



Hennepin Avenue Bicycle Plan

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Prepared for
The City of Minneapolis



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Executive Summary



The City of Minneapolis in partnership with the Non-Motorized Transportation Pilot Program (NTP) has identified a need to prepare a Bicycle Plan for both the Hennepin Avenue and Central Avenue corridors. This report documents the Hennepin Avenue Bicycle Plan (Bicycle Plan) and will be used to identify infrastructure and capital investments, elements to enhance bicycle travel within the corridor, and provides a recommended implementation plan.

Project Location

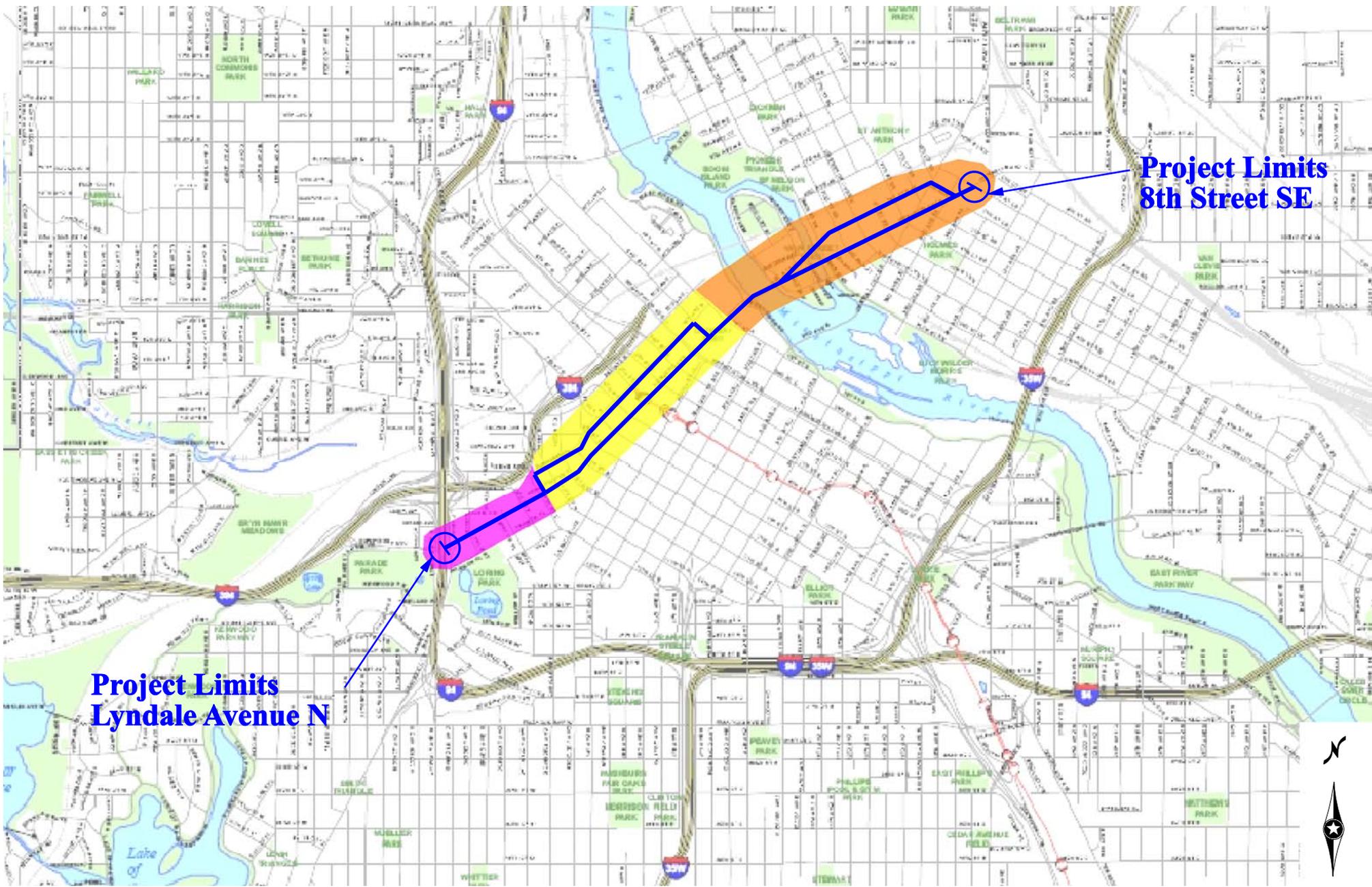
Hennepin Avenue serves as a primary link and direct connection between Uptown, Downtown and Northeast Minneapolis and is a critical segment in interconnecting the city's bicycle network. The corridor limits evaluated in the Bicycle Plan include the following:

- Hennepin Avenue from Lyndale Avenue N to 8th Street SE
- 1st Avenue from DeLaSalle Drive NE to Central Avenue
- 1st Avenue from 2nd Street N to 9th Street N
- Hawthorne Avenue from 9th Street N to 12th Street N

Along the corridor, the study area has been divided into the following three distinct sub-areas:

- South End: Lyndale Avenue N to 12th Street N
- Downtown: 12th Street N to 1st Street N
- Northeast: 1st Street N to 8th Street SE

Figure ES-1 illustrates the study roadways as well as their proximity to major roadways.



Hennepin Avenue Bicycle Plan



Alliant Engineering

- Downtown Sub-Area
- Northeast Sub-Area
- South End Sub-Area

Figure ES-1
Bicycle Plan Study Limits

Public Involvement

Public involvement is a critical element of any planning process. It is meant to enhance the participation of the community and key stakeholders by providing a means to have a direct impact on the study's decisions. The Bicycle Plan involved the public in a variety of ways:

- Agency Meetings
- Stakeholder Presentations
- Block Meetings/Workshops
- Public Open Houses
- Website

Hennepin Avenue and 1st Avenue Two-Way Conversion Project

The Hennepin Avenue and 1st Avenue Two-Way Conversion Project (Two-Way Conversion Project) will convert Hennepin Avenue to two-way operation between 11th Street N and 2nd Street N (currently there is two-way operation south of 11th Street N and north of 2nd Street N until Wilder Street NE where one-way operation resumes). 1st Avenue will be converted to two-way operation between 9th Street N and 2nd Street N and Hawthorne Avenue will be converted between 12th Street N and 9th Street N. To support the conversion of Hennepin Avenue and 1st Avenue, 2nd Street N will also be converted to two-way operation.



The Two-Way Conversion Project was identified in the Access Minneapolis Downtown Action Plan¹, and was adopted by City Council in June 2007. The broader goal and important considerations relating to roadway design for the two-way conversion, as envisioned by the Downtown Action Plan are to:

- Enhance Economic Vitality
- Improve Local Property Access
- Promote Improved Multimodal Use
- Maintain Safety
- Improve Block to Block Circulation
- Maintain Efficiency

An important element of the Bicycle Plan is to identify the appropriate bicycle facility to be implemented within the Downtown sub-area in coordination with the Two-Way Conversion Project.

¹ Access Minneapolis Downtown Action Plan, 10-Year Transportation Action Plan, City of Minneapolis, June 29, 2007.

Design Guidelines

The following resources were used in preparing the Bicycle Plan:

- Mn/DOT Bikeway Facility Design Manual, March 2007
- American Association of State Highway and Transportation Officials (AASHTO) Guide for Development of Bicycle Facilities, 1999
- Access Minneapolis Downtown Action Plan, 10-Year Transportation Action Plan, City of Minneapolis, June 29, 2007
- Access Minneapolis Design Guidelines for Streets and Sidewalks, City of Minneapolis, February 22, 2008
- Minnesota Manual on Uniform Traffic Control Devices (MMUTCD), 2005
- Minnesota State Rule 8820

Bicycle Plan Purpose

The direct and regional connectivity of Hennepin Avenue makes this corridor well suited to serving as an important piece of the overall bicycle network. The purpose of the Bicycle Plan is to identify the feasibility of providing bicycle lanes or accommodations within the corridor and to identify the appropriate lane configurations and document impacts. The Bicycle Plan will also identify bicycle improvements, roadway improvements, improved bicycle parking and other elements to encourage and promote increased bicycling and improved safety. The Bicycle Plan includes documentation of the following components:

- Introduction
- Existing and Future Transportation Network
- Evaluation of Alternatives
- Recommended Bicycle Plan



An example of shared lane usage.

Existing and Future Transportation Network

An examination of the existing and future transportation characteristics included a review of geometric and operation elements, transit, motor vehicle and bicycle demand, bicycle network and roadway safety.

Geometric and Operation Elements

Within the study limits, Hennepin Avenue currently consists of five different cross-section types. Hennepin Avenue was divided into six segments based upon the existing roadway cross-sectional characteristics. The segments include:

- Segment 1: Lyndale Avenue N to 11th Street N (5-lane undivided).
- Segment 2: 11th Street N to 2nd Street N (northbound one-way, two-way center bike lane and southbound bus only lane).
- Segment 3: 2nd Street N to Wilder Street NE (6-lane divided).
- Segment 4: Wilder Street NE to Central Avenue (northbound one-way).
- Segment 5: Central Avenue to 2nd Avenue SE (northbound one-way).
- Segment 6: 2nd Avenue SE to 8th Street SE (4-lane undivided).

1st Avenue currently consists of two different cross-sectional designs. As such, 1st Avenue was divided into two segments based upon the roadway cross-sectional characteristics. It should be noted that between 9th Street N and 12th Street N, 1st Avenue becomes Hawthorne Avenue. The segments include:

- Segment 1: 12th Street N to 2nd Street N (southbound one-way).
- Segment 2: DeLaSalle Drive NE to Central Avenue (southbound one-way with 2-side parking).

There are many characteristics and factors that influence the design of bicycle facilities. The following key existing geometric and operation characteristics are documented. Detail discussion is provided in Chapter 2.0 and Appendix A.

- Roadway function and street type classification
- Street width
- Motor vehicle speeds
- On-street parking
- Pavement type and condition
- Manholes and catch basin grates

Transit

Encouraging the use of transit is extremely important to maintaining the mobility and sustaining the economic vitality of Downtown Minneapolis. Existing and future transit service within the study area is documented and summarized in the following:

- There are approximately 30 buses per peak hour in each direction operating along Hennepin Avenue in the Downtown sub-area
- The segment between 4th Street N and Washington Avenue N accommodates approximately 60 buses per direction during the peak hour (14 bus routes).



Heavy bus activity on Hennepin Ave.

- The Access Minneapolis Downtown Action Plan identifies Hennepin Avenue as the Southwest Transit Spine. Over the next 20 years, the bus service is expected to nearly double to approximately 110 buses per hour (55 buses per direction).

Motor Vehicle and Bicycle Demand

The roadway motor vehicle and bicycle traffic volume is an important consideration in determining the appropriate intersection design, lane configurations and bicycle accommodations. Existing motor vehicle Average Daily Traffic (ADT) volumes were provided by the City of Minneapolis through their Transportation Management Database. The City of Minneapolis field collected bicycle volumes at six locations in August 2008.

Table ES-1 documents the existing and forecast year 2030 motor vehicle and bicycle ADT volumes. Forecast year 2030 ADT volumes for the South End and Downtown sub-areas (locations 1, 2, 4 and 8) were obtained from the Access Minneapolis Downtown Action Plan provided by the City of Minneapolis. The Northeast sub-area (Locations 5, 6 and 7) forecast year 2030 ADT values were estimated by applying a 0.5 percent per year annual growth rate.

Table ES-1. Existing and Forecast 2030 Motor Vehicle and Bicycle ADT

Count Location	Existing - Motor Vehicle (ADT)		2030 Forecast ² - Motor Vehicle (ADT)	Existing - Bicycle (ADT) ⁴
	Count Data Date ¹	ADT	ADT	ADT
Location 1 (Henn. Ave @ 12th St N)	June-04	15,400	18,300	840
Location 2 (Henn. Ave @ 6th St N)	July-08	22,600	15,700	1,175
Location 3 (Henn. Ave @ 4th St N)	October-07	26,900	15,400	1,430
Location 4 ¹ (Henn. Ave @ Bridge)	October-07	29,500	33,200	1,200
Location 5 ⁵ (1st Ave @ 2nd St NE)	October-07	19,600	22,000	540
Location 6 ⁵ (Henn. Ave @ Univ. Ave NE)	July-07	12,000	13,500	290
Location 7 ⁵ (Henn. Ave between 7th & 8th St SE)	October-08	11,584	13,000	NA
Location 8 (1st Ave between 3rd St N & 4th St N)	September-05	16,870	14,300	NA

¹ All Data Obtained From City Of Minneapolis Transportation Management System Database. Where 24-Hour Counts Unavailable 12-hour Counts Were Extrapolated into 24-Hour (Using 70% Factor) and PM Peak Hour Factor of 9%

² Access Minneapolis Downtown Study. Synchro File CBD-PM-2030-Hybrid3E-RevB-narrowed lanes.sy7 provided by the City of Minneapolis and SEH. (Location 1, 2, 3, 4 and 8)

³ City of Minneapolis, Data Collected August 2008

⁴ 13-Hour count data used to estimate ADT. ADT estimated by using 80% factor.

⁵ Year 2030 vehicle ADT estimated based upon a 0.5% per year annual growth rate

Peak hour motor vehicle volumes are necessary to evaluate intersection capacity needs and/or impacts associated with the provision of bicycle lanes or other design features. A total of 31 intersections were evaluated including:

- All signalized intersections along Hennepin Avenue between Lyndale Avenue N and 1st Street N.
- All signalized intersections along 1st Avenue N between 12th Street N and 2nd Street N.
- The intersection of 1st Avenue at University Avenue NE.

The presence of a higher commercial truck and bus composition can decrease the comfort for bicyclists. Design considerations may be explored to improve bicycling comfort or the provision of wider bicycle lanes will be provided where feasible to address this concern.

- The South End and Downtown sub-areas found commercial trucks to represent 19 percent and buses to represent six percent of the total motor vehicle volume.
- The Northeast sub-area found commercial trucks to represent 26 percent and buses to represent three percent of the total motor vehicle volume.

Bicycle Network

Two major components make up the bicycle transportation network: designated on and off-street bicycle facilities and bicycle parking. The existing, planned and funded bikeways were identified and the existing bicycle parking along Hennepin Avenue and 1st Avenue was inventoried.

An important consideration of the Bicycle Plan will be to actively sign and/or appropriately design the connections to the other major bikeways (e.g., Cedar Lake Trail and Loring Bikeway).

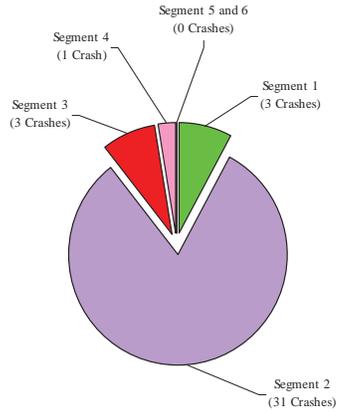
Roadway Safety

A review of the Hennepin Avenue crash records was conducted to evaluate the existing safety characteristics. In examining these crashes, five key factors were considered:

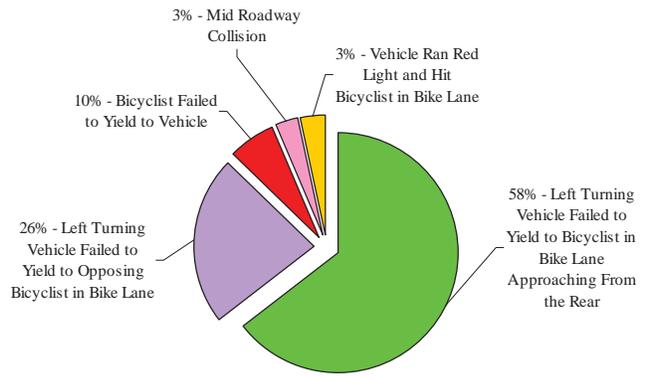
- Intersection crash type
- Segment crash rate
- Downtown sub-area bicycle and pedestrian crash breakdown
- Pedestrian and bicycle intersection crash rate
- Pedestrian and bicycle crash detail

The bicycle and pedestrian related crashes reported for Hennepin Avenue are illustrated in Table ES-2 and Table ES-3.

Table ES-2. Bicycle Crash Summary

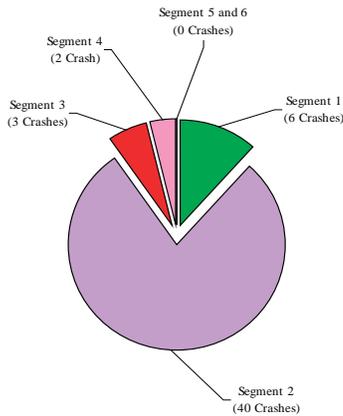


Total Bicycle Crashes by Segment

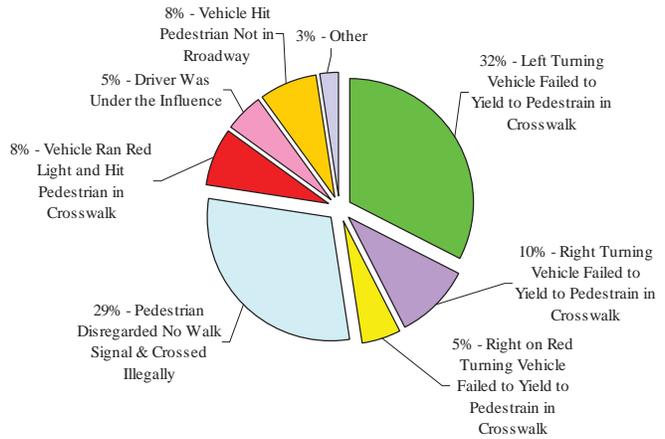


Segment 2 (Downtown) Bicycle Crash Breakdown By Crash Type

Table ES-3. Pedestrian Crash Summary



Total Pedestrian Crashes by Segment



Segment 2 (Downtown) Pedestrian Crash Breakdown By Crash Type

Segment Legend
• Segment 1: Lyndale Avenue N to 11th Street N (5-lane undivided), 2,634 ft in length.
• Segment 2: 11th Street N to 2nd Street N (northbound one-way, two-way center bike lane and southbound bus only lane), 4,030 ft in length.
• Segment 3: 2nd Street N to Wilder Street NE (6-lane divided), 2,123 ft in length.
• Segment 4: Wilder Street NE to Central Avenue (northbound one-way), 2,384 ft in length.
• Segment 5: Central Avenue to 2nd Avenue SE (northbound one-way), 641 ft in length.
• Segment 6: 2nd Avenue SE to 8th Street SE (4-lane undivided), 651 ft in length.

The following summarizes the bicycle crashes:

- 24 of the 31 bicycle crashes occurred at an intersection. Six of the remaining seven occurred at a property driveway along Hennepin Avenue. The last bicycle crash involved a bicyclist being sideswiped mid-block by a motorist traveling in the same direction.
- 23 of the 31 bicycle crashes involved a bicyclist traveling northbound within the designated bicycle lane.
- 26 of the 31 bicycle crashes (84 percent) involved a northbound motor vehicle making a left turn movement.
- 58 percent of the crashes were directly related to northbound motor vehicle making a left turn and a northbound bicycle approaching from the rear (out of motorist field of vision).
- 26 percent of the crashes were directly related to a northbound motor vehicle making a left turn and failing to yield right of way to a southbound bicycle.
- Six of the seven mid-block crashes occurring at access points were directly related to a northbound motor vehicle making a left turn and striking a northbound bicycles approaching from the rear.
- Three percent was related to a bicycle being struck by a cross street motor vehicle (i.e., running the red light).

The following summarizes the pedestrian crashes:

- 36 of the 40 pedestrian crashes occurred at an intersection. The Remaining four crashes occurred mid-block.
- 29 percent of the crashes occurred as a result of a pedestrian violating the traffic signal and crossing the street illegally.
- 32 percent of the crashes were directly related to a motor vehicle making a left turn on green and striking the pedestrian legally crossing within the crosswalk.
- Ten percent of the crashes were related to a motor vehicle making a right turn on green and five percent related to a right turn on red movement.
- Eight percent of the crashes involved a motorist running the red light and striking a pedestrian legally within the crosswalk.

Existing Issue Areas

The review of the existing and future transportation system characteristics found a number of areas or issues that require special consideration in the alternatives analysis and this Bicycle Plan. The following summarizes the key issues:

- The provision of bicycle lanes in the South End sub-area meeting MSA lane width standards will require removing a northbound travel lane. Intersection capacity will need to be evaluated.

- The existing street width within the Downtown sub-area is a significant constraint and will make for the provision of two-way bicycle lanes and two-way traffic operation a challenge. A balance between the needs of pedestrians, motorists, transit vehicles, on-street parking, loading/unloading and bicyclists will need to be met.
- The roadway safety analysis found the existing center bicycle lane to be a safety hazard. Special consideration will be required to address the significant number of left turn related bicycle crashes.
- The Northeast sub-area may require small portions of on-street parking to be removed in provision of bicycle lanes. In addition, minimum MSA lane width requirements may not be satisfied.
- The intersections of 1st Avenue/Main Street NE and 1st Avenue/University Avenue NE will require special attention in providing bicycle lanes given the existing intersection lane geometrics and lane striping.

Evaluation of Alternatives

The ultimate goal of the Bicycle Plan is to provide an on-street bicycle facility that connects Hennepin Avenue, from Lyndale Avenue N, with Northeast Minneapolis. Based on the existing transportation network characteristics, dynamics of the Two-Way Conversion Project and Downtown sub-area issues, many challenges and constraints are presented. The alternatives identified and evaluated strive to strike a balance between the competing needs of all roadway users and all vested stakeholders.

Key Project Objectives

In evaluating potential designs, each alternative considered is qualitatively measured against 12 key objectives. The key objectives are summarized below:

- Bicycle Safety
- Motor Vehicle Traffic Operations/Safety
- Transit and Delivery Loading/Unloading Conflicts
- Pedestrian Conflicts
- Traffic Laws and Ordinances
- Continuity/Consistency of Bike Lane Over Corridor
- Skill Level (Accommodate Type A and Type B Bicyclists)
- Accessibility to Bike Lane from Cross-Streets
- Directness of Bike Route
- MSA Standards / City Design Guidelines
- Maintenance
- Accommodate On-Street Parking/Loading

Complete Street Concept

The Bicycle Plan embraces the complete street concept and works to balance the needs of all roadway users, aims to uphold the vision of the Minneapolis Downtown Action Plan and selects a design that maximizes the benefits to all users. The following key roadway user and stakeholder needs will be incorporated into the Bicycle Plan:



- **Circulation.** The business community has helped lead the way for many years in achieving the Two-Way Conversion Project. As part of reconfiguring of Hennepin Avenue and 1st Avenue to two-way streets, mobility, access and safety of motor vehicle traffic to circulate efficiently is a key concern. The provision of left turn lanes is a high priority.
- **Transit.** Hennepin Avenue serves as a major transit link through Downtown. Over the next 20 years, transit vehicles and routes serviced via Hennepin Avenue are expected to nearly double. Providing efficient transit service and safe operation of the bus routes and bus stops is a critical consideration. Metro Transit also expressed the implicit safety concern of placing bicycle lanes to the right of bus stops.
- **Bicycle Facilities.** Hennepin Avenue currently provides designated center running bicycle lanes between 11th Street N and 2nd Street N. Safety of the existing facility and of any future lanes is a major consideration. However, the provision of a facility that links Lyndale Avenue N to Northeast Minneapolis is a high priority and is an essential element of the corridor.
- **On-Street Parking.** On-street parking is highly valued by the business community and is vital to the economic vitality of the corridor. On-street parking competes for street space and needs to be maximized in the balance with the other roadway users.
- **Loading/Unloading.** Both Hennepin Avenue and 1st Avenue accommodate significant loading and unloading activities (taxi cabs, valet parking, drop-off/pick-up and commercial needs). Accommodating this activity will be critical.
- **Pedestrians.** Both Hennepin Avenue and 1st Avenue are Activity Area Streets and are highly commercialized. Pedestrian activity throughout the corridor is abundant. Sidewalks are provided and the sidewalk space will remain unchanged with the project. Any elements to improve the pedestrian environment will be considered through the planning process.
- **Agency and State Engineering Standards.** Working within the context of City, State and Federal design standards is vital. Although flexibility in design will be used where appropriate, meeting minimum design standards, MSA requirements and/or other standards required based on engineering judgment is necessary to reduce risk and liability exposure.

Preferred Alternatives

On an urban thoroughfare roadway, there are four primary configurations for implementing on-street bicycle lanes. These include:

- Two-way center running
- Two-way curb lane
- Two-way contra-flow (one side of the roadway)
- One-way pair curb lane

A general safety, conflict point analysis and pros and cons assessment was completed for each option. Although each option has many pros and cons, the key conclusion of this assessment found the provision of bicycle lanes along the curb to provide the least safety and operation concern.

Under each of the four primary bicycle lane typical sections, numerous possible lane configurations can be created. Each alternative was reviewed and given a qualitative rating of poor, fair or good and were assessed based upon the key objectives highlighted previously. The following preferred alternatives were identified:

- **South End Sub-Area (Segment 1):**

Convert Hennepin Avenue into a four lane undivided roadway and provide two-way bicycle lanes on the curb.

- **Downtown Sub-Area (Hennepin Avenue Segment 2) (See Appendix G):**

- **Alternative 1b:** Two-way bicycle lane center running with left turn lanes (five lane roadway section, all motor vehicle lanes are general purpose)
- **Alternative 4:** Two-way curb bicycle lane with four general motor vehicle lanes and no left turn lanes.
- **Alternative 6:** One-way northbound curb bicycle lane (right side) with five general purpose motor vehicle lanes including left turn lanes. Southbound bicycle lane is provided on 1st Avenue.
- **Alternative 13a:** One-way northbound bicycle lane striped left of shared right turn/transit lane (left turn lanes provided). Hennepin Avenue is three general motor vehicle lanes including left turn lane with outside lanes being shared bus/right turn lanes. Southbound bicycle lane is provided on 1st Avenue
- **Alternative 13c:** Modified three-lane cross-section with left turn lanes and shared bus/bike/right turn lane in both directions Exclusive two-way curb bicycle lanes provided on 1st Avenue.

- **Downtown Sub-Area (1st Avenue Segment 1) (See Appendix G):**

- **Alternative 1:** One-way southbound curb bicycle lane with east side on-street parking. 1st Avenue has four motor vehicle lanes and no exclusive turn lanes (Paired with Hennepin Avenue Alternative 6 or 13a).

- **Alternative 2:** One-way southbound bicycle lane with west side on-street parking. 1st Avenue has four motor vehicle lanes and no exclusive turn lanes (Paired with Hennepin Avenue Alternative 6 or 13a).
 - **Alternative 5:** No bicycle lanes. Five lane roadway section with center left turn lane and no parking during peak hours. Three-lane section with on-street parking both sides during off peak hours (Paired with Hennepin Avenue Alternative 1b, 4 or 13c).
 - **Alternative 6:** Two-way curb bicycle lanes. Four travel lanes and no on-street parking provided during peak hours. During off peak hours, on-street parking is provided in the right travel lane, offset from the curb (Paired with Hennepin Avenue Alternative 13c).
- **Northeast Sub-Area (Hennepin Avenue Segment 3 and 4 and 1st Avenue Segment 2):**
 - Hennepin Avenue Segment 3 and 4. Provide one-way bicycle lane on the curb with on-street parking where existing (Bicycle lane could be on the left).
 - 1st Avenue Segment 2. Provide one-way bicycle lane on the curb with on-street parking where existing (Bicycle lane could be on the left).
 - **Northeast Sub-Area (Segment 5 and 6):**
 - Hennepin Avenue Segment 5 and 6. Provide curb lane bicycle lane or retain existing condition.

Evaluation of Preferred Alternatives

The preferred alternatives were presented at stakeholder meetings, public open houses and the block meetings. Input and comments were gathered. In addition to the public involvement, the preferred alternatives evaluation included the following:

- Evaluation matrix comparing an assessment of the key project objectives
- Pros and cons assessment
- On-street parking impact evaluation
- Traffic operation analysis (select intersections).
- Design standards



Detailed results, comparisons and discussion of impacts for all three sub-areas is discussed in the “Evaluation of Alternatives” chapter.

Recommended Bicycle Plan

Recommendations were developed based upon the input received from stakeholder and community meetings, evaluation of all feasible alternatives and balancing the impacts. The following sections document the recommended Bicycle Plan. A concept layout illustrating the key pavement marking and roadway signing elements of the recommended Bicycle Plan is shown in Figure 11 to Figure 18.

Recommended Roadway Cross-Section – South End Sub-Area

The South End sub-area includes Hennepin Avenue between Lyndale Avenue N and 12th Street N (Segment 1). Recommendations include:

- Convert Hennepin Avenue to a four lane undivided roadway with no exclusive left turn lanes.
- Provide a minimum of a seven foot bicycle lane along the curb in both the northbound and southbound directions.
- Begin the northbound bicycle lane just west of Lyndale Avenue N to allow for an appropriate distance to transition Hennepin Avenue to two motor vehicle lanes.
- End the southbound bicycle lane at 16th Street N.
- The extension of the southbound bicycle lane should not occur until bicycle lanes are pursued on Dunwoody Boulevard further to the west. At such time, a shared-lane configuration will be required between 16th Street N and Aldrich Avenue due to the limited street width.

Recommended Roadway Cross-Section – Downtown Sub-Area

The Downtown sub-area includes the segment of Hennepin Avenue between 12th Street N and 1st Street N (Segment 2) and the segment of 1st Avenue between 2nd Street N and the Hawthorne Avenue/12th Street N intersection (Segment 1). The recommendations are as follows:

- On Hennepin Avenue, implement Alternative 13c. Alternative 13c (modified three lane section with exclusive left turn lanes, a general traffic lane and a shared bus/bike and right turn lane) is expected to strike the best balance between all constituent groups and transportation modes. The following are the key factors in this determination:
 - Balances the motor vehicle operation and marks the roadway consistent with how the predominate number of motorists are expected to utilize or operate on Hennepin Avenue.
 - Provides exclusive left turn lanes and maintains the intended circulation through downtown in serving the business community.
 - Expected to improve bicycle safety by promoting awareness and two-party responsibility between both the motorist and the bicycle.
 - Improves transit service and operation by reducing motor vehicle conflicts.
 - Reduces bicycle conflicts with curbside uses and transit stops by delineating the bicycles to the left.

- Enhances curbside activity by reducing the conflicts with general traffic.
 - Removes bicycles from conflicts with same direction left turning motor vehicles.
 - Encourages a “complete street” or “complete corridor” approach to the transportation system when considering 1st Avenue and Nicollet Mall. Three different facilities will be provided to serve the varying skill levels of all bicyclists traveling through downtown.
 - The extension of two-way bike lanes along 1st Avenue provides a necessary connection to the Cedar Lake Trail.
 - Provides continuity and consistent bicycle alignment along both directions of Hennepin Avenue in transitioning west of 12th Street N and transition across the Hennepin Avenue Bridge into Northeast Minneapolis.
 - Does not require special pavement rehabilitation or snow removal maintenance activities.
 - Meets MSA design standards and minimum lane width requirements on all block segments.
- On 1st Avenue implement Alternative 6. Alternative 6 (four lane undivided roadway with two-way curb bicycle lane and offset managed on-street parking lane) is expected to strike the best balance between all constituent groups and transportation modes. The following are the key factors in this determination:
 - Encourages a “complete street” or “complete corridor” approach to the transportation system when considering Hennepin Avenue and Nicollet Mall. Three different facilities will be provided to serve the varying skill levels of all bicyclists traveling through downtown.
 - Increases the sidewalk area and improves the pedestrian environment by providing a larger buffer area between the moving motor vehicle lane.
 - Maximizes the available street space and best meets the needs of all roadway users.
 - Best balances the retention and use of on-street parking while providing bicycle lanes and reducing impacts to mobility.
 - Install No Parking, No Stopping 7 to 9 AM and 3 to 6 PM on 1st Avenue between 9th Street N and 2nd Street N
 - Install No Parking Anytime on Hawthorne Avenue between 9th Street N and 12th Street N.

Recommended Roadway Cross-Section – Northeast Sub-Area

The Northeast sub-area includes the segment of Hennepin Avenue between 1st Street N and 8th Street SE (Segment 3, 4, 5 and 6) and the segment of 1st Avenue between 8th Street SE and DeLaSalle Drive NE (Segment 2). The recommendations are as follows:

- Implement on-street bicycle lanes on the right side of the roadway, maintaining three

- motor vehicle lanes in each direction.
- Remove the inside southbound right turn lane at the 1st Avenue/University Avenue NE intersection and stripe a designated bicycle lane to the left of the outside exclusive motor vehicle right turn lane.
 - In the northbound direction of Hennepin Avenue, end the bicycle lane at Central Avenue. The extension of the northbound bicycle lane through 8th Street SE should not occur until bicycle lanes are pursued on Hennepin Avenue further to the northeast. Further review and development of a concept layout is recommended to occur at such future time.
 - On 1st Avenue, begin the bicycle lane at Central Avenue.
 - Install No Parking Anytime on Hennepin Avenue between 4th Street NE and 5th Street NE (east side of Hennepin Avenue).
 - Install No Parking Anytime on 1st Avenue between 4th Street NE and University Avenue NE (both sides).
 - Install No Parking Anytime on 1st Avenue between University Avenue NE and 2nd Street NE (east side of 1st Avenue).
 - Install four parking meters on 1st Avenue between 2nd Street NE and Main Street NE (west side of 1st Avenue).

Recommended Intersection and Roadway Treatments

Several supplemental intersection and roadway treatments have been identified to improve bicycle and pedestrian safety, to help promote the importance of these bicycle corridors and to establish appropriate delineation. The recommended intersection and roadway treatments include:

- Install Bike Boxes at the following locations
 - Hennepin Avenue at 16th Street N (southbound)
 - Hennepin Avenue at 11th Street N (northbound)
 - Hennepin Avenue at 2nd Street N (eastbound)
 - Hawthorne Avenue at 12th Street N (southbound)
 - Hawthorne Avenue at 10th Street N (southbound)
 - 1st Avenue at 4th Street N (southbound)
 - 1st Avenue at 2nd Street N (westbound)
- Install Pedestrian Countdown Timers

The traffic signals along Hennepin Avenue and 1st Avenue are being re-built with the Two-Way Conversion Project, countdown timers should be implemented with the new systems. At other signalized intersections, the City of Minneapolis should implement the countdown timers as the opportunity arises or as their operating budget allows.

- Install a Colored Bike Lane Delineation on 1st Avenue

On 1st Avenue, the block segments containing the off-set managed parking lane, the bicycle lane should include special delineation. It is recommended the bicycle lane be seal coated with a red colored pavement pigmentation. In addition, the bicycle lane should be marked with a solid double white edge line between the bicycle lane and adjacent motor vehicle lane. The double white edge line and colored pavement will provide a substantial awareness to the motorists and is expected to help maintain compliance.

- Install Protected/Permissive Left Turn Signal Phasing at Hennepin Avenue/8th Street N

The traffic operation analysis found an operational benefit to the provision of a protected/permissive southbound left turn phase. A supplemental benefit of the left turn arrow phase is that a reduction in motor vehicle/pedestrian left turn on green conflicts typically results.

- Install No Turn on Red at Bike Box Locations

Install a No Turn on Red sign on the motor vehicle approaches containing bike boxes. The presence of the No Turn on Red sign may help improve compliance and effectiveness of the bike boxes.

- Install Shared Use Pavement Markings and Associated Regulatory Signing on Hennepin Avenue

On Hennepin Avenue between 12th Street N and Washington Avenue N, shared use pavement markings (Sharrows) should be installed three per block. The Sharrows provides orientation to the bicyclist the location in the lane they are to ride. The Sharrows also give a visual indication and brings awareness to the motorist the presence of bicyclists. On 13.5 foot blocks with left turn lanes, the Sharrow should be marked in the center of the lane, combined with a “Bicycle May Use Full Lane” regulatory sign. On blocks without left turn lanes, where an 18 foot shared lane exists, the Sharrow should be installed on the left side of the lane. The Sharrow should be combined with the lane use designation sign shown to the right.



Recommended Connection Treatments

Integrating the bicycle lanes on Hennepin Avenue and 1st Avenue with each other and with other major bicycle facilities is critical. The recommended connection treatments are summarized below:

- **Loring Bikeway.** The southern termini of the Hennepin Avenue corridor should provide an easy connection to the Loring Bikeway.

- Install southbound bike box at Hennepin Avenue/16th Street N intersection.
 - Install Bike Lane Ends sign and provide a wayfinding directional sign.
 - Install sharrows on 16th Street N.
 - Install wayfinding directional sign from Loring Bikeway to Hennepin Avenue.

- **Cedar Lake Trail.** A primary benefit of the recommended Hennepin Avenue and 1st Avenue bicycle lane alternatives is the connection to the Cedar Lake Trail could easily be established. 11th Street N provides direct connection and existing on-street bicycle lanes are provided.
 - Consider installing wayfinding signs along Cedar Lake Trail directing bicyclists to Hennepin Avenue and 1st Avenue.
 - Install northbound bike box at Hennepin Avenue/11th Street N intersection.
 - Install wayfinding signs at Hennepin Avenue/11th Street N and Hawthorne Avenue/11th Street N intersections.

- **Hennepin Avenue to 1st Avenue Interconnection (north and south end).** To provide successful operation of the Hennepin Avenue and 1st Avenue bicycle facilities, easy and clearly marked transition locations should be made on both the north and south ends.
 - Provide a designated lane (northbound only) on Hennepin lane between 12th Street N and 11th Street N.
 - Install wayfinding signs at the Hennepin Avenue/11th Street N, Hawthorne Avenue/11th Street N, Hawthorne Avenue/12th Street N, 1st Avenue/2nd Street N and Hennepin Avenue/2nd Street N intersections.
 - Implement bicycle lanes on 2nd Street N between Hennepin Avenue and 1st Avenue. 2nd Street N should consist of a three-lane cross-section with a center left turn lane and two-way curb bicycle lanes. On-street parking should be provided on the southerly curb face.
 - Install bike boxes at the Hennepin Avenue/11th Street N (northbound), Hawthorne Avenue/12th Street (southbound), Hennepin Avenue/2nd Street N (eastbound) and 1st Avenue/2nd Street N (westbound) intersections.

Wayfinding

Wayfinding is a vital component of an effective bicycle system. Bicyclists need to be able to easily understand and navigate the bicycle network to conveniently find their destinations. The Bicycle Plan is promoting the use of both Hennepin Avenue and 1st Avenue as a tandem and integrated corridor facilitating both Type A and Type B bicyclists. Wayfinding is necessary at connection points to achieve this operation. In addition, wayfinding signing should be considered at locations providing connection to other major bikeways that aren't readily apparent. These facilities include the Loring Bikeway and Cedar Lake Trail. Wayfinding signs are recommended at the following locations:

- Hennepin Avenue at 16th Street N
- Harmon Place at Maple Street N
- Hennepin Avenue at 11th Street N
- Hawthorne Avenue at 11th Street N
- Hawthorne Avenue at 12th Street N
- 1st Avenue at 2nd Street N
- Hennepin Avenue at 2nd Street N
- Hennepin Avenue at 5th Street NE



Bicycle Parking

Bicycle parking facilities are essential elements for bicycle transportation. Bicycle parking facilities should be provided at both trip origin and destination points and offer a protection from theft and damage. The wide variety of bicycle parking devices is general grouped into two security levels: secure (e.g. bicycle lockers) and less-secure (e.g. bicycle racks). The overall goals were to make sure that bicyclists using either Hennepin Avenue or 1st Avenue would have safe and convenient locations to store their bicycles and serve to further promote bicycling within the corridor. The need for long term bicycle parking (bicycle lockers) was identified at the following locations:



Bicycle racks on Hennepin Ave.

- Hawthorne Avenue at 9th Street N near the Hawthorne Transit Station
- 1st Avenue at 5th Street N near the Hiawatha Light Rail Station
- Hennepin Avenue and University Avenue NE
- Hennepin Avenue at 4th Street NE
- Hennepin Avenue at Central Avenue

Bicycle racks are recommended on block segments according to the following guidelines and are denoted on Figure 22:

- Block segments containing land uses expected to attract or be a destination point for pedestrian and bicycle traffic
- Block segments where a need was observed (i.e., bicycles locked to trees or posts)
- Other logical points or gaps along the corridor

Ornamental bicycle racks are recommended at the following location:

- Northeast corner of the Hawthorne Avenue/9th Street N intersection

Bicycle Promotion, Awareness and Maintenance Plan

Making the physical environment safer and more pleasant for bicycling is vital for increasing non-motorized and transit travel. The City of Minneapolis has adopted several programs to promote and bring awareness to bicycling within the city:

- Assembly of and on-going regular Bicycle Advisory Committee (BAC) meetings
- Full-time NTP Project Coordinator responsible for managing and promoting bicycle projects and programs
- Full-time Bike Walk Ambassadors and outreach program
- Bicycle share program
- Private/Public cost participation program for bicycle racks

A specific plan has been developed and will be presented in the Central Avenue Bicycle Plan. The following provides a summary of a few additional elements that may be considered in the bicycling promotion and awareness program:

- Promote school and community education classes to teach the fundamentals of safe bicycling, state laws, bicycle maintenance and commuting.
- Host outreach events with area employers or to coincide with large city events.
- Distribute and provide easy access to digital bicycle maps via website, email or other digital media means.
- Work with the TMO and Travel Demand Management program to improve private bicycle parking and encouragement of mode share incentives.

Adopting a routine and regular maintenance program for the bicycle facilities is critical. Key elements and objectives of the maintenance program may include:

- Routinely clean and maintain the bikeways to a relatively hazard free standard.
- Encourage bicyclists to use 311 or other means to promptly report maintenance issues or other hazards.
- Design and build bikeways to minimize the potential for the collection of debris and other hazards.
- Identify a funding source (e.g., bicycle rentals or bike share program) to use towards developing a maintenance program
- Systematically maintain signs, pavement markings and other bicycle delineation and traffic control devices.

Implementation Plan and Cost Estimate

The implementation of the Bicycle Plan does not require roadway reconstruction and can be easily installed once funding becomes available. The primary components of the Bicycle Plan include new pavement markings, roadway signing and additional bicycle parking.

Implementation of the Bicycle Plan should be prioritized as follows:

- Immediate Priority (2009-2010):

The City of Minneapolis has programmed the Two-Way Conversion Project for 2009, which includes the on-street bicycle accommodations. The Two-way Conversion is expected to be complete by early 2010. The following is recommended to be installed in 2009:

- Implement the recommended Downtown sub-area (Hennepin Avenue and 1st Avenue between 12th Street N to 1st Street N) roadway cross-section.
- Implement the ornamental bicycle parking at the Hawthorne Avenue/9th Street N intersection.
- Implement the recommended wayfinding signs within the Downtown sub-area.
- Install the intersection improvement treatments applicable to the Downtown sub-area (“Recommended Bicycle Plan” chapter).

- High Priority (2010):

In order to make the appropriate bicycle and motor vehicle lane transitions at the Hennepin Avenue/12th Street N intersection, the South End sub-area recommendations are necessary. In addition, specific direction was given by the Ward 7 Council Member to escalate the priority of implementing the South End sub-area recommendations.

- Implement the recommended South End sub-area (Hennepin Avenue between Lyndale Avenue N to 12th Street N) roadway cross-section.
- Implement the recommended wayfinding signs within the South End sub-area.
- Install the intersection improvement treatments applicable to the South End sub-area (“Recommended Bicycle Plan” chapter).

- Medium Priority (2010-2012):

Extending the bicycle lanes from the Downtown sub-area over the Mississippi River into Northeast Minneapolis is important, however, it may be most practical from a network development perspective to have them coincide with a cross-street facility (e.g., 5th Street NE or Central Avenue). 5th Street NE is programmed to receive bicycle lanes in 2010-2011. At such time, the following is recommended:

- Implement the recommended Northeast sub-area (Hennepin Avenue and 1st Avenue between 1st Street N to Central Avenue) roadway cross-section.
- Implement the recommended wayfinding signs within the South End sub-area.
- Install the intersection improvement treatments applicable to the South End sub-area (“Recommended Bicycle Plan” chapter).

- Install the recommended bicycle parking (see Figure 22) for the South End, Downtown and Northeast sub-areas.

A preliminary cost estimate has been developed for the major components of the recommendations. The following is included:

- Poly-preform ground-in pavement markings
- Seal-coating the bituminous pavement sections
- Blasting the concrete pavement sections
- Black masking behind longitudinal pavement markings on the concrete pavement sections.
- Roadway and wayfinding signs (bicycle related)
- Final design and engineering services (10 percent of construction costs)
- Bicycle parking
- Miscellaneous city expenses

Table ES-4. Preliminary Cost Estimate

Description	Estimated Cost (\$)
South End Sub Area (Hennepin Avenue - Lyndale Avenue N to 12th Street N)	
Pavement Markings ¹	\$63,885.00
Final Design (10%)	\$12,289.75
Roadway Signing	\$5,000.00
Miscellaneous Project Costs	\$10,000.00
Seal Coat	\$51,012.50
Bike Parking (Racks)	\$3,000.00
SUBTOTAL	\$146,000.00
Downtown Sub-Area (Hennepin Avenue / 1st Avenue - 12th Street N to 1st Street N)	
Bike Parking (Racks and 2 Lockers)	\$11,750.00
Ornamental Bike Parking (1st Ave at 8th St)	\$4,000.00
Pavement Markings, Design, Seal Coat, Miscellaneous ²	--
SUBTOTAL	\$15,750.00
Northeast Sub-Area (Hennepin Avenue / 1st Avenue (1st Street N to Central Avenue)	
Pavement Markings ¹	\$154,582.50
Final Design (10%)	\$22,062.50
Roadway Signing	\$7,500.00
Miscellaneous Project Costs	\$15,000.00
Seal Coat (Bituminous Only)	\$48,042.50
Bike Parking (Racks and 3 Lockers)	\$10,500.00
SUBTOTAL	\$258,000.00
Total Project	\$419,750.00

¹ Cost based upon poly preform (ground-in) pavement markings. A black masking is to be provided behind pavement markings applied to concrete roadway surfaces. (Removal of existing pavement markings is included in estimated cost)

² Constructed as part of the Hennepin Ave/1st Ave Two-Way Conversion Project Programmed Funds

Introduction



The City of Minneapolis in partnership with the Non-Motorized Transportation Pilot Program (NTP) has identified a need to prepare a Bicycle Plan for both the Hennepin Avenue and Central Avenue corridors. This report documents the Hennepin Avenue Bicycle Plan (Bicycle Plan) and will be used to identify infrastructure and capital investments, elements to enhance bicycle travel within the corridor, and provides a recommended implementation plan.

