MEMORANDUM

TO: **Newton Corner Project Files** **January 8, 2009**

FROM: **Chen-Yuan Wang, Seth Asante, and Efi Pagitsas**

RE: **Newton Corner Rotary Study, Phase II**

INTRODUCTION

The purpose of this study of the Newton Corner rotary, also known as Interstate 90 Interchange 17, was to develop and test potential long-term improvements that would relieve traffic congestion on the rotary and nearby roadways. This memorandum explains the background and analysis process of the study, describes the four alternatives that were analyzed, summarizes the results of the analyses, and recommends the next steps for the improvement concepts that appear to be the most promising for relieving congestion at Interchange 17.

BACKGROUND

Newton Corner is an unusual interchange in that its ramp system is fully and directly integrated into the local roadway system and its dense urban commercial and residential environment. Regional and local traffic is mixed in a small amount of space, including maneuvers in and out of on-street parking, side streets, bus routes, parking garages, and pedestrian crosswalks.

In a previous study,[1] CTPS staff conducted a license plate survey, simulated traffic operations in the study area, and ran the simulation model with traffic improvement alternatives. Based on the license plate survey findings and those from the traffic simulations, staff suggested operational changes that would primarily improve safety. The suggested improvements are not expected to improve traffic operations significantly beyond existing conditions. In the context of the Newton Corner, Phase I, study, long-term improvement concepts were also discussed with the study advisory committee. Those concepts included closing or modifying operations of the St. James Street bridge to Nonantum Road, moving the westbound on-ramp to a new location west of the west-side bridge, and closing the westbound on-ramp and constructing a new westbound on-ramp at Interchange 16.

The discussion of these concepts was preliminary and qualitative, and was based on professional knowledge of the traffic conditions in the vicinity of the rotary. In order to effectively analyze the impacts of roadway-element closures and the construction of new roadway elements, the study recommended that a transportation planning model be developed and used to test those and

[1] Alicia Wilson, Seth Asante, and Efi Pagitsas, *I-90 Interchange 17 (Newton Corner): Traffic Patterns and Operational and Safety Improvements*, CTPS, September 19, 2006.

additional alternatives. The model would be used to examine the traffic impacts in the vicinity, and beyond, of the interchange. Consistent with the staff recommendation in the Newton Corner, Phase I, study, the Boston Region Metropolitan Planning Organization (MPO) voted to fund a Phase II study for Newton Corner.

OBJECTIVES AND STUDY PROCESS

The goal of this study was to evaluate up to five alternative packages focused primarily on I-90 Interchanges 16, 17, and 18/19/20 that would reduce traffic volumes and delays at Newton Corner. The study advisory committee (SAC) and other decision-makers can use the results of this technical evaluation to develop informed opinions about the effectiveness of each alternative in achieving this goal. To that end, the objectives of the study were:

- To calibrate and develop a transportation planning model set capable of producing traffic forecasts for the study area
- To develop long-term improvement alternatives by working with the study advisory committee
- To evaluate improvement alternatives using a set of traffic operational and safety criteria
- To present evaluation results to the study advisory committee

The advisory committee for this study consisted of Newton aldermen, staff from the Newton Planning and Public Works Departments, and representatives from the Boston Transportation Department, Watertown Planning Department, Massachusetts Turnpike Authority, and Massachusetts Executive Office of Transportation and Public Works.

Three SAC meetings were conducted during the course of the study. The purpose of the first meeting, in October 2007, was to define the study area, refine the long-term improvement concepts developed in Phase I, and develop additional concepts. At the second meeting, in November 2007, the SAC members discussed a few more improvement concepts. All of the proposed concepts were packaged into four alternatives for modeling analysis. At the final meeting, in March 2008, CTPS staff presented the model results and a preliminary evaluation of the alternatives, all of which were discussed with the SAC.

STUDY AREA

The study area for this phase is larger than that for Phase I and extends beyond the area adjacent to Newton Corner. As Figure 1 shows, the study area covers the area adjacent to I-90 from Interchange 16 to Interchange 18/19/20, the area north of I-90 to Watertown Square, and the area south of I-90 to Commonwealth Avenue (Route 30). The transportation model that was used to develop traffic forecasts for the study area covered the entire area of eastern Massachusetts.

POTENTIAL IMPROVEMENT CONCEPTS

During the course of the study, 10 potential improvement concepts were developed and examined. The description and perceived advantages and disadvantages of each concept are summarized below. Detailed analyses of each concept, including potential traffic impacts, are shown in Appendix A. Also for reference, Appendix B shows the AM and PM peak-hour traffic flows in the vicinity of the rotary.

Concept 1: Move the Existing Westbound On-Ramp at Interchange 17 to a New Location off Washington Street, Just West of Church Street

Under this concept, a new on-ramp would be constructed off of the signalized intersection of Washington Street at Church Street, located one-tenth of a mile west of the west-side bridge. The ramp would then proceed over, and to the left of, the Worcester commuter rail tracks and meet the right-hand side of I-90 at a point slightly less than half a mile west of Church Street, before the next bridge over the Turnpike at Lewis Street. The existing on-ramp to I-90 westbound, just west of the east-side bridge, would close (see Concept 1 in Figure 2).

If this concept were feasible, it would:

- Remove the weaving conflict for traffic on the east-side bridge
- Eliminate the traffic signal phase for traffic heading to I-90 westbound at the intersection of Centre Street at Washington Street and increase capacity for other approaches of the intersection

In terms of perceived disadvantages, the concept would:

- Add a relatively high traffic volume to already congested Washington Street
- Require the expansion of the intersection of Washington Street at Church Street in order to process an estimated additional 1,500 Turnpike-bound vehicles in the morning peak hour
- Require the modification of the intersection of Washington Street at the west-side bridge to accommodate the additional westbound traffic on Washington Street
- Require further examination of the feasibility of construction

Concept 2: Add a Westbound On-Ramp at Interchange 16

This concept aims to relieve the burden of heavy traffic on the westbound on-ramp at Interchange 17. It involves adding an I-90 westbound on-ramp at Interchange 16 and maintaining the existing Interchange 17 on-ramp. The new on-ramp can potentially be placed within the right-of-way of the existing westbound off-ramp by converting a portion of the ramp from one to two lanes (see Concept 2 in Figure 2).

Potential benefits from a new ramp at Washington Street (Route 16) include:

- Traffic congestion relief on the rotary by removing traffic from the existing Interchange 17 on-ramp and from the rotary
- A more direct connection to I-90 westbound for some Newton residents

The major disadvantage of this option is that it would potentially increase traffic volumes along westbound Washington Street and roadways leading to it, mainly on the north side of I-90.

Concept 3: Convert St. James Street Operations to One-Way Southbound

This option would change the current two-way operation of St. James Street to one-way southbound. The purpose of the proposed conversion would be to reduce traffic congestion at the rotary by deterring traffic from I-90 eastbound from using St. James Street northbound to reach

Watertown, Cambridge, and Brighton/Allston destinations. The conversion would also call for traffic-calming measures, including the prohibition of right turns from Centre Street to Jefferson Street in order to prevent traffic from cutting through the neighborhood to access Nonantum Road (see Concept 3 in Figure 2).

Perceived advantages include:

- Reduced traffic volume on St. James Street
- Reduced traffic congestion on the rotary, mainly in the southern section
- Reduced traffic congestion on the eastbound off-ramp and improved eastbound traffic operations on the Turnpike

Perceived disadvantages include:

- Increased traffic volume on the east-side bridge and Centre/Galen Street northbound
- Likely higher traffic volumes on local streets, such as Williams Street and Maple Street, due to the diversion of traffic heading to Watertown and areas beyond
- Likely higher traffic volumes on local streets south and east of the rotary due to diversion of I-90 eastbound traffic heading to Brighton/Allston and adjacent areas
- Making direct and toll-free connections to Watertown, Cambridge, and downtown Boston unavailable to Newton residents south of the rotary

Concept 4: Add an I-90 Westbound Off-Ramp to North Beacon Street (Route 20)

Currently, the main option for I-90 westbound traffic destined for Watertown, Waltham, Belmont, and other points north and west is to use Exit 17. This new ramp would provide an additional option for that traffic and would potentially relieve the congestion at Exit 17. The off-ramp would begin just west of Market Street in Brighton, running along the space between I-90 and Leo M. Birmingham Parkway, and would meet with the parkway at a point near the intersection of North Beacon Street at the Parkway (see Concept 4 in Figure 2).

Potential advantages of this concept include:

- Reduced traffic congestion on the Exit 17 westbound off-ramp and on Centre Street north of the rotary, and, consequently, reduced congestion on the east-side bridge
- Reduced traffic congestion on westbound I-90 mainline near the Exit 17 off-ramp
- Lower traffic volume on the westbound off-ramp to Cambridge Street at Exit 18/19/20
- Provision of more direct access for I-90 westbound traffic to Watertown, Waltham, Belmont, and adjacent areas

Potential disadvantages include:

- Increased northbound and westbound traffic volumes on North Beacon Street (Route 20), Nonantum Road, and Leo M. Birmingham Parkway
- Requiring modifications of the intersection of North Beacon Street and Leo M. Birmingham Parkway in order to accommodate the new ramp

Concept 5: Add a Slip-Ramp next to the East-Side Bridge from Centre Avenue to I-90 Westbound

This concept would provide more direct access to I-90 westbound for traffic from west and south of the rotary, thus reducing weaving conflicts on the east-side bridge. The slip ramp would be placed just next to the east-side bridge and would merge with the existing ramp to the south of the rail track (see Concept 5 in Figure 2). As available right-of-way is limited at the merge area, an engineering study would be required to examine the feasibility of this concept.

Advantages of this concept include:

- Direct access to I-90 westbound from Centre Avenue
- Reduced weaving conflicts on the east-side bridge
- Additional capacity of the east-side bridge

The major disadvantage of the concept is the high cost of building a new bridge or retrofitting the east-side bridge with an additional lane, given the number of users who would potentially use it.

Concept 6: Construct a New Two-Lane, Two-Way Bridge over I-90 Connecting Centre Street on Both Sides of the Rotary

In the first SAC meeting, a concept of converting the east-side bridge to two-way operation in order to connect Centre Street on both sides of the rotary was initiated. In the Phase I study, CTPS staff examined an alternative similar to the proposed concept. The alternative (Alternative 4 in the study) involves construction of a new, two-lane, two-way bridge over I-90 connecting Centre Street on both sides of the rotary, but maintaining the existing operation of the east-side bridge (see Figure 3).

In terms of perceived advantages, the concept would:

- Provide direct access for continuous Centre Street traffic and pedestrians
- Remove some traffic from the rotary, mainly on Washington Street and Centre Avenue
- Reduce traffic congestion on Washington Street, at the northern section of the rotary

In terms of perceived disadvantages, the concept would:

- Potentially cause more congestion on the east-side bridge due to additional weaving activities
- Increase delays for Centre Avenue eastbound traffic due to the reduction of green time needed by the Centre Street southbound through traffic
- Add to motorists' confusion regarding the complex rotary operation

The analyses in the Phase I study indicated that either building a new Centre Street bridge or converting the east-side bridge to two-way operation would potentially reduce the rotary capacity and add to motorists' confusion regarding the complex rotary operation.

Concept 7: Expand the Rotary beyond the East- and West-Side Bridges

This concept would involve enlarging the Newton Corner rotary interchange so that the maneuvers and lane changes that presently take place in a restricted right-of-way environment would be somewhat easier. It assumes that the right-of-way is available for the expansion. The idea is to expand the rotary by allowing additional circulation elements beyond the present east- and west-side bridges and by incorporating St. James Street on the east and Church Street on the west into a "concentric" traffic circulation pattern (see Figure 4 for the conceptual diagram of the improvement).

This concept has two major advantages:

- Reduction of the weaving conflicts on both the east- and west-side bridges
- Increasing the capacity of the rotary, as it would be stretched out, to better accommodate weaving maneuvers in the rotary

Major disadvantages include:

- Significant impacts to the neighborhoods in the vicinity of the rotary, especially for the areas near Charlesbank Road and Richardson Street
- Low feasibility due to the fully developed surrounding areas
- High cost of right-of-way acquisitions and roadway modifications

Concept 8: Add an Eastbound Off-Ramp at Interchange 16

Currently, there is no eastbound off-ramp at Exit 16. Adding an off-ramp at this location would provide eastbound I-90 traffic destined for West Newton, Newtonville, Watertown, and adjacent neighborhoods more direct access. To maintain the existing traffic operations at Exit 16, the new ramp would merge with the existing I-90 westbound off-ramp by flying over I-90 from its eastbound location just east of Commonwealth Avenue (Route 30). Figure 5 is a conceptual diagram of the flyover.

This new exit would potentially help in sharing the traffic burden at the Exit 17 eastbound off-ramp and at Newton Corner. However, it would potentially increase traffic on major streets in the vicinity of Interchange 16.

Concept 9: Institute a $0.50 Toll at the I-90 Eastbound On-Ramps at Interchanges 16 and 17

Currently there are no tolls for traffic entering I-90 eastbound at Interchange 16. Residents in the vicinity have been concerned about traffic increases along Washington Street and other neighborhood roads since the toll plaza was removed at this location many years ago. The assumption is that the increase in traffic is due to an increase of drivers from the western and southwestern suburbs who choose to avoid paying tolls at I-90 Exit 14/15 and drive along Washington Street (Route 16) or Commonwealth Avenue (Route 30) to reach this on-ramp instead.

The committee discussed the issue and considered testing the institution of a $0.50 toll at both I-90 eastbound on-ramps (at Interchanges 16 and 17) as a way to alleviate cut-through traffic at both interchanges. The moderate toll was chosen in consideration of minimizing the burden for Newton residents.

Concept 10: Modify Traffic Operations at the East-Side Bridge Approach

This is an operational improvement that aims to remove weaving conflicts and congestion on the east-side bridge. The concept calls for the addition of traffic signal control for traffic entering the east-side bridge. At each phase, the signal would only allow traffic to enter the bridge from the Centre Avenue eastbound approach or from the Washington Street westbound approach. Figure 6 shows the approximate location of the new traffic signal and layout of the new signalized intersection.

Although this is not a long-term improvement that would change traffic patterns, the committee wishes to examine it further as it may have potential benefits in both traffic operations and safety. In addition, if it is evaluated as favorable, the city can implement it in a relatively short time.

SELECTED ALTERNATIVES FOR MODELING

Following a discussion of the merits and potential of each of the improvement concepts, the committee selected three concepts, each as a stand-alone alternative, for further study. They are:

Concept 4: Add an I-90 Westbound Off-Ramp to North Beacon Street (Route 20) in Brighton
Concept 9: Install a $0.50 Toll at the I-90 Eastbound On-Ramps at Interchanges 16 and 17
Concept 10: Modify Traffic Operations at the East-Side Bridge Approach

In addition, the committee combined Concept 2 (adding a westbound on-ramp at Interchange 16) and Concept 8 (adding an eastbound off-ramp at Interchange 16) into a single alternative for further study. It was proposed that the potential impacts and benefits of introducing additional access/egress at Interchange 16 be examined.

In summary, in addition to the future no-build scenario (Alternative 1), the following four "build" alternatives were modeled and evaluated. They are:

Alternative 2: Add an I-90 Westbound Off-Ramp to North Beacon Street (Route 20)
Alternative 3: Add a Westbound On-Ramp and an Eastbound Off-Ramp at Interchange 16
Alternative 4: Install a $0.50 Toll at the I-90 Eastbound On-Ramps at Interchanges 16 and 17
Alternative 5: Modify Traffic Operations for the East-Side Bridge Approach

To test and evaluate the alternatives, CTPS staff used the software TransCAD[2] to estimate future traffic volumes for Alternatives 1 to 4, based on the network and trip tables converted from the Boston Region MPO's transportation planning model set. Alternative 5, which pertains to

[2] TransCAD, Version 4.8, Caliper Corporation, June 2006.

operational improvements only in the vicinity of the east-side bridge, was evaluated by using the traffic simulation model CORSIM, a traffic simulation model.[3]

TRANSPORTATION PLANNING MODEL: DEVELOPMENT AND ASSUMPTIONS

As mentioned earlier, the transportation planning model set developed for this study was derived from the Boston Region MPO's transportation planning model. In order to capture the regional character of travel through Newton Corner, the model set covers the entire area of Eastern Massachusetts. This area includes 101 Boston Region MPO communities inside of I-495 and another 63 communities beyond I-495.

The model set consists of the base year (2006) and the future year (2030) models developed for the AM and PM peak periods. Peak-hour traffic volumes were obtained by applying the peak-hour/period conversion factor to the projected peak-period volumes. The factor was calculated from the most recent available traffic counts in the study area.

The development of future-year model for this study was consistent with the most recent Regional Transportation Plan for the region.[4] The Plan includes two major assumptions related to future travel demand and transportation supply. First, for the projection of future travel demand, the Plan development process selected the Smart Growth Plus land use scenario as the region's socioeconomic profile for the year 2030. Second, the same process selected a list of major infrastructure and expansion transportation projects to be included in the region's most recent recommended transportation plan. The recommended projects, together with the existing transportation system, represent the future supply of transportation infrastructure in the region. Appendix C provides additional details of the model development and the recommended transportation plan.

SUMMARY OF MODEL RESULTS

Alternative 1: Future No-Build Alternative

The future no-build alternative is a baseline for evaluating the "build" alternatives. In this alternative, "no-build" means that no capital transportation improvements are expected in the study area. Outside the study area, transportation improvements in the region are expected to be in place as specified in the Boston Region MPO transportation plan. Overall, peak-hour traffic in the study area is expected to increase by about 10 to 15 percent between 2006, the base year, and 2030, in the no-build scenario. Figures 7 and 8 show the projected future AM and PM peak-hour traffic volumes.

Alternative 2: Add an I-90 Westbound Off-Ramp to North Beacon Street (Route 20)

In this alternative, a new I-90 westbound off-ramp would be constructed. It would connect the Turnpike from a point just west of Market Street to North Beacon Street in Brighton. The ramp would run along the space between I-90 and Leo M. Birmingham Parkway and would meet with

[3] Traffic Software Integrated System, CORSIM Version 5.1, developed for Office of Operations Research and Development, Federal Highway Administration, February 2003.

[4] *Journey to 2030: Transportation Plan of the Boston Region Transportation Planning Organization*, prepared by the Central Transportation Planning Staff, June 28, 2007.

the Parkway at a point near the intersection of North Beacon Street. In the model, it was assumed that both right turns to the Parkway and left turns to North Beacon Street would be allowed at the end of the new ramp.

