Midtown Corridor Alternatives Analysis

Transportation Operations Review

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Prepared by the
SRF Consulting Group Team

for

Metro Transit

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Introduction

This technical report presents the results of the traffic and bicycle and pedestrian operations review for the Midtown Corridor Alternatives Analysis (AA). The purpose of the report is to provide a planning-level review that identifies the potential impacts of the four project alternatives on automobile drivers, bicyclists and pedestrians in the Midtown Corridor. The AA includes a no-build alternative and three proposed build alternatives:

- No-build alternative
  - The no-build alternative is included in every AA to establish a base condition for evaluating the benefits and costs of proposed build alternatives, as well as to identify the consequences of not making improvements. The 2030 no-build alternative includes modifications to the current services as well as planned enhancements to the existing transit system as stated in the Metropolitan Council's 2030 Transportation Policy Plan (amended in May 2013).
- Enhanced bus on Lake Street (Figure 1)
  - The enhanced bus on Lake Street alternative is along Lake Street/ Lagoon Avenue from the proposed Green Line (Southwest) light rail transit (LRT) West Lake Station to Minnehaha Avenue.
- Double/single-track rail in the Greenway (Figure 2)
  - The double/single-track rail alternative would operate in the Midtown Greenway from the proposed Green Line LRT West Lake Station to the Blue Line (Hiawatha) LRT Lake Street-Midtown Station.
- Dual alternative (Figure 3)
  - The dual alternative is a combination of the enhanced bus on Lake Street alternative and the double/single-track rail alternative, and would use the same routes as described above. Enhanced bus trips would not end at Minnehaha Avenue, however, but instead continue on East Lake Street to Marshall Avenue in Saint Paul, then travel north on Snelling Avenue and end at University Avenue. Because the extension falls outside the project study area, this segment was not analyzed as part of the transportation operations review.

For a full description of each alternative, please see the project's the *Detailed Definition of Alternatives* report (under separate cover).

