

**DRAFT**

Date: September 30, 2014  
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Subject: North 40 Area - Preliminary Traffic Study

BETA Project #: 4505-12

As part of the North 40 project, BETA Group, Inc. has conducted a preliminary traffic study of the surrounding area roadways. This preliminary traffic study focused on evaluating the existing traffic operational conditions and identifying the deficiencies of the surrounding roadway systems adjacent to the North 40 site. The study area, shown in Figure 1, included:

- Weston Road Corridor between Route 9 and Central Street (Route 135)
- Central Street (Route 135) Corridor between Bacon Street and Weston Road
- Adjacent residential roads

The study also explored solutions to mitigate the deficiencies. The findings of this preliminary study were presented at a North 40 Public Meeting on Tuesday, September 9<sup>th</sup>, 2014. The preliminary study and findings are discussed as follows.

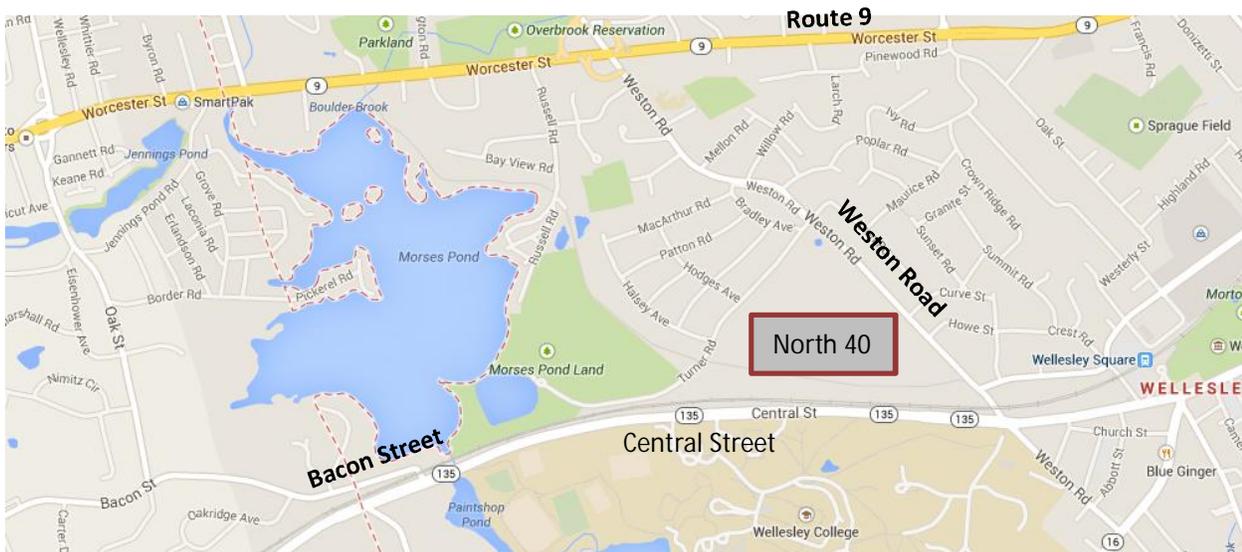


Figure 1: North 40 Study Area (Source: Google Maps)

## EXISTING CONDITIONS

To conduct the preliminary study of the North 40 area roadway traffic conditions, we utilized historical traffic data for the Weston Road and Central Street corridors from several previous traffic impact and roadway studies. In addition, new traffic data were collected from September 15, 2013 to September 20, 2014. The data revealed that the Average Daily Traffic (ADT) on Weston Road is approximately 15,500 vehicles per day. Based on these volumes, it was determined that the intersection of Weston Road and Central Street operates with Level of Service (LOS) F with long queues on Weston Road and Central Street. For example, the queue for Weston Road southbound extends beyond Curve Street. This intersection serves as a crossroads between Route 135, which serves as a regional east/west connector, and Weston Road which functions as a major north/south connector from Route 135 to Route 9. It is known that Weston Road is used as a bypass for vehicles traveling on Route 9. Vehicles exit the congested Route 9 and travel southbound on Weston Road to Route 135 and split eastbound or westbound accordingly. In addition, Weston Road is used as a connection to/from Route 30 in Weston, MA.

