
Date: May 4, 2021

Project #: 24929

Project: Western Avenue Transportation Study

Subject: Draft Modeling Process and Assumptions for Long-Term Buildout

1.0 INTRODUCTION

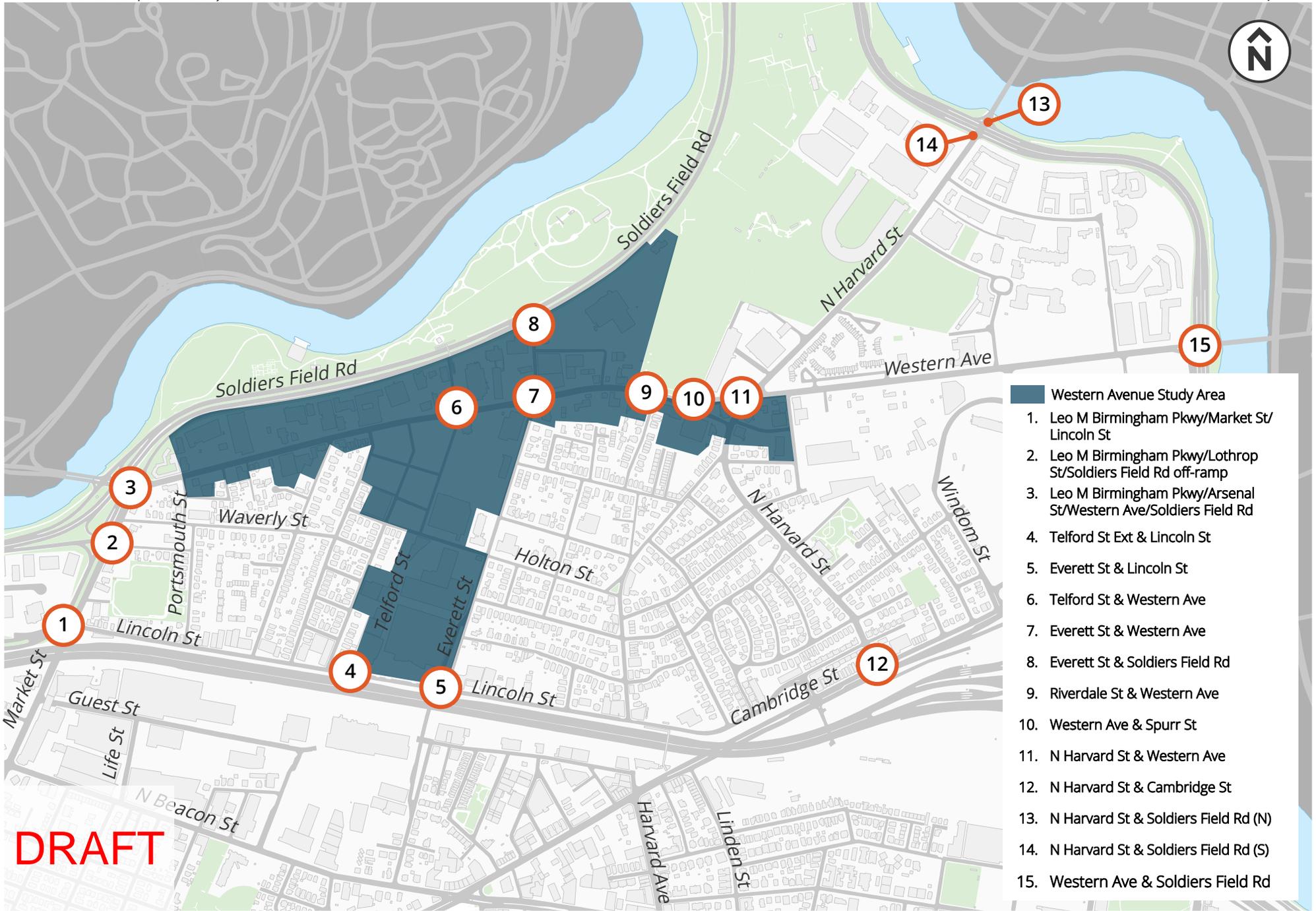
The Boston Planning & Development Agency's (BPDA) *Western Avenue Corridor and Rezoning Study* is a planning effort to engage local stakeholders in conversations about future development on Western Avenue situated between Barry's Corner and Leo Birmingham Parkway, together with both the sections of Telford Street and Everett Street situated between Lincoln Street and Soldier's Field Road (**Figure 1**).

The City's primary goals for this process include:

- Inform recommendations for new or modified zoning
- Build on previous and ongoing planning in the area, including:
 - o North Allston Strategic Framework for Planning
 - o North Allston-Brighton Community-Wide Plan
 - o Harvard's Institutional Master Plan
 - o The Allston-Brighton Mobility Study (the "A-B Mobility Study")
- Foster a dialogue with developers and property owners
- Recommend transportation enhancements
- Recommend public realm improvements

Development and growth along Western Avenue will entail the formation of new land uses and street connections that must support multiple transportation modes, including walking, bicycling, public transit, and driving. The transportation planning that is being conducted considers local needs and conditions, and future changes guided by citywide plans and policies, including Imagine Boston 2030, Go Boston 2030, Boston's Complete Streets Guidelines, and the Vision Zero Action Plan.

The *Western Avenue Corridor and Rezoning Study* began with an assessment of existing transportation conditions in the Western Avenue study area. The BPDA and the study team (Kittelison & Associates, Inc.) tested a series of potential development and land use scenarios to identify a preferred development and land use scenario that will enable the City to both improve existing network issues and allow for additional neighborhood growth.



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The final transportation recommendations for Western Avenue will include an assessment of the neighborhood's long-term build-out, as well as measures to make the area safer, alleviate congestion experienced today, and allow for future growth. These measures will include potential changes to the existing cross-sections for Western Avenue, Everett Street, and Telford Street.

This memorandum summarizes the technical evaluation of long-term build-out traffic operations in the Western Avenue study area. Findings from this memorandum will inform the identification, testing, and selection of additional transportation recommendations for the study area. A future update to this memorandum will summarize the impacts of the final transportation recommendations on long-term build-out traffic operations.

2.0 EXISTING CONDITIONS ANALYSIS PROCESS

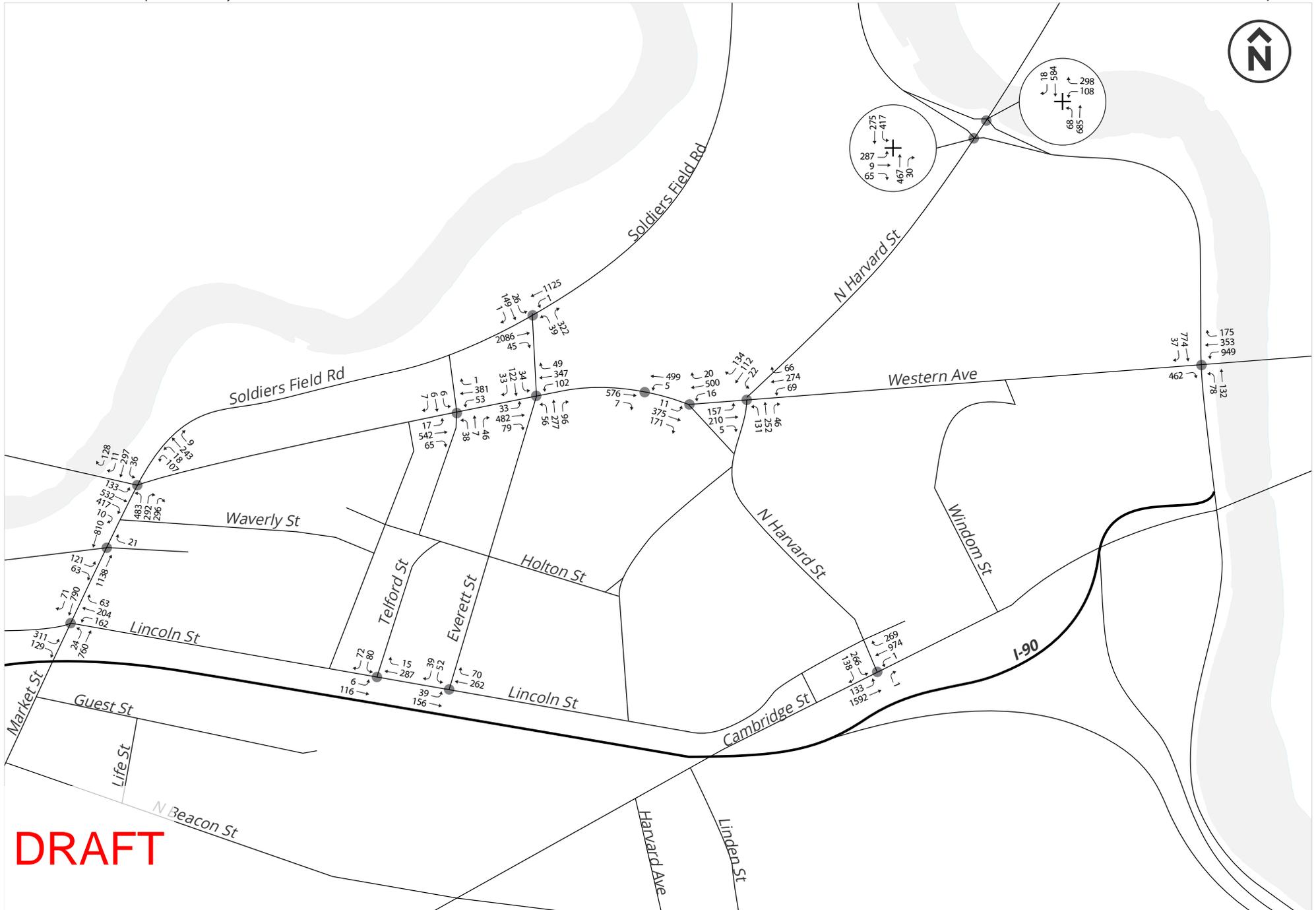
Kittelson conducted multi-modal trip data assembly and collection for study intersections, and developed a.m. peak period and p.m. peak period Synchro models for the study intersections. The Western Avenue Corridor Study area is shown in **Figure 1**.

