6.0 TRANSPORTATION IMPACT ANALYSIS

This chapter presents an inventory of the existing transportation conditions in the Central Corridor and the potential transportation impacts of the transit alternatives under consideration. Potential impacts and mitigation measures are documented in this chapter for the following transportation related subjects:

- Roadway Operations
- Bus Transit Operations
- Rail Transit Ridership and Operating Costs
- Regional Travel Demand Summary
- Parking
- Railroad Facilities and Services
- Pedestrians and Bicycle Environment
- Utilities
- Effects due to Construction
- Environmental Justice

The analysis of the potential impacts of the alternatives on the existing transportation system will identify transportation-related issues in the Central Corridor due to the proposed alignment. These potential impacts will be addressed with proposed mitigation measures in this Chapter.

Graphics for Chapter 6.0 are included together at the end of the chapter.

6.1 ROADWAY OPERATIONS

This section reviews the existing roadway conditions and estimates the potential impacts of the proposed alternatives on the roadway system within the Central Corridor Study Area, and includes the following:

- A review of the existing roadway system in the Central Corridor, along with all planned or programmed improvements and developments.
- Assessments of the need for improvements at-grade crossings of the surface streets at selected locations to maintain an acceptable level of service (LOS), including the potential for grade separation.
- A roadway segment and intersection LOS impact analyses for select street segments and intersections that may be impacted by the proposed University Avenue Light Rail Transit (LRT) or Buwsay/Bus Rapid Transit (BRT) Alternatives.
- An assessment of the potential impacts to the supporting transportation network, including an analysis of station area traffic impacts.

A complete *Traffic Operations Report* is included in Appendix 9.8 as a support document to the Draft Environmental Impact Statement (EIS). This report details the traffic operations analysis results and recommendations for the transportation engineering improvements within the Central Corridor Study Area.

The *Traffic Operations Report* was prepared with the support of a Traffic Analysis Committee (TAC), which was organized in order to utilize the vast expertise from the agencies impacted by the proposed project. The agencies represented on the TAC included:

- Ramsey County Regional Railroad Authority (RCRRA)
- Twin Cities Metropolitan Council

- City of St. Paul
- Minnesota Department of Transportation (Mn/DOT)
- Ramsey County Public Works
- City of Minneapolis Public Works
- University of Minnesota
- Hennepin County

The TAC also provided the agencies with the opportunity to participate in developing the traffic analysis methodology, to provide input into the assumptions made that were necessary to complete the traffic analysis and to provide reaction to the analysis results.

6.1.1 Methodology and Assumptions

Grade crossings, roadway segments, and intersections perceived to be impacted by the proposed University Avenue LRT or Busway/BRT Alternatives were chosen for analysis by the TAC. The potential impacts that the proposed alternatives may create when introduced in the Central Corridor are most likely to effect the roadway infrastructure and operations. Various grade crossing locations where high roadway volumes have been counted, or are projected for the future, may be candidates for special treatments to manage safety and mobility conflicts between vehicular traffic and the proposed fixed guideway transit alternatives. In addition, roadway segments were analyzed to measure their respective operating characteristics. Finally, key intersections near the proposed University Avenue LRT or Busway/BRT Alternatives were chosen for analysis to assess the impacts of the alternatives to the traffic stream characteristics.

With the help of the TAC, a total of 21 grade crossing locations, 14 roadway segments and 34 intersections were identified to be included in the traffic analysis. This section documents the procedures used in analyzing the impacts on the transportation operations and infrastructure in the Central Corridor.

TRANSIT ALTERNATIVES

As described in Chapter 2.0: Alternatives Considered, three alternatives are under consideration for the proposed Central Corridor transit project for implementation in 2020: Baseline Alternative, University Avenue LRT Alternative, and University Avenue Busway/BRT Alternative. The transportation conditions for 2020 were assembled by first establishing the existing traffic operations as it exists in the year 2001 and building the 2020 conditions. The three alternatives considered in this analysis include:

- *Baseline Alternative, Year 2020 Condition* – starts with the 2001 existing conditions and accounts for the programmed and planned improvements described in this section in addition to the forecasted background growth in population, employment, and traffic through 2020.
- *University Avenue LRT Alternative, Year 2020 Condition* – in addition to the proposed LRT alignment, this alternative includes the baseline improvements and forecasted growth in population, employment, and traffic volumes through 2020.
- *University Avenue Busway/BRT Alternative, Year 2020 Condition* – in addition to the BRT alignment, this alternative includes the baseline improvements and forecasted growth in population, employment, and traffic volumes through 2020.

For the most part, the proposed LRT and BRT Alternatives are similar through the Central Corridor. However, the operating characteristics are different in downtown Minneapolis, downtown St. Paul and through the University of Minnesota campus. In these three areas, the BRT system is proposed to operate within the mix of vehicular traffic, instead of in its own exclusive right-of-way, similar to that of the existing bus system. The LRT Alternative is proposed for operation in an exclusive fixed guideway throughout the corridor, and located in a tunnel through the University of Minnesota campus, which is expected to have minimal impacts on the local traffic network after construction is completed.

EXISTING ROADWAYS

The existing roadway system in the Study Area includes limited access roadways, principal and minor arterial streets, collector streets, and local streets. Limited-access roadways, such as the interstate system, are physically separated from the surface street system and include grade-separated crossings of the surface streets. These roadways, such as Interstate 94 (I-94), provide both inter-city and regional travel. Access to the street network is provided via interchange ramps, typically at principal or minor arterial roadways. Principal arterials, such as University Avenue, accommodate trips across the region and typically include at-grade intersections with other surface streets. Minor arterial streets supply access to sub-regions. Collector streets connect local and residential streets with either principal or minor arterial roadways, while local streets provide access to individual residences and businesses.

PROGRAMMED AND PLANNED ROADWAY SYSTEM

The Twin Cities Metro Division of the Mn/DOT 2001-2004 *Transportation Improvement Plan* (TIP) designates improvements to be funded for completion throughout the metropolitan area, typically over a three-year period. The improvements planned within the Central Corridor Study Area and are committed for TIP funding between the years of 2001 and 2004 were documented in Section 1.4.2: Planned Transportation Improvements, and include the following in the Baseline Alternative.

- I-94 between Snelling Avenue and Cedar Street – pavement resurfacing (completed)
- I-94 between downtown St. Paul and downtown Minneapolis - widened shoulders for bus-only lane bypasses (completed)
- I-94/TH 280 - development of a high occupancy vehicle (HOV) bypass
- I-94/Snelling Avenue - bus stop improvements (completed)
- Snelling Avenue area - development of the Snelling Avenue garage site for Metro Transit
- I-94/Victoria Street - development of a noise wall near the interchange

Overall these improvements are not expected to have a substantial effect on the traffic operations in the corridor, although they can be expected to improve the operating efficiency of the regional transportation network. In addition to these scheduled improvements, Metro Transit, the Twin Cities metropolitan transit agency, plans to increase the frequency of its bus services, increase its coverage of its routes, and improve the efficiency of the existing bus system to meet new demands.

In addition to the programmed roadway and bus service improvements, the Hiawatha LRT segment between downtown Minneapolis and Fort Snelling is planned to be operating in the fall of 2003 and the segment from Fort Snelling to the Mall of America is planned to be operational in fall 2004. This will be the first LRT line in the metropolitan area and the connection of the Central Corridor into the Hiawatha LRT line will be important to the regional connectivity of the transit system.

TRAFFIC VOLUMES

Data were collected at all of the key intersections identified by the TAC, including peak hour turning movement counts, roadway geometry, and signal timing. Project team personnel collected a majority of the volumes and geometry in the field during September and October of 2001. Due to construction activities during the data collection effort, the downtown Minneapolis intersection volumes were obtained from the SRF Consulting Group report *Downtown Minneapolis Transportation Study* dated April 2000. The downtown St. Paul intersection volumes were not collected until December of 2001 after the alignment around the State Capitol area and the downtown had been established. Signal timing data for each intersection were obtained from the respective operating agencies.

Forecast volumes were developed for the baseline and build conditions. The forecast volumes were developed by using the existing intersection turn movement counts, an applied growth rate, and adjusted for any changes to the roadway alignment due to the LRT or BRT Alternatives. Development of the forecast volumes took into consideration the impacts due to proposed future developments along the corridor, the impact of revisions to the roadway geometry due to the proposed project, and the effect on pedestrian volumes due to the proposed project. The detailed methodologies for the growth rates are documented in the *Traffic Operations Report*, attached in Appendix 9.8.

TRANSIT OPERATIONAL ASSUMPTIONS

The proposed LRT and BRT vehicles were assumed to operate with the signals, <u>not</u> by priority timing. Priority timing for the transit vehicles could result in additional traffic delays depending on the signal timing parameters applied and the intersection signal controller system used. In most instances, the impact to traffic would be expected to be minimal; therefore, the impact will likely not be reflected in the LOS analysis. Because of the complexity of traffic operations and high density of traffic in an urbanized location such as the Central Corridor, priority signal timing could minimize the disruptions to the existing traffic network because it would not substantially impact the coordinated signal system. This could be addressed in future analyses.

The LRT operations plan assumed 16 trains per hour service during the peak travel periods. This operating plan equates to eight trains at 7.5-minute headway in each direction. It is assumed that each train would require 35-seconds to clear an intersection or grade crossing. The BRT operations plan assumed 20 buses per hour service, which equates to headways of approximately 4-minutes in each direction. BRT is proposed to operate similar to the existing bus services in downtown Minneapolis, the University of Minnesota campus, and downtown St. Paul, as it will operate in the mix of vehicular traffic. In the remainder of the corridor, the BRT system would be operating in its own right-of-way similar to the operations of the light rail vehicles (LRVs), generally operating in the center of the street

TYPICAL TRAFFIC CONTROL TREATMENTS

Signal timing and phasing was spot optimized for the Baseline, LRT and BRT Alternatives, including increasing cycle lengths and splits and adjusting offsets where necessary. In order to maintain a safe operation of either the LRT or BRT system, all parallel left-turn movements to the alignment were assumed to require exclusive left-turn phases for the build alternatives. The only location where the layouts did not include an exclusive left-turn lane along University Avenue was at the intersection with Malcolm Avenue. Therefore, the intersection of University Avenue and Malcolm Avenue was assumed to operate split-phased on University Avenue.