The performance of Alternative 2 was evaluated against Alternative 1, the no-build alternative, by comparing the projected roadway traffic volumes. Figures 9 and 10 show changes in the AM and PM peak-hour traffic volumes from the no-build alternative to this alternative at major locations in the study area. Projected traffic impacts and diversions due to this alternative include:

- The new ramp would attract about 850 vehicles in the AM peak hour and 1,150 in the PM peak hour.
- The addition of the new ramp would alter the traffic patterns in the vicinity of the North Beacon Street/Soldiers Field Road/Nonantum Road rotary. The net increase of traffic in the vicinity of the rotary would be about 650 vehicles in both the AM and PM peak hours.
- Peak-hour westbound traffic on the Turnpike, just east of the new ramp, would increase by about 500 vehicles in the AM and 630 in the PM.
- At the Interchange 17 (Newton Corner) westbound off-ramp, there would be a reduction of about 300 vehicles in the AM peak hour and about 500 in the PM peak hour.
- At Interchange 18/19/20 (Cambridge/Allston), there would be a reduction of about 300 vehicles in the AM peak hour, and about 400 in the PM peak hour, at the westbound off-ramp. This diversion would also bring about a reduction of about 100 westbound vehicles per peak hour on Cambridge Street west of the exit.
- The decrease of traffic in the Newton Corner westbound off-ramp would in turn yield additional capacity for the east-side bridge approach, which would attract to the bridge about 150 additional vehicles in the AM peak hour, and about 250 in the PM peak hour, from roadways south of the rotary.

In evaluating the traffic diversion effects, it is important to note that, because traffic in the study area is nearly saturated during the peak hours, the model can take advantage of any roadway capacity that becomes available to it. So traffic “fills-in” or “can be diverted” from one path to another, sometimes in a not-so-obvious way, due to the replacement of different groups of vehicles. This reflects the reality that, over time, drivers will divert to roadways where additional or residual capacities are available and find their perceived shortest-time paths. The additional capacity of a roadway will appeal to drivers who go through the area using another roadway, as well as those who do not go through the area but will potentially be attracted to it.

Alternative 3: Add a Westbound On-Ramp and an Eastbound Off-Ramp at Interchange 16

This alternative includes a new I-90 westbound on-ramp and a new I-90 eastbound off-ramp at Interchange 16. The purpose of this alternative is to examine impacts to Interchanges 16 and 17 and other roadways in their vicinity.

Major traffic impacts and diversions due to this alternative include (see Figures 11 and 12):

- The new eastbound off-ramp would attract about 400 (300) additional vehicles (in the AM and PM peak hour, respectively), half of which would be diversions to the Turnpike eastbound from other roads. Traffic volumes at the Newton Corner eastbound off-ramp would decrease by about 100 vehicles in both the AM and PM peak hours. At

Interchange 16, traffic at the existing eastbound on-ramp would increase by about 150 (30) vehicles in the AM and PM peak hour, respectively.

- The new westbound on-ramp would attract about 250 (400) vehicles in the AM and PM peak hour, respectively. Traffic at the Newton Corner westbound on-ramp would decrease by about 50 (100) in the AM and PM peak hour, respectively.
- I-90 eastbound and westbound traffic, just east of Route 128, would increase by about 200 vehicles in both the AM and PM peak hours. This increase corresponds to projected decreases in traffic volumes along Commonwealth Avenue and Auburn Street, north of the Turnpike. This means a portion of the traffic north of the Turnpike that travels westbound on Auburn Street and Commonwealth Avenue to reach the Turnpike via Route 128 southbound would now enter the Turnpike at the new westbound on-ramp.
- This alternative would increase the total number of vehicles at Interchange 16 in the AM and PM peak hours by about 300 to 400 (AM) and 250 to 300 (PM).

Alternative 4: Institute a $0.50 Toll at the I-90 Eastbound On-Ramps at Interchanges 16 and 17

This alternative would institute a $0.50 toll at the I-90 eastbound on-ramps at both Interchange 16 and Interchange 17 to deter drivers from cutting through Newton neighborhoods to reach the Turnpike at both interchanges. The $0.50 toll was chosen because it is half of the existing (2007) toll at Interchange 14/15 (Weston) and at Interchange 18/19/20 (Brighton/Allston). It is assumed that future tolls at these locations would remain half of the toll at Interchange 14/15 and Interchange 18/19/20. Figures 13 and 14 show changes in the AM and PM peak-hour traffic volumes from the no-build alternative to this alternative.

Major traffic impacts and diversions due to the institution of a toll at Interchange 16 include:

- It would deter about 400 vehicles in the AM peak hour, and about 350 in the PM peak hour, from using the eastbound on-ramp.
- It would cause an increase of eastbound traffic at the Washington Street (Route 16) overpass at Interchange 16 by about 250 vehicles in the AM peak hour and about 200 in the PM peak hour.
- Traffic at the Interchange 17 eastbound off-ramp would decrease by about 200 vehicles in the AM peak hour and about 100 in the PM peak hour.
- Eastbound I-90 traffic just east of Route 128 would increase by about 250 vehicles in the AM peak hour and about 200 in the PM peak hour.
- Washington Street (Route 16) eastbound traffic going to the interchange would decrease by about 100 vehicles per peak hour. The decrease is not as high as the volume of traffic diverted from the on-ramp. This is due to (1) a major portion of the traffic originally on Washington Street diverting from the on-ramp to the rotary and continuing east, and (2) traffic from other paths taking advantage of the released roadway capacity and switching to Washington Street.
- Overall, it would decrease traffic volumes on the south side of the interchange. However, traffic on local streets on the north side of the interchange would increase, as some drivers would change their routes to avoid the toll.

Major traffic impacts and diversions due to the institution of a toll at Interchange 17 include:

- It would deter about 400 vehicles in the AM peak hour, and about 300 in the PM peak hour, from using the eastbound on-ramp.
- The on-ramp would still carry nearly 1,800 vehicles in the AM peak hour. Additional studies are required to examine if the toll facilities would cause extensive traffic queues and adversely impact the traffic operations at the rotary.
- It would decrease traffic on Centre Avenue south of I-90 by about 200 vehicles in the AM peak hour and about 150 in the PM peak hour.
- East of the eastbound on-ramp, there would be a decrease of about 300 vehicles in both the AM and PM peak hours on I-90 eastbound.
- At the intersection of Washington Street and St. James Street, just before the eastbound on-ramp, traffic on Washington Street westbound would decrease by about 100 vehicles in the AM peak hour and about 50 in the PM peak hour. Traffic on St. James Street would remain about the same as in the no-build alternative.
- Overall, it would decrease the traffic volumes mainly on the south side of the Newton Corner rotary. However, some drivers would switch to local streets east of Newton Corner in order to avoid the new toll.

The volumes shown on Figures 13 and 14 are net results of a lot of route changing going on simultaneously due to the two tolls being assumed. The effects of the tolls at Interchange 16 and 17 would interact with one another and the impacts of each would be obscured by the impacts of the other. Further discussions of these effects and traffic impacts of Alternative 4 on Route 9 and St. James Street are described in Appendix D.

Alternative 5: Modify Traffic Operations for the East-Side Bridge Approach

This is an operational improvement that aims to remove weaving conflicts and congestion on the east-side bridge. The proposal is to establish traffic signal control for traffic entering the east-side bridge. The signal design would be such that traffic entering the bridge from the Centre Avenue eastbound approach would be on a separate phase from that entering from the direction of Washington, Park, and St. James streets.

The following impacts are expected to result from the installation of the new signal at the south side of the east-side bridge:

- As the traffic signal would regulate traffic entering the east-side bridge, there would be a reduction in weaving and merging between the Centre Avenue traffic and traffic from Washington, Park, and St. James streets. This would reduce conflicts, delays, and queues. As a result, it would make the bridge safer.
- This option would adversely impact Centre Avenue eastbound and Centre Street northbound traffic. Delays and queues would increase slightly because of the split-phase design of the new signal.

Overall, the total delay resulting from the alternative would remain pretty much the same (with a slight decrease), as in the existing conditions in the AM and PM peak hours. This is because the reductions in delay from the reduced weaving and merging on the east-side bridge would be

offset by the extra delay incurred at the new signal on the south side of the bridge. Results from the CORSIM model and traffic operations analyses are summarized in Appendix E.

EVALUATION OF ALTERNATIVES

Table 1 presents a preliminary evaluation of the alternatives based on projected traffic impacts and related qualitative assessments. These assessments take into account the improvement objectives of reducing traffic congestion at Newton Corner and at the two adjacent I-90 interchanges (16 and 18/19/20), attracting traffic from local streets to the Turnpike, improving traffic operations and safety, and minimizing right-of-way impacts and construction costs. Due to the complexity of the project, at this stage of the study the benefits and impacts of the improvements can only be measured approximately, in four general categories: significant, moderate, some, and negligible.

In general, Alternatives 2, 3, and 4 would all help in reducing traffic congestion at the Newton Corner rotary and on streets connected to the rotary. At Interchange 16, Alternative 2 would have negligible impacts; Alternative 3 would attract a noticeable amount of traffic to the entire interchange; Alternative 4 would increase some traffic on the east side of the interchange but would decrease traffic on local streets connected to the interchange. At Interchange 18/19/20, Alternative 2 would significantly reduce traffic volume at the westbound off-ramp and reduce traffic congestion at the interchange; Alternatives 3 and 4 would have negligible impacts.

Alternatives 2, 3, and 4 would effect various traffic diversions from local streets to the Turnpike. As a result, traffic operations and safety would be somewhat improved at Newton Corner. However, Alternative 3 would potentially increase delays at Interchange 16; Alternative 2 would increase delays at the interchange area of North Beacon Street (Route 20) and the new off-ramp, but would decrease delays at Interchange 18/19/20. The right-of-way and construction costs of Alternative 3 would be much higher than those of Alternative 2 or 4.

Alternative 5 would improve safety for traffic entering the east-side bridge and would have a marginal operational benefit. It would have negligible impacts on locations beyond Newton Corner.

CONCLUSION AND IMPLEMENTATION

This study has developed several improvement concepts and tested four improvement alternatives. Table 2 summarizes the potential benefits and impacts of the various alternatives. It indicates that among the three long-term alternatives, Alternative 2 is the most beneficial, Alternative 3 is the least favorable, and Alternative 4 shows some potential.

Though both Alternatives 2 and 4 show potential for relieving the congestion at Newton Corner without significant impacts to other locations in the study area, further operational analyses would be required to support these findings. The major issue of Alternative 2 is the increase in traffic at the interchange area of North Beacon Street (Route 20), Soldiers Field Road, and Nonantum Road. The area appears to have room for reconfiguration of the interchange. A further study could explore different designs to accommodate the additional traffic, as well as the current, congested traffic, in the peak hours. For Alternative 4, additional study could clarify if locating the toll booth at the Interchange 17 on-ramp would have any adverse impact on the

capacity of the rotary. The study should also look into the feasibility of having a toll booth within the limited ramp space, and the possibility that it might cause vehicle queues to spill into the rotary.

The implementation of Alternative 2, Alternative 4, or any other long-term alternative resulting from further studies would be a major undertaking that would require an extensive planning and environmental review process. Interstate 90 in the study area and its associated ramps are administered by the Massachusetts Turnpike Authority (MTA). The roadways leading to Interchanges 16 and 17 are all under Newton's jurisdiction. The roadways leading to the rotary of North Beacon Street (Route 20), Soldiers Field Road, and Nonantum Road; the nearby Leo M. Birmingham Parkway; and the rotary itself are administered by the Massachusetts Department of Conservation and Recreation (DCR). Some local streets in the vicinity are under Boston's jurisdiction. In addition, the Worcester commuter rail line of the Massachusetts Bay Transportation Authority (MBTA) runs along I-90, with three stops in the study area, and several MBTA bus routes have stops at Interchanges 16 and 17. Therefore, major stakeholders of the project include the Cities of Boston and Newton, the Massachusetts Executive Office of Transportation and Public Works, MTA, DCR, MBTA, and nearby communities, such as Watertown and Cambridge.

Coordination among these stakeholders, public participation, and securing federal funding are keys to successful implementation of the project. For reference, a description of the implementation process of the Massachusetts Highway Department is provided (see Appendix F). The process for implementing new and modified MBTA services is based on the service planning process defined in the Authority's Service Delivery Policy (see Appendix G).

For the reasons described above, the process for implementing this project would be more extensive than for the usual highway or transit project. Therefore, planning and design agencies would have to work closely with the Massachusetts Executive Office of Energy and Environmental Affairs in the early stage of the project.

CW/cw

Table 1: Estimation of Potential Benefits and Impacts from Alternatives 2, 3, 4, and 5 under 2030 AM and PM Peak-Hour Conditions

OBJECTIVES	ALTERNATIVE 2 Adding an I-90 WB Off-Ramp to North Beacon Street, Brighton	ALTERNATIVE 3 Adding a WB On-Ramp and an EB Off-Ramp at Interchange 16, Newton	ALTERNATIVE 4 Institution of Tolls at Interchanges 16 and 17, Newton	ALTERNATIVE 5 Operational Improvements at East-Side Bridge, Newton
Reduce Traffic Volume at Newton Corner (Interchange 17)	**Significant Benefits** • Reduction of about 300 to 500 vehicles at I-90 WB off-ramp • Moderate traffic reductions at Newton Corner Rotary, mainly north of I-90	**Some Benefits** • Moderate traffic reduction on I-90 EB and WB off-ramps at Newton Corner • Slight traffic reduction at Newton Corner	**Significant Benefits** • Significant reduction of traffic on EB on-ramp, and I-90 EB east of Interchange 17 • Moderate reduction of traffic at Newton Corner Rotary, mainly south of I-90	**Negligible** • Slight overall reduction in delay • Slight increase in delay on streets feeding into the east-side bridge and Centre St. NB
Reduce Traffic Volume at Interchange 16	**Negligible** • Negligible traffic volume changes at Interchange 16	**Significant Impacts** • Significant traffic increase at the interchange • Moderate traffic increase on local streets north of the interchange	**Some Benefits** • Traffic reduction at I-90 EB on-ramp • Traffic increase on the east side of the interchange • Traffic reduction on local streets south of the interchange, but slight increase on the north	**Negligible** • Negligible traffic-volume changes
Reduce Traffic Volume at Interchange 18/19/20	**Significant Benefits** • Reduction of about 300 to 400 vehicles at I-90 WB off-ramp	**Negligible** • Negligible traffic volume changes	**Negligible** • Negligible traffic volume changes	**Negligible** • Negligible traffic-volume changes
Divert Traffic from Local Streets to I-90	**Significant Benefits** • Significant traffic diversion from local streets in Allston/Brighton to I-90 WB • High increase in traffic volume in the vicinity of Route 20 and Soldiers Field Rd. near I-90 • Traffic volume reduction on local streets WB, such as Cambridge St. and Soldiers Field Rd., east of Market St.	**Moderate Benefits** • About 200 vehicles diverted from local streets to I-90 EB/WB • Traffic volume increase on local streets near Interchange 16 • Slight traffic reduction on local streets near Newton Corner	**Negligible** • About 200 to 250 vehicles diverted from local roads to I-90 EB, east of Route 128 • About 300 vehicles diverted from I-90 EB east of Newton Corner, potentially to local streets in Newton and Brighton • Some traffic diverted to local streets further away from I-90	**Negligible** • Negligible traffic diversions expected
Improve Traffic Operations and Safety at Newton Corner	**Moderate Benefits** • Reduced delays on I-90 WB off-ramp at the rotary • Reduced delays and improved safety on east-side bridge	**Some Benefits** • Somewhat reduced delays on the rotary and nearby local streets	**Moderate Benefits** • Reduced delays for the southern part of the rotary due to a reduction in traffic volume • Potentially increased delays near I-90 EB on-ramp from queues created by toll facilities	**Some Benefits** • Improved safety on the east-side bridge • Slightly increased delays on streets entering the bridge and Centre St. NB at Centre Ave.
Improve Traffic Operations and Safety on I-90	**Significant Benefits** • Reduced queue on I-90 WB off-ramp at Newton Corner, and improved safety at I-90 WB upstream of the off-ramp • Reduced delays on I-90 WB off-ramp at Interchange 18/19/20 and improved I-90 safety	**Some Impacts** • Increased traffic volume and weaving/merging/diverging activities on I-90 EB/WB west of Interchange 16 • Somewhat reduced delays on I-90 EB/WB mainlines west of Interchange 17 (Newton Corner)	**Some Benefits** • Reduced merging activities on I-90 EB at Interchange 16 and Interchange 17 • Somewhat reduced delays on I-90 EB between Interchange 16 and Interchange 18/19/20	**Negligible** • Negligible traffic-volume changes expected on I-90
Improve Traffic Operations and Safety at Other Locations	**Some Impacts** • Potentially increased delays at the rotary of Route 20 and Soldiers Field Rd. near I-90	**Significant Impacts** • Increased delays at Interchange 16 and nearby streets	**Some Impacts** • Potentially increased delays near I-90 EB on-ramp at Interchange 16 due to tolls • Potentially increased delays on local streets in Newton	**Negligible** • Negligible effects on locations beyond Newton Corner
Minimize Right-of-Way (ROW) Impacts	**Moderate Impacts** • Potentially required ROW changes for a DCR roadway (Birmingham Parkway)	**Significant Impacts** • Potential ROW acquisitions on the north side of I-90 near Interchange 16	**Some Impacts** • Modification of Interchange 17 on-ramp may be required	**Negligible** • No ROW cost
Minimize Construction Costs	**Moderate Impacts** • Regular highway off-ramp construction cost	**Significant Impacts** • Significant cost for the EB flyover off-ramp • Moderate cost for the WB on-ramp	**Some Impacts** • Ramp layout modifications • Installation of toll facilities	**Negligible** • Installation of a new traffic signal

Table 2: Summary of Potential Benefits and Impacts

Objectives	Alt. 2 Add a I-90 WB Off-Ramp to Rt. 20	Alt. 3 Add I-90 WB On- and EB Off-Ramps at Int. 16	Alt. 4 Add I-90 EB Tolls at Ints. 16 and 17	Alt. 5 Operational Improvements at East-Side Bridge
Reduce Traffic Congestion at Newton Corner	●	○	●	◇
Reduce Traffic Congestion at Interchange 16	◇	●	○	◇
Reduce Traffic Congestion at Interchange 18/19/20	●	◇	◇	◇
Divert Traffic from Local Streets to I-90	●	◑	◇	◇
Improve Traffic Operations and Safety at Newton Corner	◑	○	◑	○
Improve Traffic Operations and Safety on I-90	●	○	○	◇
Improve Traffic Operations and Safety at Other Locations	○	●	○	◇
Minimize Right-of-Way Impacts	◑	●	○	◇
Minimize Construction Costs	◑	●	○	◇

Legend

Benefits	●	Significant	◑	Moderate	○	Some	◇	Negligible
Impacts	●	Significant	◑	Moderate	○	Some	◇	Negligible

