Main Street Traffic Calming Study - Plaistow, NH

April, 2011

Prepared for the Town of Plaistow by The Rockingham Planning Commission

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Introduction

By definition, a "Main Street" is a highway with mixed functions that is not just a channel for vehicular traffic but a destination in its own right. Main Streets in general are highways that travel through areas of mixed uses including residential, commercial, and civic and these generate bicycle and pedestrian traffic in addition to motor vehicles making inclusion of facilities for those users important. Usually aesthetics, historic and cultural features, and the streetscape are of primary importance as well. Main Street in Plaistow touches upon many of the components of the definition of a classic Main Street and the intent of this study is to determine ways to enhance that aspect of the corridor by improving the transportation environment on the corridor. Main Street in Plaistow (NH 121A) extends approximately 5 miles through the town connecting from Hampstead in the Northwest to the state line with Massachusetts and the City of Haverhill in the south. For the purposes of this study, the focus will be primarily on the approximately 3 mile long portion of the corridor known as South Main Street that lies between the state line, and where the roadway crosses NH 125 and becomes North Main Street.

In addition to the overall goal of enhancing Main Street as a destination within the town of Plaistow, there are some more specific transportation related objectives of the study and areas where recommendations will be offered:

1. Reducing vehicle speeds on Main Street
2. Improving the environment for pedestrians and cyclists
3. Redirect heavy vehicles to utilize NH 125 where possible
4. Enhance the aesthetics of the corridor

Study Process

The Main Street study started with data collection efforts to gather traffic volume and classification information, accident statistics, and vehicle speeds. Following data collection, the collected information was summarized and analyzed to draw out the relevant data and to establish any patterns. At the same time, discussions were held with the Plaistow Highway Safety Committee regarding traffic calming measures and determining what aspects might fit best on Main Street. Once the analysis was completed, development of the draft study report began as a point for beginning discussion of recommendations for the corridor.

Issues and Opportunities

There are a number of traffic problems that occur on Main Street and provide the motivation to make improvements that will further the "New England village" character of the community and create a more pedestrian and resident friendly town center for Plaistow. While these problems exist, there are also a number of opportunities that can aid the town in implementing changes. These issues and opportunities are discussed below.

Issue: Truck Traffic on Main Street

The traffic volume and vehicle classification counts have confirmed the anecdotal evidence that there are significant numbers of trucks utilizing Main Street to avoid the existing signals on Route 125 in both Plaistow and Haverhill. Trucks account for 6-8% of total traffic on Main Street with much heavier northbound volume than southbound. It is expected that since the number of signals will be increasing as NH 125 is reconstructed Main Street will continue to be an attractive route for trucks.

Issue: Main Street as a shortcut for commuters

Traffic patterns show that there is a significant use of Main Street during AM and PM peak commuter periods and like the truck traffic, much of it is likely done to avoid congestion and the traffic signals on NH 125. There are also significant residential developments that access Main Street and many residents must use it to travel to work.

Issue: Construction on NH 125

There are concerns that during the reconstruction of NH 125 that will be continuing for a number of years, traffic will shift to Main Street and not go back to NH 125 once construction is complete. This is certainly of great concern during the next few years as construction will be occurring in locations easily circumvented by utilizing Main Street, and depending on how well the ultimate build of NH 125 manages traffic, it may continue to be an issue in the future.

Issue: Speeding on Main Street

Anecdotal evidence is that many of the motor vehicles utilizing Main Street are exceeding the posted speed limit and contributing to dangerous conditions along the corridor.

Opportunity: Community Anchors

The village district in Plaistow has a vital advantage over many other communities in that the "town center" is already in place and features a number of community anchor facilities that can help to form the basis for village style development on the corridor. Included in this category are the Elementary School, Town Hall, the Town Green, Library, Recreation Fields, Safety Complex, Courts, and the US Post Office.

Opportunity: Main Street is NOT the only Street

While Main Street carries a significant amount of traffic, it is not the primary route through Plaistow, and that gives the community and NH DOT additional flexibility in how the roadway is designed and traffic is managed.

Opportunity: Intermodal Center

The location of the Park and Ride and the potential for MBTA service from that location is a potential opportunity for the community and for the village to provide goods, services, employment opportunities, and potentially housing within a walkable distance.

Existing Conditions

The existing conditions analysis will summarize the current state of land use, zoning, and traffic conditions on the corridor. This provides a basis for the development of recommendations and provides a comparison point for different types of analysis on the intersections.

Land Use and Zoning

Much of the property frontage on South Main Street is zoned as Commercial II (C-II). North of the train crossing, the zoning transitions into Medium Density Residential (MDR), then transitions again into Commercial I (C-I) as South Main Street approaches Route 125. In addition, the region from Ingalls Terrace south to approximately Bittersweet Drive has been zoned with a Village Center (VC) overlay district. Table 1 summarizes some of the dimensional requirements for these four zones.

The C-II zone is the predominant designation along the roadway and examples of permitted uses include small retail (2,000 ft^2/lot), places of worship, business and professional office, public safety and service uses, as well as single and multi-family housing. The Village Center Overlay changes the underlying C-II zone by permitting Mixed-Use with the limitation that the buildings must be owner-occupied and may have rental units and/or a commercial operation. The dimensional standards for the Village Center district do not differ from the C-II zone and are similar to those of the MDR zone as well except for the maximum lot coverage which is slightly higher in the VC zone.

Table 1: Selected Dimensional Requirements for Land Use Zones on Main Street

	MDR	C-I	C-II	VC
Minimum Lot Size	40,000 ft^2	80,000 ft^2	40,000 ft^2	40,000 ft^2
Minimum Frontage	150 ft	150 ft	150 ft	150 ft
Maximum Lot Coverage	20%	75%	30%	30%
Maximum Height	45’ or 3 Stories whichever is less			
Minimum Setback	None	50’ from property line	None	None
Mixed Use Allowed?	No	No	No	Yes, Owner-Occupied


Main Street Near Library

North of the Village Center overlay area, much of the frontage along South Main Street is zoned as Medium Density Residential (MDR). This zone permits the construction of single-family and duplex units on lots 40,000 square feet or more. Article VI of the Town's Zoning Ordinance provides for the development of Planned Residential Developments (PRD), which also allows multi-family units and manufactured housing. South of the Village Center, the roadway transitions back to the C-II zone before transitioning to the C-I zone close to the NH 125 corridor. The C-I zone has similar dimensional requirements as well although setbacks are required (50' from property line) and minimum lot size (80,000 ft^2) and maximum lot coverage (75%) are much bigger.

There are no special parking requirements for the zones along the corridor beyond those required for all zones. All uses must construct a required minimum amount of off –street parking, and parking for any mixed use development must total the required amount for each use individually.

As Main Street is a state highway, driveway access is controlled and permitted by NH DOT according to state standards. Town Subdivision Regulations require that the preference is for a single driveway per parcel and if more than that is necessary the number should be kept to a minimum. The town has no dimensional requirements for driveways.


Main Street near Elm Street

Plaistow Master Plan

The community Master Plan states a desire to see the Village Center area reflect a "New England village" town center with the current uses enhanced with additional uses and an aesthetically pleasing, pedestrian-oriented environment. It is desired that the Village Center have relatively intense land use on lots ranging from 10,000 ft^2 to 40,000 ft^2 as well as higher lot coverage allowances (65%). Uses are intended to include a mixture of single and multi-family housing, retail and service businesses, professional offices, public uses, small bed and breakfast establishments and other uses. Development is expected to adhere to architectural design and landscape standards that reflect this arrangement.


Main Street at Pollard School

The remainder of the Main Street corridor is desired to become more pedestrian oriented and develop uses that can be accessible by both car and foot. Use is expected to be somewhat less dense than the Town Center with a minimum lot size of 20,000 ft2 and smaller coverage allowances of no more than 50% for commercial activities and 30% for residential uses. Building placement should be such that helps to maintain the small town character of Plaistow.

Traffic Volumes

Traffic volumes were collected at five locations along the corridor during September, 2009. Data was collected from Monday 9/14/2009 to Monday 9/21/2009 with the data for the two Mondays not being included in the analysis as the counters were active for only part of those days. All of the counts were directional (northbound and southbound) and in three locations, vehicle classification information was collected as well.

	Weekday Average			**Saturday**			**Sunday**		
	NB	SB	**Total**	NB	SB	**Total**	NB	SB	**Total**
Between NH 125 & North	5291	5214	***10506***	5676	5162	***10838***	4475	3919	***8394***
Between North & Pine	6994	6879	***13873***	6128	5978	***12106***	4700	4543	***9243***
Between Forest & Westville	6484	6183	***12666***	5601	5217	***10818***	4214	4005	***8219***
Between Westville & Elm	6055	5218	***11274***	5053	5156	***10209***	3999	3910	***7909***
North of RR Tracks	4031	3950	***7981***	3164	3044	***6208***	2351	2335	***4686***
Corridor Average	**5771**	**5489**	***11260***	**5124**	**4911**	***10036***	**3948**	**3742**	***7690***

As seen in ***Table 2***, average weekday traffic ranges from almost 8,000 vehicles per day on the northern end of the study area to nearly 14,000 vehicles per day in the center of the corridor and dropping back down somewhat at the southern end of the corridor to approximately 10,500 vehicles per day. Volumes are well balanced between north and southbound traffic with a slight weight towards northbound volumes at 51% of the total. The exception to this is the weekday traffic between Westville Road and Elm Street which shows a much larger differentiation between northbound (54%) than southbound (46%) traffic. In general, weekday average traffic is higher than weekend traffic with the exception of the very southerly end of the corridor between NH 125 and North Avenue which shows slightly higher Saturday volumes.

Figure 1 examines the hourly volumes along the corridor in more detail. Main Street shows a significant weekday AM peak period southbound in the morning between approximately 7:00 and 9:00AM, and no defined northbound peak during that same timeframe. Northbound traffic shows a long peak period in the afternoon between about 3:00 and 7:00 PM during which time over 1/3 (38%) of the total average daily northbound traffic travels the roadway. There is a southbound afternoon peak during the same time period however the total volume of traffic is much lower in that direction. Weekend traffic shows a more mid-day orientation as southbound traffic peaks during the 11:00 AM and 12:00 PM hour and northbound peaks between 12:00 and 1:00 PM. Overall volumes during that time of day are higher than the equivalent time frame on weekdays reflecting the varied use of Main Street as a commuter corridor as well as for access to shopping and services.

Figure 2 provides additional site level detail as well as showing the different patterns between weekdays and Saturdays along the corridor. Sunday, which is not shown in graphic form, has a pattern of traffic very similar to Saturday with lower volumes. Figure 2 shows commuter peaks in the AM and PM for all five sites on weekdays with both ends of the corridor showing less peaking than

Figure 1: Comparison of Weekday and Weekend Directional Volumes

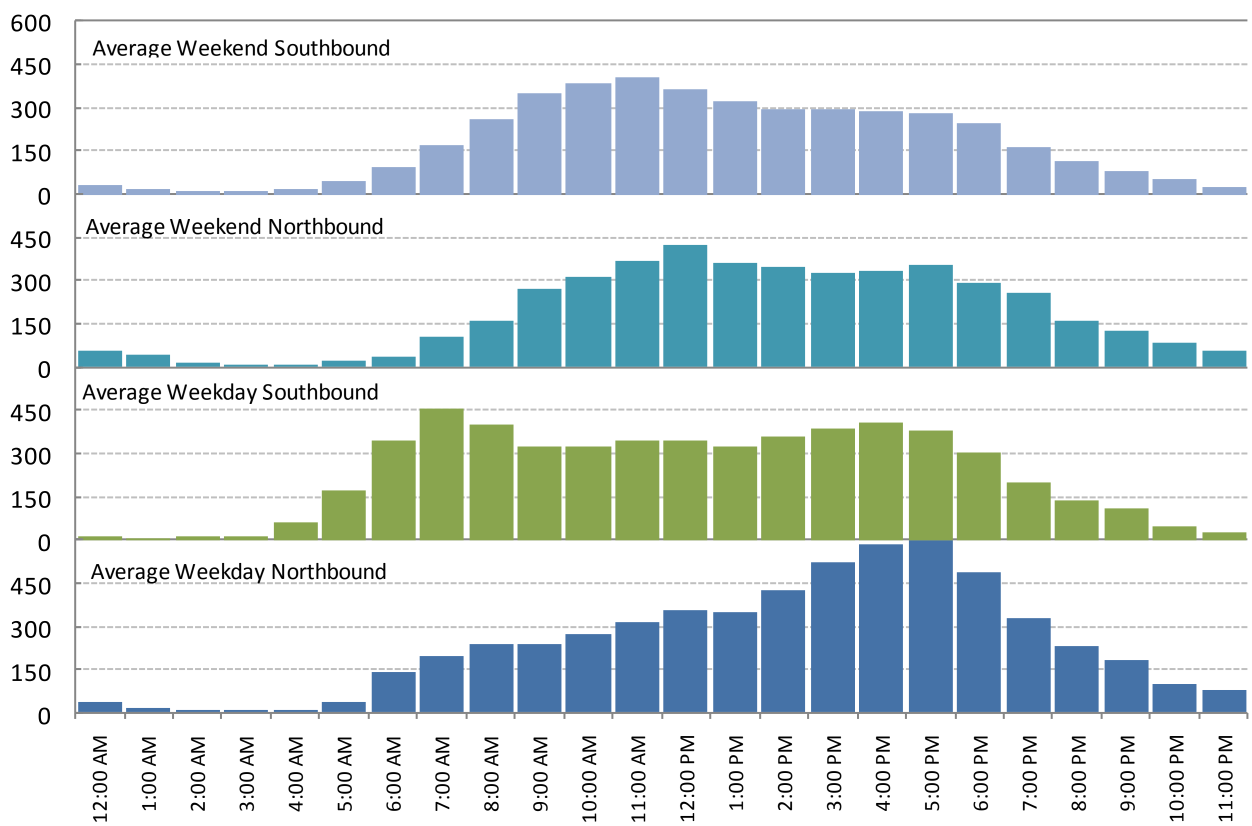
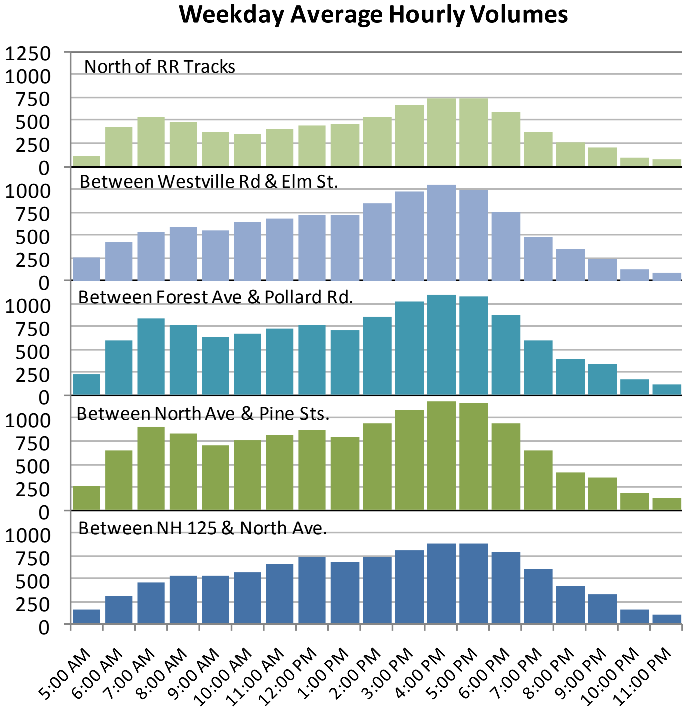


