In addition to the intersection movements listed in the table above, some deficiencies were identified at the intersection of Snelling Avenue and University Avenue. The south approach through movement and right-turn movement were reported as expected to both operate at LOS C for the Baseline PM peak hour condition. However, due to the close proximity to the adjacent intersection to the south on Snelling Avenue and the expected queue lengths, these movements are expected to operate worse than LOS C and impact the operations at adjacent intersections.

Queuing Analysis

During the PM Peak hour, the locations where the queue lengths were reported to be exceeding the storage lengths or the distances between intersections included those movements listed in **Table 20**.

Table 20: Queue Lengths Exceeded in Baseline PM Peak Hour

Intersection	Movement	Queue Length exceeds Storage Length by (feet)
Fairview Avenue / University Avenue	North Approach LT South Approach LT West Approach RT	87 56 110
Snelling Avenue / University Avenue	North Approach TH Lanes, LT South Approach RT, TH Lanes, LT	308[a], 454 2000, 2012[a], 2157
Hamline Avenue / University Avenue	North Approach Shared TH/RT West Approach RT, TH Lanes	50 80, 17[a]
Lexington Parkway / University Avenue	North Approach TH Lanes, LT East Approach RT, LT South Approach TH Lanes, LT West Approach RT, TH Lanes, LT	418[a], 640 101, 137 632[a], 407 1944, 828[a], 700
Victoria Street /University Avenue	North Approach Shared LT/TH/RT South Approach Shared LT/TH/RT	50 45

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

[a] Average length used for movements with multiple lanes where the queue exceeded the storage length or distance between intersections.

Queue lengths that exceeded the available turn bay storage length by 50 feet or less were not considered deficiencies. The analysis assumed that the taper length leading into the turn bay would be able to accommodate these vehicles. Any through lane queue that was reported to exceed the available storage length, or distance to the adjacent intersection, was reported as a deficiency. A through lane queue indicates that vehicles are expected to be extending into the adjacent intersection and potentially impacting the operations at that intersection.

Potential Roadway Improvements

A general discussion of potential roadway improvements and mitigation measures to be considered for the Final EIS is included in the Potential Roadway Improvements and Mitigation Measure section later in this report.

BUILD CONDITION ANALYSIS

Two build alternatives were considered in the Draft EIS, busway/bus rapid transit and light rail transit. In general, these two transit technologies have the same operating characteristics and alignment, but because of minor differences in the technologies and operations, these alternatives were analyzed separately. BRT was analyzed to be operating in the median along University Avenue between Bedford Street and Rice Street in its own right-of-way. In the rest of the Corridor, the BRT will operate within the mix of vehicular traffic. The LRT system, on the other hand, will operate in the median between 29th Street and Robert Street on University Avenue, tunnel below the University of Minnesota East Bank campus, and side running in the central business districts. In addition, during the peak period, the BRT is expected to have a 4-minute headway, whereas the LRT is expected to have 7.5 minutes. The results of the future build conditions are documented below.

Grade Separation Analysis and Results

A grade separation analysis was conducted for the Forecast Year 2020 to determine the impact of implementing rail or bus transit technologies crossings, at-grade level, of the existing and future surface street system. As noted in the Methodology and Assumption Section, the headway assumed was 7.5 minutes for the LRT and 4 minutes for the BRT, resulting in a total of 16 LRT vehicles and 30 BRT vehicles per hour. This analysis was completed at the Traffic Analysis Committees 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.

None of the analysis locations 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 21** presents the results for the selected grade crossings analysis. The LRT analysis resulted in four locations reaching 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 5th Street in Downtown Minneapolis, which are a result of the combination of the Central Corridor system and the Hiawatha LRT system. It is expected that this combination will result in a 1-3/4 minute headway during the peak hour, essentially making 5th 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 be assessed in the Intersection LOS analysis, also.

The BRT analysis resulted in eight locations attaining a threshold Level 3, due to the increased frequency of BRT crossings with a 4-minute headway. As noted above, BRT is expected to be feasible for these crossings, as long as increased delays can be expected or vast improvements are made to the area. The same four locations that attained 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 Level 3 for BRT were located in the Vissim simulation area and will be looked at further in the Intersection analysis results. Other locations that reached this level were at Raymond Avenue, Dale Street, Rice Street, and 12th Street in Downtown St. Paul.

As noted in the Existing condition analysis, geometric improvements and traffic control measures to reduce the impact of the crossing gate activation may be desired, even though the threshold analysis does not indicate that any special measures need to be implemented.

Table 21: 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 #[2]	BRT Threshold #[2]
						Approach Volume	Vehicles per lane		
1	Hennepin Ave[3]	6th St S	4th St S	3	19,200	1730	580	3	3
3	5th Ave S[3]	6th St S	4th St S	3	22,200	2000	670	3	3
6	Malcolm Ave	Orlin Ave SE	4th 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.

Roadway Segment Analysis and Results

Roadway segments along the Central Corridor were analyzed for the forecasted build conditions for the Year 2020. The forecasted Average Daily Traffic (ADT) volumes were obtained by applying the growth rate, as noted in the Methodology Section. The Florida DOT LOS Handbook was used to determine the forecast build conditions level of service, 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 22.**

Table 22: Build Condition Segment Analysis Results

Map Reference Letter	Facility	Segment	Build BRT/LRT ADT[1]	Build BRT LOS	Build LRT LOS
A	5th St [2]	3rd Ave N to Park Ave	12,600	F	F
B	4th St [3]	Chicago Ave to Washington Ave Bridge	9,400	C	C
C	Washington Ave Bridge	4th St to Pleasant St Ramps	26,700	D	F
D	Washington Ave	Pleasant St Ramps to University Ave	21,400	D	D
E	University Ave	Washington Ave to Highway 280	29,700	D	D
F	University Ave	Highway 280 to Snelling Ave	29,700	D	D
G	University Ave	Snelling Ave to Lexington Ave	29,700	D	D
H	University Ave	Lexington Ave to Dale St	29,700	D	D
I	University Ave	Dale St to Rice St	32,700	E	E
J	University Ave	Rice St to Robert St	23,800	D	F
K	Robert St	University Ave to Columbus Ave	9,500	C	D
L	Columbus Ave	Robert St to Cedar Ave	1,500	C	C
M	Cedar Ave[4]	11th St to 4th St	8,900	C	E
N	4th St[4]	Cedar Ave to Sibley Ave	7,300	C	D

Source: Florida Department of Transportation Level of Service Handbook 1998 and URS Corp. 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
[4] Downtown St. Paul has road closures due to the proposed BRT/LRT alignment

Two roadway segments, 5th Street in Downtown Minneapolis and University Avenue between Dale Street and Rice St, are expected to operate below the acceptable LOS D with the proposed BRT Alignment. The geometry of 5th Street is proposed to be only 1-lane in the future, due to the implementation of the Hiawatha LRT line.

The LRT alignment analysis of roadway segments 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, the Washington Avenue Bridge, University Avenue between Rice Street and Robert Street, and Cedar Avenue are all expected to have operational issues due to the alignment. In these locations, the roadway geometry changes because of the LRT alignment, whereas the BRT will operate within the mix of vehicular traffic in these areas. The Washington Avenue Bridge, that operates with 4-lanes of bi-directional traffic in the existing, will be reduced to one-lane in each direction. On University Avenue between Rice Street and Robert Street, because of the Cedar Avenue Bridge Over University Avenue, the roadway can not be expanded without expensive reconstruction of the bridge and right-of-way acquisition. Potential mitigation measures or roadway improvements are addressed in the next section of this report.

Intersection Analysis and Results

The capacity analysis and queuing analysis were conducted to determine the Build condition impacts at key intersections in the corridor. As with the Existing and Baseline conditions, two separate results were reported for the capacity analysis. The more general analysis results of the macroscopic analysis utilizing the Synchro software and the microscopic analysis utilizing the SimTraffic software were reported together. The results of the detailed microscopic analysis utilizing Vissim for the Snelling Avenue / Lexington Parkway area were reported separately.

The Build condition analysis used the forecast turning movement volumes for the intersections included in the study. The Build condition volumes are included in **Appendix Table A1.** The volumes were used in conjunction with the proposed roadway geometry and optimized signal operations to develop the Build condition level of service and queue length results.

Bus Rapid Transit (BRT) Analysis and Results

General Intersection Analysis Results

The PM peak hour macroscopic intersection level of service was evaluated for the future Build condition (Year 2020) for the key intersections chosen by the Traffic Analysis Committee. The peak period geometry, traffic volumes, and signal timings were entered into Synchro. In addition, for some analysis intersections, the data was transferred into the SimTraffic modeling software to more accurately account for impacts due to closely spaced intersections, as noted in the methodology section.

The proposed alignment for the BRT alternative includes areas where the buses are proposed to be center running and areas where the buses will be operating with traffic. Consequently, in the areas where the BRT is operating in mixed traffic the analysis results are similar to the Baseline condition, and in other areas where the BRT is operating in exclusive lanes the analysis results are similar to the Build LRT condition. Because the signal timing is optimized for the Build condition, some overall intersection and/or intersection movement levels of service may actually improve compared to the Existing and Baseline conditions.

Intersection Level of Service

The results of the intersection level of service analysis are included in **Table 3**. During the PM peak hour, all intersections included in this analysis were expected to operate at a LOS D or better, except those intersections listed in **Table 23**.

Table 23: Build BRT PM Peak Hour Intersections at LOS E and F

Intersection	Overall Intersection LOS
Hennepin Avenue / 5th Street	E
Marquette Avenue / 5th 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

The queues created from the delays at the intersection of Rice Street and University Avenue are creating 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 level of service would be expected at the adjacent intersections as well.

Intersection Movement Level of Service

During the PM peak hour, all individual movements at each intersection were expected to operate at a LOS D or better, except those listed in **Table 24**.

Table 24: Build BRT PM Peak Hour Intersection Movements at LOS E and F

Intersection	Movement	Movement LOS
Hennepin Avenue / 5th Street	East Approach TH	F
Marquette Avenue / 5th 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

Queuing Analysis

During the PM Peak hour, the locations where the queue lengths were expected to exceed the storage lengths or the distances between intersections included those movements listed in **Table 25**.

Table 25: Queue Lengths Exceeded in Build BRT PM Peak Hour

Intersection	Movement	Queue Length exceeds Storage Length by (feet)
Hennepin Avenue / 5th Street	East Approach TH South Approach Shared LT/TH South Approach TH Lanes	474 258 258 [a]
Marquette Avenue / 5th Street	East Approach Shared TH/RT	103
Eustis Street / University Avenue	West Approach TH North Approach Shared LT/TH	61 381
Cromwell Avenue / University Avenue	West Approach LT, TH South Approach TH	103, 86 18
Raymond Avenue / University Avenue	West Approach LT East Approach TH, Shared TH/RT North Approach Shared LT/TH	60 201, 49 457
Dale Street / University Avenue	West Approach TH, Shared TH/RT East Approach RT South Approach LT	505, 2948 192 60
Marion Street / University Avenue	West Approach LT, RT East Approach RT South Approach LT North Approach RT	124, 3846 58 61 51
Rice Street / University Avenue	West Approach TH, Shared TH/RT East Approach Shared TH/RT South Approach Shared LT/TH, TH/RT North Approach Shared LT/TH, TH/RT	117, 1019 162 312, 315 411, 411
Constitution Avenue /University Avenue	East Approach Shared TH/RT	792
Robert Street / University Avenue	South Approach LT, Shared TH/RT	99, 78
11th Street / Cedar Street	West Approach Shared LT/TH, TH/RT	5, 20
Jackson Street / 4th Street	East Approach Shared LT/TH North Approach Shared LT/TH, TH	30 86, 45

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

[a] Average length used for movements with multiple lanes where the queue exceeded the storage length or distance between intersections.

Queue lengths that exceeded the available turn bay storage length by 50 feet or less were not considered deficiencies. The analysis assumed that the taper length leading into the turn bay would be able to accommodate these vehicles. Any through lane queue that was reported to exceed the available storage length, or distance to the adjacent intersection, was reported as a

deficiency. A through lane queue indicates that vehicles are expected to be extending into the adjacent intersection and potentially impacting the operations at that intersection.