Data Collection

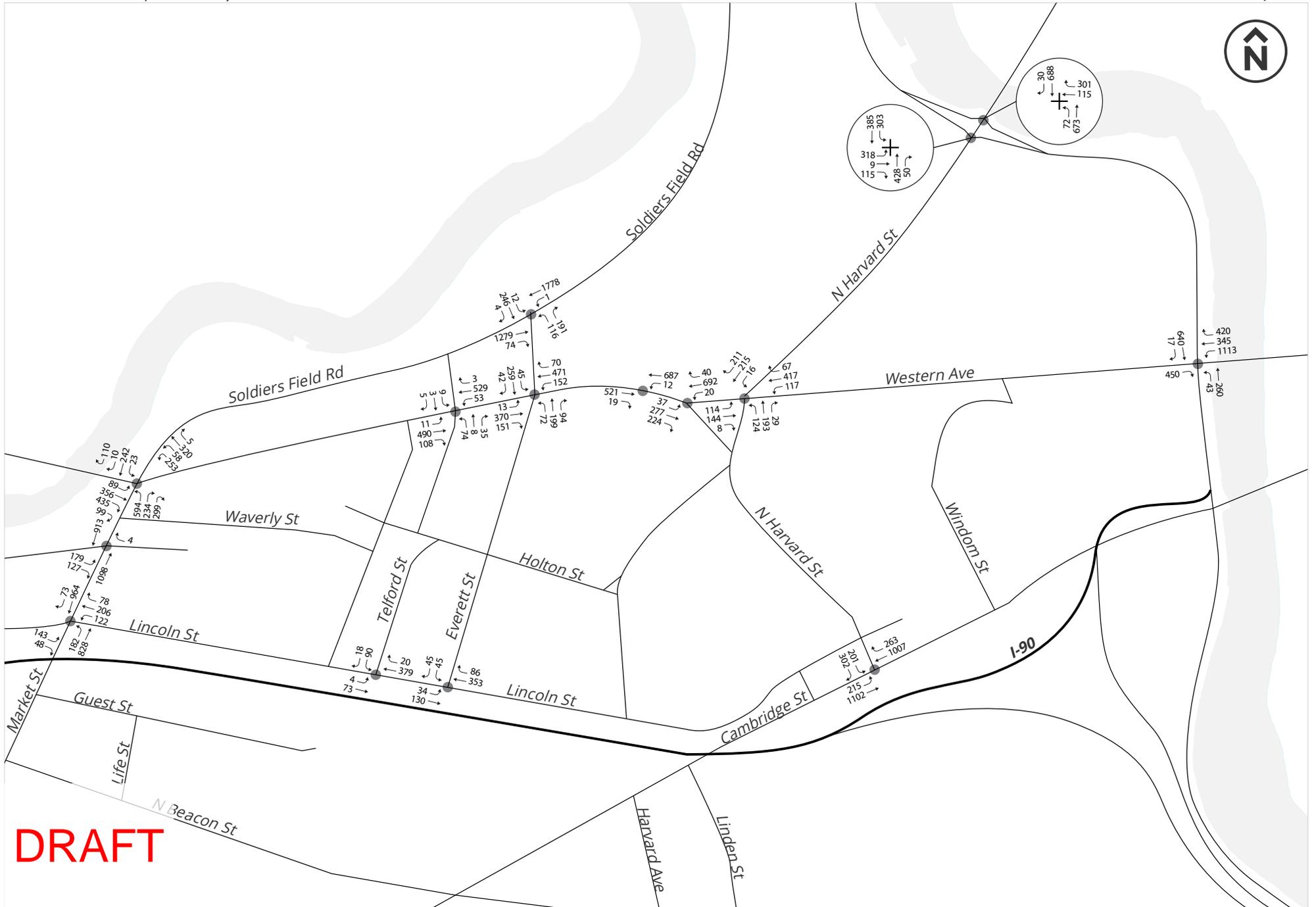
For the baseline condition, Kittelson and the BPDA compiled recent peak hour turning movement counts. These counts were collected between 2013 and 2018. A 2% annual growth rate was applied to counts taken before 2019 to develop 2019 volumes. Turning movement counts were not available at one study intersection (Lincoln Street and Telford Street Extended), so volumes from adjoining intersections were used to develop a turning movement count estimate at this location. Intersection-specific peak hours were used for the analysis. At intersections within the study area, the morning and evening peak hours ranged between 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m., respectively.

Figure 2 and **Figure 3** provide a summary of the resulting 2019 Existing Condition traffic volume counts for the weekday a.m. and p.m. peak periods.

The traffic count worksheets used in this study are available upon request.