Figure 2



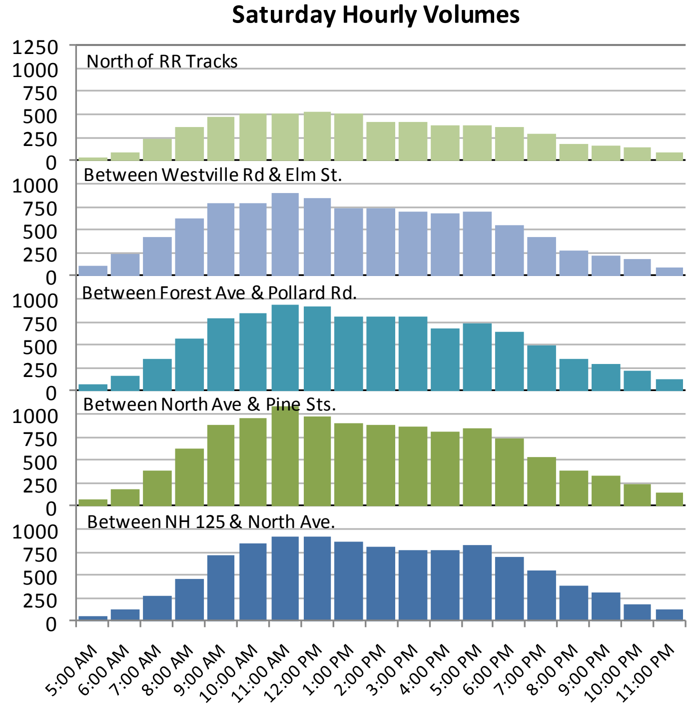
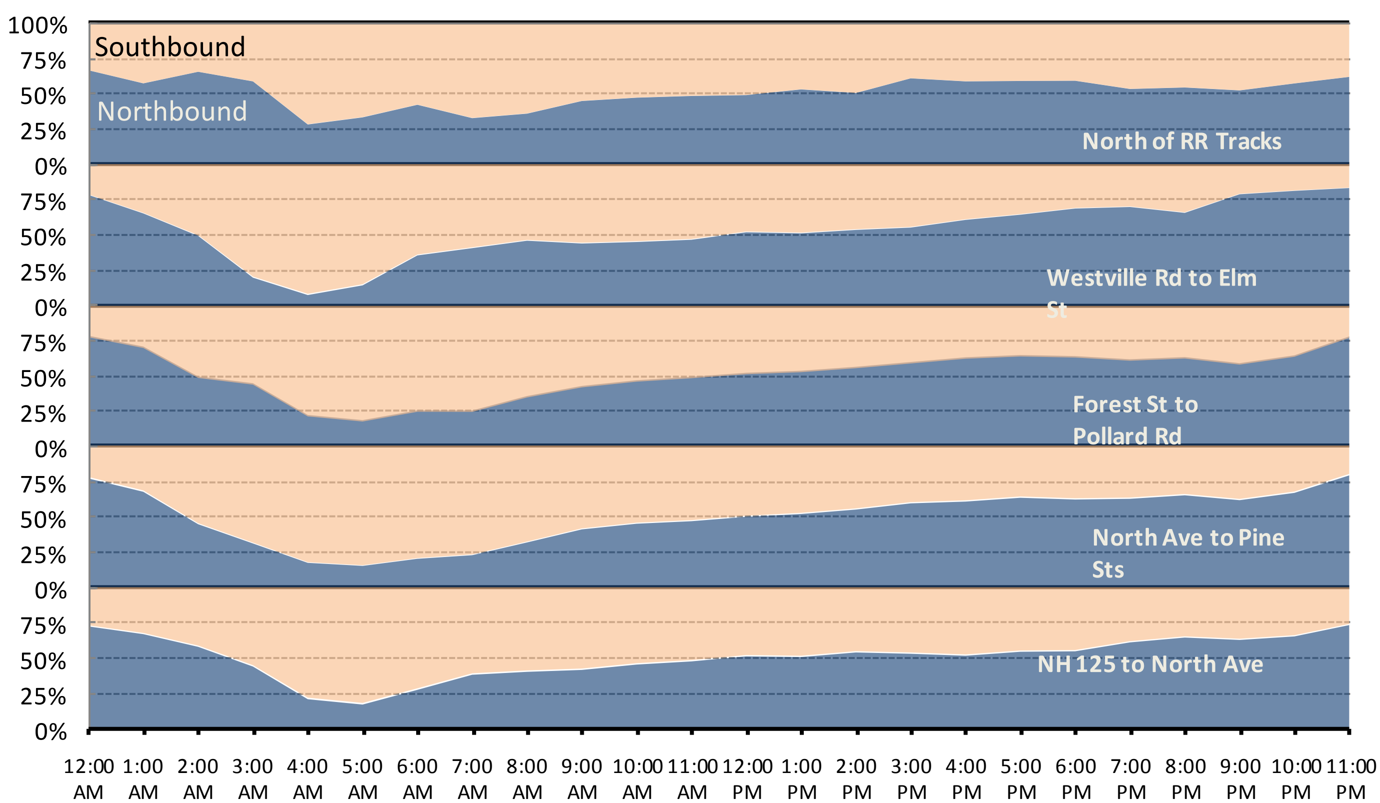


Figure 3: Weekday Directional Travel by Time of Day on Main Street



the middle sites. Hourly volumes are the highest during the PM peak period and reach nearly 1200 vehicles per hour between North Avenue and East/West Pine Street and exceed 1000 vehicles per hour through the Village area as well. Saturday mid-day peak volumes are similar generally higher than the weekday AM peak period and slightly lower than the weekday PM peak period in most cases. Between NH 125 and North Avenue, Saturday peak volumes are higher than peak weekday volumes reflecting the proximity to the retail centers on NH 125 as well as the easier access to Main Street via North Avenue during weekday commute periods.

Figure 3 shows the distribution of traffic for each count location by direction of travel with the lighter shading being the percentage of traffic that is southbound and the darker shading being the percentage of traffic that is northbound during each hour of the day. While overall, the split of traffic by direction shows slightly more travelling northbound (51% to 49%), there are time periods of the day where the difference is much more. During the late night/early morning period where traffic volumes are at the lowest the extremes of directional travel are reached with high percentages of northbound traffic in the late evening (10:00 PM to 12:00 AM), and high percentages of southbound traffic in the early morning (4:00-5:00 AM). During the AM commute period, travel is heavier in the Southbound direction with an average of approximately 60% of traffic moving in that direction. Between 7:00 and 8:00 AM the area between North Avenue and Pine Streets show an average of 77% of traffic moving southbound on weekdays. The PM peak period does not show a directional bias as much as the AM peak period does with an average of 54% of vehicles moving northbound during that time. However, there are instances of heavy directional flow most notably through the center of the corridor from 5:00 to 6:00 PM which shows approximately 64% of traffic moving northbound during that time period.

Overall the patterns are indicative of the use of Main Street as a route around congestion and traffic signals on NH 125 both in Plaistow and Haverhill during weekday commutes as well as Saturday mid-day. The central area of Main Street may be avoided by some commuters during the morning peak due drivers not wanting to be caught in bus and car traffic related to the Pollard School but this is not something that is easily measured. Volumes along the corridor do not indicate any roadway capacity issues that would require additional lanes.

Turning Movement Counts

Turning movement counts were collected for the PM peak period at six locations along the corridor as well as for the AM peak at two locations (the North Avenue and Pine Street intersections). From the turning movement counts, information regarding the Level of Service (LOS), or quality of function, at each intersection can be generated. LOS provides a general indicator as to how well or poorly each intersection is operating, and can be utilized as a basis for a full signal warrant analysis if indications are that the LOS is poor. ***Table 3*** shows various LOS measures that are utilized in analyzing capacity of unsignalized intersections and roadways, and in this instance the primary concern is with the delays experienced in making movements through intersections that are either two-way or four-way stop controlled. All of the intersections analyzed along Main Street are two-way stop controlled in that Main Street traffic has the right-of-way while the traffic on the approaching streets is forced to stop before accessing the intersection.

Table 3: Level of Service Measures

Level of Service	Unsignalized Intersection Stopped Delay per Vehicle (Seconds)	Equivalent Volume to Capacity Ratio (v/c)*	Density Range (passenger cars per mile per lane)*
A	≤ 10.0	≤ 0.50	0 – 11
B	10.1 to 15.0	0.60 to 0.69	> 11 – 18
C	15.1 to 25.0	0.70 to 0.79	> 18 – 26
D	25.1 to 35.0	0.80 to 0.89	> 26 – 35
E	35.1 to 50.0	0.90 to .99	> 35 – 45
F	> 50.0	≥ 1.00	> 45

When considering the operation of each intersection as a whole, north-south travel along the corridor is operating at an acceptable LOS during the PM peak hour, which is generally the most congested time of day. On the other hand, with the exception of Forest Street and West Pine Street (LOS C), the side street approaches to Main Street are almost all experiencing significant delay and poor LOS (E and F) during the peak periods. Specifically, left turn movements onto Main Street are the most problematic as through volumes on Main Street at that time do not leave many gaps that are adequate for drivers to feel comfortable entering traffic. While flared approaches to the intersections on the side streets do help to alleviate the congestion to some extent by allowing space for vehicles making right turns, the length of the flares are limited and even queues of a few vehicles can block access to that space. Longer delays also tend to prompt unsafe driving behaviors and risk taking where drivers will attempt to move into the intersection with smaller gaps between cars and this can result in safety problems.

The individual intersection analyses are summarized in ***Table 4*** which shows various measures of effectiveness for each, and ***Figure 4*** which shows, an aerial photo of the location, peak hour turning movements, as well as some of the measures of effectiveness. Further study will be necessary to determine if particular intersections meet warrants for signalization or some other treatment to improve operations. However, the analysis completed so far will provide a good indicator of the

Table 4: Intersection Analysis Summary (PM Peak)

	Main Street				Minor Street			
	LOS	Delay	95% Queue Length	v/c	LOS	Delay	95% Queue Length	v/c
Elm Street	A	8.3	0.32	0.1	F	52.9	7.84	0.85
Westville Road	A	8.6	0.4	0.12	E	36.8	4.52	0.67
Pollard Road	A	9.6	0.41	0.12	E	38.6	3.53	0.6
Forest Street	A	9.2	0.28	0.09	C	19.8	1	0.26
East Pine Street	A	8.4	0.16	0.05	F	86.4	3.81	0.7
West Pine Street	A	8.4	0.16	0.05	C	24.7	2.1	0.43
Chandler Avenue*	A	9.8	2.19	0.43	F	286.2	3.17	0.89
North Avenue**	A	9.2	0.82	0.22	F	317.2	35.8	1.62

* Analyzed for AM Peak and separately from North Avenue movements

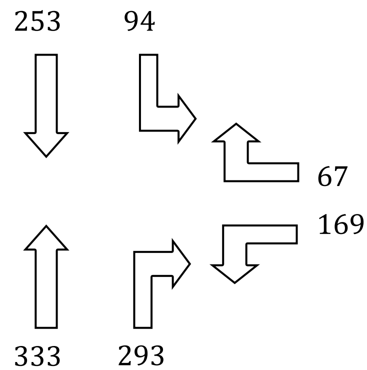
** Analyzed for PM Peak and separately from Chandler Avenue movements

Figure 4: Turning Movement Count Locations and Conditions (PM Peak)

Main Street and Elm Street

Estimated LOS Along Main Street = **A**

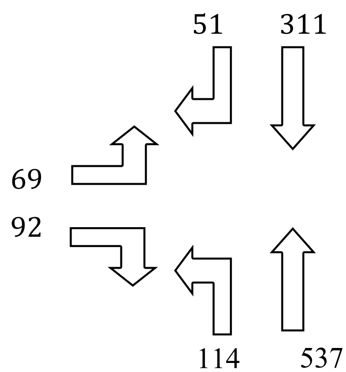
Estimated LOS of turns from Elm Street = **F**



Main Street and Westville Road

Estimated LOS along Main Street = **A**

Estimated LOS for turns from Westville Road = **E**



Main Street and Pollard Road

Estimated LOS along Main Street = **A**

Estimated LOS for turns from Pollard Road = **E**

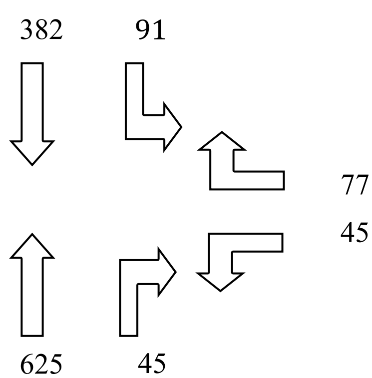
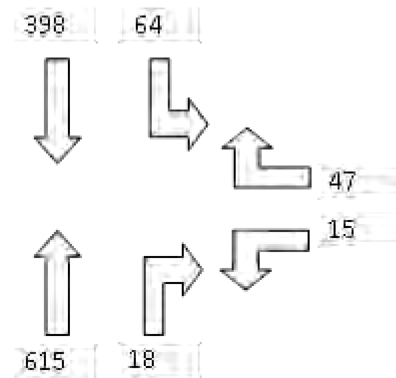


Figure 4: Turning Movement Count Locations and Conditions (PM Peak)

<u>Main Street and Forest Street</u>

Estimated LOS along Main Street = **A**

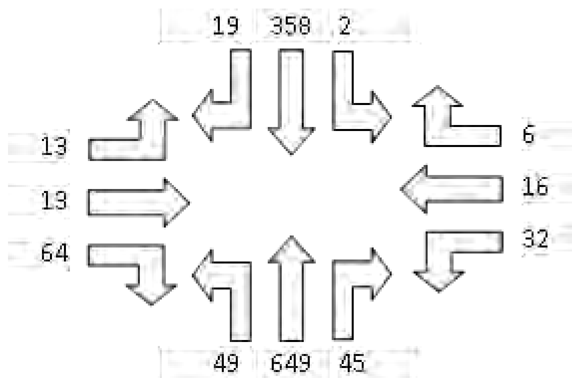
Estimated LOS for turns from Forest Street = **C**



Main Street and E/W Pine Streets

Estimated LOS along Main Street = **A**

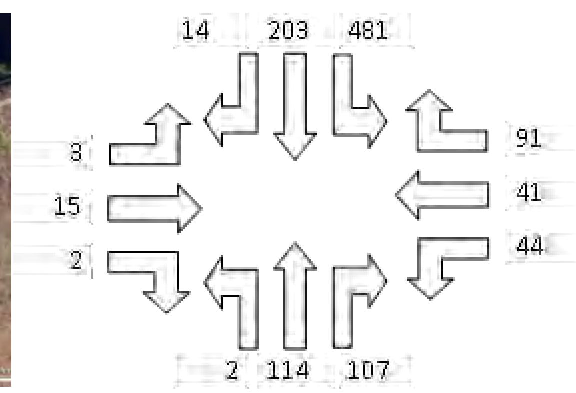
Estimated LOS for turns from Pine Street = **F**



<u>Main Street and North Avenue (AM Peak)</u>

Estimated LOS along Main Street = A

Estimated LOS for turns from Chandler Ave or North Ave = F



functioning of the intersection and will help to identify the intersections where further study should be pursued.