The signal timing was optimized for the Baseline and two build alternatives analyses in order to more accurately simulate the future operations. Over time as the traffic operating conditions change, the signal operations would be adjusted to accommodate the conditions. The project team recognizes the desire of the City of St. Paul to maintain the signal timing operations at the University Avenue intersections at Snelling Avenue and Lexington Parkway where the air quality monitors are located. However, for purposes of the analysis, optimization was necessary to help understand the level of impact due to the background growth in traffic and the LRT and BRT operations.

GRADE SEPARATION ANALYSIS

Grade separation may be necessary for grade crossing locations that have excessive interference between roadway traffic and transit vehicles or where traffic safety is substantially diminished due to adverse configuration of the grade crossing. Some of the concerns include: vehicular traffic delay due to the activation of train or bus warning systems; occupancy of the grade crossing by trains or buses; traffic operational impacts such as disruption of the traffic signal system; and safety concerns due to violation of traffic control devices or by queuing of roadway vehicles in the grade crossing area. Grade separations are used when other reasonable and effective traffic mitigation measures are not feasible and no physical, environmental, financial, or other constraints would preclude a grade separation system.

Intersections within the Study Area that may be affected by University Avenue LRT or Busway/BRT were chosen by the TAC for analysis of the appropriateness of grade separation or other traffic control measures. The Institute of Transportation Engineers (ITE) threshold exposure methodology was used for this analysis, from *Light Rail Transit Grade Separation Guidelines* from the *ITE Journal, 1993.* The ITE methodology provides guidance for identifying crossings which are good candidates for grade separation based on density of highway traffic (vehicles per hour [vph] per lane) and gate activation (determined by the number of LRT trains per hour). This methodology provides four "threshold" levels representing increasing levels of interference between vehicular flow and train traffic. They are interpreted as follows:

- Threshold Level 1: At-Grade Is Feasible
- Threshold Level 2: At-Grade Should Be Feasible
- Threshold Level 3: At-Grade Possible with Delay to LRT Trains
- Threshold Level 4: May Require Grade Separation

The methodology is meant as a general guideline and not a hard and fast rule. There may be occasions in which a grade separation can be avoided, even with high levels of interference. For example, in congested urban areas where travel speeds are very low and where the travel time saving provided by a grade separation would not be substantial. In other situations a grade separation may be highly desirable even if the quantitative threshold is not met.

At Level 2, and especially at Level 3, it is important to consider the design of the crossing activation system and traffic control devices, as well as the train operating and signaling circumstances, so that the grade crossing impacts can be mitigated even though a grade separation is not provided.

The following threshold numbers, which are functions of the level of exposure of the LRV to traffic (See Table 6.1-1: Vehicular Traffic Exposure to Transit Vehicles At-grade Crossings), aid in the determination of the feasibility of crossing the surface street system at-grade.

Table 6.1-1: Vehicular Traffic Exposure to Transit Vehicles At-Grade Crossings

Threshold Levels	Threshold Definition	LRT Peak Hour Vehicles per Lane (# of vehicles)[1/]	BRT Peak Hour Vehicles per Lane (# of vehicles)[2/]
1	Light Rail at-grade is feasible	Less than 345	Less than 216
2	Light Rail at-grade should be feasible, though minimal delay may be expected	Less than 716	Less than 540
3	Possible traffic signal solutions if LRV delay is acceptable	Less than 1095	Less than 1025
4	At-grade crossing is probably not feasible	Greater than or equal to 1095	Greater than or equal to 1025

Source: *Light Rail Transit Grade Separation Guidelines*, ITE Journal 1993
[1/] Based on the assumed operations plan of 16 LRVs per hour
[2/] Based on the assumed operations plan of 30 BRT vph

TRAFFIC ANALYSIS SOFTWARE BACKGROUND

Three model software programs were utilized in conducting the traffic analysis. A macroscopic analysis using Synchro5.0 was conducted for the downtown Minneapolis area (3 intersections) and the downtown St. Paul area (10 intersections) where select isolated intersections were analyzed out of a grid network system. A microscopic analysis using SimTraffic5.0 was conducted for the University of Minnesota area (3 intersections), TH 280 Interchange area (4 intersections), and Dale Street/State Capitol area (5 intersections). In these locations, intersections were closely spaced and the operations at one intersection could impact the results at adjacent intersections. A detailed microscopic analysis using Vissim3.5 was conducted for the Snelling Avenue/Lexington Parkway area (9 intersections) to include the potential impact of buses and a more detailed account of the proposed transit operations. The approach to the traffic operations analysis, as noted in the Traffic Operations Report, is derived from established methodologies documented in the *Highway Capacity Manual,* 2000 (HCM).

CAPACITY ANALYSIS

A capacity analysis is a process that estimates the quality of traffic flow along segments of roadway and intersections. The key factors affecting capacity includes: roadway geometry, traffic volumes, incidents, and intersection control.

Level of Service (LOS) Definitions

The results of a capacity analysis are typically presented in the form of a LOS letter grade (A through F) that provides a qualitative indication of the operational efficiency or effectiveness. In general, the LOS is a function of average delay or density of traffic at a given intersection or roadway segment. By definition, LOS A conditions represent high-quality operations (i.e., motorists experience very little delay or interference) while LOS F conditions represent failing operations (i.e., extreme delay or severe congestion).

LOS for roadway segments and intersections typically range from A to F and are defined as:

- LOS A – represents virtually free flow of traffic with no congestion or delay.
- LOS B – represents stable traffic flow, but other vehicles in the flow are noticeable.
- LOS C – represents stable flow, but marks the beginning of the range where individual vehicles become substantially affected by interactions with other vehicles in the traffic stream.
- LOS D – represents high density of traffic but stable flow.
- LOS E – represents operating conditions at or near the capacity level. All speeds are reduced to a low but relatively uniform flow.
- LOS F – represents a breakdown in the operating conditions resulting in significant congestion and delay.

In general, LOS A through D is typically considered acceptable in the Twin Cities Metropolitan Area. Typically, designing a new roadway for a LOS D is practical in a built urban environment, such as the Central Corridor. In general, metropolitan areas consider a LOS E or F to be unacceptable, as this indicates that the roadway has reached or exceeded its capacity, resulting in extended travel delays and substantial congestion. Each movement (left turn, through, and right turn) at an intersection approach has a corresponding LOS grade. The overall intersection LOS is calculated by using a weighted average of the volumes and delay associated with each individual movement.

Roadway Segment Capacity Analysis

Using the information collected for the analysis segments, the resulting roadway segment LOS was estimated. The segments were analyzed following the methodologies defined by the Florida Department of Transportation (FDOT) *Level of Service Handbook.* These methodologies, which are essentially an implementation adaptation of the HCM, establish a measure of effectiveness based on average travel speed on a given roadway segment. The detailed methodologies for the roadway segment capacity analysis are documented in the *Traffic Operations Report*, attached in Appendix 9.8.

Intersection Capacity Analysis

Using the information collected for the analysis intersections, the resulting intersection LOS was estimated. Each movement (left turn, through, and right turn) at an intersection approach has a corresponding LOS grade. The overall intersection LOS is calculated by using a weighted average of the volumes and delay associated with each individual movement. Figure 6.1-1: Level of Service Criteria, shows a graphical interpretation of LOS for intersections.

Synchro5.0 uses the HCM methodology to analyze intersection operations through one cycle of a traffic signal while both Vissim3.5 and SimTraffic5.0 simulate the operation of the network of traffic signals though multiple cycles over a specified period of time (e.g. 60 minutes). The LOS designations defined by the HCM, as described in the LOS definitions, are applied to the Vissim3.5 and SimTraffic5.0 results as well, but note that the calculation of delay in HCM and microscopic models are not identical. The delay calculations in both Vissim3.5 and SimTraffic5.0 include the control (traffic signal) delay, in addition to accounting for delay on each approach. Some of the delay could be attributed to lane changes or vehicles braking in response to upstream vehicle movements, among other typical characteristics in the traffic stream. Although the delay calculated using Vissim3.5 and SimTraffic5.0 accounts for "other" travel delay, this amount is typically minor in comparison to that created from the traffic control device; therefore, the HCM designated LOS is felt to be appropriate for identifying both the Vissim3.5 and SimTraffic5.0 results.

IMPACT DEFINITIONS

Traffic impacts with transit operations can be defined in a number of ways including: a) the threshold level of the grade crossing, b) the LOS of the roadway segment, c) the LOS of the entire intersection, d) the LOS of individual movements within an intersection, and e) the relation between the queue length and the storage length of an intersection movement.

For the grade separation analysis, an acceptable threshold for grade crossings is a Level 2 or better. As defined by the *ITE Light Rail Grade Separation Guidelines*, a Level 4 grade crossing is considered unfeasible for standard operations. In general, LOS A through D is typically considered acceptable in the Twin Cities Metropolitan Area for roadway segments and intersections. Designing a new roadway for a LOS D is practical in a built urban environment, such as the Central Corridor. In general, metropolitan areas consider a LOS E or F to be unacceptable, as this indicates that the roadway has reached or exceeded its capacity, resulting in extended travel delays and substantial congestion.

The following guidelines are applied when conducting the traffic analysis and identifying the need to consider roadway improvements or mitigation measures:

- All grade crossings reported at threshold Level 3 should be mitigated, and transit grade crossings at Level 4 should be grade-separated.
- All roadway segments and intersections operating at a LOS E or F as a result of background traffic or site-generated traffic would be considered for potential roadway improvement or mitigation measures, respectively.
- Not all intersection movements expected to be at a LOS E or F require roadway improvements or mitigation measures.
- Intersections or specific movements at an intersection that warrant consideration for mitigation due to the increased traffic volumes from a development would only be applied to return the intersection or specific movement back to the existing (background) traffic conditions.

6.1.2 Grade Crossings of the Surface Street System

GRADE SEPARATION

A grade separation analysis was conducted to determine the impact of future surface street grade crossings for the Forecast Year 2020. This analysis was completed at the TACs direction at the selected 21 highest volume traffic crossings of the proposed alignments. The analysis, similar to that completed for the intersection LOS analysis, was completed for the PM peak hour.