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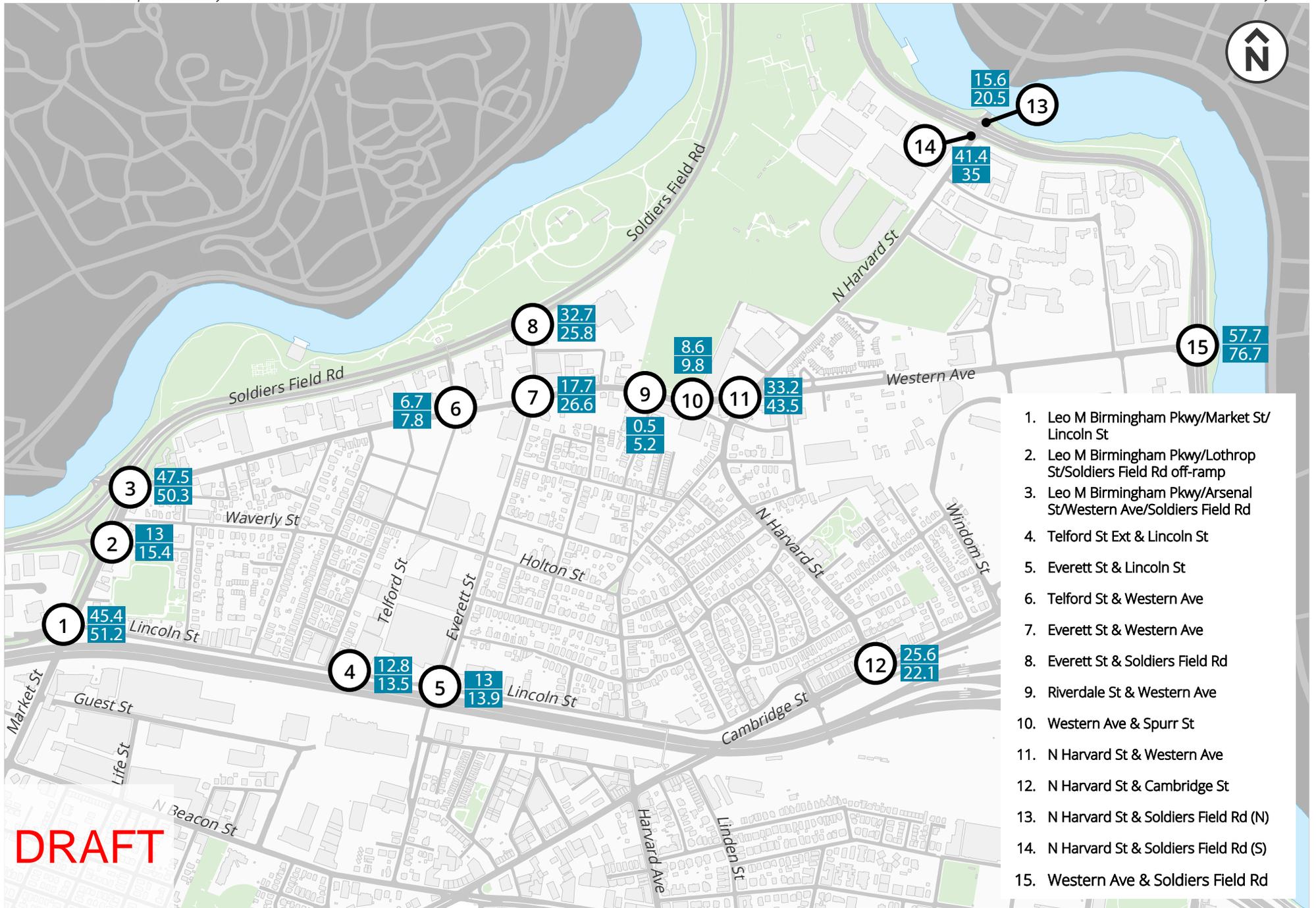
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Existing Intersection Delay

Traffic operations analyses were performed at study area intersections in accordance with the 2000 Highway Capacity Manual (HCM) for signalized intersections and the Sixth Edition HCM for unsignalized intersections using Synchro 10. Kittelson used intersection delay as the measure of intersection performance. Delay represents that amount of time it takes vehicles to pass through an intersection (reported in seconds).

Figure 4 summarizes delay for the study intersections under the weekday a.m. and p.m. peak periods. The intersections of Western Avenue/Soldiers Field Road/Leo Birmingham Parkway/Arsenal Street (#3) and Western Avenue/Soldiers Field Road (#15) experience the highest levels of delay.

The level-of-service worksheets for 2019 existing conditions are available upon request.



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Intersection #



Peak Hour Delay (seconds)

| | |
|-----|---------|
| X.X | AM Peak |
| X.X | PM Peak |

3.0 LONG-TERM BUILD-OUT WESTERN AVENUE ANALYSIS PROCESS

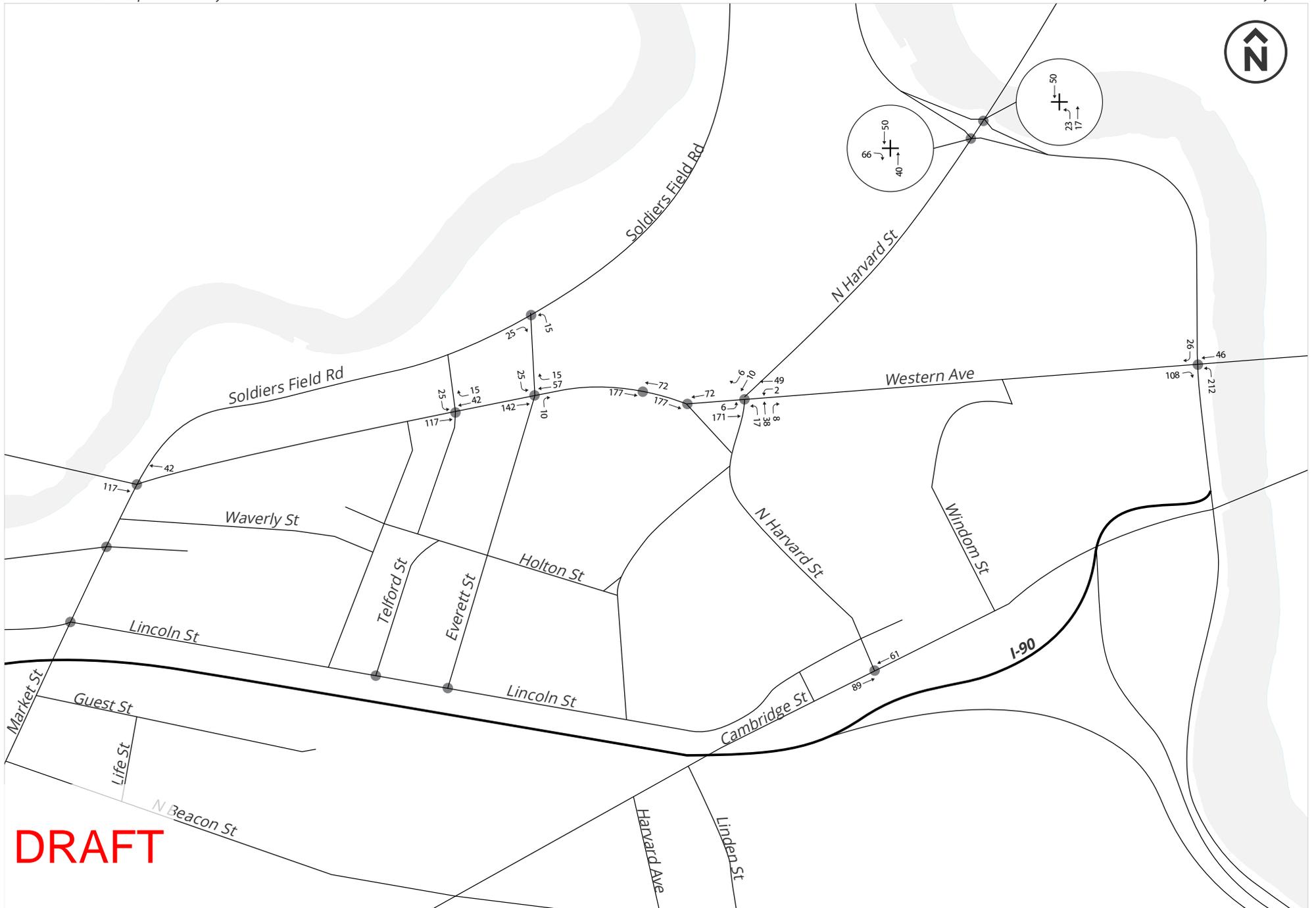
This portion of the study was developed to provide a thorough and technical evaluation of long-term build-out traffic operations along Western Avenue to support the future vision of the *Western Avenue Corridor Study*. Future potential development, land use, and changes to the street network were provided by the BPDA for this analysis.