Project Location

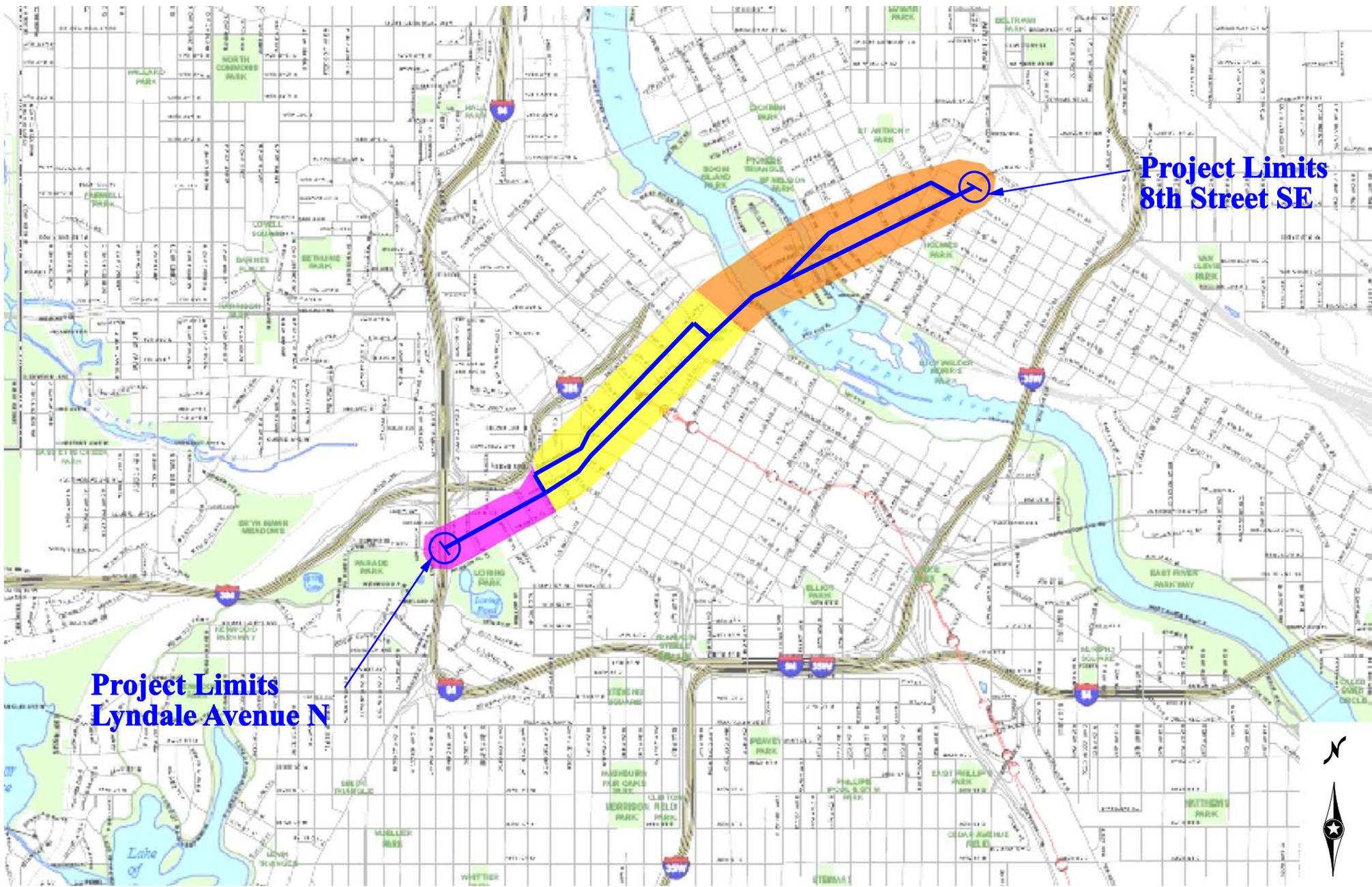
Hennepin Avenue serves as a primary link and direct connection between Uptown, Downtown and Northeast Minneapolis and is a critical segment in interconnecting the City's bicycle network. To fully evaluate the need and design of bicycle facilities specific to the Hennepin Avenue corridor, the Bicycle Plan must also include the parallel segments of 1st Avenue. The corridor limits evaluated in the Bicycle Plan include the following:

- Hennepin Avenue from Lyndale Avenue N to 8th Street NE
- 1st Avenue from DeLaSalle Drive NE to Central Avenue
- 1st Avenue from 2nd Street N to 9th Street N
- Hawthorne Avenue from 9th Street N to 12th Street N

Along the corridor, the study area has been divided into the following three distinct sub-areas:

- South End: Lyndale Avenue N to 12th Street N
- Downtown: 12th Street N to 1st Street N
- Northeast: 1st Street N to 8th Street SE

The sub-area division allows for individual evaluation and prioritization of bicycle needs specific to each area. Figure 1 illustrates the study roadways as well as their proximity to major roadways.



**Project Limits
Lyndale Avenue N**

**Project Limits
8th Street SE**



Hennepin Avenue Bicycle Plan



Alliant Engineering

- Downtown Sub-Area
- Northeast Sub-Area
- South End Sub-Area

**Figure 1
Bicycle Plan Study Limits**

Design Guidelines

The following resources were used in preparing the Bicycle Plan:

- Minnesota Department of Transportation (Mn/DOT) Bikeway Facility Design Manual, March 2007
- American Association of State Highway and Transportation Officials (AASHTO) Guide for Development of Bicycle Facilities, 1999
- Access Minneapolis Downtown Action Plan, 10-Year Transportation Action Plan, City of Minneapolis, June 29, 2007
- Access Minneapolis Design Guidelines for Streets and Sidewalks, City of Minneapolis, February 22, 2008
- Minnesota Manual on Uniform Traffic Control Devices (MMUTCD), 2005

Both Hennepin Avenue and 1st Avenue are Municipal State Aid (MSA) roadways. The design of MSA streets and bridges is governed by design standards that are established Minnesota State Legislature (Minnesota Rules 8820). Any design features that do not meet MSA standards must be approved through a variance process before the construction plans will be approved by Mn/DOT. Therefore, to the extent feasible, the Bicycle Plan intends to meet the provisions of the MSA Requirements. Minnesota Rule 8820.9936 sets forth the minimum required lane widths, parking lane widths and curb reaction distances. Based on the above design resources and the Minnesota Rule 8820.9936, the following minimum lane widths are required by MSA:

- Motor Vehicle Through Lane: 11 feet
- Motor Vehicle Left Turn Lane: Ten feet
- Motor Vehicle Right Turn Lane: 11 feet (13 feet including curb reaction zone)
- Parking Lane (Average Daily Traffic greater than 10,000 motor vehicles): Ten feet
- Parking Lane (Average Daily Traffic less than 10,000 motor vehicles): Eight feet
- Curb Reaction Zone: Two feet

The following standards recognized in the Hennepin Avenue Bicycle Plan are not required by MSA:

- Bicycle Lane (adjacent to parking): Five to six feet (six feet is ideal)
- Bicycle Lane (adjacent to curb): Six to Seven feet including gutter pan (seven feet is ideal)

Coordination with Hennepin Avenue and 1st Avenue Two-Way Conversion

An important element of the Bicycle Plan is to identify the appropriate bicycle facility to be implemented within the Downtown sub-area in coordination with the Hennepin Avenue and 1st Avenue Two-Way conversion project (Two-Way Conversion Project). The Two-Way Conversion Project was identified in the Access Minneapolis Downtown Action Plan², and was adopted by City

2 Access Minneapolis Downtown Action Plan, 10-Year Transportation Action Plan, City of Minneapolis, June 29, 2007.

Council in June 2007. The broader goal and important considerations relating to roadway design for the two-way conversion, as envisioned by the Downtown Action Plan are to:

- Enhance Economic Vitality
- Improve Local Property Access
- Promote Improved Multimodal Use
- Maintain Safety
- Improve Block to Block Circulation
- Maintain Efficiency

The specific goal of accommodating two-way operation on both Hennepin Avenue and 1st Avenue is to strike a balance between the transportation modes and competing needs of each stakeholder. Primary considerations include addressing bicycle safety at intersections, providing bicycle lanes, providing left turn lanes to improve circulation, maintaining efficient transit operation and schedules, accommodating curbside loading, deliveries and on-street parking.

The Two-Way Conversion Project will convert Hennepin Avenue to two-way operation between 11th Street N and 2nd Street N (currently there is two-way operation south of 11th Street N and north of 2nd Street N until Wilder Street NE where one-way operation resumes). 1st Avenue will be converted to two-way operation between 9th Street N and 2nd Street N and Hawthorne Avenue will be converted to two-way operation between 12th Street N and 9th Street N. To support the conversion of Hennepin Avenue and 1st Avenue, 2nd Street N will also be converted to two-way operation. As part of the project, the intersection of Hawthorne Avenue/12th Street N will be reconstructed to allow the I-394 exit ramp traffic (two lanes) to continue northbound onto 1st Avenue, reducing the demand to use Hennepin Avenue. In addition, the easterly side of the 1st Avenue segment (between 8th Street N and 9th Street N) will be reconstructed to provide a consistent cross-sectional width as the remainder of the corridor.



An important consideration is that the Two-Way Conversion Project will not include any curb-line or roadway width changes, other than the two locations noted above. The roadway surface will be re-stripped and seal coated only. Completion of the Two-Way Conversion Project is expected to occur by Spring 2010.

Public Involvement

Public involvement is a critical element of any planning process. It is meant to enhance the participation of the community and key stakeholders by providing a means to have a direct impact on the study's decisions. The Bicycle Plan included agency coordination, stakeholder participation, business owner block meetings and public open houses.

The public involvement component focused heavily on the Downtown sub-area and was conducted in coordination with the Two-Way Conversion Project. The South End and Northeast sub-areas were generally discussed. Specific details and impacts of providing bicycle lanes were not a focus of the public involvement. However, they were discussed in great length with key agency stakeholders. The Northeast sub-area will be presented and discussed with the public as part of the Central Avenue Bicycle Plan, since the businesses and neighborhood organizations for the two corridors overlap.

Agency Coordination

Several coordination meetings with staff from key agencies were held throughout the study process. The agencies involved include:

- City of Minneapolis Public Works
- Hennepin County Transportation Department
- Metro Transit

The purpose of these meetings was to obtain input, provide guidance with respect to the study objectives and discuss solutions to potential impacts and agency concerns.

Stakeholders

The Bicycle Plan in coordination with the Two-Way Conversion Project involved the input of many stakeholders. The stakeholder, presentation dates and their opportunities for comment are summarized below:

- Minneapolis Bicycle Advisory Committee presentations on October 1, 2008, November 12, 2008 and February 4, 2009.
- Downtown Transportation Management Organization presentation on October 23, 2008.
- The Downtown Council presentation on November 26, 2008.
- Warehouse District Business Association presentation on November 11, 2008.
- Downtown Bar Owners presentation on November 18, 2008.
- Hennepin 2010 Partners presentation on October 30, 2008.

Although all stakeholder input is important, particular consideration was given to the Minneapolis Bicycle Advisory Committee (BAC). Meetings with the Minneapolis BAC were held on three separate occasions to coincide with critical milestones of the Bicycle Plan. The meetings are summarized below:

- October 1, 2008. Meeting held to discuss the Hennepin Avenue Bicycle Planning project and to present the preferred conceptual layouts for the Downtown sub-area.
- November 12, 2008. Meeting held to present the recommended alternative concept design layouts and specific design elements included for Hennepin Avenue and 1st Avenue (Downtown sub-area). The BAC motioned to approve the preferred alternatives. The motion carried eight votes to one.

- February 4, 2009. Meeting held to provide an update on the recommended alternative design layouts (Downtown sub-area) and to discuss the evaluation of options to improve connections to other major bikeways at the northern and southern ends of the Downtown sub-area (2nd Street N and 12th Street N, respectively). The recommended connection alternative was presented (refer to Chapter 4.0). The BAC approved the recommended connection alternative unanimously.

Block Meetings

A series of block meetings (two blocks per meeting, 12 meetings in total) were conducted between October 16 and October 28, 2008. The purpose of the block meetings was to provide an opportunity for individual business owners, adjacent property owners or property managers to ask questions or discuss specific issues relating to their block.

Public Open Houses

Three large group public open houses were held over the course of the Bicycle Plan and in coordination with the Two-Way Conversion Project. The public open houses were held on the following dates:

- October 8, 2008 (Information Meeting)
- October 21, 2008 (Information meeting)
- December 3, 2008 (Recommended Alternative)

The first two public open houses were held during the design investigation process and served as venues to present potential concept configurations, solicit public input and to compile concerns, questions and general issues. Both meetings were well attended by the bicycling and business communities. The third public open house presented the recommended alternative for both Hennepin Avenue and 1st Avenue corridors (Downtown sub-area) and gathered final comments and questions.

Project Website

The City of Minneapolis established and managed a project website. The purpose of the website was to provide another way for the general public to be informed about the project and to provide input. Documents prepared for the project were posted to the website. The website included a form allowing interested persons to submit comments and suggestions.

The outcome of the public involvement and coordination with the interested stakeholders on the design issues and ultimately the recommended alternatives garnered positive support from attendees and participants.

Bicycle Plan Purpose

The direct and regional connectivity of Hennepin Avenue makes this corridor well suited to serving as an important piece of the overall bicycle network. The purpose of the Bicycle Plan is to identify the feasibility of providing bicycle lanes or accommodations within the corridor and to identify the appropriate lane configurations and document impacts. The Bicycle Plan will also identify bicycle improvements, roadway improvements, improved bicycle parking and other elements to encourage

and promote increased bicycling and improved safety. The Bicycle Plan includes documentation of the following components:

- Existing and Future Transportation Network
- Evaluation of Alternatives
- Recommended Bicycle Plan

Existing and Future Transportation Network



An efficient transportation system is vital to the economic viability of the city, the region and the state. Minneapolis must remain livable and walkable to maintain its regional and national competitiveness. Transportation along Hennepin Avenue is multi-modal, comprised of pedestrian, bicycle, transit and automobile. There are unique design challenges and often times competing interests associated with each mode. Existing and future transportation network characteristics are documented to provide a baseline condition. The characteristics of the transportation network set the framework for evaluating the feasibility of or impacts of providing bicycle lanes within the Hennepin Avenue corridor. Key considerations documented in this chapter include geometric and operational characteristics, transit characteristics, motor vehicle and bicycle volume demand, bicycle network, and roadway safety.

Geometric and Operation Characteristics

There are many characteristics and factors that influence the design of bicycle facilities. The following sections discuss the key existing geometric and operation characteristics.

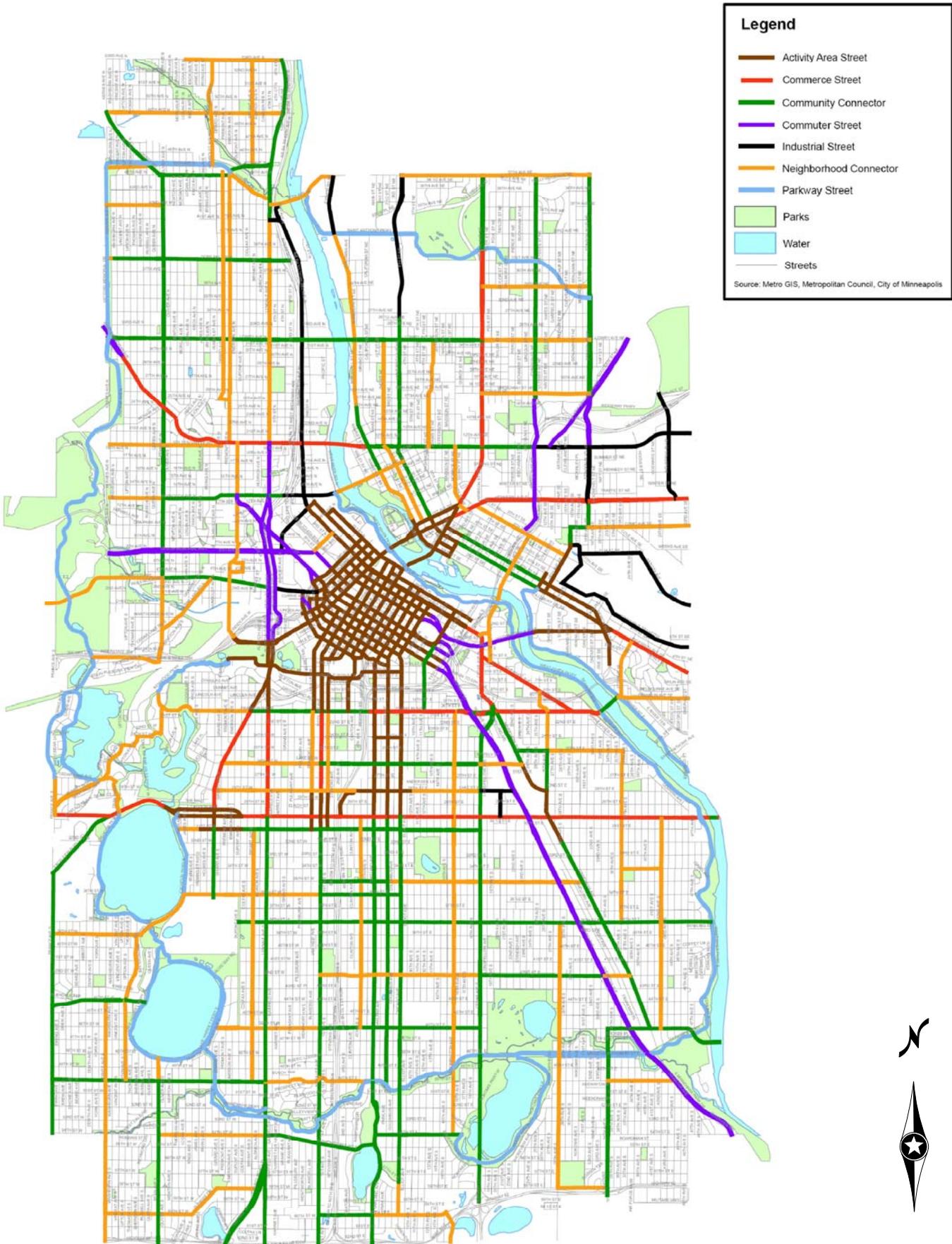
Roadway Function and Street Type Classification

Roadways serve two major functions: access and mobility. The function of a roadway is dependent on its classification. Both Hennepin Avenue and 1st Avenue are classified as an Activity Area Street.³ Figure 2 documents the street types surrounding the study area. Activity Area Streets support retail, service commercial and higher intensity residential land uses in a large node of several blocks. Activity Area Streets may have many different design characteristics and capacities depending on the unique needs within the specific area where they are located.

There is no one design appropriate for an Activity Area Street because each street may have unique needs depending on the adjacent land uses and how the street fits into and serves the area. Activity Area Streets typically need significant pedestrian capacity, need to accommodate high transit loadings/unloadings, often serve high bicycle volumes, and have significant on-street and/or off-street parking demand. Motorist traffic volumes are often high in these areas with a large share of traffic accessing parking and properties within or near the adjoining activity center, growth area or other high density area.

3

Access Minneapolis, Ten Year Transportation Action Plan, Design Guidelines for Streets and Sidewalks, February 2008.



Source: Access Minneapolis Design Guidelines for Streets and Sidewalks Figure 2-3 Street Design Types, February 22, 2008



Existing Cross-Sections

Hennepin Avenue currently consists of five different cross-section types within the project limits. Hennepin Avenue was divided into six segments based upon the existing roadway cross-sectional characteristics. The segments include:

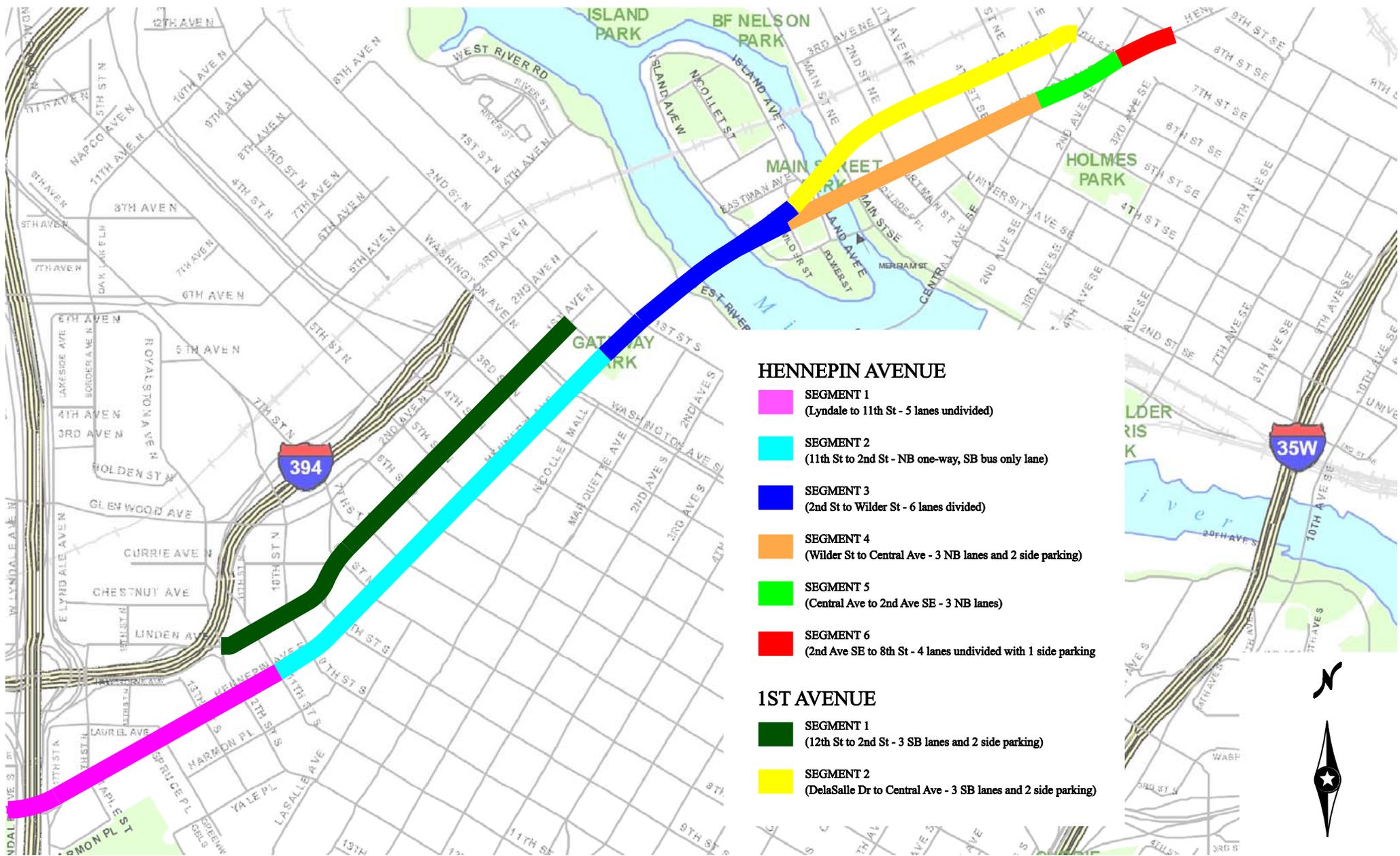
- Segment 1: Lyndale Avenue N to 11th Street N (5-lane undivided).
- Segment 2: 11th Street N to 2nd Street N (northbound one-way, two-way center bike lane and southbound bus only lane).
- Segment 3: 2nd Street N to Wilder Street NE (6-lane divided).
- Segment 4: Wilder Street NE to Central Avenue (northbound one-way).
- Segment 5: Central Avenue to 2nd Avenue SE (northbound one-way).
- Segment 6: 2nd Avenue SE to 8th Street SE (4-lane undivided).

1st Avenue currently consists of two different cross-sectional designs. As such, 1st Avenue was divided into two segments based upon the roadway cross-sectional characteristics. It should be noted that between 9th Street N and 12th Street N, 1st Avenue becomes Hawthorne Avenue. The segments include:

- Segment 1: 12th Street N to 2nd Street N (southbound one-way).
- Segment 2: DeLaSalle Drive NE to Central Avenue (southbound one-way with 2-side parking).

The segment limits are illustrated in Figure 3. As part of the Two-Way Conversion Project, the Hennepin Avenue Segment 2 and 1st Avenue Segment 1 will be changed to two-way traffic operation. The lane geometrics and cross-sectional design will be determined in coordination with the Bicycle Plan.

Both Hennepin Avenue and 1st Avenue consist of urban street design with curb, gutter and adjacent sidewalks along the length of the corridors.



Street Widths

The existing street width is often a primary factor influencing the design of the bicycle lanes or facilities. Insufficient street width to accommodate the demands of other transportation modes may require unique or innovative treatments to provide bicycle lanes, or it may render an on-street bicycle facility infeasible. Widening the roadway or moving curb faces is cost prohibitive and is not a practical consideration for the Bicycle Plan. Therefore, any future bicycle facility within the corridor must fit within the existing street width. Every block segment included in the Bicycle Plan was inventoried. The data was collected from a combination of existing topography surveys, aerial photos and field measurements. The existing street width inventory is provided in Appendix A.

Motor Vehicle Speeds

Motor vehicle speeds is an important consideration in selecting the appropriate on-street bike lane design. The posted speed limit along both Hennepin Avenue and 1st Avenue is 30 mph. However, within the Downtown sub-area, the average operating speed can often be much less when considering the 330 feet traffic signal spacing and peak period congestion.

On-Street Parking

On-street parking along commercial corridors, especially 1st Avenue is highly valued by the business community. On-street parking is a convenience and competes for street space in the same regard as providing accommodations for transit vehicles, automobiles and bicycle lanes. The need to provide on-street parking will be considered in the effort to balance all the street user's needs. However, to adhere to the principles of the Downtown Action Plan of sustaining economic vitality, consideration will be given to minimizing the impact on on-street parking. On-street parking is provided along several Hennepin Avenue blocks (primarily located in the Northeast sub-area) and the majority of the 1st Avenue blocks. Detailed parking on-street counts and locations on a block by block basis are provided in Appendix A. A summary of the estimated on-street parking quantity is as follows:



On-street parking is highly valued by the business community.

- South End sub-area: 25 parking stalls
- Downtown sub-area: 151 parking stalls
- Northeast sub-area: 129 parking stalls

Pavement Type, Pavement Conditions, Manholes and Catch Basin Grates

Hennepin Avenue between Lyndale Avenue N and 1st Street N consists of bituminous pavement and between 1st Street N and Central Avenue is concrete. 1st Avenue is bituminous along its entire length. The pavement type will impact the cost of re-striping and reconditioning the roadway surface to provide bicycle lanes. Other important considerations include the location of manholes, style of catch basin grates and the condition of the longitudinal seam between the gutter pan and bituminous roadway pavement. Each of these features can present hazardous situations for bicyclists if the existing longitudinal seam conditions are poor, the manhole is set too deep or the catch basin grate is parallel with the curb face. Both Hennepin Avenue and 1st Avenue were inventoried and

each block is tabulated in Appendix A. As a result of the inventory, the following key items of concern were found:

- Several locations along Hennepin Avenue between 16th Street N and 11th Street N were noted to contain a rough longitudinal seam.
- Deep set manholes are periodically located adjacent to the curb face (approximately 2 ½ feet wide) along Hennepin Avenue between 16th Street N and Washington Avenue N. The deep set manhole will have the potential to impact curb bicycle lanes.

The longitudinal seam along Hennepin Avenue and 1st Avenue within the Downtown sub-area is also rough in many locations. However, as part of the Two-Way Conversion Project, the roadway seal coating procedure will work to help smooth the seam.

Transit Characteristics

Encouraging the use of transit is extremely important to maintaining the mobility and sustaining the economic vitality of Downtown Minneapolis. There are approximately 30 buses per peak hour in each direction operating along Hennepin Avenue in downtown today. The segment between 4th Street N and Washington Avenue N accommodates approximately 60 buses per direction during the peak hour. Currently buses operate in a mixed traffic lane, with the exception of the southbound Hennepin Avenue bus only contra-flow lane between 2nd Street N and 11th Street N. Table 1 and Table 2 on the following pages display the transit routes serving both Hennepin Avenue and 1st Avenue, respectively. Figure 4 illustrates the location of all bus stops along Hennepin Avenue and 1st Avenue.



The Access Minneapolis Downtown Action Plan identifies Hennepin Avenue as the Southwest Transit Spine. Over the next 20 years, the bus service is expected to nearly double to approximately 110 buses per hour (55 buses per direction).

Table 1. Transit Routes – Hennepin Avenue

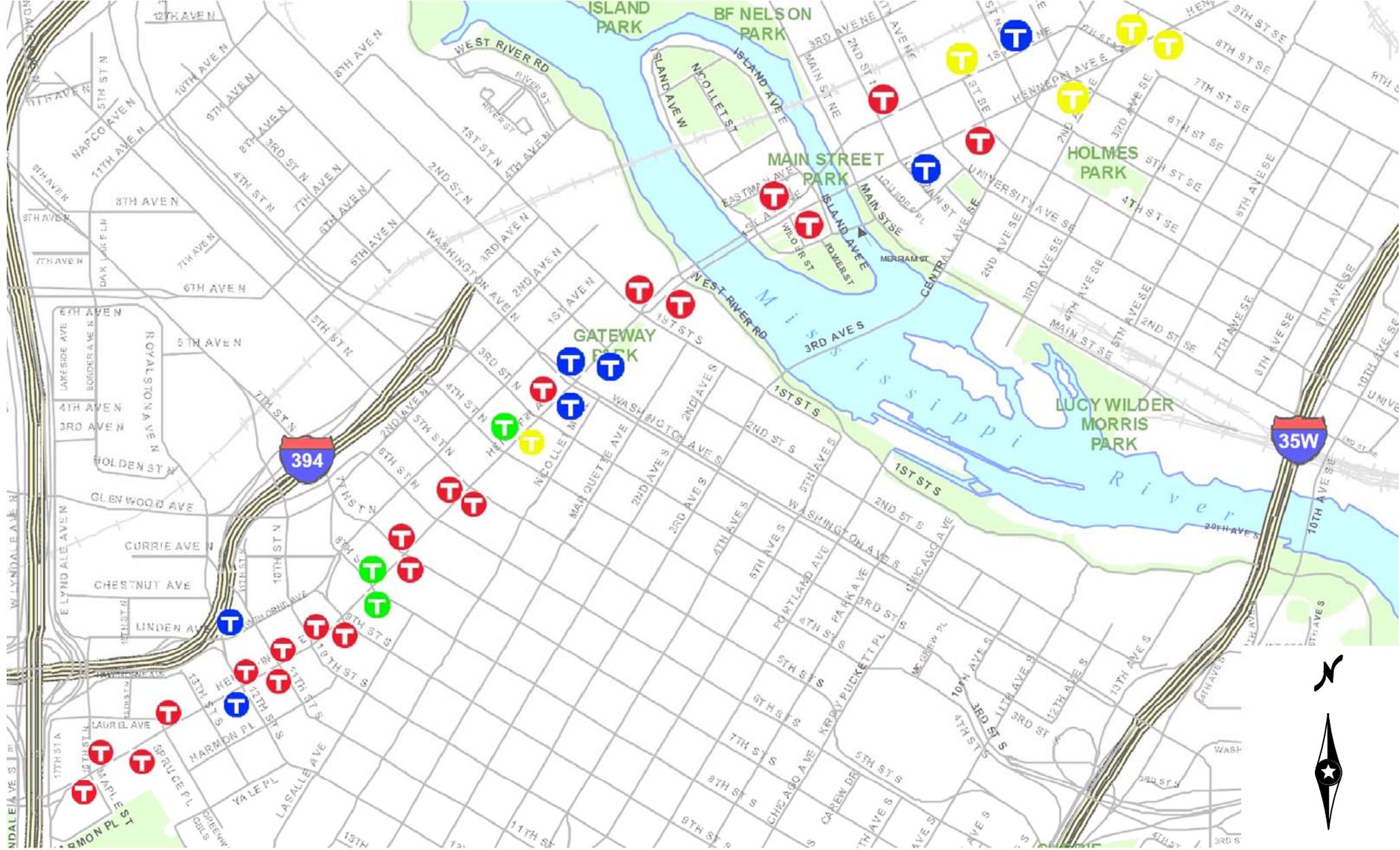
Metro Transit Route	Service Type	Segment	Service Area	Frequency	# of Buses in Peak Hour	# of Buses Daily ¹
3	Local	4th St N - Washington Ave N	Downtown Minneapolis University of Minnesota Dinkytown Como Avenue St. Paul	Rush Hours: 10-15 minute Headway Midday: 10 minute Headway Evening: 15-30 minute Headway Saturday: 30 minute Headway Sunday/Holiday: 30-60 minute Headway	6	101
4	Local	Lyndale Ave N - 8th St SE	New Brighton Silver Lake Village NE Minneapolis Downtown Minneapolis South Minneapolis	Rush Hours: 7-15 minute Headway Midday: 15 minute Headway Evening: 15-30 minute Headway Saturday: 15-30 minute Headway Sunday/Holiday: 30 minute Headway	8	106
6	Local	Lyndale Ave N - University Ave NE	Minneapolis France Avenue South Xerxes Avenue South Edina	Rush Hours: 5-7 minute Headway Midday: 10 minute Headway Evening: 15 minute Headway Saturday: 10-15 minute Headway Sunday/Holiday: 15 minute Headway	12	140
7	Local	4th St N - 1st St N	North Minneapolis Downtown Minneapolis Cedar/Riverside South Minneapolis	Rush Hours: 30 minute Headway Midday: 30 minute Headway Evening: 30 minute Headway Saturday: 30 minute Headway Sunday/Holiday: 30-60 minute Headway	2	38
9	Local	11th St N - 9th St N	Minnetonka St. Louis Park Golden Valley Minneapolis Downtown Minneapolis	Rush Hours: 15 minute Headway Midday: 30 minute Headway Evening: 30 minute Headway Saturday: 30-60 minute Headway Sunday/Holiday: 30-60 minute Headway	4	51
11	Local	Washington Ave N - 2nd St NE	Columbia Heights NE Minneapolis Fridley Downtown Minneapolis South Minneapolis	Rush Hours: 12-15 minute Headway Midday: 30 minute Headway Evening: 30 minute Headway Saturday: 30-60 minute Headway Sunday/Holiday: 30-60 minute Headway	5	58
12	Local/ Limited Stop	Lyndale Ave N - Washington Ave N	Minnetonka Hopkins St. Louis Park Minneapolis	Rush Hours: 15-20 minute Headway Midday: 30 minute Headway Evening: 30 minute Headway Saturday: 30 minute Headway Sunday/Holiday: 30 minute Headway	4	51
14	Local	7th St N - Washington Ave N	Robbinsdale West Broadway Avenue North Minneapolis Downtown Minneapolis South Minneapolis	Rush Hours: 10-15 minute Headway Midday: 15 minute Headway Evening: 20-30 minute Headway Saturday: 15-30 minute Headway Sunday/Holiday: 20-30 minute Headway	6	83
16	Local	4th St N - Washington Ave N	Downtown Minneapolis Minneapolis St. Paul Downtown St. Paul	Rush Hours: 10 minute Headway Midday: 10 minute Headway Evening: 15 minute Headway Saturday: 10 minute Headway Sunday/Holiday: 15-30 minute Headway	6	101
25	Local	Central Ave - 8th St SE	Blaine Mounds View Fridley New Brighton/St. Anthony Minneapolis	Rush Hours: 7-10 minute Headway Midday: 60 minute Headway Evening: No Service Saturday: 80 minute Headway Sunday/Holiday: No Service	8	62
50	Limited Stop	4th St N - Washington Ave N	Downtown Minneapolis Minneapolis St. Paul Downtown St. Paul	Rush Hours: 12 minute Headway Midday: No Service Evening: No Service Saturday: No Service Sunday/Holiday: No Service	5	33
61	Local	9th St N - 8th St SE	Downtown Minneapolis East Hennepin Avenue Industrial Boulevard Macy's Warehouse / UPS St. Paul	Rush Hours: 30 minute Headway Midday: 30 minute Headway Evening: 60 minute Headway Saturday: 60 minute Headway Sunday/Holiday: No Service	2	32
94	Express	4th St N - Washington Ave N	Downtown Minneapolis University of MN (Huron Station) St. Paul Downtown St. Paul	Rush Hours: 5-10 minute Headway Midday: 15 minute Headway Evening: 30 minute Headway Saturday: 30 minute Headway Sunday/Holiday: 30 minute Headway	12	115
824	Limited Stop	1st St N - University Ave NE	Coon Rapids / Blaine Spring Lake Park Fridley Columbia Heights Minneapolis	Rush Hours: 3 trips Midday: No Service Evening: No Service Saturday: No Service Sunday/Holiday: No Service	1	6

¹Bus Count is from 6am-1am Monday-Friday
Source: Metropolitan Council's MetroTransit Website

Table 2. Transit Routes – 1st Avenue

Metro Transit Route	Service Type	Segment	Service Area	Frequency	# of Buses in Peak Hour	# of Buses Daily ¹
4	Local	DelaSalle Dr NE-Central Ave	New Brighton Silver Lake Village NE Minneapolis Downtown Minneapolis South Minneapolis Edina South Metro	Rush Hours: 7-15 minute Headway Middy: 15 minute Headway Evening: 15-30 minute Headway Saturday: 15-30 minute Headway Sunday/Holiday: 30 minute Headway	8	106
6	Local	DelaSalle Dr NE-Central Ave	Minneapolis France Avenue South Xerxes Avenue South Edina	Rush Hours: 5-7 minute Headway Middy: 10 minute Headway Evening: 15 minute Headway Saturday: 10-15 minute Headway Sunday/Holiday: 15 minute Headway	12	140
61	Local	DelaSalle Dr NE-Central Ave	Downtown Minneapolis East Hennepin Avenue Industrial Boulevard Macy's Warehouse / UPS St. Paul	Rush Hours: 30 minute Headway Middy: 30 minute Headway Evening: 60 minute Headway Saturday: 60 minute Headway Sunday/Holiday: No Service	2	32

¹Bus Count is from 6am-1am Monday-Friday
Source: Metropolitan Council's MetroTransit Website



*Not To Scale

Hennepin Avenue Bike Lane Study



Bus Stop Type

- T Permanent Structure
- T Bench
- T Sign Only
- T Shelter

Figure 4
Bus Stop Locations

Motor Vehicle and Bicycle Volume Demand

The roadway motor vehicle and bicycle traffic volume is an important consideration in determining the appropriate intersection design, lane configurations and bicycle accommodations. The roadway motor vehicle volume, in combination with the roadway function, will help provide an understanding of the bicycle user types and bicycle lane design that the facility will need to accommodate. Key motor vehicle and bicycle volume demand statistics collected include Average Daily Traffic (ADT), peak hour intersection turning movement counts and vehicle classification (traffic composition).

Figure 5 illustrates the eight primary motor vehicle and bicycle count locations.

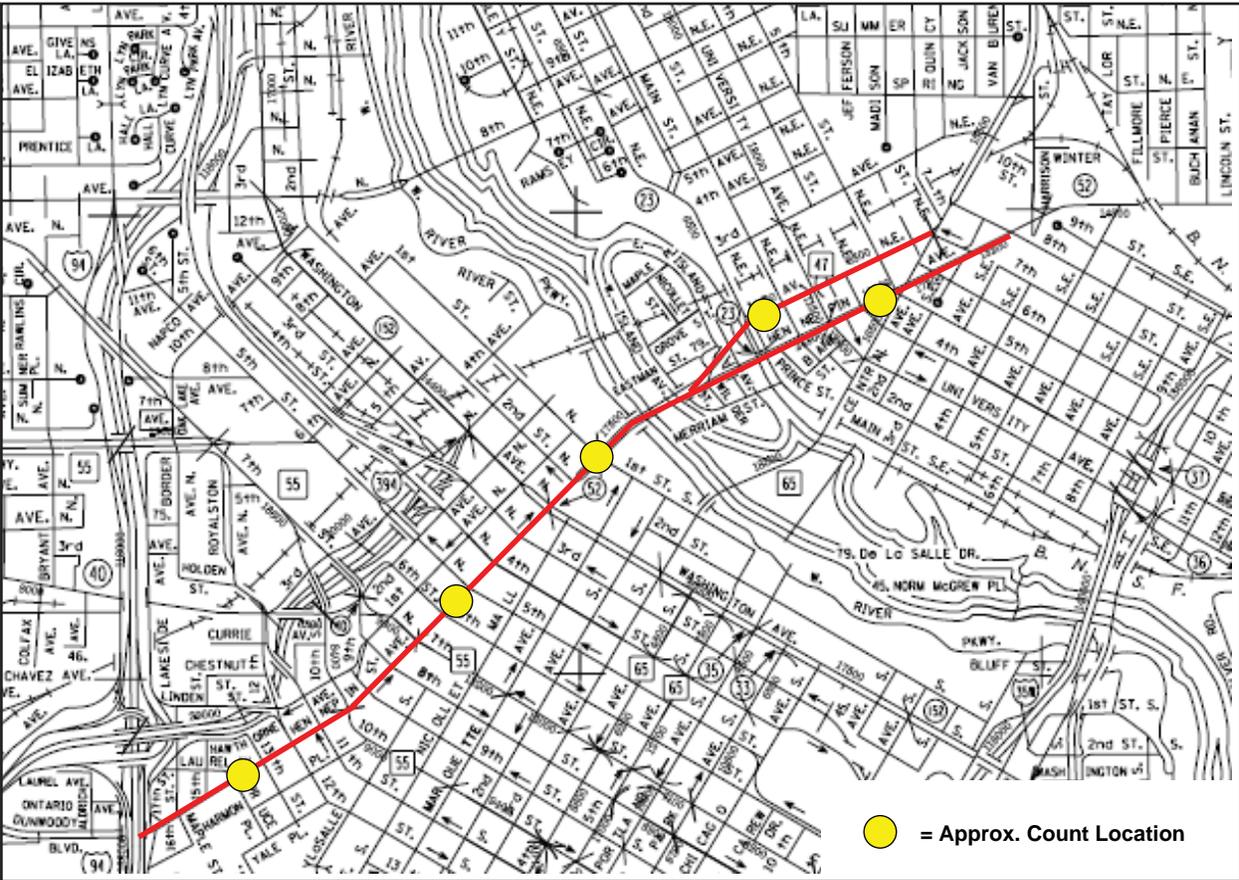


Figure 5. Motor Vehicle and Bicycle Count Locations

Motor Vehicle and Bicycle ADT

Existing motor vehicle ADT volumes were provided by the City of Minneapolis through their Transportation Management Database. The City of Minneapolis field collected bicycle volumes at Location 1 through Location 6 in August 2008. Where full 24-hour data is not available, the ADT was estimated based upon appropriate daily factors derived from other adjacent area traffic and bicycle counts.

Forecast year 2030 ADT volumes for the South End and Downtown sub-areas (locations 1, 2, 4 and 8) were obtained from the Access Minneapolis Downtown Action Plan provided by the City

of Minneapolis. The Northeast sub-area (Locations 5, 6 and 7) forecast year 2030 ADT values were estimated by applying a 0.5 percent per year annual growth rate. Table 3 documents the existing and forecast year 2030 motor vehicle and bicycle ADT volumes.

Table 3. Existing and Forecast 2030 Motor Vehicle and Bicycle ADT

Count Location	Existing - Motor Vehicle (ADT)		2030 Forecast ² - Motor Vehicle (ADT)
	Count Data Date ¹	ADT	ADT
Location 1 (Henn. Ave @ 12th St N)	June-04	15,400	18,300
Location 2 (Henn. Ave @ 6th St N)	July-08	22,600	15,700
Location 3 (Henn. Ave @ 4th St N)	October-07	26,900	15,400
Location 4 ¹ (Henn. Ave @ Bridge)	October-07	29,500	33,200
Location 5 ⁴ (1st Ave @ 2nd St NE)	October-07	19,600	22,000
Location 6 ⁴ (Henn. Ave @ Univ. Ave NE)	July-07	12,000	13,500
Location 7 ⁴ (Henn. Ave between 7th & 8th St SE)	October-08	11,584	13,000
Location 8 (1st Ave between 3rd St N & 4th St N)	September-05	16,870	14,300

¹ All Data Obtained From City Of Minneapolis Transportation Management System Database. Where 24-Hour Counts Unavailable 12-hour Counts Were Extrapolated into 24-Hour (Using 70% Factor) and PM Peak Hour Factor of 9%

² Access Minneapolis Downtown Study. Synchro File CBD-PM-2030-Hybrid3E-RevB-narrowed lanes.sy7 provided by the City of Minneapolis and SEH. (Location 1, 2, 3, 4 and 8)

³ 13-Hour count data used to estimate ADT. ADT estimated by using 80% factor.

⁴ Year 2030 vehicle ADT estimated based upon a 0.5% per year annual growth rate

Peak Hour Motor Vehicle and Bicycle Volumes

Peak hour motor vehicle volumes are necessary to evaluate intersection capacity needs and/or impacts associated with the provision of bicycle lanes or other design features. Based on a review of the Hennepin Avenue and 1st Avenue corridors, not all intersections are expected to be impacted by the Bicycle Plan. Also, major system changes will be occurring with the Two-Way Conversion Project. Only those intersections deemed critical (i.e., may have a motor vehicle traffic capacity impact) as a result of the Bicycle Plan were included and evaluated as part of this study. A total of 31 intersections will be evaluated, including:

- All signalized intersections along Hennepin Avenue between Lyndale Avenue N and 1st Street N.
- All signalized intersections along 1st Avenue between 12th Street N and 2nd Street N.
- The intersection of 1st Avenue at University Avenue NE.

