

Route 27 (Main Street) Corridor Study

Route 2 to Brook Street

Acton,
Massachusetts

Prepared for **Town of Acton**
Acton, Massachusetts

Prepared by **VHB/Vanasse Hangen Brustlin, Inc.**
Watertown, Massachusetts

August 1, 2001

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Executive Summary

Route 27 (Main Street), one of the key roads within the Town of Acton, has experienced significant growth as a result of development along the corridor as well as general growth in the area. Vanasse, Hangen, Brustlin, Inc. (VHB) was retained by the Town of Acton to provide planning, traffic engineering, bicycle / pedestrian safety, community outreach, and streetscaping services to the town to develop a publicly acceptable and effective improvement plan for the Route 27 corridor.

The Route 27 study area is located just to the northeast of Route 2 and to the west of Route 2A. This study process involved four tasks. The first task involved an assessment of the existing traffic conditions in the study area, and included an inventory of roadway geometrics, observations of traffic flow, and the review of daily and peak period traffic counts conducted for this study. Next, future traffic volumes were projected for the year 2010 by taking into account background growth and specific approved developments. These future traffic volumes were then analyzed and future corridor deficiencies were identified. The third task involved the development and assessment of various improvement options and a discussion of these impacts on Route 27 and the Acton community. The final task included developing a conceptual preferred improvement plan which addresses operational deficiencies and safety concerns identified from the analyses of the existing and future traffic conditions, while taking into consideration public input.

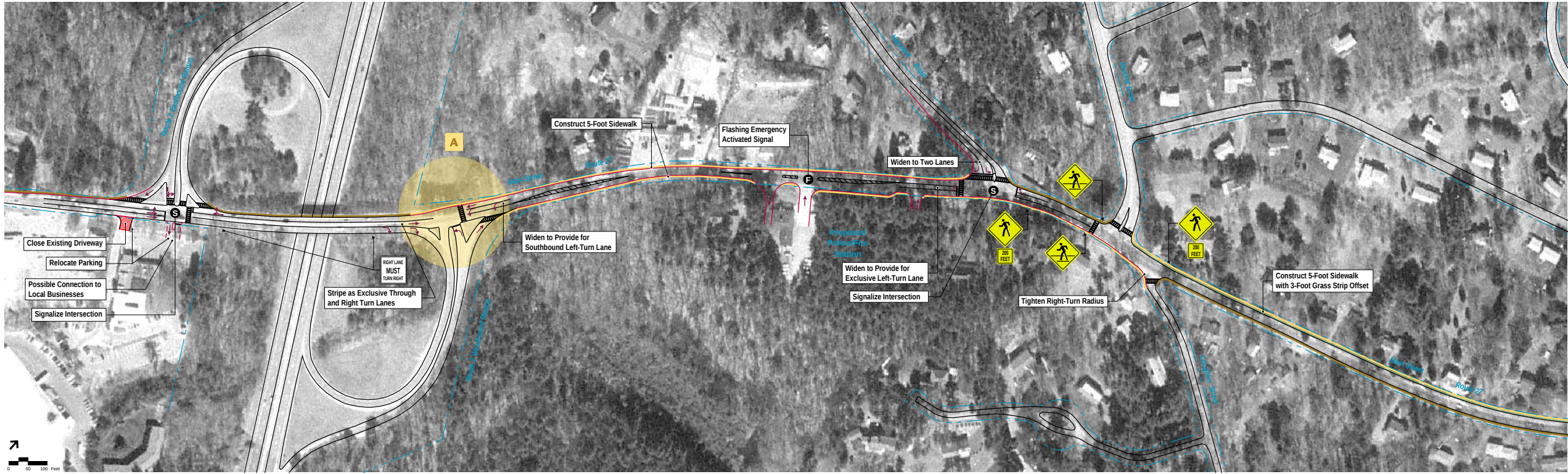
A meaningful component of this project was public participation. Much of the information used to identify the issues came from the public process. Input from the local community was not only important in gaining a clear idea of the issues, but was critical in developing support for the recommended strategies. As part of the public outreach process, four Community Workshops were held during two stages of the study. These sessions were held to provide opportunities for the general public to voice their concerns and suggestions.

The alternatives were narrowed down to a final improvement plan based on input from the public, the study's Advisory Committee and an engineering screening process. Action items were prioritized into immediate, short-term and long-term recommendations for implementation. Preliminary cost estimates were also developed to implement, construct, or advance the recommendations to the next step. Table E-1 presents a summary of the proposed improvement plan with a brief description of each of the recommended action and the associated costs. Figure E-1 presents a summary of the proposed improvements for the Route 27 corridor. The prioritization of the improvement measures is further explained in Figure E-2.

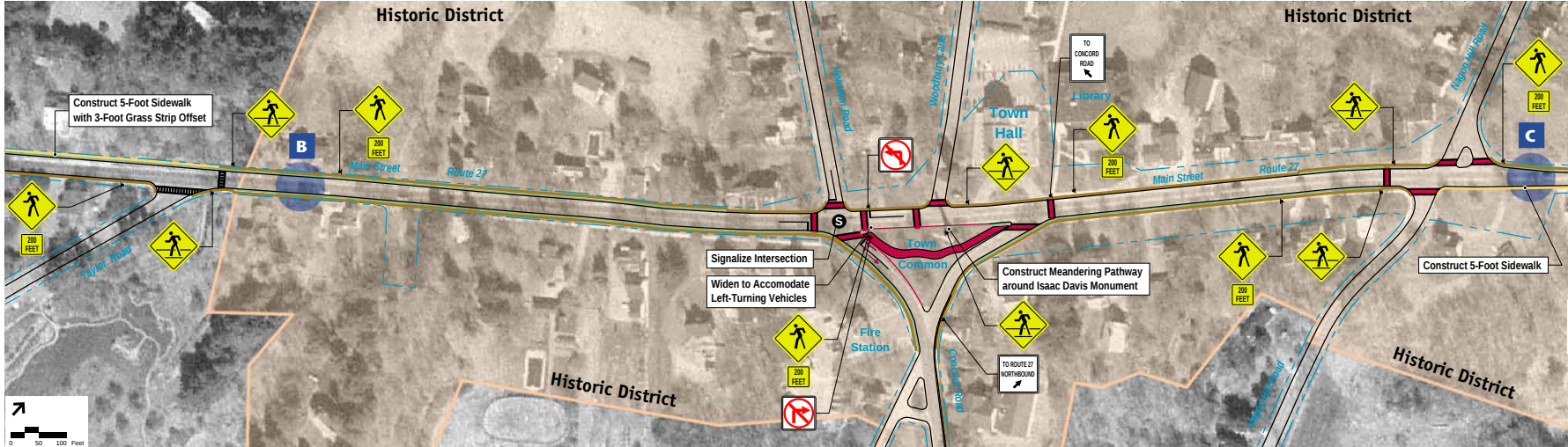
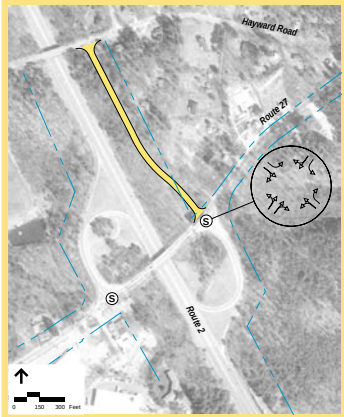
The timeline for the recommendations are as follows:

- Immediate Action Recommendation: 1-3 Years
- Short -Term Recommendation: 3-5 Years
- Long-Term Recommendation: 5-10 Years

The challenge facing Route 27 is to identify and provide the transportation infrastructure needed to support and enhance the town center, and maintain the historic characteristics of the Town. The proposed recommendations identify specific intersection enhancements and potential corridor-wide enhancements that will help improve the operations and safety for all users, while at the same time preserving the residential and historic nature of the area.



A :: Long Term Improvements:
Service Road to Hayward Road



B :: Historic District Northbound

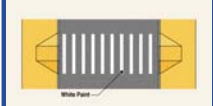


C :: Historic District Southbound

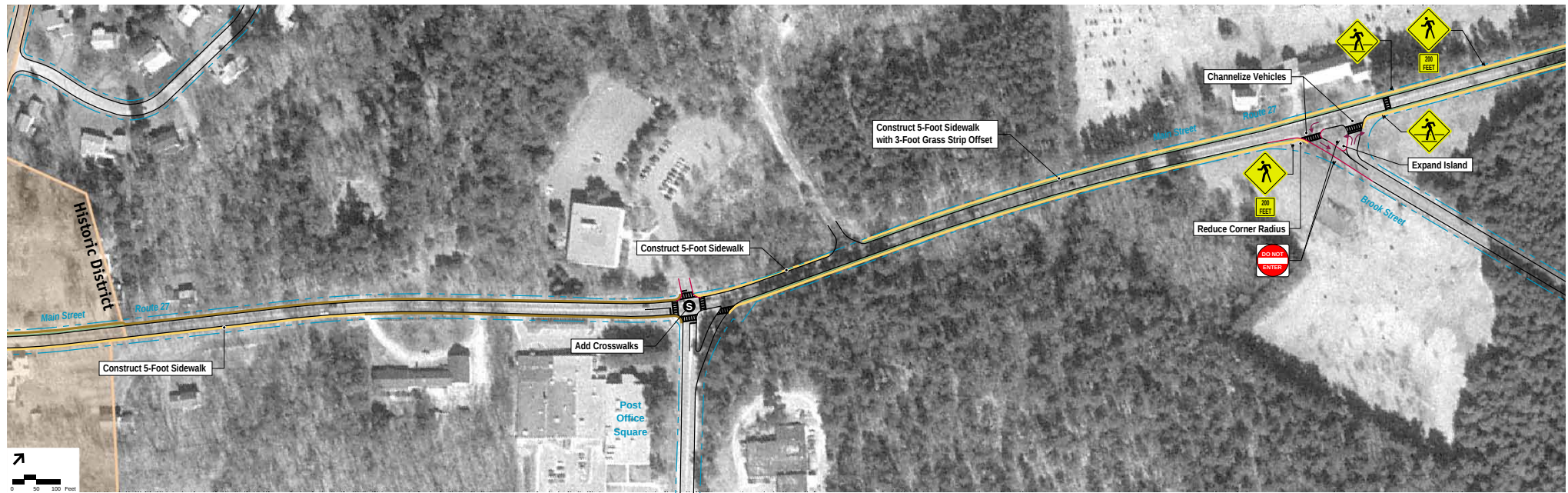
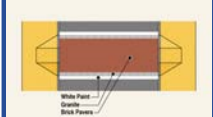


Pedestrian Crossings

Outside Historic District



Historic District



Legend

- Existing Pavement
- Widening
- Existing Sidewalk
- Proposed Sidewalk
- Right-of-Way
- Brick Crosswalk
- Signalized Intersection
- Flashing Emergency Activated Signal
- Prominent Gateway
- Historic District
- Long Term Improvement

Main Street (Route 27)

Corridor Improvement Project

Figure E-1

Prepared for:
Town of Acton

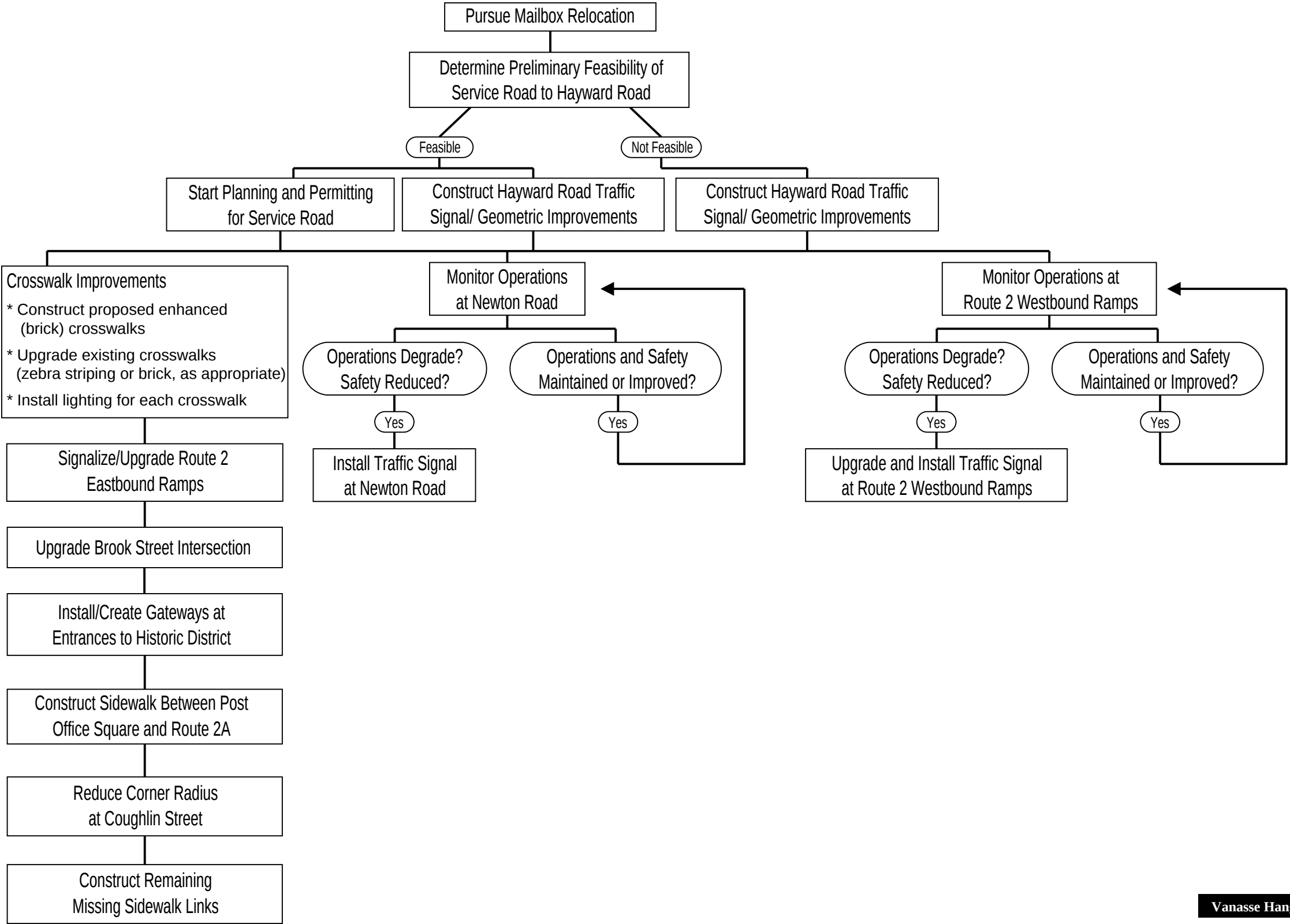
Prepared by:
VHB/Vanassee Hangen Brustlin, Inc

January 2001

2001

Time Frame

2011



Vanasse Hangen Brustlin, Inc.

Figure ES-2
Prioritization of Main Street
(Route 27)
Corridor Improvement Project

Table E-1
Main Street (Route 27) Recommended Improvement Plan

Immediate Actions (2001-2004)		
Project	Description	Investment*
Hayward Road	Signalize intersection. Widen Route 27 northbound approach to provide an exclusive left-turn lane and a through lane. Widen Route 27 southbound approach to provide a longer right-turn storage bay. Widen Hayward Road to provide two approach lanes.	\$350,000
Route 2 Eastbound Ramps	-Signalize intersection of Route 2 eastbound ramps at Route 27. Widen Route 27 northbound approach to provide two lanes. Restripe (within existing pavement) Route 27 southbound approach to provide two receiving lanes for northbound traffic.	\$250,000
	-Relocate existing driveway (Acton Medical Center) on east side of Route 27 to connect to proposed signal.	\$150,000
Route 2 Westbound Ramps	Restripe northbound approach to provide an exclusive right-turn lane and a through lane. Widen Route 27 southbound approach to provide an exclusive left-turn lane and a through lane.	\$95,000
Crosswalks		
Mid-Block Crosswalks	-Install yellow-green pedestrian signage at all mid-block pedestrian crossings. Install W11-2 at crossings and W11-A2 with "200 feet" sign as advance warning signs.	Painted \$1,200/each Brick \$4,500/each
	-Install lower pedestrian-scale lighting at all pedestrian crossings.	\$5,000/light
Crosswalks outside of Acton Centre's Historic District	Paint crosswalks (zebra striped) outside the historic district.	\$400/each
Crosswalks within Acton Centre's Historic District	Construct crosswalks within the historic district using brick pavers with granite edges. Stripe outside using white thermoplastic lines.	\$3750/each
Sidewalks		
East or west side of Route 27 - Between Route 2A/119 and Post Office Square	Implement Priority #1 - Grass median and five foot sidewalk except at culvert sections.	\$270,000
West side of Route 27 - Between Hayward Road and Route 2 Ramps	Implement Priority #2 - Five foot sidewalk adjacent to travelway.	\$17,000**

Short-Term Actions (2004-2011)		
Project	Description	Investment*
Route 2 Westbound Ramps	Monitor Route 27/Route 2 Westbound ramp intersection for possible future signalization.	N/A
Newtown/Concord Road	Signalize intersection. Widen northbound approach to allow through vehicles to go around left turning vehicles. Improve signage on Route 27 southbound directing motorists towards Concord Road.	\$250,000
Post Office Square	Monitor operations/ increase in volumes and retime traffic signal accordingly.	N/A
Brook Street	Channelize Brook Street approach, one way on each side of the island. Reduce corner radius and expand island.	\$30,000
Acton Centre's Historic District Gateways	Construct gateways at the northern and southern entrances on Route 27 into Acton Centre's Historic District.	\$10,000-100,000/each
Musket Drive/Coughlin Street	Tighten right-turn radius onto Coughlin Street.	\$3,500
Crosswalks		
Mid-Block Crosswalks	-Install yellow-green pedestrian signage at all mid-block pedestrian crossings. Install W11-2 at crossings and W11-A2 with "200 feet" sign as advance warning signs.	Painted \$1,200/each Brick \$4,500/each
	-Install lower pedestrian-scale lighting at all pedestrian crossings.	\$5,000/light
Crosswalks outside of Acton Centre's Historic District	Paint crosswalks (zebra striped) outside the historic district.	\$400/each
Crosswalks within Acton Centre's Historic District	Continue the construction of crosswalks within the historic district using brick pavers with granite edges. Stripe outside using white thermoplastic lines.	\$3750/each
Sidewalks		
West side of Route 27 - Between Taylor Road and Musket Drive	Implement Priority #3 - Grass median and five foot sidewalk.	\$60,000
Crosswalks		
Mid-Block Crosswalks	-Install yellow-green pedestrian signage at all mid-block pedestrian crossings. Install W11-2 at crossings and W11-A2 with "200 feet" sign as advance warning signs.	Painted \$1,200/each Brick \$4,500/each
	-Install lower pedestrian-scale lighting at all pedestrian crossings.	\$5,000/light
Crosswalks outside of Acton Centre's Historic District	Paint crosswalks (zebra striped) outside the historic district.	\$400/each
Crosswalks within Acton Centre's Historic District	Continue the construction of crosswalks within the historic district using brick pavers with granite edges. Stripe outside using white thermoplastic lines.	\$3750/each
Sidewalks		
East or west side of Route 27 - Between Route 2A/119 and Post Office Square	Implement Priority #1 - Grass median and five foot sidewalk except at culvert sections.	\$270,000
West side of Route 27 - Between Hayward Road and Route 2 Ramps	Implement Priority #2 - Five foot sidewalk adjacent to travelway.	\$17,000**

Long-Term Actions (Beyond 2011)		
Project	Description	Investment*
Route 2 Westbound Ramps	Construct service road to Hayward Road. Signalize intersection of Route 2 westbound ramps at Route 27. (includes estimate for planning, permitting, design, ROW acquisition and construction)	\$1,100,000
Brook Street	Reduce crest/vertical curve on Route 27 northbound as it approaches the Brook Street intersection to increase sight distance.	\$60,000
Crosswalks		
Mid-Block Crosswalks	-Install yellow-green pedestrian signage at all mid-block pedestrian crossings. Install W11-2 at crossings and W11-A2 with "200 feet" sign as advance warning signs.	Painted \$1,200/each Brick \$4,500/each
	-Install lower pedestrian-scale lighting at all pedestrian crossings.	\$5,000/light
Crosswalks outside of Acton Centre's Historic District	Paint crosswalks (zebra striped) outside the historic district.	\$400/each
Crosswalks within Acton Centre's Historic District	Continue the construction of crosswalks within the historic district using brick pavers with granite edges. Stripe outside using white thermoplastic lines.	\$3750/each
Sidewalks		
East side of Route 27 - Between Newton Road and north branch of Concord Road.	Implement Priority #4 - Grass median and meandering five foot sidewalk.	\$6,000**
East side of Route 27 - Between Nagog Hill Road and Post Office Square	Implement Priority #5 - Five foot sidewalk adjacent to travelway.	\$32,000

* Represents preliminary estimated design and construction costs. No utility lowering assumed, no takings or easements included, no drainage improvements included
** Survey & curbing included in intersection improvements

1

Introduction

Acton is a community located 25 miles northwest of Boston. Although Acton's population has almost tripled in the last three decades, the town has retained much of its rural New England character, as evidenced by the traditional town center and green, with fine examples of historic architecture, stone walls, and tree-lined country roads. Commerce continues to thrive and grow in Acton due in large part to its prime location along Routes 2, 27 and 111, the commuter rail stop, and its proximity to Route 495¹. Route 27 (Main Street), one of the key roads within the Town, has experienced significant growth as a result of general growth in the area as well as development along the corridor. Vanasse, Hangen, Brustlin, Inc. (VHB) was retained by the Town of Acton to provide planning, traffic engineering, bicycle/pedestrian safety, community outreach, and streetscaping services to the town to develop a publicly acceptable and effective improvement plan for the Route 27 corridor.

This section of the report provides a general overview of the goals for the study. Chapter 2 presents a review of existing conditions for the study area. Chapter 3 presents a summary of future conditions.

Project Goals

The goals of this study as defined by the town are to:

- Balance the needs of the various users of the road including motorists, pedestrians and bicyclists by improving operations and safety,
- Discourage and control excessive vehicle speeds,
- Ease difficulty of left-turns into and out of side streets,
- Improve large truck accommodations,
- Discourage potential spill-over traffic on local streets, and
- Preserve the historic resource and present character of the road.

This study will define the preferred improvement program that will promote enhanced safety, operations, and aesthetics for all users.