Known Area Development

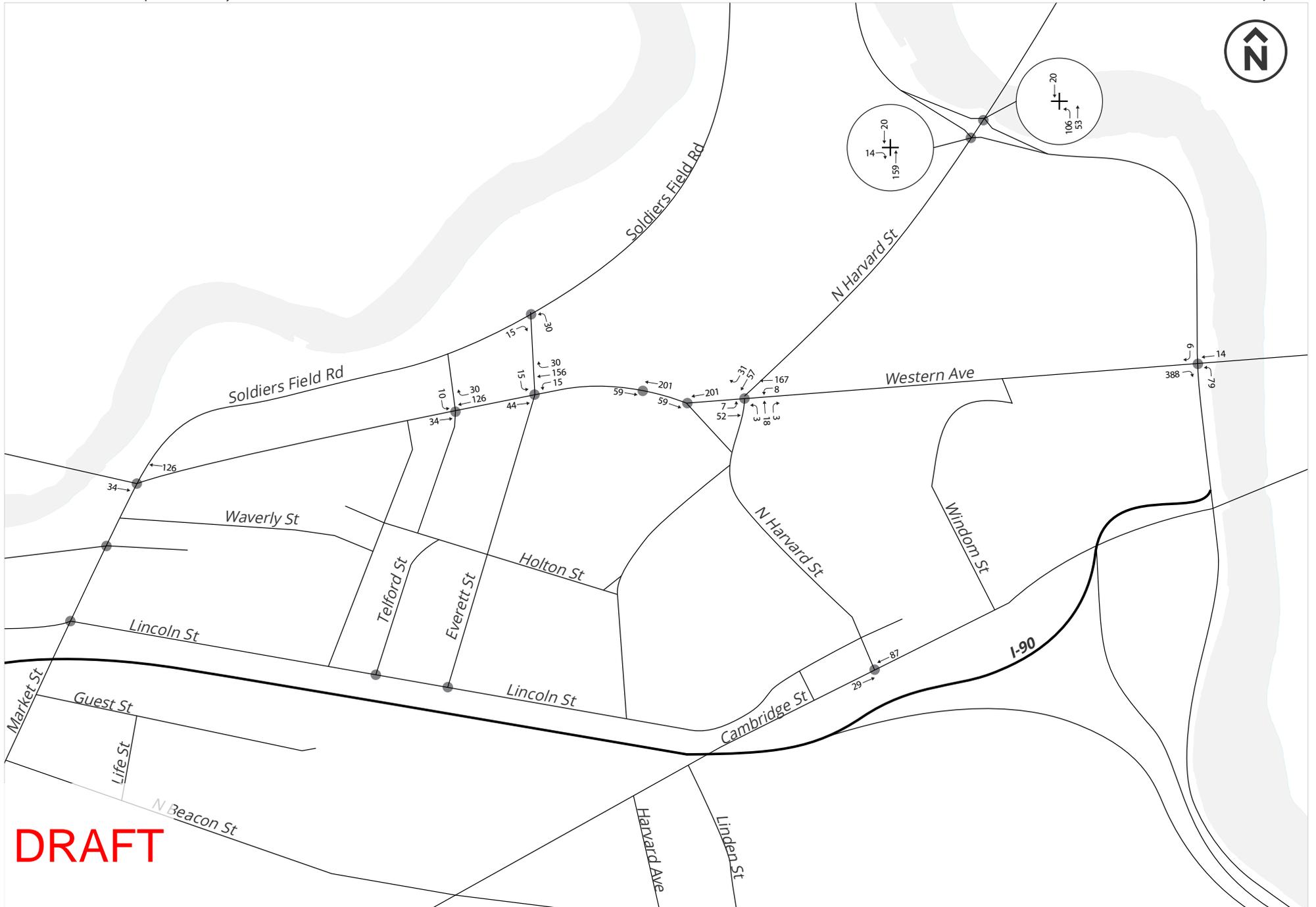
Future traffic volumes from six known in-process developments were included in the long-term build-out Western Avenue analysis:

- **Harvard Enterprise Research Campus (ERC):** Planned for a 36-acre area across Western Avenue from Harvard Business School, this project will contain approximately 1,800,000 square feet of mixed-use development consisting of residential, office/lab, hotel, conference center, restaurant, and retail use, along with over two acres of public open space. Site generated vehicle trips from the approved traffic study for the project were added to the long-term build-out Western Avenue analysis.
- **Harvard Business School Faculty & Admin:** Located on Gordon Road east of N. Harvard Street, this project will contain 110,000 square feet of faculty and administrative office uses. Background vehicle trips from this site for the approved traffic study for the Harvard ERC project were added to the long-term build-out Western Avenue analysis.
- **Harvard Mixed Use Project:** Located on Ivy Lane west of N. Harvard Street, this project will include a 60,000 square foot basketball venue, 200,000-250,000 square feet of residential uses, and 10,000-30,000 square feet of retail uses. Background vehicle trips from this site for the approved traffic study for the Harvard ERC project were added to the long-term build-out Western Avenue analysis.
- **Harvard Gateway:** Located in the northeast quadrant of the intersection of Western Avenue and N. Harvard Street, this project will include 250,000-265,000 square feet of institutional/mixed use uses and 35,000-50,000 square feet of retail uses. Background vehicle trips from this site for the approved traffic study for the Harvard ERC project were added to the long-term build-out Western Avenue analysis.
- **Harvard Hotel/Conference Center:** Located east of the Harvard ERC site, this project will contain 250,000 square feet of hotel and conference space. Background vehicle trips from this site for the approved traffic study for the Harvard ERC project were added to the long-term build-out Western Avenue analysis.
- **Science and Engineering Complex (SEC):** Located west of the Harvard ERC site, this project will include 496,850 square feet of academic space. Background vehicle trips from this site for the approved traffic study for the Harvard ERC project were added to the long-term build-out Western Avenue analysis.

Figure 5 and Figure 6 show the vehicle trips added by the known area developments during the weekday a.m. and p.m. peak periods.



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New Grid

Transportation infrastructure needs are important to consider and evaluate while planning future development in the Western Avenue Study Area. The current street network includes pinch points and gaps, particularly between Western Avenue and Soldiers Field Road. Without a long-range plan, growth may occur without network transportation benefits. As a result, a new street grid concept was developed and analyzed as part of considering how to incorporate future growth and increased traffic volumes within the study area as well as improve existing network problems. A denser grid system helps disperse traffic while allowing more capacity to be accommodated. The conceptual grid model helps ensure that new growth and development can be accommodated. Improved connectivity and circulation for both vehicular traffic and alternative transportation modes are some of the benefits of a future grid network. The new streets also serve to break down superblocks and provide more human scaled streets