Snelling Avenue / Lexington Parkway Area Analysis Results

The detailed microscopic analysis evaluated all intersections and access points that are currently located between Fairview Avenue and Victoria Street along University Avenue, which included the Snelling Avenue and Lexington Parkway intersections. As completed for the macroscopic traffic analyses, the PM peak period turning movement counts and proposed geometry of each intersection were input into the simulation software for the Build condition. The signal operations were optimized for each intersection to accommodate the future operating conditions. Because the signal timing is optimized for the Build condition, some overall intersection and/or intersection movement levels of service may actually improve compared to the Existing and Baseline conditions.

Intersection Level of Service

The results of the intersection level of service analysis are included in **Table 3**. During the PM peak hour, all intersections included in this analysis were expected to operate at a LOS D or better, except those intersections listed in **Table 26**.

Table 26: Build 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

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 a LOS E and impact the operations at adjacent intersections in the area.

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 level of service would be expected at the adjacent intersections as well.

Intersection Movement Level of Service

During the PM peak hour, all individual movements at each intersection were expected to operate at a LOS D or better, except those listed in **Table 27**.

Table 27: Build 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.

In addition to the intersection movements listed in the table above, some deficiencies were identified at the intersection of Snelling Avenue and University Avenue. The south approach through movement and right-turn movement were reported as expected to operate at LOS C and D, respectively, for the Build PM peak hour condition. However, due to the close proximity to the adjacent intersection to the south on Snelling Avenue and the expected queue lengths, these movements are expected to operate worse than LOS C and D and impact the operations at adjacent intersections.

Queuing Analysis

During the PM Peak hour, the locations where the queue lengths were reported to be exceeding the storage lengths or the distances between intersections included those movements listed in **Table 28**.

Table 28: Queue Lengths Exceeded in Build BRT PM Peak Hour

Intersection	Movement	Queue Length exceeds Storage Length by (feet)
Fairview Avenue / University Avenue	North Approach LT East Approach LT South Approach LT	130 273 104
Aldine Street / University Avenue	West Approach Shared TH/RT, TH	1350, 1350
Fry Street / University Avenue	West Approach Shared TH/RT, TH	2586, 2586
Snelling Avenue / University Avenue	North Approach TH Lanes, LT East Approach LT South Approach RT, TH Lanes, LT West Approach Shared TH/RT, TH, LT	25 [a], 123 494 2154, 2164 [a], 2386 3070, 3070, 3391
Pascal Street / University Avenue	South Approach LT	57
Albert Street / University Avenue	West Approach Shared TH/RT, TH	847, 847
Hamline Avenue / University Avenue	North Approach Shared TH/RT East Approach LT South Approach Shared TH/RT, TH, LT West Approach Shared TH/RT, TH, LT	85 524 140, 140, 87 1128, 1128, 183
Lexington Parkway / University Avenue	North Approach RT, TH Lanes, LT East Approach LT South Approach RT, TH Lanes West Approach Shared TH/RT, TH, LT	658, 959 [a], 429 466 768, 525 [a] 1595, 1595, 2604
Victoria Street /University Avenue	North Approach Shared LT/TH/RT South Approach Shared LT/TH/RT	48 61

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

[a] Average length used for movements with multiple lanes where the queue exceeded the storage length or distance between intersections.

Queue lengths that exceeded the available turn bay storage length by 50 feet or less were not considered deficiencies. The analysis assumed that the taper length leading into the turn bay would be able to accommodate these vehicles. Any through lane queue that was reported to exceed the available storage length, or distance to the adjacent intersection, was reported as a deficiency. A through lane queue indicates that vehicles are expected to be extending into the adjacent intersection and potentially impacting the operations at that intersection.

Potential Mitigation Measures

A general discussion of potential roadway improvements and mitigation measures to be considered for the Final EIS is included in the Potential Roadway Improvements and Mitigation Measure section later in this report.

Light Rail Transit (LRT) Analysis and Results

General Intersection Analysis Results

The PM peak hour macroscopic intersection level of service was evaluated for the future Build condition (Year 2020) for the key intersections chosen by the Traffic Analysis Committee along the alignments. The peak period geometry, traffic volumes, and signal timings were entered into Synchro. In addition, for some analysis intersections, the data was transferred into the SimTraffic modeling software to more accurately account for impacts due to closely spaced intersections, as noted in the methodology section.

Because the signal timing is optimized for the Build condition, some overall intersection and/or intersection movement levels of service may actually improve compared to the Existing and Baseline conditions.

Intersection Level of Service

The results of the intersection level of service analysis are included in **Table 3**. During the PM peak hour, all intersections included in this analysis were expected to operate at a LOS D or better, except those intersections listed in **Table 29**.

Table 29: Build LRT PM Peak Hour Intersections at LOS E and F

Intersection	Overall Intersection LOS
Hennepin Avenue / 5th 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

The queues created from the delays at the intersection of Rice Street and University Avenue are creating problems at the adjacent intersections along University Avenue at Marion Street, Constitution Avenue and Robert Street. Therefore, if the conditions are improved at the Rice Street / University Avenue intersection, then improvements in the level of service would be expected at the adjacent intersections as well.

Intersection Movement Level of Service

During the PM peak hour, all individual movements at each intersection were expected to operate at a LOS D or better, except those listed in **Table 30**.

Table 30: Build LRT PM Peak Hour Intersection Movements at LOS E and F

Intersection	Movement	Movement LOS
Hennepin Avenue / 5th Street	South Approach LT and TH East Approach TH	E F
Marquette Avenue / 5th 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.

Queuing Analysis

During the PM Peak hour, the locations where the queue lengths were expected to exceed the storage lengths or the distances between intersections included those movements listed in **Table 31**.

Table 31: Queue Lengths Exceeded in Build LRT PM Peak Hour

Intersection	Movement	Queue Length exceeds Storage Length by (feet)
Hennepin Avenue / 5th Street	East Approach TH, RT South Approach Shared LT/TH South Approach TH Lanes	427, 111 299 299 [a]
Marquette Avenue / 5th Street	East Approach TH South Approach Shared LT/TH South Approach TH Lanes	224 22 22 [a]
Eustis Street / University Avenue	West Approach TH North Approach Shared LT/TH	61 381
Cromwell Avenue / University Avenue	West Approach LT, TH South Approach TH	103, 86 18
Raymond Avenue / University Avenue	West Approach LT East Approach TH, Shared TH/RT North Approach Shared LT/TH	60 201, 49 457
Dale Street / University Avenue	West Approach TH, Shared TH/RT East Approach RT South Approach LT	505, 2948 192 60
Marion Street / University Avenue	West Approach LT, RT East Approach RT South Approach LT North Approach RT	124, 3846 58 61 51
Rice Street / University Avenue	West Approach TH, Shared TH/RT East Approach Shared TH/RT South Approach Shared LT/TH, TH/RT North Approach Shared LT/TH, TH/RT	117, 1019 162 312, 315 411, 411
Constitution Avenue / University Avenue	East Approach Shared TH/RT	792
Robert Street / University Avenue	East Approach Shared LT/TH, TH/RT South Approach LT, Shared TH/RT	76, 135 981, 1101
12th Street / Cedar Street	East Approach Shared LT/TH, TH East Approach Shared TH/RT	43, 43 43
11th Street / Cedar Street	West Approach Shared LT/TH, TH/RT	212, 238
7th Street / Cedar Street	East Approach Shared LT/TH, TH North Approach Shared LT/TH/RT	63, 63 615
6th Street / Cedar Street	East Approach TH Lanes	16 [a]
5th Street / Cedar Street	North Approach LT	380

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

[a] Average length used for movements with multiple lanes where the queue exceeded the storage length or distance between intersections.

Queue lengths that exceeded the available turn bay storage length by 50 feet or less were not considered deficiencies. The analysis assumed that the taper length leading into the turn bay would be able to accommodate these vehicles. Any through lane queue that was reported to exceed the available storage length, or distance to the adjacent intersection, was reported as a deficiency. A through lane queue indicates that vehicles are expected to be extending into the adjacent intersection and potentially impacting the operations at that intersection.

Snelling Avenue / Lexington Parkway Area Analysis Results

The detailed microscopic analysis evaluated all intersections and access points that are currently located between Fairview Avenue and Victoria Street along University Avenue, which included the Snelling Avenue and Lexington Parkway intersections. As completed for the macroscopic traffic analyses, the PM peak period turning movement counts and proposed geometry of each intersection were input into the simulation software for the Build condition. The signal operations were optimized for each intersection to accommodate the future operating conditions. Because the signal timing is optimized for the Build condition, some overall intersection and/or intersection movement levels of service may actually improve compared to the Existing and Baseline conditions.

Intersection Level of Service

The results of the intersection level of service analysis are included in **Table 3**. During the PM peak hour, all intersections included in this analysis were expected to operate at a LOS D or better, except those intersections listed in **Table 32**.

Table 32: Build 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

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 a LOS E and impact the operations at adjacent intersections in the area.

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 level of service would be expected at the adjacent intersections as well.

Intersection Movement Level of Service

During the PM peak hour, all individual movements at each intersection were expected to operate at a LOS D or better, except those listed in **Table 33**.

Table 33: Build 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 condition.

In addition to the intersection movements listed in the table above, some deficiencies were identified at the intersection of Snelling Avenue and University Avenue. The south approach through movement and right-turn movement were reported as expected to operate at LOS C and D, respectively, for the Build PM peak hour condition. However, due to the close proximity to the adjacent intersection to the south on Snelling Avenue and the expected queue lengths, these movements are expected to operate worse than LOS C and D and impact the operations at adjacent intersections.

Queuing Analysis

During the PM Peak hour, the locations where the queue lengths were reported to be exceeding the storage lengths or the distances between intersections included those movements listed in **Table 34**.

Table 34: Queue Lengths Exceeded in Build LRT PM Peak Hour

Intersection	Movement	Queue Length exceeds Storage Length by (feet)
Fairview Avenue / University Avenue	North Approach LT East Approach LT South Approach LT	130 273 104
Aldine Street / University Avenue	West Approach Shared TH/RT, TH	1350, 1350
Fry Street / University Avenue	West Approach Shared TH/RT, TH	2586, 2586
Snelling Avenue / University Avenue	North Approach TH Lanes, LT East Approach LT South Approach RT, TH Lanes, LT West Approach Shared TH/RT, TH, LT	25 [a], 123 494 2154, 2164 [a], 2386 3070, 3070, 3391
Pascal Street / University Avenue	South Approach LT	57
Albert Street / University Avenue	West Approach Shared TH/RT, TH	847, 847
Hamline Avenue / University Avenue	North Approach Shared TH/RT East Approach LT South Approach Shared TH/RT, TH, LT West Approach Shared TH/RT, TH, LT	85 524 140, 140, 87 1128, 1128, 183
Lexington Parkway / University Avenue	North Approach RT, TH Lanes, LT East Approach LT South Approach RT, TH Lanes West Approach Shared TH/RT, TH, LT	658, 959 [a], 429 466 768, 525 [a] 1595, 1595, 2604
Victoria Street /University Avenue	North Approach Shared LT/TH/RT South Approach Shared LT/TH/RT	48 61

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

[a] Average length used for movements with multiple lanes where the queue exceeded the storage length or distance between intersections.

Queue lengths that exceeded the available turn bay storage length by 50 feet or less were not considered deficiencies. The analysis assumed that the taper length leading into the turn bay would be able to accommodate these vehicles. Any through lane queue that was reported to exceed the available storage length, or distance to the adjacent intersection, was reported as a deficiency. A through lane queue indicates that vehicles are expected to be extending into the adjacent intersection and potentially impacting the operations at that intersection.

Potential Mitigation Measures

A general discussion of potential roadway improvements and mitigation measures to be considered for the Final EIS is included in the Potential Roadway Improvements and Mitigation Measure section later in this report.

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 level of service, intersection movement level of service, or the queue lengths to acceptable conditions (see previous discussion on Defining Impacts). Potential Roadway Improvements are measures to improve traffic conditions due to the expected background traffic as a part of the Baseline condition. Potential Mitigation Measures are measures to improve traffic conditions due to expected project-generated traffic impacts as a part of the BRT and/or LRT Build conditions. A list of improvements was developed with the help of the Traffic Analysis Committee to include in the Draft EIS text as a general list to address traffic related impacts.