Given the high volumes in the peak hours and the existing number of travel lanes for each approach, the Weston Road and Central Street intersection is currently operating over capacity. The data showed the intersection is processing 2,300 vehicles in the commuting peak hours, but can only physically handle 1,800 vehicles in the commuting peak hours. For this intersection to operate at or below capacity approximately 500 vehicles will need to be removed from the intersection.

Several alternatives were developed to improve the operational capacity at this intersection. Alternatives 1 & 2 explored methods to accommodate the 500 vehicles within the intersection by creating additional lanes and adjusting signal operations with the adjacent intersection of Linden Street at Weston Road. Alternatives 3, 4, 5, and 6 explored the option of diverting the 500 vehicles from the intersection of Central Street and Weston Road. Since Weston Road travels over the CSX/MBTA railroad tracks adjacent this intersection, all six alternatives will require coordination with the MBTA and CSX. These alternatives are discussed as follows:

### ALTERNATIVE 1 – WESTON ROAD SOUTHBOUND RIGHT TURN LANE (FIGURE 2)

This alternative explored options to add more lanes to the intersection of Weston Road and Central Street to alleviate the poor operating conditions. The traffic volume data revealed that each approach processes high volumes in the peak hour, approximately 400 vehicles per hour to 975 vehicles per hour. Based on this information, we evaluated the potential for lane additions by examining the right-of-way impacts caused by widening the roadway for each approach. The right-of-way information provided by the Town's GIS mapping shows that Central Street and the Weston Road northbound approaches to this intersection have very limited right-of-way to add any additional travel lanes. Given the lack of right-of-way and the potential significant impact to businesses and abutters, adding lanes is unfeasible for these three approaches. The Weston Road



southbound approach consists primarily of a bridge structure with potential right-of-way to add an additional lane. Currently, this approach consists of one travel lane in the southbound direction and one travel lane in the northbound direction. Due to the heavy turn volumes on the Weston Road southbound approach, an exclusive right turn lane and a shared through/left lane is proposed under this alternative. This configuration requires widening the existing bridge over the MBTA Commuter Rail and CSX Freight Rail. Currently the bridge provides a pavement width of approximately 30 feet from curb to curb. Given this width, it is not possible to provide for three lanes of traffic over the bridge as the truck turning radii onto the bridge encroaches on the opposing travel lane. The short bridge span, approximately 200 feet, coupled with the steep 10% vertical grade also prevents the existing bridge from being striped for three travel lanes. Therefore, to add a right turn lane the bridge will require widening by at least seven feet. The seven feet widening would allow for an exclusive right turn lane for southbound vehicles wishing to travel on Route 135 westbound.