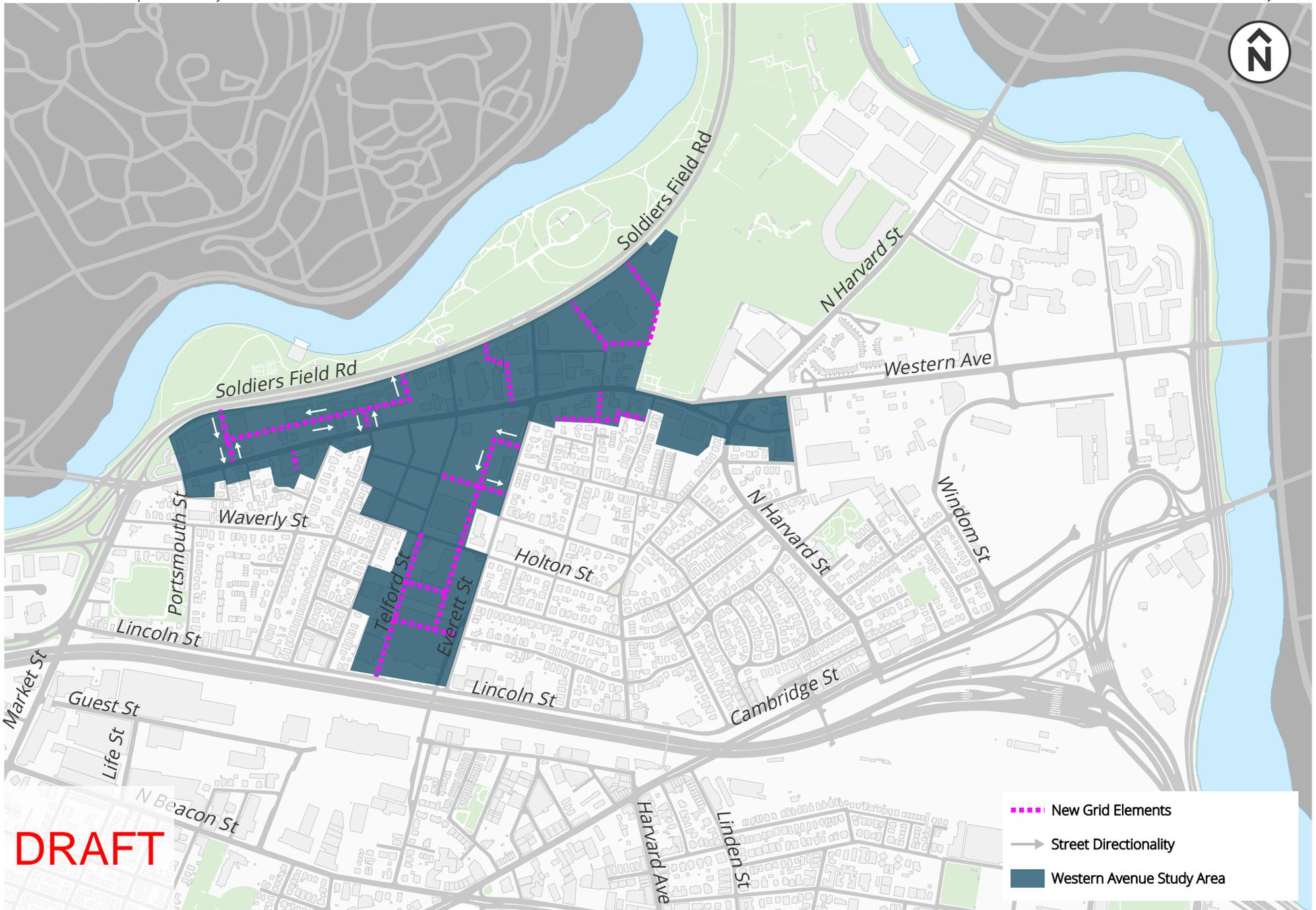
Street Circulation

Today, Western Avenue is a primary east-west roadway in the study area. Motorists use Western Avenue to access local streets within the study area and key regional facilities at the eastern and western bounds of the study area (i.e., Soldiers Field Road). There are few connections between Western Avenue and Soldier's Field Road within the study area (i.e., Telford Street, Everett Street, N. Harvard Street). Without changes to the area's street network, traffic will continue to be added to these connecting streets, which are nearing capacity during peak hours.

The planned grid concept adds four additional north-south connections between Western Avenue and Soldier's Field Road, including:

- Extending Richardson Street north across Western Avenue to Soldiers Field Road
- Extending Litchfield Street north across Western Avenue to a new east-west connection between Richardson Street extended and a new north-south connection to Solders Field Road
- Providing a new north-south connection from Western Avenue and Soldiers Field Road (between Telford Street and Everett Street)
- Extending Speedway Avenue north to Soldiers Field Road via the two existing driveway entrances to the Westinghouse Broadcasting Company building

The concept also proposes to connect Telford Street between Western Avenue and Lincoln Street. Connections between Telford Street and Everett Street via future extended east-west roadways such as Brentwood Street will grow the grid network south of Western Avenue. More street alternatives will help improve circulation within the study area and provide for future building access with development. The proposed conceptual grid network is displayed in **Figure 7**. Unless noted on Figure 7, streets are assumed to be two-way.



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Western Avenue Development Forecast

The BPDA tested two different long-term buildout scenarios for the Western Avenue study area so that the recommended zoning strategy for the study area could be informed by the results of transportation modeling. This sensitivity testing allowed the BPDA to understand how changes in land use mix (e.g., residential vs. office/lab), land use quantity, and land use location would influence the number of new trips, times of day that trips would take place, and how trips would move through the street network.

Table 1 summarizes the two scenarios included in the sensitivity testing. The sensitivity testing showed that Scenario A is the most likely to support the planning vision for the Western Avenue study area while providing access to all future users and uses of the street network.

Table 1. Long-Term Buildout Scenario Comparison

| Scenario | Land Use | Size | Percent of Total |
|------------|--------------|----------------|------------------|
| Scenario A | Residential | 4.7M SF | 71% |
| | Office | 1.9M SF | 29% |
| | Total | 6.6M S | 100% |
| Scenario B | Residential | 2.7M SF | 43% |
| | Office | 3.6M SF | 57% |
| | Total | 6.3M SF | 100% |

The following sections detail the sensitivity testing process applied to both land use scenarios but only provide the results of the sensitivity testing for Scenario A.

Trip Generation

To estimate the new trips expected with the potential full build-out of the Western Avenue study area, the following development program was tested:

- 4,708,743 square feet of residential
- 1,889,648 square feet of office

Trips were estimated using the Trip Generation, 10th Edition, published by the Institute of Transportation Engineers (ITE). The following Land Use Codes (LUCs) were selected for the proposed uses:

- LUC 221 – Multifamily Housing (Mid-Rise)
- LUC 710 – General Office Building

ITE’s trip generation data provide unadjusted vehicle trip estimates that assume that all new trips will be vehicle trips. These unadjusted trips were first converted to person trips using historic vehicle occupancy rates for the study area.¹ Next, to account for the use of alternative transportation modes available within

¹ 2018 ACS 5-Year Estimates for the Census Block Groups encompassing the Western Avenue Study Area

the Western Avenue study area, the person trips were assigned to specific modes, based on historic trends in the area. **Table 2** shows the local mode splits assumed for the Western Avenue study area.

Table 2. Peak Hour Mode Splits

| Public Transportation | Walk/Bike/Other | Vehicle Trips |
|-----------------------|-----------------|---------------|
| 29% | 31% | 40% |

Source: 2018 ACS 5-Yr Estimates

Since Scenario A will be comprised of mixed uses, an internal capture rate was applied to the weekday a.m. and p.m. vehicle trips. The internal capture rates were assigned using Trip Generation 3rd Edition methodology, which is based on NCHRP Report 684: Enhancing Internal Trip Capture Estimation for Mixed-Use Developments. **Table 3** shows the internal capture rates assumed for weekday a.m. and weekday p.m. vehicle trips.

Table 3. Internal Capture Rates

| Internal Capture Rate | A.M. Peak Hour | P.M. Peak Hour |
|-----------------------|----------------|----------------|
| | 1.34% | 3.26% |

The resulting estimated motor vehicle trip generation is shown in **Table 4**.

Table 4. Trip Generation Summary

| Time Period/Direction | Vehicle Trips |
|---|---------------|
| Weekday Daily | |
| Total | 15,344 |
| Morning Peak Hour (minus internal capture) | |
| Enter | 780 |
| <u>Exit</u> | <u>543</u> |
| Total | 1,323 |
| Evening Peak Hour (minus internal capture) | |
| Enter | 551 |
| <u>Exit</u> | <u>872</u> |
| Total | 1,423 |

Scenario A is estimated to generate approximately 1,323 vehicle trips (780 entering and 543 exiting new developments) during the morning peak hour. During the evening peak hour, the program would generate approximately 1,423 vehicle trips (551 entering and 872 exiting). These trips will be distributed among development parcels throughout the study area and onto the supporting roadway network.

Trip Replacement

Scenario A will replace existing land uses along Western Avenue, such as the existing Star Market grocery store, Mahoney’s Garden Center, and various offices, autobody shops, and restaurants. The BPDA identified 936,925 square feet of land uses expected to be replaced with the potential full build-out of the Western Avenue study area. Since general land use codes (LUCs) were used for the proposed uses for the study area, LUC 710 (General Office Building) was applied to 744,818 square feet of existing land uses. More specific LUCs were selected for 192,107 square feet of existing land uses that produce a substantially higher number of trips than the General Office Building use (e.g., Star Market, German International School of Boston).

Using the same process that was applied to the trips generated by Scenario A, the unadjusted trips provided by ITE’s trip generation data were converted to person trips and assigned to specific modes. The same internal capture rate was applied to the weekday a.m. and p.m. vehicle trips to avoid overestimating the number of existing trips to be replaced by Scenario A.

The trips generated through this process were removed from the estimated motor vehicle trip generation. The resulting estimated motor vehicle trip generation is shown in **Table 5**.