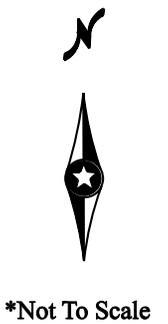
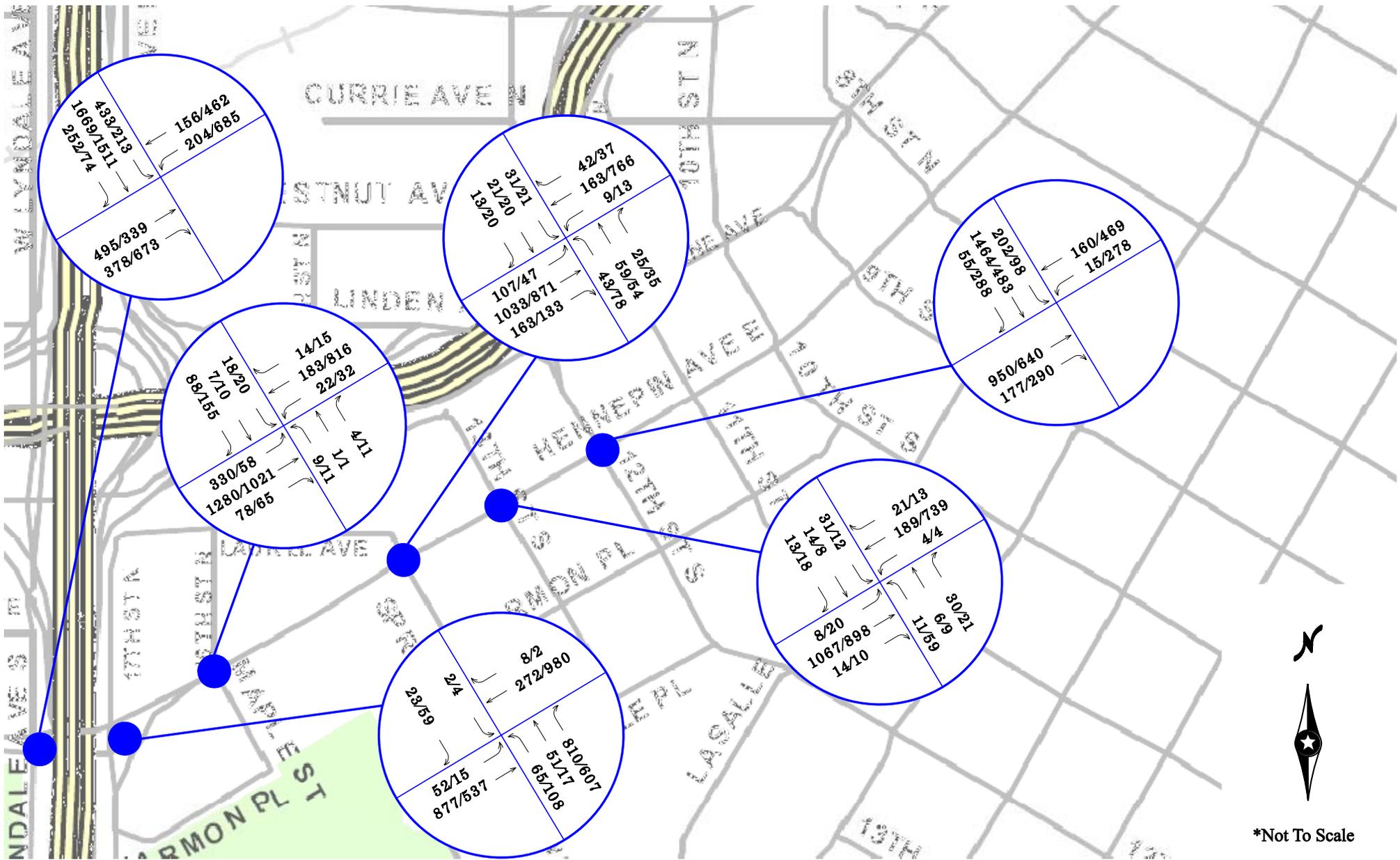
The intersection turning movement volumes were provided by the City of Minneapolis and include the Two-Way Conversion Project and estimated volume growth factors. Figure 6 and Figure 7 document the turning movement volumes at key intersections evaluated as part of the Bicycle Plan.

Peak hour bicycle volumes were obtained from the City of Minneapolis field data collection conducted in August 2008. Similar to motor vehicle traffic patterns, the bicycle volume peaks also correspond to the traditional AM peak hour and PM peak hour time periods (approximately 7 to 8 AM and 4:30 to 5:30 PM). Table 4 documents the AM and PM peak hour bicycle volume demand at the six key count locations.

Table 4. Peak Hour Bicycle Volume

Count Location	Existing - Bicycle ¹ (PM Peak Hour)		Existing - Bicycle ¹ (AM Peak Hour)	
	Northbound	Southbound	Northbound	Southbound
Location 1 (Henn. Ave @ 12th St N)	30	31	60	31
Location 2 (Henn. Ave @ 6th St N)	24	45	50	62
Location 3 (Henn. Ave @ 4th St N)	91	59	45	94
Location 4 (Henn. Ave @ Bridge)	119	73	48	94
Location 5 (1st Ave @ 2nd St NE)	17	17	1	58
Location 6 (Henn. Ave @ Univ. Ave NE)	28	8	12	6
Location 7 (Henn. Ave between 7th & 8th St SE)	NA	NA	NA	NA
Location 8 (1st Ave between 3rd St N & 4th St N)	NA	NA	NA	NA

¹ City of Minneapolis, Data Collected August 2008



Hennepin Avenue Bicycle Plan

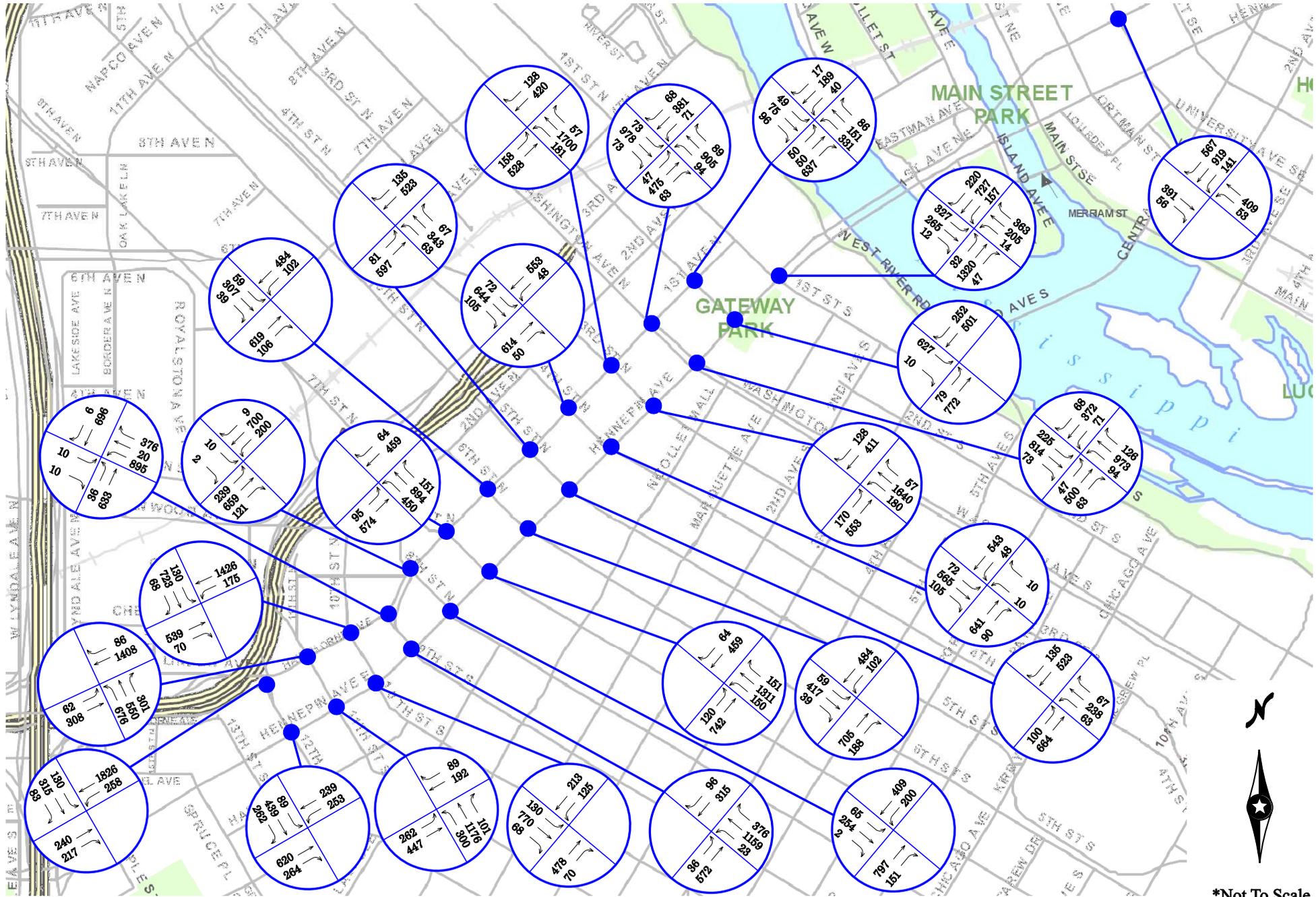


Alliant Engineering

Legend

XX/XX AM Peak/PM Peak Hour Volume

Figure 6
Motor Vehicle Turning Movement Volumes
- Key Intersections (South End Sub-Area)



Hennepin Avenue Bicycle Plan



Alliant Engineering

Legend

XX PM Peak Hour Volume

Figure 7
Motor Vehicle Turning Movement Volumes
- Key Intersections
(Downtown and Northeast Sub-Area)

Motor Vehicle Traffic Composition

The City of Minneapolis performed a Motor Vehicle Classification Count in October 2008. Data was collected at two locations: Hennepin Avenue at 7th Street N (Downtown sub-area) and Hennepin Avenue at 4th Street NE (Northeast sub-area). Table 5 summarizes the traffic composition collected.

Table 5. Motor Vehicle Traffic Composition Summary

Hennepin Avenue at 7th Street N (Downtown)

Motor Vehicle Type	Percent
Passenger Vehicle	74%
Bus	6%
Commercial Trucks	19%

Hennepin Avenue at 4th Street NE (Northeast)

Motor Vehicle Type	Percent
Passenger Vehicle	71%
Bus	3%
Commercial Trucks	26%

Source: City of Minneapolis, Data Collected October 2008 (48-Hour Average)

As shown, the Hennepin Avenue corridor has a relatively high commercial truck percentage. The presence of a higher commercial truck and bus composition can decrease the comfort for bicyclists. Design considerations may be explored to improve bicycling comfort or the provision of wider bicycle lanes will be provided where feasible to address this concern.

Bicycle Transportation Network

Two major components make up the bicycle transportation network: Designated on and off-street bicycle facilities and bicycle parking.

Existing and Planned Bikeways

Minneapolis is one of the nation’s highest ranked cities for bicycle use as a mode of transportation and the downtown is a popular designation for cyclists. There are currently several on-street and off-street bikeways throughout the metro area. The Access Minneapolis Downtown Action plan also recommends several action steps for the downtown bike lane system which will improve and increase overall bicycle ridership (e.g., opening up Nicollet Mall to bicycles). Figure 8 shows the existing, funded and planned bikeways for the City of Minneapolis and surrounding areas.



An important consideration of the Bicycle Plan will be to actively sign and/or appropriately design the connections to the other major bikeways (e.g., Cedar Lake Trail and Loring Bikeway). Promoting connections and providing alternatives for bicycle types will be an effective strategy to improving increased bicycling and network awareness.

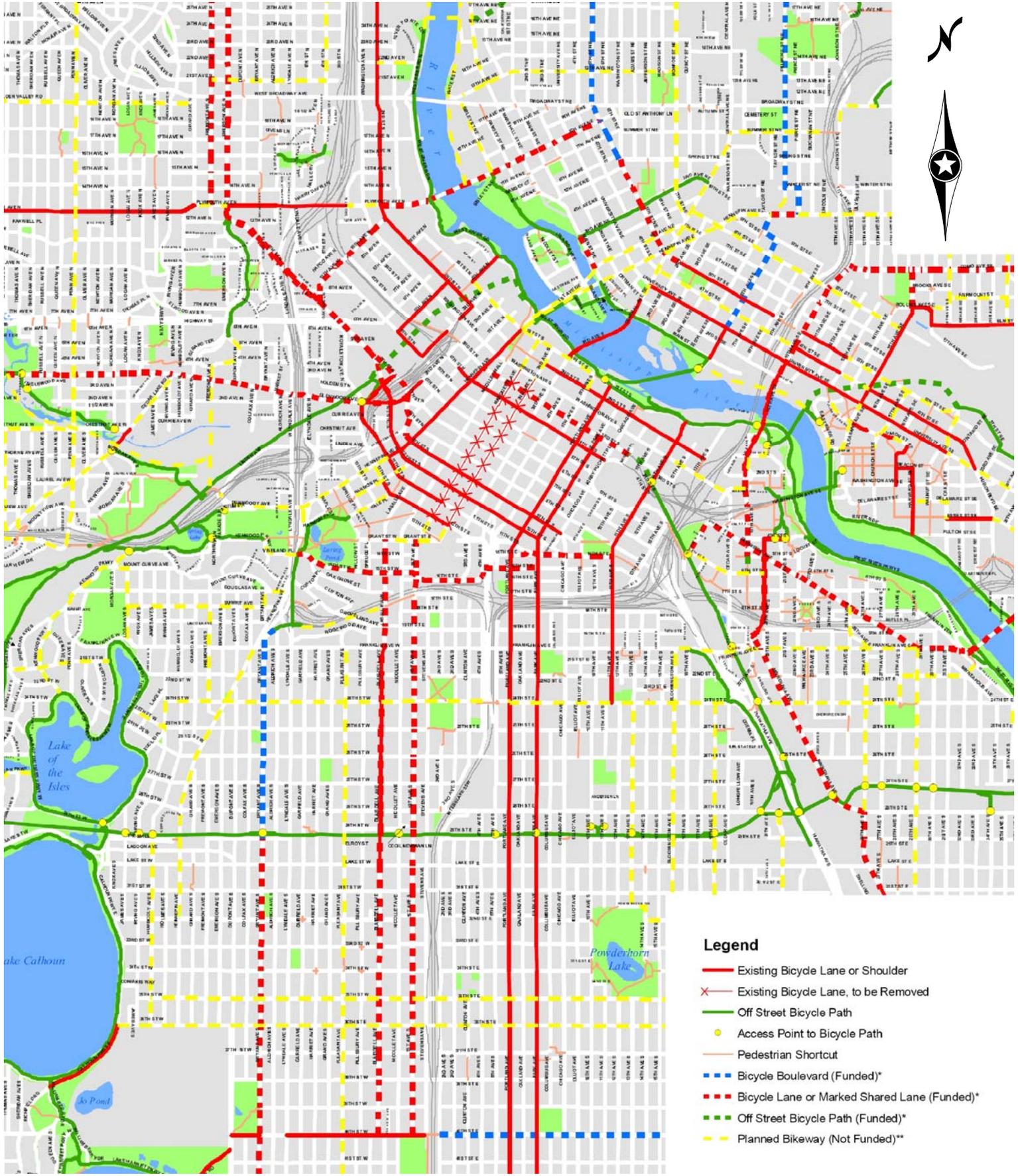
Bicycle Parking

Bicycle parking facilities are essential elements for bicycle transportation. Every bicycle trip begins and ends with the need for a safe and secure place to park one's bike. A lack of adequate and secure parking will discourage people from biking. The wide variety of bicycle parking devices is general grouped into two security levels: secure (e.g. bicycle lockers) and less-secure (e.g. bicycle racks).

The existing bicycle parking along Hennepin Avenue and 1st Avenue was inventoried. In addition, locations where bicycles were locked to trees, sign posts or other fixtures were noted. Often times, this may be an indication of a need for additional bicycle parking. Figure 9 displays the location of existing bicycle parking within the study area. Existing bicycle parking locations are also tabulated in Appendix A.



Inadequate bicycle parking can lead to bicyclists chaining bikes to poles.



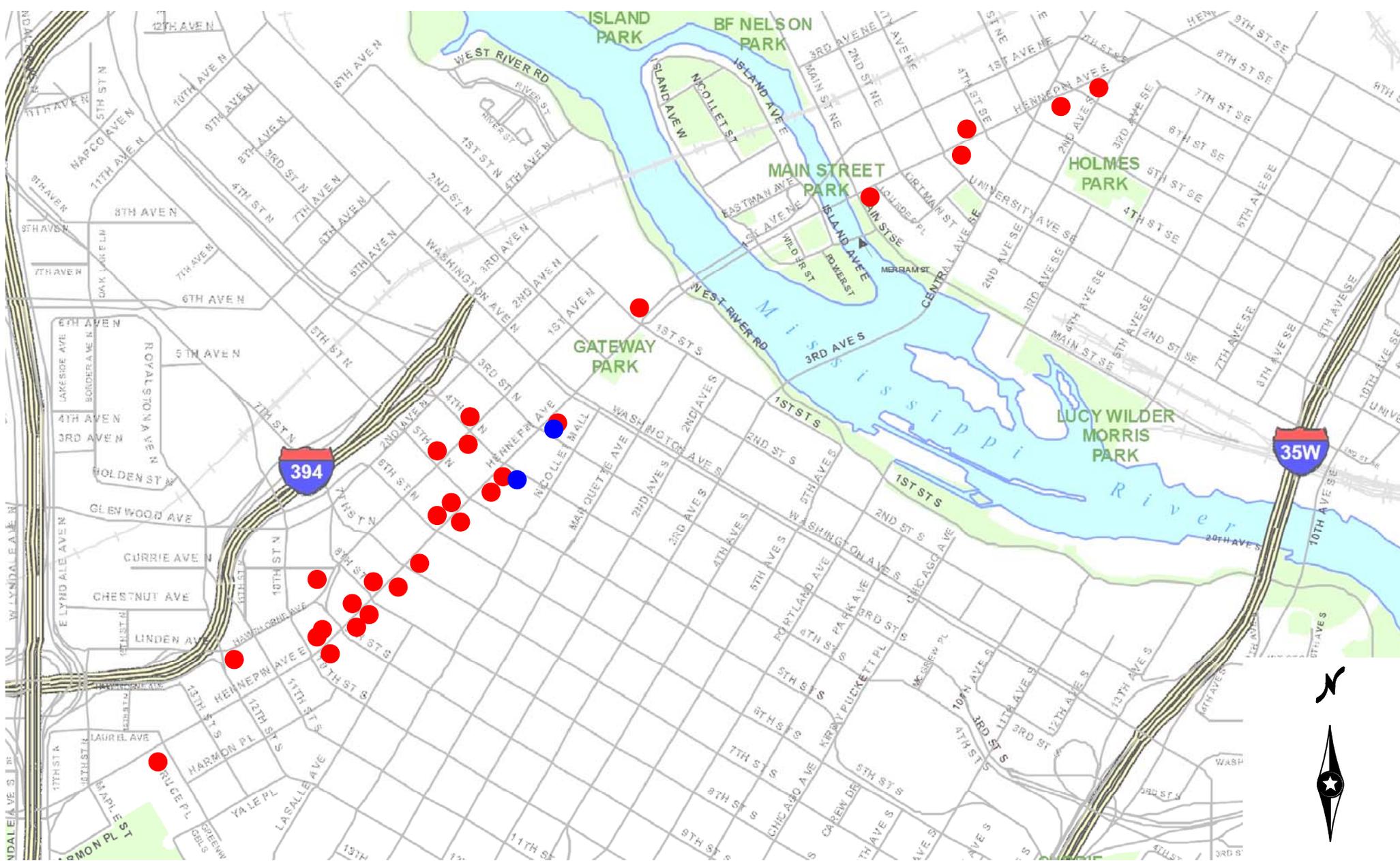
Source: Minneapolis Public Works, August 2008

Hennepin Avenue Bicycle Plan



Alliant Engineering

Figure 8
Existing, Funded, and Planned Bikeways



*Not To Scale

Hennepin Avenue Bicycle Plan



Alliant Engineering

- Bicycle Racks
- Bicycle Lockers

Figure 9
Existing Bicycle Parking

Roadway Safety

A review of the Hennepin Avenue crash records was conducted to evaluate the existing safety characteristics. Every crash involving a motor vehicle within the state of Minnesota (with a filed police report) is entered into a master database maintained by the Department of Public Safety, and made available to the public. Historical crash data for the years 2004 to April 2008 was provided by the City of Minneapolis

In examining these crashes, five key factors were considered:

- Intersection crash type
- Segment crash rate
- Downtown sub-area bicycle and pedestrian crash breakdown
- Pedestrian and bicycle intersection crash rate
- Pedestrian and bicycle crash detail

Crash Summary and Intersection Crash Type

The total number of crashes, documented by the crash type distribution is illustrated in Table 6 on the following page. It should be noted that motor vehicle crashes are reported for crashes occurring between the following: motor vehicle-bicycle, motor vehicle-motor vehicle, and motor vehicle-pedestrian. Crashes occurring between bicycle-bicycle and bicycle-pedestrian are not reported. The following summarizes the key findings:

- 314 of the 505 total crashes in the study area were reported for Hennepin Avenue Segment 2.
- Of the 314 crashes, rear-end (72), right-angle (102), pedestrian (40) and bicycle crashes (31) represented 79 percent of the crashes.
- Hennepin Avenue Segment 2 represents 78 percent of the total corridors pedestrian crashes and 82 percent of bicycle crashes.

Table 6. Intersection Crash Summary and Crash Type Distribution

Hennepin Avenue Intersection Crash Type Summary															
Segment	Description	Intersection	Rear End	Side Swipe	Left Turn	Fixed Object	Right Angle	Right Turn	Backing/Parking	Parked Vehicle	Head On	Pedestrian	Bicycle	Total	
1	Lyndale Ave N to 11th St N (5-lane Undivided)	17th St N	3	2	1	1	1								
		16th St N	2		3	1			1	1		3	1		
		Laurel Ave N	3	1	3		3				1			1	70
		13th St N	2				1						1		
		12th St N	6	4	2	1	13	1	1				2	1	
		11th St N	2	2	3		36							1	
2	11th St N to 2nd St N (NB One-way SB Bus Lane)	10th St N	5		1	1	10		1		1	4	1		
		9th St N	4		2	1	12					2	3		
		8th St N	5	4			6	1				4	2		
		7th St N	13	6		1	4	1			2	9	6		
		6th St N	10	1	2	1	4	1	1			6	1		
		5th St N	7	4	3	1	1	1	1			1	5	4	
		4th St N	14	4	3	1	4					4	2		
		3rd St N	10	5	2	1	18				2		1	8	
		Washington Ave N	2	1	3	2	6		1				5	2	
		2nd St N				1	3	1						1	
3	2nd St N to DeLaSalle Dr NE (6-lane Divided)	1st St N	4	2	2	3	8					3	1		
		Robert Fisher Dr/ High St	1												
		Wildier St NE		1											
		DeLaSalle Dr											2		
4	DeLaSalle Dr NE to Central Ave (One-Way)	Main St SE	10		4		5								
		2nd St NE				2	2			1					
		University Ave NE	5	4		1	2		1				2	1	
		4th St NE	1	2			3		1						
		5th St NE	5	1	2		1		1						
		Central Ave	11		1	1									
5	Central Ave to 2nd Ave SE (One-Way)	6th St SE		4	1	1	3			1				10	
6	2nd Ave SE to 8th St SE (One-Way)	7th St SE	1	2		2									
		8th St SE		2	3		4							14	
		Totals	126	52	39	25	148	8	8	8	2	51	38	505	

Source: City of Minneapolis, Data Collected January 2004- April 2008

Segment Crash Rate

History has proven that crashes are a function of exposure. Roadways with higher traffic volumes experience more crashes than similar roadways with lower volumes. Rather than documenting the number of crashes that occur in a particular segment or at a particular intersection, the crash rate must be considered. Crash rates normalize different locations with varying traffic volumes, providing a useful tool in comparing the locations with respect to safety.

The crash rate for any roadway segment is defined as the number of crashes occurring per million motor vehicle miles traveled (MVMT). The segment crash rate allows for the comparison of safety characteristics between different segments and facility types.

Table 7 documents the segment motor vehicle crash rate and Table 8 documents the segment bicycle crash rate. The following summarizes the findings:

- Considering all crashes, the highest crash rates (crashes per million miles traveled) occurred within Segment 2 (10.51) and Segment 4 (8.17).
- The estimated statewide average crash rate for an undivided urban roadway is 5.9. Both Segment 1 and Segment 6 fall below the statewide average rate.
- The estimated statewide average rate for a divided roadway is 4.0. Average rates for one-way roadway is unavailable, but is assumed to be less than a divided facility (less conflict points). Both Segment 2 and Segment 4 greatly exceed this value.
- Segment 2 has a bicycle crash rate of 9.86 (crashes per 10 million miles traveled), which is four times greater than any other segment along Hennepin Avenue.

Table 7. Hennepin Avenue Motor Vehicle Crash Rate Summary

Hennepin Avenue Segment Motor Vehicle Crash Rate (All Crashes)						
Segment	Description	Segment Length (Ft)	Weighted Segment Vehicle ADT	Vehicle Miles Traveled	Total Crashes	Vehicle Crash Rate (crashes per million VMT)
1	Lyndale Avenue N to 11th Street N	2,634	15,400	12,150,127	70	5.8
2	11th Street N to 2nd Street N	4,030	24,750	29,876,374	314	10.5
3	2nd Street N to DeLaSalle Drive NE	2,123	29,500	18,759,430	27	1.4
4	DeLaSalle Drive NE to Central Avenue	2,384	12,000	8,569,098	70	8.2
5	Central Avenue to 2nd Avenue SE	641	22,600	4,339,244	10	2.3
6	2nd Avenue SE to 8th Street SE	651	19,600	3,821,947	14	3.7

Source: Crash Data Obtained From City of Minneapolis, Data Collected January 2004- April 2008
 Vehicle Volumes Obtained From City of Minneapolis Transportation Management System Database

Table 8: Hennepin Avenue Bicycle Crash Rate Summary

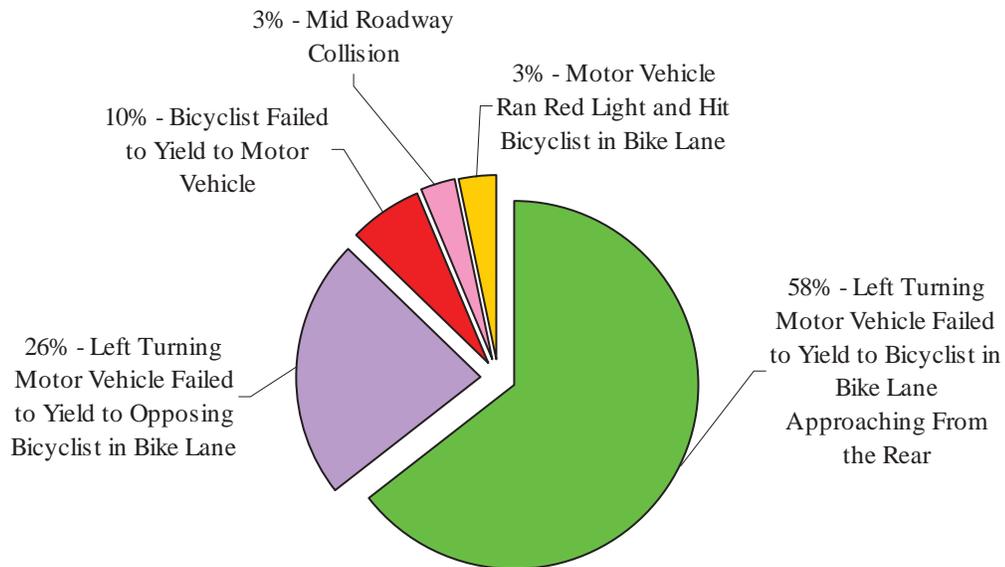
Segment	Description	Bicycle Lane Location	Segment Length (Ft)	Weighted Segment Vehicle ADT	Weighted Segment Bicycle ADT	VMT (Bicycle + Vehicle)	Total Bicycle Crashes	Bicycle Crash Rate (crashes per 10 million VMT)
1	Lyndale Avenue N to 11th Street N	None (Shared Lane)	2,634	15,400	840	12,812,861	3	2.3
2	11th Street N to 2nd Street N	Center Bike Lane	4,030	24,750	1,303	31,448,655	31	9.9
3	2nd Street N to DeLaSalle Drive NE	None (Shared Lane)	2,123	29,500	1,200	19,522,526	3	1.5
4	DeLaSalle Drive NE to Central Avenue	None (Shared Lane)	2,384	12,000	290	8,776,185	1	1.1
5	Central Avenue to 2nd Avenue SE	None (Shared Lane)	641	22,600	--	4,339,244	0	0.0
6	2nd Avenue SE to 8th Street SE	None (Shared Lane)	651	19,600	--	3,821,947	0	0.0

Source: Crash Data Obtained From City of Minneapolis, Data Collected January 2004- April 2008
 Bicycle Volumes Obtained City of Minneapolis, Data Collected August 2008
 Vehicle Volumes Obtained From City of Minneapolis Transportation Management System Database

Downtown Sub-Area Bicycle and Pedestrian Crash Breakdown

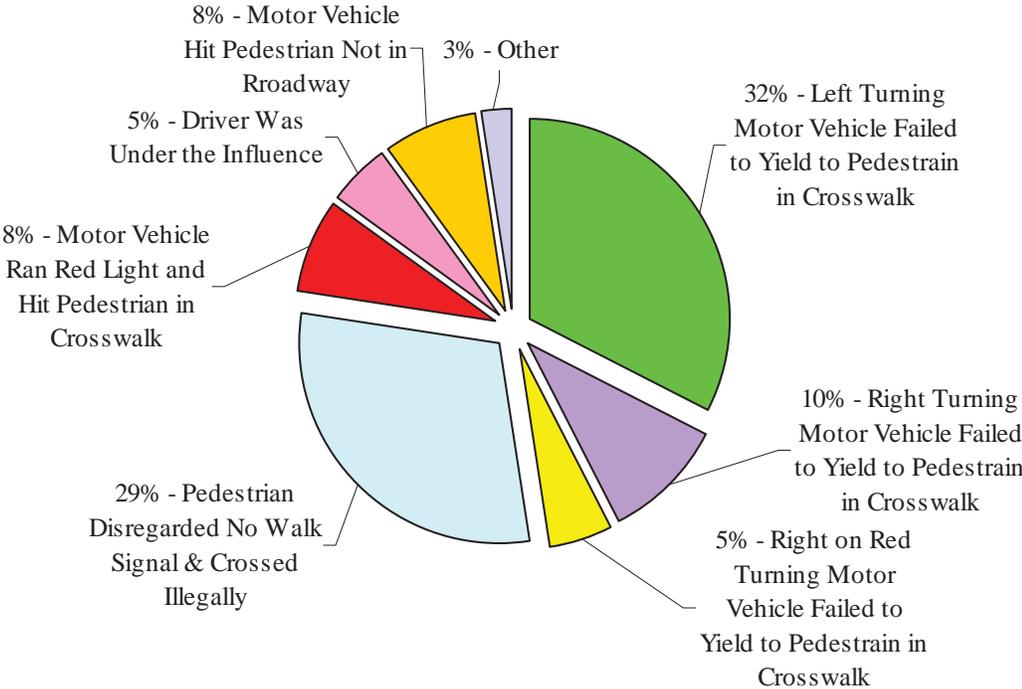
40 pedestrian and 31 bicycle crashes were reported within Hennepin Avenue Segment 2 (Downtown sub-area) between 12th Street N and 1st Street N. Segment 2 by a significant margin, had the highest crash rate and the highest number of bicycle and pedestrian crashes, which warrants further investigation. Table 9 and Table 10 illustrate the bicycle and pedestrian crash breakdown, respectively.

Table 9. Hennepin Avenue Segment 2 Bicyclist Crash Type Breakdown



Source: City of Minneapolis, Data Dated 2004 to April 2008

Table 10. Hennepin Avenue Segment 2 Pedestrian Crash Type Breakdown



Source: City of Minneapolis, Data Dated 2004 to April 2008

The following summarizes the bicycle crashes:

- 24 of the 31 bicycle crashes occurred at an intersection. Six of the remaining seven occurred at a property driveway along Hennepin Avenue. The last bicycle crash involved a bicyclist being sideswiped mid-block by a motorist traveling in the same direction.
- 23 of the 31 bicycle crashes involved a bicyclist traveling northbound within the designated bicycle lane.
- 26 of the 31 bicycle crashes (84 percent) involved a northbound motor vehicle making a left turn movement.
- 58 percent of the crashes were directly related to a northbound motor vehicle making a left turn and a northbound bicycle approaching from the rear (out of motorist field of vision).
- 26 percent of the crashes were directly related to a northbound motor vehicle making a left turn and failing to yield right of way to a southbound bicycle.
- Six of the seven mid-block crashes occurring at access points were directly related to a northbound motor vehicle making a left turn and striking a northbound bicycle approaching from the rear.
- Three percent were related to a bicycle being struck by a cross-street motor vehicle (i.e., running the red light).

The following summarizes the pedestrian crashes:

- 36 of the 40 pedestrian crashes occurred at an intersection. The remaining four crashes occurred mid-block.
- 29 percent of the crashes occurred as a result of a pedestrian violating the traffic signal and crossing the street illegally.
- 32 percent of the crashes were directly related to a motor vehicle making a left turn on green and striking the pedestrian legally crossing within the crosswalk.
- Ten percent of the crashes were related to a motor vehicle making a right turn on green and five percent related to a right turn on red movement.
- Eight percent of the crashes involved a motorist running the red light and striking a pedestrian legally within the crosswalk.

Pedestrian and Bicycle Intersection Crash Rate

The majority of bicycle and pedestrian crashes occurred at intersections. To normalize the segment crash rate and to account for the full exposure of total intersection volume, an intersection bicycle and pedestrian crash rate was calculated.

Table 11 documents the bicycle and pedestrian crash rate by intersection. The following summarizes the key findings:

- The highest intersection crash rates along the Hennepin Avenue corridor (Lyndale Avenue N to 8th Street SE) occurred at 9th Street N, 7th Street N, 5th Street N and 3rd Street N, the westbound one-way streets (i.e., involved a left turning motor vehicle). The bicycle intersection crash rates at these four locations ranged from two to five times higher than any other intersection.
- The highest pedestrian crash rates occurred within the Downtown sub-area between 10th Street N and Washington Avenue N.

Table 11. Pedestrian and Bicycle Intersection Crash Rate

Hennepin Avenue Pedestrian & Bicycle Intersection Crash Rate										
Segment	Intersection	Bicycle Lane Location	Existing Total Entering (Motor Vehicle) ADT ²	Existing Total Entering (Bicycle) ADT ¹	Total Entering Volume (Motor Vehicle)	Total Entering Volume (Bicycle + Motor Vehicle)	Total Pedestrian Crashes	Total Bicycle Crashes	Pedestrian Crash Rate (Crashes per 10 Million Entering Motor Vehicles)	Bicycle Crash Rate (Crashes per 10 Million Entering Motor Vehicles)
1	Lyndale Ave N	None (Shared Lane)	--	840	--	--	0	0	--	--
	17th St N	None (Shared Lane)	--	840	--	--	0	0	--	--
	16th St N	None (Shared Lane)	35,647	840	56,377,561	57,706,058	3	0	0.53	--
	Laurel Avenue N	None (Shared Lane)	19,394	840	30,671,878	32,000,376	0	1	--	0.312
	13th St N	None (Shared Lane)	17,338	840	27,421,298	28,749,796	1	0	0.36	--
	12th St N	None (Shared Lane)	31,594	840	49,966,727	51,295,225	2	1	0.40	0.195
	11th St N	Center Bike Lane	28,840	1,303	45,612,431	47,672,393	0	1	--	0.210
	10th St N	Center Bike Lane	28,387	1,303	44,895,688	46,955,650	4	1	0.89	0.213
	9th St N	Center Bike Lane	28,332	1,303	44,808,198	46,868,161	2	2	0.45	0.427
	8th St N	Center Bike Lane	26,383	1,303	41,725,868	43,785,830	4	0	0.96	--
2	7th St N	Center Bike Lane	33,570	1,303	53,092,802	55,152,765	8	5	1.51	0.907
	6th St N	Center Bike Lane	27,700	1,303	43,808,797	45,868,759	5	1	1.14	0.218
	5th St N	Center Bike Lane	15,591	1,303	24,658,642	26,718,604	4	2	1.62	0.749
	4th St N	Center Bike Lane	29,043	1,303	45,932,105	47,992,067	4	1	0.87	0.208
	3rd St N	Center Bike Lane	28,583	1,303	45,205,267	47,265,229	1	8	0.22	1.693
	Washington Ave N	Center Bike Lane	36,145	1,303	57,164,439	59,224,402	5	2	0.87	0.338
	2nd St N	Center Bike Lane	23,494	1,200	37,156,213	39,054,067	0	1	--	0.256
	1st St N	None (Shared Lane)	48,404	1,200	76,553,556	78,451,410	3	1	0.39	0.127
	Robert Fisher Dr/High St	None (Shared Lane)	--	1,200	--	--	0	0	--	--
	Wildier St NE	None (Shared Lane)	--	1,200	--	--	0	0	--	--
3	DeLaSalle Dr NE	None (Shared Lane)	N/A ³	1,200	N/A ³	N/A ³	0	2	--	N/A ³
	Main St NE	None (Shared Lane)	--	290	--	--	0	0	--	--
	2nd St NE	None (Shared Lane)	--	290	--	--	0	0	--	--
	University Ave NE	None (Shared Lane)	26,553	290	41,995,212	42,453,860	2	1	0.48	0.236
	4th St NE	None (Shared Lane)	--	290	--	--	0	0	--	--
4	5th St NE	None (Shared Lane)	--	290	--	--	0	0	--	--
	Central Ave	None (Shared Lane)	--	290	--	--	0	0	--	--
	6th St SE	None (Shared Lane)	--	--	--	--	0	0	--	--
5	7th St SE	None (Shared Lane)	--	--	--	--	0	0	--	--
	8th St SE	None (Shared Lane)	--	--	--	--	0	0	--	--
6	8th St SE	None (Shared Lane)	--	--	--	--	0	0	--	--
							Average	0	0.76	0.43

¹ 13-Hour count data used to estimate ADT. ADT estimated by using 80% factor.

² Intersection turning movement count data used to estimate ADT. 12-hour count represents 70% and 7-hour (AM, Mid, PM peak periods) represent 47% of the ADT.

³ Intersection turning count data was not available

Source: City of Minneapolis

Pedestrian and Bicycle Crash Detail

A comprehensive review and summary of every pedestrian and bicycle crash reported along Hennepin Avenue was completed and is provided for reference in Appendix B. The detailed summary reconstructs the contributing factors involved with each crash occurrence. The following summarizes the bicycle crash review findings for the key intersections noted above:

- At the Hennepin Avenue/9th Street N, 7th Street N, 5th Street N and 3rd Street N intersections, all crashes involved a bicycle being struck by a left turning motorist.
- Nearly all of the crashes involved a bicyclist traveling northbound bound being struck by a northbound motor vehicle making a left turn movement.
- A few crashes included a southbound bicyclist being struck by a northbound left turning motor vehicle.

The key contributing factors resulting in pedestrian related crashes was summarized previously.

Existing Issue Areas

The review of the existing and future transportation system characteristics found a number of areas or issues that require special consideration in the alternatives analysis and this Bicycle Plan. The following summarizes the key issues:

- The provision of bicycle lanes in the South End sub-area meeting MSA lane width standards will require removing a northbound travel lane. Intersection capacity will need to be evaluated.
- The existing street width within the Downtown sub-area is a significant constraint and will make for the provision of two-way bicycle lanes and two-way traffic operation a challenge. A balance between the needs of pedestrians, motorists, transit vehicles, on-street parking, loading/unloading and bicyclists will need to be met.
- The roadway safety analysis found the existing center bicycle lane to be a safety hazard. Special consideration will be required to address the significant number of left turn related bicycle crashes.
- The Northeast sub-area may require small portions of on-street parking to be removed in provision of bicycle lanes.
- The intersections of 1st Avenue/Main Street NE and 1st Avenue/University Avenue NE will require special attention in providing bicycle lanes given the existing intersection lane geometrics and lane striping.

Evaluation of Alternatives



This section documents the alternatives analysis process and evaluation conducted in preparing the Bicycle Plan. The ultimate goal of the Bicycle Plan is to provide an on-street bicycle facility that connects Hennepin Avenue, from Lyndale Avenue N, with Northeast Minneapolis. Based on the existing transportation network characteristics, dynamics of the Two-Way Conversion Project and Downtown sub-area issues, many challenges and constraints are presented. The alternatives identified and evaluated strive to strike a balance between the competing needs of all roadway users and all vested stakeholders.

Bicycle User Types

There are three categories of bicyclists:

- **Type A:** Advanced or experienced. Typically the commuter bicyclists that are comfortable operating a bicycle under higher traffic volumes or as a motor vehicle mixed in traffic.
- **Type B:** Basic or recreational bicyclists. Prefer to avoid roads with higher traffic volumes/speeds unless there is more roadway width.
- **Type C:** Children.



Type A Bicyclist



Type B Bicyclist



Type C Bicyclist

Based on the existing transportation characteristics residing within the Hennepin Avenue corridor, Type A and Type B bicyclists will be the focus of the Bicycle Plan.

Bicycle Compatibility Index

In 1998, the U.S. Department of Transportation Federal Highway Administration published the Bicycle Compatibility Index: A Level of Service Concept, Implementation Manual. The primary objective of this manual was to develop a bicycle compatibility index (BCI) that could be used by bicycle coordinators, transportation planners, traffic engineers, and others to evaluate the capability of specific roadways to accommodate both motorists and bicyclists. The BCI methodology was developed for urban and suburban roadway segments and incorporates those variables that bicyclists typically use to access the “bicycle friendliness” of a roadway. The following variables are considered in the BCI model:

- Lane Configuration – number of through motor vehicles in one direction and the presences or absence of a bicycle lane or paved shoulder.
- Curb Lane Width – width of the motor vehicle travel lane closest to the curb.
- Bicycle Lane (Paved Shoulder) Width – width of the bicycle lane or paved shoulder (if present).
- Motor Vehicle Speed – 85th percentile speed of traffic.
- Traffic Volume – hourly traffic volume by lane in one direction of travel.
- Presence and Density of On-street Parking – presence of an on-street parking lane and percentage of spaces occupied.
- Type of Development – type of development or land use adjacent to the roadway.
- Large Truck Volume – hourly large truck volume in the curb lane.
- Parking Time Limits – parking time limits for on-street spaces.
- Right turn Volumes – hourly volume of motor vehicles turning right into all driveways and intersecting streets along the mid-block segment being evaluated.

Specific corridor challenges or constraints are not addressed with the BCI tool. However, the BCI does provide value in giving an initial assessment of the feasibility of bicycle accommodations in the corridor. Table 12 documents the BCI for the Hennepin Avenue and 1st Avenue corridors.

Table 12. Bicycle LOS Results Summary

Segment		Description	BCI	LOS	Bicycle Compatibility Level
Hennepin Avenue	1	Lyndale Avenue N to 11th Street N	3.271	C	Moderately High
	2	11th Street N to 2nd Street N (Blocks With Left Turn Lanes)	3.032	C	Moderately High
	2	11th Street N to 2nd Street N (Blocks without Left Turn Lanes)	2.606	C	Moderately High
	3	2nd Street N to DeLaSalle Drive NE	2.932	C	Moderately High
	4	DeLaSalle Drive NE to Central Avenue	2.876	C	Moderately High
	5	Central Avenue to 2nd Avenue SE	2.045	B	Very High
	6	2nd Avenue SE to 8th Street SE	2.531	C	Moderately High
1 st Avenue	1	12th Street N to 2nd Street N	3.435	D	Moderately Low
	2	2nd Street N to Central Avenue	3.381	C	Moderately High

Source: U.S. Department of Transportation Federal Highway Administration Bicycle Compatibility Index (BCI) Model

Complete Street Concept

The Bicycle Plan embraces the complete street concept and works to balance the needs of all roadway users, aims to uphold the vision of the Minneapolis Downtown Action Plan and selects a design that maximizes the benefits to all users. Stakeholder involvement was a critical element to the Bicycle Plan. All stakeholders were given the opportunity to participate and voice concerns and issues and to vocalize their important design considerations. The following key roadway user and stakeholder needs will be incorporated into the Bicycle Plan:



- **Circulation.** The business community has helped lead the way for many years in achieving the Two-Way Conversion Project. As part of reconfiguring of Hennepin Avenue and 1st Avenue to two-way streets, mobility, access and safety of motor vehicle traffic to circulate efficiently is a key concern. The provision of left turn lanes is a high priority.
- **Transit.** Hennepin Avenue serves as a major transit link through Downtown. Over the next 20 years, transit vehicles and routes serviced via Hennepin Avenue are expected to nearly double. Providing efficient transit service and safe operation of the bus routes and bus stops is a critical consideration. Metro Transit also expressed the implicit safety concern of placing bicycle lanes to the right of bus stops.
- **Bicycle Facilities.** Hennepin Avenue currently provides designated center running bicycle lanes between 11th Street N and 2nd Street N. Safety of the existing facility and of any future lanes is a major consideration. However, the provision of a facility that links Lyndale Avenue N to Northeast Minneapolis is a high priority and is an essential element of the corridor.
- **On-Street Parking.** On-street parking is highly valued by the business community and is vital to the economic vitality of the corridor. On-street parking competes for street space and needs to be maximized in the balance with the other roadway users.
- **Loading/Unloading.** Both Hennepin Avenue and 1st Avenue accommodate significant loading and unloading activities (taxi cabs, valet parking, drop-off/pick-up and commercial needs). Accommodating this activity will be critical.
- **Pedestrians.** Both Hennepin Avenue and 1st Avenue are Activity Area Streets and are highly commercialized. Pedestrian activity throughout the corridor is abundant. Sidewalks are provided and the sidewalk space will remain unchanged with the project. Any elements to improve the pedestrian environment will be considered through the planning process.
- **Agency and State Engineering Standards.** Working within the context of City, State and Federal design standards is vital. Although flexibility in design will be used where appropriate, meeting minimum design standards, MSA requirements and/or other standards required based on engineering judgment is necessary to reduce risk and liability exposure.