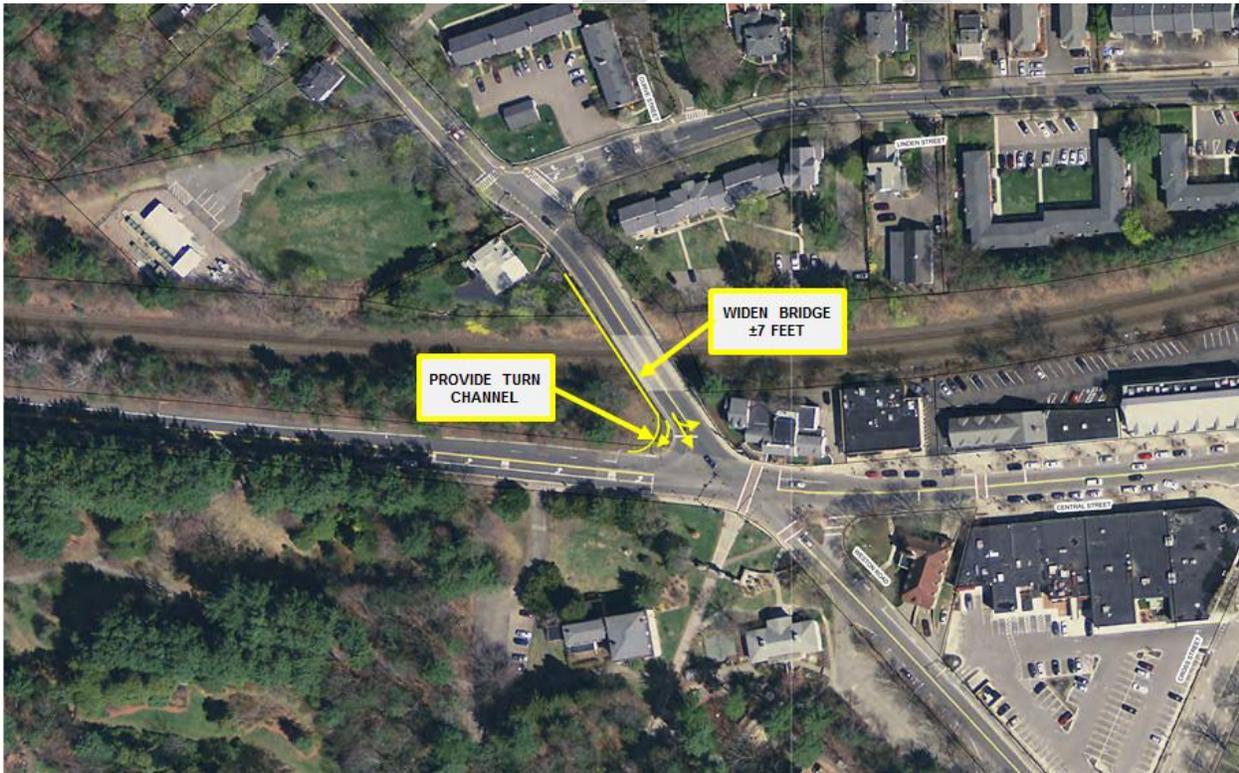


Figure 2: Weston Road Southbound Right Turn Lane

The analysis revealed that the added right turn lane provides small relief to queues on Weston Road, but it does not provide any benefit to other approaches to the Weston Road at Central Street or Weston Road at Linden Street intersections. These intersections continue to operate with LOS F in the peak hours. This alternative will have right-of-way impacts at both the southern and northern ends of the bridge abutment areas.

## ALTERNATIVE 2 – SIGNALIZE LINDEN STREET (FIGURE 3)

A large contributor to the queuing on Weston Road is due to the signalized flashing operation of the Weston Road and Linden Street intersection. This alternative explored the option of converting the flashing operation to a conventional full signal “Stop and Go” operation coordinated with the Weston Road and Central Street intersection.

This intersection currently contains a traffic signal in flash mode, which gives Weston Road a flashing yellow light and Linden Street a flashing red light. When a pedestrian activates the pedestrian push button, all approaches receive a solid red light until the pedestrian phase clears.

Due to the high volume on Weston Road, vehicles wishing to exit Linden Street must wait for gaps in traffic to make their turn maneuver. These gaps are inadequate which creates queue and increase delays. Left turns from Linden Street are particularly difficult due to the long queues on Weston Road. Depending on the drivers, this occasionally operates like a merge/zipper movement (e.g. one Linden Street car, one Weston Road car, one Linden Street car, etc.). Other times Linden Street vehicles will pull out into the intersection and block northbound Weston Road vehicles, decreasing the efficiency of the intersection. Similarly, vehicles attempting to turn left onto Linden Street block traffic on Weston Road. The roadway width on Weston Road is not wide enough to allow vehicles to overtake a vehicle waiting to turn left onto Linden Street unless that vehicle encroaches on the northbound lane. These instances increase queues on Weston Road such that some southbound signal phases at the Central Street and Weston Road intersection go unused.

It is important to note that as part of the Weston Road improvements project, previously completed, consideration was given to widen this section of Weston Road to allow room for through vehicles to bypass waiting left turn vehicles destined for Linden Street. Due to the right-of-way constraints the full widening was not feasible. In addition, the flashing signal was designed and installed to be easily converted for conventional signal operations should traffic conditions change.





