



Technical Memorandum 3 – Recommendations

# South Lexington Transportation Study Lexington, Massachusetts

Engineering and Planning Departments



FAY, SPOFFORD & THORNDIKE

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With RKG Associates, Inc.



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## 3.1 INTRODUCTION

### 3.1.1 SYNOPSIS

The Town of Lexington retained Fay, Spofford & Thorndike, LLC with RKG Associates to conduct a South Lexington Transportation Study for a 10-year horizon between 2013 and 2023.

The 10-year horizon was originally going to assume “Moderate” and “High” Builds, where the “Moderate” build would entail background traffic growth of ½% per year plus generated traffic from 542,000 gross square feet (GSF) of future office/R&D development. This represents the amount of Study Area development already approved and permitted within existing zoning along the Hayden Avenue and Spring Streets commercial areas. “Moderate” build findings were reviewed within the context of the Town’s traffic analysis guidelines. These guidelines require peak hour traffic operations *no worse than* level of service (LOS) A-D during peak hours at Town intersections vis-à-vis the impacts of new development. With the “Moderate” Build case, traffic volumes projected for peak hour intersection conditions were worse than the Town’s traffic analysis guideline maximums (i.e., LOS E to F, rather than LOS A-D) *even with practical mitigate, on measures implemented*. In consultation with Town representatives to discuss these findings, a “High” Build condition was *deemed infeasible* over the next ten years. Therefore, the Study allocated more level of effort on identifying and evaluating options for problem areas that would worsen with the “Moderate” Build. Attention was focused on enhancing pedestrian and bike circulation connections and safety for other traffic under the most likely future traffic conditions.

**Technical Memorandum 1** documents existing conditions analyses findings and future build out assumptions, based on detailed market analyses findings completed by RKG Associates and can be found separately to this report.

**Technical Memorandum 2** follows up on Technical Memorandum 1 (Existing Conditions) by identifying a 10-year horizon traffic projection pertaining to infill of existing approved developments with anticipated background growth. It identifies and evaluates alternative transportation mitigation measures from a multimodal usage perspective. After consultation with the Town of Lexington, it was agreed *to identify the highest development scenario on an assumption that allows the Town to have a general*

idea about how much additional development *can conceivably be absorbed* on the Hayden Avenue/Spring Street/Concord Avenue/Waltham Street corridors *before a major congestion problem emerges*. This turned out to be the ‘Moderate’ projection, consistent with the Town’s existing guidelines.

Basically, increasing the South Lexington development build out beyond the “Moderate” assumptions requires the Town to alter its existing guidelines and adopt special zoning modifications that are not now in place. For example, a change in the Town’s traffic impact guidelines to adopt the MEPA/MassDOT environmental impact threshold *allowing mitigation for new development to “better than or equal to” the No-Build LOS, not a strict LOS A-D adherence*. Such a modified policy could conceivably permit greater development than the assumed “Moderate” Build from this study without worsening conditions beyond those expected with already approved development plans for the Spring/Hayden Streets commercial zone.

**Technical Memorandum 3** (this memorandum) follows up on the findings of Technical Memoranda 1 and 2 by documenting the public process for the Study and identifying recommendations to address South Lexington multi-modal circulation problem areas, based on input received and follow-up analyses.

Overall, the South Lexington Transportation Study, referred to as ‘the Study’, provides an operational analysis of walking, biking, and motor vehicle modes under existing and future traffic conditions with recommendations for enhancing circulation safety for all modes and promoting environmentally-friendly circulation modes. Study findings were coordinated with the Town as well as neighborhood and business growth area stakeholders.

### **STUDY AREA**

The Study Area includes detailed analysis of 15 intersections along Waltham Street, Marrett Road, Spring Street, Concord Avenue, Hayden Avenue, and Lincoln Street. Both automatic and manual counts were performed twice; once during late November 2012 and a second time during January 2013 to address traffic diversion impacts from underground utility construction on Marrett Road (2A). This work was completed prior to year 2014 Marrett Road pavement and sidewalk upgrades.

## **EXISTING CONDITIONS FINDINGS**

Measured AM peak hour traffic was found to be generally 16% *higher than* PM peak hour traffic at Study Area intersections, likely due to greater morning peak hour traffic diversions in South Lexington from I-95 and Route 2 westbound congestion. Based on a review of historical and new counts by others, during peak periods, traffic on the Marrett Road/Waltham Street corridors and short cut routes is variable, subject to traffic increases when congestion occurs on I-95. What this means is that signalization of intersections must be able to adapt to a range of varying traffic flow conditions.

Busiest streets were Waltham Street (15,500 average annual daily traffic or AADT), Marrett Road (9,000 AADT), Spring Street (7,200 AADT), Concord Avenue (7,100 AADT), and Hayden Avenue (5,750 AADT ). Remaining streets carried from 300-1,700 AADT.

Existing *capacity* trouble spots (i.e. Level of Service or LOS E/F) with traffic signals included:

- Concord Avenue at Waltham Street
- Waltham Street at Marrett Road
- Marrett Road (Route 2A) at Spring Street

Because main South Lexington travel corridors are subject to conditions occurring on existing *capacity* trouble spots without traffic signals included:

- Hayden Avenue at Waltham Street
- Hayden Avenue at WB Rte. 2 off-ramp
- Marrett Road (Route 2A) at Lincoln Street
- Concord Avenue at Pleasant Street
- Spring Street at Shade Street
- Concord Avenue at Walnut Street

Intersections where the calculated crash rate exceeded average crash rates for Massachusetts or District 4 included:

- Marrett Road at Lincoln Street (1.02 crashes/million entering vehicles)
- Hayden at Waltham Street (1.00 rate)
- Marrett Road at Middle Street/Cary Avenue (0.79 rate)

- Concord Avenue at Walnut Street (0.72 rate)
- Concord Avenue at Spring Street (0.69 rate)
- Lincoln at Middle Streets (1.98 rate is not relevant, as fewer than 1 crash reported annually and Lincoln/Middle Streets carry very low traffic volumes)

The Town of Lexington either has or will be addressing existing conditions trouble spots at the following locations:

- *Concord Avenue at Spring Street* - A traffic control signal with lane and geometric improvements was recently installed.
- *Concord Avenue at Waltham Street* - The existing traffic signal has been designed for upgrades to be installed in the next year. Upgrades will include new signal phasing and exclusive left turn lanes on Waltham Street. Signal upgrades will improve the safety of all intersection users.
- *Shade Street* - Traffic calming, including striping, signs and speed humps and new crosswalk markings at Spring Street have been installed
- Hayden Avenue bike lanes and resurfacing/sidewalks
- Concord Avenue bike sharrows and a new sidewalk

### **PROJECTION FINDINGS**

As of 2013, the Hayden Avenue/Spring Street corridors adjacent to Route 2 had approximately 2 million sf of development primarily in 10 properties already constructed. By the horizon year 2023, an additional 542K GSF of already-approved development is expected to be constructed, representing the combined “Moderate/High” development growth scenario.

#### *Projected Traffic Growth*

Between the years 2013 and 2023, we project Study Area AM peak hour traffic volumes, typically the highest of the weekday peak hours will grow by 12%, while PM peak hour traffic will grow by 10%.

#### *Projected Traffic Operations*

We project traffic operations at *all five* Study Area signalized intersections will be operating at LOS E-F by 2023 during either the AM or PM peak hours, or both, *even with signal timing mitigation measures implemented.*

Of the unsignalized intersections:

- Route 2/Waltham Street interchange area, Marrett Road (2A) at Lincoln Street, and Concord Avenue at Pleasant Street are expected to be operating at LOS F during both the AM/PM peak hours.
- The Concord Avenue /Route 2 eastbound off-ramp will degrade from LOS E to LOS F during the AM peak hour.

#### *Future Safety Implications*

Without mitigation, crash rates will likely worsen at Marrett Road (2A)/Lincoln Street, Hayden Avenue at Waltham Street, Marrett Road/Cary/Middle Streets, and Concord Avenue/Waltham Streets.

#### **MITIGATION FOCUS AREAS**

Mitigation recommendation focus areas included the following:

- Marrett Road (2A) /Lincoln/School Streets
- Marrett Road (2A)/Carey Avenue/Middle Streets
- Area 3: Route 2 Westbound off-ramps to Waltham Street and Hayden Avenue
- Concord Avenue at Pleasant and Walnut Streets
- Lincoln at Middle Streets

Based on input received subsequent to the last community meeting, specific recommendations for the intersection of Shade at Spring Streets are also included.