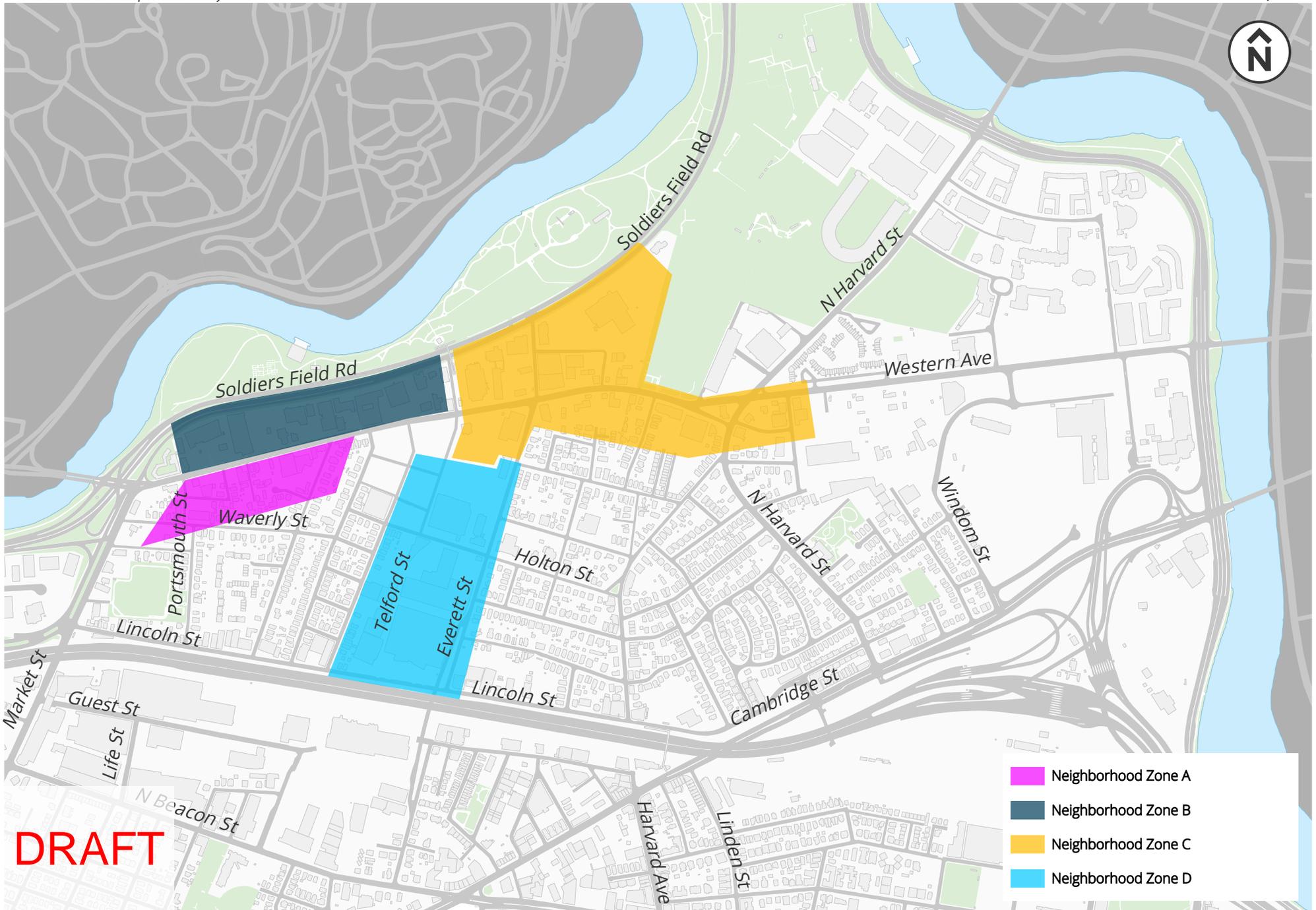
Table 5. Trip Replacement

| Time Period/Direction | Development Vehicle Trips | Vehicle Trips from Existing Uses being Replaced | Net New Development Vehicle Trips |
|--------------------------|---------------------------|---|-----------------------------------|
| Morning Peak Hour | | | |
| Enter | 780 | 448 | 332 |
| <u>Exit</u> | <u>543</u> | <u>192</u> | <u>351</u> |
| Total | 1,323 | 640 | 683 |
| Evening Peak Hour | | | |
| Enter | 551 | 242 | 309 |
| <u>Exit</u> | <u>872</u> | <u>447</u> | <u>425</u> |
| Total | 1,423 | 689 | 734 |

Trip Distribution

Since trip patterns vary within the Western Avenue Study area, four neighborhood zones were identified for trip distribution. The four neighborhood zones are shown graphically in **Figure 8**. Trips were distributed to and from each neighborhood zone based on BTD’s guidelines for the project area. These guidelines are based on historic census data that identify where area residents work and where area employees live. BTD’s Trip Distribution Zones are depicted in **Figure 9**. A summary of the regional trip distribution results is presented in **Table 6**.

New vehicle trips proposed by BPDA’s future land use scenario were added to the six known area development volumes using the local trip distribution patterns shown in **Table 6**.



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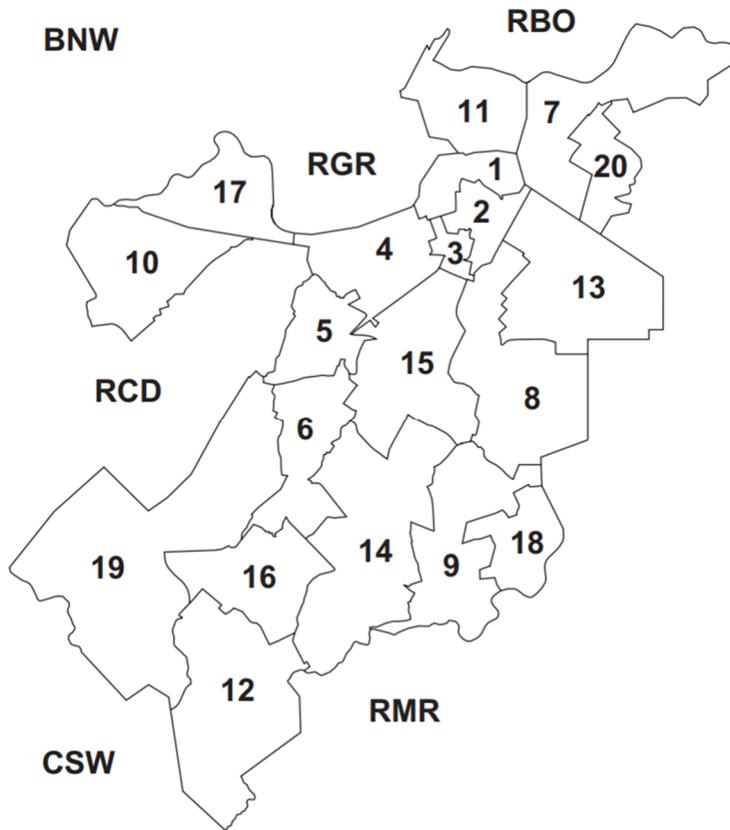


Figure 9. BTD Transportation Distribution Zone Map

Table 6. Trip Distribution

| To/From (BTD Zones and Suburbs): | AM | | PM | |
|---|-------------|-------------|-------------|-------------|
| | In | Out | In | Out |
| North (Stoneham, Burlington, Wakefield, Andover, Methuen, Wakefield) | 11% | 4% | 5% | 8% |
| Northeast (7, 11, Lynn, Salem, Saugus, Everett) | 8% | 6% | 8% | 9% |
| Northwest (Belmont, Watertown) | 9% | 8% | 7% | 7% |
| South (12, 16, 19) | 3% | 2% | 2% | 3% |
| Southeast (5, 6, 8, 9, 14, 15, 18, Milton and South Shore) | 13% | 11% | 13% | 13% |
| Southwest (10, Oak Hill, Newton, Needham, Dedham) | 24% | 21% | 23% | 25% |
| East (1, 2, 3, 4, 13, 20, Cambridge) | 15% | 34% | 28% | 20% |
| West (Natick) | 11% | 5% | 5% | 8% |
| Western Avenue Study Area ¹ | 6% | 9% | 9% | 7% |
| Total | 100% | 100% | 100% | 100% |