Operations along Main Street are by most indicators very efficient and effective. The north-south movement through each of the intersections shows minimal delay (under 10 seconds) and very low volume to capacity ratios and queue lengths. Level of Service of "A" at each location reflects these low numbers. The one location where operations along Main Street show some potential problems is in the vicinity of North Avenue and Chandler Avenue where volumes of traffic and turning movements are beginning to limit the number of vehicles that each intersection can process.

The Elm Street intersection indicates failure conditions are present during the PM peak period. Delays for vehicles turning left from Elm Street are approximately 53 seconds which is just within the threshold for an Level of Service of "F". However, the results for the intersection can change significantly depending on the assumptions regarding the space available for right-turning vehicles to queue along side those waiting to turn left. Current assumption is that there is space for a single vehicle, but extending the flare of the intersection enough to allow for two vehicles improves the level of service to "E" and drops delay to approximately 48 seconds. The right-turn channelization present at this intersection helps considerably with operations by separating those vehicles from through vehicles and opening gaps for drivers wanting to make turns from Elm Street. This channelization also contributes to high speeds through the intersection as vehicles do not need to slow much or at all to make the corner.

The Westville Road and Pollard Road intersections show very similar operational results from the analysis. Each indicates an LOS of "E" with delays between 35 and 40 seconds, 95th percentile queue lengths of 3.5-4.5 vehicles, and volume to capacity ratios of .6 to .67. While operations at these intersections are still considered adequate, a small increase in traffic volumes either along Main Street or from the approaches could push either of them into failure conditions.

Low volumes of left turn movements at Forest Street keep that intersection operating at an LOS of "C" and that is primarily due to the delay experienced by the few vehicles that do need to turn left at that location. Right turn movements indicate little to no delay.

Westbound approaches to Main Street at the intersection with East Pine show significant delay and a failure level of service as well. Delay is indicated to be 1.5 minutes on that approach during the PM peak period and this impacts primarily left turn and through movements from that direction. Eastbound from West Pine Street indicates a much higher level of service (LOS C) and shorter delay primarily due to lower volumes of left turning and through movement vehicles.

The intersections experiencing the most operational difficulties were those with North Avenue/ Chandler Avenue. The analyses at North Avenue identified serious capacity constraints and as many as 30 vehicles were observed queued to make a left turn in that location during the turning movement counts. During both the AM and PM peak periods, this intersection has a failure condition on movements from the North Avenue approach and the results show significant delay as well as volumes well over capacity. It should be noted that when an intersection approaches or exceeds capacity the seconds of delay produced by the formulas in the Highway Capacity Manual and using the Highway Capacity Software (HCS+) can produce numbers higher than would be anticipated or experienced in most cases. In that regard, the delay indicated for Chandler Avenue and North Avenue should be considered as showing potentially very long waits for left turns and not taken at the absolute values shown.

Overall, the Chandler Avenue and North Avenue intersections with Main Street should be considered for more detailed operational analysis as should the intersection with Pine Streets and Elm Streets. Any significant increases in traffic volumes may warrant further analysis at Westville Road and Pollard Road as well.

Truck Traffic

Three of the automatic traffic recorders placed along the corridor to gather traffic volume data were configured to collect vehicle classification data as well. The counters placed between NH 125 and North Avenue, between Westville Road and Elm Street, and north of the Rail Road tracks all tracked traffic according to the 13 category federal classification system. These numbers were consolidated into passenger vehicles and heavy duty vehicles with the latter category including vehicles pulling trailers as well as buses and heavy trucks of all kinds.

Overall volumes of truck traffic can be very high during certain hours of the day, with an average approaching 70 vehicles per hour in the central part of the corridor and nearly 60 on the northern end (***Figure 5***). The most southern section of Main Street has the fewest trucks generally, with hourly volumes peaking just above 20 vehicles. Generally, the higher truck volumes coincide with

Figure 5: Average Weekday Hourly Truck Volumes

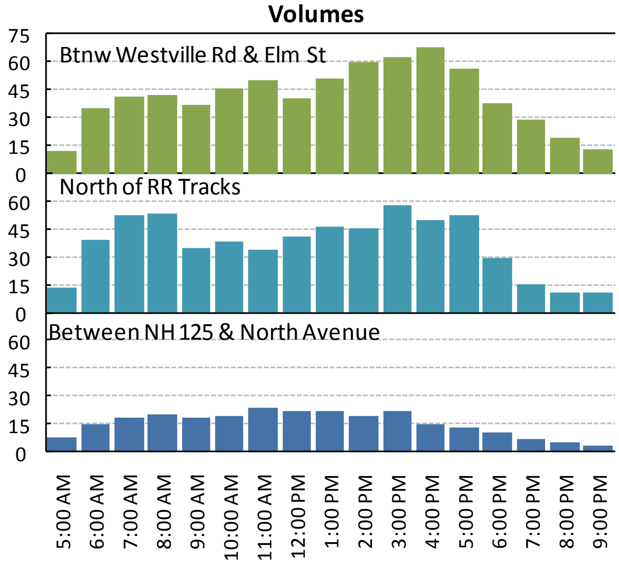
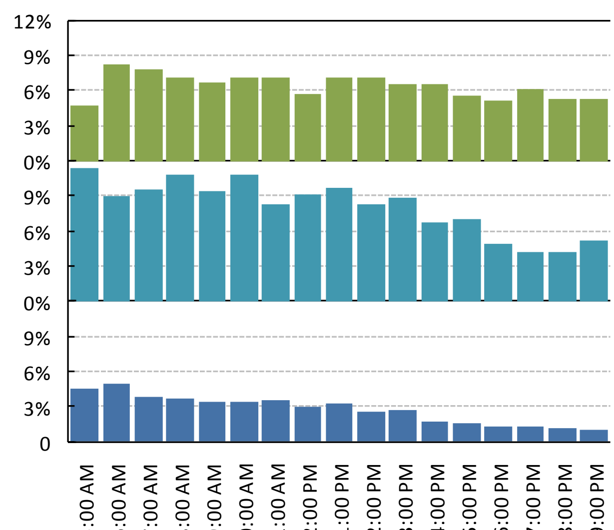


Figure 6: Average Weekday % Trucks



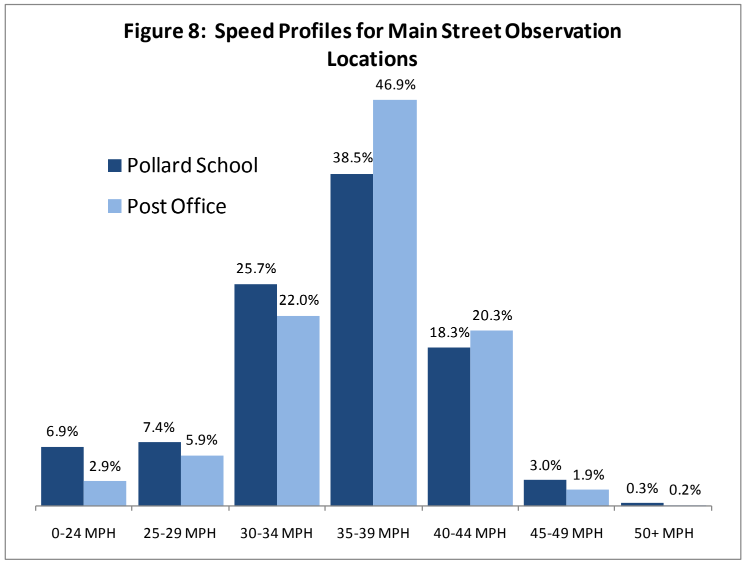
higher levels of traffic and so those areas of the corridor with more overall traffic see more trucks as well.

As a percentage of total traffic, larger vehicles account for approximately 2 to 12 percent of the volume on the roadway depending upon the location on the corridor (***Figure 6***). The segment of the corridor between NH 125 and North Avenue has a very low volume of trucks that averages about 3.6% of total traffic. On the other end of the corridor, the area north of the railroad tracks has the highest average percentage of trucks at 8.2%. The center of the corridor between Elm Street and Westville Road averages approximately 6.5% trucks. During the late night and early morning hours when traffic volumes are especially low, truck volumes as a percentage of traffic can be greater than 15%, however in most cases this still means less than 10 trucks an hour.

Examining the direction of travel shows a pattern of heavier northbound truck traffic on Main Street. At all observed locations throughout the day, the southbound number and percentage of

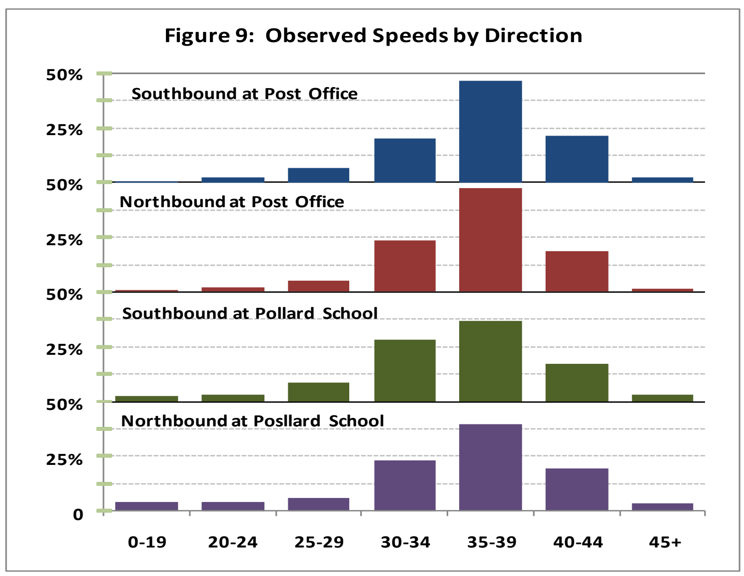
Figure 7

trucks is smaller than the northbound with the exception of weekend truck volumes southbound in the area of the corridor between NH 125 and the rail road track crossing just north of Town Hall. At the two ends of the corridor, the volumes and average percentages by directions are relatively balance with just a few percentage points separating the averages. In the center part of the corridor however there is a wide disparity with northbound truck traffic averaging 10.1% of average weekday traffic and southbound truck traffic averaging a mere 2.2%. In terms of volumes, this translates to an average of 610 trucks moving northbound on Main Street each day between 5:00 AM and 9:00 PM, compared to 116 southbound during the same timeframe. This helps to verify the anecdotal evidence that trucks enter Main Street via North Avenue and leave via Elm Street at least partially to avoid traffic on NH 125.



Travel Speeds

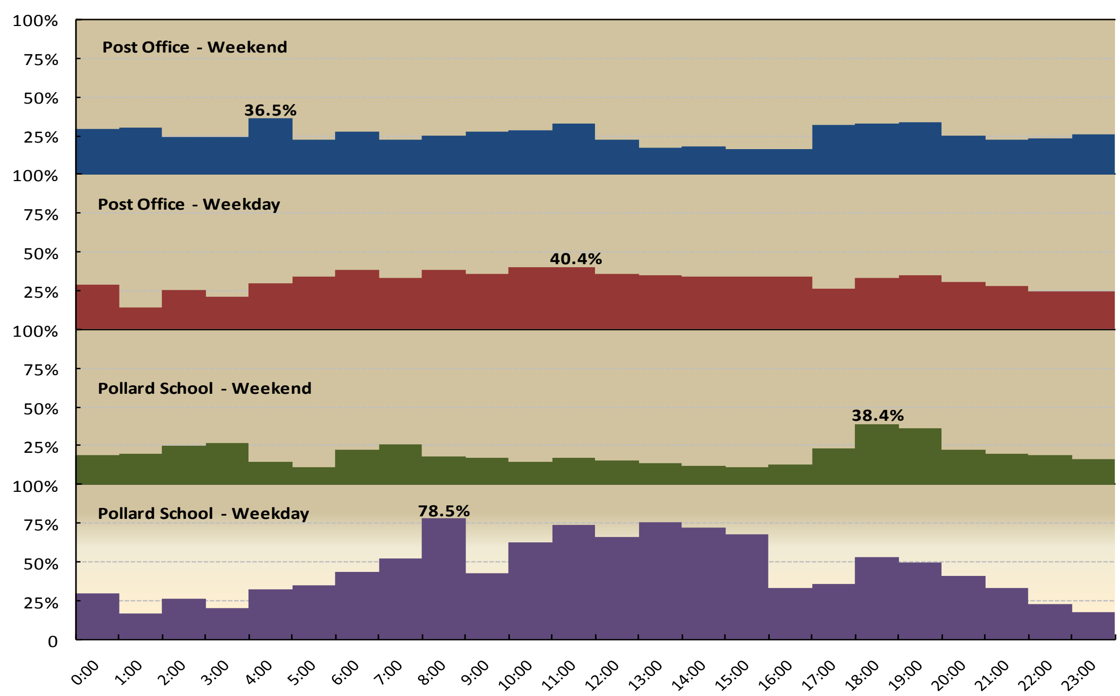
The perception of many Plaistow residents is that traffic exceeding the posted speed limit of 35 MPH is a significant problem on Main Street. To gain an understanding of how much speeding is occurring and when, over 100,000 observations of vehicle travel speeds were collected near Pollard School and near the Post Office from Wednesday, October 27th to Sunday, October 31st, 2010. Tube based automatic traffic counters were utilized in a configuration that collected data into 5 mile per hour ranges split by direction of travel along Main Street. For simplicity, and because of very few observations at the slowest and fastest speeds, the information shown in the speed related charts has been consolidated into a narrower range of speeds. In Figure 8 and Figure 9, show distinctions between vehicles travelling at less than 25 MPH, 25-34 MPH, 35-44 MPH, and 45 or more MPH. Figure 10 simplifies things further and shows those travelling at less than 35 MPH only.