## 3.2 Public Review Process

### 3.2.1 Public Meeting on 10/21/13 – Discussion of Existing Findings and Options

An initial meeting was held at the Cubist site on October 14, 2013 to meet with Hayden/Spring business representatives to provide a basis for the upcoming public meeting. The meeting with Hayden/Spring businesses essentially had the same subject matter as the immediate follow up public meeting held on October 21, 2013 at Brookhaven. Based on the Lexington Town Planner notes<sup>i</sup> and subsequent letters received, following is a summary of *public* meeting and letter comments and responses:

#### **Public Meeting Notes (10/21/13)**

*C: What are the rules or guidelines, if any, for addressing sightlines? Specifically is there a correlation between the number of accidents and sightline issues?*

A: In areas where traffic speeds are higher crashes are more likely to occur with movements that have sightline issues. When speeds are lower, sight line requirements are lower. Both stopping and intersection sight lines are important, and when sight lines are less than minimums required to come to a complete stop, crashes can increase, particularly where volumes on the cross street are high. MassDOT and Lexington sight line requirements are based on nationally recognized roadway sight line guidelines provided in the *American Association of State Highways and Transportation Officials report entitled: A Policy on Geometric Design of Highways and Streets (2011)*. Roadway sight line requirements are not fixed, as motorist sight line requirements are not the same as those needed by pedestrians. They vary by the individual's ability to respond to a particular situation. Street grades and 85<sup>th</sup> percentile speeds – the speed at which 85% of the vehicles are travelling at or below – are critical factors in estimating necessary stopping and intersections sight distances to reduce crash potentials. Engineers who design roads are typically responsible for evaluating appropriate sight distance criteria being applied to each situation where roadway, driveway, and crosswalk conflicts may occur.

*C: I liked the three options you presented to address traffic and safety issues for the intersection of Carey/Middle/Marrett but do not think the crosswalk at Marrett Road is the best location.*

### 3.2.1 Meeting on 10/21/13 – Existing Findings and Options (Continued)

A: The bike path exits onto the north side of Marrett Road right at the proposed crosswalk opposite where the cyclists/pedestrians are traveling to and from Carey/Middle Streets approximately at the apex of the Marrett Road horizontal curve. If the crosswalk was relocated, it would need to be moved quite far from where it is to create adequate sight lines in both directions. Its relocation or elimination would be detrimental to the safety of the many persons who would likely continue to cross at the ‘desire line’ on the end of the bike path. Visibility of the crosswalk is an issue due to the curve and would be enhanced by installing either a Lexington-style overhead flashing display or overhead rectangular rapid flashing beacons (RRFBs) in both directions making sure vegetation and branch trimming is regularly done as necessary to demonstrate that sight lines 85<sup>th</sup> percentile travel speeds on Marrett Road are maintained on both approaches such that motorists become more aware of the crossing with supplemental signs as necessary to alert motorists about the crossing. Additionally would enhance visibility of the crosswalk.

*C: There is a good amount of pedestrian activity near the intersection of Walnut and Concord given the proximity to the Western Greenway Trail. There are currently no sidewalks at this location and the landscape is not maintained causing sightline issues. I would like to see more accommodations for pedestrians at this intersection.*

A: This issue is addressed in Section 3.3.5 Assuming a crosswalk is warranted, a corner sidewalk/ADA compliant landing should be installed at the northwest corner of Walnut Street at Concord Avenue to provide a waiting area for pedestrians who use Walnut Street. Installation of a sidewalk or even a ‘country trail’ with crushed pea stone or gravel would benefit trail users.

*C: Have you spoken to engineers from surrounding towns to see what they are doing in their communities to address traffic?*

A: FST contacted surrounding towns to obtain information on approved development projects, and reviewed the projects MassDOT is planning in the South Lexington area. We also coordinated with Central Transportation Planning Staff on the background growth rate for future development.

### 3.2.1 Meeting on 10/21/13 –Existing Findings and Options (Continued)

*C: Did you think of surveying motorists coming from Waltham to get their feedback and ask them where are they going?*

A: Such motorist surveys were not included in our Scope of Services. However, we collected traffic data, including counts and crash information, and made visual observations of the Study Area corridors and intersections to identify traffic conditions. Traffic issues were discussed with Town staff to meet the goals of the Study.

*C: The road off of Waltham is Brookside Avenue, have you considered extending that road (not sure to where)?*

A: We understand there is an undeveloped layout that connects Brookside Avenue to Stedman Road. We did not look at extending Brookside Avenue as we were focusing on transportation issues related to the development along the Spring Street/Hayden Avenue corridor.

*Q. Did you consider putting in a stop light at Pleasant and Concord?*

Yes, we did. This issue is also addressed in Section 3.3.5. This location meets peak hour volume signal warrants, but does not meet 8 hour or crash signal warrants at this time. Additionally, fitting a signal in the immediate residential setting would be very challenging, and should only be considered if the crash rate for the intersection exceeds the statewide or Districtwide average crash rate for similar unsignalized intersections. This intersection was below the average crash rate for the period of 2006 – 2010.

*C: How is the placement of sidewalks being determined? Hayden Avenue has one but Walnut Street does not. There is a sidewalk on one side of Waltham but this limits pedestrian access.*

A: A recent Lexington Town wide study,<sup>ii</sup> of sidewalk and crosswalk ramp materials, conditions, and ADA/MAAB compliance deficiencies for all Town roadways. It identifies adding a Waltham Street sidewalk as high priority. Due to its proximity of schools and the high volume, adding a sidewalk to both sides of Waltham Street would be beneficial.

### 3.2.1 Meeting on 10/21/13 – Existing Findings and Options (Continued)

In a perfect world, adding a sidewalk to the west side of Walnut Street between the Western Greenway Trail and Concord Avenue --a distance of approximately 1,700 feet--would be very beneficial to serve pedestrian demands between the Trail and Concord Avenue. Unfortunately, costly tree removals, impacts on walls, and steep sidewalk grades adjacent to Walnut Street would make ADA/MAAB compliance very difficult to achieve. If the Town is ok with the environmental and abutter impacts, the installation of a sidewalk would be feasible.

*C: What is the definition of Sharrows?*

A: It is a term used to describe shared lane markings which are bicycle logos plus double arrow white pavement markings placed on a roadway to alert motorists that bikes are allowed to share the road. Sharrows also may be used as a trail blazing guide for cyclist road routes.

*C: The traffic light installed at Spring and Marrett has resulted in diverting traffic to Downing Road and Middleby Road. Concerned that the additional traffic lights you are showing as options at the various intersections will divert additional traffic to local streets.*

A: The intersection of Spring and Marrett Roads would operate acceptably if it had separate westbound left and through lanes. Because such a configuration is not possible at this time, the intersection operates with delays that may encourage westbound motorists to divert during peak hours.

Due to their maintenance requirements, a typical increase in rear-end collisions and the potential for short-cutting, traffic signals are always a *'last', not first, traffic control option*. If installed where warranted with necessary lane configurations, with appropriate signal controls to address a wide range of traffic demands, they can be an effective way to manage traffic, especially if crash rates for other options involving angle collisions or pedestrian crashes need to be addressed. We also evaluated unsignalized solutions and roundabouts that do not involve signalization. But unsignalized options have their own set of drawbacks.

### 3.2.1 Meeting on 10/21/13 –Existing Findings and Options (Continued)

*C: Shade Street has become a significant cut through that has created an unsafe condition for walkers and bikers. The recently installed striping gives a false sense of security for walkers.*

A: Following this meeting, during 2014, the Town installed several speed humps along Shade Street to address cut through usage. At this time, it is anticipated that Shade Street traffic ‘cut-through’ traffic will decline over time, if it has not done so already.

*C: Is there data that indicates this type of striping on Shade Street is effective? There has already been an accident at Shade and Fairbanks on a Sunday. What would you recommend for this area?*

A: The Town has subsequently installed speed humps on Shade Street to assist in creating a slower route for those who like to use Shade Street for a shortcut.

*C: Is there a rule to how far apart sharrows should be placed?*

A: Sharrows typically should be spaced every 250-350 feet depending on the location and the cycling route that is being identified.

*C: Can the speed detection signs that were recently put up be able to collect traffic volume data?*

A: Speed detection equipment can collect volume and approach speed data to track speeding trends at the signs.

*C: MassDOT is proposing roundabouts on Route 2A near 128 and you have roundabout options for all of the intersections you reviewed. Is there a limit to where these can go and the number?*

A: The Federal Highway Administration has one of their top-ten roadway safety enhancement features. Roundabouts, whether full size with raised center islands or mini-roundabouts with mountable center islands, have been shown to reduce traffic speeds and crashes at intersections where entering traffic volumes are within 3 times of one another. They involve motorists slowing to 15-20 miles per hour and yielding into the roundabout. They are a form of traffic calming and are certainly not appropriate everywhere. Single lane roundabouts, such as those identified in Technical

### 3.2.1 Meeting on 10/21/13 – Existing Findings and Options (Continued)

Memorandum 2, operate best when conflicting volumes on any given weaving segment are lower than 1,200 vehicles per hour with grades and ‘deflection’ that work properly in all weather conditions. Public response to roundabouts tends to be unpopular prior to installation, but favorable after installation. For spacing minimums, the City of Malta, NY has seven roundabouts within 1.3 miles on Routes 67 and 118 including two at the I-87/Route 67 interchange.

Geometric features of roundabouts are such that they do require available right of way for installation along with typically raised ‘splitter islands’. They require motorists/bicyclists to yield to conflicting traffic in the roundabout and pedestrians to cross at the splitter islands. Pedestrian safety experience at roundabouts has generally been good.

*C: Any situation turning right onto Waltham from Hayden needs to consider the sightline issues and ability of elderly to turnaround.*

A: This was considered in coming up with conceptual ideas for this intersection and certainly will be considered in the re-design of this interchange.

