Westford Town Center Traffic and Parking Study

Prepared by:
Northern Middlesex Council of Governments
March 2014

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40 Church Street

Lowell, MA 01852

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I. Introduction

The Northern Middlesex Council of Governments (NMCOG) has undertaken a comprehensive traffic operations and parking study of the Town Center area of Westford, Massachusetts. The purpose of the study is to assess existing traffic operations, inventory parking supply and assess parking needs, and develop improvement recommendations and strategies within the study area shown on Map 1. The findings of the study will assist local decision-makers in addressing future transportation, parking, and land use policy issues affecting the Westford Center area.

A. Westford Center Overview

Westford Center is defined as much by function as by geographic area, and is delineated as one of the six historic villages in the Town's 2009 Comprehensive Plan (p. 32-33). The Master Plan further states (p.5) that "Westford Center will remain the cultural, institutional, and civic heart of the Town." The seat of municipal government, the fire and police department headquarters and the Town Library are located here, as this is the confluence of many of the major roadways that run through the community: Main Street, Boston Road, Depot Street and Graniteville Road. The Center is also the location of many ongoing and annual events, such as the weekly Farmer's Market, the "Strawberry n' Arts Festival" and high school prom photographs. Many of these events are centered on the Town Green, known as the "Common", a 1.13 acre parcel located at the intersections of Main Street, Boston Road and Lincoln Street.

Photo 1: Westford Farmer's Market.

The Common is one of the oldest parcels of public open space in the Town. In addition, there are two small triangular-shaped parcels nearby that are considered part of the Town Common. One parcel, located just to the east of Boston Road, south of Main Street, is home to several benches and a monument to the original Westford Academy. The second parcel is located southwest of the Town Common where Hildreth Street, Lincoln Street and Boston Road intersect and contains a monument to those who fought in the Civil War. All roadways within the study area are owned and maintained by the Town.

Photo 2: Civil War monument near the Westford Town Common.

The neighborhood within the Center consists of a mix of residences, municipal buildings and buildings controlled by non-profits entities. These structures include Town Hall, J.V. Fletcher

Library, Roudenbush Children's Center, Roudenbush Community Center, Westford Museum and the Public Safety Buildings which house the Police and Fire Department Headquarters. Private businesses include a specialty boutique, a bank and an insurance company. The First Parish Church and the Parish Center for the Arts contribute to the community and cultural activities in the Town Center.

Photo 3: Aerial view of Westford Town Common.

The Town Common was established in 1723 and was redesigned in 1919 by landscape architect Bremer Pond. According to an article from the website "Wicked Local" published on November 22, 2005 and updated on March 15, 2008, the Westford Town Common was purchased as a training field for the local militia from resident Joseph Underwood for 20 pounds in 1748. This tradition continued for many generations with soldiers from the Revolutionary War, Civil War and World War I drilling on the Town Common. At the start of the Revolutionary War, one hundred thirty Minutemen gathered on the Town Common to begin the march to Concord.

Photo 4: Westford Common War Memorial

Various monuments can be found within the Town Common, including a cannon captured from Cuba in 1899. An octagonal memorial was erected in 1924 honoring the veterans of conflicts and wars from the Colonial times until World War I. Over the years, additional monuments were added for Revolutionary War hero Colonial John Robinson, and for veterans of World War II, the Korean Conflict and the Vietnam War. A water trough was installed in 1913 and still remains.[1]

There are a number of historically significant structures located within the Westford Center area, including Town Hall, Roudenbush Community Center, the Westford Museum (which was the original Westford Academy), portions of the J.V. Fletcher Library and the Parish Center for the Arts. The Town Center is designated as a National Register Historic District, and, according to the Town's Comprehensive Master Plan, contains 155 contributing properties (p.44). The Master Plan (p.46) recommends that the Town Center also be designated as a local historic district under M.G.L. c. 40C.

[1] Wicked Local Westford. By Parks and Recreation (GHS). Posted November 22, 2005 and last updated March 15, 2008.

Originally dedicated in 1871, Westford Town Hall is the location of most town offices. Due to structural deficiencies, the Town Hall building was temporarily closed in 2007. After extensive renovations, the building was reopened in 2011. Upgrades were made to the exterior and interior of the building, and great care was taken to maintain the building's historic integrity and character.

B. Problem Statement and Study Approach

Public policy makers, citizens and the business community have a stake in understanding and responding to demands on the transportation system. A properly developed traffic study can provide the factual basis for good decision-making and facilitate the timely implementation of necessary improvements. The Town Center is the location for a variety of community activities. Most of these activities revolve around the numerous public buildings in the Center including Town Hall, the Police Station, Center Fire Station, J.V. Fletcher Library, Westford Museum, Parish Center for the Arts, First Parish Church and the Town Common. Two of the town's major roadways, Boston Road and Main Street, traverse the Town Center. These roadways not only serve the town center, but also provide access to I-495 and the Route 110 business corridor. When activities within the Town Center take place during peak hours, traffic and parking in the area can become a significant challenge.

NMCOG has conducted a comprehensive evaluation of traffic conditions and parking facilities in the Westford Town Center area. Recommendations are outlined in this report to mitigate deficiencies identified through the analysis. The study includes a land use analysis, an analysis of traffic and crash data, and an inventory of pedestrian and parking facilities.

C. Public Outreach Process

During the course of the study, NMCOG and Town staff conducted a number of public meetings to solicit input regarding the transportation issues within the Town Center. On November 15, 2012, NMCOG met with town staff and the Town Manager to discuss the goals and objectives of the study, draft a project schedule and identify key project stakeholders. A stakeholders meeting was held at the J.V. Fletcher Library on March 11, 2013. During this meeting, a scope of work was distributed and maps were displayed showing traffic volumes, the sidewalk and parking inventories, and the existing level of service for selected intersections. This meeting provided an opportunity for Westford officials, residents and workers to describe their perspectives on traffic and parking issues within the study area. Many interested individuals who were unable to attend the meeting submitted comments via email. The comments received through this process are summarized on the following pages by category.

Comments on Westford Center Parking:

1. There is an inadequate supply of parking, especially during special events;
2. Library parking needs to be expanded; create additional parking at the Library;
3. Increase parking around the Common and PCA;
4. Change the Connell Drive traffic flow so that one of the two streets is two-way and use the other street for parking;
5. Install angle parking on Lincoln Street;
6. Unutilized police vehicles should be parked somewhere else in town;
7. Library employees should park at Town Hall and walk across the street;
8. The farmers market utilizes too many parking spaces; move farmers market to the Abbott School;
9. Town Hall employees should park at the Abbott School and either walk or be shuttled to Town Hall;
10. Additional public parking should be provided at the Public Safety buildings;
11. There should be more handicap parking spaces on Lincoln Street;
12. Enforce parking restrictions;
13. Property owners within the Town Center should be required to share parking;
14. The changes made to Connell Drive should be reconsidered, thereby allowing parking on the right side of the road, with the areas where parking is prohibited clearly marked and signed;
15. There is a lack of “front door” parking for businesses in the Town Center;
16. The two parking spaces in front of the insurance company need to be protected spaces for the elderly; and
17. Parking in front of the library should be prohibited during peak hours.

Comments on sidewalks/crosswalks:

1. Snow should be promptly removed from sidewalks;
2. Brush and trees should be trimmed along the edges of the sidewalks to make them passable;
3. Motorists do not stop for those in the crosswalk-better enforcement is needed;
4. Crosswalk at the Lincoln Street/Boston Road intersection is dangerous;
5. The sidewalk on Boston Road is too narrow and there should be a sidewalk on the odd-numbered side of the road;
6. Sidewalk improvements should be designed into the drainage improvement projects on Boston Road and Graniteville Road;
7. Expand the sidewalk/curb extension in front of the Parish Center for the Arts;
8. Safety at the crosswalk in front of the library is compromised by the presence of large vehicles;

9. The crosswalk sign at Fisher Way is missing;
10. Add more sidewalks along Boston Road and along Forge Village Road, then add crosswalks at regular intervals; and
11. Add a crosswalk at Hildreth Street crossing Boston Road to Lincoln Street.

Comments on traffic and traffic enforcement:

1. Motorists do not respect school bus flashers-better enforcement is needed;
2. Speeding is a problem and better enforcement of the speed limit is needed;
3. Motorists do not obey the speed limit in the school zone;
4. A roundabout should be considered at the intersection of Boston Road and Main Street;
5. Heavy truck traffic is a problem in the Center;
6. Vehicles go too fast when taking the corner from Graniteville Road to Main Street;
7. Create a three-way stop at Main Street and Boston Road;
8. Limit the motorists within the Town Center to only Westford residents using a sticker system;
9. Vehicles traveling west on Main Street and taking a left onto Boston Road should be required to stop;
10. Prohibit cut-through traffic and exclude large trucks;
11. Travel speeds on Boston Road should be reduced;
12. Flashing lights should be installed at the intersection of Boston Road and Main Street and a crosswalk should be created;
13. Traffic calming is needed at the intersection of Boston Road and Main Street, perhaps by installing a raised crosswalk; and
14. There should be one-way traffic flow around the Common, with the parking on Lincoln Street relocated to a new one-way section of Boston Road.

Other Comments:

1. A long-term strategic plan for town-owned facilities is needed;
2. The library should be expanded;
3. The character of the Town Center and Common should be protected and maintained;
4. Town offices are too scattered and should be concentrated in the Town Center;
5. The Town should acquire the building next to Town Hall;
6. Town organizations should coordinate events better so as to not overwhelm the Town Center;
7. Run a “jitney” from the Center to Route 110;
8. Move the farmer’s market to the 4-H fairgrounds;
9. Issues raised by public safety officials regarding the farmers market are overblown;
10. Move the fire station to the south end of town.

11. The Center needs a coffee shop or small bistro which would serve as a neighborhood gathering spot;
12. Replace the trees that have been cut down along Boston Road over the last fifteen years;
13. Lights with motion detectors should be installed at Roudenbush Field;
14. Improve street lighting within the Center; and
15. Create a skating rink on the common during the winter months.

On March 26, 2013, Beverly Woods, NMCOG Executive Director, and Paul Starratt, Town Engineer, attended the Board of Selectmen meeting to provide an overview of the project scope and to outline the project schedule. This brief presentation was also broadcast over the local cable channel.

On April 4, 2013, NMCOG staff met with the Historical Commission to solicit their input relative to the project. It was clear from this meeting that the Historical Commission is dedicated to protecting and preserving the Town Common, and does not want to see traffic solutions developed that impact the Common or existing open space within the Town Center. The Commission would also like to explore the feasibility of creating a walkway from the parking area at the Public Safety buildings to the Westford Museum.

On April 29, 2013 Town Engineer Paul Starratt presented the scope of work and project schedule to the Planning Board. Comments were then provided by the board members and broadcast over the local cable channel and the internet.

On August 5, 2013, NMCOG staff met with the Board of Library Trustees to better understand the future plans for the library and to gather input from the Trustees' relative to existing conditions within the Town Center. The Library Trustees described the challenges that they encounter with parking, particularly on days when special events are being held on the Common. In addition, the Trustees find that the Library parking area is not large enough to accommodate some of the activities and events that are held there, particularly the children's events which are very popular. The Library has applied for grant money to study the possibility of constructing an addition, and the Trustees feel strongly that the parking situation must be addressed in the near future.

A public meeting was held on the draft report on December 4, 2013 to receive comments on the findings of the report. Approximately forty (40) residents attended the meeting and offered the following comments:

1. The safety of pedestrians utilizing the proposed library parking lot may be an issue;
2. A question was raised as to whether the sharrows meet MassDOT design standards;
3. Improving operating conditions in the Center will attract additional traffic;
4. A temporary traffic signal should be installed to determine whether residents are comfortable with the concept;

5. The speed limit within the Center should be 20 mph;
6. The Town should discourage non-Westford residents from using the Center as a cut-through;
7. Raised crosswalks should be considered;
8. The crosswalk at the Town Hall ends at a driveway opening and should be realigned or moved;
9. Traffic flow around the Common should be one-way;
10. The existing library parking lot needs to be redesigned;
11. Stormwater management for the proposed library parking lot must be carefully considered and designed so as to not impact property on Randolph Circle;
12. Three residents spoke in opposition to erecting a traffic signal in the Center;
13. Concerns were expressed regarding the impacts to the Town Common, which has been redesigned to historical accuracy. The restoration is not compatible with signals or a roundabout;
14. Paving the parking on Fisher Way may exacerbate existing drainage problems;
15. Bicycle racks in the Town Center are not needed, as the steep terrain discourages cyclists from accessing the area;
16. The safety of pedestrians is in jeopardy when visiting the Farmers Market;
17. Vendors will not come to the Farmers Market if it is moved to a Saturday;
18. Relocate the Farmers Market to Fisher Way;
19. The Farmers Market should not be moved to a weekend or to another location;
20. Proposed traffic solutions should be regional in nature as a local solution may be counterproductive. Traffic should be balanced across all viable routes;
21. A regional traffic study is needed for the area between Route 2 and Route 3 south of the New Hampshire border. Identified solutions should be funded by all Massachusetts and New Hampshire users; and
22. The proposed Fisher Way lot is too far from the Center, and the proposed Library lot is inconvenient to Library patrons. Additional parking should be located behind the Town Hall and Police Station.

On January 28, 2014, NMCOG staff met with the Westford Board of Selectmen to present the recommendations of the draft Study for the Board's consideration.

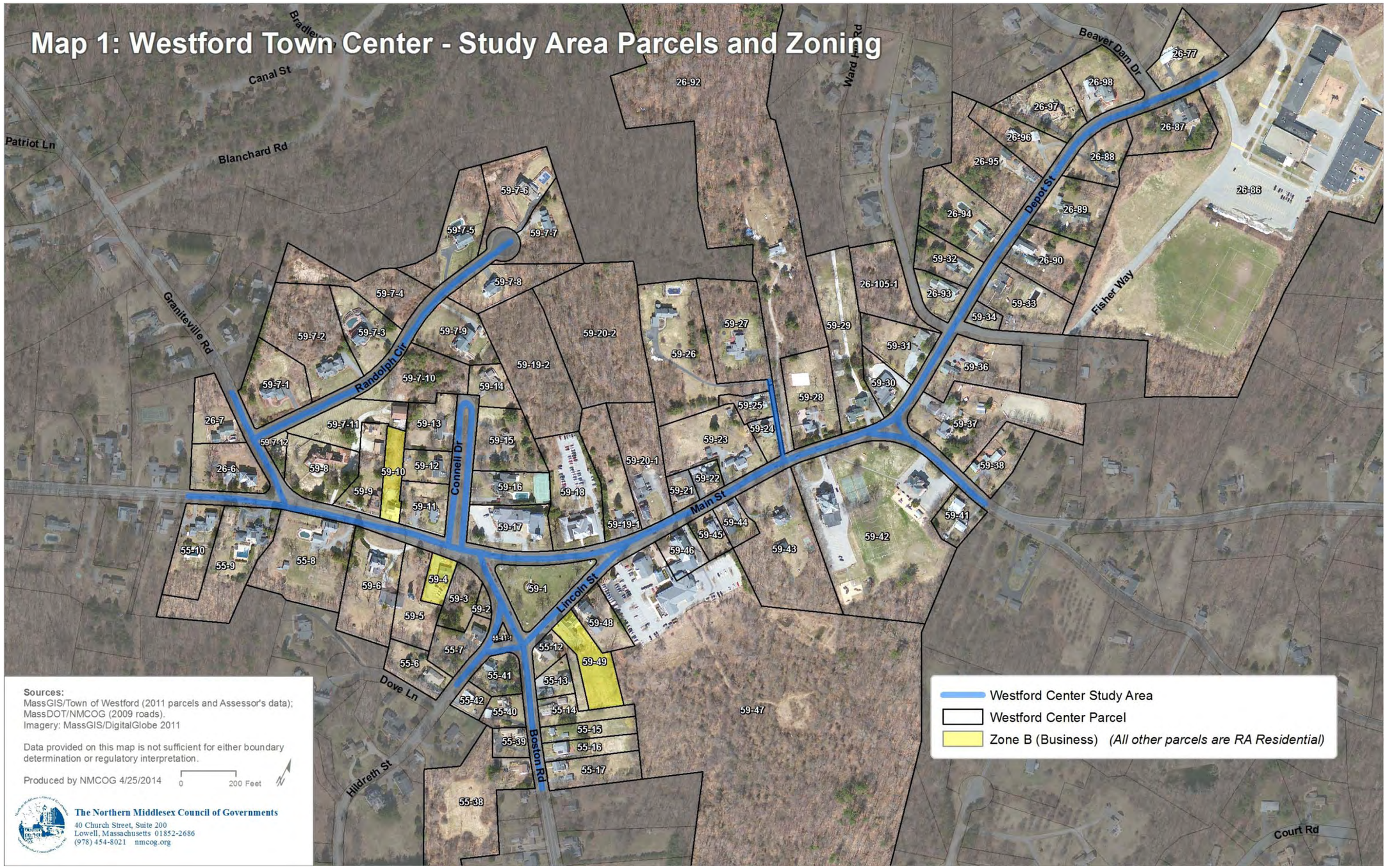
II. Existing Conditions

A. Land Use, Zoning, and Municipal Regulations

The Westford Center study area is comprised of approximately 191 acres. Map 1 delineates the parcel boundaries and corresponding zoning classifications within the study area. The major land uses in the study area include municipal buildings, municipally-owned open space, along with single-family and multi-family residences. The most prevalent zoning classification within the Study Area is RA, Single Family. Three commercially-zoned properties (Zone B) can also be found in the area. These properties comprise less than two acres in total and have been in commercial uses for many years. These three parcels do not conform to all dimensional or area requirements outlined in the Town's current Zoning Bylaw. A Land Use Inventory, (LUI) can be found in Appendix A which details the use, size and zoning classification for each parcel.

Town Hall, the Center Fire Station and the Police Department are located in separate buildings on two separate parcels: 59-46 and 59-47. The first parcel consists of the Town Hall, while second parcel contains the fire and police buildings, as well as the off-street parking areas for all three facilities. In the rear of the building is a large open space, comprising 28± acres, and consisting mostly of wetlands or streams. This open space falls under the jurisdiction of the Town Conservation Commission. The J.V. Fletcher Library is directly across Main Street from the Town Common. A large vacant parcel located behind the library is owned by the Town and contains 2.5± acres of land.

The Town's current zoning bylaw does not allow a "Municipal parking lot or garage" as a stand-alone use in either of the zoning classifications found in the Town Center. However, use variances are allowed in the regulations, as per the second paragraph in section 9.2.2 of the zoning by-law. Should the town decide to create an additional stand-alone parking facility within the Town Center it would need to be developed in conjunction with another municipal use, or a variance or regulation revision would be needed.


Map 1: Westford Town Center - Study Area Parcels and Zoning
Canal St
Patriot Ln
Blanchard Rd
Graniteville Rd
Randolph Cir
Conneil Dr
Ward Hill Rd
Beaver Dam Dr
Depot St
Fisher Way
Main St
Lincoln St
Boston Rd
Dove Ln
Hildreth St
Court Rd
26-92
26-77
26-98
26-97
26-87
26-96
26-88
26-95
26-86
26-94
26-89
59-32
26-90
26-93
59-33
59-34
26-105-1
59-27
59-29
59-31
59-36
59-30
59-28
59-25
59-24
59-37
59-23
59-38
59-22
59-21
59-41
59-44
59-45
59-46
59-43
59-42
59-48
59-49
59-47
59-7-6
59-7-5
59-7-7
59-7-8
59-7-4
59-7-2
59-7-3
59-7-9
59-20-2
59-19-2
59-7-1
59-7-10
59-14
26-7
59-7-11
59-13
59-7-12
59-15
26-6
59-8
59-10
59-12
59-9
59-11
59-16
59-18
59-20-1
59-17
59-19-1
55-10
55-9
55-8
59-6
59-4
59-3
59-2
59-1
59-5
55-7
55-6
55-41
55-12
55-13
55-42
55-40
55-14
55-39
55-15
55-16
55-17
55-38
Sources:
MassGIS/Town of Westford (2011 parcels and Assessor's data);
MassDOT/NMCOG (2009 roads).
Imagery: MassGIS/DigitalGlobe 2011
Data provided on this map is not sufficient for either boundary determination or regulatory interpretation.
Produced by NMCOG 4/25/2014
0
200 Feet
The Northern Middlesex Council of Governments
40 Church Street, Suite 200
Lowell, Massachusetts 01852-2686
(978) 454-8021 nmcog.org
Westford Center Study Area
Westford Center Parcel
Zone B (Business) (All other parcels are RA Residential)

B. Roadway Characteristics

The roadway network within the Town Center is the direct result of the town's historic development pattern. Typical of many New England towns, the Town Common is located where several major roadways converge, including Boston Road, Lincoln Street, Main Street, Depot Street, and Graniteville Road. In addition to processing local traffic, this area handles commuter traffic from the north on Depot Road and from the south on Boston Road, impacting traffic conditions during peak hours. Travel conditions can deteriorate when there is an incident on either I-495 or Route 3.

While the portion of Boston Road extending from Crown Road to Route 110 south of the study area is owned and controlled by MassDOT, the roadways within the study area are all owned by the Town. The characteristics of the study area roadways are described below.

Boston Road

Boston Road is an urban minor arterial extending in a north-south direction from the Route 110 (Littleton Road) to the intersection of Main Street in Westford Center. From Littleton Road (Route 110) to Crown Road, the roadway is owned and maintained by MassDOT. From Crown Road north to the Boston Road/ Main Street intersection, the roadway is owned by the Town of Westford. Boston Road connects the Center to I-495 (via Exit 32), and to the many commercial and business destinations along Route 110, the main commercial corridor in Town. Boston Road is generally 28-feet wide south of Hildreth Street, with additional lanes to accommodate turning movements and traffic demands as it approaches I-495 and the Littleton Road intersection. The land uses adjacent to Boston Road consist primarily of single-family homes. The Westford Historical Museum is also located on Boston Road near the Lincoln Street intersection.

Four-foot sidewalks run along the northbound side of Boston Road from the Main Street to Crown Road. South of Crown Road, sidewalks were installed from Blake's Hill Road to the driveway for the MassDOT maintenance facility. The posted speed limit for Boston Road within the study area is 25 miles per hour (mph).

Main Street

Main Street is a Town-owned urban minor arterial and provides access from Forge Village Road to the Town of Chelmsford to the east. Main Street is generally two lanes with added turning lanes near its intersection with Boston Road. Because the speed limit is not posted within the Center area, Main Street follows the Massachusetts State Law set speed limit of 30 mph. Main Street is home to the majority of municipal buildings, such as Town Hall, the Public Safety buildings, J.V. Fletcher Library, Roudenbush Community Center and the Roudenbush Children's Center. Businesses, including a bank and a boutique, are located on Main Street just west of the

Town Common. Single-family homes make up the majority of the land uses along Main Street. Within the study area, the roadway is generally 40-feet wide with on-street parking located on the north side of the road, directly to the east and west of the J.V. Fletcher Library entrance.

The Main Street sidewalk network follows the north side of Main Street from 27 Main Street to the Graniteville Road intersection. East of the Graniteville Road intersection a gravel bed exists which is utilized by pedestrians, until the sidewalk begins again at 40 Main Street, just west of Connell Drive. From 40 Main Street heading east, the sidewalk continues to the Depot Street intersection. The sidewalk along this section is between 4 to 6 feet wide. The sidewalk on the south side of Main Street starts at 39 Main Street and continues towards the Center, ending at the eastern edge of 45 Main Street. No sidewalk exists on the south side of Main Street where it borders the Town Common. The sidewalk begins again on the southern side of Main Street, directly east of the Lincoln Street intersection, and follows Main Street through the Main Street/ Depot Street intersection, ending at the Roudenbush Children's Center.

Depot Street

Depot Street is functionally classified as an urban minor arterial with a single travel lane in each direction. The Town-owned roadway runs in a general north/south direction, beginning at the Main Street intersection and ending at Groton Road (Route 40). In general, the roadway is 26-feet wide with 4-foot wide sidewalk that runs along the majority of the western side of Depot Street within the study area. The Abbot Elementary School is located on Depot Street, and the School Administration Offices are located in the Millennium School directly behind the Abbot School. Single-family residences dominate the land uses along the roadway, with the exception of a farm stand located at the Westford Depot.

Lincoln Street

Lincoln Street is a town-owned local roadway that extends in a general northeast/ southwest direction from Boston Road to Main Street, forming the southeastern border of the Town Common. One-way traffic flow is permitted along the 32-foot wide roadway. There are 8-foot shoulders on both sides Lincoln Street where on-street parking is allowed where marked.

There is no posted speed limit signage, so the 30 mph statewide speed limit is in force. A 6-foot sidewalk runs along the southeastern edge of Lincoln Street from Boston Road, and meets up with the sidewalk network along Main Street. Lincoln Street has two ADA-compliant crosswalks: one at the intersection where it meets Boston Road, and the other on Lincoln Street at the end of the Town Common near the Public Safety Buildings. Lincoln Street is predominantly residential, except for one mixed-use building which is both commercial and residential.

Connell Drive

Connell Drive is split by a median, with one-way traffic allowed in each direction. The roadway is town-owned and provides access to the parking lot for the First Parish Church and to the single-family dwellings on Connell Drive.

Photo 5: Connell Drive on-street parking.

The beginning section of Connell Drive is two-way for approximately 150 feet when entering from Main Street. This accommodates traffic leaving the First Parish Church before and after services and events. The remainder of the roadway is designated as one-way north of the First Parish Church driveway. Public on-street parking is found on the inside of the island that separates the entrance and exit roads of Connell Drive.

Graniteville Road

Graniteville Road is classified as an urban minor arterial. The roadway is owned by the Town, extends in a general northwest/ southeast direction, and accommodates traffic flow between the Center and points north and west. In general, the roadway is 26-feet wide with a 1-foot shoulder on the southwest side and a 2-foot shoulder on the northeast side. The shoulders widen at the intersection of Main Street and Graniteville Road. Graniteville Road does not have sidewalks or bicycle accommodations, although it serves a residential neighborhood.

Randolph Circle

Randolph Circle is a Town-owned, dead-end local road located off Graniteville Road. A 4-foot wide asphalt sidewalk runs along the east side of the roadway and ends at 11 Randolph Circle. The roadway provides access to a residential subdivision located behind the former Abbot Estate.

C. Intersection Characteristics

The Westford Center Traffic and Parking Study examined existing traffic flow patterns, geometrics, bicycle and pedestrian movements, and parking at the following five study area intersections:

- Graniteville Road at Main Street;
- Boston Road at Main Street;
- Depot Street at Main Street;
- Lincoln Street at Main Street; and

- Boston Road at Hildreth Street/ Lincoln Street.

The following section provides an overview of geometric and traffic control conditions at each intersection.

Graniteville Road at Main Street

Graniteville Road has a northwest/ southeast orientation and intersects Main Street west of the Town Common. The roadway has an average width of 26-feet but widens out to a maximum width of 84-feet where it meets Main Street and forms a T-intersection. The extraordinary width at the Graniteville Road approach includes a slip lane for vehicles turning right or heading west onto Main Street from Graniteville Road. All traffic turning onto Main Street from Graniteville Road is controlled by a stop sign.

Photo 6: Intersection of Graniteville Road and Main Street.

Boston Road at Main Street

Boston Road and Main Street extend along the western and northern edges of the Town Common respectively, and form a T-intersection with stop control on Boston Road. Boston Road has an average width of 28 feet, but widens to approximately 70 feet where it intersects with Main Street. The additional width at the mouth of Boston Road, along with the right-turn only lane located on eastbound Main directly west of the Boston Road intersection, allows eastbound traffic on Main Street to proceed uninterrupted onto Boston Road when traveling south.

Photo 7: Intersection of Boston Rd and Main St.

Eastbound Main Street, as it approaches the intersection, widens to accommodate a right-turn-only lane onto Boston Road, as well as a through lane for vehicles continuing east on Main Street. Eastbound Main Street is reduced to a single lane east of the Boston Road intersection. Westbound Main Street accommodates a left-turn only and through lane, between the Fletcher Library and the First Parish Church. West of the Boston Road intersection, westbound Main Street narrows to a single lane. Because Main Street left turns are permitted onto Boston Road, traffic yields to eastbound drivers at the intersection. A crosswalk extends across Main Street immediately east of the Boston Road intersection.

Depot Street at Main Street

Depot Street intersects Main Street east of the Town Common where the two roadways form a split T-intersection with stop control for the Main Street westbound approach. At the intersection, Main Street splits into two lanes: one for vehicles turning north onto Depot Street and the other for vehicles continuing west on Main Street. Both legs are controlled by a stop sign, and are separated by a small grassy traffic island.

Photo 8: Intersection of Depot and Main Streets

Lincoln Street at Main Street

Lincoln Street is a one-way roadway allowing vehicles to travel north-east from Boston Road to the intersection with Main Street. Lincoln Street forms a skewed "T" intersection where it meets Main Street in front of the Public Safety buildings. Lincoln Street traffic must yield to vehicles travelling on Main Street. A crosswalk is located at the intersection of Main and Lincoln, in the vicinity of the Public Safety buildings and the Fletcher Library.

Photo 9: Intersection of Lincoln St. and Main St.

Boston Road at Hildreth Street

The Hildreth Street approach splits near Boston Road, creating separate travel lanes for vehicles leaving Hildreth Street and turning either north or south on Boston Road. The southern leg of the Hildreth Street approach also allows vehicles to cross Boston Road heading east, in order to access Lincoln Street. Traffic on Hildreth Street is controlled by a stop sign located on both legs of the Hildreth Street intersection, which are separated by a traffic island containing a monument honoring Westford residents who served in the Civil War. Traffic travelling along Boston Road is not subject to traffic control at this intersection.

Boston Road at Lincoln Street

Lincoln Street is one-way allowing vehicular movement in a northeast direction from Boston Road to Main Street. Parking is prohibited along both sides of Lincoln Street for approximately 75 feet from the Boston Road intersection, thereby providing a wide turning radius for vehicles entering Lincoln Street from Boston Road. A crosswalk is located at the southwest end of Lincoln Street, and signage is present indicating that drivers must yield to pedestrians in the crosswalk.

Photo 10: Intersection of Boston Rd./ Hildreth St. and Lincoln St.

D. Traffic Volumes and Turning Movements

Automatic traffic recorder (ATR) counts were collected along key roadway segments in and around Westford Center. The counts quantify the traffic volumes moving through the area on a daily basis and at peak travel times. Table 1 below shows the Average Daily Traffic (ADT) volumes within the study area and Map 2 shows the location of each count. Boston Road experiences the highest traffic volume within the study area, with an ADT of 15,500 vehicles per day south of Hildreth Street, and an ADT of 10,100 vehicles per day just south of Main Street. Main Street and Depot Street also carry significant volumes of traffic, with ADTs of 12,500 and 8,900 vehicles per day respectively.

Table 1: Average Daily Traffic Volumes (2012)

Location	Average Daily Traffic (ADT) vehicles per day (vpd)	P.M. Peak Hour Volume	A.M. Peak Hour Volume
Boston Road south of Hildreth Street	15,500	1,768	1,368
Boston Road south of Main Street	10,100	862	1,140
Depot Street North of Main Street	8,900	1,191	810
Graniteville Road north of Bixby Lane	3,700	372	378
Hildreth Street west of Boston Road	1,400	145	118
Lincoln Street east of Boston Road	5,000	873	251
Main Street east of Depot Street	3,900	471	450
Main Street east of Lincoln Street	12,500	1,546	1,242
Main Street west of Lincoln Street	8,400	811	1,112
Main Street east of Graniteville Road	7,500	860	887

Manual turning movement counts (TMCs) were collected in November 2012 during peak periods of the day (7:00 – 9:00 A.M. and 4:00 – 6:00 P.M.). Table 2 summarizes the turning movement count data for the A.M. peak periods. For purposes of analysis, this study examined five distinct

intersections: (1) Graniteville Road at Main Street; (2) Boston Road at Main Street; (3) Depot Street at Main Street; (4) Lincoln Street/ Library at Main Street; and (5) Boston Road at Hildreth Street/ Lincoln Street. Table 3 shows the number of vehicles passing through each intersection during the P.M. peak travel periods.

During the morning peak travel period, the majority of traffic is destined for major travel routes, such as I-495, Route 225 or Route 27, or to the employment centers along Route 110. A reversal of this trend can be seen in the P.M. peak hour. With the exception of Graniteville Road at Main Street and Boston Road at Main Street, all intersections within the study area experience an increase in traffic volumes during the evening peak travel period, when compared to the morning peak hour. Figures 1 through 5 show the peak hour turning movement volumes at each study area intersection.