Figure 3: Signalize Linden Street

As an effort to improve traffic operations, converting the flashing traffic signal at the intersection of Weston Road and Linden Street to conventional signal operations was examined. This signal would be coordinated with the signal at Central Street such that traffic traveling over the bridge does not negatively impact either intersection. Coordinating these two signals allows the Linden Street intersection to operate at LOS D however the Central Street intersection continues to operate at LOS F. The overall queuing problem on Weston Road southbound did not improve significantly. This alternative also increases queues on Central Street westbound which continue to spill back to Wellesley Square.

#### ALTERNATIVE 3 – LINDEN STREET EXTENSION (FIGURE 4)

Since Alternatives 1 & 2 do not provide significant improvements to the Weston Road and Central Street intersection, Alternative 3 examines diverting 500 vehicles from the intersection such that it would operate at or below capacity. Based on the traffic data, it was determined that the largest (and most logical) volume movements to be diverted in the peak hour are vehicles turning right onto Central Street westbound from Weston Road, and vehicles turning left onto Weston Road northbound from Central Street. To divert these volumes, a new 500 to 600 feet long roadway/bridge over the existing MBTA/CSX railroad tracks. The proposed bridge will be



approximately 600 feet west of the Weston Road and Central Street. This alternative would create a direct connection from Central Street to Linden Street, which can be referred to as the Linden Street Extension. The Linden Street Extension would receive all vehicles from Central Street eastbound destined north on Weston Road or eastbound on Linden Street. Likewise, all vehicles from Weston Road southbound or Linden Street westbound destined west on Central Street would also use the Linden Street Extension. These movements would not be required at the Weston Road and Central Street intersection, thereby improving the intersection operations from LOS F to LOS E.



Figure 4: Linden Street Extension

The Linden Street Extension would require a new signal on Central Street. This new signal would only require two phases. One phase would give westbound vehicles green time, and the second phase would stop westbound vehicles to allow eastbound vehicles to turn left onto the new Linden Street Extension. Eastbound through vehicles would always receive a green signal phase. All vehicles exiting the Linden Street Extension would be restricted to right turns onto Central Street and would be yield controlled. This new signal and the two existing signals at Linden Street and Central Street would be coordinated to maintain efficient traffic flow. Preliminary analysis shows that this alternative improves the Central Street at Weston Road intersection to LOS E, with LOS D at Linden Street and reduces queues on Weston Road.

One of the benefits to this alternative is it provides vehicles on Central Street (Route 135) direct access to Linden Street and vice versa. The new Linden Street Extension will also be more attractive for vehicles destined to the Linden Square shopping area than continuing on Central Street through Wellesley Square via Crest Road. Therefore, the Linden Street Extension alternative has the potential to divert some Central Street eastbound and westbound through vehicles from the Square area as well as the two key turn movements discussed above. A disadvantage to this alternative is that it provides little benefit for the North 40 parcel as it is located south of the parcel separated by the Electrical Sub Station.

#### ALTERNATIVE 4 – BRIDGE CONNECTION TO CURVE STREET (FIGURE 5)

Since Alternative 3 provides little benefits to the North 40 Parcel, Alternative 4 was developed to provide a connection to the North 40 Parcel. It provides a similar bridge connection approximately 1,500 feet west of the Central Street and Weston Road intersection. The alternative would create a road through the North 40 parcel and meet Weston Road at Curve Street forming a conventional four legged intersection. This bridge connection to Curve Street maintains the same principle of removing lefts and right turns from the Central Street at Weston Road intersection noted above. The intersection of Curve Street was chosen as a viable connecting point because it is approximately halfway (1,200 feet) between Central Street and Turner Road. The spacing of this new intersection (which could also be the future North 40 driveway) between the two Turner Road and Central Street intersections will provide the most ideal location for managing traffic along the Weston Road corridor. While a detailed traffic analysis has not been performed, the direct connection to Curve Street may require a traffic signal and could potentially encourage cut-through traffic on Curve Street. Currently due to the Weston Road traffic queues from the Linden Street and Central Street intersections, Curve Street is being used as a cut through to Linden Street. The potential for increased cut-through traffic will need to be fully investigated as part of a detailed analysis.