*C: What is the town’s position on speed bumps, there are plenty of other towns that us them. What about installing inverted ones?*

A: Many emergency responders do not like them. There are more mild options such as speed humps or speed pillows which can be considered. Inverted options create potholes and have drainage issues.

*C: Does your accident data reflect only vehicle to vehicle incidents? Are there differences between methods that may improve safety for vehicles but degrade conditions for pedestrians?*

A: Crash data was collected involving vehicle, pedestrians and cyclists from 2006-2010. The Complete Streets philosophy must consider the design impacts of all users and there are impacts to the different users.

### 3.2.1 Meeting on 10/21/13 –Existing Findings and Options (Continued)

*C: Will this presentation be available on the town website?*

A: Yes.

*C: Making a left onto Marrett Road from School Street is challenging perhaps look at joining School with Lincoln ahead of Marrett Road to improve conditions. I live on Spring Street where a lot of signage and striping was place recently. It changed driver behavior but only for a short period of time until drivers became accustomed to it; perhaps another option is to lower the posted speed limit on Spring Street.*

A: Some communities have opted to provide yellow warning signs for advisory speed limits rather than posting the speed limit derived from 85<sup>th</sup> percentile speeds. They must be the proper shape and color to comply as a ‘warning’ not ‘regulatory’ sign, as the regulatory ‘prima facie’ speed limit is what is enforceable, as this time.

*C: Is it possible to have three-way stop at the intersection of Fairbanks and Shade Street?*

A: It is possible, if sightline issues are found on the Fairbanks approach to Shade Street. Subsequent to this meeting speed humps were installed on Shade Street which should assist in addressing speeding concerns on Shade Street near Fairbanks.

*C: A major flaw with most of the traffic studies assumes Route 2 is a free flow and not sure if you took that into consideration for future projections. Regarding Spring Street it is odd that the speed limit is 30 mph in the commercial/industrial area and 35 mph in the residential. Would hope that the consultant would provide some insight as to how the Town can move towards reducing the speed. The recently implemented striping and signage on Shade Street currently addresses about 20% of the issues that exist. Would like to see more of an effort to address the issues along Shade Street and recommend revising your charge to get Shade Street in the scope of work.*

A: Comparing historical and newer traffic volumes in the area to one another, traffic diversions on the Marrett Road, Waltham and Spring Streets corridors vary significantly depending on the level of congestion on both I-95 and Route 2. When regional highway

### 3.2.1 Meeting on 10/21/13 – Existing Findings and Options (Continued)

congestion is higher—for example as during typical morning peak hours—diversions are greater on these three corridors and possibly along the residential neighborhood short cutting routes. This means that the Town’s traffic controls on Spring Street/Marrett Road/Waltham Street corridors ideally will be adaptive to a wide range of traffic conditions. All existing signal controllers along these corridors are detector-driven to maximize adaptability to changing traffic conditions. The Town monitors signals under its control to adjust controller settings (for example, phasing sequences, cycle lengths, maximum and minimum times) as necessary to achieve flexible signal operations. It needs to coordinate with MassDOT to adjust controller settings at signals under MassDOT control, such as those at Spring Street/Marrett Road and Waltham Street/Marrett Road.

*C: How are certain streets designated in town?*

A: For funding purposes, the State functionally classifies all roadways as different levels of arterials, collectors and local streets, including those in Lexington. Lexington, from its zoning article §175-45 – *Streets and Rights of Way*, in turn, has its own classification system as follows:

“Classification hierarchy. The hierarchy of the street classification system is based on the volume and characteristics of the traffic which is likely to use the street. The hierarchy is:

(a) **Minor residential street** (dead end): the lowest classification of residential street designed to serve not more than four proposed, potential or existing dwelling units. It carries only the traffic that has its origin or destination on the lots which have access to the street. In nearly every case, the limitation of not more than four proposed, potential or existing dwelling units served means the street will be a dead end. As many dwellings in a subdivision as is possible shall have their access onto this class of street.

(b) **Local street**: the next lowest street designed to serve five or more proposed, potential or existing dwelling units. It carries traffic that has its origin or destination in the immediate neighborhood, such as on the lots that have access to the street and from minor residential streets which connect to it. Dead-end streets with more than five proposed, potential or existing dwelling units are in this class of street. As many dwellings in a subdivision as is

### 3.2.1 Meeting on 10/21/13 – Existing Findings and Options (Continued)

possible shall have their access onto this class of street rather than a higher classification street.

(c) **Collector street:** the next lowest street designed to serve 15 or more existing, proposed or potential dwelling units, or a commercial development in a commercial subdivision, and to act as a connection to other streets. It conducts and distributes traffic between lower classification streets and higher classification streets. In larger residential developments, a collector street may be necessary to carry traffic from one neighborhood to another adjoining neighborhood or from the neighborhood to other areas in the Town. In a residential development, it is not intended to be a bypass or shortcut to serve through traffic that has its origin or destination outside of Lexington, in a commercial area, or in other, more distant, residential neighborhoods in Lexington such as those that are a mile or more away. On corner lots, access should be to the lower classification street.

(d) **Arterial street:** the highest classification street designed primarily to carry through traffic that does not have its origin or destination within a proposed subdivision. It carries traffic to and from commercial districts within Lexington, residential neighborhoods in Lexington that are a mile or more away, and to and from activity centers in adjoining cities and towns. Private access and frontage should be discouraged and limited to higher volume generators of traffic such as large commercial or multifamily residential developments. Arterial streets would rarely be appropriate for a single-family residential development.”

*Q: When were traffic counts done and for how long?*

A: Traffic counts, including several Automatic Traffic Recorders (ATRs) placed throughout the study area over a 48 hour period, plus manual counts were conducted during November 2012 and then in January 2013. Both occurred while schools were in session. The two count periods were necessitated by utility construction on Marrett Road that caused traffic diversions. Past counts conducted in the study area were also reviewed for comparison.

### 3.2.1 Meeting on 10/21/13 – Existing Findings and Options (Continued)

*C: Why not construct a sidewalk along Shade Street?*

A: Shade Street is designated a historic route which has restrictions on changing the basic nature of the route. A meeting attendee noted that some of the residents got together to develop and launch a survey to identify exactly what all the neighbors would like to see. They were looking for a 100% response rate. Following this survey and neighbor involvement, Shade Street speed humps were installed in 2014.

### 3.2.2 Public Meeting on 11/18/14 – Discussion of Preliminary Recommendations

Again, the following comments and responses are based on the Lexington Town Planner's<sup>iii</sup> notes from the meeting.

#### **Marrett/Cary/Middle Streets Concept**

*C: Is it possible to move the proposed crosswalk to a location that would have a straighter crossing? There are issues at this location because you have a bike trail there and would have dangerous conflicts. Pedestrians see the cars but the cars don't see the pedestrians.*

A: Any re-design would follow FHWA guidelines to determine the appropriate crosswalk location. The existing crosswalk is located at the apex of a horizontal curve on Marrett Road. Sliding it one way or the other would lower motorist visibility from one direction, worsening crosswalk visibility in one direction. To enhance visibility, we recommend keeping the crosswalk approximately where it exists, but adding mast-arm mounted above the roadway 'Lexington-style' pedestrian-activated flashers, as used on Waltham Street near Brookhaven at the crosswalk. It is possible to substitute RRFB's for the flashing yellow signals above and below the pedestrian warning sign. Refer to Section 3.3.3 for details on the recommended strategy for this crosswalk.

*C: Have you considered flashing speed limit signs at this intersection. Shade Street has one and heard it was somewhat effective.*

A: This is something that could be considered, but would be needed in both directions. It is reasonable to add a 30 miles per hour static speed limit sign to the eastbound approach, as there is only one on the westbound approach and the speed limit increases

### 3.2.2 Meeting on 11/18/14 – Preliminary Recommendations (Continued)

to 35 mph just west of the crosswalk. We believe the pedestrian-actuated ‘Lexington-style’ flashers or RRFB as noted above would be more effective than the supplemental automated ‘your speed’/speed limit signs. The benefit of permanent ‘your speed’/speed limit signs is that they can provide speed data that can be helpful in identifying appropriate times of the day or week when speed limits are being most violated for speed enforcement purposes.

*C: Is this a candidate for a traffic signal? Believe placing a turn lane would create safety issues for pedestrians and may increase the number of rear end accidents.*

A: The Cary Avenue/Middle Street volumes do not warrant consideration of a traffic signal with projected 2023 volumes. Recommended changes do not preclude installation of a traffic signal, if signal warrants are eventually met.

*C: Problem is caused by WB vehicles making left turns onto Middle St. There is confusion of drivers who believe Middle St is a continuation of Route 2A. Would you be able to extend the double yellow lines to indicate the difference between Marrett & Middle? There really is an abrupt breakage in the double yellow line.*

A: Regarding the problem cited, the consolidated intersection addresses this important issue. We understand the Town of Lexington already installed a double-yellow ‘skip dash’ line on Marrett Road across its intersection with Middle Street. This measure is included as an interim recommendation in this Technical Memorandum in Section 3.3.3 as an ‘immediate action’ mitigation measure.