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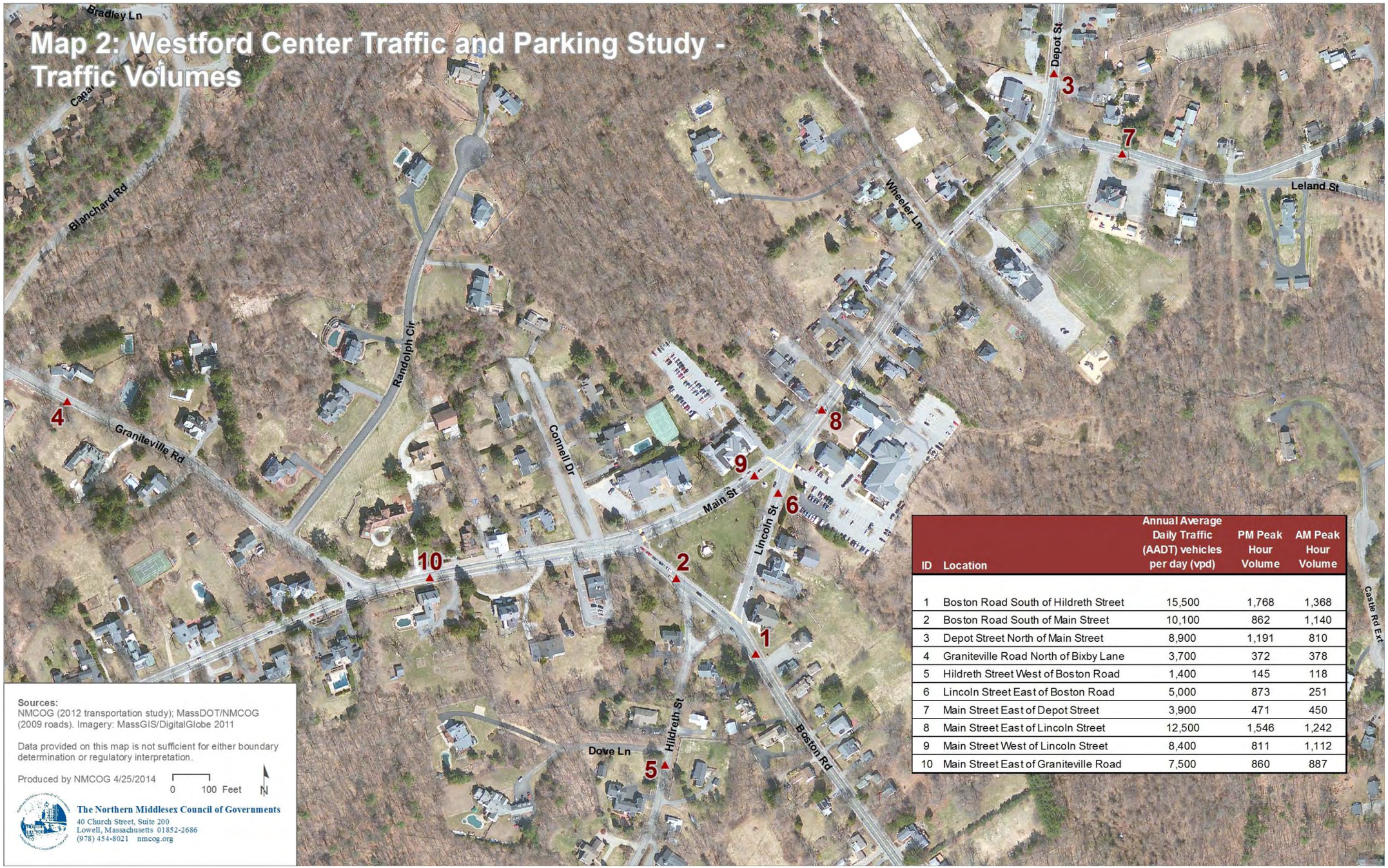


ID	Location	Annual Average Daily Traffic (AADT) vehicles per day (vpd)	PM Peak Hour Volume	AM Peak Hour Volume
1	Boston Road South of Hildreth Street	15,500	1,768	1,368
2	Boston Road South of Main Street	10,100	862	1,140
3	Depot Street North of Main Street	8,900	1,191	810
4	Graniteville Road North of Bixby Lane	3,700	372	378
5	Hildreth Street West of Boston Road	1,400	145	118
6	Lincoln Street East of Boston Road	5,000	873	251
7	Main Street East of Depot Street	3,900	471	450
8	Main Street East of Lincoln Street	12,500	1,546	1,242
9	Main Street West of Lincoln Street	8,400	811	1,112
10	Main Street East of Graniteville Road	7,500	860	887

Table 2: Intersection Turning Movement Volume Totals and Directional Distribution (A.M. Peak Period)

Intersection	A.M. Peak Period				
	No. of vehicles processed through intersection	Percent Directional Distribution			
		Southbound	Westbound	Northbound	Eastbound
Graniteville Road at Main Street	1,095	25%	32%	0%	44%
Boston Road at Main Street	1,576	0%	47%	10%	43%
Main Street at Depot Street	1,244	0%	54%	15%	31%
Lincoln Street at Main Street/ Library	1,186	1%	64%	16%	19%
Boston Road at Hildreth Street/ Lincoln Street	1,398	74%	0%	21%	5%

Table 3: Intersection Turning Movement Volume Totals and Directional Distribution (P.M. Peak Period)

Intersection	P.M. Peak Period				
	No. of vehicles processed through intersection	Percent Directional Distribution			
		Southbound	Westbound	Northbound	Eastbound
Graniteville Road at Main Street	778	14%	60%	0%	26%
Boston Road at Main Street	1,158	0%	43%	32%	24%
Main Street at Depot Street	1,477	0%	23%	15%	62%
Lincoln Street at Main Street/ Library	1,372	4%	29%	57%	10%
Boston Road at Hildreth Street/ Lincoln Street	1,707	29%	0%	67%	3%

Figure 1: Peak Hour Turning Movement Counts for Lincoln St/ Fletcher Library at Main St; A.M. (P.M.)

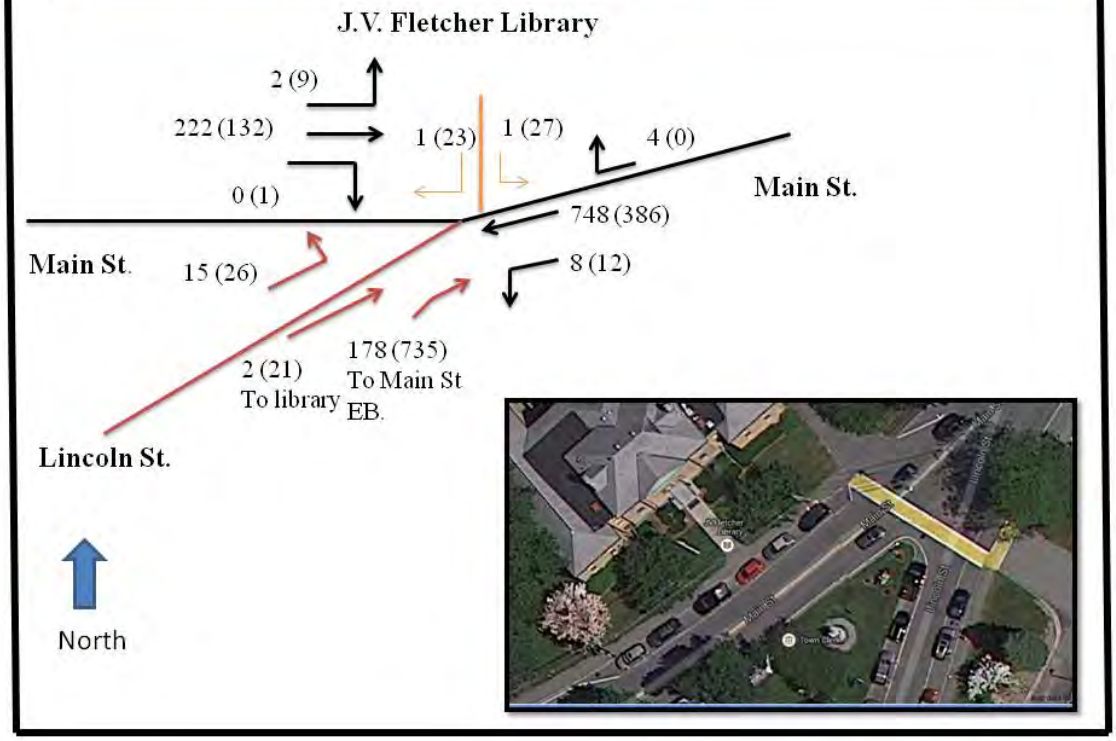


Figure 2: Boston Rd at Hildreth/ Lincoln St.; A.M. (P.M.)

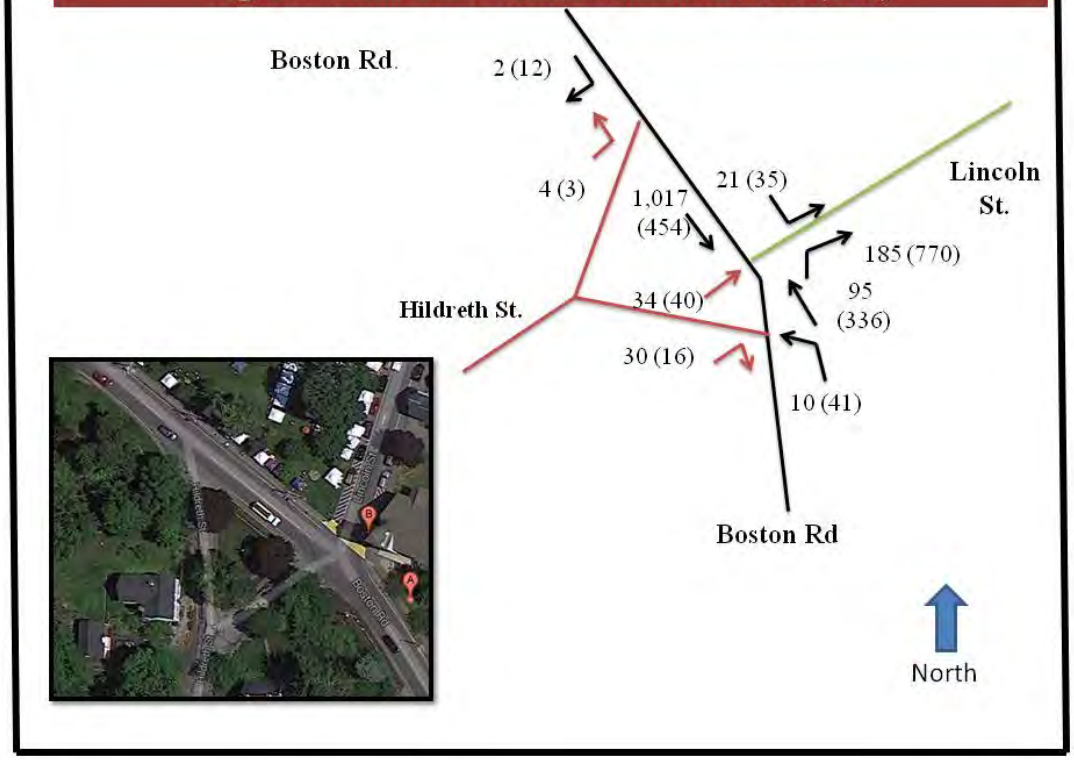


Figure 3: Graniteville Rd at Main St.; A.M. (P.M.)

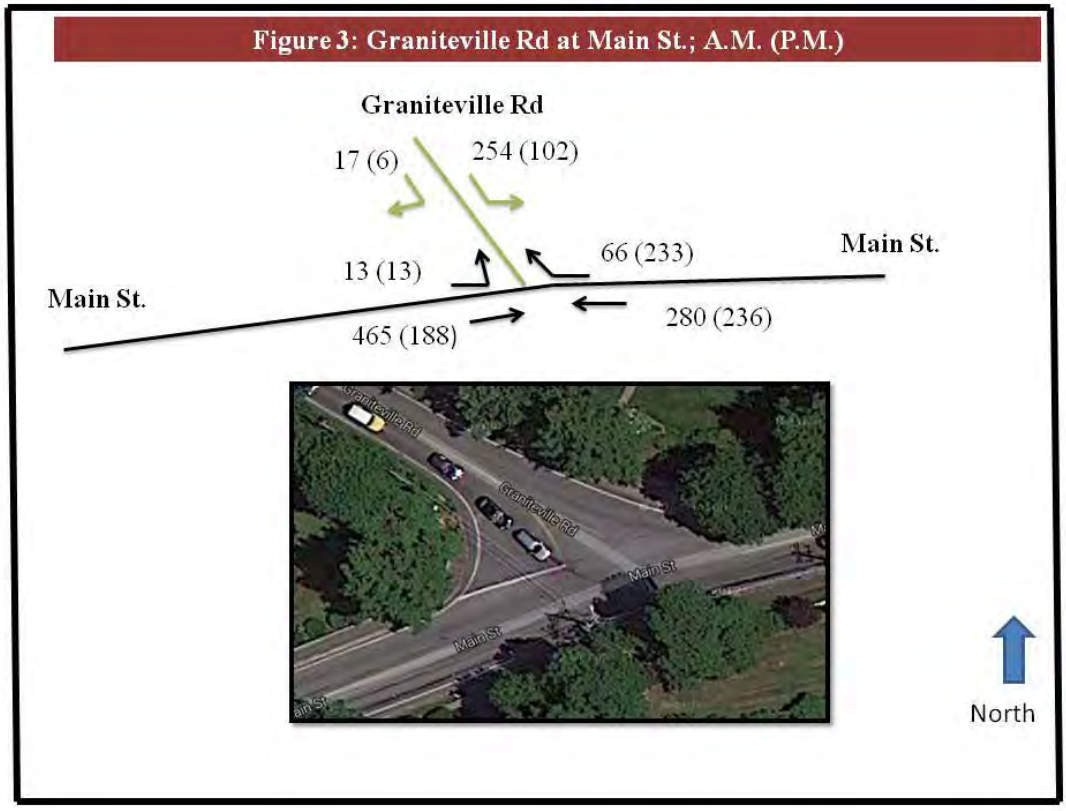


Figure 4: Boston Rd at Main St.; A.M. (P.M.)

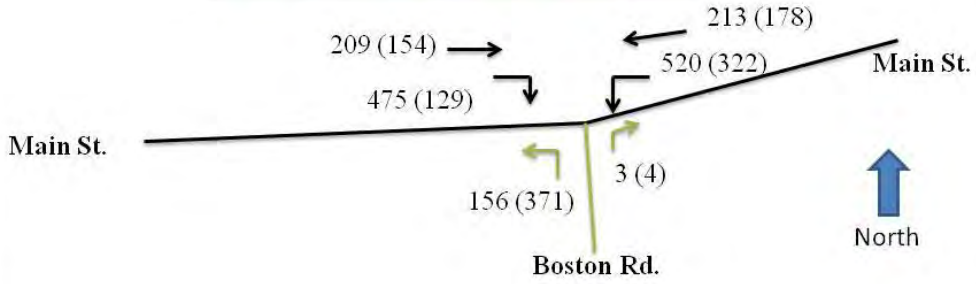
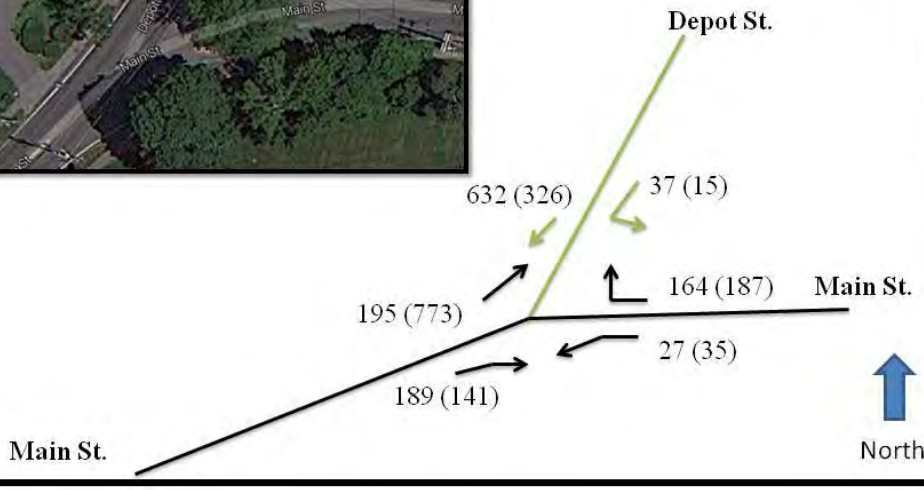


Figure 5: Depot St at Main St.; A.M. (P.M.)



E. Crash Data Analysis

Crash data for the key intersections within the study area was analyzed. The data was derived from MassDOT's statewide accident database, and includes traffic crashes that occurred over a three-year period between 2008 and 2010. Table 4 below summarizes the crash rate for each intersection and provides a comparisons to other similar intersections in MassDOT District 3 area. Information regarding the type of crash, severity, time of day, and surface conditions is also provided.

Table 4: Westford Center Crash Data Analysis Summary

Major Street	Main St	Main St	Main St	Main St	Boston Rd
Minor Street	Graniteville Rd	Boston Rd	Lincoln St	Depot St	Hildreth St/ Lincoln St
Year					
2008	1	4	1	3	4
2009	1	3	0	1	2
2010	0	1	1	1	2
Total	2	8	2	5	8
MassDOT District 3 Crash Rate	0.87	0.87	0.87	0.87	0.87
Calculated Crash Rate	0.21	0.55	0.11	0.29	0.41
Higher than expected?	no	no	no	no	no
Type					
Angle	1	5	0	2	0
Rear-End	0	2	2	1	4
Side Swipe	0	0	0	0	1
Run-off Road	1	0	0	1	3
Other	0	1	0	1	0
Time of Day					
AM Peak	0	3	0	1	3
PM Peak	0	3	1	0	0
Off Peak	2	2	1	4	5
Pavement Conditions					
Dry	2	8	1	3	4
Wet	0	0	1	0	3
Snow/Ice	0	0	0	1	1
Other	0	0	0	1	0
Severity					
Property Damage Only	1	8	2	4	8
Personal Injury	1	0	0	1	0
Fatal	0	0	0	0	0
Other/unknown	0	0	0	0	0

Source: MassDOT Statewide Accident Database, 2008-2010

The results of the crash analysis are summarized below:

- Each of the study area intersections has a lower than expected crash rate when compared with the MassDOT District 3 average. None of the reported crashes during the three-year study period involved pedestrians, bicyclists, or parked vehicles.

- The intersection of Main Street and Graniteville Road was the site of two (2) crashes during the study period. One was an angle accident that occurred around 2:30 p.m. and involved a non-fatal injury. The other reported crash involved a single vehicle that ran off the road and struck a utility pole, resulting in property damage.

- There were eight (8) reported crashes at the intersection of Main Street and Boston Road. All of the crashes were reported as property damage only incidents with no injuries. Angle crashes were the most prevalent accident type at this location, and crashes were evenly split between peak and off peak hours.

- Two (2) crashes occurred at the Main Street/Lincoln Street intersection. Both incidents were property damage only rear end crashes. One crash occurred during the evening peak hour under wet roadway conditions. The other occurred after the P.M. peak on a dry evening in November.

- The Main Street at Depot Street intersection experienced five (5) crashes, with one reported injury occurring in an angle incident in 2008. Two crashes were the result of single vehicles running off the road during a snow event in February 2010.

- Eight (8) crashes were reported at the intersection of Boston Road and Hildreth Street/Lincoln Street, with no injuries occurring. The majority of crashes were either rear end or run off the road type incidents. Of the three run off the road incidents, two occurred under adverse weather conditions.

F. Traffic Operations

Traffic operations within the study area were analyzed at key intersections along Boston Road, Lincoln Street, Main Street and Depot Street using accepted traffic analysis techniques. The level of service (LOS) was calculated for the morning and evening peak travel periods. Level of Service (LOS), as defined within in the Institute of Traffic Engineer's *Highway Capacity Manual*, is used to qualitatively describe general operating conditions based on performance measures such as control delay, speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. There are six levels of service ranging from A (free flow conditions) to F (highly delayed conditions). LOS takes into account factors specific to each location, such as traffic volume, roadway capacity, speed, roadway grade, traffic control

devices, geometry, and delay. LOS A through D is considered acceptable in an urbanized area such as Westford, while LOS E and F indicate delay and congestion warranting mitigation.

Level of Service (LOS) for a two-way stop-controlled intersection is determined by the computed or measured control delay. Control delay at an unsignalized intersection is the result of vehicle delay associated with a traffic control device. Control delay includes initial deceleration delay, stopped delay, queue move up time, and final acceleration delay.

LOS is determined for each minor street movement, as well as for major street left turns, using criteria described in Table 5 below. LOS is not defined for the major street approaches or for the overall intersection for three primary reasons: (1) major street through vehicles are assumed to experience zero delay; (2) the disproportionate number of major street through vehicles at a typical two-way stop-controlled intersection skews the weighted average of all movements, resulting in a very low overall average delay for all vehicles; and (3) the resulting low delay can mask important LOS deficiencies for minor movements.

Table 5: Level of Service Criteria for Unsignalized Intersections*

LOS	Control Delay per Vehicle (s/veh)
A	≤ 10
B	> 10-15
C	>15-25
D	> 25-35
E	> 35-50
F	> 50

**Highway capacity Manual*; Transportation Research Board; Washington DC; 2000; p 17-2.

The results of the traffic operations analysis for Westford Center are provided in Table 6 on the following page, and the information is also graphically displayed on Map 3 located on page 26. The average control delay for each vehicle, as well as the critical movement level of service for each intersection, is shown for the peak travel period during a typical weekday

.

Table 6: Existing Peak Hour Levels of Service for Study Area Intersections

Intersection	Minor Street Movement[1]	Type of Control	AM Control Delay (sec/veh)	AM Peak LOS	PM Control Delay (sec/veh)	PM Peak LOS
Main Street at Graniteville Road	Graniteville Road SB Left Turn	Stop	60.4	F	18.1	C
	Graniteville Road SB Right Turn	Stop	10.3	B	10.7	B
Main Street at Boston Road	Boston Road All Turns	Stop	-	F	626.9[2]	F
Main Street at Lincoln St/Library	Lincoln Street Through/Right Turns	Yield	11.0	B	30.4	D
	Library Entrance All Turns	Stop	26.3	D	754.2[2]	F
Boston Road at Hildreth Street	Hildreth Street Through/Right	Stop	41.1	E	89.1	F
	Hildreth Street Left Turns	Stop	34.5	D	37.7	E
Main Street at Depot Street	Main Street WB Left Turns	Stop	58.1	F	-	F
	Main Street WB Right Turns	Stop	10.2	B	18.5	C

[1] *For unsignalized intersections, the minor street movement with most control delay is considered the critical movement. HCM 2000.*
[2] *For movements with high delays, the model has not accurately portrayed the realistic delay per vehicle.*

The analysis showed that minor street movements controlled by stop signs experienced long delays, leading to poor levels of service during the peak commute periods. The main cause of congestion throughout the Center is directly related to operations at the Main Street/Boston Road intersection. Currently, all Boston Road movements at Main Street must yield to Main Street movements. While this intersection operates at an acceptable level of service during off-peak hours, during morning and evening peak commuting times unacceptable delays occur. During both peak periods, queues form along Boston Road from Main Street to the I-495 interchange. This queuing backs up through the Boston Road/Hildreth Street intersection, impacting this intersection as well. The Main Street intersection with Boston Road also affects other Main Street intersections in the study area. The library entrance/ exit experiences long delays, especially during the evening commute when the library is open, because of the queuing on Main Street.

Left turning vehicles from Graniteville Road onto Main Street experience unacceptable delays during the AM peak period. This is most likely due to lack of acceptable gaps on Main Street at this time of day. The intersection suffers from lack of lane designation for all movements, leading to confusion among drivers attempting to access Main Street from Graniteville Road, which may also contribute to the delay at this location. Appropriate pavement markings and

signage on the Graniteville Road approach would help to better channelize traffic and reduce driver confusion.

At the intersection of Main Street and Depot Street left turning vehicles experience poor levels of service during each peak period. However, due to the low volumes of traffic turning left the installation of a signal is not warranted at this location. Because Main Street intersects Depot Street at a sharp angle, left turning drivers may have difficulty judging gaps in the mainline traffic flow. In order to improve their ability to judge these gaps in traffic, the Main Street minor approach should be straightened by moving the southern intersection approach to the north where the existing triangle median is located. This should eliminate the need for drivers to look over their shoulder to judge gaps in the traffic stream.

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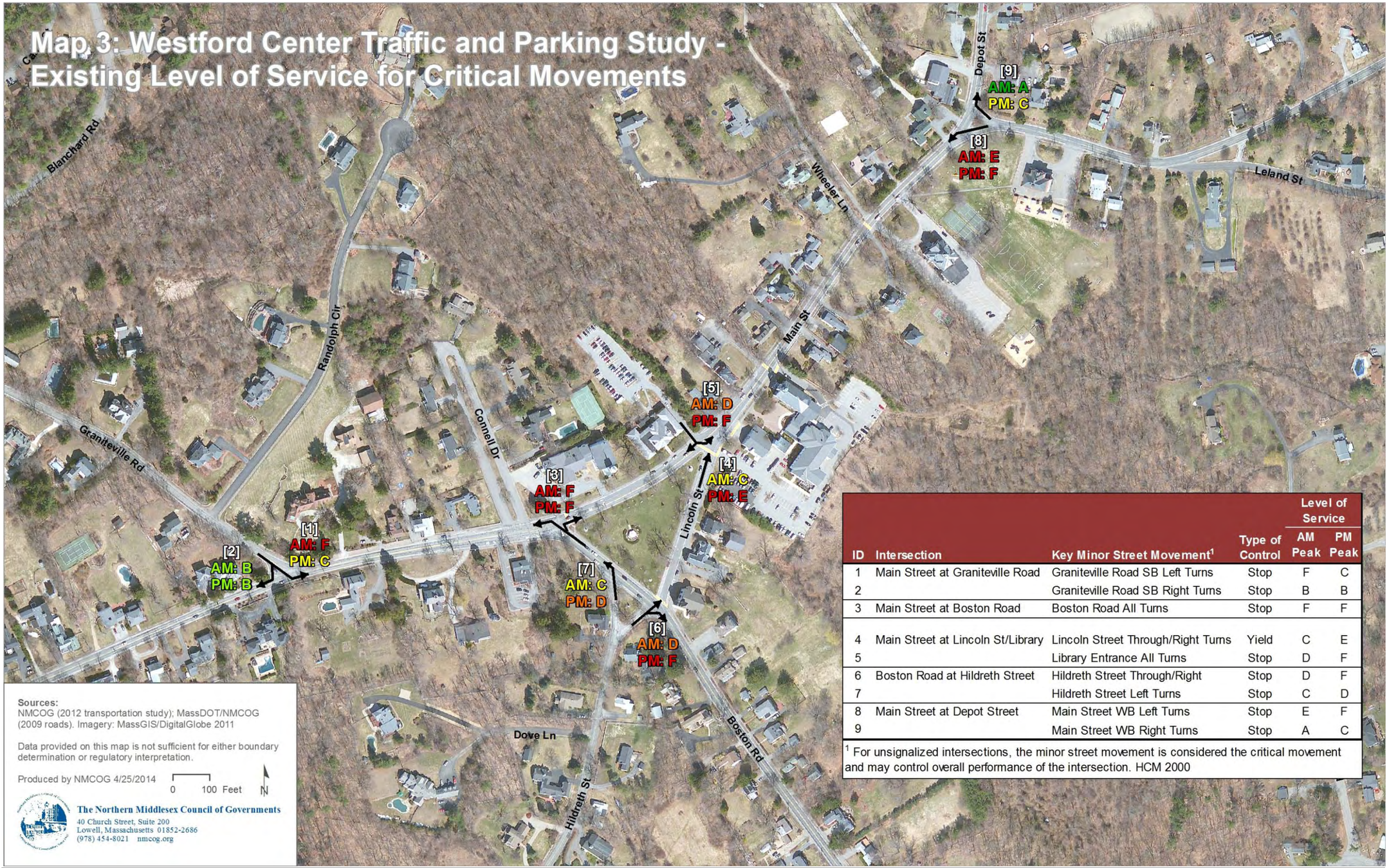


ID	Intersection	Key Minor Street Movement[1]	Type of Control	Level of Service AM Peak	Level of Service PM Peak
1	Main Street at Graniteville Road	Graniteville Road SB Left Turns	Stop	F	C
2		Graniteville Road SB Right Turns	Stop	B	B
3	Main Street at Boston Road	Boston Road All Turns	Stop	F	F
4	Main Street at Lincoln St/Library	Lincoln Street Through/Right Turns	Yield	C	E
5		Library Entrance All Turns	Stop	D	F
6	Boston Road at Hildreth Street	Hildreth Street Through/Right	Stop	D	F
7		Hildreth Street Left Turns	Stop	C	D
8	Main Street at Depot Street	Main Street WB Left Turns	Stop	E	F
9		Main Street WB Right Turns	Stop	A	C

[1] For unsignalized intersections, the minor street movement is considered the critical movement and may control overall performance of the intersection. HCM 2000

G. Analysis of Improvement Alternatives for Main Street and Boston Road

The existing conditions analysis show that the intersection of Boston Road and Main Street experiences unacceptable delays during the peak periods of the day. The congestion at this intersection affects the operations at other nearby intersections as well. Three possible improvement scenarios were analyzed for this location: (1) the installation of a modern roundabout, (2) the installation of a multi-way stop control, and (3) installation of a fully-actuated traffic signal. The analysis methodology for each alternative is discussed in detail below.

Roundabout Analysis Methodology

In considering a roundabout, a screening process must first be conducted. NMCOG uses a tool provided by CTPS and MassDOT as a guide for assessing candidate roundabout locations. The complete screening tool is located in Appendix C. Table 7 below outlines the range of roundabout parameters initially used for screening purposes. For this location, the initial screening focused on a single-lane roundabout given the characteristics of the Boston Road and Main Street intersection.

Table 7: Initial Range of Roundabout Parameters for Screening Purposes

Roundabout Parameter	Type of Roundabout		
	Mini	Single-Lane	Multi-Lane
Average daily traffic (vehicles)	< 16,000	< 25,000	< 45,000
Sum of entry and conflicting flows (vehicle per hour)		0-1,000 vehicles per hour	>1,000 vehicles per hour
Number of lanes	1	1	> 1
Inscribed circle diameter (feet)	45 – 90	90 – 150	120 – 200
Circulating roadway width (feet)		14 – 20	29 feet minimum
Entry width (feet)		14 – 18	25 feet minimum
Entry lane width (feet)		12 – 16	12 – 16
Entry radius (feet)		55 – 130 (100 feet typical)	65 – 130(100 feet typical)
Entry angle (degree)		20 – 60 (30 – 40 desired)	20 – 60(30 – 40 desired)

The analysis showed that the roundabout worked well during the evening peak, but the westbound Main Street approach failed during the morning peak. In addition, the construction of a roundabout would likely impact the Town Common or First Parish Church property as right-of-way to accommodate the roundabout design would be needed. The extent of the impact would need to be determined through additional engineering and survey work.

Multi-Way Stop Control Methodology

While there are no standards that must be met to consider a multi-way stop control intersection, the Manual of Uniform Traffic Control Devices (MUTCD 2009) does have guidance pertaining to the installation decision: "Multi-way stop control can be useful as a safety measure at intersections if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal." The MUTCD provides the following criteria for consideration of a multi-way STOP sign installation:

A. Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.

B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.

C. Minimum volumes:

1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and
2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but
3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70% of the values provided in Items 1 and 2.

D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.

Because the above criteria are not mandated, a multi-way stop can be considered for the Boston Road and Main Street intersection even if none of the above conditions are met. As outlined in MUTCD, other optional criteria that may be considered include the following:

A. The need to control left-turn conflicts;

B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;

C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and

D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.

Methodology and Criteria for Installation of a Traffic Control Signal

To consider a traffic control signal installation, traffic signal warrants are required. As outlined in the MUTCD, these warrants justify the need for a traffic control signal at a particular location. Traffic volumes and crash data were used to analyze whether, from a traffic engineering perspective, a traffic signal could be considered at the intersection of Main Street and Boston Road.

The 2009 edition of the Manual of Uniform Traffic Control Devices (MUTCD) states,

" The investigation of the need for a traffic control signal shall include an analysis of factors related to existing operation and safety at the study location and the potential to improve these conditions, and the applicable factors contained in the following traffic signal warrants:

Warrant 1: Eight-Hour Vehicular Volume
Warrant 2: Four-Hour Vehicular Volume
Warrant 3: Peak Hour
Warrant 4: Pedestrian Volume
Warrant 5: School Crossing
Warrant 6: Coordinated Signal System
Warrant 7: Crash Experience
Warrant 8: Roadway Network
Warrant 9: Intersection near a Railroad Grade Crossing

For purposes of this analysis, Warrants 1, 2, and 7 were analyzed for installation of a traffic signal at the intersection of Boston Road and Main Street.

a) Warrant 1: Eight-Hour Vehicular Volume

The eight-hour vehicular volume warrant considers traffic volumes throughout the day. Table 8 on the following page provides the minimum standards for justifying the need for a traffic signal. The bolded sections are the minimum standards that are applicable to the intersection of Boston Road and Main Street, given Main Street has a multi lane approach while Boston Road has a single lane approach.

Table 8: Warrant 1, Eight Hour Vehicular Volume

Condition A – Minimum Vehicular Volume							
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			Vehicles per hour on higher-volume minor-street approach (one direction only)		
Major Street	**Minor Street**	**100%**	**80%**	**70%**	**100%**	**80%**	**70%**
1……	1……	500	400	350	150	120	105
2 or more…	1……	**600**	480	420	**150**	120	105
2 or more…	2 or more…	600	480	420	200	160	140
1……	2 or more…	500	400	350	200	160	140

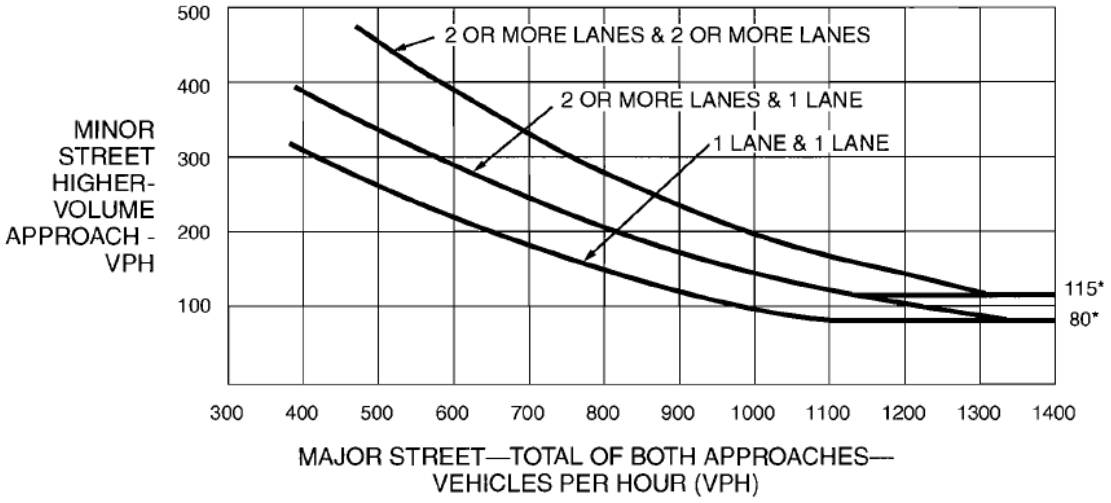
For the intersection of Boston Road and Main Street, Warrant 1 is satisfied in that for eight hours of a typical weekday the traffic volume on the major street approaches are greater than 600 vehicles per day and the minor street approach volume totals over 150 vehicles per day.

b) Warrant 2: Four Hour Vehicular Volume

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. According to the MUTCD, the need for a traffic control signal shall be considered if, "for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the minor street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 (see chart on the following page) for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours."

For the intersection of Main Street and Boston Road, Warrant 2 is satisfied with five hours of a typical weekday experiencing volumes above the warrant thresholds outlined in Figure 4C-1.