All of these roadway user and stakeholder needs compete for limited roadway space and requirements. With the Two-Way Conversion Project and throughout the remainder of the corridor, existing curb lines and street widths will not change. This factor is a significant constraint and may govern many decisions. Developing an alternative that maximizes the corridor priorities and minimizes the trade-offs is the end goal.

Key Project Objectives

In evaluating potential designs, each alternative considered is qualitatively measured against 12 key objectives. The assessment of these objectives will help compare and screen the effectiveness of each alternative. The key objectives are summarized below:

- **Bicycle Safety.** Qualitative assessment and comparison of expected level of safety based upon motor vehicle-bike conflict points and critical conflicts. Critical conflict points refer to those locations where a motor vehicle is making a turning move, but may unexpectedly cross paths with a bicyclist approaching from behind or out of the driver's field of vision.
- **Motor Vehicle Traffic Operations/Safety.** Qualitative assessment and comparison of the bike lane alternatives expected impact to motor vehicle traffic and motorist safety.
- **Transit and Delivery Loading/Unloading Conflicts.** Qualitative assessment of an alternative's potential to have conflicts with transit and/or delivery vehicles.
- **Pedestrian Conflicts.** Qualitative assessment of an alternative's potential to have conflicts with pedestrians.
- **Traffic Laws and Ordinances.** Qualitative assessment of an alternative's compliance with applicable traffic laws and ordinances. A bicycle facility should not encourage or require bicyclists to operate in a manner inconsistent with the State Statues.
- **Continuity/Consistency of Bike Lane Over Corridor.** Qualitative assessment of an alternative's overall consistency or continuity along the bike route. Optimal continuity/consistency would not require the bicyclist to transition lanes or merge within the route to the least consistent design of the route requiring multiple turns and/or transferring to a different street.
- **Skill Level (Accommodate Type A and Type B Bicyclists).** Qualitative assessment of an alternative's ability to accommodate bicyclist types. Comparison of the expected comfort level and the cyclist's abilities required to merge, enter and exit the bike lane facility.
- **Accessibility to Bike Lane from Cross-Streets.** Qualitative assessment of how easy, difficult or convenient it is for a bicycle to gain access to the bicycle lane from an intersecting bike lane or from an approaching cross-street.
- **Directness of Bike Route.** Qualitative assessment evaluating how direct the bike route alternative's line of travel from Lyndale Avenue to 8th Street SE.
- **MSA Standards / City Design Guidelines.** Qualitative assessment of how well the bike lane alternative meets the minimum lane width standards required of MSA and the City Design Guidelines.
- **Maintenance.** Qualitative assessment of the effort required to maintain pavement markings, signing and snow removal.

- **Accommodate On-Street Parking/Loading.** Qualitative assessment of a bike lane alternative's potential to accommodate on-street parking or loading zones.

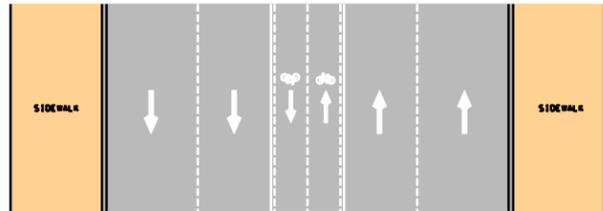
Four Primary Bicycle Lane Typical Sections

On an urban thoroughfare roadway, there are four primary configurations for implementing on-street bicycle lanes. These include:

- Two-way center running
- Two-way curb lane
- Two-way contra-flow (one side of the roadway)
- One-way pair curb lane

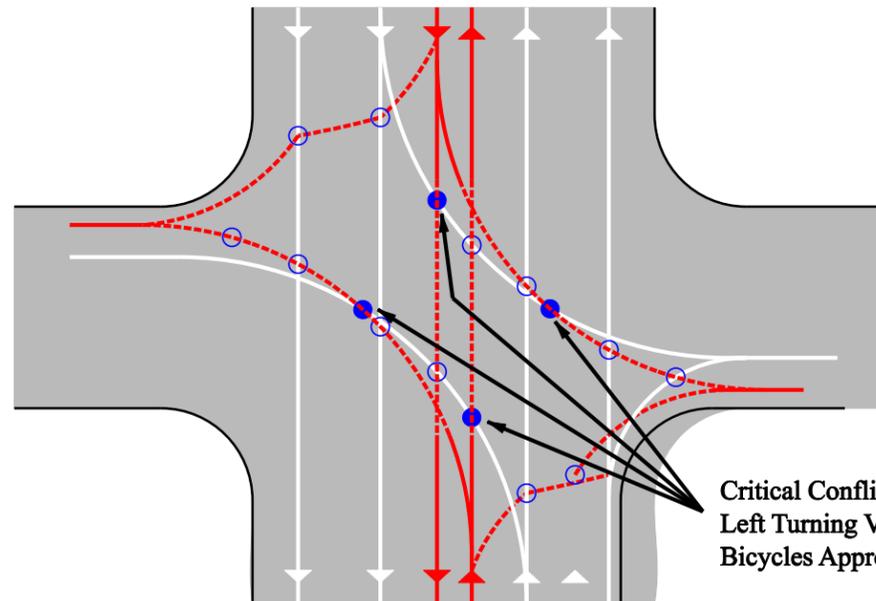
A general safety and conflict point assessment was completed for each option. For this assessment, the one-way pair curb lane option is the same as the two-way curb lane, except it would result in half the conflicts. Figure 10 documents the conflict point analysis.

A pros and cons assessment of each option was also conducted. Table 13 summarizes the key pros and cons for each primary typical section.



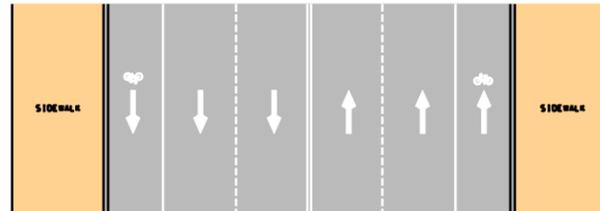
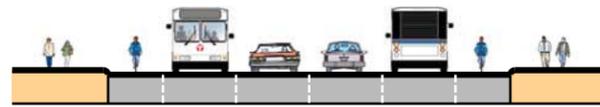
Option 1: Two Way Center Bike Lane

16 Conflict Points (Excludes Bike - Bike, Bike-Ped, & Bike-Transit)
 4 Critical Conflict Points
 2 Lane Merges



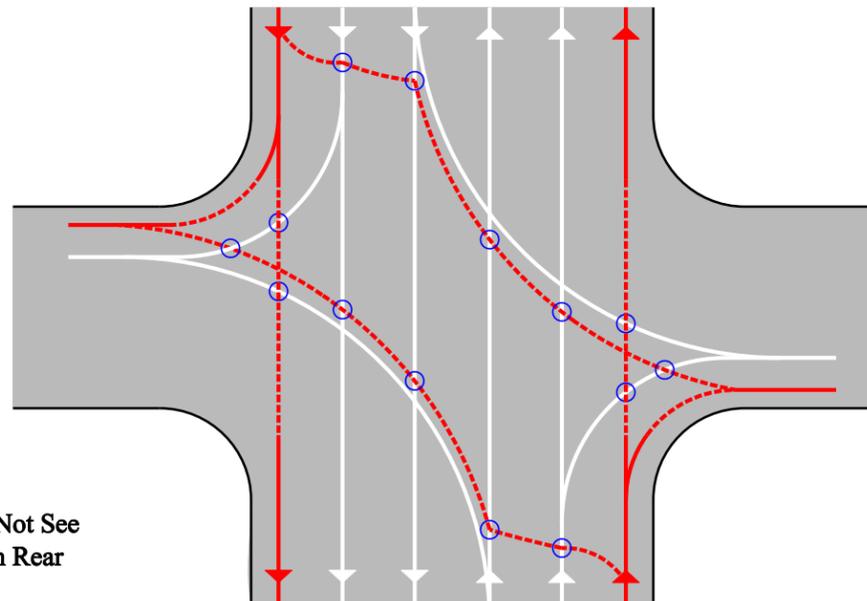
Critical Conflict Point:
 Left Turning Vehicles Can Not See
 Bicycles Approaching From Rear

Note: Conforms to Figure 6-10 Minneapolis Design Guidelines for Streets and Sidewalks

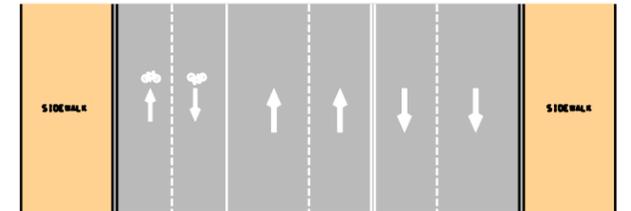


Option 2: Two Way Curblane Bike Lane

14 Conflict Points (Excludes Bike - Bike, Bike-Ped, & Bike-Transit)
 0 Critical Conflict Points
 2 Lane Merges



Note: Conforms to Figure 6-10 Minneapolis Design Guidelines for Streets and Sidewalks



Option 3: Two Way Contra Flow Bike Lane (Side of Roadway)

17 Conflict Points (Excludes Bike - Bike, Bike-Ped, & Bike-Transit)
 5 Critical Conflict Points
 1 Lane Merge

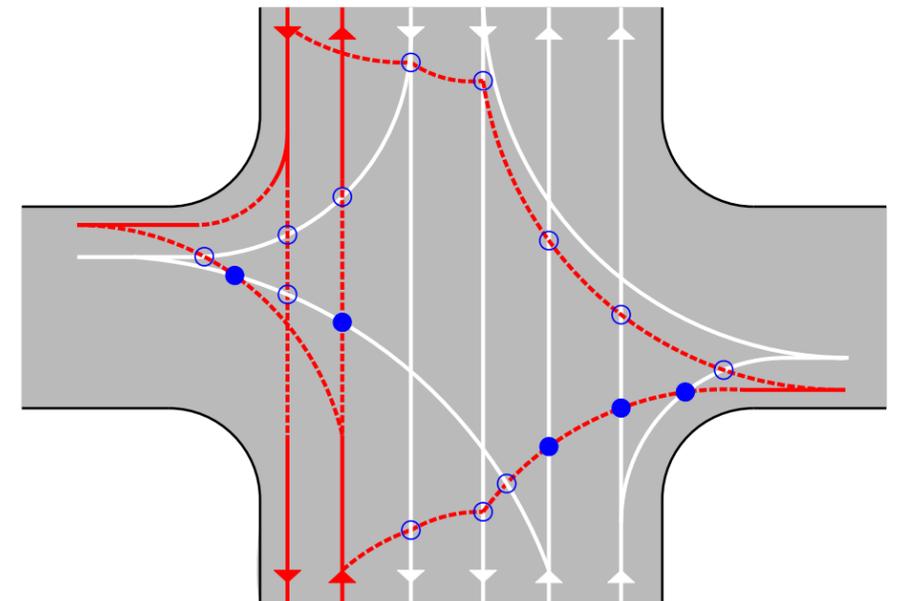


Table 13. Primary Bicycle Lane Typical Sections – Pros and Cons Assessment

Option 1
Two-way Center Bike Lane

Pros	<ul style="list-style-type: none"> ■ Removes bikes from right lane conflicts (peds, right turns, buses and stopped vehicles). ■ Left turn lanes could be provided if bike lane drops into turn bay.
Cons	<ul style="list-style-type: none"> ■ Prohibits left turn lanes along length of corridor without introducing major lane shifts, requiring significant width, or dropping bike lane into turn lane. ■ Opposite direction bicycle is out of motorists' field of vision. May result in unexpected left turn conflicts. ■ Challenging transition to alternative configurations at corridor ends (e.g. side bike lanes). ■ Transitions decrease continuity and consistency along length of corridor. ■ Type A bicyclists only. Due to advanced skills required to make both left and right turns, does not cater well to Type B & C users. ■ Requires difficult left and right turn movements for bicyclists to enter or exit lanes. ■ May require special intersection or signal phasing treatments to provide safe operation and reduce critical conflicts.

Option 2
Two-way Curb Lane Bike Lane

Pros	<ul style="list-style-type: none"> ■ Eliminates critical conflict points. ■ Allows flexibility for center left turn lane. ■ Provides for consistent signing/pavement markings along length of corridor. ■ Better facilitates Type B bicyclists by providing lanes with direct access to crosswalks for making left turn movements and allows a non-conflicting right turn movement.
Cons	<ul style="list-style-type: none"> ■ Bike lane adjacent to curb friction with buses, right turns, pedestrians and stopped vehicles. ■ Narrow street widths may not allow easy passing of stopped vehicles or obstructions.

Option 3
Two-way Contra Flow Bike Lane (Side of Roadway)

Pros	<ul style="list-style-type: none"> ▪ Flexible to allow center left turn lane. ▪ Removes bikes from right turn lane conflicts (peds, right turns, buses).
Cons	<ul style="list-style-type: none"> ▪ Bike lane adjacent to curb friction with buses, right turns, pedestrians and stopped vehicles. ▪ Disrupts 1 direction of bus service. ▪ Challenging crossing turn movement. ▪ Challenging transitions (one direction) to alternative configurations at corridor ends (e.g. side bike lanes). ▪ Opposite direction bicycle is out of motorists field of vision. May result in unexpected conflicts. ▪ Several sources, including AASHTO Guide for Development of Bicycle Facilities, 1999, recommend this configuration not be used. ▪ Transitions decrease continuity and consistency of bike lane over length of corridor. ▪ Oncoming vehicles' headlights present glare issue for opposing bicyclists and may result in safety issue. ▪ May require special intersection or signal phasing treatments to provide safe operation and reduce critical conflicts.

Based on the assessment of conflict points and pros and cons of each typical section, the two-way contra-flow (one side of the roadway) configuration was eliminated. Four primary determinations lead to this decision, as follows:

- **Encourages wrong way bicycle riding.** Additional signing will be required; however, it may still be possible that bicyclists would continue along this alignment at transition points, leading the bicyclist into oncoming traffic lanes.
- **Headlight glare.** Bicyclists traveling against the traffic flow will have motor vehicle headlights directly in their line of sight and may cause glare issues on the pavement. This may result or contribute to a potential safety concern.
- **Avoiding debris, motor vehicle, etc.** Avoiding objects in the contra-flow lane can place the opposite direction bicyclist into oncoming traffic. This is a serious safety concern.
- **Violates Expectations.** Contra-flow lanes violate the expectations of motorists. This can lead to several safety concerns and unexpected conflicts at intersections. When expectations are violated, motorists or bicyclists can react to situations in more unpredictable fashion, which leads to safety issues.

Universe of Alternatives

Under each of the four primary bicycle lane typical sections, numerous possible lane configurations can be created. Considering the existing transportation characteristics and controlling block street width, a multitude of potential typical sections were developed for each the Hennepin Avenue and 1st Avenue segments. Within the Downtown sub-area, 17 typical section alternatives were developed for Hennepin Avenue and six alternatives for 1st Avenue. Each alternative was reviewed and given a qualitative rating of poor, fair or good and was assessed based upon the key objectives highlighted previously. Table 14 provides a summary of the typical section alternatives considered for each segment of Hennepin Avenue. Table 15 provides a summary of the typical section alternatives considered for each segment of 1st Avenue.

The screening analysis identified several feasible preferred typical section alternatives for the Downtown sub-area. The highlighted alternatives are carried forward for further investigation. Within the South End and Northeast sub-areas, the most feasible alternatives that emerged are as follows:

- Hennepin Avenue Segment 1. Provide two-way bicycle lanes on the curb.
- Hennepin Avenue Segment 3 and Segment 4. Provide one-way bicycle lane on the curb with on-street parking where existing. (Bicycle lane could be on the left).
- Hennepin Avenue Segment 5 and 6. Provide curb lane bicycle lane or retain existing condition.
- 1st Avenue Segment 2. Provide one-way bicycle lane on the curb with on-street parking where existing. (Bicycle lane could be on the left).

Table 14. Universe of Alternatives Screening Analysis – Hennepin Avenue

Segment	Alternative	Typical Section	Description	Qualitative Rating		
				Poor	Fair	Good
1 (South End)	Existing Conditions	No-bike	Existing 5-lane undivided section	●		
	Alternative 1	Two Way Northbound Curb Lane Bike	4-traffic lanes, no turn lanes			●
	Alternative 2	Two Way Northbound Curb Lane Bike	5-traffic lanes with either TWCLTL or 3rd NB Thru Lane	●		
	Existing Conditions	Two Way Contra Flow Bike Lane	NB one-way, SB bus only lane	●		
	Alternative 1a	Two Way Center Bike Lane	4-traffic lanes, no turn lanes	●		
	Alternative 1b	Two Way Center Bike Lane	5-traffic lanes with left turn lanes		●	
	Alternative 2	Two Way Curb Lane Bike Lane	4-traffic lanes, no turn lanes and barrier between bike lane	●		
	Alternative 3	Two Way Curb Lane Bike Lane	5-traffic lanes with left turn lanes	●		
	Alternative 4	Two Way Curb Lane Bike Lane	4-traffic lanes, no turn lanes		●	● (1)
	Alternative 5	Two Way Curb Lane Bike Lane	4-traffic lanes, no turn lanes with off peak parking	●		
	Alternative 6	One Way Northbound Curb Lane Bike (Right Side)	5-traffic lanes with left turn lanes			●
	Alternative 7	One Way Northbound Curb Lane Bike (Right Side)	5-traffic lanes with left turn lanes with off peak parking	●		
	2 (Downtown)	Alternative 8	One Way Northbound Curb Lane Bike (Right Side)	4-traffic lanes, no turn lanes with NB parking lane	●	
Alternative 9		One Way Northbound Curb Lane Bike (Right Side)	4-traffic lanes, no turn lanes with SB parking lane		●	
Alternative 10		Two Way Contra Flow Bike Lane (Side)	4-traffic lanes, no turn lanes, with barrier between bike lanes	●		
Alternative 11		Two Way Contra Flow Bike Lane (Side)	5-traffic lanes with left turn lanes	●		
Alternative 12		No-bike	5-traffic lanes with left turn lanes and NB parking lane	●		
Alternative 12a		No-bike	Alternative bike route options	●		
Alternative 13a		One Way Northbound Bike Lane Left of Shared Transit/Right Turn Lane	3-traffic lanes with left turn lanes and shared transit/right turn lane northbound/southbound directions			●
Alternative 13b		Two Way Bike Lane Left of Shared Transit/Right Turn Lane (Northbound and Southbound Directions)	3-traffic lanes with left turn lanes and shared transit/right turn lane northbound/southbound directions	●		
Alternative 13c		Two-Way Hybrid Shared Lane	3-traffic lanes with left turn lanes and shared bike/transit/right turn lane northbound/southbound directions			●
3 (Northeast)		Existing Conditions	No-bike	Existing 6-lane divided section	●	
	Alternative 1	Two Way Curb Lane Bike Lane	6-lane divided section with marked bike lane			●
	Alternative 2	Two Way Curb Lane Bike Lane	6-lane divided section with wide curb lane (WCL)		●	
4 (Northeast)	Existing Conditions	No-bike	3 NB traffic lanes and 2-side parking	●		
	Alternative 1	One Way Northbound Curb Lane Bike Lane	3 NB traffic lanes and no parking (40 foot street width)			●
	Alternative 2	One Way Northbound Curb Lane Bike Lane	3 NB traffic lanes and 1-side parking (48 foot street width)			●
	Alternative 3	One Way Northbound Curb Lane Bike Lane	3 NB traffic lanes and 2-side parking (56 foot street width)			●
5 (Northeast)	Existing Conditions	No-bike	Existing 3 NB traffic lanes			●
	Alternative 1	One Way Northbound Curb Lane Bike Lane	3 NB traffic lanes with wide curb lane (WCL)		●	
	Alternative 2	One Way Northbound Curb Lane Bike Lane	2 NB traffic lanes			●
6 (Northeast)	Existing Conditions	No-bike	Existing 4-lane undivided section with 1-side parking	●		
	Alternative 1	Two Way Curb Lane Bike Lane	4-traffic lanes, no turn lanes and no parking	●		
	Alternative 2	Two Way Curb Lane Bike Lane	4-traffic lanes, no turn lanes and 1-side parking		●	

Table 15. Universe of Alternatives Screening Analysis – 1st Avenue

Segment	Alternative	Typical Section	Description	Qualitative Rating		
				Poor	Fair	Good
1 (2) (Downtown)	Existing Conditions	No-bike	3 SB traffic lanes and 2-side parking	●		
	Alternative 1	One Way Southbound Curb Lane Bike Lane	4-traffic lanes and 1-side parking (East)		●	● (1)
	Alternative 2	One Way Southbound Curb Lane Bike Lane	4-traffic lanes and 1-side parking (West)			● (1)
	Alternative 3	One Way Southbound Curb Lane Bike Lane	5-traffic lanes with left turn lanes and no parking	●		
	Alternative 4	One Way Southbound Curb Lane Bike Lane	5-traffic lanes with left turn lanes and NB off peak parking	●		
	Alternative 5	No-bike	5-traffic lanes with left turn lanes (3-traffic lanes with 2-side parking off peak)			●
	Alternative 6	Two Way Curb Lane Bike Lane (Paired with Hennepin Avenue Alternative 13C)	4-traffic lanes with off peak 2-side parking (parking is managed lane offset from curb face)			●
2 (Northeast)	Existing Conditions	No-bike	3 SB traffic lanes and 2-side parking	●		
	Alternative 1	One Way Southbound Curb Lane Bike Lane	3 SB traffic lanes and no parking (40 foot street width)			●
	Alternative 2	One Way Southbound Curb Lane Bike Lane	3 SB traffic lanes and 1-side parking (49 foot street width)			●
	Alternative 3	One Way Southbound Curb Lane Bike Lane	3 SB traffic lanes and 2-side parking (56 foot street width)			●

(1) Applies only to blocks without left turn lanes
 (2) Bike lane alternatives apply only with Hennepin Avenue Segment 2, Alternatives 6-9 and 13c

Evaluation of Preferred Alternatives (Downtown Sub-Area)

The Downtown sub-area (Hennepin Avenue Segment 2 and 1st Avenue Segment 1) found several potential alternatives requiring further investigation and will be discussed in the following sections. The conclusions of the Downtown sub-area evaluation will influence the final recommended bicycle lane placement in the South End and Northeast sub-areas (i.e., bicycle lanes on right or left side of roadway).

Preferred Alternatives Concept Layouts

Concept layouts depicting a typical three block segment of Hennepin Avenue were developed to illustrate the alternative Downtown sub-area typical sections. The concept layouts helped support the alternatives evaluation and provided visual aid in presenting to the stakeholders and community groups. The following summarizes the preferred alternatives:

- **Alternative 1b:** Two-way bicycle lane center running with left turn lanes (five lane roadway section; all motor vehicle lanes are general purpose).
- **Alternative 4:** Two-way curb bicycle lane with four general motor vehicle lanes and no left turn lanes.
- **Alternative 6:** One-way northbound curb bicycle lane (right side) with five general purpose motor vehicle lanes including left turn lanes. Southbound bicycle lane is provided on 1st Avenue.
- **Alternative 13a:** One-way northbound bicycle lane striped left of shared right turn/transit lane (left turn lanes provided). Hennepin Avenue is three general motor vehicle lanes including left turn lane with outside lanes being shared bus/right turn lanes. Southbound bicycle lane is provided on 1st Avenue.
- **Alternative 13c:** Modified three-lane cross-section with left turn lanes and shared bus/bike/right turn lane in both directions. Exclusive two-way curb bicycle lanes provided on 1st Avenue.

The concept layouts prepared for Hennepin Avenue Segment 2 are illustrated in Appendix C.

The 1st Avenue typical section schematics and concept layouts were developed for the following alternatives:

- **Alternative 1:** One-way southbound curb bicycle lane with east side on-street parking. 1st Avenue has four motor vehicle lanes and no exclusive turn lanes (Paired with Hennepin Avenue Alternative 6 or 13a)
- **Alternative 2:** One-way southbound bicycle lane with west side on-street parking. 1st Avenue has four motor vehicle lanes and no exclusive turn lanes (Paired with Hennepin Avenue Alternative 6 or 13a)
- **Alternative 5:** No bicycle lanes. Five lane roadway section with center left turn lane and no parking during peak hours. Three lane section with on-street parking both sides during off peak hours. (Paired with Hennepin Avenue Alternative 1b, 4 or 13c).
- **Alternative 6:** Two-way curb bicycle lanes. Four travel lanes and no on-street parking provided during peak hours. During off peak hours, on-street parking is provided in the right travel lane, offset from the curb. (Paired with Hennepin Avenue Alternative 13c).

The concept layouts developed for 1st Avenue are illustrated in Appendix C.

Evaluation Matrix

The preferred alternatives were evaluated against the 12 key project objectives and given a qualitative score of “meets objective”, “partially meets objective” and “does not meet objective.” Table 16 provides the evaluation matrix for the Hennepin Avenue Segment 2 alternatives.

Table 16. Evaluation Matrix – Hennepin Avenue (Downtown Sub-Area)

Priority	Project Objective	Alternative 1a	Alternative 1b	Alternative 4	Alternative 6	Alternative 13A	Alternative 13C
		(Two-way Center Bike Lane - No Left Turn Lanes)	(Two-way Center Bike Lane - w/ Left Turn Lanes)	(Two-way Curb Lane Bike Lane - No Left Turn Lanes)	(One-way Curb Lane Bike Lane - w/ Left Turn Lanes)	(One-way Left of Curb Lane Bike Lane - w/ Left Turn Lanes)	(Two-way Hybrid Shared Lane - w/ Left Turn Lanes)
1	Bicycle Safety (Conflicts)	○	○	■	●	■	●
2	Motor Vehicle Traffic Operations/Safety	○	■	○ ¹	●	○ ■ ²	○ ■ ²
3	Transit and Delivery Loading/Unloading Conflicts	●	●	○	■	●	●
4	Pedestrian Conflicts	●	●	■	■	●	●
5	Traffic Laws and Ordinances	■	■	●	●	●	●
6	Continuity / Consistency of Bike Lane over Corridor	○	○	●	■	■	■
7	Skill Level (Accommodate Type A and B Bicyclists)	■	■	●	●	■	■
8	Accessibility to Bike Lane from Cross-Street	■	■	●	■	■	■
9	Directness of Bike Route	●	●	●	○	○	●
10	MSA Standards / City Design Guidelines	■ / ●	○ / ■	● / ●	○ / ●	○ / ●	●
11	Maintenance	■	■	■	■	■	■
12	Accommodates On-street Parking/Loading	○	○	○	○	○	○

¹Receives a ● for block segments not containing left turn movements (e.g., typically every other block within downtown)

²Requires detailed analysis of transit operations to validate

- = Meets Objective
- = Partially Meets Objective
- = Does Not Meet Objective

Table 17 provides the evaluation matrix for the Hennepin Avenue Segment 2 alternatives.

Table 17. Evaluation Matrix – 1st Avenue (Downtown Sub-Area)

1st Avenue		Segment 1			
Priority	Project Objective	Alternative 1	Alternative 2	Alternative 5	Alternative 6
		(One-way Curb Lane Bike Lane - w/ East Side Parking)	(One-way Curb Lane Bike Lane - w/ West Side Parking)	(No Bike Lane)	(Two-way Curb Lane Bike Lane - w/ Two Side Parking)
1	Bicycle Safety (Conflicts)	●	■	NA	■
2	Motor Vehicle Traffic Operations/Safety	■	■	●	○ ■ ¹
3	Transit and Delivery Loading/Unloading Conflicts	■	■	●	■
4	Pedestrian Conflicts	■	■	■	■
5	Traffic Laws and Ordinances	●	●	●	●
6	Continuity / Consistency of Bike Lane over Corridor	■	■	NA	●
7	Skill Level (Accommodate Type A and B Bicyclists)	●	●	NA	●
8	Accessibility to Bike Lane from Cross-Street	■	■	NA	■
9	Directness of Bike Route	○	○	NA	●
10	MSA Standards / City Design Guidelines	■ / ●	■ / ●	○ / ●	○ / ●
11	Maintenance	■	■	●	■
12	Accommodates On-street Parking/Loading	■	■	●	●

¹Requires detailed analysis of transit operations to validate

- = Meets Objective
- = Partially Meets Objective
- = Does Not Meet Objective

Preferred Alternatives Pros and Cons Assessment

As part of assessing each preferred alternative, a comprehensive list of pros and cons were developed. The pros and cons provide a valuable means of comparing trade-offs and ensuring a balance between transportation modes and stakeholder needs is met.

Table 18 through Table 22 document the pros and cons associated with the Hennepin Avenue Alternatives 1b, 4, 6, 13a and 13c concepts, respectively.

Table 18. Pros and Cons Comparison – Hennepin Avenue Alternative 1b

Alternative 1b <i>(Two-way Center Bike Lane - w/ Left Turn Lanes)</i>	
Pros	<ul style="list-style-type: none"> ■ Removes bike lanes from heavy curb lane conflicts with Transit vehicles, right turning motor vehicles, taxis, loading/unloading and delivery operations. ■ Provides a continuous two-way delineated bicycle facility on Hennepin Avenue, consistent with the existing operation. ■ Approximately one-third of the bicycling community supports two-way center bike lane operation. ■ Snow removal and general maintenance is routine and bike lanes are typically free of debris. ■ Pavement conditions are excellent and center location removes the bicyclist from uneven gutter seam, drains, inlets or other curbside drainage structures. ■ Provides for exclusive left turn lanes to improve motor vehicle operations. ■ The provision of a shared motor vehicle-bike left turn lane reduces the potential for the left hook type crash.
Cons	<ul style="list-style-type: none"> ■ Although the potential for a left hook type crash is reduced at the intersection, this type of crash occurrence cannot be easily controlled at mid-block accesses and private driveways. The concern may be further escalated at these locations due to the narrow vehicle lanes, small space between the bike lane (five feet) and the two adjacent moving lanes. ■ Motorist expectation is violated at the intersection between a through moving bicycle and an opposing left turn motor vehicle. Because the bicycle is in the left turn lane, the opposing motor vehicle may be expecting the bicycle to be turning left. Additional signing is likely required to address this concern. ■ The “left squeeze” type crash is expected to increase. Several scenarios involving the merging of bicycles and motor vehicles (whether too early into the lane, or while either the motor vehicle or bicycle is overtaking the other) could result in the bicyclist reacting to the left. Due to the narrow lanes and small margin of error, any reaction of the bicyclist to the left could result in the bicyclist encroaching into the oncoming lane of traffic. ■ The right most general traffic lane will be subject to frequent conflicts with bus stops, curbside uses and pedestrians. As a result, erratic lane changes and poor lane utilization is expected to occur. ■ The center bike lane alignment results in challenging transitions to/from curb lane treatments on either end of the downtown segment. Transitions decrease continuity and consistency along the length of the corridor. ■ The center bike lane caters to Type A bicyclists only. Due to the advanced skills or comfort level required to make both left and right turns, Type B bicyclists will not be attracted to Hennepin Avenue. ■ Requires difficult left and right turn movements to enter and exit the corridor. ■ May require special intersection, signing/markings, physical lane line delineation (removable pylons), colored pavement treatments or signal phasing treatments to provide safe operation and reduce the critical conflict points and merging safety issues. ■ Although the provision of special treatments may be feasible at the intersection, mid-block access points and private driveways, where the same safety concerns exist, are not as easily controlled. ■ Defies speed positioning principles. The center bike lane places the bicyclists adjacent to the faster moving lane. ■ There does not seem to be a single documented example of a two-way center bike lane in operation any where in the Country. ■ An MSA variance will be required on half of the block segments.

Table 19. Pros and Cons Comparison – Hennepin Avenue Alternative 4

Alternative 4 <i>(Two-way Curb Lane Bike Lane - No Left Turn Lanes)</i>	
Pros	<ul style="list-style-type: none"> ■ Reduces overall conflicts and eliminates the critical conflict points compared to Alternative 1b. ■ Delineated bike lane position and location is much more conventional with the City of Minneapolis and other municipality’s practices throughout the Country. ■ Provides a continuous two-way delineated bicycle facility on Hennepin Avenue, and provides for consistent transitions between other segments along the corridor (e.g., Northeast and South End). ■ Approximately two-thirds of the Bicycling community supports two-way curb bike lane operation. ■ Better facilitates Type B bicyclists by providing lanes with direct access to crosswalks for making left turn movements and allows a non-conflicting right turn movement. ■ Provides for a minimum six foot bike lane width (including two foot gutter). The extra foot of width helps pull the bicycle off the rough gutter/pavement seam. ■ Meets MSA requirements for street widths.
Cons	<ul style="list-style-type: none"> ■ Places bike lane in the location of heavy curb lane conflicts with Transit vehicles, right turning motor vehicles, taxis, loading/unloading and delivery operations. Due to the existing and anticipated activity of the curb-side uses, the bicycle lane may be frequently rendered unusable in locations. ■ Due to the narrow travel lane widths, maneuvering around stopped curbside vehicles may cause frequent merging into the adjacent travel lane. ■ Curb side bike lane places the bicyclist to the right of transit vehicles at bus stops. Due to the high level of transit service along Hennepin Avenue, there is a significant safety risk with buses (large blind spot on right side of bus) potentially squeezing the bicycle between the curb and bus. Metro Transit has expressed strong opposition to this alternative. ■ Motor vehicle traffic safety risk is also increased. Left turn movements will occur out of a shared lane and are offset from the opposing left turn lane. This condition will result in reduced sight lines and a greater exposure to rear end crashes. It is likely that left turn motor vehicles will block the bicycle lanes while waiting to make their movement. ■ Due to the street width, two-way curb bike lanes along Hennepin will prohibit exclusive left turn lanes along the length of the corridor, which is expected to significantly impact traffic operations. Specifically in the event of a left turn motor vehicle in left lane and a stopped bus in the right lane. ■ The right most general motor vehicle traffic lane will be subject to frequent conflicts with bus stops, curbside uses and pedestrians. As a result, erratic lane changes and poor lane utilization are expected to occur. ■ Curb side bike lanes are typically a challenge to keep clean and maintain. They often collect debris, and snow removal can be problematic. ■ The pavement/gutter seam can also be problematic and often requires routine maintenance to keep smooth. Along Hennepin Avenue, there are many manholes along the curbside (within pavement along gutter seam) that are set deep (several in excess of several inches). Deep set manholes are expected to be problematic for safe bike operation.

Table 20. Pros and Cons Comparison – Hennepin Avenue Alternative 6

Alternative 6 <i>(One-way Curb Lane Bike Lane - w/ Left Turn Lanes)</i>	
Pros	<ul style="list-style-type: none"> ■ Provides for exclusive left turn lanes to improve motor vehicle operations. ■ Reduces overall conflicts and eliminates the critical conflict points compared to Alternative 1b and Alternative 4. ■ Delineated bike lane position and location is much more conventional with the City of Minneapolis and other municipality’s practices throughout the Country. ■ Provides a continuous delineated bicycle facility on Hennepin Avenue with consistent transitions between other segments along the corridor (e.g., Northeast and South End) in one direction of Hennepin Avenue. ■ Better facilitates Type B bicyclists by providing lanes with direct access to crosswalks for making left turn movements, and allows a non-conflicting right turn movement.
Cons	<ul style="list-style-type: none"> ■ Places bike lane in the location of heavy curb lane conflicts with Transit vehicles, right turning motor vehicles, taxis, loading/unloading and delivery operations. Due to the existing and anticipated activity of the curb-side uses, the bicycle lane may be frequently rendered unusable in locations. ■ Due to the narrow travel lane widths, maneuvering around stopped curbside motor vehicles may cause frequent merging into the adjacent travel lane. ■ Curb side bike lane places the bicyclist to the right of transit vehicles at bus stops. Due to the high level of transit service along Hennepin Avenue, there is a significant safety risk with buses (large blind spot on right side of bus) potentially squeezing the bicycle between the curb and bus. Metro Transit has expressed strong opposition to this alternative. ■ The southbound delineated bike lane would be moved to 1st Avenue. The bike lane continuity in this direction is disrupted. As a result, the occurrence of wrong-way bicycle operation may increase or the southbound bicyclists will elect to operate in an unmarked general motor vehicle traffic lane. ■ The southbound bike lane along 1st Avenue will need to transition back to Hennepin Avenue via 10th Street N (eastbound one-way). However, the Hennepin Avenue block segment of 11th Street N to 12th Street N can not accommodate two-way bike operation and left turn lanes. As an alternative, the southbound bike lane on 1st Avenue could extend to 12th Street N. However, this would then require the bicyclist to change lanes and make a left turn at a high volume 394 freeway entrance ramp terminal intersection. ■ The right most general motor vehicle traffic lane will be subject to frequent conflicts with bus stops, curbside uses and pedestrians. As a result, erratic lane changes and poor lane utilization are expected to occur. ■ Curb side bike lanes are typically a challenge to keep clean and maintain. They often collect debris and snow removal can be problematic. ■ The bike lane width is five feet including the two foot gutter. The pavement/gutter seam is expected to be problematic and would initially require surface work, followed by routine maintenance, to keep smooth. Along Hennepin Avenue, there are many manholes along the curbside (within pavement along gutter seam) that are set deep (several in excess of several inches). Deep set manholes are expected to be problematic for safe bike operation. ■ An MSA variance will be required on half of the block segments.

Table 21. Pros and Cons Comparison – Hennepin Avenue Alternative 13a

Alternative 13A <i>(One-way Left of Curb Lane Bike Lane - w/ Left Turn Lanes)</i>	
Pros	<ul style="list-style-type: none"> ■ Provides for exclusive left turn lanes to improve motor vehicle operations. ■ Locates the delineated bike lane left of the curbside bus/right turn only traffic lane, thus removing bicycles from conflicts with Transit vehicles, right turning motor vehicles, taxis, loading/unloading and delivery operations. ■ Reduces overall conflicts and eliminates the critical conflict points compared to Alternative 1b and Alternative 4. ■ Provides a continuous delineated bicycle facility on Hennepin Avenue with consistent transitions between other segments along the corridor (e.g., Northeast or South End) in one direction of Hennepin Avenue. ■ Better facilitates Type B bicyclists by providing lanes with better access to crosswalks for making left turn movements as opposed to Alternative 1b. ■ Snow removal and general maintenance is routine, and bike lanes are typically free of debris. ■ Pavement conditions are excellent and the lane location removes the bicyclist from uneven gutter seam, drains, inlets or other curbside drainage structures. ■ Transit operation is improved by removing the general traffic from the curb side traffic lane. ■ The probability of sideswipe crashes and erratic lane change behavior is reduced (reduces overall impact on capacity and safety) by removing general traffic from behind stopped buses, curbside loading, taxis and other uses. The modified three-lane configuration marks the roadway consistent with how traffic is expected to utilize or operate on Hennepin. As such, vehicle safety is expected to improve with minimal impact to motor vehicle operations. ■ Curb side loading, deliveries, valets, taxis and other uses can be more easily accommodated by reducing the overall conflict with general moving traffic lane. ■ A marked shared lane facility is provided in the southbound direction to maintain bike lane continuity over the length of Hennepin Avenue. Refer to Alternative 13c for further discussion.
Cons	<ul style="list-style-type: none"> ■ Weaving and crossing movements over the bike lane are expected to occur every other block. An indirect impact of right turning motor vehicles bypassing a stopped bus and crossing over the bike lane is expected to occasionally occur. This may contribute to sideswipe or “left squeeze” type crashes. ■ Although a marked shared lane is delineated in the southbound direction, the provision of a solid delineated bike lane in the northbound direction may solicit occasional wrong-way bicyclists. With the lane being located between two moving traffic lanes, any occurrence of wrong way biking would be extremely hazardous. ■ An increase in enforcement will be required to maintain the intended vehicle operation of the bus and right turn only lane. ■ The use of the “sharrows” (shared lane bicycle symbol) will require Federal Highway approval. ■ An MSA variance will be required on half of the block segments.

Table 22. Pros and Cons Comparison – Hennepin Avenue Alternative 13c

Alternative 13C <i>(Two-way Hybrid Shared Lane - w/ Left Turn Lanes)</i>	
Pros	<ul style="list-style-type: none"> ■ Provides for exclusive left turn lanes to improve motor vehicle operations. ■ The “sharrows” delineate the intended location for bicycles to operate and notifies motorists to where they are expected. ■ Provides flexibility to locate and direct the bicycles left of the curbside bus/right turn only traffic lane, thus removing bicycles from conflicts with Transit vehicles, taxis, loading/unloading and delivery operations. ■ On blocks with left turn lanes, bicycles share the space with transit vehicles, curbside uses and occasional passenger vehicles. There is a good probability that bicycles will benefit from unoccupied space or low conflict, yielding a much more comfortable ride. At intersections where bus stops are present, the lane width is such that safe passage of stopped buses, without intruding on the adjacent travel lane, is possible. ■ On blocks without left turn lanes, an 18.5 foot lane is provided. Sufficient space is available to direct bicyclists (using the “sharrows”) to operate left of all curbside activity and right turning vehicles, minimizing the overall conflicts. ■ Reduces overall conflicts and eliminates the critical conflict points compared to Alternative 1b and Alternative 4 and alternative 6. ■ Provides a continuous two-way marked bicycle facility on Hennepin Avenue with consistent transitions between other segments along the corridor (e.g., Northeast and South End). ■ Better facilitates Type B bicyclists by providing lanes with better access to crosswalks for making left turn movements, as opposed to Alternative 1b. ■ Snow removal and general maintenance is priority (traffic lane), and its location will be typically free of debris. ■ Pavement conditions are excellent and the lane location removes the bicyclist from uneven gutter seam, drains, inlets or other curbside drainage structures. ■ Transit operation is improved by removing the general traffic from the curb side traffic lane. ■ The probability of sideswipe crashes and erratic lane change behavior is reduced (reduces overall impact on capacity and safety) by removing general traffic from behind stopped buses, curbside loading, taxis and other uses. The modified three-lane configuration marks the roadway, consistent with how traffic is expected to utilize or operate on Hennepin. As such, vehicle safety is expected to improve with minimal impact to motor vehicle operations. ■ Curb side loading, deliveries, valet’s, taxis and other uses can be more easily accommodated by reducing the overall conflict with general moving traffic lane. ■ MSA standards and lane width requirements are satisfied on all block segments.
Cons	<ul style="list-style-type: none"> ■ Weaving and crossing movements over the bike lane are expected to occur every other block. An indirect impact of right turning motor vehicles bypassing a stopped bus and crossing over the shared bike space is expected to occasionally occur. This may contribute to sideswipe or “left squeeze” type crashes. ■ An increase in enforcement will be required to maintain the intended vehicle operation of the bus and right turn only lane. ■ The use of the “sharrows” (shared lane bicycle symbol) may require Federal Highway approval.

As a result of the pros and cons assessment, Alternative 4 was eliminated from further consideration. Alternative 4 is expected to result in a significant operational impact in the event of a side-by-side waiting left turn motor vehicle and stopped transit vehicle. Remedies to this situation (i.e., turn restrictions) result in violation of the Downtown Action Plan vision for the corridor and is directly opposite of the primary concern of the business community, which is to improve circulation.

Table 23 through Table 25 document the key pros and cons associated with the 1st Avenue Alternatives 1, 2, 5 and 6 concepts, respectively.

Table 23. Pros and Cons Comparison – 1st Avenue Alternative 1 and 2

Alternative 1 and Alternative 2 (One-way Curb Lane Bike Lane - w/ Either East Side or West Parking)	
Pros	<ul style="list-style-type: none"> ■ Provides for four motor vehicle travel lanes. ■ Delineated bike lane position and location is conventional with the City of Minneapolis and other municipality’s practices throughout the Country. ■ Maintains permanent and full-time on-street parking along one side of the street ■ MSA standards and lane width requirements are satisfied on all block segments. ■ Facilitates Type B bicyclists by providing lanes with direct access to crosswalks for making left turn movements.
Cons	<ul style="list-style-type: none"> ■ Due to the narrow travel lane widths, maneuvering around stopped curbside vehicles may cause frequent merging into the adjacent travel lane. ■ Exclusive left turn lanes cannot be provided due to street width constraint. ■ Removes approximately half of the on-street parking quantity ■ The northbound delineated bike lane is located on Hennepin Avenue. The bike lane continuity in this direction is disrupted. As a result, the occurrence of wrong-way bicycle operation may increase or the northbound bicyclists will elect to operate in an unmarked general traffic lane. ■ The southbound bike lane along 1st Avenue will need to transition back to Hennepin Avenue via 10th Street N (eastbound one-way). However, the Hennepin Avenue block segment of 11th Street N to 12th Street N cannot accommodate two-way bike operation and left turn lanes. As an alternative, the southbound bike lane on 1st Avenue could extend to 12th Street N. However, this would require the bicyclist to change lanes and make a left turn at a high volume 394 freeway entrance ramp terminal intersection. ■ Curb side bike lanes are typically a challenge to keep clean and maintain. They often collect debris, and snow removal can be problematic.

Table 24. Pros and Cons Comparison – 1st Avenue Alternative 5

Alternative 5 <i>(No Bike Lane - 5-Lane Section)</i>	
Pros	<ul style="list-style-type: none"> ■ Provides for five motor vehicle travel lanes, including an exclusive left turn lane during peak periods. ■ Delineated bike lane position and location is conventional with the City of Minneapolis and other municipality’s practices throughout the Country. ■ Maintains permanent on-street parking along both sides of the street during off-peak periods. ■ MSA standards and lane width requirements are satisfied on all block segments.
Cons	<ul style="list-style-type: none"> ■ Does not include bicycle accommodations. ■ Parking is restricted during both the AM and PM peak periods.