Figure 1: Enhanced Bus on Lake Street Alternative

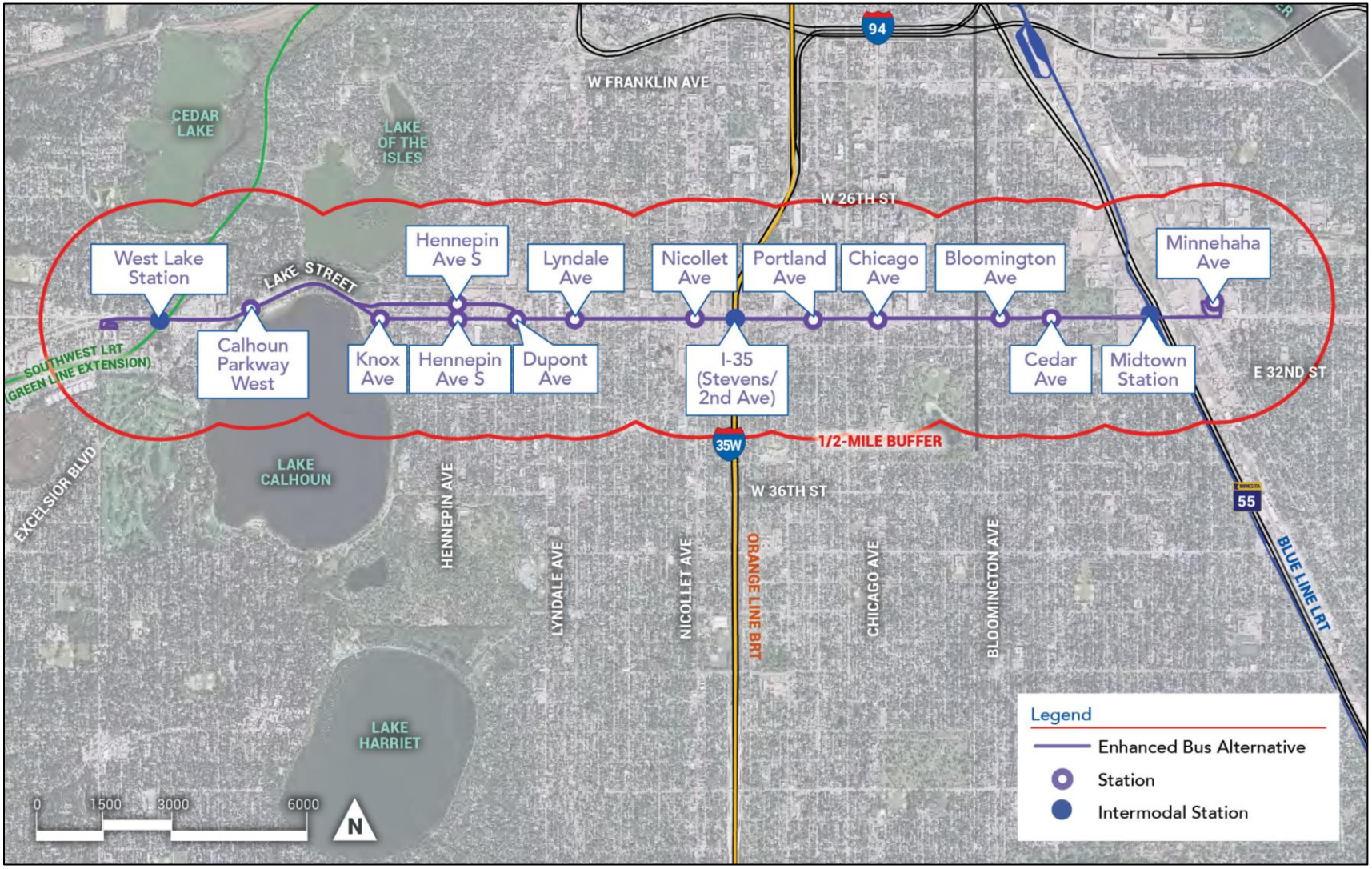


Figure 2: Double/Single Track Rail in the Greenway

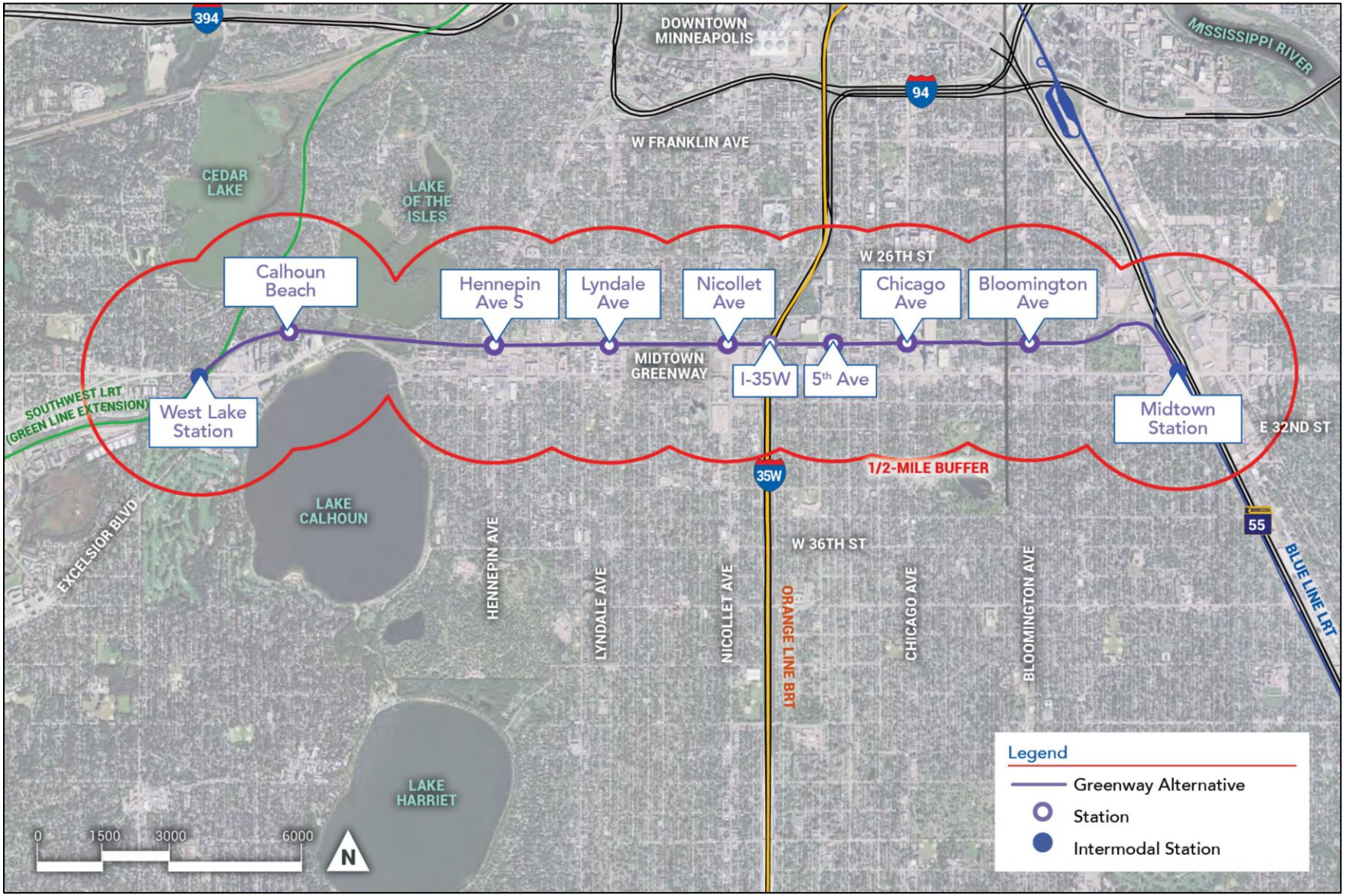
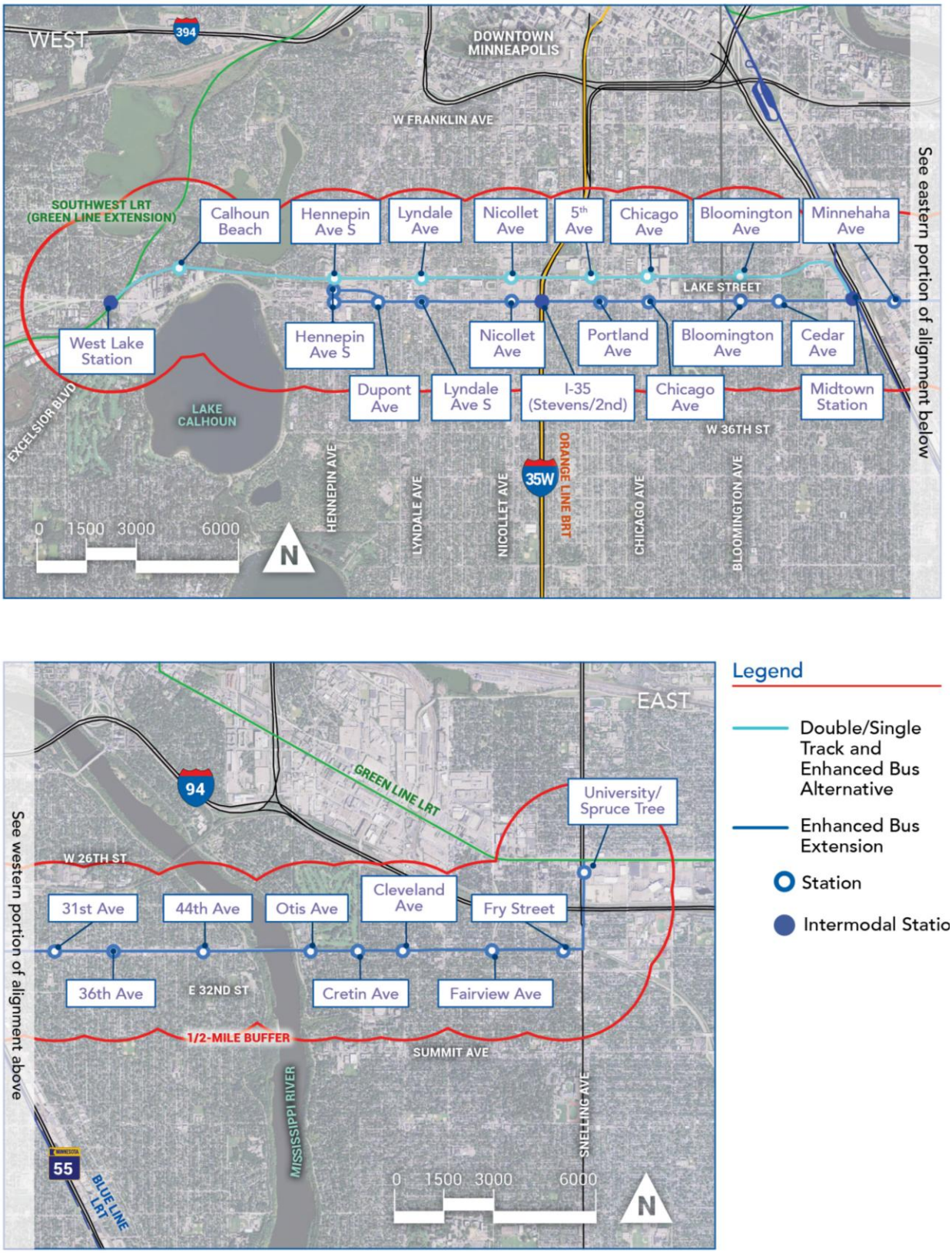