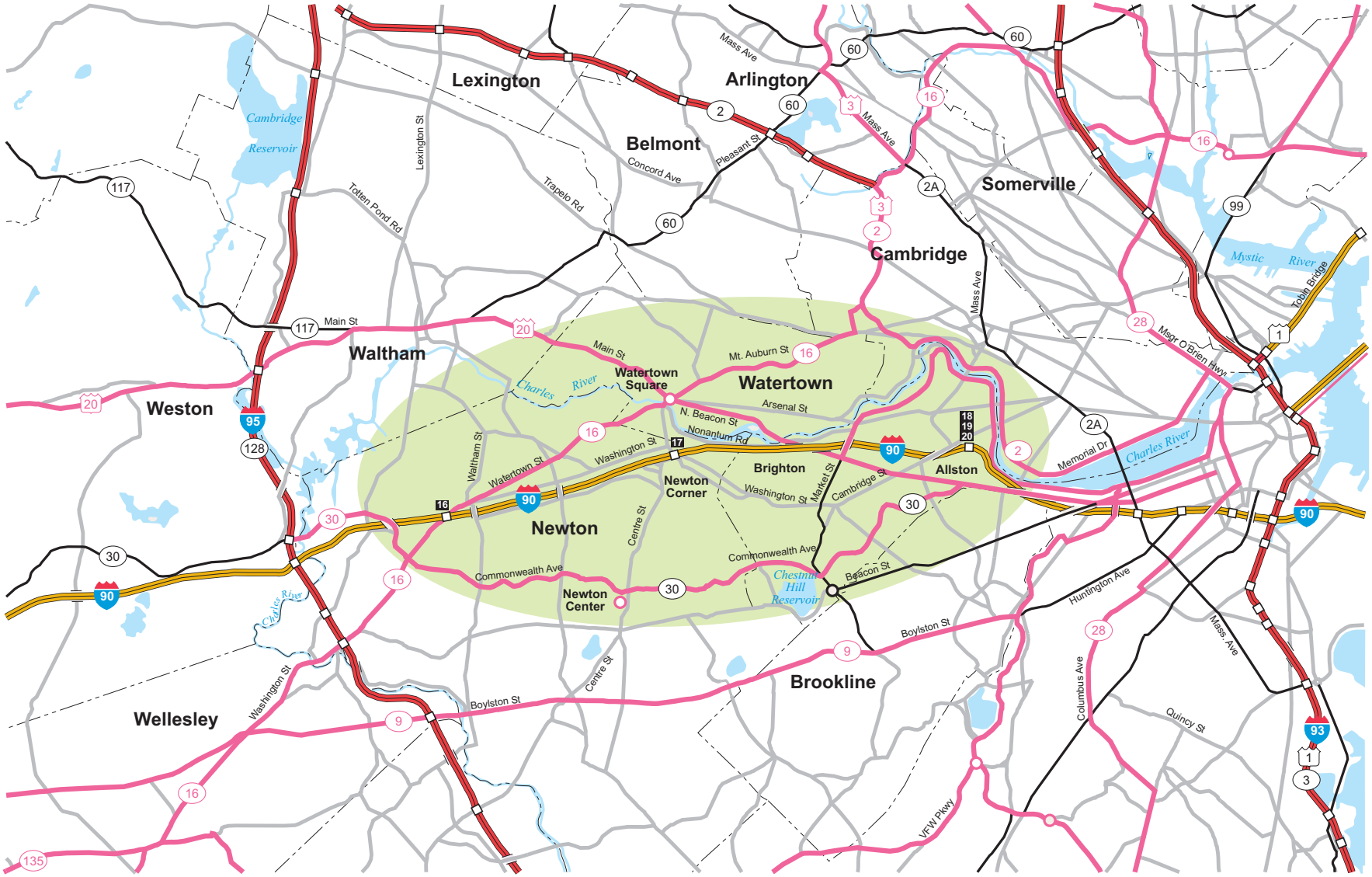


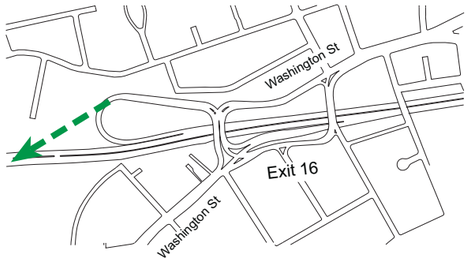
Figure 1: Study Area

Concept 1:

Move the Existing WB On-Ramp at Interchange 17 to a New Location West of Church Street

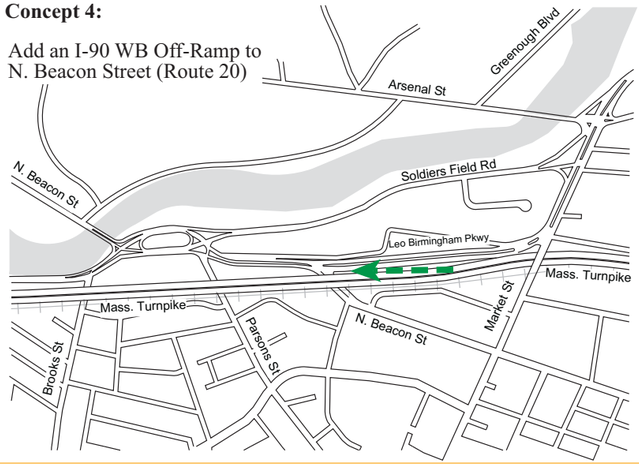
Concept 2:

Add a WB On-Ramp at Interchange 16



Concept 4:

Add an I-90 WB Off-Ramp to N. Beacon Street (Route 20)

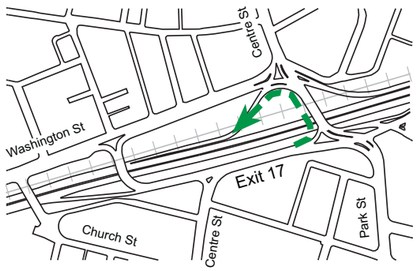


Concept 3:

Convert St. James Street to One-Way Southbound

Concept 5:

Add a Slip On-Ramp next to the East-Side Bridge to I-90 WB from Centre Ave.



Legend:

Commuter rail station

Turnpike on- or off-ramp

N

Figure 2: Improvement Concepts 1 to 5

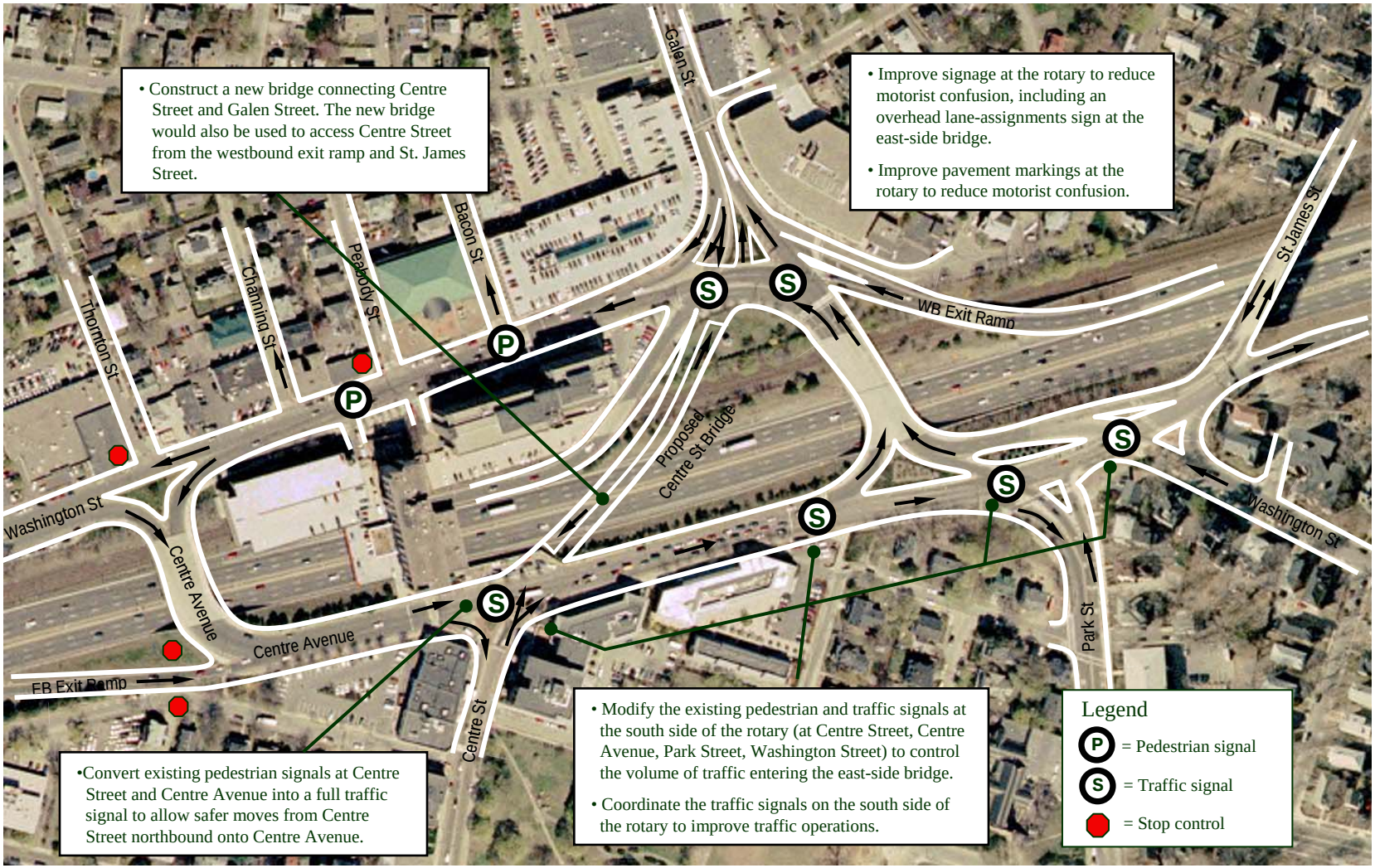


Figure 3: Improvement Concept 6

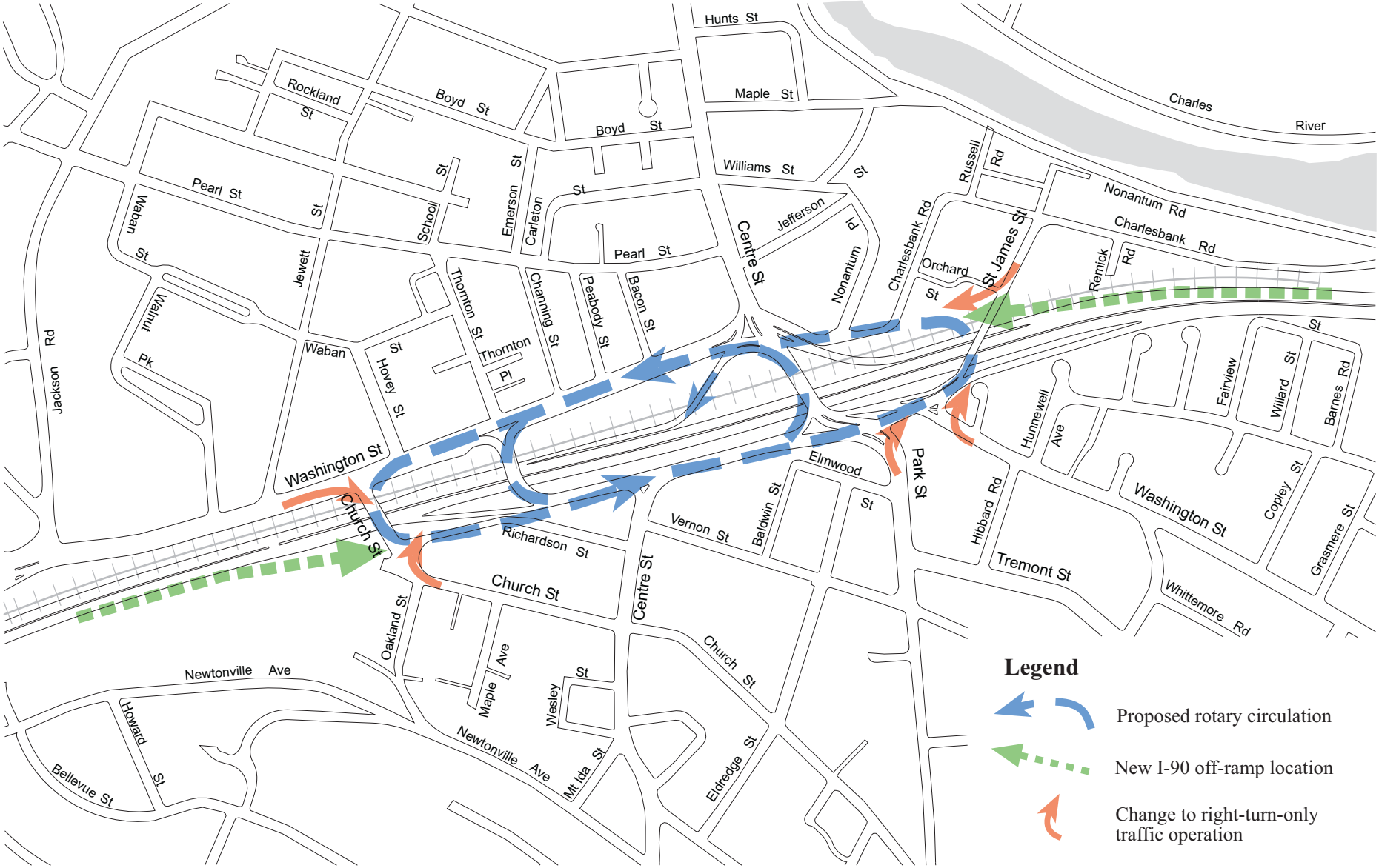


Figure 4: Improvement Concept 7

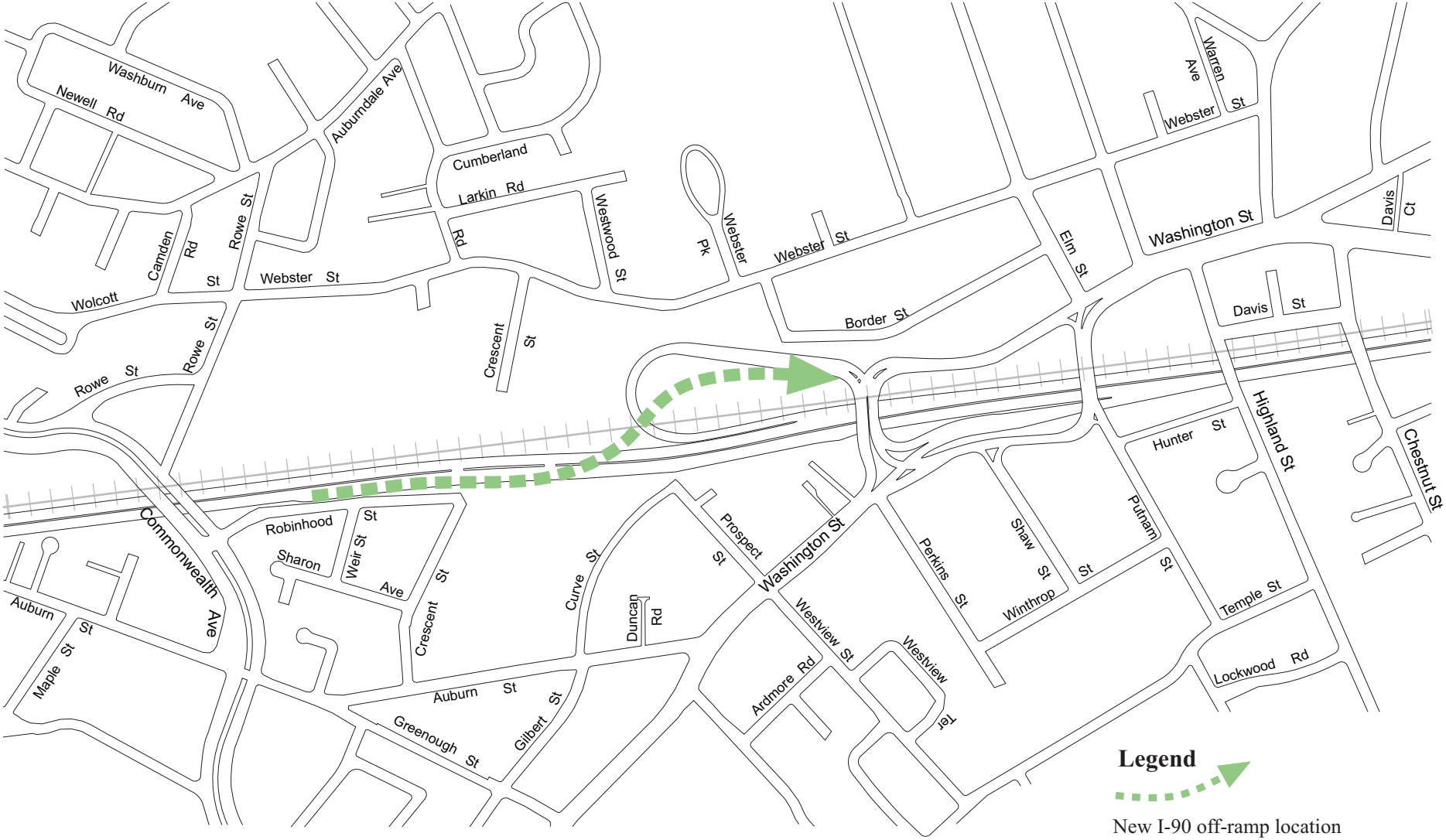


Figure 5: Improvement Concept 8

Figure 6: Improvement Concept 10

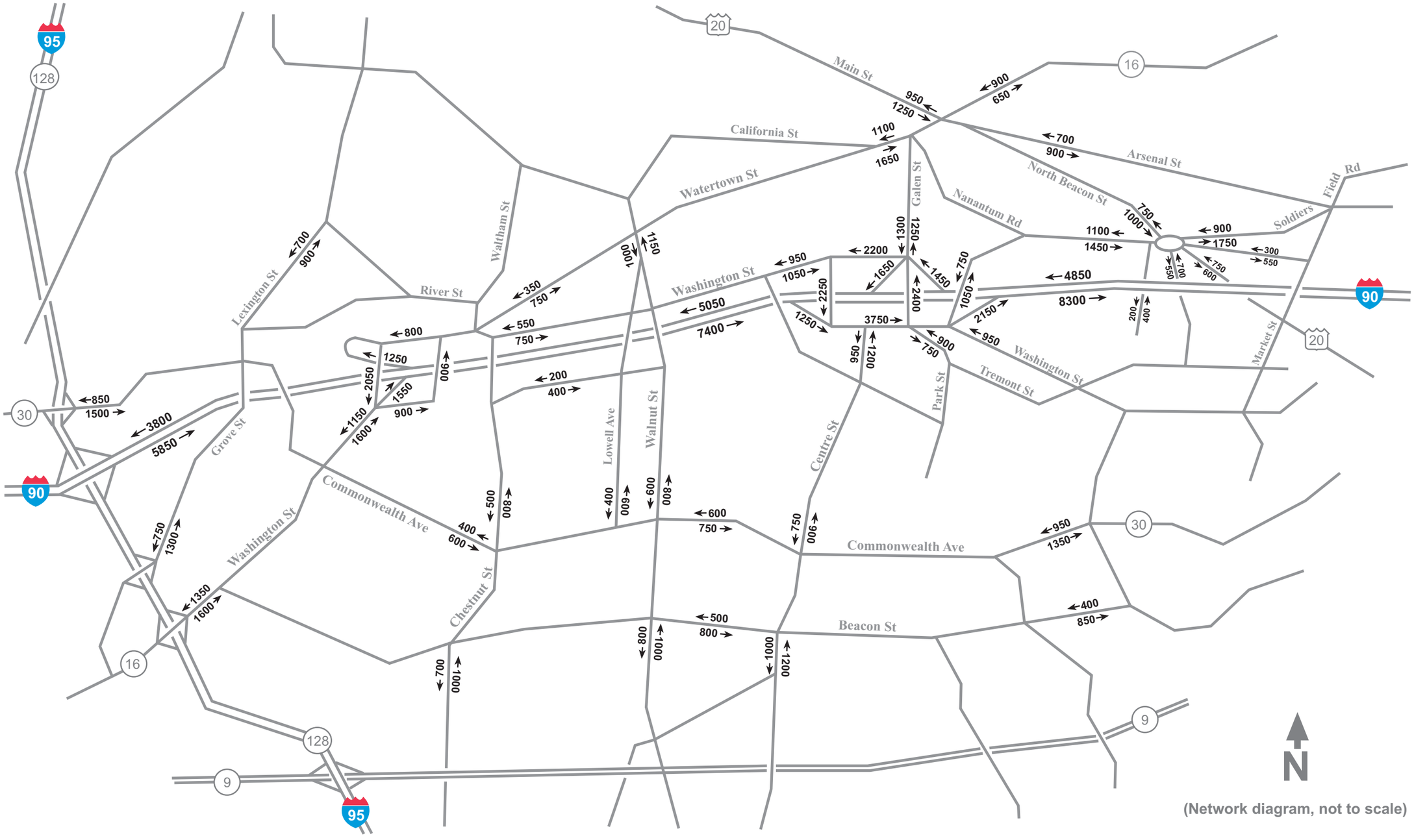
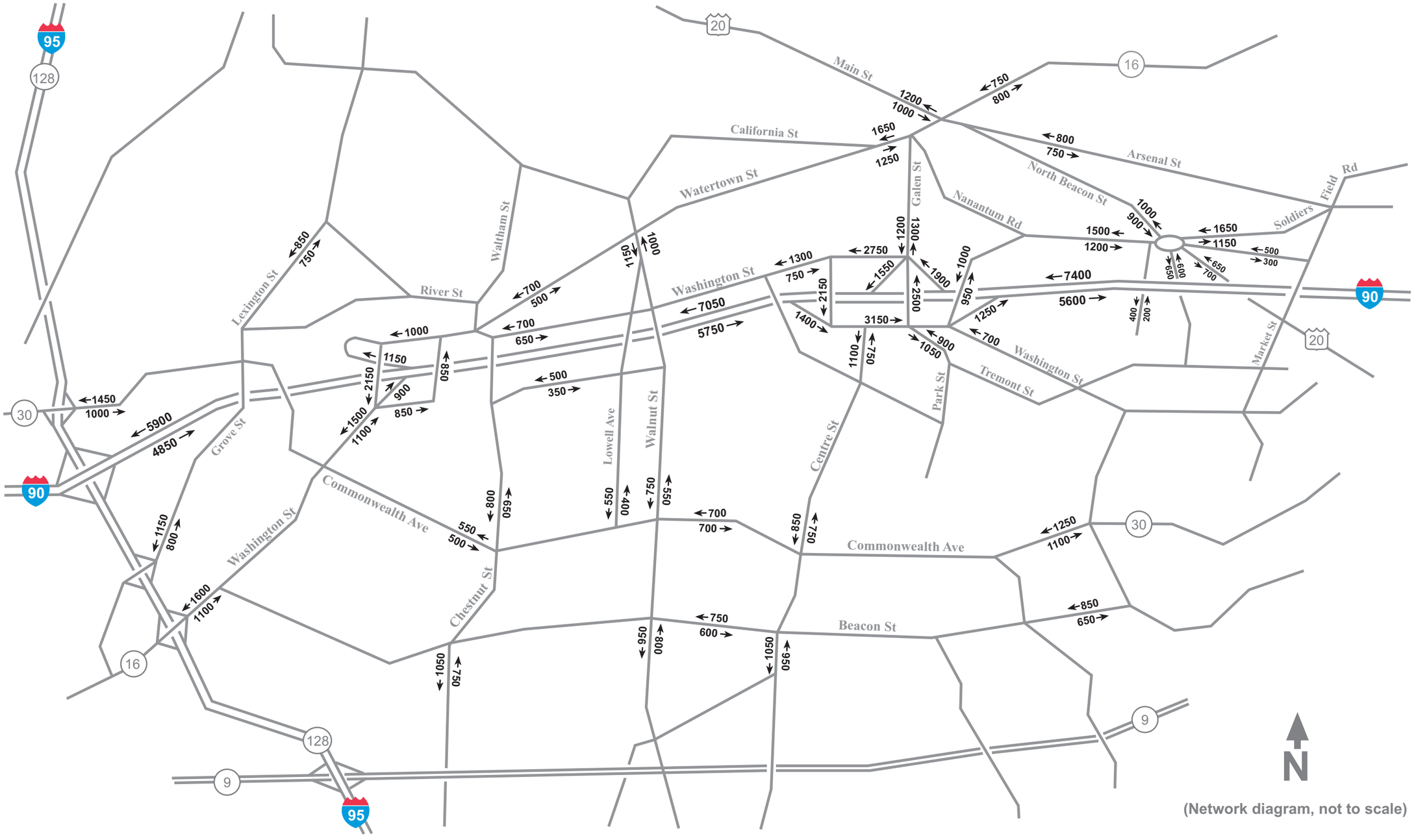


Figure 7: Alternative 1 (No-Build) - Projected 2030 AM Peak-Hour Traffic Volumes



(Network diagram, not to scale)

Figure 8: Alternative 1 (No-Build) - Projected 2030 PM Peak-Hour Traffic Volumes

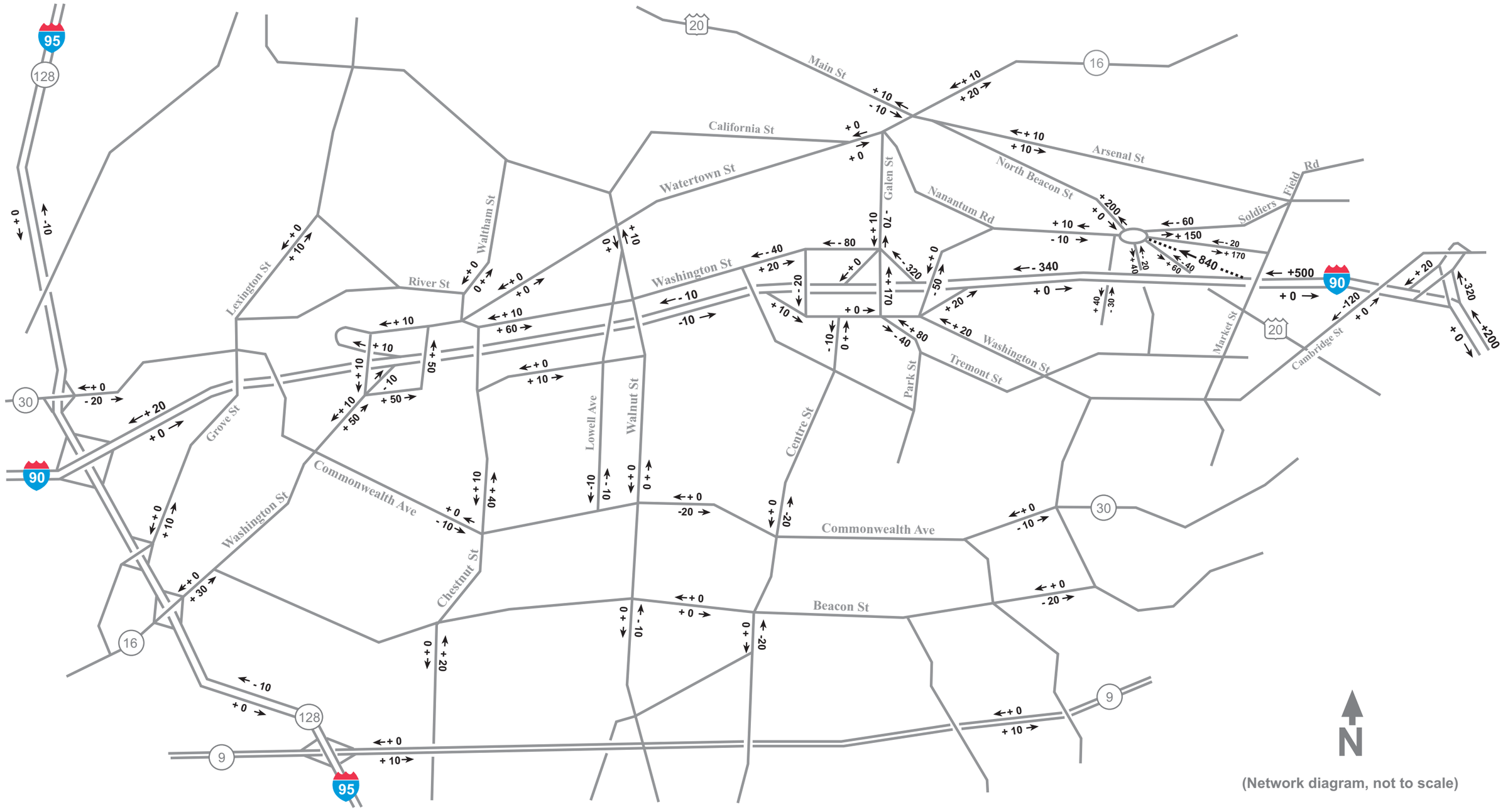


Figure 9: Alternative 2 - Projected 2030 AM Peak-Hour Traffic-Volume Changes from No-Build

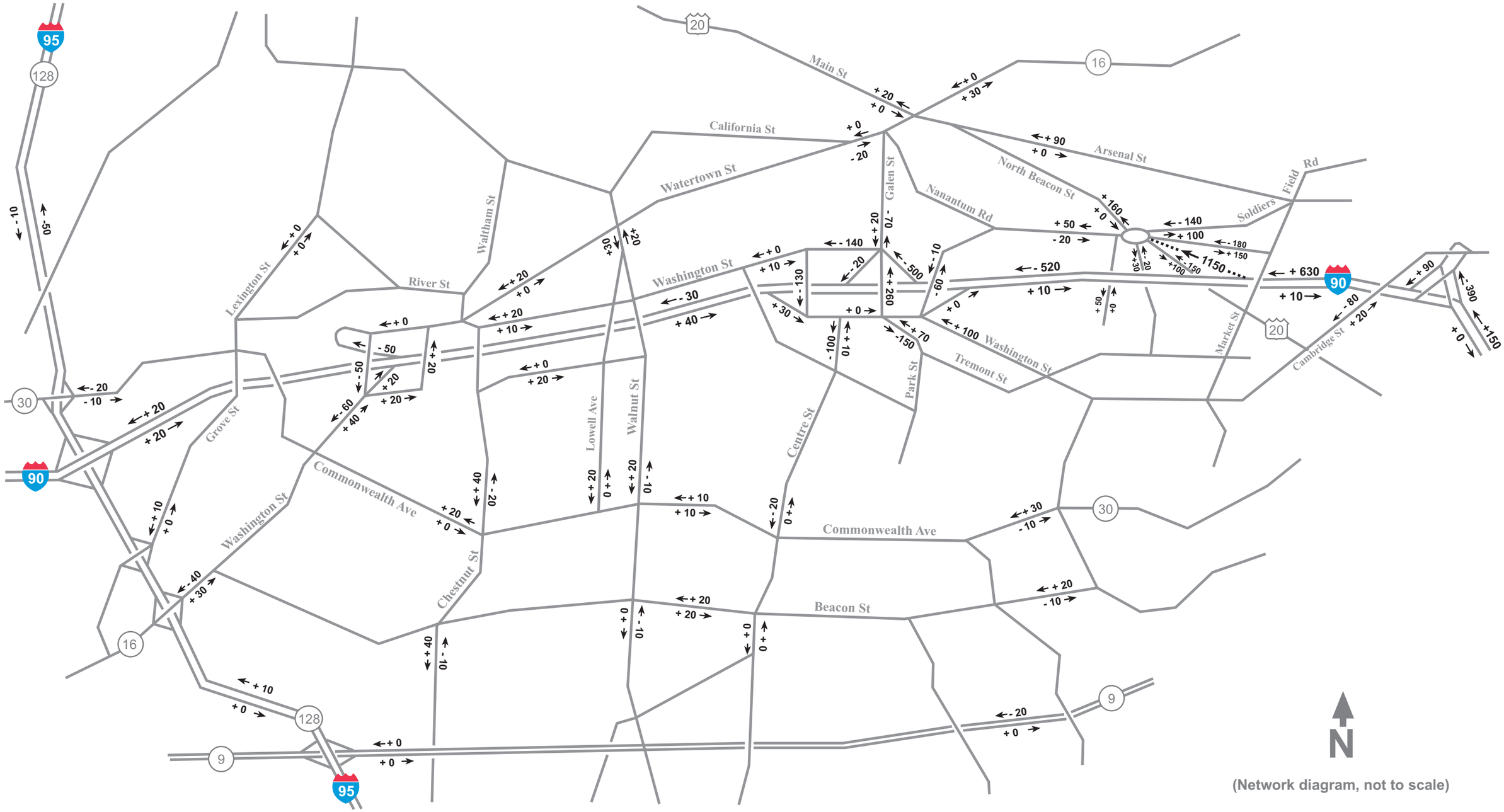
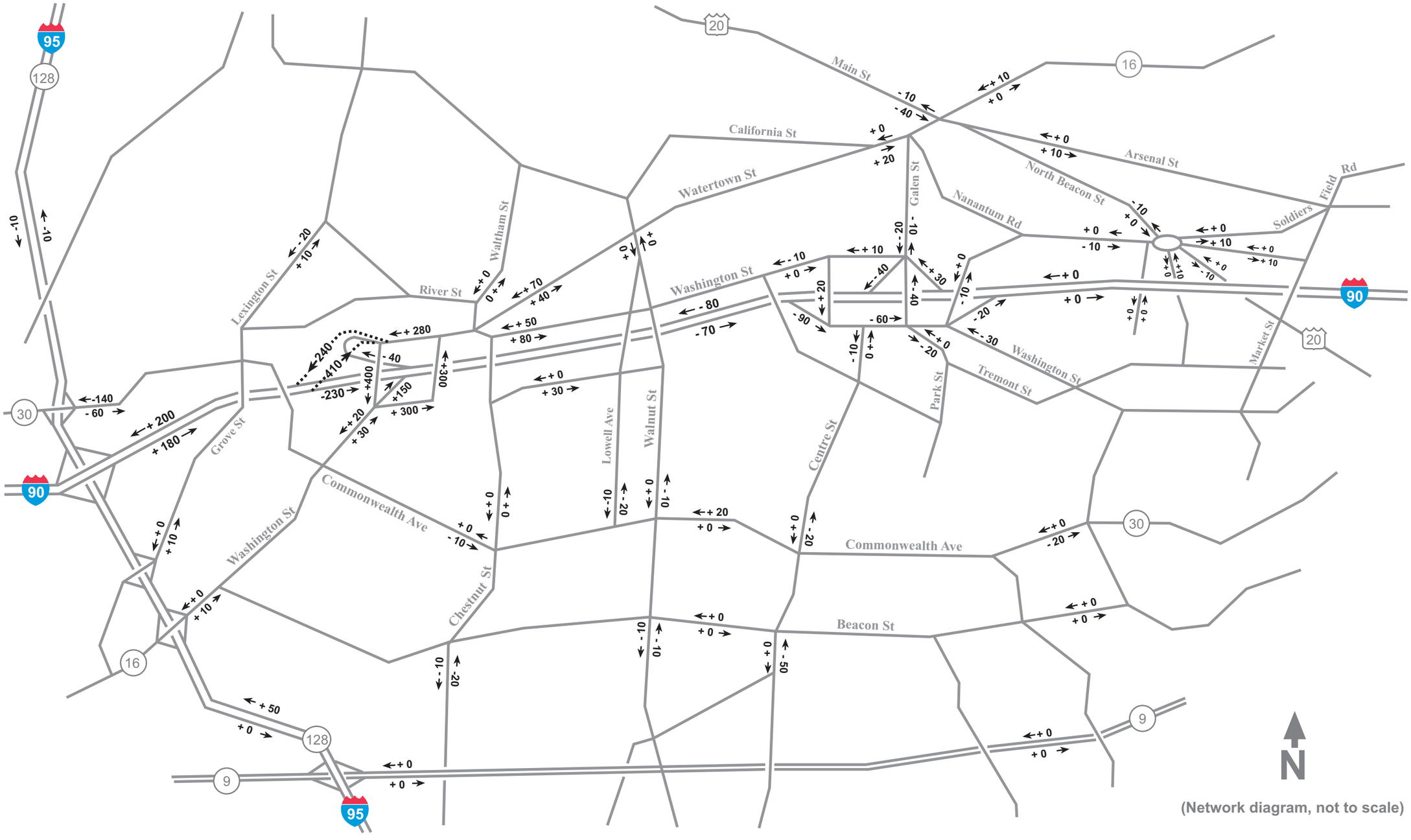


Figure 10: Alternative 2 - Projected 2030 PM Peak-Hour Traffic-Volume Changes from No-Build



(Network diagram, not to scale)

Figure 11: Alternative 3 - Projected 2030 AM Peak-Hour Traffic-Volume Changes from No-Build

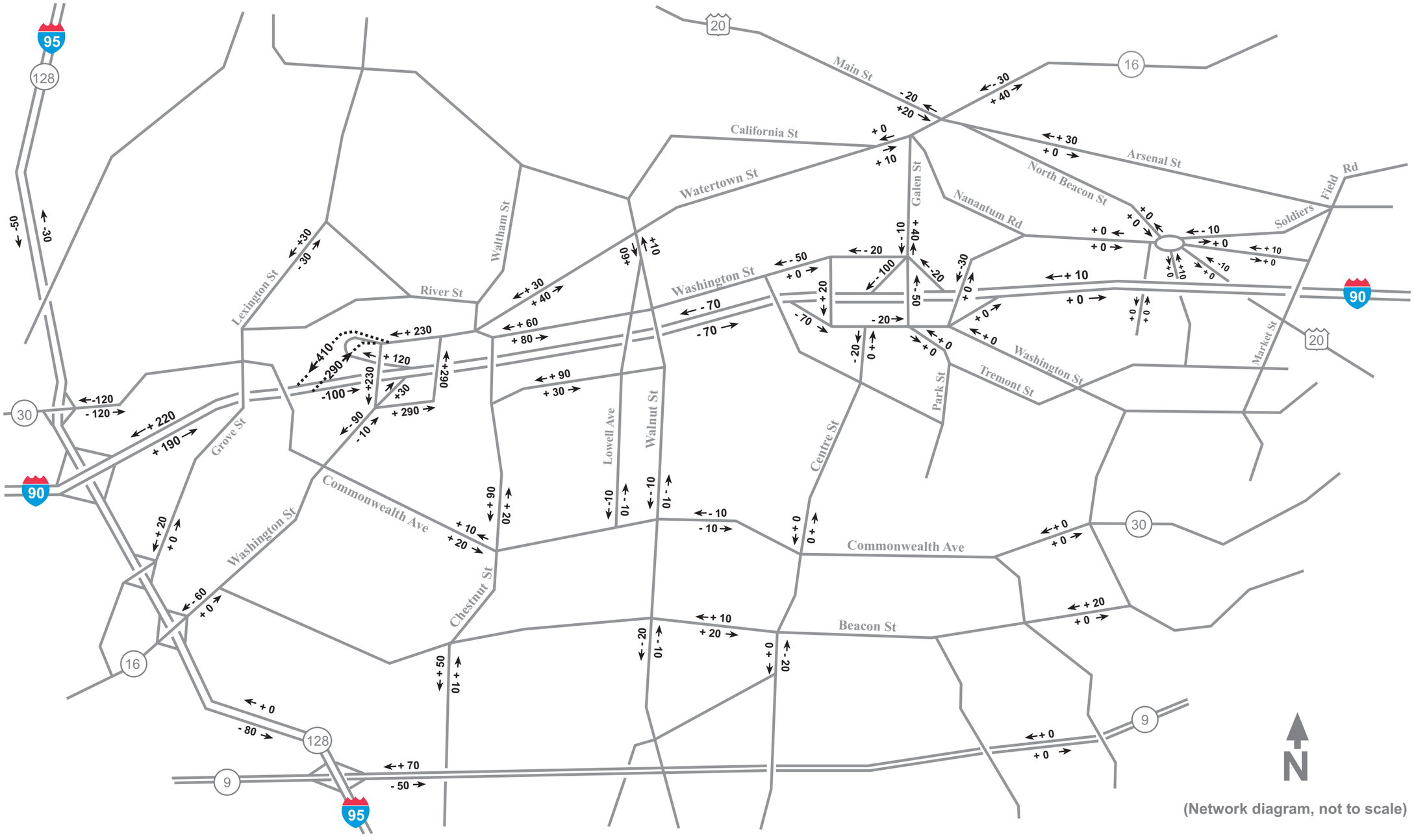


Figure 12: Alternative 3 - Projected 2030 PM Peak-Hour Traffic-Volume Changes from No-Build