Table 25. Pros and Cons Comparison – 1st Avenue Alternative 6

Alternative 6 <i>(Two-way Curb Lane Bike Lane - w/ Two Side Parking)</i>	
Pros	<ul style="list-style-type: none"> ■ Provides for four motor vehicle travel lanes during AM and PM peak periods. ■ Maximizes the street space by utilizing the right most travel lane for on-street parking during off peak periods. This minimizes the on-street parking removal. ■ MSA standards and lane width requirements are satisfied on all block segments. ■ Provides a buffer between the sidewalk and on-street parking. Increases pedestrian space and improves environment. ■ Reduces potential for motor vehicle door/bicycle conflicts by placing the lane on the right side of the parking. ■ Facilitates Type B bicyclists by providing lanes with direct access to crosswalks for making left turn movements. Also provides buffer between traffic lane and bicycle lane on several blocks, providing greater comfort.
Cons	<ul style="list-style-type: none"> ■ Exclusive left turn lanes cannot be provided due to street width constraint. ■ Several on street parking stalls will need to be removed on each block to provide clearance zones and left/right turn bypass lanes. ■ Routine enforcement will be required to operate as designed. ■ Unique and complex roadway signing will be required to achieve intended operation. In addition, special pavement markings and painting may be required to provide sufficient delineation. ■ Transitions between Hennepin Avenue and 1st Avenue corridors will need to be addressed. ■ Curb side bike lanes are typically a challenge to keep clean and maintain. They often collect debris, and snow removal can be problematic.

On-Street Parking Impact

On-street parking within the Downtown sub-area is a critical consideration and an important element to many stakeholders. The following documents the estimated on-street parking impact with each Hennepin Avenue alternative.

- Alternative 1b: No Impact
- Alternative 4: No Impact
- Alternative 6: No Impact
- Alternative 13a: No Impact
- Alternative 13c: No Impact

The following documents the estimated on-street parking impact with each 1st Avenue alternative.

- Alternative 1: 92 full-time on-street metered parking stalls (permanently remove 54 meters)
- Alternative 2: 62 full-time on-street metered parking stalls (permanently remove 84 meters)
- Alternative 5: 146 off peak metered on-street parking stalls. Zero peak hour parking spaces.
- Alternative 6: 77 off peak metered on-street parking stalls (permanently remove 69 meters). Zero peak hour parking spaces.

Preferred Alternatives Motor Vehicle Traffic Operation Analysis

The efficient movement of motor vehicle traffic is a key objective in weighing the feasibility of the preferred alternatives. A traffic operation analysis was conducted to compare the relative performance of the alternatives, identify any additional concerns, and generate key conclusions.

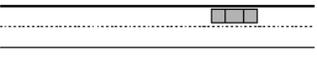
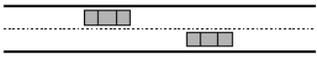
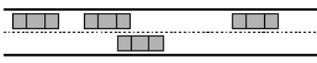
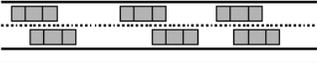
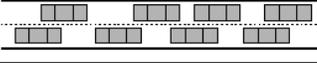
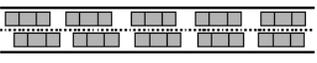
The Downtown is complex and dynamic system, including many variables that influence motor vehicle mobility. However, the primary variables influencing the intersection capacity along Hennepin Avenue and 1st Avenue include: motor vehicle volumes, traffic signal timing, pedestrian activity, transit routes/schedules and stops, and lane configuration. From an intersection operation and capacity standpoint, the bicycle lane placement impact is reflected in how the general vehicle traffic lanes are configured (e.g., bicycle removes motor vehicle lane or precludes left turn lane, etc.) The interaction of these variables, and how this relates to operation capacity, can be captured using micro-simulation techniques. A VISSIM simulation model was created by SEH, Inc. and used to conduct the operation analysis of the transportation network. Several of the alternatives are expected to have similar operating characteristics and were generalized together. SEH developed the following PM peak hour VISSIM models:

- **Scenario 1:** Hennepin Avenue is five-lane section with general traffic lanes and 1st Avenue is four-lane section. (Reflects Hennepin Avenue Alternatives 1b, 6 and 13a, and 1st Avenue Alternatives 1, 2 and 6).
- **Scenario 2:** Hennepin Avenue is modified three-lane section (right lane is shared bus, right turn and bicycle) and 1st Avenue is four-lane section. (Reflects Hennepin Avenue Alternative 13c and 1st Avenue Alternatives 1, 2 and 6).
- **Scenario 3:** Hennepin Avenue is modified three-lane section (right lane is shared bus, right turn and bicycle) and 1st Avenue is three-lane section. (Reflects Hennepin Avenue Alternative 13c and 1st Avenue Alternative 6 with full-time on-street parking).

The results of traffic operation analysis are presented in the form of a Level of Service⁴ and given a letter grade (A-F) that provides a qualitative indication of the operational efficiency or effectiveness. By definition, LOS A conditions represents high-quality operations and LOS F conditions represent very poor operations. The general relationship between delay and LOS are graphically displayed in Table 26.

4 Highway Capacity Manual, 2000 Edition, Transportation Research Board

Table 26. LOS Definition

Level of Service	Description	Delay per Vehicle (Seconds)	
		Signalized Intersection	Un-signalized Intersection
A	 Free Flow. Low volumes and no delays.	0 - 10	0 - 10
B	 Stable Flow. Speeds restricted by travel conditions, minor delays.	>10 - 20	>10 - 15
C	 Stable Flow. Speeds and maneuverability closely controlled due to higher volumes.	>20 - 35	>15 - 25
D	 Stable Flow. Speeds considerably affected by change in operating conditions. High density traffic restricts maneuverability, volume near capacity.	>35 - 55	>25 - 35
E	 Unstable Flow. Low speeds, considerable delay, volume at or slightly over capacity.	>55 - 80	>35 - 50
F	 Forced Flow. Very low speeds, volumes exceed capacity, long delays with stop and go traffic.	>80	>50

Source: Highway Capacity Manual, 2000 Edition, Transportation Research Board, Exhibit 16-2 for Signalized Intersections and Exhibit 17-2 for Unsignalized Intersections.

The detailed results of the VISSIM simulation analyses are included in Appendix D. Table 27 documents the results of the three scenarios evaluated. The key conclusions of the traffic operation analysis are as follows:

- Exclusive left turn lanes on Hennepin Avenue are required to provide acceptable circulation and motor vehicle mobility.
- Four motor vehicle travel lanes (without exclusive left turn lane) are expected to provide acceptable peak period traffic operations on 1st Avenue.
- A traditional three-lane section along 1st Avenue is inadequate during peak periods. The analysis found on-street parking should be restricted between 7 and 9 AM and 3 to 6 PM and during Target Center and Twins Stadium events.
- The incremental capacity difference between the Hennepin Avenue five general traffic lane section and the three-lane with shared bus/right turn and bicycle section is minimal. In other words, they both provide approximately equal peak period capacity. This is due to the high number of buses, frequent bus stops and significant pedestrian activity, which all serve to minimize the capacity of the right curbside lane.

Table 27. Motor Vehicle Traffic Analysis Results Summary – Downtown Sub-Area

Intersection	Scenario 1		Scenario 2		Scenario 3	
	Delay (Sec/Veh)	LOS	Delay (Sec/Veh)	LOS	Delay (Sec/Veh)	LOS
Hennepin Avenue at 12 th Street N	9.0	A	10.0	A	40.0	D
Hennepin Avenue at 11 th Street N	59.0	E	75.0	E	129.0	F
Hennepin Avenue at 10 th Street N	9.0	A	14.0	B	45.0	D
Hennepin Avenue at 9 th Street N	76.0	E	84.0	F	273.0	F
Hennepin Avenue at 8 th Street N	11.0	B	17.0	B	61.0	E
Hennepin Avenue at 7 th Street N	21.0	C	24.0	C	57.0	E
Hennepin Avenue at 6 th Street N	9.0	A	13.0	B	17.0	B
Hennepin Avenue at 5 th Street N	28.0	C	44.0	D	23.0	C
Hennepin Avenue at 4 th Street N	9.0	A	45.0	D	15.0	B
Hennepin Avenue at 3 rd Street N	28.0	C	45.0	D	249.0	F
Hennepin Avenue at Washington Avenue N	17.0	B	24.0	C	61.0	E
Hennepin Avenue at 2 nd Street N	15.0	B	20.0	B	97.0	F
Hennepin Avenue at 1 st Street N	20.0	C	21.0	C	96.0	F
1 st Avenue at Washington Avenue N	14.0	B	15.0	B	76.0	E
1 st Avenue at 3 rd Street N	12.0	B	12.0	B	120.0	F
1 st Avenue at 4 th Street N	21.0	C	21.0	C	74.0	E
1 st Avenue at 5 th Street N	14.0	B	14.0	B	58.0	E
1 st Avenue at 6 th Street N	12.0	B	11.0	B	108.0	F
1 st Avenue at 7 th Street N	18.0	B	18.0	B	38.0	D
1 st Avenue at 8 th Street N	32.0	C	34.0	C	31.0	C
Hawthorne Avenue at 9 th Street N	40.0	D	41.0	D	97.0	F
Hawthorne Avenue at 10 th Street N	21.0	C	38.0	D	192.0	F
Hawthorne Avenue at 11 th Street N	27.0	C	28.0	C	30.0	C
Hawthorne Avenue at 12 th Street N	10.0	B	11.0	B	12.0	B

¹ Analysis results obtained using VISSIM
Source: SEH, Inc. and City of Minneapolis

Evaluation of Preferred Alternatives (South End Sub-Area)

The most feasible and practical alternative is to provide northbound and southbound curb bicycle lanes between Lyndale Avenue and 12th Street N. However, in order to meet minimum design standards, the third northbound motor vehicle through lane will need to be removed, converting this segment to a four-lane undivided roadway. On-street parking is not impacted by the provision of bicycle lanes in this segment. MSA minimum design standards are satisfied.

To assess the impact of removing a northbound motor vehicle lane, a traffic operation analysis was conducted. Both the AM and PM peak hours were evaluated. Table 28 documents the results of the traffic analysis

Table 28. Motor Vehicle Traffic Analysis Results Summary – South End Sub-Area

AM Peak Hour

Intersection	Existing Roadway Lane Geometrics		Proposed Bicycle Lane	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Hennepin Avenue at Lyndale Avenue N	108.0	F ¹	96.0	F ²
Hennepin Avenue at 17th Street N	33.0	C	34.0	C
Hennepin Avenue at 16th Street N	17.0	B	31.0	C
Hennepin Avenue at Laurel Avenue N	8.0	B	20.0	C
Hennepin Avenue at 13th Street N	3.0	A	5.0	A

¹ SB Lyndale Avenue N Approach had a LOS of F

² SB Lyndale Avenue N Approach had a LOS of F

³ EB Hennepin Avenue Approach had a LOS of E

PM Peak Hour

Intersection	Existing Roadway Lane Geometrics		Proposed Bicycle Lane	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Hennepin Avenue at Lyndale Avenue N	34.0	C ⁴	35.0	C ⁶
Hennepin Avenue at 17th Street N	19.0	B	22.0	C
Hennepin Avenue at 16th Street N	9.0	A	11.0	B
Hennepin Avenue at Laurel Avenue N	19.0	B	27.0	C
Hennepin Avenue at 13th Street N	8.0	A	8.0	A

⁴ SB Lyndale Avenue N Approach had a LOS of E

⁵ WB Hennepin Avenue Approach had a LOS of F

⁶ SB Lyndale Avenue N Approach had a LOS of E

⁷ WB Hennepin Avenue Approach had a LOS of F

Based on the motor vehicle traffic analysis, a four-lane undivided roadway with curb bicycle lanes in both the northbound and southbound directions is expected to provide acceptable motor vehicle operations.

Evaluation of Preferred Alternatives (Northeast Sub-Area)

The review of potential alternatives in the Northeast sub-area found the most feasible option is to provide a designated curb lane bicycle lane. Since both Hennepin Avenue and 1st Avenue are one-way pairs in this segment, the bicycle lane could be provided on either the right or left side of the roadway. The determination of the appropriate side is based upon the Downtown sub-area alignment, with the primary desire to provide consistent transitions. Placing the bicycle lanes on the right side of Hennepin Avenue and 1st Avenue is recommended.

On-Street Parking Impact

To provide bicycle lanes in the Northeast sub-area, the following on street parking impacts are expected:

- Hennepin Avenue (4th Street NE to 5th Street NE): Remove 12 on-street parking stalls on the east side.
- 1st Avenue (4th Street NE to University Avenue NE): Remove six on-street parking stalls (three on each side)
- 1st Avenue (University Avenue NE to 2nd Street NE): Remove 14 on-street metered parking stalls on the east side.
- 1st Avenue (2nd Street NE to Main Street NE): Add four on-street metered parking stalls.

Traffic Operations

The implementation of on-street bicycle lanes is not expected to impact traffic operations along Hennepin Avenue. All existing intersection lane geometrics can be maintained through narrowing the traffic lanes.

Along 1st Avenue, the intersection of University Avenue NE is expected to present a safety concern. Currently, the southbound approach consists of one right turn lane and a shared through-right turn lane. This situation presents a potential right turn conflict with through destined bicyclists. This situation can be mitigated through pavement marking and signing requiring the bicyclist to merge or the inside right turn movement can be removed. The impact of converting this approach to only a single right turn lane was evaluated. The results of the PM peak hour traffic operation analysis are shown in Table 29.

**Table 29. Motor Vehicle Traffic Analysis Results Summary –
1st Avenue at University Avenue NE**

Roadway Geometry	1st Avenue at University Avenue NE									
	University Avenue NE				1st Avenue				Overall Intersection	
	EB Approach		WB Approach		SB Approach		SB Right		Delay (sec/veh)	LOS
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS		
Existing Roadway Lane Geometrics	24.7	C	26.9	C	8.5	A	6.8	A ¹	15.4	B
Option 1 - 1 Southbound Right Turn Lane	24.8	C	31.1	C	8.9	B	8.1	A ²	15.7	B
Option 2 - 1 Southbound Right Turn Lane with Extended Storage	24.8	C	31.1	C	8.5	B	7.4	A ³	15.5	B

¹ Southbound thru-right turn lane queue length is 210 feet and southbound right turn lane queue length is 150 feet

² Southbound right turn lane queue length > 150 feet (impacts adjacent thru lane)

³ Southbound right turn lane queue length is 235 feet (no queue impact)

The following analysis conclusions are drawn:

- The southbound right turn volume is approximately 200-300 motor vehicles per hour during the morning and early afternoon time periods.
- During the PM peak hour (highest right turn volume for the day), the southbound right turn volume is approximately 570 motor vehicles.
- A field review found approximately 80 percent of the motor vehicles are already making the right turn from the curb lane.
- The operation analysis shows minimal change in motor vehicle delay between the “with” and “without” double right turn scenarios.

Considering the right turn motor vehicle volume, the southbound right turn lane will require additional storage. In addition, the bicycle lane should be striped as an exclusive lane to the left of the right turn lane.

Minimum Design Standards

The provision of on-street bicycle lanes on Hennepin Avenue between Wilder Street NE and Central Avenue and on 1st Avenue between Central Avenue and DeLaSalle Drive NE is expected to require a MSA variance. On several blocks, the minimum parking width of ten feet cannot be met (only eight feet is available) and the left motor vehicle lane is 12 feet (a 13 foot minimum lane, including reaction zone, is required). Several block segments could avoid an MSA variance by reducing the width of the bicycle lane to five feet and increasing the motor vehicle travel lane to 13 feet.

Recommended Bike Plan



Recommendations were developed based upon the input received from stakeholder and community meetings, evaluation of all feasible alternatives and balancing the impacts. The following sections document the recommended Bicycle Plan. A concept layout illustrating the key pavement marking and roadway signing elements of the recommended Bicycle Plan is shown in Figure 11 to Figure 18.

Recommended Roadway Cross-Section – South End Sub-Area

The South End sub-area includes Hennepin Avenue between Lyndale Avenue N and 12th Street N (Segment 1). Recommendations include:

- Convert Hennepin Avenue to a four lane undivided roadway with no exclusive left turn lanes.
- Provide a minimum of a seven foot bicycle lane along the curb in both the northbound and southbound directions.
- Begin the northbound bicycle lane, just west of Lyndale Avenue N to allow for an appropriate distance to transition Hennepin Avenue to two motor vehicle lanes.
- End the southbound bicycle lane at 16th Street N.
- The extension of the southbound bicycle lane should not occur until bicycle lanes are pursued on Dunwoody Boulevard further to the west. At such time, a shared-lane configuration will be required between 16th Street N and Aldrich Avenue due to the limited street width.

Recommended Roadway Cross-Section – Downtown Sub-Area

The Downtown sub-area includes the segment of Hennepin Avenue between 12th Street N and 1st Street N (Segment 2) and the segment of 1st Avenue between 2nd Street N and the Hawthorne Avenue/12th Street N intersection (Segment 1). The recommendations are as follows:

- On Hennepin Avenue implement Alternative 13c. Alternative 13c (modified three lane section with exclusive left turn lanes, a general traffic lane and a shared bus/bike and right turn lane) is expected to strike the best balance between all constituent groups and transportation modes. The following are the key factors in this determination:
 - Balances the motor vehicle operation and marks the roadway consistent with how the predominate number of motorists are expected to utilize or operate on Hennepin Avenue.
 - Provides exclusive left turn lanes and maintains the intended circulation through downtown in serving the business community.
 - Expected to improve bicycle safety by promoting awareness and two-party responsibility between both the motorist and the bicycle.
 - Improves transit service and operation by reducing motor vehicle conflicts.
 - Reduces bicycle conflicts with curbside uses and transit stops by delineating the bicycles to the left.

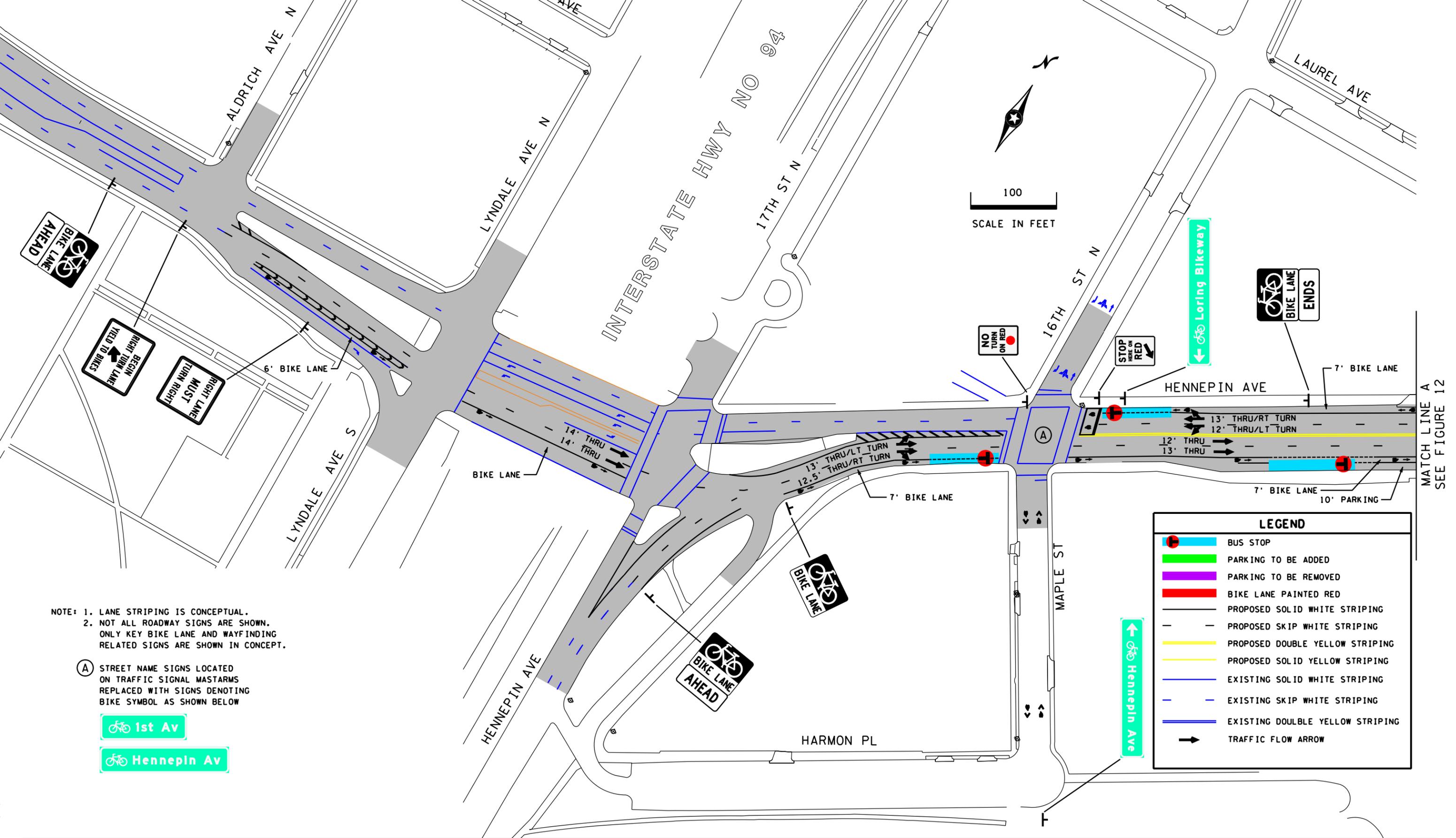
- Enhances curbside activity by reducing the conflicts with general traffic.
 - Removes bicycles from conflicts with same direction left turning motor vehicles.
 - Encourages a “complete street” or “complete corridor” approach to the transportation system when considering 1st Avenue and Nicollet Mall. Three different facilities will be provided to serve the varying skill levels of all bicyclists traveling through downtown.
 - The extension of two way bike lanes along 1st Avenue provides a necessary connection to the Cedar Lake Trail.
 - Provides continuity and consistent bicycle alignment along both directions of Hennepin Avenue in transitioning west of 12th Street N and across the Hennepin Avenue Bridge into Northeast Minneapolis.
 - Does not require special pavement rehabilitation or snow removal maintenance activities.
 - Meets MSA design standards and minimum lane width requirements on all block segments.
- On 1st Avenue, implement Alternative 6. Alternative 6 (four lane undivided roadway with two-way curb bicycle lane and offset managed on-street parking lane) is expected to strike the best balance between all constituent groups and transportation modes. The following are the key factors in this determination:
 - Encourages a “complete street” or “complete corridor” approach to the transportation system when considering Hennepin Avenue and Nicollet Mall. Three different facilities will be provided to serve the varying skill levels of all bicyclists traveling through downtown.
 - Increases the sidewalk area and improves the pedestrian environment by providing a larger buffer area between the moving motor vehicle lane.
 - Maximizes the available street space and best meets the needs of all roadway users.
 - Best balances the retention and use of on-street parking while providing bicycle lanes and reducing impacts to mobility.
 - Install No Parking, No Stopping 7 to 9 AM and 3 to 6 PM on 1st Avenue between 9th Street N and 2nd Street N.
 - Install No Parking Anytime on Hawthorne Avenue between 9th Street N and 12th Street N.

Recommended Roadway Cross-Section – Northeast Sub-Area

The Northeast sub-area includes the segment of Hennepin Avenue between 1st Street N and 8th Street SE (Segment 3, 4 5 and 6) and the segment of 1st Avenue between 8th Street SE and DeLaSalle Drive NE (Segment 2). The recommendations are as follows:

- Implement on-street bicycle lanes on the right side of the roadway, maintaining three motor vehicle lanes in each direction.
- Remove the inside southbound right turn lane at the 1st Avenue/University Avenue NE intersection and stripe a designated bicycle lane to the left of the outside exclusive motor vehicle right turn lane.

- In the northbound direction of Hennepin Avenue, end the bicycle lane at Central Avenue. The extension of the northbound bicycle lane through 8th Street SE should not occur until bicycle lanes are pursued on Hennepin Avenue further to the northeast. Further review and development of a concept layout is recommended to occur at such future time.
- On 1st Avenue, begin the bicycle lane at Central Avenue.
- Install No Parking Anytime on Hennepin Avenue between 4th Street NE and 5th Street NE (east side of Hennepin Avenue).
- Install No Parking Anytime on 1st Avenue between 4th Street NE and University Avenue NE (both sides).
- Install No Parking Anytime on 1st Avenue between University Avenue NE and 2nd Street NE (east side of 1st Avenue).
- Install four parking meters on 1st Avenue between 2nd Street NE and Main Street NE (west side of 1st Avenue).

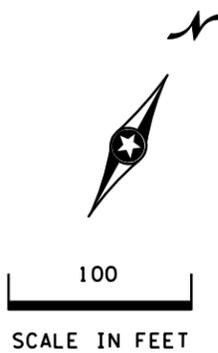


NOTE: 1. LANE STRIPING IS CONCEPTUAL.
 2. NOT ALL ROADWAY SIGNS ARE SHOWN. ONLY KEY BIKE LANE AND WAYFINDING RELATED SIGNS ARE SHOWN IN CONCEPT.

(A) STREET NAME SIGNS LOCATED ON TRAFFIC SIGNAL MASTARMS REPLACED WITH SIGNS DENOTING BIKE SYMBOL AS SHOWN BELOW



LEGEND	
	BUS STOP
	PARKING TO BE ADDED
	PARKING TO BE REMOVED
	BIKE LANE PAINTED RED
	PROPOSED SOLID WHITE STRIPING
	PROPOSED SKIP WHITE STRIPING
	PROPOSED DOUBLE YELLOW STRIPING
	PROPOSED SOLID YELLOW STRIPING
	EXISTING SOLID WHITE STRIPING
	EXISTING SKIP WHITE STRIPING
	EXISTING DOUBBLE YELLOW STRIPING
	TRAFFIC FLOW ARROW



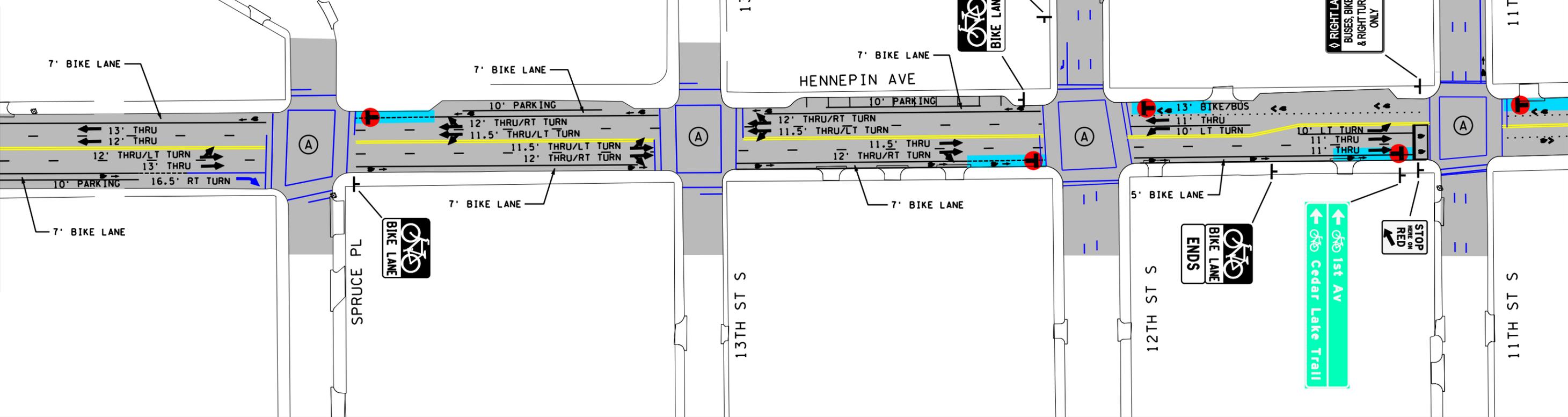
LEGEND	
	BUS STOP
	PARKING TO BE ADDED
	PARKING TO BE REMOVED
	BIKE LANE PAINTED RED
	PROPOSED SOLID WHITE STRIPING
	PROPOSED SKIP WHITE STRIPING
	PROPOSED DOUBLE YELLOW STRIPING
	PROPOSED SOLID YELLOW STRIPING
	EXISTING SOLID WHITE STRIPING
	EXISTING SKIP WHITE STRIPING
	EXISTING DOUBLE YELLOW STRIPING
	TRAFFIC FLOW ARROW

NOTE: 1. LANE STRIPING IS CONCEPTUAL.
 2. NOT ALL ROADWAY SIGNS ARE SHOWN. ONLY KEY BIKE LANE AND WAYFINDING RELATED SIGNS ARE SHOWN IN CONCEPT.

(A) STREET NAME SIGNS LOCATED ON TRAFFIC SIGNAL MASTARMS REPLACED WITH SIGNS DENOTING BIKE SYMBOL AS SHOWN BELOW

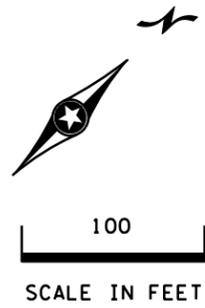


MATCH LINE A
SEE FIGURE 11



MATCH LINE B
SEE FIGURE 13

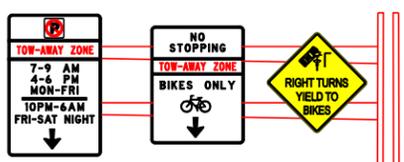
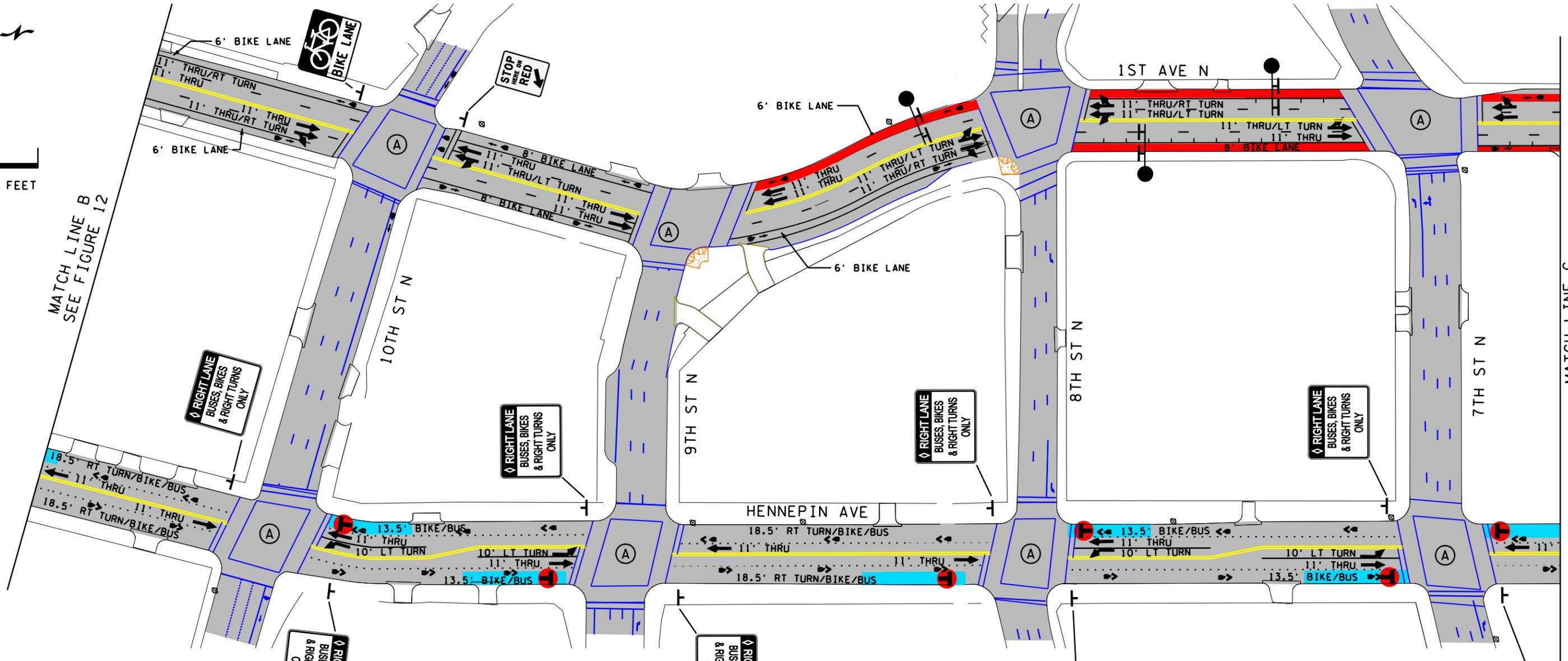
Figure 12
 Recommended Bicycle Plan Concept Layout
 16th Street N to 11th Street N



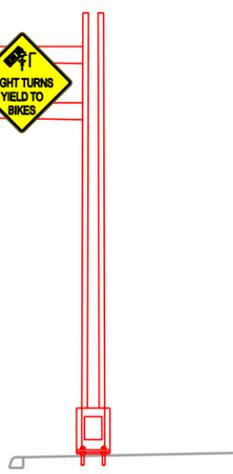
100
SCALE IN FEET

MATCH LINE B
SEE FIGURE 12

MATCH LINE C
SEE FIGURE 14



(B)



OVERHEAD SIGN

NOTE: 1. LANE STRIPING IS CONCEPTUAL.
2. NOT ALL ROADWAY SIGNS ARE SHOWN. ONLY KEY BIKE LANE AND WAYFINDING RELATED SIGNS ARE SHOWN IN CONCEPT.

(A) STREET NAME SIGNS LOCATED ON TRAFFIC SIGNAL MASTARMS REPLACED WITH SIGNS DENOTING BIKE SYMBOL AS SHOWN BELOW



(B) PARKING IS ALLOWED FRI-SAT EVENINGS BETWEEN 6TH ST AND 10TH ST

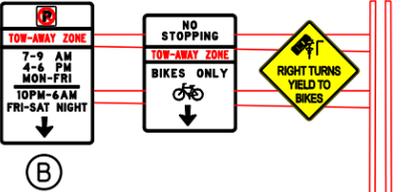
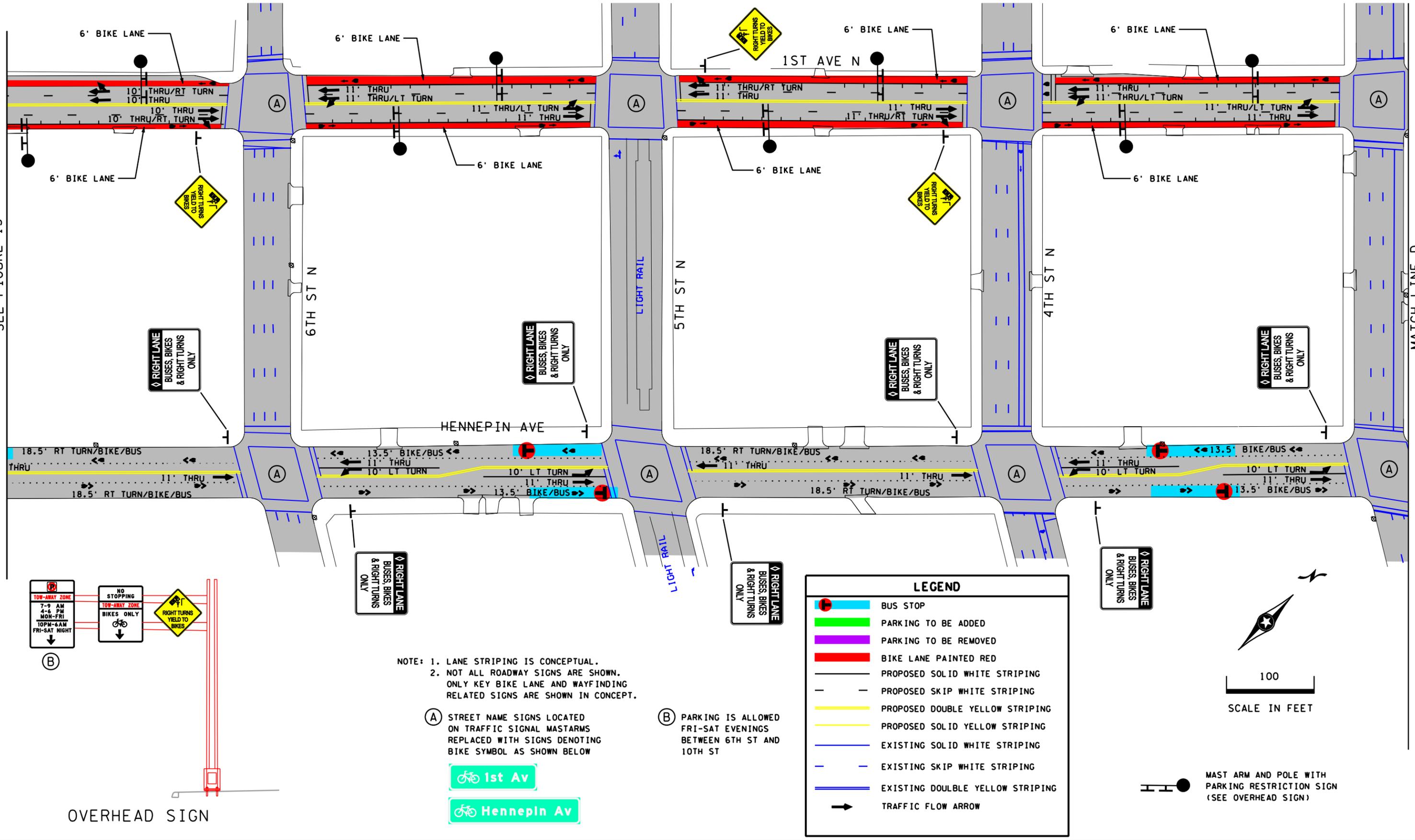


MAST ARM AND POLE WITH PARKING RESTRICTION SIGN (SEE OVERHEAD SIGN)

LEGEND	
	BUS STOP
	PARKING TO BE ADDED
	PARKING TO BE REMOVED
	BIKE LANE PAINTED RED
	PROPOSED SOLID WHITE STRIPING
	PROPOSED SKIP WHITE STRIPING
	PROPOSED DOUBLE YELLOW STRIPING
	PROPOSED SOLID YELLOW STRIPING
	EXISTING SOLID WHITE STRIPING
	EXISTING SKIP WHITE STRIPING
	EXISTING DOUBBLE YELLOW STRIPING
	TRAFFIC FLOW ARROW

MATCH LINE C
SEE FIGURE 13

MATCH LINE D
SEE FIGURE 15



NOTE: 1. LANE STRIPING IS CONCEPTUAL.
2. NOT ALL ROADWAY SIGNS ARE SHOWN. ONLY KEY BIKE LANE AND WAYFINDING RELATED SIGNS ARE SHOWN IN CONCEPT.

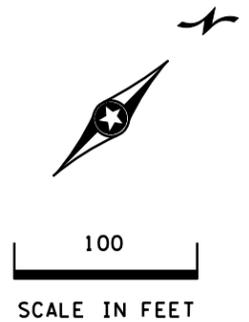
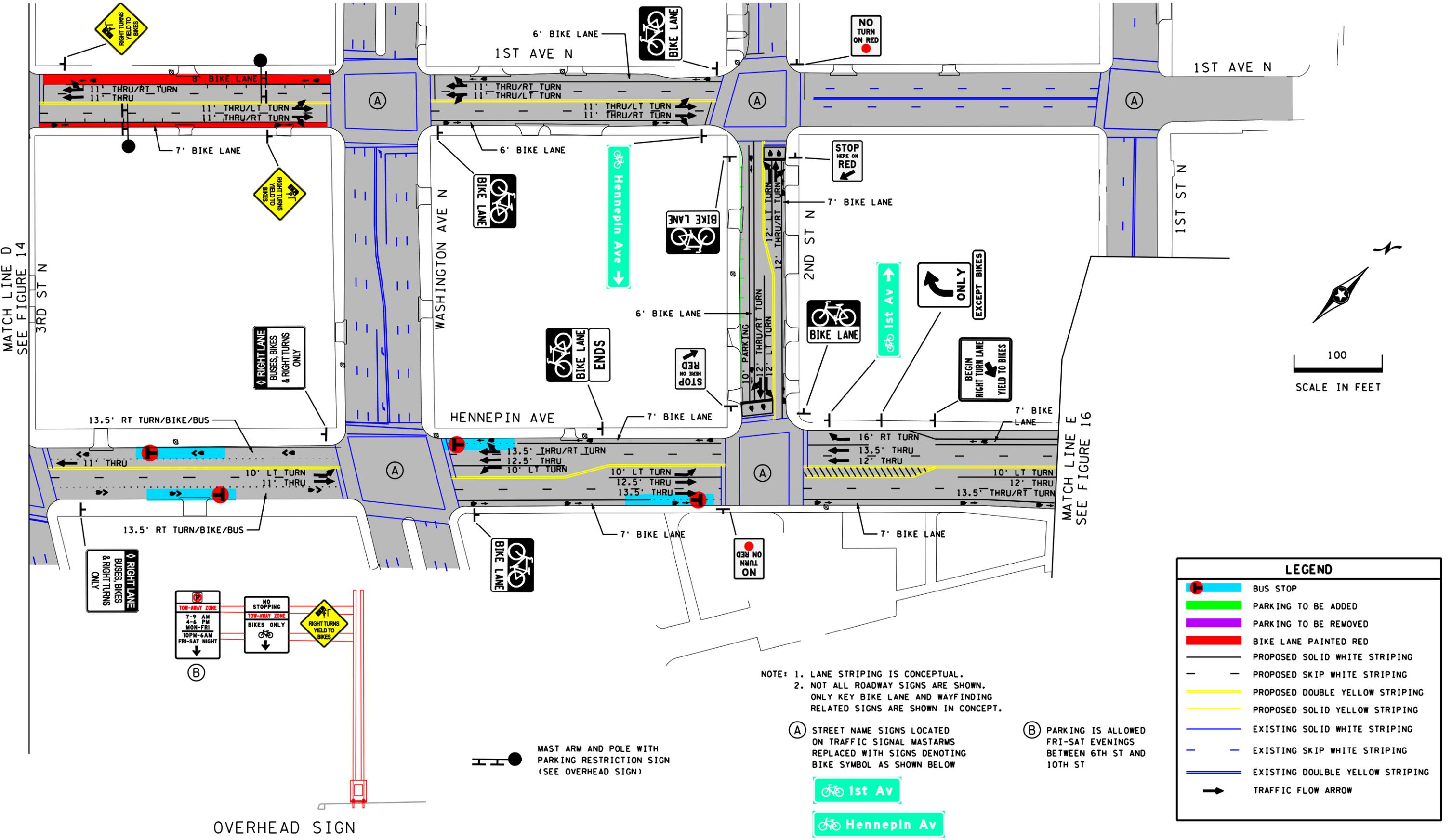
(A) STREET NAME SIGNS LOCATED ON TRAFFIC SIGNAL MASTARMS REPLACED WITH SIGNS DENOTING BIKE SYMBOL AS SHOWN BELOW

(B) PARKING IS ALLOWED FRI-SAT EVENINGS BETWEEN 6TH ST AND 10TH ST



OVERHEAD SIGN

Figure 14
Recommended Bicycle Plan Concept Layout
7th Street N to 3rd Street N

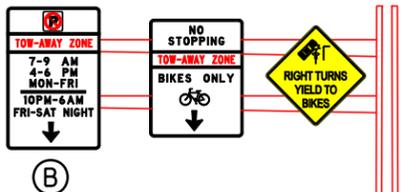


LEGEND	
	BUS STOP
	PARKING TO BE ADDED
	PARKING TO BE REMOVED
	BIKE LANE PAINTED RED
	PROPOSED SOLID WHITE STRIPING
	PROPOSED SKIP WHITE STRIPING
	PROPOSED DOUBLE YELLOW STRIPING
	PROPOSED SOLID YELLOW STRIPING
	EXISTING SOLID WHITE STRIPING
	EXISTING SKIP WHITE STRIPING
	EXISTING DOUBLE YELLOW STRIPING
	TRAFFIC FLOW ARROW

NOTE: 1. LANE STRIPING IS CONCEPTUAL.
 2. NOT ALL ROADWAY SIGNS ARE SHOWN. ONLY KEY BIKE LANE AND WAYFINDING RELATED SIGNS ARE SHOWN IN CONCEPT.

