SUMMARY

SOUTHWEST/UNIVERSITY AVENUE CORRIDORS STUDY

TRANSIT ALTERNATIVES ANALYSIS AND DRAFT ENVIRONMENTAL IMPACT STATEMENT

For Discussion at Joint Public Meeting of
Metropolitan Council and Regional Transit Board
January 23 - 7 p.m.
Council Chambers, St. Paul

Metropolitan Council of the Tiwn Cities Area
300 Metro Square Building, 7th and Robert Streets
St. Paul, Minnesota 55101 Tel. 612 291-6359

Publication No. 26-85-006A

January 1985

ABOUT THIS SUMMARY

In 1982 the Metropolitan Council, in conjunction with several state and local agencies, received a grant from the federal Urban Mass Transportation Administration (UMTA) to conduct a study of major transit improvements in two corridors of the Twin Cities Metropolitan Area.

This summary of the Southwest/University Avenue Corridors Study: Transit Alternatives Analysis and Draft Environmental Impact Statement is based on a preliminary version of a Draft Environmental Statement being prepared at this time for consideration by UMTA. It is a concise discussion of the most comprehensive documentation of the study available at this point, and contains background information, a description of the alternatives considered in each corridor, and the major impacts of each of these alternatives.

This report and the preliminary DEIS which it summarizes are being reviewed by UMTA as part of the federal decision-making process. Once a final draft Environmental Impact Statement is authorized for release by UMTA, a formal public hearing will be held, and preferred alternatives will be selected in each of the two corridors for purposes of qualifying for possible federal funding of the proposed improvements.

Copies of the full preliminary draft EIS may be obtained by calling the Communications Department at 291-6464. For additional information on the Southwest/University Avenue Corridors Study, please call Steve Wilson (291-6344).

SOUTHWEST/UNIVERSITY AVENUE CORRIDORS STUDY
TRANSIT ALTERNATIVES ANALYSIS AND DRAFT ENVIRONMENTAL IMPACT STATEMENT

SUMMARY

PURPOSE OF THE STUDY

The purpose of this study is to identify problems and analyze solutions regarding transit services in the University Avenue and Southwest Corridors. Each corridor is considered separately in the analysis.

The University Avenue Corridor runs between downtown Minneapolis and downtown St. Paul, generally following University Avenue; it serves the University of Minnesota and other traffic generators along that route in addition to the downtown areas.

The Southwest Corridor extends generally in a southwesterly direction from downtown Minneapolis and traverses southwest Minneapolis, St. Louis Park, Hopkins, Minnetonka, and several Lake Minnetonka suburbs before ending in Excelsior.

The study includes: a definition of goals and policies; the definition of a range of alternative transit improvements; the selection, through a scoping process, of a small number of alternatives which were found to be most reasonable; a detailed definition of the characteristics of those alternatives; analyses of the effects of each on the transportation system, the community and the environment; and an evaluation of the alternatives to determine which is considered best.

The major document of the study is a draft Environmental Impact Statement (DEIS), prepared under the guidance of the federal Urban Mass Transportation Administration (UMTA). The DEIS will be circulated to inform the public of the proposed improvements and their consequences. Public meetings and hearings will be held to further inform the affected public and to receive comments from public and private agencies, organizations, and citizens.

At the end of the public hearing period, the Steering Committee for the study will consider the DEIS and comments and select a preferred alternative for each corridor. This committee is composed of elected officials from: Hennepin and Ramsey Counties; the Cities of Minneapolis, St. Paul, St. Louis Park, Hopkins, and Minnetonka; and representatives of the Regional Transit Board, Minnesota Department of Transportation, the University of Minnesota, the Metropolitan Transit Commission, and the Metropolitan Council.

Preparation of a DEIS is a requirement of the National Environmental Policy Act. It is prepared as a part of the alternatives analysis process developed and defined by UMTA. The successful completion of an alternatives analysis is a prerequisite to an application for federal financial participation in the construction of a fixed-guideway transit line. The DEIS will also fulfill state requirements for environmental impacts statements.

The outcome of the study will be the selection of a preferred alternative in each corridor for the purpose of obtaining federal funding. The Regional Transit Board and Metropolitan Council will be able to use the Steering Committee's recommendations as input to the regional transit decision-making process.