Similar to Alternative 3, the bridge connection will cross over the existing MBTA/CSX railroad tracks. At this location Central Street is approximately five feet higher in elevation than the railroad tracks. This elevation difference is fairly consistent approximately 300' to 400' east of this location. However, the difference in elevation increases to the west of this location. For example, the Central Street is approximately 15 to 20 feet higher than the railroad tracks at the Wellesley College Entrance Driveway (signalized intersection) location. Due to the low grade difference between the railroad tracks and the Central Street roadway, a longer bridge span will be required in order to meet the required vertical clearance (20 feet) by the MBTA. While this study assumes a bridge connection over the existing MBTA/CSX Rail tracks, an at-grade crossing was also briefly explored. From a safety standpoint, the at-grade crossing scenario will be a concern for the MBTA/CSX, however, this option should not be ruled out.

The benefit to this alternative is that it provides direct access to the North 40 parcel such that any potential development may feed into this access roadway. A disadvantage is that it does not



explicitly provide a direct connection to Linden Street; however, an optional connection, displayed in Figure 5 as a broken yellow line, can be accommodated. This Linden Street connection can be achieved north of the existing Electrical Sub Station.

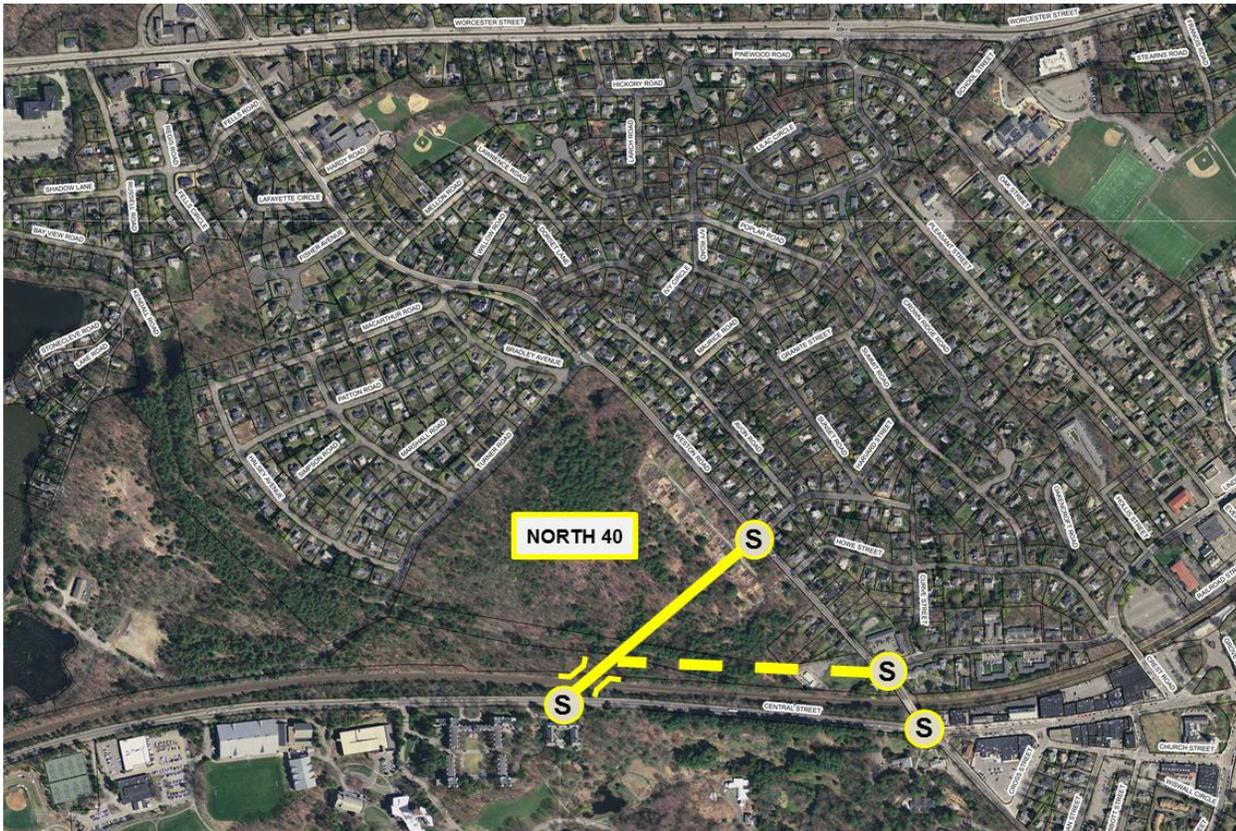


Figure 5: Bridge Connection to Curve Street

Based on the Town's GIS mapping, the Linden Street connection can be provided with no right-of-way impacts. Another disadvantage to this alternative is that it proposes the addition of two new signals (one on Central Street and one at Curve Street). Under this alternative, the existing flashing signal system at Linden Street will be converted to a conventional traffic signal particularly if the Linden Street connection is made available.

#### ALTERNATIVE 5 – BRIDGE CONNECTION FROM WELLESLEY COLLEGE

The following two alternatives (5A and 5B) examine reducing the number of new signalized intersections and connections to Turner Road. With this insight, the existing signalized intersection of Wellesley College at Central Street was considered. In this alternative, a new bridge is proposed across from Wellesley College into the North 40 parcel, in which a new access road would run through the parcel to the connection with Curve Street. Similar to Alternative 4, an optional extension road shown as a yellow broken line could be used to connect with Linden Street. This alternative adds only one signal at Curve Street, while two existing signal systems would need to be