The overall speed profiles for each of the two sites indicate some differences. ***Figure 8*** shows that speeds in the vicinity of Pollard School are generally slower than those near the Post Office, with the difference especially noticeable during school hours. Delving into the data in more detail, ***Figure 9*** shows the daily differences between the two sites. Weekdays show generally slower traffic in the vicinity of Pollard School with a greater percentage of drivers travelling slower than the 35 MPH speed limit and the vast majority of drivers travelling below 40 MPH. Thursday numbers are somewhat different than Wednesday and Friday due to a equipment malfunction that only tabulated speeds in one direction during much of that day. Weekends show the reverse of the weekday pattern; speeds adjacent to the school are higher than near the post office with much a much lower percentage of drivers travelling slower than 35 MPH, and an average of 7.2% of drivers travelling faster than 45 MPH through the school zone, compared to 1.4% on weekdays.

Figure 10 compares the patterns on weekdays and weekends at the two collection sites and finds that drivers are much more likely to take the school zone speeds seriously during weekdays. The Post Office site shows a very consistent pattern of approximately 20-40% observance of the speed limit across all days and times. The school site shows a marked difference between week days and weekends. On weekdays during the 8:00 to 9:00 AM hour, approximately 84% of drivers near the school are observing the 35 MPH speed limit or lower, and nearly 14% are driving below 25 MPH. Most of the time during school hours observance of the speed limit is relatively high and the time period from 2:00-4:00 shows forms a second peak for weekdays with approximately 60-70% of drivers travelling at less than 35 MPH. Weekends near the school show a fairly uniform low observance of the speed limit which peaks around 40% several times throughout the day.

Figure 10: % Vehicles Travelling <35 MPH by Time of Day and Day of Week



Accident Statistics

(*Table 5* shows the distribution of accidents along the corridor by intersection location from 2006 to mid-2009. The North Road intersection has the greatest number of accidents at 27 during the time period followed by the Pine Streets intersection which combines for 15, and Westville Road which had 10 over the 3 ½ year period. The most common motor vehicle crashes occurring are those that relate to turning on or off Main Street. There were 27 accidents between 2006 and June 2009 that involved vehicles turning onto or crossing Main Street and another 19 involving vehicles attempting to make a right or left turn off of Main Street. The next most common accident type in-

Table 5: Accident Statistics for Main Street Intersections

Intersection	2006	2007	2008	2009 (Thru June)	Street Totals
Chandler Ave	1	0	0	0	1
East Pine St	**2**	**3**	**0**	**1**	**6**
Elm Street	2	3	0	1	6
Forest St.	0	0	2	0	2
Jesse George	0	0	1	0	1
North Ave	**7**	**6**	**6**	**8**	**27**
Plaistow Rd.	1	3	0	0	4
Pollard Rd.	0	3	0	1	4
Spinney Ave	0	1	1	0	2
West Pine St.	**1**	**6**	**2**	**0**	**9**
Westville Rd.	5	2	2	1	10
Witch Lane	1	0	0	0	1
	20	27	14	12	73

volved failure to stop at stop signs and that resulted in 7 accidents over the time period.

Recommended Measures

Implementation of a comprehensive traffic calming program on Main Street requires a multi-faceted approach, a substantial effort and investment by the community, and will take time to do properly. Justifying the expenditure of resources on street and landscape improvements that may be seen as a lower priority than other infrastructure issues (or not spending money at all) is often not an easily accomplished task. However making this types of investment can do much beyond solving the immediate transportation issue in that the changes can enhance the unique identity of

1 A small sample includes the Homer Town Center Project, 2008 (http://www.homertownsquare.com/pdf/EconomicBenefits.pdf); Economic Effects of Traffic Calming on Urban Small Businesses, 2003 (http://www.emilydrennen.org/TrafficCalming_full.pdf); Victoria Transport Policy Institute online TDM Encyclopedia (http://www.vtpi.org/tdm/tdm4.htm); and Street Redesign for Revitalization, West Palm Beach, FL (http://www.walkinginfo.org/pedsafe/casestudy.cfm?CS_NUM=16)

an area and provide a wide range of economic and social benefits to the community. Studies have shown that traffic calming produces the following benefits[1]:

- Slower traffic increases road safety through both reduced numbers of accidents and less severe outcomes, for motor vehicles as well as for bicycles and pedestrians.
- Improved mobility for non-motorized travel as the area "feels" more safe for walking and biking and generates more activity of that nature because of that.
- Reduced impacts from automobile congestion and pollution as walking and biking becomes an option.
- Increased neighborhood interaction as the streets become more hospitable people are out more and interact with neighbors and visitors.
- Residential property values increase at locations where traffic is not seen as an issue to homebuyers. Businesses benefit from locations where people want to spend time.
- Public health benefits expand as more opportunities for walking and biking are provided.
- Economic benefits are realized though increased spending from new and repeat visitors, increased employment, increased employment, and increased tax revenues.

Successful implement of both regulatory, policy, and physical improvements on Main Street will also require that the following principles be generally applied to the corridor by planners, engineers, and community leadership:

- ***Engage the community:*** The design process needs to be as inclusive as is feasible and work with community residents, business interests, and town leadership to incorporate feedback into the final designs.
- ***Plan for all modes:*** while there may be no transit service along Main Street at this time, there will likely be some bus service along the corridor in the future. Any improvement projects and land development should be inclusive of transportation improvements for all modes. This includes the construction of transit stops and bus pull-outs, adequate roadway shoulders, sidewalks and buffers, crosswalks, as well as landscaping and streetscape improvements.
- ***Maintain safety for all users:*** Sight lines should be kept clear of visual obstructions at all intersections and space should be maintained on sidewalks for pedestrian circulation. In higher speed areas, clear zones adjacent to the roadway need to provide the opportunity for drivers to make corrective actions without striking roadside hazards. In addition, as Main Street is a primary emergency response route through the community, the movement of emergency services vehicles is critical to include within the designs approved.
- ***Maintain what is built:*** To ensure the safety of users, encourage continued use, and maintain the potential for economic development, sufficient maintenance funds should be provided for sidewalks, shoulder areas, and streetscape improvements.

Policy Changes

1. ***Take Ownership of Main Street from NH DOT:*** Transferring ownership of Main Street from DOT to the Town of Plaistow would allow the community to immediately restrict truck useage and would allow the implementation of many of the improvements discussed in this document without having to wait for NH DOT design approval. This allows the community control over driveway permitting as well as a free hand in shaping a major component in the appearance of Main Street. The primary drawback of taking the roadway is the burden of additional road maintenance costs however, this is mitigated in the short-term by the NHDOT policy that the roadway be improved to a certain standard before the transfer occur.

2. ***Allow for additional mixed use development:*** As studies and concepts evolve in relation to the Village Center, the Town may want to reconsider the standards set forth by the Village Overlay Zone which supersedes the C-2 zone by allowing for owner-occupied mixed-use buildings. The Village Center zoning does not allow what is typically thought of as traditional Main Street style land use development pattern however. A minimum lot size of 40,000 square feet and a minimum frontage of 150 feet are prohibitive to establishing a more dense, pedestrian friendly downtown area on Main Street. Parking requirements must also be modified to account for shared parking that can occur with mixed-use development as well as some allowances given to make use of on-street parallel parking. Successful villages in the region have very dense land use patterns and extensive mixing of uses that aren't limited to owner-occupied businesses as well as the ability to use on-street spaces or municipal parking lots to offset some or all of the parking requirements. While current sewer and water infrastructure limitations will keep density relatively low on Main Street, higher densities in the town center create economic opportunities, and help create a sense of place that can be leveraged into a vibrant and dynamic area.

3. ***Enforcement:*** Increased or more visible enforcement can work in a few ways to improve the village. Increased levels of law enforcement will encourage motorists to drive at the posted speeds and penalize those who do not. This approach is effective when consistently high levels of enforcement are implemented however this can be a costly response to a speeding problem in the long term. Additionally, working with the State Department of Safety to set up temporary truck inspection sites on Main Street will very quickly (if temporarily) decrease the number of trucks using that roadway. Finally, with a bike and pedestrian friendly area, walking or bike patrols can be utilized increasing the visibility and community interaction of officers.

4. ***Education:*** Public education can be an effective tool to help change the attitude and behavior of drivers. Educational efforts aim at addressing the possibility that drivers are not attentive to the speeds that they are traveling at and that modifications of their own behavior may solve the problem can be effective on a neighborhood level. These efforts are fairly cost-effective, but are typically found to solve the problem only in the short term. In the case of Main Street, where the problem is just as likely to be through traffic as local residents, it may not have any impact at all. Where education may be more effective in this case is as part of the design process informing residents and business owners about how the various aspects of the streetscape

work to create a safe, attractive place within the community and what the benefits are of investing in the community.

5. ***Utilize a Complete Streets Philosophy for Improving the Village District:*** Complete Streets is a philosophy of ensuring that the roadway right-of-way is designed, engineered and operated to enable safe access for all users. This means making improvements that allow for the safe movement along and across the street by pedestrians, bicyclists, motorists, and transit riders of all ages and abilities. The relatively compact area of the village overlay district (approximately .8 miles in length) provides an opportunity to implement a complete streets approach and further define the Village of Plaistow, although the philosophy and improvements could be applied to all of Main Street if desired. Pollard School, at .4 miles from the Library and the recreation fields, is almost exactly in the center of the overlay district and provides a great anchor to streetscape improvements as well as the opportunity to increase the number of children that walk and bike to school. In that regard, the following improvements should be considered:

    - ***Curb bulbs:*** In combination with on-street parking these support pedestrian activity at corners, shorten crossing distances and slow speeds for turning vehicles. They also help to clearly delineate locations where parking is not allowed.
    - ***On-street parking:*** Utilize parallel parking on both sides of Main Street and formalize with striping and curb bulbs to eliminate parking too close to corners and driveways.
    - ***Sidewalks:*** Wide sidewalks on both sides of Main Street in the Village district would provide space for pedestrians to move and should be at least 5 feet wide in residential areas and 6 feet wide in commercial areas. In areas where outdoor displays, café seating for restaurants, and other active uses of the public space are occurring even wider spaces are required.
    - ***Visible Crosswalks:*** Crosswalks should be highly visible and across all intersection approaches. A midblock crossing is recommended at the Pollard School and could be a raised crosswalk, a unique surface, or otherwise well marked to stand out from the surrounding roadway.
    - ***Buffer zones:*** Green space between sidewalk and curb that is ideally wide enough to plant trees and other plants. Providing a buffer between the road and the sidewalk promotes use of the sidewalk as pedestrians feel safer and more relaxed and generate more use. Buffers can be composed of parked motor vehicles as well.
    - ***Lighting:*** Street lighting should be pedestrian scale and the design should fit the character of the village. Priorities for lighting should be at crossing locations, where there are safety concerns, and where adjacent land uses support pedestrian activity.
    - ***Street furniture:*** Benches, shelters, bicycle parking, signs/maps, and even artwork all support pedestrian use and should be encouraged within the streetscape.

- ***Driveways:*** The number of driveways should be minimized to reduce pedestrian hazards, provide for longer stretches of continuous sidewalk, and allow for smoother traffic flow along the roadway. Driveway designs should incorporate handicapped accessible crossings and width should be minimized to limit crossing distances.

6. ***Lower Speed Limit to 25 through village area:*** Combined with changes to the physical layout of the roadway, lowering the speed limit will have positive benefits for safety and reduce noise in the village area. This combination may also have the impact of reducing through traffic on the roadway due to it being "too slow" to use Main Street, especially if combined with increased enforcement efforts. Given that approximately 80% of drivers are travelling at 39 MPH or less through the village area, especially during school hours, it can be anticipated that most would also stay close to a lower speed limit as well. Even if people are speeding, it is likely that the speeds would overall be lower through the village and if the overall average speed can be reduced, it will be beneficial for safety as well as for the general pedestrian environment on the corridor.
7. ***Install Shoulders:*** Ensure that Main Street has at least 4 foot wide shoulders, especially in areas without a curbed sidewalk. This will provide a more safe and friendly location for pedestrians to walk as well as provide space for bicycles on the corridor.

Location Specific Recommendations

Based on the existing conditions on the corridor, the analysis of traffic patterns and intersections, and discussions with the community, the following recommendations are made for infrastructure improvements on Main Street. These are not listed in a prioritized order, but simply by location on the Main Street (NH 121A) corridor from north to south as shown on ***Figure 11***.