¹ Department of Housing and Community Development, State of Massachusetts Home page www.state.ma.us

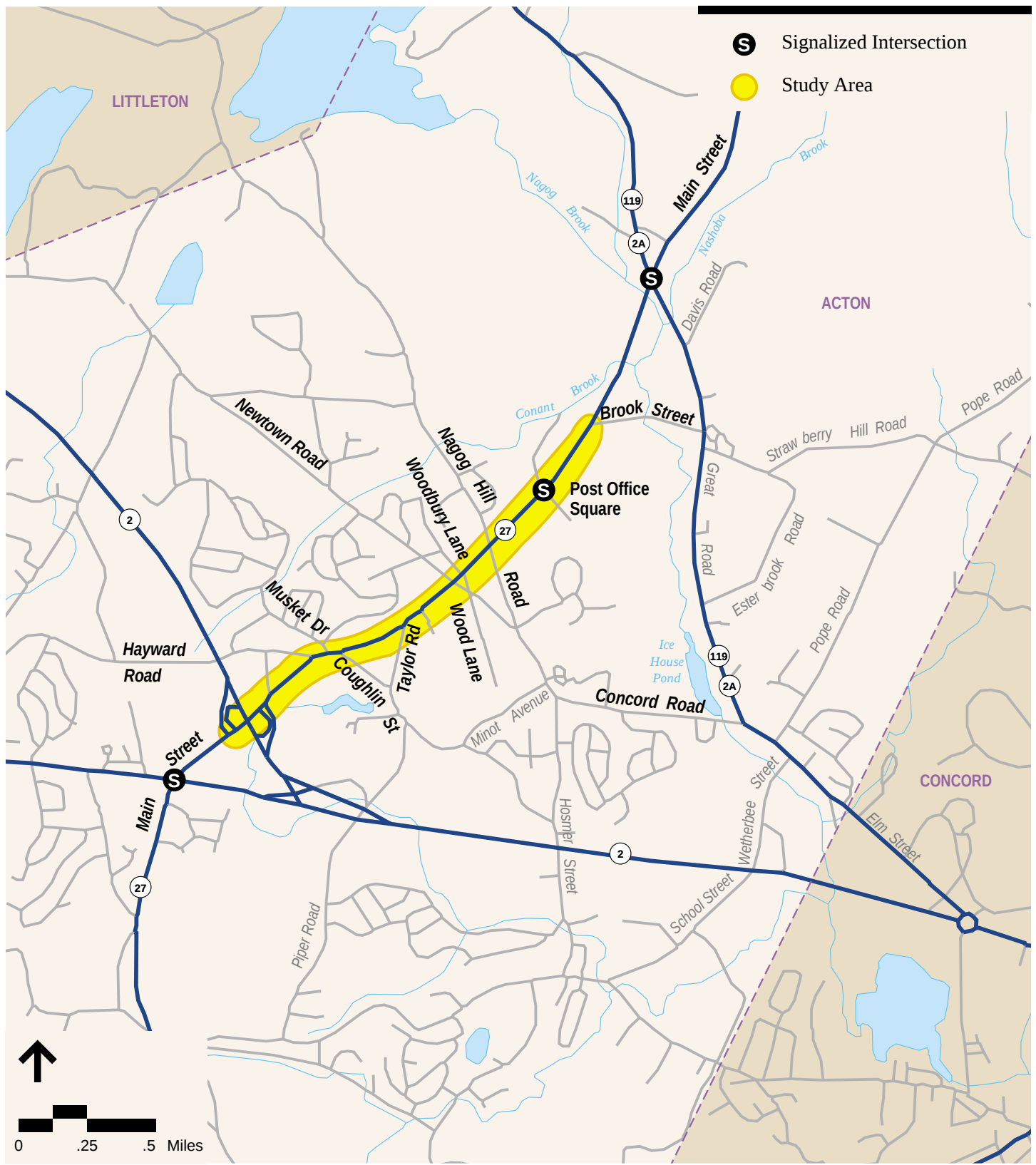
Study Area

As shown in Figure 1, the Route 27 study area is located just to the northeast of Route 2 and the west of Route 2A. The corridor is easily accessed by residents of Acton, Boxborough, Concord, and Littleton.

An inventory of the existing conditions at each of the study area intersections is provided in the next chapter.

Study Methodology

This study process involved four tasks. The first task involved an assessment of the existing traffic conditions in the study area, and included an inventory of roadway geometrics, observations of traffic flow, and the review of daily and peak period traffic counts conducted for this study. Next, future traffic volumes were projected for the year 2010 by taking into account background growth and specific approved developments. These future traffic volumes were then analyzed and future corridor deficiencies were identified. The third task involved the development and assessment of various improvement options. The impacts on Route 27 and the Acton community are discussed. The final task included developing a conceptual preferred improvement plan which addresses operational deficiencies and safety concerns identified from the analyses of the existing and future traffic conditions, while taking into consideration public input.



Vanasse Hangen Brustlin, Inc.

Project Study Area
Route 27 Corridor
Acton, MA

Figure 1

Public Outreach

A meaningful component of this project was public participation. Prior to developing a feasible set of strategies for the Route 27 corridor, the study team first gained a full understanding of the existing transportation issues within the study area. Much of the information used to identify the issues came from the public process. Input from the local community was not only important in gaining a clear idea of the issues, but was critical in developing support for the recommended strategies. As part of the public outreach process, four Community Workshops were held during two stages of the study. These sessions were held to provide opportunities for the general public to voice their concerns and suggestions. Each of the community workshops had a specific function as follows:

Community Workshop #1 & 2: The first two meetings were an introduction of the project to the community and a fact-finding session designed to assist the project team in gaining insight on the problems and their perceived causes along Route 27.

Community Workshop #3 & 4: The project team presented its assessment of the existing and future transportation problems and issues facing the Route 27 corridor. The study team then presented the various improvements strategies developed for the Route 27 area. Afterward, participants discussed the recommendations, discussed what they liked and disliked about the strategies, and provided their preferences for the improvement options.

2

Existing Conditions

A broad understanding of the existing transportation conditions is an essential foundation to define the improvement strategies for the Route 27 study area. This chapter presents an assessment of the existing transportation conditions along Route 27. Specifically, this section focuses on roadway geometrics and traffic controls, highlights current safety issues, and provides a discussion of how well the roadway is accommodating the current demands placed upon it. The evaluation of the corridor includes a quantitative evaluation of operations within the study area. The existing physical and operating conditions of Route 27 provide a basis for developing an understanding of the existing (and future) deficiencies and the needs of the area.

Existing Traffic Demand & Characteristics

Route 27 (Main Street) is a two-lane undivided roadway, which runs northeasterly through Acton. As shown in Figure 1, the Route 27 study area is located just to the northeast of Route 2 and the west of Route 2A. The corridor is easily accessed by residents of Acton and adjacent towns. Within the study area, Route 27 is bounded by Route 2 to the southwest and Brook Street to the northeast. The roadway within the study area is mainly residential and provides access to retail and commercial establishments. The roadway width varies from approximately 24 feet just south of Hayward Road to over 40 feet at the Route 2 bridge. The majority of the roadway is between 27 and 29 feet wide. The posted speed limit varies between 30 and 40 mph along the study corridor (as discussed in more detail in the *Observed Travel Speeds* section).

The study area includes 12 key intersections:

- Route 27 (Main Street) at Route 2 Eastbound Ramps
- Route 27 at Route 2 Westbound Ramps
- Route 27 at Hayward Road
- Route 27 at Musket Drive / Coughlin Street
- Route 27 at Taylor Road
- Route 27 at Newtown / Concord Road
- Route 27 at Woodbury Lane
- Concord Road at Wood Lane
- Route 27 at Concord Road, north leg

- Route 27 at Nagog Hill Road
- Route 27 at Post Office Square
- Route 27 At Brook Street

Of these intersections only Route 27 at Post Office Square is signalized. The principal roadways and intersections in the study area are described in detail in the Appendix. These descriptions include the physical characteristics, geometric conditions, adjacent land uses, and current operating conditions.

To better understand the magnitude of the traffic issues in the study area, the following traffic data was collected and is discussed in this section:

- Daily and peak hour traffic volumes at key locations along Route 27
- Speed measurements
- Accident data along Route 27
- Pedestrian and bicycle amenities

Observed Traffic Volumes

The following presents the daily and peak hour traffic volumes and trends for key study area roadway links and intersections. Automatic Traffic Recorder (ATR) counts were conducted for a 24-hour period on Route 27, Hayward, and Newtown/Concord Roads. A summary of the existing weekday and Saturday volumes are presented below in Tables 1 and 2. The original traffic counts can be found in the Appendix.

Approximately 16,500 to 20,000 vehicles per day travel on Route 27 during a typical weekday, and 12,500 to 14,500 during a typical Saturday. Between 7 and 11 percent of the daily volume along Route 27 occurs during any one of the peak periods. Morning peak hour activity occurs from 8:00 AM to 9:00 AM with 1,200 to 1,500 vehicles, depending on location, traveling the corridor. Higher levels of traffic activity occur during the evening peak hour from 4:45 PM to 5:45 PM, with 1,600 to 1,800 vehicles traveling along Route 27. Approximately 1,350 vehicles travel Route 27 during the Saturday peak hour, which occurs from 11:15 AM to 12:15 PM. Traffic flow patterns along Route 27 can be seen in Figures 2 and 3 below. As shown, the evening peak hour is consistently higher than the morning peak hour with traffic steadily increasing throughout the day. Figure 3 presents the hourly variation of Route 27 by directions. As shown Route 27 northbound peaks in the morning and Route 27 southbound peaks in the evening. This is most likely due to vehicles headed to Route 2A and Route 2 in the morning and vice-versa in the evening.

Table 1
Existing Weekday Traffic Volume Summary

Location	Weekday Daily Traffic		Weekday Morning Peak Hour			Weekday Evening Peak Hour		
	Volume (vpd) ¹	Directional Distribution	Volume (vph) ²	K Factor ³	Directional Distribution	Volume (vph) ²	K Factor ³	Directional Distribution
Route 27 (South of Newtown/Concord Road)	19,015	52% NB	1,475	7.8	62% NB	1,650	8.7	59% SB
Route 27 ⁴ (North of Newtown/Concord Road)	17,230	51% SB	1,230	7.1	58% NB	1,685	9.8	61% SB
Newtown Road (West of Route 27)	2,085	54% WB	170	8.2	62% EB	165	7.9	69 %WB
Concord Road (East of Route 27)	3,270	58% EB	305	9.3	77% EB	230	7.0	52% WB
Route 27 ⁴ (South of Hayward Road)	19,075	53% NB	1,340	7.0	58% NB	1,630	8.5	55% SB
Route 27 ⁴ (North of Hayward Road)	20,340	51% SB	1,460	7.1	64% NB	1,770	8.7	59% NB
Hayward Road ⁴ (West of Route 27)	6,185	53% WB	535	8.6	54% WB	630	10.2	56% WB
Route 27 ⁴ (South of Brook Street)	16,345	50% NB	1,180	7.2	56% NB	1,635	10.0	56% SB

Source: ATR counts conducted by the Town of Acton in August 2000.

1 Daily traffic volumes expressed in vehicles per day.

2 Peak hour volumes expressed in vehicles per hour.

3 Percent of daily traffic occurring during the peak hour.

4 Volumes at these locations reflect September 2000 counts.

Table 2
Existing Traffic Volume Summary (Saturday)

Location	Saturday Daily Traffic (vpd) ¹	Saturday Midday Peak Hour		
		Volume (vph) ²	K Factor ³	Directional Distribution
Route 27 (North of Taylor Road)	14,385	1,430	9.9	54% NB
Route 27 (Between Nagog Hill Road and Post Office Square)	12,620	1,255	9.9	52% NB

Source: ATR counts conducted by the Town of Acton in August 2000.

1 Daily traffic volumes expressed in vehicles per day.

2 Peak hour volumes expressed in vehicles per hour.

3 Percent of daily traffic occurring during the peak hour.

Figure 2
Route 27 Weekday Hourly Demand Fluctuation (Various Locations)

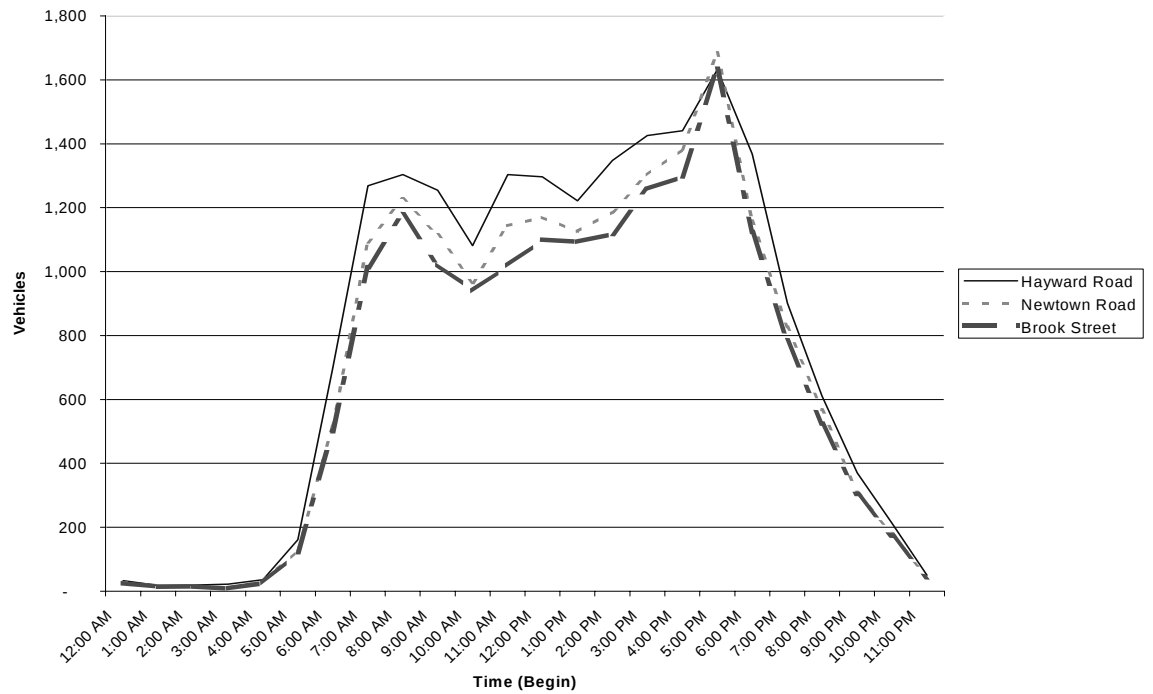
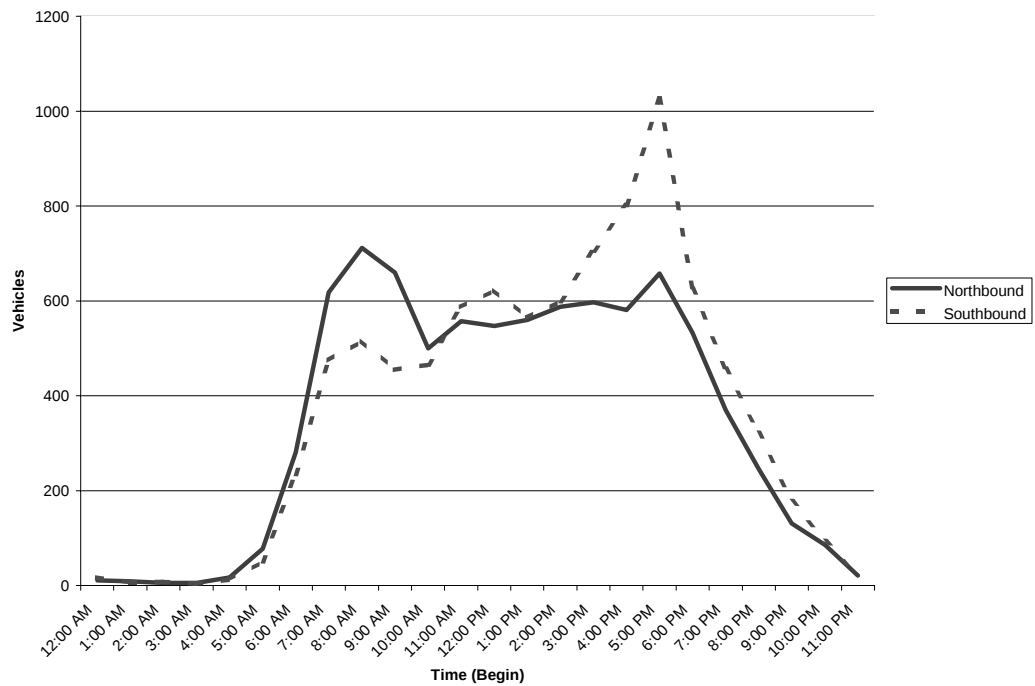


Figure 3
Bi-directional Hourly Demand Fluctuation for Route 27 (North of Newtown Road)



Concurrent with the ATR collection, peak period turning movement counts (TMCs) were conducted at the 12 study area intersections described above. TMCs were conducted in August 2000, during the weekday morning (7:00 – 9:00 AM), weekday evening (3:00-6:00 PM), and Saturday (11:00AM – 1:00 PM) peak periods. Peak hour traffic conditions were determined using the collected traffic data.

Massachusetts Highway Department (MHD) historical traffic volume information was reviewed to determine the seasonal traffic variations in the vicinity of the study area. The various data indicated that the August traffic volumes are between three and 10 percent higher than the average month condition. Therefore the existing traffic volumes are conservative estimates of the average annual conditions.

To corroborate the data supplied by MHD, spot ATRs and TMCs were conducted in September 2000. While these spot checks were conducted along the entire corridor, specific attention was paid to the intersection of Route 27 and Hayward Road, a major access point to Acton /Boxborough Regional High School. There was a minor change in traffic between the August and September daily counts, specifically an increase in traffic during the evening peak hour. Therefore the evening peak hour traffic network was adjusted to reflect this increase.

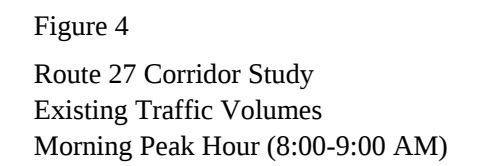
The resulting peak hour traffic volume networks for the weekday morning and evening and Saturday midday peak hours are presented in Figures 4 through 6.

Observed Travel Speeds

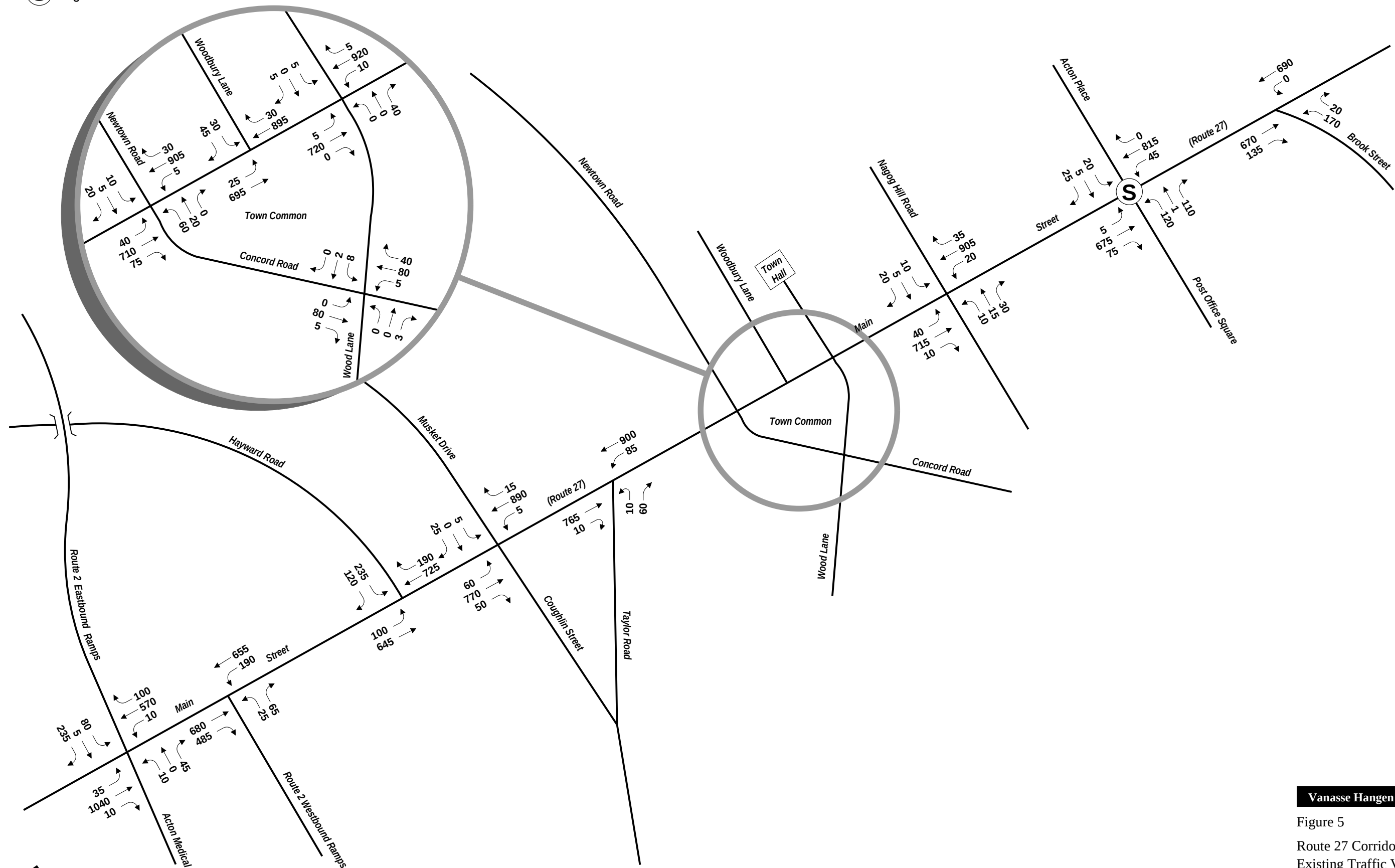
The posted speed limit between the Route 2 ramps and Brook Street changes approximately four times. The posted speed limit varies between 30 and 40 miles per hour (mph) along the study corridor and is posted as 35 mph between the Route 2 ramps and Concord Road, 30 mph between Concord Road and Nagog Hill Road, 35 mph between Nagog Hill Road and Post Office Square, and 40 mph between Post Office Square and Brook Street. Figure 7 illustrates the speed limit zones². A speed study was conducted by the Town of Acton during both weekdays and a Saturday in August 2000. Existing travel speeds on Route 27 were determined by an ATR recorder at various ATR locations along the corridor. Data was collected by placing ATR tubes at a predetermined distance along Route 27. Speeds were calculated based on vehicle travel time between ATR tubes. The results, as shown in Tables 3 and 4, include the posted speed limit, the median travel speed (half of all vehicles travel faster than this speed and half travel slower), the 85th-percentile speed (the upper limit of speeds traveled by most motorists, often serving as a guideline for posted speed limits), and observed maximum speeds.