MAJOR GOALS AND OBJECTIVES, PROBLEMS BEING ADDRESSED

Major transportation goals and objectives for this study can be summarized as follows:

- Provide attractive transportation choices for metropolitan residents as measured by increase transit use in the proposed facilities and diversion of auto users.
- Reduce automobile traffic in the downtown areas by increasing transit use.
- Provide better transit service for existing users as measured by travel time savings.
- Provide effective, productive and efficient transit services.
- Relieve congestion particularly in congested highways and in the downtowns.

These overall goals and objectives relate to some specific problems. In the University Avenue corridor, those problems are:

- Congestion on I-94 between the two downtowns
- Low transit speeds on University Avenue
- Insufficient capacity to handle anticipated growing demand

In the Southwest Corridor, the problems are:

- Poor accessibility to downtown Minneapolis due to a bottleneck east of France Avenue
- Use of local streets for commuting purposes
- High transit travel times
- High concentration of buses on Hennepin Avenue.

In addition, congestion and negative environmental impacts in downtown areas and the high cost of existing transit operations were identified as problems pertaining to both corridors.

Other goals and objectives identified are:

- To encourage economic development
- To minimize environmental impacts

ALTERNATIVES CONSIDERED

In late 1982, the Metropolitan Council received a grant form UMTA to conduct a transit alternatives analysis for the University Avenue and Southwest corridors. A scoping process, including public meetings and an evaluation process, was used to screen down an initial set of alternatives to a smaller set of alternatives in each corridor that would be studied in detail as part of the AA/DEIS.

Four basic alternatives in each corridor are considered for detailed evaluation in the Southwest/University Avenue Corridors Study:

o NULL: Continuation of existing bus service, with only slight revisions

- o TRANSPORTATION SYSTEM MANAGEMENT (TSM): Improvements to existing service primarily by adding routes or increasing service frequencies short of a major capital improvement.

- o BUSWAY: Diesel buses operating on reserved rights-of-way, but with at-grade street crossings permitted.

- o LIGHT RAIL TRANSIT (LRT): Electrically powered (from an overhead wire power source) rail vehicles operating on reserved rights-of-way, but with at-grade street crossings permitted.

University Avenue Corridor

The Null alternative consists primarily of MTC Route 16A, which provides local service along University Avenue, and Route 94B/D, which provide express service between downtown Minneapolis and downtown St. Paul on I-94.

The TSM alternative introduces selected service improvements, such as better service to the University of Minnesota and a Lexington Avenue crosstown route.

For the "fixed guideway" alternatives, busway and light rail, the transit vehicles would travel on a pair of exclusive lanes (tracks for the LRT) in the middle of University Avenue, with similar exclusive treatments on the other streets of the route (see Figure S-1). Consideration of small variations in routing and/or station spacing are considered, leading to the following fixed guideway alternatives in the University Avenue Corridor:

- BUSWAY: Downtown St. Paul (through the Capitol Area), University Avenue, Washington Avenue (through the University of Minnesota), downtown Minneapolis. Stops would be basically located 1/4 mile along the route.