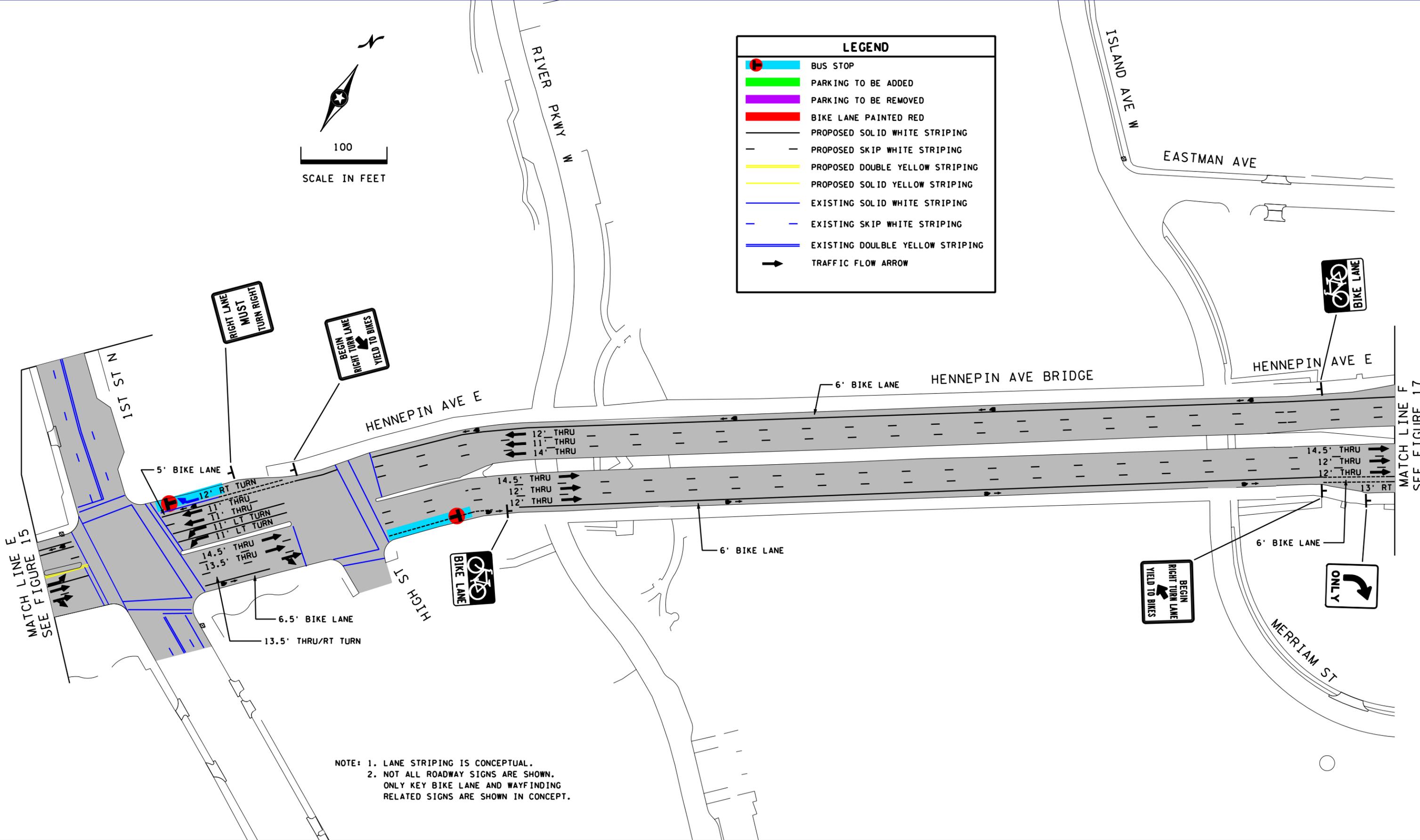
(A) STREET NAME SIGNS LOCATED ON TRAFFIC SIGNAL MASTARMS REPLACED WITH SIGNS DENOTING BIKE SYMBOL AS SHOWN BELOW

(B) PARKING IS ALLOWED FRI-SAT EVENINGS BETWEEN 6TH ST AND 10TH ST



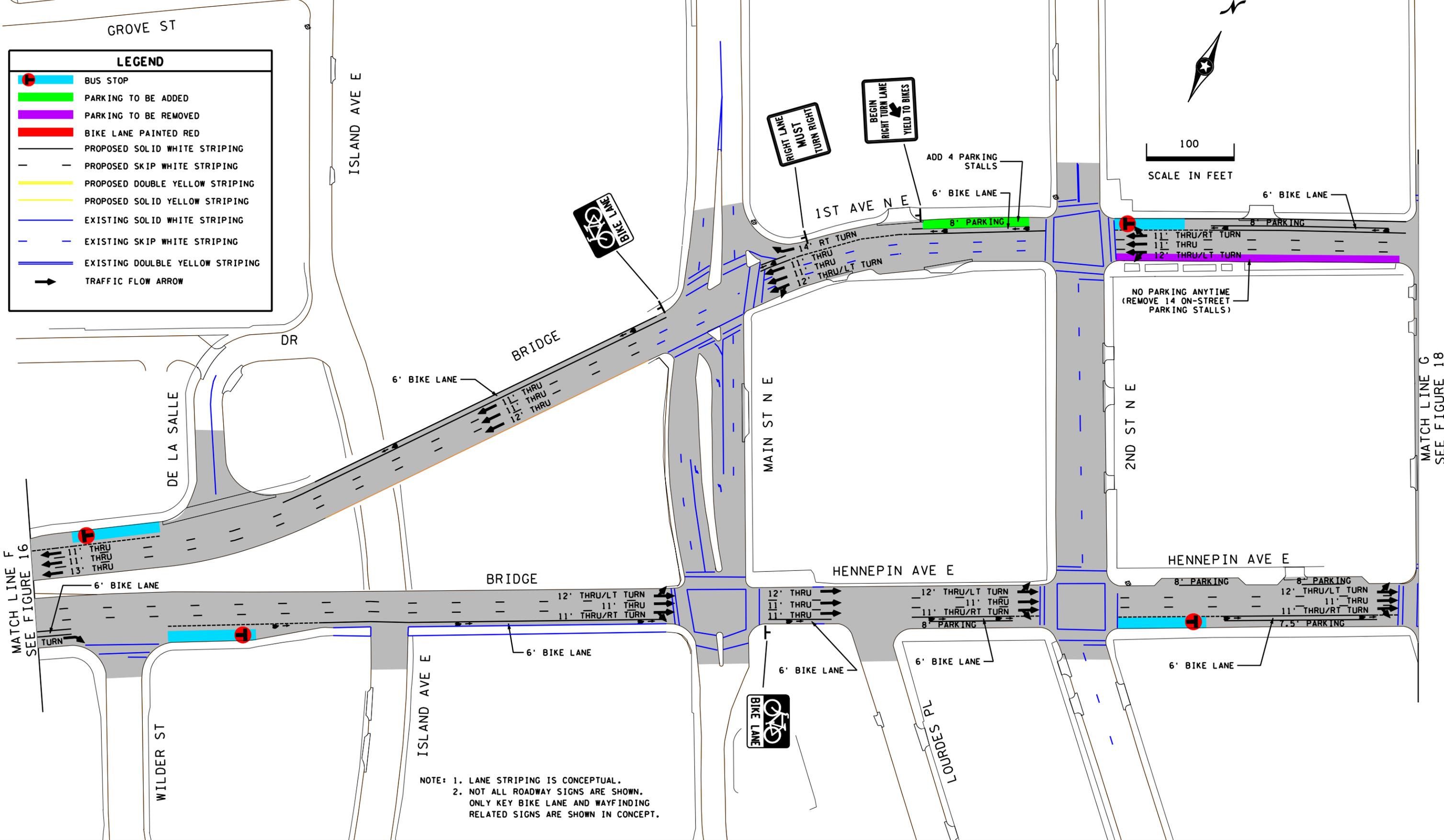
MAST ARM AND POLE WITH PARKING RESTRICTION SIGN (SEE OVERHEAD SIGN)





LEGEND	
	BUS STOP
	PARKING TO BE ADDED
	PARKING TO BE REMOVED
	BIKE LANE PAINTED RED
	PROPOSED SOLID WHITE STRIPING
	PROPOSED SKIP WHITE STRIPING
	PROPOSED DOUBLE YELLOW STRIPING
	PROPOSED SOLID YELLOW STRIPING
	EXISTING SOLID WHITE STRIPING
	EXISTING SKIP WHITE STRIPING
	EXISTING DOULBLE YELLOW STRIPING
	TRAFFIC FLOW ARROW

NOTE: 1. LANE STRIPING IS CONCEPTUAL.
 2. NOT ALL ROADWAY SIGNS ARE SHOWN. ONLY KEY BIKE LANE AND WAYFINDING RELATED SIGNS ARE SHOWN IN CONCEPT.



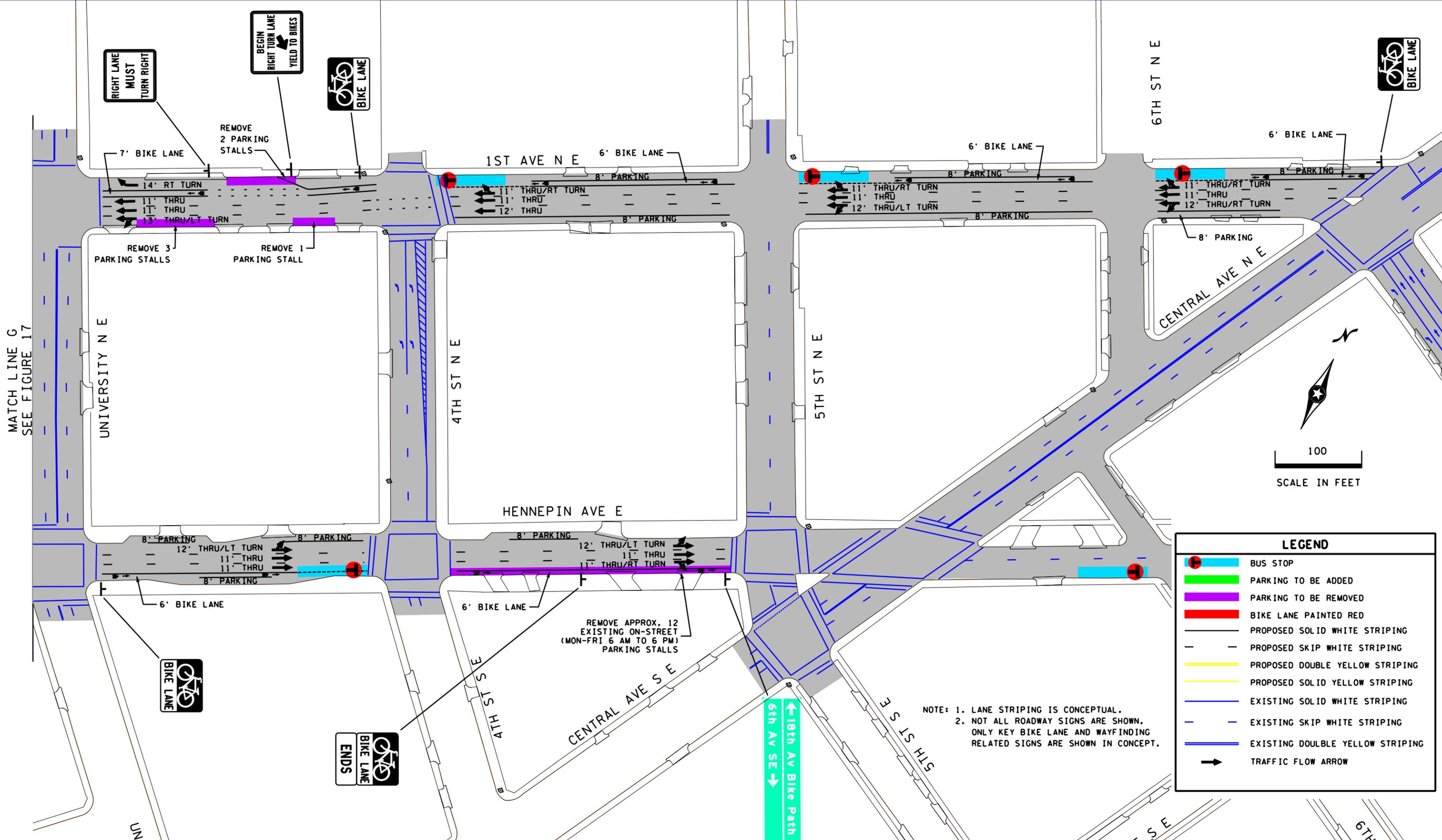
Hennepin Avenue Bicycle Plan



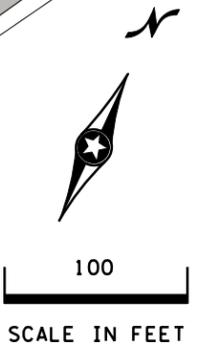
Figure 17
*Recommended Bicycle Plan Concept Layout
Merriam Street to 2nd Street NE*

MATCH LINE C
SEE FIGURE 18

MATCH LINE F
SEE FIGURE 16



MATCH LINE C
SEE FIGURE 17



LEGEND	
	BUS STOP
	PARKING TO BE ADDED
	PARKING TO BE REMOVED
	BIKE LANE PAINTED RED
	PROPOSED SOLID WHITE STRIPING
	PROPOSED SKIP WHITE STRIPING
	PROPOSED DOUBLE YELLOW STRIPING
	PROPOSED SOLID YELLOW STRIPING
	EXISTING SOLID WHITE STRIPING
	EXISTING SKIP WHITE STRIPING
	EXISTING DOUBBLE YELLOW STRIPING
	TRAFFIC FLOW ARROW

NOTE: 1. LANE STRIPING IS CONCEPTUAL.
2. NOT ALL ROADWAY SIGNS ARE SHOWN. ONLY KEY BIKE LANE AND WAYFINDING RELATED SIGNS ARE SHOWN IN CONCEPT.

Recommended Intersection and Roadway Treatments

Several supplemental intersection and roadway treatments have been identified to improve bicycle and pedestrian safety, to help promote the importance of these bicycle corridors and to establish appropriate delineation. The recommended intersection and roadway treatments include:

- Install Bike Boxes at the following locations
 - Hennepin Avenue at 16th Street N (southbound)
 - Hennepin Avenue at 11th Street N (northbound)
 - Hennepin Avenue at 2nd Street N (eastbound)
 - Hawthorne Avenue at 12th Street N (southbound)
 - Hawthorne Avenue at 10th Street N (southbound)
 - 1st Avenue at 4th Street N (southbound)
 - 1st Avenue at 2nd Street N (westbound)

The bike box is an intersection safety treatment to help reduce crashes between bicycles and motorists. Specifically, the bike box is a space for bicycles to pull in front of the motor vehicles during the red signal phase, which allows cyclists to more easily make left turn and right turn movements or cross the intersection with fewer conflicts. The bike box improves visibility and awareness of the bicyclist and may serve to reduce potential for left hook and right hook related crashes.

Bike boxes have not been used within the state of Minnesota; however, they have been applied successfully around the country. Two potential challenges with bike boxes include motorist compliance with the stop bar location and notifying bicyclists when the signal will change to the green indication.

Education materials and routine enforcement will be necessary immediately following their installation to help improve awareness and compliance. The installation of pedestrian countdown timers (discussed below) may help minimize the second issue noted.

The bike box should provide ten to 15 feet of space between the crosswalk and stop bar, contain two bike symbols and have a 24 inch stop bar.

- Install Pedestrian Countdown Timers

Pedestrian countdown timers provide a visual representation, typically the number of seconds remaining, before the traffic signal will change phases. It is recommended that



The City of Portland has implemented several bike boxes to increase safety for bicyclists.

pedestrian countdown timers be added to all signalized intersections along Hennepin Avenue and 1st Avenue.

According to the intersection safety analysis, approximately eight percent of the crashes within downtown involved a pedestrian still in the crosswalk when the signal phase changed. The addition of these devices has been shown to provide pedestrians with more information during their crossing maneuvers and can help reduce the possibility of pedestrians being within the crosswalk when the conflicting movement receives the right of way. By reducing the potential for conflict, both safety and operations can be improved.



The traffic signals along Hennepin Avenue and 1st Avenue are being re-built with the two-way conversion project, countdown timers should be implemented with the new systems. At other signalized intersections, the City of Minneapolis should implement the countdown timers as the opportunity arises or as their operating budget allows.

- Install a Colored Bike Lane Delineation on 1st Avenue

On 1st Avenue, with the block segments containing the off-set managed parking lane, the bicycle lane should include special delineation. It is recommended the bicycle lane be seal coated with a red colored pavement pigmentation. In addition, the bicycle lane should be marked with a solid double white edge line between the bicycle lane and adjacent motor vehicle lane. The double white edge line and colored pavement will provide a substantial awareness to the motorists and is expected to help maintain compliance.



New York City has colored bicycle lanes to clearly define where they exist on roadways.

- Install Protected/Permissive Left Turn Signal Phasing at Hennepin Avenue/8th Street N

The traffic operation analysis found an operational benefit to the provision of a protected/permissive southbound left turn phase. A supplemental benefit of the left turn arrow phase is that a reduction in motor vehicle/pedestrian left turn on green conflicts typically results.

- Install No Turn on Red at Bike Box Locations

Install a No Turn on Red sign on the motor vehicle approaches containing bike boxes. The presence of the No Turn on Red sign may help improve compliance and effectiveness of the bike boxes.

- Install Shared Use Pavement Markings and Associated Regulatory Signing on Hennepin Avenue



On Hennepin Avenue between 12th Street N and Washington Avenue N, shared use pavement markings (Sharrows) should be installed three per block. The Sharrows provide orientation to the bicyclist for the location in the lane they are to ride. The Sharrows also give a visual indication and bring awareness to the motorist of the presence of bicyclists. On 13.5 foot blocks with left turn lanes, the Sharrow should be marked in the center of the lane, combined with a “Bicycle May Use Full Lane” regulatory sign. On blocks without left turn lanes, where an 18 foot shared lane exists, the Sharrow should be installed on the left side of the lane. The Sharrow should be combined with the lane use designation sign shown to the right.

Recommended Connection Treatments

Integrating the bicycle lanes on Hennepin Avenue and 1st Avenue with each other and with other major bicycle facilities is critical. The major connection locations requiring attention include:

- To Loring Bikeway via 16th Street N.
- To Cedar Lake Trail via 11th Street N.
- Hennepin Avenue to 1st Avenue or vice versa via 11th Street N and/or 12th Street N.
- Hennepin Avenue to 1st Avenue or vice versa via 2nd Street N.

Loring Bikeway Connection

The Loring Bikeway is an existing off-street shared use path that traverses through Loring Park and provides connection into Uptown. The southern termini of the Hennepin Avenue corridor should provide an easy connection to the Loring Bikeway. To make this connection, the following recommendations are made:

- Install southbound bike box at Hennepin Avenue/16th Street N intersection.
- Install Bike Lane Ends sign and provide a wayfinding directional sign.
- Install sharrows on 16th Street N.
- Install wayfinding directional sign from Loring Bikeway to Hennepin Avenue.

Cedar Lake Trail Connection

The Cedar Lake Trail is an off-street shared-use path that provides regional connectivity in the year 2010 to West River Road (Minneapolis Park Board system) and to the Kenilworth and Midtown Greenway trails. A primary benefit of the recommended Hennepin Avenue and 1st Avenue bicycle lane alternatives is that the connection to the Cedar Lake Trail could easily be established. 11th Street N provides direct connection and existing on-street bicycle lanes are provided. The following connection treatments are recommended:

- Consider installing wayfinding signs along Cedar Lake Trail directing bicyclists to Hennepin Avenue and 1st Avenue.
- Install northbound bike box at Hennepin Avenue/11th Street N intersection.
- Install wayfinding signs at Hennepin Avenue/11th Street N and Hawthorne Avenue/11th Street N intersections.

Hennepin Avenue to 1st Avenue Inter-Connection

To provide successful operation of the Hennepin Avenue and 1st Avenue bicycle facilities, easy and clearly marked transition locations should be made on both the north and south ends. The connection on the southerly end considered three options highlighted below and illustrated in Figure 19 to Figure 21:

- Option 1: Provide a designated lane (northbound only) on Hennepin Avenue between 12th Street N and 11th Street N.
- Option 2: Provide an off-street shared-use path parallel to the 394 exit ramp and between 13th Street N and 12th Street N.
- Option 3: Provide contra-flow lane on 12th Street N.

The connection on the northerly end is most efficiently provided via 2nd Street N.

The following recommendations are made:

- Implement Option 1. Option 1 was also displayed on the recommended concept layout (Figure 12).
- Install wayfinding signs at the Hennepin Avenue/11th Street N, Hawthorne Avenue/11th Street N, Hawthorne Avenue/12th Street N, 1st Avenue/2nd Street N and Hennepin Avenue/2nd Street N intersections.
- Implement bicycle lanes on 2nd Street N between Hennepin Avenue and 1st Avenue. 2nd Street N should consist of a three-lane cross-section with a center left turn lane and two-way curb bicycle lanes. On street parking should be provided on the southerly curb face. 2nd Street N bicycle lanes are illustrated on the recommended concept layout Figure 14.
- Install bike boxes at the Hennepin Avenue/11th Street N (northbound), Hawthorne Avenue/12th Street N (southbound), Hennepin Avenue/2nd Street N (eastbound) and 1st Avenue/2nd Street N (westbound) intersections.

Hennepin Ave and 1st Ave N (One-Way to Two-Way)

Recommended Option 1
January 29, 2008

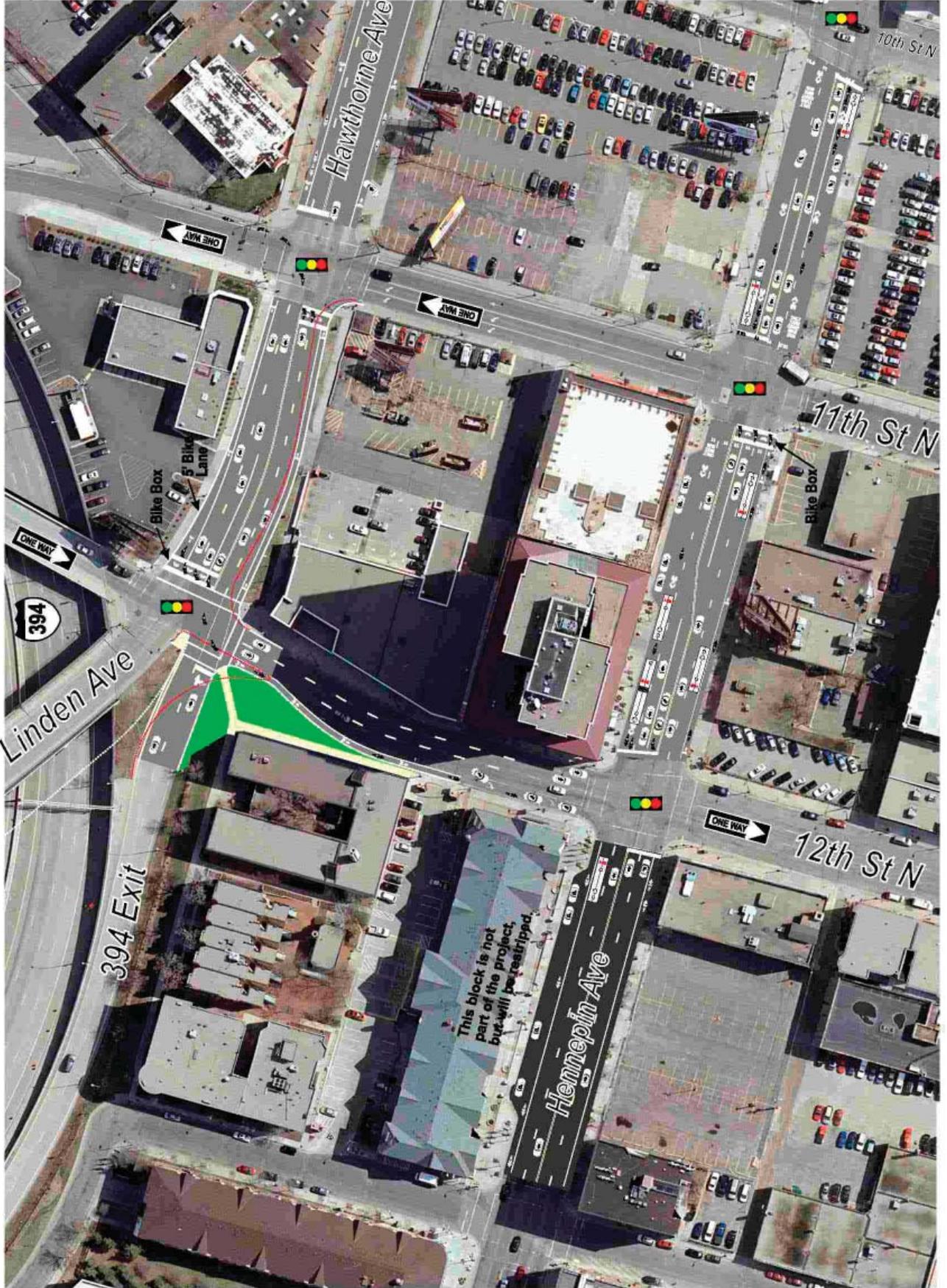


Figure 19. Hennepin Avenue to 1st Avenue Connection Option 1

Wayfinding

Wayfinding is a vital component of an effective bicycle system. Bicyclists need to be able to easily understand and navigate the bicycle network to conveniently find their destinations. The Bicycle Plan is promoting the use of both Hennepin Avenue and 1st Avenue as a tandem and integrated corridor facilitating both Type A and Type B bicyclists. Wayfinding is necessary at connection points to achieve this operation. In addition, wayfinding signing should be considered at locations providing connection to other major bikeways that aren't readily apparent. These facilities include the Loring Bikeway and Cedar Lake Trail. The wayfinding signs should include the destination, direction and distance and be consistent with the City of Minneapolis Bicycle Destination Signing Standards⁵. In accordance with the above recommendations on establishing connections to alternate bikeways, wayfinding signs are recommended at the following locations and are illustrated on the recommended concept layout (Figure 11 to Figure 18).

- Hennepin Avenue at 16th Street N
- Harmon Place at 16th Street N
- Hennepin Avenue at 11th Street N
- Hawthorne Avenue at 11th Street N
- Hawthorne Avenue at 12th Street N
- 1st Avenue at 2nd Street N
- Hennepin Avenue at 2nd Street N
- Hennepin Avenue at 5th Street NE

Bicycle Parking

Bicycle parking facilities are essential elements for bicycle transportation. Every bicycle trip begins and ends with the need for a safe and secure place to park one's bike. A lack of adequate and secure parking will discourage people from biking. Bicycle parking facilities should be provided at both trip origin and destination points and offer a protection from theft and damage. The wide variety of bicycle parking devices is general grouped into two security levels: secure (e.g. bicycle lockers) and less-secure (e.g. bicycle racks). More secure bicycle parking is generally needed if the rider is leaving their bicycle unattended for a longer period of time.

Several key factors were analyzed to determine whether the current bicycle parking would meet the needs of the project. On blocks with bus stops, bicycle racks were added where none existed. There is typically a greater demand for long-term parking at transit stations. The need for long term bicycle parking (bicycle lockers) was identified at the following locations:

- Hawthorne Avenue at 9th Street N near the Hawthorne Transit Station
- 1st Avenue at 5th Street N near the Hiawatha Light Rail station
- Hennepin Avenue and University Avenue NE
- Hennepin Avenue at 4th Street NE
- Hennepin Avenue at Central Avenue

5 Bicycle Route and Bicycle Destination Signing Standards, City of Minneapolis, January 2009.

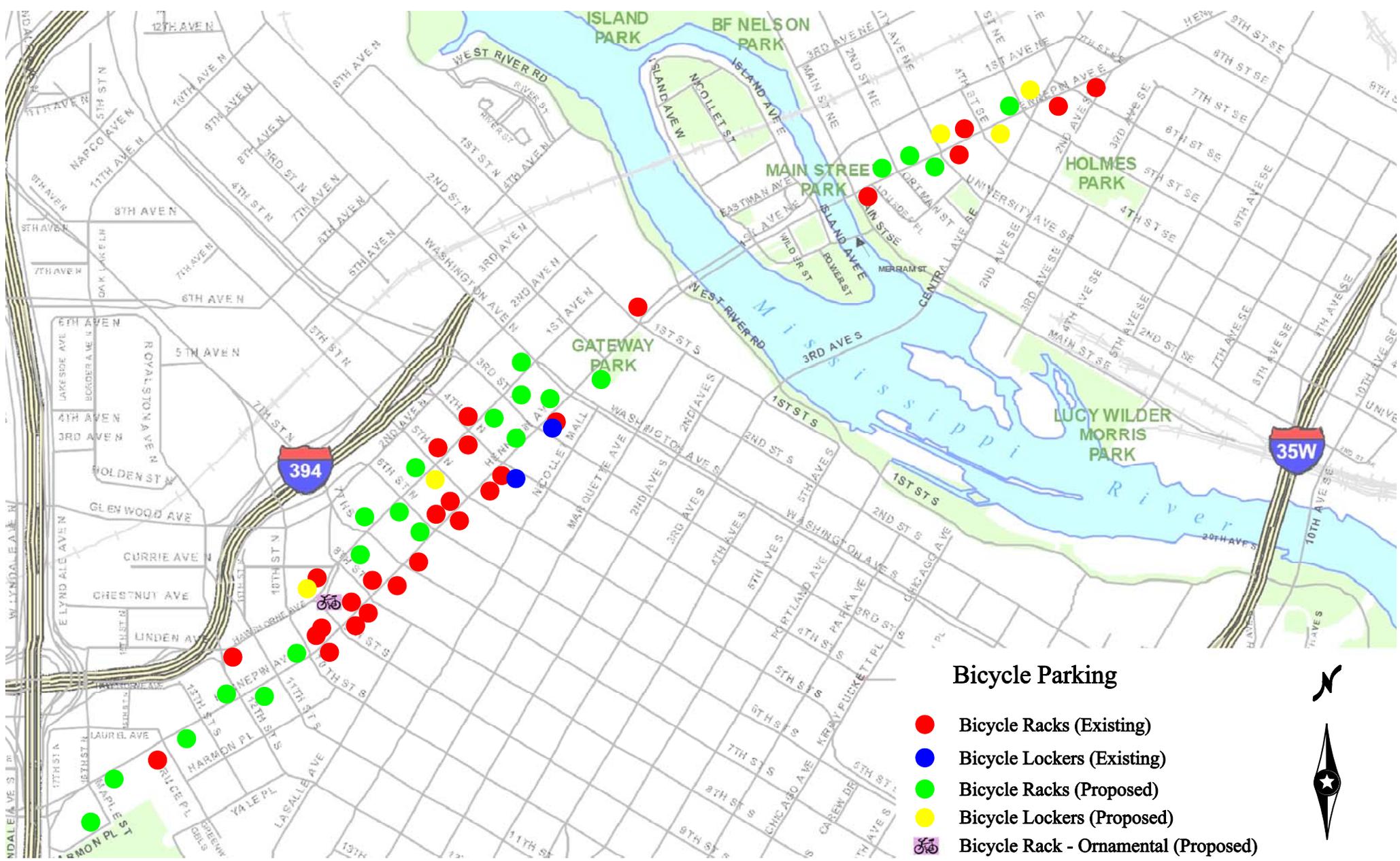
The bicycle lockers would provide bicyclists with a long-term high security option.

Land uses along both Hennepin Avenue and 1st Avenue were also analyzed to identify additional short term parking needs. Bicycle racks are being recommended on block segments according to the following guidelines:

- Block segments containing land uses expected to attract or be a destination point for pedestrian and bicycle traffic.
- Block segments where a need was observed (i.e., bicycles locked to trees or posts).
- Other logical points or gaps along the corridor.

As part of the Two-Way Conversion Project, the Hawthorne Avenue /9th Street N intersection is being reconstructed. The northeast corner will become a large concrete and landscape area. Being located across from the Target Center and Hawthorne Transportation Center, parking in this space would serve well for the area land uses and be well suited to give character to the corridor. It is recommended the City of Minneapolis work with vendors or local artists to provide ornamental bike racks on the northeast corner of the Hawthorne Avenue/9th Street intersection.

The overall goals were to make sure that bicyclist using either Hennepin Avenue or 1st Avenue would have safe and convenient locations to store their bicycles and serve to further promote bicycling within the corridor. Figure 22 documents the recommended bicycle parking within the Hennepin Avenue and 1st Avenue corridors. The bicycle parking locations and type (rack, locker or ornamental) have been identified on a block by block level. Specific installation locations have not been determined. It is recommended this be completed as part of final design activities.



Hennepin Avenue Bicycle Plan



Figure 22
Recommended Bicycle Parking

Bicycle Promotion, Awareness and Maintenance Plan

Making the physical environment safer and more pleasant for bicycling is vital for increasing non-motorized and transit travel. However, the work needs to be coupled with dedicated and on-going marketing, promotion and awareness efforts. Awareness of the opportunities and benefits, and excellent maintenance of the facilities, is essential to increasing mode share. Maintenance and bicycling promotion/awareness programs cannot be applied specifically to a corridor; rather they need to be implemented on a city wide level in order to be successful. The City of Minneapolis has adopted several programs to promote and bring awareness to bicycling within the city:

- Assembly of and on-going regular Bicycle Advisory Committee (BAC) meetings.
- Full-time NTP Project Coordinator responsible for managing and promoting bicycle projects and programs.
- Full-time Bike Walk Ambassadors and outreach program
- Bicycle share program.
- Private/Public cost participation program for bicycle racks.

Growing these programs may provide greater value. A specific plan has been developed and will be presented in the Central Avenue Bicycle Plan. The following provides a summary of a few additional elements that may be considered in the bicycling promotion and awareness program:

- Promote school and community education classes to teach the fundamentals of safe bicycling, state laws, bicycle maintenance and commuting.
- Host outreach events with area employers or to coincide with large city events.
- Distribute and provide easy access to digital bicycle maps via website, emailer or other digital media means.
- Work with the TMO and Travel Demand Management program to improve private bicycle parking and encouragement of mode share incentives.

Adopting a routine and regular maintenance program for the bicycle facilities is critical. Bicyclists are particularly sensitive to maintenance problems (e.g., potholes, debris, snow removal, etc.) since they are directly exposed to the environment and have less or no suspension systems compared to a motorist. Key elements and objectives of the maintenance program may include:

- Routinely clean and maintain the bikeways to a relatively hazard free standard.
- Encourage bicyclists to use 311 or other means to promptly report maintenance issues or other hazards.
- Design and build bikeways to minimize the potential for the collection of debris and other hazards.
- Identify a funding source (e.g., bicycle rentals or bike share program) to use towards developing a maintenance program.
- Systematically maintain signs, pavement markings and other bicycle delineation and traffic control devices.

Implementation Plan and Cost Estimate

The implementation of the Bicycle Plan does not require roadway reconstruction and can be easily installed once funding becomes available. The primary components of the Bicycle Plan include new pavement markings, roadway signing and additional bicycle parking.

Implementation Plan

Implementation of the Bicycle Plan should be prioritized as follows:

- Immediate Priority (2009-2010):

The City of Minneapolis has programmed the Two-Way Conversion Project for 2009, which includes the on-street bicycle accommodations. The Two-way Conversion is expected to be complete by early 2010. The following is recommended to be installed in 2009:

- Implement the recommended Downtown sub-area (Hennepin Avenue and 1st Avenue between 12th Street N to 1st Street N) roadway cross-section.
- Implement the ornamental bicycle parking at the Hawthorne Avenue/9th Street N intersection.
- Implement the recommended wayfinding signs within the Downtown sub-area.
- Install the intersection improvement treatments applicable to the Downtown sub-area.

- High Priority (2010):

In order to make the appropriate bicycle and motor vehicle lane transitions at the Hennepin Avenue/12th Street N intersection, the South End sub-area recommendations are necessary. In addition, specific direction was given by the Ward 7 Council Member to escalate the priority of implementing the South End recommendations.

- Implement the recommended South End sub-area (Hennepin Avenue between Lyndale Avenue N to 12th Street N) roadway cross-section.
- Implement the recommended wayfinding signs within the South End sub-area.
- Install the intersection improvement treatments applicable to the South End sub-area.

- Medium Priority (2010-2012):

Extending the bicycle lanes from the Downtown sub-area over the Mississippi River into Northeast Minneapolis is important; however, it may be most practical from a network development perspective to coincide with a cross-street facility (e.g., 5th Street NE or Central Avenue). 5th Street NE is programmed to receive bicycle lanes in 2010-2011. At such time, the following is recommended:

- Implement the recommended Northeast sub-area (Hennepin Avenue and 1st Avenue between 1st Street N to Central Avenue) roadway cross-section.
- Implement the recommended wayfinding signs within the South End sub-area.
- Install the intersection improvement treatments applicable to the South End sub-area.
- Install the recommended bicycle parking (see Figure 22) for the South End, Downtown and Northeast sub-areas.

Preliminary Cost Estimate

A preliminary cost estimate has been developed for the major components of the recommendations. The following is included:

- Poly-preform ground-in pavement markings
- Seal-coating the bituminous pavement sections
- Blasting the concrete pavement sections
- Black masking behind longitudinal pavement markings on the concrete pavement sections.
- Roadway and wayfinding signs (bicycle related)
- Final design and engineering services (10 percent of construction costs)
- Bicycle parking
- Miscellaneous city expenses

Table 30. Preliminary Cost Estimate

Description	Estimated Cost (\$)
South End Sub Area (Hennepin Avenue - Lyndale Avenue N to 12th Street N)	
Pavement Markings ¹	\$63,885.00
Final Design (10%)	\$12,289.75
Roadway Signing	\$5,000.00
Miscellaneous Project Costs	\$10,000.00
Seal Coat	\$51,012.50
Bike Parking (Racks)	\$3,000.00
SUBTOTAL	\$146,000.00
Downtown Sub-Area (Hennepin Avenue / 1st Avenue - 12th Street N to 1st Street N)	
Bike Parking (Racks and 2 Lockers)	\$11,750.00
Ornamental Bike Parking (1st Ave at 8th St)	\$4,000.00
Pavement Markings, Design, Seal Coat, Miscellaneous ²	--
SUBTOTAL	\$15,750.00
Northeast Sub-Area (Hennepin Avenue / 1st Avenue (1st Street N to Central Avenue)	
Pavement Markings ¹	\$154,582.50
Final Design (10%)	\$22,062.50
Roadway Signing	\$7,500.00
Miscellaneous Project Costs	\$15,000.00
Seal Coat (Bituminous Only)	\$48,042.50
Bike Parking (Racks and 3 Lockers)	\$10,500.00
SUBTOTAL	\$258,000.00
Total Project	\$419,750.00

¹ Cost based upon poly preform (ground-in) pavement markings. A black masking is to be provided behind pavement markings applied to concrete roadway surfaces. (Removal of existing pavement markings is included in estimated cost)

² Constructed as part of the Hennepin Ave/1st Ave Two-Way Conversion Project Programmed Funds

Appendix



A: Existing Conditions Inventory

B: Bicycle and Pedestrian Detailed Crash Review

C: Hennepin Avenue and 1st Avenue Preferred Alternatives Concept Layouts

D: VISSIM Detailed Analysis Results

**Appendix A:
Existing Conditions Inventory**

Table A-1. Existing Conditions Inventory - Hennepin Avenue

Segment	From	To	Traffic Direction	Road Width	Bike Lane (y/n)	Bike Parking	Bus Stop	Car Parking	Pavement Type	Pavement Conditions	Observation Notes
Hennepin Avenue											
Hennepin Avenue Segment 1	Lyndale Ave N	17th St N	2 way traffic - 4 northbound lanes (left, 2 straight, 1 straight/right), 4 southbound lanes (2 straight, 2 left turns)	95 (47 ft northbound, 48 feet southbound)	N	none	none	none	Bituminous	Good	Bus traveled in either direction. Bikes used side walks on either side and traffic lanes. There was a public parking lot on North side of Dunwoody Avenue.
	17th St N	16th St N	2 way traffic - 3 lanes traveling north (1 straight/left, 1 straight, 1 straight/right), 2 lanes (straight) with a 3rd lane going straight half way along road traveling southbound	66	N	none	1 stop for northeast bound travel near corner of Hennepin and 16th St N	none	Bituminous	Good	Bus traveled in either direction. Bikes used side walks on either side and traffic lanes. There is a center median at the south end dividing north and southbound traffic. Roadway splits at the south end to 60 feet for northbound traffic and 39 feet for southbound traffic.
	16th St N	Laurel Ave N	2 way traffic - 3 northbound lanes (1 straight/left, 2 straight, 1 right/metered parking), 2 southbound lanes (1 straight/right, 1 straight/left)	64	N	17 bike racks on Metro State's property (east side of street)	2 stops, 1 in either direction at the corners	metered parking at corner (road widens 11 ft for bus stop and then for parking/right turn) (Approx. 8 stalls)	Bituminous	East Side: 1-45 degree CB grate East Side: Rough seam on south end West Side: Deep set manhole mid-block West Side: Rough seam along length	Bus traveled in either direction. Bikes used side walks on either side and traffic lanes. Roadway widens to 75 feet at north end for bus stop and right turn/metered parking lane
	Laurel Ave N	13th St N	2 way traffic - 3 northbound lanes (1 straight/right, 1 straight, 1 straight/left), 2 southbound lanes (1 straight/right, 1 straight/left)	61	N	none	1 stop, southbound	8 metered spots on west side of hennepin ave (road widens 13 feet for this)	Bituminous	East Side: Rough seam along length West Side: Rough seam along length	Bus traveled in either direction. Bikes used side walks on either side and traffic lanes.
	13th St N	12th St N	2 way traffic - 3 northbound lanes (2 straight, 1 straight/right), 2 southbound lanes (1 straight/right, 1 straight/left)	61	N	none	1 stop, northbound	9 metered spots on west side of hennepin ave (road widens 13 feet for this)	Bituminous	East Side: Deep set manhole mid-block East Side: Moderate rough seam along length West Side: Rough seam along length	Bus traveled in either direction. Bikes used side walks on either side and traffic lanes. Parking lot on east side of Hennepin
	12th St N	11th St N	2 way traffic - 3 northbound lanes (1 straight/left, 2 straight), 2 southbound lanes (1 straight, 1 straight/left)	61	N	none	2 stops, 1 in either direction at the corners	6 metered spots on west side of hennepin ave (road widens 13 feet for this)	Bituminous	East Side: Deep set manhole mid-block East Side: Moderate rough seam along length	Bus traveled in either direction. Bikes used side walks on either side and traffic lanes. Parking lot on east side of Hennepin
Hennepin Avenue Segment 2	11th St N	10th St N	1 way traffic - 3 northbound lanes (2 straight, 1 straight/right), 1 southbound bus lane, 1 two way bike lane	57/61	Y - 2 way	none	1 stop, southbound	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Parking lot on east and west side of Hennepin
	10th St N	9th St N	1 way traffic - 3 northbound lanes (1 straight/left, 2 straight), 1 southbound bus lane, 1 two way bike lane	61	Y - 2 way	16 bike racks on west side. 8 bike racks on east side	2 stops, 1 in either direction at the corners	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Parking lot on east and west side of Hennepin
	9th St N	8th St N	1 way traffic - 3 northbound lanes (2 straight, 1 straight/right), 1 southbound bus lane, 1 two way bike lane	57/61	Y - 2 way	10 bike racks on west side. 16 bike racks on east side	none	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Parking lot on west side of Hennepin. There were metal benches along both sides with bikes locked to some of them
	8th St N	7th St N	1 way traffic - 3 northbound lanes (1 straight/left, 2 straight), 1 southbound bus lane, 1 two way bike lane	57/61	Y - 2 way	10 bike racks on west side. 8 bike racks on east side	2 stops, 1 in either direction at the corners	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Parking lot on east and west side of Hennepin
	7th St N	6th St N	1 way traffic - 3 northbound lanes (2 straight, 1 straight/right), 1 southbound bus lane, 1 two way bike lane	57/61	Y - 2 way	4 bike racks on east side	1 stop, southbound	7 metered spots on east side of hennepin ave - road widens 8 feet to accommodate the metered parking	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction.
	6th St N	5th St N	1 way traffic - 3 northbound lanes (1 straight/left, 2 straight), 1 southbound bus lane, 1 two way bike lane	58/61	Y - 2 way	20 bike racks on west side. 10 bike racks on east side	2 stops, 1 in either direction	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Parking lot on east and west side of Hennepin. Light rail crosses at 5th
	5th St N	4th St N	1 way traffic - 3 northbound lanes (2 straight, 1 straight/right), 1 southbound bus lane, 1 two way bike lane	58/61	Y - 2 way	13 bike racks on east side	none	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Parking lot on east and west side of Hennepin. Light rail crosses at 5th
	4th St N	3rd St N	1 way traffic - 3 northbound lanes (1 straight/left, 2 straight), 1 southbound bus lane, 1 two way bike lane	58/61	Y - 2 way	none	2 stops, 1 in either direction	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Parking lot on west side of Hennepin.
	3rd St N	Washington Ave N	1 way traffic - 3 northbound lanes (1 straight/left, 1 straight, 1 straight/right), 1 southbound bus lane, 1 two way bike lane	58/61	Y - 2 way	16 bike racks on east side	2 stops, 1 in either direction	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Parking lot on east and west side of Hennepin. There was a transit station on the corner of 3rd and Hennepin
	Washington Ave N	2nd St N	1 way traffic - 3 northbound lanes (3 straight) w/ left turn lane at corner of 2nd st, 1 southbound bus lane, 1 way bike lane southbound	76	Y - 1 way (s)	none	2 stops, 1 in either direction	none	Bituminous (Seal Coat -2009)	NA	Bus traveled in either direction. Bike traffic traveling northbound used sidewalks and traffic lanes

Table A-1. Existing Conditions Inventory - Hennepin Avenue

Segment	From	To	Traffic Direction	Road Width	Bike Lane (y/n)	Bike Parking	Bus Stop	Car Parking	Pavement Type	Pavement Conditions	Observation Notes
Hennepin Avenue/1st Avenue Segment 3	2nd St N	1st St N	2 way traffic - 3 northbound lanes (2 straight, 1 straight/left) w/ left turn lane at corner of 2nd st, 2 southbound right turn only lanes with 1 straight bus lane only at corner of 2nd and Hennepin, 1 way bike lane southbound	84, then widens to 94 at the north end	Y - 1 way (s)	none	none	none	Bituminous (Seal Coat -2009)	Good	Bus traveled in either direction. Bike traffic traveling northbound used sidewalks and traffic lanes. Southbound bike traffic also used sidewalks even though there was a bike lane in the center
	1st St N	Robert Fisher Drive/ High Street	2 way traffic - 4 northbound lanes (straight only), 5 southbound (2 straight, 2 left turn only & 1 right turn only lane (except buses) at corner)	123, then decreases to 106 at the north end	N	12 bike racks on west side	2 stops, 1 in either direction	none	Concrete	Good	Bus traveled in either direction. Bikes used side walks on either side and traffic lanes.
	Robert Fisher Drive/ High Street	Wilder St NE	2 way traffic - 3 northbound lanes (straight only) & 1 right turn only lane at corner, 3 southbound lanes (straight only) & 1 straight lane added at corner	106, then splits across bridge to 1 way with 43 foot width (both sides of bridge), then widens to 55 feet for right turn lane	N	none	1 stop, southbound	none	Concrete	Good	Bus traveled in either direction. Bikes used side walks on either side and traffic lanes. Section is bridge over river, roadway splits into Hennepin and 1st ave at Wilder St. Note that on the 1st ave side of the bridge the road is 54 feet wide from Delasalle drive then it goes down to 43 feet across the bridge.
Hennepin Avenue Segment 4	Wilder St NE	Main St NE	1 way traffic - 3 northbound lanes (straight/left, straight, straight/right)	40, then widens to 55 at the north end for the bus stop	N	none	1 stop, northbound	none	Concrete	Good	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes.
	Main St NE	2nd St NE	1 way traffic - 3 northbound lanes (straight/left, straight, straight/right)	40	N	none	none	6 metered spots on north half of east side of hennepin, road widens 8 feet for parking	Concrete	Good	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes. Road width is 48 ft where there is metered parking.
	2nd St NE	University Ave NE	1 way traffic - 3 northbound lanes (straight/left, straight, straight/right)	48	N	none	1 stop, northbound	10 metered spots on east side, 4 metered spots on west side (road widens 8 feet for this)	Concrete	Good	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes. Public parking lot on west side of hennepin. Where there is parking on both sides road width is 56 ft.
	University Ave NE	4th St NE	1 way traffic - 3 northbound lanes (1 straight/left, 2 straight)	40, then widens to 48 for metered parking on east	N	16 bike racks on east side, 5 bike racks on west side	1 stop, northbound	6 metered spots on east side, 6 metered spots on west side (road widens 8 feet)	Concrete	East Side: 1-45 degree CB grate	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes. Parking lot on west side of hennepin. Where there is parking on both sides road width is 56 ft.
	4th St NE	5th St NE	1 way traffic - 3 northbound lanes (1 left, 1 straight/left, 1 straight)	40	N	none	none	street parking on east side only during certain hours, 5 metered spots on west side of street (road widens 8 feet for this)	Concrete	East Side: 1-45 degree CB grate	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes. Parking lots on east side of hennepin. Road width is 48 ft where there is metered parking.
	5th St NE	Central Ave	1 way traffic - 3 northbound lanes (1 left, 1 straight/left, 1 straight)	51	N	none	none	none	Concrete	Good	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes. Commercial loading zone on west side of street, 30 min limit
Hennepin Avenue Segment 5	Central Ave	6th St SE	1 way traffic - 2 northbound lanes (1 left/straight, 1 right/straight)	36	N	2 bike racks on east side	1 stop, northbound	2 hr parking on east side, also a driving lane	Concrete	Good	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes. Parking lots on east side of hennepin
	6th St SE	2nd Ave SE	1 way traffic - 2 northbound lanes (1 straight, 1 right/straight)	36	N	6 bike racks on east side	none	none, east side has wide shoulder	Concrete	Good	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes. There was a bike route sign on the corner of Hennepin and 2nd Ave pointing east
Hennepin Avenue / 1st Avenue Segment 6	2nd Ave SE	8th St SE	2 way traffic - 2 northbound lanes (1 straight/left, 1 straight/right) and 2 southbound lanes (directed onto 7th St SE)	60	N	none	2 stops, 1 in either direction	street parking on east side only during certain hours	Concrete	Good	North and southbound bike traffic used sidewalks, northbound bike traffic also used traffic lanes. There was a bike route sign on the corner of Hennepin and 8th St SE. 3 north bound lanes from Hennepin (36 ft) merge with 2 southbound lanes (24 ft) to form 2 way. 2 southbound lanes split at south side of block to form 1st ave

= North end and south end of block differ by 4 feet. The average cross-sectional width is 59 feet.