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

c) Warrant 7: Crash Experience

The Crash Experience signal warrant is used where frequency and severity of crashes are the principal reasons for installing a traffic signal. According to the MUTCD, the need for a traffic control signal shall be considered if all of the following criteria are met:

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12 month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 8 (of the MUTCD) exists on the major street and the higher-volume minor-street approach, respectively, to the intersection. These major-street and minor-street volumes shall be for the same eight hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours."

At the intersection of Main Street and Boston Road Warrant 7 is not met because the number of reported crashes (8 in three years, no more than 4 in one year) is lower than the five crash minimum standard stated in the warrant.

Summary of Improvement Alternatives Analysis

Table 9 on the following page summarizes the results of the improvement alternative analysis based on the three traffic control scenarios explored for the intersection of Main Street and Boston Road. First, the modern roundabout design was investigated to determine if this alternative would mitigate the existing congestion. The roundabout worked well during the evening peak, but the Main Street westbound approach failed in the A.M. peak. In addition, this alternative would likely impact a portion of the Town Common and the First Parish Church property. Such impacts are likely to generate significant public opposition to this alternative.

The Multi-Way Stop option would benefit those drivers approaching the intersection on Boston Road during both peak periods. However, it adversely affects the eastbound and westbound approaches on Main Street, to the point where there are noted unacceptable delays. This option would not involve taking of right of way, in that pavement markings and signage would be the only improvements needed.

The traffic signal scenario mitigates the congested conditions currently seen at the intersection, with overall operations at LOS B for both peak periods of the day. This option would serve to reduce the existing long queues seen throughout Town Center. Given that the Town Center is part of a National Register Historic District, the visual implications of constructing a signal within the Town Center may be unacceptable. The decision of whether to install a signal will need to be discussed and publicly vetted by local decision-makers.

Table 9: Traffic Operations at Main Street/Boston Road Intersection with Traffic Control Options

Traffic Control Option	Minor Street Movement[1]	Type of Control	AM Control Delay (sec/veh)	AM LOS	PM Control Delay (sec/veh)	PM Peak
Modern Roundabout	EB Approach	Yield	17.0	C	7.0	A
	WB Approach	Yield	65.0	F	11.0	B
	NB Approach	Yield	5.0	A	7.0	A
Multi-Way Stop Control	EB Approach	Stop	45.0	E	12.1	B
	WB Approach	Stop	65.3	F	18.6	C
	NB Approach	Stop	15.5	C	23.2	C
	Complete Intersection	Stop	51.6	F	18.4	C
Fully Actuated Traffic Signal	EB Approach	Traffic Signal	18.7	B	13.6	B
	WB Approach	Traffic Signal	12.2	B	12.1	B
	NB Approach	Traffic Signal	21.6	C	12.4	B
	Complete Intersection	Traffic Signal	15.9	B	12.5	B

H. Bicycle and Pedestrian Facilities

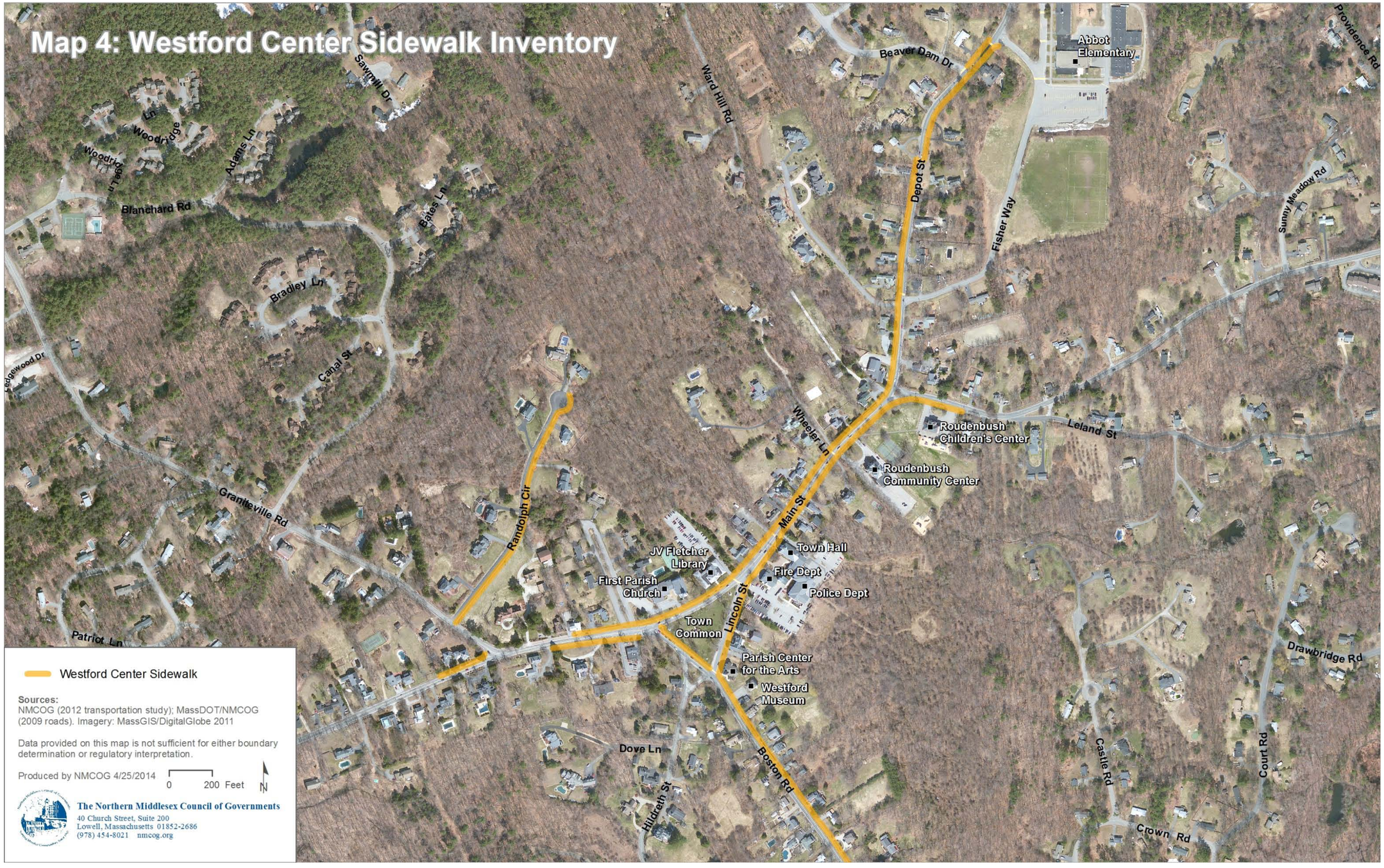
Communities that promote walking and other forms of non-motorized transportation can reap significant social, environmental and health benefits. Safe, convenient and pedestrian-friendly sidewalks and walkways provide opportunities for exercise, help people meet and socialize, and give children and others who do not drive mobility options. With the option to walk and bike available, communities can decrease the number of vehicles on the roadway, helping reduce congestion, air pollution and the need for large parking facilities.

When considering improvements to pedestrian and bicycle facilities, it is important to take into account the needs of all users, including those with disabilities or physical impairments. Sidewalks should be wide enough to safely accommodate wheelchairs and wheelchair ramps at crosswalks should meet ADA standards.

Children are often users of the bicycle and sidewalk network when walking to and from school. Programs such as Safe Routes to Schools have been designed to promote physical activity for school children, increase safety, reduce traffic congestion and improve air quality. The program is aimed at providing information to elementary school children, parents, and the general public

relative to the benefits of walking, bicycling, carpooling, utilizing public transportation, and riding the school bus to and from school.

Map 4 shows the location and the extent of the sidewalk network within the study area. There are sidewalks throughout most of the study area, although gaps in the network exist along Main Street between the Common and Graniteville Road. The characteristics of the sidewalk network are discussed in the following section of this report.


Map 4: Westford Center Sidewalk Inventory
Sawmill Dr
Ward Hill Rd
Beaver Dam Dr
Abbot Elementary
Providence Rd
Woodridge Ln
Woodridge Ln
Adams Ln
Blanchard Rd
Bates Ln
Depot St
Fisher Way
Sunny Meadow Rd
Bradley Ln
Canal St
Hedgewood Dr
Wheeler Ln
Roudenbush Children's Center
Leland St
Roudenbush Community Center
Granteville Rd
Randolph Cir
Main St
JV Fletcher Library
Town Hall
Fire Dept
First Parish Church
Police Dept
Lincoln St
Town Common
Patriot Ln
Parish Center for the Arts
Westford Museum
Drawbridge Rd
Dove Ln
Boston Rd
Castle Rd
Court Rd
Hildreth St
Crown Rd
Westford Center Sidewalk
Sources:
NMCOG (2012 transportation study); MassDOT/NMCOG (2009 roads). Imagery: MassGIS/DigitalGlobe 2011
Data provided on this map is not sufficient for either boundary determination or regulatory interpretation.
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The Northern Middlesex Council of Governments
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Lowell, Massachusetts 01852-2686
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1. Sidewalk Inventory

Boston Road

An asphalt sidewalk runs along the northbound side of Boston Road from the Main Street south to Crown Road. South of Crown Road, no sidewalks exist along Boston Road until the road approaches Cornerstone Square and the Littleton Road intersection. The sidewalks along Boston Road are generally 4-feet wide with granite curbing throughout.

Photo 11: Boston Rd. north of Crown Rd.

Main Street

Photo 12: Main St in front of the Fletcher Library.

The Main Street sidewalk network follows the north side of the road from 27 Main Street to the Graniteville Road intersection. East of Graniteville Road, a path runs along Main Street until 40 Main Street, where the sidewalk begins again. The sidewalk continues on to the Depot Street intersection. The asphalt sidewalk along this section ranges between 4 to 6 feet wide, with concrete ramps and truncated domes in place, providing the proper transition between the sidewalk and the crosswalk in front of the Library. The sidewalk on the south side of Main Street begins at 39 Main Street and continues towards the Center, ending at the eastern edge of 45 Main Street, directly west of the Main Street/ Boston Road intersection. The sidewalk on the southern side of Main Street connects with the Lincoln Street intersection, and follows the eastbound lane of Main Street through the Main Street/ Depot Street intersection, ending at the Roudenbush Children's Center.

Depot Street

The Depot Street sidewalk network was inventoried from the Abbot Elementary School to the Depot Street/ Main Street intersection. The sidewalks are constructed of asphalt and are generally in fair condition, with the exception of a few locations. The sidewalk on the western side of Depot Street ends at Beaver

Photo 13: Depot St south of Beaver Dam Dr.

Dam Drive and decorative pillars line the front of a residential property where the sidewalk would otherwise be located. The sidewalk resumes on the western side of the roadway at 18 Depot Street near the mid-block crosswalk. Depot Street sidewalks do not have ADA compliant ramps at crosswalks within the study area.

Lincoln Street

Photo 14: Sidewalk on Lincoln St.

A 6-foot asphalt sidewalk runs along the southeastern edge of Lincoln Street, connecting the Boston Road sidewalk to the Main Street network. Lincoln Street has two crosswalks, one at the intersection where it meets Boston Road and the other at Main Street. Concrete ramps with truncated domes provide the transition between the sidewalk and the Lincoln Street crosswalk in front of the Public Safety building. Brick pavers cross the northeastern point of the Town Common from the Fire Station to the Fletcher Library.

Graniteville Road

There are no sidewalks located along the section of Graniteville Road within the study area.

Randolph Circle

A 4-foot wide asphalt sidewalk runs along the east side of this roadway, beginning at Graniteville Road and ending at 11 Randolph Circle.

Photo 15: Sidewalk at Randolph Circle.

2. Crosswalks

The Westford Center study area has eight crosswalks, four of which are located at intersections and four that are at mid-block locations.

- The crosswalk at the Lincoln Street/Boston Road intersection runs in a general northwest/ southeast orientation crossing Lincoln Street;
- The crosswalk at the Lincoln Street/Main Street intersection traverses both Lincoln and Main Street at the eastern tip of the Town Common, and provides access between the Fletcher Library, the Public Safety buildings and Town Hall;
- The crosswalk at the Main Street/ Boston Road intersection crosses Main Street between the Town Common and the First Parish Church;

Photo 16: Crosswalk on Depot St by Fisher Way.

- The mid-block crosswalk on Main Street at Town Hall allows pedestrians to access the C. Thomas Paul Trail from Town Hall;
- A crosswalk exists on Main Street directly west of the Roudenbush Community Center;
- A crosswalk is located at the Depot Street/ Fisher Way/ Woolsack Drive intersection;
- A mid-block crosswalk is found at 16 Depot Street; and
- A crosswalk traverses Depot Street from 24 Depot Street to the Abbot School.

During the public outreach process, Town residents commented on the lack of a crosswalk between Hildreth Street and Lincoln Street crossing Boston Road. Currently there is no existing sidewalk along the west side of Boston Road or on Hildreth Street to connect a crosswalk. The lack of infrastructure inhibits pedestrian safety and is not be recommended at this location until such time as sidewalks are constructed in the area.

3. Pedestrian Trails

The C. Thomas Paul Trail is nearly 2.5 miles long. The unimproved trail runs between Town Hall and the Stone Arch Bridge at Stony Brook, with a spur that connects Town Hall to the Roudenbush Community Center. The trailhead sign in Photo 17 is located on the north side of Main Street across from Town Hall. Another sign at the rear of the Town Hall parking lot designates the beginning of the spur trail. Maintained by the Westford Conservation Trust, the main trail runs between Cold

Photo 17: C. Thomas Paul trailhead

Spring Road and Forge Village Road, and passes the town-owned Day Farm and through the Boutwell Brook Conservation land. The majority of the trail is marked by yellow blazes and much of the woodland that the trail passes through is permanently preserved open space belonging to Blanchard Farms.

4. Pedestrian Facility Analysis

With the exceptions of Graniteville Road and Hildreth Street, sidewalks are located on at least one side of every roadway within the Westford Center study area. The majority of the sidewalks are in good condition structurally but not all are ADA compliant. Some of the sidewalk deficiencies noted include cracked or poor pavement condition, sidewalk approaches that are not properly aligned with the crosswalk, crosswalks that do not connect, and lack of snow removal in winter. These issues can make it difficult for pedestrians to navigate Westford Center and the surrounding areas in a safe manner.

The sidewalk deficiencies noted as part of this study are as follows:

- The sidewalk along Boston Road on the western side of the Town Common has signage (Photo 18) directing people to the handicap walkway that leads to the bandstand. When the Common was restored, material was placed under the grass to provide ADA compliant access. However, the area with this accommodation is not well delineated.

Photo 18: Signage at the Town Common leading patrons to the bandstand.

Photo 19: Walkway leading to the bandstand.

- The sidewalk in front of the Roudenbush Children's Center is in poor condition and is only 2.5 feet wide, while ADA standards require a minimum 4- foot wide clear path;
- The sidewalk adjacent to a utility pole in front of the residence at 24 Depot Street is failing and a large hole has developed, thereby narrowing the useful portion of the sidewalk. Tree roots are also pushing through and raising the sidewalk in this area;
- The sidewalk on the northwest side of Depot Street stops a few feet west of Beaver Dam Drive. Decorative pillars line the area where the sidewalk would otherwise be located. The sidewalk does not resume on this side of Depot Street until 18 Depot Street, near the crosswalk;

- The sidewalk along the west side of Depot Street, continuing west from 16 Depot Street, is in fair to poor condition. Tree roots are lifting the sidewalk and causing structural problems;
- The sidewalk on the north side of Main Street in front of 68 Main Street is showing significant damage due to tree roots;
- The crosswalk at Lincoln Street and Boston Road is cracking where the sidewalk meets the crosswalk.
- The southern end of the crosswalk on Main Street east of Boston Road does not meet ADA standards, as shown in Photo 20. The curb cut opening is very narrow and is not aligned with the existing crosswalk. Pedestrians with limited mobility would encounter difficulty navigating this end of the crosswalk.

Photo 20: Crosswalk on Main Street East of Boston Road

- The crosswalk that transverses Depot Street in front of the Abbot Elementary School does not connect to a sidewalk network at the school. Pedestrians are forced to share the school driveway with vehicles and buses in order to access the front entrance of the school. In the warmer months, able-bodied pedestrians and students can use the lawn for refuge, but during winter months when there is snow on the ground pedestrians are forced to use the travel lanes. A connected sidewalk network from Depot Street into the Abbot School is needed.

Photo 21: Crosswalk on Depot Street at the Abbot School

- The crosswalk in front of Town Hall on Main Street ends at a driveway opening causing a conflict between pedestrians and vehicles. Moving this crosswalk slightly to the west will remove the conflict and improve pedestrian safety.

5. Bicycle Facilities

On June 2, 2010, the Massachusetts Department of Transportation introduced the GreenDOT Policy Directive, a comprehensive environmental responsibility and sustainability initiative that is intended to "green" the state's transportation system. The following are the principal goals of the GreenDOT policy directive:

- Reduce greenhouse gas (GHG) emissions;
- Promote the healthy transportation options of walking, bicycling, and public transit; and

- Support smart growth development.

The plan details sustainability goals, including MassDOT's statewide mode shift goal, which aims to triple the current mode share of bicycling, public transit, and walking by 2030.

By law, bicyclists are considered vehicle operators and are allowed to use all roadways except limited access highways within the Commonwealth of Massachusetts. Encouraging safe bicycle usage along the roadways of Westford Center would not only help promote a healthier lifestyle, but could translate into more residents using alternative modes of transportation for short distance errands or to attend events in the Town Center, relieving some of the parking burdens that have been identified by project stakeholders.

Overall, the study area lacks designated bicycle facilities. There are no marked bicycle lanes or signage reminding drivers to "share the road" with bicycles. Bicycle racks are uncommon, as the library is the only building within the Town Center equipped with a bicycle rack. Based on field observations, bike lanes could be added on two roads within the study area without disturbing traffic flow and without major construction.

Photo 22: Bike lane example

Lincoln Street is a single-lane road with a roadway width of approximately thirty-eight (38) feet. Eight (8) foot shoulders on each side of the roadway are used for on-street parking. A travel lane of twenty-two (22) feet exists which exceeds minimum width standards for a one-way street. There is more than enough space for adding a designated bike lane.

Photo 23: Bicycle signage example

Main Street around Westford Common has a roadway width between thirty-four (34) to forty (40) feet, with a westbound shoulder width between five (5) and six (6) feet. Currently parking occupies the shoulder in front of the Library. It is possible to create a bike lane at this location but it would require removal of the on-street parking spaces. Without creating additional parking behind the Library this would represent a hardship for the Library, as expressed during a meeting with the Library Trustees as part of the stakeholder outreach for this project.

Where dedicated bike lanes are not an option due to roadway width limitations throughout most of the study area, the Town should consider erecting "share the road" signage and/or painting "sharrows" on the roadways. When performing rehabilitation projects on existing roadways, a "Complete Streets" approach to construction should be utilized, providing bicycle and pedestrian

accommodations wherever possible. Small changes to roadway design can foster an environment where motor vehicle operators and bicyclists feel comfortable sharing the roadway.

Shared lane markings or sharrows, help convey to motorists and bicyclists that they must share the roads on which they are operating. The purpose of the markings is to create improved conditions for bicyclists, by clarifying where they are expected to ride, and to remind motorists to expect bicyclists on the road. In the absence of bicycle lanes, motorists often neglect to safely share travel lanes with bicyclists, which can compel bicyclists to ride closer to parked vehicles.

The Manual on Uniform Traffic Control Devices states that shared lane markings cannot be placed on roadways that have a speed limit above 35 mph, making all of the roadways within the study area viable candidates for sharrows or shared lane markings. Based on the characteristics of the study area roadways, the following improvements are recommended to enhance bicycle travel:

- Install a bicycle lane on Lincoln Street; and
- Install sharrows and appropriate signage on Boston Road between Crown Road and Main Street, on Main Street between Graniteville Road and Depot, and on Depot Street between the Abbott School and Main Street.

Map 5 graphically displays the locations of the proposed bicycle accommodation improvements. The recommended “share the road” sign and sharrow pavement marking is shown below.

Photo 24: MUTCD bicycle signage

Photo 25: A sharrow pavement marking

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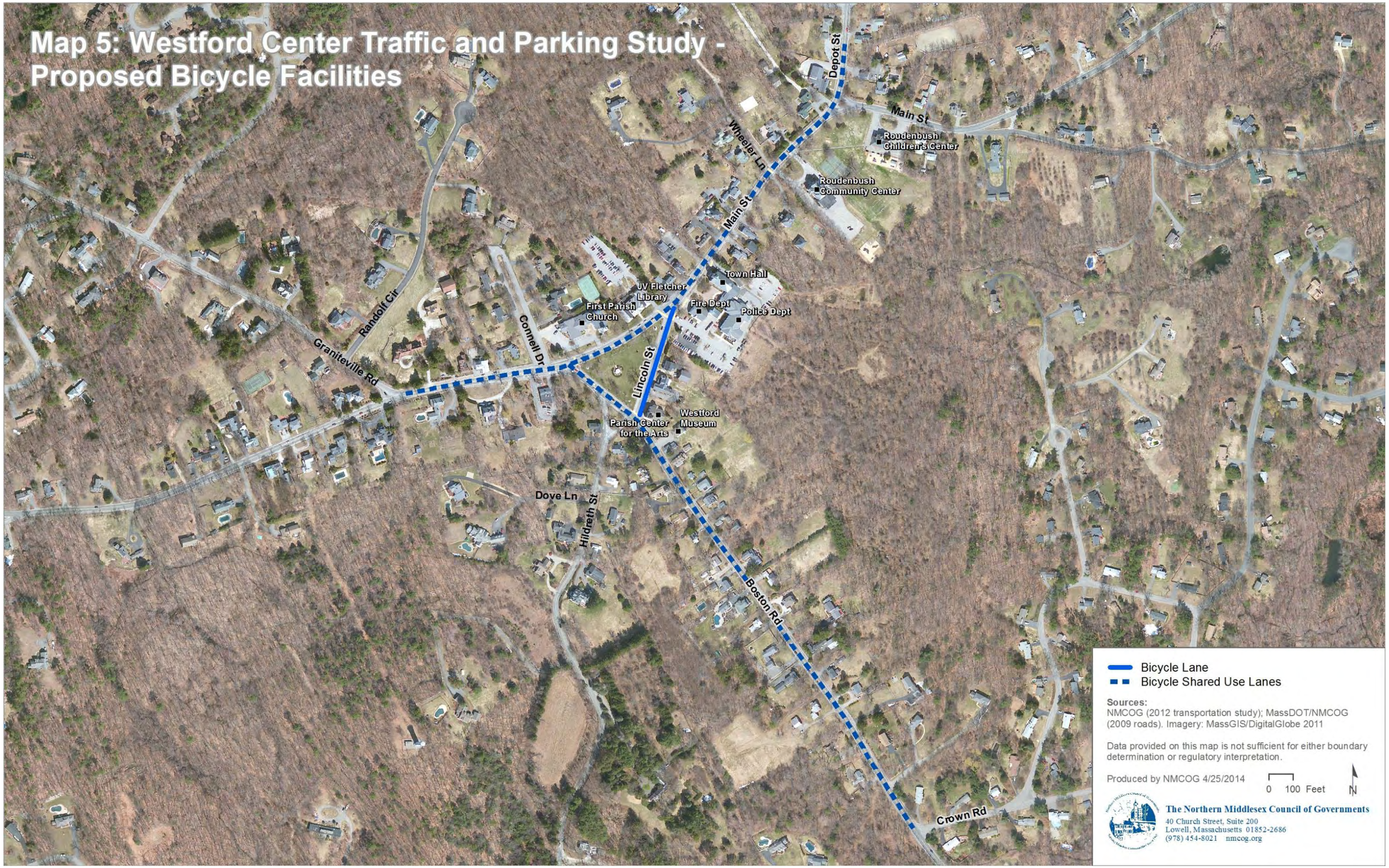
Map 5: Westford Center Traffic and Parking Study - Proposed Bicycle Facilities
Depot St
Main St
Wheeler Ln
Roudenbush Children's Center
Roudenbush Community Center
Main St
Town Hall
JV Fletcher Library
First Parish Church
Fire Dept
Police Dept
Randolf Cir
Graniteville Rd
Connell Dr
Lincoln St
Westford Museum
Parish Center for the Arts
Doye Ln
Hildreth St
Boston Rd
Crown Rd
Bicycle Lane
Bicycle Shared Use Lanes
Sources:
NMCOG (2012 transportation study); MassDOT/NMCOG (2009 roads). Imagery: MassGIS/DigitalGlobe 2011
Data provided on this map is not sufficient for either boundary determination or regulatory interpretation.
Produced by NMCOG 4/25/2014
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I. Parking in Westford Center

There is a need for additional parking within the Center, especially during special events such as the Strawberry Festival and the weekly summer Farmer's Market. Map 6 shows the locations of the three hundred seventy-two (372) parking spaces currently available in Westford Center, including 294 public parking spaces available in municipal lots and on the street. There are sixty-two (62) parking spots at the Roudenbush Children's Center, including two (2) spots reserved for handicap parking. The Fletcher Library lot has fifty-nine (59) public parking spaces and two (2) reserved spaces for vehicles with handicap placards. The First Parish Church lot has twenty-seven (27) parking spaces, while the Westford Museum has approximately seven (7) unmarked parking spaces.

The Emergency Services building complex, which houses the Police and Fire Departments, has a total of ninety-two (92) parking spaces, although most of the lot is used for service vehicles and police/fire employees. Twenty-five (25) parking spaces in the Emergency Services building area are reserved for public parking, including four (4) handicap accessible parking spaces, while sixty-three (63) spaces are reserved for public safety personnel and vehicles. Town Hall has forty-four (44) parking spaces with forty (40) reserved for the public, one (1) reserved for emergency vehicles, and three (3) for handicap parking.

Within the study area, three (3) streets are marked for on-street parking. Lincoln Street has twenty-two (22) public parking spaces located on both the northwest and southeast sides of the street. The only parking restriction noted for Lincoln Street is a single reserved parking spot for the Edward M. Connolly Insurance Company. On-street parking is allowed on Main Street across from Town Hall, in front of the Fletcher Library, and between Connell Drive and Graniteville Road for businesses on Main Street. In total there are fourteen (14) on-street spaces along Main Street, with six (6) having a 15-minute time limit during Library and Town Hall operating hours. Connell Drive has eighteen (18) on-street parking spaces along the median that separates the inbound and outbound sides of Connell Drive. A summary of the off- and on-street parking facilities can be found in Table 10.

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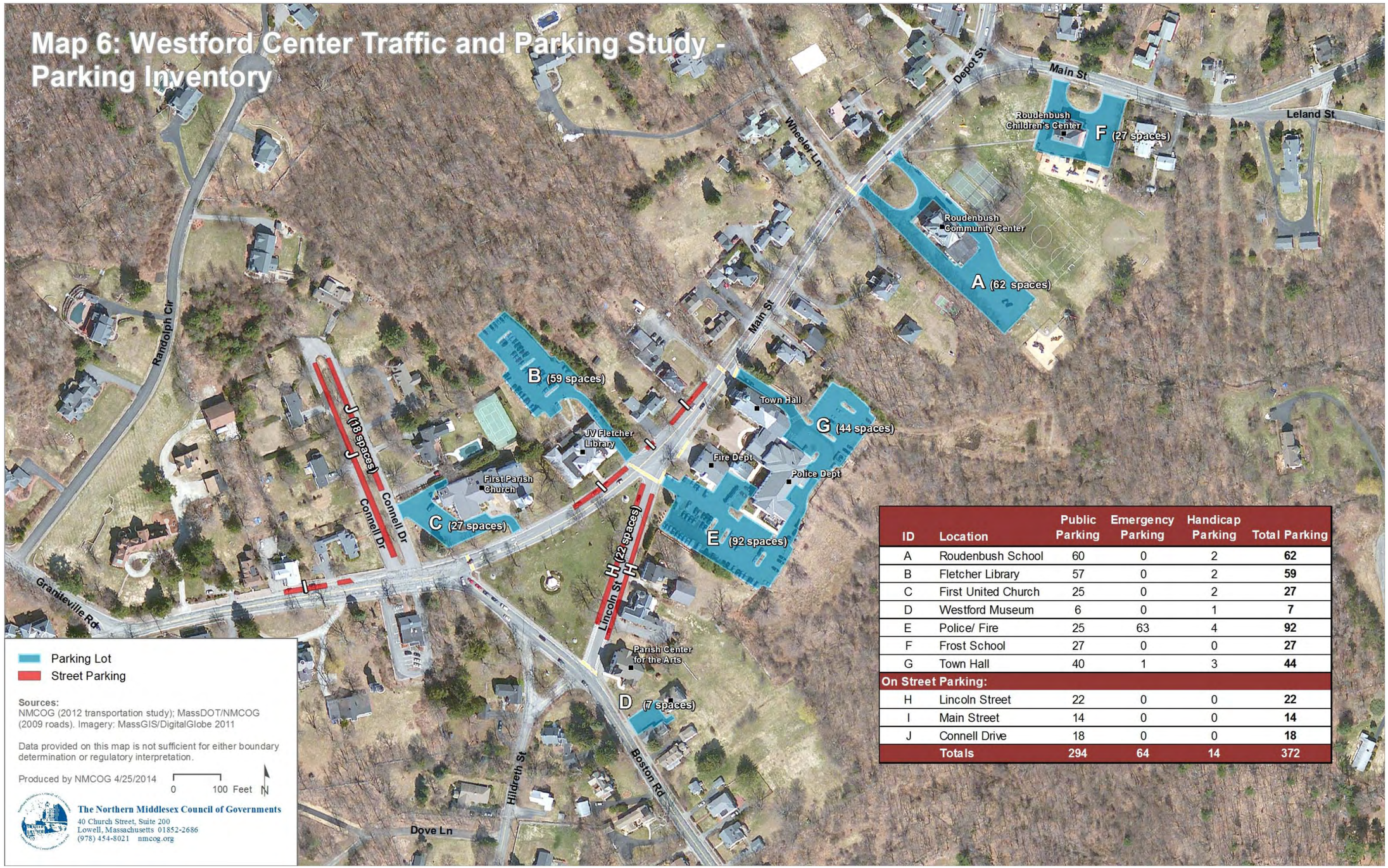

ID	Location	Public Parking	Emergency Parking	Handicap Parking	Total Parking
A	Roudenbush School	60	0	2	**62**
B	Fletcher Library	57	0	2	**59**
C	First United Church	25	0	2	**27**
D	Westford Museum	6	0	1	**7**
E	Police/ Fire	25	63	4	**92**
F	Frost School	27	0	0	**27**
G	Town Hall	40	1	3	**44**
On Street Parking:					
H	Lincoln Street	22	0	0	**22**
I	Main Street	14	0	0	**14**
J	Connell Drive	18	0	0	**18**
	Totals	**294**	**64**	**14**	**372**

Table 10: Westford Center Parking Inventory

Location	Public Parking	Restricted Parking	Handicap Parking	Total Parking
Roudenbush	60	0	2	62
Fletcher Library	57	0	2	59
First Parish Church	25	0	2	27
Westford Museum	6	0	1	7
Police/ Fire	25	63	4	92
Frost School	27	0	0	27
Town Hall	40	1	3	44
On- Street Parking				
Lincoln Street	22	0	0	22
Main Street	14	0	0	14
Connell Drive	18	0	0	18
Totals	**294**	**64**	**14**	**372**

J. Public Transit Facilities

Although the Center of Westford does not have fixed route bus service, the Lowell Regional Transit Authority (LRTA) operates both fixed route and demand responsive transit service within the Town of Westford. The # 15 Chelmsford/ Westford bus route operates on weekdays along the Littleton Road (Route 110) corridor from 6:00 A.M. to 8:45 P.M. Service is provided between the IBM facility in Littleton and the Kennedy Bus Transfer Hub in Lowell. The service operates on 90-minute headways Monday through Saturday.

The LRTA's Road Runner provides demand responsive paratransit service within a ¾ mile radius of the #15 bus route for seniors over the age of 60 and persons with a disability, as defined by the Americans with Disabilities Act (ADA). This service is available during the same hours of operation as the #15 route. However, the Town Center lies outside the geographic limits of the service.

Road Runner curb-to-curb demand responsive service to the Center is available through the Westford Council on Aging (COA). The Council service operates Monday through Friday, from 8:00 A.M. to 4:00 P.M. for seniors over the age 60 and persons with disabilities. The COA operates three Road Runner vans throughout the entire Town of Westford, with a 24-hour advanced reservation required.

III. Summary of Findings and Recommendations

There are several public facilities and amenities that draw residents and visitors to Westford Center. These include the J.V. Fletcher Library, Town Hall, Parish Center for the Arts, Westford Museum, First Parish Church and the festivals and events that take place on or around the Town Common. Westford Center truly is the civic and social heart of the community. Under existing conditions, the town center roadways experience traffic congestion during peak commuting hours. In addition, there is insufficient parking during special events or when more than one event is being held within the Center. Enhancing the walkability of the Center area neighborhoods would serve to make the Center more appealing to visitors, customers and residents. Encouraging users of the Town Center and the Common area to walk or bicycle to events would help reduce parking demand, and may have a slight impact on improving congestion. The following section outlines recommendations for addressing parking, pedestrian, bicycle, and traffic issues within the study area.

A. Parking Recommendations

1. **Create an Overflow Parking Area -** A small unpaved area located across from the athletic field on Fisher Way is a suitable location for additional overflow parking during Town-sponsored events such as the Strawberry Festival. The site presently appears to be used for parking during athletic events at the field. Additionally, during periods of high demand, the site could be utilized for Library and Town Hall employee parking, if needed. The proposed parking area is shown in Figure 6 on the following page.

Photo 26: Parking area across from athletic field on Fisher Way.

The distance between Fisher Way and the Town Common is approximately 0.4 miles. In order to provide a safe route for people to get from the Fisher Way parking area to the Town Common, the sidewalk network would need to be extended along Fisher Way. A minimum five-foot wide sidewalk with ADA compliant design is recommended with pedestrian-scale lighting for use at night. Shuttle transportation to and from this overflow lot may be needed for residents or employees with mobility issues and during inclement weather.