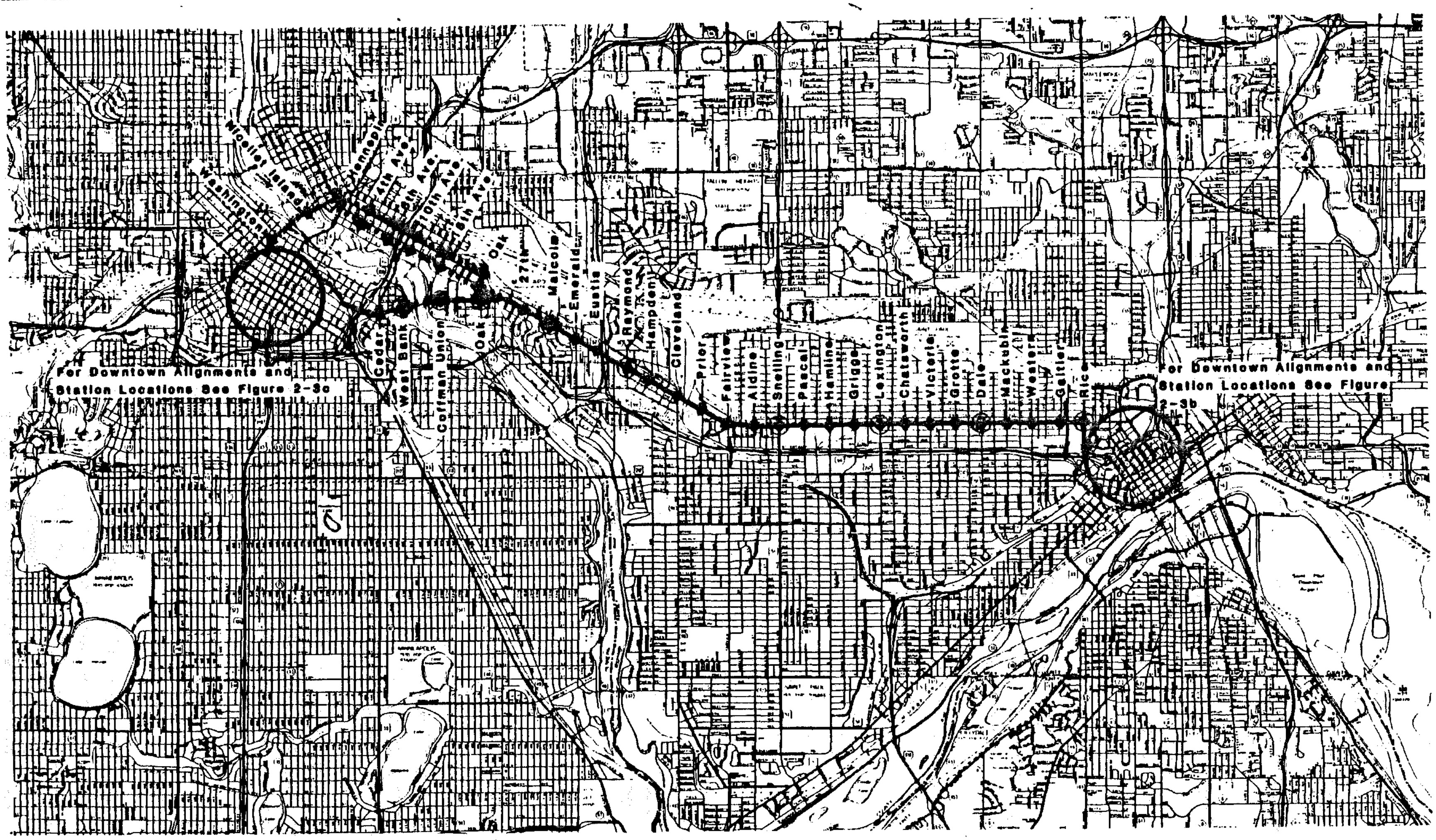
- LRT-1: The same routing and spacing as the busway alternative.

- LRT-2: This alternative would approach downtown St. Paul in an east-west direction (along 5th and 6th Streets from John Ireland Blvd.), skirting the Capitol area rather than going through it. In Minneapolis the routing would be along University Avenue and 4th St. S.E. through Dinkytown, St. Anthony-Main and Riverplace, entering the downtown area via Hennepin Avenue.

- LRT-3: The same routing as LRT-1, but stops along University Avenue would be approximately one mile apart. Local bus service would be augmented in adjacent neighborhoods to offset the loss of closely spaced stops.

- LRT-3S: The same as LRT-3 except the downtown Minneaoplis portion of the route would be in a subway tunnel.