Table A-2. Existing Conditions Inventory - 1st Avenue

Segment	From	To	Traffic Direction	Road Width	Bike Lane (y/n)	Bike Parking	Bus Stop	Car Parking	Pavement Type	Pavement Conditions	Observation Notes
1st Avenue Segment 1	Hawthorne Avenue										
	12th St N	11th St N	1 way traffic - 4 southbound lanes (3 straight, 1 left)	49, then widens to 65 at south end for bus stop and left turn	N	none	1 stop, southbound	5 metered spots on west side	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Parking lots on east and west side of street
	11th St N	10th St N	1 way traffic - 3 southbound lanes (2 straight, 1 straight/right)	56	N	none	none	6 metered spots on east side, 11 metered spots on west side	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Parking lots on east side of street, vacant lot on west side of street
	10th St N	9th St N	1 way traffic - 4 southbound lanes (3 straight, 1 left)	60	N	none	none	1 stop for northeast bound travel near corner of Hennepin and 16th St N	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Greyhound bus station on west side of street. 2 Traffic merging on from 9th St N (going southbound)
	1st Avenue										
	9th St N	8th St N	2 way traffic - 2 northbound lanes (1 left, 1 left/right) and 3 southbound lanes (1 straight/right, 2 straight)	74, then decreases to 38 feet and becomes 1 way	N	5 bike racks on west side of street	none	none	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Greyhound bus station on west side of street. 2 Traffic merging on from 9th St N (going northbound). There is a center median that increases in size at the south end.
	8th St N	7th St N	1 way traffic - 4 southbound lanes (1 straight/right, 2 straight, 1 left)	60	N	none	none	5 metered spots on east side, 7 metered spots on west side	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Commercial loading zone near corner of 7th St
	7th St N	6th St N	1 way traffic - 3 southbound lanes (2 straight, 1 straight/right)	51	N	none	none	6 metered spots on east side, 6 metered spots on west side (road widens 9 feet for this)	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Taxis loading zone near corner of 6th St
	6th St N	5th St N	1 way traffic - 3 southbound lanes (2 straight, 1 straight/left)	56	N	none	none	9 metered spots on east side, 11 metered spots on west side	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Parking lot on east side
	5th St N	4th St N	1 way traffic - 3 southbound lanes (2 straight, 1 straight/right)	56	N	2 bike racks on east side, 4 bike racks on west side	none	8 metered spots on east side, 13 metered spots on west side	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Taxis loading zone near corner of 4th St
	4th St N	3rd St N	1 way traffic - 3 southbound lanes (2 straight, 1 straight/left)	56	N	2 bike racks on west side	none	8 metered spots on east side, 9 metered spots on west side	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Parking lot on east side. Commercial loading zone 30 min limit near corner of 4th
3rd St N	Washington Ave N	1 way traffic - 3 southbound lanes (2 straight, 1 straight/right)	56	N	none	none	5 metered spots on east side, 12 metered spots on west side	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Parking lot on west side. Commercial loading zone 30 min limit near corner of 3rd St	
Washington Ave N	2nd St N	1 way traffic - 3 southbound lanes (1 straight/right, 1 straight, 1 straight/left)	55	N	none	none	7 metered spots on east side, 5 metered spots on west side	Bituminous (Seal Coat -2009)	NA	Bikes used side walks on either side and traffic lanes. Parking lot on west side. 2 lanes of traffic merged onto 1st ave from 2nd St, 2 other lanes of traffic merged from 1st ave north of 2nd st	
1st Avenue Segment 2	DelaSalle Dr NE	Main St NE	1 way traffic - 3 southbound lanes (1 straight/right, 2 straight)	40	N	none	none	none	Concrete	Good	Bikes used side walk and traffic lanes. Much more bike traffic than on south side of river.
	Main St NE	2nd St NE	1 way traffic - 4 southbound lanes (1 right, 2 straight, 1 straight/left)	48	N	none	none	none	Bituminous	Good	Bikes used side walk and traffic lanes. Much more bike traffic than on south side of river. May have a lane transition/merge issue
	2nd St NE	University Ave NE	1 way traffic - 3 southbound lanes (1 straight/right, 1 straight, 1 straight/left)	49	N	none	1 stop, southbound	14 metered spots on east side, 8 metered spots on west side (also a drive lane)	Bituminous	Good	Bikes used side walk and traffic lanes. Much more bike traffic than on south side of river. WILL NEED TO REMOVE PARKING (1-SIDE)
	University Ave NE	4th St NE	1 way traffic - 4 southbound lanes (1 right, 1 straight/right, 2 straight)	56	N	none	none	4 metered on east side, 2 open on west side	Bituminous	Good	Bikes used side walk and traffic lanes. Much more bike traffic than on south side of river.
	4th St NE	5th St NE	1 way traffic - 3 southbound lanes (2 straight, 1 straight/left)	56	N	none	1 stop, southbound	9 metered on east side, 6 metered on west side	Bituminous	Good	Bikes used side walk and traffic lanes. Much more bike traffic than on south side of river.
	5th St NE	6th St SE	1 way traffic - 3 southbound lanes (1 straight/right, 1 straight, 1 straight/left)	56	N	none	1 stop, southbound	11 metered on east side, 7 metered on west side	Bituminous	Good	Bikes used side walk and traffic lanes. Much more bike traffic than on south side of river. Saw a bike chained to a non parking sign.
	6th St SE	Central Ave	1 way traffic - 3 southbound lanes (1 straight/right, 1 straight, 1 straight/left)	56, then widens to 102 at the north end	N	none	1 stop, southbound	2 hr parking: (7 on west side and 4 on east side)	Bituminous	Good	Bikes used side walk and traffic lanes. Much more bike traffic than on south side of river. 2 lanes from Central and 2 lanes from SE 7th St merge into the 3 lanes on 1st ave May have a lane transition/merge issue

**Appendix B:
Bicycle and Pedestrian Detailed Crash Review**

Table B-1. Pedestrian and Bicycle Crash Detail Summary

Segment	Intersecting Cross-Street	Pedestrian or Bike	Details of Crash
1 (Lyndale Avenue N to 11th Street N)	16th Street N	Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 16th St making a left onto Northeast bound Hennepin Ave and failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Bus was traveling Northwest on 16th St making a right onto Northeast bound Hennepin Ave and failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on 16th St making a left onto Southwest bound Hennepin Ave and failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Bike	Crash occurred 50 feet Northeast of intersection on Hennepin Ave. Vehicle and bicyclist were both traveling Northeast on Hennepin Ave, bicyclist improperly slowed down and vehicle went to pass and hit bicyclist.
	Laurel Avenue N	Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a right turn onto Southeast bound Spruce Place and failed to see bicyclist traveling Northeast through intersection along curb on Hennepin Ave.
	13th Street N	Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 13th St making a left onto Northeast bound Hennepin Ave and failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
	12th Street N	Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 12th St, pedestrian disregarded no walk signal and crossed illegally across 12th St in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 12th St making a left onto Northeast bound Hennepin Ave and failed to yield to Pedestrian crossing Hennepin Ave in crosswalk.
		Bike	Crash occurred in intersection. Vehicle was traveling Southeast on 12th St making a left turn onto Northeast bound Hennepin Ave failed to yield right of way to bicyclist on left side traveling Southeast through intersection down center of roadway.
	2 (11th Street N to 1st Street N)	11th Street N	Bike
10th Street N		Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 10th St making a left onto Northeast bound Hennepin Ave and failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling the in the wrong direction on a 1-way going Northwest on 10th St, pedestrian disregarded no walk signal and crossed illegally across 10th St in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a right turn onto Southeast bound 10th St and failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a right turn on red onto Southeast bound 10th St and failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Bike	Crash occurred in intersection. Vehicle ran red-light traveling Southeast on 10th St and failed to yield to Bicyclist traveling Northeast on Hennepin Ave in designated bike lane.
9th Street N		Ped	Crash occurred in intersection. Vehicle ran red-light traveling Northwest on 9th St and failed to yield to pedestrian crossing 9th St in crosswalk.
		Ped	Crash occurred 10 feet Southwest of intersection on Hennepin Ave. Vehicle was stopped in traffic traveling Northeast on Hennepin Ave and hit pedestrian working on right side of roadway.
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 9th St failed to yield right of way to bicyclist on left side traveling Northeast through intersection in designated bike lane.
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 9th St failed to yield right of way to bicyclist on left side traveling Northeast through intersection in designated bike lane.
		Bike	Crash occurred 100 feet Northeast of intersection on Hennepin Ave. Vehicle was traveling Northeast on Hennepin Ave making a U-left turn failed to yield right of way to bicyclist on left side traveling Northeast through intersection in designated bike lane.
8th Street N		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave, pedestrian disregarded no walk signal and crossed illegally across Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a right turn onto Southeast bound 8th St and failed to yield to pedestrian crossing 8th St in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 8th St making a left onto Northeast bound Hennepin Ave and failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Drive of vehicle was under the influence of drugs or alcohol traveling Northeast on Hennepin Ave making a right on red onto Southeast bound 8th St failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Bike	Crash occurred 150 feet Northeast of intersection on Hennepin Ave. Vehicle was traveling Northeast on Hennepin Ave making a left turn into a driveway failed to yield right of way to bicyclist on left side traveling Northeast in designated bike lane.
		Bike	Crash occurred 50 feet Southwest of intersection on Hennepin Ave. Vehicle was making a left turn from a driveway onto Northeast bound Hennepin Ave and failed to yield to bicyclist traveling Northeast on Hennepin Ave in designated bike lane.
7th Street N		Ped	Crash occurred 150 feet Northeast of intersection on Hennepin Ave. Vehicle was traveling Northeast on Hennepin Ave, it was raining and Vehicle hit pedestrian not in roadway.
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave, pedestrian disregarded no walk signal and crossed illegally across Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Both vehicle and pedestrian had been drinking. Vehicle was traveling Northwest on 7th St, pedestrian disregarded no walk signal and crossed illegally across 7th St in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 7th St and failed to yield to pedestrian crossing 7th St in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on 7th St making a left turn onto Southwest Hennepin Ave (into the Bus & Authorized Vehicle only lane) failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on 7th St making a right turn onto Northeast bound Hennepin Ave failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on 7th St making a left turn onto Southwest Hennepin Ave (into the Bus & Authorized Vehicle only lane) failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left onto Northwest 7th St failed to yield to pedestrian crossing 7th St in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on 7th St making a left onto Southwest Hennepin Ave (into the Bus & Authorized Vehicle only lane) failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 7th St failed to yield right of way to bicyclist on left side traveling Northeast through intersection in designated bike lane.
		Bike	Crash occurred 100 feet Northeast of intersection on Hennepin Ave. Both vehicle and bicycle were traveling Northeast on Hennepin Ave and collided. Details of crash are unknown.
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 7th St failed to yield to pedestrian crossing 7th St in crosswalk.
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 7th St failed to yield right of way to bicyclist on left side traveling Northeast through intersection in designated bike lane.
	Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 7th St failed to yield right of way to opposing bicyclist traveling Southwest through intersection in designated bike lane.	

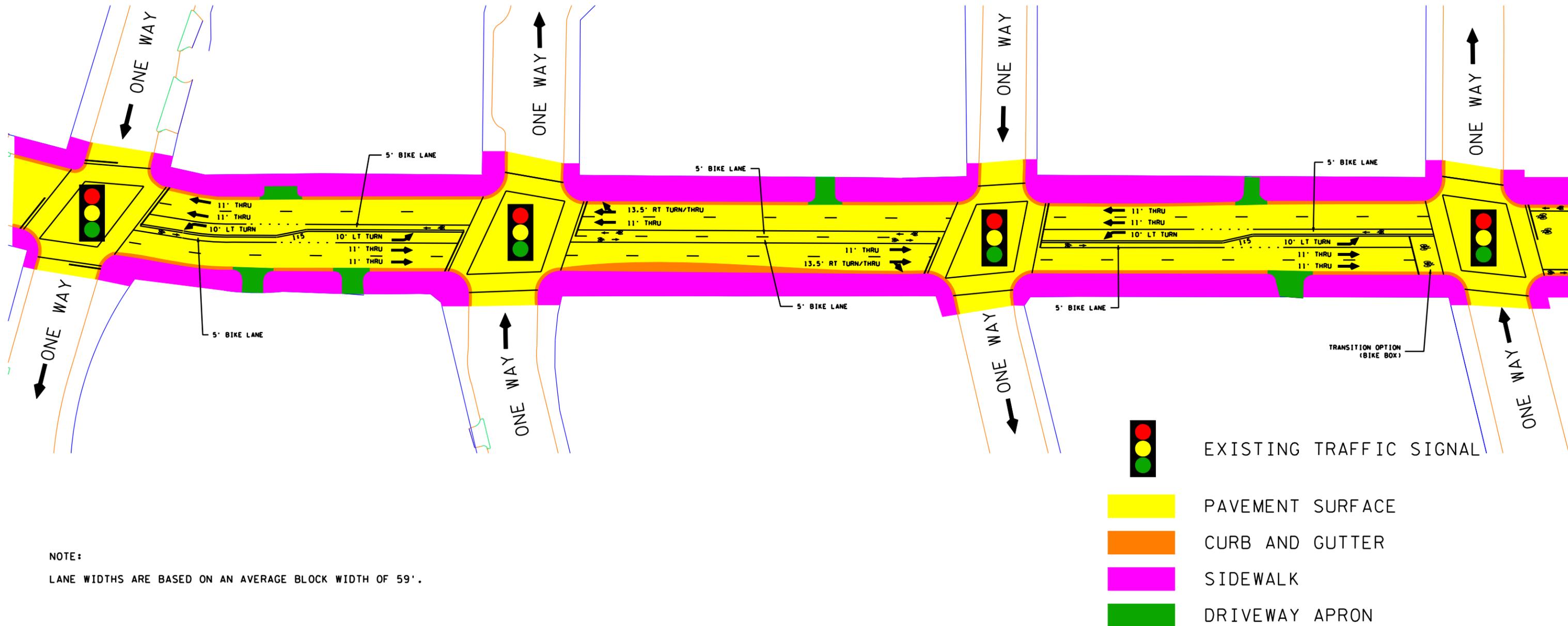
Table B-1. Pedestrian and Bicycle Crash Detail Summary

Segment	Intersecting Cross-Street	Pedestrian or Bike	Details of Crash	
2 (11th Street N to 2nd Street N)	6th Street N	Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 6th St, pedestrian disregarded no walk signal and crossed illegally across 6th St in crosswalk. Pedestrian was under the influence.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a right turn on red onto Southeast bound 6th St, pedestrian was crossing Hennepin Ave in front of vehicle without a walk signal.	
		Ped	Crash occurred 50 feet Northeast of intersection on Hennepin Ave. Vehicle was traveling Northeast on Hennepin Ave and pedestrian crossed into traffic on Hennepin Ave in a non designated crossing area. Pedestrian had been drinking.	
		Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 6th St making a left turn onto Northeast bound Hennepin Ave failed to yield to pedestrian crossing Hennepin Ave in crosswalk.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave, pedestrian disregarded no walk signal and crossed illegally across Hennepin Ave in crosswalk. Pedestrian was under the influence.	
		Ped	Crash occurred in intersection. Pedestrian was crossing Hennepin Ave with signal, vehicle ran red light traveling Northeast on Hennepin Ave.	
		Bike	Crash occurred in intersection. Vehicle was traveling Southeast on 6th St making a left turn on red onto Northeast bound Hennepin Ave failed to yield right of way to bicyclist traveling Southwest through intersection in designated bike lane.	
	5th Street N	Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave, pedestrian disregarded no walk signal and crossed illegally across Hennepin Ave in crosswalk. Both vehicle and pedestrian had been drinking.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on 5th St, pedestrian disregarded no walk signal and crossed illegally across 5th St in cross walk. Pedestrian had been drinking and it was raining.	
		Ped	Crash occurred 200 feet Southwest of intersection on Hennepin Ave. Vehicle was traveling Northeast on Hennepin Ave and hit pedestrian not in roadway.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on 5th St, pedestrian disregarded no walk signal and crossed illegally across 5th St in cross walk.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on 5th St, pedestrian disregarded no walk signal and crossed illegally across 5th St in cross walk.	
		Bike	Crash occurred 20 feet Southwest of intersection on Hennepin Ave. Vehicle was traveling Northeast on Hennepin Ave making left turn into driveway failed to yield to bicyclist traveling Northeast on Hennepin Ave in designated bike lane.	
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making left turn onto Northwest bound 5th St failed to yield right of way to bicyclist on left side traveling Northeast through intersection in designated bike lane.	
		Bike	Crash occurred 75 feet Southwest of intersection on Hennepin Ave. Vehicle was traveling Northeast on Hennepin Ave making U-turn failed to yield to bicyclist traveling Northeast on Hennepin Ave in designated bike lane.	
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making left turn onto Northwest bound 5th St failed to yield right of way to opposing bicyclist traveling Southwest through intersection in designated bike lane.	
	4th Street N	Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 4th St making a left turn onto Northeast bound Hennepin Ave failed to yield to pedestrian crossing Hennepin Ave in crosswalk.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto the wrong direction on a 1-way going Northwest on 4th St failed to yield to pedestrian crossing 4th St in crosswalk.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave, pedestrian disregarded no walk signal and crossed illegally across Hennepin Ave in crosswalk.	
		Ped	Crash occurred in intersection. Pedestrian was crossing 4th St with signal, vehicle ran red light traveling Southeast on 4th St.	
		Bike	Crash occurred 200 feet Southwest of intersection on Hennepin Ave. Vehicle was traveling Northeast on Hennepin Ave making left turn into driveway failed to yield to bicyclist on left side traveling Northeast on Hennepin Ave in designated bike lane.	
		Bike	Crash occurred in intersection. Vehicle was traveling Southeast on 4th St making a left turn on red onto Northeast bound Hennepin Ave failed to yield right of way to opposing bicyclist traveling Southwest through intersection in designated bike lane.	
		3rd Street N	Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 3rd St failed to yield to pedestrian crossing 3rd St in crosswalk.
			Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making left turn onto Northwest bound 3rd St failed to yield right of way to bicyclist on left side traveling Northeast on Hennepin Ave in designated bike lane
			Bike	Crash occurred in intersection. Vehicle was traveling Northwest on 3rd St following roadway, bicyclist was traveling Northeast on Hennepin Ave improperly using a lane. Details of crash are unknown. Assumed that bicyclist crossed intersection without signal.
	Bike		Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 3rd St failed to yield right of way to opposing bicyclist traveling Southwest through intersection in designated bike lane	
	Bike		Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making left turn onto Northwest bound 3rd St failed to yield right of way to bicyclist on left side traveling Northeast on Hennepin Ave in designated bike lane	
	Bike		Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 3rd St failed to yield right of way to opposing bicyclist traveling Southwest through intersection in designated bike lane	
	Bike		Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making left turn onto Northwest bound 3rd St failed to yield right of way to bicyclist on left side traveling Northeast on Hennepin Ave in designated bike lane. Vehicle was under the influence of drugs or alcohol.	
	Bike		Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making left turn onto Northwest bound 3rd St failed to yield right of way to bicyclist on left side traveling Northeast on Hennepin Ave in designated bike lane	
2 (11th Street N to 2nd Street N)	Washington Avenue N	Ped	Crash occurred in intersection. Vehicle was traveling Southeast on Washington Ave following roadway, pedestrian was crossing Washington Ave in crosswalk. Both failed to yield right of way, unsure of details of crash.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a right turn onto Southeast bound Washington Ave failed to yield to pedestrian crossing Washington Ave in crosswalk. Vehicle driver had been drinking.	
		Ped	Crash occurred in intersection. Vehicle was traveling Northwest on Washington Ave and hit pedestrian crossing with traffic signal Northwest along Washington Ave in crosswalk. Vehicle drive was under the influence of drugs or alcohol.	
		Ped	Crash occurred in intersection. Bicyclist was traveling Northwest on Washington Ave making a left turn into the Southwest bound bike lane on Hennepin Ave failed to yield to pedestrian crossing Hennepin Ave in crosswalk.	
		Ped	Crash occurred in intersection. Vehicle was traveling Southeast on Washington Ave making a left turn onto Northeast bound Hennepin Ave failed to yield to pedestrian crossing Hennepin Ave in crosswalk.	
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave going through the intersection and bicyclist was making a right turn onto Southeast bound Washington Ave from designated bike lane. Bicyclist failed to yield to through traffic.	
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making left turn onto Northwest bound Washington Ave failed to yield right of way to bicyclist on left side traveling Northeast on Hennepin Ave in designated bike lane. Vehicle was under the influence of drugs or alcohol.	
	2nd Street N	Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 2nd St failed to yield right of way to opposing bicyclist traveling Southwest on Hennepin Ave in designated bike lane.	

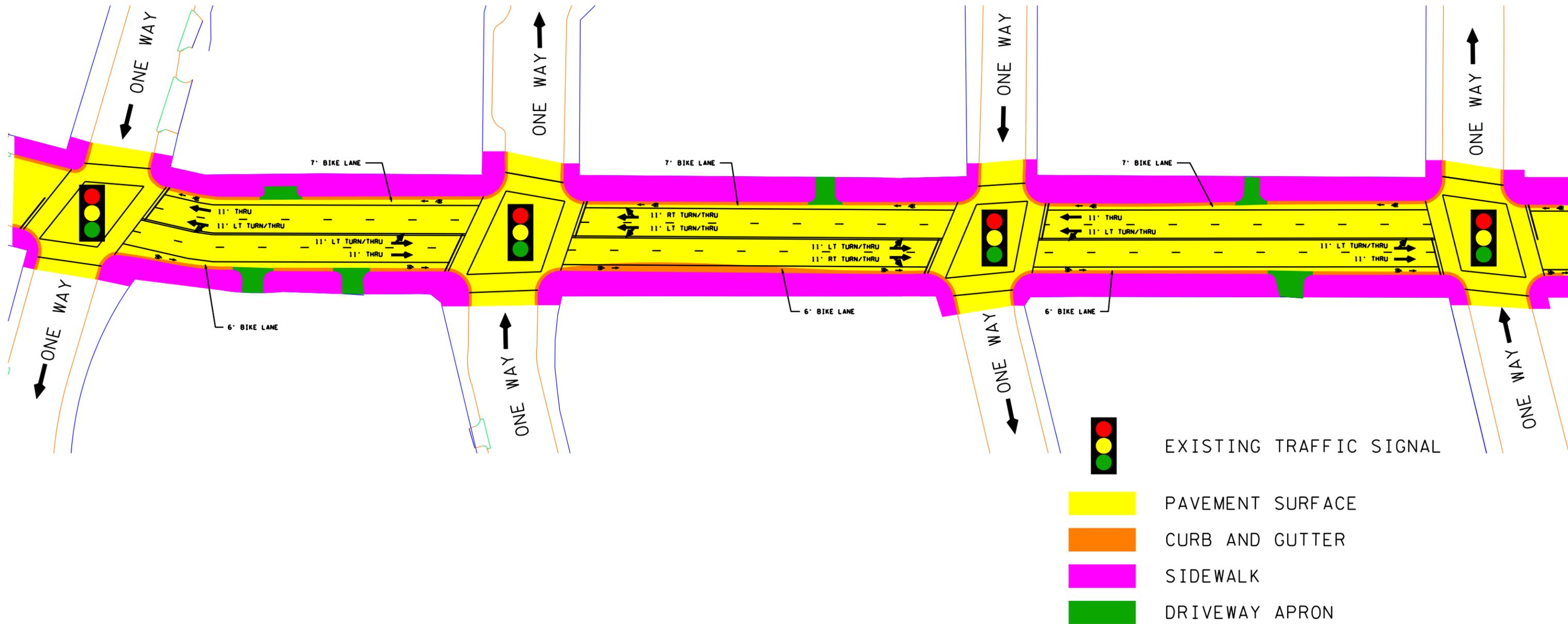
Table B-1. Pedestrian and Bicycle Crash Detail Summary

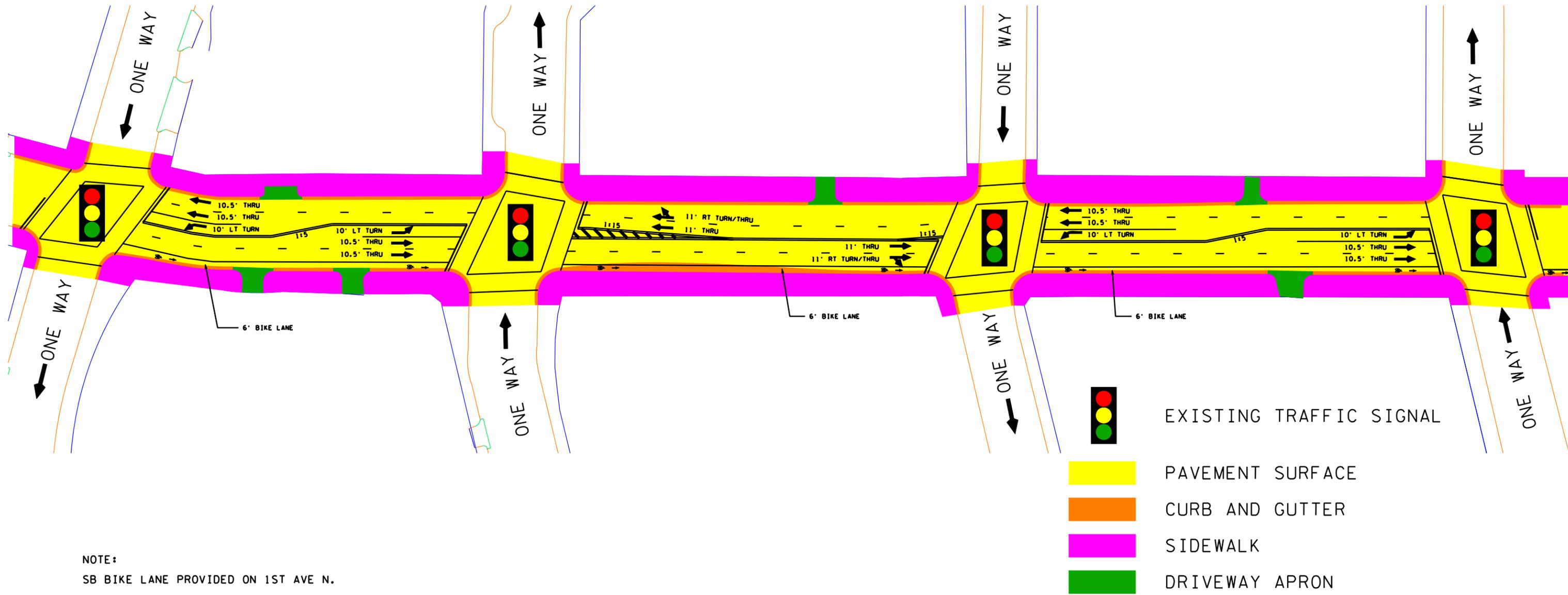
Segment	Intersecting Cross-Street	Pedestrian or Bike	Details of Crash
3 (2nd Street N to DeLaSalle Drive NE)	1st Street N	Ped	Crash occurred in intersection. Vehicle was traveling Southwest on Hennepin Ave making a right turn onto Northwest bound 1st St failed to yield to pedestrian crossing 1st St in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Southeast on 1st St making a left turn onto Northeast bound Hennepin Ave failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Ped	Crash occurred in intersection. Vehicle was traveling Southwest on Hennepin Ave going through intersection, pedestrian was cross Hennepin Ave in crosswalk and failed to yield to vehicle. Unsure of details of crash, assume that pedestrian crossed illegally.
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound 1st St failed to yield right of way to opposing bicyclist traveling Southwest on Hennepin Ave in designated bike lane.
	Robert Fisher Drive/ High Street	None	
	Wilder Street NE	None	
	DeLaSalle Drive NE	Bike	Crash occurred in intersection. Vehicle was traveling Southwest on 1st St N making a right turn onto Northwest bound DeLaSalle Dr, bicyclists was traveling Southwest along the curb on 1st St N on the vehicle's right side. No bike lane present.
	Bike	Crash occurred in intersection. Vehicle was traveling Southeast on DeLaSalle Dr making a right turn on red onto Southwest bound 1st St N failed to yield right of way to bicyclist traveling Northeast (opposite direction of traffic) on 1st St N in crosswalk.	
4 (DeLaSalle Drive NE to Central Avenue)	Main Street NE	None	
	2nd Street NE	None	
	University Avenue NE	Ped	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound University Ave failed to yield to pedestrian crossing University Ave in cross walk.
		Ped	Crash occurred in intersection. Vehicle was traveling Southeast on University Ave making a left turn onto Northeast bound Hennepin Ave failed to yield to pedestrian crossing Hennepin Ave in crosswalk.
		Bike	Crash occurred in intersection. Vehicle was traveling Northeast on Hennepin Ave making a left turn onto Northwest bound University Ave, bicyclist was traveling Northeast on Hennepin Ave through intersection in traffic lane on vehicles left side. No bike lane present.

**Appendix C:
Hennepin Avenue and 1st Avenue Preferred Alternatives
Concept Layouts**

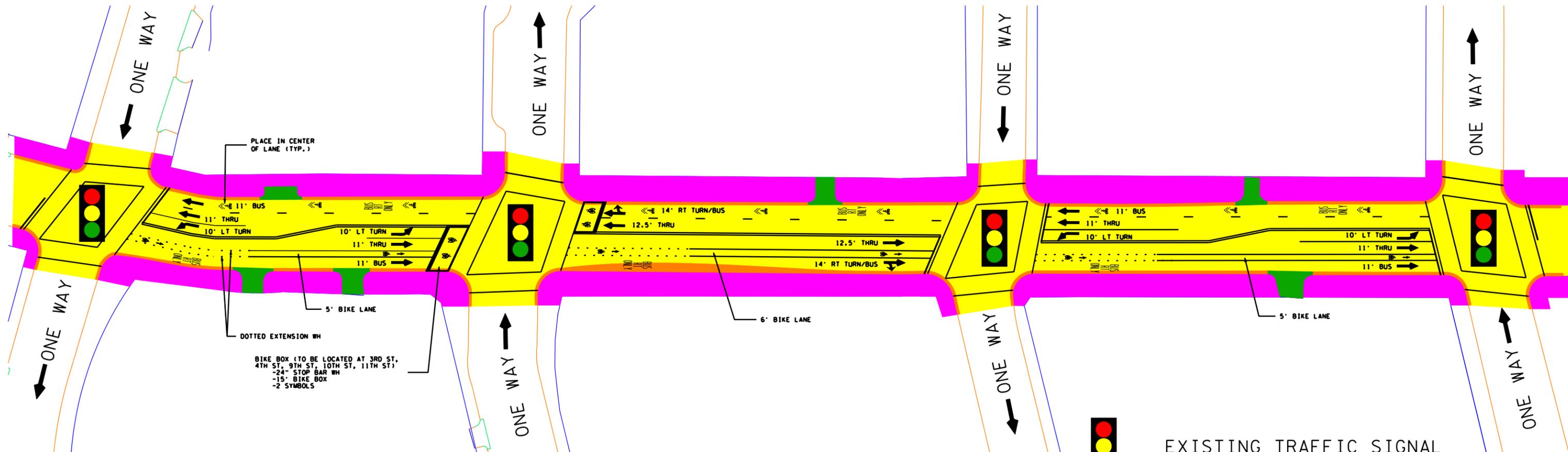


NOTE:
LANE WIDTHS ARE BASED ON AN AVERAGE BLOCK WIDTH OF 59'.





NOT TO SCALE



PLACE IN CENTER OF LANE (TYP.)

BIKE BOX (TO BE LOCATED AT 3RD ST, 4TH ST, 9TH ST, 10TH ST, 11TH ST)
 -24" STOP BAR WH
 -15" BIKE BOX
 -2 SYMBOLS

DOTTED EXTENSION WH

5' BIKE LANE

6' BIKE LANE

5' BIKE LANE



EXISTING TRAFFIC SIGNAL



PAVEMENT SURFACE



CURB AND GUTTER



SIDEWALK



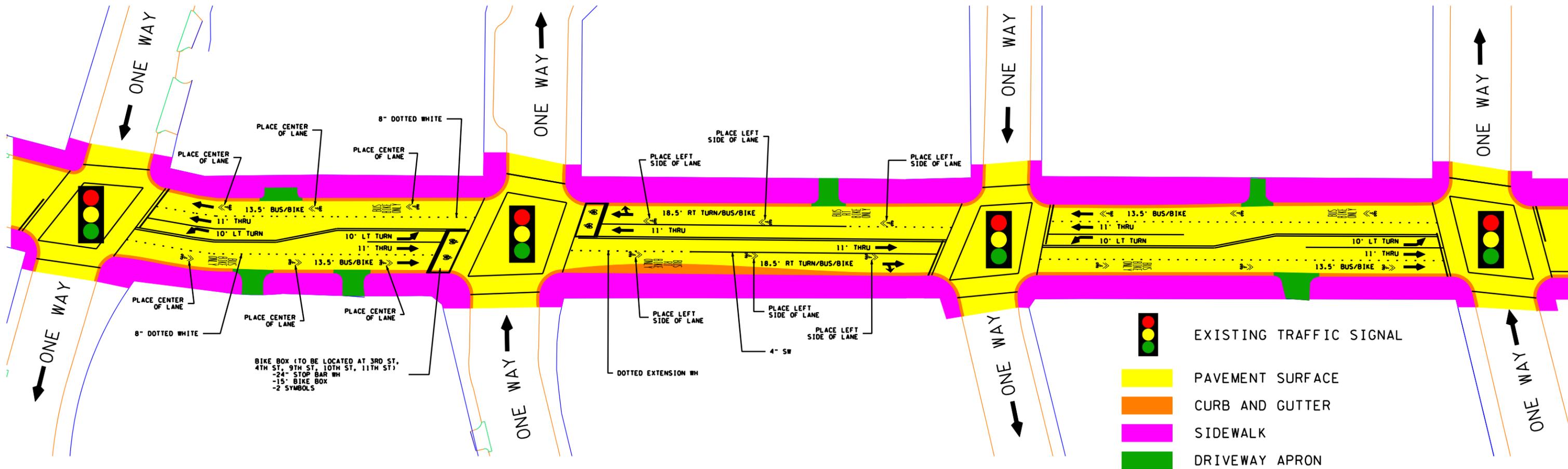
DRIVEWAY APRON

NOTE:

✕ SB BIKE LANE PROVIDED ON 1ST AVE N. (SEE 1ST AVENUE - ALTERNATIVE 3)

✕ LANE WIDTHS BASED ON AN AVERAGE BLOCK WIDTH OF 59'.

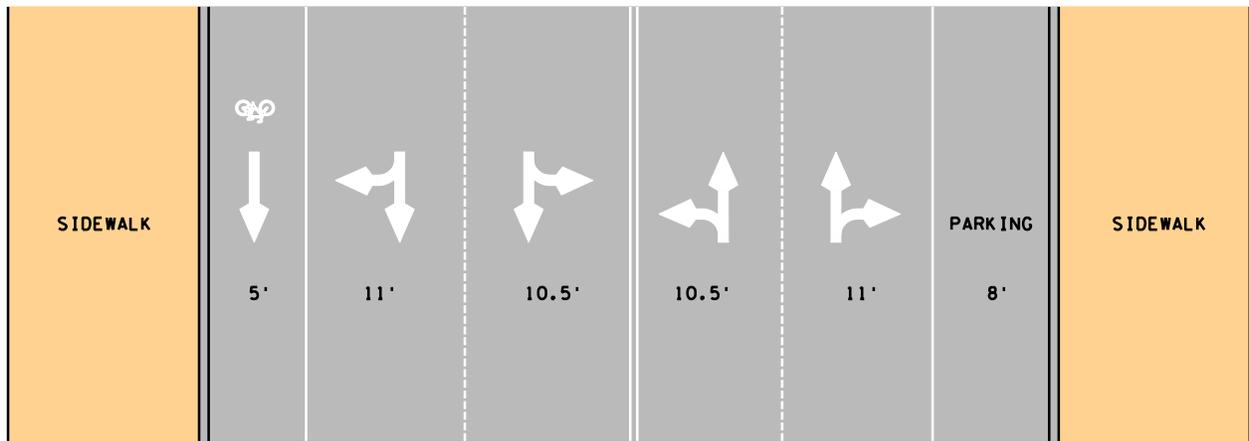
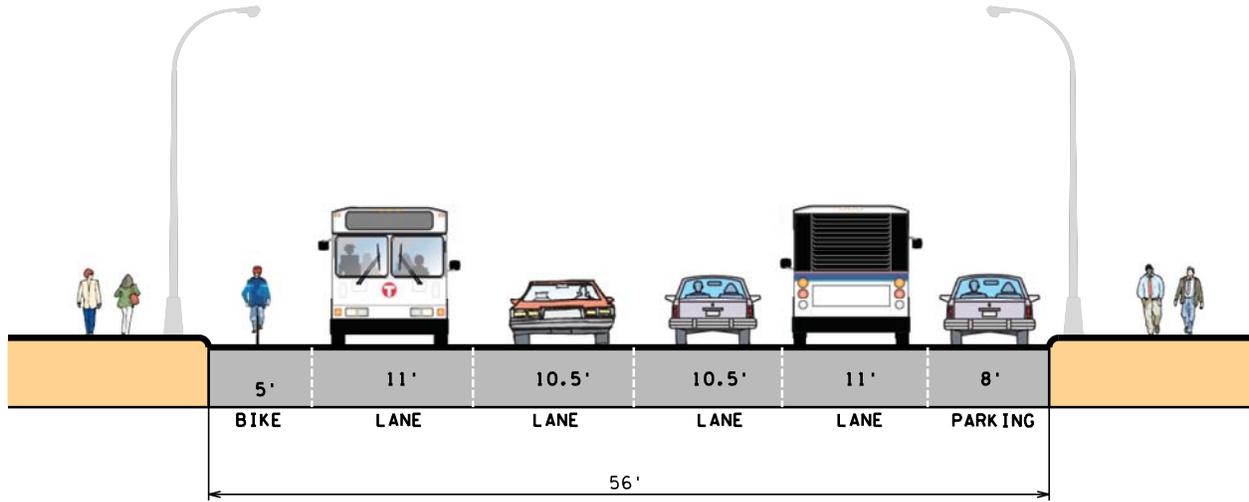


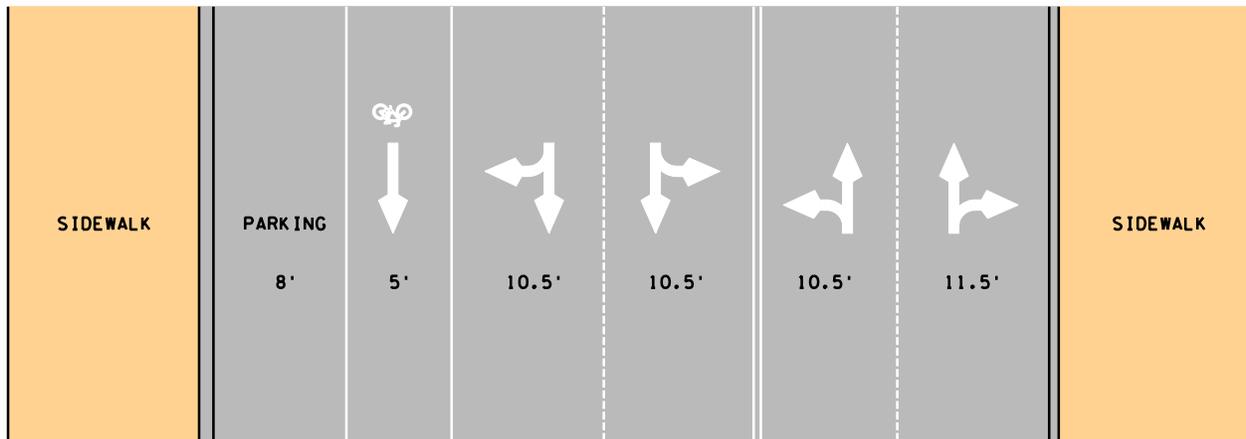
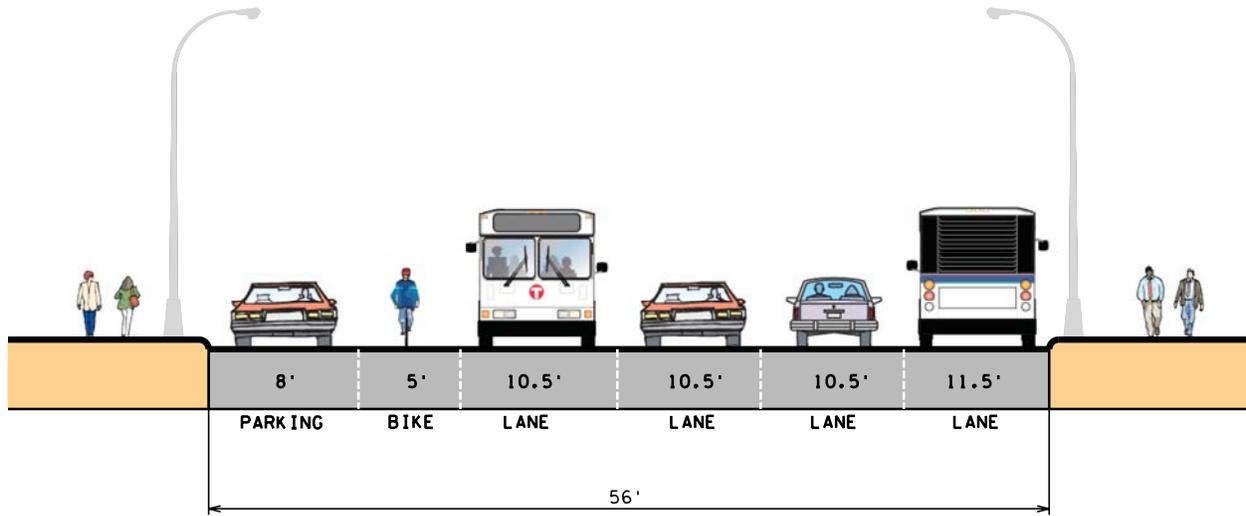


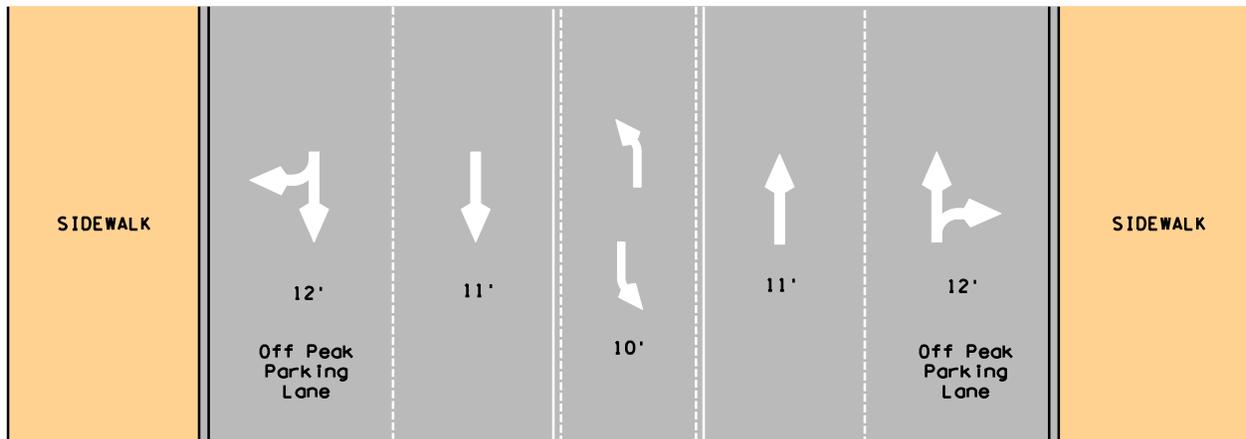
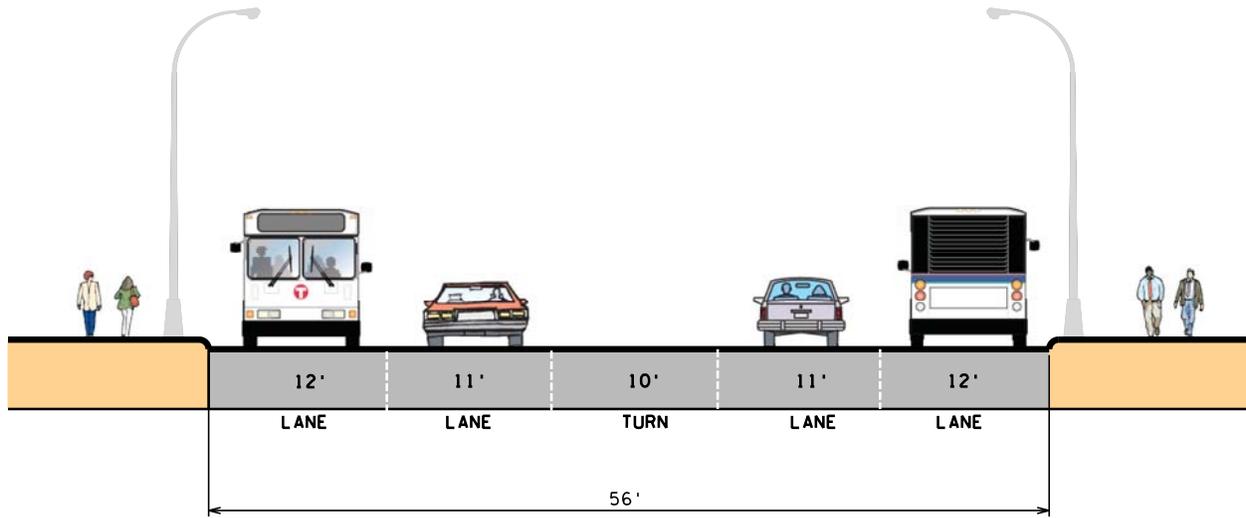
NOTE:

- ✱ PROVIDE DIAMOND BUS/BIKE/RT ONLY ON HENNEPIN AVENUE.
- ✱ PROVIDE TWO-WAY BIKE LANE FACILITY ON 1ST AVENUE.
(SEE 1ST AVENUE - ALTERNATIVE 1 AND ALTERNATIVE 2)
- ✱ LANE WIDTHS ARE BASED ON AN AVERAGE BLOCK WIDTH OF 59'.