ANALYSIS AND RESULTS

None of the locations analyzed attained the threshold Level 4, which may have resulted in a grade separation being required to prevent delays and avoid collisions between vehicles and trains or buses. Table 6.1-2: Build Condition Grade Separation Analysis Results, presents the results for the selected grade crossings analysis. The LRT analysis resulted in four locations that reached a threshold Level 3, which has been defined as LRT being possible with increased train and vehicular delays or extensive improvements made to the crossing. Two of these locations are located on Fifth Street in downtown Minneapolis, which are a result of the combination of the Central Corridor system and the Hiawatha LRT system. The combination of LRT systems is expected to result in a one and three-quarter minute interval between trains during the peak hour at intersections in the common area of operation, essentially making Fifth Street a dedicated transitway. The other two areas that reached a threshold Level 3 were at the Highway 280 area (Cromwell Avenue) and at Snelling Avenue. These areas will also be assessed in the Intersection LOS analysis.

Table 6.1-2: Build Condition Grade Separation Analysis Results

Map Ref No.	Roadway	From	To	Total Number of Lanes	ADT[1/]	Build LRT/BRT Peak Hour Volumes		LRT Threshold Number[2/]	BRT Threshold Number[2/]
						Approach Volume	Vehicles per lane		
1	Hennepin Ave[3/]	Sixth St S	Fourth St S	3	19,200	1730	580	3	3
3	5th Ave S[3/]	Sixth St S	Fourth St S	3	22,200	2000	670	3	3
6	Malcolm Ave	Orlin Ave SE	Fourth St SE	2	3,500	320	160	1	1
7	Eustis Ave	Territorial Rd	Franklin Ave	3	14,700	1330	440	2	2
8	Cromwell Ave	Territorial Rd	Franklin Ave	2	16,500	1490	750	3	3
10	Raymond Ave	Territorial Rd	Wabash Ave	2	12,600	1140	570	2	3
11	Fairview Ave	Thomas Ave	Shields Ave	4	11,500	1040	260	1	2
14	Snelling Ave	Thomas Ave	Shields Ave	4	35,500	3200	800	3	3
17	Hamline Ave	Thomas Ave	St. Anthony Ave	4	14,700	1330	330	1	2
18	Lexington Pkwy	Thomas Ave	St. Anthony Ave	5	37,000	3330	670	2	3
20	Dale St	Thomas Ave	St. Anthony Ave	4	24,600	2220	560	2	3
21	Marion St	Thomas Ave	St. Anthony Ave	4	18,300	1650	410	2	2
22	Rice St	Como Avenue	John Ireland Blvd	4	20,000	1800	450	2	2
24	Robert St	Capitol Heights	Columbus Ave	2	9,400	850	430	2	2
25	12th St E	St. Peter St	Jackson St	3	18,100	1630	540	2	3
26	11th St E	St. Peter St	Jackson St	3	15,700	1420	470	2	2
27	7th St	St. Peter St	Jackson St	4	20,300	1830	460	2	2
28	6th St	St. Peter St	Jackson St	3	12,200	1100	370	2	2
29	5th St	St. Peter St	Jackson St	3	12,600	1140	380	2	2
31	Robert St	5th Street	Kellogg Blvd	4	15,200	1370	340	1	2
32	Jackson St	5th Street	Kellogg Blvd	3	17,400	1570	520	2	2

Source: *Light Rail Transit Grade Separation Guidelines, ITE Journal 1993*
[1/] ADT was calculated using turning movement data, assuming the PM peak period represented 9 percent of the daily volumes.
[2/] Threshold number is based on the transit vehicle exposure to traffic
[3/] Data collected from SRF Consulting Group, April 2000.

The BRT analysis resulted in eight locations attaining a threshold Level 3, due to the increased number of crossings with a 6-minute headway. As noted above, BRT is expected to be feasible for these crossings, as long as increased delays are acceptable or vast improvements are made to the area. The same four locations that attained threshold Level 3 in the LRT analysis were found to have the same results for the BRT. Two of the highest volume crossings, Snelling Avenue and Lexington Parkway, that attained the threshold Level 3 for BRT were located in the Vissim simulation and will be looked at further in the Intersection LOS analysis results. Other locations that reached this threshold level along University Avenue were at Raymond Avenue, Dale Street and Rice Street, and in downtown St. Paul along Cedar Street at 12th Street.

6.1.3 Existing Traffic Analysis

The surface streets and intersections potentially impacted by the proposed Central Corridor LRT or BRT Alternatives have been identified by the TAC for this impact assessment. This existing condition analysis defines the transportation network for 2001 and serves as a basis for comparison of the forecasted future analyses. Roadway segments and two types of intersection LOS analyses were completed and documented in the following sections.

ROADWAY SEGMENT ANALYSIS

The TAC identified roadway segments for analysis based on whether the proposed alignments are located within the existing roadway system (Figures 6.1-2a-k: University Alignment Plan-Sheets 1-11). For each of the roadway segments chosen for this analysis, which covers the entire length of the proposed alignments, information was collected in regard to roadway geometry, estimated capacity, and average daily traffic (ADT). Using this information, the resulting roadway segment LOS was estimated.

Table 6.1-3: Existing Roadway Segment LOS, summarizes the results of the existing condition analysis for the major and principal arterials that may be impacted by the proposed University Avenue LRT or Busway/BRT Alternatives throughout the Central Corridor Study Area.

Table 6.1-3: Existing Roadway Segment LOS

Map Ref. No.	Facility	Segment	Estimated ADT (Year 2001)[1/]	2001 Existing LOS
A	Fifth St	Third Ave N to Park Ave[2/]	8,800	C
B	Fourth St	Chicago Ave and Washington Ave Bridge	7,200[3/]	C
C	Washington Ave Bridge	Fourth St and Pleasant St Ramps	22,500	D
D	Washington Ave	Pleasant St Ramps and University Ave	18,000	D
E	University Ave	Washington Ave and Highway 280	25,000	D
F	University Ave	Highway 280 and Snelling Ave	25,000	D
G	University Ave	Snelling Ave and Lexington Ave	25,000	D
H	University Ave	Lexington Ave and Dale St	25,000	D
I	University Ave	Dale St and Rice St	27,500	D
J	University Ave	Rice St and Robert St	20,000	D
K	Robert St	University Ave and Columbus Ave	8,000	C
L	Columbus Ave	Robert St and Cedar Street	1,200	C
M	Cedar Street	11th St and 4th St	6,800	C
N	4th St	Cedar Street and Sibley Ave	5,600	C

Source: FDOT Level of Service Handbook 1998 and BRW 2001.
[1/] ADT was calculated using turning movement data collected in September and December 2001, assuming the PM peak period represented 9 percent of the daily volumes.
[2/] Data collected from SRF Consulting Group, April 2000.
[3] ADT was taken from the 2000 Mn/DOT Flow Maps

No roadway segments in the existing condition analysis are expected to operate below the acceptable threshold of LOS D on a daily basis.

INTERSECTION CAPACITY ANALYSIS

The intersection capacity analysis was conducted to determine the existing traffic volume impacts on the existing roadway geometry. All of the existing condition analyses consisted of using the field counted turning movement volumes collected for the intersections included in the study. These volumes were then used in conjunction with existing roadway geometry and existing signal timing to develop the existing condition LOS and queue length results. Two separate results were reported for the capacity analysis—a general intersection analysis and the Snelling Avenue/Lexington Parkway area analysis.

The results of the macroscopic and general microscopic intersection LOS analysis are included in Table 6.1-4: Summary of PM Peak Hour Intersection LOS Analysis. During the PM peak hour, all intersections included in this analysis were reported to be operating at a LOS D or better except for the Raymond Avenue/University Avenue intersection, which operates at a LOS E.

The results of the detailed microscopic intersection LOS analysis for the Snelling Avenue/Lexington Parkway area existing conditions are also included in Table 6.1-4. This area considered all intersections and access points that are currently located between Fairview Avenue and Victoria Street. As shown in the table, no intersections are currently operating below the acceptable LOS standard. The intersection of Lexington Parkway and University Avenue, which had the highest average vehicle delay, is currently operating at LOS D. All other intersections in this microscopic analysis area are expected to operate at LOS C or better during the peak periods.

Table 6.1-4: Summary of PM Peak Hour Intersection LOS Analysis

Map Ref No.	Intersection	Existing LOS	Baseline LOS	Build Condition	
				LRT LOS	BRT LOS
1	Hennepin Avenue/Fifth Street South	B	E	E	E
2	Marquette Avenue/Fifth Street South	B	E	D [2/]	E
3	5th Avenue South/Fifth Street South	A	A	A	A
4	Washington Avenue/Church Street	B	B	B [7/]	B
5	29th Street/University Avenue	A	A	A	A
6	Malcolm Avenue/University Avenue	B	B	E [3/]	B
7	Hwy 280 SB (Eustis Ave)/University Avenue	D	D	F [4/]	F [4/]
8	Hwy 280 NB (Cromwell Ave)/University Avenue	C	C	C	C
9	Franklin Avenue/University Avenue	B	B	A [4/]	A [4/]
10	Raymond Avenue/University Avenue	E	F	F	F
11	Fairview Avenue/University Avenue	B	C	E	E
12	Aldine Street/University Avenue	B	B	F [4/]	F [4/]
13	Fry Street/University Avenue	A	A	E [4/]	E [4/]
14	Snelling Avenue/University Avenue	C	D	E [1/]	E [1/]
15	Pascal Avenue/University Avenue	C	B	C	C
16	Albert Street/University Avenue	A	B	B [5/]	B [5/]
17	Hamline Avenue/University Avenue	C	C	E [4/]	E [4/]
18	Lexington Parkway/University Avenue	D	E	F [1/]	F [1/]
19	Victoria Street/University Avenue	B	C	C	C
20	Dale Street/University Avenue	D	F	F	F
21	Marion Street/University Avenue	C	E	F [4/]	F [4/]
22	Rice Street/University Avenue	D	F	F [1/]	F [1/]
23	Constitution Avenue/University Avenue	B	C	F [4/]	F [4/]

Table 6.1-4: Summary of PM Peak Hour Intersection LOS Analysis (Cont.)