The capital cost estimates of each alternative include the costs of vehicles, park and ride lots, stations, maintenance facilities, and fixed-guideway facilities where applicable. Annualized capital costs are estimated since some system components wear out and need replacement more often than others. The University Avenue Corridor alternatives (see Table S-1) range in capital cost from $13.9 million (Null) and $16.1 million (TSM), to $36.8 million for



◆ LRT or Busway Station
○ LRT-3 or LRT-3S Stations
▬▬▬ Common Segment for All Alternatives
▬ ▬ ▬ Alignment for LRT-1,LRT-3,LRT-3S and Busway-1
········· Alignment for LRT-2

Scale : 1" = 1 Mile

0 1 2

Figure S-1

University Avenue Corridor, Guideway Alignments and Station Locations

Barton-Aschman Associates, Inc.

the Busway, and $105.1 to $226.1 million for LRT alternatives. The LRT-3S costs approximately $115 million more than other LRT alternatives because of the cost of the downtown Minneapolis subway tunnel.

Annual operating costs are estimated for each alternative, including costs of the guideway vehicles as well as any feeder buses, where applicable.

The University Avenue Corridor alternatives have estimated annual operating costs ranging from $7.08 million (LRT-3, LRT-3S) to $8.66 million (TSM).

Southwest Corridor