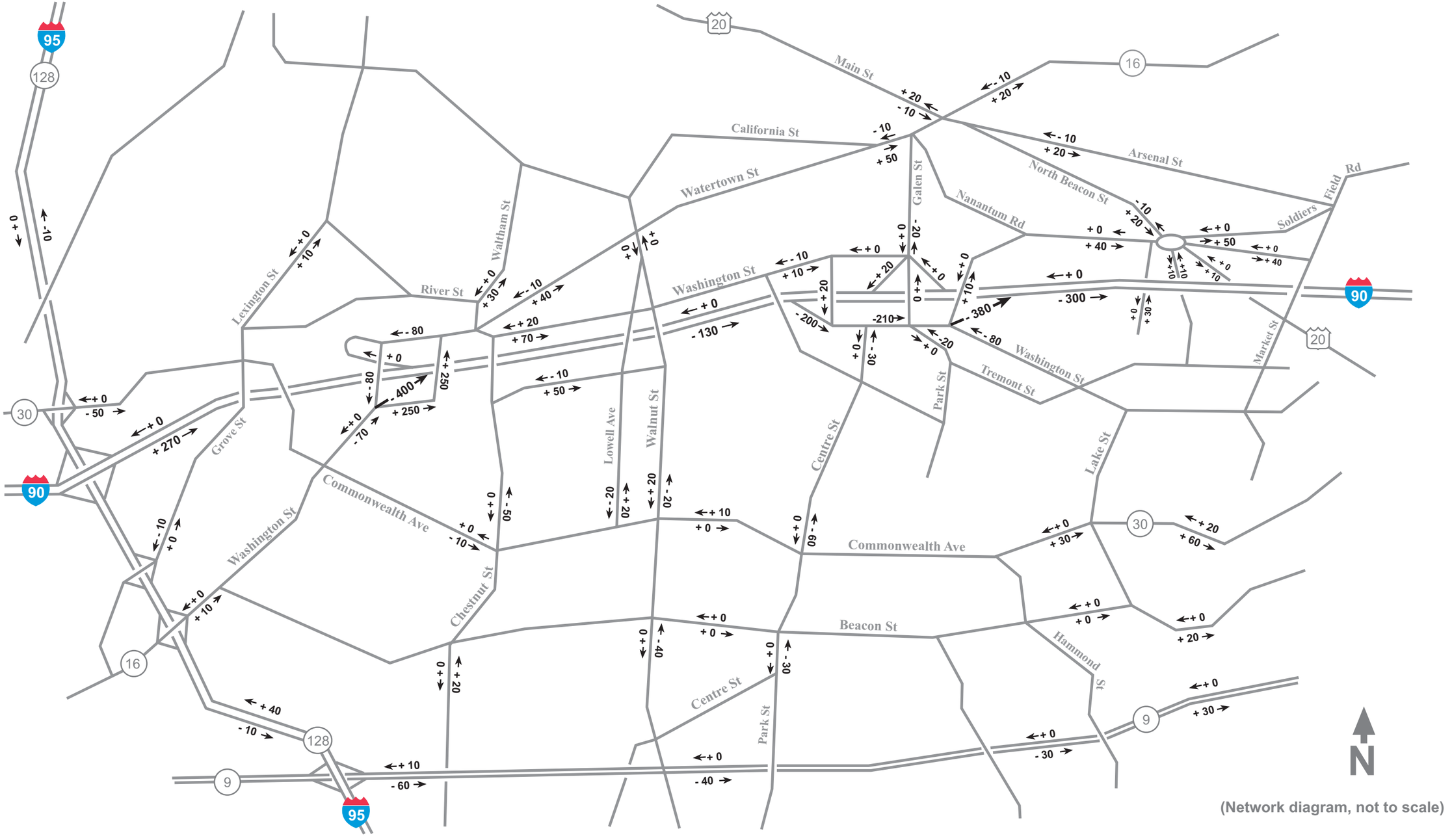


Figure 13: Alternative 4 - Projected 2030 AM Peak-Hour Traffic-Volume Changes from No-Build

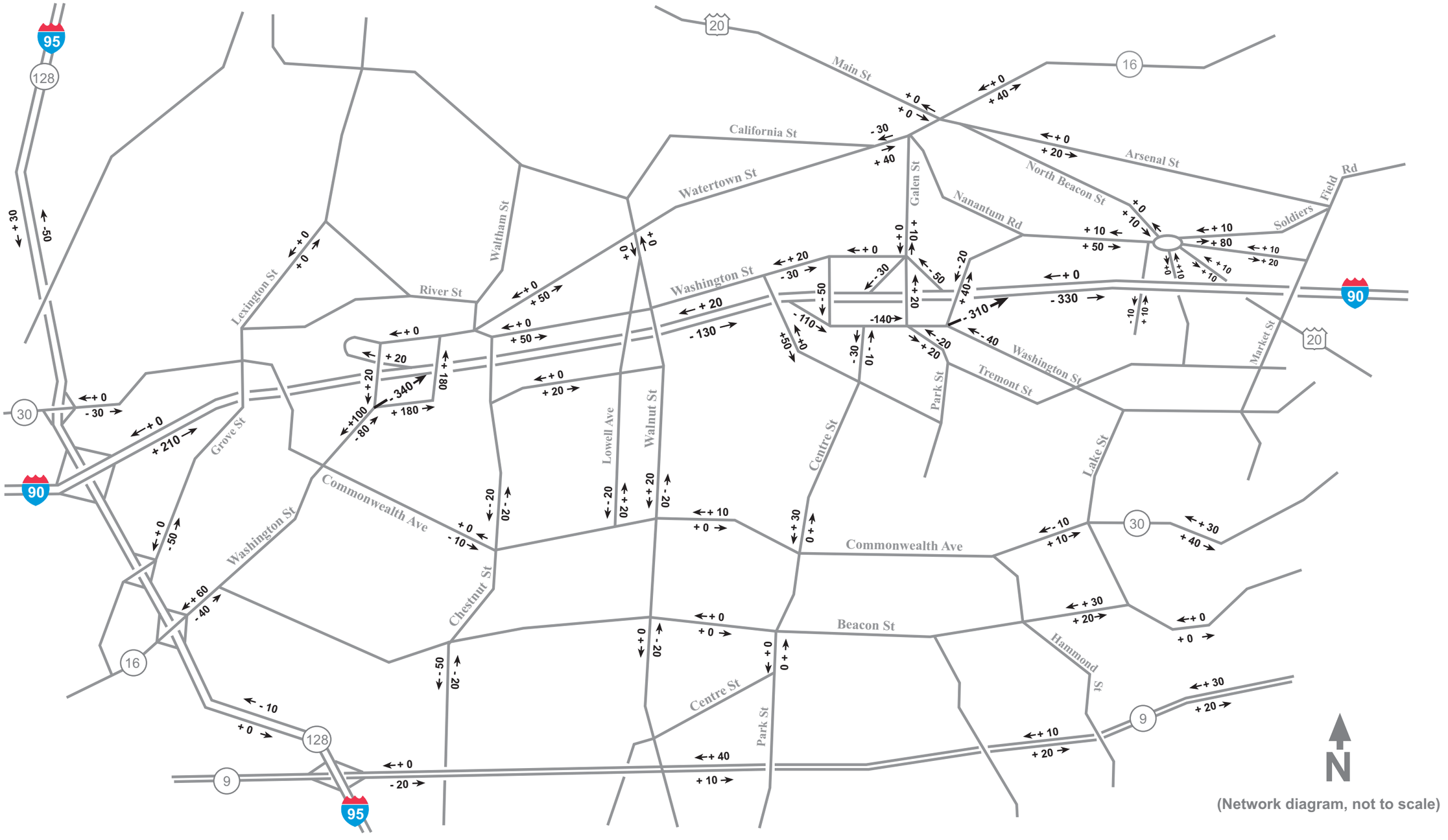


Figure 14: Alternative 4 - Projected 2030 PM Peak-Hour Traffic-Volume Changes from No-Build

Appendix A

Analyses of Potential Improvement Concepts

During the course of the study, 10 potential improvement concepts were developed and examined. The first 6 were developed in the first SAC meeting. These concepts (see Figures A-1 and A-2) are summarized below, with qualitative analyses of estimated traffic-flow changes and perceived advantages and disadvantages associated with these concepts. The estimation of traffic-flow changes is based on the origin-destination (O-D) survey conducted at the rotary in the Phase I study.[1]

Concept 1: Move the Existing Westbound On-Ramp at Interchange 17 to a New Location off Washington Street, Just West of Church Street

The existing on-ramp is the only entry point to I-90 westbound between Allston and Weston. It carries about 1,700 vehicles in the morning peak hour. About 50 percent of this traffic originates, roughly equally, from Boston, Watertown, and Newton.

Under this concept, a new on-ramp would be constructed off of the signalized intersection of Washington Street at Church Street, located one-tenth of a mile west of the rotary's west-side bridge. The ramp would then proceed over, and to the left of the Worcester commuter rail tracks and meet the right-hand side of I-90 at a point slightly less than half a mile west of Church Street, before the next bridge over the Turnpike at Lewis Street. Under this scenario, the existing ramp at the east-side bridge of the rotary would close.

Potential traffic-flow changes in the AM peak hour would include:

- Adding about 1,500 vehicles on Washington Street westbound between Centre Street and Church Street: 600 vehicles from north of the rotary and about 900 vehicles from south and east of the rotary.
- Possible removal of about 200 vehicles from the rotary, as vehicles from Washington Street west of the rotary would now enter I-90 using the new ramp. However, even if the relocation of the present ramp to Church Street were feasible, turning right from Washington Street eastbound onto the relocated ramp would be difficult, even impossible, especially for large vehicles.

If this concept were feasible, it would:

- Remove the weaving conflict on the east-side bridge between traffic proceeding to Washington Street westbound and traffic proceeding to the present on-ramp to I-90 westbound.
- Eliminate the traffic signal phase for the traffic entering the I-90 westbound on-ramp at the intersection of Centre Street at Washington Street. The time for this phase could then be redistributed to the signal's green phases for the other intersection approaches, thus improving their capacity to process more traffic.

[1] Alicia Wilson, Seth Asante, and Efi Pagitsas, *I-90 Interchange 17 (Newton Corner): Traffic Patterns and Operational and Safety Improvements*, CTPS, September 19, 2006

In terms of perceived disadvantages, the concept would:

- Add a relatively high traffic volume to already congested Washington Street, on the north side of the rotary. Currently, that section of Washington Street carries about 2,100 vehicles in the AM peak hour.
- Require the expansion of the intersection of Washington Street at Church Street in order to process the nearly 1,500 Turnpike-bound vehicles in the morning peak hour.
- Require the modification of the intersection of Washington Street at the west-side bridge to accommodate the additional Washington Street westbound traffic.

Meanwhile, the concept would need to be examined for design and construction feasibility. The required vertical and horizontal clearances may simply be unavailable over and beside the rail tracks between the Turnpike and Washington Street to allow for construction of the on-ramp.

Concept 2: Add a Westbound On-Ramp at Interchange 16

This concept aims to relieve the burden of heavy traffic on the westbound on-ramp at Interchange 17. It would involve adding an I-90 westbound on-ramp at Interchange 16 and maintaining the existing Interchange 17 on-ramp. The new on-ramp could potentially be placed within the right-of-way of the existing westbound off-ramp by converting a portion of the ramp from one to two lanes.

O-D information for Interchange 16 is not available, and it is not clear how many commuters from Newton, Watertown, and points north and west of Watertown would take advantage of a ramp from Route 16 westbound.

Potential benefits from the new ramp at Route 16 would include:

- Providing traffic congestion relief on the rotary by removing traffic from the existing Exist 17 on-ramp and from the rotary
- A more direct connection to I-90 westbound for some Newton residents

The main perceived disadvantage is the increase of traffic volumes along westbound Washington Street and roadways leading to it, mainly on the north side of I-90.

In addition, the right-of-way requirements for this ramp need to be examined closely for construction feasibility. The space appears to be tight for a new on-ramp connecting to I-90 between the existing off-ramp and the adjacent property.

Concept 3: Convert St. James Street Operation to One-Way Southbound

Currently St. James Street traffic moves in both directions. This option would change the two-way operation of St. James Street to one-way southbound. The purpose of the proposed conversion would be to reduce traffic congestion at the rotary by deterring traffic from I-90 eastbound to St. James Street northbound to reach Watertown, Cambridge, and Brighton/Allston destinations. The conversion would also call for traffic-calming measures, including the

prohibition of right turns from Centre Street to Jefferson Street in order to prevent traffic from cutting through the neighborhood to access Nonantum Road.

The O-D survey in the Phase I study indicates that, of the more than 800 St. James Street northbound vehicles in the AM peak hour, about 350 are from the I-90 eastbound off-ramp; about 250 are from streets south of the rotary (Centre Street, Park Street, and Washington Street); and about 200 are from west of the rotary. However, if the concept is implemented, not all of the St. James Street northbound traffic would be removed from the rotary, and a portion of the traffic would stay on the rotary but divert to Centre/Galen Street northbound.

Perceived advantages include:

- Lower traffic volume on St. James Street
- Reduced traffic congestion on the rotary, mainly in the southern section
- Reduced traffic congestion on the eastbound off-ramp and improved eastbound traffic operations on the Turnpike

Perceived disadvantages include:

- Higher traffic volume on the east-side bridge and Centre/Galen Street northbound
- Likely higher traffic volumes on local streets east of Centre/Galen Street, such as Williams Street and Maple Street, due to the diversion of traffic heading to Watertown and areas beyond
- Likely higher traffic volumes on local streets south and east of the rotary due to diversion of I-90 eastbound traffic heading to Brighton/Allston and adjacent areas
- Making direct and toll-free connections to Watertown, Cambridge, and downtown Boston unavailable to Newton residents south of the rotary

Concept 4: Add an I-90 Westbound Off-Ramp to North Beacon Street (Route 20)

Currently, the main option for westbound I-90 traffic destined for Watertown, Waltham, Belmont, and other points north and west is to use Exit 17. The Exit 17 off-ramp is congested during peak hours, especially in the PM peak hour, with traffic frequently queuing westbound onto the I-90 mainline.

This conceptual off-ramp would begin just west of Market Street in Brighton, running along the space between I-90 and Leo M. Birmingham Parkway, and would meet with the parkway at a point near the intersection of North Beacon Street at the Parkway. The parkway leads to the Massachusetts Department of Conservation and Recreation (DCR) rotary at Soldiers Field Road, Nonantum Road, and North Beacon Street. This concept would potentially require modification of the intersection of North Beacon Street at Leo M. Birmingham Parkway and the section of the parkway east of the intersection in order to accommodate the new ramp.

Based on the O-D survey for Interchange 17, among the more than 1,250 vehicles taking the westbound off-ramp in the AM peak hour, nearly 350 were destined to areas north of the rotary, via Centre Street (nearly 300 vehicles), Beacon Street, and other streets. If 80 percent of these vehicles are assumed to reach areas beyond Watertown Square, nearly 300 vehicles would

potentially use the new off-ramp instead of the Interchange 17 off-ramp. In addition, the new ramp would draw a portion of I-90 traffic that currently uses Interchange 18/19/20 to avoid the congested Newton Corner rotary.

Potential advantages of this concept include:

- Reduced traffic congestion on the Interchange 17 westbound off-ramp and on Centre Street north of the rotary, and, consequently, reduced congestion on the east-side bridge
- Reduced traffic congestion on westbound I-90 mainline near the Interchange 17 off-ramp
- Lower traffic volume on the westbound off-ramp to Cambridge Street at Interchange 18/19/20
- Provision of more direct access for I-90 westbound traffic going to Watertown, Waltham, Belmont, and adjacent areas

The major perceived disadvantage is the increased volume of northbound/westbound traffic on North Beacon Street (Route 20), Nonantum Road, and Birmingham Parkway.

In general, the addition of an off-ramp at this location would potentially reduce traffic congestion on the existing off-ramp, the I-90 mainline, and at the Newton Corner rotary. The new ramp would also relieve traffic pressure at Interchange 18/19/20 by providing I-90 westbound traffic additional access to Cambridge, Allston, Brighton, Newton, Watertown, and points northwest of the rotary.

Concept 5: Add a Slip Ramp next to the East-Side Bridge from Centre Avenue to I-90 Westbound

This concept would provide more direct access to I-90 westbound for traffic from west and south of the rotary, thus reducing weaving conflicts on the east-side bridge. The slip ramp would be placed next to the east-side bridge and merge with the existing ramp to the south of the rail track. As available right-of-way is limited at the merge area, an engineering study would be required to examine the feasibility of this concept.

Based on the O-D survey, the I-90 westbound on-ramp currently carries about 1,600 vehicles in the AM peak hour. Among them, roughly 200 from west and south of the rotary would be diverted from the east-side bridge to the new slip ramp.

Advantages of this concept include:

- Direct access to I-90 westbound from Centre Avenue
- Reduced weaving conflicts on the east-side bridge
- Additional capacity to the east-side bridge

Disadvantages of the concept include the high cost of building a new bridge or retrofitting the east-side bridge with an additional lane, given the potential number of users who will use it. The largest portion of the traffic destined to points west on I-90 (from Park Street, Washington Street, and St. James Street, about 850 vehicles per AM peak hour) would not use the new ramp and would remain on the east-side bridge.