Figure 6: Potential Town Center Overflow Parking Area on Fisher Way

2. **Change the Schedule or Location for the Farmer's Market** - Changing the schedule for the Farmer's Market to a weekend day rather than Tuesday would help address the current parking crunch and reduce impacts to traffic flow during the evening peak hour. In addition, more residents would available to shop at the Farmer's Market on the weekend, compared to the commuting hours during the workweek. Hosting the Farmers Market at another location in Town may be another option to reduce pedestrian/vehicle conflicts in the Town Center.

3. **Construct Additional Parking behind the J.V. Fletcher Library** - A Town-owned parcel located behind the existing library parking lot has been identified as a viable candidate for additional parking. The parcel is primarily wetlands, but the west side of the parcel is located outside of the wetland buffer zone, providing room for additional parking with minimal wetland impacts. As shown in a conceptual design provided in Figure 7, this expanded parking area could provide approximately sixty-five (65) new parking spaces. Access to the new parking area would be through the existing parking lot, alleviating the need for any additional curb cuts on Main Street. The addition of a new parking area would necessitate the removal of seven (7) existing parking spaces at the northern end of the existing library parking lot in order to accommodate a driveway and sidewalk leading to the new parking area.

Alternatively, it is possible to simply expand the existing library parking lot by 6-8 spaces by paving an area in the northwest corner of the lot. There may be some minimal wetlands buffer impacts in this area, but it is outside of the fifty-foot "do not disturb" zone required by the Town's wetlands bylaw.

4. **Reconsider the use of the parking lot at the Public Safety buildings** – Currently 63 spaces are reserved for public safety vehicles and personnel. The Town needs to closely examine whether it is truly necessary to reserve so many spaces within the lot based on the number of personnel on duty at any given time. Is it possible to garage or park public safety vehicles that are not used on a daily basis at another location, thereby freeing up additional parking spaces for the public?

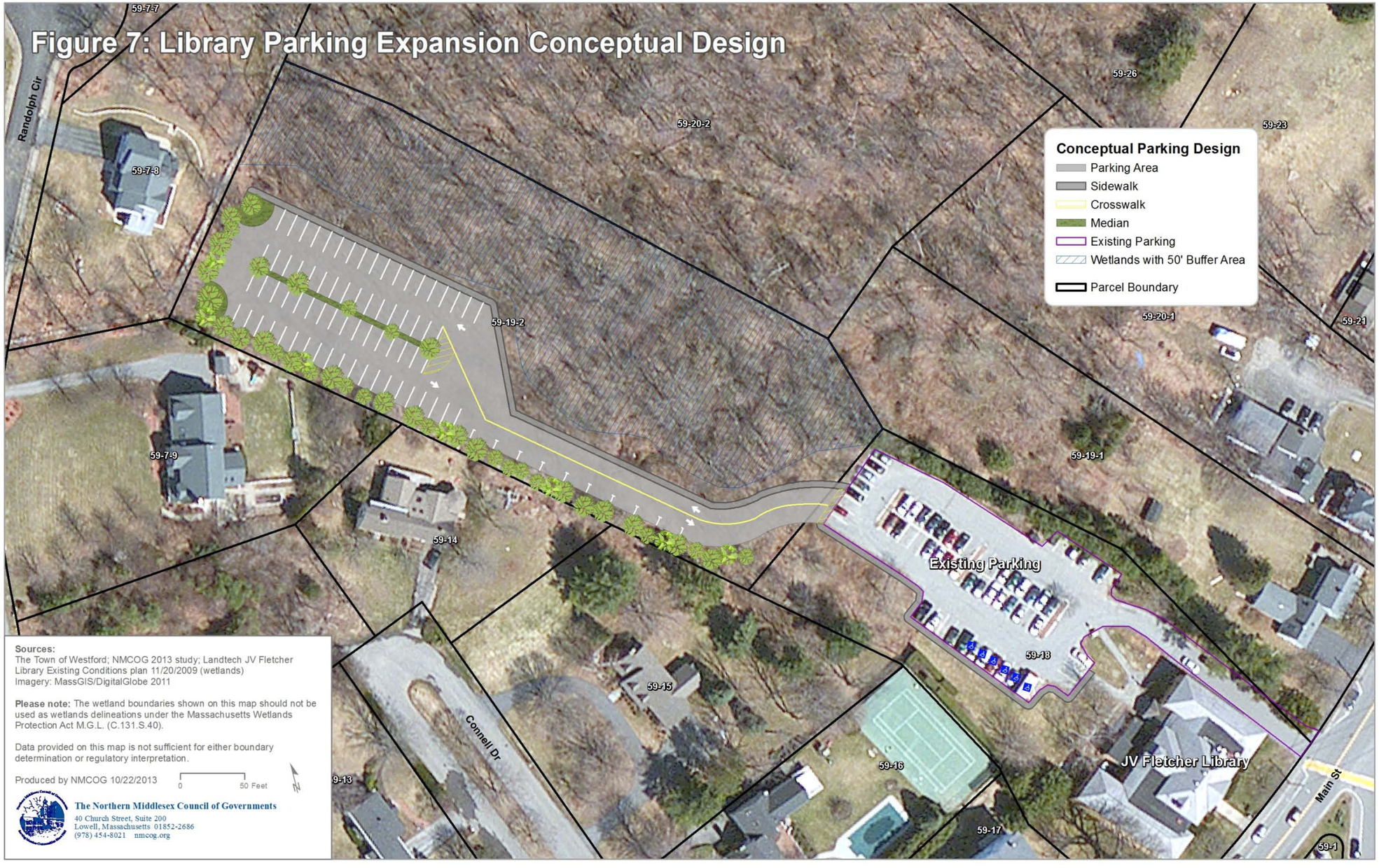
Figure 7: Library Parking Expansion Conceptual Design
Conceptual Parking Design
Parking Area
Sidewalk
Crosswalk
Median
Existing Parking
Wetlands with 50' Buffer Area
Parcel Boundary
Existing Parking
JV Fletcher Library
Randolph Cir
Connell Dr
Main St
59-7-7
59-7-8
59-7-9
59-20-2
59-26
59-23
59-19-2
59-19-1
59-20-1
59-21
59-14
59-18
59-15
59-16
59-17
59-1
Sources:
The Town of Westford; NMCOG 2013 study; Landtech JV Fletcher Library Existing Conditions plan 11/20/2009 (wetlands)
Imagery: MassGIS/DigitalGlobe 2011
Please note: The wetland boundaries shown on this map should not be used as wetlands delineations under the Massachusetts Wetlands Protection Act M.G.L. (C.131.S.40).
Data provided on this map is not sufficient for either boundary determination or regulatory interpretation.
Produced by NMCOG 10/22/2013
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B. Zoning Recommendation

Under the Town's Zoning Bylaw, a "Municipal parking lot or garage" is not allowed as a stand-alone use within the zoning districts found in the Town Center. (See Appendix B "Table of Principal Use Regulations" p. 129 of the Westford Zoning Bylaw). Municipal parking facilities must be an accessory use. However, use variances are allowed in the regulations per the second paragraph in section 9.2.2 of the Bylaw. If the Town is interested in adding off-street parking capacity as the primary land use, a use variance would be needed. The Town should review this section of the Zoning Bylaw to determine whether changes are desired or necessary.

C. Pedestrian Recommendations

Communities that promote walking and other forms of non-motorized transportation can reap significant social, environmental and health benefits that are not often available in automobile dominated places. Safe, convenient and comfortable sidewalks and walkways provide opportunities for exercise, help people meet and socialize, and give children and others who do not drive mobility options. A well-defined sidewalk network connecting the Town Center to surrounding neighborhoods is vital to creating a vibrant pedestrian friendly community. The following recommendations are directed at improving pedestrian accommodations within the study area:

1. **Address ADA Compliance Issues** - ADA compliance in sidewalk design is necessary for individuals with mobility issues. Sidewalks should be wide enough to safely accommodate wheelchairs, and wheelchair ramps at crosswalks should meet ADA standards. Earlier sections of this report note locations where ADA deficiencies are present.

2. **Install pedestrian-scale ornamental lighting** – Pedestrian-scale ornamental lighting would improve the pedestrian experience and enhance the historic character of the Center. Pedestrian-scale lights are typically positioned over the sidewalk, rather than the street, at about 12 to 15 feet above the sidewalk. The choice of light fixtures must meet the community's preferences, based on the character of the neighborhood. Factors to consider include number of luminaires per post (single, double, or lighting standards with three or more); materials, colors, and finishes; and historical style. Finally, in order to design the street as a public space, light fixtures should be conceived of as part of a coordinated line of amenities – not pieced together from a variety of incongruous components.

3. **Construct a Curb Extension on Lincoln Street at the intersection of Boston Road** - Curb extensions or bulb outs are a traffic calming device that narrows an intersection by extending the sidewalk further into the intersection. The narrowing of the street forces vehicles to slow down, reduces pedestrian crossing distances, and shields the end of an on-street parking lane from moving traffic. After hearing concerns from stakeholders regarding the speed at which vehicles take right turns from Boston Road onto Lincoln Street, the possibility of installing a curb extension was investigated. A curb extension would not only slow vehicles turning onto Lincoln Street, but would also provide a larger protected area for pedestrians crossing Lincoln Street in area of the Parish Center for the Arts (PCA).

Figure 8: Conceptual design of a curb extension at the intersection of Lincoln St and Boston Rd.

The width of the roadway at a curb extension is typically no wider than is necessary to accommodate the through lanes –that is 10 to 12 feet per lane plus an additional offset of 1 to 2 feet from the edge of the travel way. Lincoln Street, being one-way with parking lanes on both sides, has more than enough width to allow for a curb extension, while still maintaining turning radii appropriate for all vehicles using the roadway. A curb extension placed in front of the Parish Center for the Arts would not only slow vehicles turning on to Lincoln Street, but the protection offered by the curb extension would allow for an additional parking spot to be placed on the east side of Lincoln Street in front of the PCA. Figure 8 shows a conceptual drawing of what the curb extension at the Lincoln Street/ Boston Road intersection may look like when constructed.

4. **Realign mid-block crosswalks on Depot Street at the Abbot School and on Main Street at Town Hall** - The crosswalk located on Depot Street at the Abbot School should be realigned to a location a few feet south of the Abbot School entrance, eliminating the current alignment where the crosswalk ends at the vehicle entrance to the Abbott School. In addition, the ends of the crosswalk and the sidewalk network leading to the school should be kept free of snow and ice during the winter months. The crosswalk on Main Street in front of Westford Town Hall should be realigned so that it does not end at the

Photo 27: Snow blocking crosswalk in front of Abbot School.

mouth of the driveway for Town Hall. Moving the crosswalk slightly to the west and constructing new entrance ramp areas will serve to enhance pedestrian safety.

5. **Expand the sidewalk network on Depot Street -** Currently the sidewalk on the western side of Depot Street, south of Beaver Dam Drive, ends and does not re-emerge on the west side of the street until it meets the crosswalk in front of 18 Depot Street. Decorative pillars are found in the right-of-way where the sidewalk would otherwise be located. Completing the sidewalk network throughout the Depot Street corridor would promote walking, increase safety for pedestrians and would allow Safe Routes to School programs to be implemented. This in turn would decrease the number of vehicles that drop off and pick up students at the Abbot School.

Photo 28: Depot Street south of Beaver Dam Drive.

6. **Implement the Recommendations Outlined in the Town's Comprehensive Plan-** Westford promotes Smart Growth principles in its Comprehensive Plan and under the Land Use and Zoning section of Plan, on page 64, makes sidewalks a "high priority" given the lack of direct access to public transportation. Chapter Six "Housing and Neighborhoods", states that residents are "quite vocal about the shortage of sidewalks". Even where sidewalks do exist, as they do in most of the Center area, ". . . they do not connect with other sidewalks. . ." Further, there is a clear indication in Chapter Eight, "Transportation and Pedestrian Circulation", of the importance of sidewalks, stating: ". . . a community's transportation system encompasses much more than roadways. Sidewalks, bikeways, railroads and trails contribute to a multi-modal network and help form an effective system of moving people and goods to and from their destinations." (p. 117) The Plan lists recommendations on page 129 that address sidewalks and these recommendations apply to the Center, as well as to other parts of the community. The recommendations include:

- Prioritize sidewalk construction: the Town should develop a pedestrian plan to identify priority sidewalk locations and develop a vehicle for funding sidewalk projects in the future; and
- Adopt the Massachusetts Safe Routes to Schools, a program which promotes sidewalks around schools. This recommendation is especially important given the presence of the Abbot School to the town center study area.

7. **Promote the C. Thomas Paul Trail for pedestrian access to the Town Center from the neighborhoods to the north and west -** The Tom Paul Trail would mainly be accessible during the months when snow is not blanketing the ground. Promoting the trail would encourage healthy lifestyle choices for residents and potentially result in fewer vehicles in the Town Center.

8. Adopt a town regulation that requires the removal of snow from sidewalks - During field work for this project, NMCOG staff observed that the sidewalks are essentially impassable when

snow is on the ground. Chapter 148 of the town code governs driveways that cross sidewalks, snow deposits on sidewalks, curb cut replacement and discharge of storm water onto the town's sidewalks. Subsection 148.11.1 prohibits deposition of snow on any public sidewalks which has been previously cleared by the Town, and subsection 148.6 prohibits the intentional discharge of water onto or into a public sidewalk.

In its winter storm policy, the Town Highway Department outlines its procedures for clearing snow and residents are informed that the Town "does not perform winter maintenance on sidewalks". The policy also indicates that "residents are encouraged to clear sidewalks in front of their property". There is no town regulation that mandates residents clear sidewalks of snow or ice, unless the sidewalk has been previously cleared by the Town. Westford should consider implementing a regulation that requires the clearing of snow from the sidewalk by abutting property owners. Alternatively, the Town could purchase special equipment for sidewalk snow removal, as has been done in Chelmsford and other communities with the intent of having this responsibility rest with the Highway Department.

D. Bicycle Recommendations

The promotion of bicycle facilities within the area would help alleviate congestion and reduce parking demand. The following recommendations are aimed at promoting bicycle use in the study area:

1. **Install bicycle racks within the Town Center** -Install additional bicycle racks at J.V. Fletcher Library, Roudenbush Community Center, the Abbott School, Town Hall and on the Common. Racks should be placed with adequate clearance from curb ramps and crosswalks, street furniture, driveways, and parked cars.

2. **Establish a "Complete Streets" policy to provide accommodations for all roadway users on future roadway construction and reconstruction projects, where possible and practical**- By adopting a Complete Streets policy, communities direct their planners and engineers to routinely design and operate the transportation network to enable safe access for all users, regardless of age, ability, or mode. Roadways that are planned and designed using a Complete Streets approach may include: sidewalks, bike lanes (or wide paved shoulders), frequent and safe crossing opportunities, median islands, curb extensions, and narrower travel lanes.

3. **Install bicycle accommodations on study area roadways** - Install a bicycle lane on Lincoln Street, and install "sharrows" and "Share the Road signs on Boston Road between Crown Road and Main Street, on Main Street between Graniteville Road and Depot, and on Depot Street between the Abbott School and Main Street.

E. Traffic Improvement Recommendations

Three intersections in the Town Center study area experience unacceptable delays during the peak hours of a typical weekday. Improvement strategies for alleviating congested conditions at these locations are outlined below:

1. **Initiate a Community Discussion on the Possibility of Installing Signals at the intersection of Boston Road and Main Street -** As stated in the Traffic Analysis section of this report, improvements to the intersection of Boston Road and Main Street are needed to alleviate the congestion during peak traffic hours. The following three options were investigated:

- a modern roundabout (resulted in acceptable delays in PM Peak, but failed in AM Peak);
- an multi-way stop (acceptable delays in PM Peak, but failed in AM Peak); and
- a fully- actuated traffic control signal (acceptable delays during both peak periods).

A roundabout would likely involve right of way impacts to the Town Common and to the First Parish Church property. Given the poor level of service it would generate in the AM peak period, this option has been discarded by NMCOG staff.

The multi-way stop sign option would have no impacts to neighboring property as it merely involves new pavement markings and signage. The option is low-cost, but does not alleviate congested conditions in the AM peak period.

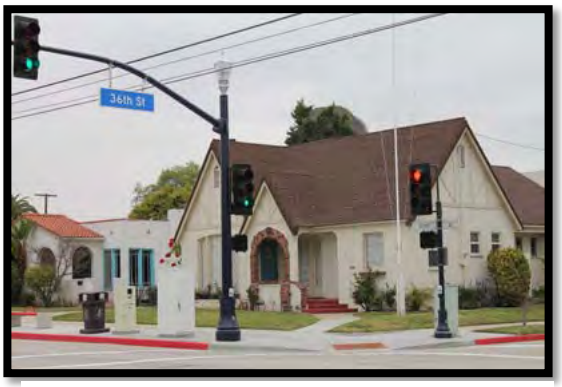

Photo 29: Example of a traffic signal in a historic district.

The installation of a traffic control signal improves congestion at the intersection and does not have any major right of way issues. Installation of a fully actuated traffic control signal would promote an orderly flow of traffic through the Boston Road/ Main Street intersection, which would also relieve congestion at the Lincoln Street/ Main Street/Hildreth Street intersection. However, the Town will need to consider the visual impacts to the historic district and the implications on community character. As shown in Photo 29 above, traffic signals can be designed to address some of the aesthetic issues, depending on the desires of the community.

2. **Implement channelization and lane designation improvements at the intersection of Main Street and Graniteville Road** – The intersection of Main Street and Graniteville Road experiences poor levels of service for vehicles turning left from Graniteville Road to eastbound Main Street. The intersection suffers from lack of lane designation, which often confuses drivers making turning maneuvers. It is recommended that the Town add pavement markings and

signage designating lane use for both Main Street approaches and Graniteville Road. Better channelizing traffic will help reduce driver confusion at this location. Specifically, the Graniteville Road approach should have pavement markings showing the left turn lane and right turn lane. MUTCD compliant signage conveying that the "Right Lane Must Turn Right" on the Graniteville Road approach should be installed. On the Main Street eastbound approach, drivers will often "go around" left turning vehicles at Graniteville Road. Pavement markings on Main Street should clearly indicate whether this approach to the intersection is intended to be used as one lane or two lanes.

3. **Realign the Main Street westbound approach at the Depot Street and Main Street intersection** - The intersection of Main Street and Depot Street experiences poor levels of service for left turning vehicles from westbound Main Street. While the left turning volumes during peak hours are very low (27 vehicles in the A.M. Peak hour, 35 vehicles in the P.M. peak hour), the recommendation is to reduce the skew in the intersection by straightening the Main Street westbound approach. The reduction in skew will improve a motorist's ability to judge gaps in the mainline Depot Street/Main Street traffic stream, as the driver would no longer need to look over his or her shoulder to view traffic before making the turn. This would not involve the acquisition of additional right of way. The Westford Water Department is currently designing a water line installation project on Main Street. The intersection improvements at Depot and Main Street, as well as new sidewalks along Main Street, could be bundled with the water line project, creating some additional efficiencies, which would not be otherwise achieved by completing the work under two separate contracts.

Appendices

A. Westford Town Center Land Use Inventory

B. Traffic Volume Data

C. Massachusetts Roundabout Installation Screening Tool

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Appendix A: Westford Town Center Land Use Inventory

LAND USE INVENTORY

Property ID	Address	AREA (Acres)	Land Use Code	Zoning District
026 0006 0000	30 MAIN ST	0.77	104-Two-Family Residential	RA
026 0007 0000	4 GRANITEVILLE RD	0.57	101-Single Family Residential	RA
026 0077 0000	24 DEPOT ST	0.94	101-Single Family Residential	RA
026 0086 0000	25 DEPOT ST	32.07	934-Improved, Education (Municipal or County)	RA
026 0087 0000	21 DEPOT ST	1.17	101-Single Family Residential	RA
026 0088 0000	17 DEPOT ST	1	101-Single Family Residential	RA
026 0089 0000	13 DEPOT ST	1.2	101-Single Family Residential	RA
026 0090 0000	9 DEPOT ST	1.33	111-Apartments with Four to Eight Units	RA
026 0092 0000	64 MAIN ST	26.44	018-Mixed Use (Primarily Residential, some Recreation)	RA
026 0093 0000	6 DEPOT ST	0.51	101-Single Family Residential	RA
026 0094 0000	10 DEPOT ST	1.5	104-Two-Family Residential	RA
026 0095 0000	14 DEPOT ST	1.81	101-Single Family Residential	RA
026 0096 0000	16 DEPOT ST	0.91	101-Single Family Residential	RA
026 0097 0000	18 DEPOT ST	1.08	101-Single Family Residential	RA
026 0098 0000	20 DEPOT ST	1.39	101-Single Family Residential	RA
026 0105 0001	0 PARCEL A WOOLSACK DR	1.21	132-Undevelopable Residential Land	RA
055 0006 0000	3 HILDRETH ST	2	101-Single Family Residential	RA
055 0007 0000	1 HILDRETH ST	1.89	101-Single Family Residential	RA
055 0008 0000	33 MAIN ST	1.21	101-Single Family Residential	RA
055 0009 0000	29 MAIN ST	0.48	101-Single Family Residential	RA

Property ID	Address	AREA (Acres)	Land Use Code	Zoning District
055 0010 0000	25 MAIN ST	0.36	101-Single Family Residential	RA
055 0012 0000	10 LINCOLN ST	0.62	934-Improved, Education (Municipal or County)	RA
055 0013 0000	2 BOSTON RD	0.42	931-Improved, Selectmen (Municipal)	RA
055 0014 0000	6 BOSTON RD	0.55	101-Single Family Residential	RA
055 0015 0000	8 BOSTON RD	0.8	101-Single Family Residential	RA
055 0016 0000	10 BOSTON RD	4.8	101-Single Family Residential	RA
055 0017 0000	12 BOSTON RD	0.37	101-Single Family Residential	RA
055 0038 0000	11 BOSTON RD	4.8	101-Single Family Residential	RA
055 0039 0000	7 -9 BOSTON RD	0.25	996-Other, Non-Taxable Condominium Common Land	RA
055 0039 0001	7 A BOSTON RD	0	102-Residential Condominium	RA
055 0039 0002	9 BOSTON RD	0	102-Residential Condominium	RA
055 0040 0000	5 BOSTON RD	0.37	101-Single Family Residential	RA
055 0041 0000	2 HILDRETH ST	0.56	101-Single Family Residential	RA
055 0041 0001	0 BOSTON RD	0.01	930-Vacant, Selectmen (Municipal)	RA
055 0042 0000	4 HILDRETH ST	0.24	101-Single Family Residential	RA
059 0001 0000	0 MAIN ST	1.13	930-Vacant, Selectmen (Municipal)	RA
059 0002 0000	0 LOT 4 BOSTON RD	0.16	930-Vacant, Selectmen (Municipal)	RA
059 0003 0000	0 HILDRETH ST	0.58	132-Undevelopable Residential Land	RA
059 0004 0000	45 MAIN ST	0.35	341-Bank Buildings	B
059 0005 0000	39 MAIN ST	0.99	132-Undevelopable Residential Land	RA
059 0006 0000	39 MAIN ST	2	109-Multiple Houses on one parcel	RA

Property ID	Address	AREA (Acres)	Land Use Code	Zoning District
059 0007 0001	2 RANDOLPH CIR	1.3	101-Single Family Residential	RA
059 0007 0002	4 RANDOLPH CIR	2.07	101-Single Family Residential	RA
059 0007 0003	6 RANDOLPH CIR	1.01	101-Single Family Residential	RA
059 0007 0004	8 RANDOLPH CIR	1.41	936-Vacant, Tax Title/Treasurer	RA
059 0007 0005	10 RANDOLPH CIR	1.44	101-Single Family Residential	RA
059 0007 0006	12 RANDOLPH CIR	1.28	101-Single Family Residential	RA
059 0007 0007	11 RANDOLPH CIR	1.03	101-Single Family Residential	RA
059 0007 0008	9 RANDOLPH CIR	0.98	101-Single Family Residential	RA
059 0007 0009	7 RANDOLPH CIR	1.1	101-Single Family Residential	RA
059 0007 0010	5 RANDOLPH CIR	1.14	130-Developable Residential Land	RA
059 0007 0011	3 RANDOLPH CIR	1	130-Developable Residential Land	RA
059 0007 0012	1 GRANITEVILLE RD	0.16	132-Undevelopable Residential Land	RA
059 0008 0000	32 MAIN ST	1.19	101-Single Family Residential	RA
059 0009 0000	36 MAIN ST	0.92	013-Mixed Use (Primarily Residential, some Commercial)	RA
059 0010 0000	40 MAIN ST	0.5	013-Mixed Use (Primarily Residential, some Commercial)	B
059 0011 0000	44 MAIN ST	0.65	101-Single Family Residential	RA
059 0012 0000	4 CONNELL DR	0.48	101-Single Family Residential	RA
059 0013 0000	6 CONNELL DR	0.76	101-Single Family Residential	RA
059 0014 0000	9 CONNELL DR	0.52	101-Single Family Residential	RA
059 0015 0000	5 CONNELL DR	1.14	101-Single Family Residential	RA
059 0016 0000	3 CONNELL DR	0.8	101-Single Family Residential	RA

Property ID	Address	AREA (Acres)	Land Use Code	Zoning District
059 0017 0000	48 MAIN ST	1.09	960-Church, Mosque, Synagogue, Temple, etc...	RA
059 0018 0000	50 MAIN ST	1.59	931-Improved, Selectmen (Municipal)	RA
059 0019 0001	54 MAIN ST	1.25	101-Single Family Residential	RA
059 0019 0002	0 MAIN ST	2.52	930-Vacant, Selectmen (Municipal)	RA
059 0020 0001	56 MAIN ST	1.45	111-Apartments with Four to Eight Units	RA
059 0020 0002	0 LOT 2 WHEELER LN	3.63	130-Developable Residential Land	RA
059 0021 0000	58 MAIN ST	0.29	101-Single Family Residential	RA
059 0022 0000	60 MAIN ST	0.28	101-Single Family Residential	RA
059 0023 0000	62 MAIN ST	1.63	101-Single Family Residential	RA
059 0024 0000	2 WHEELER LN	0.5	101-Single Family Residential	RA
059 0025 0000	4 WHEELER LN	0.39	101-Single Family Residential	RA
059 0026 0000	8 WHEELER LN	2.2	101-Single Family Residential	RA
059 0027 0000	6 WHEELER LN	1.69	101-Single Family Residential	RA
059 0028 0000	66 MAIN ST	1.79	101-Single Family Residential	RA
059 0029 0000	68 MAIN ST	2.13	013-Mixed Use (Primarily Residential, some Commercial)	RA
059 0030 0000	2 DEPOT ST	0.54	430-Telephone Exchange Stations	RA
059 0031 0000	4 DEPOT ST	1	101-Single Family Residential	RA
059 0032 0000	8 DEPOT ST	0.72	101-Single Family Residential	RA
059 0033 0000	7 DEPOT ST	1.13	101-Single Family Residential	RA
059 0034 0000	5 DEPOT ST	0.21	101-Single Family Residential	RA
059 0036 0000	3 DEPOT ST	1.21	101-Single Family Residential	RA
059 0037 0000	72 MAIN ST	2.54	109-Multiple Houses on one parcel	RA

Property ID	Address	AREA (Acres)	Land Use Code	Zoning District
059 0038 0000	76 MAIN ST	0.74	101-Single Family Residential	RA
059 0041 0000	75 MAIN ST	0.38	101-Single Family Residential	RA
059 0042 0000	73 MAIN ST	5.2	931-Improved, Selectmen	RA
059 0043 0000	63 MAIN ST	2.93	101-Single Family Residential	RA
059 0044 0000	59 MAIN ST	0.3	101-Single Family Residential	RA
059 0045 0000	57 MAIN ST	0.36	101-Single Family Residential	RA
059 0046 0000	55 MAIN ST	0.5	931-Improved, Selectmen (Municipal)	RA
059 0047 0000	51 -53 MAIN ST	30	985-Improved Municipal or Public Safety, Other Town	RA
059 0048 0000	4 LINCOLN ST	0.55	101-Single Family Residential	RA
059 0049 0000	6 LINCOLN ST	0.92	013-Mixed Use (Primarily Residential, some Commercial)	B
		191.38		

Source: Westford Assessor database

Appendix B: Traffic Volume Data

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Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1 Page: 1
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Boston Rd S of Hildreth St
Direction: NORTH

File: bostonShildreth.prn
City: Westford
ID Number: 804-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			34	38	43	38	66	84	53	265
02:00			13	16	12	14	35	34	22	110
03:00			7	7	13	9	18	13	12	58
04:00			8	7	6	7	8	12	8	41
05:00			15	9	13	12	5	8	10	50
06:00			34	19	25	26	26	17	24	121
07:00			138	163	164	155	39	23	105	527
08:00			304	380	294	326	118	104	240	1200
09:00			344	396	313	351	248	194	299	1495
10:00			295	267	294	285	411	227	299	1494
11:00		322	312	298	342	318	463	314	342	2051
12:00		337	362	346	401	362	545	381	395	2372
13:00		373	395	376	443	397	542	477	434	2606
14:00		414	436	376	494	430	521	418	443	2659
15:00		494	516	562	608	545	545	436	527	3161
16:00		680	701	773	720	718	507	459	640	3840
17:00		947	988	993	884	953	505	377	782	4694
18:00		1217	1143	1238	1150	1187	471	375	932	5594
19:00		1175	1092	1189	1009	1116	380	312	860	5157
20:00		562	539	622	506	557	312	260	467	2801
21:00		274	357	338	244	303	216	169	266	1598
22:00		181	200	250	242	218	194	92	193	1159
23:00		91	119	100	185	124	153	55	117	703
24:00		55	59	69	102	71	155	39	80	479
TOTALS		7122	8411	8832	8507	8522	6483	4880	7550	44235
% AVG WKDY		83.6	98.7	103.6	99.8		76.1	57.3		
% AVG WEEK		94.3	111.4	117.0	112.7		85.9	64.6		
AM Times		12:00	12:00	09:00	12:00	12:00	12:00	12:00	12:00	
AM Peaks		337	362	396	401	121	545	381	132	
PM Times		18:00	18:00	18:00	18:00	18:00	15:00	13:00	18:00	
PM Peaks		1217	1143	1238	1150	396	545	477	311	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Boston Rd S of Hildreth St
Direction: SOUTH

File: bostonShildreth.prn
City: Westford
ID Number: 804-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			14	24	19	19	36	33	25	126
02:00			5	5	6	5	12	12	8	40
03:00			8	0	4	4	11	7	6	30
04:00			14	14	12	13	7	10	11	57
05:00			49	47	48	48	14	10	34	168
06:00			218	206	181	202	70	31	141	706
07:00			599	654	583	612	146	74	411	2056
08:00			1136	1034	956	1042	303	159	718	3588
09:00			960	955	825	913	524	236	700	3500
10:00			602	569	606	592	601	327	541	2705
11:00		487	436	406	483	453	597	432	474	2841
12:00		463	444	421	429	439	624	406	464	2787
13:00		453	386	401	439	420	564	486	455	2729
14:00		455	371	368	394	397	497	411	416	2496
15:00		627	503	533	526	547	510	435	522	3134
16:00		662	534	520	510	556	455	415	516	3096
17:00		679	437	485	460	515	455	351	478	2867
18:00		695	517	584	528	581	378	287	498	2989
19:00		620	461	543	491	529	342	225	447	2682
20:00		396	255	272	284	302	292	207	284	1706
21:00		221	203	222	205	213	155	119	188	1125
22:00		161	118	140	235	164	106	76	139	836
23:00		80	53	60	106	75	121	44	77	464
24:00		49	25	30	81	46	65	28	46	278
TOTALS		6048	8348	8493	8411	8687	6885	4821	7599	43006
% AVG WKDY		69.6	96.1	97.8	96.8		79.3	55.5		
% AVG WEEK		79.6	109.9	111.8	110.7		90.6	63.4		
AM Times		11:00	08:00	08:00	08:00	08:00	12:00	11:00	08:00	
AM Peaks		487	1136	1034	956	347	624	432	239	
PM Times		18:00	16:00	18:00	18:00	18:00	13:00	13:00	15:00	
PM Peaks		695	534	584	528	194	564	486	174	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Boston Rd S of Hildreth St
Direction: ROAD TOTAL

File: bostonShildreth.prn
City: Westford
ID Number: 804-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			48	62	62	57	102	117	78	391
02:00			18	21	18	19	47	46	30	150
03:00			15	7	17	13	29	20	18	88
04:00			22	21	18	20	15	22	20	98
05:00			64	56	61	60	19	18	44	218
06:00			252	225	206	228	96	48	165	827
07:00			737	817	747	767	185	97	517	2583
08:00			1440	1414	1250	1368	421	263	958	4788
09:00			1304	1351	1138	1264	772	430	999	4995
10:00			897	836	900	878	1012	554	840	4199
11:00		809	748	704	825	772	1060	746	815	4892
12:00		800	806	767	830	801	1169	787	860	5159
13:00		826	781	777	882	816	1106	963	889	5335
14:00		869	807	744	888	827	1018	829	859	5155
15:00		1121	1019	1095	1134	1092	1055	871	1049	6295
16:00		1342	1235	1293	1230	1275	962	874	1156	6936
17:00		1626	1425	1478	1344	1468	960	728	1260	7561
18:00		1912	1660	1822	1678	1768	849	662	1430	8583
19:00		1795	1553	1732	1500	1645	722	537	1306	7839
20:00		958	794	894	790	859	604	467	751	4507
21:00		495	560	560	449	516	371	288	454	2723
22:00		342	318	390	477	382	300	168	332	1995
23:00		171	172	160	291	198	274	99	194	1167
24:00		104	84	99	183	118	220	67	126	757
TOTALS		13170	16759	17325	16918	17211	13368	9701	15150	87241
% AVG WKDY		76.5	97.4	100.7	98.3		77.7	56.4		
% AVG WEEK		86.9	110.6	114.4	111.7		88.2	64.0		
AM Times		11:00	08:00	08:00	08:00	08:00	12:00	12:00	09:00	
AM Peaks		809	1440	1414	1250	456	1169	787	333	
PM Times		18:00	18:00	18:00	18:00	18:00	13:00	13:00	18:00	
PM Peaks		1912	1660	1822	1678	589	1106	963	477	
D%		65	70	70	70		55	50		
K%		15	10	11	10		9	10		

Wkday AADT(Factored & Rounded)= 15500
Week AADT(Factored & Rounded)= 13700

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Boston Rd S of Hildreth St
Direction: NORTH