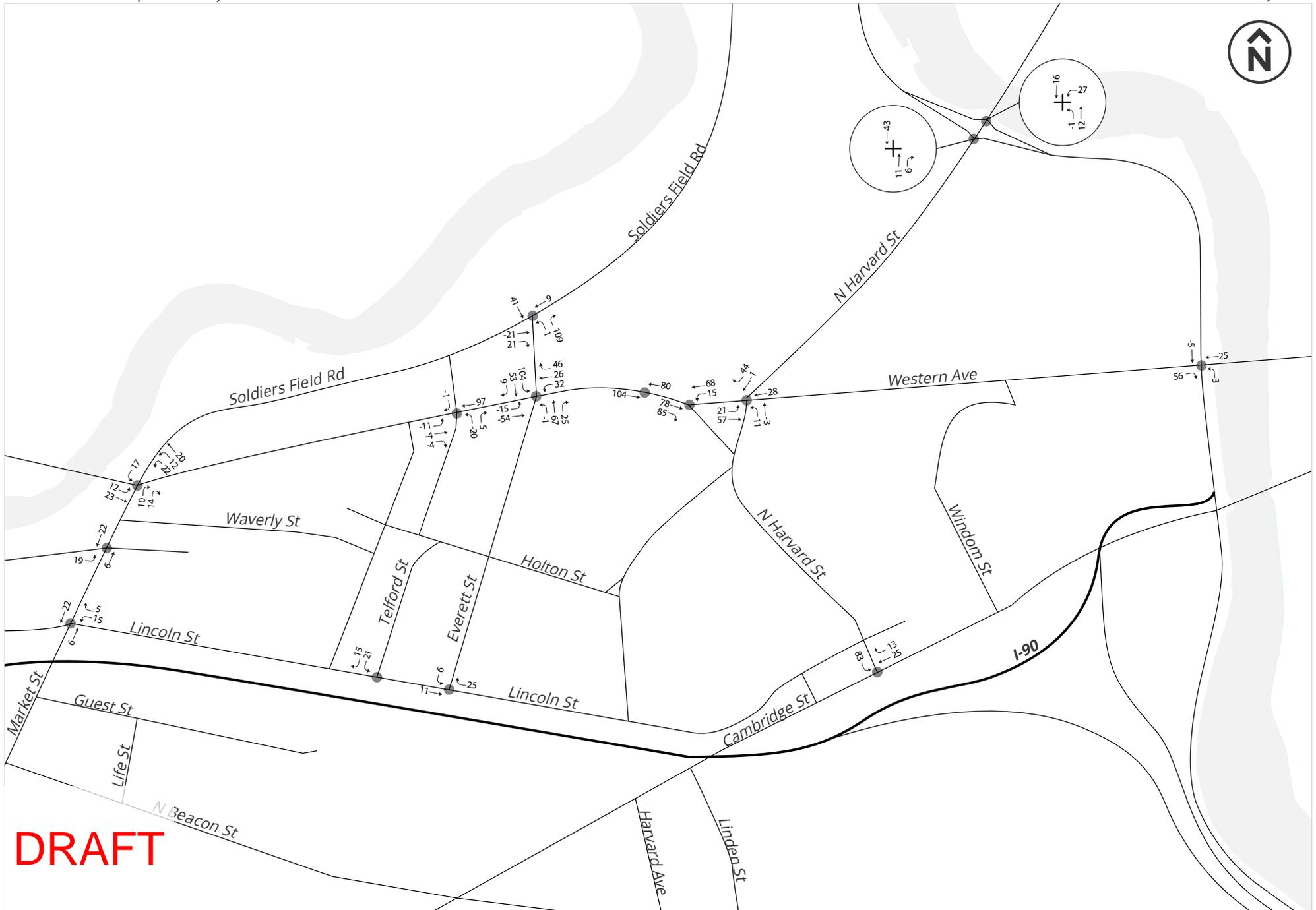
¹The Western Avenue Study Area is located within BTD Zone 17. Trips distributed within Zone 17 were not assigned to the study area’s roadway network.

Source: BTD Trip Distribution Percentages for Zone 17 AM and PM

Trip Assignment

Net new vehicle trips were assigned to the transportation network following the trip distribution patterns identified above. Trips were assigned origin-destination pairs comprised of the four Western Avenue zones and each of BTD's Trip Distribution Zones. For each origin-destination pair, the analysis team considered two to four routes following common traffic patterns. Trips for each pair were divided among the possible routes and combined to create net new traffic through the study intersections.

Figure 10 and **Figure 11** show the net new development vehicle trips added to the street network during the weekday a.m. and p.m. peak periods.



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Long-term Build-Out Intersection Delay

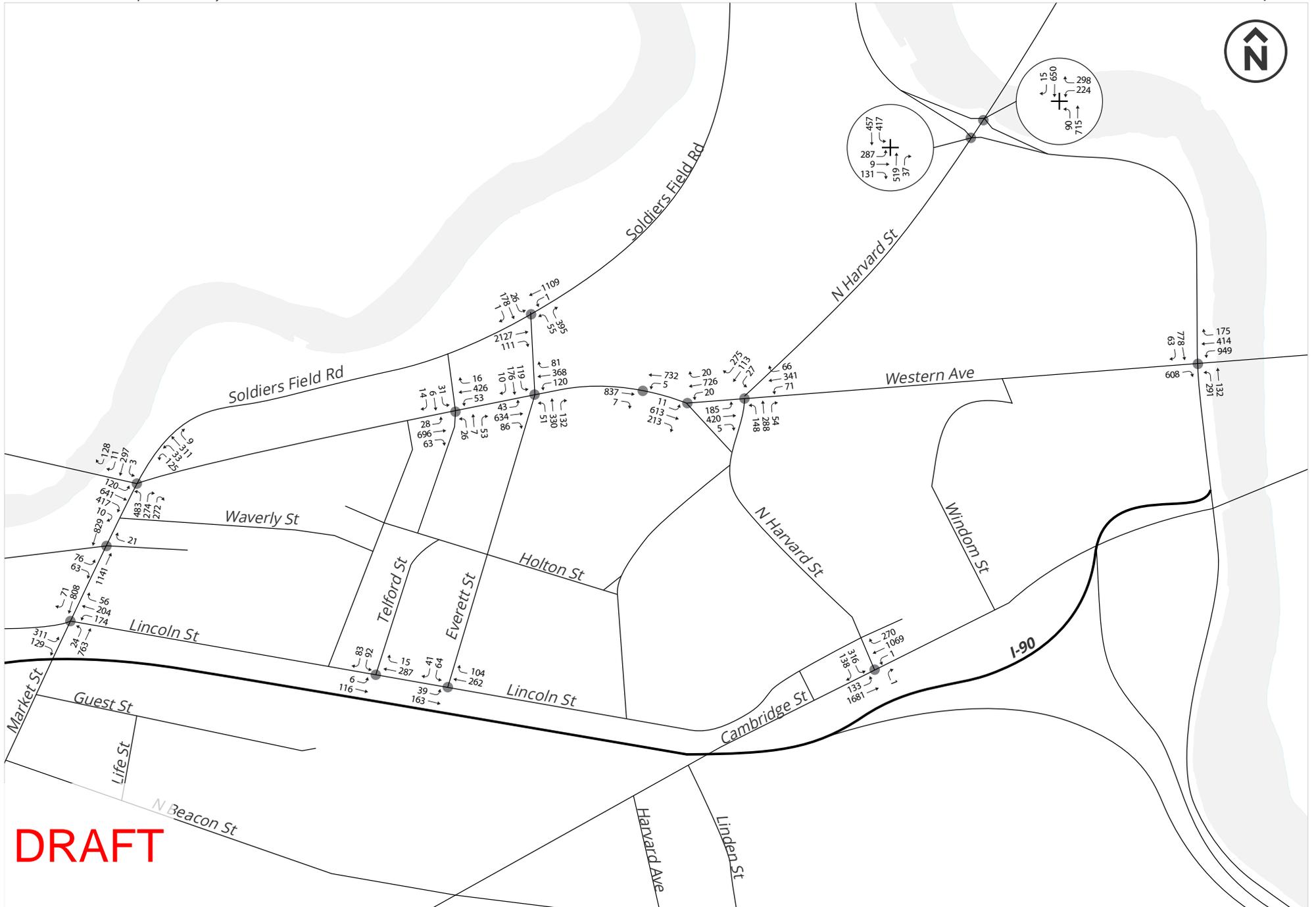
The resulting long-term build-out volumes are shown in **Figure 12** and **Figure 13** for the morning and evening peak periods, respectively. The volumes shown in these figures include known development traffic and estimated longer-term future Western Avenue study area development traffic.

Figure 14 summarizes delay for the study intersections under the weekday a.m. and p.m. peak periods. The intersections of Western Avenue/Everett Street (#7) and Western Avenue/Soldiers Field Road (#15) experience the highest levels of delay (greater than 75 seconds during the p.m. peak). Kittelson will test mitigations (e.g., signal timing modifications) to reduce vehicle delay at these intersections.