² See Appendix for Massachusetts law on speed limits and special regulations for Route 27 in Acton.



S Signalized Intersection

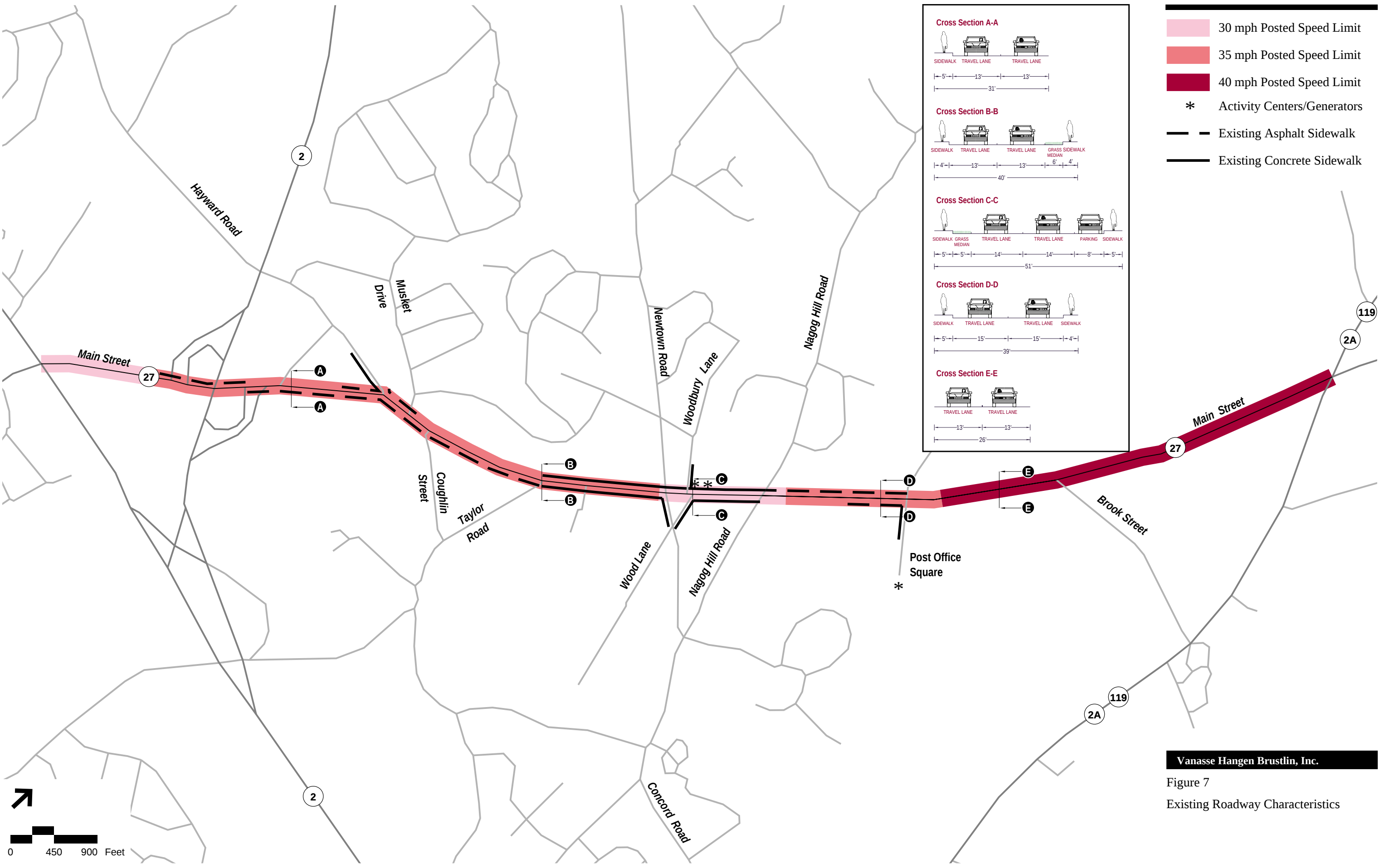


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Figure 5
Route 27 Corridor Study
Existing Traffic Volumes
Evening Peak Hour (4:45-5:45 PM)



Figure 6
Route 27 Corridor Study
Existing Traffic Volumes
Saturday Midday Peak Hour
(11:15 AM-12:15 PM)



Vanasse Hangen Brustlin, Inc.

Figure 7
Existing Roadway Characteristics

Table 3
Weekday Observed Traffic Speeds - Route 27 (miles per hour)¹

Travel Direction	Posted Speed Limit	Median Speed	85% Speed	Maximum Speed ²
Route 27 – at Newtown/Concord Road				
Northbound	30	36	40	55+
Southbound	30	37	43	55+
Route 27 - at Hayward Road				
Northbound	35	31	37	55+
Southbound	35	33	38	55+
Route 27 - south of Brook Street				
Northbound	40	38	43	55+
Southbound	40	37	42	55+

1 Speeds based on approximately 10,000 random observations per travel direction, along Route 27 on August 1 and 8, 2000.

2 The tubes become inaccurate in the reading at the higher end of the speed measurements.

Table 4
Saturday Observed Traffic Speeds - Route 27 (miles per hour)¹

Travel Direction	Posted Speed Limit	Median Speed	85% Speed	Maximum Speed ²
Route 27 – North of Taylor Road				
Northbound	35	36	41	55+
Southbound	35	37	42	55+
Route 27 - between Nagog Hill and PO Square				
Northbound	35	39	43	55+
Southbound	35	40	43	55+

1 Speeds based on approximately 10,000 random observations per travel direction, along Route 27 on August 12, 2000.

2 The tubes become inaccurate in the reading at the higher end of the speed measurements.

As presented in the above tables, the observed median speeds along the corridor differ slightly from the posted speed limits and are generally higher than the posted speed limit. The observed 85th-percentile speeds are fairly consistent with the posted speed limit, except in the section of Route 27 near Newtown and Concord Roads, where observed 85th percentile speeds exceed the posted speed limit by 10 to 15 mph. Maximum travel speeds of over 55 mph were also observed throughout the corridor.

Safety

In order to identify accident trends, safety concerns, and /or roadway deficiencies within the study area, accident data were obtained from the Massachusetts Highway Department for the three-year time period from January 1, 1997 to December 31, 1999 (the most recent data available). A summary of the accident data is presented in Table 5.

Table 5 Intersection Accident Summary — 1997 to 1999

Scenario	Route 2 Ramps	Hayward Road	Musket Drive Coughlin Street	Newtown Road Concord Road	Woodbury Lane	Nagog Hill Road	Post Office Square Acton Place	Brook Street	Concord Road	Total
Year										
1997	10	6	2	7	0	3	1	3	1	33
1998	18	2	1	11	2	2	4	7	0	47
1999	17	4	3	4	1	3	3	6	0	41
Total	45	12	6	22	3	8	8	16	1	121
Type										
Angle	16	3	3	15	1	4	2	8	1	53
Rear-end	16	8	2	5	1	3	4	4	0	43
Head-on	0	0	0	1	0	0	0	0	0	1
Unknown-Other	13	1	1	1	1	1	2	4	0	24
Total	45	12	6	22	3	8	8	16	1	121
Severity										
Property Damage Only	27	9	2	18	2	7	4	13	0	82
Personal Injury	18	3	4	4	1	1	4	3	1	39
Fatality	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0
Total	45	12	6	22	3	8	8	16	1	121
Weather										
Clear	28	8	6	13	2	6	5	8	0	76
Cloudy	8	3	0	6	0	0	2	6	1	26
Rain	4	0	0	2	0	1	0	1	0	8
Snow	4	1	0	0	0	1	1	1	0	8
Fog	1	0	0	0	0	0	0	0	0	1
Unknown	0	0	0	1	1	0	0	0	0	2
Total	45	12	6	22	3	8	8	16	1	121
Time										
7:00 AM to 9:00 AM	8	2	0	4	0	1	0	4	1	20
9:00 AM to 4:00 PM	19	6	3	10	2	4	5	5	0	54
4:00 PM to 6:00 PM	6	2	3	6	1	2	1	2	0	23
6:00 PM to 7:00 AM	12	2	0	2	0	1	2	5	0	24
Total	45	12	6	22	3	8	8	16	1	121

Source: Compiled by Vanasse Hangen Brustlin, (VHB) Inc. from data supplied by the Massachusetts Highway Department

The table shows that a total of 121 crashes occurred during the three-year period. The highest crash incidence was reported at the intersection of Route 27 and the Route 2 ramps. A total of 45 crashes were reported over the three-year period from 1997 to 1999. However, Route 2 intersects Route 27 in two locations and the MassHighway data does not distinguish between the two. The next highest incidence was at Newtown / Concord Road (22 accidents), followed by Brook Street (16 accidents) and Hayward Road (12 accidents). There were no accidents reported at Taylor Road or Concord Road (north branch) / Town Hall Driveway during the period analyzed.

The majority of crashes at these locations are of the angle or rear-end type. These crashes illustrate the difficulty of vehicles turning onto Route 27 from a minor road or from Route 27 onto a minor road. Angle-type accidents are indicative of vehicles from the minor road turning onto a high-speed major road or vice versa. Rear-end accidents are often indicative of vehicles attempting to turn onto or from a minor road and the vehicles behind them either not slowing in enough time or, thinking that the turning vehicles has made their move starting up again.. The high number of personal injury accidents occurring along the corridor can also be attributed to higher speeds along Route 27.

MHD has prepared a list of the top 1,000 high accident locations (HAL) throughout the State of Massachusetts. The intersections of Route 27 and Route 2 is designated as a HAL, rating as the 927th highest accident location in Massachusetts.³ Again, MHD does not distinguish between the two Route 27 intersections with Route 2.

The 1999 statewide accident rate is 0.75 for an unsignalized intersection and 1.02 for a signalized intersection. Accident rates at Route 27 and Route 2 ramps, Route 27 and Newtown / Concord Road, and Route 27 and Brook Street exceed the statewide average. Accident rates at these locations are 1.58, 0.94, and 0.78 respectively.

Pedestrian and Bicycle Amenities

Perhaps due to the travel speeds and high traffic volumes along Route 27 or the lack of pedestrian accommodations, the corridor is not a heavily traveled pedestrian area. An inventory of the pedestrian facilities along Route 27 shows crosswalk treatments are inconsistent and / or faded. In addition, the sidewalk often shifts sides of the road and is made of inconsistent materials⁴. The sidewalk south of Taylor Road is constructed with asphalt, while sidewalks north of Taylor Road are concrete. With the exception of the town center, none of the minor roadways intersecting Route 27



1

³ High Accident Intersection Report. Prepared by the MassHighway Safety Management Unit. 1999.

⁴ The Acton policy on sidewalk construction calls for granite curb and concrete sidewalk face in town centers, and for bituminous surface and Cape Cod burm outside the centers.

in the study area provide sidewalks. Sidewalks also do not exist on either side of Route 27 north of Post Office Square. Generally, existing sidewalks are 4.5 to 5 feet wide with a 5-foot grass median between the sidewalk and road in some areas (mainly between Taylor and Newtown/Concord Roads). Fewer than five pedestrians were observed at any study area intersection during the peak hours. Existing pedestrian conditions can be seen in figure 7

Currently, the study corridor has no designated bicycle facilities. Bicyclists who choose to use Route 27 must ride within the roadway, thus sharing the road with vehicular traffic. Several bicyclists were observed during the peak hours. In many instances bicyclists slowed traffic or were forced onto the sidewalk by vehicles unwilling to yield. Most children observed biking along Route 27 were using the sidewalks. Bicyclists in the study area ranged from children to adults, some with small children attached to the bicycles in trailers.

Existing Traffic Operations

Traffic operations analysis measures existing traffic volumes and quantifies traffic flow within the study area. To assess quality of flow, roadway and intersection capacity analyses were conducted with respect to existing and projected future traffic volume conditions. Capacity analyses provide an indication of how well the roadway and intersection facilities serve the traffic demands placed on them. Operating conditions are classified by calculated levels of service.

Level of Service Criteria

Level of service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment or intersection under various traffic volume loads. It is a qualitative measure of the effect of a number of factors, including roadway geometrics, speed, travel delay, freedom to maneuver, and safety. Level of service provides an index to the operational qualities of a roadway segment or an intersection. Level of service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. Generally speaking, roadways or intersections are considered to operate at an acceptable level as long as they operate at LOS D or better for this type of area.

Level of service designation is reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of each lane or lane group entering the intersection and the level of service designation is for overall conditions at the intersection. For unsignalized intersections, however, the analysis assumes that traffic on the mainline is not affected by traffic on the side streets. The level of service is only determined for left-turns from the main street and

all movements from the minor street. The overall level of service designation is for the most critical movement, which is most often the left-turn out of the side street. The evaluation criteria used to analyze area intersections are based on the 1997 *Highway Capacity Manual*⁵.

Unsignalized Intersection Capacity Analysis

Unsignalized intersection capacity analyses were conducted for all study area intersections with the exception of Route 27 and Post Office Square (which is signalized). Unsignalized analyses were conducted using HCS intersection analysis software. A summary of the unsignalized capacity analysis results is presented in Table 6.

According to the analysis there are long delays experienced at Route 27 and the Route 2 Ramps, Hayward Road, Newtown Road / Concord Road, Woodbury Lane, Nagog Hill Road and Brook Street. These intersections all currently operate at or above capacity during at least one peak hour. In all cases, the critical movement is the left-turn out of the minor street. These delays are indicative of the heavy traffic on Route 27 opposing the vehicles attempting to turn onto the side streets.

⁵Transportation Research Board, *Highway Capacity Manual*, Special Report 209, Washington, D.C., 1997.

Table 6
Unsignalized Intersection Capacity Analysis

Location	Peak Hour	2000 Existing Conditions		
		Critical Approach	Delay ¹	LOS ²
Route 27 at Route 2 EB Ramps/Acton Medical	Weekday Morning	EB	>60	F
	Weekday Evening	EB	>60	F
	Saturday Midday	EB	41	E
Route 27 at Route 2 WB Ramps	Weekday Morning	WB	25	C
	Weekday Evening	WB	47	E
	Saturday Midday	WB	21	C
Route 27 at Hayward Road	Weekday Morning	EB	44	E
	Weekday Evening	EB	>60	F
	Saturday Midday	EB	35	D
Route 27 at Musket Drive/Coughlin Street	Weekday Morning	EB	19	C
	Weekday Evening	EB	25	C
	Saturday Midday	EB	25	C
Route 27 at Taylor Road	Weekday Morning	WB	26	D
	Weekday Evening	WB	26	D
	Saturday Midday	WB	18	C
Route 27 at Newtown Road/Concord Road	Weekday Morning	WB	>60	F
	Weekday Evening	WB	>60	F
	Saturday Midday	WB	>60	F
Route 27 at Woodbury Lane	Weekday Morning	EB	20	C
	Weekday Evening	EB	40	E
	Saturday Midday	EB	20	C
Concord Road at Wood Lane	Weekday Morning	SB	11	B
	Weekday Evening	SB	10	A
	Saturday Midday	SB	10	A
Route 27 at Concord Road (north branch)/Town Hall	Weekday Morning	WB	14	B
	Weekday Evening	EB	41	E
	Saturday Midday	WB	13	B
Route 27 at Nagog Hill Road	Weekday Morning	EB	35	D
	Weekday Evening	WB	61	F
	Saturday Midday	EB	25	D
Route 27 at Brook Street	Weekday Morning	WB	25	D
	Weekday Evening	WB	>60	F
	Saturday Midday	WB	30	D

1 Average delay expressed in seconds per vehicle.

2 Level of service

Signalized Intersection Capacity Analysis

Signalized intersection capacity analysis was performed at the intersection of Route 27 and Post Office Square. The signalized analysis was conducted using SYNCHRO intersection analysis software⁶. Table 7 summarizes the analysis results.

Table 7
Signalized Intersection Capacity Analysis

Location	Peak Hour	2000 Existing Conditions		
		V/C ¹	Delay ²	LOS ³
Route 27 at Post Office Square	Weekday Morning	0.62	5	A
	Weekday Evening	0.67	9	A
	Saturday MIDDAY	0.58	6	A

1 Volume-to-capacity ratio.

2 Control delay per vehicle, expressed in seconds, includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

3 Level-of-Service

As shown in the table, the intersection of Route 27 and Post Office Square currently operates at LOS A during all peak hour periods.

Roadway Capacity Analysis

To further identify traffic flow constraints in the study area, roadway link analysis was performed along the Route 27 roadway segments in each of the peak hours. Based on collected traffic data, the critical roadway link during the morning and Saturday peak hour is Route 27 between Taylor Road and Newtown/Concord Road. The critical link during the evening peak hour is Route 27 between Hayward Road and Musket Drive. Critical link is defined as the portion of roadway that has the highest traffic volume during the peak hour.

The evaluation criteria used to analyze critical roadway links are based on the 1997 *Highway Capacity Manual*⁷. Level of service is determined according to roadway geometry, traffic volume, and volume to capacity ratio (v/c).

⁶ SYNCHRO 4, Version 4 (Build 223), Traffic Signal Coordination Software, Trafficware Corporation, Albany, CA.

⁷ Transportation Research Board, *Highway Capacity Manual*, Special Report 209, Washington, D.C., 1997.

Table 8
Route 27 Roadway Link Capacity Analysis

Location – Route 27	Peak Hour	2000 Existing Conditions		
		Flow Rate	VIC	LOS ²
Route 27 between Route 2EB and Route 2 WB Ramps	Weekday Morning	1,475	0.68	E
	Weekday Evening	1,845	0.83	E
	Saturday Midday	1,485	0.65	E
Route 27 between Route 2 WB Ramps and Hayward Road	Weekday Morning	1,345	0.59	E
	Weekday Evening	1,590	0.67	E
	Saturday Midday	1,340	0.56	E
Route 27 between Hayward Road and Musket Drive	Weekday Morning	1,350	0.59	E
	Weekday Evening	1,795	0.75	E
	Saturday Midday	1,380	0.58	E
Route 27 between Musket Drive and Taylor Road	Weekday Morning	1,270	0.53	E
	Weekday Evening	1,685	0.71	E
	Saturday Midday	1,290	0.54	E
Route 27 between Taylor Road and Newtown Road	Weekday Morning	1,380	0.58	E
	Weekday Evening	1,810	0.76	E
	Saturday Midday	1,435	0.60	E
Route 27 between Newtown Road and Woodbury Lane	Weekday Morning	1,215	0.53	E
	Weekday Evening	1,665	0.72	E
	Saturday Midday	1,245	0.51	E
Route 27 between Woodbury Lane and Wood Lane	Weekday Morning	1,210	0.53	E
	Weekday Evening	1,650	0.71	E
	Saturday Midday	1,220	0.50	E
Route 27 between Concord Road (north branch) and Nagog Hill Road	Weekday Morning	1,235	0.54	E
	Weekday Evening	1,695	0.72	E
	Saturday Midday	1,240	0.51	E
Route 27 between Nagog Hill Road and Post Office Square	Weekday Morning	1,285	0.56	E
	Weekday Evening	1,715	0.74	E
	Saturday Midday	1,260	0.52	E
Route 27 between Post Office Square and Brook Street	Weekday Morning	1,215	0.52	E
	Weekday Evening	1,665	0.70	E
	Saturday Midday	1,210	0.50	E

1 Free flow speed

2 Level of service

As shown in Table 8, all of the roadway segments operate at an unacceptable LOS E during the peak hours, indicating that Route 27 operates at or above capacity at these times. Roadway LOS analysis can be found in the Appendix.

3

Future Conditions

To determine future roadway operations, 10-year traffic volumes were estimated for the morning, evening, and Saturday peak hours. These volumes are developed by factoring existing conditions volumes to include normal area growth and traffic associated with specific planned projects for the area.

Regional Background Growth

Regional background growth is generally determined based on historical traffic volume data and projected demographics and travel behaviors. Review of traffic volume data provided by MassHighway, on-going studies in the Acton area, and a forecast model developed by the Central Transportation Planning Staff (CTPS) show that a regional background growth rate of one percent per year is reasonable to assume for the morning, evening, and Saturday peak hour traffic volume networks.

Background Developments

In addition to the one-percent per year regional background growth rate, several future developments in the Acton area are expected to increase traffic along Route 27 during the next 10 years. Following is a brief description of each development included in future condition traffic volumes.

- **Brookside Shops** – Construction of an approximately 82,300 gross square foot (sf) shopping area is proposed at a site located on Great Road (Route 2A / 119) in Acton, Massachusetts.
- **Andrew's Crossing** - This proposed project consists of new development of approximately 88,470 sf of retail space, 6,400 sf of restaurant space, 26,000 sf of office space, and a 12,300 sf day care center located in Littleton, Massachusetts.
- **Clock Tower Place** – Development of approximately 950,000 sf of office space is planned for the former Digital Plant in Maynard, Massachusetts.
- **Post Office Square Rezoning** – The Town of Acton is considering a zoning change in the Post Office Square area that is expected to allow an additional 109,000 sf (of 217,000 total sf) of office space by 2010.
- **Cisco Systems** – This proposed project consists of construction of an additional 900,000 sf of office space in Boxborough, Massachusetts.

- **Gutierrez Boxborough Office Center** – Construction of 250,000 sf of office space is expected in the vicinity of the Route 111/I-495 interchange in Boxborough, Massachusetts.
- **NEC Building** – This project proposes re-use of 300,000 sf of office space at the NEC building located off Route 111 in Boxborough, Massachusetts.
- **Police/Fire Station Consolidation** – The Town of Acton is considering a proposal that will relocate two Acton fire stations to the site of the existing police station, just south of Hayward Road, and provide a new state-of-the-art facility.



Trip Generation and Distribution

The trip generation for the above developments used for this corridor study was obtained through review of available traffic studies and if no study was done, is based on data compiled by the Institute of Transportation Engineers (ITE) in *Trip Generation*¹. The data is based on information collected through studies conducted on sites throughout the United States. Estimated trip generation for the proposed police/fire consolidation was developed through conversations with the Police and Fire Chiefs and the Town of Acton.

Using 1990 U.S. Census journey-to-work data provided by the U.S. Department of Transportation and present trip distribution patterns, the portion of trips that can be expected to travel Route 27 to/from various destinations were estimated. To present a conservative estimate of traffic conditions, it is assumed that trips from a majority of the developments travel the length of the study area corridor.

Table 9 summarizes the projected weekday and Saturday trip generation and trip distribution of each development expected to impact the Route 27 corridor study area.