File: bostonShildreth.prn
City: Westford
ID Number: 804-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	23					23			23	23
02:00	9					9			9	9
03:00	17					17			17	17
04:00	4					4			4	4
05:00	6					6			6	6
06:00	29					29			29	29
07:00	127					127			127	127
08:00	320					320			320	320
09:00	325					325			325	325
10:00										0
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	860					860			860	860
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	09:00					09:00			09:00	
AM Peaks	325					325			325	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Boston Rd S of Hildreth St
Direction: SOUTH

File: bostonShildreth.prn
City: Westford
ID Number: 804-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	10					10			10	10
02:00	2					2			2	2
03:00	5					5			5	5
04:00	10					10			10	10
05:00	40					40			40	40
06:00	200					200			200	200
07:00	635					635			635	635
08:00	1014					1014			1014	1014
09:00	941					941			941	941
10:00										0
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	2857					2857			2857	2857
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	1014					1014			1014	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Boston Rd S of Hildreth St
Direction: ROAD TOTAL

File: bostonShildreth.prn
City: Westford
ID Number: 804-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	33					33			33	33
02:00	11					11			11	11
03:00	22					22			22	22
04:00	14					14			14	14
05:00	46					46			46	46
06:00	229					229			229	229
07:00	762					762			762	762
08:00	1334					1334			1334	1334
09:00	1266					1266			1266	1266
10:00										0
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	3717					3717			3717	3717
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	1334					1334			1334	
PM Times										
PM Peaks										
D%	75									
K%	36									

Wkday AADT(Factored & Rounded)= 3400
Week AADT(Factored & Rounded)= 3400

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000023256
Location: Boston Rd S of Main St
Direction: NORTH

File: bostonSmain.prn
City: Westford
ID Number: 867-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			10	18	18	15	26	40	22	112
02:00			8	11	5	8	8	20	10	52
03:00			3	3	3	3	5	7	4	21
04:00			8	4	4	5	6	3	5	25
05:00			9	6	8	8	1	0	5	24
06:00			16	12	14	14	18	13	15	73
07:00			98	94	93	95	21	9	63	315
08:00			143	169	151	154	48	77	118	588
09:00			132	162	112	135	126	131	133	663
10:00			130	105	109	115	180	146	134	670
11:00			138	117	139	131	187	173	151	754
12:00			139	142	173	151	213	196	173	863
13:00		167	167	159	174	167	214	219	183	1100
14:00		197	182	149	233	190	248	189	200	1198
15:00		212	219	233	260	231	220	197	224	1341
16:00		242	274	314	258	272	210	209	251	1507
17:00		327	350	301	246	306	206	173	267	1603
18:00		318	307	329	304	314	220	167	274	1645
19:00		368	365	379	372	371	175	163	304	1822
20:00		235	229	263	239	242	127	117	202	1210
21:00		119	166	147	137	142	101	80	125	750
22:00		83	83	128	122	104	88	34	90	538
23:00		46	54	45	82	57	73	23	54	323
24:00		22	17	30	48	29	59	12	31	188
TOTALS		2336	3247	3320	3304	3259	2780	2398	3038	17385
% AVG WKDY		71.7	99.6	101.9	101.4		85.3	73.6		
% AVG WEEK		76.9	106.9	109.3	108.8		91.5	78.9		
AM Times			08:00	08:00	12:00	08:00	12:00	12:00	12:00	
AM Peaks			143	169	173	51	213	196	58	
PM Times		19:00	19:00	19:00	19:00	19:00	14:00	13:00	19:00	
PM Peaks		368	365	379	372	124	248	219	101	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000023256
Location: Boston Rd S of Main St
Direction: SOUTH

File: bostonSmain.prn
City: Westford
ID Number: 867-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			9	19	16	15	31	32	21	107
02:00			4	5	5	5	9	8	6	31
03:00			5	0	4	3	8	8	5	25
04:00			11	11	10	11	5	8	9	45
05:00			49	44	45	46	12	10	32	160
06:00			207	194	176	192	64	30	134	671
07:00			565	621	551	579	133	74	389	1944
08:00			1071	959	926	985	270	147	675	3373
09:00			904	857	790	850	452	227	646	3230
10:00			561	549	573	561	535	309	505	2527
11:00			396	389	445	410	572	415	443	2217
12:00			426	396	399	407	603	382	441	2206
13:00		352	363	391	418	381	543	471	423	2538
14:00		336	339	350	364	347	484	392	378	2265
15:00		487	473	529	504	498	504	417	486	2914
16:00		498	530	507	492	507	440	394	477	2861
17:00		479	383	471	437	442	438	336	424	2544
18:00		526	477	586	509	524	364	279	457	2741
19:00		514	441	519	490	491	319	216	416	2499
20:00		292	229	287	274	270	298	205	264	1585
21:00		167	184	209	184	186	156	117	170	1017
22:00		109	99	136	221	141	104	73	124	742
23:00		50	43	50	89	58	114	41	64	387
24:00		34	22	25	66	37	65	28	40	240
TOTALS		3844	7791	8104	7988	7946	6523	4619	7029	38869
% AVG WKDY		48.4	98.0	102.0	100.5		82.1	58.1		
% AVG WEEK		54.7	110.8	115.3	113.6		92.8	65.7		
AM Times			08:00	08:00	08:00	08:00	12:00	11:00	08:00	
AM Peaks			1071	959	926	328	603	415	225	
PM Times		18:00	16:00	18:00	18:00	18:00	13:00	13:00	15:00	
PM Peaks		526	530	586	509	175	543	471	162	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000023256
Location: Boston Rd S of Main St
Direction: ROAD TOTAL

File: bostonSmain.prn
City: Westford
ID Number: 867-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			19	37	34	30	57	72	44	219
02:00			12	16	10	13	17	28	17	83
03:00			8	3	7	6	13	15	9	46
04:00			19	15	14	16	11	11	14	70
05:00			58	50	53	54	13	10	37	184
06:00			223	206	190	206	82	43	149	744
07:00			663	715	644	674	154	83	452	2259
08:00			1214	1128	1077	1140	318	224	792	3961
09:00			1036	1019	902	986	578	358	779	3893
10:00			691	654	682	676	715	455	639	3197
11:00			534	506	584	541	759	588	594	2971
12:00			565	538	572	558	816	578	614	3069
13:00		519	530	550	592	548	757	690	606	3638
14:00		533	521	499	597	538	732	581	577	3463
15:00		699	692	762	764	729	724	614	709	4255
16:00		740	804	821	750	779	650	603	728	4368
17:00		806	733	772	683	748	644	509	691	4147
18:00		844	784	915	813	839	584	446	731	4386
19:00		882	806	898	862	862	494	379	720	4321
20:00		527	458	550	513	512	425	322	466	2795
21:00		286	350	356	321	328	257	197	294	1767
22:00		192	182	264	343	245	192	107	213	1280
23:00		96	97	95	171	115	187	64	118	710
24:00		56	39	55	114	66	124	40	71	428
TOTALS		6180	11038	11424	11292	11209	9303	7017	10064	56254
% AVG WKDY		55.1	98.5	101.9	100.7		83.0	62.6		
% AVG WEEK		61.4	109.7	113.5	112.2		92.4	69.7		
AM Times			08:00	08:00	08:00	08:00	12:00	11:00	08:00	
AM Peaks			1214	1128	1077	380	816	588	264	
PM Times		19:00	19:00	18:00	19:00	19:00	13:00	13:00	18:00	
PM Peaks		882	806	915	862	287	757	690	244	
D%		60	90	85	85		75	70		
K%		14	11	10	10		9	10		

Wkday AADT(Factored & Rounded)= 10100
Week AADT(Factored & Rounded)= 9100

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000023256
Location: Boston Rd S of Main St
Direction: NORTH

File: bostonSmain.prn
City: Westford
ID Number: 867-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
	15									
01:00	9					9			9	9
02:00	4					4			4	4
03:00	6					6			6	6
04:00	2					2			2	2
05:00	2					2			2	2
06:00	12					12			12	12
07:00	75					75			75	75
08:00	149					149			149	149
09:00	120					120			120	120
10:00	103					103			103	103
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	482					482			482	482
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	149					149			149	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000023256
Location: Boston Rd S of Main St
Direction: SOUTH

File: bostonSmain.prn
City: Westford
ID Number: 867-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	10					10			10	10
02:00	2					2			2	2
03:00	4					4			4	4
04:00	10					10			10	10
05:00	38					38			38	38
06:00	193					193			193	193
07:00	616					616			616	616
08:00	980					980			980	980
09:00	905					905			905	905
10:00	578					578			578	578
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	3336					3336			3336	3336
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	980					980			980	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000023256
Location: Boston Rd S of Main St
Direction: ROAD TOTAL

File: bostonSmain.prn
City: Westford
ID Number: 867-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	19					19			19	19
02:00	6					6			6	6
03:00	10					10			10	10
04:00	12					12			12	12
05:00	40					40			40	40
06:00	205					205			205	205
07:00	691					691			691	691
08:00	1129					1129			1129	1129
09:00	1025					1025			1025	1025
10:00	681					681			681	681
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	3818					3818			3818	3818
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	1129					1129			1129	
PM Times										
PM Peaks										
D%	85									
K%	30									

Wkday AADT(Factored & Rounded)= 3400
Week AADT(Factored & Rounded)= 3400

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/16/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Depot Rd N of Main St
Direction: NORTH

File: depotNmain.prn
City: Westford
ID Number: 613-2012

TIME	MON	TUE 16	WED 17	THU 18	FRI 19	WKDAY AVG	SAT 20	SUN	WEEK AVG	TOTAL
01:00			21	18	32	24	43		28	114
02:00			9	8	8	8	17		10	42
03:00			7	6	6	6	4		6	23
04:00			6	6	5	6	6		6	23
05:00			3	5	5	4	2		4	15
06:00			12	19	14	15			15	45
07:00			52	53	51	52			52	156
08:00			183	198	192	191			191	573
09:00			232	260	205	232			232	697
10:00		42	181	211	189	156			156	623
11:00		172	172	181	222	187			187	747
12:00		197	207	244	228	219			219	876
13:00		227	220	219	219	221			221	885
14:00		228	250	238	262	244			244	978
15:00		341	333	303	353	332			332	1330
16:00		451	455	461	451	454			454	1818
17:00		614	686	724	742	692			692	2766
18:00		883	824	935	793	859			859	3435
19:00		656	594	665	602	629			629	2517
20:00		262	339	376	292	317			317	1269
21:00		223	268	240	173	226			226	904
22:00		96	141	134	141	128			128	512
23:00		47	70	66	115	74			74	298
24:00		31	36	34	75	44			44	176
TOTALS		4470	5301	5604	5375	5320	72		5326	20822
% AVG WKDY		84.0	99.6	105.3	101.0		1.4			
% AVG WEEK		83.9	99.5	105.2	100.9		1.4			
AM Times		12:00	09:00	09:00	12:00	09:00	01:00		09:00	
AM Peaks		197	232	260	228	77	43		77	
PM Times		18:00	18:00	18:00	18:00	18:00			18:00	
PM Peaks		883	824	935	793	286			286	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/16/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Depot Rd N of Main St
Direction: SOUTH

File: depotNmain.prn
City: Westford
ID Number: 613-2012

TIME	MON	TUE 16	WED 17	THU 18	FRI 19	WKDAY AVG	SAT 20	SUN	WEEK AVG	TOTAL
01:00			4	2	7	4	13		6	26
02:00			1	5	1	2	4		3	11
03:00			2	1	5	3	2		2	10
04:00			6	3	4	4	3		4	16
05:00			20	15	21	19	1		14	57
06:00			89	88	65	81			81	242
07:00			321	351	335	336			336	1007
08:00			621	594	545	587			587	1760
09:00			627	608	498	578			578	1733
10:00		100	334	394	344	293			293	1172
11:00		223	235	227	200	221			221	885
12:00		185	187	228	232	208			208	832
13:00		192	201	184	217	198			198	794
14:00		226	222	216	215	220			220	879
15:00		239	267	259	284	262			262	1049
16:00		274	302	303	283	290			290	1162
17:00		278	284	293	237	273			273	1092
18:00		314	323	388	305	332			332	1330
19:00		273	251	324	274	280			280	1122
20:00		148	161	205	162	169			169	676
21:00		111	104	146	96	114			114	457
22:00		34	54	60	89	59			59	237
23:00		46	30	39	83	50			50	198
24:00		16	8	13	37	18			18	74
TOTALS		2659	4654	4946	4539	4601	23		4598	16821
% AVG WKDY		57.8	101.2	107.5	98.7		0.5			
% AVG WEEK		57.8	101.2	107.6	98.7		0.5			
AM Times		11:00	09:00	09:00	08:00	08:00	01:00		08:00	
AM Peaks		223	627	608	545	196	13		196	
PM Times		18:00	18:00	18:00	18:00	18:00			18:00	
PM Peaks		314	323	388	305	111			111	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/16/2012

Site Reference: Rd Class u5
Site ID: 000000013257
Location: Depot Rd N of Main St
Direction: ROAD TOTAL

File: depotNmain.prn
City: Westford
ID Number: 613-2012

TIME	MON	TUE 16	WED 17	THU 18	FRI 19	WKDAY AVG	SAT 20	SUN	WEEK AVG	TOTAL
01:00			25	20	39	28	56		35	140
02:00			10	13	9	11	21		13	53
03:00			9	7	11	9	6		8	33
04:00			12	9	9	10	9		10	39
05:00			23	20	26	23	3		18	72
06:00			101	107	79	96			96	287
07:00			373	404	386	388			388	1163
08:00			804	792	737	778			778	2333
09:00			859	868	703	810			810	2430
10:00		142	515	605	533	449			449	1795
11:00		395	407	408	422	408			408	1632
12:00		382	394	472	460	427			427	1708
13:00		419	421	403	436	420			420	1679
14:00		454	472	454	477	464			464	1857
15:00		580	600	562	637	595			595	2379
16:00		725	757	764	734	745			745	2980
17:00		892	970	1017	979	964			964	3858
18:00		1197	1147	1323	1098	1191			1191	4765
19:00		929	845	989	876	910			910	3639
20:00		410	500	581	454	486			486	1945
21:00		334	372	386	269	340			340	1361
22:00		130	195	194	230	187			187	749
23:00		93	100	105	198	124			124	496
24:00		47	44	47	112	62			62	250
TOTALS		7129	9955	10550	9914	9925	95		9928	37643
% AVG WKDY		71.8	100.3	106.3	99.9		1.0			
% AVG WEEK		71.8	100.3	106.3	99.9		1.0			
AM Times		11:00	09:00	09:00	08:00	09:00	01:00		09:00	
AM Peaks		395	859	868	737	270	56		270	
PM Times		18:00	18:00	18:00	18:00	18:00			18:00	
PM Peaks		1197	1147	1323	1098	397			397	
D%		75	70	70	70		75			
K%		17	12	13	11		59			

Wkday AADT(Factored & Rounded)= 8900
Week AADT(Factored & Rounded)= 9000

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/16/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Graniteville Rd N of Bixby Ln
Direction: NORTH

File: anitevilleNbixby.prn
City: Westford
ID Number: 622-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY	SAT	SUN	WEEK	TOTAL
		16	17	18	19	AVG	20	21	AVG	
01:00			9	5	11	8	23	12	12	60
02:00			1	0	6	2	8	12	5	27
03:00			0	2	2	1	10	4	4	18
04:00			2	1	0	1	0	2	1	5
05:00			5	3	4	4	4	1	3	17
06:00			20	23	20	21	7	2	14	72
07:00			82	83	68	78	9	7	50	249
08:00			183	145	144	157	34	49	111	555
09:00			135	129	110	125	56	96	105	526
10:00			127	129	103	120	111	104	115	574
11:00			98	90	89	92	136	124	107	537
12:00		98	117	118	114	112	166	123	123	736
13:00		81	93	115	119	102	167	166	124	741
14:00		119	115	112	128	118	171	98	124	743
15:00		157	151	156	146	152	148	97	142	855
16:00		186	171	182	124	166	137	138	156	938
17:00		199	204	214	182	200	117	115	172	1031
18:00		255	300	242	210	252	120	138	211	1265
19:00		278	245	264	217	251	102	104	202	1210
20:00		152	181	158	117	152	83	58	125	749
21:00		94	106	93	98	98	74	38	84	503
22:00		53	71	72	81	69	50	21	58	348
23:00		22	20	27	40	27	36	27	29	172
24:00		13	15	21	37	22	43	14	24	143
TOTALS		1707	2451	2384	2170	2330	1812	1550	2101	12074
% AVG WKDY		73.3	105.2	102.3	93.1		77.8	66.5		
% AVG WEEK		81.2	116.7	113.5	103.3		86.2	73.8		
AM Times		12:00	08:00	08:00	08:00	08:00	12:00	11:00	12:00	
AM Peaks		98	183	145	144	52	166	124	41	
PM Times		19:00	18:00	19:00	19:00	18:00	14:00	13:00	18:00	
PM Peaks		278	300	264	217	84	171	166	70	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/16/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Graniteville Rd N of Bixby Ln
Direction: SOUTH

File: anitevilleNbixby.prn
City: Westford
ID Number: 622-2012

TIME	MON	TUE 16	WED 17	THU 18	FRI 19	WKDAY AVG	SAT 20	SUN 21	WEEK AVG	TOTAL
01:00			1	2	2	2	3	4	2	12
02:00			0	0	2	1	3	3	2	8
03:00			0	0	1	0	4	1	1	6
04:00			2	0	2	1	1	2	1	7
05:00			6	8	9	8	2	1	5	26
06:00			50	47	48	48	11	7	33	163
07:00			122	126	119	122	39	22	86	428
08:00			217	234	211	221	56	40	152	758
09:00			192	175	182	183	87	64	140	700
10:00			121	138	120	126	133	96	122	608
11:00			64	78	74	72	137	177	106	530
12:00		66	89	104	84	86	162	136	107	641
13:00		77	92	85	101	89	145	152	109	652
14:00		81	93	102	73	87	149	100	100	598
15:00		121	122	144	156	136	158	112	136	813
16:00		109	122	112	110	113	109	90	109	652
17:00		114	83	107	83	97	127	96	102	610
18:00		118	126	137	101	120	109	65	109	656
19:00		121	123	123	82	112	75	61	98	585
20:00		59	67	76	61	66	49	60	62	372
21:00		41	45	49	45	45	42	39	44	261
22:00		24	62	31	56	43	40	16	38	229
23:00		5	8	17	28	14	31	10	16	99
24:00		7	2	6	16	8	23	3	10	57
TOTALS		943	1809	1901	1766	1800	1695	1357	1690	9471
% AVG WKDY		52.4	100.5	105.6	98.1		94.2	75.4		
% AVG WEEK		55.8	107.0	112.5	104.5		100.3	80.3		
AM Times		12:00	08:00	08:00	08:00	08:00	12:00	11:00	08:00	
AM Peaks		66	217	234	211	74	162	177	51	
PM Times		15:00	18:00	15:00	15:00	15:00	15:00	13:00	15:00	
PM Peaks		121	126	144	156	45	158	152	45	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/16/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Graniteville Rd N of Bixby Ln
Direction: ROAD TOTAL

File: anitevilleNbixby.prn
City: Westford
ID Number: 622-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY	SAT	SUN	WEEK	TOTAL
		16	17	18	19	AVG	20	21	AVG	
01:00			10	7	13	10	26	16	14	72
02:00			1	0	8	3	11	15	7	35
03:00			0	2	3	2	14	5	5	24
04:00			4	1	2	2	1	4	2	12
05:00			11	11	13	12	6	2	9	43
06:00			70	70	68	69	18	9	47	235
07:00			204	209	187	200	48	29	135	677
08:00			400	379	355	378	90	89	263	1313
09:00			327	304	292	308	143	160	245	1226
10:00			248	267	223	246	244	200	236	1182
11:00			162	168	163	164	273	301	213	1067
12:00		164	206	222	198	198	328	259	230	1377
13:00		158	185	200	220	191	312	318	232	1393
14:00		200	208	214	201	206	320	198	224	1341
15:00		278	273	300	302	288	306	209	278	1668
16:00		295	293	294	234	279	246	228	265	1590
17:00		313	287	321	265	296	244	211	274	1641
18:00		373	426	379	311	372	229	203	320	1921
19:00		399	368	387	299	363	177	165	299	1795
20:00		211	248	234	178	218	132	118	187	1121
21:00		135	151	142	143	143	116	77	127	764
22:00		77	133	103	137	112	90	37	96	577
23:00		27	28	44	68	42	67	37	45	271
24:00		20	17	27	53	29	66	17	33	200
TOTALS		2650	4260	4285	3936	4131	3507	2907	3786	21545
% AVG WKDY		64.1	103.1	103.7	95.3		84.9	70.4		
% AVG WEEK		70.0	112.5	113.2	104.0		92.6	76.8		
AM Times		12:00	08:00	08:00	08:00	08:00	12:00	11:00	08:00	
AM Peaks		164	400	379	355	126	328	301	88	
PM Times		19:00	18:00	19:00	18:00	18:00	14:00	13:00	18:00	
PM Peaks		399	426	387	311	124	320	318	107	
D%		70	70	70	60		50	50		
K%		15	10	9	9		9	11		

Wkday AADT(Factored & Rounded)= 3700
Week AADT(Factored & Rounded)= 3400

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/22/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Graniteville Rd N of Bixby Ln
Direction: NORTH

File: anitevilleNbixby.prn
City: Westford
ID Number: 622-2012

TIME	MON 22	TUE 23	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	5	8				6			6	13
02:00	0	4				2			2	4
03:00	2	0				1			1	2
04:00	0	4				2			2	4
05:00	5	5				5			5	10
06:00	9	14				12			12	23
07:00	63	58				60			60	121
08:00	120	118				119			119	238
09:00	91	105				98			98	196
10:00	89	89				89			89	178
11:00	95					95			95	95
12:00	97					97			97	97
13:00	100					100			100	100
14:00	98					98			98	98
15:00	128					128			128	128
16:00	142					142			142	142
17:00	215					215			215	215
18:00	253					253			253	253
19:00	247					247			247	247
20:00	154					154			154	154
21:00	82					82			82	82
22:00	46					46			46	46
23:00	16					16			16	16
24:00	12					12			12	12
TOTALS	2069	405				2079			2079	2474
% AVG WKDY	99.5	19.5								
% AVG WEEK	99.5	19.5								
AM Times	08:00	08:00				08:00			08:00	
AM Peaks	120	118				60			60	
PM Times	18:00					18:00			18:00	
PM Peaks	253					127			127	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/22/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Graniteville Rd N of Bixby Ln
Direction: SOUTH

File: anitevilleNbixby.prn
City: Westford
ID Number: 622-2012

TIME	MON 22	TUE 23	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	4	5				4			4	9
02:00	1	2				2			2	3
03:00	0	1				0			0	1
04:00	2	3				2			2	5
05:00	9	9				9			9	18
06:00	44	46				45			45	90
07:00	136	139				138			138	275
08:00	227	239				233			233	466
09:00	195	187				191			191	382
10:00	123	97				110			110	220
11:00	63					63			63	63
12:00	114					114			114	114
13:00	77					77			77	77
14:00	96					96			96	96
15:00	118					118			118	118
16:00	102					102			102	102
17:00	106					106			106	106
18:00	115					115			115	115
19:00	120					120			120	120
20:00	70					70			70	70
21:00	61					61			61	61
22:00	21					21			21	21
23:00	9					9			9	9
24:00	7					7			7	7
TOTALS	1820	728				1813			1813	2548
% AVG WKDY	100.4	40.2								
% AVG WEEK	100.4	40.2								
AM Times	08:00	08:00				08:00			08:00	
AM Peaks	227	239				117			117	
PM Times	19:00					19:00			19:00	
PM Peaks	120					60			60	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/22/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Graniteville Rd N of Bixby Ln
Direction: ROAD TOTAL

File: anitevilleNbixby.prn
City: Westford
ID Number: 622-2012

TIME	MON 22	TUE 23	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	9	13				11			11	22
02:00	1	6				4			4	7
03:00	2	1				2			2	3
04:00	2	7				4			4	9
05:00	14	14				14			14	28
06:00	53	60				56			56	113
07:00	199	197				198			198	396
08:00	347	357				352			352	704
09:00	286	292				289			289	578
10:00	212	186				199			199	398
11:00	158					158			158	158
12:00	211					211			211	211
13:00	177					177			177	177
14:00	194					194			194	194
15:00	246					246			246	246
16:00	244					244			244	244
17:00	321					321			321	321
18:00	368					368			368	368
19:00	367					367			367	367
20:00	224					224			224	224
21:00	143					143			143	143
22:00	67					67			67	67
23:00	25					25			25	25
24:00	19					19			19	19
TOTALS	3889	1133				3893			3893	5022
% AVG WKDY	99.9	29.1								
% AVG WEEK	99.9	29.1								
AM Times	08:00	08:00				08:00			08:00	
AM Peaks	347	357				176			176	
PM Times	18:00					18:00			18:00	
PM Peaks	368					184			184	
D%	70	65								
K%	9	32								

Wkday AADT(Factored & Rounded)= 3500
Week AADT(Factored & Rounded)= 3500

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.99
WEEKLY SUMMARY FOR LANE 1
Starting: 10/16/2012

Site Reference: Rd Class u0
Site ID: 000000013256
Location: Hildreth St W of Boston Rd
Direction: EAST

File: hildrethWboston.prn
City: Westford
ID Number: 869-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY	SAT	SUN	WEEK	TOTAL
		16	17	18	19	AVG	20	21	AVG	
01:00			2	1	2	2	4	7	3	16
02:00			0	2	0	1	2	0	1	4
03:00			1	2	1	1	0	2	1	6
04:00			0	1	1	1	3	3	2	8
05:00			1	2	1	1	1	3	2	8
06:00			8	5	8	7	1	2	5	24
07:00			19	26	19	21	6	6	15	76
08:00			39	44	38	40	22	17	32	160
09:00			59	54	42	52	44	33	46	232
10:00			53	54	58	55	46	36	49	247
11:00			47	47	46	47	64	52	51	256
12:00		40	45	39	38	40	72	37	45	271
13:00		47	41	36	31	39	67	40	44	262
14:00		32	34	47	44	39	44	68	45	269
15:00		59	62	54	60	59	56	41	55	332
16:00		60	41	58	64	56	55	53	55	331
17:00		52	63	74	61	62	48	32	55	330
18:00		79	67	93	63	76	37	23	60	362
19:00		48	51	70	44	53	53	20	48	286
20:00		37	36	40	25	34	32	13	30	183
21:00		18	15	20	17	18	23	27	20	120
22:00		9	11	14	16	12	11	9	12	70
23:00		5	5	10	11	8	17	5	9	53
24:00		8	5	1	7	5	13	5	6	39
TOTALS		494	705	794	697	729	721	534	691	3945
% AVG WKDY		67.8	96.7	108.9	95.6		98.9	73.3		
% AVG WEEK		71.5	102.0	114.9	100.9		104.3	77.3		
AM Times		12:00	09:00	09:00	10:00	10:00	12:00	11:00	11:00	
AM Peaks		40	59	54	58	18	72	52	17	
PM Times		18:00	18:00	18:00	16:00	18:00	13:00	14:00	18:00	
PM Peaks		79	67	93	64	25	67	68	20	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.99
WEEKLY SUMMARY FOR LANE 2
Starting: 10/16/2012

Site Reference: Rd Class u0
Site ID: 000000013256
Location: Hildreth St W of Boston Rd
Direction: WEST

File: hildrethWboston.prn
City: Westford
ID Number: 869-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY	SAT	SUN	WEEK	TOTAL
		16	17	18	19	AVG	20	21	AVG	
01:00			1	0	3	1	5	5	3	14
02:00			3	0	1	1	1	2	1	7
03:00			2	1	2	2	1	2	2	8
04:00			0	0	0	0	0	1	0	1
05:00			1	3	2	2	1	0	1	7
06:00			4	5	3	4	1	0	3	13
07:00			17	19	11	16	4	3	11	54
08:00			55	47	50	51	12	4	34	168
09:00			63	74	53	63	24	19	47	233
10:00			66	66	57	63	32	31	50	252
11:00			39	37	36	37	55	42	42	209
12:00		38	40	38	36	38	70	47	45	269
13:00		62	50	49	63	56	77	48	58	349
14:00		51	49	56	59	54	58	57	55	330
15:00		62	53	59	51	56	67	52	57	344
16:00		55	64	56	65	60	66	41	58	347
17:00		65	61	72	57	64	61	59	62	375
18:00		54	80	75	69	70	60	56	66	394
19:00		83	60	86	55	71	46	41	62	371
20:00		44	51	44	37	44	36	17	38	229
21:00		43	29	54	19	36	27	26	33	198
22:00		15	21	30	31	24	30	11	23	138
23:00		7	8	16	20	13	13	6	12	70
24:00		5	2	4	16	7	20	5	9	52
TOTALS		584	819	891	796	833	767	575	772	4432
% AVG WKDY		70.1	98.3	107.0	95.6		92.1	69.0		
% AVG WEEK		75.6	106.1	115.4	103.1		99.4	74.5		
AM Times		12:00	10:00	09:00	10:00	09:00	12:00	12:00	10:00	
AM Peaks		38	66	74	57	21	70	47	17	
PM Times		19:00	18:00	19:00	18:00	19:00	13:00	17:00	18:00	
PM Peaks		83	80	86	69	24	77	59	22	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.99
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/16/2012

Site Reference: Rd Class u0
Site ID: 000000013256
Location: Hildreth St W of Boston Rd
Direction: ROAD TOTAL

File: hildrethWboston.prn
City: Westford
ID Number: 869-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY	SAT	SUN	WEEK	TOTAL
		16	17	18	19	AVG	20	21	AVG	
01:00			3	1	5	3	9	12	6	30
02:00			3	2	1	2	3	2	2	11
03:00			3	3	3	3	1	4	3	14
04:00			0	1	1	1	3	4	2	9
05:00			2	5	3	3	2	3	3	15
06:00			12	10	11	11	2	2	7	37
07:00			36	45	30	37	10	9	26	130
08:00			94	91	88	91	34	21	66	328
09:00			122	128	95	115	68	52	93	465
10:00			119	120	115	118	78	67	100	499
11:00			86	84	82	84	119	94	93	465
12:00		78	85	77	74	78	142	84	90	540
13:00		109	91	85	94	95	144	88	102	611
14:00		83	83	103	103	93	102	125	100	599
15:00		121	115	113	111	115	123	93	113	676
16:00		115	105	114	129	116	121	94	113	678
17:00		117	124	146	118	126	109	91	118	705
18:00		133	147	168	132	145	97	79	126	756
19:00		131	111	156	99	124	99	61	110	657
20:00		81	87	84	62	78	68	30	69	412
21:00		61	44	74	36	54	50	53	53	318
22:00		24	32	44	47	37	41	20	35	208
23:00		12	13	26	31	20	30	11	20	123
24:00		13	7	5	23	12	33	10	15	91
TOTALS		1078	1524	1685	1493	1561	1488	1109	1465	8377
% AVG WKDY		69.1	97.6	107.9	95.6		95.3	71.0		
% AVG WEEK		73.6	104.0	115.0	101.9		101.6	75.7		
AM Times		12:00	09:00	09:00	10:00	10:00	12:00	11:00	10:00	
AM Peaks		78	122	128	115	39	142	94	33	
PM Times		18:00	18:00	18:00	18:00	18:00	13:00	14:00	18:00	
PM Peaks		133	147	168	132	48	144	125	42	
D%		60	55	55	50		55	55		
K%		12	10	10	9		10	11		

Wkday AADT(Factored & Rounded)= 1400
Week AADT(Factored & Rounded)= 1300

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.99
WEEKLY SUMMARY FOR LANE 1
Starting: 10/22/2012

Site Reference: Rd Class u0
Site ID: 000000013256
Location: Hildreth St W of Boston Rd
Direction: EAST

File: hildrethWboston.prn
City: Westford
ID Number: 869-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
	22	23								
01:00	1	0				0			0	1
02:00	0	0				0			0	0
03:00	0	0				0			0	0
04:00	0	1				0			0	1
05:00	3	2				2			2	5
06:00	9	10				10			10	19
07:00	19	23				21			21	42
08:00	57	47				52			52	104
09:00	69	63				66			66	132
10:00	37	36				36			36	73
11:00	44	42				43			43	86
12:00	45					45			45	45
13:00	32					32			32	32
14:00	39					39			39	39
15:00	59					59			59	59
16:00	66					66			66	66
17:00	72					72			72	72
18:00	67					67			67	67
19:00	58					58			58	58
20:00	23					23			23	23
21:00	20					20			20	20
22:00	9					9			9	9
23:00	2					2			2	2
24:00	2					2			2	2
TOTALS	733	224				724			724	957
% AVG WKDY	101.2	30.9								
% AVG WEEK	101.2	30.9								
AM Times	09:00	09:00				09:00			09:00	
AM Peaks	69	63				33			33	
PM Times	17:00					17:00			17:00	
PM Peaks	72					36			36	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.99
WEEKLY SUMMARY FOR LANE 2
Starting: 10/22/2012

Site Reference: Rd Class u0
Site ID: 000000013256
Location: Hildreth St W of Boston Rd
Direction: WEST

File: hildrethWboston.prn
City: Westford
ID Number: 869-2012

TIME	MON 22	TUE 23	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	1	1				1			1	2
02:00	1	1				1			1	2
03:00	0	0				0			0	0
04:00	0	0				0			0	0
05:00	1	0				0			0	1
06:00	3	2				2			2	5
07:00	12	17				14			14	29
08:00	49	47				48			48	96
09:00	76	77				76			76	153
10:00	65	61				63			63	126
11:00	36	45				40			40	81
12:00	44					44			44	44
13:00	59					59			59	59
14:00	54					54			54	54
15:00	57					57			57	57
16:00	56					56			56	56
17:00	61					61			61	61
18:00	81					81			81	81
19:00	77					77			77	77
20:00	38					38			38	38
21:00	28					28			28	28
22:00	17					17			17	17
23:00	11					11			11	11
24:00	3					3			3	3
TOTALS	830	251				831			831	1081
% AVG WKDY	99.9	30.2								
% AVG WEEK	99.9	30.2								
AM Times	09:00	09:00				09:00			09:00	
AM Peaks	76	77				38			38	
PM Times	18:00					18:00			18:00	
PM Peaks	81					41			41	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.99
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/22/2012

Site Reference: Rd Class u0
Site ID: 000000013256
Location: Hildreth St W of Boston Rd
Direction: ROAD TOTAL

