
ASH STREET
WEST ELM STREET

MassDOT District 5
RPA OCPC
EPDO 150
Number of Fatal Crashes 0
Number of Injury Crashes 24
Number of Non-Injury Crashes 30
Total Crashes 54

Legend

- Crash Locations 2008-2010
- Local Roads
- All Functional Classification Except Local Roads
- Top Crash Intersections

Top Crash Intersections 2008-2010



0 42.5 85 127.5 170 Feet



RANK
77

BROCKTON

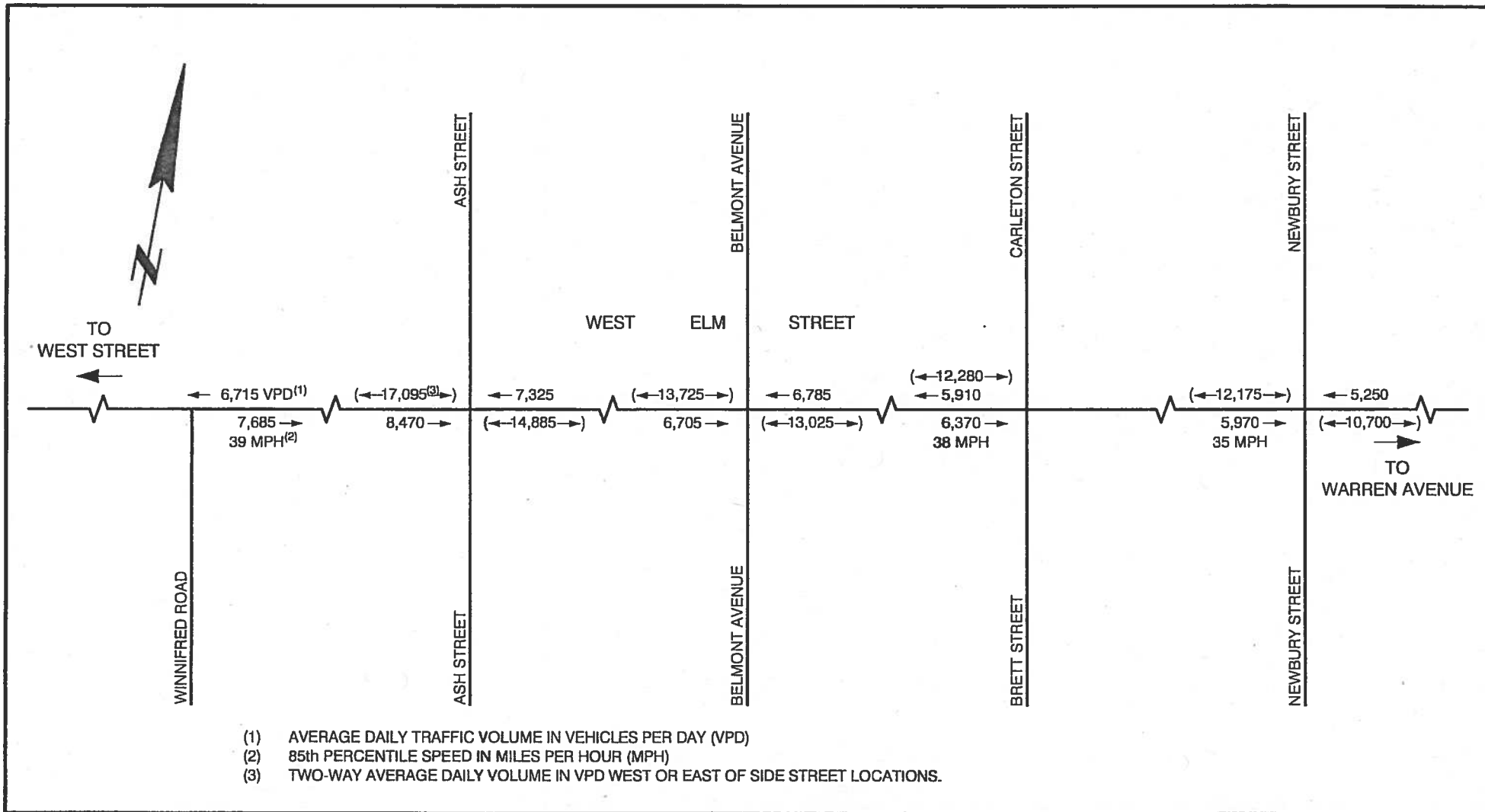
WEST ELM STREET
NEWBURY STREET

MassDOT District 5
RPA OCPC
EPDO 127
Number of Fatal Crashes 0
Number of Injury Crashes 21
Number of Non-Injury Crashes 22
Total Crashes 43