Figure 3: Dual Alternative



Traffic Operations Review

This section of the report describes the potential impacts of all four project alternatives on traffic operations. First, the existing traffic conditions on Lake Street, and on streets that intersect with the Midtown Greenway, are reviewed and then the potential impacts of the alternatives are discussed.

Existing Traffic Conditions on Lake Street and the Midtown Greenway

Existing Transit System Operations on Lake Street

Metro Transit, a division of the Metropolitan Council, currently operates five local and two limited-stop bus routes along at least some part of Lake Street. Routes 21 and 53 are the primary Lake Street service, while the other bus routes run through smaller portions of the corridor. Route 21 is a high frequency bus route that operates at least every 15 minutes from 6 a.m. to 7 p.m. on weekdays and serves all posted bus stops. Route 53 is a limited-stop route which only serves designated bus stops and operates during rush hours. Routes 21 and 53, as well as other local bus routes, use curbside bus stops (both within and outside the travel lane) throughout the corridor. There are approximately 30 local bus stops, typically spaced every few city blocks, in each direction along the corridor. In general, buses arrive every 7.5 to 10 minutes during the morning and afternoon peak hours, meaning there are 8 bus trips per hour along the Lake Street Corridor.

Existing Segment Traffic Operations on Lake Street

Existing annual average daily traffic (AADT) volumes on Lake Street/Lagoon Avenue were obtained from the most recent counts from the Minnesota Department of Transportation (MnDOT), Hennepin County and the City of Minneapolis. This data is a combination of traffic counts take in the area during 2011 and 2012. Existing AADT volumes were compared against the typical planning-level roadway capacities shown in Table 1 to determine if Lake Street roadway segments are currently under capacity, approaching capacity or over capacity.

Table 1: Roadway Capacity by Facility Type

Facility Type	Maximum Two-Way AADT	Approaching Capacity (85% of Max. Daily Capacity)(1)
One-Lane One-Way Urban	7,000–9,000	7,650
Two-Lane Undivided Urban	8,000–10,000	8,500
Three-Lane One-Way Urban	23,000–27,000	22,950
Four-Lane Undivided Urban	18,000–22,000	18,700
Four-Lane Divided Urban (Five-Lane)	28,000–32,000	27,200
Six-Lane Undivided Urban	40,000–45,000	38,250

(1) Approaching capacity value represents 85 percent of the maximum two-way AADT upper limit.

The comparison of existing AADT volumes to the planning-level roadway capacities indicates that one segment currently exceeds its planning-level capacity. The existing AADT volume along Lake Street from Dupont Avenue to Lyndale Avenue slightly exceeds what would typically be considered the capacity for

such a four-lane undivided urban segment. A number of other segments are currently approaching planning-level roadway capacities. See Appendix A for details of the segment operations analysis.