File: hildrethWboston.prn
City: Westford
ID Number: 869-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
	22	23								
01:00	2	1				2			2	3
02:00	1	1				1			1	2
03:00	0	0				0			0	0
04:00	0	1				0			0	1
05:00	4	2				3			3	6
06:00	12	12				12			12	24
07:00	31	40				36			36	71
08:00	106	94				100			100	200
09:00	145	140				142			142	285
10:00	102	97				100			100	199
11:00	80	87				84			84	167
12:00	89					89			89	89
13:00	91					91			91	91
14:00	93					93			93	93
15:00	116					116			116	116
16:00	122					122			122	122
17:00	133					133			133	133
18:00	148					148			148	148
19:00	135					135			135	135
20:00	61					61			61	61
21:00	48					48			48	48
22:00	26					26			26	26
23:00	13					13			13	13
24:00	5					5			5	5
TOTALS	1563	475				1560			1560	2038
% AVG WKDY	100.2	30.4								
% AVG WEEK	100.2	30.4								
AM Times	09:00	09:00				09:00			09:00	
AM Peaks	145	140				71			71	
PM Times	18:00					18:00			18:00	
PM Peaks	148					74			74	
D%	55	55								
K%	9	29								

Wkday AADT(Factored & Rounded)= 1400
Week AADT(Factored & Rounded)= 1400

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.99
WEEKLY SUMMARY FOR LANE 1
Starting: 10/10/2012

Site Reference: Rd Class u0
Site ID: 000000007584
Location: Lincoln St E of Boston Rd
Direction: EAST

File: lincolnEboston.prn
City: Westford
ID Number: 848-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY	SAT	SUN	WEEK	TOTAL
			10	11	12	AVG	13	14	AVG	
01:00				21	24	22	46	49	35	140
02:00			4	5	6	5	25	14	11	54
03:00			6	4	10	7	13	6	8	39
04:00			1	3	2	2	3	8	3	17
05:00			5	5	4	5	5	8	5	27
06:00			18	8	8	11	8	5	9	47
07:00			54	78	65	66	22	18	47	237
08:00			155	177	156	163	81	28	119	597
09:00			231	238	223	231	144	55	178	891
10:00			181	186	210	192	259	95	186	931
11:00			201	211	231	214	290	152	217	1085
12:00			257	245	251	251	363	216	266	1332
13:00			230	227	288	248	336	250	266	1331
14:00			258	247	284	263	300	252	268	1341
15:00			312	340	381	344	363	250	329	1646
16:00			456	473	499	476	338	269	407	2035
17:00			681	716	704	700	316	208	525	2625
18:00			830	919	869	873	265	215	620	3098
19:00			701	741	565	669	226	152	477	2385
20:00			328	375	269	324	190	138	260	1300
21:00			197	201	120	173	125	84	145	727
22:00			118	142	132	131	107	60	112	559
23:00			61	60	114	78	98	55	78	388
24:00			42	36	60	46	99	29	53	266
TOTALS			5327	5658	5475	5494	4022	2616	4624	23098
% AVG WKDY			97.0	103.0	99.7		73.2	47.6		
% AVG WEEK			115.2	122.4	118.4		87.0	56.6		
AM Times			12:00	12:00	12:00	12:00	12:00	12:00	12:00	
AM Peaks			257	245	251	84	363	216	89	
PM Times			18:00	18:00	18:00	18:00	15:00	16:00	18:00	
PM Peaks			830	919	869	291	363	269	207	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.99
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/10/2012

Site Reference: Rd Class u0
Site ID: 000000007584
Location: Lincoln St E of Boston Rd
Direction: ROAD TOTAL

File: lincolnEboston.prn
City: Westford
ID Number: 848-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY	SAT	SUN	WEEK	TOTAL
			10	11	12	AVG	13	14	AVG	
01:00				21	24	22	46	49	35	140
02:00			4	5	6	5	25	14	11	54
03:00			6	4	10	7	13	6	8	39
04:00			1	3	2	2	3	8	3	17
05:00			5	5	4	5	5	8	5	27
06:00			18	8	8	11	8	5	9	47
07:00			54	78	65	66	22	18	47	237
08:00			155	177	156	163	81	28	119	597
09:00			231	238	223	231	144	55	178	891
10:00			181	186	210	192	259	95	186	931
11:00			201	211	231	214	290	152	217	1085
12:00			257	245	251	251	363	216	266	1332
13:00			230	227	288	248	336	250	266	1331
14:00			258	247	284	263	300	252	268	1341
15:00			312	340	381	344	363	250	329	1646
16:00			456	473	499	476	338	269	407	2035
17:00			681	716	704	700	316	208	525	2625
18:00			830	919	869	873	265	215	620	3098
19:00			701	741	565	669	226	152	477	2385
20:00			328	375	269	324	190	138	260	1300
21:00			197	201	120	173	125	84	145	727
22:00			118	142	132	131	107	60	112	559
23:00			61	60	114	78	98	55	78	388
24:00			42	36	60	46	99	29	53	266
TOTALS			5327	5658	5475	5494	4022	2616	4624	23098
% AVG WKDY			97.0	103.0	99.7		73.2	47.6		
% AVG WEEK			115.2	122.4	118.4		87.0	56.6		
AM Times			12:00	12:00	12:00	12:00	12:00	12:00	12:00	
AM Peaks			257	245	251	84	363	216	89	
PM Times			18:00	18:00	18:00	18:00	15:00	16:00	18:00	
PM Peaks			830	919	869	291	363	269	207	
D%			100	100	100		100	100		
K%			16	16	16		9	10		

Wkday AADT(Factored & Rounded)= 5000
Week AADT(Factored & Rounded)= 4200

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Main St E of Depot St
Direction: EAST

File: mainEdepot.prn
City: Westford
ID Number: 868-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			1	7	3	4	5	11	5	27
02:00			1	0	3	1	5	5	3	14
03:00			2	0	1	1	2	1	1	6
04:00			0	0	2	1	2	2	1	6
05:00			4	1	1	2	1	2	2	9
06:00			11	11	8	10	3	3	7	36
07:00			35	42	50	42	8	4	28	139
08:00			233	268	232	244	41	15	158	789
09:00			192	223	156	190	63	33	133	667
10:00			85	102	111	99	69	53	84	420
11:00			66	99	100	88	102	57	85	424
12:00		108	122	126	112	117	120	82	112	670
13:00		111	94	89	125	105	108	97	104	624
14:00		94	93	89	116	98	92	85	95	569
15:00		153	161	155	170	160	119	94	142	852
16:00		164	148	163	167	160	121	108	145	871
17:00		162	156	178	220	179	103	97	153	916
18:00		247	194	216	283	235	88	81	185	1109
19:00		147	173	175	162	164	84	45	131	786
20:00		94	85	115	90	96	54	56	82	494
21:00		68	58	86	49	65	30	48	56	339
22:00		34	46	50	71	50	29	29	43	259
23:00		17	15	17	36	21	39	14	23	138
24:00		9	5	10	17	10	32	7	13	80
TOTALS		1408	1980	2222	2285	2142	1320	1029	1791	10244
% AVG WKDY		65.7	92.4	103.7	106.7		61.6	48.0		
% AVG WEEK		78.6	110.6	124.1	127.6		73.7	57.5		
AM Times		12:00	08:00	08:00	08:00	08:00	12:00	12:00	08:00	
AM Peaks		108	233	268	232	81	120	82	53	
PM Times		18:00	18:00	18:00	18:00	18:00	16:00	16:00	18:00	
PM Peaks		247	194	216	283	78	121	108	62	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Main St E of Depot St
Direction: WEST

File: mainEdepot.prn
City: Westford
ID Number: 868-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			1	2	2	2	4	7	3	16
02:00			0	2	2	1	4	5	3	13
03:00			1	0	2	1	2	1	1	6
04:00			2	2	4	3	0	2	2	10
05:00			2	3	2	2	2	2	2	11
06:00			14	14	15	14	3	2	10	48
07:00			74	85	86	82	20	10	55	275
08:00			203	206	208	206	52	40	142	709
09:00			213	211	177	200	93	62	151	756
10:00			134	101	142	126	116	59	110	552
11:00			100	99	117	105	125	77	104	518
12:00		89	116	137	115	114	129	83	112	669
13:00		113	131	103	135	120	130	87	116	699
14:00		120	98	136	119	118	98	98	112	669
15:00		130	145	150	145	142	122	75	128	767
16:00		151	145	172	156	156	109	121	142	854
17:00		172	154	195	216	184	92	91	153	920
18:00		243	207	225	270	236	108	96	192	1149
19:00		142	156	215	190	176	70	59	139	832
20:00		94	97	110	127	107	55	55	90	538
21:00		66	73	57	47	61	33	30	51	306
22:00		31	25	30	49	34	23	18	29	176
23:00		7	12	14	27	15	37	8	18	105
24:00		6	5	5	18	8	12	6	9	52
TOTALS		1364	2108	2274	2371	2213	1439	1094	1874	10650
% AVG WKDY		61.6	95.3	102.8	107.1		65.0	49.4		
% AVG WEEK		72.8	112.5	121.3	126.5		76.8	58.4		
AM Times		12:00	09:00	09:00	08:00	08:00	12:00	12:00	09:00	
AM Peaks		89	213	211	208	69	129	83	50	
PM Times		18:00	18:00	18:00	18:00	18:00	13:00	16:00	18:00	
PM Peaks		243	207	225	270	79	130	121	64	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Main St E of Depot St
Direction: ROAD TOTAL

File: mainEdepot.prn
City: Westford
ID Number: 868-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			2	9	5	5	9	18	9	43
02:00			1	2	5	3	9	10	5	27
03:00			3	0	3	2	4	2	2	12
04:00			2	2	6	3	2	4	3	16
05:00			6	4	3	4	3	4	4	20
06:00			25	25	23	24	6	5	17	84
07:00			109	127	136	124	28	14	83	414
08:00			436	474	440	450	93	55	300	1498
09:00			405	434	333	391	156	95	285	1423
10:00			219	203	253	225	185	112	194	972
11:00			166	198	217	194	227	134	188	942
12:00		197	238	263	227	231	249	165	223	1339
13:00		224	225	192	260	225	238	184	220	1323
14:00		214	191	225	235	216	190	183	206	1238
15:00		283	306	305	315	302	241	169	270	1619
16:00		315	293	335	323	316	230	229	288	1725
17:00		334	310	373	436	363	195	188	306	1836
18:00		490	401	441	553	471	196	177	376	2258
19:00		289	329	390	352	340	154	104	270	1618
20:00		188	182	225	217	203	109	111	172	1032
21:00		134	131	143	96	126	63	78	108	645
22:00		65	71	80	120	84	52	47	72	435
23:00		24	27	31	63	36	76	22	40	243
24:00		15	10	15	35	19	44	13	22	132
TOTALS		2772	4088	4496	4656	4357	2759	2123	3663	20894
% AVG WKDY		63.6	93.8	103.2	106.9		63.3	48.7		
% AVG WEEK		75.7	111.6	122.7	127.1		75.3	58.0		
AM Times		12:00	08:00	08:00	08:00	08:00	12:00	12:00	08:00	
AM Peaks		197	436	474	440	150	249	165	100	
PM Times		18:00	18:00	18:00	18:00	18:00	15:00	16:00	18:00	
PM Peaks		490	401	441	553	157	241	229	125	
D%		50	55	55	50		50	55		
K%		18	11	11	12		9	11		

Wkday AADT(Factored & Rounded)= 3900
Week AADT(Factored & Rounded)= 3300

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Main St E of Depot St
Direction: EAST

File: mainEdepot.prn
City: Westford
ID Number: 868-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
	15									
01:00	3					3			3	3
02:00	1					1			1	1
03:00	2					2			2	2
04:00	1					1			1	1
05:00	1					1			1	1
06:00	11					11			11	11
07:00	49					49			49	49
08:00	230					230			230	230
09:00	201					201			201	201
10:00										0
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	499					499			499	499
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	230					230			230	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Main St E of Depot St
Direction: WEST

File: mainEdepot.prn
City: Westford
ID Number: 868-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
	15									
01:00	4					4			4	4
02:00	0					0			0	0
03:00	0					0			0	0
04:00	1					1			1	1
05:00	2					2			2	2
06:00	13					13			13	13
07:00	71					71			71	71
08:00	213					213			213	213
09:00	202					202			202	202
10:00										0
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	506					506			506	506
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	213					213			213	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007788
Location: Main St E of Depot St
Direction: ROAD TOTAL

File: mainEdepot.prn
City: Westford
ID Number: 868-2012

TIME	MON	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
	15									
01:00	7					7			7	7
02:00	1					1			1	1
03:00	2					2			2	2
04:00	2					2			2	2
05:00	3					3			3	3
06:00	24					24			24	24
07:00	120					120			120	120
08:00	443					443			443	443
09:00	403					403			403	403
10:00										0
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	1005					1005			1005	1005
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	443					443			443	
PM Times										
PM Peaks										
D%	50									
K%	44									

Wkday AADT(Factored & Rounded)= 910
Week AADT(Factored & Rounded)= 910

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007789
Location: Main St E of Lincoln St
Direction: EAST

File: mainElincoln.prn
City: Westford
ID Number: 865-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			24	25	21	23	47	51	34	168
02:00			6	5	8	6	29	17	13	65
03:00			6	4	9	6	12	6	7	37
04:00			1	1	2	1	4	7	3	15
05:00			8	6	6	7	5	8	7	33
06:00			27	20	18	22	10	6	16	81
07:00			89	106	103	99	29	22	70	349
08:00			532	544	467	514	114	37	339	1694
09:00			459	636	370	488	218	96	356	1779
10:00			261	267	305	278	334	148	263	1315
11:00			243	265	316	275	377	221	284	1422
12:00		315	335	336	331	329	459	292	345	2068
13:00		313	312	288	389	326	431	345	346	2078
14:00		306	346	319	369	335	370	310	337	2020
15:00		495	479	507	557	510	427	316	464	2781
16:00		529	576	607	635	587	437	341	521	3125
17:00		756	792	818	894	815	386	282	655	3928
18:00		982	974	1085	1056	1024	314	262	779	4673
19:00		843	800	857	674	794	284	195	609	3653
20:00		455	381	447	353	409	203	169	335	2008
21:00		240	252	291	175	240	136	115	202	1209
22:00		144	156	183	256	185	124	87	158	950
23:00		54	67	69	133	81	120	42	81	485
24:00		44	49	40	82	54	120	38	62	373
TOTALS		5476	7175	7726	7529	7408	4990	3413	6286	36309
% AVG WKDY		73.9	96.9	104.3	101.6		67.4	46.1		
% AVG WEEK		87.1	114.1	122.9	119.8		79.4	54.3		
AM Times		12:00	08:00	09:00	08:00	08:00	12:00	12:00	09:00	
AM Peaks		315	532	636	467	171	459	292	119	
PM Times		18:00	18:00	18:00	18:00	18:00	16:00	13:00	18:00	
PM Peaks		982	974	1085	1056	341	437	345	260	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007789
Location: Main St E of Lincoln St
Direction: WEST

File: mainElincoln.prn
City: Westford
ID Number: 865-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			4	7	9	7	15	29	13	64
02:00			2	6	3	4	10	7	6	28
03:00			5	0	5	3	6	5	4	21
04:00			5	6	6	6	1	8	5	26
05:00			23	21	26	23	9	7	17	86
06:00			103	94	90	96	31	13	66	331
07:00			349	418	369	379	102	48	257	1286
08:00			771	718	693	727	169	106	491	2457
09:00			717	691	598	669	323	146	495	2475
10:00			484	425	448	452	427	205	398	1989
11:00			328	335	326	330	485	252	345	1726
12:00		280	302	348	309	310	444	242	321	1925
13:00		303	344	339	350	334	409	281	338	2026
14:00		318	309	327	335	322	378	293	327	1960
15:00		387	371	397	398	388	407	285	374	2245
16:00		422	447	460	457	446	339	340	411	2465
17:00		415	361	442	483	425	322	256	380	2279
18:00		557	460	509	561	522	289	270	441	2646
19:00		429	376	458	427	422	236	178	351	2104
20:00		277	236	287	268	267	177	159	234	1404
21:00		194	180	199	153	182	135	84	158	945
22:00		86	70	97	153	102	95	47	91	548
23:00		61	54	52	99	66	102	26	66	394
24:00		29	20	18	53	30	47	20	31	187
TOTALS		3758	6321	6654	6619	6512	4958	3307	5620	31617
% AVG WKDY		57.7	97.1	102.2	101.6		76.1	50.8		
% AVG WEEK		66.9	112.5	118.4	117.8		88.2	58.8		
AM Times		12:00	08:00	08:00	08:00	08:00	11:00	11:00	09:00	
AM Peaks		280	771	718	693	242	485	252	165	
PM Times		18:00	18:00	18:00	18:00	18:00	13:00	16:00	18:00	
PM Peaks		557	460	509	561	174	409	340	147	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007789
Location: Main St E of Lincoln St
Direction: ROAD TOTAL

File: mainElincoln.prn
City: Westford
ID Number: 865-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			28	32	30	30	62	80	46	232
02:00			8	11	11	10	39	24	19	93
03:00			11	4	14	10	18	11	12	58
04:00			6	7	8	7	5	15	8	41
05:00			31	27	32	30	14	15	24	119
06:00			130	114	108	117	41	19	82	412
07:00			438	524	472	478	131	70	327	1635
08:00			1303	1262	1160	1242	283	143	830	4151
09:00			1176	1327	968	1157	541	242	851	4254
10:00			745	692	753	730	761	353	661	3304
11:00			571	600	642	604	862	473	630	3148
12:00		595	637	684	640	639	903	534	666	3993
13:00		616	656	627	739	660	840	626	684	4104
14:00		624	655	646	704	657	748	603	663	3980
15:00		882	850	904	955	898	834	601	838	5026
16:00		951	1023	1067	1092	1033	776	681	932	5590
17:00		1171	1153	1260	1377	1240	708	538	1034	6207
18:00		1539	1434	1594	1617	1546	603	532	1220	7319
19:00		1272	1176	1315	1101	1216	520	373	960	5757
20:00		732	617	734	621	676	380	328	569	3412
21:00		434	432	490	328	421	271	199	359	2154
22:00		230	226	280	409	286	219	134	250	1498
23:00		115	121	121	232	147	222	68	146	879
24:00		73	69	58	135	84	167	58	93	560
TOTALS		9234	13496	14380	14148	13918	9948	6720	11904	67926
% AVG WKDY		66.3	97.0	103.3	101.7		71.5	48.3		
% AVG WEEK		77.6	113.4	120.8	118.9		83.6	56.5		
AM Times		12:00	08:00	09:00	08:00	08:00	12:00	12:00	09:00	
AM Peaks		595	1303	1327	1160	414	903	534	284	
PM Times		18:00	18:00	18:00	18:00	18:00	13:00	16:00	18:00	
PM Peaks		1539	1434	1594	1617	515	840	681	407	
D%		65	70	70	65		50	50		
K%		17	11	11	11		9	10		

Wkday AADT(Factored & Rounded)= 12500
Week AADT(Factored & Rounded)= 10700

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007789
Location: Main St E of Lincoln St
Direction: EAST

File: mainElincoln.prn
City: Westford
ID Number: 865-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	13					13			13	13
02:00	7					7			7	7
03:00	13					13			13	13
04:00	2					2			2	2
05:00	6					6			6	6
06:00	23					23			23	23
07:00	99					99			99	99
08:00	543					543			543	543
09:00	432					432			432	432
10:00	296					296			296	296
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	1434					1434			1434	1434
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	543					543			543	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007789
Location: Main St E of Lincoln St
Direction: WEST

File: mainElincoln.prn
City: Westford
ID Number: 865-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	10					10			10	10
02:00	1					1			1	1
03:00	3					3			3	3
04:00	4					4			4	4
05:00	23					23			23	23
06:00	98					98			98	98
07:00	382					382			382	382
08:00	741					741			741	741
09:00	683					683			683	683
10:00	474					474			474	474
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	2419					2419			2419	2419
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	741					741			741	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007789
Location: Main St E of Lincoln St
Direction: ROAD TOTAL

File: mainElincoln.prn
City: Westford
ID Number: 865-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	23					23			23	23
02:00	8					8			8	8
03:00	16					16			16	16
04:00	6					6			6	6
05:00	29					29			29	29
06:00	121					121			121	121
07:00	461					461			461	461
08:00	1284					1284			1284	1284
09:00	1115					1115			1115	1115
10:00	770					770			770	770
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	3853					3853			3853	3853
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	1284					1284			1284	
PM Times										
PM Peaks										
D%	60									
K%	33									

Wkday AADT(Factored & Rounded)= 3500
Week AADT(Factored & Rounded)= 3500

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007787
Location: Main St W of Lincoln St
Direction: EAST

File: mainWlincoln.prn
City: Westford
ID Number: 866-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			0	4	0	1	3	10	3	17
02:00			2	0	1	1	3	2	2	8
03:00			0	0	0	0	1	1	0	2
04:00			1	2	0	1	0	3	1	6
05:00			4	1	3	3	1	0	2	9
06:00			9	11	11	10	6	1	8	38
07:00			44	51	55	50	15	13	36	178
08:00			370	361	322	351	52	11	223	1116
09:00			218	333	173	241	82	37	169	843
10:00			99	99	114	104	115	61	98	488
11:00			81	97	94	91	137	84	99	493
12:00			106	99	96	100	120	86	101	507
13:00		82	91	94	105	93	114	115	100	601
14:00		90	116	78	100	96	99	77	93	560
15:00		203	204	207	218	208	102	89	170	1023
16:00		166	163	179	167	169	110	95	147	880
17:00		161	151	162	199	168	100	78	142	851
18:00		240	195	215	216	216	60	56	164	982
19:00		153	158	181	132	156	61	44	122	729
20:00		129	67	129	92	104	40	37	82	494
21:00		74	62	107	61	76	23	29	59	356
22:00		30	29	48	121	57	22	29	46	279
23:00		10	12	12	25	15	30	9	16	98
24:00		6	3	3	21	8	20	7	10	60
TOTALS		1344	2185	2473	2326	2319	1316	974	1893	10618
% AVG WKDY		58.0	94.2	106.6	100.3		56.7	42.0		
% AVG WEEK		71.0	115.4	130.6	122.9		69.5	51.5		
AM Times			08:00	08:00	08:00	08:00	11:00	12:00	08:00	
AM Peaks			370	361	322	117	137	86	74	
PM Times		18:00	15:00	18:00	15:00	18:00	13:00	13:00	15:00	
PM Peaks		240	204	215	218	72	114	115	57	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007787
Location: Main St W of Lincoln St
Direction: WEST

File: mainWlincoln.prn
City: Westford
ID Number: 866-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			4	9	10	8	18	35	15	76
02:00			3	6	3	4	10	7	6	29
03:00			3	0	5	3	7	5	4	20
04:00			7	8	8	8	2	12	7	37
05:00			25	23	28	25	9	8	19	93
06:00			103	95	94	97	35	14	68	341
07:00			349	421	359	376	97	46	254	1272
08:00			801	738	744	761	184	113	516	2580
09:00			748	743	610	700	351	150	520	2602
10:00			482	438	467	462	442	205	407	2034
11:00			334	347	343	341	502	257	357	1783
12:00			347	399	318	355	481	261	361	1806
13:00		330	352	360	371	353	447	307	361	2167
14:00		348	324	340	354	342	399	313	346	2078
15:00		437	407	452	398	424	437	307	406	2438
16:00		517	496	517	495	506	368	371	461	2764
17:00		499	417	481	503	475	358	277	422	2535
18:00		635	539	596	609	595	308	276	494	2963
19:00		519	437	506	453	479	244	181	390	2340
20:00		293	247	321	284	286	195	162	250	1502
21:00		215	195	271	159	210	135	87	177	1062
22:00		126	86	134	154	125	97	48	108	645
23:00		58	50	51	99	64	114	41	69	413
24:00		37	27	26	60	38	69	26	41	245
TOTALS		4014	6783	7282	6928	7037	5309	3509	6059	33825
% AVG WKDY		57.0	96.4	103.5	98.5		75.4	49.9		
% AVG WEEK		66.2	111.9	120.2	114.3		87.6	57.9		
AM Times			08:00	09:00	08:00	08:00	11:00	12:00	09:00	
AM Peaks			801	743	744	254	502	261	173	
PM Times		18:00	18:00	18:00	18:00	18:00	13:00	16:00	18:00	
PM Peaks		635	539	596	609	198	447	371	165	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES
Starting: 10/9/2012

Site Reference: Rd Class u5
Site ID: 000000007787
Location: Main St W of Lincoln St
Direction: ROAD TOTAL

File: mainWlincoln.prn
City: Westford
ID Number: 866-2012

TIME	MON	TUE 9	WED 10	THU 11	FRI 12	WKDAY AVG	SAT 13	SUN 14	WEEK AVG	TOTAL
01:00			4	13	10	9	21	45	19	93
02:00			5	6	4	5	13	9	7	37
03:00			3	0	5	3	8	6	4	22
04:00			8	10	8	9	2	15	9	43
05:00			29	24	31	28	10	8	20	102
06:00			112	106	105	108	41	15	76	379
07:00			393	472	414	426	112	59	290	1450
08:00			1171	1099	1066	1112	236	124	739	3696
09:00			966	1076	783	942	433	187	689	3445
10:00			581	537	581	566	557	266	504	2522
11:00			415	444	437	432	639	341	455	2276
12:00			453	498	414	455	601	347	463	2313
13:00		412	443	454	476	446	561	422	461	2768
14:00		438	440	418	454	438	498	390	440	2638
15:00		640	611	659	616	632	539	396	577	3461
16:00		683	659	696	662	675	478	466	607	3644
17:00		660	568	643	702	643	458	355	564	3386
18:00		875	734	811	825	811	368	332	658	3945
19:00		672	595	687	585	635	305	225	512	3069
20:00		422	314	450	376	390	235	199	333	1996
21:00		289	257	378	220	286	158	116	236	1418
22:00		156	115	182	275	182	119	77	154	924
23:00		68	62	63	124	79	144	50	85	511
24:00		43	30	29	81	46	89	33	51	305
TOTALS		5358	8968	9755	9254	9358	6625	4483	7953	44443
% AVG WKDY		57.3	95.8	104.2	98.9		70.8	47.9		
% AVG WEEK		67.4	112.8	122.7	116.4		83.3	56.4		
AM Times			08:00	08:00	08:00	08:00	11:00	12:00	08:00	
AM Peaks			1171	1099	1066	371	639	347	246	
PM Times		18:00	18:00	18:00	18:00	18:00	13:00	16:00	18:00	
PM Peaks		875	734	811	825	270	561	466	219	
D%		75	70	65	70		80	80		
K%		16	13	11	12		10	10		

Wkday AADT(Factored & Rounded)= 8400
Week AADT(Factored & Rounded)= 7200

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 1
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007787
Location: Main St W of Lincoln St
Direction: EAST

File: mainWlincoln.prn
City: Westford
ID Number: 866-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	1					1			1	1
02:00	2					2			2	2
03:00	3					3			3	3
04:00	0					0			0	0
05:00	2					2			2	2
06:00	12					12			12	12
07:00	49					49			49	49
08:00	363					363			363	363
09:00	262					262			262	262
10:00	105					105			105	105
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	799					799			799	799
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	363					363			363	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR LANE 2
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007787
Location: Main St W of Lincoln St
Direction: WEST

File: mainWlincoln.prn
City: Westford
ID Number: 866-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	11					11			11	11
02:00	1					1			1	1
03:00	3					3			3	3
04:00	5					5			5	5
05:00	26					26			26	26
06:00	99					99			99	99
07:00	379					379			379	379
08:00	766					766			766	766
09:00	691					691			691	691
10:00	490					490			490	490
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	2471					2471			2471	2471
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	766					766			766	
PM Times										
PM Peaks										

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.92 AXLE CORRECTION: 0.98
WEEKLY SUMMARY FOR ALL LANES Page: 6
Starting: 10/15/2012

Site Reference: Rd Class u5
Site ID: 000000007787
Location: Main St W of Lincoln St
Direction: ROAD TOTAL

File: mainWlincoln.prn
City: Westford
ID Number: 866-2012

TIME	MON 15	TUE	WED	THU	FRI	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00	12					12			12	12
02:00	3					3			3	3
03:00	6					6			6	6
04:00	5					5			5	5
05:00	28					28			28	28
06:00	111					111			111	111
07:00	428					428			428	428
08:00	1129					1129			1129	1129
09:00	953					953			953	953
10:00	595					595			595	595
11:00										0
12:00										0
13:00										0
14:00										0
15:00										0
16:00										0
17:00										0
18:00										0
19:00										0
20:00										0
21:00										0
22:00										0
23:00										0
24:00										0
TOTALS	3270					3270			3270	3270
% AVG WKDY	100.0									
% AVG WEEK	100.0									
AM Times	08:00					08:00			08:00	
AM Peaks	1129					1129			1129	
PM Times										
PM Peaks										
D%	70									
K%	35									

Wkday AADT(Factored & Rounded)= 2900
Week AADT(Factored & Rounded)= 2900

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.93 AXLE CORRECTION: 1.00
WEEKLY SUMMARY FOR LANE 1
Starting: 9/17/2012

Site Reference: Rd Class u5
Site ID: 000000023256
Location: Main St E of Graniteville Rd, 624-2012
Direction: EAST

File: ainEgraniteville.prn
City: Westford
ID Number: MassDOT 4043

TIME	MON 17	TUE 18	WED 19	THU 20	FRI 21	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00		30	9	15	14	17			17	68
02:00		22	6	6	9	11			11	43
03:00		15	2	2	4	6			6	23
04:00		5	1	3	6	4			4	15
05:00		1	3	4	5	3			3	13
06:00		9	17	19	14	15			15	59
07:00		20	121	117	114	93			93	372
08:00		83	288	313	283	242			242	967
09:00		122	178	182	179	165			165	661
10:00		167	172	173	151	166			166	663
11:00		208	151	172		177			177	531
12:00		230	191	222		214			214	643
13:00		271	228	212		237			237	711
14:00		263	243	219		242			242	725
15:00		208	281	292		260			260	781
16:00		213	344	399		319			319	956
17:00		244	436	388		356			356	1068
18:00		270	509	494		424			424	1273
19:00		196	460	470		375			375	1126
20:00		160	318	282		253			253	760
21:00		92	193	175		153			153	460
22:00		88	114	138		113			113	340
23:00		42	42	75		53			53	159
24:00	12	22	19	24		19			19	77
TOTALS	12	2981	4326	4396	779	3917			3917	12494
% AVG WKDY	0.3	76.1	110.4	112.2	19.9					
% AVG WEEK	0.3	76.1	110.4	112.2	19.9					
AM Times		12:00	08:00	08:00	08:00	08:00			08:00	
AM Peaks		230	288	313	283	61			61	
PM Times	24:00	13:00	18:00	18:00		18:00			18:00	
PM Peaks	12	271	509	494		106			106	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.93 AXLE CORRECTION: 1.00
WEEKLY SUMMARY FOR LANE 2
Starting: 9/17/2012

Site Reference: Rd Class u5
Site ID: 000000023256
Location: Main St E of Graniteville Rd, 624-2012
Direction: WEST

File: ainEgraniteville.prn
City: Westford
ID Number: MassDOT 4043

TIME	MON 17	TUE 18	WED 19	THU 20	FRI 21	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00		6	3	7	3	5			5	19
02:00		1	3	1	3	2			2	8
03:00		1	1	0	1	1			1	3
04:00		5	7	7	11	8			8	30
05:00		10	36	35	39	30			30	120
06:00		24	136	133	140	108			108	433
07:00		73	381	386	405	311			311	1245
08:00		107	634	678	649	517			517	2068
09:00		186	435	477	451	387			387	1549
10:00		230	230	273	258	248			248	991
11:00		314	213	218		248			248	745
12:00		263	215	223		234			234	701
13:00		312	211	210		244			244	733
14:00		206	305	282		264			264	793
15:00		171	325	340		279			279	836
16:00		149	297	288		245			245	734
17:00		210	278	261		250			250	749
18:00		191	331	276		266			266	798
19:00		152	271	215		213			213	638
20:00		114	163	180		152			152	457
21:00		54	102	100		85			85	256
22:00		39	58	34		44			44	131
23:00		17	18	21		19			19	56
24:00	4	7	25	16		13			13	52
TOTALS	4	2842	4678	4661	1960	4173			4173	14145
% AVG WKDY	0.1	68.1	112.1	111.7	47.0					
% AVG WEEK	0.1	68.1	112.1	111.7	47.0					
AM Times		11:00	08:00	08:00	08:00	08:00			08:00	
AM Peaks		314	634	678	649	129			129	
PM Times	24:00	13:00	18:00	15:00		15:00			15:00	
PM Peaks	4	312	331	340		70			70	

Massachusetts Highway Department
NMCOG
FACTORS = SEASONAL: 0.93 AXLE CORRECTION: 1.00
WEEKLY SUMMARY FOR ALL LANES
Starting: 9/17/2012

Site Reference: Rd Class u5 File: ainEgraniteville.prn
Site ID: 000000023256 City: Westford
Location: Main St E of Graniteville Rd, 624-2012 ID Number: MassDOT 4043
Direction: ROAD TOTAL

TIME	MON 17	TUE 18	WED 19	THU 20	FRI 21	WKDAY AVG	SAT	SUN	WEEK AVG	TOTAL
01:00		36	12	22	17	22			22	87
02:00		23	9	7	12	13			13	51
03:00		16	3	2	5	6			6	26
04:00		10	8	10	17	11			11	45
05:00		11	39	39	44	33			33	133
06:00		33	153	152	154	123			123	492
07:00		93	502	503	519	404			404	1617
08:00		190	922	991	932	759			759	3035
09:00		308	613	659	630	552			552	2210
10:00		397	402	446	409	414			414	1654
11:00		522	364	390		425			425	1276
12:00		493	406	445		448			448	1344
13:00		583	439	422		481			481	1444
14:00		469	548	501		506			506	1518
15:00		379	606	632		539			539	1617
16:00		362	641	687		563			563	1690
17:00		454	714	649		606			606	1817
18:00		461	840	770		690			690	2071
19:00		348	731	685		588			588	1764
20:00		274	481	462		406			406	1217
21:00		146	295	275		239			239	716
22:00		127	172	172		157			157	471
23:00		59	60	96		72			72	215
24:00	16	29	44	40		32			32	129
TOTALS	16	5823	9004	9057	2739	8089			8089	26639
% AVG WKDY	0.2	72.0	111.3	112.0	33.9					
% AVG WEEK	0.2	72.0	111.3	112.0	33.9					
AM Times		11:00	08:00	08:00	08:00	08:00			08:00	
AM Peaks		522	922	991	932	190			190	
PM Times	24:00	13:00	18:00	18:00		18:00			18:00	
PM Peaks	16	583	840	770		173			173	
D%	75	55	70	70	70					
K%	100	10	10	11	34					