Concept 6: Construct a New Two-Lane, Two-Way Bridge over I-90 Connecting Centre Street on Both Sides of the Rotary

In the first SAC meeting, a concept of converting the east-side bridge to two-way operation in order to connect the segments of Centre Street on both sides of the rotary was initiated. A further review indicated that the concept would also require the modification of a portion of the southern section of the rotary (Centre Avenue from the east-side bridge to Centre Street) from one-way eastbound to a two-way operation. It would potentially reduce the capacity of the rotary unless additional space is available to accommodate a new southbound lane on the east-side bridge and a new westbound lane on Centre Avenue. A traffic signal would also be needed to create gaps for traffic turning left to Centre Street from Centre Avenue.

In the Phase I study, CTPS staff examined an alternative similar to the proposed concept. The alternative (Alternative 4 in that study) involves construction of a new two-lane, two-way bridge over I-90 connecting the segments of Centre Street on both sides of the rotary, but maintaining the existing operation of the east-side bridge. On the south side, the bridge would meet Centre Avenue at a traffic signal, but left turns from or to Centre Avenue would be prohibited. On the north side, the bridge would connect to the existing traffic signal at Washington Street. Left turns to the bridge from the I-90 off-ramp and from the east-side bridge would be allowed, but left turns to Washington Street from the bridge would be prohibited in order to maintain the existing three-phase signal operation.

The preliminary traffic simulation analysis in the first phase shows that the new bridge would create weaving problems at its intersection with Washington Street, especially for traffic coming from the I-90 off-ramp or the east-side bridge heading to Washington Street westbound, I-90 westbound, or Centre Street southbound. It would require complex signage and pavement markings and would add to motorists' confusion. According to the simulation analysis, weaving maneuvers appear to impede traffic flow from the east-side bridge and the I-90 off-ramp and to cause long queues.

Based on the Interchange 17 O-D survey, Centre Street through traffic consists of about 600 southbound and 150 northbound vehicles in the AM peak hour. If the new bridge is built, potentially this traffic would be removed from the rotary. However, 600 vehicles per hour is a relative high volume crossing Centre Avenue and would cause delays for Centre Avenue eastbound traffic.

In terms of perceived advantages, the concept would:

- Provide direct access for continuous Centre Street traffic and pedestrians
- Remove some traffic from the rotary, mainly on Washington Street and Centre Avenue
- Reduce traffic congestion on Washington Street, the northern section of the rotary

In terms of perceived disadvantages, the concept would:

- Potentially cause more congestion on the east-side bridge due to additional weaving activities

- Increase delays for Centre Avenue eastbound traffic due to reduction of green time needed by the Centre Street southbound through traffic
- Add to motorists' confusion due to the complex rotary operation

These analyses indicate that either building a new Centre Street bridge or converting the east-side bridge to two-way operation would potentially reduce the rotary capacity and add to motorists' confusion due to the complex rotary operation.

In the second SAC meeting, four additional improvement concepts were developed and discussed. As most of them (Concepts 7, 8, and 9) are more complicated than the first six, the potential traffic-flow changes would have to be estimated from the transportation planning model. The analysis of the last one (Concept 10) would require the application of the CORSIM traffic simulation model. The content and perceived advantages and disadvantages of each of the concepts are summarized below.

Concept 7: Expand the Rotary beyond the East- and West-Side bridges

This improvement concept attempts to enlarge the Newton Corner Rotary interchange so that the maneuvers and lane changes that presently take place in a restricted right-of-way environment would be less difficult. As such, it assumes that the right-of-way is available for the expansion. The idea is to expand the rotary by allowing additional circulation elements beyond the present east- and west-side bridges and by incorporating St. James Street on the east and Church Street on the west into a "concentric" traffic circulation pattern.

Given the existing conditions at Newton Corner, this concept would require extensive roadway redesign, reconstruction, and traffic operational changes for efficient traffic circulation. Roadway modifications would include:

- Redesign of the St. James Street bridge to accommodate additional traffic and connection to the rotary
- Expansion of Charlesbank Road between Centre Street and St. James Street, with the redesign of the St. James Street bridge
- Modification of Richardson Street between Church Street and the west-side bridge
- Relocation of the existing I-90 eastbound and westbound off-ramps further upstream

This concept would also require several traffic operational changes to the following streets entering the rotary:

- Washington Street between the west-side bridge and Church Street to one-way westbound
- Washington Street eastbound to right-turn-only at Church Street
- Church Street westbound to right-turn-only at Richardson Street
- Park Street northbound to right-turn-only at St. James Street
- St. James Street between Park Street and Washington Street to one-way eastbound
- Washington Street westbound to right-turn-only at St. James Street

Concept 7 has two major advantages. First, it would reduce the weaving conflicts on both the east- and west-side bridges. Second, it would increase the capacity of the rotary, as the rotary would be expanded to better accommodate rotary weaving maneuvers.

However, Concept 7 would also have significant impacts on neighborhoods in the vicinity of the rotary, especially for the areas near Charlesbank Road and Richardson Street. Further engineering studies would be needed to examine the feasibility of modifications of the two streets, as well as the relocation of the eastbound and westbound off-ramps. Even if they were feasible, the cost of these modifications would be rather prohibitive.

Concept 8: Add an Eastbound Off-Ramp at Interchange 16

Currently, there is no eastbound off-ramp at Interchange 16. Adding an off-ramp at this location would provide eastbound I-90 traffic destined for West Newton, Newtonville, Watertown, and adjacent neighborhoods more direct access.

The concept would potentially help in sharing the traffic burden at the Interchange 17 eastbound off-ramp and at Newton Corner. However, it would potentially increase traffic on major streets in the vicinity of Interchange 16. Application of the regional model could provide an estimation of these impacts.

To maintain the existing traffic operations at Interchange 16, the new ramp would need to merge with the existing I-90 westbound off-ramp by flying over I-90 from its eastbound location just east of Commonwealth Avenue. However, further studies would be required to determine its feasibility from a design and construction point of view.

Concept 9: Institute a $0.50 Toll at the I-90 Eastbound On-Ramps at Interchanges 16 and 17

Currently there are no tolls for traffic entering I-90 eastbound at Interchange 16. Residents in the vicinity have been concerned about traffic increases along Washington Street and other neighborhood roads since the toll plaza was removed at this location many years ago. The assumption is that the increase in traffic is due to drivers from the western and southwestern suburbs who choose to avoid paying tolls at I-90 Interchange 14/15 and drive along Route 16 or Route 30 to reach this on-ramp instead.

A previous study[2] tested reinstating a $0.75 toll at Interchange 16 and estimated a reduction of about 1,000 vehicles (333 vehicles per hour) in the AM peak period (6:00-9:00) at the I-90 eastbound on-ramp. However, the study also estimated an increase of about 250 vehicles (83 vehicles per hour) during the same period at the Interchange 17 on-ramp to I-90 eastbound, where there is no toll collection at present.

The committee discussed the issue and considered testing the institution of a $0.50 toll at both I-90 eastbound on-ramps (at Interchanges 16 and 17) as a way to alleviate cut-through traffic at

[2] *The Effects of the July 1, 2002 Boston Extension (I-90) Toll Increase on Newton Neighborhoods*, URS Corporation in association with Howard/Stein Hudson Associates and Central Transportation Planning Staff, January 2003.

both interchanges. The moderate toll was chosen in consideration of minimizing the burden for Newton residents.

Concept 10: Modify Traffic Operations at the East-Side Bridge Approach

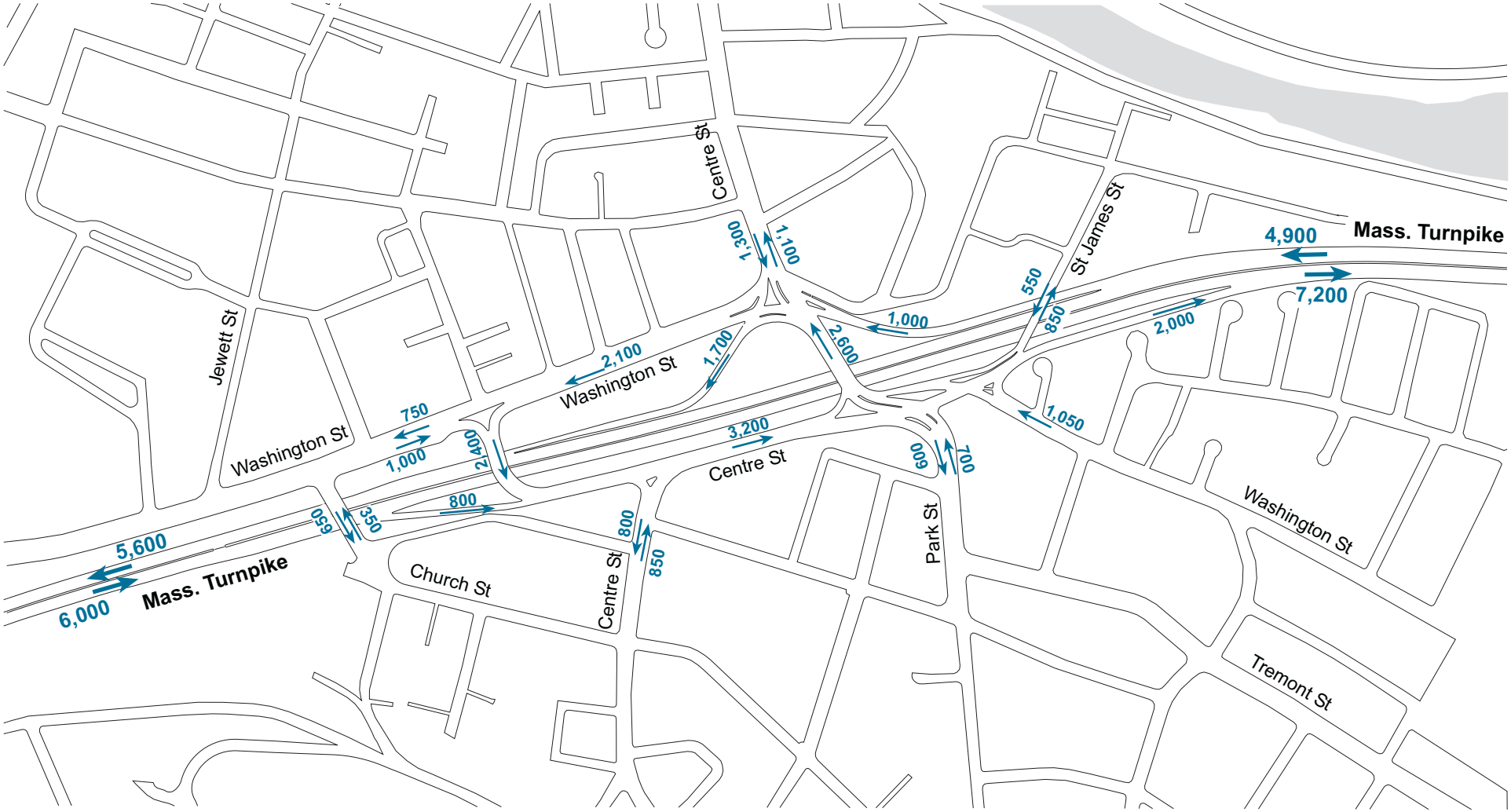
This is an operational improvement that aims to remove weaving conflicts and congestion on the east-side bridge. To test and evaluate the concept, CTPS staff will use the CORSIM traffic simulation model instead of the TransCAD transportation planning model.

The concept calls for the addition of traffic signal control for traffic entering the east-side bridge. At each phase, the signal would allow traffic to enter the bridge only from the Centre Avenue eastbound approach or from the Washington Street westbound approach.

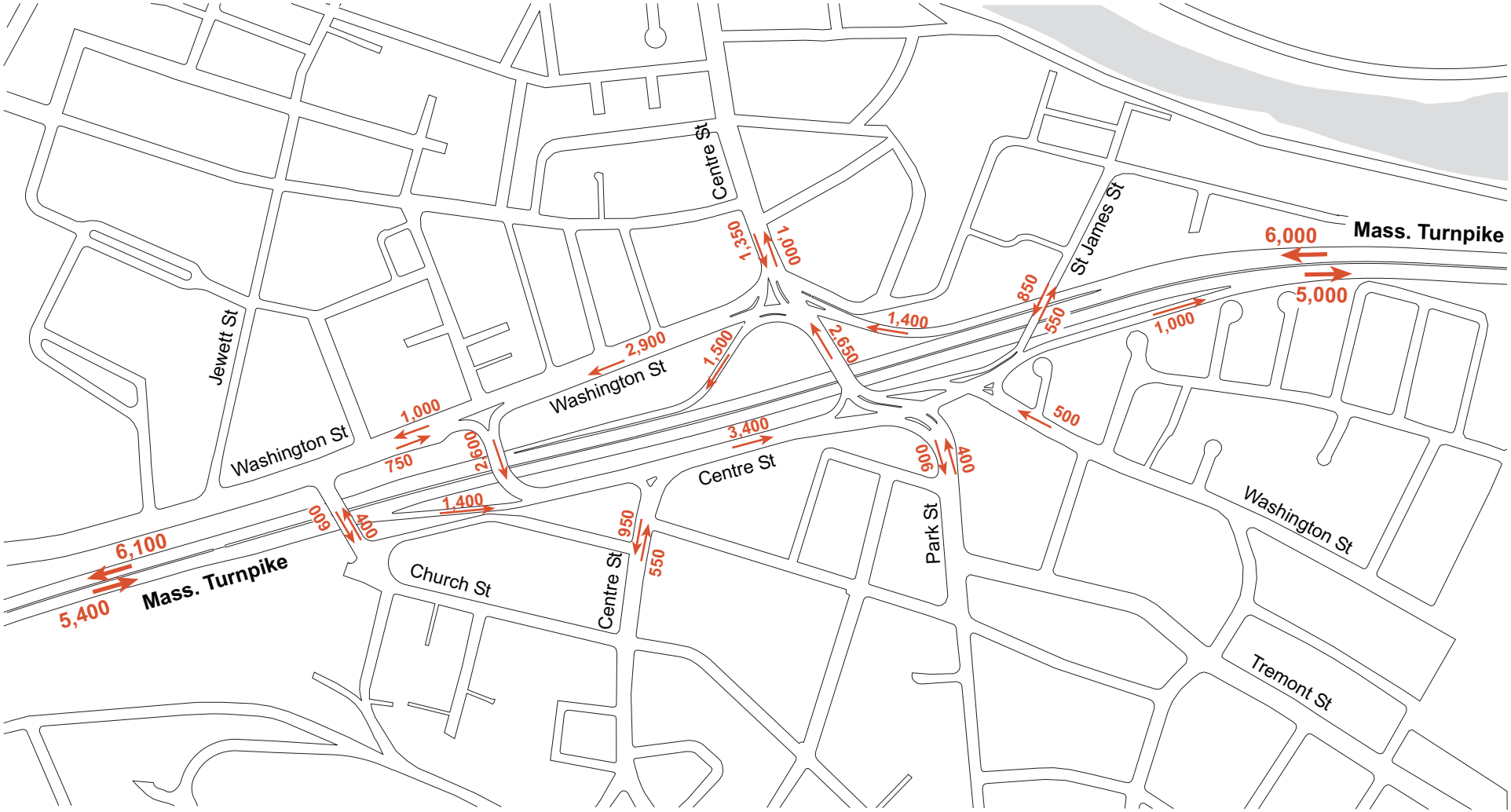
Although this is not a long-term improvement that would change traffic patterns, the committee considered examining it further as it may have potential benefits in both traffic operations and safety. In addition, if it is evaluated as favorable, the city could implement it in a relative short time.

Appendix B

Newton Corner: Estimated 2006 AM and PM Peak-Hour Traffic Volumes



Estimated Existing (2006) Weekday AM Peak-Hour (8:00-9:00 AM) Traffic Volumes



Estimated Existing (2006) Weekday PM Peak-Hour (5:00-6:00 PM) Traffic Volumes

Appendix C

Transportation Planning Model Set: Development and Assumptions

The transportation planning model set used for this study is derived from the Boston Region MPO transportation planning model. The model is used to test alternatives for the Transportation Plan and numerous capital improvement projects in the MPO region. It covers the entire Boston Region MPO area, which is essentially the area within I-495, and extends into 63 communities outside this area. The MPO model set consists of the base year 2006 and the future year 2030 models, calibrated and estimated for an average weekday in four time periods: AM peak (6:00-9:00), midday (9:00-15:00), PM peak (15:00-18:00), and nighttime (18:00-6:00). The model set for this study consists of the same base and future years in the AM and PM peak periods.

The model development and calibration consist of a series of procedures. First, the base year model was calibrated to match available traffic counts in the study area.[1] Adjustments of the base-year model calibration, such as link distance, speed, and capacity, were also carried over to the future no-build model. The various alternatives were then built upon the future no-build network. The derived no-build future vehicle trip table was applied to different alternative networks in the trip assignment procedure. The procedure produced peak-period traffic volumes that were assigned to network links. To convert peak-period to peak-hour traffic volumes, CTPS staff applied the conversion factor 43 percent to the AM peak-period traffic volumes and 38 percent to the PM peak-period traffic volumes. The factor was calculated from the most recent available traffic counts for the study area.

The future-year models for this study were developed consistently with the most recent Transportation Plan for the region.[2] The Plan includes two major assumptions related to future travel demand and transportation supply. First, for the projection of future travel demand, the Plan development process selected the Smart Growth Plus land use scenario as the Region's socioeconomic profile in year 2030. Second, the same process selected a list of major infrastructure and expansion projects for inclusion in the Region's recommended future transportation plan. The recommended projects, together with the existing transportation system, represent the future supply of transportation infrastructure in the region.

Under the Smart Growth Plus scenario, growth in the region is anticipated to be relatively slow, totaling only 10 to 12 percent from 2007 to 2030. It assumes that community development allowed by current zoning would continue at current rates until the demand for water and sewer capacity exceeds a community's ability to provide for it. Additional development is then allocated only to communities where water and sewer capacity, and commuter rail and other transit services are available. Within communities, development is assumed to occur mostly in town and neighborhood centers and other centers of concentrated activity. Reservation of additional open space, agricultural land, and water resources over current levels are all part of this scenario.

The following table and figure were obtained directly from the Transportation Plan. They show the items and the locations of the expected major infrastructure and expansion projects in the recommended transportation plan.

---

[1] The study area for this study consist of the area adjacent to I-90 from Interchange 16 to Interchange 18/19/20, the area north of I-90 to Watertown Square, and the area south of I-90 to Commonwealth Avenue (Route 30).

[2] *Journey to 2030: Transportation Plan of the Boston Region Transportation Planning Organization*, prepared by the Central Transportation Planning Staff, June 28, 2007.