*C: Existing signs do cause some confusion. We need additional signage that provide clarification for this intersection. Also, please look at the crash data.*

A: Redesign would involve adding any necessary signage along with striping and the pedestrian signal. We reviewed the crash data and concluded that this location warrants crash-reduction attention. Recommendations in Section 3.3.3 address proposed measures to reduce the likelihood of crashes involving both vehicles and pedestrians.

### 3.2.2 Meeting on 11/18/14 –Preliminary Recommendations (Continued)

*C: There is not enough signage on Marrett Road and would recommend that in pavement reflectors be installed at the crosswalks.*

A: Installation of centerline raised pavement marker (RPM's) reflectors is a reasonable strategy approaching the intersection from both directions, spacing them closer together approaching the cross-walk. RPM's should be included in the future design for this intersection.

*C: Believe you will create a bottleneck and backups along Cary and Middle with the proposed recommendation. What do you think will happen in this area?*

A: Volumes observed at this intersection indicate the proposed reconfiguration should be able to process projected year 2023 traffic demands and reduce the level of conflicts and confusion for all users.

*C: Have you considered looking at turning some of the side streets into one way in each direction?*

A: One-way streets, under certain situations, can reduce short-cutting motorists. Unfortunately, they may have the undesirable impact of causing traffic diversions to nearby residential streets, adversely affecting emergency access, and increasing speeding on residential streets. We did not see any good candidates for converting residential streets in the South Lexington Study Area to one-way operation. We would not recommend such a conversion to one-way operations without strong support from the street, affected nearby neighbors, and the Town's emergency providers.

*C: Have you been in communication with the state about all of these recommendations?*

A: Generally, we believe it is too early in the process to involve the State, as this study really is supposed to reflect what the Town would like to see along the corridors. For this intersection, for example, Lexington has jurisdiction on the Town roads that are more affected than Marrett Road. If the design proceeds, MassDOT will need to become involved at an early stage of the design.

### 3.2.2 Meeting on 11/18/14 –Preliminary Recommendations (Continued)

#### Hayden/Waltham/Route 2 Ramps

*C: Signage on Route 2 for the off ramps needs to be improved.*

A: This should be done when the interchange of Waltham Street/Hayden Avenue is

*C: Difficult to see the median strip on Waltham as you travel southbound. The reflectors do not work properly in this area.*

A: We agree and recommend that reflectorized pavement markers be used with any median reconstruction that may occur with an interchange upgrade at this location.

*C: I don't believe the Route 2 off ramp at Hayden Ave experiences traffic issues.*

A: Much of the problem in this area is related to crashes, not necessarily congestion at this ramp. Crash data shows this is a high crash area with motorists making a very short weave to turn left at Hayden Avenue from this ramp, rather than using the direct ramp to Hayden Avenue

*C: How would the proposed signals along Waltham at Hayden operate?*

A: The signals would be coordinated in this area and are expected to operate at acceptable levels of service. This assumes lane designations as indicated in Section 3.3.4 include a state of the art, multi-modal detection system.

#### Concord/Pleasant/Walnut

*C: Would like to see your recommendation at Pleasant and Concord include the addition of a crosswalk across the mouth of Pleasant to connect the existing sidewalks on either side.*

A: This has been included in the recommendations highlighted in Section 3.3.5.

*C: Is the intent of the proposal at Walnut and Concord to have a biker or walker continue traveling along the roadway once you get past the sidewalk? Believe no one would walk on that side of the roadway with their back to traffic but do believe the proposed creation of a corner sidewalk would help with existing sightline issues.*

### 3.2.2 Meeting on 11/18/14 – Preliminary Recommendations (Continued)

A: In an ideal world, the best solution would be a 4-foot sidewalk on the west side of Walnut Street or a ‘country trail’ design that could be used by both cyclists and walkers. The impacts on trees in this area would be significant and it would be a costly endeavor. We recommend the more feasible approach suggested above by the meeting attendee.

#### Spring Street

*C: Would like to reduce the speed limits along Spring St and recommend that speed mitigation be considered as part of this study. The posted speed limit on Spring Street, formerly 30 mph, actually went up to 35mph with the Shire Development. Would like to see that a recommendation in the study include returning the posted speed limit on Spring Street to 30 mph.*

A: Unfortunately, the 85<sup>th</sup> percentile of actual speeds measured on Spring Street, were probably close to 35 mph, so the designers probably recommended the 30 mph signs be replaced with the higher 35 mph speed limit.

Though not specifically addressed in the Manual on Uniform Traffic Control Devices, we are aware that another Massachusetts community that replaced 30 mph regulatory signs on a street that was previously posted with 20 mph white regulatory signs. Adjacent residents were so opposed to this change, the community replaced the 30 mph signs with *unenforceable 20 mph yellow diamond-shaped warning signs*.

When a regulatory speed limit sign is replaced by an advisory sign, it is only be possible for motorists travelling above the 35 miles per hour true speed limit to be ticketed, not those who may be exceeding the advisory speed limit. Replacing the white 35 mph rectangular regulatory signs with *unenforceable 25 mph diamond warning signs* is something that could be tested on Spring Street . If such a change results in *lowering measured* travel speeds on Spring Street, it will be possible to convert to back to the rectangular white 30 mph (or 25 mph) signs for enforcement purposes.

*C: Will the installation of a Greenway crossing located near Spring St and Shade St be included in the report? Believe it would be a nice visual queue for drivers to transition from a commercial to residential area.*

### 3.2.2 Meeting on 11/18/14 –Preliminary Recommendations (Continued)

A: This report includes the crossing recommendation that we believe is a good one to connect Shade Street to the trail further south on the east side of Spring Street.

#### **Marrett Road/Lincoln Street**

*C: Did you consider a roundabout at Marrett and Lincoln? Believe a signal at this location would actually impede traffic? Recommend a roundabout at Lincoln Street and Marrett Road similar to the ones being considered by MassDOT at the Route 2A interchanges with Route 128.*

A: We did look at that as one option that we believed would actually work well, but Town staff concluded they preferred the option discussed in Section 3.3.3.

#### **Other Locations**

*C: Have you considered the intersection at Concord Avenue and Waltham Street?*

A: The intersection of Concord Avenue at Waltham Street was evaluated with existing and future conditions. The Town is designing improvements to this intersection as part of Concord Avenue sidewalk project.

*C: Waltham Street and Marrett Rd intersection is an issue with significant backups.*

A: The Town has asked FST to prepare a memo requesting signal timing modifications at this intersection that it will forward to MassDOT for implementation. This should happen in the very near future.

*C: Believe there are safety issues for cyclists at roundabouts. Would like to have a separated bike path at the roundabouts instead. Narrowing the roadway seems counterintuitive.*

A: Due to comments received from Town staff, roundabouts are not recommended at any of the locations where they were considered in Technical Memorandum 2.

### 3.2.3 Recent Letters Received

Attached are text copies two recent letters received by the Town subsequent to the 11/18/14 meeting. The first letter involves a request for a crosswalk at Shade Street and Spring Streets and is addressed in Section 3.3.7.

The second letter involves a request to enhance the pedestrian environment along Pleasant Street. Section 3.3.5 addresses the crosswalk at Concord Avenue. The other two locations are outside the Study Area. We understand these are being addressed in a separate study by the Town.

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November 19, 2014

David Kucharsky, Planner  
Town of Lexington

Re: Crosswalk at Spring and Shade Street

The Greenways Corridor Committee wishes to recommend that a pedestrian crosswalk with flashing light to be located at the intersection of Spring and Shade Street, be included in the final plans for the South Lexington Transportation Study. A pedestrian crossing in this location will be an important link in long term draft plans for the ACROSS Lexington trail system to connect trails in Hayden Woods with a proposed trail through the property on the west side of Spring Street, currently occupied by Shire Pharmaceuticals. The Conservation Department at the request of the Conservation Stewards is in the process of negotiating an easement for said trail as part of negotiations between the Town of Lexington and Shire for a Conservation Restriction on a portion of this property.

As was pointed out in last night's South Lexington Transportation Study public hearing in comments by Richard Canale, a pedestrian crossing at this location will also greatly benefit the local neighborhood in providing a safe crossing of Spring Street, and will also serve notice to motorists that they are entering a residential area where reduced speed is desirable.

Thank you.

Keith Ohmart, Chair

cc. John Livsey, Town Engineer  
Richard Canale, Planning Board

## 2.3 Recent Letters Received (Continued)

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November 18, 2014

John Livsey, P.E.  
Town Engineer, Town of Lexington, MA

Re: Advocating for Pedestrian Crosswalks in the South Lexington Transportation Study Area

At the junction of Pleasant Street and Concord Avenue, there is a sidewalk on the north side of Concord Avenue on both sides of this T-intersection. Pedestrian safety would be greatly improved if these two sidewalks were connected by a crosswalk. Motorists travelling southbound on Pleasant Street and turning right onto Concord Avenue often only look for potential vehicles to the left before rolling through the intersection without stopping. A crosswalk would reinforce the stop line and alert motorists to look for pedestrians. This is especially important in low light conditions.

The intersection of Pleasant Street and Walnut Street is very hazardous for pedestrians. The Walnut Street approach is steep and narrow with poor sight lines. Abutters have landscaped the ROW such that pedestrians are pushed further into the roadway. This intersection leads to a key access point to the Western Greenway, a regional multi-use trail. The Metropolitan Area Planning Council (MAPC) has been developing the Boston Greenway, a long distance trail which utilizes the street connections along Pleasant Street, Concord Avenue and Walnut Street in order to access the Western Greenway. A schematic map of regional trails including these two greenways through Lexington is being mailed to 5000 MAPC households at the end of this calendar year.