For this report, each proposed potential improvement developed for the Draft EIS includes an example of locations throughout the corridor where impacts were identified and the improvements could be applied for future analysis. However, no analysis of improvements or mitigation is intended to be conducted for the Draft EIS.

With the direction to proceed into Final EIS, the intent of the project team would be, with the help of the Traffic Analysis Committee, to develop procedures 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 begin to identify the potential benefits of implementing improvements along the project corridor.

The following list of improvements and mitigation measures were developed with the Traffic Analysis Committee. In general, the approach toward addressing intersection operational impacts would be to evaluate the least obtrusive and less expensive improvements first before resorting to drastic, high impact measures, which create a lot of additional project cost and delay or elongate construction of the corridor. Depending on the specific location, the order of the list below provides a stepped approach toward addressing an intersection with general impacts.

- 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

A more detailed description of each improvement and, in some cases, potential issues with the mitigation is discussed below. Also included, as indicated previously, is an example of where each improvement could be evaluated for potential benefits in future analysis. Any mitigation should take into consideration the impact to on-street parking as well as the traffic operations. In an area where currently on-street parking is critical to the success of some businesses, any

improvement that would require the loss of additional on-street parking stalls, without replacing the parking with off-street spaces, should be evaluated thoroughly.

Modify Signal Operations

One of the least expensive and obtrusive improvements could be to modify the signal operations. The benefits of this improvement would be expected to be limited since the Baseline and Build conditions analysis already included spot optimized timing including increased cycle lengths and splits, and adjusted offsets where necessary. However, this improvement could include additional signal timing and phasing optimization, addition of cross-street detectors and upgrade of controllers, software and hardware. Applying priority timing for the LRT and/or BRT vehicles could improve transit operations but, depending on the choice of controller used, could also adversely impact traffic operations.

An example of phasing optimization that could be implemented at certain intersections along the corridor could be to operate lagging left-turn phases or modified split-phased operations for a cross street. A good example of a location that potentially could benefit from additional signal timing and phasing modifications is the Raymond Avenue / University Avenue intersection with a heavy north approach left-turn movement opposed by a moderately low south approach volume.

Far Side Intersection Bus Stops

There are obvious benefits and shortcomings for creating far side intersection bus stops. At select locations along University Avenue, the elimination of bus stops in the shared through and right-turn lane would significantly lessen the impact the bus operations would be expected to have on right-turn movements and through movements at intersections. However, the introduction of far side bus stops would most likely result in displacement of on-street parking spaces or could interfere with planned station locations in order to create a bus pullout area.

An example of an intersection with an existing near side bus stop that could benefit from a far side operations is the Fairview Avenue / University Avenue intersection.

Limit Development Trips

The forecast rate applied to the traffic volumes develop the background forecast growth along the project corridor indicates a substantial increase to an area primarily already built out. The current master planning for the corridor, especially along University Avenue, has the intention to stimulate new development or redevelopment of areas. Therefore, considering limiting development trips to the area would go against the current desire to encourage development along the corridor.

The corridor, especially along University Avenue, is already congested and shows signs of minimal growth potential based on the current roadways and land use conditions. However, redevelopment of certain areas has the potential of generating the forecast growth projected in this report. Therefore, from a traffic standpoint the entire corridor could benefit from limiting development trips, but economically the area would be left stagnate.

Increase Turn Bay Lengths

Many of the turn bay lengths for the proposed University Avenue roadway were minimized in an attempt to limit the impact to on-street parking stalls and in order to locate transit stations. However, increasing turn bay lengths could prevent through vehicle queues from blocking access to turn bays and to allow additional storage to better utilize signalized turn phases. In addition, longer turn bay lengths could prevent turn queues from impacting the progression of vehicles in the adjacent through lane. The down side of providing longer turn bays are the reasons the storage area was limited to begin with—the potential loss of on-street parking and impact on the transit station locations.

An example of a location with insufficient turn bay lengths that could potentially benefit from this mitigation is at the Hamline Avenue / University Avenue intersection.

Additional Cross-Street Lanes

The addition of lanes on the cross-streets along the corridor could improve the operating conditions both on the cross street and the mainline. Additional cross-street lanes could be constructed in the form of exclusive left or right-turn lanes or even an additional through lane. The purpose of the additional lanes would be to reduce the required green time for the cross-street traffic and allow additional green time for the major movements. The addition of lanes could extend for blocks along the cross-street or be cut in as a minimal turn bay, and could come at the cost of acquiring right-of-way or potentially replacing on-street parking stalls.

An example of a cross-street location that could benefit from the addition of turn lanes is at the Victoria Street / University Avenue intersection. The north and south approaches on Victoria Street have substantial volumes confined to one lane of approach.

Additional Mainline Turn Lanes

Additional mainline turn lanes could be constructed in the form of right-turn lanes to separate the right-turning vehicles from the through vehicles or additional exclusive left-turn lanes for more storage. The purpose of the additional turn lanes would be to minimize impacts to through vehicles, but could come at the cost of acquiring right-of-way.

An example of a location where the addition of mainline turn lanes could result in a substantial benefit to the traffic operations is at the Malcolm Avenue / University Avenue intersection. Currently, the geometry at the Malcolm Avenue intersection on University Avenue is a shared through / left-turn lane and a shared through / right-turn lane. Because the transit operating guidelines require all turn movements across the BRT or LRT alignment to be protected movements only, the intersection of Malcolm Avenue and University Avenue is required to be split phased on University Avenue. The addition of exclusive left-turn lanes would be expected to improve the efficiency of the signal operations and thus improve the level of service.

Diverted Trips

Another improvement could be to consider diverting trips away from problem intersections and onto either existing parallel roadways or new parallel roadways. This mitigation is already in practice for the northbound left-turn movement at the intersection of University Avenue and Snelling Avenue by utilizing Spruce Tree Avenue and Fry Street on the south and west side of the

main intersection. The diverted trips could result in additional traffic through residential areas adjacent to the corridor and additional costs for acquiring right-of-way. In order to obtain the full benefit from diverting trips, turn restrictions could be implemented at the problem intersection.

The Snelling Avenue / University Avenue intersection is not only an example of a location where diverted trips improve the operating conditions currently, but where additional diversions would be expected to improve conditions even more. In addition, the Lexington Avenue / University Avenue intersection, which has the highest volume of traffic of any of the intersections in the corridor, could also potentially benefit from the implementation of diverted trips and turn restrictions.

Improve Parallel Roadways

Improving parallel roadways along the corridor would support the ability to divert through trips away from the corridor. Potential existing roadways identified by the Traffic Analysis Committee, which have the potential of diverting through trips away from University Avenue, include Larpenteur Avenue, Pierce Butler Road, Energy Park Drive, and St. Anthony Avenue and Concordia Avenue, the frontage roads to I-94. In addition, new connections to existing roadways immediately adjacent to University Avenue similar to Spruce Tree Avenue and Fry Street could be identified.

The improvement of parallel roadways would be expected to benefit the entire project corridor. However, any improvements would most likely come at a steep cost and potentially require obtaining right-of-way and revising land uses in certain areas.

Reduce Access Locations

The practice of reducing access locations along the corridor would condense the number of turn maneuvers onto and off of University Avenue, which would be expected to increase the capacity of the roadway. However, closing access points limits mobility and access in the area and could result in additional traffic diverted to side streets or neighborhoods.

An example of a location that could benefit from reducing the number of access driveways and roadways could be around the Dale Street / University Avenue intersection. The balanced volumes on Dale Street and University Avenue on the intersection approaches has the potential to create long queues and a volatile condition that can be impacted severely by any additional conflicts such as vehicles turning in and out of the queues.

Additional Through Lanes

The addition of through lanes on the mainline roadways would be expected to be an extremely costly mitigation, because it could require significant right-of-way purchases. Prior to evaluating the impact of widening a roadway such as University Avenue over an extended distance, the benefits of adding turn lanes and diverting trips should carefully be considered. The addition of a turn lane could also require right-of-way purchases, but for a much more limited segment. To be effective, the addition of a through lane must extend through a significant portion of a corridor, preferably between major cross-street intersections. Otherwise, the addition of a through lane for a short segment could potentially make conditions worse by creating merge locations.

An example of a location where the addition of a through lane could be beneficial is at the intersection of Rice Street and University Avenue. The current preliminary alignment indicates the need to drop one of the existing through lanes along University Avenue east of Rice Street. Consequently, the traffic operations are expected to be very poor at the Rice Street intersection, which impacts adjacent intersections.

Summary of Improvements

Not only could each of the improvements discussed 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. However, this level of mitigation would be considered extreme and require severe modifications to the area to upgrade the roadways to handle access ramp conditions and to obtain the adequate right-of-way for construction of ramps and structures. 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.

APPENDIX

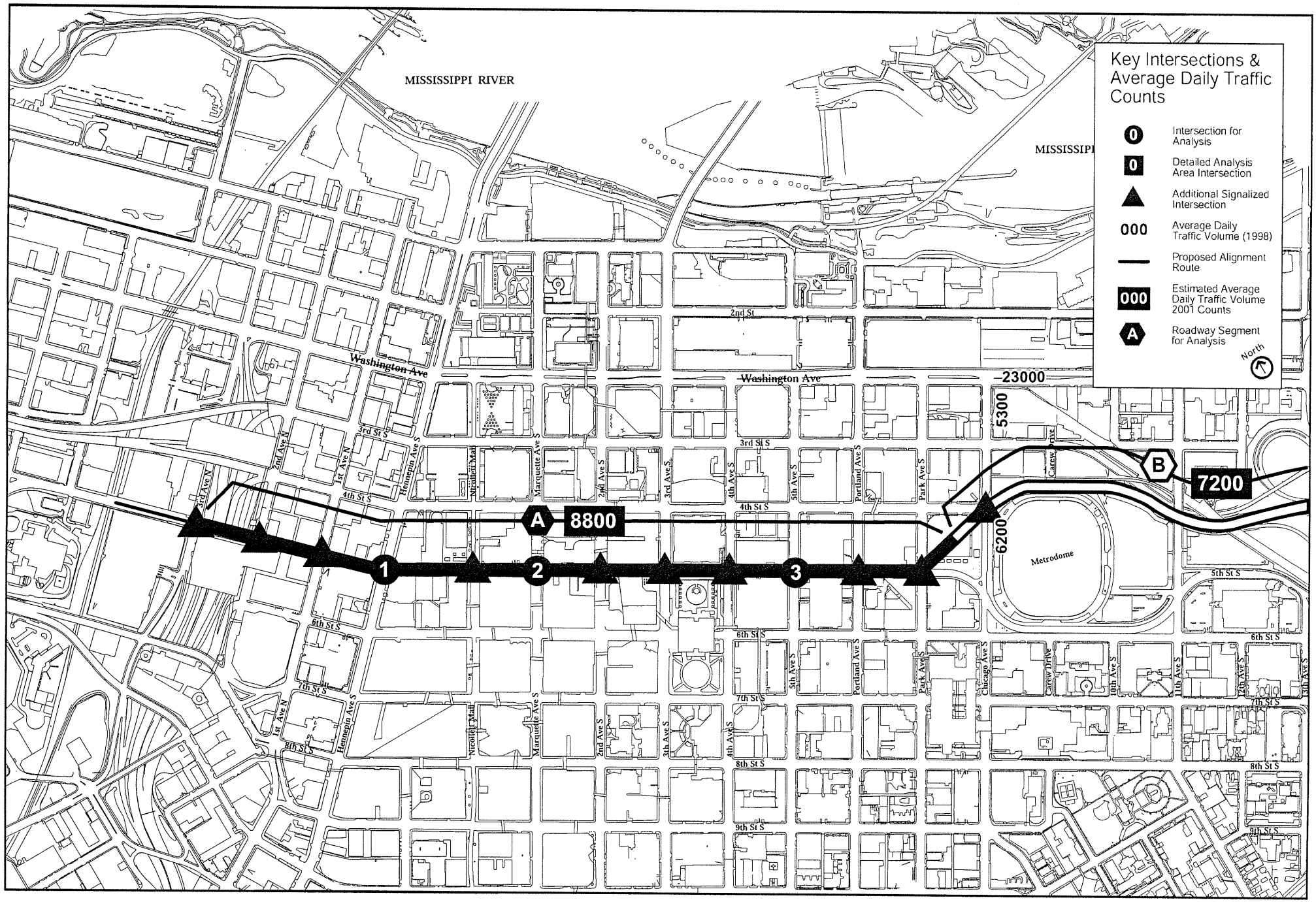
- Central Corridor Intersections and Segments **Figures A1 through A11**