Wkday AADT(Factored & Rounded)= 7500
Week AADT(Factored & Rounded)= 7500

Turn Count Summary

Location: Lincoln St/library at Main St, Westford

Date: 11/06/12 Day of week: Wednesday Weather: cloudy

Analyst: JH Peak hour: 07:15 - 08:15

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	1	2	169	2	5	0	24	0	37	0	240
7:15	0	0	0	0	229	4	9	1	40	0	65	0	348
7:30	0	0	0	1	158	3	3	1	40	0	78	0	284
7:45	0	5	1	2	186	1	1	0	51	0	47	0	294
8:00	1	0	0	1	175	0	2	0	47	2	32	0	260
8:15	0	0	2	1	192	4	1	0	50	0	56	1	307
8:30	1	0	0	2	132	0	2	3	45	0	45	1	231
8:45	0	0	0	0	168	2	2	3	60	0	38	0	273

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	1	2	164	2	5	0	23	0	36	0	233
7:15	0	0	0	0	226	4	9	1	37	0	62	0	339
7:30	0	0	0	1	157	3	3	1	39	0	76	0	280
7:45	0	5	1	2	179	1	1	0	49	0	43	0	281
8:00	1	0	0	1	170	0	2	0	45	2	32	0	253
8:15	0	0	2	0	186	4	1	0	48	0	50	1	292
8:30	1	0	0	2	124	0	1	3	45	0	41	1	218
8:45	0	0	0	0	166	2	2	3	60	0	38	0	271

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	0	5	0	0	0	1	0	1	0	7
7:15	0	0	0	0	3	0	0	0	3	0	3	0	9
7:30	0	0	0	0	1	0	0	0	1	0	2	0	4
7:45	0	0	0	0	7	0	0	0	2	0	4	0	13
8:00	0	0	0	0	5	0	0	0	2	0	0	0	7
8:15	0	0	0	1	6	0	0	0	2	0	6	0	15
8:30	0	0	0	0	8	0	1	0	0	0	4	0	13
8:45	0	0	0	0	2	0	0	0	0	0	0	0	2

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	1	0	1	0	0	0	1	0	1	2
7:45	0	1	1	1	0	1	1	0	1	0	0	0	3
8:00	0	0	0	2	0	2	0	0	0	0	0	0	2
8:15	0	2	2	0	0	0	0	0	0	0	0	0	2
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	1	5	1	4	748	8	15	2	178	2	222	0	1186
Factor	0.25	0.25	0.25	0.5	0.82	0.5	0.42	0.5	0.87	0.25	0.71	0	0.8
Approach Factor	0.29			0.82			0.94			0.72			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	1	5	1	4	732	8	15	2	170	2	213	0	1153
Truck	0	0	0	0	16	0	0	0	8	0	9	0	33
Bicycle	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	1	1	4	0	4	1	0	1	1	0	1	7

Turn Count Summary

Location: Lincoln St/Library at Main St, Westford, MA

Date: 2012-12-04 Day of week: Tuesday Weather: Cloudy

Analyst: JH Peak hour: 17:00 - 18:00

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	5	0	7	3	90	6	4	2	128	4	34	0	283
16:15	3	0	3	2	88	2	4	4	141	1	28	1	277
16:30	6	0	6	1	93	4	3	2	162	3	30	0	310
16:45	5	0	8	0	93	1	5	4	139	2	27	0	284
17:00	4	0	9	0	63	2	5	3	181	4	31	0	302
17:15	7	0	4	0	109	3	1	2	184	1	34	1	346
17:30	3	0	8	0	75	4	9	7	182	2	42	0	332
17:45	9	0	6	0	139	3	11	9	188	2	25	0	392

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	5	0	7	3	88	6	3	2	124	4	34	0	276
16:15	3	0	3	2	87	2	3	4	139	1	28	1	273
16:30	6	0	6	1	91	4	3	2	161	3	30	0	307
16:45	5	0	8	0	91	1	5	4	137	2	27	0	280
17:00	4	0	9	0	62	2	5	3	180	3	31	0	299
17:15	7	0	3	0	108	3	1	2	183	1	34	1	343
17:30	3	0	8	0	75	4	9	7	179	2	42	0	329
17:45	9	0	6	0	137	3	11	9	187	2	25	0	389

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	2	0	1	0	4	0	0	0	7
16:15	0	0	0	0	1	0	1	0	2	0	0	0	4
16:30	0	0	0	0	2	0	0	0	1	0	0	0	3
16:45	0	0	0	0	2	0	0	0	2	0	0	0	4
17:00	0	0	0	0	1	0	0	0	1	1	0	0	3
17:15	0	0	1	0	1	0	0	0	1	0	0	0	3
17:30	0	0	0	0	0	0	0	0	3	0	0	0	3
17:45	0	0	0	0	2	0	0	0	1	0	0	0	3

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	1	0	1	0	0	0	1	0	1	1	0	1	3
16:45	0	0	0	0	1	1	2	0	2	0	0	0	3
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	2	2	0	0	0	3	0	3	5
17:45	0	1	1	0	0	0	0	3	3	0	0	0	4

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	23	0	27	0	386	12	26	21	735	9	132	1	1372
Factor	0.64	0	0.75	0	0.69	0.75	0.59	0.58	0.98	0.56	0.79	0.25	0.84
Approach Factor	0.83			0.7			0.94			0.81			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	23	0	26	0	382	12	26	21	729	8	132	1	1360
Truck	0	0	1	0	4	0	0	0	6	1	0	0	12
Bicycle	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	1	1	0	2	2	0	3	3	3	0	3	9

Turn Count Summary

Location: Depot St at Main St, Westford

Date: 2012-11-07 Day of week: Wednesday

Weather: cloudy Analyst: ghr Peak hour: 07:15 - 08:15

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	1	134	0	50	0	2	0	33	28	248
7:15	0	0	0	7	170	0	71	0	2	0	52	50	352
7:30	0	0	0	14	150	0	33	0	11	0	57	66	331
7:45	0	0	0	7	153	0	26	0	4	0	47	40	277
8:00	0	0	0	9	159	0	34	0	10	0	39	33	284
8:15	0	0	0	9	164	0	32	0	10	0	52	51	318
8:30	0	0	0	8	106	0	39	0	9	0	58	36	256
8:45	0	0	0	7	128	0	38	0	14	0	59	41	287

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	1	131	0	50	0	2	0	32	26	242
7:15	0	0	0	7	167	0	70	0	2	0	48	46	340
7:30	0	0	0	14	146	0	33	0	10	0	54	63	320
7:45	0	0	0	6	151	0	22	0	4	0	44	38	265
8:00	0	0	0	9	154	0	33	0	7	0	38	30	271
8:15	0	0	0	9	158	0	30	0	10	0	49	46	302
8:30	0	0	0	6	103	0	35	0	8	0	56	33	241
8:45	0	0	0	7	128	0	35	0	14	0	59	40	283

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	0	3	0	0	0	0	0	1	2	6
7:15	0	0	0	0	3	0	1	0	0	0	4	4	12
7:30	0	0	0	0	3	0	0	0	1	0	2	1	7
7:45	0	0	0	1	2	0	4	0	0	0	3	2	12
8:00	0	0	0	0	5	0	1	0	3	0	1	3	13
8:15	0	0	0	0	6	0	2	0	0	0	3	4	15
8:30	0	0	0	2	3	0	4	0	1	0	2	3	15
8:45	0	0	0	0	0	0	3	0	0	0	0	1	4

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	1	0	0	0	0	0	1	2	4
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	1	1
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	1	0	1	1
7:30	0	0	0	0	0	0	0	0	0	1	0	1	1
7:45	0	0	0	0	0	0	0	2	2	1	0	1	3
8:00	0	0	0	2	0	2	0	0	0	2	2	4	6
8:15	0	2	2	0	0	0	0	0	0	0	0	0	2
8:30	0	0	0	2	0	2	0	0	0	0	0	0	2
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	37	632	0	164	0	27	0	195	189	1244
Factor	0	0	0	0.66	0.93	0	0.58	0	0.61	0	0.86	0.72	0.83
Approach Factor	0			0.94			0.65			0.78			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	0	0	0	36	618	0	158	0	23	0	184	177	1196
Truck	0	0	0	1	13	0	6	0	4	0	10	10	44
Bicycle	0	0	0	0	1	0	0	0	0	0	1	2	4

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	0	0	2	0	2	0	2	2	5	2	7	11

Turn Count Summary

Location: Main Street at Depot Street, Westford, MA

Date: 2012-11-29 Day of week: Thursday Weather: sunny

Analyst: Nathaniel strosberg Peak hour: 16:45 - 17:45

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	2	37	0	23	0	7	0	82	24	175
16:15	0	0	0	2	62	0	29	0	9	0	157	35	294
16:30	0	0	0	3	56	0	34	0	6	0	145	26	270
16:45	0	0	0	4	90	0	39	0	6	0	182	30	351
17:00	0	0	0	4	77	0	53	0	7	0	172	41	354
17:15	0	0	0	4	85	0	58	0	8	0	204	35	394
17:30	0	0	0	3	74	0	37	0	14	0	215	35	378
17:45	0	0	0	2	55	0	39	0	11	0	178	38	323

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	2	37	0	21	0	6	0	82	24	172
16:15	0	0	0	2	59	0	29	0	9	0	157	35	291
16:30	0	0	0	3	55	0	34	0	5	0	143	26	266
16:45	0	0	0	3	87	0	36	0	6	0	178	29	339
17:00	0	0	0	4	76	0	52	0	7	0	169	41	349
17:15	0	0	0	4	82	0	58	0	8	0	202	34	388
17:30	0	0	0	3	72	0	37	0	14	0	214	35	375
17:45	0	0	0	2	55	0	38	0	11	0	177	37	320

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	0	0	2	0	1	0	0	0	3
16:15	0	0	0	0	3	0	0	0	0	0	0	0	3
16:30	0	0	0	0	1	0	0	0	1	0	1	0	3
16:45	0	0	0	1	3	0	3	0	0	0	4	1	12
17:00	0	0	0	0	1	0	1	0	0	0	3	0	5
17:15	0	0	0	0	3	0	0	0	0	0	2	1	6
17:30	0	0	0	0	2	0	0	0	0	0	1	0	3
17:45	0	0	0	0	0	0	1	0	0	0	1	1	3

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	1	0	1
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	15	326	0	187	0	35	0	773	141	1477
Factor	0	0	0	0.94	0.91	0	0.81	0	0.62	0	0.9	0.86	0.9
Approach Factor	0			0.91			0.84			0.91			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	0	0	0	14	317	0	183	0	35	0	763	139	1451
Truck	0	0	0	1	9	0	4	0	0	0	10	2	26
Bicycle	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0

Turn Count Summary

Location: Boston Rd at Main St, Westford

Date: 2012-11-13 Day of week: Thursday Weather: Sunny

Analyst: ghr Peak hour: 07:00 - 08:00

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	128	56	0	53	0	0	0	29	106	372
7:15	0	0	0	109	102	0	48	0	0	0	77	122	458
7:30	0	0	0	138	29	0	25	0	1	0	68	145	406
7:45	0	0	0	145	26	0	30	0	2	0	35	102	340
8:00	0	0	0	145	16	0	21	0	0	0	37	93	312
8:15	0	0	0	156	31	0	20	0	0	0	47	109	363
8:30	0	0	0	130	17	0	24	0	1	0	43	85	300
8:45	0	0	0	135	32	0	23	0	1	0	48	95	334

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	126	55	0	53	0	0	0	28	104	366
7:15	0	0	0	109	98	0	46	0	0	0	75	121	449
7:30	0	0	0	133	28	0	23	0	1	0	68	142	395
7:45	0	0	0	138	21	0	28	0	2	0	32	101	322
8:00	0	0	0	142	16	0	21	0	0	0	37	92	308
8:15	0	0	0	149	30	0	19	0	0	0	45	102	345
8:30	0	0	0	127	15	0	23	0	1	0	40	83	289
8:45	0	0	0	132	27	0	21	0	0	0	46	89	315

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	2	1	0	0	0	0	0	1	2	6
7:15	0	0	0	0	4	0	1	0	0	0	2	1	8
7:30	0	0	0	5	1	0	2	0	0	0	0	3	11
7:45	0	0	0	7	5	0	2	0	0	0	3	1	18
8:00	0	0	0	3	0	0	0	0	0	0	0	1	4
8:15	0	0	0	7	1	0	1	0	0	0	2	7	18
8:30	0	0	0	3	2	0	1	0	0	0	3	2	11
8:45	0	0	0	3	5	0	2	0	1	0	2	6	19

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	1	0	0	0	0	0	1
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
7:00	0	0	0	0	1	1	0	1	1	2	0	2	4
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	1	0	1	1
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	1	1	0	0	0	0	0	0	0	0	0	1

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	520	213	0	156	0	3	0	209	475	1576
Factor	0	0	0	0.9	0.52	0	0.74	0	0.38	0	0.68	0.82	0.83
Approach Factor	0			0.87			0.75			0.8			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	0	0	0	506	202	0	150	0	3	0	203	468	1532
Truck	0	0	0	14	11	0	5	0	0	0	6	7	43
Bicycle	0	0	0	0	0	0	1	0	0	0	0	0	1

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	0	0	0	1	1	0	1	1	2	0	2	4

Turn Count Summary

Location: Boston Rd at Main St, Westford, MA

Date: 2012-11-13 Day of week: Tuesday Weather: cloudy

Analyst: drt Peak hour: 17:00 - 18:00

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	60	35	0	71	0	2	0	31	58	257
16:15	0	0	0	64	38	0	72	0	0	0	16	40	230
16:30	0	0	0	62	38	0	75	0	0	0	28	39	242
16:45	0	0	0	60	33	0	92	0	1	0	26	35	247
17:00	0	0	0	89	42	0	79	0	2	0	34	37	283
17:15	0	0	0	78	34	0	102	0	1	0	43	32	290
17:30	0	0	0	74	53	0	98	0	1	0	35	31	292
17:45	0	0	0	81	49	0	92	0	0	0	42	29	293

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	60	35	0	70	0	1	0	31	57	254
16:15	0	0	0	63	38	0	72	0	0	0	16	40	229
16:30	0	0	0	61	38	0	74	0	0	0	28	39	240
16:45	0	0	0	60	32	0	92	0	1	0	26	35	246
17:00	0	0	0	89	42	0	78	0	2	0	34	37	282
17:15	0	0	0	77	34	0	102	0	1	0	43	31	288
17:30	0	0	0	74	53	0	98	0	1	0	34	31	291
17:45	0	0	0	81	48	0	91	0	0	0	42	29	291

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	0	0	1	0	1	0	0	1	3
16:15	0	0	0	1	0	0	0	0	0	0	0	0	1
16:30	0	0	0	0	0	0	1	0	0	0	0	0	1
16:45	0	0	0	0	1	0	0	0	0	0	0	0	1
17:00	0	0	0	0	0	0	1	0	0	0	0	0	1
17:15	0	0	0	1	0	0	0	0	0	0	0	1	2
17:30	0	0	0	0	0	0	0	0	0	0	1	0	1
17:45	0	0	0	0	1	0	1	0	0	0	0	0	2

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	1	0	0	0	0	0	0	0	0	1
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	2	0	2	0	0	0	0	0	0	2
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	322	178	0	371	0	4	0	154	129	1158
Factor	0	0	0	0.9	0.84	0	0.91	0	0.5	0	0.9	0.87	0.94
Approach Factor	0			0.95			0.91			0.94			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	0	0	0	321	177	0	369	0	4	0	153	128	1152
Truck	0	0	0	1	1	0	2	0	0	0	1	1	6
Bicycle	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0

Turn Count Summary

Location: Graniteville Rd at Main St, Westford

Date: 2012-11-14 Day of week: Wednesday Weather: clear

Analyst: ghr Peak hour: 07:00 - 08:00

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	53	0	3	0	86	19	0	0	0	2	114	0	277
7:15	42	0	7	0	123	21	0	0	0	5	131	0	329
7:30	92	0	4	0	29	13	0	0	0	4	146	0	288
7:45	67	0	3	0	42	13	0	0	0	2	74	0	201
8:00	57	0	5	0	40	8	0	0	0	1	80	0	191
8:15	61	0	4	0	38	18	0	0	0	3	98	0	222
8:30	56	0	1	0	23	12	0	0	0	1	54	0	147
8:45	51	0	1	0	34	23	0	0	0	1	52	0	162

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	53	0	3	0	82	18	0	0	0	1	110	0	267
7:15	41	0	7	0	122	18	0	0	0	4	126	0	318
7:30	87	0	4	0	27	13	0	0	0	4	143	0	278
7:45	64	0	2	0	36	12	0	0	0	2	70	0	186
8:00	57	0	5	0	40	7	0	0	0	0	78	0	187
8:15	60	0	4	0	35	15	0	0	0	3	95	0	212
8:30	54	0	0	0	20	10	0	0	0	1	50	0	135
8:45	50	0	1	0	31	22	0	0	0	1	50	0	155

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	0	4	1	0	0	0	1	4	0	10
7:15	1	0	0	0	1	3	0	0	0	1	5	0	11
7:30	5	0	0	0	2	0	0	0	0	0	3	0	10
7:45	3	0	1	0	6	1	0	0	0	0	4	0	15
8:00	0	0	0	0	0	1	0	0	0	0	2	0	3
8:15	1	0	0	0	3	3	0	0	0	0	3	0	10
8:30	2	0	1	0	3	2	0	0	0	0	4	0	12
8:45	1	0	0	0	3	1	0	0	0	0	2	0	7

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	1	0	0	1
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
7:00	0	0	0	0	0	0	0	0	0	2	0	2	2
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	1	1	0	0	0	0	0	0	1	0	1	2
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	254	0	17	0	280	66	0	0	0	13	465	0	1095
Factor	0.69	0	0.61	0	0.57	0.79	0	0	0	0.65	0.8	0	0.7
Approach Factor	0.71			0.6			0			0.8			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	245	0	16	0	267	61	0	0	0	11	449	0	1049
Truck	9	0	1	0	13	5	0	0	0	2	16	0	46
Bicycle	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	0	0	0	0	0	0	0	0	2	0	2	2

Turn Count Summary

Location: Main St at Graniteville Rd, Westford

Date: 2012-12-04 Day of week: Tuesday Weather: overcast

Analyst: ghr Peak hour: 17:00 - 18:00

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	22	0	2	0	55	32	0	0	0	0	74	0	185
16:15	24	0	1	0	67	42	0	0	0	2	44	0	180
16:30	19	0	2	0	63	33	0	0	0	2	43	0	162
16:45	25	0	3	0	56	48	0	0	0	1	37	0	170
17:00	29	0	0	0	43	47	0	0	0	0	41	0	160
17:15	28	0	2	0	64	58	0	0	0	7	42	0	201
17:30	17	0	1	0	58	63	0	0	0	5	61	0	205
17:45	28	0	3	0	71	65	0	0	0	1	44	0	212

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	22	0	2	0	53	31	0	0	0	0	72	0	180
16:15	22	0	1	0	67	40	0	0	0	2	44	0	176
16:30	18	0	2	0	61	32	0	0	0	2	43	0	158
16:45	25	0	3	0	55	48	0	0	0	1	36	0	168
17:00	29	0	0	0	40	46	0	0	0	0	40	0	155
17:15	28	0	2	0	63	57	0	0	0	6	41	0	197
17:30	17	0	1	0	58	63	0	0	0	5	60	0	204
17:45	28	0	3	0	69	64	0	0	0	1	43	0	208

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	2	1	0	0	0	0	2	0	5
16:15	2	0	0	0	0	2	0	0	0	0	0	0	4
16:30	1	0	0	0	2	1	0	0	0	0	0	0	4
16:45	0	0	0	0	1	0	0	0	0	0	1	0	2
17:00	0	0	0	0	3	1	0	0	0	0	1	0	5
17:15	0	0	0	0	1	1	0	0	0	1	1	0	4
17:30	0	0	0	0	0	0	0	0	0	0	1	0	1
17:45	0	0	0	0	2	1	0	0	0	0	1	0	4

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
16:00	0	1	1	0	0	0	0	0	0	0	0	0	1
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	102	0	6	0	236	233	0	0	0	13	188	0	778
Factor	0.88	0	0.5	0	0.83	0.9	0	0	0	0.46	0.77	0	0.83
Approach Factor	0.87			0.86			0			0.76			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	102	0	6	0	230	230	0	0	0	12	184	0	764
Truck	0	0	0	0	6	3	0	0	0	1	4	0	14
Bicycle	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0

Turn Count Summary

Location: Boston Rd at Hildreth St/Lincoln St, Westford,MA

Date: 2012-11-29 Day of week: Thursday Weather: Sunny

Analyst: JH Peak hour: 07:30 - 08:30

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	232	6	0	0	0	6	48	26	0	1	8	327
7:15	0	248	3	0	0	0	4	47	32	1	3	4	342
7:30	1	283	3	0	0	0	4	25	37	3	7	4	367
7:45	1	244	5	0	0	0	1	31	35	0	5	8	330
8:00	0	235	5	0	0	0	3	20	49	0	10	8	330
8:15	0	255	8	0	0	0	2	19	64	1	12	10	371
8:30	0	209	10	0	0	0	1	29	43	1	6	7	306
8:45	2	218	4	0	0	0	5	26	57	2	10	5	329

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	229	5	0	0	0	4	47	26	0	1	8	320
7:15	0	247	3	0	0	0	4	46	30	1	3	4	338
7:30	1	277	3	0	0	0	3	23	36	3	6	4	356
7:45	1	237	5	0	0	0	1	29	35	0	5	8	321
8:00	0	232	5	0	0	0	3	20	46	0	10	8	324
8:15	0	242	8	0	0	0	2	18	56	1	12	10	349
8:30	0	204	10	0	0	0	0	28	41	1	6	7	297
8:45	2	214	4	0	0	0	5	24	54	1	9	5	318

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	3	1	0	0	0	2	1	0	0	0	0	7
7:15	0	1	0	0	0	0	0	1	2	0	0	0	4
7:30	0	6	0	0	0	0	1	2	1	0	1	0	11
7:45	0	6	0	0	0	0	0	2	0	0	0	0	8
8:00	0	3	0	0	0	0	0	0	3	0	0	0	6
8:15	0	12	0	0	0	0	0	1	8	0	0	0	21
8:30	0	5	0	0	0	0	0	1	2	0	0	0	8
8:45	0	4	0	0	0	0	0	2	3	0	1	0	10

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	1	0	1	1
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	2	2	0	0	0	2
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	1	1	0	0	0	0	0	0	1
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	2	1017	21	0	0	0	10	95	185	4	34	30	1398
Factor	0.5	0.9	0.66	0	0	0	0.62	0.77	0.72	0.33	0.71	0.75	0.88
Approach Factor	0.91			0			0.85			0.74			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	2	988	21	0	0	0	9	90	173	4	33	30	1350
Truck	0	27	0	0	0	0	1	5	12	0	1	0	46
Bicycle	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	0	0	0	0	0	0	2	2	0	0	0	2

Turn Count Summary

Location: Boston Rd at Hildreth St/ Lincoln St, Westford

Date: 2012-11-29 Day of week: Thursday Weather: sun

Analyst: drt Peak hour: 17:00 - 18:00

Total vehicle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	4	117	6	1	1	0	26	45	100	1	11	2	314
16:15	2	94	2	0	0	0	11	72	148	0	9	4	342
16:30	2	91	6	0	0	0	6	69	146	2	9	3	334
16:45	5	110	6	0	0	0	9	82	163	1	16	5	397
17:00	2	121	11	0	0	0	7	71	173	2	11	5	403
17:15	6	109	12	0	0	0	6	87	206	0	13	5	444
17:30	4	124	8	0	0	0	12	89	213	1	7	3	461
17:45	0	100	4	0	0	0	16	89	178	0	9	3	399

Car traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	4	111	6	1	1	0	26	45	99	1	11	2	307
16:15	2	89	2	0	0	0	11	70	144	0	9	4	331
16:30	2	88	6	0	0	0	6	67	146	2	9	3	329
16:45	5	108	6	0	0	0	9	81	161	1	16	5	392
17:00	2	120	11	0	0	0	7	70	173	2	11	5	401
17:15	6	108	11	0	0	0	6	86	206	0	13	5	441
17:30	4	122	8	0	0	0	12	88	213	1	7	3	458
17:45	0	99	3	0	0	0	16	86	176	0	9	3	392

Truck traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	6	0	0	0	0	0	0	1	0	0	0	7
16:15	0	5	0	0	0	0	0	2	4	0	0	0	11
16:30	0	3	0	0	0	0	0	1	0	0	0	0	4
16:45	0	2	0	0	0	0	0	1	2	0	0	0	5
17:00	0	1	0	0	0	0	0	1	0	0	0	0	2
17:15	0	1	0	0	0	0	0	1	0	0	0	0	2
17:30	0	2	0	0	0	0	0	1	0	0	0	0	3
17:45	0	1	1	0	0	0	0	3	2	0	0	0	7

Bicycle traffic

Interval starts	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	1	0	0	0	0	1
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	1	0	0	0	0	0	0	0	0	0	1
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian volumes

Interval starts	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Peak Hour

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	12	454	35	0	0	0	41	336	770	3	40	16	1707
Factor	0.5	0.92	0.73	0	0	0	0.64	0.94	0.9	0.38	0.77	0.8	0.91
Approach Factor	0.92			0			0.91			0.82			

Peak Hour Vehicle Summary

	Southbound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	12	449	33	0	0	0	41	330	768	3	40	16	1692
Truck	0	5	1	0	0	0	0	6	2	0	0	0	14
Bicycle	0	0	1	0	0	0	0	0	0	0	0	0	1

Peak Hour Pedestrians

	NE			NW			SW			SE			Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C: Massachusetts Roundabout Installation Screening Tool

MASSACHUSETTS ROUNDABOUT INSTALLATION SCREENING TOOL

What is the purpose of this tool?

This planning tool is intended to provide consistent and systematic information regarding the issues, geometric characteristics, and traffic parameters related to a location under consideration for roundabout design. The tool is expected to assist MassDOT, MPOs, RPAs, and municipalities in screening roundabout concepts and formulating informed opinions about the appropriateness of roundabout designs, and in conveying to other interested technical staff, consultants, decision makers, and interested people the reasoning leading to these opinions.

Why this tool is needed?

The installation of a roundabout is beneficial only if it addresses a unique purpose for the location and if the environment is appropriate for its use. Installing a roundabout for the wrong purpose or in an inappropriate environment may lead to adverse effects. MassDOT, MPOs, RPAs, and municipalities are interested in having a consistent tool that would help in assessing whether a roundabout is a viable alternative for advancing for further analysis and design.

Why this tool should be used?

The following benefits will be realized from using the tool:

- Streamlining and standardizing roundabout installation screening process for MassDOT, MPOs, RPAs, and municipalities
- Encouraging municipalities to construct more roundabouts, if screening points to the feasibility of such design
- Preventing planners from proceeding to the design phase, which would use funding sources before there is some consensus on the feasibility and viability of a roundabout design

Who should use this tool?

MassDOT staff, in the following areas—the districts, Office of Transportation Planning, Highway Design, Traffic Engineering, and Project Management—will find the tool useful. Staff will use the tool to ensure that when a roundabout concept is considered, the appropriate planning, analysis, and design aspects are well thought out early in the design process. The tool will also be useful to MPOs and RPAs, as well as to municipalities and their consultants.

When to use this tool?

This tool should be used during planning, project scoping, and preliminary engineering stages of the design process. MassDOT, the MPOs, RPAs, and municipalities can apply the tool when they:

- Review proposals for the design and construction of roundabouts
- Consider roundabout concepts for improving intersections
- Respond to roundabout requests

What comprises the tool?

The tool consists of general information and five steps, both sections to be completed by the user. The general information section includes fields to be filled in about the location and roadway characteristics of the intersection. The five steps are:

Step 1: Description of the existing problems
Step 2: Project objectives
Step 3: Type of roundabout and space requirements
Step 4: Roundabout screening factors
Step 5: Screening Evaluation

What is needed to use the tool?

Information needed to use the tool includes, but is not limited to, the following:

- Traffic counts and turning movements
- Crash data (three years)
- Crash diagram
- Plan sheet, layout, and right-of-way of existing intersection
- Aerial photograph of location
- Geometric layout of roundabout
- Planning-level capacities for roundabouts (included with the tool)
- Initial ranges of roundabout parameters for space requirements (included with the tool)

MPOs and RPAs may be able to assist municipalities in preparing crash diagrams.

How to use the tool?

The tool consists of a series of questions that identify the opportunities a roundabout alternative may offer and the considerations to be taken into account in making a decision about whether or not to install a roundabout, and the possible impacts of a roundabout alternative at the intersection. By focusing on the existing problems, project objectives, benefits, and an evaluation of the roundabout application, the user answers the questions in the screening form to identify the feasibility and impacts of a roundabout alternative.

In the final step of the screening process, the user decides, based on the answers to the questions, whether or not the space requirements and/or the project objectives are met. The user accepts or rejects a roundabout alternative based on the following criteria:

- *Candidate:* Advance a roundabout design for further analysis and design if it meets the space requirements and one or more of the project objectives.
- *Conditional:* Advance a roundabout design for further analysis and design if it meets the space requirements and one or more of the project objectives under certain conditions; which are determined by the user.
- *Not recommended:* Reject a roundabout from further consideration if it does not meet the space requirements or any of the project objectives.

Who signs off on the decision?

For locations maintained by MassDOT, the MassDOT Highway Division, working in conjunction with interested parties such as MPOs, RPAs, and municipalities, will sign off on whether or not a roundabout alternative is feasible and worthy of advancing for additional analysis and design.

TYPES OF CIRCULAR INTERSECTIONS

There are three forms of circular intersections in the United States where traffic travels counterclockwise around a central island and entering traffic must yield to circulating traffic. They are roundabouts, rotaries, and traffic circles. The design features of each form present operational and safety benefits or disadvantages. The sections below draw heavily from NCHRP Report 672, Chapter 1, and the reader is encouraged to refer to it for more information.[1]

Roundabouts

Roundabouts are characterized by having smaller circular intersections than rotaries do. They operate with yield control of all entering traffic, and have channelized approaches and deflections to achieve slower entry and circulating speeds. These features of roundabouts improve safety by reducing the number and severity of crashes and allow the roundabouts to operate efficiently.

Example of a roundabout

Mini-Roundabouts

Mini-roundabouts are small roundabouts with a fully traversable central island to accommodate trucks. They are most commonly used in low-speed urban environments with average operating speeds of 30 mph or less. They can be useful in environments where a conventional roundabout design is precluded by right-of-way constraints. Because they are small, mini-roundabouts are perceived as pedestrian-friendly,

Example of a mini-roundabout

[1] Transportation Research Board, National Cooperative Highway Research Program (NCHRP) Report 672: Roundabouts: An Informational Guide – Second Edition, Chapter 3, Washington, D.C., 2010.

with short crossing distances and very low vehicle speeds on approaches and exits.

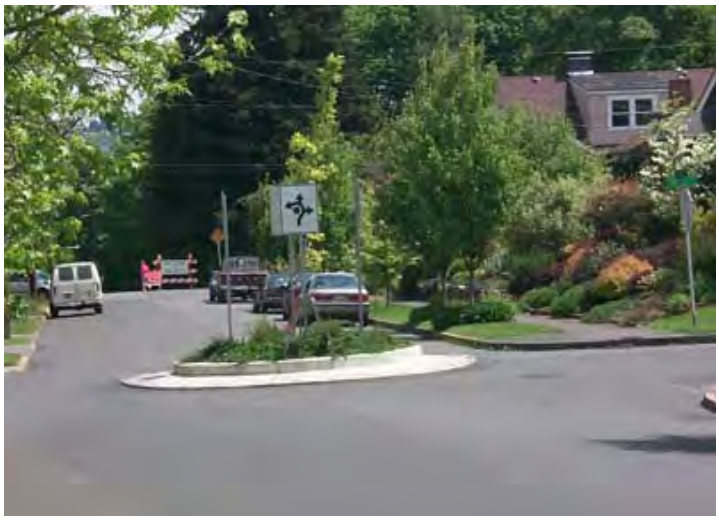
Rotaries

Rotaries are sometimes called traffic circles. Rotaries are large-diameter circular intersections, usually with high entry and circulating speeds. Due to the high speeds and weaving at rotaries, maneuvers are challenging and injuries from crashes are more severe. Rotaries can be signalized or unsignalized (stop-controlled or uncontrolled), and they have different operational conditions than roundabouts.

Example of a rotary

Neighborhood Traffic-Calming Circles

Neighborhood traffic-calming circles are much smaller than modern roundabouts and often replace stop signs at four-way intersections. They are typically used in residential neighborhoods to decrease traffic speeds and reduce accidents, but are typically not designed to accommodate large vehicles.



Example of a neighborhood traffic-calming circle

ROUNDABOUT AND ROTARY TRAFFIC RULES

The following sections about how one should approach and drive within roundabouts and rotaries draws heavily from MassDOT's Registry of Motor Vehicles Driver's Manual (revised October 2012).

Approaching or Driving in a Roundabout or Rotary

- Traffic travels counterclockwise in a roundabout or a rotary.
- Slow down and obey traffic signs when approaching and entering.
- Yield to pedestrians and bicyclists as you enter and exit.
- Yield the right-of-way to vehicles already in the rotary (unless told differently by signs or police officers).
- Use turn signals in the same way as at any other intersection.
- Yield to emergency vehicles; if an emergency vehicle enters the roundabout, exit the roundabout or pull over to let the emergency vehicle pass.