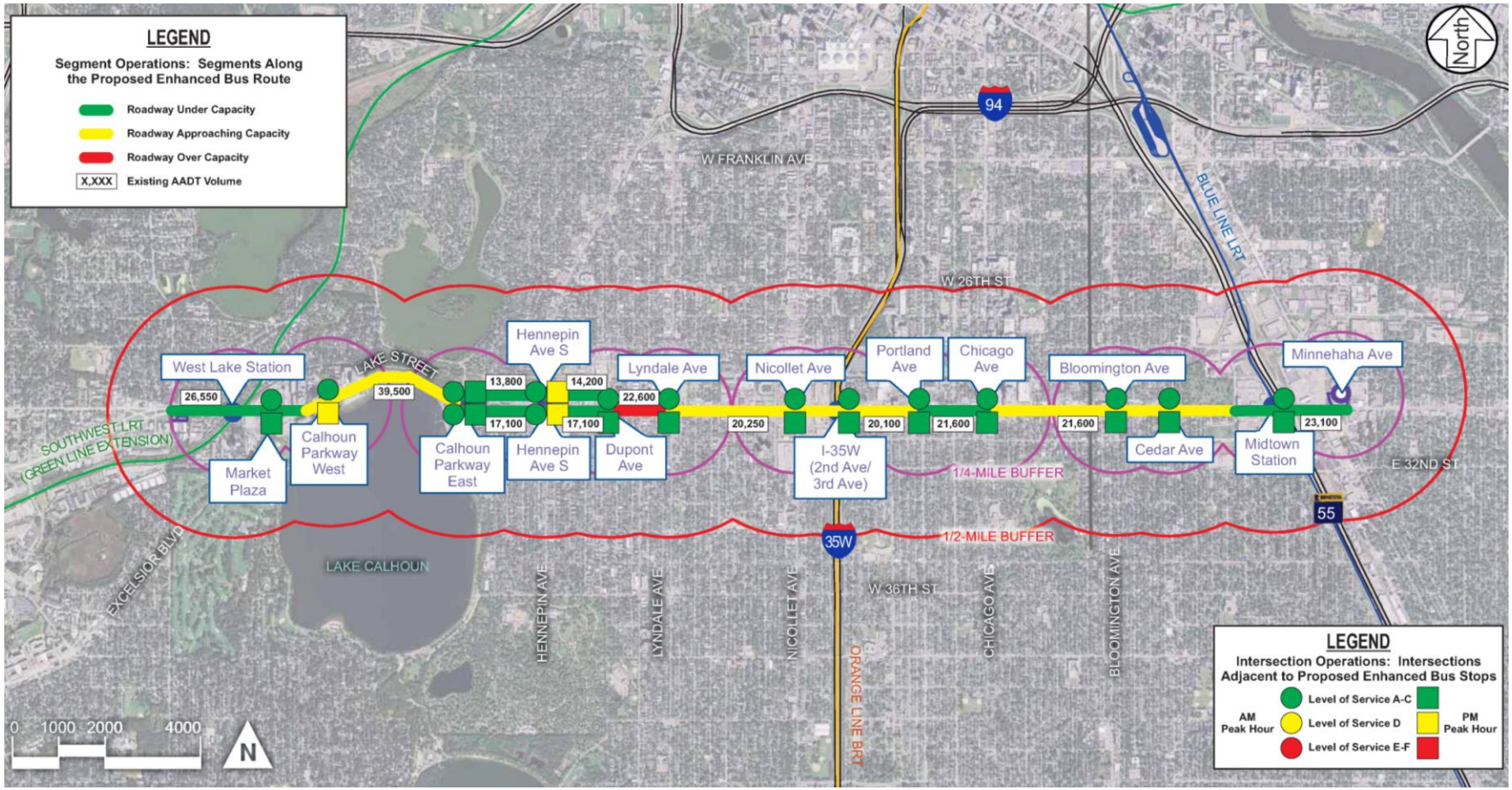
Existing Lake Street Intersection Traffic Operations

Existing intersection operations at locations adjacent to proposed enhanced bus stations were also reviewed from a capacity perspective. This review was based on existing intersection turning movement counts provided by Kimley-Horn and Associates, and analysis using intersection level of service (LOS) classifications specified in the Highway Capacity Manual (HCM). The HCM classifies intersections as LOS A through LOS F, as show in Table 2. While detailed traffic signal timing plans along the proposed enhanced bus route were not immediately available, the traffic signals were optimized to produce a realistic representation of existing conditions.

Table 2: Highway Capacity Manual Level of Service Criteria for Signalized Intersections

Level of Service	General Description
A	Free flow of traffic
B	Stable flow of traffic (slight delays)
C	Stable flow (acceptable delays)
D	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	Unstable flow (intolerable delay)
F	Forced flow (jammed)

Figure 4: Existing Segment Intersection Operations



Existing Automobile Travel Times on Lake Street

Existing Lake Street travel times (from the intersection of Lake Street and France Avenue to the intersection of Lake Street and Hiawatha Avenue), shown in Table 3, were identified using two methodologies. The first method was to complete actual vehicle runs through the study corridor during the morning and afternoon peak hours. These actual vehicle runs were then compared to estimated travel times made by using results from a corridor Synchro model and assumed arterial speeds. This comparison indicates that the modeled travel times are relatively consistent with the actual travel times.