The third intersection—Pleasant Street at Worthen Road East—is along the shortest pedestrian path from the eastern portion of the study area to the sole MBTA bus connection toward Cambridge and Boston—the 76 bus stop at Pleasant Street and Watertown Street. Pedestrians walking from Concord Avenue toward this bus stop utilize the sidewalk on the southeast side of Pleasant Street, cross under Route 2 and are then directed to cross Pleasant Street at the adjacent mid-block crosswalk with the flashing light. They then must cross Worthen Road East, where the roadway exceeds 50 ft and lacks a crosswalk. Because it is a T-intersection, motorists from all three approaches often only look in one direction to see if their path is clear, and do not have visual cues to be alert for pedestrians.

Although this intersection is outside of the South Lexington Study Area, a crosswalk is critically needed. Pleasant Street at Worthen Road East is the main arterial entrance to the Bowman School neighborhood. This intersection is extremely busy during peak hours with vehicular school traffic and cut-through traffic. Bowman Safe Routes to School has worked hard to encourage pedestrian travel in the neighborhood, and this crosswalk is a missing element needed to improve safety.

As part of Lexington's commitment to Complete Streets, please consider adding a crosswalk at the intersection of Pleasant Street and Worthen Road East.

Laurel Carpenter  
94 Pleasant Street  
Precinct 2 Town Meeting Member

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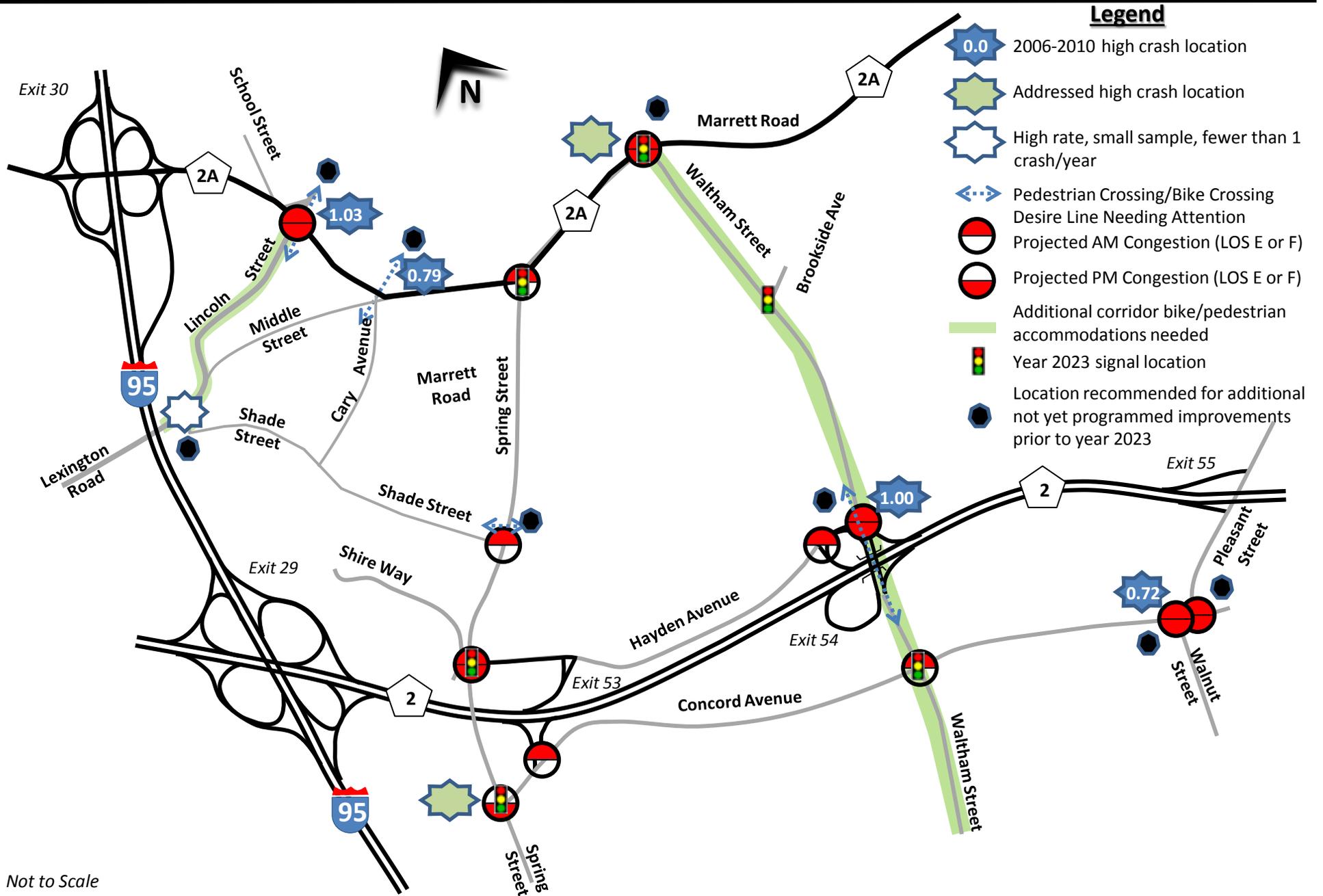
## 3.3 Recommendations at Mitigation Focus Areas

### 3.3.1 OVERVIEW

Figure 3.1 is an illustrative overview of Study Area intersections and known major pedestrian or bike crossing areas that may require additional attention above and beyond programmed improvements over then next ten years.

From Figure 3.1, focus areas for multi-modal mitigation measures above and beyond programmed improvements include:

- Marrett Road (2A) at Lincoln and School Streets
- Marrett Road (2A)/Carey Avenue/Middle Streets
- Area 3: Route 2 Westbound off-ramps to Waltham Street and Hayden Avenue
- Concord Avenue at Pleasant and Walnut Streets
- Lincoln at Middle Streets
- Shade Street at Lexington Street
- Waltham Street at Marrett Road (Route 2A)



### 3.3.2 Marrett Road (Route 2A) at Lincoln and School Streets

After reviewing pros and cons of three options for this intersection documented in Technical Memorandum 2, following discussions with Town of Lexington staff and public comments at three public meetings, we recommend the following improvements:

- Signalize the Lincoln Street (south) intersection with Marrett Road (Route 2) with a fully actuated controller providing pedestrian/bike crossing accommodations.
- Replace the north leg of Lincoln Street with additional greenspace relocating driveways to Lincoln and Marrett Road's without taking properties.
- Adjust driveway connections to accommodate the altered roadways and turning radii of largest vehicles to be using them.
- Re-orient School Street to reduce the magnitude of the pedestrian/bike/vehicle conflict zone.

Proposed intersection modifications will address safety and capacity deficiencies, while improving bike/pedestrian crossings. Bus stop operations at the intersection will also be enhanced, allowing bus users to cross Marrett Road under signal control.

The cost range for the proposed modifications excluding engineering/permitting/utility relocations is estimated at approximately \$280,000 - \$350,000. A programmatic estimate inclusive of *all* potential costs could range from **\$400,000 to \$600,000**. Costs should be refined during preliminary engineering.

Signalizing the intersection will provide an opportunity to cross cyclists and pedestrians under signal control. Proposed modifications will allow traffic coming from both directions of Lincoln Street to access or cross Marrett Road in an easier manner, with fewer conflict points with an improved level of service.

Figure 3.2A provides an aerial view of the intersection improvements and summarizes the projected levels of service with and without enhancements. Acceptable levels of service are projected with the improvements. Two additional displays were prepared to show before/after photo concept visualizations. Figures 3.2B is looking south on Lincoln Street to Marrett Road, while Figure 3.2C is looking west on Marrett Road to School Street.



	2023 No Action		2023 W/Mods	
	AM	PM	AM	PM
Unsignalized Lincoln St N at Marrett Rd*	B-14	B-12	N/A	
Unsignalized Lincoln St S at Marrett Rd*	F-120+	F-120+	N/A	
Signalized Lincoln S (Combo) at Marrett Rd	N/A		D-43	B-17



With RKG Associates, Inc.



Town of Lexington Engineering and Planning Departments

South Lexington Transportation Study  
 Figure 3.2A - Preliminary Recommendations  
 Signalize/Add Greenspace Marrett Rd (Rte. 2A) at Lincoln St



**South Lexington Transportation Study**

Figure 3.2B – Concept Visualization South on Lincoln Street to Marrett Road (Route 2A)



**South Lexington Transportation Study**  
Figure 3.2C – Concept Visualization West across Lincoln Street to School Street and Marrett Road (Route 2A)

### 3.3.3 Marrett Road (Route 2A) at Carey and Middle Streets

After reviewing pros and cons of three options as presented in Technical Memorandum 2 with the Town and input received at three public meetings, we recommend the following safety improvements:

- Prior to physical modifications, skip dash the yellow centerline broken at the intersection of Middle Street to emphasize that Marrett Road, not Middle Street, is the through route (we understand this was very recently done).
- Re-align and replace the two closely spaced intersections at Marrett Road/Carey Avenue/Middle Street with a single intersection plus a *flush* painted median on Marrett Road to add emphasis to what should be a *'slow point'* on Marrett Road. Add a 30 mph speed limit sign to the WB approach.
- Add new usable greenspace by relocating park amenities to the larger greenspace created on the southeast corner of the relocated intersection.
- Provide a push button controlled Lexington-style (e.g., Brookhaven at Waltham Street) *overhead flashing beacons* (or overhead *rectangular rapid flashing beacons*) facing both directions to enhance the safety of pedestrian/bike crossings.
- Trim vegetation to provide adequate sight lines for pedestrians and motorists approaching in all directions of the realigned intersection. The Marrett Road crosswalk would be located approximately where it is today.