Map Ref No.	Intersection	Existing LOS	Baseline LOS	Build Condition LRT LOS	Build Condition BRT LOS
24	Robert Street/University Avenue	B	B	F [6/]	B
25	12th Street/Cedar Street	B	B	C	B
26	11th Street/Cedar Street	B	B	D	B
27	7th Street/Cedar Street	B	B	F [6/]	B
28	6th Street/Cedar Street	B	B	D	B
29	5th Street/Cedar Street	B	A	F [6/]	A
30	Cedar Street/4th Street	A	A	A	A
31	Robert Street/4th Street	B	B	A	B
32	Minnesota Street/4th Street	A	B	B	B
33	Jackson Street/4th Street	B	C	C	C
34	Sibley Avenue/4th Street	B	B	B	B

[1/] These intersections have a significant impact on the operations of the adjacent intersection. Mitigation measures at these intersections may result in considerable improvements to the adjacent intersections.
[2/] Build condition reported improved from Baseline condition due to removal or restricted turn movements.
[3/] No exclusive left-turn lanes were provided, thus split phase timing was required for the Build condition.
[4/] Intersection impacted by poor operations and queuing at adjacent intersection potentially resulting in improved LOS reported due to the inability of vehicles to access the intersection.
[5/] Intersection signalized for Existing and Baseline conditions, but unsignalized for Build Condition.
[6/] Intersection operations reduced due to turn movements across LRT tracks.
[7/] Intersection unsignalized for the Existing, Baseline and Build BRT condition; signalized for the Build LRT condition.

The intersection of Washington Avenue and Church Street may have additional traffic issues due to the high level of pedestrian traffic and number of bus vehicles that serve this area. Additionally, the typical peak hour may not have the highest traffic volumes of the day because of the difference in school and hospital schedules, although it is not expected to operate at an unacceptable LOS.

Specific approaches and turning movements are expected to operate below LOS E, though their impact is not expected to impair the entire intersection's operating conditions. The deficient intersection movements are listed in Table 6.1-5: Existing PM Peak Hour Intersection Movements at LOS E and F.

Table 6.1-5: Existing PM Peak Hour Intersection Movements at LOS E and F

Intersection	Movement	Movement LOS
Eustis Street/University Avenue	North Approach LT	F
Cromwell Avenue/University Avenue	West Approach LT	E
Raymond Avenue/University Avenue	North Approach All	F
Dale Street/University Avenue	East and North Approach LT	E
Marion Street/University Avenue	South Approach LT	E
Rice Street/University Avenue	South Approach LT and North Approach TH North Approach LT	E F

Note: LT = Left Turn movement; RT = Right Turn movement; TH = Through movement; All = All Movements for the approach

6.1.4 Year 2020 Traffic Analysis

ROADWAY SEGMENT ANALYSIS

Roadway segments along the proposed Central Corridor were analyzed for the forecasted Baseline and two build alternatives for the Year 2020. The forecasted ADT volumes were obtained by applying the growth rate, as noted in the Methodology Section. The FDOT *Level Of Service Handbook 1998* was used to determine the forecast build conditions LOS, taking into account future developments, roadway improvements, geometry changes due to the proposed alignments, and forecasted growth in traffic. The results of this macroscopic roadway segment analysis are shown in Table 6.1-6: Year 2020 LRT and BRT Roadway Segment LOS Results.

Table 6.1-6: Year 2020 LRT and BRT Roadway Segment LOS Results

Map Ref.	Facility	Segment	Baseline ADT[1/]	Baseline LOS	Build BRT/LRT 2020 ADT[1/]	Build LRT LOS	Build BRT LOS
A	Fifth Street[2/]	Third Ave North to Park Ave	11,800	F	12,600	F	F
B	Fourth Street[3/]	Chicago Ave to Cedar Ave	9,400	C	9,400	C	C
C	Washington Ave Bridge	Cedar Ave to Pleasant St Ramps	26,700	D	26,700	F	D
D	Washington Ave	Pleasant Street Ramps to University Ave	21,400	D	21,400	D	D
E	University Ave	Washington Ave to Highway 280	29,700	D	29,700	D	D
F	University Ave	Highway 280 to Snelling Ave	29,700	D	29,700	D	D
G	University Ave	Snelling Ave to Lexington Pkwy	29,700	D	29,700	D	D
H	University Ave	Lexington Ave to Dale St	29,700	D	29,700	D	D
I	University Ave	Dale St to Rice St	32,700	E	32,700	E	E
J	University Ave	Rice St to Robert St	23,800	D	23,800	F	D
K	Robert St	University Ave to Columbus Ave	9,500	C	9,500	D	C
L	Columbus Ave	Robert St to Cedar Street	1,500	C	1,500	C	C
M	Cedar Street	11th St to 4th St	8,900	C	8,900	E	C
N	4th Street	Cedar Street to Sibley Ave	7,300	C	7,300	D	C

Source: FDOT *Level of Service Handbook 1998* and BRW 2001.
[1/] ADT was calculated using turning movement data collected in September and December 2001, assuming the PM peak period represented 9 percent of the daily volumes.
[2/] Data collected from SRF Consulting Group, April 2000.
[3/] ADT was taken from the 2000 Mn/DOT Flow Maps

Two segments are forecasted to be operating below the acceptable LOS D for the Forecast 2020 Baseline Alternative. Fifth Street in downtown Minneapolis, which as noted before, will only provide one travel lane because of the implementation of the Hiawatha LRT system. Many of the forecasted trips on this roadway will be expected to divert to parallel routes in the grid transportation network in downtown Minneapolis. The segment of University Avenue between Dale Street and Rice Street is also expected to operate at LOS E. All other roadway segments analyzed in the corridor are expected to operate at an acceptable LOS for the Baseline Alternative.

For the proposed University Avenue Busway/BRT Alternative, the two roadway segments that were found to operate below the acceptable LOS D for the Baseline Alternative are again expected to be unacceptable. The LRT roadway segment analysis produced five segments that are expected to operate below LOS D. In addition to the two segments found to operate below LOS D for the BRT and Baseline Alternatives, the Washington Avenue Bridge, University Avenue between Rice Street and Robert Street, and Cedar Street are all expected to have operational issues due to the alignment. In these locations, the roadway geometry would change because of the LRT alignment, whereas the BRT would operate within the mix of vehicular traffic in these areas. The Washington Avenue Bridge that currently operates with 4-lanes of bi-directional traffic, would be reduced to one-lane in each direction. On University Avenue between Rice Street and Robert Street, because of the Cedar Street Bridge, which carries over University Avenue, the roadway can not be expanded without right-of-way acquisition and reconstruction of the bridge. Potential mitigation measures or roadway improvements are addressed in Section 6.1.6: Potential Roadway Improvements and Mitigation Measures.

INTERSECTION CAPACITY ANALYSIS

The capacity analysis was conducted to determine the impacts at key intersections in the corridor for the Baseline and two build alternatives. As with the existing condition, two separate results were reported for the capacity analysis—a general intersection analysis and the Snelling Avenue/Lexington Parkway area analysis. The Baseline and build alternatives analyses consisted of using the forecasted turning movement volumes for the intersections included in the study. These volumes were then used in conjunction with optimized signal operations and existing roadway geometry for the Baseline Alternative and proposed roadway geometry for the two build alternatives to develop the LOS results.

GENERAL INTERSECTION ANALYSIS

A summary of the results of the Baseline and two build alternatives macroscopic and general microscopic intersection LOS analysis was included previously in Table 6.1-4. During the PM peak hour, all intersections included in the Baseline Alternative analysis were expected to operate at a LOS D or better, except those intersections listed in Table 6.1-7: Baseline PM Peak Hour Intersections at LOS E and F. In addition, the individual intersection movements that are expected to operate below LOS D are identified in Table 6.1-8: Baseline PM Peak Hour Movements at LOS E and F.

Table 6.1-7: Baseline PM Peak Hour Intersections at LOS E and F

Intersection	Overall Intersection LOS
Hennepin Avenue/Fifth Street	E
Marquette Avenue/Fifth Street	E
Raymond Avenue/University Avenue	F
Dale Street/University Avenue	F
Marion Street/University Avenue	E
Rice Street/University Avenue	F

Table 6.1- 8: Baseline PM Peak Hour Movements at LOS E and F

Intersection	Movement	Movement LOS
Fairview Avenue/University Avenue	North Approach LT and South Approach LT	F
Aldine Street/University Avenue	North Approach LT and South Approach RT	E
Snelling Avenue/University Avenue	North, East and South Approach LT	F
Lexington Parkway/University Avenue	South Approach TH North, East and South Approach LT, and West Approach All	E F
Victoria Street/University Avenue	North Approach All and South Approach LT	E

Note: LT = Left Turn movement; RT = Right Turn movement; TH = Through movement; All = All Movements for the approach

During the PM peak hour, all intersections included in the University Avenue LRT Alternative analysis were expected to operate at a LOS D or better, except those intersections listed in Table 6.1-9: LRT PM Peak Hour Intersections at LOS E and F. In addition, the individual intersection movements that are expected to operate below LOS D are identified in Table 6.1-10: LRT PM Peak Hour Intersection Movements at LOS E and F.

Table 6.1-9: LRT PM Peak Hour Intersections at LOS E and F

Intersection	Overall Intersection LOS
Hennepin Avenue/Fifth Street	E
Malcolm Avenue/University Avenue	E
Eustis Street/University Avenue	F
Raymond Avenue/University Avenue	F
Dale Street/University Avenue	F
Marion Street/University Avenue	F
Rice Street/University Avenue	F
Constitution Avenue/University Avenue	F
Robert Street/University Avenue	F
7th Street/Cedar Street	F
5th Street/Cedar Street	F

Table 6.1-10: LRT PM Peak Hour Intersection Movements at LOS E and F

Intersection	Movement	Movement LOS
Hennepin Avenue/Fifth Street	South Approach LT and TH East Approach TH	E F
Marquette Avenue/Fifth Street [a]	East Approach TH	E
Malcolm Avenue/University Avenue	West Approach TH and North Approach LT East Approach TH	E F
Eustis Street/University Avenue	North Approach LT and TH West Approach TH and RT	E F
Cromwell Avenue/University Avenue	West Approach LT	F
Raymond Avenue/University Avenue	West Approach LT East Approach TH and RT, and North Approach LT	E F
Dale Street/University Avenue	East Approach LT West, South and North Approach All	E F
Marion Street/University Avenue	East Approach LT and South Approach RT West Approach All, South Approach LT and TH, and North Approach LT	E F
Rice Street/University Avenue	West Approach LT and TH, South and North Approach All	F
Constitution Avenue/University Avenue	East Approach TH and RT, and North Approach LT	F
Robert Street/University Avenue	East Approach TH and South Approach All	F
11th Street/Cedar Street	West Approach TH and North Approach LT	E
7th Street/Cedar Street	North Approach All	F
5th Street/Cedar Street	North Approach LT	F

Note: LT= Left Turn movement; RT= Right Turn movement; TH= Through movement; All= All movements for the approach
[a] The east approach right-turn movement was assumed to be restricted for the Build condition.