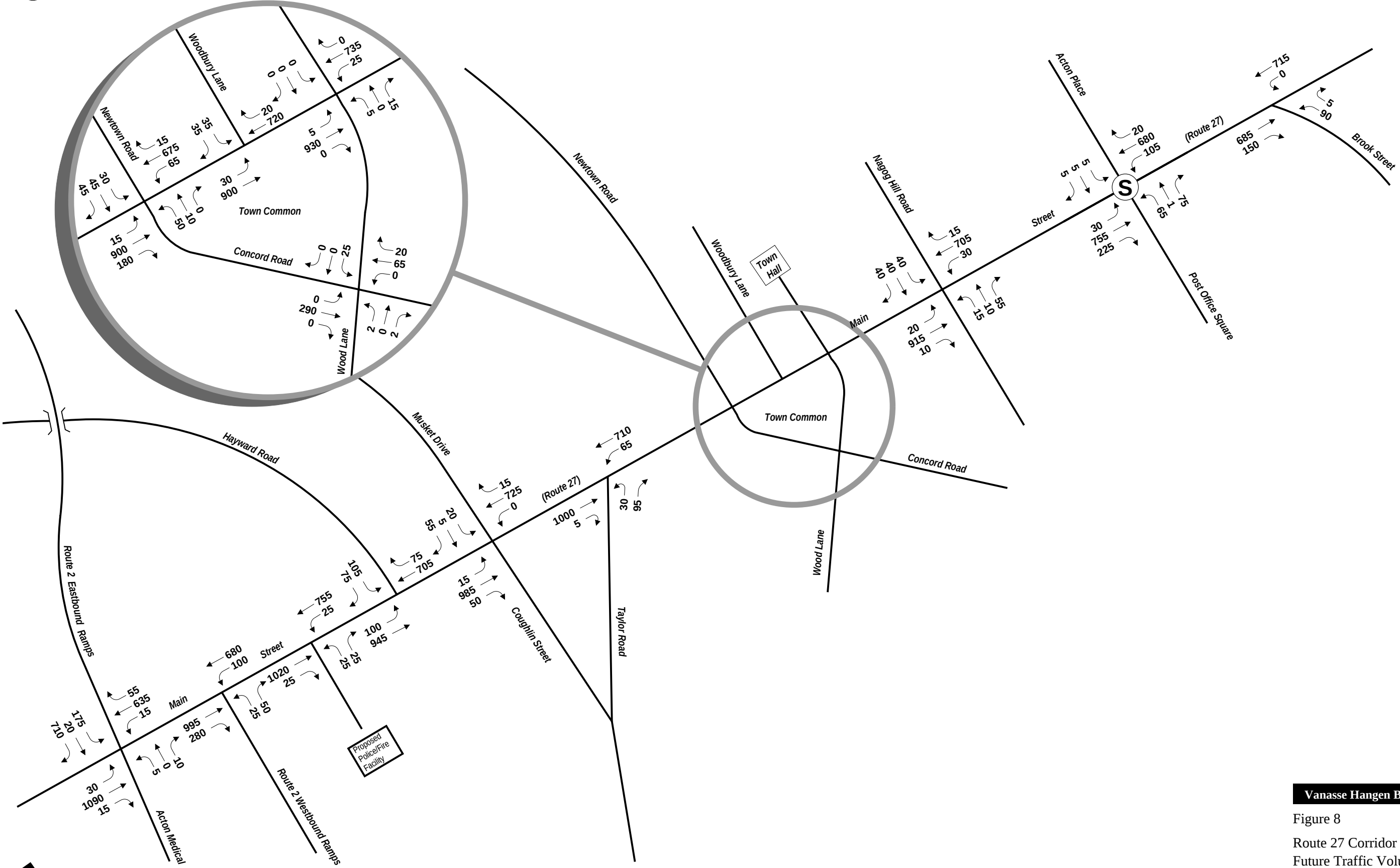
Table 9
Estimated Background Development Trip Generation

Development	Weekday Morning Peak Hour		Weekday Evening Peak Hour		Saturday Midday Peak Hour	
	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound
Brookside Shops	N/A	N/A	40	35	45	50
Andrew's Crossing	10	10	20	20	15	20
Clock Tower Site	107	28	28	158	27	34
Post Office Square Rezoning	45	90	65	65	15	17
Cisco Systems	37	5	5	31	6	5
Boxborough Executive Center	10	1	2	9	2	1
NEC Building	13	2	2	11	2	2
Police/Fire Consolidation	15	15	15	15	15	15

¹ Institute of Transportation Engineers, *Trip Generation*, Sixth Edition, 1997, Washington, DC.

The resulting 2010 peak hour traffic volume networks from the anticipated regional and project specific growth for the weekday morning and evening and Saturday midday peak hours are presented in Figures 8 through 10. Traffic distribution networks for each development can be found in the Appendix.

S Signalized Intersection



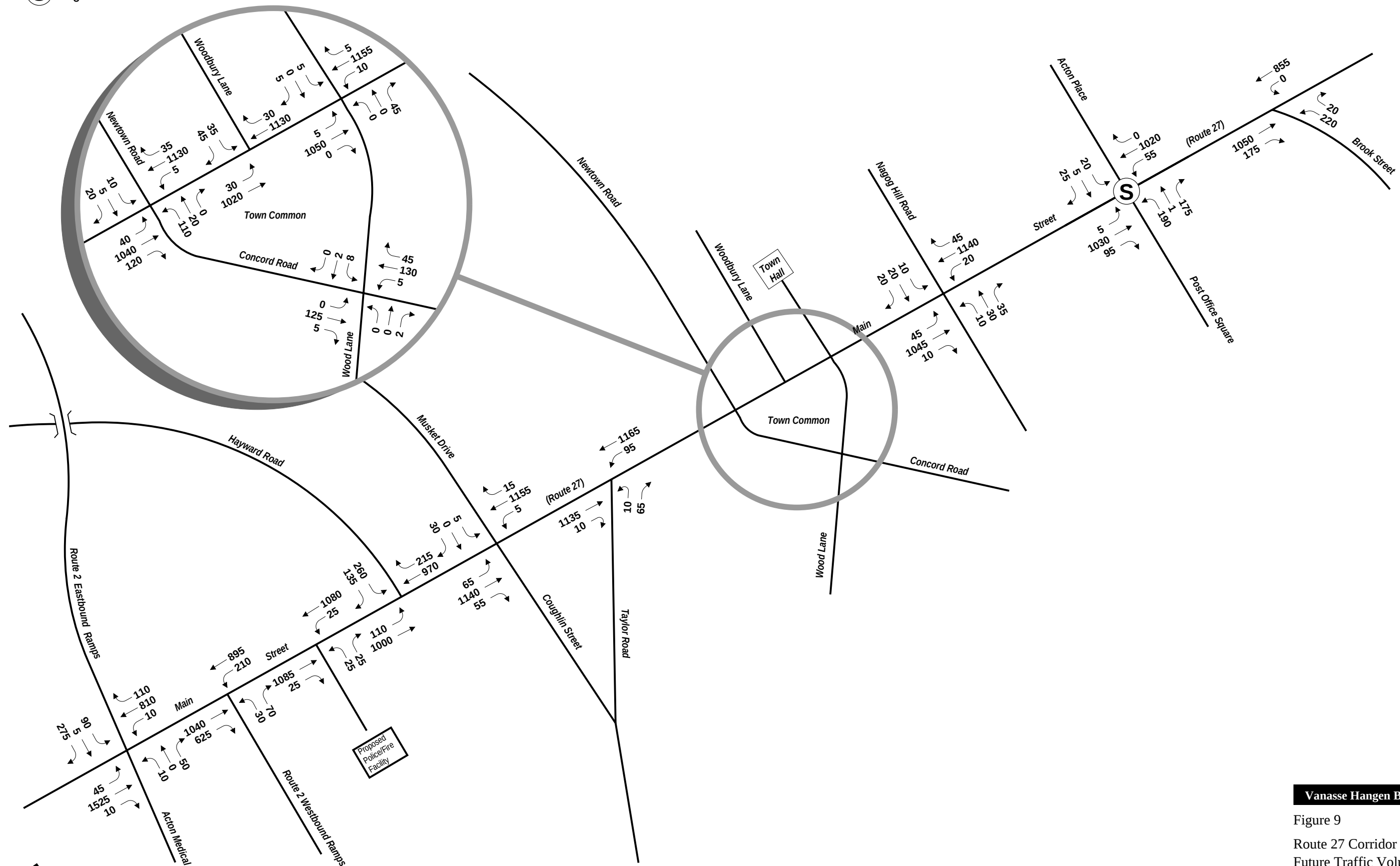
Vanasse Hangen Brustlin, Inc.

Figure 8
Route 27 Corridor Study
Future Traffic Volumes
Morning Peak Hour (8:00-9:00 AM)



Not to Scale

S Signalized Intersection

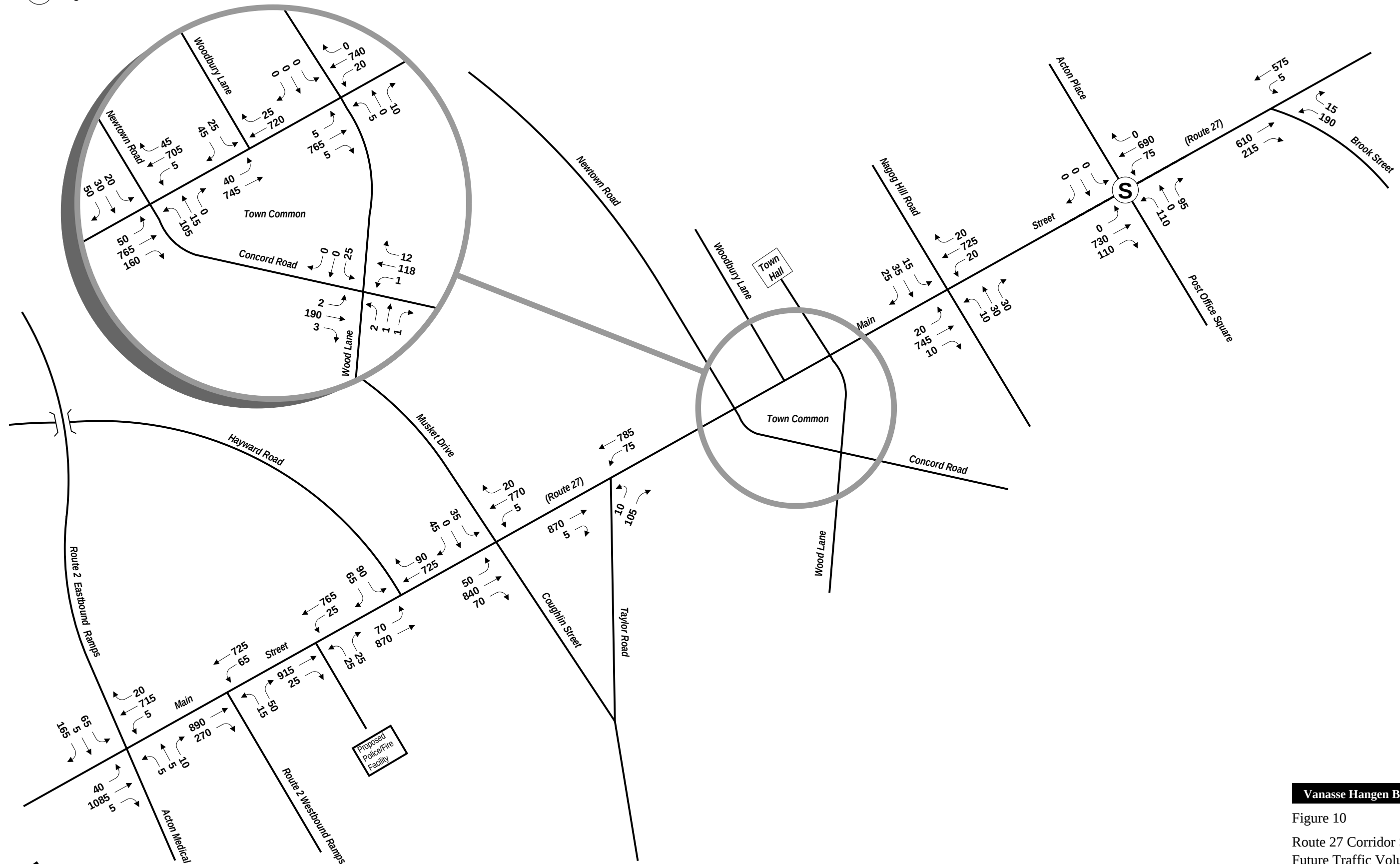


Not to Scale

Vanasse Hangen Brustlin, Inc.

Figure 9
Route 27 Corridor Study
Future Traffic Volumes
Evening Peak Hour (4:45-5:45 PM)

S Signalized Intersection



Vanasse Hangen Brustlin, Inc.

Figure 10
Route 27 Corridor Study
Future Traffic Volumes
Saturday Peak Hour
(11:15 AM-12:15 PM)

Traffic Volume Increase

Based on the traffic assignments described above, a comparison of existing and future condition peak hour volumes for Route 27 (just north of Hayward Road) is presented in Table 10. The projected traffic increase at this location is a conservative representation of traffic increase throughout the corridor.

Table 10
Peak Hour Traffic Volume Increases

Condition	Route 27 (north of Hayward Road)					
	Weekday Morning Peak Hour Southbound	Weekday Morning Peak Hour Northbound	Weekday Evening Peak Hour Southbound	Weekday Evening Peak Hour Northbound	Saturday Midday Peak Hour Southbound	Saturday Midday Peak Hour Northbound
Existing	525	825	915	880	635	745
Future	750	1,052	1,186	1,260	815	960
Percent Increase (by direction)	43%	28%	30%	43%	28%	29%
Overall Percent Increase	33%		36%		29%	

Acton-Boxborough School Enrollment Increase

To assess the impact of the growing Acton-Boxborough school district, projected school enrollment was provided by the Town of Acton. The data show that over the next 10 years, the enrollment at the junior high school and high school level is expected to increase approximately 2.9 percent and 4.9 percent per year respectively⁹. To be conservative, the highest enrollment number projected within the next 10 years for each school was used to estimate the growth. Enrollment at the elementary school level is expected to decrease by approximately 0.5 percent per year. To present a conservative view, this decrease was not taken into account.

The trip generation estimates for the enrollment increase are based on data compiled by the Institute of Transportation Engineers (ITE) in *Trip Generation*¹⁰. Trip generation calculations can be found in the appendix. Based on current trip distribution patterns, 40 percent of the total school trips generated by the enrollment increase are projected to travel along Route 27. The remaining 60 percent of trips are



⁹ Data provided by the ABRSD to the Town of Acton Planning Department.

¹⁰ Institute of Transportation Engineers, *Trip Generation*, Sixth Edition, 1997, Washington, DC.

projected to travel west on Hayward Road. It is anticipated that the increase in enrollment will generate an additional 185 morning peak hour trips and 60 evening peak hour trips (approximately 40 percent of the total) along Route 27. Trips were distributed according to current travel patterns observed on Route 27.

A sensitivity analysis was preformed at Route 27 and Hayward Road to determine what (if any) impact the additional trips will have on this intersection. This intersection is expected to receive the greatest impact since it is a direct connection to both schools. With no improvements to the current intersection geometry the delay turning off of Hayward will increase and the intersection will remain at LOS F. Should Hayward Road be widened to a 2-lane approach, the additional vehicles are not expected to degrade the expected operation of the intersection.

Kelley's Corner

The full build-out of Kelley's Corner was also assessed to determine what (if any) impact the additional traffic generated is expected to have on the Route 27 corridor. Estimated full-build site generated traffic volumes were provided by the Town. While it is unlikely that full build-out will occur by 2010, a conservative portion of the expected trips were considered. Based on the current trip distribution at the Kelley's Corner intersection, it was determined that the additional traffic is expected to have little impact on the Route 27 corridor.

Traffic Analysis

Consistent with the manner described in Chapter 2, capacity analyses were conducted for future conditions for the weekday morning, weekday evening, and Saturday peak hours. Tables 11 and 12 present the results of the future conditions analysis.

Unsignalized Intersection Capacity Analysis

According to the 2010 analysis, long delays are anticipated at all Route 27 intersections. With the exception of Route 27 and Concord Road (north branch) and Concord Road and Wood Lane, all intersections are expected to operate at an unacceptable LOS during at least two peak hours. As in the existing conditions analysis, the critical movement is most often the left-turn out of the minor street. These delays are indicative the heavy traffic on Route 27 opposing the vehicles attempting to exit the side streets.

Table11
Unsignalized Intersection Capacity Analysis

Location	Peak Hour	2000 Existing Conditions			2010 Future Conditions		
		Critical Approach	Delay ¹	LOS ²	Critical Approach	Delay	LOS
Route 27 at Route 2 EB Ramps/Acton Medical	Weekday Morning	EB	>60	F	EB	>60	F
	Weekday Evening	EB	>60	F	EB	>60	F
	Saturday MIDDAY	EB	41	E	EB	>60	F
Route 27 at Route 2 WB Ramps	Weekday Morning	WB	25	C	WB	53	F
	Weekday Evening	WB	47	E	WB	>60	F
	Saturday MIDDAY	WB	21	C	WB	31	D
Route 27 at Hayward Road	Weekday Morning	EB	44	E	EB	>60	F
	Weekday Evening	EB	>60	F	EB	>60	F
	Saturday MIDDAY	EB	35	D	EB	37	E
Route 27 at Musket Drive/Coughlin Street	Weekday Morning	EB	19	C	EB	37	E
	Weekday Evening	EB	25	C	EB	55	F
	Saturday MIDDAY	EB	25	C	EB	53	F
Route 27 at Taylor Road	Weekday Morning	WB	26	D	WB	>60	F
	Weekday Evening	WB	26	D	WB	>60	F
	Saturday MIDDAY	WB	18	C	WB	28	D
Route 27 at Newtown Road/Concord Road	Weekday Morning	WB	>60	F	WB	>60	F
	Weekday Evening	WB	>60	F	WB	>60	F
	Saturday MIDDAY	WB	>60	F	WB	>60	F
Route 27 at Woodbury Lane	Weekday Morning	EB	20	C	EB	44	E
	Weekday Evening	EB	40	E	EB	>60	F
	Saturday MIDDAY	EB	20	C	EB	29	D
Concord Road at Wood Lane	Weekday Morning	SB	11	B	SB	11	B
	Weekday Evening	SB	10	A	SB	11	B
	Saturday MIDDAY	SB	10	A	SB	11	B
Route 27 at Concord Road (north branch)/ Town Hall	Weekday Morning	WB	14	B	WB	30	D
	Weekday Evening	EB	41	E	EB	>60	F
	Saturday MIDDAY	WB	13	B	WB	26	D
Route 27 at Nagog Hill Road	Weekday Morning	EB	35	D	EB	>60	F
	Weekday Evening	WB	61	F	WB	>60	F
	Saturday MIDDAY	EB	25	D	WB	>60	F
Route 27 at Brook Street	Weekday Morning	WB	25	D	WB	>60	F
	Weekday Evening	WB	>60	F	WB	>60	F
	Saturday MIDDAY	WB	30	D	WB	>60	F

1 Average delay expressed in seconds per vehicle.

2 Level of service

Signalized Intersection Capacity Analysis

Signalized intersection capacity analysis was performed at the intersection of Route 27 and Post Office Square. The signalized analysis was conducted using SYNCHRO intersection analysis software¹¹. Table 12 summarizes the analysis results.

Table 12
Signalized Intersection Capacity Analysis

Location	Peak Hour	2000 Existing Conditions			2010 Future Conditions		
		V/C ¹	Delay ²	LOS ³	V/C	Delay	LOS
Route 27 at Post Office Square	Weekday Morning	0.62	5	A	0.95	25.4	C
	Weekday Evening	0.67	9	A	0.97	58.5	E
	Saturday Middy	0.58	6	A	0.80	15.5	B

4 Volume-to-capacity ratio.

5 Control delay per vehicle, expressed in seconds, includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

6 Level-of-Service

The intersection of Route 27 and Post Office Square is expected to degrade from LOS A during all peak hour periods under existing conditions to LOS C, E, and B during future morning, evening, and Saturday peak hours, respectively. Adjustment to the signal cycle length and signal timing is expected to allow this intersection to operate at LOS B during the morning and Saturday peak hour and LOS D during the evening peak hour in the future.

Roadway Capacity Analysis

Similar to existing conditions analyses, roadway link analysis was performed along the Route 27 roadway segments in each of the future peak hours. Roadway analysis aids in further identifying traffic flow constraints in the study area under future conditions. The evaluation criteria used to analyze critical roadway links are based on the 1997 *Highway Capacity Manual*¹². Level of service is determined according to roadway geometry, traffic volume, and volume to capacity ratio (v/c).

¹¹ SYNCHRO 4, Version 4 (Build 223), Traffic Signal Coordination Software, Trafficware Corporation, Albany, CA.

¹² Transportation Research Board, *Highway Capacity Manual*, Special Report 209, Washington, D.C., 1997.