As this was cited as a high crash rate location, the consolidation of the approaches and elimination of the Middle Street confusion should produce safer intersection conditions along with the pedestrian warning enhancements. Refer to Figure 3.3A for an aerial overview and summary of peak hour operations analysis findings. Figures 3.3B-3.3D show three before/after concept visualizations with proposed intersection modifications.

A few public reviewers of the plan expressed concern over future traffic operations at the relocated/combined intersection. We expect acceptable operations during peak hours, even with the combined Middle/Carey Streets traffic volumes. By 2023, we expect on typical worst-case morning peak hour operations at and acceptable LOS D, as today with slightly more delay than projected operations without the modifications. We conclude that safety and pedestrian/bike crossing benefits will outweigh the relatively small loss of intersection capacity.



	2023 No Action		2023 W/Mods	
	AM	PM	AM	PM
Unsignalized Cary St at Marrett Rd*	D-27	C-20	N/A	
Unsignalized Middle St at Marrett Rd*	B-15	B-11	N/A	
Unsignalized Middle St at Cary Av*	A-10	A-10	N/A	
Unsignalized Rel Middle St at Cary Av*	N/A		A-9	A-9
Unsignalized Rel Middle St at Marrett Rd*	N/A		28-D	C-24



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Town of Lexington Engineering and Planning Departments

**South Lexington Transportation Study**

Figure 3.3A - Preliminary Recommendations  
Combine and 'T' Cary Avenue and Middle Streets at Marrett Road  
Including overhead Lexington-style Pedestrian Flashing Beacons



**South Lexington Transportation Study**  
Figure 3.3B – Concept Visualization West across Marrett Road (Route 2A)  
At Middle Street and Carey Avenue



**South Lexington Transportation Study**  
Figure 3.3C– Concept Visualization East across Marrett Road (Route 2A)  
At Middle Street and Carey Avenue



**South Lexington Transportation Study**

Figure 3.3D– Concept Visualization Northeast across Marrett Road (Route 2A)  
At Middle Street and Carey Avenue

### 3.3.3 Marrett Road (Route 2A) at Carey and Middle Streets (Continued)

The cost range for the proposed modifications excluding engineering/permitting/utility relocations is estimated at approximately \$250,000 - \$325,000. A programmatic estimate inclusive of all potential costs could range from **\$350,000 to \$450,000**. Costs should be refined during preliminary engineering.

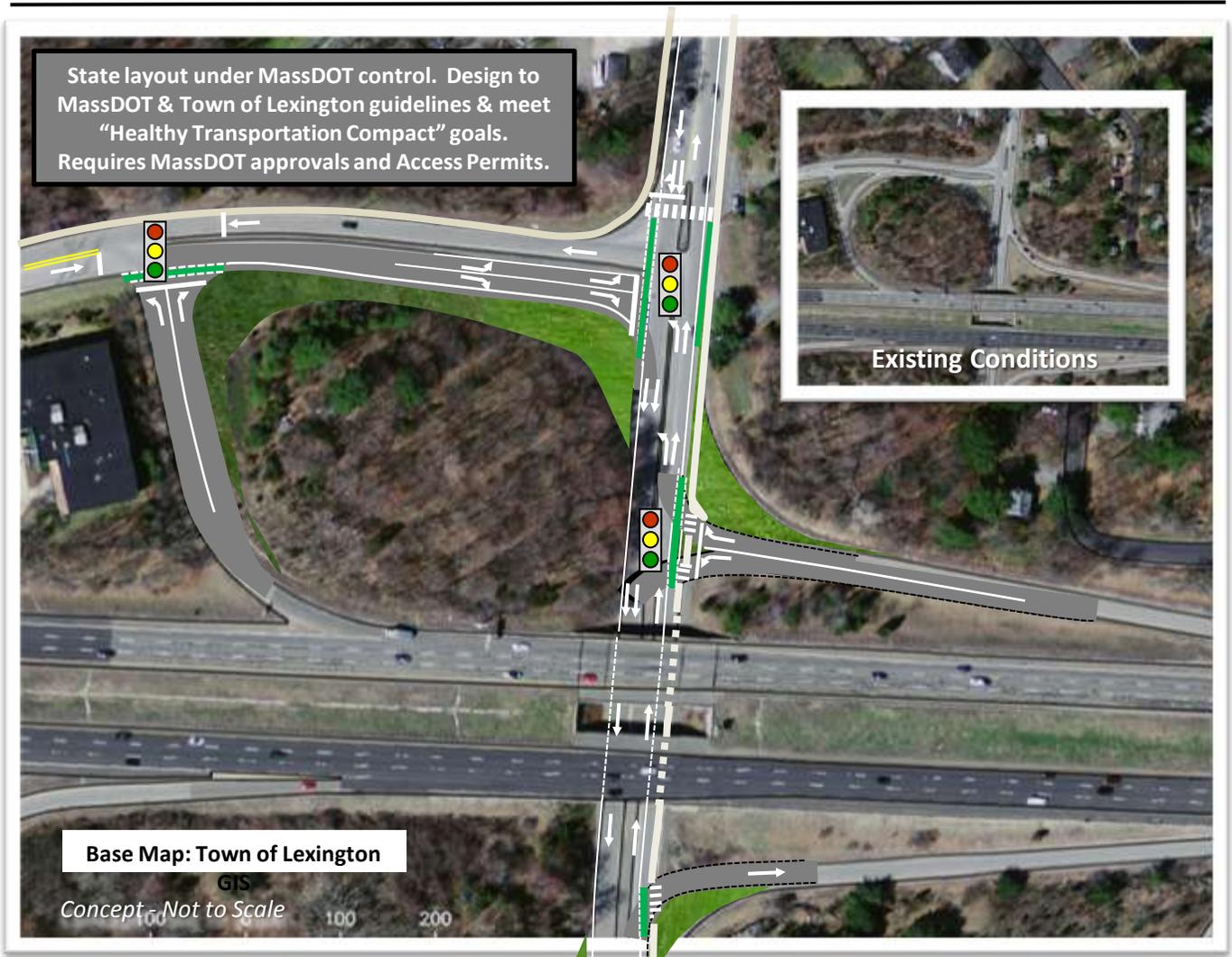
### 3.3.4 Hayden Avenue at Route 2 Interchange Area

Pros and cons were reviewed with the Town and input received at three public meetings on three potential options for Hayden Avenue and Waltham Street interchange area. Most, but not all, of the work on this interchange area will be within MassDOT and National Highway System layouts and would therefore be subject to MassDOT design and environmental requirements. Because Route 2 is on the National Highway System (NHS) classified as an 'Other Route', ramp design standards must comply with NHS standards and any design exceptions must be addressed during design. Figure 3.4 provides a visual display of preliminary recommendations for the interchange area. Preliminary recommendations include the following:

- Provide coordinated signal control at the northern half of the interchange area including:
  - Westbound Route 2 off ramp to Waltham Street
  - Westbound Route 2 off ramp to Hayden Avenue
  - Waltham Street at Hayden Avenue.

At this time, all three locations meet peak hour signal warrants *only*. A full signal warrant analysis will be needed prior to consideration of a full signal system. If installed, signals should include primarily *mast-arm mounted displays above lanes* with selected post-mounted displays as necessary to comply with Manual on Uniform Traffic Control Devices (MUTCD) signal head visibility requirements. Back plates should be provided behind all signal faces. Signals, including appropriate modern detection for vehicles, bikes, and pedestrians, should be designed to accommodate all users.

- Create redundancy in the westbound off ramp movements to allow southbound flow on Waltham Street from either westbound off-ramp terminal, not just the Hayden Avenue ramp, as today. Signalizing both ramp terminals would serve to distribute the traffic to both ramps.



	2023 No Action		2023 W/Mods	
	AM	PM	AM	PM
Unsignalized Rte 2 WB Off-ramp at Waltham St*	E-47	F-97	N/A	
Unsignalized Hayden Av at Waltham St*	F-120+	F-120+	N/A	
Unsignalized Rte 2 WB Off-ramp at Hayden Av*	F-82	D-29	N/A	
Signalized Rte 2 WB Off-ramp at Waltham St*	N/A		A-9	A-9
Signalized Hayden Av at Waltham St*	N/A		B-19	C-30
Signalized Rte 2 WB Off-ramp at Hayden Av*	N/A		C-24	B-10



With RKG Associates, Inc.