During the PM peak hour, all intersections included in the Busway/BRT Alternative analysis were expected to operate at a LOS D or better, except those intersections listed in Table 6.1-11: BRT PM Peak Hour Intersections at LOS E and F. In addition, the individual intersection movements that are expected to operate below LOS D are identified in Table 6.1-12: BRT PM Peak Hour Intersection Movements at LOS E and F.

Table 6.1-11: BRT PM Peak Hour Intersections at LOS E and F

Intersection	Overall Intersection LOS
Hennepin Avenue/Fifth Street	E
Marquette Avenue/Fifth Street	E
Eustis Street/University Avenue	F
Raymond Avenue/University Avenue	F
Dale Street/University Avenue	F
Marion Street/University Avenue	F
Rice Street/University Avenue	F
Constitution Avenue/University Avenue	F

Table 6.1-12: BRT PM Peak Hour Intersection Movements at LOS E and F

Intersection	Movement	Movement LOS
Hennepin Avenue/Fifth Street	East Approach TH	F
Marquette Avenue/Fifth Street	East Approach TH and RT	F
Eustis Street/University Avenue	East Approach LT and North Approach LT and TH West Approach TH and RT	E F
Cromwell Avenue/University Avenue	West Approach LT	F
Raymond Avenue/University Avenue	West Approach LT East Approach TH and RT, and North Approach LT	E F
Dale Street/University Avenue	East Approach LT West, South and North Approach All	E F
Marion Street/University Avenue	East Approach LT and South Approach RT West Approach All, South Approach LT and TH, and North Approach LT	E F
Rice Street/University Avenue	West Approach LT and TH, South and North Approach All	F
Constitution Avenue/University Avenue	East Approach TH and RT, and North Approach LT	F
Jackson Street/4th Street	East Approach LT and TH	E

Note: LT = Left Turn movement; RT = Right Turn movement; TH = Through movement; All = All Movements for the approach

The queues created from the delays at the intersection of Rice Street and University Avenue for both of the build alternatives are expected to create problems at the adjacent intersections along University Avenue at Marion Street and Constitution Avenue. Therefore, if the conditions are improved at the Rice Street/University Avenue intersection, then improvements in the LOS would be expected at the adjacent intersections as well.

SNELLING AVENUE/LEXINGTON PARKWAY AREA ANALYSIS

A summary of the results of the Baseline and two build alternatives for the detailed microscopic intersection LOS analysis for the Snelling Avenue/Lexington Parkway area are included in Table 6.1-4.

During the PM peak hour, all Baseline Alternative intersections included in this analysis were expected to operate at LOS D or better, except the intersection of Lexington Parkway and

University Avenue, which is expected to operate at LOS E. Although the intersection of Snelling Avenue and University Avenue is reported as being expected to operate at LOS D, due to the close proximity to the adjacent intersection to the south on Snelling Avenue and the expected queue lengths, this intersection is expected to operate worse than LOS D and impact the operations at adjacent intersections in the area. In addition, the individual intersection movements that are expected to operate below LOS D are identified in Table 6.1-13: Baseline PM Peak Hour Movements at LOS E and F.

Table 6.1-13: Baseline PM Peak Hour Movements at LOS E and F

Intersection	Movement	Movement LOS
Fairview Avenue/University Avenue	North Approach LT and South Approach LT	F
Aldine Street/University Avenue	North Approach LT and South Approach RT	E
Snelling Avenue/University Avenue	North, East and South Approach LT	F
Lexington Parkway/University Avenue	South Approach TH North, East and South Approach LT, and West Approach All	E F
Victoria Street/University Avenue	North Approach All and South Approach LT	E

Note: LT = Left Turn movement; RT = Right Turn movement; TH = Through movement; All = All Movements for the approach

During the PM peak hour, all intersections included in the University Avenue Busway/BRT Alternative analysis were expected to operate at a LOS D or better, except those intersections listed in Table 6.1-14: BRT PM Peak Hour Intersections at LOS E and F. In addition, the individual intersection movements that are expected to operate below LOS D are identified in Table 6.1-15: BRT PM Peak Hour Movements at LOS E and F.

During the PM peak hour, all intersections included in the University Avenue LRT Alternative analysis were expected to operate at a LOS D or better, except those intersections listed in Table 6.1-16: LRT PM Peak Hour Intersections at LOS E and F. In addition, the individual intersection movements that are expected to operate below LOS D are identified in Table 6.1-17: LRT PM Peak Hour Movements at LOS E and F.

For both of the build alternatives, although the intersection of Snelling Avenue and University Avenue is reported as being expected to operate at LOS E, due to the close proximity to the adjacent intersection to the south on Snelling Avenue and the expected queue lengths, this intersection is expected to operate worse than LOS E and impact the operations at adjacent intersections in the area.

Table 6.1-14: BRT PM Peak Hour Intersections at LOS E and F

Intersection	Overall Intersection LOS
Fairview Avenue/University Avenue	E
Aldine Street/University Avenue	F
Fry Street/University Avenue	E
Snelling Avenue/University Avenue	E
Hamline Avenue/University Avenue	E
Lexington Parkway/University Avenue	F

Table 6.1-15: BRT PM Peak Hour Movements at LOS E and F

Intersection	Movement	Movement LOS
Fairview Avenue/University Avenue	West Approach TH and RT North, East, South and West Approach LT, and South Approach RT	E F
Aldine Street/University Avenue	West Approach TH	F
Fry Street/University Avenue	West Approach TH and RT	F
Snelling Avenue/University Avenue	North Approach LT, East Approach TH and RT, South Approach LT East Approach LT and West Approach All	E F
Pascal Street/University Avenue	North Approach TH, South Approach LT	E
Albert Street/University Avenue [a]	South Approach RT	F
Hamline Avenue/University Avenue	North Approach TH, South Approach All, and West Approach TH and RT North, East and West Approach LT	E F
Lexington Parkway/University Avenue	North Approach RT, East Approach TH and RT, and South Approach All North Approach LT and TH, East Approach LT, and West Approach All	E F
Victoria Street/University Avenue	South Approach LT and TH	E

Note: LT = Left Turn movement; RT = Right Turn movement; TH = Through movement; All = All Movements for the approach
[a] This intersection was assumed to be unsignalized for the Build condition.

Table 6.1-16: LRT PM Peak Hour Intersections at LOS E and F

Intersection	Overall Intersection LOS
Fairview Avenue/University Avenue	E
Aldine Street/University Avenue	F
Fry Street/University Avenue	E
Snelling Avenue/University Avenue	E
Hamline Avenue/University Avenue	E
Lexington Parkway/University Avenue	F

Table 6.1-17: LRT PM Peak Hour Movements at LOS E and F

Intersection	Movement	Movement LOS
Fairview Avenue/University Avenue	West Approach TH and RT North, East, South and West Approach LT, and South Approach RT	E F
Aldine Street/University Avenue	West Approach TH	F
Fry Street/University Avenue	West Approach TH and RT	F
Snelling Avenue/University Avenue	North Approach LT, East Approach TH and RT, South Approach LT East Approach LT and West Approach All	E F
Pascal Street/University Avenue	North Approach TH and South Approach LT	E
Albert Street/University Avenue [a]	South Approach RT	F
Hamline Avenue/University Avenue	North Approach TH, South Approach All, and West Approach TH and RT North, East and West Approach LT	E F
Lexington Parkway/University Avenue	North Approach RT, East Approach TH and RT, and South Approach All North Approach LT and TH, East Approach LT, and West Approach All	E F
Victoria Street/University Avenue	South Approach LT and TH	E

Note: LT = Left Turn movement; RT = Right Turn movement; TH = Through movement; All = All Movements for the approach
[a] This intersection was assumed to be unsignalized for the build alternatives.

The queues created from the delays at the Snelling Avenue/University Avenue intersection and the Lexington Parkway/University Avenue are expected to create problems at the adjacent intersections along University Avenue at Fairview Avenue, Aldine Street, Fry Street and Hamline Street. Therefore, if the conditions are improved at the Snelling Avenue/University Avenue and Lexington Parkway/University Avenue intersections, then improvements in the LOS would be expected at the adjacent intersections as well.

6.1.5 Assessment of Traffic Impacts at Station Locations

The proposed station areas along the Central Corridor for both LRT and Busway/BRT Alternatives are expected to produce a minimal amount of new traffic because no parking facilities are provided. Overall, each station would have limited opportunities for drop-and-ride facilities, so it is expected that most riders on the system would primarily access the Central Corridor LRT or Busway/BRT system through other transit mode transfers (i.e., bus, Hiawatha LRT) or by walking to a station. Due to the limited opportunities for parking or drop-off facilities, the amount of neighborhood "cut-through" traffic is expected to be minimal. For these reasons, a detailed traffic impact study was not completed at each station site because the traffic generated by the station sites through automobile access can be expected to be negligible.

6.1.6 Potential Roadway Improvements and Mitigation Measures

The purpose of this section is to identify potential roadway improvements and mitigation measures that could be made through roadway construction or through modifying the signal system that would improve the intersection LOS, intersection movement LOS, or the queue lengths to acceptable conditions (see previous discussion on Impact Definitions). Potential Roadway Improvements are measures to improve traffic conditions due to the expected background traffic as a part of the Baseline Alternative. Potential Mitigation Measures are measures to improve traffic conditions due to expected project-generated traffic impacts as a part of the LRT or BRT Alternatives. A list of improvements was developed with the help of the TAC to include in the Draft EIS text as a general list to address traffic related impacts. However, no analysis of improvements or mitigation is intended to be conducted for the Draft EIS.

With the direction to proceed into Final EIS, procedures would be developed for identifying the appropriate roadway improvements and mitigation measures to apply throughout the corridor and to analyze the impact of the improvements. The intention would be to include this additional analysis in the Final EIS, which would also identify the potential benefits of implementing improvements along the proposed project corridor.

The list of potential improvements includes:

- Modify Signal Operations
- Far Side Intersection Bus Stops
- Limit Development Trips
- Increase Turn Bay Lengths
- Add Cross-Street Lanes
- Add Mainline Turn Lanes
- Divert Trips
- Improve Parallel Roadways
- Reduce Access Locations
- Add Mainline Through Lanes

Not only could each of the improvements listed above be evaluated independently to determine the impact at a location, but the treatments could also be applied concurrently to gain additional benefits.