Table 3: Existing Lake Street Travel Times - from France Avenue to Hiawatha Avenue

Travel Direction and Peak Hour	Actual Travel Times (minutes)	Modeled Travel Times (minutes)
Eastbound A.M. Peak Hour	15–17	15.0
Westbound A.M. Peak Hour	15–17	15.75
Eastbound P.M. Peak Hour	22–25	22.25
Westbound P.M. Peak Hour	24–27	22.25

Existing Traffic Conditions near the Midtown Greenway

Automobile traffic is not currently permitted in the Midtown Greenway and this is expected to remain true under future conditions. There are six existing at-grade crossings where roadways intersect the Midtown Greenway along the proposed rail route:

- James Avenue
- Irving Avenue
- Humboldt Avenue
- 5th Avenue
- 20th Avenue
- 21st Avenue

These existing at-grade crossings currently experience few issues with regard to traffic operations. Vehicular traffic is currently required to stop at each crossing and volumes are fairly minimal. Five of six crossing roadways have an existing volume of less than 3,000 vehicles per day, while 5th Avenue has an existing volume of approximately 4,300 vehicles per day. Sidewalks are present on at least one side of each crossing roadway, except 20th Avenue which serves as an industrial site access.

No-Build Alternative (Year 2030)

This section reviews the no-build alternative traffic conditions (year 2030) on Lake Street and at locations along the Midtown Greenway.

No-Build Transit System Operations on Lake Street

To meet the expected growth in demand, the no-build transit operating plan increases the frequency of both Routes 21 and 53. The result is 12 peak hour, peak direction bus trips compared to 8 today.

No-Build Lake Street Segment Traffic Operations

Year 2030 forecasted AADT volumes were obtained from the 2030 Hennepin County Transportation Systems Plan. In most locations along Lake Street/Lagoon Avenue, existing traffic volumes exceed year 2030 forecasted traffic volumes. Therefore, in order to provide a conservative year 2030 traffic forecast, a one-half percent annual growth rate was applied to existing traffic volumes. Forecasted year 2030 volumes were compared against the typical planning-level roadway capacities previously shown in Table 1 to determine if roadway segments are expected to be under capacity, approaching capacity or over capacity.

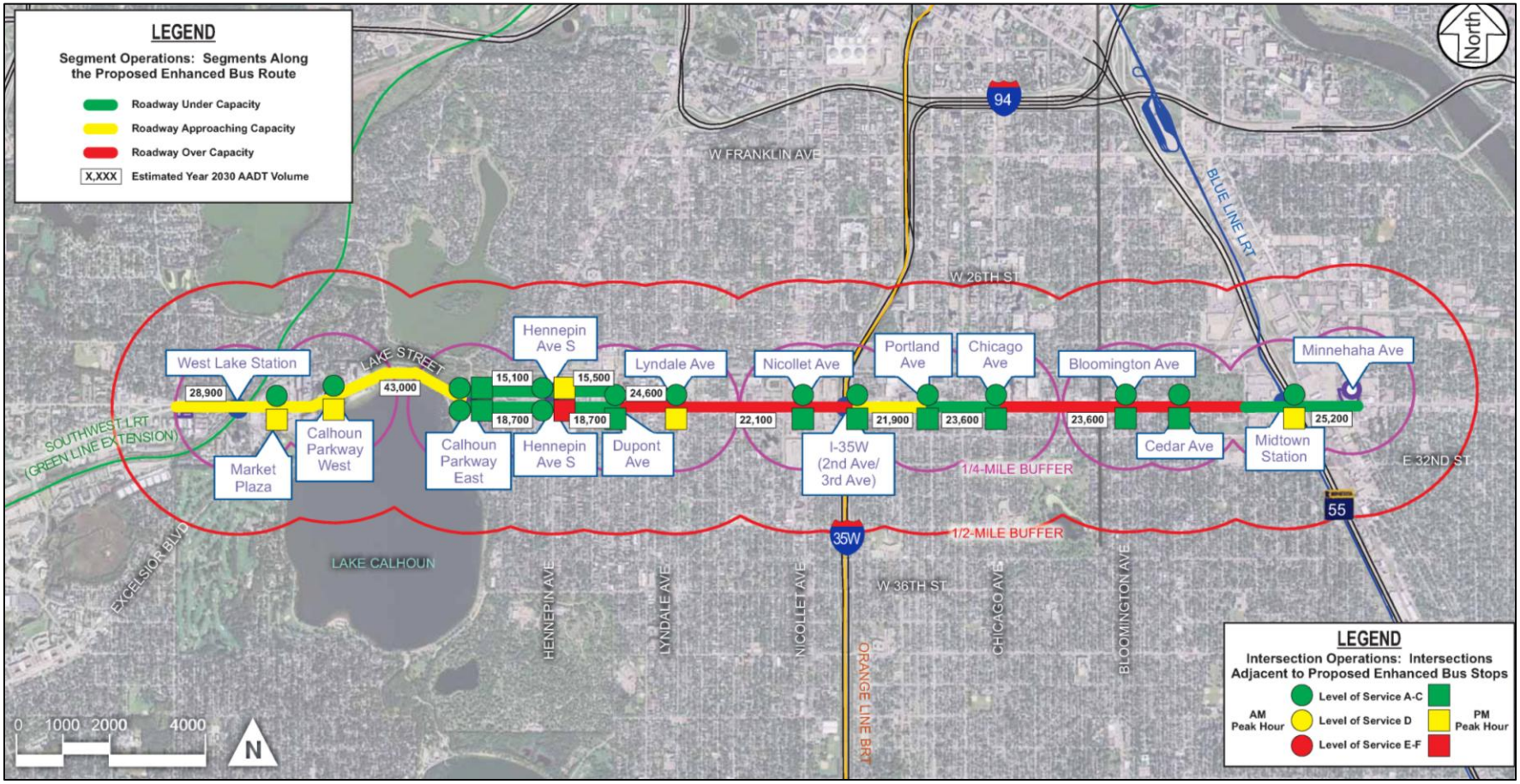
Using this method, the comparison of forecasted year 2030 AADT volumes to the typical planning-level roadway capacities (previously shown in Table 1) indicates that five segments are expected to exceed their planning-level capacity for four-lane undivided urban segments. These five segments are located along Lake Street between Dupont Avenue/2nd Avenue and Elliot Avenue/21st. It should be noted that a number of other segments are expected to approach planning-level roadway capacities by year 2030. See Appendix A for details of the segment operations analysis.