Table 13
Route 27 Roadway Link Capacity Analysis

Location – Route 27	Peak Hour	2000 Existing Conditions			2010 Future Conditions		
		Flow Rate	V/C ¹	LOS ²	Flow Rate	V/C	LOS
Route 27 between Route 2EB and Route 2 WB Ramps	Weekday Morning	1,475	0.68	E	1,980	0.88	E
	Weekday Evening	1,845	0.83	E	2,595	1.12	F
	Saturday Midday	1,485	0.65	E	1,900	0.83	E
Route 27 between Route 2 WB Ramps and Hayward Road	Weekday Morning	1,345	0.59	E	1,825	0.78	E
	Weekday Evening	1,590	0.67	E	2,215	0.92	E
	Saturday Midday	1,340	0.56	E	1,730	0.73	E
Route 27 between Hayward Road and Musket Drive	Weekday Morning	1,350	0.59	E	1,830	0.78	E
	Weekday Evening	1,795	0.75	E	2,445	1.02	F
	Saturday Midday	1,380	0.58	E	1,775	0.75	E
Route 27 between Musket Drive and Taylor Road	Weekday Morning	1,270	0.53	E	1,745	0.75	E
	Weekday Evening	1,685	0.71	E	2,320	0.97	E
	Saturday Midday	1,290	0.54	E	1,670	0.69	E
Route 27 between Taylor Road and Newtown Road	Weekday Morning	1,380	0.58	E	1,870	0.81	E
	Weekday Evening	1,810	0.76	E	2,460	1.02	F
	Saturday Midday	1,435	0.60	E	1,835	0.77	E
Route 27 between Newtown Road and Woodbury Lane	Weekday Morning	1,215	0.53	E	1,685	0.71	E
	Weekday Evening	1,665	0.72	E	2,225	0.94	E
	Saturday Midday	1,245	0.51	E	1,545	0.64	E
Route 27 between Woodbury Lane and Wood Lane	Weekday Morning	1,210	0.53	E	1,675	0.70	E
	Weekday Evening	1,650	0.71	E	2,215	0.93	E
	Saturday Midday	1,220	0.50	E	1,515	0.62	E
Route 27 between Concord Road (north branch) and Nagog Hill Road	Weekday Morning	1,235	0.54	E	1,705	0.72	E
	Weekday Evening	1,695	0.72	E	2,270	0.95	E
	Saturday Midday	1,240	0.51	E	1,535	0.63	E
Route 27 between Nagog Hill Road and Post Office Square	Weekday Morning	1,285	0.56	E	1,760	0.75	E
	Weekday Evening	1,715	0.74	E	2,330	1.00	F
	Saturday Midday	1,260	0.52	E	1,600	0.66	E
Route 27 between Post Office Square and Brook Street	Weekday Morning	1,215	0.52	E	1,640	0.68	E
	Weekday Evening	1,665	0.70	E	2,300	0.97	E
	Saturday Midday	1,210	0.50	E	1,590	0.66	E

1 Volume to Capacity Ratio

2 Level of service

As shown in Tables 13 all of the roadway segments are expected to operate at an unacceptable LOS under future conditions, indicating that Route 27 is expected to continue to operate at or above capacity during this time. During the evening peak

hour, four roadway links degrade from LOS E to LOS F. Future conditions roadway LOS can be found in the Appendix.

Next Steps

The next steps in the development of the Route 27 Corridor Plan will involve the identification and evaluation of improvement alternatives to address the existing and anticipated corridor deficiencies. These improvement alternatives will focus back on the study objectives as previously described in Chapter 1. This process and the candidate strategies reviewed are described in Chapter 4 of this report.

4

Improvement Alternatives

Once the existing and projected traffic conditions were defined, ideas intended to address the corridor's needs and deficiencies were generated. Through the input of Town officials and the Route 27 Advisory Committee, the study team developed a wide range of options. This chapter overviews the process of evaluating and refining these initial ideas into the recommended improvement plan.

Study Objectives

In developing the improvement options, it is imperative to realize the nature of the roadway and identify design improvements that maintain the character of the area. With this in mind, key objectives of the corridor improvements, as defined by the community and refined through the study process, include:

- Preserving a safe flow of traffic while accommodating a range of users
- Easing the difficulty of left-turns out of side streets
- Improving large truck accommodations, particularly between Route 2 and Hayward Road
- Discouraging potential spill-over traffic on local streets
- Controlling / Discouraging excessive vehicle speeds
- Improving pedestrian and bicycle accommodations and safety

These objectives were initially used to guide the development of improvement options for the Route 27 corridor. Many of the alternatives identified can be directly linked to one or more of these fundamental objectives.

Corridor Improvement Strategies

Corridor improvement strategies were developed to address the wide range of needs and deficiencies identified in the existing conditions analysis. These strategies include traffic management, speed control, pedestrian safety, and roadway cross-section treatments.

The preliminary recommendations, evaluation criteria and alternatives screening process were initially presented to the Route 27 Advisory Committee and then the community at public meetings held on December 7, 2000 and December 12, 2000. A

summary of public comments received through this process is provided in the appendix to this report. Many of the alternatives had several refinements or iterations in the development of the concept through this process, as “options” were presented and reviewed by the study’s Advisory Committee, town staff, and others.

Strategies were screened through the process of evaluating each on the basis of its technical merits and implementation feasibility. The potential impacts/benefits of each strategy considered as part of this screening process included:

- Cut-through traffic onto adjacent streets
- Reduced speeds
- Increased roadway safety
- Emergency access impacts
- Increased pedestrian mobility and safety
- Increased bicycle mobility and safety
- Reduced traffic congestion
- Cost
- Right-of-way impacts
- Community character
- Maintenance issues
- Overall feasibility for Route 27

Table 14 presents a description of the initial strategies identified for the corridor (the shaded strategies represent those that were deemed infeasible or undesirable through engineering judgement and through discussions with Town officials and the public). Those chosen to move forward were further investigated by the study team as possible additions to the final preferred improvement plan. The strategies presented in Table 14 are broken into four categories: Cross-sectional Treatments, Speed Control Strategies, Pedestrian Safety and Traffic Management. Many of the strategies in Table 14 have been carried forward and are reflected in the specific intersection improvement alternative. These are described in more detail later in this chapter. Two of the corridor improvements strategies were further investigated for potential impacts to Route 27, corridor-wide sidewalks and a uniform 32 foot-cross section to better accommodate bicycles. These are discussed in the following paragraphs.

Table 14
Route 27 (Main Street) Corridor Improvement Strategies

Potential Impacts/ Benefits																
Cross-sectional Treatments	Description	Advantages	Disadvantages	Reduced Cut-through Traffic Onto Adjacent Roads	Reduced Speeds	Increased Roadway Safety	Emergency Access Impacts	Increased Pedestrian Mobility	Increased Bicycle Mobility	Reduced Traffic Congestion	Cost	Right-of-way Impacts	Community Character	Maintenance Issues	Overall Feasibility for Route 27	Comments
Corridor-wide Sidewalks	Uniform sidewalk system connecting local attractions and residences.	Provides continuity in pedestrian access with minimal conflicts.	Potential right-of-way impacts, costs.	○	○	✓	○	✓	○	○	Moderate	Moderate	○	○	1	ADA requirements need to be considered. ROW availability also an issue.
On-road Bicycle Accommodation	Providing on-road bicycle accommodation per MassHighway directive.	Provides 30 to 32-foot cross-section for better bicycle accommodation.	Potential right-of-way impacts, costs.	○	○	✓	○	✓	✓	○	Moderate	Moderate	○	○	1	Requires widening certain segments of Route 27 to provide cross-section.
Consistent Corridor Sidewalk Treatment	Uniform sidewalk treatment throughout corridor.	Provides continuity in pedestrian access and enhanced aesthetics.	Potential right-of-way impacts, costs.	○	○	✓	○	✓	○	○	High	Moderate	○	○	1	Reconstructing existing walks hard to justify. Could adopt standards for all future sidewalks: asphalt w/ sloped (60 degree) granite curb.
Provide Uniform Shoulder	Widen roadway to provide uniform shoulder per AASHTO	Provides 40-foot cross-section to better accommodate traffic demands.	Right-of-way impacts, costs.	✓	x	✓	✓	x	x	x	High	High	x	x	2	Not feasible due to right-of-way constraints, impact on corridor character, and pedestrian safety.
Speed Control Strategies																
Enforcement	"Zero Tolerance" approach to speeding violations.	Reduces speeds but on-going presence is needed.	Cost and staffing.	○	✓	✓	○	✓	✓	○	High	None	○	○	1	Requires long-term commitment to be effective.
Residential Speed Control Program	Implement residential speed control program through signing, radar guns, education, etc.	Potential to reduce speeds but on-going commitment is needed.	Cost and on-going commitment.	○	✓	✓	○	✓	✓	○	Low	None	○	○	1	Requires long-term commitment to be effective.
Reduce Speed Limit	Provide uniform speed limit through corridor.	Potential to reduce speeds but requires design treatments to calm traffic.	May encourage use of alternate routes.	○	✓	✓	○	✓	✓	○	Moderate	None	○	○	1	Requires MassHighway acceptance.
Narrow Travel Lanes	Reduce travel lanes to 11 feet to slow traffic.	Potential to reduce speeds. Safety effects unclear.	Impacts truck movements. Safety effects unclear.	○	✓	✓	○	○	x	○	Moderate	None	○	○	1	
Neckdown/ Bulb-out	Narrowing the roadway by extending the curb at key intersections and mid-block locations.	Slows traffic, increases pedestrian safety, alters street environment.	Costs, maintenance, drainage, alters street environment.	○	✓	✓	x	✓	x	○	Moderate-High	None	○	x	1	Already being done at certain locations and offers potential for additional applications.
Diverter	Raised barrier diagonally across intersection creating two unconnected streets at an intersection.	Reduces pedestrian exposure, prohibits through traffic.	Emergency access, restricts movements on roadway.	x	✓	○	x	✓	x	○	Moderate	None	x	x	3	Not applicable for Route 27 as an arterial.
Chicane	Narrowing and realigning the roadway through a series of curb extensions creating a slalom effect.	Slows traffic, diverts traffic, alters street environment.	Traffic delays, costs, maintenance, drainage, right-of-way, alters street environment.	✓	✓	✓	✓	✓	✓	✓	High	None	○	x	3	Not applicable for Route 27 as an arterial.
Rumble Strip	Raised buttons, bars or grooves closely spaced on roadway to create noise and vibration.	Increases awareness, reduces speeds, permanent presence.	Increases noise, maintenance.	✓	✓	✓	✓	✓	✓	✓	Low	None	x	x	3	Not applicable for Route 27 as an arterial.
Speed Hump	Raised area of roadway deflecting both the wheels and frame of traversing vehicle. (Typically 12-14 feet long)	Increases awareness, permanent presence, slows traffic.	Increases noise, maintenance.	✓	✓	✓	✓	✓	✓	✓	Moderate	None	○	x	3	Not applicable for Route 27 as an arterial.

✓ = Positive Impact
○ = No Impact
x = Negative Impact

Table 14
Route 27 (Main Street) Corridor Improvement Strategies

Potential Impacts/ Benefits																	
Pedestrian Safety	Description	Advantages	Disadvantages	Reduced Cut-through Traffic Onto	Adjacent Roads	Reduced Speeds	Increased Roadway Safety	Emergency Access Impacts	Increased Pedestrian Mobility	Increased Bicycle Mobility	Reduced Traffic Congestion	Cost	Right-of-way Impacts	Community Character	Maintenance Issues	Overall Feasibility for Route 27	Comments
Consistent Crosswalk Treatment	Provide uniform crosswalk treatment through corridor.	Increases awareness of walkways. Improves aesthetics.	None.	○	✓	✓	○	✓	○	○	None	None	○	○		1	Most recent markings are white crosswalk markings with diagonal lines. Other options include longitudinal lines, colored crosswalks, brick paver with painted edge or granite edge.
Enhance Crosswalk Treatment	Supplement crosswalk locations with additional signs and/or stantions.	Increases awareness of walkways. Improves visibility of crossing locations.	May be viewed negatively within context of historic district depending on materials used.	○	✓	✓	○	✓	○	○	Varies	None	○	○		1	New high visibility pedestrian signs, stantions, wider crosswalks, wider paint lines, refuge islands, ped cones.
Lighting	Provide adequate lighting along corridor, specifically at crosswalks and intersections.	Improves visibility of turning vehicles. Increases pedestrian safety. Increases awareness of crosswalks.	Cost, Maintenance.	○	○	✓	○	✓	✓	○	Moderate	None	✓	✗		1	\$10,000 = 25 lights and power for one year. Lights would be full cut-off lumiares, white light. Town owns lighting system.
Raised Crosswalk	Elongated speed hump with flat section where pedestrians cross.	Increases awareness, permanent presence, slows traffic.	Increased noise, cost, maintenance.	✗	✓	✓	✗	✓	✗	○	Moderate	None	✓	✗		2	Not applicable for Route 27 as an arterial.
Traffic Management																	
Traffic Circulation Changes	Altering traffic flows through a series of one-way circulation changes.	Limits access. Often requires additional vehicle circulation for local traffic.	Limits access, introduces circulating traffic patterns, emergency access, safety.	✓	○	✓	✗	○	✗	○	Low	None	○	○		1	May be applicable at certain locations. See intersection treatments.
Access Management	Consolidating driveways to better channelize vehicles into adjacent uses.	Better defines the edge of pavement of the adjacent roadway.	May limit or change access for residences or businesses.	○	✓	✓	○	✓	✓	○	Low	Varies	✓	○		1	
Increased Signage	Signage could include speed limit, crosswalk (pedestrian), traffic control, historic district or directional signage.	Helps to alert drivers to situation. Special materials could be used to increase aesthetics.	Unattractive, obstruct view, compete with pedestrian space.	○	○	✓	○	✓	○	○	Low	None	○	○		1	Should be used in combination with other strategies. Minimal benefits if used alone.
Corner Radii Treatment	Reduces corner radii at intersections making turning movements tighter.	Slows turning vehicles, increases pedestrian safety.	Limits truck and bus turning.	○	✓	○	○	✓	○	○	Low	None	○	○		1	Reduces high speeds. Good application at high right-turn locations.
Gateway	Creating a focal point indicating use/ character of roadway.	Increases awareness, permanent presence.	Right-of-way impacts, costs, maintenance.	○	✓	✓	○	○	○	○	Moderate	Varies	✓	✗		1	Should be used in combination with other strategies. Minimal benefits if used alone.
Traffic Island	Raised, often landscaped, area between traffic lanes to control and channelized vehicle turning movements.	Increases awareness, improves pedestrian safety, permanent presence.	Right-of way impacts, costs, maintenance.	○	✓	✓	○	○	○	○	Moderate-High	None	○	✗		1	May be applicable at certain locations. See intersection treatments.
Traffic Circle	Raised, often landscaped, island in center of intersection requiring vehicles to travel counter-clockwise around island.	Permanent presence, good gateway, increases awareness, creates landscaping area.	Right-of way impacts, costs, restricts truck turning.	○	✓	✓	○	○	○	✓	Moderate	Varies	✓	✗		1	There is no good location to consider this type of treatment.
Raised Intersections/ Speed Table	Intersection (including crosswalk) constructed at a higher elevation than the adjacent roadway.	Increases awareness, permanent presence, slows traffic.	Increased noise, cost, maintenance.	✗	✓	✓	✗	✓	✗	○	Moderate-High	None	✓	✗		3	Not applicable for Route 27 as an arterial.

✓ = Positive Impact
○ = No Impact
✗ = Negative Impact

Corridor-Wide Sidewalk Evaluation

In an effort to improve pedestrian safety, corridor-wide sidewalk implementation was considered. Table 15 evaluates the impacts associated with supplying missing sidewalk links along the corridor. Three types of sidewalk links were considered, a 5-foot sidewalk abutting the travelway, a 5-foot sidewalk with a 3-foot offset from the travelway, or a meandering sidewalk with varying offset (as shown in Figure 12). Based on impacts to the right-of-way, wetlands, structures, culverts, trees, utility poles, and stone walls and ledges, recommendations are given for the type of sidewalk (if any) most appropriate for each segment reviewed. Each segment was also given an initial priority ranking. Figure 13 presents the recommendations and priority rankings. Based on discussions with the Advisory Committee and the public, the priorities were revised and the final action plan for the sidewalk improvements is presented in Chapter 5.

Uniform Cross-Section Evaluation

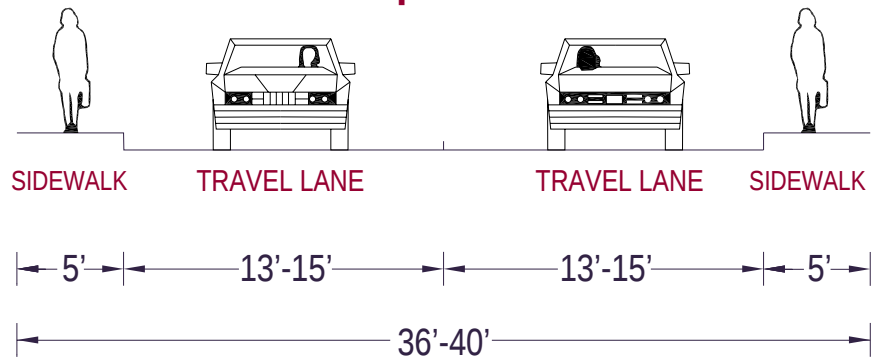
Implementation of a uniform bike lane cross-section was also considered. Table 16 evaluates implementing a uniform 32-foot cross-section along the corridor. This would consist of providing 12-foot lanes with 4-foot shoulders (as shown in Figure 14). Table 16 describes the necessary construction needed on each existing segment and the anticipated impacts associated with providing a uniform cross-section. The 1998 Acton Master Plan Update recommends that the Town study issues surrounding widening the paved area to accommodate bicycles and / or constructing an off-road bicycle path or bike lanes along Route 27. The general consensus at the Route 27 corridor public meetings was that roadway widening is not amenable.

Table 15
Route 27 (Main Street) Corridor-wide Sidewalks Evaluation

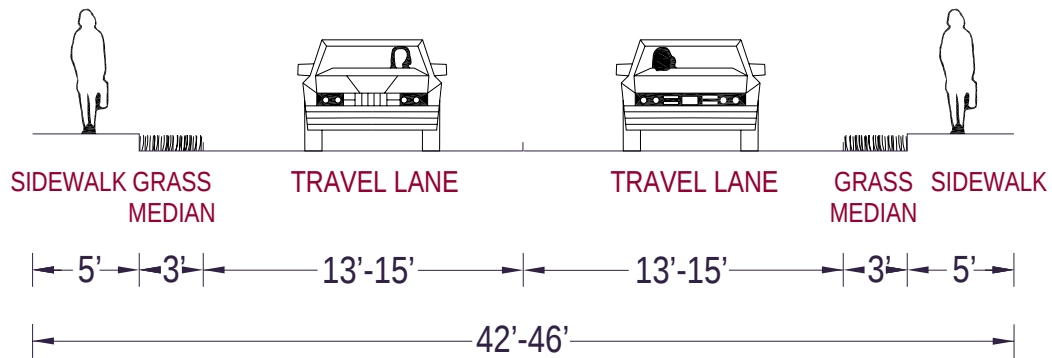
Segment	Right-of-way	Wetlands	Structures/culverts	Trees	Utility Poles	Stone Walls/ledges	Recommendation	Initial Priority*
EAST SIDE OF ROUTE 27 - between Route 2 ramps								
Option 1	No impact	No impact	High - Impact to Route 2 overpass	No impact	No impact	No impact	Discard alternative due to structural impacts	7 - Link to Main Street south of Route 2
Option 2	No impact	No impact	High - Impact to Route 2 overpass	No impact	No impact	No impact	Discard alternative due to structural impacts	
Option 3	Not applicable							
EAST SIDE OF ROUTE 27 - between Newtown Road and Wood Lane								
Option 1	No impact	No impact	Low - Requires relocation of water trough/planter and altered monument landscaping	No impact	No impact	No impact	Discard alternative	1 - Provides continuity between existing sidewalks at a key activity center
Option 2	No impact	No impact	Low - Requires relocation of water trough/planter and altered monument landscaping	No impact	No impact	No impact	Recommended alternative	
Option 3	Not applicable							
EAST SIDE OF ROUTE 27 - between Nagog Hill Road and Post Office Square								
Option 1	Moderate (20-foot grade drop at #521,523) ¹	Low (isolated wetland)	No impact	Moderate - Two large (>3-foot diameter) trees are impacted ; brush/small tree clearing	No impact	Low - Stone wall at #525 requires replacement	Recommended alternative	2 - Provides key connection to Post Office Square
Option 2	Moderate (20-foot grade drop at #521,523)	Low (isolated wetland)	No impact	High - Four large (>3-foot diameter) trees are impacted ; brush/small tree clearing	No impact	Low - Stone wall at #525 requires replacement	Discard from further consideration - higher ROW and tree impacts	
Option 3	Moderate (20-foot grade drop at #521,523)	Low (isolated wetland)	No impact	High - Four large (>3-foot diameter) trees are impacted ; brush/small tree clearing	No impact	Low - Stone wall at #525 requires replacement	Discard from further consideration	
EAST SIDE OF ROUTE 27 - between Post Office Square and Brook Street								
Option 1	Low (undeveloped parcels)	Low (isolated wetland)	No impact	Low - Removal of small trees and brush clearing	Moderate - Approx. 4 utility pole relocations	No impact	Discard alternative due to utility pole impacts	6a - Links Post Office Square to Route 2A/119
Option 2	Low (undeveloped parcels)	Low (isolated wetland)	No impact	Low - Removal of small trees and brush clearing	No impact (existing utility poles would remain within proposed offset)	No impact	Recommended alternative	
Option 3	Low (undeveloped parcels)	Low (isolated wetland)	No impact	Low - Removal of small trees and brush clearing	No impact (existing utility poles would remain within proposed offset)	No impact	Discard alternative	
EAST SIDE OF ROUTE 27 - between Brook Street and 2A/119								
Option 1	Low (undeveloped parcels)	Low (with culverts)	Moderate - 3 culvert extensions	Moderate - One large tree (3-foot diam.) is impacted	High - 22 utility pole relocations (approx.)	Moderate - Stone wall replacement at various locations	Recommended alternative <u>at culvert sections only</u>	6b - Links Post Office Square to Route 2A/119
Option 2	Low (undeveloped parcels)	Low (with culverts)	Moderate - 3 culvert extensions	Moderate - One large tree (3-foot diam.) is impacted	No impact (existing utility poles remain within proposed offset)	Moderate - Stone wall replacement at various locations	Recommended alternative, <u>except at culvert sections</u>	
Option 3	Low (undeveloped parcels)	Low (with culverts)	Moderate - 3 culvert extensions	Moderate - One large tree (3-foot diam.) is impacted	No impact (existing utility poles remain within proposed offset)	Moderate - Stone wall replacement at various locations	Discard alternative	
WEST SIDE OF ROUTE 27 - between 2A/119 and Post Office Square								
Option 1	Low (undeveloped parcels)	Low (with culverts)	Moderate - 3 culvert extensions	Moderate - Two large trees (>3-foot diam.) are impacted, removal of smaller trees and brush	Moderate - 6 utility pole relocations (approx.)	Moderate - Stone wall replacement at #592-622, 594	Recommended alternative <u>at culvert sections only</u>	5 - Provides continuity between Route 2A/119 and Post Office Square
Option 2	Low (undeveloped parcels)	Low (with culverts)	Moderate - 3 culvert extensions	Moderate - Two large trees (>3-foot diam.) are impacted, removal of smaller trees and brush	No impact (existing utility poles remain within proposed offset)	Moderate - Stone wall replacement at #592-622, 594	Recommended alternative, <u>except at culvert sections</u>	
Option 3	Low (undeveloped parcels)	Low (with culverts)	Moderate - 3 culvert extensions	High - Two large trees (>3-foot diam.) are impacted, <u>significant</u> removal of smaller trees and brush	No impact (existing utility poles remain within proposed offset)	Moderate - Stone wall replacement at #592-622, 594	Discard alternative	
WEST SIDE OF ROUTE 27 - between Taylor Road and Musket Drive								
Option 1	Low (strip takings on residential parcels)	No impact	No impact	Moderate - Three large trees (>3-foot diam.) are impacted, removal of smaller trees and brush	Moderate - 10 utility pole relocations (approx.)	Moderate - 4-foot rock ledge cut at #416; stone wall replacement at #404, 408, 412	Discard alternative due to utility pole impacts	3 - Provides continuity between existing sidewalks through residential parcels
Option 2	Low (strip takings on residential parcels)	No impact	No impact	Moderate - Three large trees (>3-foot diam.) are impacted, removal of smaller trees and brush	No impact (existing utility poles remain within proposed offset)	Moderate - 4-foot rock ledge cut at #416; stone wall replacement at #404, 408, 412	Recommended alternative	
Option 3	Moderate (strip takings on residential parcels)	No impact	No impact	High - Two large trees (>3-foot diam.) are impacted, <u>significant</u> removal of smaller trees and brush	No impact (existing utility poles remain within proposed offset)	Moderate - 4-foot rock ledge cut at #416; stone wall replacement at #404, 408, 412	Discard alternative due to high tree impacts	
WEST SIDE OF ROUTE 27 - between Hayward Road and Route 2 ramps								
Option 1	Low (strip takings on residential parcels)	No impact	No impact	Moderate - Two large trees (>3-foot diam.) are impacted, removal of smaller trees and brush	No impact	No impact	Recommended alternative	4 - Provides continuity to Route 2 overpass sidewalk
Option 2	Low (strip takings on residential parcels)	No impact	No impact	Moderate - Two large trees (>3-foot diam.) are impacted, removal of smaller trees and brush	No impact	No impact	Discard alternative due to higher ROW impacts	
Option 3	Moderate (strip takings on residential parcels)	No impact	No impact	High - Two large trees (>3-foot diam.) are impacted, <u>significant</u> removal of smaller trees and brush	No impact	No impact	Discard alternative due to higher ROW and tree impacts	