One potential mitigation measure not discussed in the above section would be to grade-separate roadways creating an interchange. Due to the cost and construction impacts to grade-separate roadways, especially in a built-out area, this mitigation measure should only be considered for traffic impact reasons if all of the other improvements discussed above are not expected to improve conditions to an adequate level of operation.

6.2 BUS TRANSIT OPERATIONS

This section details the existing and planned bus transit system serving the Central Corridor, including potential impacts, planned bus transit improvements, and projected bus operations with the proposed build alternatives.

6.2.1 Existing Bus Transit Operations

The Central Corridor is served by Metro Transit, the regional transit authority in the Twin Cities, along with four other localized transit agencies that provide suburban communities with transit services. These suburban transit providers, which include Maple Grove Transit, Southwest Metro, Minnesota Valley Transit Authority, and Plymouth Metrolink, offer some commuter services that connect into downtown Minneapolis. Currently, these transit providers account for 42 bus routes that serve the Central Corridor, primarily connecting into the Minneapolis Central Business District (CBD). These routes operate within the corridor, but are not expected to be substantially impacted by the build alternatives considered in the Draft EIS. These routes are considered low impact routes and are not described in detail in this section.

Metro Transit, as a whole, provides 132 bus routes in its service coverage area, which encompasses nearly the entire Twin Cities Metropolitan Area. The existing bus fleet includes 939 vehicles that serve 63 local, 48 express and 31 contract routes. The Central Corridor, considered the backbone of the regional transit system, has the highest ridership routes in the entire metropolitan area, resulting in approximately 65,000 person trips per weekday. Twelve (12) local routes, three (3) limited stop routes, and five (5) express routes serve the corridor.

Table 6.2-1: Central Corridor Existing Bus Service Transit Operations, illustrates the service type, service frequencies, span of service, annual operating cost, and estimated weekday ridership of the existing bus transit services in the Central Corridor.

The Central Corridor is host to three major activity centers. This corridor has traditionally been the base of the metropolitan area's transit system and major focus for specialized services and amenities to promote transit ridership. Some of these amenities are described below.

- **Nicollet Mall**- This transit-only parkway serves the core of the office and retail district of downtown Minneapolis. This facility is a major destination for many of the bus routes in downtown Minneapolis and has bus shelters and wide pedestrian sidewalks.
- **University of Minnesota Transitway**- This bus transit-only parkway serves as a connection between the University of Minnesota's Minneapolis and St. Paul campuses, aligned parallel with University Avenue east of the East Bank campus. This transitway provides the bus services on a roadway with minimal automobile conflicts, allowing the bus services with improved travel times in comparison to those services on University Avenue.
- **I-94 Shoulder Bus Lanes and HOV Bypasses**- The shoulders on I-94 between Minneapolis and St. Paul have been widened to provide the capability of bus services to pass stopped vehicular traffic in congested conditions. In addition, ramp meters at select interchanges in this corridor provide bypasses for high-occupancy vehicles and bus transit services to minimize the wait time at the on-ramps.

Table 6.2-1: Central Corridor Existing Bus Service Transit Operations

Route	Description	Type of Service	Service Frequencies (in minutes)						Span of Service (Hours Per Day)		
			Peak	Midday	Evening	Saturday	Sunday	Weekday Number of Trips	Weekday	Saturday	Sunday
3	St Paul CBD-Front-Como-Minneapolis CBD	Local	10	15	30	30	30	86	18	18	18
16	St Paul CBD-University-Minneapolis CBD	Local	10	10	10	10	10	112	20	22	22
21	Lake-Selby-St Paul CBD	Local	7.5	15	15	10	10	135	20	22	22
50	St Paul CBD-University-Minneapolis CBD	Limited Stop	30	60	0	0	0	53	14	0	0
62	Rice-St Paul CBD	Local	30	30	30	30	60	37	19	18	18
63	Grand-St Paul CBD	Local	10	15	15	20	20	68	19	20	19
65	Rosedale-Dale-St Paul CBD	Local	30	30	30	60	60	29	12	6	10
67	Cleveland-Minnehaha-Minneapolis CBD	Local	30	30	30	60	60	40	16	14	10
68	Jackson-St Paul CBD	Local	30	30	30	30	30	45	20	20	18
76	Midway-St Paul CBD	Local	0	60	0	0	0	6	6	0	0
83	Rosedale-Lexington	Local/Limited Stop	30	30	0	60	0	20	12	12	0
84	Rosedale-Snelling-Airport-Mall of America	Local	15	15	15	20	20	70	19	20	18
87	Rosedale-Cleveland	Local	30	30	0	60	0	24	12	10	0
94B	St Paul CBD- I-94 – Minneapolis CBD	Express	30	30	0	20	30	34	12	18	16
94C	St Paul CBD- I-94 – Minneapolis CBD	Express	30	30	30	0	0	23	12	0	0
94D	St Paul CBD- I-94 – Minneapolis CBD	Express	30	30	0	0	0	23	12	0	0
134	Ford-Cretin- I-94 - Minneapolis CBD	Limited Stop	12	0	0	0	0	15	6	0	0
191	Lake-Marshall-St Paul CBD	Express	20	0	0	0	0	4	6	0	0
194	Snelling-I-94-Minneapolis CBD	Express	30	0	0	0	0	4	6	0	0
52F	Cretin-Snelling-University of Minnesota	Local	60	0	0	0	0	2	6	0	0

Source: Metro Transit 2001, BRW 2001.

Travel time is one of the key components in attracting new ridership from the typical automobile commuter. The travel times of the limited stop and express bus routes that connect the Minneapolis and St. Paul CBDs, are shown in Table 6.2-2: Existing Bus Transit Travel Times.

Table 6.2-2 Existing Bus Transit Travel Times

Route Number	Route Description	Route Type	Average One-Way Travel Time (minutes)
16	Minneapolis/St. Paul	Local	58:00
50	St Paul CBD-University-Minneapolis CBD	Limited Stop	50:35
94B	St Paul CBD- I-94 -Minneapolis CBD	Express	33:40
94C	St Paul CBD- I-94 -Minneapolis CBD	Express	32:10
94D	St Paul CBD- I-94 -Minneapolis CBD	Express	32:10

Source: Metro Transit and BRW 2001.

6.2.2 Planned Bus Transit Operations

This section presents the current transit system plans and goals for Twin Cities Metropolitan Area. According to the adopted *Transit 2020 Master Plan*, significant transit improvements are planned in the Central Corridor and throughout the metropolitan area. The focus of this transit master plan is to improve access and mobility throughout the entire metropolitan area to serve forecasted growth in population and employment and to limit the rising levels of congestion. The five main strategies outlined in the plan include:

- Develop a network of dedicated transit corridors
- Develop the transit system to meet unique needs of the transit markets
- Double the capacity of the existing bus system
- Double the transit passengers and support facilities
- Promote "smart growth" initiatives along dedicated transit corridors

In addition to planned transit improvements outlined by the regional transit authority, other measures that could improve the operations and increase transit ridership documented in the *Transit 2020 Master Plan* for the Central Corridor specifically include:

- Increase the use of diamond lanes and provide priority signal timing at select intersections for buses to provide high-speed quality service for riders
- Intensify the regional coverage of bus-only shoulder by-pass lanes on I-94 and expand the number of ramp meter bypasses
- Encourage better integration with University of Minnesota shuttle services and use of the dedicated transitway
- Upgrade high volume stations to "Transit Center" style to foster ticket sales areas, sheltered areas, and increased marketing of the transit system
- Enhance local neighborhood services to directly link into the greater transit network
- Develop pricing strategies and customer incentives that encourage the use of transit
- Implement policies and strategies that encourage the efficient use of land along transit corridors that provide pedestrian-oriented developments
- Enrich Travel Demand Management (TDM) and parking management strategies in the CBDs to decrease single-occupant vehicle

In addition to some of the bus transit operations improvements outlined above, the following transit corridors are currently undergoing some level of planning or feasibility analysis:

- Hiawatha Corridor (LRT, under construction)
- Riverview Corridor (BRT/Priority Treatments along West 7th Street)
- St. Paul Northeast Busway/Rush Line Corridor
- Minneapolis East Busway
- Minneapolis Northwest Busway
- Minneapolis Southwest LRT
- North Star Commuter Rail
- Red Rock Commuter Rail
- Northeast Diagonal

These transit corridors could provide a thorough network of transit options throughout the metropolitan area. As these corridors are constructed and open for service, competing bus services would be eliminated or converted to local feeder routes to serve these higher levels of transit service corridors. Many of the local routes can be modified to serve the proposed LRT or BRT stations to provide distribution and circulation from these facilities.

6.2.3 Projected Bus Transit Operations

This section illustrates the projected transit operations for the Baseline, University Avenue LRT and University Avenue Busway/BRT Alternatives for the Year 2020. The summary of the potential services for each alternative includes the projected service frequencies, the number of additional bus trips due to the alternatives, and the change in annual operating costs due to the changes (in $2002).

BASELINE ALTERNATIVE BUS TRANSIT OPERATIONS

Table 6.2-3: Baseline Alternative Bus Transit Operating Plan, illustrates the changes between the Year 2020 Baseline Alternative and the existing conditions. Overall, minimal changes to the existing bus system are expected in the Central Corridor, as this area has a strong nucleus of bus transit services. The Limited Stop service on University Avenue, provided by Route 50, is projected to double its existing service. New service frequencies of 15-minutes in the peak periods and 30-minutes in the midday hours are expected. In addition, Route 94D, an express route that operates on I-94, would increase its service to 20-minute frequencies during the peak periods.