No-Build Lake Street Intersection Traffic Operations

Year 2030 intersection operations at locations adjacent to proposed enhanced bus stations were also reviewed. Existing intersection turning movement counts were increased by an annual growth rate of one-half percent to develop year 2030 intersection turning movement volumes. These volumes were analyzed using the HCM methodology. Traffic signals were assumed to be optimized.

The analysis results indicate that five intersections adjacent to proposed enhanced bus stations are expected to operate below a LOS C during the p.m. peak hour under year 2030 conditions. Only the Lake Street/Hennepin Avenue intersection is expected to operate at an LOS E during the p.m. peak hour. During the a.m. peak hour, all analyzed intersections are expected to operate at an acceptable overall LOS C or better under year 2030 conditions. See Appendix B for details of the intersection operations analysis. An illustration of year 2030 segment/intersection operations is shown in Figure 5.

Figure 5: Year 2030 Segment/Intersection Operations



No-Build Automobile Lake Street Travel Times

Year 2030 corridor travel times, shown in Table 4, were estimated by using results from a corridor Synchro model and assumed arterial speeds. Under 2030 conditions, travel time increases along Lake Street/ Lagoon Avenue are expected and range between one and two minutes in the a.m. peak hour and three to four minutes in the p.m. peak hour. The expected increase in corridor travel times is a result of the modeled increase in intersection/segment traffic volumes.

Table 4: No-Build (Year 2030) Corridor Travel Times

Travel Direction and Peak Hour	Modeled Travel Times (minutes)	Modeled Travel Time Increase from Existing Conditions (minutes)
Eastbound A.M. Peak Hour	16.5	+1.5
Westbound A.M. Peak Hour	17.25	+1.5
Eastbound P.M. Peak Hour	26.0	+3.75
Westbound P.M. Peak Hour	25.5	+3.25

No-Build Traffic Conditions on the Midtown Greenway

Significant traffic/pedestrian/bicyclist volume increases are not expected at the at-grade crossings along the proposed rail route from existing to year 2030 conditions. Therefore, year 2030 conditions at the at-grade crossings are expected to be similar to existing conditions.

Enhanced Bus on Lake Street Alternative

The proposed enhanced bus on Lake Street alternative would use limited-stop service and technological improvements to provide a more efficient trip when compared to existing local bus routes. A total of 14 bidirectional stations would serve the proposed enhanced bus alternative along Lake Street/Lagoon Avenue from the proposed Green Line LRT West Lake Station to the Blue Line LRT Lake Street-Midtown Station. Enhanced buses are expected to run in mixed traffic in the right travel lane.

Enhanced buses would use off-board fare collection and up to three doors to load passengers, thus reducing dwell time as compared to local buses. Additionally, traffic signal priority (TSP) is expected to be implemented along the proposed enhanced bus route, allowing a brief green time extension for both buses.

Upon implementation of this alternative, the Route 53 is replaced by the enhanced bus service while Route 21 is reduced to trips every 15 minutes. Enhanced buses would arrive approximately every 7.5 minutes during the a.m. and p.m. peak hours, meaning there would be 12 bus trips per hour along Lake Street. Therefore, the enhanced bus alternative results in same number of peak period, peak direction trips per hour as the no-build alternative.. Based on ridership forecasts for this alternative (see the

Ridership Forecast report, under separate cover) this increased level of transit service would increase the person throughput[1] on Lake Street by approximately 15 percent over the no-build alternative.

The majority of enhanced bus stations along the Midtown Corridor would use existing or new curb extension bumpouts to allow buses to make passenger stops while staying in the right travel lane. The bumpouts are expected to be the main impact to vehicular traffic and would create short-term, localized delay/queues in the immediate vicinity of buses. Although some vehicles are expected to switch lanes and pass stopped buses, it is likely that a few vehicles will not be able to switch lanes due to heavier traffic conditions.

With new bumpout construction, approximately 26 total on-street parking stalls are expected to be eliminated. In most locations, a nearby local bus stop would be incorporated into the enhanced bus station. Approximately eight total local bus stops that are currently configured as stops where the transit vehicle pulls out of the travel lane and into the parking lane are expected to be eliminated and incorporated into enhanced bus stations. These local stops are located at the following cross streets:

Curbside Stops that will be converted from 'outside the travel lane' stops to bumpout configurations:

Eastbound Locations:

- Hennepin Avenue
- Dupont Avenue
- Lyndale Avenue
- Bloomington Avenue
- Cedar Avenue

Westbound Locations:

- Bloomington Avenue
- 3rd Avenue
- Lyndale Avenue

Replacing these existing stops with bumpout enhanced bus stations is expected to introduce new traffic delay to the corridor, because the transit vehicle will no longer be leaving the travel lane. However, since this delay is expected to be localized, the net effect on the overall corridor travel time is negligible.