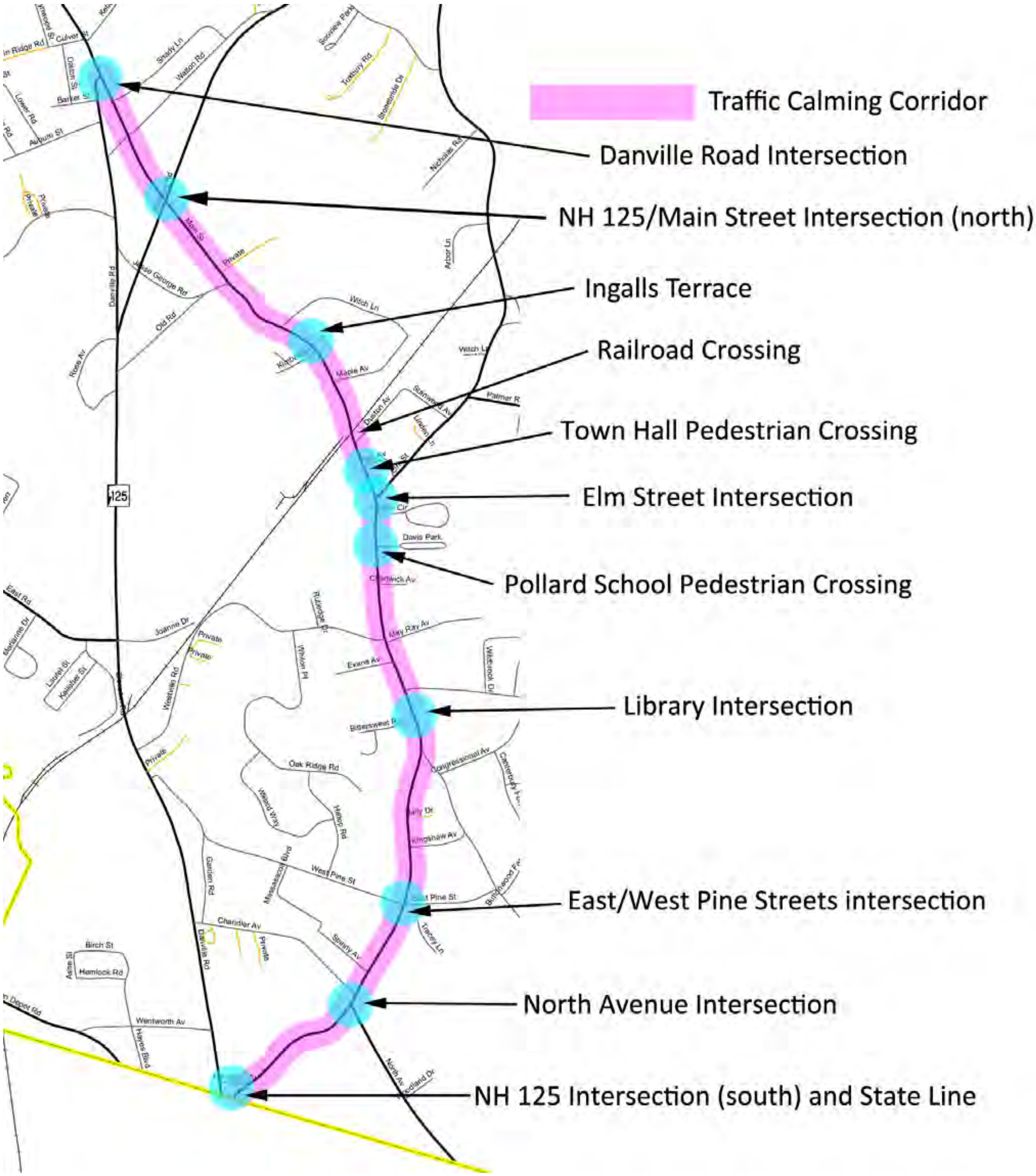
Danville Road Intersection with Main Street

A NH DOT conducted signal warrant analysis in 2008 determined that traffic conditions at the intersection of Danville Road with NH 121A (Main Street) met two conditions (Warrant 2—Four Hour volumes and Warrant 3– Peak Hour volumes) for the installation of traffic signals. The analysis also concluded that additional improvements would be necessary however what specifically would be appropriate would need to be determined in a more detailed operational analysis. Given the close proximity of other street connections, and the changes that will be occurring along NH 125 over the next few years, it would be beneficial to wait on any improvements to this intersection to see what traffic patterns are established with the addition of the signals at NH 125 and Danville Road as well as the expansion of the signals at NH 125 and NH 121A. It is recommended also that any improvements in that area of Main Street examine a roundabout option, as well as reconfiguration of access points in the area. Given the location of the Timberlane School in that area as well as several residential neighborhoods it may also be desirable to extend pedestrian facilities and other improvements proposed for the Village area out to that location.

NH 125 Intersection with Main Street

This intersection is scheduled to be widened and improved beginning as soon as spring 2011. Pedestrian crossings have been incorporated into all four legs of the intersection with button acti-

Figure 11:
Locations of Recommended Improvements on Main Street

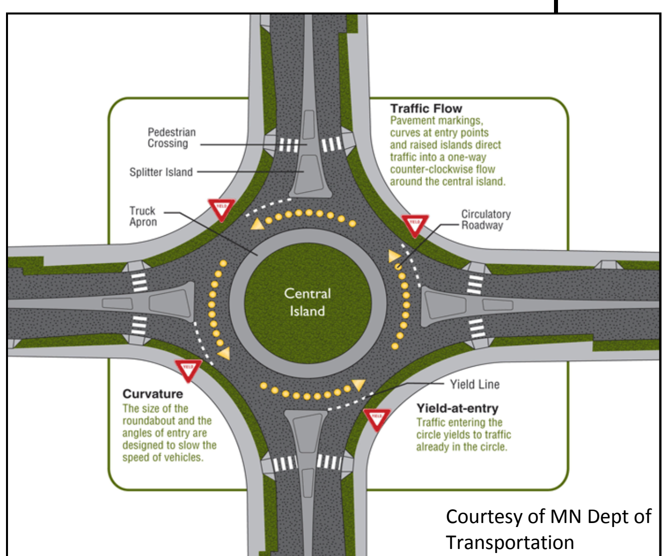


Roundabouts: Features and Benefits

Roundabouts are a form of circular intersection in which traffic travels counterclockwise (in the US) around a central island and in which entering traffic must yield to traffic already circulating[2]. A roundabout has a number of distinguishing features:

- **Central Island**: The raised area in the center of a roundabout around which traffic circulates. The central island does not need to be circular in shape and in some cases may be traversable.
- **Splitter island**: A raised or painted area on an approach used to separate entering from exiting traffic, deflect and slow entering traffic, and allow pedestrians to cross the road in two stages.
- **Circulatory roadway**: The circulatory roadway is the curved path used by vehicles to travel in a counterclockwise fashion around the central island.
- **Apron**: An apron is the traversable portion of the central island adjacent to the circulatory roadway that may be needed to accommodate the wheel tracking of large vehicles. An apron is sometimes provided on the outside of the circulatory roadway.
- **Entrance line/ Yield Line**: Marks the point of entry into the circulatory roadway. This line is physically an extension of the circulatory roadway edge line but functions as a yield line in the absence of a separate yield line. Entering vehicles must yield to any circulating traffic coming from the left before crossing this line into the circulatory roadway.
- **Accessible pedestrian crossings**: For roundabouts designed with pedestrian pathways, the crossing location is typically set back from the entrance line, and the splitter island is typically cut to allow pedestrians, wheelchairs, strollers, and bicycles to pass through.
- **Landscape strip**: Landscape strips separate vehicular and pedestrian traffic and assist with guiding pedestrians to the designated crossing locations. This feature is particularly important as a wayfinding cue for individuals who are visually impaired. Landscape strips can also significantly improve the aesthetics of the intersection.

Roundabouts come in three different varieties; mini, single lane, and multi-lane configurations. These variations are based on desired travel speed and volume of traffic and have different characteristics that aid both in facilitating traffic flow and limiting speeds to desired levels. The primary differences are in the size of the circle and the barrier that the median provides. Mini-roundabouts are generally designed to handle lower traffic volumes (up to 15,000) at lower speeds (15-20 MPH) and often have fully traversable medians. Single-lane roundabouts handle up to 25,000 vehicles per day and higher design speeds (20 to 25 MPH) and have a center median apron that is traversable by large trucks and buses, Multilane roundabouts are generally used on larger volume roadways (up to 45,000 for two lanes). Design speeds are generally higher at 25-30 MPH and medians are not traversable except for the truck apron.



Courtesy of MN Dept of Transportation

[2]This information is taken from Roundabouts: Technical Summary from the FHWA (2010) . FHWA-SA-10-006.

Roundabouts: Features and Benefits

Roundabouts provide significant benefits in several areas:

Design Element	Mini-Roundabout	Single-Lane Roundabout	Multilane Roundabout
Desirable maximum entry design speed	15 to 20 mph (25 to 30 km/h)	20 to 25 mph (30 to 40 km/h)	25 to 30 mph (40 to 50 km/h)
Maximum number of entering lanes per approach	1	1	2+
Typical inscribed circle diameter	45 to 90 ft (13 to 27 m)	90 to 180 ft (27 to 55 m)	150 to 300 ft (46 to 91 m)
Central island treatment	Fully traversable	Raised (may have traversable apron)	Raised (may have traversable apron)
Typical daily service volumes on 4-leg roundabout below which may be expected to operate without requiring a detailed capacity analysis (veh/day)*	Up to approximately 15,000	Up to approximately 25,000	Up to approximately 45,000 for two-lane roundabout

*Operational analysis needed to verify upper limit for specific applications or for roundabouts with more than two lanes or four legs.

Traffic Safety: The shape of roundabouts and the movement patter eliminate crossing conflicts (the most severe) that are present at more conventional intersections. Studies have shown an overall reduction of 35% in total crashes and 76% in injury crashes, 89% reduction in severe incapacitating injuries, and in some cases a 100% decrease in fatalities

Operational Performance: When within capacity, roundabouts typically have lower overall delay than signalized and all-way stop-controlled intersections. Delay reduction is most significant during off-peak when traffic may otherwise be sitting at a traffic signal awaiting a green with no opposing traffic. A benefit of their overall good performance is that it can often mean reductions in lane requirements as opposed to traffic signals.

Environmental Factors: Reduced delay and reduced number and duration of stops provide air quality and noise benefits compared with signal controls and all-way stop controls. The slow movement of queued vehicles entering a roundabout reduces air quality impacts as well because traffic is rarely stopped and not moving.

Access Management: Roundabouts facilitate U-turns and can be utilized to eliminate left turn movements at driveways on busy arterials

Traffic Calming: Roundabouts use geometric design to reduce vehicle speeds. The curvature of the circle is designed to promote speeds within a specific range and going faster is not comfortable for drivers.

Pedestrian Safety: Pedestrian crossing opportunities are improved due to reduced vehicle speeds as slower moving vehicles are more likely to stop for someone walking, and the splitter island provide the opportunity to focus on crossing one stream of traffic at a time. Pedestrians with visual impairments face the greatest difficulty in crossing via a roundabout in that the audio clues that might be present at a signalized intersection are not there.

Aesthetics: The central island and splitter islands offer space for landscaping or artwork.

Land Use: Roundabouts act as gateways providing a transition between high-speed and low-speed areas such as entering a downtown from a rural area or moving between residential and commercial areas.

Operations & Maintenance: Typically roundabouts have lower operating and maintenance costs compared to traffic signals as they do not require technical hardware, signal timing equipment, or electricity. The reduction in crashes provides cost savings in terms of reduced accidents and reduced injuries and fatalities when there are accidents.

Right-of-way Requirements: Roundabouts typically require similar or greater right-of-way at the intersection however need much less moving away resulting in much narrower approach roadways as there is no need for right or left turn lanes.

vated crossing phases and sidewalks extend along all four approaches as well. The sidewalks north on Main Street extend to Walton Road, while the sidewalks southbound appear to extend approximately 400-450 feet and end near the limit of the construction zone. This leaves approximately 2000 feet of Main Street between the construction zone and Ingalls Terrace without sidewalk. One concern with the current design is the very long distance that pedestrians are being asked to traverse across NH 125 which is between 100 and 125 feet depending on the approach crossed. This distance could take an older pedestrian more than 30 seconds to navigate and could be very intimidating to potential users. Extending the proposed medians to provide a safety refuge and installing pedestrian signal buttons at the medians would provide a safety refuge and allow for phased crossings of one direction of traffic at a time if necessary. The town should also work with NH DOT engineers to ensure that a design is implemented that can act as a gateway into the community with improved landscaping and signage that identifies that the "Historic Village" is on Main Street.

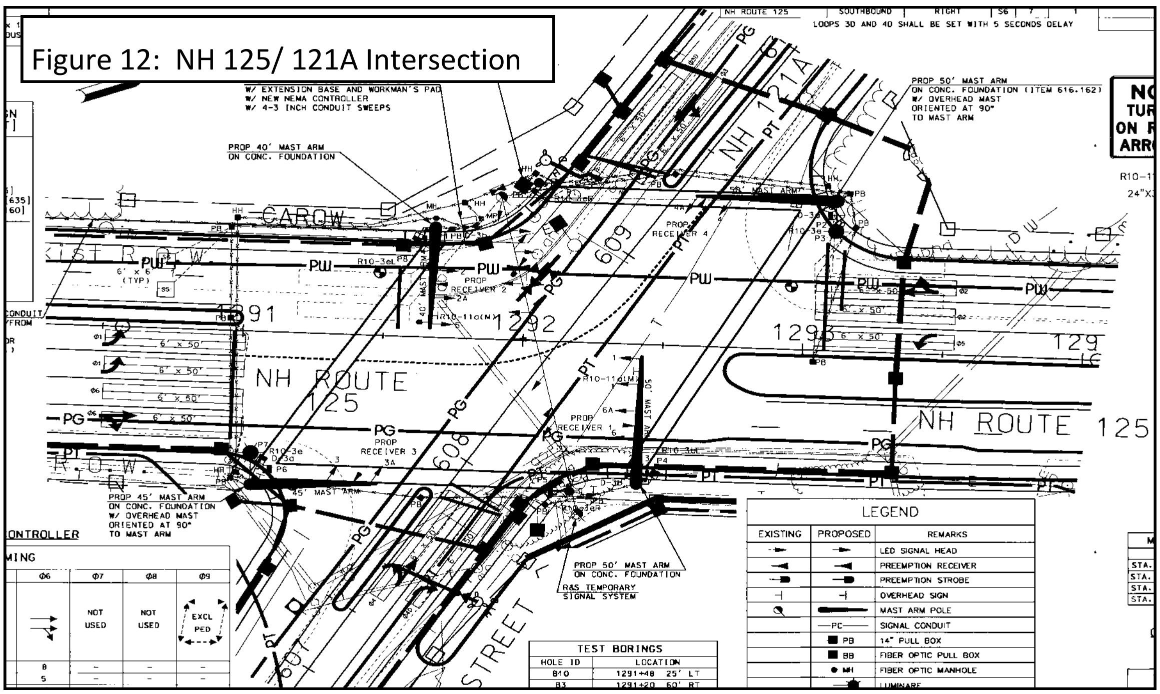
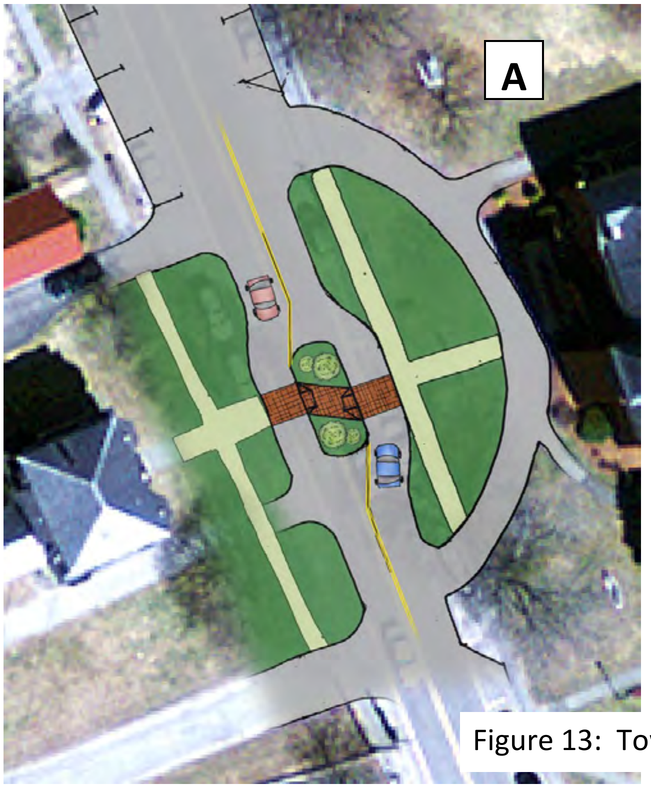


Figure 12: NH 125/ 121A Intersection

NH 125 to Rail Road Crossing

This segment of the corridor has a limited section of sidewalk that extends from approximately Witch lane southward but as stated above an approximately a 2000 foot gap will remain once construction of the NH 125 improvements are completed. While much of this area is not currently part of the Village Center overlay district, it does include some commercial uses as well as recreation fields on Ingalls Terrace. Shoulders appropriate for bicycle travel (4 foot minimum) would be appropriate as would connecting the sidewalks on either end. If the NH 125 intersection is not utilized as a gateways to Main Street, the Town should determine a location within this section of the corridor to do so. One such location might be near the terminus of the existing sidewalks at Witch Lane. The location of community recreation fields and the approximate .4 miles from there to Pollard School and another .4 miles to the Library would create a village centered around the School and Town Hall.