- Existing, Baseline and Build Condition Volumes **Table A1**

- Detailed LOS Results Tables
  - Existing Condition
  - Baseline Condition
  - Build Condition

- Detailed Queue Result Tables
  - Existing Condition
  - Baseline Condition
  - Build Condition

Central Corridor Intersections and Segments Figures A1 through A11



THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A1

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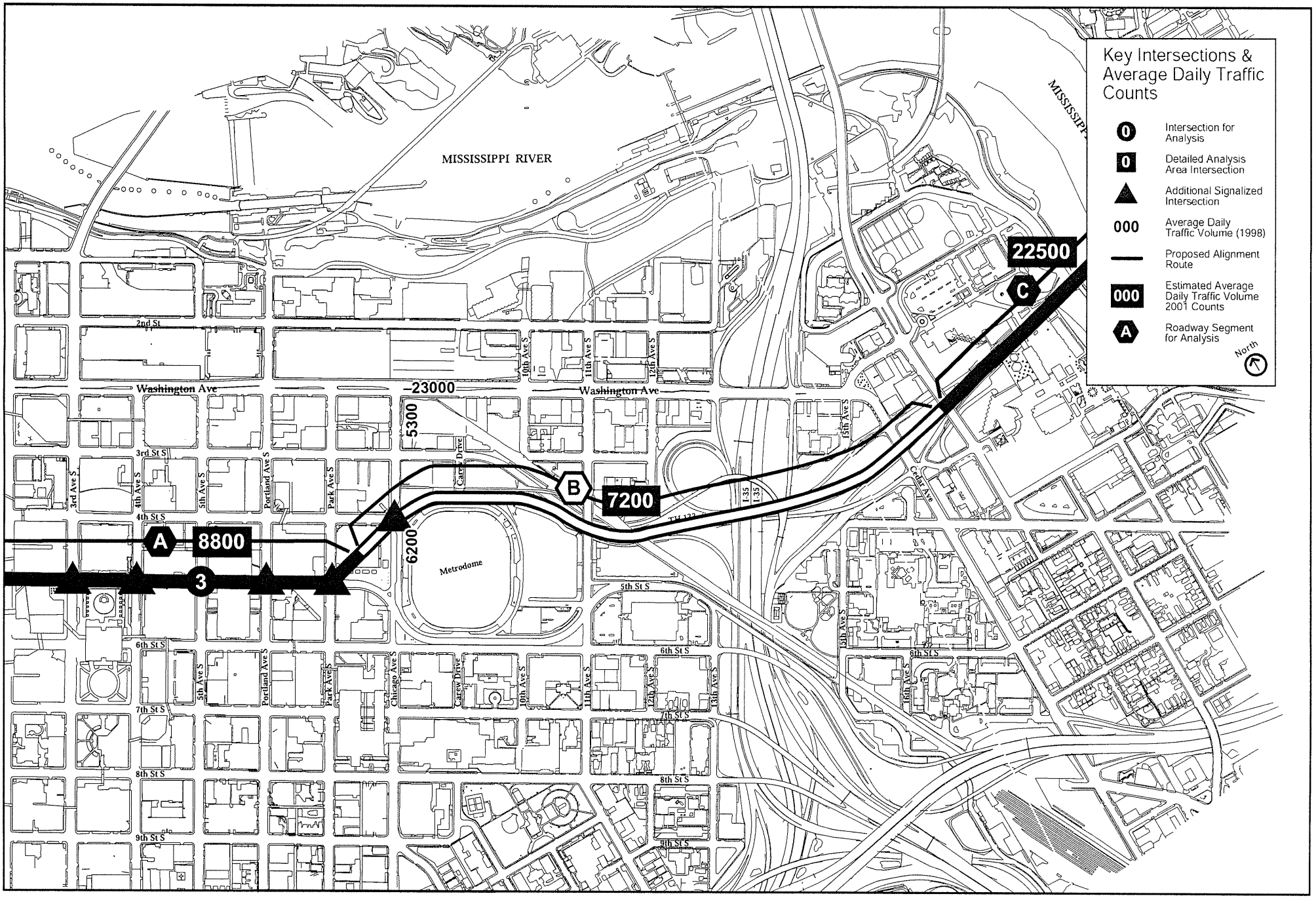

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A2

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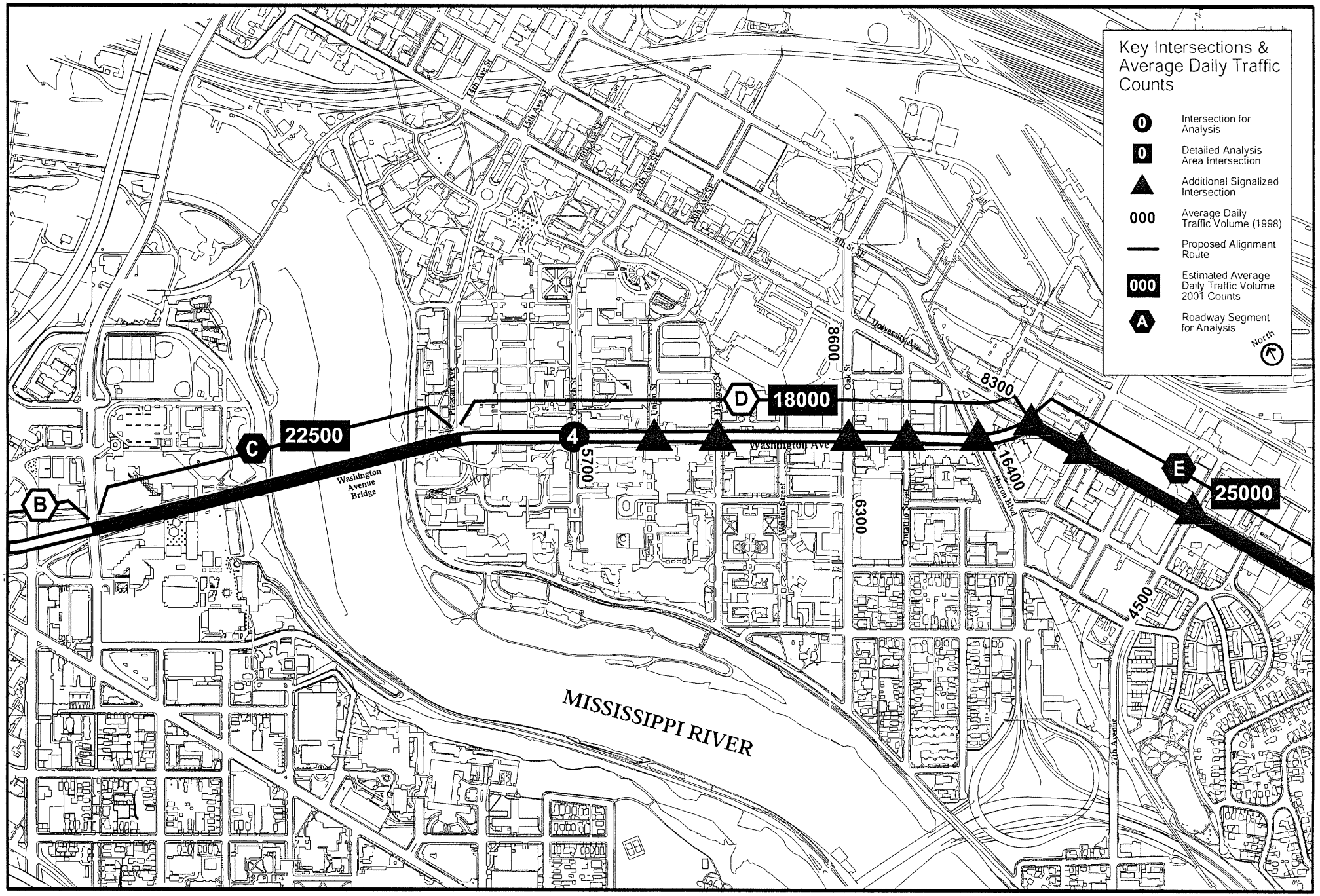

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A3

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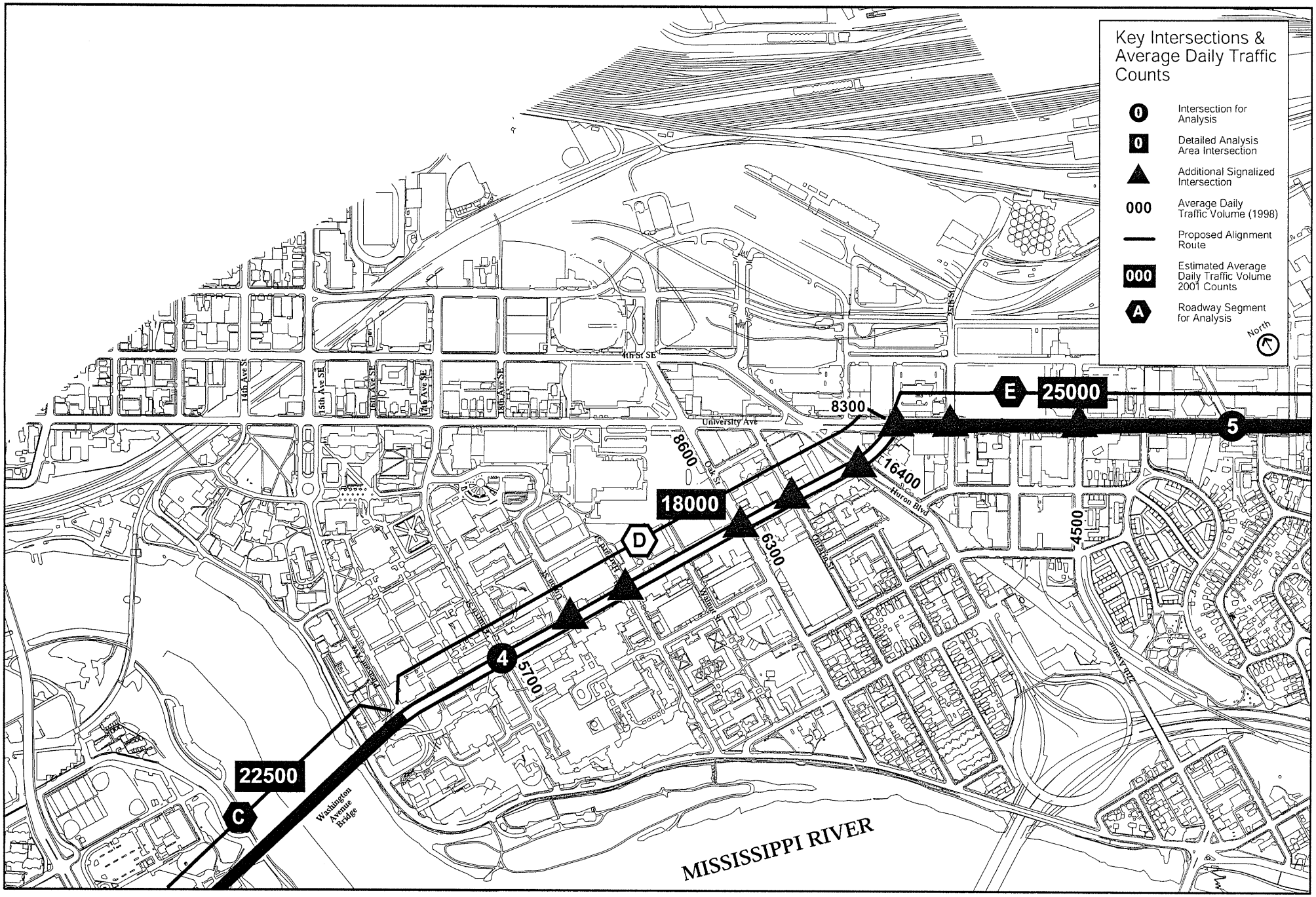