Expected Mode Shift for the Enhanced Bus Alternative

Preliminary year 2030 ridership projections show approximately 300 people are expected to change mode of travel from automobile/non-motorized transportation to the enhanced bus alternative. In theory, 300 new transit riders could equate to approximately 200 to 300 fewer daily vehicles on Lake Street/Lagoon Avenue along the Midtown Corridor. In reality, the vehicle reduction at any given point along Lake Street/Lagoon Avenue would be far less considering that most of the new transit riders would not travel the entire corridor by automobile under the no-build alternative. Rather, most of the

[1] Person throughput is the sum of person trips made by automobile or transit along a transportation facility. Average vehicle occupancy of 1.3 persons was assumed in this calculation.

new transit riders would be likely to travel portions of the corridor, cross the corridor or even avoid the corridor with an automobile under the no-build alternative. Considering this, the enhanced bus alternative is expected to have a relatively minor effect on traffic volumes.

Therefore, the result of the enhanced bus on Lake Street alternative is a negligible net effect on automobile traffic delay, queues and travel times.

Double/Single-Track Rail in the Greenway Alternative

The proposed double/single-track rail alternative would use limited-stop service along the Midtown Greenway. Significant improvements would be required along the corridor to serve the proposed rail alternative (i.e. new tracks, retaining walls, path alignments, etc.). However, since the majority of the Midtown Greenway passes below street level, the rail alternative would likely have minimal impact to the existing roadway network. A total of 10 stations would serve the double/single-track rail route from the proposed Green Line LRT West Lake Station to the Blue Line LRT Lake Street-Midtown Station.

Minor delays are expected for vehicular traffic when encountering a crossing rail vehicle at the six at-grade crossings along the double/single-track rail route. Considering that rail vehicles would not be expected to stop at roadway crossings and that vehicular traffic is currently required to stop for pedestrian/bicycle traffic along the Midtown Greenway, minimal additional delay (i.e. less than 10 seconds) is expected. Furthermore, only a few vehicles are expected to be impacted at each crossing. Pedestrians and bicyclists attempting to cross the tracks in these locations may also experience delays, but as with the delay experienced by automobiles, the delay would be minimal.

Under this alternative, the Route 21 would see a reduction in service from the no-build alternative (from eight trips to four trips in the a.m. and p.m. peak hours). However, rail vehicles would arrive along the Midtown Greenway approximately every 10 minutes throughout the day. The Route 53 operating plan would remain the same as the no-build alternative. Therefore, the rail alternative results in four fewer peak period, peak direction bus trips per day along Lake Street/Lagoon Avenue when compared to the no-build alternative.

According to the ridership forecasts, this alternative reduces the number of person trips made on Lake Street by approximately 5 percent; however this drop is due to transit riders choosing to ride the rail in the Greenway versus using the remaining bus service on Lake Street.

Expected Mode Shift for the Double/Single-Track Rail in the Greenway Alternative

Preliminary year 2030 ridership projections show approximately 2,200 people are expected to change modes of travel from automobile/non-motorized transportation to the rail alternative. Given this, a reduction of approximately 50 to 100 peak hour (500 to 1,000 daily) vehicles could be expected at any location along Lake Street/Lagoon Avenue. This equates to an average reduction of approximately two vehicles per 90 second traffic signal cycle and no more than a five percent reduction in peak hour traffic volumes along Lake Street/Lagoon Avenue.

Therefore, although the rail alternative is anticipated to slightly reduce automobile traffic volumes on Lake Street, a nearly negligible net effect on automobile traffic delay, queues and travel times is expected under this alternative.

Dual Alternative

The proposed dual alternative would entail a combination of the enhanced bus on Lake Street alternative and the double/single-track rail alternative, with the addition of enhanced bus service into Saint Paul along Lake Street/Marshall Avenue/Snelling Avenue as far as University Avenue.

The dual alternative assumes Route 53 would be replaced by enhanced bus service. The enhanced bus would arrive approximately every 10 minutes throughout the day under this alternative. Route 21 would see a reduction in service under the dual alternative when compared to the no-build to every 15 minutes during the a.m. and p.m. peak hour; reducing the trips per hour from 8 to 4 trips. Therefore, the dual alternative results in two fewer peak period, peak direction bus trips per hour when compared to the no build alternative. According to ridership forecasts, this alternative is expected to increase person throughput on Lake Street by 10 percent when compared to the no-build alternative.

Expected Mode Shift for the Dual Alternative

Preliminary year 2030 ridership projections show approximately 3,300 people are expected to change modes of travel from automobile/non-motorized transportation to transit under the dual alternative. However, this number includes riders expected to use enhanced buses into Saint Paul. The number of people expected to make a mode shift would not be expected to exceed the sum of new riders from the individual enhanced bus and rail alternatives (i.e. 2,500 riders per day). A reduction of approximately 60 to 120 peak hour (600 to 1,200 daily) vehicles could be expected at any location along Lake Street/Lagoon Avenue under the dual alternative. This equates to an average reduction of approximately three vehicles per 90 second traffic signal cycle and no more than a six percent reduction in peak hour traffic volumes along Lake Street/Lagoon Avenue.

Therefore, although the dual alternative is anticipated to slightly reduce automobile traffic volumes on Lake Street, a nearly negligible net effect on automobile traffic delay, queues and travel times is expected under this alternative.

Automobile Traffic Review Conclusions

Congestion and automobile traffic is expected to increase on Lake Street, adding three to four minutes to existing automobile travel times in the corridor, under the no-build alternative. This increased automobile delay is also expected under all three build alternatives. Although some localized automobile traffic delay is expected at stations locations under the enhanced bus on Lake Street and dual alternatives, the overall net effect on automobile traffic delay, queues and travel times is expected to be negligible under all three build alternatives. This means that the two alternatives that add additional bus trips to Lake Street (enhanced bus and dual alternatives) have an almost insignificant impact on travel times while increasing the person throughput of Lake Street by 10 to 15 percent.