Option 1 - 5-foot sidewalk abutting travelway
Option 2 - 5-foot sidewalk with 3-foot offset from travelway
Option 3 - Meandering sidewalk (varying offset)
* These initial priorities were established by the consultant team and were later revised through input from the community.
1 refers to street address

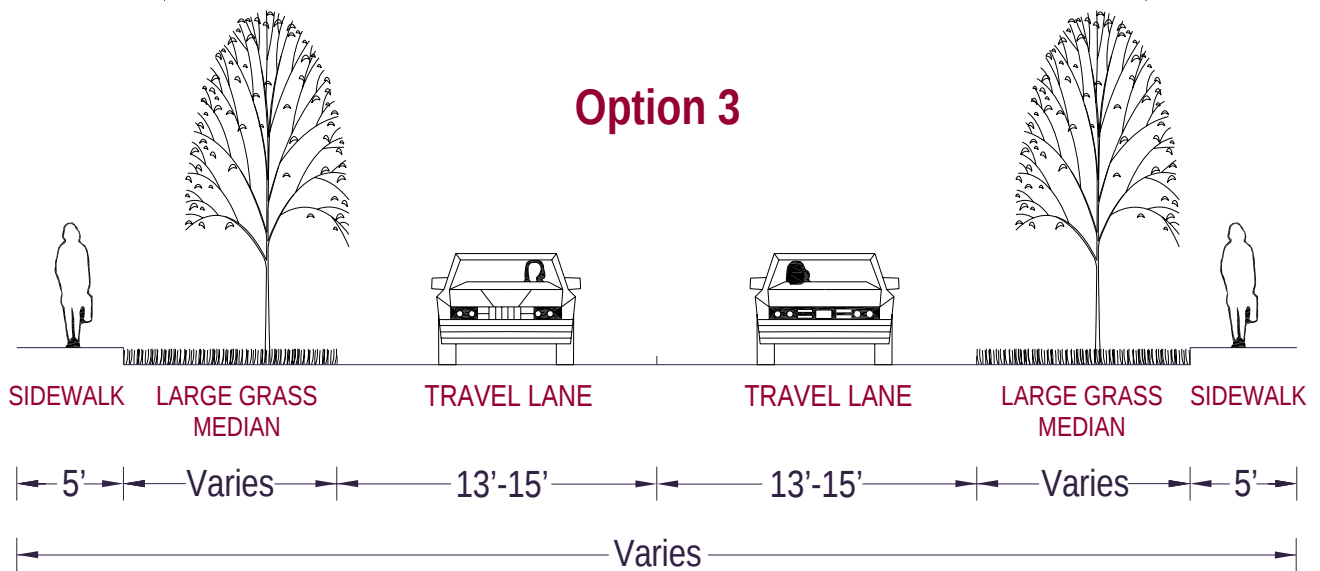
Option 1



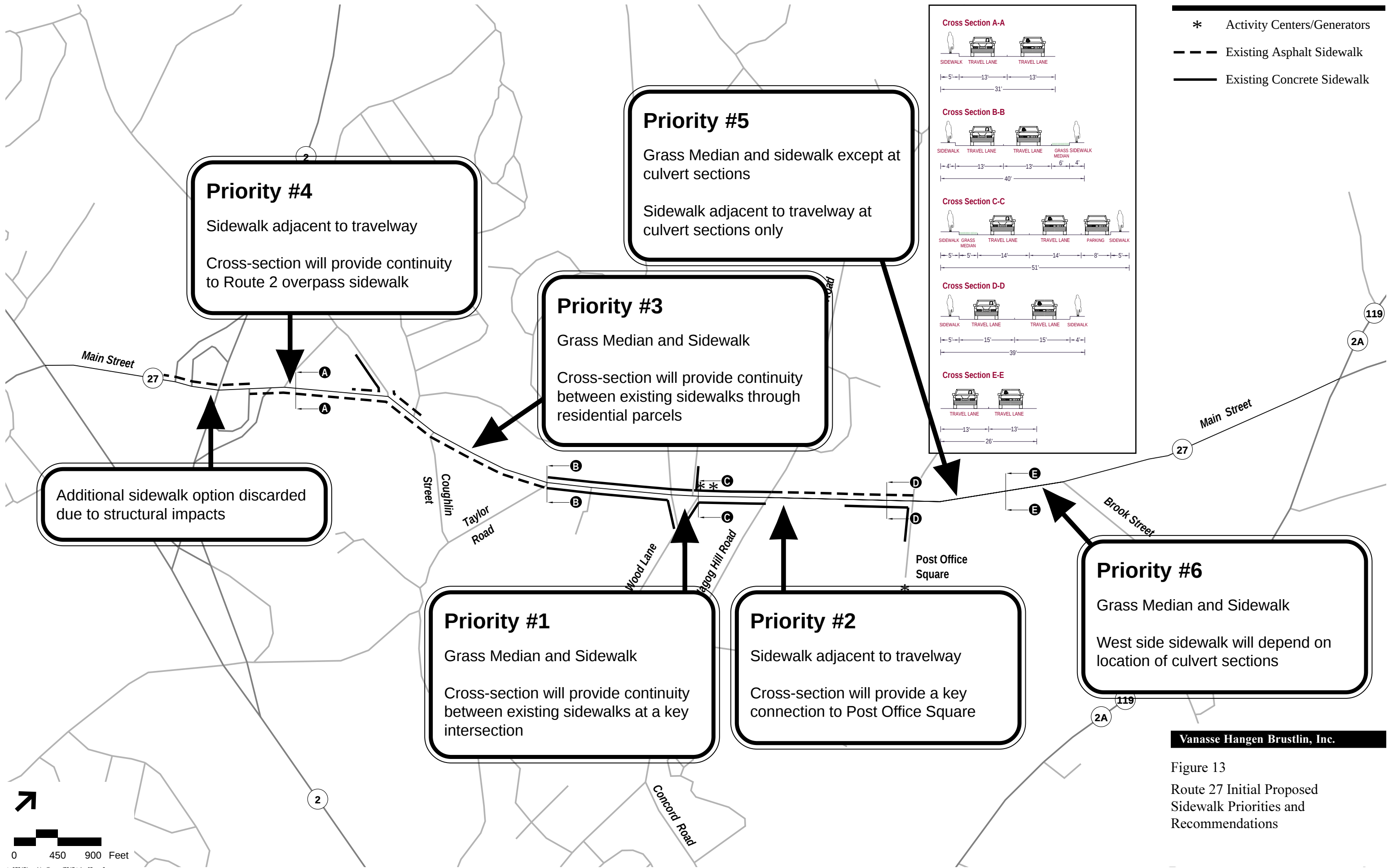
Option 2



Option 3

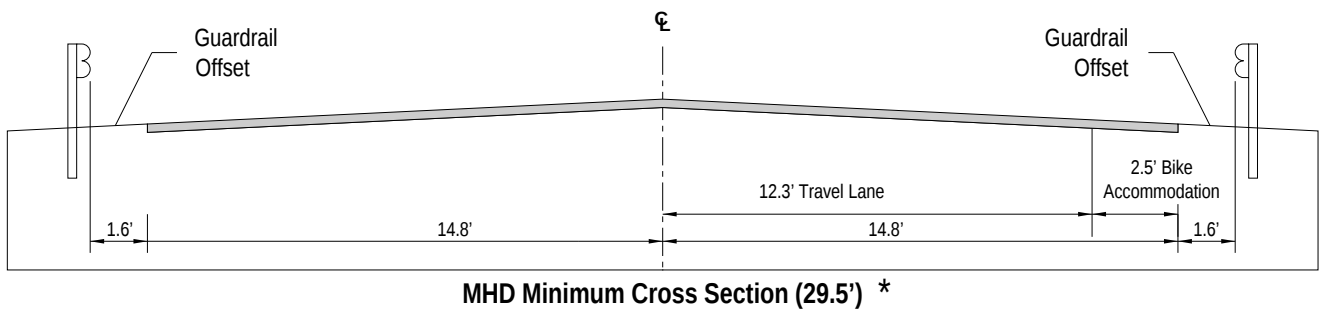
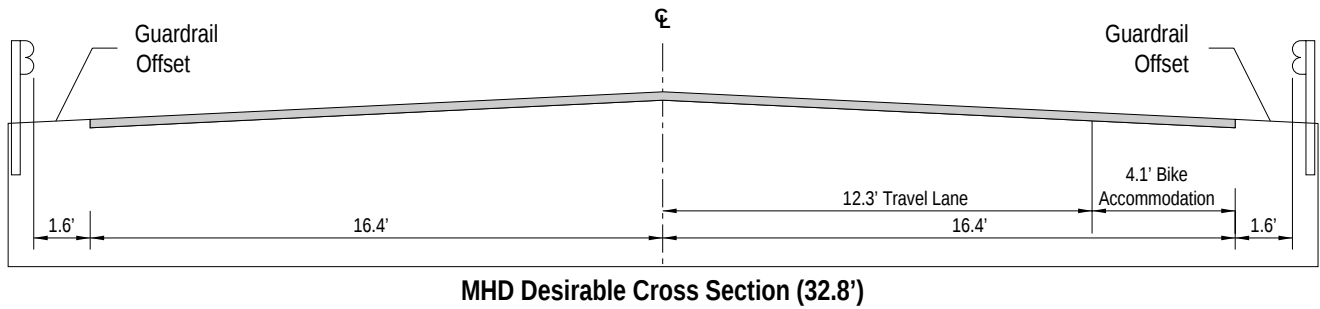


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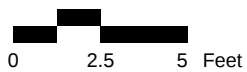


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Figure 13
Route 27 Initial Proposed
Sidewalk Priorities and
Recommendations



Horizontal Scale



* If Speed Limit is <45mph and ADT is <2000vpd, the Cross Section may be reduced

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Route 27 Uniform
Cross-Section Alternative
MHD Engineering Directive (5/5/98)
Bicycles and Pedestrian Accommodation

Figure 14

Table 16
Route 27 (Main Street) Uniform 32-foot Cross-Section Evaluation (4-foot shoulders with 12-foot lanes)*

Direction	Existing Travelway	Action	Right-of-way	Wetlands	Structures/culverts	Trees	Utility Poles	Stone Walls/ledges/fences
BETWEEN ROUTE 2 RAMPS AND HAYWARD ROAD								
NB	12-foot travel lane, 1-foot shoulder	Provide 4-foot shoulder (net 3-foot widening)	No impact	Low (isolated wetland)	No impact	Low - Small tree removal and brush clearing	Low - 3 utility pole relocations (approx.)	No impact
SB	12-foot travel lane, 1-foot shoulder	Provide 4-foot shoulder (net 3-foot widening)	No impact	No impact	No impact	Moderate - Two large trees (>3-foot diam.) are impacted, removal of smaller trees and brush	No impact	No impact
NB		Add LT lane onto Hayward Road and provide 4-foot shoulder	Low (strip takings on residential parcels)	No impact	No impact	Low - Small tree removal and brush clearing	Low - 3 utility pole relocations (approx.)	No impact
SB		Add LT lane onto Route 2 WB on-ramp and provide 4-foot shoulder	No impact	No impact	High - Impact to Route 2 overpass	No impact	No impact	No impact
BETWEEN HAYWARD ROAD AND TAYLOR ROAD								
NB	12-foot travel lane, 1-foot shoulder	Provide 4-foot shoulder (net 3-foot widening)	No impact	No impact	No impact	Low - Small tree removal and brush clearing	Low - 4 utility pole relocations (approx.)	Low - 10-foot fence section at #401/403, 10-foot fence at #419/3
SB	12-foot travel lane, 1-foot shoulder	Provide 4-foot shoulder (net 3-foot widening)	No impact	No impact	No impact	Moderate - One large tree (>3-foot diam.) is impacted, removal of smaller trees and brush	Moderate - 10 utility pole relocations (approx.)	Low - 4-foot rock ledge cut at #416
SB		Add LT lane onto Taylor Road and provide 4-foot shoulder	Low (strip takings on residential parcels)	No impact	No impact	Moderate - One large tree (>3-foot diam.) and several smaller trees at Taylor Road intersection are impacted, removal of smaller trees and brush	Moderate - 12 utility pole relocations (approx.)	Low - 4-foot rock ledge cut at #416
BETWEEN TAYLOR ROAD AND NEWTOWN ROAD								
NB	12-foot travel lane, 1-foot shoulder	Provide 4-foot shoulder (net 3-foot widening)	Moderate (strip takings on residential parcels with narrow 15-foot building setbacks at #445,451,455)	No impact	No impact	Low - Removal of approx. 5 trees (>2-diam.)	No impact	Low - Stone wall replacement at #431
SB	12-foot travel lane, 1-foot shoulder	Provide 4-foot shoulder (net 3-foot widening)	No impact	No impact	No impact	No impact	Moderate - 8 utility pole relocations (approx.)	No impact
BETWEEN NEWTOWN ROAD AND NAGOG HILL ROAD (Acton Common)								
NB	13 to 14-foot travel lane, 1-foot shoulder	Provide 12-foot lane and 4-foot shoulder (net 1 to 2-foot widening)	Low (possible strip takings on residential parcels)	No impact	Low - Requires relocation of water trough/planter and altered monument landscaping	No impact	No impact	No impact
SB	13 to 14-foot travel lane, 8-foot parking (parking along a portion of this segment)	Provide 4-foot shoulder where there is no parking	No impact	No impact	No impact	No impact	Low - 5 utility pole relocations (approx.)	No impact
SB		Add LT lane onto Concord Road and provide 4-foot shoulder	Moderate (strip takings at #468, potential impact to common green)	No impact	Low - Requires relocation of water trough/planter and altered monument landscaping	No impact	No impact	No impact
BETWEEN NAGOG HILL ROAD AND POST OFFICE SQUARE								
NB	14-foot travel lane, 1-foot shoulder	Provide 12-foot lane and 4-foot shoulder (net 1-foot widening)	Low (20-foot grade drop at #521,523)	Low (isolated wetland)	No impact	Moderate - One large (>3-foot diameter) trees is impacted ; brush/small tree clearing at grade drop at #521/523	Low - One utility pole relocation at Post Office Square	Low - Shrub hedge at Post Office Square is impacted
SB	14-foot travel lane, 1-foot shoulder	Provide 12-foot lane and 4-foot shoulder (net 1-foot widening)	No impact	No impact	No impact	No impact	Moderate - 10 utility pole relocations (approx.)	No impact
BETWEEN POST OFFICE SQUARE AND BROOK STREET								
NB	12-foot travel lane, 1-foot shoulder	Provide 12-foot lane and 4-foot shoulder (net 3-foot widening)	No impact	Low (isolated wetland)	No impact	Low - Small tree removal and brush clearing	Low - 5 utility pole relocations (approx.)	No impact
SB	12-foot travel lane, 1-foot shoulder	Provide 12-foot lane and 4-foot shoulder (net 3-foot widening)	No impact	No impact	No impact	Low - Small tree removal and brush clearing	Low - 6 utility pole relocations (approx.)	No impact
SB		Add LT lane onto Post Office Square and provide 4-foot shoulder	Low (strip takings parcel #526)	Low (isolated wetland at #526)	No impact	Low - Small tree removal and brush clearing	Low - 6 utility pole relocations (approx.)	Low - Stone wall replacement at #562
BETWEEN BROOK STREET AND ROUTE 2A/119								
NB	12-foot travel lane, 1-foot shoulder	Provide 12-foot lane and 4-foot shoulder (net 3-foot widening)	No impact	Low (with culverts)	Moderate - 3 culvert extensions	Moderate - One large tree (3-foot diam.) is impacted	High - 22 utility pole relocations (approx.)	Moderate - Stone wall replacement at various locations
SB	12-foot travel lane, 1-foot shoulder	Provide 12-foot lane and 4-foot shoulder (net 3-foot widening)	No impact	Low (with culverts)	Moderate - 3 culvert extensions	Moderate - Two large trees (>3-foot diam.) are impacted, removal of smaller trees and brush	No impact	Moderate - Stone wall replacement at #592-622, 594

* Some locations are also evaluated for the provision of a left-turn lane, where warranted.
Assumes existing sidewalk widths are not reduced
Assumes existing centerline is maintained
Impacts do not include the accommodation of new sidewalks

Intersection Improvement Alternatives

Localized improvement strategies at intersections along the corridor were also evaluated. These strategies are presented in Table 17 and presented graphically in the Appendix. Similar to the corridor improvement strategies, some of these ideas were deemed infeasible by the Advisory Committee and eliminated from further consideration. Those chosen to move forward were further developed by the study team. Localized improvement options were developed for the Route 2 ramps (four alternatives), Hayward Road (four alternatives), Taylor Road (one alternative), the Town Green area (four alternatives), and Brook Street (four alternatives).

In developing the range of improvement alternatives, left-turn lane warrant and traffic signal warrant analyses were conducted for the study intersections, as appropriate. The results of these analyses are presented in the Appendix.

Again, improvement strategies were screened through the process of evaluating each on the basis of its technical merits and implementation feasibility. The evaluation criteria generally considered as part of this screening process included:

- Existing and future traffic operations
- Safety
- Pedestrians and bicycles
- Speed concerns
- Cut-through traffic
- Cost
- Right-of-way impacts
- Community character
- Maintenance issues
- Overall feasibility for Route 27

The intersection improvement alternatives were presented along with the corridor improvement strategies to the Advisory Committee on December 4, 2000, and to the community at public meetings held on December 7, 2000 and December 12, 2000. A summary of the public comments received are provided in the appendix. Many alternatives were refined based on discussions held during these meetings. For example, while a signalized one-way triangle around the town common was not supported, interest was shown in an unsignalized version of that option.

The shaded options were those deemed infeasible or undesirable for the Route 27 corridor. The final action plan was developed through a refinement of the strategies presented in Table 17. A complete description of the recommended improvements carried forward is presented in Chapter 5.

Table 17
Evaluation of Route 27 Corridor Improvement Options

Corridor Location/Alternative Description	Noted Deficiencies			Expected Results					Other Issues		
	Safety	Existing LOS	Future LOS	Improves Roadway Safety	Addresses Capacity Problems	Enhances Pedestrian/ Bicycle Safety	Addresses Speed Concerns	Minimizes Cut-through Traffic	Available ROW	Costs	Comments
Route 2 Eastbound Ramps	●	●	●								
Signalize intersection. Widening northbound approach				✓	✓	○	✓	○	✓	Moderate	Signalization may reduce number of accidents.
Route 2 Westbound Ramps	●	●	●								
Construct service road to Hayward Road. Signalize Route 2 westbound ramp.				✓	✓	✓	✓	✓	✗	High	Signalization of this service road would replace the signalization at Hayward Road/Route 27.
Restripe northbound approach to provide right-turn lane. Widen southbound approach to provide left-turn lane.				✓	✓	○	○	○	✓	Moderate	Would require narrow lanes due to bridge structure & lane shadowing.
Construct Diamond Interchange				✓	✓	✓	✓	○	✓	High	Signalization may reduce number of accidents.
Construct Full Cloverleaf Interchange				✓	✓	○	○	○	✗	High	Impacts to adjacent businesses deem this infeasible.
Hayward Road		●	●								
Signalize and add northbound left-turn lane : Alternative 1				✓	✓	✓	✓	○	✓	Moderate	Addition of a left turn storage lane will help eliminate the desire to drive on the sidewalk.
Signalize, add northbound left-turn lane, and create 2-lane eastbound approach: Alternative 2				✓	✓	✓	✓	○	✓	Moderate	2-lane eastbound approach will ease congestion on Hayward Road.
Signalize, add northbound left-turn lane, create 2-lane eastbound approach, and widen southbound right-turn storage bay : Alternative 3				✓	✓	✓	✓	○	✓	Moderate	
Implement coordinated signal system with proposed Police/Fire Station: Alternative 4				✓	○	○	✓	○	✓	Moderate	
Musket Drive/Coughlin Street			●								
Tighten right-turn radius onto Coughlin Street				✓	○	✓	✓	○	✓	Low	Reduced radius will slow traffic turning off Route 27.
Taylor Road			●								
Tighten right-turn radius onto Taylor Road				✓	○	✓	✓	○	✓	Low	Reduced radius will slow traffic turning off Route 27.
Add left-turn lane on Route 27 westbound				✓	✓	○	○	○	✓	Moderate	
Create one-way pair with Coughlin Street (eastbound) and Taylor Road (westbound)				✓	✗	○	○	○	✓	Low	Left turn onto Coughlin an issue due to angle.
Newtown/Concord Road		●	●								
Signalize Newtown Road : Alternative 1				✓	✓	✓	✓	○	✓	Moderate	
Signalize Newtown Road, add left-turn lane to Woodbury Lane : Alternative 2				✓	✓	✓	✓	○	✓	Moderate	
Signalize Newtown Road, designate Concord Road north leg as one way westbound : Alternative 3				✓	○	○	○	○	✓	Low	
Create one-way triangle around town green, with possible signalization : Alternative 5				✓	✗	○	○	○	✓	Moderate	One-way triangle will provide more on-street parking or additional greenspace.
Create one-way pair with Concord Road (westbound) and Brook Street (eastbound) : Alternative 4				○	✗	○	○	○	✓	Low	Would inconvenience residents along both roads.
✓ = Positive Impact ○ = No Impact ✗ = Negative Impact ● = Deficiency											

Table 17
Evaluation of Route 27 Corridor Improvement Options

Corridor Location/Alternative Description	Noted Deficiencies			Expected Results					Other Issues		
	Safety	Existing LOS	Future LOS	Improves Roadway Safety	Addresses Capacity Problems	Enhances Pedestrian/ Bicycle Safety	Addresses Speed Concerns	Minimizes Cut-through Traffic	Available ROW	Costs	Comments
Woodbury Lane		●	●								
Installation of bulb-out with crosswalk at town center				○	○	✓	○	○	✓	Low	Bulb-out will reduce pedestrian crossing length.
Nagog Hill Road		●	●								
Create better designed on-street parking between Nagog Hill and Town Center				○	○	✓	○	○	✓	Low	
Develop Gateway into Town Center (within Historic District)				○	○	○	○	○	✓	Moderate	
Installation of median from Nagog Hill Road to Town Center				✓	○	✓	○	○	✓	Moderate	Would be a flush median (cobblestone, scored concrete). Raised median would limit access for residents.
Channelize Nagog Hill Road southbound approach				✓	○	✓	○	○	✓	Low	Intersection does not require improvements at this time.
Consolidate Nagog Hill Road southbound approach				✓	○	✓	○	○	✓	Low	Intersection does not require improvements at this time.
Intersection realignment				✓	○	✓	○	○	✓	Moderate	Intersection does not require improvements at this time.
Create one-way pair with Nagog Hill Road (eastbound) and Concord Road (westbound)				○	○	○	○	✗	✓	Low	Would inconvenience residents along both roads.
Post Office Square			●								
Retiming of traffic signal				○	✓	○	○	○	✓	Low	
Brook Street	●	●	●								
Channelize Brook Street approach, one way on each side of the island : Alternative 2				✓	○	✓	✓	○	✓	Low	Reduced corner radius will aid in slowing turning vehicles. Channelization will increase sight distance.
Consolidate Brook Street approach to the east : Alternative 3				✓	○	✓	✓	○	✓	Low	Consolidation will reduce speeds of turning vehicles and increase sight distance.
Realign intersection : Alternative 4				✓	○	✓	✓	○	✗	Moderate-High	Relocation of roadway will improve sight distance to the AASHTO standards for 40 mph speed limit (increasing it to 355 feet)
Channelize Brook Street approach, channelize right-turns from Brook Street, vertical grade adjustment : Alternative 1				✓	○	✓	○	○	✓	Moderate	Vertical grade adjustment will increase sight distance.