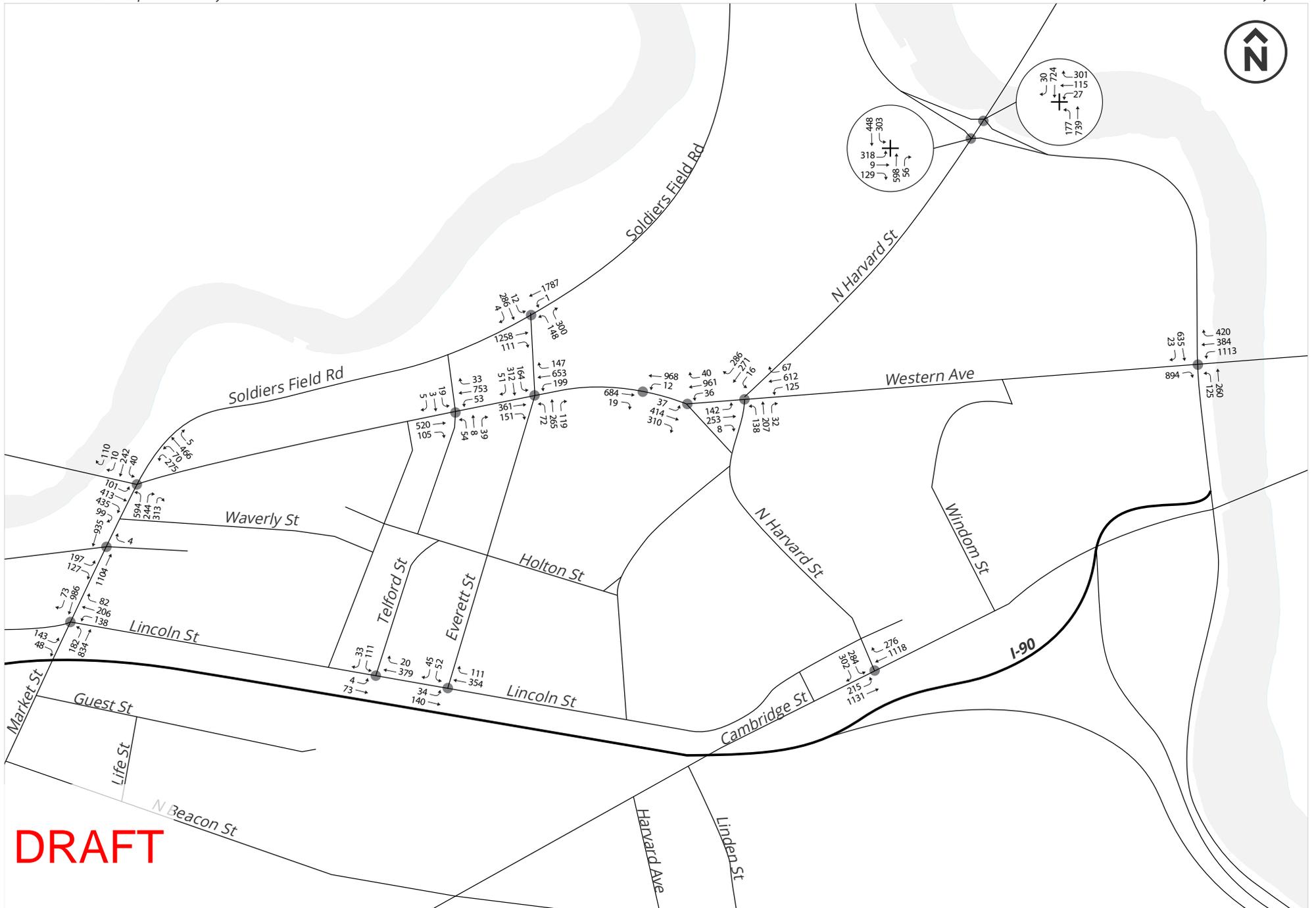
The level-of-service worksheets for long-term build-out conditions are available upon request.

4.0 NEXT STEPS

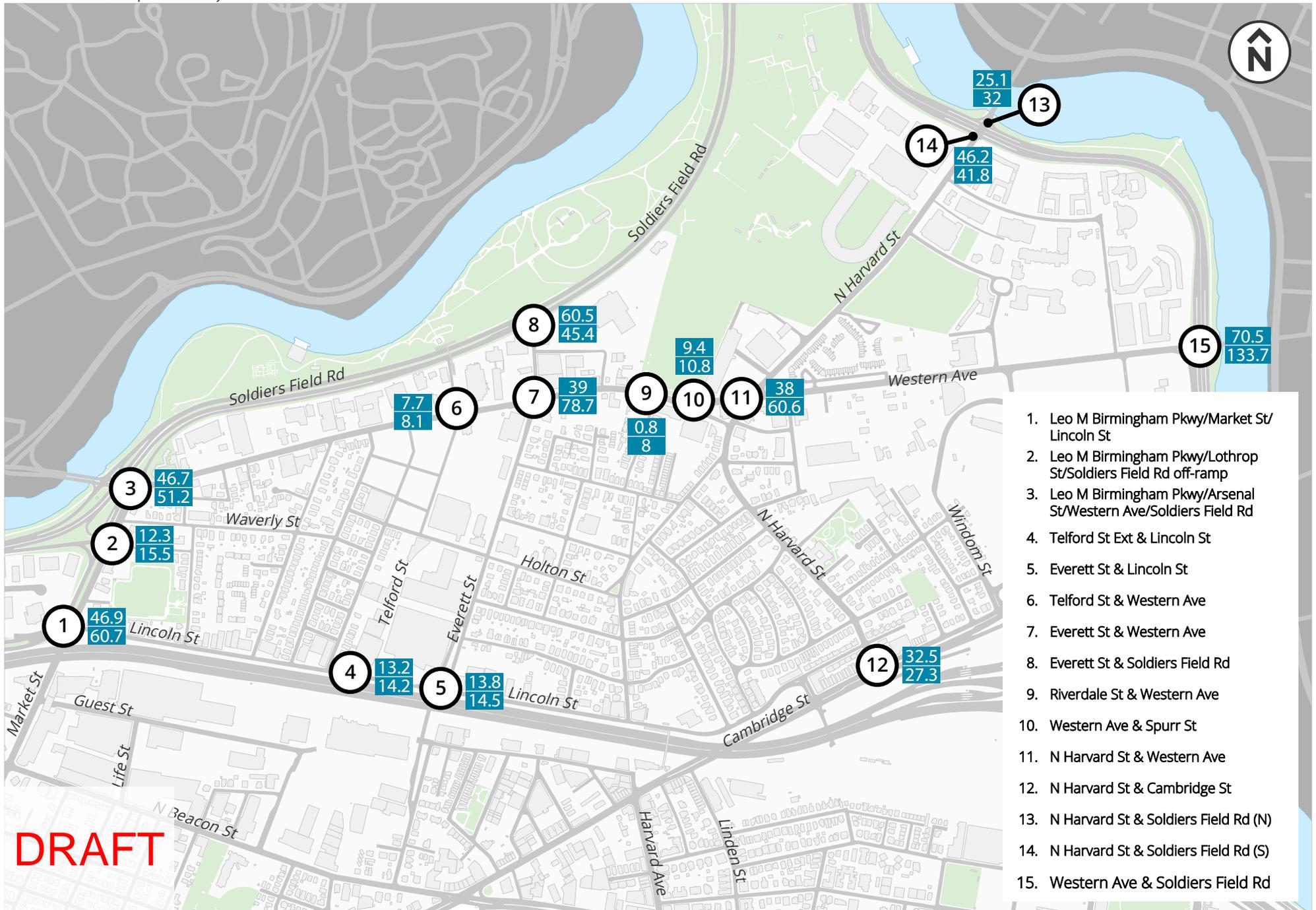
Kittelson will test multimodal changes to the street network and potential shifts in mode share to address impacts of the long-term build-out on traffic operations in the Western Avenue Study Area.



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Intersection #



Peak Hour Delay (seconds)

| | |
|-----|---------|
| X.X | AM Peak |
| X.X | PM Peak |