reconfigured, (Linden Street and Wellesley College driveway). Alternative 5 (A or B) provides the most benefit to the North 40 parcel as it includes a circumference type of roadway system along the southerly site that could provide ample room for site driveways connectivity while still providing the traffic bypass from the Central Street at Weston Road intersection.

As mentioned previously, at this location Central Street is approximately 15 to 20 feet higher in elevation than the railroad tracks. The required bridge span for this location (approximately 200 feet to 300 feet) is not as long when compared to Alternative 4 due the large grade elevation, however, a grade crossing approach will be challenging due to the large elevation and short approach section (less than 100 feet) from the railroad track to Central Street.

Alternative 5A – Bridge Connection to Turner Road (Figure 6)

Alternative 5A proposes a connection from the site access road to Turner Road. This connection is proposed under the concept that spreading traffic out over multiple areas will reduce queues and improve traffic conditions overall. This alternative would provide three means of access from Central Street to Weston Road: at Linden Street, at Curve Street, and via Turner Road. This alternative may increase traffic impacts to the Turner Road neighborhood.



Figure 6: Bridge Connection to Turner Road

Depending on the outcome of the North 40 Project development, the connection to Turner Road could be used as a bicycle/pedestrian/emergency vehicle access pathway rather than a typical roadway for general traffic use. The pathway would ensure that the neighborhood is still accessible but it will not increase traffic. If the Turner Road connection is used for general traffic, the existing pedestrian signal at Weston Road will need to be converted to a full traffic signal.

Alternative 5B – Bridge Connection to North 40 (Figure 7)

This alternative is identical to Alternative 5A but removes the vehicle connection to Turner Road. This would require vehicles to access and egress the North 40 parcel via the intersections of Wellesley College at Central Street and Weston Road at Curve Street. Similarly, the vehicles bypassing the Central Street and Weston Road intersection will also utilize these two new intersections. Consistent with Alternative 4, an optional connection road to Linden Street (shown in broken yellow lines in Figure 7) could be provided.



Figure 7: Bridge Connection to North 40

This alternative reduces the number of new traffic signals to one and has no direct traffic impact to the Turner Road neighborhood but still requires a new bridge over the MBTA railroad tracks.