- ✓ = Positive Impact
- = No Impact
- ✗ = Negative Impact
- = Deficiency

5

Recommended Improvements

The alternatives presented in Chapter 4 were narrowed down to a final improvement plan based on input from the public, the study's Advisory Committee and an engineering screening process. Action items were prioritized into immediate, short-term and long-term recommendations for implementation. Preliminary cost estimates were also developed to implement, construct or advance the recommendations to the next step. This chapter provides a complete description of each of the recommended actions. The timeline for the recommendations are as follows:

- Immediate Action Recommendation: 1-3 Years
- Short -Term Recommendation: 3-5 Years
- Long-Term Recommendation: 5-10 Years

The challenge facing Route 27 is to identify and provide the transportation infrastructure needed to support and enhance the town center, and maintain the historic characteristics of the Town. The proposed recommendations identify specific intersection enhancements and potential corridor-wide enhancements that will help improve the operations and safety for all users, while at the same time preserving the residential and historic nature of the area. Figure 15 presents a summary of the proposed improvements for the Route 27 corridor.

Intersection Enhancements

The following section describes in more detail the intersection enhancements chosen to improve safety and operations at key locations in the future. Some of the intersections have recommended plans that can be implemented over time and are, therefore, broken into immediate, short, and long-term improvements. Others are smaller improvements, recommended to be implemented in the immediate action timeframe. A summary of the level of service analysis conducted for each of the improvements, where appropriate, is presented in the Appendix.

Hayward Road

To reduce congestion and increase safety and operations at the intersection of Route 27 and Hayward Road, the following improvements are recommended to be implemented in the immediate action timeframe:

- Signalize intersection;
- Widen the Route 27 northbound approach to provide an exclusive left-turn lane and a through lane;
- Widen Route 27 southbound approach to extend the right-turn storage bay;
- Widen Hayward Road to provide two approach lanes; and
- Implement a coordinated signal system with the proposed Police / Fire Station.

These changes will improve operations to LOS A during the morning peak hour and LOS C during the evening peak hour and allow for coordination with a future signal at the site of the proposed Public Safety Facility. It is imperative that coordination between the improvements proposed at Hayward Road intersection and the site access associated with the proposed Police and Fire Station occur.

For the long-term improvements proposed for Hayward Road, refer to the following discussion under the Route 2 Ramps.

Route 2 Ramps

To help alleviate turning conflicts, accidents and projected vehicular delays at the Route 2 ramps, several improvement options were considered. These options can be implemented over time, addressing the most pressing concerns first.

Immediate Action

The immediate action improvements can be accomplished at a moderate cost and low impacts. The improvements suggested for immediate action include the following:

Route 2 Eastbound Ramps

- Signalize the intersection of Route 27 at the Route 2 eastbound ramps;
- Widen the southwest edge of Route 27 at the Route 2 eastbound ramps to provide for one southbound receiving lane and two northbound travel lanes;
- Restripe (within existing pavement) the Route 27 southbound approach to provide two receiving lanes for northbound traffic; and
- Install a crosswalk across the Route 27 southbound approach and the Route 2 eastbound ramp approach.

Observations and public input revealed that there is a safety and operational issue with vehicles attempting to enter and exit the driveway to the medical center which is currently offset from the Route 2 eastbound ramps. These movements could be better and safely accommodated if the driveway were relocated to the proposed traffic signal at the Route 2 eastbound ramps. As such the following is recommended:

- Relocate the Acton Medical Center driveway to opposite the eastbound ramps and operate under traffic signal control.

Route 2 Westbound Ramps

- Restripe the northbound Route 27 approach at the Route 2 westbound ramp to provide an exclusive right-turn lane and a through lane; and
- Widen the Route 27 southbound approach to provide an exclusive left-turn lane and a through lane.

These improvements are expected to significantly improve the operations of the eastbound ramp and ease congestion of the westbound ramp by redefining the intersection geometry and travel way. Upon implementation of these improvements, level of service at the intersection of Route 27 and the Route 2 Eastbound Ramps is expected to be at LOS A during the morning and evening peak hour under future 2010 conditions. As the design of this intersection is moved forward, coordination with the Kelley's Corner traffic signal should be considered.

In addition, the Route 2 westbound approach to the intersection of the Route 2 westbound ramps at Route 27 is expected to improve from LOS F to E during the morning peak hour and continue to operate at LOS F during the evening peak hour. The analysis however, does not take into account the fact that signalizing the eastbound ramps would help to create gaps for turning vehicles at the Route 2 westbound ramps (for vehicles making a left turn from Route 27 southbound onto the Route 2 westbound ramps and vehicles turning off of the Route 2 westbound ramps onto Route 27).

Short-Term Improvements

The short-term improvements can be accomplished in the near future at a moderate cost and slightly more implementation issues. The following recommended improvements are intended to build upon the improvements proposed in the immediate action recommendations.

Route 27 at the Route 2 Westbound Ramps

It is recommended that this intersection be monitored prior to moving forward with signalization of the westbound ramps to ensure that a traffic signal is warranted. Under the immediate action improvements, the signalization of the Route 2 eastbound ramps is expected to improve operations at the Route 2 westbound ramps by creating gaps in the Route 27 traffic flow. Consideration of the installation of a traffic signal at this intersection should take both the warrants and observed operations into account. With the signalization of Route 27 and the Route 2 westbound ramps the intersection operations are improved. If and when warranted, the following is recommended:

- Signalize the Route 2 westbound ramps.

With the installation of a traffic signal at the intersection of Route 27 and the Route 2 westbound ramps, the operation is expected to improve to LOS A and B during the morning and evening, respectively under future 2010 conditions. This assumes that under future signalization of the Route 2 ramps, these intersections are implemented as a coordinated system. As such, the intersection of Route 27 at the Route 2 eastbound ramps is expected to operate at LOS C and LOS B during the morning and evening peak hours, respectively with a coordinated system.

Long-Term Improvements (Route 2 Ramps/Hayward Road)

A long-term recommended plan was devised to ease traffic, particularly truck traffic, along Route 27 and at Hayward Road. This improvement directly affects the Route 2 westbound ramps intersection operations. The following is considered a long-term project due to the high cost and long time-frame associated with these proposed improvements. The following is a summary of the recommended long-term plan:

- Construct a service road, within the current Route 2 right-of-way to the maximum degree possible, providing a direct connection between the Route 2 westbound ramps and Hayward Road; and
- Widen the Route 27 southbound approach to provide an exclusive left-turn lane and a shared through-right lane as well as two receiving lanes for northbound traffic.

Construction of this service road will remove a majority of left-turns from Route 27 onto Hayward Road and move many of the existing conflicting movements to the traffic signal. The service road would also provide a more direct connection for the trucks currently destined for industrial uses along Hayward Road. This service road would provide a safer and more direct route for regional access (Route 2) for these trucks. It is anticipated that operations at the intersection of Route 27 and the Route 2 westbound ramps will operate at LOS B and D during the morning and evening peak hours, respectively. Again, this analysis considered the signals at the Route 2 westbound and eastbound ramps as a coordinated system. The Route 27 at

Route 2 eastbound ramps are projected to operate at LOS A during both peak periods, with the Route 2 westbound ramp intersection controlling the coordinated system.

A preliminary review of the projected operations of the new intersection of the Service Road and Hayward Road would be controlled with a stop sign on the Service Road. One lane would be provided on all of the approaches. Operations at the intersection of the Service Road with Hayward Road is expected to be LOS B and C during the morning and evening peak hours, respectively.

Town Center

To improve safety and operations at the Town Center, the following short-term action plan is recommended:

- Signalize the intersection of Route 27 and Newtown Road;
- Widen the northbound approach to allow vehicles to go around left-turning vehicles;
- Improve signage along Route 27 (on the north side of the triangle) for Concord Road;
- Restrict left turns from Route 27 southbound onto Concord Road at Newtown Road (these vehicles would be accommodated at the northern leg of the Town Center triangle);
- Restrict right turns from Concord Road at Newtown Road onto Route 27 (these vehicles would be accommodated at the north leg of the Town Center triangle); and
- Install crosswalks on all approaches of the intersection.

The volume of Route 27 northbound left turns onto Newtown Road is not enough to warrant their own lane, however, it is important to provide enough room for Route 27 northbound through vehicles to go around these left turning vehicles. If this area is not provided, long delays to the northbound approach would most likely be incurred. Upon implementation of the above listed improvements, operations at the intersection of Route 27 and Newtown Road and Concord Road are expected to be LOS B during the morning peak hour and LOS C during the evening peak hour under future 2010 conditions.

Post Office Square

The existing geometry at Route 27 / Post Office Square / Acton Place is expected to accommodate the projected future 2010 volumes. As volumes increase on Route 27, Post Office Square and Acton Place, however, the existing signalized intersection should be monitored for possible retiming of the traffic signal. With minor signal timing adjustments, the intersection of Route 27 at Post Office Square is expected to operate at LOS B during the morning peak hour and LOS D during the evening peak hour under future 2010 conditions.

Brook Street

The following is recommended as a short-term action to ease sight distance issues and to clarify right of way at the intersection of Brook Street, increasing the overall safety of the intersection.

- Channelize vehicles on Brook Street approach as one way on each side of the island; and
- Reduce corner radius and expand island.

As any roadway construction occurs on Route 27, future consideration should also be given to reducing the vertical curvature on Route 27 south of Brook Street to further improve the sight distance along this segment of the corridor.

Coughlin Street

Coughlin Street is one way eastbound, heading away from Route 27. Currently there is a fairly wide expanse of pavement on the Coughlin Street leg and there is an opportunity to reduce the corner radius on the southeast corner. It is proposed to tighten the right turn radius from Route 27 northbound onto Coughlin Street. This reduction in the radius serves two purposes: it would slow vehicles making a right turn from Route 27 northbound onto Coughlin Street and would enhance pedestrian safety by reducing the crossing distance for pedestrians.

Corridor- Wide Enhancements

The following is a summary of corridor-wide enhancements that are proposed to increase safety and improve operations of the Route 27 corridor, while maintaining the characteristics and nature of the area.

Gateways

It is recommended that gateways be constructed on Route 27 at the entrances to Acton Centre's Historic District. The northbound gateway should be located just to the north of Taylor Road, consistent with the historic district boundary. The southbound gateway should be located just to the south of Nagog Hill Road. A gateway treatment is presented in a rendering in Figure 16 and is also shown on the accompanying poster. The gateway can consist of landscaping, period (historic) lighting, aesthetic signage or a monument (such as those presented in the rendering that captures and reproduces the historic monument that exists within the Town Center island). These gateways are important to create a sense of place and alert motorists to slow because they are entering the village center. The gateways also begin to help bring the Route 27 corridor to a pedestrian scale where all users can take advantage of Acton's Town Centre.

Corridor Wide Sidewalks

The sidewalk system proposed along Route 27 is suggested in order to provide an environment that promotes walking through this area. The priority system proposed for the installation of the sidewalks is consistent with the goal of providing a continuous sidewalk on at least one side of Route 27 for its length between the Route 2 ramps north to Route 2A. This goal addresses many of the issues raised in wanting improved accessibility along Route 27, specifically to the North Acton Recreational Area located further north on Route 27. The sidewalks should contribute to the character of both the Route 27 neighborhood and the Acton Centre's Historic District and strengthen their identity.

To increase pedestrian safety it is recommended that a continuous sidewalk on at least one side of the roadway be constructed within the study area. As shown in Figure 17, six sidewalk links are identified and prioritized for construction. The recommended priority will allow for continuous sidewalk throughout the study area and then for filling missing links as funding becomes available.

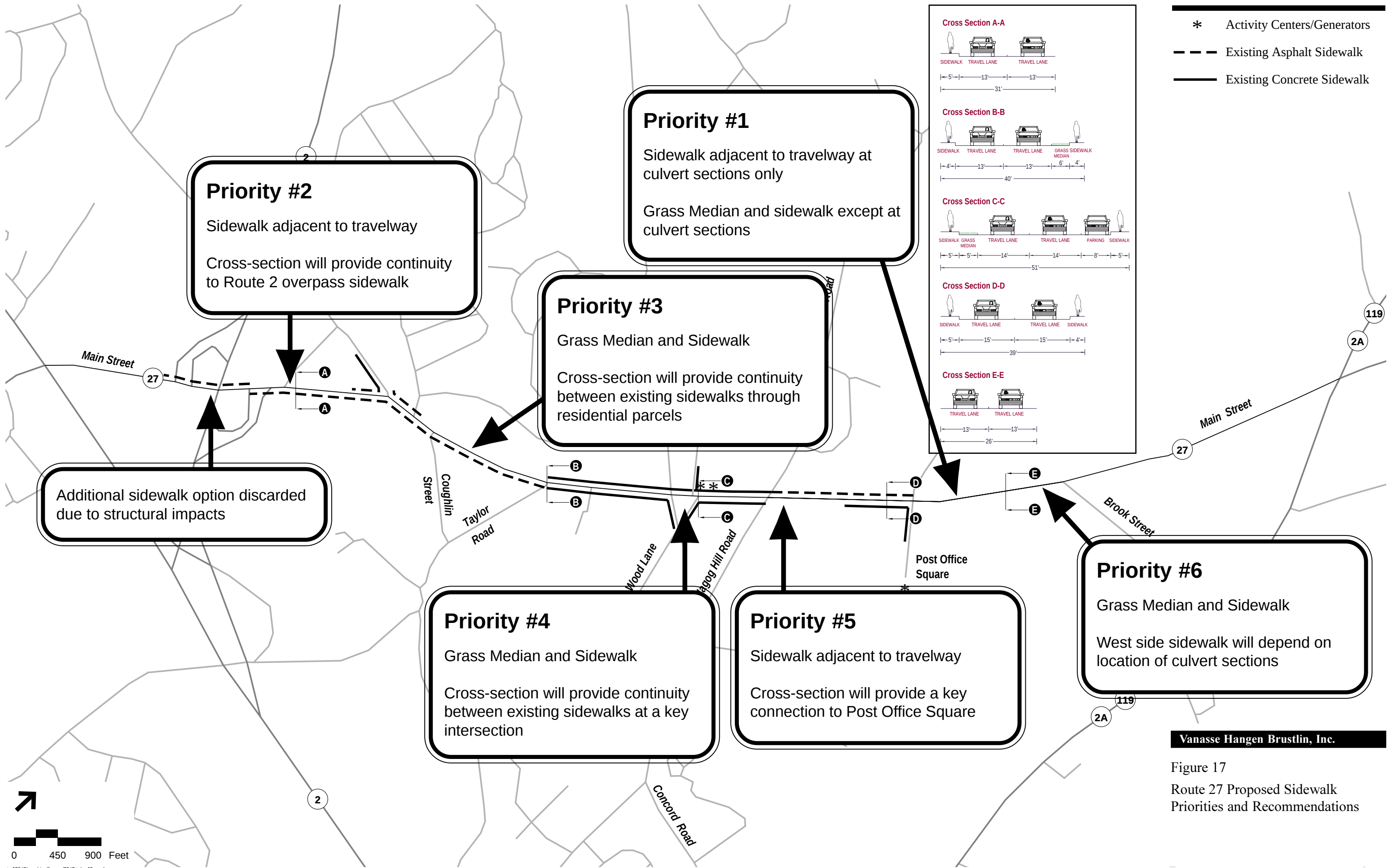
Historic District Northbound (North of Taylor Road)



Historic District Southbound (North of Nagog Hill Road)



Vanasse Hangen Brustlin, Inc.



Vanasse Hangen Brustlin, Inc.

Figure 17
Route 27 Proposed Sidewalk
Priorities and Recommendations

The goal in the design of the sidewalks should be to provide a buffer zone between the sidewalk and the edge of the roadway. Where possible, it is suggested to install, at a minimum, a five-foot wide sidewalk with grass strip (at a minimum of 3 feet wide) between the sidewalk and the curb / edge of the roadway. Separating pedestrians from the travel lanes greatly increases their comfort as they use the sidewalks. As the design of the sidewalks along Route 27 progresses, this goal should be maintained and implemented wherever possible. The proposed sidewalks, for the most part, are located within the public right-of-way.

Sidewalk Material

The plan recommends the construction of sidewalks continue with the existing sidewalk materials that are currently used for the Route 27 corridor. Specifically, outside of Acton Centre's Historic District, the sidewalks should consist of bituminous concrete. Within the Historic District, the sidewalks should be constructed of concrete.

The use of curbs is also recommended to help to define the pedestrian environment within the streetscape. Where bituminous concrete is used, sloped granite curbing installed at a 60 degree angle is recommended with a curb height of no less than six inches. Where concrete is used, vertical granite curbing is recommended as concrete breakage has been noticed with the use of sloped granite in this situation.

Crosswalks

Crosswalks are a critical element of the pedestrian network. It is of little use to have a complete sidewalk system if pedestrians cannot safely and conveniently cross the intervening streets. It is important that it is clear where pedestrians should cross, that the crosswalks are visible to approaching traffic, and that the crossings are located at convenient locations. It is suggested that different crosswalks be installed within the historic district along Route 27 than those outside the district. This is suggested, again, to reinforce the sense of place within the historic district and to help make drivers aware that they are driving through a different area.

Midblock crossings are suggested at the following locations along the Route 27 corridor (some of these locations may already exist and need to be upgraded to the standards suggested herein):

- North of the Route 2 eastbound ramps
- North of the Route 2 westbound ramps
- South of Hayward Road
- South of Musket Drive
- North of Taylor Road

- South of Newtown Road
- North of Newtown Road
- North of Woodbury Lane
- South of Nagog Hill Road
- South of Post Office Square
- North of Post Office Square
- North of Brook Street

Based on the final recommended improvement plan, some of these crossings will be signalized. Installation / upgrading of these crosswalks should move forward independent of the intersection improvements, particularly at Newtown Road and Woodbury Lane.

These crossings have been located in areas where there is a logical pedestrian travel pattern. Consistent crosswalk treatment helps drivers recognize that heavy pedestrian areas exist along the study area corridor. Outside Acton's Town Centre, "zebra striped" crosswalks are recommended at all current crosswalk locations. Inside the Town Centre pre-cast pavers made to look like brick with granite block edges and painted lines marking the outer boundaries are recommended to increase safety for pedestrians.

Crosswalk Signage

It is recommended that the existing signage associated with mid-block crosswalks be replaced with the more visible yellow-green pedestrian warning signs (W11-2) with a distance marker indicating the distance to the mid-block crossing location. These signs should be posted to give enough advance notice for approaching vehicles to stop, a minimum of 200 feet in advance of the crosswalk.

At each mid-block crossing, a yellow-green crosswalk (W11A-2) sign is also recommended. It is important to maintain a consistent signage treatment for the midblock crossings throughout the corridor so that motorists are aware and prepared for them.

Crosswalk ADA Standards

All crosswalks built in the future along Route 27 should be consistent with current ADA standards. All curb ramps should be consistent with the ADA standards.

Other Crosswalks Improvements

Traffic Signals

As the traffic signals move forward to the design stage priority for the pedestrians should be considered for the signal timing, particularly within Acton Centre due to heavier pedestrian activity. All signals should be designed with pedestrian detection with a pedestrian push button.

Traffic signals help pedestrians cross the street by providing a controlled crossing at the signalized intersection. In addition, these signals provide gaps in traffic flow for pedestrian attempting to cross down the road from the signalized intersection. It is anticipated that as the traffic signals suggested as part of the recommended improvement plan for Route 27 are installed this will help pedestrians cross Route 27.