The major transit routes today, and in the Null alternative, are MTC Routes 12, 17, and 67.

Some rerouting of the lines and improvements in service frequencies constitute the TSM alternative.

Busway and LRT alternatives in the corridor mainly follow routings that are presently railroad rights-of-way. For the busway alternatives, railroad tracks would be relocated where necessary and a two lane bus-only roadway would be built; where the alignments use existing streets, special lanes would be used, similar to the transit lanes in downtown Minneapolis. For the light rail alternatives, tracks would be built instead of the roadway. The fixed guideway alternatives are defined on the basis of the western terminus of the guideway and the routing through Minneapolis (see Figure S-2):

Western Termini	Minneapolis Routing
1. T.H. 101 (Minnetonka)	A. CNW Railroad (through Kenwood)
2. T.H. 7 (Hopkins)	B. Milwaukee Road/Nicollet Ave.
3. Wooddale Avenue (St. Louis Pk.)	

For example, the LRT alternative from downtown Minneapolis to Hopkins entirely along the CNW railroad is referred to as LRT-2A. The Wooddale Avenue terminus was only selected for busway alternatives.

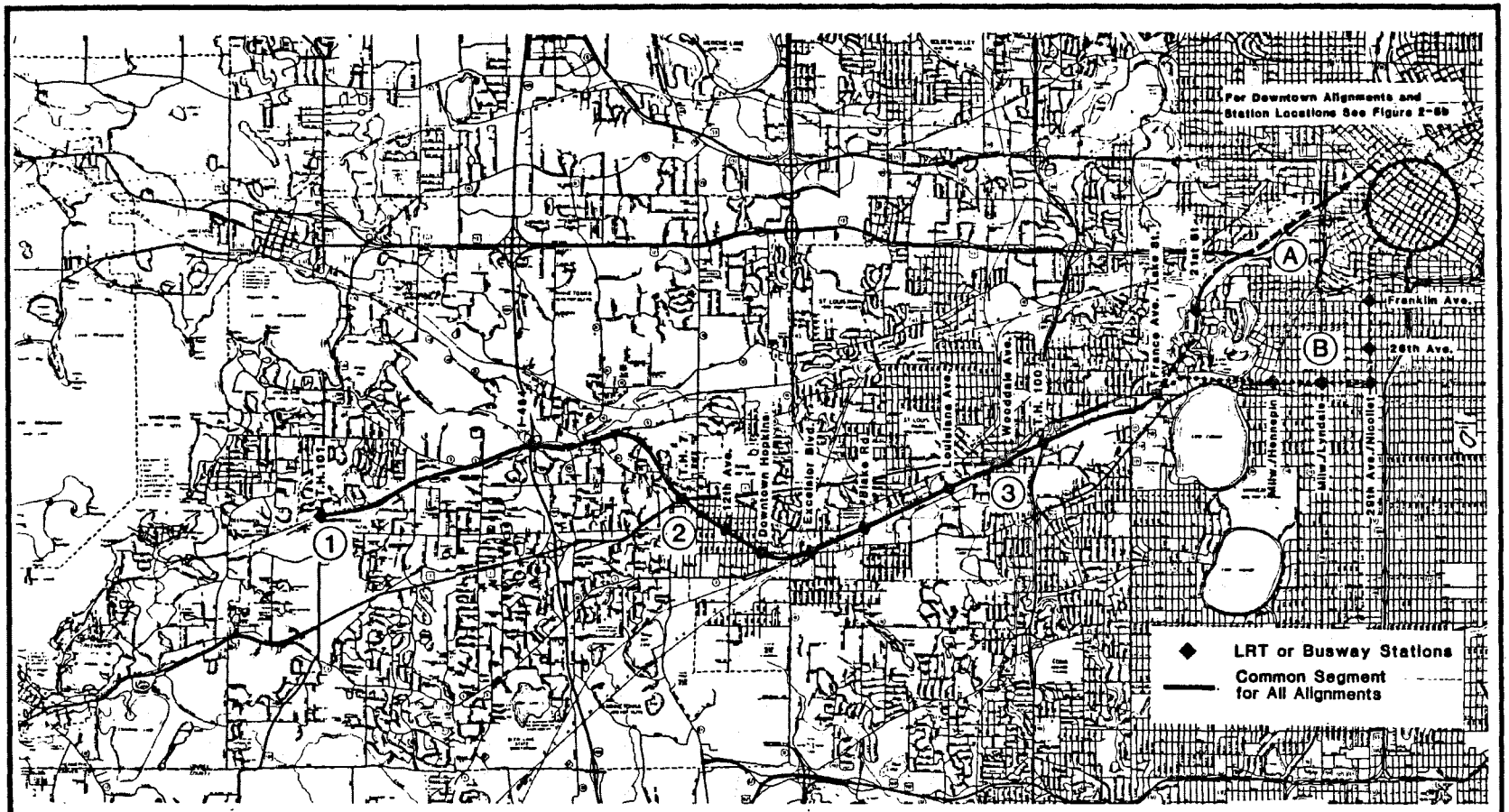
For the busway and light rail alternatives in the corridor, bus services would be extensively rearranged to feed into the guideway (Figure S-3).