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A4

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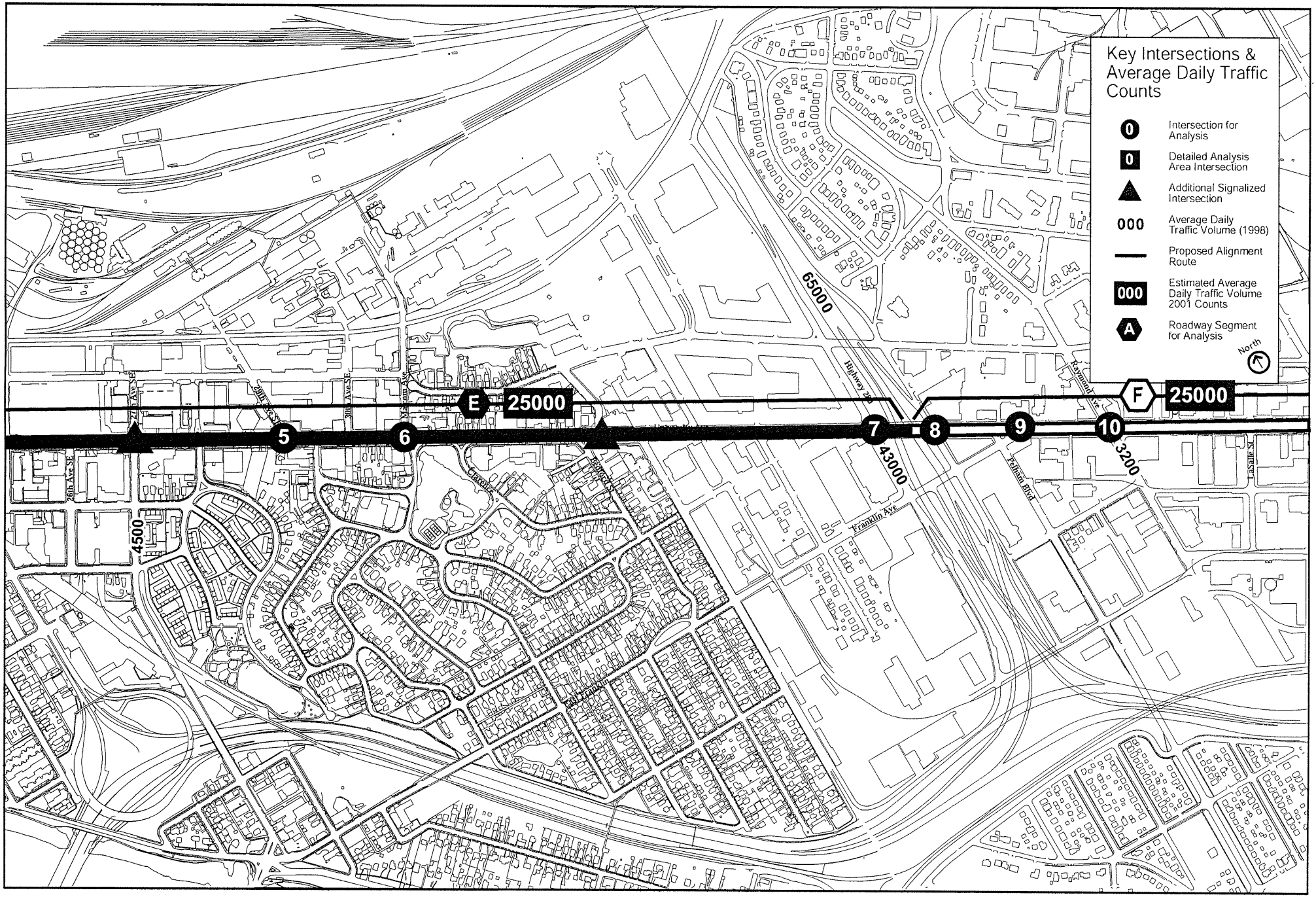

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A5

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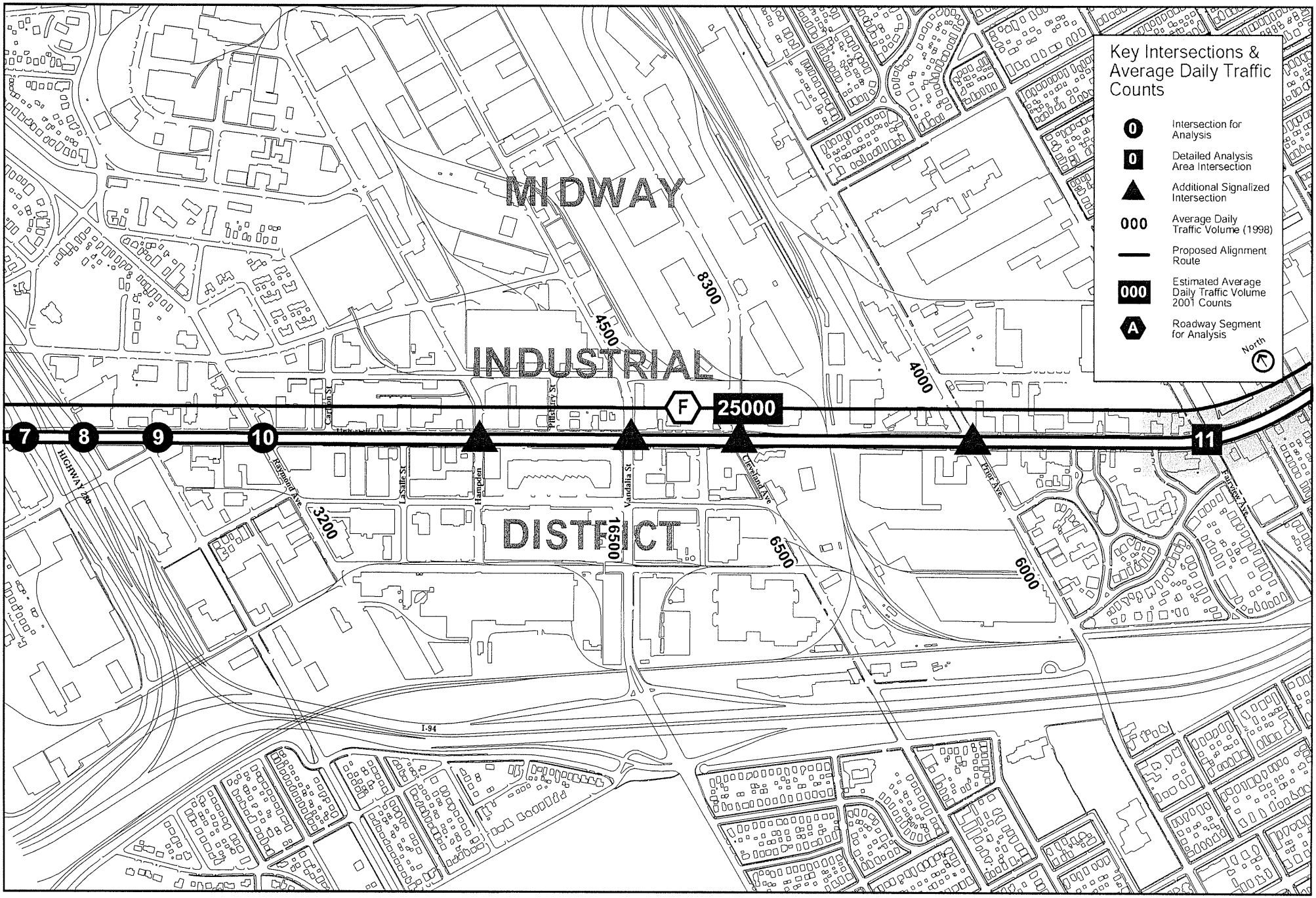

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A6

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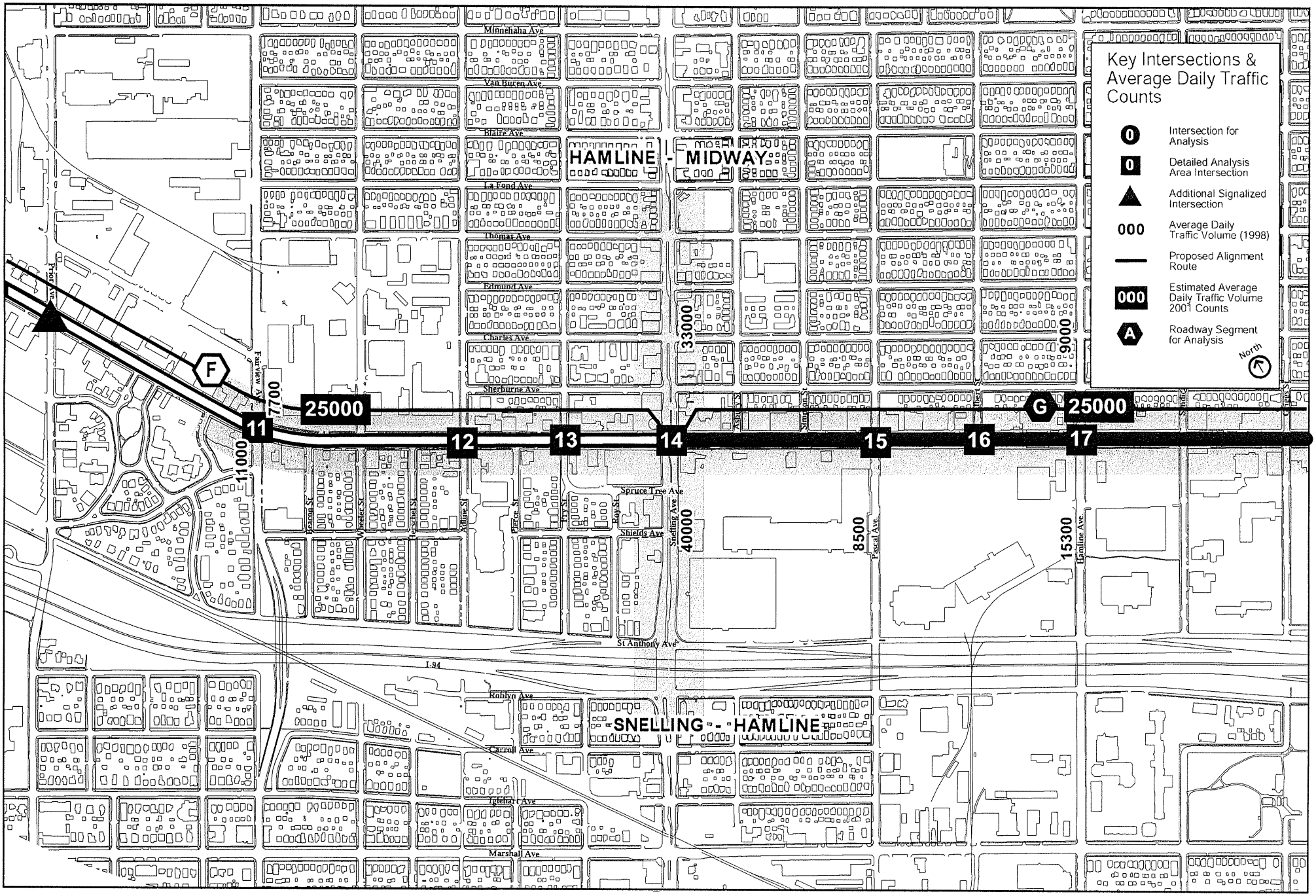