Town of Lexington Engineering and Planning Departments

**South Lexington Transportation Study**

Figure 3.4 - Preliminary Recommendations

Signalize and coordinate—Provide Bicycle and Pedestrian Crossing Enhancements

### 3.3.4 Hayden Avenue at Route 2 Interchange Area (Continued)

Conceptually, ramps would be converted from one lane to two lanes as soon as possible after exiting the Route 2 westbound mainline in single lanes. Redundancy allows for better distribution of traffic between the two ramps and should minimize ramp queues, as motorists will be able to see which ramp is the best option.

- Place off-ramp queue detectors close to the Route 2 main line to reduce the possibility of queues extending onto the Route 2 mainline. The right-turn only ramp to Waltham Street would permit rights and lefts under signal control. Eliminate the potential for weaving between traffic exiting from this ramp that desires to turn left onto Hayden Avenue conflicting with through traffic heading north on Waltham Street.
- Create bike lanes adjacent to both sides of Waltham Street at the interchange.
- Reduce the speeds of crossing conflicts between cyclists and motor vehicles by tightening the radii of curves where vehicles enter and leave the ramps on Waltham Street. If physically possible within the right-of-way, buffer new bike lanes by 2-3 feet with transverse markings.
- As is done today, orient pedestrian interchange access to the east side of Waltham Street.
- Enhance the walking environment by reducing the crosswalk lengths in conflict with motor vehicles. Make all crossings ADA/MAAB compliant and provide adequate lighting under the Route 2 viaducts. Countdown pedestrian signals should be used running concurrent with traffic flows. If, for any reason, pedestrians do end up on the west side of Waltham Street, they will at least be walking within a 5+ foot bike lane, rather than in a narrow 1-2-foot shoulder, as today.
- With a narrowed median, make sure that reflectorized pavement markers are used throughout the interchange near the new narrower median.
- Provide additional greenspace in the curve reduction areas used to reduce pedestrian and bike conflicts.

### 3.3.4 Hayden Avenue at Route 2 Interchange Area (Continued)

Elimination of weaving between the Route 2 westbound ramp and Hayden Avenue should produce safer interchange conditions along with the pedestrian and bike circulation enhancements.

Order of magnitude costs of proposed interchange modifications excluding permitting/right of way acquisition and design costs were estimated at \$850,000- \$1,500,000. Because Route 2 is on the NHS, including all potential costs, a full programmatic cost estimate ranges could range from **\$2,000,000 - \$3,000,000**. Costs should be refined during preliminary engineering when MassDOT/FHWA would be involved in refining the scope of potential interchange area improvements.

### 3.3.5 Concord Avenue at Walnut and Pleasant Streets

Pros and cons were reviewed with the Town and input received at three public meetings on options for the closely-spaced ‘T’ intersections of Walnut Street at Concord Avenue and Pleasant Street at Concord Avenue. Refer to Figure 3.5A for an overhead illustration of the two intersections and recommendations for them.

#### *Walnut Street at Concord Avenue*

In a perfect world, a *raised* ADA-compliant 4-foot minimum sidewalk would be installed on the west side of Walnut Street between the Greenway path access and Concord Avenue. This solution to the observed pedestrian connection would require several tree, bush, and wall removals within the public layout.

At minimum, because we do not believe the tree removals and environmental impacts will be acceptable, install an ADA sidewalk landing on the southwest corner of Walnut Street at Concord Avenue will be beneficial to pedestrians who walk along Walnut Street. Consider a pavement alteration to increase friction on the Walnut Street downslope approaching Concord Avenue. Refer to Figure 3.5B for a concept visualization of Walnut Street at Concord Avenue.

#### *Pleasant Street at Concord Avenue*

Add a crosswalk with ADA-compliant landings on the Pleasant Street approach to Concord Avenue.

	2023 No Action		2023 W/Mods	
	AM	PM	AM	PM
Unsignalized Walnut St at Concord Av*	F-52	C-19	F-52	C-19
Unsignalized Pleasant St at Concord Av*	F-120+	F-79	N/A	
Signalized Pleasant St. at Concord Av	N/A		C-31	B-16

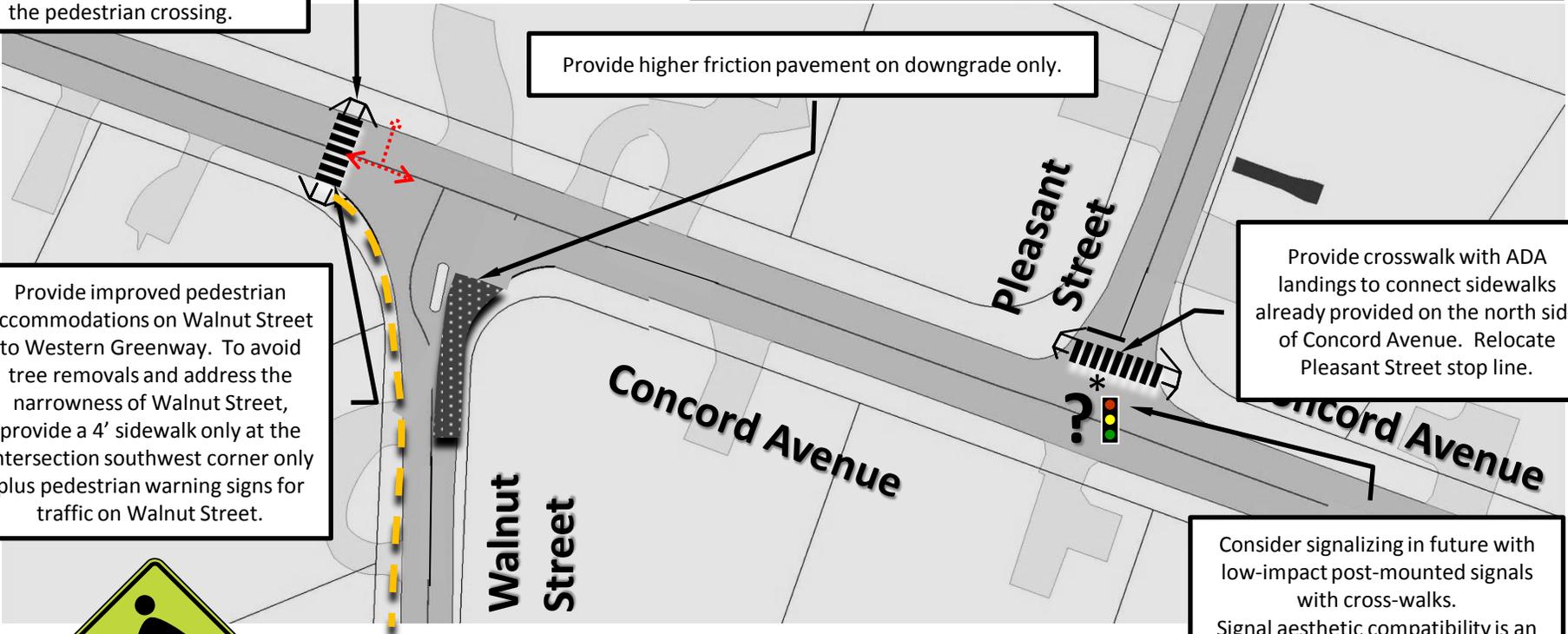
Consider crosswalk if warrants are met, with ADA-compliant sidewalk landings on both sides. A Lexington-style flasher (or RRFB) may be needed to draw further attention to the pedestrian crossing.

Provide higher friction pavement on downgrade only.

Provide improved pedestrian accommodations on Walnut Street to Western Greenway. To avoid tree removals and address the narrowness of Walnut Street, provide a 4' sidewalk only at the intersection southwest corner only plus pedestrian warning signs for traffic on Walnut Street.

Provide crosswalk with ADA landings to connect sidewalks already provided on the north side of Concord Avenue. Relocate Pleasant Street stop line.

Consider signaling in future with low-impact post-mounted signals with cross-walks. Signal aesthetic compatibility is an issue; AM/PM peak police control is a costly option\*



\* Signalization may help reduce congestion on Pleasant Street, but will increase delays on Concord Avenue and may increase rear end collisions. A signal at this intersection does not fit well into the tight residential neighborhood environment, so it should only be considered as a last resort, and only if the future crash rate at the intersection increases due to increasing approach demands on Pleasant Street. A crosswalk at the Pleasant Street approach with Concord Avenue with ADA-compliant landings should be considered in any event.