Table 6.2-3: Baseline Alternative Bus Transit Operating Plan

Route	Description	Type of Service	Service Frequencies (in minutes)				
			Peak	Midday	Evening	Saturday	Sunday
3	St Paul CBD-Front-Como-Minneapolis CBD	Local	10	15	30	30	30
16	St Paul CBD-University-Minneapolis CBD	Local	10	10	10	10	10
21	Lake-Selby-St Paul CBD	Local	7.5	15	15	10	10
50	St Paul CBD-University-Minneapolis CBD	Limited Stop	**15**	**30**	0	0	0
62	Rice-St Paul CBD	Local	30	30	30	30	60
63	Grand-St Paul CBD	Local	10	15	15	20	20
65	Rosedale-Dale-St Paul CBD	Local	30	30	30	60	60
67	Cleveland-Minnehaha-Minneapolis CBD	Local	30	30	30	60	60
68	Jackson-St Paul CBD	Local	30	30	30	30	30
76	Midway-St Paul CBD	Local	0	60	0	0	0
83	Rosedale-Lexington	Local/Limited Stop	30	30	0	60	0
84	Rosedale-Snelling-Airport-Mall of America	Local	15	15	15	20	20
87	Rosedale-Cleveland	Local	30	30	0	60	0
94B	St Paul CBD- I-94 -Minneapolis CBD	Express	30	30	0	20	30
94C	St Paul CBD- I-94 -Minneapolis CBD	Express	30	30	30	0	0
94D	St Paul CBD- I-94 -Minneapolis CBD	Express	**20**	30	0	0	0
134	Ford-Cretin- I-94 -Minneapolis CBD	Limited Stop	12	0	0	0	0
191	Lake-Marshall-St Paul CBD	Express	20	0	0	0	0
194	Snelling-I-94-Minneapolis CBD	Express	30	0	0	0	0
52F	Cretin-Snelling-University of Minnesota	Local	60	0	0	0	0
60	**Hamline-Victoria Loop**		**30**	**30**	**30**	**30**	**30**

Source: Metro Transit and BRW 2001.
BOLD indicates change in service

The only new route projected for the Baseline Alternative is the addition of Route 60, which is expected to be a circulator route serving the Hamline Avenue and Victoria Street area. This local service would operate with 30-minute frequencies. Overall, the Baseline Alternative bus transit operations plan is expected to need 34 additional bus vehicles to serve weekday trips, resulting in an increase in the annual operating cost of approximately $4.3 million (in $2002). Additional bus transit services may be added or reconfigured to serve the future demands of the transit market.

UNIVERSITY AVENUE LRT ALTERNATIVE - BUS TRANSIT OPERATIONS

The LRT bus transit operations plan, similar to that of the BRT Alternative, would have substantial impacts on the forecasted Baseline Alternative bus services, as shown in Table 6.2-4: LRT Alternative Bus Transit Operating Plan. Overall, 39 bus vehicles would be removed from the Central Corridor, although 26 new LRT vehicles would be added. Similar to the BRT Alternative, Route 16 would have reduced services and Route 50 services would be eliminated. Additionally, all Route 94BC bus services, including the peak period services have been projected for elimination. Route 94D is expected to continue operating with 20-minute service frequencies in each direction, though the midday service provided in the BRT Alternative would not be supplied. Route 194, an express route from Snelling Avenue to downtown Minneapolis, would also be eliminated. Overall, the net number of transit vehicles in the corridor would be reduced by a total of 13 vehicles.

Table 6.2-4: LRT Alternative Bus Transit Operating Plan

Route	Description	Type of Service	Service Frequencies (in minutes)				
			Peak	Midday	Evening	Saturday	Sunday
3	St Paul CBD-Front-Como-Minneapolis CBD	Local	10	15	30	30	30
16	St Paul CBD-University-Minneapolis CBD	Local	**20**	**30**	**30**	**30**	**30**
21	Lake-Selby-St Paul CBD	Local	7.5	15	15	10	10
50	St Paul CBD-University-Minneapolis CBD	Limited Stop	**0**	**0**	**0**	**0**	**0**
62	Rice-St Paul CBD	Local	30	30	30	30	60
63	Grand-St Paul CBD	Local	10	15	15	20	20
65	Rosedale-Dale-St Paul CBD	Local	30	30	30	60	60
67	Cleveland-Minnehaha-Minneapolis CBD	Local	30	30	30	60	60
68	Jackson-St Paul CBD	Local	30	30	30	30	30
76	Midway-St Paul CBD	Local	0	60	0	0	0
83	Rosedale-Lexington	Local/Limited Stop	30	30	0	60	0
84	Rosedale-Snelling-Airport-Mall of America	Local	15	15	15	20	20
87	Rosedale-Cleveland	Local	30	30	0	60	0
94B	St Paul CBD- I-94 -Minneapolis CBD	Express	**0**	**0**	**0**	**0**	**0**
94C	St Paul CBD- I-94 -Minneapolis CBD	Express	**0**	**0**	**0**	0	0
94D	St Paul CBD- I-94 -Minneapolis CBD	Express	20	0	0	0	0
134	Ford-Cretin- I-94 -Minneapolis CBD	Limited Stop	12	0	0	0	0
191	Lake-Marshall-St Paul CBD	Express	20	0	0	0	0
194	Snelling-I-94-Minneapolis CBD	Express	**0**	**0**	**0**	**0**	**0**
52F	Cretin-Snelling-University of Minnesota	Local	60	0	0	0	0
60	Hamline-Victoria Loop	Local	30	30	30	30	30
LRT	**Light Rail Transit Service**	LRT	**8**	**10**	**10**	**10**	**10**

Source: Metro Transit and BRW 2002.
BOLD indicates change in service.

The reduced bus services and lower operating costs of bus services associated with the LRT Alternative would result in a projected annual reduction in bus transit operations costs of over $10.2 million (in $2002) for the bus operations in the LRT Alternative when compared to the Baseline Alternative.

UNIVERSITY AVENUE BUSWAY/BRT ALTERNATIVE - BUS TRANSIT OPERATIONS

The bus service operations plans are expected to be impacted due to the implementation of the proposed BRT Alternative, as shown in Table 6.2-5: BRT Alternative Bus Transit Operating Plan. With the new service frequencies provided by the BRT, which are projected at every 6-minutes in each direction during the peak and midday periods, the existing services provided by Route 16 and Route 50 would be reduced. Route 16 is expected to decrease to 15-minute frequencies, instead of the 10-minute frequencies offered in the Baseline Alternative, and Route 50 services are expected to be taken over by the BRT service. In addition, the express services provided by Routes 94BC would be displaced during off-peak times, as the BRT would provide a comparable LOS.

Table 6.2-5: Busway/BRT Alternative Bus Transit Operating Plan

Route	Description	Type of Service	Service Frequencies (in minutes)				
			Peak	Midday	Evening	Saturday	Sunday
3	St Paul CBD-Front-Como-Minneapolis CBD	Local	10	15	30	30	30
16	St Paul CBD-University-Minneapolis CBD	Local	**30**	**30**	**30**	**30**	**30**
21	Lake-Selby-St Paul CBD	Local	7.5	15	15	10	10
50	St Paul CBD-University-Minneapolis CBD	Limited Stop	**0**	**0**	**0**	**0**	**0**
62	Rice-St Paul CBD	Local	30	30	30	30	60
63	Grand-St Paul CBD	Local	10	15	15	20	20
65	Rosedale-Dale-St Paul CBD	Local	30	30	30	60	60
67	Cleveland-Minnehaha-Minneapolis CBD	Local	30	30	30	60	60
68	Jackson-St Paul CBD	Local	30	30	30	30	30
76	Midway-St Paul CBD	Local	0	60	0	0	0
83	Rosedale-Lexington	Local/Limited Stop	30	30	0	60	0
84	Rosedale-Snelling-Airport-Mall of America	Local	15	15	15	20	20
87	Rosedale-Cleveland	Local	30	30	0	60	0
94B	St Paul CBD- I-94 -Minneapolis CBD	Express	30	**0**	**0**	**0**	**0**
94C	St Paul CBD- I-94 -Minneapolis CBD	Express	30	**0**	**0**	0	0
94D	St Paul CBD- I-94 -Minneapolis CBD	Express	20	30	0	0	0
134	Ford-Cretin- I-94 -Minneapolis CBD	Limited Stop	12	0	0	0	0
191	Lake-Marshall-St Paul CBD	Express	20	0	0	0	0
194	Snelling-I-94-Minneapolis CBD	Express	30	0	0	0	0
52F	Cretin-Snelling-University of Minnesota	Local	60	0	0	0	0
60	Hamline-Victoria Loop	Local	30	30	30	30	30
BRT	**Bus Rapid Transit Service**	BRT	**6**	**6**	**10**	**10**	**10**

Source: Metro Transit and BRW 2002.
BOLD indicates change in service

Overall, the Busway/BRT Alternative is forecasted to add 21 low-floor articulated bus vehicles during the weekday, but the net change in number of bus vehicles needed to serve the corridor would be reduced by a total of 2 vehicles, due to the change in services provided by the BRT.

Routes 16 and 50 would be the most impacted bus routes, with a reduction of 2 peak bus vehicles attributed to these two routes. The total changes in annual operating costs are expected to increase the net costs by approximately $1,600,000 (in $2002), including the operations of the new BRT low-floor articulated vehicles.

CONCLUSION TO PROJECTED BUS TRANSIT OPERATIONS

The express and limited stop bus services are projected to have the most impacts from the future Baseline Alternative and build alternatives. Minimal impacts are expected to the local routes, but they may be realigned in the future to serve the enhanced station sites after the implementation of the LRT or BRT. Changes in the demand requirements in vehicles, number of platform hours, and the total miles traveled generally assesses the total costs of each alternative. The results of the costs for each alternative are shown in Table 6.2-6: Annual Total Bus Operating Costs ($2002) of Alternatives.

Table 6.2-6: Annual Total Bus Operating Costs ($2002) of Alternatives

	2002 Existing	2020 Baseline	2020 LRT	2020 BRT
Bus Vehicle Requirements	143	162	123	160
Vehicle Total Costs	$ 8,165,972	$ 9,250,961	$ 6,952,611	$ 9,136,752
Annual Platform Hours Costs	$ 23,128,192	$ 25,545,207	$ 19,882,250	$ 26,607,610
Annual Total Miles Costs	$ 9,215,715	$ 9,979,333	$ 7,824,554	$ 10,642,234
Annual Total Operating Costs ($2002)	**$ 40,509,879**	**$ 44,775,501**	**$ 34,659,415**	**$ 46,386,596**

Source: Metro Transit and BRW 2002.

In general, the LRT Alternative would have the lowest annual bus operating costs of the three alternatives. This is because of the lower costs of operating the LRT and the minimizing of the number of bus services needed to serve the area. In fact, the annual operating costs of bus vehicles for the LRT Alternative are approximately 65 percent of the BRT Alternative.