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A7

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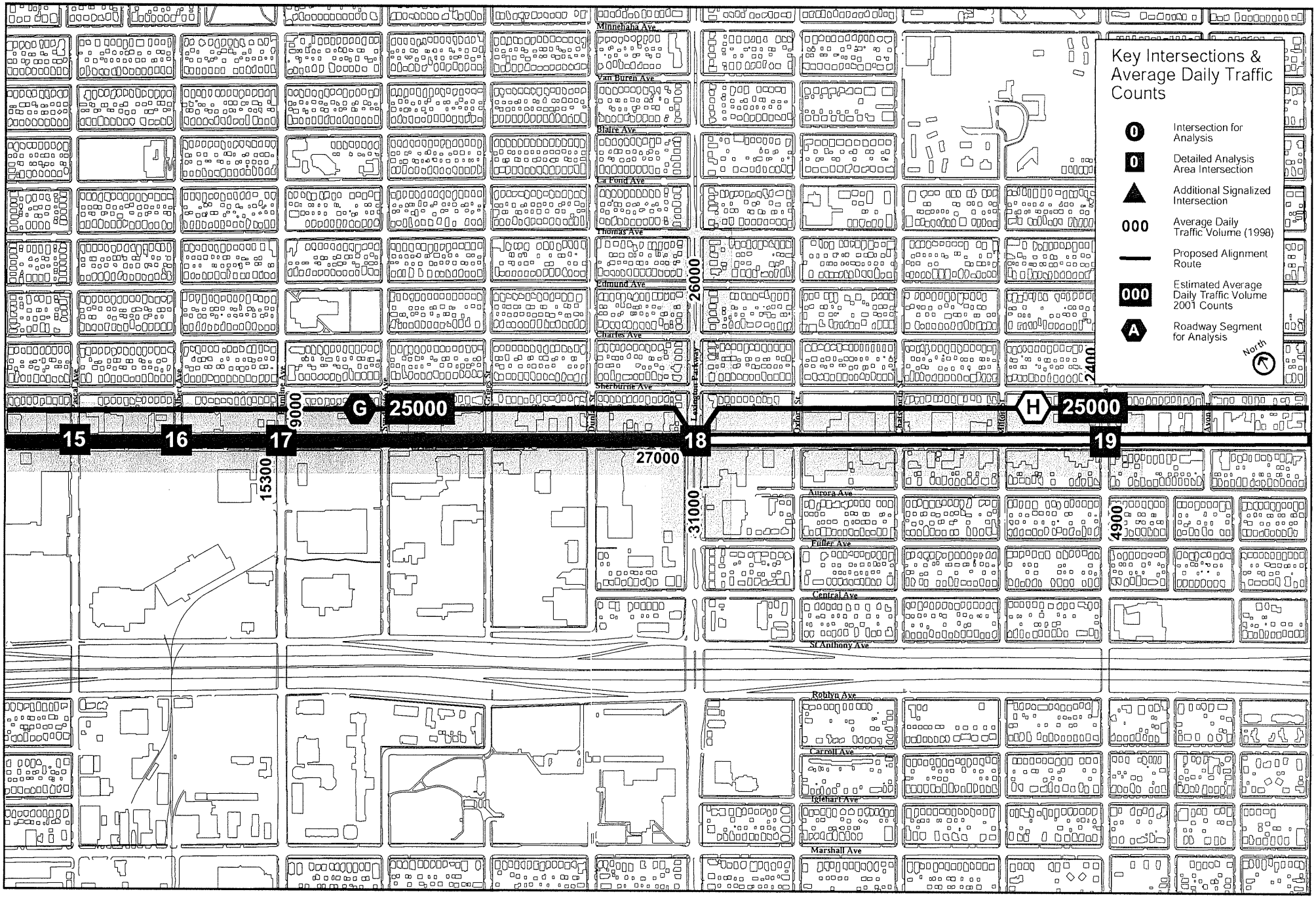

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A8

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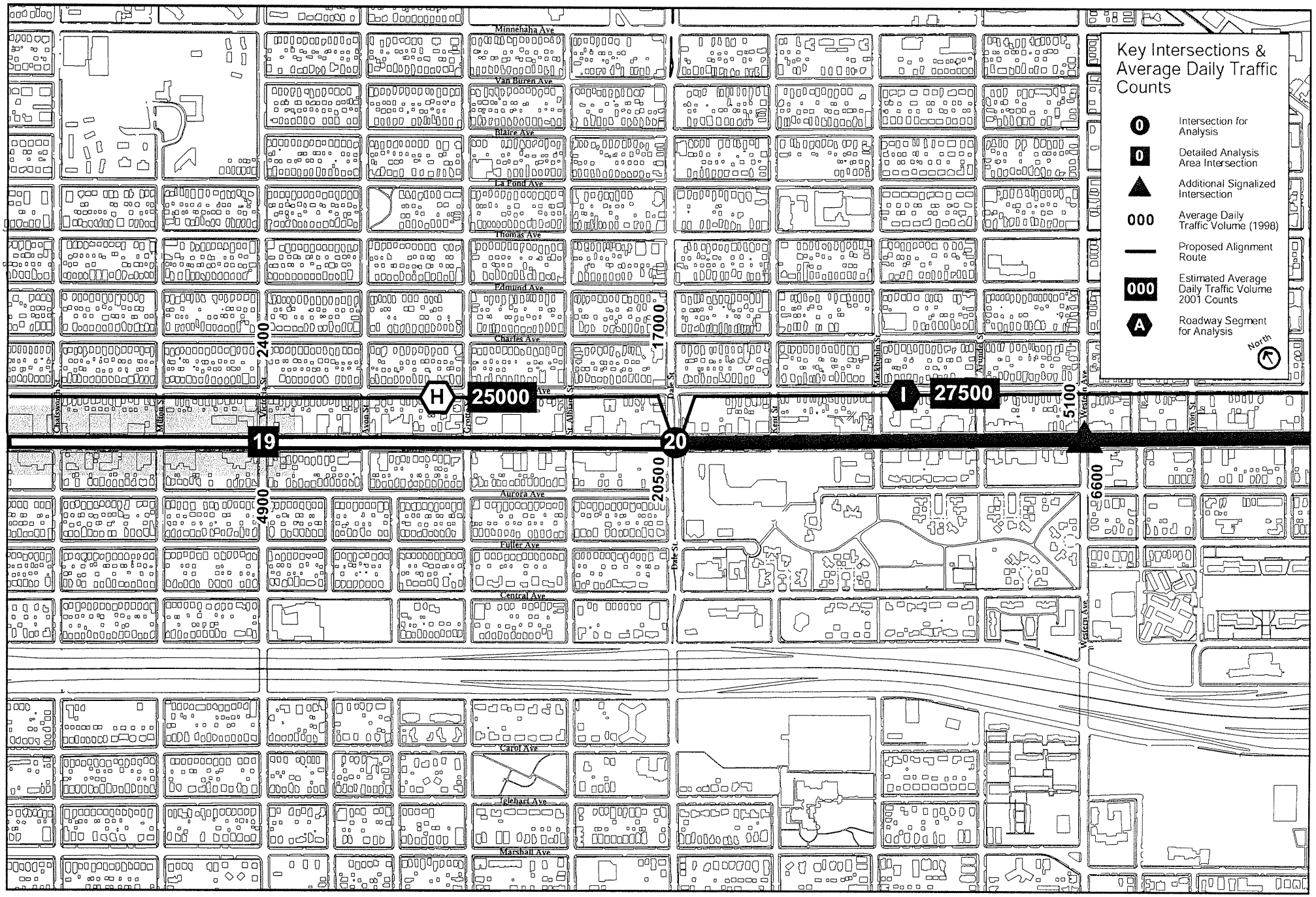

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A9

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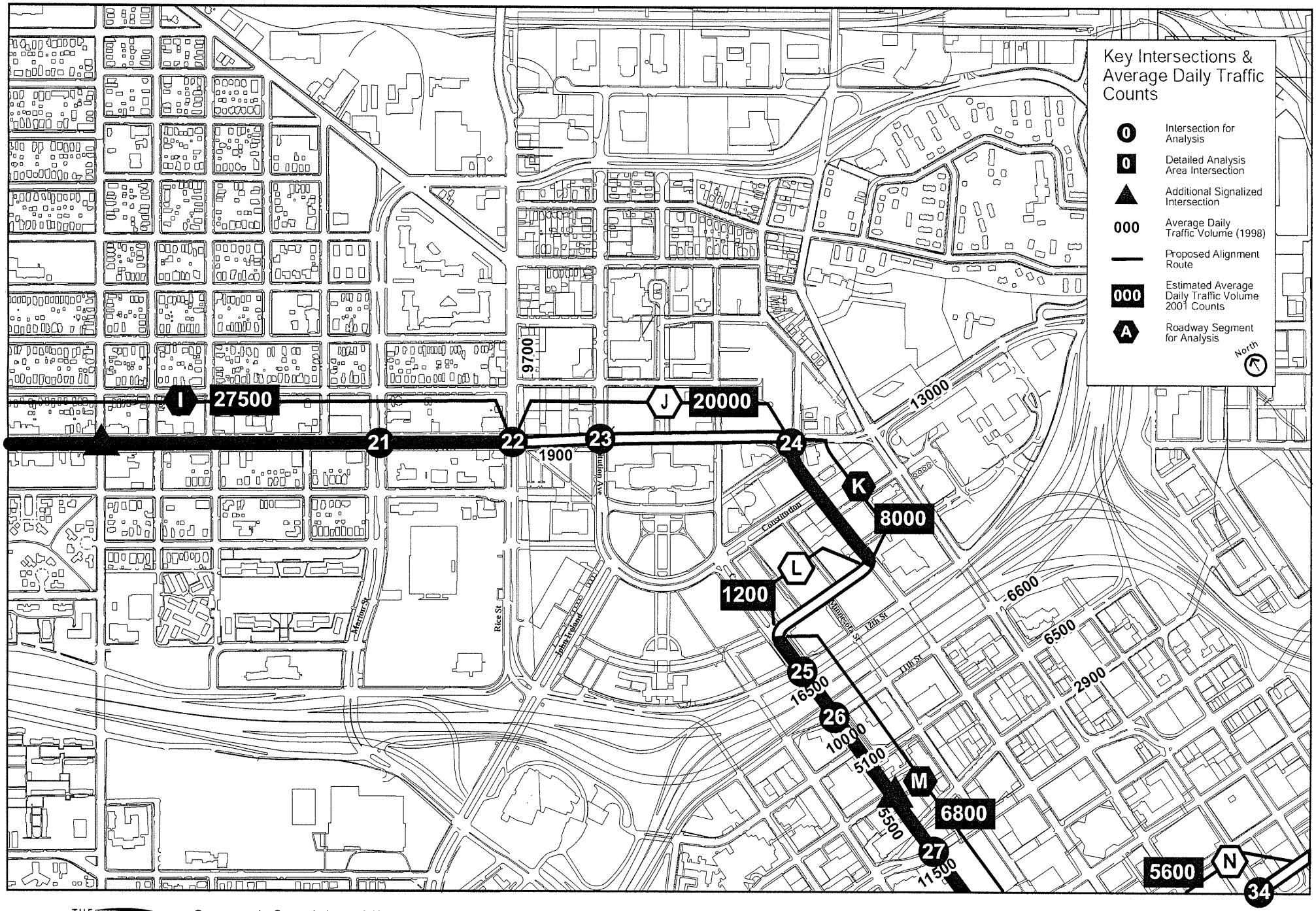