TABLE 13-1

Major Infrastructure and Expansion Projects in the Recommended Plan

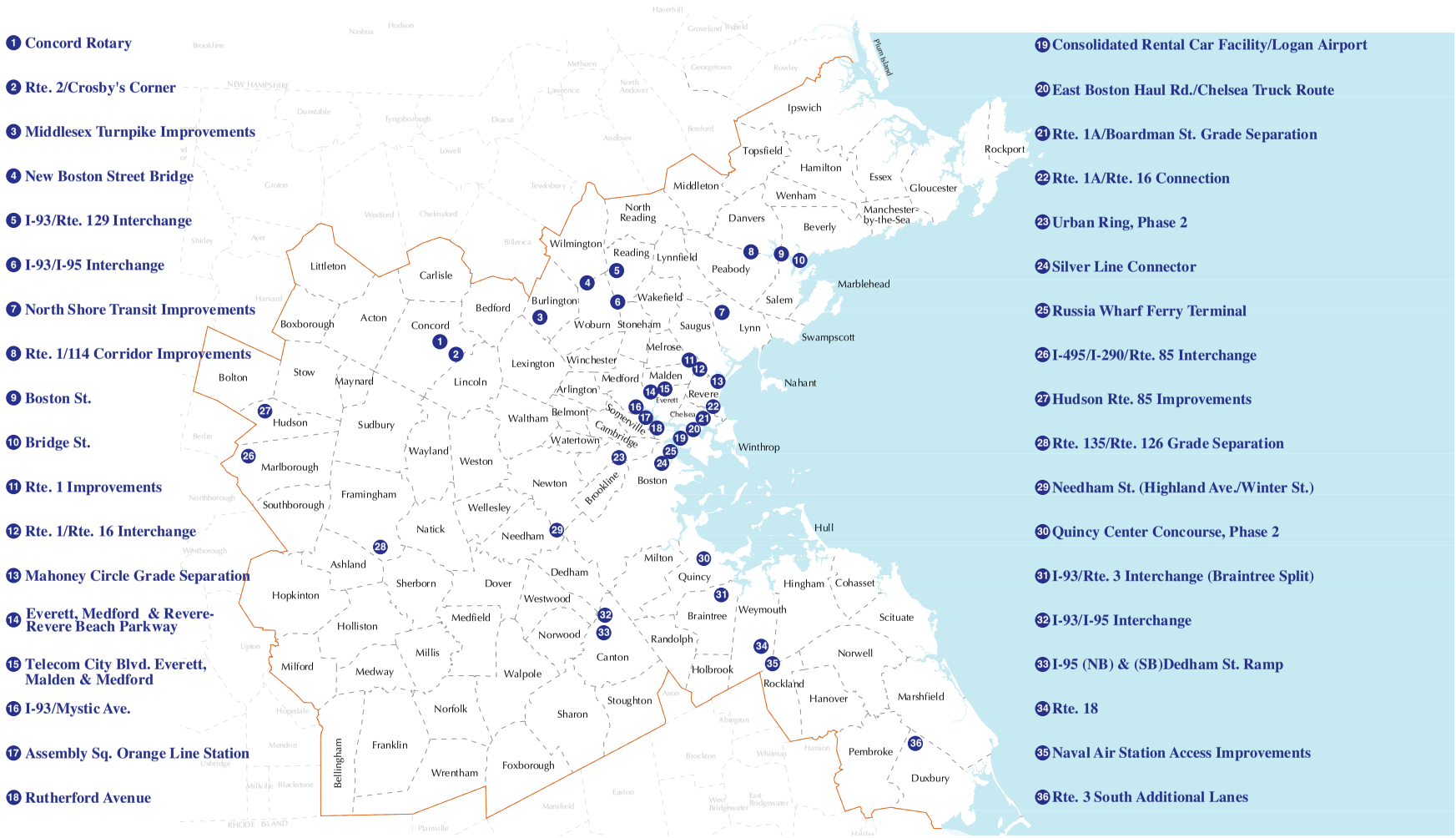
PROJECT	TYPE OF PROJECT*	COST
MIDDLESEX TURNPIKE (BEDFORD, BURLINGTON, AND BILLERICA)	EXP	$14,400,000
ROUTE 128 CAPACITY IMPROVEMENTS (BEVERLY TO PEABODY)	MI/EXP	$293,743,000
EAST BOSTON HAUL ROAD/CHELSEA TRUCK ROUTE (BOSTON)	EXP	$17,169,100
ARBORWAY RESTORATION OR SUBSTITUTE PROJECTS (BOSTON)	MI/EXP	**
RED LINE/BLUE LINE CONNECTOR (BOSTON)	MI/EXP	**
ROUTE 1A/BOARDMAN STREET GRADE SEPARATION (BOSTON)	EXP	$13,686,000
RUSSIA WHARF FERRY TERMINAL (BOSTON)	EXP	$2,200,000
RUTHERFORD AVENUE/SULLIVAN SQUARE (BOSTON)	MI	$100,695,500
CONSOLIDATED RENTAL CAR FACILITY (LOGAN AIRPORT, BOSTON)	MI/EXP	$453,000,000
SILVER LINE, PHASE III (BOSTON)	MI/EXP	$1,067,484,000
GREEN LINE TO BALL SQUARE (BOSTON, MEDFORD, AND SOMERVILLE)	MI/EXP	**
I-93/ROUTE 3 INTERCHANGE – BRAINTREE SPLIT (BRAINTREE)	MI/EXP	$45,573,000
URBAN RING, PHASE 2 (COMPACT COMMUNITIES)	MI/EXP	$1,954,000,000
I-93/I-95 INTERCHANGE (CANTON)	MI/EXP	$164,228,000
I-95 (NB)/DEDHAM STREET RAMP (CANTON)	EXP	$3,500,000
CONCORD ROTARY (CONCORD)	MI	$81,033,000
ROUTE 2/CROSBY'S CORNER (CONCORD AND LINCOLN)	MI/EXP	$31,500,000
ROUTE 1/114 CORRIDOR IMPROVEMENTS (DANVERS AND PEABODY)	MI/EXP	$94,808,000
RIVER'S EDGE BOULEVARD [TELECOM CITY BOULEVARD] (EVERETT, MALDEN, AND MEDFORD)	EXP	$20,802,000
REVERE BEACH PARKWAY (EVERETT, MEDFORD AND REVERE)	MI/EXP	$189,616,000
ROUTE 126/135 GRADE SEPARATION (FRAMINGHAM)	MI	$101,291,000
ROUTE 85 IMPROVEMENTS (HUDSON)	EXP	$8,075,000
ROUTE 1 IMPROVEMENTS (MALDEN AND REVERE)	MI/EXP	$131,678,000
I-495/I-290/ROUTE 85 CONNECTOR INTERCHANGE (MARLBOROUGH AND HUDSON)	MI/EXP	$37,773,000
NEEDHAM STREET/HIGHLAND AVENUE/WINCHESTER STREET (NEWTON AND NEEDHAM)	EXP	$10,538,000
QUINCY CENTER CONCOURSE, PHASE 2 (QUINCY)	EXP	$9,580,000
I-93/I-95 INTERCHANGE (READING AND WOBURN)	MI	$234,025,000
100 ADDITIONAL BUSES TO IMPROVE SERVICE ON EXISTING ROUTES (REGIONWIDE)	MI/EXP	$68,428,000
MAHONEY CIRCLE GRADE SEPARATION (REVERE)	EXP	$30,387,000
ROUTE 1/ROUTE 16 INTERCHANGE (REVERE)	EXP	$6,295,000
ROUTE 1A/ROUTE 16 CONNECTION (REVERE)	MI	$93,795,000
NORTH SHORE TRANSIT IMPROVEMENTS (REVERE TO LYNN)	MI/EXP	$695,600,000
BOSTON STREET (SALEM)	EXP	$3,148,000
BRIDGE STREET (SALEM)	EXP	$4,790,000
ASSEMBLY SQUARE ORANGE LINE STATION (SOMERVILLE)	MI/EXP	$25,000,000
I-93/MYSTIC AVENUE INTERCHANGE (SOMERVILLE)	MI/EXP	$118,510,000
NAVAL AIR STATION ACCESS IMPROVEMENTS (WEYMOUTH)	MI/EXP	$42,000,000
ROUTE 18 CAPACITY IMPROVEMENTS (WEYMOUTH)	EXP	$24,000,000
ROUTE 3 SOUTH ADDITIONAL LANES (WEYMOUTH TO DUXBURY)	MI/EXP	$426,637,000
I-93/ROUTE 129 INTERCHANGE (WILMINGTON AND READING)	EXP	$23,950,000
NEW BOSTON STREET BRIDGE (WOBURN)	EXP	$4,862,000

* Exp = Expansion – Project adding capacity to the roadway or transit system
MI = Major Infrastructure – Project costing $25 million or more

** SIP Commitment project currently being reevaluated by EOT and DEP. The cost for this project is included in the total cost of $743,130,000, which has been included in the Plan for the SIP projects to be constructed in the future.

FIGURE 13-1

Major Infrastructure and Expansion Projects in the Recommended Plan



Appendix D

Response to Comments on Alternative 4 Model Results

MEMORANDUM

TO: **David Koses** **December 16, 2008**
Newton Planning and Development Department

FROM: **Chen-Yuan Wang and Efi Pagitsas**

RE: **Response to Comments on Alternative 4 Model Results, Newton Corner Rotary Study, Phase II**

The purpose of this memo is to address your concerns about the model results for Alternative 4 in our final report. We have examined those results in detail and find that they appear reasonable to us. We hope to persuade you to this view. First, we discuss four issues that bear on the model results. Then, we discuss the results with respect to Route 9 and St. James Street, as these are two roadways whose projected volumes struck you as unreasonable.

The Decrease in Turnpike On-ramp Volumes in Alternative 4 Seems Reasonable

The modeled decrease in turnpike traffic resulting from the introduction of tolls at Exit 16 and Exit 17 is consistent with past observations. Specifically, at the West Newton on-ramp, the reduction is consistent with what had been observed in 1996 when the toll was removed. Then, traffic increased by 33% at the on-ramp as a result of the removal of the toll. Now, in this study, we predict that traffic would decrease by 26% in the AM peak hour and 38% in the PM peak hour with a reinstitution of a toll there. Thus, predicted changes are similar to actual historical changes.

There is no observation against which to compare the modeled result for the Newton Corner on-ramp, but the model predicted that the relative traffic decrease there would be somewhat less than at West Newton. This makes sense to us because many of the motorists at West Newton would have the ability and inclination, with the toll restoration, to shift back to the Turnpike/Route 128 interchange or other alternative routes before West Newton.

Many Roadways Would Already Be at Capacity in the 2030 No-build Case

Many roadways in the study area and vicinity, including Route 9 and St. James, would already be at capacity in the 2030 no-build case. This means that there is almost no room for traffic to grow on these roadways, and they cannot, therefore, accept traffic that would divert away from the Turnpike due to the imposition of tolls.

Results Shown on the Maps are a Combination of Two Tolls Introduced Simultaneously

The volumes shown on Figures 13 and 14 in our report are net results of a lot of route changing going on simultaneously due to the two tolls being assumed. They would interact with one another and the impacts of each would be obscured by the impacts of the other. Also, there is a "domino" effect when you raise the cost of traveling on one route, and this also muddies the effects of the toll change alone. That is, the results are the net effect of vehicles leaving the turnpike and switching to other routes, but also of vehicles on those routes, in turn, switching to other routes, due to the increase in congestion on their preferred routes. That is what happens in a congested network like this.

The Model Properly Reflects the Route-Shifting Effects of the Toll Options

For many roadway segments, one can trace the net effect of vehicles shifting routes. For example, we traced where the 300 vehicles are that would be removed from the turnpike, east of Newton Corner in the AM peak hour, and we have found about as many of them as we expect to find. From Figures 13 and 14, across an imaginary screen-line just east of Newton Corner in the study area, you can see traffic increases ranging from 20 to 60 vehicles per peak hour on Mt. Auburn Street (Route 16), Arsenal Street, N. Beacon Street (Route 20), Nonantum Road, Commonwealth Avenue (Route 30), Beacon Street, and Boylston Street (Route 9). These increases total over 200 vehicles, or two-thirds of those that would be removed from the turnpike in the AM peak hour. The rest of the fewer than 100 vehicles are dispersed on the streets that are outside the immediate study area.

As you are aware, many of the Newton Corner on-ramp users (about 20%, according to the O-D survey in Phase I study) are from the suburbs west and south of Newton. The route shifts of some of these users would not be detectable on these maps. For example, the trips from Needham heading to Boston now switching to routes such as Kendrick St.-Nahanton St.-Brookline St. or Needham St. (in Dedham)-Spring St.-Centre St. (in West Roxbury) are not shown in Figures 13 and 14.

The sections below specifically address your questions of the model results on Route 9 and St. James Street.

Traffic Impacts of Alternative 4 on Route 9

We examined the V/C (Volume to Capacity) ratios of the section of Route 9 east of Route 128 south of the study area. The model indicated that all the locations on Route 9 in this section would be highly congested in 2030 with V/C ratios greater than 1 for both the no-build and Alternative 4 scenarios. This means that, during peak hours in 2030, drivers along this section of Route 9 would experience extensive delays and other drivers would not be attracted to it.

As shown in Figures 13 and 14, we predict that Route 9 east of Hammond Street in Newton, and similar locations on parallel roadways (such as Beacon Street and Commonwealth Avenue), would have more traffic in Alternative 4 than in the no-build scenario. This increased congestion would consequently deter some drivers from taking Route 9 in the section west of Hammond Street. This is why traffic volumes under Alternative 4 assumptions are somewhat lower in that section of Route 9 than in the no-build scenario.

The increased traffic on Route 9 and its parallel roadways in the eastern part of Newton is mainly due to new tolls at the Newton Corner on-ramp. This option would also cause traffic increases on other parallel roadways on both sides of I-90 east of Newton Corner. Overall, the model properly represents the reality that the diverted vehicles, due to the new tolls, would spread through roadways parallel to I-90 to the north and south of it, depending on the origin-destination pattern of these trips.

Traffic Impacts of Alternative 4 on St. James Street

The primary reason that traffic would not increase significantly along St. James Street under this alternative is that it would be very congested during the peak hours in 2030, even without a Turnpike toll increase. The model showed that during peak hours the St. James Street's V/C would be greater than 1 for the northbound direction; close to 1 for the southbound direction. Therefore, there would be little room for traffic to grow on St. James Street.

In addition, the model showed that several roadways in the Newton Corner vicinity, such as Centre Street on both sides of I-90, Washington Street, and Centre Avenue, would also have V/C ratios near or greater than 1. This would also discourage people from using St. James Street, as they would have to pass through these congested roadways before they can even reach St. James Street.

It is likely that some of the Newton Corner on-ramp users coming from the south and west of Newton Corner would divert to St. James Street in order to avoid the new tolls. But the net increase of this diversion may not be as much as we expected due to the roadway's capacity restraints. Another group of St. James Street users, those who come from the I-90 eastbound off-ramp, would probably decrease (as the model showed that the off-ramp would have a total decrease of 100 to 200 vehicles per peak hour due to the new tolls at the West Newton on-ramp). The mixed effect of these diversions and mainly the roadway capacity restraints result in a slight increase in traffic on St. James Street, although intuitively one would expect a significant increase.

In conclusion, we believe that the model results are reasonable and the model properly represents the future conditions based on the underlining land use and transportation assumptions under the proposed options. We hope that the above analysis answers your questions. Please let us know if you have further questions about the results or the model.

CW/cw

cc: Karl Quackenbush, CTPS

Appendix E

Alternative 5: Microsimulation Model Results and Analysis

Description and Purpose of Alternative 5

Alternative 5 was suggested by the Newton Corner Study Advisory Committee with the intended purpose of improving traffic operations on the east-side bridge, especially to reduce the weaving and merging that takes place on the bridge among the traffic streams heading for the westbound Turnpike on-ramp, Centre/Galen Street, and Center Avenue on the north side of the rotary. Presently, these weaving and merging maneuvers, which are carried out by motorists in order to position themselves in the appropriate lanes for turning, slow down traffic on the east-side bridge and create a traffic queue during peak periods that spreads onto Center Avenue. It is believed that reducing the weaving and merging on the bridge would improve traffic operations on the bridge. This would be achieved by controlling through signalization, one at a time, the streams of traffic entering the bridge from Centre Avenue, and from Washington/Park/St. James streets. The SAC wishes to know the impacts that this new signal and associated signalization strategy would have on the traffic operations of the Newton Corner rotary. CTPS staff were asked to carry out this assessment as part of the Newton Corner Rotary, Phase II, study.

The following sections report on the results of using a microscopic traffic simulation model to examine the existing conditions and the potential impacts of Alternative 5. Such models simulate the behavior of individual drivers as they respond to circumstances of weaving, merging, and diverging within the general traffic flow. A particularly useful aspect of simulation models is that they can estimate changes in queues and delays related to operational changes, such as those being considered for the Newton Corner rotary.

CORSIM Traffic Simulation Model

The CORSIM traffic simulation model was used to evaluate Alternative 5. This model, developed by the Federal Highway Administration, identifies each vehicle by fleet (auto, carpool, truck, or bus) and by type (based on nine different operating and performance characteristics). In addition, behavioral characteristics of drivers (passive or aggressive) are assigned to individual vehicles. In the simulation, the vehicles are moved according to car-following logic in response to the circumstances within which the vehicles are traveling. Each time a vehicle is moved in the model, its position and relationship to other nearby vehicles are recalculated, as are its speed, acceleration, and other variables. The data are accumulated on a second-by-second basis for all of the vehicles in the highway network being simulated. At the end of the simulation, the accumulated data are used to estimate how the various system components are operating. The simulation network used here covers the entire Newton Corner rotary and the roadway approachs feeding traffic to and from it.

The traffic simulations were undertaken in a two-part process. In the first, the model was calibrated to 2006 AM and PM peak-hour conditions using 2006 traffic volumes and information obtained through the 2005 origin-destination survey, and by adjusting CORSIM's calibration parameters to match existing conditions (volumes, observed delays, and queues). In the second part of the process, the calibrated model was used to test Alternative 5 traffic-improvement assumptions. In the CORSIM calibration process, two types of variables needed to be considered: one was traffic queues observed at the major approaches to the rotary, and the other was traffic volumes observed at each entry point and their distribution to the various exit points.

Calibration was conducted to duplicate as closely as possible the origin-destination pattern and the observed traffic volumes and queues.

Assumptions Included in Alternative 5

Testing of Alternative 5 was carried out after calibrating the traffic simulation model for the existing conditions. The following assumptions were included. Some of these were recommendations that were part of the previous study: Newton Corner, Phase I (see Figure E-1).

- Signalization at the intersection of Centre Avenue, Park Street, Washington Street, and St. James Street at the south side of the east-side bridge.
- Coordination of the traffic signals on Centre Avenue at Centre Street, Park Street, and Washington Street to control the volume of traffic entering the east-side bridge. (Both Park Street and Washington Street are controlled by the same traffic signal.)
- Conversion of the existing pedestrian signal at Centre Street/Center Avenue to a full traffic signal in order to provide safer moves from Centre Street northbound onto Centre Avenue.
- Improved signage at the rotary: add overhead lane-assignment signs at the east-side bridge.
- Improved pavement markings at the rotary to reduce motorist confusion.

In the traffic simulation analysis for Alternative 5, the recommendations of improved signing and pavement markings were accounted for by raising, from 60 percent to 80 percent, the proportion of drivers who are familiar with the circulation of traffic at the Newton Corner rotary and who therefore know which lane they need to use and can position themselves in advance. The results of the testing, expressed in terms of delay, level of service, and queuing in the AM and PM peak hours (2006), are presented in Table E-1, which also shows the simulation results for existing conditions. The results for the existing conditions serve as a baseline for assessing the impacts of Alternative 5.