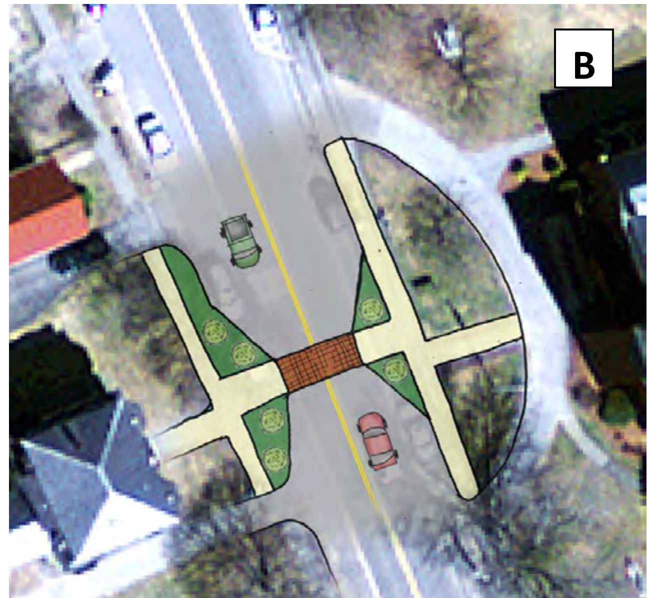


Figure 13: Town Hall Options

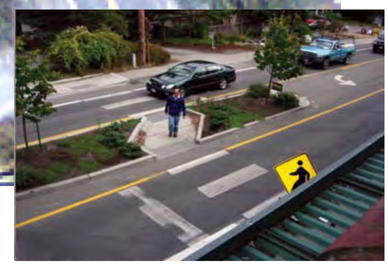


Photo Credit: Bruce Landis, Angled cut-through in Bainbridge, WA

Town Hall

Concerns in the vicinity of the Plaistow Town Hall revolve primarily around the safety of crossing Main Street given the narrow roadway, parked cars, and fast moving traffic. The options shown in ***Figure 13*** present two methods of addressing these concerns and improving the connection across Main Street to the Town Hall through narrowed crossing distances and slower moving traffic. These designs evolved from discussions with the Highway Safety Committee and interest in a raised crosswalk or speed table to slow vehicles in front of the building and provide similar benefits without introducing the vertical alignment shift and resulting difficulties for plowing, drainage, and noise impacts from large vehicles passing over it. ***Option A*** creates a horizontal deflection of traffic similar to a roundabout via a center raised median that requires vehicles to turn slightly and slow to avoid. The crosswalk passes through the median providing a refuge for pedestrians allowing for crossing of one lane of roadway at a time while providing a location for landscaping, artwork, or other aesthetic improvements. The crosswalk is angled as it passes through the median to ensure that pedestrians are always facing oncoming traffic before they start crossing a lane. This option would eliminate parking in the immediate vicinity of the crossing and there are some potential driveway access issues that would need to be addressed as well. The alternative developed for this location (***Option B***) narrows the crossing distance to a minimum with curb bulbouts through what are currently parking spaces. This improves visibility both for the pedestrian waiting to cross and the approaching vehicles. This does eliminate some parking, however less than the median based approach.

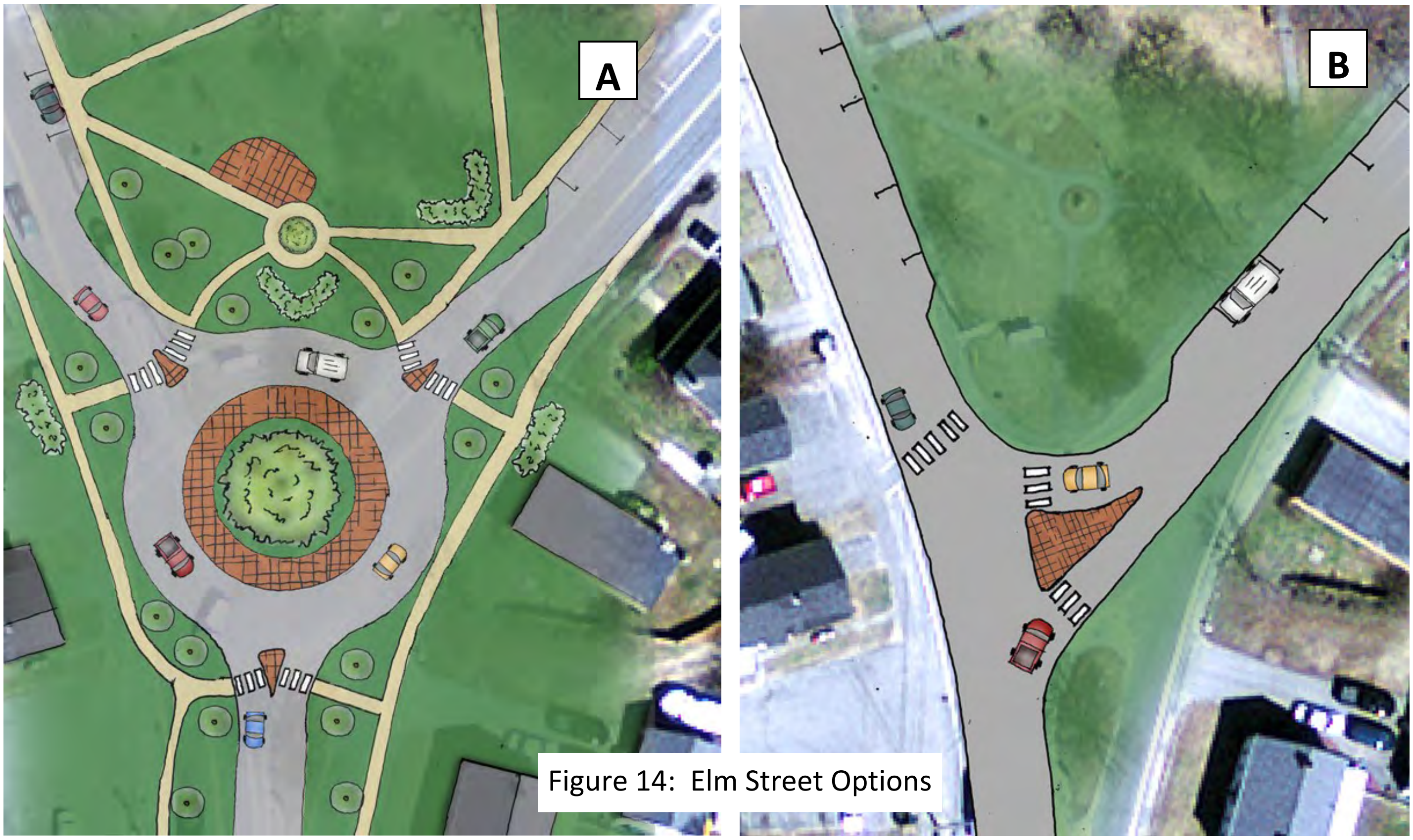


Figure 14: Elm Street Options

Elm Street

Two options have been developed for the Elm Street Intersection shown in ***Figure 14***. ***Option A*** locates a roundabout at this intersection that provides the benefit of slowing the right turn movement of northbound traffic from Main Street to Elm Street as well as slowing southbound traffic entering a school zone and northbound traffic passing in front of the Town Hall. A roundabout eliminates much of the delay that drivers face when trying to access Main Street from Elm Street during peak hours, and the installation of multiple roundabouts along the corridor will help to keep speeds lower, while improving access to the roadway from side streets. Aesthetically, a roundabout could provide an excellent sightline northbound on Main Street to the Town Hall and highlighting any memorials, statuary, or other items located at the south end of the common. The roundabout itself also provides a complimentary location for a monument or artwork. As this location is very close to the community public safety complex, and would be on a primary fire response route, it is critical that any concerns regarding the impacts of a roundabout on emergency response be addressed prior to implementation.

The second alternative developed for this location (***B***) constructs a more standard "T" intersection that requires north bound vehicles to slow for the turn to Elm Street by removing the slip lane that currently exists at the site. This would create some greenspace where the slip lane currently is and move Elm Street further away from the houses on that corner of the intersection. A small splitter Island would continue to separate traffic entering and exiting Elm Street and would provide a pedestrian refuge which breaks the crossing into two short segments. This alternative would slow traffic movement onto Elm Street in a similar manner to that of the roundabout, however there would be little to no impact on speeds of traffic along Main Street.

Figure 15: Pollard School

Pollard School

The intent of the improvements shown near Pollard School is to narrow the roadway, slow traffic, and provide a pedestrian friendly environment. The option shown in ***Figure 15*** creates a curve in the currently straight roadway known as a chicane. This curvature slows traffic while at the same time narrowing the crossing distance by extending the green space between the curb and the sidewalk into what is currently roadway. Parking is eliminated within the chicane although some could be added back in with proper implementation that does not block sight lines for pedestrians or motor vehicles. A wide sidewalk and crosswalk with a textured surface (or otherwise different than surround pavement) creates a highly visible crossing point letting drivers know what to expect at that location. Street trees and a wider green space between the sidewalk and the curb to the north and south provides separation from the roadway for pedestrians and could be continued further in each direction although the width would need to be reduced.

Alternatively at this location, the curvature of the roadway could be reversed toward the school or solutions similar to those in front of Town Hall (Figure 13) could be equally effective at providing improved safety, aesthetics, and slowing traffic.