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A10

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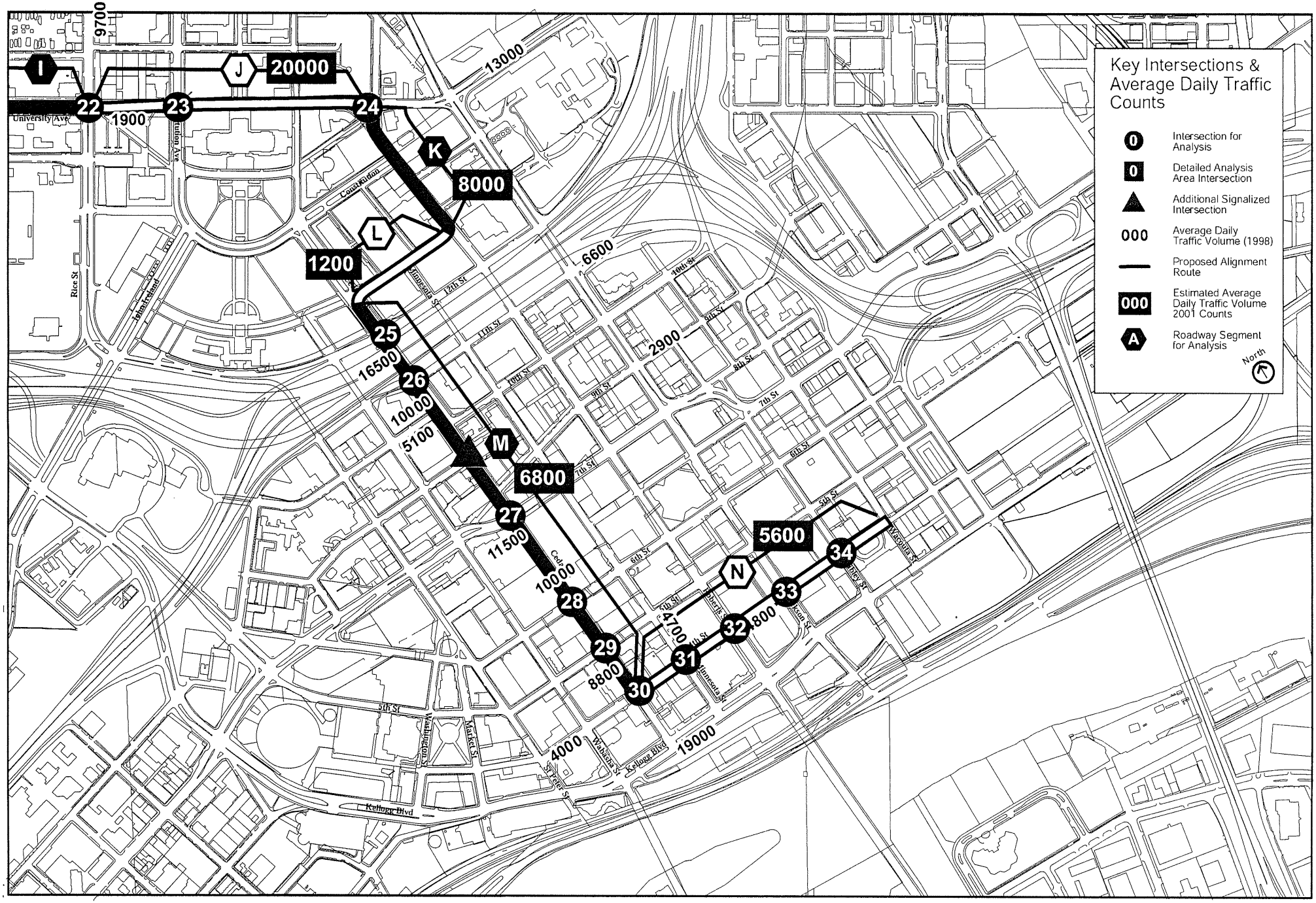

THE CENTRAL CORRIDOR

Central Corridor Alignment - Key Intersections and Roadway Segments

April 2002

Figure A11

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Existing, Baseline and Build Condition Volumes Table A1

Table A1: Intersection Turning Movement Volumes

INTERSECTION NUMBER	INTERSECTION	TIME PERIOD	NORTH APPROACH			EAST APPROACH			SOUTH APPROACH			WEST APPROACH			Total
			RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT	
1	Hennepin Avenue / 5th Street South[2]	Existing[1]	0	29	0	321	991	4	0	1,303	166	0	0	0	2,814
		Year 2020 Baseline	0	40	0	330	625	0	0	1,635	215	0	0	0	2,845
		Year 2020 Build	0	44	0	365	690	0	0	1,806	237	0	0	0	3,143
2	Marquette Avenue / 5th Street South[2]	Existing[1]	4	88	0	264	917	4	0	887	215	0	0	0	2,379
		Year 2020 Baseline	0	125	0	65	465	0	0	1,470	225	0	0	0	2,350
		Year 2020 Build	0	138	0	0	514	0	0	1,624	249	0	0	0	2,524
3	5th Avenue South / 5th Street South	Existing[1]	0	0	0	58	641	0	0	1,042	345	0	0	0	2,086
		Forecast Year 2020	0	0	0	17	282	0	0	1,900	392	0	0	0	2,590
4	Washington Avenue / Church Street[3]	Existing (2001)	2	2	1	0	841	56	71	1	67	46	574	2	1,663
		Year 2020 Baseline	2	2	1	0	997	66	84	1	79	55	681	2	1,972
		Year 2020 Build	2	2	1	0	997	66	84	1	79	55	681	2	1,972
5	29th Street / University Avenue[2][3]	Existing (2001)	45	0	15	15	894	0	0	0	0	0	1,167	15	2,151
		Year 2020 Baseline	53	0	18	18	1,060	0	0	0	0	0	1,384	18	2,550
		Year 2020 Build	0	0	0	18	1,060	0	0	0	0	0	1,384	0	2,461
6	Malcolm Avenue / University Avenue[2]	Existing (2001)	22	2	166	24	732	24	18	2	32	18	1,264	18	2,322
		Year 2020 Baseline	26	2	197	28	868	28	21	2	38	21	1,499	21	2,753
		Year 2020 Build	79	2	215	28	868	28	21	2	38	21	1,499	21	2,824
7	Highway 280 Southbound (Eustis Avenue) / University Avenue	Existing (2001)	175	779	314	0	703	28	0	0	0	230	1,261	0	3,490
		Forecast Year 2020	207	924	372	0	833	33	0	0	0	273	1,495	0	4,138
8	Highway 280 Northbound (Cromwell Avenue) / University Avenue	Existing (2001)	0	0	0	400	529	0	23	391	202	0	1,098	477	3,120
		Forecast Year 2020	0	0	0	474	627	0	27	464	239	0	1,302	566	3,699
9	Franklin Avenue / University Avenue	Existing (2001)	0	0	0	0	929	346	334	0	0	0	1,048	0	2,657
		Forecast Year 2020	0	0	0	0	1,101	410	396	0	0	0	1,242	0	3,150
10	Raymond Avenue / University Avenue	Existing (2001)	152	89	281	124	1,078	9	18	107	45	6	1,177	199	3,285
		Forecast Year 2020	180	106	333	147	1,278	11	21	127	53	7	1,395	236	3,895
11	Fairview Avenue / University Avenue	Existing (2001)	62	307	84	44	558	107	98	288	73	187	866	84	2,758
		Forecast Year 2020	74	364	100	52	662	127	116	341	87	222	1,027	100	3,270
12	Aldine Street / University Avenue	Existing (2001)	61	7	63	46	627	31	122	49	21	6	1,005	37	2,075
		Forecast Year 2020	72	8	75	55	743	37	145	58	25	7	1,192	44	2,460
13	Fry Street / University Avenue	Existing (2001)	19	17	17	22	614	27	41	13	71	111	1,046	33	2,031
		Forecast Year 2020	23	20	20	26	728	32	49	15	84	132	1,240	39	2,408
14	Snelling Avenue / University Avenue[3]	Existing (2001)	92	934	203	154	473	143	182	1,162	98	78	845	181	4,545
		Forecast Year 2020	109	1,107	241	183	561	170	216	1,378	116	92	1,002	215	5,388
15	Pascal Avenue / University Avenue[2]	Existing (2001)	20	93	33	32	682	131	150	92	68	145	1,035	50	2,531
		Year 2020 Baseline	24	110	39	38	809	155	178	109	81	172	1,227	59	3,001
		Year 2020 Build	24	110	39	38	809	189	178	109	81	172	1,227	59	3,035
16	Albert Street / University Avenue[4]	Existing (2001)	31	5	6	29	765	115	161	38	49	122	1,082	14	2,417
		Year 2020 Baseline	37	6	7	34	907	136	191	45	58	145	1,283	17	2,866
		Year 2020 Build	37	0	0	34	941	0	191	0	0	145	1,283	0	2,631
17	Hamline Avenue / University Avenue[2]	Existing (2001)	30	291	69	60	754	109	137	359	125	94	1,085	70	3,183
		Year 2020 Baseline	36	345	82	71	894	129	162	426	148	111	1,286	83	3,774
		Year 2020 Build	36	345	82	71	894	231	162	426	148	111	1,286	83	3,876
18	Lexington Parkway / University Avenue[3]	Existing (2001)	124	968	102	64	653	177	174	1,080	170	220	894	208	4,834
		Forecast Year 2020	147	1,148	121	76	774	210	206	1,280	202	261	1,060	247	5,731

INTERSECTION NUMBER	INTERSECTION	TIME PERIOD	NORTH APPROACH			EAST APPROACH			SOUTH APPROACH			WEST APPROACH			Total
			RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT	
19	Victoria Street / University Avenue	Existing (2001)	54	147	58	40	821	32	59	153	59	62	1,039	51	2,575
		Forecast Year 2020	64	174	69	47	973	38	70	181	70	74	1,232	60	3,053
20	Dale Street / University Avenue [3]	Existing (2001)	119	480	171	108	779	146	216	787	139	98	1,001	162	4,206
		Forecast Year 2020	141	569	203	128	924	173	256	933	165	116	1,187	192	4,987
21	Marion Street / University Avenue	Existing (2001)	104	317	58	17	837	132	207	461	132	137	1,120	113	3,635
		Forecast Year 2020	123	376	69	20	992	156	245	547	156	162	1,328	134	4,310
22	Rice Street / University Avenue [3]	Existing (2001)	144	397	98	124	767	51	75	499	75	78	1,056	251	3,615
		Forecast Year 2020	171	471	116	147	909	60	89	592	89	92	1,252	298	4,286
23	Constitution Avenue / University Avenue	Existing (2001)	66	107	120	98	825	42	51	75	51	101	1,097	31	2,664
		Forecast Year 2020	78	127	142	116	978	50	60	89	60	120	1,301	37	3,158
24	Robert Street / University Avenue [3]	Existing (2001)	8	5	11	8	659	24	209	106	183	185	941	7	2,346
		Forecast Year 2020	10	7	14	10	858	31	272	138	238	241	1,225	9	3,055
25	12th Street / Cedar Avenue	Existing (2001)	183	246	0	42	1,141	92	0	109	47	0	0	0	1,860
		Forecast Year 2020	238	320	0	55	1,486	120	0	142	61	0	0	0	2,422
26	11th Street / Cedar Avenue [3]	Existing (2001)	0	242	115	0	0	0	85	130	0	40	993	31	1,636
		Forecast Year 2020	0	315	150	0	0	0	111	169	0	52	1,293	40	2,131
27	7th Street / Cedar Avenue [3]	Existing (2001)	132	366	110	0	579	88	0	0	0	183	644	0	2,102
		Forecast Year 2020	172	477	143	0	754	115	0	0	0	238	839	0	2,737
28	6th Street / Cedar Avenue [3]	Existing (2001)	144	493	0	0	715	208	0	0	0	0	0	0	1,560
		Forecast Year 2020	188	642	0	0	931	271	0	0	0	0	0	0	2,032
29	5th Street / Cedar Avenue [2]	Existing (2001)	0	428	300	0	0	0	0	0	0	201	653	0	1,582
		Year 2020 Baseline	0	557	391	0	0	0	0	0	0	262	850	0	2,060
		Year 2020 Build	0	0	948	0	0	0	0	0	0	0	1,112	0	2,060
30	4th Street / Cedar Avenue [2]	Existing (2001)	93	446	57	0	65	27	0	0	0	52	71	0	811
		Year 2020 Baseline	121	581	74	0	85	35	0	0	0	68	92	0	1,056
		Year 2020 Build	0	0	0	0	85	35	0	0	0	160	0	0	280
31	Minnesota Street / 4th Street [2][3]	Existing (2001)	0	0	0	110	79	0	83	274	17	0	80	40	683
		Year 2020 Baseline	0	0	0	143	103	0	108	357	22	0	104	52	889
		Year 2020 Build	0	0	0	0	0	0	0	454	33	0	0	0	487
32	Robert Street / 4th Street [2][3]	Existing (2001)	52	417	25	97	84	50	69	530	39	43	102	16	1,524
		Year 2020 Baseline	68	543	33	126	109	65	90	690	51	56	133	21	1,985
		Year 2020 Build	0	643	0	197	0	103	0	831	0	0	0	0	1,775
33	Jackson Street / 4th Street [2]	Existing (2001)	87	1,004	47	0	139	204	0	0	0	108	96	0	1,685
		Year 2020 Baseline	113	1,308	61	0	181	266	0	0	0	141	125	0	2,194
		Year 2020 Build	113	1,369	0	0	181	266	0	0	0	0	0	0	1,929
34	Sibley Avenue / 4th Street [2][3]	Existing (2001)	0	0	0	35	155	0	75	456	139	0	94	61	1,015
		Year 2020 Baseline	0	0	0	46	202	0	98	594	181	0	122	79	1,322
		Year 2020 Build	0	0	0	46	202	0	0	692	181	0	0	0	1,120

Notes:

[1] Volumes in Downtown Minneapolis are from 1999 and were obtained from the SRF Report: "Downtown Minneapolis Transportation Study" (April 2000).