Evaluation of Alternative 5

Signalizing the intersection of Centre Avenue, Park Street, Washington Street, and St. James Street at the south side of the east-side bridge would benefit traffic operations on the east-side bridge, as it would regulate traffic entering the east-side bridge and reduce weaving and merging between the Centre Avenue traffic and traffic from Washington, Park, and St. James streets. On the other hand, it would create traffic queues on Centre Avenue and introduce additional delay into the system as a result of this new signal. Overall, total delay would remain pretty much the same as in the existing conditions because the reductions in delay from the reduced weaving and merging on the east-side bridge would be offset by the extra delay incurred at the new signal on the south side of the bridge.

Table E-1: Summary of CORSIM Model Results

Approach/Intersection	AM Peak Hour						PM Peak Hour					
	Existing Conditions			Alternative 5			Existing Conditions			Alternative 5		
	Control Delay[1]	Average Queue Length[2]	LOS	Control Delay	Average Queue Length	LOS	Control Delay	Average Queue Length	LOS	Control Delay	Average Queue Length	LOS
EB exit ramp	> 180	> 30	F	> 180	> 30	F	163	> 30	F	178	> 30	F
Centre Street NB	25	6	B	35	8	B	18	6	B	23	7	B
Centre Avenue EB	19	18	B	25	20	C	14	10	C	14	10	C
Park Street	22	11	C	21	11	C	20	11	C	19	10	C
Washington Street NB	28	15	C	29	18	C	19	18	B	19	21	B
St. James St. WB	3	8	A	11	7	B	11	7	B	21	12	C
WB exit ramp	34	17	C	34	17	C	> 180	> 30	F	> 180	> 30	F
Centre/Galen Street SB	57	18	E	53	20	D	53	20	D	58	20	E
East-side bridge (north)	40	8	D	30	7	C	33	8	D	24	7	C
East-side bridge (south)	22	8	C	39	9	E	16	6	D	28	8	E
West-side bridge	NA	NA		NA	NA		NA	NA		NA	NA	
Network Statistics												
Total vehicles discharged from all origins[2] (peak hour)		7,365			7,414			7,349			7,370	
Total vehicle miles		3,561			3,599			3,646			3,680	
Total network delay time (veh-hrs)		274			253			307			329	
Average network speed (mph)		9.1			9.7			8.5			8.2	

[1] Seconds per vehicle
[2] Vehicles

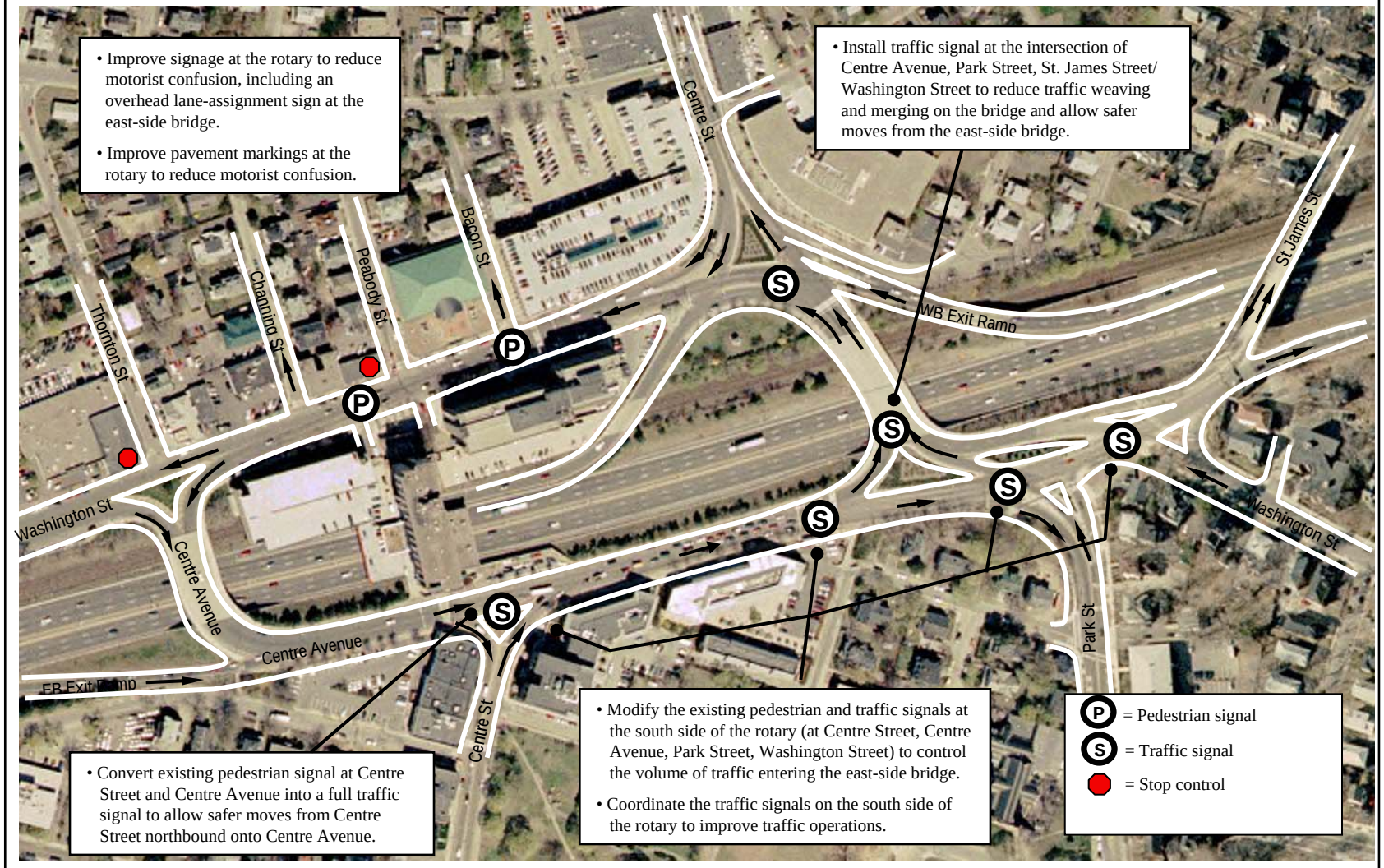


Figure E-1: Improvements Tested in Alternative 5

Appendix F

Massachusetts Highway Department Project Implementation Process

The following description of the implementation process is based on Chapter 2 of the *Massachusetts Highway Department Project Development and Design Guide (2005)*. The text below borrows heavily from that document.

Needs Identification

For each of the locations at which an improvement is to be implemented, MassHighway leads an effort to define the problem, establishes project goals and objectives, and defines the scope of the planning needed for implementation. To that end, it has to complete a Project Need Form (PNF), which states in general terms the deficiencies or needs related to the transportation facility or location. The PNF documents the problems and explains why corrective action is needed. For this study, the information defining the need for the project will be drawn primarily, perhaps exclusively, from the present report. Also, at this point in the process, MassHighway meets with potential participants, such as the Boston Region Metropolitan Planning Organization (MPO) and community members, to allow for an informal review of the project.

The PNF is reviewed by the MassHighway district office whose jurisdiction includes the location of the proposed project. MassHighway also sends the PNF to the MPO, for informational purposes. The outcome of this step determines whether the project requires further planning, whether it is already well supported by prior planning studies, and, therefore, whether it is ready to move forward into the design phase, or whether it should be dismissed from further consideration.

Planning

This phase will likely not be required for the implementation of the improvements proposed in this planning study, as this planning report should constitute the outcome of this step. However, in general, the purpose of this implementation step is for the project proponent to identify issues, impacts, and approvals that may need to be obtained, so that the subsequent design and permitting processes are understood.

The level of planning needed will vary widely, based on the complexity of the project. Typical tasks include: define the existing context, confirm project need, establish goals and objectives, initiate public outreach, define the project, collect data, develop and analyze alternatives, make recommendations, and provide documentation. Likely outcomes include consensus on the project definition to enable it to move forward into environmental documentation (if needed) and design, or a recommendation to delay the project or dismiss it from further consideration.

Project Initiation

At this point in the process, the proponent, MassHighway, fills out, for each improvement, a Project Initiation Form (PIF), which is reviewed by its Project Review Committee (PRC) and the MPO. The PRC is composed of the Chief Engineer, each District Highway Director, and representatives of the Project Management, Environmental, Planning, Right-of-Way, Traffic, and Bridge departments, and the Capital Expenditure Program Office (CEPO). The PIF documents the project type and description, summarizes the project planning process, identifies likely funding and project management responsibility, and defines a plan for interagency and public

participation. First the PRC reviews and evaluates the proposed project based on the Executive Office of Transportation and Public Works's statewide priorities and criteria. If the result is positive, MassHighway moves the project forward to the design phase, and to programming review by the MPO. The PRC may provide a Project Management Plan to define roles and responsibilities for subsequent steps. The MPO review includes project evaluation based on the MPO's regional priorities and criteria. The MPO may assign a project evaluation criteria score, a Transportation Improvement Program (TIP) year, a tentative project category, and a tentative funding category.

Environmental, Design, and Right-of-Way Process

This step has four distinct but closely integrated elements: public outreach, environmental documentation and permitting (if required), design, and right-of-way acquisition (if required). The outcome of this step is a fully designed and permitted project ready for construction. However, a project does not have to be fully designed in order for the MPO to program it in the TIP.

Programming

Programming, which typically begins during the design phase, can actually occur at any time during the process, from planning to design. In this step, which is distinct from project initiation, where the MPO receives preliminary information on the proposed project, the proponent requests that the MPO place the project in the region's TIP. The MPO considers the project in terms of regional needs, evaluation criteria, and compliance with the regional Transportation Plan and decides whether to place it in the draft TIP for public review and then in the final TIP.

Procurement

Following project design and programming, MassHighway publishes a request for proposals. It then reviews the bids and awards the contract to the qualified bidder with the lowest bid.

Construction

After a construction contract is awarded, MassHighway and the contractor develop a public participation plan and a management plan for the construction process.

Project Assessment

The purpose of this step is to receive constituents' comments on the project development process and the project's design elements. MassHighway can apply what is learned in this process to future projects.

Appendix G

Service Planning Process Chapter from the MBTA Service Delivery Policy

Chapter 4: Service Planning Process

The MBTA regularly evaluates the performance of its services through the service planning process. The primary objective of the service planning process is to ensure that the MBTA uses available resources in the most effective manner by developing strategies to improve performance and/or to reallocate service within the system.

The service planning process varies somewhat by mode and is affected by whether or not the service is operated directly by the MBTA (bus and rapid transit), or is operated for the MBTA by a contractor (commuter rail and boat). Following is a discussion of the process for each mode. The final section of this chapter outlines the procedures for public participation in the service planning process.

Directly Operated Services

- **Bus Service Planning Process**
  The bus service planning process takes place on two levels. One is the on-going evaluation and implementation of incremental service changes that occur on a quarterly basis. The other is a two-year planning cycle for development of the biennial Service Plan, which can include major restructuring of existing bus routes and proposals for new bus services.

  The data used for all service evaluations are collected on a regular basis through various means to track and evaluate the performance of services against each of the Service Standards (as defined in Chapter 3).

  The primary differences between the on-going service planning process and the planning process used to develop the Biennial Service Plan include:
  - the magnitude of the service changes considered (minor or major—as defined below);
  - the extent and type of analysis used;
  - the level of public participation; and
  - whether the effort is incremental or comprehensive in nature.

  Minor changes to bus services are made through the on-going service planning process and can be implemented with existing equipment, within the adopted budget, and without significantly affecting route structure or service delivery.

  Major changes are ones that will have a significant effect on riders, resource requirements, route structure, or service delivery (as defined in Table 1). These are evaluated and implemented only through development of the Biennial Service Plan (with the exception of new services associated with a major capital investment).

Table 12: Minor & Major Service Changes

Magnitude:	Type:	Resource Implications:
Minor	• Running time adjustments • Departure time adjustments • Headway changes to match ridership and service levels (provided the frequency and loading standards are still met) • Changes to bus stop locations • Alignment changes • Span of service changes within 1 hour or less • Route extensions of 1 mile or less • Route variation modifications	Changes that can be implemented with existing equipment and within the adopted budget
Major	• Major service restructuring • Implementation of new routes or services • Elimination of a route or service • Elimination of part of a route • Span of service changes greater than 1 hour	Changes that will have a significant affect on resources and may potentially have a significant affect on riders

The On-going Bus Service Planning Process: The service changes that are evaluated in the on-going service planning process can be initiated in a variety of ways. These include, but are not limited to:

- service requests and/or complaints from the public;
- feedback from MBTA Bus Operations staff, such as drivers, garage superintendents or schedule makers;
- proposals made by the MBTA Service Planning staff; and
- studies completed by CTPS (for the Boston MPO), by other regional entities, or by municipalities.

Service Planning staff screen all potential service changes to determine whether they are minor or major in nature (as defined above). In addition, each potential change is considered using the criteria listed below (not all criteria are necessarily used in every evaluation).

- Performance measured against the Service Standards
- The rationale for the change
- Net cost per new passenger
- Net savings per lost passenger
- Changes in ridership
- Changes in travel time for existing riders
- Changes in operating costs
- Changes in fare revenue
- Key characteristics and demographics of the market
- Contribution to the achievement of external mandates, such as Title VI
- Other factors, as appropriate

Proposed minor changes that have been analyzed by the Service Planning Department are presented to the Service Committee, which is chaired by the Manager of Service Planning and includes representatives of the following departments:

- Service Planning
- Plans and Schedules
- Bus Operations
- Operations Support
- Customer Communications Center
- Office for Transportation Access
- Public Affairs,
- Intergovernmental Affairs
- Other Departments, as appropriate

Minor changes that are approved by the Service Committee, and that can be made within the adopted budget, are implemented as soon as possible—usually in the next quarterly schedule change.

The Biennial Service Plan Process: Every two years, the MBTA develops a biennial Service Plan that describes the performance of the system and the services that will be operated in the upcoming two years. The plan encompasses all fixed-route services and includes:

- a description of the performance of existing services;
- recommendations for major service changes;
- a discussion of service changes that were considered and/or evaluated, but are not recommended at the time; and
- a general review of the effectiveness of previous major service changes (major service changes would not be reported on in the service planning cycle immediately after their implementation, but would be evaluated in the following planning cycle to allow time for ridership to build).

As with the on-going service planning process, a major goal in the development of the biennial Service Plan is to ensure that the MBTA uses available funds in the most effective manner. However, this planning process can also identify major service changes and enhancements that have merit, but that cannot be funded within the existing operating budget. In such cases, the need for additional operating funds can be identified for request, and the service can be implemented when sufficient resources become available.

A key component of the biennial service planning process is an evaluation of the performance of existing services, as measured using the Service Standards found in Chapter 3 of this policy. Based on this analysis, the Service Planning Department proposes major service changes that will improve the performance of services that fail any of the Service Standards. (Minor service changes may also be identified at this time; however, they may be implemented as soon as possible, rather than waiting for the full acceptance of the Service Plan.)

Service changes considered in the biennial Service Plan can also be proposed through all of the same avenues as those considered in the on-going service planning process. Indeed, many may be identified through the on-going screening of projects. In addition, public input for the biennial Service Plan is sought through public meetings and public hearings, as described later in this chapter.

During development of the biennial Service Plan, potential major changes are evaluated through a comparative evaluation to determine which represent the best allocation of available resources. To complete the comparative evaluation, the Service Planning Department creates a list of all proposed service increases and reductions. The proposed service increases are ranked using the net cost per new passenger: those that garner the most new passengers at the lowest incremental cost are ranked highest priority for implementation. The proposed service reductions are ranked using the net savings per lost passenger: those that save the most money with the lowest loss of passengers are ranked highest priority for implementation.

Other evaluation criteria are also used in the comparative evaluation, as appropriate, to determine the rank of service change proposals. For example, higher priority would be given to a proposed change that improved a route's performance on one or more of the service standards (as defined in Chapter 3).

After the rankings are completed, the savings from the major service reductions are compared to the cost of major service enhancements to help select the proposed service changes. The goal is to maximize ridership and service performance in a cost-effective manner. The recommendations that result from this process are reviewed by the Service Committee to assess the feasibility of implementation before they are included in the Preliminary Service Plan. Each Preliminary Service Plan is made available to the public for review and comment (as described later in this chapter). A list of the final recommendations, an indication of the routes that still violate one or more of the service standards, and the Title VI analysis are then submitted to the MBTA Board of Directors for final approval before the changes are implemented.

Table 13: Summary of Service Planning Processes

	On-going Service Planning Process	Biennial Service Plan Process
Magnitude of changes:	• Minor	• Major
Initiation of changes:	• Requests/complaints from public • Bus Operations feedback • Service Planning Staff • Service Studies	• Requests/complaints from public • Bus Operations feedback • Service Planning Staff • Service Studies • Public Meetings
Evaluation of changes:	• Route or garage level analysis using the Evaluation Criteria • Review by Service Committee	• Route or garage level analysis using the Evaluation Criteria (including performance review of all services using Service Standards) • Comparative evaluation of proposed service changes, and possible new services • Review by Service Committee • Public review and comment • Title VI analysis
Implementation of changes:	• Quarterly with regular schedule changes	• Biennially, upon approval of the Service Plan by the MBTA Board of Directors

- **Light Rail/Heavy Rail Service Planning Process (to be completed)**

Contract Services

- **Commuter Rail Service Planning Process (to be completed)**
- **Commuter Boat Service Planning Process (to be completed)**

Public Participation

Public participation in the service planning process varies somewhat by mode and occurs as both an on-going process and as a Service Plan specific process. The purpose of public involvement in the service planning process is to promote a regular dialogue with existing and potential riders, elected officials, and communities regarding their ever-changing service needs

- **On-Going Public Outreach**
  The MBTA provides avenues for on-going communication through the MBTA's website, as well as the customer complaints phone line and comments sent to individual MBTA officials. Service related comments/requests are directed to the appropriate department for consideration and response. Upon request, MBTA staff also attend public meetings held by municipalities and meetings with public

officials to address specific service issues. In addition, from time to time, the MBTA may conduct specific market or route-based surveys to gather direct input on a major service change or potential new service.

- **Biennial Service Plan Public Outreach**
  Service Plan outreach efforts are intended to provide members of the public with the opportunity to submit service requests to the MBTA for consideration in development of the Biennial Service Plan. To this end, the MBTA solicits ideas for service changes through written comments (submitted on-line or via the mail), as well as through public meetings throughout the service area, before a draft plan is written.

  Upon completion of the draft biennial Service Plan, the MBTA schedules a second round of public meetings in appropriate locations. At these open meetings the MBTA presents the analysis and issues behind the proposed service changes and solicits public comments on them. In addition, at least one Public Hearing is held to receive formal public comments on the draft Biennial Service Plan. MBTA staff then assess and analyze the suggestions made through the public comments and, as appropriate, incorporate them into the final recommendations that go to the MBTA Board of Directors for approval before implementation.

  All Service Plan public notifications, meetings, and hearings will conform to the requirements of the Americans with Disabilities Act, Title VI of the Civil Rights Act of 1964, and MBTA policies associated with these laws.