Not to Scale

Base Map: Town of Lexington GIS

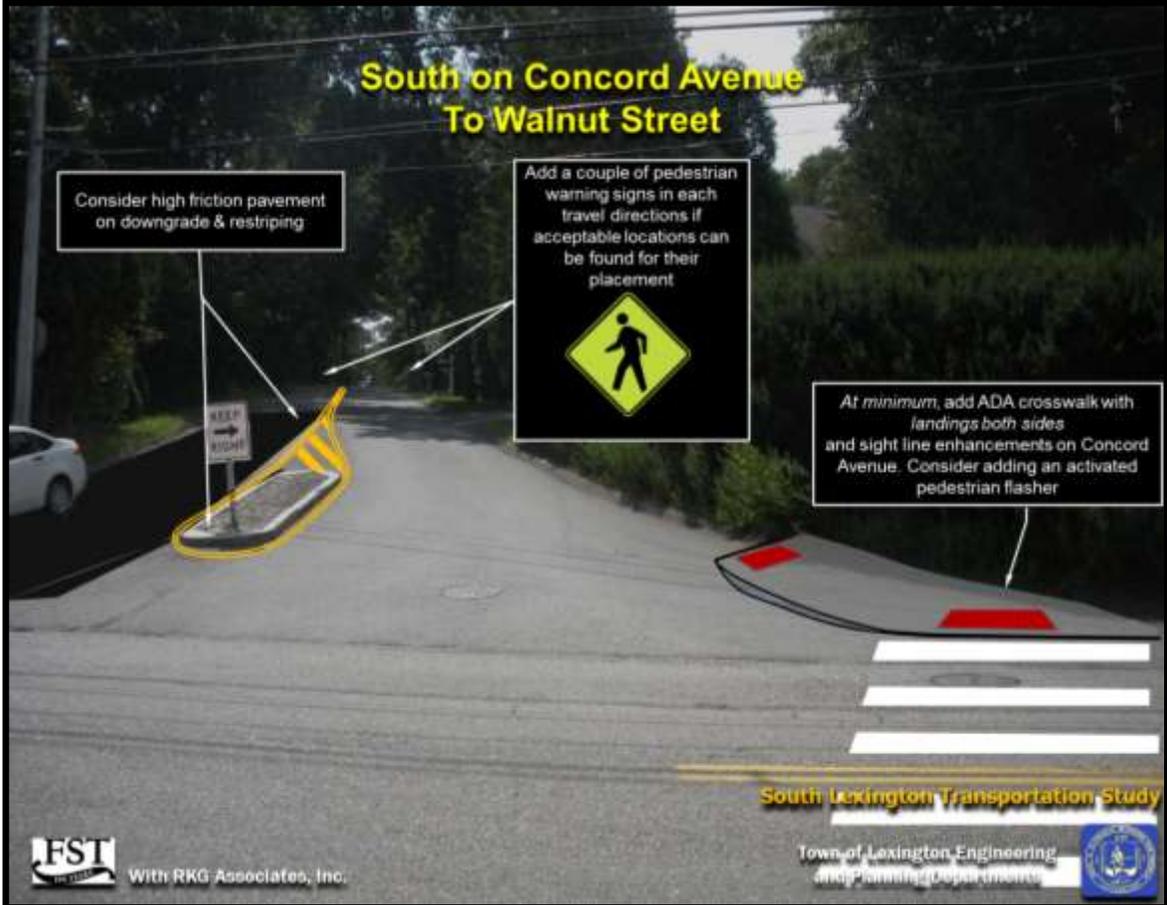


With RKG Associates, Inc.



Town of Lexington Engineering and Planning Departments

South Lexington Transportation Study  
Figure 3.5A –Preliminary Recommendations  
Concord Avenue at Walnut and Pleasant Streets



South Lexington Transportation Study  
Figure 3.5B – Concept Visualization South on Concord Avenue to Walnut Street

### 3.3.5 Concord Avenue at Walnut and Pleasant Streets (Continued)

Consider signaling Pleasant at Concord Avenue only with local abutter concurrence and only if future crash rates increase above Statewide or Districtwide average crash rates. The 2006-2010 crash rate for this unsignalized intersection was below average Statewide and District 4 for similar intersections.

Full programmatic costs for these two intersections could greatly vary, depending on the assumptions for the modifications. With the pavement alteration on Walnut Street, but without a signal at Concord Avenue at Pleasant Street, and without a pedestrian flasher at Concord Avenue and Walnut Street, we estimate total **programmatic costs at approximately \$90,000 - \$110,000**. However, if we also assume a pedestrian flasher at the Walnut Street intersection with Concord Avenue, *and* a traffic signal at Pleasant Street and Concord Avenue, we estimate total **programmatic costs of \$200,000 to \$250,000**. Costs should be refined during preliminary engineering, when the scope of improvements and improvement quantities will be closely defined.

### 3.3.6 Lincoln Street at Middle Street

If directly abutting neighbors concur, modify geometry to ‘T’ Middle Street into Lincoln Street to simplify traffic operations and improve the safety of this large, open intersection. The purpose of the modified geometry is to enhance the sight lines of motorists turning from Middle Street onto Lincoln Street by relocating the stop line. The changes would also reduce the speed of right turns from Lincoln Street into Middle Street. Changes in the geometry must account for any permitted on-street parking demands of abutting neighbors. Refer to Figure 3.6A for an overhead illustration of the two intersections and recommendations for them. Refer to Figure 3.6B for a before/after concept visualization of Lincoln Street at Middle Street.

Construction costs of proposed intersection modifications excluding permitting/right of way acquisition and design costs are estimated at \$125,000- \$175,000. For programmatic purposes, possible full **costs are estimated at \$175,000 to \$245,000**. Costs should be refined during preliminary engineering, when the scope of improvements will be more closely defined.



	2023 No Action		2023 W/Mods	
	AM	PM	AM	PM
Unsignalized Lincoln St at Middle St*	B-13	A-9	B-13	A-9



With RKG Associates, Inc.



Town of Lexington Engineering and Planning Departments

**South Lexington Transportation Study**  
 Figure 3.6A - Preliminary Recommendations  
 'T' Lincoln Street into Middle Street



With RKG Associates, Inc.

South Lexington Transportation Study

Town of Lexington Engineering  
and Planning Departments



South Lexington Transportation Study  
Figure 3.6B – Concept Visualization Northeast on Lincoln Street to Middle Street

### 3.3.7 Shade Street at Spring Street

Based on public input, pending an evaluation of pedestrian crossing demand warrants, consider adding a crosswalk on the north leg of the intersection of Shade and Spring Streets with Lexington-style overhead flashing beacons to enhance the visibility of the new crossing.

The purpose of this crossing is to allow pedestrians and bicyclists to cross Spring Street at Shade Street and improve the multi-modal connectivity of the intersection. A trail is connected to the east side of Spring Street approximately 350 feet south of the intersection. Because Shade Street is also a designated bike route, placing a crossing at Spring Street will provide better sight lines than where the existing path intersects the east side of Shade Street. The proposed crosswalk will require ADA-compliant landings on both sides of Spring Street. On the east side of Spring Street, the new landing will provide a spot for the pedestrian flasher foundation. Refer to Figure 3.7 for an illustration of the proposed new crosswalk location.

### 3.3.8 Additional Recommendations & Final Thoughts

#### Additional Recommendations

- Emphasize/maximize traffic demand management measures & shuttle buses for all Hayden Avenue commercial development sites to reduce traffic impacts.
- At new pedestrian or bike crossings --address ADA compliance; sight lines; use recommended FHWA guidelines for crosswalk placement.
- Consider adding sharrows with 11-foot travel lanes & shoulders to Waltham Street between Marrett Road and City of Waltham Line except at interchange where separate bike lanes are needed.
- Optimize/regularly maintain all signals & multimodal transportation infrastructure.
- Take available opportunities to enhance pedestrian and bicycle network along Waltham Street and Marrett Road in conjunction with any future traffic operations modifications.



With RKG Associates, Inc.

Town of Lexington Engineering and Planning Departments

**South Lexington Transportation Study**  
 Figure 3.7 - Preliminary Recommendations  
 New Crosswalk on Spring Street at Shade Street with Pedestrian Flasher and Yield Lines

## Final Thoughts

- The Town of Lexington is generally doing a good job with implementing the notion of Complete Streets in South Lexington. It continues to pursue opportunities to enhance pedestrian and bicycle network in South Lexington. For example, the conditions of its sidewalks and ramps town wide were documented and evaluated in its recent comprehensive sidewalk and ramps study.<sup>iv</sup> This will help guide the Town in addressing the highest priorities of sidewalk and ramp deficiencies first.
- Additional bicycle enhancement measures are possible along Waltham Street and Marrett Road (Route 2A) in conjunction with future traffic operations modifications.
- Three of the top focus areas are on MassDOT layouts. These will require close coordination with MassDOT to find funding sources (e.g., MassWorks grants) along with traffic mitigation commitments from developers who may wish to pursue further expansions.
- Lexington’s existing Town traffic operations standard calling for peak hour conditions no worse than LOS D constrains the potential for additional growth in the Spring Street/Hayden Street area beyond the ‘moderate’ growth scenario. If, in the future, the Town desires continued Hayden Avenue/Spring Street area commercial growth above and beyond that which has been approved, it could adopt less-stringent MEPA environmental guidelines for mitigation traffic analysis. Adoption of these guidelines would permit developments which can demonstrate projected future ‘Build’ traffic volumes no worse than those projected with the ‘No-Build’ alternative. In this case, the ‘No-Build’ assumes is the environmental equivalent of the ‘moderate’ projections of already-approved growth.

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<sup>i</sup> Source: Meeting Notes, David Kucharsky Lexington Town Planner.

<sup>ii</sup> 2014 Pedestrian Accessibility Study, Fay, Spofford & Thorndike, December 2014.

<sup>iii</sup> Source: Meeting Notes, David Kucharsky Lexington Town Planner

<sup>iv</sup> 2014 Pedestrian Accessibility Study, Fay, Spofford & Thorndike, December 2014.