### ALTERNATIVE 6 – RUSSELL ROAD CONNECTION (FIGURE 8)

This alternative examines other roadway networks within the study area to provide an alternate route for vehicles on Route 9 to access Central Street (Route 135) in an effort to relieve traffic congestion on Weston Road. The only nearby roadway that can provide a parallel connection other than Weston Road is Russell Road. This alternative explores connecting the new roads discussed in Alternative 5 with Russell Road and Route 9. The Russell Road connection would require connecting Halsey Avenue to meet up with Turner Road as shown in Figure 8. The major disadvantage to this alternative is that it requires significant right-of-way and neighborhood impacts.



Figure 8: Russell Road Connection

Upon examining the traffic data at the Route 9 and Weston Road intersection, it was found that approximately 250 vehicles during the peak commuting hour originated from Route 9 eastbound continued to Weston Road southbound. Based on the small traffic volumes that will be diverted via the Russell Road connection, it was determined that this alternative is not recommended due to the small benefits that would be achieved and the high design/construction cost and significant right-of-way and neighborhood impacts.



SUMMARY

This preliminary traffic study of the North 40 area traffic conditions explored ways to mitigate the traffic operational problems on Weston Road, particularly at the intersection of Weston Road at Linden Street and Central Street. Traffic data for this area have shown that the intersection is currently operating over capacity by approximately 500 vehicles. Alternatives 1 & 2 explored methods to accommodate the 500 vehicles within the intersection by creating additional lanes and adjusting signal operations, however these two alternatives provide little traffic congestion relief. To improve operations at this intersection traffic volume must be diverted. Alternatives 3 to 6 explore methods of diverting vehicle movements from this intersection, including: a new bridge connection to Linden Street, a new bridge connection to Curve Street, and a new bridge connection at the Wellesley College entrance driveway. For comparison purposes, a summary table of pros and cons for each of the six alternatives was developed as shown in Table 1. An order of magnitude construction cost associated with each of the Alternatives was developed. These costs do not include any right-of-way acquisition costs.

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Table 1: North 40 Preliminary Traffic Study Alternatives Comparison