Lastly, a very small increase in delay (i.e. less than ten seconds) in traffic is expected at each of the six at-grade crossing under the rail in the Greenway and dual alternatives. Traffic counts at these locations are expected to remain low in the future, therefore the potential impacts to automobile operations under these two alternatives at each at-grade crossing is expected to be minimal.

Bicycle and Pedestrian Operations Review

This section of the report describes the potential impacts of all four project alternatives on bicycle and pedestrian operations. First, existing bicycle and pedestrian operations are reviewed and then the potential impacts of the alternatives are discussed.

Existing Conditions

Existing Bicycle and Pedestrian Conditions on Lake Street

Lake Street is a heavily used pedestrian corridor. The alignment is completely lined with sidewalks on both sides of the street, and pedestrian amenities such as street trees and benches, especially near transit shelters, are common. Lake Street is not a heavily used bicycle corridor and is not designated as a bicycle corridor in the City of Minneapolis' *Bicycle Master Plan*.

Existing Bicycle and Pedestrian Conditions on the Midtown Greenway

The Midtown Greenway is heavily used by bicyclists and pedestrians and is designated as a trail in the city's *Bicycle Master Plan*. A paved multi-use trail runs along the entire alignment. Generally, the trail is 20 feet wide, but in a few places, such as at the Nicollet Avenue Bridge, the trail narrows to 10 feet wide. The majority of the corridor is grade-separated from the street network and the entire alignment is closed to automobile traffic.

Enhanced Bus Alternative

The enhanced bus is expected to have no negative impacts to pedestrians and bicyclists traveling along Lake Street. All sidewalks will be maintained under this alternative, and at locations where bumpout stations are proposed the alternative will increase pedestrian space in the corridor. Also, since all bumpouts will be created out of existing parking spaces and do not affect the width of the travel lane, conditions for bicyclists on Lake Street remain almost exactly the same.

Double/Single-Track Rail in the Greenway Alternative

The proposed double/single-track rail alternative will have minor impacts to pedestrians and bicyclists that utilize the Midtown Greenway trail. The addition of a transit service along the corridor allows pedestrians an efficient way to travel from West Lake to Minnehaha, and will add a new demographic of riders to the corridor. Some of the impacts to existing trail users will include reduced lane widths, access modifications, additional pedestrian/bicyclist traffic, additional grade crossings, temporary construction impacts, and aesthetic differences.

Trail Width Reductions

In order to fit both a transit service, which requires a minimum of 30 feet for a double-track system, and the existing trail within the corridor, the trail width will be reduced in two locations to accommodate

existing infrastructure, such as existing bridges. Aside from the temporary reconstruction impacts, reducing the trail width will potentially minimize lateral movement and rider comfort for bikers along the affected portions. The following sections of trail are anticipated to be reduced:

Location	Existing Trail Width	Reduced Trail Width	Reason for Impact
Humboldt Ave to Fremont Ave	20’	15’	Limited span under Hennepin Ave Bridge limits existing trail width
Emerson Ave to Dupont Ave	14’ (Bike path only)	10’ (Bike path only)	Trail must shift to North portal of bridges to allow streetcar transit in center portal

Trail/Access Modifications

Proposed access modifications and trail relocations are another potential impact for bicyclists and pedestrians. The existing trail profile and ramp configurations are anticipated to change at three locations to accommodate the proposed transit service. These modifications are not anticipated to have significant permanent impacts.

In addition, fencing will be added throughout the corridor between the tracks and trail to prevent pedestrians or bicyclists from crossing the tracks at unprotected locations.

Location	Planned Modification	Permanent Impact
West Lake Station	Shift trail Southeast to accommodate SWLRT and Midtown projects. Add crossing to north side of tracks.	Minimal
12th Ave S to 17th Ave S	Shift trail to North portal of bridges to accommodate guideway in center portal. Modify trail access ramp at 13th Ave to match trail shift.	Elevated Trail profile
Thomas Ave S to James Ave S	Shift trail north (~15 ft.) to accommodate guideway within existing ROW. Modify access ramp between new pedestrian bridges west of Calhoun Pkwy to accommodate trail shift.	Minimal

Increased Pedestrian and Bicyclist Traffic

Proposed station locations will provide direct access to the existing trail, likely increasing pedestrian and bicyclist traffic near station locations and potentially affecting the flow of bicycle and pedestrian movements along the trail. Although proposed vertical circulation is intended to provide access to the transit service, it will likely also serve as another way for recreational trail users to access the Midtown Greenway trail. Vertical circulation facilities will be provided at the following station locations:

- Hennepin Ave Station
- Lyndale Ave Station
- Nicollet Ave Station
- Chicago Ave Station
- Bloomington Ave Station

At-Grade Crossings

At-grade roadway crossings along the corridor introduce direct locations along the Midtown Greenway for pedestrians, cyclists, and drivers to interact with the rail vehicles. Passive and active warning devices would be provided at these locations to indicate when a rail vehicle is approach the at-grade roadway crossing and when it is safe for a pedestrian or bicyclist to cross the rail corridor. The six at-grade roadway crossings within the corridor are located at James Ave S, Irving Ave S, Humboldt Ave S, 5th Ave S, 20th Ave S and 21st Ave S.

Dual Alternatives

As the dual alternative is a combination of the enhanced bus and rail in the Greenway alternatives, all the impacts to pedestrians and bicyclists discussed above for both alternatives apply to the dual alternative.