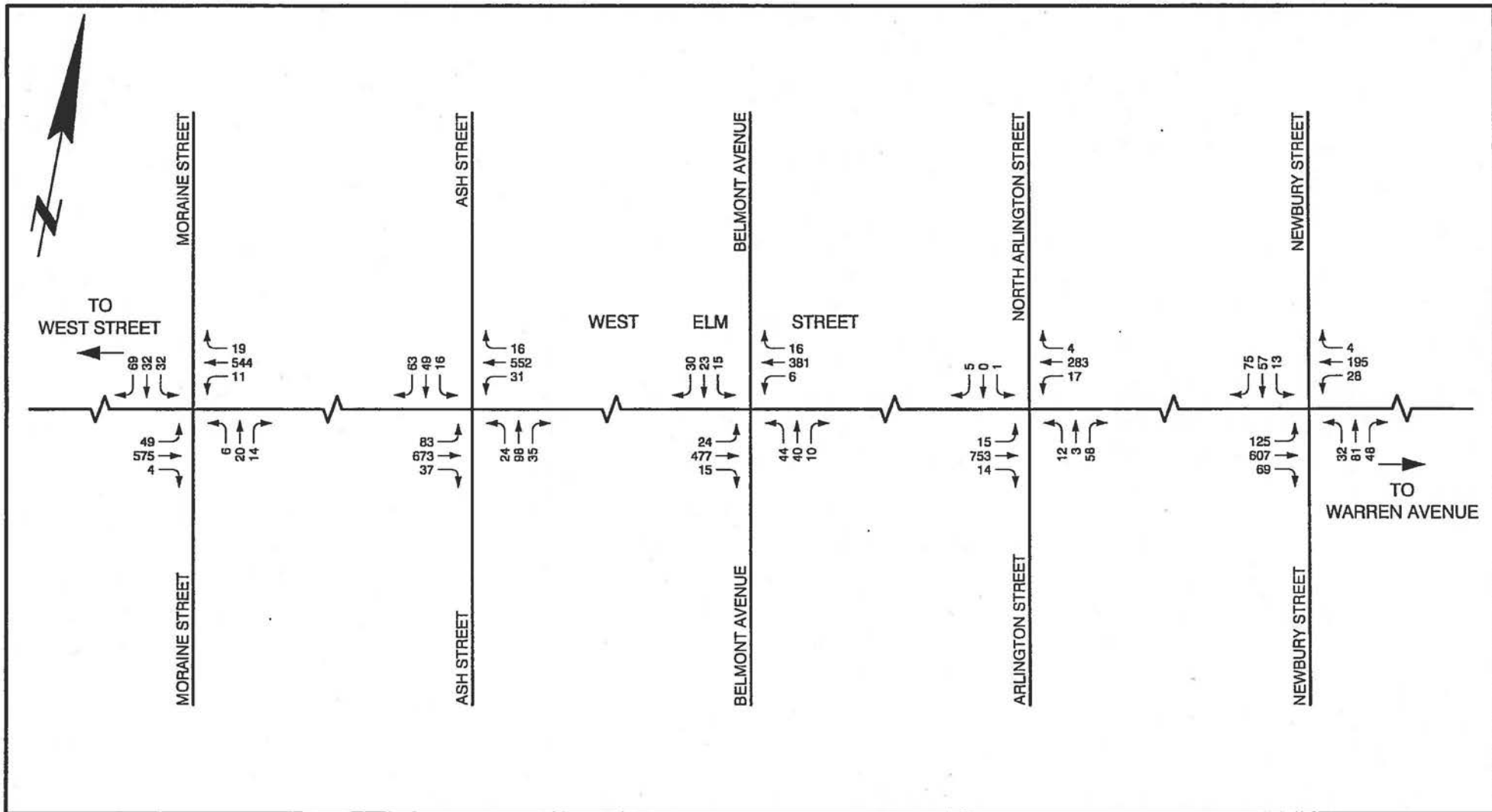
Legend

- Crash Locations 2008-2010
- ~ Local Roads
- ~ All Functional Classification Except Local Roads
- Top Crash Intersections

Appendix D. Traffic Volume Information



<p>hwmoore ASSOCIATES, INC. CIVIL ENGINEERING LAND PLANNING</p> <p>112 Shawmut Avenue Boston, MA 02118 tel 617-357-8145 fax 617-357-9495</p>	Project Title	WEST ELM STREET RECONSTRUCTION	<p>2009 DAILY TRAFFIC VOLUMES AND SPEEDS</p>
	Location	BROCKTON, MA	
	Scale	NOT TO SCALE	<p>FIGURE 3</p>
	Date	SEPTEMBER 2009	