**Appendix D:
VISSIM Detailed Analysis Results**

Table D-1. Scenario 1 (Hennepin Avenue 5-Lane, 1st Avenue/Hawthorne Avenue 4-Lane)

Intersection	Approach	Demand Volumes				Modeled Volumes				Model-Demand by approach					Delay			LOS By Approach		LOS By Intersection		Max Queue			Ave Queue		
		L	T	R	Total	L	T	R	Total	L	T	R	Total	%	L	T	R	Delay(S/ Veh)	LOS	Delay(S/ Veh)	LOS	L	T	R	L	T	R
Hennepin Ave @ 13th St N	EB	11	7	17	35	9	12	17	38	-2	5	0	3	9%	35.0	17.3	6.7	17	B	8	A	44.5	44.5	44.5	2.9	2.9	2.9
	WB	56	8	20	84	67	10	25	102	11	2	5	18	21%	3.5	5.7	2.9	4	A			67.5	67.5	67.5	0.4	0.4	0.4
	NB	19	853	9	881	22	848	15	885	3	-5	6	4	0%	15.3	9.9	5.6	10	B			172.0	172.0	172.0	18.2	18.4	18.1
	SB	4	485	12	501	4	437	12	453	0	-48	0	-48	-10%	0.4	4	0.6	4	A			67.6	67.6	67.6	7.0	7.0	7.0
Hennepin Ave @ 12th St N	EB	89	439	262	790	81	432	255	768	-8	-7	-7	-22	-3%	22.4	18.4	5.1	14	B	9	A	164.9	164.9	70.5	26.9	27.7	2.8
	WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
	NB	0	620	264	884	0	612	268	880	0	-8	4	-4	0%	0.0	2.5	4.7	3	A			0.0	196.3	196.3	0.0	9.7	8.2
	SB	253	239	0	492	296	196	0	492	43	-43	0	0	0%	7.1	14.1	0	10	B			105.2	148.2	0.0	6.4	8.5	0.0
Hennepin Ave @ 11th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	59	E	0.0	0.0	0.0	0.0	0.0	0.0
	WB	300	1,176	101	1,577	307	1,057	70	1,434	7	-119	-31	-143	-9%	46.3	99.8	128.3	90	F			1656.0	1656.0	1655.2	1117.9	1118.1	1008.4
	NB	262	447	0	709	256	439	0	695	-6	-8	0	-14	-2%	22.0	8.9	0	14	B			203.0	87.9	0.0	18.3	12.7	0.0
	SB	0	192	89	281	0	183	92	275	0	-9	3	-6	-2%	0.0	17	10.4	15	B			0.0	132.8	132.3	0.0	18.5	16.2
Hennepin Ave @ 10th St N	EB	130	770	68	968	114	785	68	967	-16	15	0	-1	0%	15.2	13.5	9.7	13	B	9	A	254.0	252.2	252.1	32.2	38.3	38.3
	WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
	NB	0	478	70	548	0	437	69	506	0	-41	-1	-42	-8%	0.0	5.3	2.2	5	A			0.0	113.4	113.4	0.0	12.8	9.9
	SB	125	213	0	338	119	210	0	329	-6	-3	0	-9	-3%	2.4	2.9	0	3	A			42.4	41.7	0.0	0.8	2.6	0.0
Hennepin Ave @ 9th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	76	E	0.0	0.0	0.0	0.0	0.0	0.0
	WB	23	1,159	376	1,558	14	793	228	1,035	-9	-366	-148	-523	-34%	34.5	105.9	175.4	120	F			1656.0	1656.0	1656.0	1550.2	1550.6	1501.8
	NB	36	572	0	608	32	520	0	552	-4	-52	0	-56	-9%	23.6	27.9	0	28	C			63.5	194.1	0.0	3.7	46.5	0.0
	SB	0	315	96	411	0	316	79	395	0	1	-17	-16	-4%	0.0	16.7	66.9	27	C			0.0	206.1	205.7	0.0	36.8	35.1
Hennepin Ave @ 8th St N	EB	65	254	2	321	64	251	1	316	-1	-3	-1	-5	-2%	15.6	13.9	0.5	14	B	11	B	117.5	115.9	115.8	10.9	11.7	11.7
	WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
	NB	0	797	151	948	0	636	117	753	0	-161	-34	-195	-21%	0.0	10.1	7.8	10	B			0.0	273.8	273.8	0.0	36.0	35.0
	SB	200	409	0	609	211	393	0	604	11	-16	0	-5	-1%	7.1	12.3	0	10	B			128.6	132.7	0.0	4.9	16.7	0.0
Hennepin Ave @ 7th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	21	C	0.0	0.0	0.0	0.0	0.0	0.0
	WB	150	1,311	151	1,612	159	1,308	151	1,618	9	-3	0	6	0%	25.2	22.9	10.1	22	C			333.1	333.1	46.4	77.3	78.2	1.2
	NB	120	742	0	862	107	596	0	703	-13	-146	0	-159	-18%	26.3	18.8	0	20	C			126.5	199.1	0.0	9.8	34.6	0.0
	SB	0	459	64	523	0	442	58	500	0	-17	-6	-23	-4%	0.0	18	15	18	B			0.0	201.2	200.3	0.0	52.9	51.3
Hennepin Ave @ 6th St N	EB	59	417	39	515	53	431	29	513	-6	14	-10	-2	0%	16.6	14.3	6.3	14	B	9	A	91.7	91.7	91.7	17.7	19.3	18.6
	WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
	NB	0	705	188	893	0	599	147	746	0	-106	-41	-147	-16%	0.0	3.8	4.1	4	A			0.0	169.9	167.7	0.0	11.4	9.8
	SB	102	484	0	586	98	473	0	571	-4	-11	0	-15	-3%	3.8	14.2	0	12	B			45.6	138.7	0.0	1.1	24.4	0.0
Hennepin Ave @ 5th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	28	C	0.0	0.0	0.0	0.0	0.0	0.0
	WB	63	238	67	368	66	256	68	390	3	18	1	22	6%	58.8	57.3	31.1	53	D			179.8	179.8	179.8	57.9	57.9	56.9
	NB	100	664	0	764	76	576	0	652	-24	-88	0	-112	-15%	10.1	10.2	0	10	B			68.4	111.5	0.0	3.6	20.1	0.0
	SB	0	523	135	658	0	506	123	629	0	-17	-12	-29	-4%	0.0	33.5	17.3	30	C			0.0	338.5	338.2	0.0	106.5	105.9
Hennepin Ave @ 4th St N	EB	72	565	105	742	72	543	88	703	0	-22	-17	-39	-5%	13.2	12.1	7.6	12	B	9	A	42.8	236.3	21.4	2.9	21.7	0.2
	WB	10	0	10	20	8	0	12	20	-2	0	2	0	0%	5.0	0	0.5	2	A			0.0	0.0	0.0	0.0	0.0	0.0
	NB	0	641	90	731	0	569	75	644	0	-72	-15	-87	-12%	0.0	1.2	2.1	1	A			0.0	112.9	112.9	0.0	3.3	2.0
	SB	48	543	0	591	37	533	0	570	-11	-10	0	-21	-4%	11.7	16.1	0	16	B			61.9	150.5	0.0	1.8	25.1	0.0
Hennepin Ave @ 3rd St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	28	C	0.0	0.0	0.0	0.0	0.0	0.0
	WB	180	1,640	57	1,877	177	1,604	59	1,840	-3	-36	2	-37	-2%	29.4	28.5	24.6	28	C			442.3	442.3	42.3	69.6	75.1	0.4
	NB	170	553	0	723	148	507	0	655	-22	-46	0	-68	-9%	21.1	22.1	0	22	C			132.7	148.2	0.0	14.9	33.7	0.0
	SB	0	411	128	539	0	391	134	525	0	-20	6	-14	-3%	0.0	40.3	13.3	33	C			0.0	357.6	356.5	0.0	76.7	75.6
Hennepin Ave @ Washington Ave N	EB	225	814	73	1,112	200	755	73	1,028	-25	-59	0	-84	-8%	11.6	7.3	3	8	A	17	B	145.6	104.7	104.7	9.5	13.9	13.6
	WB	94	973	126	1,193	87	950	176	1,213	-7	-23	50	20	2%	33.2	25.1	32.3	27	C			282.1	282.1	282.1	36.3	36.7	35.1
	NB	47	500	63	610	42	418	55	515	-5	-82	-8	-95	-16%	11.2	12.2	5.3	11	B			41.9	304.5	21.3	1.9	33.9	0.2
	SB	71	372	68	511	63	362	65	490	-8	-10	-3	-21	-4%	32.7	18.7	5.8	19	B			57.1	303.0	41.4	3.6	32.6	0.3
Hennepin Ave @ 2nd St N	EB	627	0	10	637	626	0	15	641	-1	0	5	4	1%	9.7	0	4.9	10	B	15	B	224.4	0.0	224.4	24.8	0.0	22.9
	WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
	NB	79	772	0	851	71	718	0	789	-8	-54	0	-62	-7%	26.7	28.4	0	28	C			107.2	262.1	0.0	8.4	65.7	0.0
	SB	0	501	252	753	0	476	252	728	0	-25	0	-25	-3%	0.0	7	2.7	6	A			0.0	145.2	145.7	0.0	10.7	4.5
Hennepin Ave @ 1st St N	EB	327	265	12	604	315	271	18	604	-12	6	6	0	0%	24.9												

Table D-1. Scenario 1 (Hennepin Avenue 5-Lane, 1st Avenue/Hawthorne Avenue 4-Lane)

VISSIM MOE Table

Intersection	Approach	Demand Volumes				Modeled Volumes				Model-Demand by approach					Delay			LOS By Approach		LOS By Intersection		Max Queue			Ave Queue		
		L	T	R	Total	L	T	R	Total	L	T	R	Total	%	L	T	R	Delay(S/ Veh)	LOS	Delay(S/ Veh)	LOS	L	T	R	L	T	R
Hawthorne Ave @ 12th St N	EB	130	315	83	528	140	312	74	526	10	-3	-9	-2	0%	33.7	27.4	19.5	28	C	10	B	219.9	219.9	219.9	48.0	48.0	48.0
	WB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A			0.0	0.0	0.0	0.0	0.0	0.0
	NB	0	240	217	457	0	236	227	463	0	-4	10	6	1%	0.0	7.4	4.5	6	A			0.0	131.9	131.9	0.0	7.4	7.4
	SB	258	1,826	0	2,084	234	1571	0	1805	-24	-255	0	-279	-13%	2.8	6.2	0	6	A			0.0	316.7	0.0	0.0	28.3	0.0
Hawthorne Ave @ 11th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	27	C	0.0	0.0	0.0	0.0	0.0	0.0
	WB	676	550	301	1,527	630	478	265	1373	-46	-72	-36	-154	-10%	31.7	54.1	52	43	D			425.9	423.8	423.8	260.6	258.5	258.5
	NB	62	308	0	370	74	304	0	378	12	-4	0	8	2%	59.9	14.9	0	24	C			107.5	109.3	0.0	13.5	14.7	0.0
	SB	0	1,408	86	1,494	0	1173	58	1231	0	-235	-28	-263	-18%	0.0	8.3	12.6	9	A			0.0	302.1	302.1	0.0	36.6	36.6
Hawthorne Ave @ 10th St N	EB	130	723	68	921	128	738	72	938	-2	15	4	17	2%	47.4	43.6	40.6	44	D	21	C	342.7	342.7	342.7	93.7	93.7	89.9
	WB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A			0.0	0.0	0.0	0.0	0.0	0.0
	NB	0	539	70	609	0	492	79	571	0	-47	9	-38	-6%	0.0	7.8	4.4	7	A			0.0	85.6	85.6	0.0	7.4	7.4
	SB	175	1,426	0	1,601	151	1157	0	1308	-24	-269	0	-293	-18%	8.4	10.4	0	10	B			272.4	272.4	0.0	37.3	37.3	0.0
Hawthorne Ave @ 9th St N	EB	10	0	10	20	10	0	12	22	0	0	2	2	10%	24.5	0	13.3	18	B	40	D	21.8	21.8	21.8	0.5	0.5	0.5
	WB	895	20	376	1,291	626	9	251	886	-269	-11	-125	-405	-31%	6.0	44.5	129.6	41	D			308.9	307.3	306.9	220.6	241.8	241.4
	NB	36	633	0	669	26	595	0	621	-10	-38	0	-48	-7%	91.0	64.2	0	65	E			331.9	331.9	0.0	110.1	110.1	0.0
	SB	0	696	6	702	0	673	9	682	0	-23	3	-20	-3%	0.0	16.9	31	17	B			0.0	237.9	237.9	0.0	30.8	30.8
1st Ave @ 8th St N	EB	10	0	2	12	8	0	1	9	-2	0	-1	-3	-25%	23.2	0	0.3	21	C	32	C	22.7	22.7	22.7	0.9	0.9	0.9
	WB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A			0.0	0.0	0.0	0.0	0.0	0.0
	NB	239	659	121	1,019	196	553	100	849	-43	-106	-21	-170	-17%	58.9	44.6	34.4	47	D			316.8	316.8	316.8	239.7	239.7	239.7
	SB	200	700	9	909	212	680	8	900	12	-20	-1	-9	-1%	17.3	16.8	10.6	17	B			284.9	284.9	284.9	47.3	47.3	47.3
1st Ave @ 7th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	18	B	0.0	0.0	0.0	0.0	0.0	0.0
	WB	450	894	151	1,495	421	866	170	1457	-29	-28	19	-38	-3%	17.1	16.2	18.2	17	B			382.1	382.1	382.1	69.6	71.0	69.4
	NB	95	574	0	669	82	475	0	557	-13	-99	0	-112	-17%	33.5	28.5	0	29	C			217.0	217.0	0.0	50.7	50.7	0.0
	SB	0	459	64	523	0	482	49	531	0	23	-15	8	2%	0.0	8.3	9.9	8	A			0.0	130.4	130.4	0.0	14.9	14.9
1st Ave @ 6th St N	EB	59	307	39	405	64	313	40	417	5	6	1	12	3%	34.1	33.6	25.4	33	C	12	B	91.0	91.0	91.0	22.0	23.1	22.6
	WB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A			0.0	0.0	0.0	0.0	0.0	0.0
	NB	0	619	106	725	0	548	98	646	0	-71	-8	-79	-11%	0.0	4.8	3.9	5	A			0.0	86.7	86.7	0.0	8.7	8.7
	SB	102	484	0	586	102	492	0	594	0	8	0	8	1%	7.1	3	0	4	A			65.0	65.0	0.0	6.0	6.0	0.0
1st Ave @ 5th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	14	B	0.0	0.0	0.0	0.0	0.0	0.0
	WB	63	343	67	473	68	315	73	456	5	-28	6	-17	-4%	21.3	19.4	17.3	19	B			421.5	421.5	421.5	49.3	49.3	49.3
	NB	81	597	0	678	77	534	0	611	-4	-63	0	-67	-10%	15.8	10.3	0	11	B			109.1	109.1	0.0	22.1	22.1	0.0
	SB	0	523	135	658	0	525	139	664	0	2	4	6	1%	0.0	13.5	15.3	14	B			0.0	193.3	193.3	0.0	26.0	26.0
1st Ave @ 4th St N	EB	72	644	105	821	66	616	106	788	-6	-28	1	-33	-4%	30.7	30.3	20.8	29	C	21	C	158.5	158.5	63.3	30.6	31.1	1.3
	WB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A			0.0	0.0	0.0	0.0	0.0	0.0
	NB	0	614	50	664	0	567	41	608	0	-47	-9	-56	-8%	0.0	16.6	13.7	16	B			0.0	137.2	137.2	0.0	31.4	31.4
	SB	48	553	0	601	48	555	0	603	0	2	0	2	0%	20.3	13.6	0	14	B			156.7	156.7	0.0	26.0	26.0	0.0
1st Ave @ 3rd St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	12	B	0.0	0.0	0.0	0.0	0.0	0.0
	WB	181	1,700	57	1,938	186	1643	56	1885	5	-57	-1	-53	-3%	15.0	10.2	14.9	11	B			334.2	334.2	334.2	48.6	49.2	48.7
	NB	158	528	0	686	141	495	0	636	-17	-33	0	-50	-7%	6.4	6.1	0	6	A			151.6	151.6	0.0	13.5	13.5	0.0
	SB	0	420	128	548	0	419	124	543	0	-1	-4	-5	-1%	0.0	19.5	19.8	20	C			0.0	170.1	170.1	0.0	31.8	31.8
1st Ave @ Washington Ave N	EB	73	978	73	1,124	85	911	81	1077	12	-67	8	-47	-4%	21.5	23.7	16.7	23	C	14	B	85.0	214.3	21.0	4.4	38.5	0.4
	WB	94	905	89	1,088	88	866	103	1057	-6	-39	14	-31	-3%	11.7	9.7	5.4	9	A			65.6	167.7	43.8	2.3	21.8	0.5
	NB	47	475	63	585	50	455	46	551	3	-20	-17	-34	-6%	4.3	6.8	7.1	7	A			173.0	173.0	173.0	11.9	11.9	11.9
	SB	71	381	68	520	73	376	77	526	2	-5	9	6	1%	18.8	15	9.6	15	B			151.9	151.9	151.9	24.7	24.7	24.7
1st Ave @ 2nd St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	4	A	0.0	0.0	0.0	0.0	0.0	0.0
	WB	331	0	0	331	323	0	0	323	-8	0	0	-8	-2%	0.6	0	0	1	A			0.0	0.0	0.0	0.0	0.0	0.0
	NB	0	0	637	637	0	0	643	643	0	0	6	6	1%	0.0	0	2	2	A			0.0	32.5	32.5	0.0	0.0	0.0
	SB	0	189	0	189	0	201	0	201	0	12	0	12	6%	0.0	18.3	0	18	C			0.0	154.7	0.0	0.0	23.9	0.0

Table D-2. Scenario 2 (Hennepin Avenue 3-Lane + Hybrid Bike/Bus/RT Lane, 1st Avenue/Hawthorne Avenue 4-Lane)

VISSIM MOE Table

	Intersection	Approach	Demand Volumes				Modeled Volumes				Model-Demand by approach					Delay			LOS By Approach		LOS By Intersection		Max Queue			Ave Queue		
			L	T	R	Total	L	T	R	Total	L	T	R	Total	%	L	T	R	Delay(S/ Veh)	LOS	Delay(S/ Veh)	LOS	L	T	R	L	T	R
635	Hawthorne Ave @ 12th St N	EB	130	315	83	528	140	312	74	526	10	-3	-9	-2	0%	31.3	26.8	20	27	C	11	B	218.2	218.2	218.2	46.8	46.8	46.8
635		WB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A			0.0	0.0	0.0	0.0	0.0	0.0
635		NB	0	240	217	457	0	236	227	463	0	-4	10	6	1%	0.0	8.6	4.3	6	A			0.0	107.3	107.3	0.0	7.0	7.0
635		SB	258	1,826	0	2,084	231	1552	0	1783	-27	-274	0	-301	-14%	9.0	7.7	0	8	A			86.1	388.2	0.0	5.7	39.6	0.0
724	Hawthorne Ave @ 11th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	28	C	0.0	0.0	0.0	0.0	0.0	0.0
724		WB	676	550	301	1,527	615	491	257	1363	-61	-59	-44	-164	-11%	30.3	57.7	52.9	44	D			426.7	424.6	424.6	223.2	220.4	220.4
724		NB	62	308	0	370	75	304	0	379	13	-4	0	9	2%	73.3	13.6	0	25	C			146.5	130.5	0.0	20.5	13.8	0.0
724		SB	0	1,408	86	1,494	0	1159	62	1221	0	-249	-24	-273	-18%	0.0	11	15.2	11	B			0.0	302.1	302.1	0.0	50.1	50.1
637	Hawthorne Ave @ 10th St N	EB	130	723	68	921	132	749	73	954	2	26	5	33	4%	90.6	93.7	96.6	93	F	38	D	629.7	629.7	629.7	228.5	228.5	225.9
637		WB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A			0.0	0.0	0.0	0.0	0.0	0.0
637		NB	0	539	70	609	0	481	78	559	0	-58	8	-50	-8%	0.0	7.4	2.6	7	A			0.0	82.2	82.2	0.0	7.4	7.4
637		SB	175	1,426	0	1,601	149	1154	0	1303	-26	-272	0	-298	-19%	11.1	12.1	0	12	B			350.5	350.5	0.0	44.0	44.0	0.0
638	Hawthorne Ave @ 9th St N	EB	10	0	10	20	10	0	12	22	0	0	2	10%	13.5	0	13.8	14	B	41	D	21.8	21.8	21.8	0.5	0.5	0.5	
638		WB	895	20	376	1,291	617	10	240	867	-278	-10	-136	-424	-33%	8.0	8.6	147	46			D	300.4	298.8	298.4	179.3	199.0	198.5
638		NB	36	633	0	669	27	586	0	613	-9	-47	0	-56	-8%	82.6	58.3	0	59			E	316.6	316.6	0.0	90.3	90.3	0.0
638		SB	0	696	6	702	0	676	9	685	0	-20	3	-17	-2%	0.0	18.3	31.1	18			B	0.0	302.4	302.4	0.0	35.6	35.6
625	1st Ave @ 8th St N	EB	10	0	2	12	8	6	1	15	-2	6	-1	3	25%	23.4	8.5	0.3	16	B	34	C	69.5	69.5	69.5	1.0	1.0	1.0
625		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
625		NB	239	659	121	1,019	200	539	99	838	-39	-120	-22	-181	-18%	55.3	49.5	38.4	50	D			317.1	317.1	317.1	247.7	247.7	247.7
625		SB	200	700	9	909	213	685	8	906	13	-15	-1	-3	0%	19.1	18.5	18.9	19	B			278.3	278.3	278.3	52.4	52.4	52.4
626	1st Ave @ 7th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	18	B	0.0	0.0	0.0	0.0	0.0	0.0	
626		WB	450	894	151	1,495	436	861	168	1465	-14	-33	17	-30	-2%	17.8	16	16.9	17			B	414.1	414.1	414.1	67.2	69.2	68.7
626		NB	95	574	0	669	78	468	0	546	-17	-106	0	-123	-18%	35.0	28.3	0	29			C	232.8	232.8	0.0	50.0	50.0	0.0
626		SB	0	459	64	523	0	471	52	523	0	12	-12	0	0%	0.0	9.9	11.7	10			B	0.0	128.6	128.6	0.0	17.2	17.2
627	1st Ave @ 6th St N	EB	59	307	39	405	64	333	37	434	5	26	-2	29	7%	33.0	32.8	26	32	C	11	B	104.5	104.5	101.6	22.6	24.2	22.3
627		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
627		NB	0	619	106	725	0	543	94	637	0	-76	-12	-88	-12%	0.0	5.1	5.1	5	A			0.0	118.1	118.1	0.0	10.4	10.4
627		SB	102	484	0	586	105	489	0	594	3	5	0	8	1%	6.4	2.6	0	3	A			82.3	82.3	0.0	5.8	5.8	0.0
628	1st Ave @ 5th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	14	B	0.0	0.0	0.0	0.0	0.0	0.0	
628		WB	63	343	67	473	68	325	73	466	5	-18	6	-7	-1%	20.2	18.8	17.4	19			B	256.0	256.0	256.0	46.5	46.5	46.5
628		NB	81	597	0	678	79	533	0	612	-2	-64	0	-66	-10%	13.0	10.7	0	11			B	154.6	154.6	0.0	21.7	21.7	0.0
628		SB	0	523	135	658	0	528	141	669	0	5	6	11	2%	0.0	12	14	12			B	0.0	260.5	260.5	0.0	24.1	24.1
629	1st Ave @ 4th St N	EB	72	644	105	821	64	637	106	807	-8	-7	1	-14	-2%	34.9	31.1	20	30	C	21	C	156.5	156.5	62.2	33.8	34.5	1.5
629		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
629		NB	0	614	50	664	0	561	43	604	0	-53	-7	-60	-9%	0.0	15.9	9.5	15	B			0.0	131.8	131.8	0.0	29.7	29.7
629		SB	48	553	0	601	48	559	0	607	0	6	0	6	1%	16.5	13.9	0	14	B			150.1	150.1	0.0	26.1	26.1	0.0
630	1st Ave @ 3rd St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	12	B	0.0	0.0	0.0	0.0	0.0	0.0	
630		WB	181	1,700	57	1,938	188	1634	57	1879	7	-66	0	-59	-3%	13.6	11.7	12.7	12			B	363.5	363.5	363.5	52.9	53.2	52.7
630		NB	158	528	0	686	139	487	0	626	-19	-41	0	-60	-9%	6.6	4.7	0	5			A	108.8	108.8	0.0	10.5	10.5	0.0
630		SB	0	420	128	548	0	417	129	546	0	-3	1	-2	0%	0.0	18.5	20.2	19			B	0.0	133.7	133.7	0.0	31.2	31.2
631	1st Ave @ Washington Ave N	EB	73	978	73	1,124	85	917	81	1083	12	-61	8	-41	-4%	19.7	24	13.8	23	C	15	B	62.8	189.3	21.0	4.1	38.4	0.4
631		WB	94	905	89	1,088	87	898	102	1087	-7	-7	13	-1	0%	15.4	11.3	6.3	11	B			66.8	314.8	62.6	3.7	29.2	0.8
631		NB	47	475	63	585	50	449	47	546	3	-26	-16	-39	-7%	6.5	6.9	6.7	7	A			146.1	146.1	146.1	12.2	12.2	12.2
631		SB	71	381	68	520	71	378	76	525	0	-3	8	5	1%	20.0	14.7	11.9	15	B			147.1	147.1	147.1	25.5	25.5	25.5
1015	1st Ave @ 2nd St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	5	A	0.0	0.0	0.0	0.0	0.0	0.0	
1015		WB	331	0	0	331	324	0	0	324	-7	0	0	-7	-2%	0.6	0	0	1			A	0.0	0.0	0.0	0.0	0.0	0.0
1015		NB	0	0	637	637	0	0	635	635	0	0	-2	-2	0%	0.0	0	2.1	2			A	0.0	0.0	0.0	0.0	0.0	0.0
1015		SB	0	189	0	189	0	200	0	200	0	11	0	11	6%	0.0	18.8	0	19			C	0.0	152.0	0.0	0.0	24.3	0.0

Table D-3. Scenario 3 (Hennepin Avenue 3-Lane + Hybrid Bus/Bike/Right Turn, 1st Avenue/Hawthorne Avenue 3-Lane)

VISSIM MOE Table

ID	Intersection	Approach	Demand Volumes				Modeled Volumes				Model-Demand by approach					Delay			LOS By Approach		LOS By Intersection		Max Queue			Ave Queue		
			L	T	R	Total	L	T	R	Total	L	T	R	Total	%	L	T	R	Delay(S/ Veh)	LOS	Delay(S/ Veh)	LOS	L	T	R	L	T	R
645	Hennepin Ave @ 13th St N	EB	11	7	17	35	7	10	12	29	-4	3	-5	-6	-17%	63.4	12.6	15.3	26	C	75	E	151.8	151.8	151.8	25.9	25.9	25.9
645		WB	56	8	20	84	38	5	12	55	-18	-3	-8	-29	-35%	2.7	0.5	3.2	3	A			1073.4	1073.4	1073.4	301.3	301.3	301.3
645		NB	19	853	9	881	10	472	8	490	-9	-381	-1	-391	-44%	10.8	127.1	277	127	F			1118.7	1118.7	1118.7	438.2	438.3	438.0
645		SB	4	485	12	501	1	280	7	288	-3	-205	-5	-213	-43%	0.2	5.7	5.6	6	A			121.4	121.4	121.4	6.5	6.5	6.5
646	Hennepin Ave @ 12th St N	EB	89	439	262	790	50	372	214	636	-39	-67	-48	-154	-19%	127.3	21.4	5.2	24	C	40	D	259.6	259.6	71.4	82.0	82.2	2.7
646		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
646		NB	0	620	264	884	0	292	151	443	0	-328	-113	-441	-50%	0.0	97.5	24.8	73	E			0.0	391.7	391.7	0.0	196.9	195.2
646		SB	253	239	0	492	103	73	0	176	-150	-166	0	-316	-64%	19.5	14.2	0	17	B			463.0	164.1	0.0	219.0	36.4	0.0
647	Hennepin Ave @ 11th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	129	F	0.0	0.0	0.0	0.0	0.0	0.0	
647		WB	300	1,176	101	1,577	148	724	55	927	-152	-452	-46	-650	-41%	50.6	160.4	410.9	158			F	1655.8	1655.8	1655.8	1480.2	1480.2	1111.8
647		NB	262	447	0	709	116	172	0	288	-146	-275	0	-421	-59%	20.6	94.3	0	65			E	469.0	466.3	0.0	38.0	271.9	0.0
647		SB	0	192	89	281	0	49	27	76	0	-143	-62	-205	-73%	0.0	15.8	26.9	20			C	0.0	140.0	140.0	0.0	13.8	13.8
648	Hennepin Ave @ 10th St N	EB	130	770	68	968	39	420	40	499	-91	-350	-28	-469	-48%	384.3	9.5	6.1	39	D	45	D	314.9	313.0	313.0	114.1	117.0	117.0
648		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
648		NB	0	478	70	548	0	154	25	179	0	-324	-45	-369	-67%	0.0	86.9	26.6	78	E			0.0	338.6	338.6	0.0	191.9	191.9
648		SB	125	213	0	338	24	43	0	67	-101	-170	0	-271	-80%	4.5	5.3	0	5	A			44.6	161.3	0.0	0.3	94.7	0.0
649	Hennepin Ave @ 9th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	273	F	0.0	0.0	0.0	0.0	0.0	0.0	
649		WB	23	1,159	376	1,558	9	350	53	412	-14	-809	-323	-1146	-74%	171.6	265	595.6	305			F	1678.1	1678.1	1677.5	1648.8	1651.1	1099.9
649		NB	36	572	0	608	9	172	0	181	-27	-400	0	-427	-70%	31.7	246.9	0	236			F	42.6	394.7	0.0	0.6	282.2	0.0
649		SB	0	315	96	411	0	70	50	120	0	-245	-46	-291	-71%	0.0	79.9	407.5	216			F	0.0	356.1	356.1	0.0	318.9	318.9
650	Hennepin Ave @ 8th St N	EB	65	254	2	321	12	108	76	196	-53	-146	74	-125	-39%	28.2	27.2	138.4	70	E	61	E	400.6	399.0	399.0	204.0	207.2	207.2
650		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
650		NB	0	797	151	948	0	134	43	177	0	-663	-108	-771	-81%	0.0	7	43.7	16	B			0.0	366.2	366.2	0.0	230.7	230.7
650		SB	200	409	0	609	42	74	0	116	-158	-335	0	-493	-81%	34.8	158.7	0	114	F			484.4	511.7	0.0	270.7	426.3	0.0
651	Hennepin Ave @ 7th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	57	E	0.0	0.0	0.0	0.0	0.0	0.0	
651		WB	150	1,311	151	1,612	82	1007	120	1209	-68	-304	-31	-403	-25%	34.4	64.5	56.1	62			E	1676.9	1676.9	1675.4	601.9	602.2	407.2
651		NB	120	742	0	862	11	128	0	139	-109	-614	0	-723	-84%	33.4	24.9	0	26			C	463.6	458.8	0.0	338.1	248.3	0.0
651		SB	0	459	64	523	0	47	4	51	0	-412	-60	-472	-90%	0.0	31.7	22.2	31			C	0.0	404.8	404.8	0.0	327.5	327.5
652	Hennepin Ave @ 6th St N	EB	59	417	39	515	21	213	11	245	-38	-204	-28	-270	-52%	32.0	27	23.5	27	C	17	B	240.3	240.3	240.3	16.4	18.7	17.3
652		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
652		NB	0	705	188	893	0	171	40	211	0	-534	-148	-682	-76%	0.0	3.7	11.8	5	A			0.0	334.3	334.3	0.0	98.7	98.7
652		SB	102	484	0	586	12	54	0	66	-90	-430	0	-520	-89%	13.1	18	0	17	B			65.5	461.6	0.0	0.6	356.5	0.0
653	Hennepin Ave @ 5th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	23	C	0.0	0.0	0.0	0.0	0.0	0.0	
653		WB	63	238	67	368	21	62	22	105	-42	-176	-45	-263	-71%	57.7	53.4	27.3	49			D	1648.5	1648.5	1648.5	1059.5	1059.5	1059.2
653		NB	100	664	0	764	16	160	0	176	-84	-504	0	-588	-77%	6.2	6.7	0	7			A	466.4	112.7	0.0	246.4	16.9	0.0
653		SB	0	523	135	658	0	63	23	86	0	-460	-112	-572	-87%	0.0	26.7	7.8	22			C	0.0	430.8	430.4	0.0	293.7	293.0
654	Hennepin Ave @ 4th St N	EB	72	565	105	742	57	452	46	555	-15	-113	-59	-187	-25%	14.5	16.1	59.6	20	C	15	B	63.0	445.1	445.1	2.3	180.3	166.5
654		WB	10	0	10	20	3	0	12	15	-7	0	2	-5	-25%	2.3	0	0.8	1	A			0.0	0.0	0.0	0.0	0.0	0.0
654		NB	0	641	90	731	0	162	20	182	0	-479	-70	-549	-75%	0.0	2.2	4.8	2	A			0.0	124.7	124.7	0.0	1.3	1.3
654		SB	48	543	0	591	8	64	0	72	-40	-479	0	-519	-88%	5.4	8.6	0	8	A			19.5	481.0	0.0	0.1	264.1	0.0
655	Hennepin Ave @ 3rd St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	249	F	0.0	0.0	0.0	0.0	0.0	0.0	
655		WB	180	1,640	57	1,877	19	303	13	335	-161	-1337	-44	-1542	-82%	447.8	403.1	432.8	407			F	1655.9	1655.9	47.1	1613.7	1613.7	0.3
655		NB	170	553	0	723	51	166	0	217	-119	-387	0	-506	-70%	139.2	37.8	0	62			E	459.1	452.6	0.0	130.0	74.7	0.0
655		SB	0	411	128	539	0	81	28	109	0	-330	-100	-430	-80%	0.0	156.6	69.2	134			F	0.0	442.4	442.4	0.0	200.1	200.1
656	Hennepin Ave @ Washington Ave N	EB	225	814	73	1,112	131	533	55	719	-94	-281	-18	-393	-35%	10.3	6.5	5.4	7	A	61	E	106.5	88.5	88.5	5.7	10.3	10.0
656		WB	94	973	126	1,193	29	358	57	444	-65	-615	-69	-749	-63%	244.8	135.9	86.4	137	F			1654.5	1654.5	1654.5	957.5	957.8	957.7
656		NB	47	500	63	610	12	131	14	157	-35	-369	-49	-453	-74%	14.3	13.2	19.7	14	B			417.3	373.2	116.3	196.5	21.7	2.6
656		SB	71	372	68	511	14	50	20	84	-57	-322	-48	-427	-84%	101.1	245.7	212.6	214	F			44.6	436.1	365.7	1.0	353.2	17.7
657	Hennepin Ave @ 2nd St N	EB	627	0	10	637	105	0	5	110	-522	0	-5	-527	-83%	87.2	0	183.8	92	F	97	F	358.5	0.0	358.5	283.4	0.0	283.2
657		WB																										

Table D-3. Scenario 3 (Hennepin Avenue 3-Lane + Hybrid Bus/Bike/Right Turn, 1st Avenue/Hawthorne Avenue 3-Lane)

VISSIM MOE Table

ID	Intersection	Approach	Demand Volumes				Modeled Volumes				Model-Demand by approach					Delay			LOS By Approach		LOS By Intersection		Max Queue			Ave Queue		
			L	T	R	Total	L	T	R	Total	L	T	R	Total	%	L	T	R	Delay(S/ Veh)	LOS	Delay(S/ Veh)	LOS	L	T	R	L	T	R
635	Hawthorne Ave @ 12th St N	EB	130	315	83	528	129	313	76	518	-1	-2	-7	-10	-2%	29.0	27.1	21.6	27	C	12	B	228.0	228.0	228.0	48.8	48.8	48.8
635		WB	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A			0.0	0.0	0.0	0.0	0.0	0.0
635		NB	0	240	217	457	0	222	222	444	0	-18	5	-13	-3%	0.0	7.4	4.3	6	A			0.0	155.0	155.0	0.0	9.3	9.3
635		SB	258	1,826	0	2,084	120	846	0	966	-138	-980	0	-1118	-54%	6.2	5.6	0	6	A			46.9	334.9	0.0	2.2	14.0	0.0
724	Hawthorne Ave @ 11th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	30	C	0.0	0.0	0.0	0.0	0.0	0.0	
724		WB	676	550	301	1,527	383	305	159	847	-293	-245	-142	-680	-45%	27.5	59.2	73.2	47			D	397.5	395.4	395.4	253.4	251.2	251.2
724		NB	62	308	0	370	72	248	0	320	10	-60	0	-50	-14%	23.0	25.7	0	25			C	64.1	399.7	0.0	4.2	51.7	0.0
724		SB	0	1,408	86	1,494	0	575	29	604	0	-833	-57	-890	-60%	0.0	8.5	6.7	8			A	0.0	218.0	218.0	0.0	16.8	16.8
637	Hawthorne Ave @ 10th St N	EB	130	723	68	921	59	410	34	503	-71	-313	-34	-418	-45%	548.0	450.4	465.2	463	F	192	F	1264.9	1264.9	1264.9	1087.8	1087.8	1087.8
637		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
637		NB	0	539	70	609	0	333	52	385	0	-206	-18	-224	-37%	0.0	127.1	48.6	116	F			0.0	304.4	304.4	0.0	167.0	167.0
637	SB	175	1,426	0	1,601	66	563	0	629	-109	-863	0	-972	-61%	53.1	18	0	22	C	351.6	351.6	0.0	67.2	67.2	0.0			
638	Hawthorne Ave @ 9th St N	EB	10	0	10	20	7	0	12	19	-3	0	2	-1	-5%	49.7	0	8.2	23	C	97	F	22.2	22.2	22.2	0.5	0.5	0.5
638		WB	895	20	376	1,291	262	3	117	382	-633	-17	-259	-909	-70%	43.7	106.1	230.5	101	F			305.6	304.0	303.6	232.7	235.3	234.9
638		NB	36	633	0	669	14	371	0	385	-22	-262	0	-284	-42%	146.2	154.8	0	154	F			339.0	339.0	0.0	314.2	314.2	0.0
638		SB	0	696	6	702	0	351	3	354	0	-345	-3	-348	-50%	0.0	34.6	24.4	35	D			0.0	301.1	301.1	0.0	44.4	44.4
625	1st Ave @ 8th St N	EB	10	0	2	12	5	0	0	5	-5	0	-2	-7	-58%	31.6	0	0	32	C	31	C	87.7	87.7	87.7	11.6	11.6	11.6
625		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
625		NB	239	659	121	1,019	26	287	117	430	-213	-372	-4	-589	-58%	63.8	54.3	14.7	44	D			316.4	314.3	314.3	103.2	271.1	271.1
625		SB	200	700	9	909	98	355	0	453	-102	-345	-9	-456	-50%	15.2	19.9	0	19	B			483.2	491.4	491.4	95.0	111.8	111.8
626	1st Ave @ 7th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	38	D	0.0	0.0	0.0	0.0	0.0	0.0	
626		WB	450	894	151	1,495	269	622	117	1008	-181	-272	-34	-487	-33%	13.9	10.4	13.1	12			B	332.6	332.6	332.6	40.0	41.4	34.1
626		NB	95	574	0	669	26	230	0	256	-69	-344	0	-413	-62%	61.3	109.4	0	105			F	66.1	510.6	0.0	2.3	290.0	0.0
626		SB	0	459	64	523	0	217	8	225	0	-242	-56	-298	-57%	0.0	76.9	17.3	75			E	0.0	417.8	417.8	0.0	147.4	147.4
627	1st Ave @ 6th St N	EB	59	307	39	405	35	181	23	239	-24	-126	-16	-166	-41%	182.3	186.6	230.2	190	F	108	F	931.8	931.8	931.8	327.2	327.3	327.2
627		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
627		NB	0	619	106	725	0	291	23	314	0	-328	-83	-411	-57%	0.0	71.5	16.7	67	E			0.0	423.5	423.5	0.0	356.2	356.2
627		SB	102	484	0	586	42	209	0	251	-60	-275	0	-335	-57%	55.1	85.7	0	81	F			61.9	413.8	0.0	17.7	240.0	0.0
628	1st Ave @ 5th St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	58	E	0.0	0.0	0.0	0.0	0.0	0.0	
628		WB	63	343	67	473	17	74	14	105	-46	-269	-53	-368	-78%	35.9	36	24.8	34			C	407.8	407.8	407.8	20.6	20.6	20.6
628		NB	81	597	0	678	28	266	0	294	-53	-331	0	-384	-57%	19.6	35	0	34			C	41.0	437.8	0.0	11.3	232.3	0.0
628		SB	0	523	135	658	0	249	23	272	0	-274	-112	-386	-59%	0.0	99.7	22.5	93			F	0.0	453.9	453.9	0.0	329.3	329.3
629	1st Ave @ 4th St N	EB	72	644	105	821	34	574	85	693	-38	-70	-20	-128	-16%	64.0	42.1	20.9	41	D	74	E	757.0	757.0	760.3	120.2	120.5	72.1
629		WB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	0.0			0.0	0.0	0.0	0.0	0.0	
629		NB	0	614	50	664	0	247	4	251	0	-367	-46	-413	-62%	0.0	60.3	36.8	60	E			0.0	411.5	411.5	0.0	286.3	286.3
629		SB	48	553	0	601	10	229	0	239	-38	-324	0	-362	-60%	171.1	184.2	0	184	F			41.4	469.4	0.0	0.8	456.9	0.0
630	1st Ave @ 3rd St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	120	F	0.0	0.0	0.0	0.0	0.0	0.0	
630		WB	181	1,700	57	1,938	23	335	14	372	-158	-1365	-43	-1566	-81%	643.8	151.9	96.8	180			F	445.5	445.5	445.5	276.5	276.5	276.5
630		NB	158	528	0	686	51	200	0	251	-107	-328	0	-435	-63%	82.7	109.5	0	104			F	143.3	487.9	0.0	19.3	313.4	0.0
630		SB	0	420	128	548	0	236	65	301	0	-184	-63	-247	-45%	0.0	67.4	32.5	60			E	0.0	207.7	207.7	0.0	52.4	52.4
631	1st Ave @ Washington Ave N	EB	73	978	73	1,124	32	679	58	769	-41	-299	-15	-355	-32%	44.1	90.7	90.8	89	F	76	E	1518.1	1514.8	20.3	609.4	617.2	0.4
631		WB	94	905	89	1,088	27	257	33	317	-67	-648	-56	-771	-71%	18.3	15	30.4	17	B			50.4	457.1	43.5	1.0	296.2	0.3
631		NB	47	475	63	585	18	141	17	176	-29	-334	-46	-409	-70%	7.5	231.4	256.1	211	F			385.6	385.6	385.6	227.6	227.6	227.6
631		SB	71	381	68	520	25	233	49	307	-46	-148	-19	-213	-41%	27.7	28.7	21.7	28	C			261.8	261.8	261.8	101.7	101.7	101.7
1015	1st Ave @ 2nd St N	EB	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0	0	0	A	83	F	0.0	0.0	0.0	0.0	0.0	0.0	
1015		WB	331	0	0	331	117	0	0	117	-214	0	0	-214	-65%	0.4	0	0	0			A	0.0	0.0	0.0	0.0	0.0	0.0
1015		NB	0	0	637	637	0	0	174	174	0	0	-463	-463	-73%	0.0	0	218.7	219			F	0.0	470.2	470.2	0.0	325.8	325.8
1015		SB	0	189	0	189	0	202	0	202	0	13	0	13	7%	0.0	13.2	0	13			B	0.0	176.3	0.0	0.0	18.1	0.0