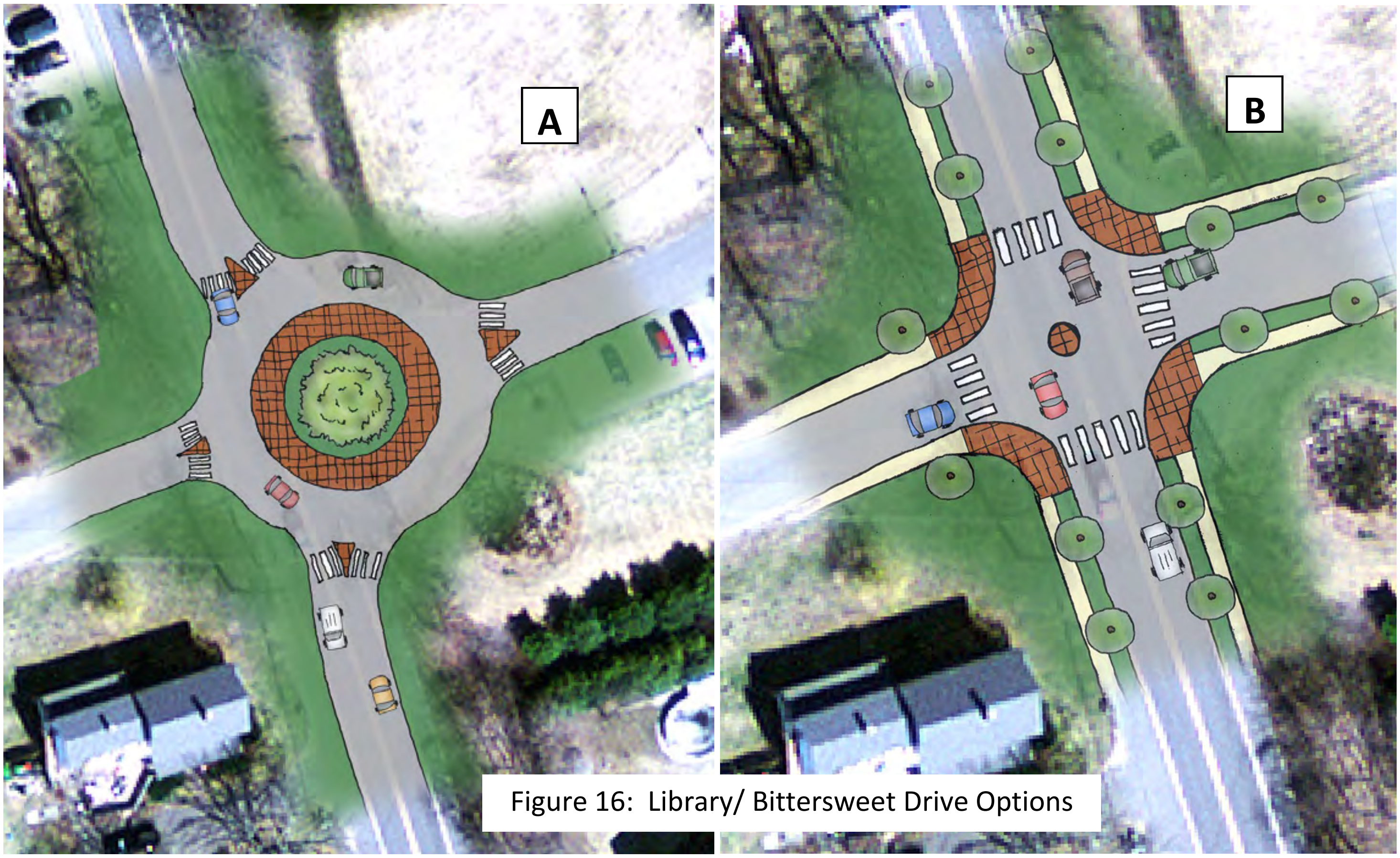
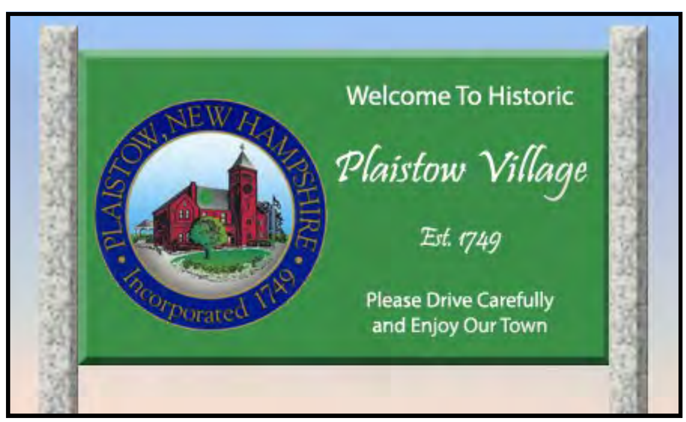
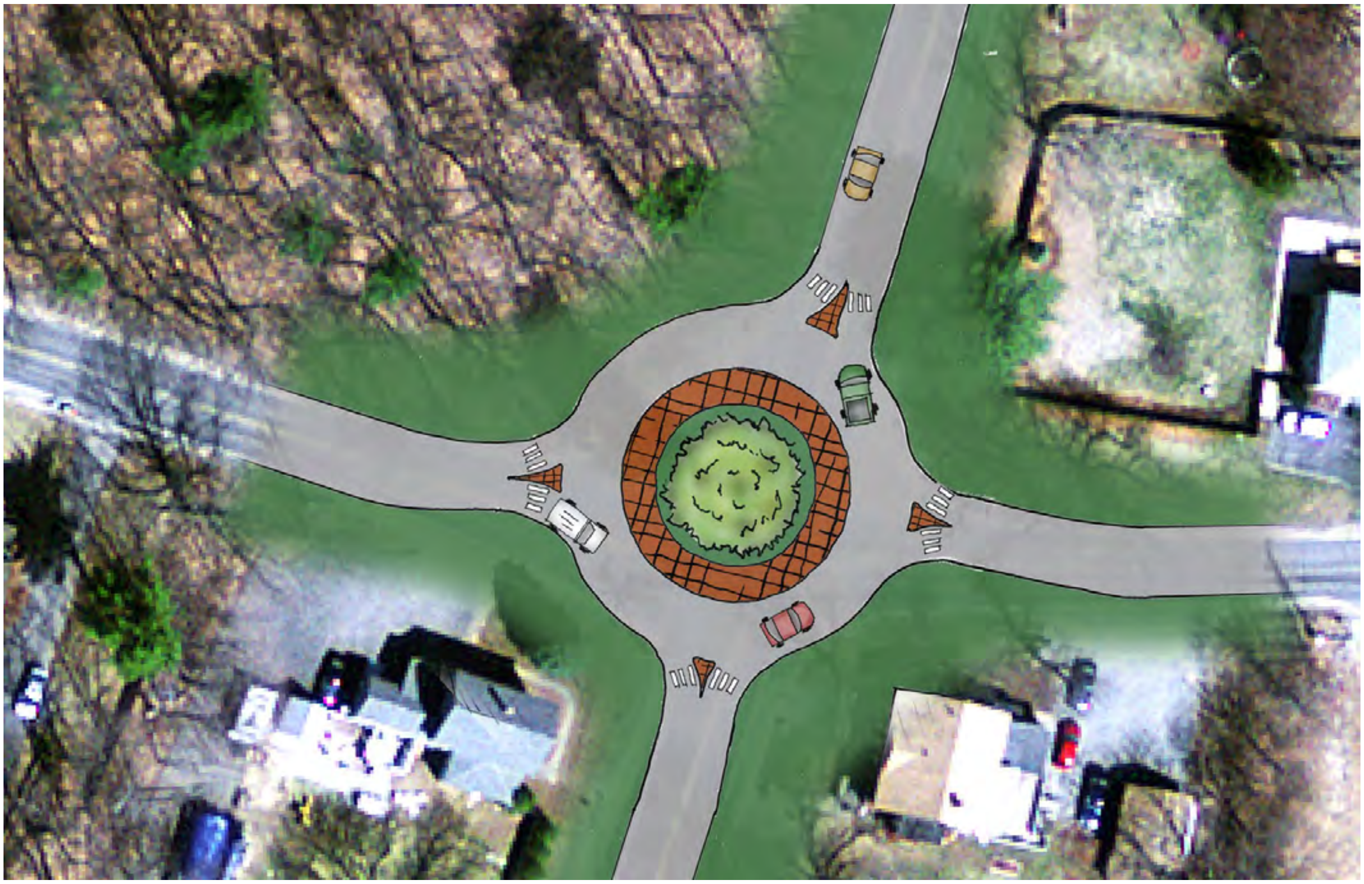


Figure 16: Library/ Bittersweet Drive Options

Library/Bittersweet Drive

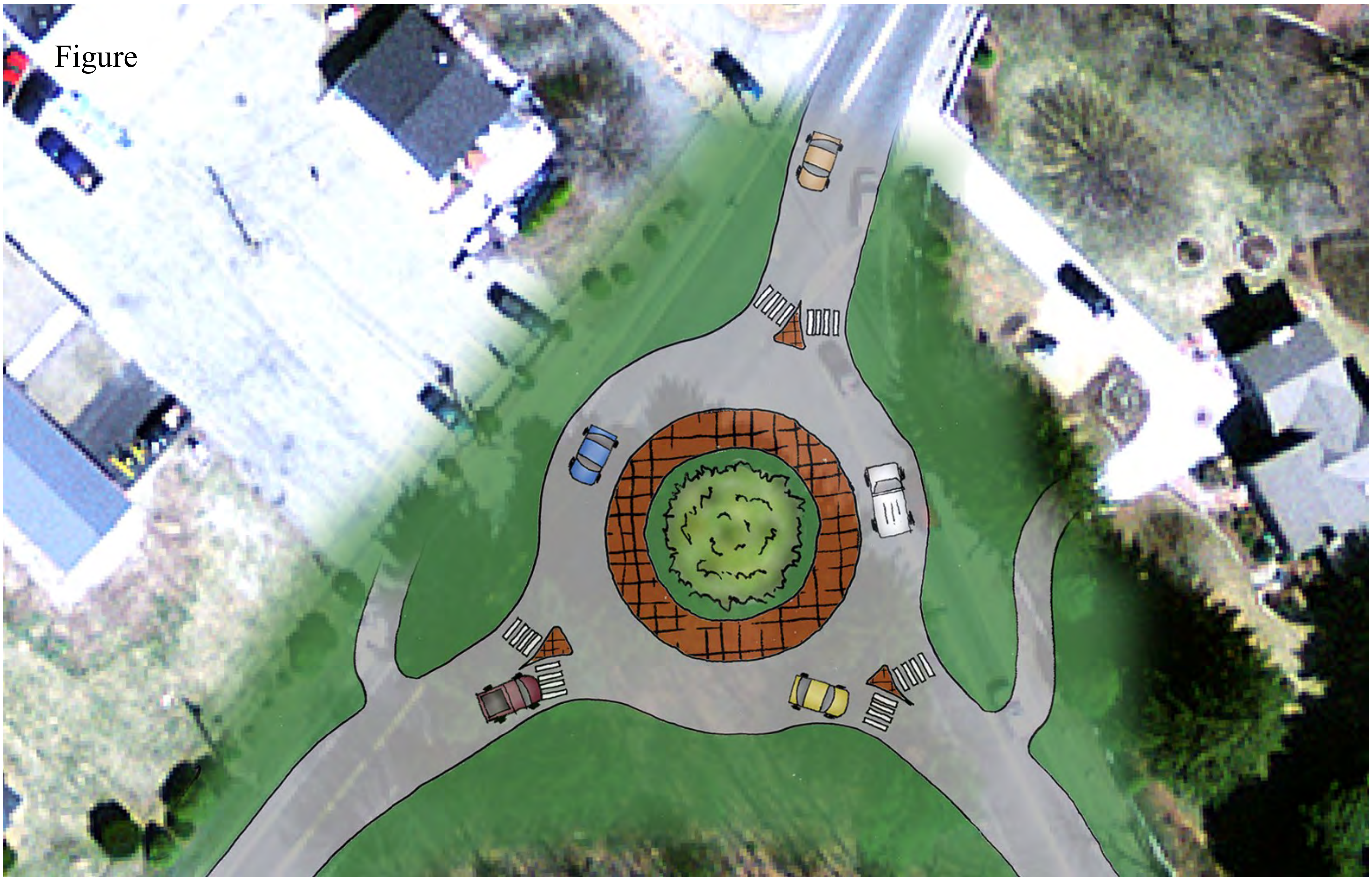
As the southern boundary for the Village District, the Library driveway and Bittersweet Drive make an ideal location to transition Main Street from an arterial roadway to a "downtown" street. A gateway should be constructed consisting of some signage that welcomes people to the "Historic Village". Roadway improvements could be as elaborate as the roundabout shown in ***Figure 16A*** or as simple as the narrowing of the intersection shown in ***B***. While likely not necessary for traffic control, the roundabout provides another component to the corridor-wide traffic calming with another spot that requires drivers to slow down and providing a definite transition. The improvements shown in B more simply narrow the roadway through tighter corner radii and curb bulb-outs could narrow this further. The tighter curb radii shorten the road crossing distance considerably and as few trucks utilize either Bittersweet Drive (a dead end street) or the Library driveway, should not impact turning capabilities to any great degree. This alternative can also include a small traversable median in the center so that it behaves like a mini-roundabout however the volume of traffic on Main Street is high enough that operationally it may not work as needed.





East and West Pine Streets Intersection

Similar to other sites along the corridor, a roundabout is proposed for the intersection of East and West Pine Street with Main Street replacing the current two-way stop controls. This change in traffic control will result in improved operations, less severe accidents and likely fewer of them as well. It will drastically reduce unsafe maneuvers by allowing more fluid entry and exit from Main Street without blocking the roadway for left turns. In addition, the installation of multiple roundabouts along the corridor is likely to discourage some of the truck traffic on Main Street. A basic operations/planning analysis of a roundabout at this location shows a maximum volume to capacity ratio of .75 during the PM peak period and an overall Level of Service of A. Unlike the current two-way stop controlled intersection however, no legs of the intersection would operate under failure conditions with a roundabout in place. Similar to the roundabout at North Avenue, concerns over the impact on emergency response times and procedures need to be addressed as do questions about the amount of right of way necessary and available.



North Avenue

Approaches of this intersection operate under failure conditions during peak hours and likely the intersection would meet warrants for signalization. NH DOT did work towards widening and installing signals at the intersection during the 1990's, however local opposition to the proposal stopped the project from moving forward. Utilizing a roundabout at this location rather than a set of traffic signals both improves safety by reducing the severity (and likely number) of traffic accidents, as well as allowing for slower moving but free flowing traffic movement. It is likely that a roundabout would work well at this location because the predominant traffic movements do not conflict as much in that configuration compared to the existing stop controls or to a traffic signal control. A basic capacity and operations analysis of a roundabout under current traffic volumes indicates that the intersection would operate well under capacity during both the AM peak period (LOS A) and PM peak period (LOS B). This analysis does not take into account the movement of traffic into and out of Chandler Avenue and this might have an impact on the operations of the intersection however, the volumes utilizing that street during peak hours are relatively small and not likely to cause significant reduction in Level of Service or increased delay. A roundabout at North Avenue could also fulfill the role of a "gateway" to the village and let drivers know that they are entering the heart of the community if it is desired. As with the other locations, design of the roundabout must take into account the use of Main Street as a primary fire response route.

NH 125 at Mass. State Line

Discussions have already been held with the City of Haverhill to close the end of NH 121A/Main Street and reroute it along Hazeltine Street where it will connect into the traffic signal located there. This will slow traffic entering Main Street as well as make it less of a convenient connection to NH 125. The signalized intersection also provides a safer connection for those using Main Street to access NH 125 southbound.

The "in-between" areas

This study has provided a number of conceptual improvements for intersections and mid-block crossing points along the Main Street corridor but has not addressed every part of the roadway. To be most effective, traffic calming measures should be implemented in a relatively regular pattern approximately 300-400 feet apart to stabilize vehicle speeds near desired levels and not provide long stretches for drivers to accelerate. In the area defined as the Village District, this would require installing 8 to 13 measures in addition to the five have been conceptualized in this document. Variations on the ideas presented however can be used in other locations along the corridor and not all need be to the same degree or even "spot" improvements. For instance, something as simple as delineating parallel parking along the corridor can accomplish the some of the same slowing of traffic as more costly changes.

Implementation

Implementation of the Main Street Traffic Calming study involves a number of steps to ensure that there is public support for the improvements and that funding is available. The best approach is to gain overall acceptance and support for the plan and proposed improvements to the corridor, prioritize those that are to be implemented, and begin to develop the funding necessary. Public hearings and design workshops are a critical part of this process as the resulting projects are based on a general consensus regarding what is desired and necessary which eases the overall implementation process. Once the concept of traffic calming on Main Street has been embraced by the community the next step will be to identify priority improvements or priority areas to improve and begin the specific engineering and design process for those locations to determine feasibility and estimated cost. Active engagement of the public in the design process will help to ensure that people are supportive of the project and will ease the overall design and implementation of the project. One item that should be considered as part of the public discussions is the concept of the town taking over the ownership and maintenance of Main Street. The costs and benefits of this action should be discussed and considered with regards to the effectiveness of the proposed traffic calming measures as well as to the community as a whole. If the community decides to take Main Street from the state, the details of the transaction such as schedule and what improvements will need to be completed before this occurs need to be determined.

1. Gain Plan Approval
2. Set priorities
3. Find funding
4. Involve the public in the design

<u>Financing</u>

A final component of the implementation process that needs to be discussed is the identification and pursuit of potential funding mechanisms. There are a number of methods to finance the transportation system improvements recommended in this document and many are described in this section. The options can be generally classified into local sources (taxes, impact fees and value capture mechanisms) or Federal/State grant programs. With the exception of the grant programs, all of these options included in this document generate revenues locally from those that benefit from the particular transportation improvements. They vary mostly in how broadly they define the geographic area encompassed, the extent of benefits, and who specifically pays to implement the projects.

Property Taxes

Taxes on property have been the historic method of communities paying for infrastructure needs in New Hampshire. These are the most broad-based of methods in that they are applied to all property owners in the community. To apply property taxes to highway improvements, the specific projects must be approved by voters at Town Meeting either via the Capital Improvement Plan or individual warrant article. Another method of funding projects via property taxes is to establish a Capital Reserve account to accrue multiple years of funding toward a specific goal. An example of this is the Capital Reserve fund that the town of Exeter established to fund roadway shoulder improvements. At Town meeting the community set aside $50,000 per year and has accumulated $150,000 which has been proposed to use to match $225,000 in federal Transportation Enhancement funds and construct shoulders on a mile of roadway connecting several residential areas to a recreation area and to the village.