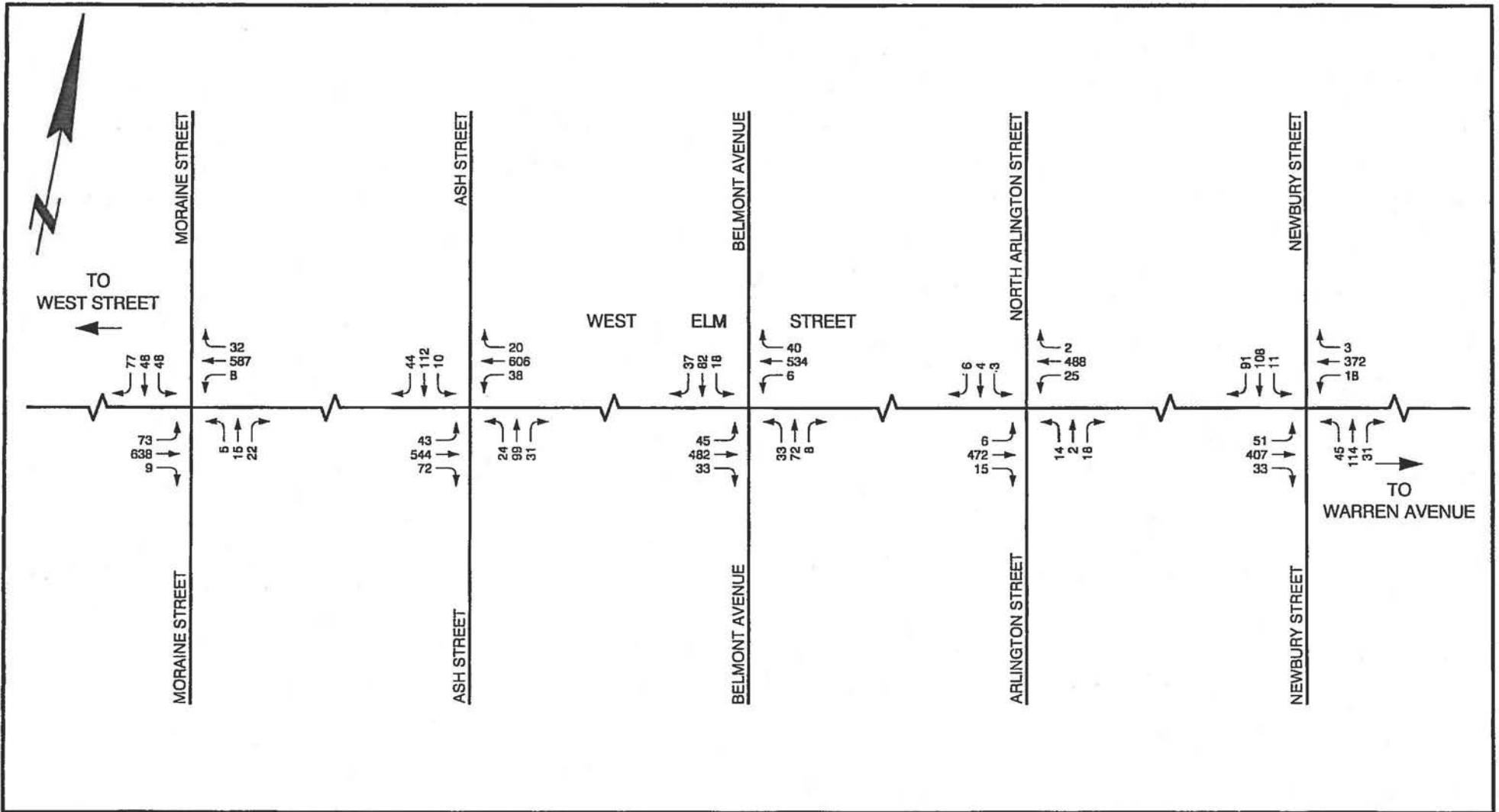


hwmoore
 ASSOCIATES, INC.
 CIVIL ENGINEERING | LAND PLANNING
 112 Shawmut Avenue
 Boston, MA 02118
 tel 617-357-8145
 fax 617-357-9495

Project Title	WEST ELM STREET RECONSTRUCTION
Location	BROCKTON, MA
Scale	NOT TO SCALE
Date	SEPTEMBER 2009

2009 WEEKDAY A.M.
 PEAK HOUR VOLUMES

FIGURE 4



hwmoore ASSOCIATES, INC. CIVIL ENGINEERING LAND PLANNING 112 Shawmut Avenue Boston, MA 02118 tel 617-357-8145 fax 617-357-9495	Project Title	WEST ELM STREET RECONSTRUCTION	2009 WEEKDAY P.M. PEAK HOUR VOLUMES
	Location	BROCKTON, MA	
	Scale	NOT TO SCALE	FIGURE 5
	Date	SEPTEMBER 2009	