6.3 RAIL TRANSIT RIDERSHIP AND OPERATING COSTS

UNIVERSITY AVENUE LRT ALTERNATIVE

Unlike the BRT Alternative, the LRT Alternative would operate in an exclusive right-of-way for the vast majority of its length between the two downtowns. The Central Corridor LRT would operate on common trackage with the Hiawatha LRT from the Minneapolis Multimodal Station to the Downtown East/Metrodome Station. The LRT would then transition to median operation over the Washington Avenue Bridge and enter a tunnel portal on the east side of the bridge to operate beneath Washington Avenue to the vicinity of Oak Street. Here the LRT would emerge from the tunnel just east of Oak Street and run parallel to the University of Minnesota transitway to 29th Avenue SE. From 29th Avenue SE, the LRT would proceed east on University Avenue in center median operation with stations at Westgate, Raymond, Fairview, Snelling, Lexington, Dale and Rice Street. The LRT would turn south on Robert Street then west on Columbus Avenue to Cedar Street where it would turn south to 4th Street. At 4th Street it would turn to the east and terminate in the vicinity of the Union Depot.

By operating in an exclusive right-of-way the LRT would have higher operating speeds and reduced running time between the two downtowns when compared to the BRT Alternative. Service would be operated at a 7 and a half-minute frequency during peak periods and 10-minute frequency during non-rush hour periods utilizing 2-car trains. On Saturdays, Sundays and holidays, LRT service would be provided every 10 minutes utilizing single car trains.

Similar to the BRT operating plan, service would be maintained on bus Route 16 but at 20-minute rather than 15-minute intervals to provide service to the intermediate stops along University Avenue between LRT stations. Service would also continue on I-94, although at a much lower level than BRT because the LRT does not have the same capacity and service reliability issues as BRT, at 20-minute intervals during rush hour periods only.

As indicated in Table 6.2-4, bus service on Routes 50, 94B, 94C and 194 are eliminated under the LRT Alternative.

A simulation of LRT operation on the final alignment resulted in a projected 43-minute running time between the terminals in downtown St. Paul and downtown Minneapolis. This running time coupled with the previously described operating plan results in 26 LRVs required to operate peak period schedules. The vehicles required by time period and day of the week are listed in Table 6.3-1: LRV Requirements.

Table 6.3-1: LRV Requirements

Service Period	Train Consist	LRVs Required
AM Peak	2-Car	26
Base	2-Car	20
PM Peak	2-Car	26
Evening	2-Car	20
Saturday	1-Car	10
Sunday/Holiday	1-Car	10

The foregoing LRT operating plan results in the provision of 70,300 annual platform hours of service and 1,650,000 annual vehicle miles of LRT service. To determine the cost of LRT service exclusive of feeder and supplemental bus services in the corridor, the Metro Transit cost model developed for LRT service on the Hiawatha Line was utilized. The application of this model indicates that the annual operating and maintenance (O&M) costs for the Central Corridor are projected to be $13.4 million in 2002 dollars. By escalating these costs at 4 percent per year, the annual LRT operation and maintenance costs would be $17 million in 2008 and $27 million in 2020. Again, it should be noted that these O&M costs do not include the costs of feeder and supplemental bus services in the corridor.

Table 6.3-2: Central Corridor Annual O&M Costs, illustrates the total cost of transit service in the Central Corridor including that of feeder and supplemental bus service for the various alternatives considered in this study effort.

Table 6.3-2: Central Corridor Annual O&M Costs

	2002	2008	2020
Existing	$40,500,000	–	–
Baseline	44,800,000	$56,700,000	$90,800,000
LRT	48,000,000	60,700,000	97,200,000
BRT	46,500,000	58,700,000	94,000,000

[1/] Year 2002 costs are inflated at 4 percent per year to derive 2008 and 2020 costs.

As indicated, the annual O&M costs associated with each of the alternatives is comparable. However, it should be noted that the quality of service, level of ridership and ability to accommodate further growth are vastly different among the three alternatives. For example, the BRT Alternative is severely constrained because of the inability to expand service beyond a 6-minute frequency and still provide a high quality service. The Baseline Alternative would continue to add vehicles to a severely congested roadway network resulting in a further deterioration of running times and diversion of trips to alternate modes.

Inasmuch as the annual O&M costs are comparable among the various alternatives, this will not be a determining factor in the selection of a Locally Preferred Alternative (LPA) to advance to the Preliminary Engineering (PE) phase of analysis.

As required by the Federal Transit Administration (FTA), ridership forecasts for all transit alternatives must assume completion of the adopted regional transportation plan outside of the Central Corridor. To this end, the following improvements were included in the background transportation network:

Commuter Rail:
- North Star
- Red Rock (Hastings to St. Paul)
- Dan Patch

Busways:
- Minneapolis – Northwest, Southwest, and East/Northeast
- St. Paul – Northeast

LRT:
- Hiawatha

BRT:
- Riverview

The service assumptions discussed in greater detail in section 6.2 and earlier in this section, may be summarized as follows:

Baseline Alternative:
- Continuation of Existing Services
- Improved North/South coverage

LRT Alternative:
- 7½-minute Peak Frequency
- 10-minute Off-peak Frequency
- 43-minute Running Time
- 20-minute I-94 Express Service

BRT Alternative:
- 6-minute Peak Frequency
- 6-minute Off-peak Frequency
- 50-minute Running Time
- 8½-minute I-94 Express Service

Utilizing these inputs/assumptions into the regional forecasting model produces the following results for the start-up year of 2008 and the forecast year of 2020:

In both Tables 6.3-3: 2008 Ridership Forecast, and 6.3-4: 2020 Ridership Forecast, the first column depicts the number of average weekday rides which would be taken on that particular alternative. For the Baseline Alternative, the average weekday rides is merely a summation of ridership on all the east/west bus service in the corridor. For the LRT and BRT Alternatives, the first column is the number of rides on that particular mode and the second column, remaining bus service, is the ridership which would utilize the remaining east/west bus service in the corridor, i.e. Route 16, Route 94B/C/D, etc.

Table 6.3-3: 2008 Ridership Forecast

Alternative	Weekday Rides		
	Alternative	Remaining Bus Service	Corridor Total
Baseline Alternative	28,400	--	28,400
LRT Alternative	32,100	6,000	38,100
BRT Alternative	26,500	9,200	35,700

Table 6.3-4: 2020 Ridership Forecast

Alternative	Weekday Rides		
	Alternative	Remaining Bus Service	Corridor Total
Baseline Alternative	33,700	--	33,700
LRT Alternative	38,100	6,700	44,800
BRT Alternative	31,200	12,400	43,600

The number of riders utilizing the remaining bus service is much higher for the BRT Alternative than the LRT Alternative because the BRT retains significantly more bus service in the corridor. As discussed in the operating plans, the BRT is limited in operation to a 6-minute headway. Thus, a much larger amount of service needs to be retained in the corridor to accommodate the volume of ridership being realized and this is reflected in this column.

As indicated, total corridor ridership in 2008 is 38,100 for the LRT and 35,700 for the BRT Alternatives. Of these, it is estimated that 3300 new riders for the LRT and 2300 new riders for the BRT would be diverted from autos. As shown in Table 6.3-5: New Transit Rider Summary, for the year 2020, the LRT Alternative would generate 3800 new rides versus 3100 for the BRT Alternative.

Table 6.3-5: New Transit Rider Summary (Trips Diverted from Autos)

Alternative	Forecast Year	
	2008	**2020**
LRT Alternative	3300	3800
BRT Alternative	2300	3100

A very important point to note is that the BRT Alternative is constrained at the 6-minute LOS frequency. This is to say that no additional ridership in rush hour time periods may be accommodated on the BRT system in 2020, as it will be at capacity.

An analysis of 2020 boarding and alighting LRT passengers by station was conducted to identify mode of access/egress by station as well as volumes by direction of travel. From this analysis it was determined that the greatest hourly volume would occur in the eastbound direction of travel in the evening rush hour time period. Also, the location that would experience the largest load of passengers on the train (maximum load point) occurs between Westgate and 29th Street. While the ridership breakdown, which appears in Table 6.3-6: Ridership Breakdown, is extracted from the LRT ridership forecast, similar but proportionately lower numbers would be experienced from a breakdown of BRT ridership.

Table 6.3-6: Ridership Breakdown

2020 Peak Hour Total LRT Boardings	
3075	Eastbound
2325	Westbound
2650	Maximum Load Eastbound
1750	Maximum Load Westbound

With respect to a breakdown of LRT ridership by station, the heaviest passenger volumes would occur at the University, the downtown stations, and Snelling Avenue. The dominant method of access/egress to the stations is people walking which comprises 68 percent of all trips followed by bus/rail transfers at 29 percent. Those individuals accessing stations by automobile is negligible, comprising only 3 percent of the total. This reflects the fact that there are no formal park-and-ride lots assumed and that such individuals are either dropped off at the station or are parking in a private lot or on a side street.

This distribution of trips by station is illustrated in Table 6.3-7: 2020 Daily Central Corridor Boardings/Alightings. Again, had an analysis of trip distribution been performed for the BRT Alternative, it would have generated similar findings.

Table 6.3-7: 2020 Daily Central Corridor Boardings/Alightings

Total Daily Access/Egress (Trip Ends)				
Station	**Walk**	**Bus/Rail**	**Auto**[2/]	**Total**
Minneapolis Multimodal	70	580	10	660
Warehouse District	1,750	180	20	1,950
Nicollet Mall	5,700	590	50	6,340
Government Center	2,800	820	10	3,630
Downtown East/Metrodome[1/]	1,580	1,830	40	3,450
West Bank	3,440	760	50	4,250
East Bank	9,260	350	90	9,700
Stadium Village	4,990	290	20	5,300
29th Avenue SE	1,220	110	120	1,450
Westgate	960	110	70	1,140
Raymond Avenue	1,400	710	130	2,240
Fariview Avenue	800	190	60	1,050
Snelling Avenue	3,170	3,350	550	7,070
Lexington Parkway	2,500	650	330	3,480
Dale Street	2,520	160	410	3,090
Rice Street	1,770	1,600	100	3,470
Capitol East	680	500	20	1,200
10th Street	1,250	20	10	1,280
6th Street	3,070	5,800	160	9,030
4th Street	2,020	1,350	20	3,390
Union Depot	1,130	1,840	60	3,030
TOTAL	**52,080**	**21,790**	**2,330**	**76,200**
	68%	29%	3%	
				38,100 Daily LRT Ridership

Maximum Load Point (Westgate to 29th Street) 10,750 per direction

1/ 1,425 Daily Transfers to/from Hiawatha LRT

2/ Estimated informal park/ride and drop-off/pick-up; no park-ride lots assumed