Alternatives	LOS	Intersection	Pros	Cons	Order of Magnitude Cost Estimate*
Existing Conditions	F F	<ul style="list-style-type: none"> <li>Central Street</li> <li>Linden Street</li> </ul>		<ul style="list-style-type: none"> <li>Exceeded intersection capacity</li> <li>Long queues (to Curve St on Weston Rd)</li> </ul>	
Alternative 1 - Weston Road Southbound Right Turn Lane	F F	<ul style="list-style-type: none"> <li>Central Street</li> <li>Linden Street</li> </ul>	<ul style="list-style-type: none"> <li>Increases capacity for right turns.</li> <li>Minor queuing improvements on Weston Road southbound</li> </ul>	<ul style="list-style-type: none"> <li>Requires bridge widening the bridge</li> <li>Bridge widening costs</li> <li>Cannot accommodate future development traffic</li> <li>Overall intersection operational problem</li> </ul>	<ul style="list-style-type: none"> <li>\$1.5M - \$2.0M</li> </ul>
Alternative 2 - Signalize Linden Street	F D	<ul style="list-style-type: none"> <li>Central Street</li> <li>Linden Street</li> </ul>	<ul style="list-style-type: none"> <li>Improve operations for vehicles exiting Linden Street</li> <li>Allows for bridge queues to be metered between two signals</li> <li>Less cost since Linden St signal already exists</li> </ul>	<ul style="list-style-type: none"> <li>Queue problem</li> <li>Cannot accommodate PM conditions (LOS F)</li> <li>Cannot accommodate future development traffic</li> </ul>	<ul style="list-style-type: none"> <li>\$1.5M - \$2.0M</li> </ul>
Alternative 3 - Linden Street Extension	E D	<ul style="list-style-type: none"> <li>Central Street</li> <li>Linden Street</li> </ul>	<ul style="list-style-type: none"> <li>Removes lefts and rights from Central Street/Weston Road intersection (500 vehicles)</li> <li>Weston Road bridge widening not required</li> <li>Direct connection between Linden Street and Rte. 135</li> <li>Improve overall traffic operations</li> </ul>	<ul style="list-style-type: none"> <li>Construct a new bridge and two signals</li> <li>Requires property easements/takings</li> <li>Bridge, roadway, and signal construction costs</li> <li>Require traffic signal at Route 135</li> <li>Limited benefit to the North 40 site</li> </ul>	<ul style="list-style-type: none"> <li>\$3.0M - \$3.5M</li> </ul>
Alternative 4 - Bridge Connection to Curve Street		<ul style="list-style-type: none"> <li>Central Street</li> <li>Linden Street</li> <li>Curve Street</li> </ul>	<ul style="list-style-type: none"> <li>Removes lefts and rights from Central Street/Weston Road intersection</li> <li>Connects Curve Street to Route 135</li> <li>Provides a roadway connecting to the project site</li> <li>Weston Road bridge widening not required</li> <li>Improve overall traffic operations</li> </ul>	<ul style="list-style-type: none"> <li>Require new bridge, roadway, and signals at Curve and Route 135</li> <li>Requires easements/takings</li> <li>May require signaling Curve St at Weston Rd</li> <li>Requires property easements/takings</li> <li>Bridge, roadway, and signals construction costs</li> </ul>	<ul style="list-style-type: none"> <li>\$4.0M - \$4.5M</li> </ul>
Alternative 5A - Bridge Connection from Wellesley College to Turner Road		<ul style="list-style-type: none"> <li>Central Street</li> <li>Linden Street</li> <li>Turner Road</li> <li>Curve Street</li> </ul>	<ul style="list-style-type: none"> <li>Removes lefts and rights from Central Street/Weston Road intersection</li> <li>Connects Turner Road to Route 135</li> <li>Connects Route 135 to Weston Road</li> <li>Provides direct connection to the North 40 site</li> <li>Weston Road bridge widening not required</li> <li>Improve overall traffic operations</li> </ul>	<ul style="list-style-type: none"> <li>Turner Road neighborhood impact</li> <li>Require new bridge, roadway, and upgrade existing signal at Wellesley College</li> <li>Require full signal/re-design at intersection of Turner and Weston</li> <li>Bridge, roadway and traffic signal Construction costs</li> <li>May require signaling Curve St at Weston Rd</li> <li>Requires property easements/takings</li> </ul>	<ul style="list-style-type: none"> <li>\$5.0M - \$5.5M</li> </ul>
Alternative 5B – Bridge Connection from Wellesley College to North 40		<ul style="list-style-type: none"> <li>Central Street</li> <li>Linden Street</li> <li>Turner Road</li> <li>Curve Road</li> </ul>	<ul style="list-style-type: none"> <li>Removes lefts and rights from Central Street/Weston Road intersection</li> <li>No Turner Road neighborhood impacts</li> <li>Less cost (No upgrades to Turner Rd at Weston Rd)</li> <li>Connects Route 135 to Weston Road</li> <li>Provides direct connection to North 40 site</li> <li>Weston Road bridge widening not required</li> <li>Improve overall traffic operations</li> </ul>	<ul style="list-style-type: none"> <li>Require new bridge, roadway, and upgrade existing signal at Wellesley College</li> <li>May require signaling Curve St at Weston Rd</li> <li>Bridge, roadway and traffic signal construction costs</li> <li>Requires property easements/takings</li> </ul>	<ul style="list-style-type: none"> <li>\$5.0M</li> </ul>
Alternative 6 – Bridge Connection from Wellesley College to Russell Road		<ul style="list-style-type: none"> <li>Central Street</li> <li>Linden Street</li> <li>Russell Road</li> </ul>	<ul style="list-style-type: none"> <li>Reduce approximately 250 vehicles from Weston Road</li> </ul>	<ul style="list-style-type: none"> <li>Significant neighborhood impacts</li> <li>Significant right-of-way impacts</li> <li>Construction cost of Russell Road connection</li> <li>Minimum cost benefits</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Note: All Alternatives require coordination with MBTA/CSX					* Excludes right-of-way acquisition costs