[2] Only at these intersections is there a difference between the Year 2020 Baseline and Build volumes due to lane or road closures or diverted trips associated with the LRT or BRT alignment.

[3] A pedestrian volume growth of an extra 30 percent was expected and applied for intersections in close proximity to a proposed station location for the Year 2020 Build condition only.

[4] This intersection is proposed to be closed to left-turn movements and converted to an unsignalized intersection for the Year 2020 Build condition.

4/5/02

Source: URS Corp. counts in September, October and December of 2001. R:\45550\Central Corridor\Documents\Traffic\DEIS\Data\[Traffic volumes and Results 032802.xls]Generalized Forecast volumes

Detailed LOS Results Tables

- Existing Condition
- Baseline Condition
- Build Condition

Minneapolis CBD
Intersection Level of Service
Year 1999 - Existing Conditions
PM Peak Period

5th Street / Hennepin Avenue

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	0	0	0	20.7	20.7	20.7	12.2	12.2	0	0	7.7	7.7	16.1	
# Trips (veh/hr)	0	0	0	4	991	321	166	1303	0	0	29	0	2814	B
Total Delay (sec/hr)	0	0	0	83	20514	6645	2025	15897	0	0	223	0	45386	
Level of Service	A	A	A	C	C	C	B	B	A	A	A	A		

5th Street / Marquette Avenue

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	0	0	0	14	14	14	16.3	16.3	0	0	5.6	5.6	14.7	
# Trips (veh/hr)	0	0	0	4	917	264	215	887	0	0	88	4	2379	B
Total Delay (sec/hr)	0	0	0	56	12838	3696	3505	14458	0	0	493	22	35068	
Level of Service	A	A	A	B	B	B	B	B	A	A	A	A		

5th Street / 5th Avenue

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	0	0	0	0	7.6	7.6	1.6	8	0	0	0	0	6.8	
# Trips (veh/hr)	0	0	0	0	641	58	345	1042	0	0	0	0	2086	A
Total Delay (sec/hr)	0	0	0	0	4872	441	552	8336	0	0	0	0	14200	
Level of Service	A	A	A	A	A	A	A	A	A	A	A	A		

Notes:
1. Results obtained using Synchro version 5.0
2. Volumes were obtained from the Downtown Minneapolis Comprehensive Study conducted by SRF Consulting Group, Inc. completed in 1999.
3. Existing cycle length of 90 seconds was used in analysis, but intersection offsets and splits were optimized.

Source: URS / BRW Inc.
4/4/02

University of Minnesota Area
Intersection Level of Service
Year 2001 - Existing Conditions
PM Peak Period

Washington Avenue / Church Street

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	27.4	18.9	25.1	24.8	18.2	0.0	34.5	41.2	17.0	0.0	26.7	7.2	19.6	
# Trips (veh/hr)	1	585	52	58	833	0	74	2	67	0	1	2	1676	B
Total Delay (sec/hr)	27	11063	1303	1428	15133	0	2567	82	1142	0	27	14	32788	
Level of Service	C	B	C	C	B	A	C	D	B	A	C	A		

University Avenue / 29th Street

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	5.9	0.5	0.0	0.0	2.0	5.9	0.0	0.0	0.0	42.9	0.0	5.5	1.6	
# Trips (veh/hr)	13	1194	0	0	901	14	0	0	0	17	0	45	2184	A
Total Delay (sec/hr)	79	597	0	0	1833	83	0	0	0	729	0	249	3569	
Level of Service	A	A	A	A	A	A	A	A	A	E	A	A		

University Avenue / Malcolm Avenue

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	19.3	13.1	7.8	14.1	7.4	3.1	25.4	0.4	7.1	35.6	15.4	24.0	12.9	
# Trips (veh/hr)	14	1273	21	18	730	29	28	1	14	160	2	24	2313	B
Total Delay (sec/hr)	270	16634	161	250	5380	89	712	1	97	5701	31	567	29891	
Level of Service	B	B	A	B	A	A	C	A	A	D	B	C		

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Source: URS / BRW Inc.
4/4/02

TH 280 Area
Intersection Level of Service
Year 2001 - Existing Conditions
PM Peak Period

University Avenue / Eustis Street

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	0.0	44.2	15.4	36.3	8.2	0.0	0.0	0.0	0.0	84.3	48.3	22.1	39.7	
# Trips (veh/hr)	0	1012	173	57	563	0	0	0	0	332	685	175	2997	D
Total Delay (sec/hr)	0	44745	2658	2067	4635	0	0	0	0	27999	33124	3860	119089	
Level of Service	A	D	B	D	A	A	A	A	A	F	D	C		

University Avenue / Cromwell Avenue

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	79.0	18.7	0.0	0.0	28.2	13.3	44.5	48.8	31.5	0.0	0.0	0.0	34.1	
# Trips (veh/hr)	451	1089	0	0	525	399	211	393	25	0	0	0	3093	C
Total Delay (sec/hr)	35618	20394	0	0	14814	5293	9368	19192	799	0	0	0	105478	
Level of Service	E	B	A	A	C	B	D	D	C	A	A	A		

University Avenue / Franklin Avenue - Pelham Boulevard

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	0.0	9.7	7.6	38.9	3.1	0.0	21.3	0.0	0.0	0.0	0.0	0.0	12.3	
# Trips (veh/hr)	0	1037	75	338	931	0	278	0	0	0	0	0	2659	B
Total Delay (sec/hr)	0	10059	570	13150	2917	0	5905	0	0	0	0	0	32601	
Level of Service	A	A	A	D	A	A	C	A	A	A	A	A		

University Avenue / Raymond Avenue

	West Approach			East Approach			South Approach			North Approach			Intersection	Intersection
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Total	LOS
Delay (sec/veh)	37.3	20.1	18.2	54.5	36.2	22.1	40.8	31.5	10.8	262.7	178.3	165.1	59.1	
# Trips (veh/hr)	199	1140	8	14	1061	124	53	107	20	276	90	154	3245	E
Total Delay (sec/hr)	7417	22876	145	763	38373	2744	2174	3360	215	72427	15988	25370	191852	
Level of Service	D	C	B	D	D	C	D	C	B	F	F	F		

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Source: URS / BRW Inc.
4/4/02

Snelling/Lexington Area
Intersection Level of Service
Year 2001 - Existing Conditions
PM Peak Period

University Avenue / Fairview Avenue

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	19.8	27.7	48.7	3.8	6.7	23.7	22.0	29.7	49.9	8.8	9.3	11.9	16.5	
# Trips (veh/hr)	57	285	84	43	544	85	104	289	82	180	879	73	2706	B
Total Delay (sec/hr)	1135	7913	4107	163	3665	2012	2295	8564	4089	1584	8201	867	44596	
Level of Service	B	C	D	A	A	C	C	C	D	A	A	B		

University Avenue / Aldine Street

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	37.4	53.4	65.6	4.6	9.0	15.8	66.3	67.3	69.8	4.1	6.8	9.7	16.2	
# Trips (veh/hr)	62	7	66	53	588	30	130	45	21	10	1008	47	2067	B
Total Delay (sec/hr)	2308	392	4330	246	5315	470	8601	3029	1442	41	6857	456	33485	
Level of Service	D	D	E	A	A	B	E	E	E	A	A	A		

University Avenue / Fry Street

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	17.1	44.1	39.9	0.7	0.5	8.0	13.1	43.0	38.8	4.2	4.6	5.9	6.1	
# Trips (veh/hr)	20	21	15	17	567	26	44	13	82	108	1065	40	2017	A
Total Delay (sec/hr)	337	911	585	12	303	209	581	573	3171	456	4862	236	12235	
Level of Service	B	D	D	A	A	A	B	D	D	A	A	A		

University Avenue / Snelling Avenue

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	6.6	14.3	57.2	16.3	35.0	102.2	12.0	19.1	51.3	9.0	28.0	32.8	25.8	
# Trips (veh/hr)	85	968	189	139	437	136	194	1149	95	86	863	174	4513	C
Total Delay (sec/hr)	558	13838	10785	2266	15295	13899	2328	21978	4853	771	24164	5690	116426	
Level of Service	A	B	E	B	C	F	B	B	D	A	C	C		

University Avenue / Pascal Street

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	46.5	50.4	55.6	11.2	9.1	13.0	11.0	34.2	41.5	17.5	26.5	18.3	21.7	
# Trips (veh/hr)	14	94	36	29	633	127	144	86	67	149	1045	51	2474	C
Total Delay (sec/hr)	667	4721	1984	328	5739	1642	1592	2941	2797	2607	27649	927	53594	
Level of Service	D	D	E	B	A	B	B	C	D	B	C	B		

Source: URS / BRW Inc.
4/4/02

University Avenue / Albert Street

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	11.0	54.6	71.7	8.5	2.8	14.5	12.2	41.9	42.9	5.3	3.1	9.7	6.1	A
# Trips (veh/hr)	28	6	3	22	720	132	161	37	44	124	1086	13	2375	
Total Delay (sec/hr)	307	309	239	184	2039	1918	1970	1536	1888	661	3403	123	14578	
Level of Service	B	D	E	A	A	B	B	D	D	A	A	A		

University Avenue / Hamline Avenue

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	35.1	41.4	30.1	12.4	17.3	33.3	25.0	29.2	32.7	16.4	13.2	14.1	21.2	C
# Trips (veh/hr)	33	290	60	61	714	105	137	362	126	102	1067	81	3138	
Total Delay (sec/hr)	1148	12016	1814	754	12328	3493	3433	10592	4124	1669	14080	1140	66593	
Level of Service	D	D	C	B	B	C	C	C	C	B	B	B		

University Avenue / Griggs Street

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	15.1	23.7	46.4	3.2	1.6	9.7	15.6	11.7	21.4	6.7	2.1	7.4	2.9	A
# Trips (veh/hr)	19	1	7	7	862	31	78	0	4	26	1212	21	2268	
Total Delay (sec/hr)	291	24	341	22	1407	305	1219	4	79	172	2505	152	6521	
Level of Service	C	C	E	A	A	A	C	B	C	A	A	A		

University Avenue / Lexington Parkway

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	52.6	70.4	70.1	20.5	22.7	90.0	46.6	69.3	79.1	23.4	37.5	79.4	54.9	D
# Trips (veh/hr)	127	949	103	62	614	167	168	1064	163	229	874	201	4721	
Total Delay (sec/hr)	6680	66801	7220	1278	13945	15000	7808	73735	12862	5343	32758	15940	259371	
Level of Service	D	E	E	C	C	F	D	E	E	C	D	E		

University Avenue / Chatsworth Street

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	9.5	25.7	30.1	3.6	1.6	6.2	24.3	49.3	40.8	5.0	1.9	6.9	3.9	A
# Trips (veh/hr)	26	3	10	17	775	80	75	2	40	34	1051	48	2163	
Total Delay (sec/hr)	249	86	301	61	1266	498	1828	115	1632	168	1996	332	8533	
Level of Service	A	D	D	A	A	A	C	E	E	A	A	A		

University Avenue / Victoria Street

	North Approach			East Approach			South Approach			West Approach			Intersection	Intersection
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	LOS
Delay (sec/veh)	50.0	42.6	49.3	5.3	9.8	18.1	45.4	50.3	53.7	7.3	9.9	18.5	18.2	B
# Trips (veh/hr)	51	151	55	32	768	33	58	159	64	60	1013	48	2492	
Total Delay (sec/hr)	2567	6418	2712	170	7526	590	2631	8014	3417	440	9998	880	45364	
Level of Service	D	D	D	A	A	B	D	D	D	A	A	B		

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Source: URS / BRW Inc.
4/4/02