- \+ ***Technically & legally acceptable***: This has been the historic method of raising funds for local roadway improvements and has been accepted legally and technically as a method of doing so.
- \+ ***Bond Security***: Funds can be used to secure and/or pay municipal bonds.
- \+ ***Administration***: Easy for public agency to administer.
- – ***Inequitable***: They have a built-in imbalance in that they are assessed to all property owners independent of whether they are users of the transportation system or not.
- – ***Political***: Requires approval at Town Meeting which can be a difficult process depending on the particular project and the “mood” of voters.

Traffic Impact Fees

A onetime fee shared to new developments to pay for the cost of serving the additional traffic generated by the new development. These fees are based on traffic studies and plans, and the fees are calculated based on the number of trips generated by various land uses. The cost of correcting existing deficiencies is usually excluded from the calculation for equity and legal reasons.

- \+ ***Politically acceptable***: because the fees are seen as being imposed on new residents or businesses, politicians are likely to approve them rather than voting for an increase in taxes.
- \+ ***Technically & legally acceptable***: They have been largely accepted on both a technical and legal grounds. A fee system based upon a detailed transportation planning study is technically sound and thus is likely to be found legally valid as well.
- \+ ***Equitable***: They are equitable for all types and sizes of development and so are favored by most developers over negotiated agreements or controls on growth. They are also known

in advance and can be figured in the initial financial feasibility studies for a development project.

- – ***Inequitable***: They have a built-in imbalance in that they are assessed only on new development and not on existing development which contributes to the traffic problem.
- – ***Piecemeal***: Revenues are collected gradually over time as development occurs, and thus may result in a piecemeal pattern of improvements that are made as funds become available. Since fees are based on development occurring over time, they are not reliable as a source of bonding revenue, and so are limited to their uses for major improvements.

Development Agreements

These agreements are negotiated during a project's local approval stage, when the local government is able to request conditions as part of its approval process. These conditions are usually applied during zoning or subdivision approval, when local government has broad discretion in approving a project.

- \+ ***Politically acceptable***: because the fees are seen as being imposed on new residents or businesses, politicians are likely to approve them rather than voting for an increase in taxes.
- \+ ***Versatile***: Because the local government has approval authority, it offers a significant inducement for developers to make such "voluntary" improvements.
- – ***Piecemeal***: Revenues are collected gradually over time as development occurs, and thus may result in a piecemeal pattern of improvements that are made as funds become available. Since fees are based on development occurring over time, they are not reliable as a source of bonding revenue, and so are limited to their uses for major improvements.
- – ***Tough to Balance***: It is difficult to treat all developers equally because of differences in sites, street configurations and other location factors. Large developments are often required to make major improvements, while small developments make few, if any, improvements.
- – ***Difficult Enforcement***: Enforcement may prove to be difficult, partly because of the administrative difficulty in coordinating among various city departments for agreements related to a large number of developments. This process is made more complex when phased improvements are required with a phased development, or when traffic monitoring is required as part of a project.

Transportation Development Districts

This type of financing creates a public-private partnership to plan and finance transportation improvements in high growth areas or districts. Properties abutting a designated section of roadway are assessed for their fair share of the cost of the road improvement with fees assessed based on linear frontage, area, or by trip generation and are usually for specific improvements benefiting property within the district. Generally this applies to all properties fronting the roadway to be improved, but can be expanded into a larger district if the improvements or impacts are to a larger area. If the district crosses municipal boundaries, it is considered a Regional Development District. Through an inter-municipal agreement allowed by RSA Section 53-A, the communities along Route 33 could form a district to provide a larger pool of funds for transportation improvements. This can be accomplished by publicly or privately financing the necessary road improvements and then assessing new development fees based on the share of available roadway capacity that they utilize. This pays the investment back instead of looking to collect enough to do the work within the confines of impact fees or other time limited methods.

+ ***Politically acceptable***: because the fees are seen as being imposed on new residents or businesses, politicians are likely to approve them rather than voting for an increase in taxes.
+ ***Technically & legally acceptable***: They have been largely accepted on both a technical and legal grounds. A fee system based upon a detailed transportation planning study is technically sound and thus is likely to be found legally valid as well.
+ ***Equitable***: They are equitable for all types and sizes of development and so are favored by most developers over negotiated agreements or controls on growth. They are also known in advance and can be figured in the initial financial feasibility studies for a development project.
+ ***Balanced***: Based on benefits received by abutting landowners and attributable to transportation improvements.
– ***Inequitable***: They have a built-in imbalance in that they are assessed only on new development and not on existing development.
– ***Piecemeal***: Revenues are collected gradually over time as development occurs, and thus may result in a piecemeal pattern of improvements that are made as funds become available. Since fees are based on development occurring over time, they are not reliable as a source of bonding revenue, and so are limited to their uses for major improvements.
– ***Challenges***: Property owners frequently challenge the establishment of this type of district.

Special Assessment District

In this type, designated areas are assessed for the cost of public improvements that benefit property within the district. The assessments are usually imposed on an ad valorem (according to value) basis, although acreage fees and front footage assessment also have been used. The key point of a special assessment district is that the fees are assessed for specific improvements benefitting property within the district. They are not taxes to be shared with other revenue sources, but must be used for specific items.

+ ***Technically & legally acceptable***: They have been largely accepted on both a technical and legal grounds. A fee system based upon a detailed transportation planning study is technically sound and thus is likely to be found legally valid as well.
+ ***Equitable***: They are equitable for all types and sizes of development and so are favored by most developers over negotiated agreements or controls on growth. They are also known in advance and can be figured in the initial financial feasibility studies for a development project.
+ ***Bond Security***: They can be used to secure bonds
+ ***Administration***: Easy for public agency to administer.

– ***Political***: Requires enabling legislation.

– ***Defining Boundaries***: Difficult to define specific boundaries.

– ***Defining Benefits and Costs***: The use of ad valorem assessments may not accurately represent the benefit derived by various properties or especially the proportion of the cost attributable to them.

Tax Increment Financing

Projected increase in property value is partially taxed for a prearranged time period. Developer pays for initial off-site improvements and the expenditure is recouped from difference in developed and undeveloped tax base. Frequently a TIF District is established.

+ ***Politically acceptable***: because the fees are seen as being imposed on new residents or businesses, politicians are likely to approve them rather than voting for an increase in taxes.

+ ***Equitable***: They are equitable for all types and sizes of development and so are favored by most developers over negotiated agreements or controls on growth. They are also known in advance and can be figured in the initial financial feasibility studies for a development project.

+ ***Consistent***: Taxing authority receives and undiminished source of income until initial costs are reimbursed.

– ***Inequitable***: They have a built-in imbalance in that they are assessed only on new development and not on existing development.

– ***Political***: Requires enabling legislation.

User Tax

Levied on all motor fuel sales, or each vehicle registered within a community's boundary, vehicle registration fees are paid to both the community and the state while fuel sales tax is paid to the state and the federal government. In New Hampshire communities can implement the ***Local Option Fee for Transportation Funding*** as one means of generating additional local funding via vehicle registration fees. HB 648, passed in 1998, allows a municipality to collect an additional motor vehicle registration fee of up to $5.00 for the purpose of supporting a municipal transportation improvement fund. Of the amount collected, up to 10% (maximum of $0.50 of each fee paid) may be retained for administrative costs. The remaining amount is deposited into the municipal transportation improvement fund to pay for improvements in the local or regional transportation system including roads, bridges, bicycle and pedestrian facilities, parking and intermodal facilities and public transportation.

+ ***Bond Security***: They can be used to secure bonds.

+ ***Administration***: Easy for public agency to administer.

+ ***Offsets Taxes***: Replaces a possible income tax increase.

+ ***Focused Use***: Use is designated for transportation issues only.

+ ***Stable***: Stable source of income.

- **_Political_**: Requires approval of fee at Town Meeting, and enabling legislation would be needed to raise the allowable fee to more than $5.00.
- **_Piecemeal_**: In smaller communities, revenues may not be collected at a rate great enough to fund larger projects in a reasonable timeframe or to make significant bond payments.
- **_Defining Benefits and Costs_**: The use of ad valorem assessments may not accurately represent the benefit derived by various properties or especially the proportion of the cost attributable to them.

State Aid Highway Program

This is a NH DOT run program that provides $2.5 million per year (including match) for reconstruction of Class I, II, and III (all state-owned) highways. These projects are municipally managed, and are funded 2/3rds with State funding and 1/3rd with local dollars. Typical projects are improvements at a town road/state highway intersection on unnumbered state routes that function more like a local roadway. The maximum project total allowable is $1,050,000 or $700,000 of state funds that may be appropriated over multiple years and unnumbered state routes may be reclassified to town roads when complete.

+ **_State Funds:_** Does not use federal funding and is easier to administer
+ **_Upfront funding:_** State pays ½ of its share at the beginning of the bid process for both engineering and construction. Remainder is reimbursement. Most programs are reimbursement only.

- **_Matching Funds:_** Higher match requirements than some programs (1/3rd vs 80/20)
- **_Waiting:_** Popular program for smaller projects and the wait can be long before funding is available.

Transportation Enhancements Program (TE)

The Transportation Enhancements (TE) program provides funding for smaller community-based projects that expand travel choices and enhance the transportation experience by improving the cultural, historic, aesthetic and environmental aspects of our transportation infrastructure. There is a list of 12 types of projects that are eligible several of which would be applicable to Main Street: Pedestrian and bicycle facilities; Pedestrian and bicycle safety and educational activities; Acquisition of scenic or historic easements and sites; landscaping and scenic beautification, Environmental mitigation of runoff pollution and provision of wildlife connectivity, as well as other potential projects. NH receives approximately $2 million per year for this program which it runs on a 2-3 year competitive cycle.

+ **_Matching Funds:_** 80/20 Match of Federal/Local minimizes need for local funding.
+ **_Program Match:_** The program matches well with Main Street projects as it is designed and intended to pay for improvements like those being recommended.
+ **_Quick Implementation:_** TE runs on a 2-3 year cycle however projects can be implemented as soon as one year after approval. The next TE round is anticipated to begin at the beginning of 2012 with project approvals by the end of 2012 and projects programmed for 2013 and 2014.

– ***Federal funding:*** Federal funds have additional and more rigorous administrative and management requirements

– ***Reimbursement based:*** Like all other Federal funding mechanisms, the TE program works on a reimbursement basis, so the community needs to generate the funding for the entire cost of the project locally, construct it, and pay for it, before requesting up to 80% repayment from the Federal Government.

– ***Competitive:*** Projects are determined through statewide competition

Congestion Mitigation and Air Quality Program (CMAQ)

The Congestion Mitigation and Air Quality Program (CMAQ) is a set-aside of federal transportation funding coming to NH that is geared towards transportation projects that reduce pollution and congestion in the area and assist in meeting the National Ambient Air Quality Standards (NAAQS). Projects can include construction, capital investment, and operating assistance for a limited time but must reduce emissions. NH receives approximately $4 million per year for this program which it runs on a 2-3 year competitive cycle.

+ ***Matching Funds:*** 80/20 Match of Federal/Local minimizes need for local funding.

+ ***Program Match:*** The program matches pretty well with Main Street projects as it is designed and intended to pay for improvements that reduce auto travel or make the existing transportation more efficient and less polluting.

+ ***Quick Implementation:*** CMAQ runs on a 2-3 year cycle however projects can be implemented as soon as one year after approval. The next CMAQ round is anticipated to begin at the beginning of 2013 with project approvals by the end of 2013 and projects programmed for 2014 and 2015.

– ***Federal funding:*** Federal funds have additional and more rigorous administrative and management requirements

– ***Demonstrated Air Quality Benefit:*** In order to be eligible, the project must be able to accurately model a reduction in emissions from the improvement.

– ***Reimbursement based:*** Like all other Federal funding mechanisms, the CMAQ program works on a reimbursement basis, so the community needs to generate the funding for the entire cost of the project locally, construct it, and pay for it, before requesting up to 80% repayment from the Federal Government.

– ***Competitive:*** Projects are determined through statewide competition although most of the funding is directed toward the communities that are within the non-attainment Area under the Clean Air Act and the National Ambient Air Quality Standards.

Safe Routes to School (SRTS)

The Safe Routes to School program is intended to encourage a greater percentage of elementary and middle school (K-8) students to bike and walk to school, and to ensure that they can do so safely. The program is designed around an integrated approach summarized as "the 5Es" – Education, Encouragement, Enforcement, Engineering, and Evaluation. SRTS funding is federal, and is passed through NHDOT. Towns or School Districts can access SRTS Start-Up grants of up to

$5,000, which are accepted on a rolling basis; and Travel Plan grants of up to $15,000 per school. This is a reimbursement program, though requires no matching funding. Once a Town completes a travel plan, they are eligible to access Project Grants of up to $250,000. The project grants are competitive, as more SRTS programs are being developed by towns and cities around the state, though not yet as difficult to secure as Transportation Enhancement funding.

- \+ ***Matching Funds:*** 80/20 Match of Federal/Local minimizes need for local funding.
- \+ ***Program Match:*** The program matches pretty well with Main Street projects as it is designed and intended to pay for improvements that reduce auto travel or make the existing transportation more efficient and less polluting.
- \+ ***Quick Implementation:*** The town is already involved with the SRTS program and incorporating Pollard School into a travel plan (which Plaistow may be able to get a grant to do) will enable access to the capital project grants which could a variety of improvements that make it safer and more attractive for children to walk or bike to school.
- – ***Federal funding:*** Federal funds have additional and more rigorous administrative and management requirements
- – ***Reimbursement based:*** Like all other Federal funding mechanisms, the project aspect of the SRTS program works on a reimbursement basis, so the community needs to generate the funding for the entire cost of the project locally, construct it, and pay for it, before requesting up to 80% repayment from the Federal Government.
- – ***Competitive:*** Project grants are determined through statewide competition although this program is currently somewhat less competitive than TE or CMAQ.

In the current climate of scarce infrastructure funding the community will need to be careful of the financing methods chosen so as to ensure the best chance for implementation. It is recommended that the Town develop individual projects for implementation within the context of the overall Main Street Traffic Calming Plan, and use different funding sources for the different components of the Plan. For instance, the Safe Routes to School program may be an avenue to fund educational and capital improvements near the school, while Transportation Enhancements or Congestion Mitigation Air Quality funding improves another area and a developer agreement improves yet another.

Appendices

- Traffic Count Summaries
- Turning Movement Count Summaries
- Intersection Operations Analyses