Choosing a Lane at a Roundabout or a Rotary

Single-Lane

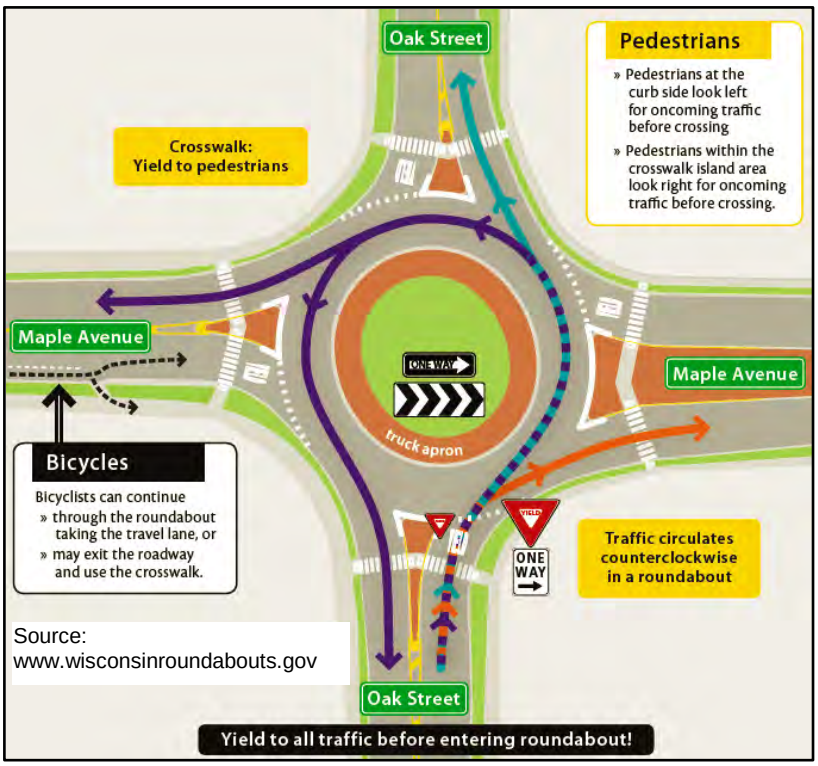
If the roundabout or rotary has a single lane, you must enter from the right lane of the road you are coming from. You must exit into the right lane of the road you intend to travel on. (See the first figure below, "An example of driving through a single-lane roundabout.")

Multi-Lane

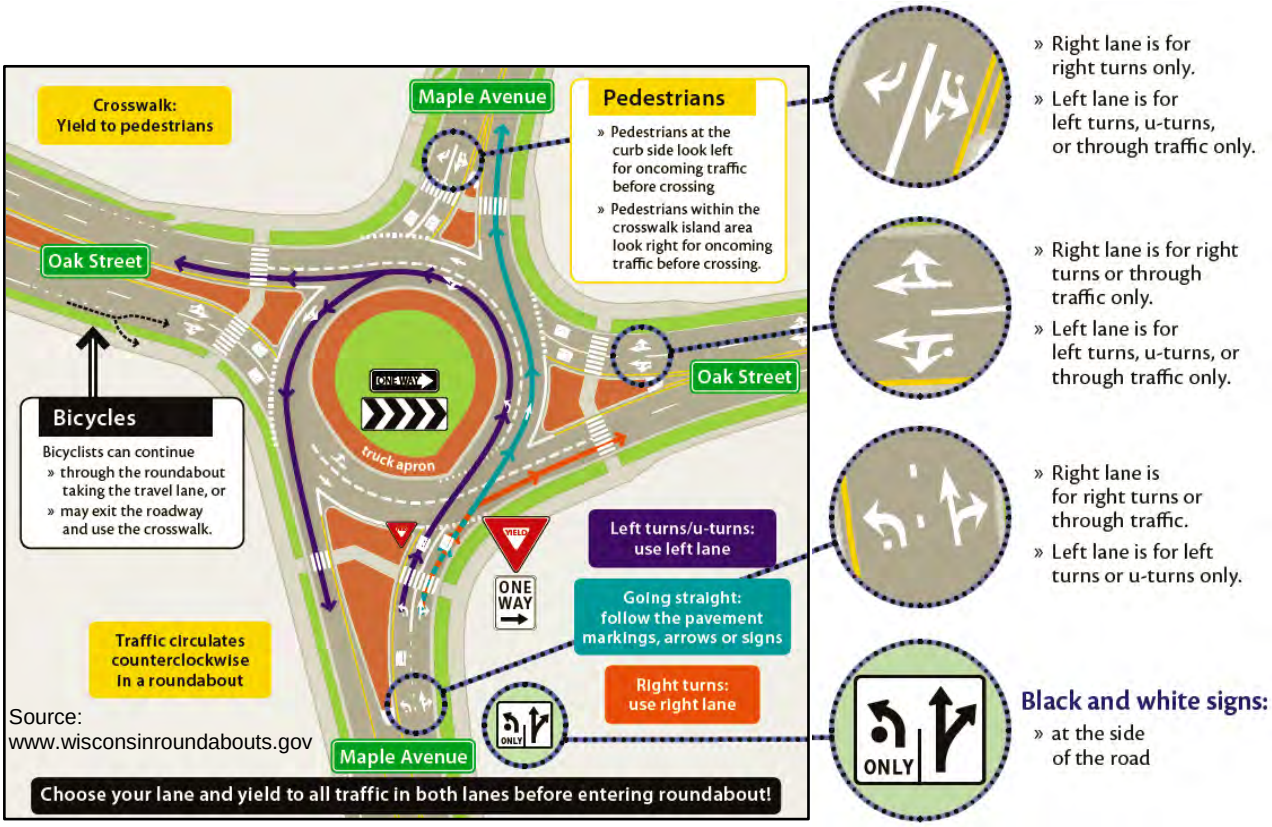
If the roundabout or rotary has multiple lanes, look for signs to help you choose the proper lane. (See the second figure below, "An example of driving through a multi-lane roundabout.") If there are no signs, you should do the following:

- For a quarter-turn, or to continue straight ahead, enter the rotary from the right lane. Stay in that lane, and exit into the right lane.
- For a three-quarter-turn, or a U-turn, enter the rotary from the left lane. Travel through the middle or inner lane. Exit into the right lane. If coming from a road with a single lane, you should stay in the right lane for the entire turn.

In a multiple-lane roundabout or rotary, there may be traffic on both sides of your vehicle. Do not attempt to move out of your lane until it is safe to do so. If you miss your exit, don't get upset. Check the traffic around you. If it is safe to do so, go around again and position your vehicle to properly and safely exit the rotary. **Do not stop in the roundabout or rotary.**



An example of driving through a single-lane roundabout



An example of driving through a multi-lane roundabout

POTENTIAL APPLICATIONS OF ROUNDABOUTS

Roundabouts have a wide range of possible applications, each with its own benefits and considerations. Therefore, during the screening of roundabout alternatives for feasibility and possible recommendation for further analysis and benefits and considerations of that application need to be considered. Some of the environments where roundabouts have potential applications and the benefits and considerations associated with each application are listed below, which draw heavily from the NCHRP Report 672, Chapter 3, and the reader is encouraged to refer to it for more information.[2]

Residential Subdivision

In residential areas, roundabouts provide traffic calming and aesthetic appeal to residents.

Benefits	Considerations
• Traffic calming promotes lower speeds	• Type of vehicle used for the design (emergency vehicles, trucks, buses)
• Single-lane roundabout often suitable	• Right-of-way needs
• Pedestrian- and bicycle-friendly	• Driveway access to corner properties
• Aesthetic and community enhancement	• Landscaping and illumination

Suburban Municipalities, Small Towns, and Rural Settings

Roundabouts provide aesthetic and community enhancement in suburban and rural municipalities, where traffic volumes are often lower and right-of-way may not be an issue but where safety problems persist.

Benefits	Considerations
• May improve operations	• Type of vehicle used for the design (emergency vehicles, trucks, buses)
• May improve safety	• Pedestrian, bicycle, and transit access
• May decrease vehicle speeds	• Intersection visibility under high-speed conditions
• May decrease maintenance costs	

[2] Transportation Research Board, National Cooperative Highway Research Program (NCHRP) Report 672: Roundabouts: An Informational Guide – Second Edition, Chapter 3, Washington, D.C., 2010.

Urban Centers

Urban centers have multimodal needs (pedestrians, bicycles, motorists, transit users, emergency vehicles, trucks, and buses), and are usually constrained, requiring U-turn and left-turn maneuvers and midblock pedestrian crossings. Roundabouts that are used in conjunction with median installations offer opportunities for improving access and mobility in urban centers.

Benefits	Considerations
• May decrease vehicle speeds	• Accessibility for visually impaired pedestrians
• Enhance safety for pedestrians	• Right-of-way needs
• May provide for aesthetic treatments	• Type of vehicle used for the design (emergency vehicles, trucks, buses)
• May improve access management	• Parking
• May reduce delay and emissions	• Interaction with adjacent traffic signals
•	• Sight distance

Schools

Roundabouts reduce speeds and improve pedestrian crossings by providing refuge in the splitter island for pedestrians and pedestrians focusing on one traffic stream at a time, therefore they may be suitable for intersections near schools.

Benefits	Considerations
• May decrease vehicle speeds	• Type of vehicle used for the design (emergency vehicles, trucks, buses)
• May improve aesthetics and gateway treatment	• Right-of-way needs
• May improve pedestrian and vehicle safety	• User education and outreach
•	• Crossing guards

Interchanges

Interchanges ramp terminals with high left turn volumes and limited storage for queues are potential candidates for roundabouts. Roundabouts require less space at the approaches and on the roadway segments leading to the approaches. Hence they could prevent expensive bridge widening and reduce cost significantly.

Benefits	Considerations
• May reduce speeds through interchange	• Type of vehicle used for the design (emergency vehicles, trucks, buses)
• May narrow the bridge cross-section	• Right-of-way needs
• May reduce costs	• Signage
• May improve landscaping and gateway treatments	• Driver familiarity

Gateways, Aesthetics, and Traffic-Calming Treatments

Roundabouts have been used in traffic-calming treatments to reduce speeds and increase safety for pedestrians and roadside activities. They are also potential candidates for gateway treatments to schools and towns. In these applications, capacity and safety are not project objectives but measures should be taken to prevent creating any safety and operations problems that currently do not exist.

Benefits	Considerations
• Central island provides space for aesthetic treatments	• Type of vehicle used for the design (emergency vehicles, trucks, buses)
• Minimal impact to traffic operations	• Right-of-way needs
• Increases landscaping opportunities	•

Commercial Centers

In commercial centers, roundabouts provide for a central focus point for a development and enhance aesthetic qualities.

Benefits	Considerations
• Introduce geometric delay to slow drivers	• Type of vehicle used for the design (emergency vehicles, trucks, buses)
• May improve safety for motorists and pedestrians	• Right-of-way needs
• Landscaping opportunities can enhance local neighborhoods	• Access to adjacent properties near the roundabout
• Allow for easy U-turn movements, so minor commercial driveways can easily be restricted to right-in-right-out, improving safety between intersections as well.	•

Unusual Geometry

Intersections with unusual geometric configurations are difficult to operate. However, the operational features of a roundabouts offer unique benefits for effectively managing traffic flows at intersections with unusual geometry.

Benefits	Considerations
• Effectively manage traffic flows in situations with unique geometric conditions	• Type of vehicle used for the design (emergency vehicles, trucks, buses)
• Reduce delay more than signalized scenarios do	• Right-of-way needs
•	• Entry path deflection and alignment

Closely-Space Intersections

Roundabouts balance traffic flows and manage queue lengths between closely spaced intersections.

Benefits	Considerations
• Improve access to properties	• Capacity analysis needed
• Reduce queues and balance traffic flow	• Right-of-way needs

PUBLIC INVOLVEMENT

Gaining public acceptance of roundabouts is a big challenge facing municipalities and agencies that plan to install roundabouts. The tool will assist MassDOT staff in screening roundabout concepts and formulating informed opinions about roundabout designs, and it will enable them to better convey to stakeholders (interested members of the public, developers, consultants, emergency departments, elected officials, and business owners) the reasoning that led to these opinions.

It is important that the public involvement process be initiated as soon as practical, preferably early in the planning stages (immediately after the roundabout screening analysis), while other intersection designs are also being considered. Therefore, the project manager must identify the stakeholders and their interests and concerns about how a roundabout is going to affect them. Equally important is how those interests and concerns are going to be addressed during the design phase.

The selection of which methods will be used to convey information to different groups of stakeholders is vital. Methods include, but not limited to, the following: public meetings, informational brochures and videos, websites, and media announcements. The effectiveness of each of these methods depends on the type of stakeholder. Because each stakeholder is affected differently, it may be prudent to use more than one method to convey information to stakeholders.

Media content is also important and should be appropriate to the type of audience that is being targeted. The content should include information and reports of experiences that may provide value for stakeholder audiences in specific situations, and it should be geared to their specific interests and concerns. For general audiences, general information about the environment, the type of roundabout, benefits and considerations, and other intersection designs may be appropriate.

Feedback garnered from the public participation process must be utilized in further design and analysis to refine alternatives and gain public acceptance. It must be emphasized that the public involvement process does not end until the project has been implemented and is operating satisfactorily.

MASSACHUSETTS ROUNDABOUT INSTALLATION SCREENING FORM

GENERAL INFORMATION	
Highway district:	Major street:
MPO/RPA:	Minor street:
City or Town:	Existing intersection control:
Prepared by:	Number of legs at the intersection:
Submitted by:	ADT on major road:
Reviewed by:	ADT on minor road:
Phone:	Total number of crashes (3-year average):
Email:	Speed limit (major road):
Date:	Speed limit (minor road):

RESOURCES: DATA AND INFORMATION REQUIRED FOR ASSESSMENT	
1. Traffic counts (ADT and turning movements)	6. Aerial photographs of location
2. Vehicle classification (trucks and buses)	7. Crash data (3 years)
3. Pedestrian and bicyclist counts	8. Crash diagrams
4. Plan sheet or layout of existing intersection	9. Speed data
5. Geometric layout of roundabout	

STEP 1: BRIEF DESCRIPTION OF EXISTING PROBLEMS

STEP 2: PROJECT OBJECTIVES (Check all that apply)

Question Number	Objectives	Primary		Secondary		Comment
		Yes	No	Yes	No	
2.1	Safety improvement					
2.2	Operational improvement					
2.3	Traffic-calming improvement					
2.4	Aesthetics/community enhancements					
2.5	Access management improvement					

MASSACHUSETTS ROUNDABOUT INSTALLATION SCREENING FORM

STEP 3: TYPE OF ROUNDABOUT AND SPACE REQUIREMENTS (Check one)

Question Number	What type of roundabout is needed?	Yes	No	Other	Comment	Considerations/Supporting Information
3.1	**Mini-roundabout** (Use Exhibit 1 for planning estimate of a mini-roundabount.)					
	Single-lane roundabout (Use Exhibit 2 or 3 for planning estimate of a single-lane roundabout.)					Familiar to many motorists, pedestrians, and bicyclists. Has fewer conflict points than multi-lane roundabouts.
	Double-lane roundabout (Use Exhibit 2 or 3 for planning estimate of a double-lane roundabout.)					Multi-lane roundabout is a big step from a single-lane roundabout and could pose challenges for pedestrians, bicyclists, and motorists. Consequently, a multi-lane roundabout could lead to project delays and may be a major factor in rejecting a roundabout design from further consideration in some cities and towns.
3.2	**Space requirement** Would there be sufficient right-of-way to build the roundabout? (Use Exhibit 4 for planning estimate of space requirements.)					Right-of-way and geometric complications can be overcome in certain situations. In addition, consider cost and impact of land acquisition.
Assessment (3.1 to 3.2)	Based on your answers above, is the space requirement met?					

STEP 4: ROUNDABOUT SCREENING FACTORS (Check all that apply)

SAFETY FACTORS

Question Number	Does the intersection where a roundabout is being considered have safety issues:	Yes	No	Other	Comment	Considerations/Supporting Information
4.1	Resulting from multi-leg intersection or unusual geometry?					Too-tight skewed intersections can be problematic for large vehicles (design issues). In addition, too many legs could preclude using a roundabout design.
4.2	Resulting from high-speed crashes?					The purpose of considering a roundabout design could be to control speeds in conjunction with addressing other intersection control needs.
4.3	Causing crashes that are angle-type?					Roundabouts reduce the number of conflict points at which opposing vehicles intersect, hence they can provide possible solutions for angle crashes involving left-turn and crossing movements.
4.4	Associated with crashes resulting in personal injuries?					Collisions at roundabouts tend to be less severe because of low speeds on the entry approach and in the circulating roadway (20 - 25 mph).

MASSACHUSETTS ROUNDABOUT INSTALLATION SCREENING FORM						
Question Number	**Does the intersection where a roundabout is being considered have safety issues:**	**Yes**	**No**	**Other**	**Comment**	**Considerations/Supporting Information**
4.5	Associated with sight distance obstructions caused by alignment on existing stop-controlled approach?					
4.6	Associated with a change-in-speed environment of the roadway?					Generally, they occur at the fringes of an urban environment.
4.7	Associated with visibility from all approaches?					Some types of topography and construction complications can be overcome. The Highway Division successfully addressed vertical alignment issues and steep grades of a roundabout proposal on Cape Cod.
4.8	Associated with pedestrian and bicyclist volumes?					This would be an issue with a multi-lane roundabout and would need for further investigation, but it is less of a concern with a single-lane roundabout.
Assessment (4-1 to 4-8)	Based on your answers above, is the project safety improvement objective met—i.e., would a roundabout design address one or more of the project safety issues?					
OPERATIONAL FACTORS						
Question Number	**Does the intersection where a roundabout is being considered have issues:**	**Yes**	**No**	**Other**	**Comment**	**Considerations/Supporting Information**
4.9	Resulting from a high percentage of left turns experiencing high delay or a need for left-turn lanes or U-turns?					Roundabouts may accommodate left-turning vehicles more efficiently with lower delays because they may not require storage lanes or separate turning phases.
4.10	Resulting in high delay but failing to meet traffic signal warrants?					
4.11	Resulting from a high proportion of left turns experiencing high delay and limited storage on an off-ramp?					A roundabout design can be particularly beneficial at interchanges if the roundabout alternative does not require bridge widening.
Question Number	**Is the intersection where a roundabout is being considered located:**	**Yes**	**No**	**Other**	**Comment**	**Considerations/Supporting Information**
4.12	Where traffic volumes on the minor roads are such that STOP or YIELD signs result in unacceptably high delays for the minor road?					
4.13	Where high traffic volumes during peak hours face excessive delays, but relatively low volumes and delays during non-peak hours?					
4.14	Away from a signalized intersection, where queues in general will not spill back into the roundabout?					Queue detection is an example of a possible remedy if queue spillback into the roundabout is occasional. Proper signal timing and coordination may remedy some queue spillbacks.

MASSACHUSETTS ROUNDABOUT INSTALLATION SCREENING FORM						
Question Number	**Is the intersection where a roundabout is being considered located:**	**Yes**	**No**	**Other**	**Comment**	**Considerations/Supporting Information**
4.15	Away from a school drop-off/pickup area, or transit stop, where queues in general will not spill back into the roundabout?					Bus bays or pullouts or locating transit stops further downstream of the splitter island may prevent queues from blocking the roundabout.
4.16	Outside of a coordinated arterial signal system or proposed roundabout where it will not impede progression through a corridor?					If the quality of progression is poor, a roundabout can replace a signalized intersection and improve coordination. Also, with correct signal timing and coordination, roundabouts and traffic signals can exist on the same corridor.
4.17	In an area where the percentage of major street traffic volume does not exceed 90% of the total entering traffic volume and the major street traffic volume is not opposed by relatively light traffic on the minor street?					Depends on how light the traffic is on the minor approach. In addition, if traffic calming is the main focus, then high or low traffic volume should not be the deciding factor.
4.18	Away from a railroad grade crossing, where queuing would not impact the roundabout or grade crossing?					Depends on the frequency of railroad trips.
4.19	Away from a direct emergency access roadway or driveway with preemption, where a roundabout would not impede emergency services?					Depends on the frequency of emergency trips.
Assessment (4.9 to 4.19)	Based on your answers above, is the project location favorable for roundabout installation—i.e., a roundabout design would function well and would not create additional operations problems?					

TRAFFIC CALMING FACTORS

Question Number	**Does the intersection where a roundabout is being considered have issues:**	**Yes**	**No**	**Other**	**Comment**	**Considerations/Supporting Information**
4.20	That need to be addressed by traffic-calming measures for pedestrians, bicyclists, motorists, and transit users?					Generally, roundabout designs addressing traffic calming are located on local and residential roads.
4.21	Resulting from changes in land-use environments or transition to a new land-use environment?					Roundabout designs addressing environment or land-use transitions are located in areas where there may be a need to signify to drivers that the character of the road and surrounding land use is changing and, therefore, they need to change their driving behavior.
Assessment (4.20 to 4.21)	Based on your answers above, is the project traffic-calming improvement objective met—i.e., would a roundabout design address one or more of the project traffic calming issues?					

MASSACHUSETTS ROUNDABOUT INSTALLATION SCREENING FORM

AESTHETICS AND COMMUNITY ENHANCEMENT FACTOR

Question Number	Is the proposed roundabout part of:	Yes	No	Other	Comment	Considerations/supporting information
4.22	A community enhancement or aesthetics (gateways) improvement project?					Roundabouts proposed for community enhancements and improved aesthetics should demonstrate that they would not introduce traffic problems that do not currently exist.
Assessment (4.22)	Based on your answer above, is the project aesthetics and community enhancement objective met—i.e., would the roundabout design address aesthetics and community enhancement issues?					

ACCESS MANAGEMENT FACTORS

Question Number	Does the corridor in which a roundabout is being considered have issues:	Yes	No	Other	Comment	Considerations/supporting information
4.23	Related to a controlled-access corridor, where U-turns/left turns are desirable at an intersection to access properties on the opposite side of the road?					Corridors that are hampered with numerous driveways, especially those to businesses, can benefit from roundabouts. Roundabouts in conjunction with raised medians facilitate the use of U-turns and left turns at intersections and allow right-in-right-out movements at driveways.
4.24	Related to many access/egress points where left turns experience unacceptable delay turning into and out of driveways and consolidating and controlling access points (installing a raised median) are desirable objectives?					
Assessment (4.23 to 4.24)	Based on your answers above, is the project access management objective met—i.e., does the roundabout address access management issues?					

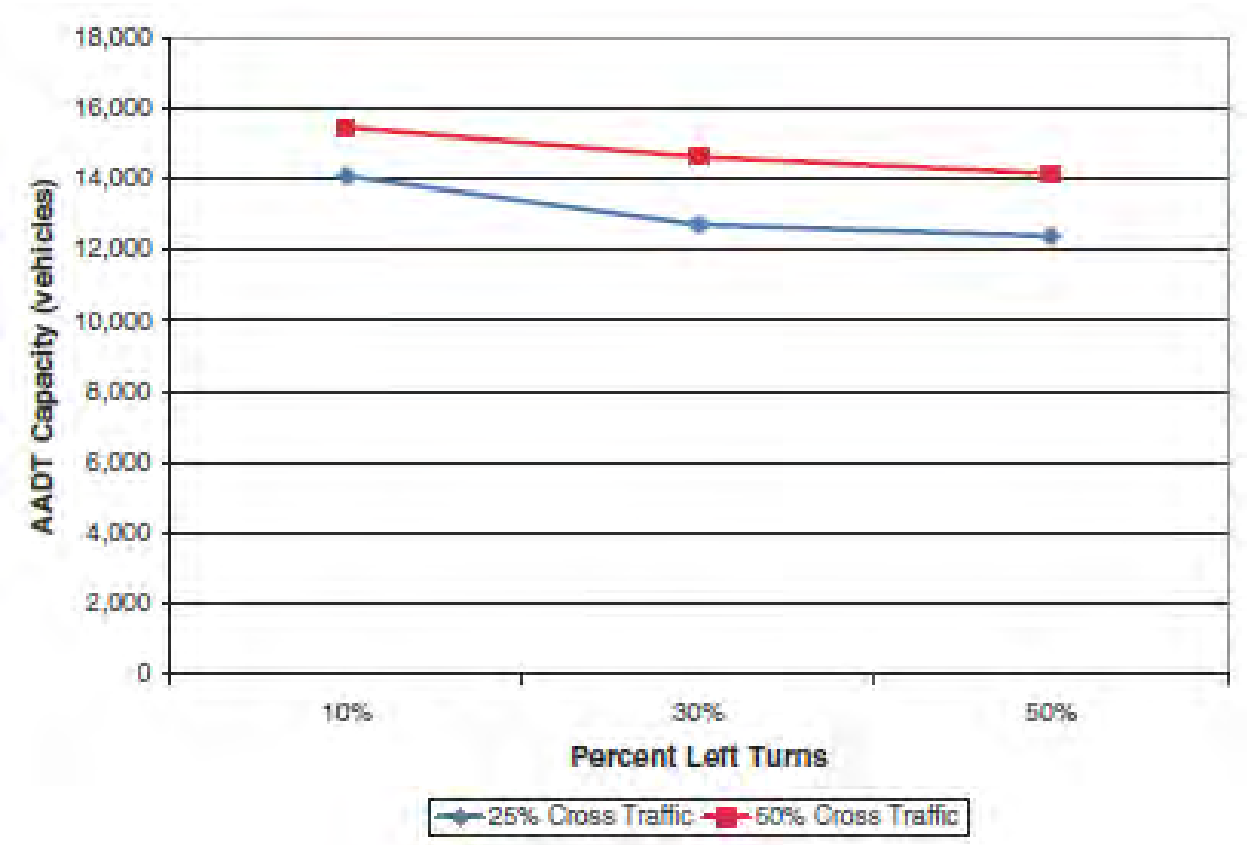
STEP 5: SCREENING EVALUATION (Please circle one decision)

Decision	Criteria	Comments
Candidate	Advance a roundabout design for further analysis and design if it meets both of these criteria: 1. Space requirements 2. One or more of the project objectives	
Conditional	Advance a roundabout design for further analysis and design under these conditions (specify):	
Not recommended	A roundabout is not recommeded for further consideration if it fails to meet either of these criteria: 1. Space requirements 2. None of the project objectives	

ATTACHMENTS

Please attach all of the data and information applied to this roundabout assessment tool to support your decision.

Exhibit 1
Planning-Level Maximum Daily Service Volumes for Mini-Roundabouts



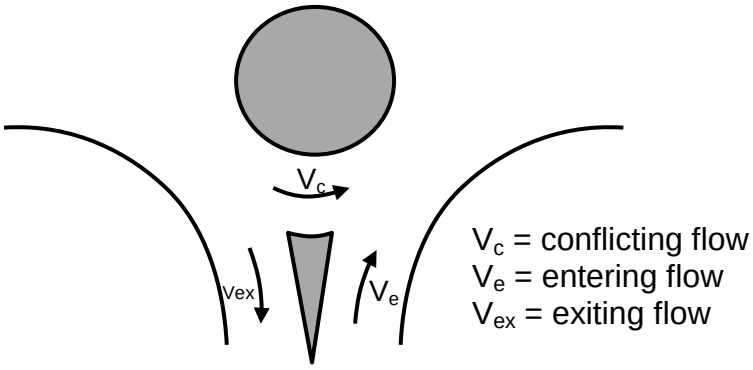
Source: Exhibit 3-16 in NCHRP Report 672, Roundabouts: Informational Guide, Second Edition, Transportation Research Board, Washington, D.C., 2010.

Exhibit 2
Volume Thresholds for Determining the Number of Entry Lanes Required
(Produce better estimates than the AADT method in Exhibit 3)

Volume Range (sum of entering and conflicting volumes*)	Number of Lanes Required
0 to 1,000 vehicles per hour	• Single-lane entry likely to be sufficient.
1,000 to 1,300 vehicles per hour	• Two-lane entry may be needed. • Single-lane entry may be sufficient based upon more detailed analysis.
1,300 to 1,800 vehicles per hour	• Two-lane entry likely to be sufficient.
Above 1,800 vehicles per hour	• More than two entering lanes may be required. • A more detailed capacity evaluation should be conducted to verify lane numbers and arrangements.

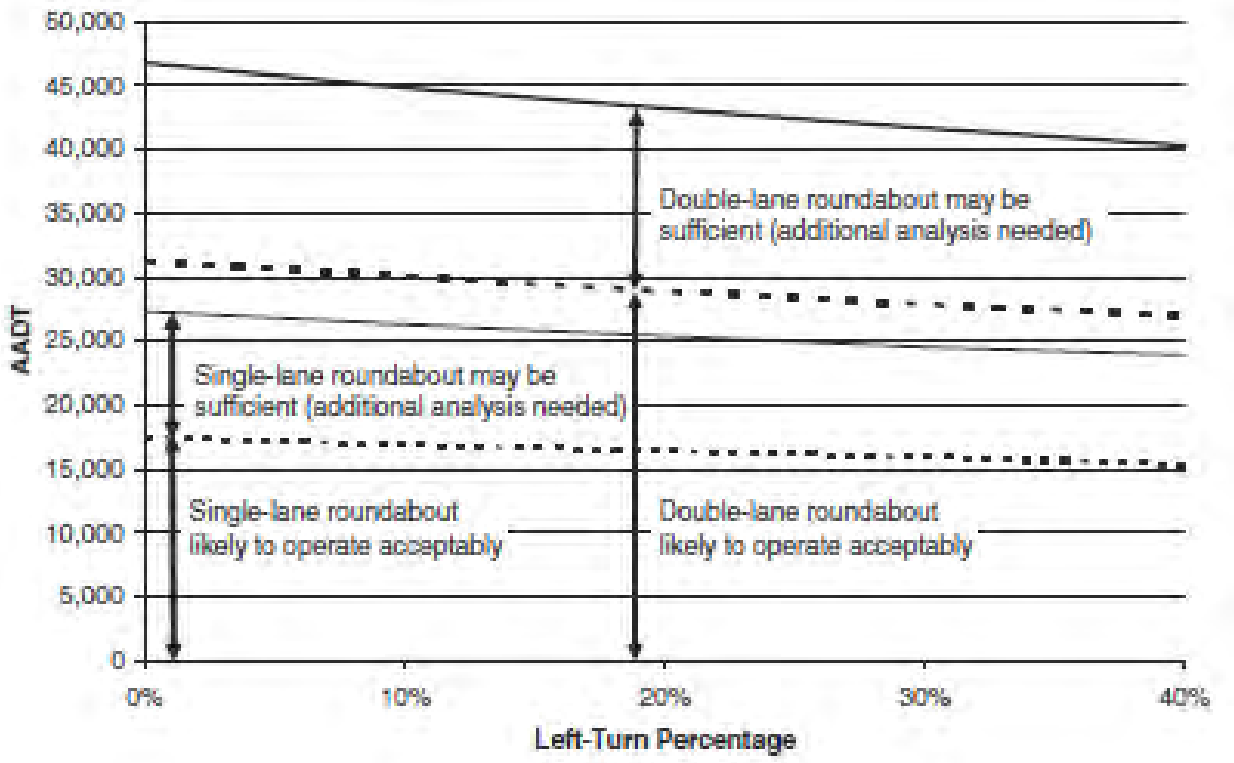
Sources: New York State Department of Transportation; from Exhibit 3-14 in NCHRP Report 672, Roundabouts: Informational Guide, Second Edition, Transportation Research Board, Washington, D.C., 2010.

*The diagram below illustrates the definitions of entering and conflicting volumes.



Traffic Flow at a Roundabout

Exhibit 3
Planning-Level Daily Intersection Volumes



Source: Exhibit 3-14 in NCHRP Report 672, Roundabouts: Informational Guide, Second Edition, Transportation Research Board, Washington, D.C., 2010.

Note: This graph is applicable for the following conditions, with other conditions requiring more detailed analysis:

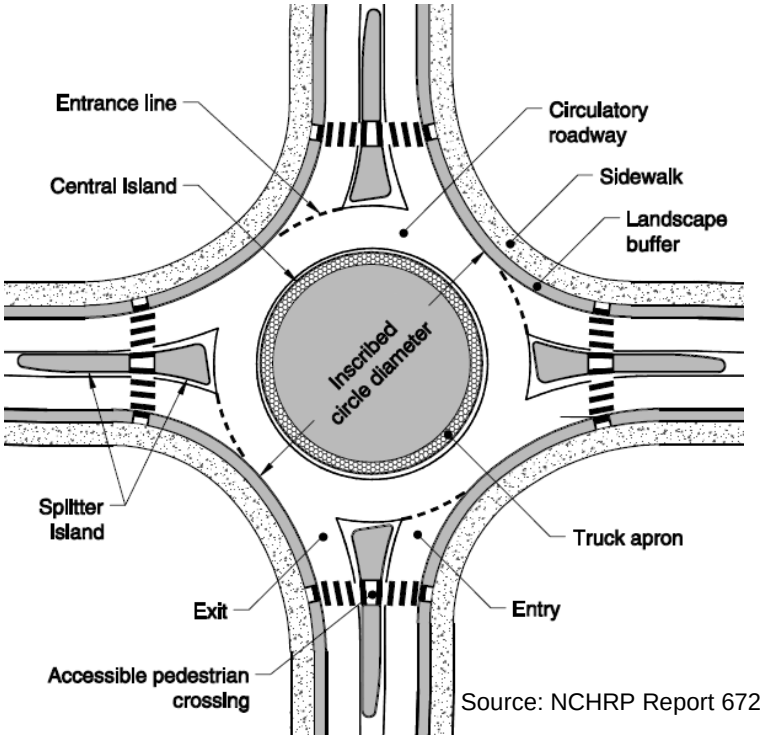
- Ratio of peak-hour to daily traffic (K) of 0.09 to 0.10
- Direction distribution of traffic (D) of 0.52 to 0.58
- Ratio of minor street to total entering traffic of 0.33 to 0.50
- Acceptable volume-to-capacity ratio of 0.85 to 1.00.

Exhibit 4
Initial Ranges of Roundabout Parameters for Screening Purposes

	Type of Roundabout		
Roundabout Parameter	**Mini**	**Single-Lane**	**Multi-Lane**
Average daily traffic (vehicles)	< 16,000	< 25,000	< 45,000
Sum of entry and conflicting flows (vehicle per hour)		See Exhibits 2 and 3	
Number of lanes	1	1	> 1
Inscribed circle diameter (feet)	45 – 90	90 – 150	120 – 200
Circulating roadway width (feet)		14 – 20	29 feet minimum
Entry width (feet)		14 – 18	25 feet minimum
Entry lane width (feet)		12 – 16	12 – 16
Entry radius (feet)		55 – 130 (100 feet typical)	65 – 130 (100 feet typical)
Entry angle (degree)		20 – 60 (30 – 40 desired)	20 – 60 (30 – 40 desired)

Note: All intersections geometry must accommodate design vehicle.

*The diagram below illustrates the basic geometric elements of a roundabout.



Source: NCHRP Report 672

Basic Geometric Elements of a Roundabout