Lighting

Although lighting exists along the Route 27 corridor, the plan proposes to change the scale and look of the lighting along the corridor. There are several options for lighting and the recommendation to move forward will depend on the funding that is obtained for subsequent stages of this project. The options are as follows and increase in scale and cost:

1. Bury the overhead wires and install ornamental lighting. At a preliminary level 16-foot poles are proposed on both sides of the road at a distance of approximately 75 feet from center to center. One suggestions would be to use acorn lights on fluted, coated poles. An option is to use house side shields within the luminaires in sensitive areas such as residences. Installation of these light could be phased with focusing on the historic district first and then extending beyond the historic district from Kelley's Corner up to Route 2A. The estimated cost of this would be \$5,000-\$6,000 per light pole including installation / wiring. This would break down to \$360,000 to \$430,000 for the historic district and \$1.5 to \$1.8 million for the extension to Kelley's Corner and Route 2A for a total of approximately \$1.9 to \$2.2 million. This does not include the cost to bury the existing overhead wiring. Based on discussions with Town officials, the approximate cost to underground utilities between Newtown Road and Nagog Hill Road is an additional \$700,000.
2. Install ornamental pedestrian scale lighting at each of the midblock crossings as well as at the gateway locations. This lighting could include antique street lamps that have a square shaped luminaire and would be installed on both sides of the road at crosswalks. The estimated cost would be approximately \$4,000-5,000 per light including the installation / wiring. With 12 midblock crossings and two gateways the cost is estimated to be approximately \$100,000 to \$150,000.

Within the historic district the lighting is suggested to be consistent and match the historic nature of the area. This lighting should complement or mirror the lighting proposed at the gateways to Acton's Town Centre Historic District. A sample of period lighting that could be used along Route 27 is presented in the Appendix.

Enforcement

Increased enforcement along Route 27 is recommended as a deterrent to speeding and illegal motor vehicle operations. While increased enforcement would help improve the Route 27 environment for residents and visitors, it is recognized that staffing and funding is necessary before current activities can be significantly expanded.

Signage

Signage should be used to aid unfamiliar drivers in navigating the roadway system. Some of the improvements described above include changing signage to better direct traffic flow and increase driver awareness of speed and pedestrian and bicycle conflicts. The specifics are discussed in the crosswalk section and within the presentation of the recommended intersection improvements.

Mailbox Locations

Many residents raised concern over having to cross Route 27 in order to get their mail. All mailboxes are currently located on the west side of Route 27 and, therefore, anyone living on the east side must cross the street to get their mail. It is suggested that residents raise this issue with the local post office through a petition. It should be noted that the traffic signals suggested as part of the recommended improvement plan for Route 27 are expected to create better opportunities for pedestrians to cross Route 27.

Implementation Priority

The 1998 Town of Acton Master Plan Update recognized the need for improvements through the Route 27 corridor. Table 18 presents the intersections recognized and the priority given by the town.

Table 18
Improvement Recommendation Priority
(from the 1998 Master Plan)

Intersection	Priority
Route 27 at Route 2	High
Route 27 at Newtown Road	High to Medium
Route 27 at Hayward	Medium
Route 27 at Brook	Medium
Route 27 at Taylor	Medium

This plan incorporates the same prioritization when considering implementation of the Route 27 improvements. The Town also already has a detailed sidewalk capital plan. The link identified as Priority 1 on Figure 17 is listed as number nine in the capital plan. No other link is found on the list.

A summary of the recommended improvement plan and a breakdown of the prioritization of the recommendations into immediate, short-term and long-term improvements is presented in Table 19. The prioritization has been further clarified in Figure 18 which presents a flow chart of the recommended actions to be taken by the Town and is briefly summarized below.

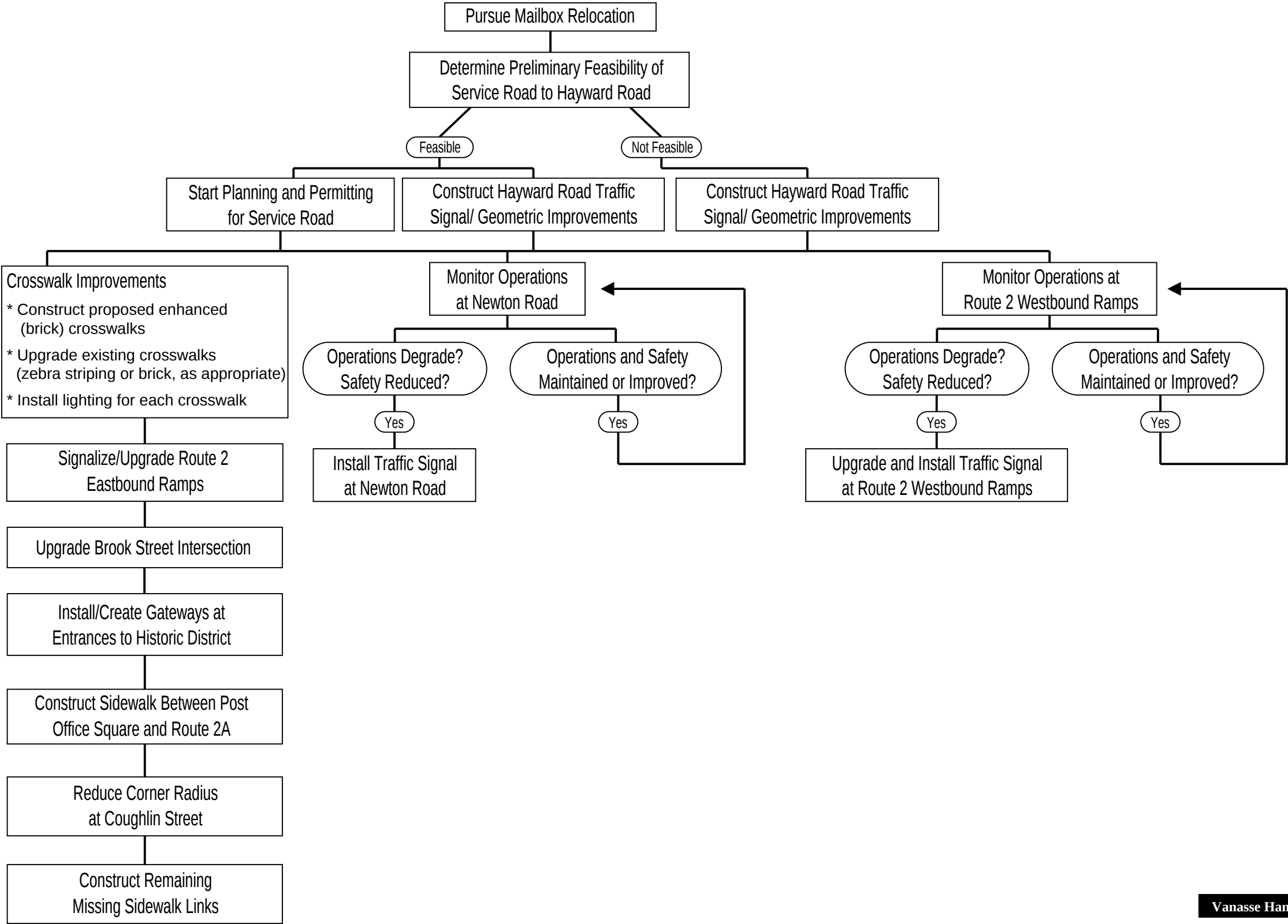
Immediate Actions

As laid out in this plan the first priority is to pursue the relocation of the mailboxes along Route 27 to correspond with the side of the residence or business. Following this measure it is proposed to conduct a preliminary feasibility study of the service road from Route 27 to Hayward Road. Because it is expected that the planning, permitting, design and construction of such an effort could possibly take between 10 and 20 years (or even longer depending on the funding and permitting), it is suggested to construct the Hayward Road traffic signal improvements regardless of the feasibility of this service road.

2001

Time Frame

2011



Vanasse Hangen Brustlin, Inc.

Figure 18
Prioritization of Main Street
(Route 27)
Corridor Improvement Project

Due to the historic nature of the Town Centre it is proposed to monitor the operations and safety at the intersection of Newtown Road with the installation of a traffic signal at Hayward Road. The traffic signal at Hayward could help alleviate the delays to vehicles exiting the side streets within the center. At the point that operations continue to degrade and /or the safety is reduced it is proposed to consider the installation of a traffic signal at Newtown Road to ease operations and improve safety.

Following the installation of the traffic signal at Hayward Road it is suggested to implement the proposed crosswalk improvements including: enhanced (brick) crosswalks, upgrade existing crosswalks to either zebra striped or brick, as appropriate, install lighting and signage, as appropriate. The next item to address would be the operations at the Route 2 eastbound ramps. It is suggested to signalize the intersection of Route 2 at Route 27 and upgrade the geometry. This improvement also includes the possible relocation of the existing Acton Medical Center driveway. Geometric upgrades to the Route 2 westbound ramps is also suggested. As part of signalizing the Route 2 eastbound ramps the operations of the westbound ramps should be monitored for possible future signalization.

Short-Term Actions

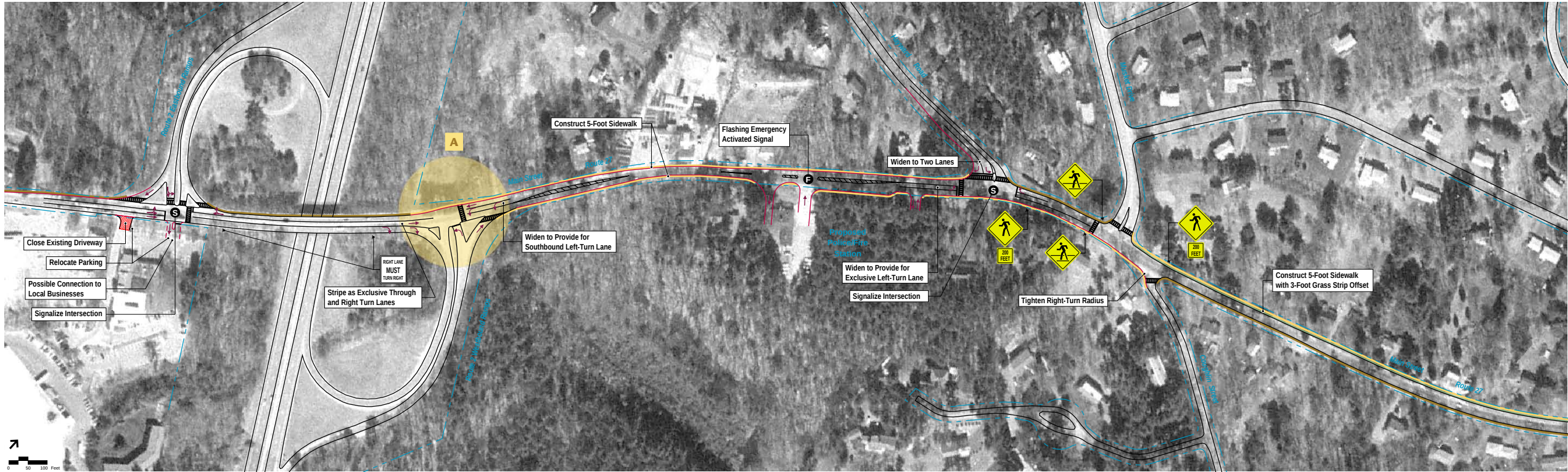
As discussed above, the improvements proposed for intersection of Newtown Road and the Route 2 westbound ramps could happen at any point in time, depending on the operations. Following the signalization of the Route 2 ramps the following are recommended:

- Upgrade the Brook Street intersection.
- Install or create the gateways at the entrances to the Historic District in order to increase drive awareness.
- Construct a sidewalk between Post Office Square and Route 2A. Construction of a sidewalk on this section would fill the missing link along the entire Route 27 corridor and would provide a sidewalk on at least one side of Route 27 from the Route 2 ramps all the way to Route 2A . Through the public process, this was clearly raised as the highest priority in the missing sidewalk links.
- Reduce the corner radius at Coughlin Street.
- Construct the remaining missing sidewalks links as funding becomes available which may bring them further along in the process. For instance, as the improvement for the Hayward Road intersection or the Route 2 Westbound ramp intersection move forward the proposed sidewalks should be considered in concert with these improvements.

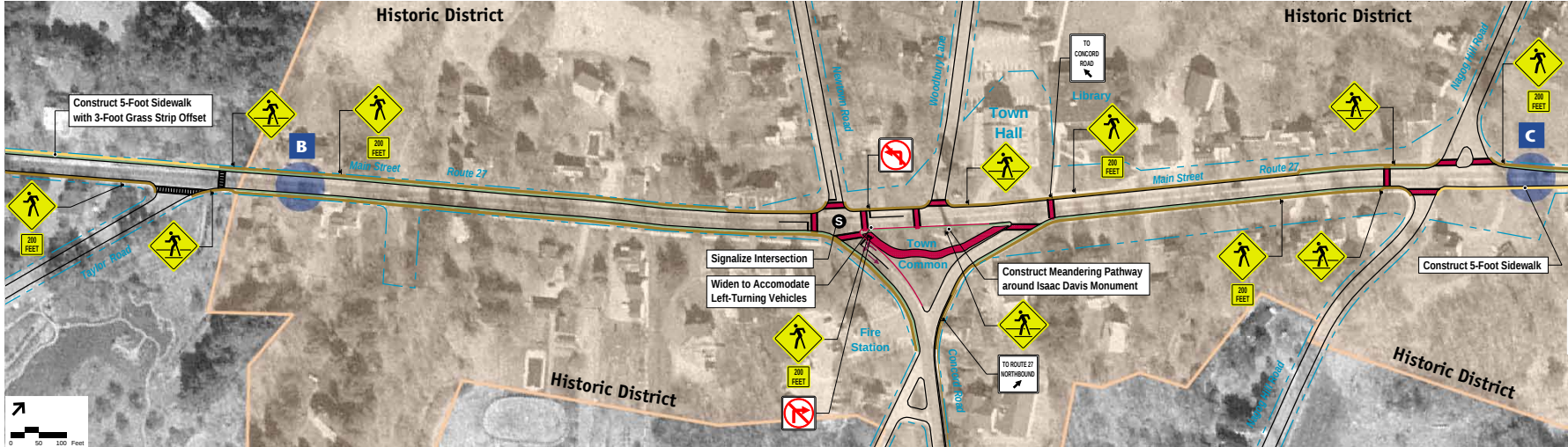
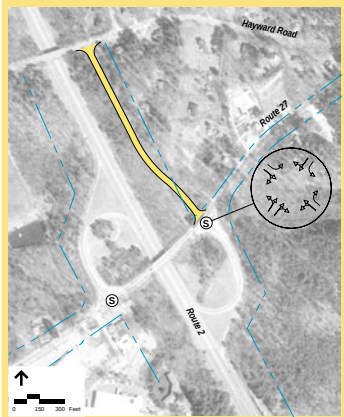
Long-Term Actions

Although the feasibility, planning and permitting for the Hayward Road service road are proposed to be pursued under the immediate action items, it is recognized that this improvement will most likely take many years to implement and should be considered a long term solution. Another long term action is to reduce the crest of the vertical curve on Route 27 northbound at it approaches the Brook Street intersection.

Crosswalk and lane restriping should be done on an as-needed basis, following the same priority as repavement of the corridor. Lighting and signage should also be addressed as needed and correspond to the crosswalk upgrades.



A :: Long Term Improvements: Service Road to Hayward Road



B :: Historic District Northbound

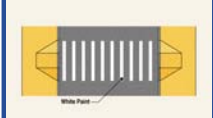


C :: Historic District Southbound

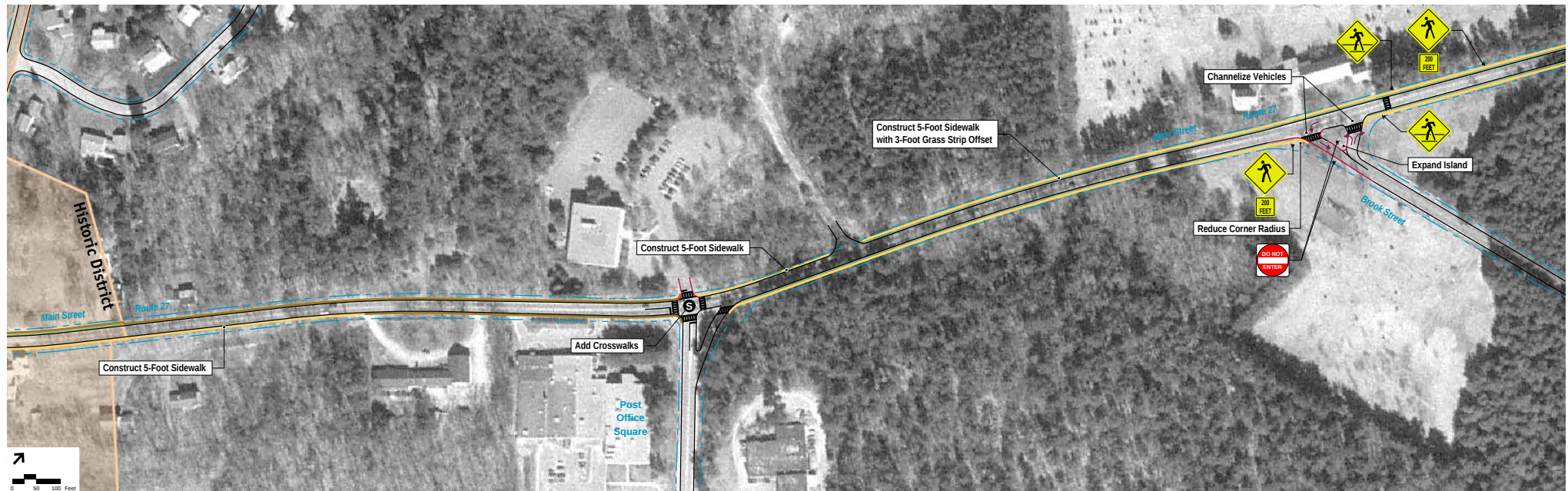
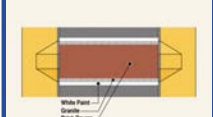


Pedestrian Crossings

Outside Historic District



Historic District



Legend

- Existing Pavement
- Widening
- Existing Sidewalk
- Proposed Sidewalk
- Right-of-Way
- Brick Crosswalk
- Ⓢ Signalized Intersection
- ⓕ Flashing Emergency Activated Signal
- Prominent Gateway
- Historic District
- Long Term Improvement

Main Street (Route 27)

Corridor Improvement Project

Figure 15

Prepared for:
Town of Acton

Prepared by:
VHB/Vanassee Hangen Brustlin, Inc

January 2001

Table 19
Main Street (Route 27) Recommended Improvement Plan

Immediate Actions (2001-2004)		
Project	Description	Investment*
Hayward Road	Signalize intersection. Widen Route 27 northbound approach to provide an exclusive left-turn lane and a through lane. Widen Route 27 southbound approach to provide a longer right-turn storage bay. Widen Hayward Road to provide two approach lanes.	\$350,000
Route 2 Eastbound Ramps	-Signalize intersection of Route 2 eastbound ramps at Route 27. Widen Route 27 northbound approach to provide two lanes. Restripe (within existing pavement) Route 27 southbound approach to provide two receiving lanes for northbound traffic.	\$250,000
	-Relocate existing driveway (Acton Medical Center) on east side of Route 27 to connect to proposed signal.	\$150,000
Route 2 Westbound Ramps	Restripe northbound approach to provide an exclusive right-turn lane and a through lane. Widen Route 27 southbound approach to provide an exclusive left-turn lane and a through lane.	\$95,000
Crosswalks		
Mid-Block Crosswalks	-Install yellow-green pedestrian signage at all mid-block pedestrian crossings. Install W11-2 at crossings and W11-A2 with "200 feet" sign as advance warning signs.	Painted \$1,200/each Brick \$4,500/each
	-Install lower pedestrian-scale lighting at all pedestrian crossings.	\$5,000/light
Crosswalks outside of Acton Centre's Historic District	Paint crosswalks (zebra striped) outside the historic district.	\$400/each
Crosswalks within Acton Centre's Historic District	Construct crosswalks within the historic district using brick pavers with granite edges. Stripe outside using white thermoplastic lines.	\$3750/each
Sidewalks		
East or west side of Route 27 - Between Route 2A/119 and Post Office Square	Implement Priority #1 - Grass median and five foot sidewalk except at culvert sections.	\$270,000
West side of Route 27 - Between Hayward Road and Route 2 Ramps	Implement Priority #2 - Five foot sidewalk adjacent to travelway.	\$17,000**

Short-Term Actions (2004-2011)		
Project	Description	Investment*
Route 2 Westbound Ramps	Monitor Route 27/Route 2 Westbound ramp intersection for possible future signalization.	N/A
Newtown/Concord Road	Signalize intersection. Widen northbound approach to allow through vehicles to go around left turning vehicles. Improve signage on Route 27 southbound directing motorists towards Concord Road.	\$250,000
	Monitor operations/ increase in volumes and retime traffic signal accordingly.	N/A
Brook Street	Channelize Brook Street approach, one way on each side of the island. Reduce corner radius and expand island.	\$30,000
Acton Centre's Historic District Gateways	Construct gateways at the northern and southern entrances on Route 27 into Acton Centre's Historic District.	\$10,000-100,000/each
Musket Drive/Coughlin Street	Tighten right-turn radius onto Coughlin Street.	\$3,500
Crosswalks outside of Acton Centre's Historic District	Maintain painting crosswalks (zebra striped) outside the historic district.	\$400/each
Crosswalks within Acton Centre's Historic District	Continue the construction of crosswalks within the historic district using brick pavers with granite edges. Stripe outside using white thermoplastic lines.	\$3750/each
West side of Route 27 - Between Taylor Road and Musket Drive	Implement Priority #3 - Grass median and five foot sidewalk.	\$60,000

Long-Term Actions (Beyond 2011)		
Project	Description	Investment*
Route 2 Westbound Ramps	Construct service road to Hayward Road. Signalize intersection of Route 2 westbound ramps at Route 27. (includes estimate for planning, permitting, design, ROW acquisition and construction)	\$1,100,000
Brook Street	Reduce crest/vertical curve on Route 27 northbound as it approaches the Brook Street intersection to increase sight distance.	\$60,000
Crosswalks outside of Acton Centre's Historic District	Maintain painting crosswalks (zebra striped) outside the historic district.	\$400/each
Crosswalks within Acton Centre's Historic District	Continue the construction of crosswalks within the historic district using brick pavers with granite edges. Stripe outside using white thermoplastic lines.	\$3750/each
East side of Route 27 - Between Newton Road and north branch of Concord Road.	Implement Priority #4 - Grass median and meandering five foot sidewalk.	\$6,000**
East side of Route 27 - Between Nagog Hill Road and Post Office Square	Implement Priority #5 - Five foot sidewalk adjacent to travelway.	\$32,000

* Represents preliminary estimated design and construction costs. No utility lowering assumed, no takings or easements included, no drainage improvements included
** Survey & curbing included in intersection improvements