In the Southwest Corridor (Table S-2), the Null and TSM alternatives are the least expensive at $9.0 and $13.4 million respectively. Busway alternatives range in cost from $38.3 million for the Busway-3A to $77.2 million for the longer Busway-1B alternative. LRT alternatives range in cost from $75.3 million (LRT-2A) to $105.5 million (LRT-2B).

Southwest Corridor alternatives have estimated operating costs range from $7.05 million for the Null, $8.53 million for the TSM, and from $8.06 to $8.55 million for the fixed guideway alternatives. These large increases compared to the Null alternative reflect the substantial increases in service to the Southwest Corridor.

IMPACTS AND EVALUATION

Each alternative is analyzed for several possible impacts. These impacts are summarized below, with several of the results presented in Tables S-1 and S-2.



Western Terminus Options:

① T.H.101 (Minnetonka)
② T.H.7 & CNW (Hopkins)
③ Wooddale Ave.

Downtown Approaches:

Ⓐ CNW Railroad ———
Ⓑ Milwaukee R.R./Nicollet Ave. •••••••

Scale 1" = 1 Mile

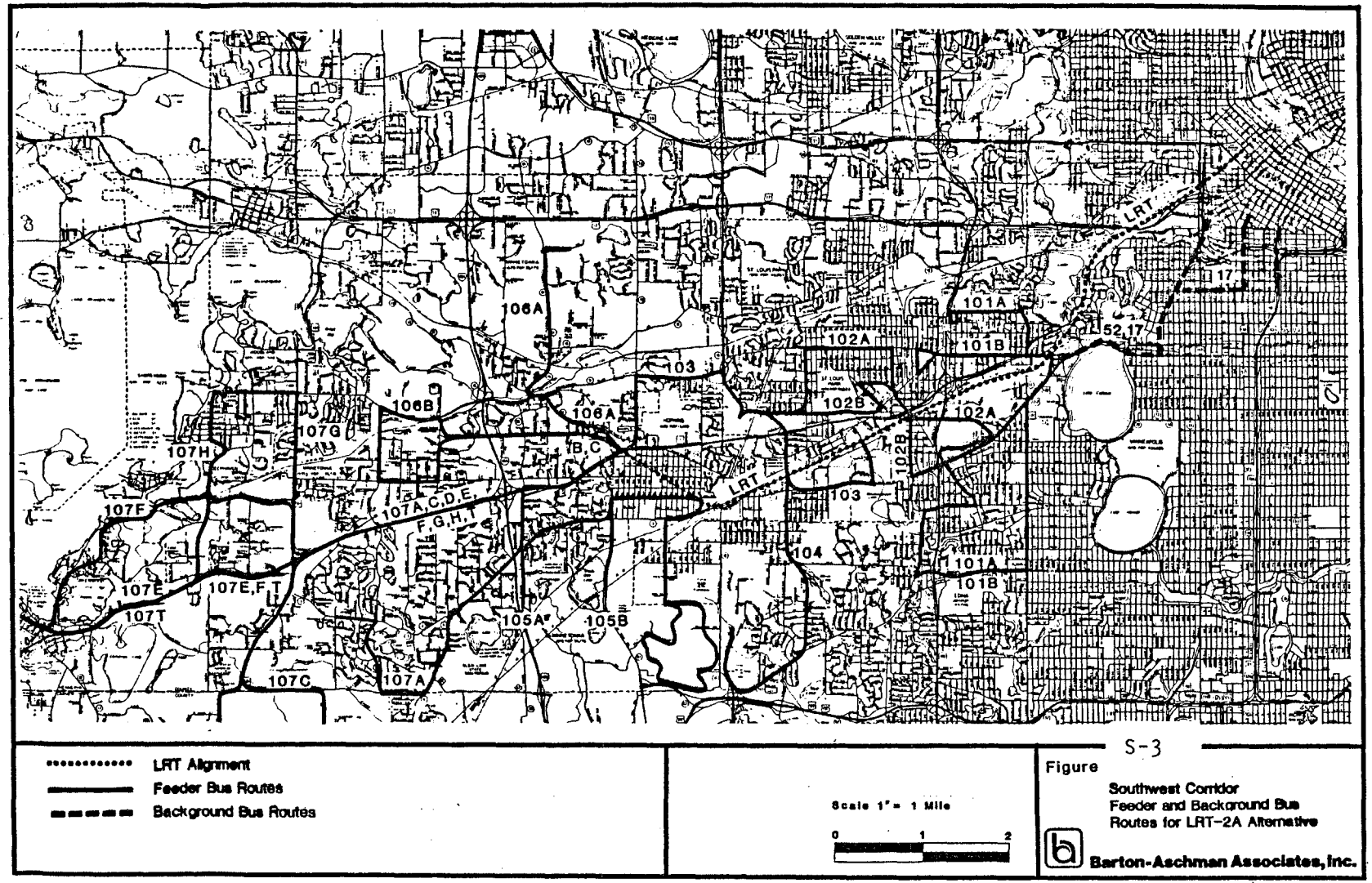
0 1 2

S-2

Figure

Southwest Corridor Guideway Alignments and Station Locations

Barton-Aschman Associates, Inc.



LRT Alignment
Feeder Bus Routes
Background Bus Routes

Scale 1" = 1 Mile
0 1 2

S-3

Figure

Southwest Corridor
Feeder and Background Bus
Routes for LRT-2A Alternative

Barton-Aschman Associates, Inc.

The impacts are analyzed in terms of effectiveness, efficiency, equity, trade-offs and financial feasibility which are defined as follows:

- Effectiveness measures the level of attainment of a given policy goal/objective or group of goals/objectives.

- Efficiency relates the level of attainment by an alternative of a given goal/objective to the cost. In other words, it gives an indication of the return or productivity on a given investment.

- Equity addressed the distribution of impacts among various population groups.

- Trade-off analysis addresses the differences among alternatives in terms of costs and benefits and outlines the advantages and disadvantages associated with each alternative.

- Financial analysis presents what revenue sources would be available for financing the capital, operating and maintenance costs of each alternative.

University Avenue Corridor

o Transportation Measures

The transportation objectives listed above have been addressed by several effectiveness measures:

- Increase in transit usage as measured by the total number of auto diversions or person-trips diverted from auto to transit
- Corridor ridership figures for each alternative
- Travel time savings
- Reduction in congestion

- Auto Diversions

In the University Avenue Corridor, all alternatives would produce person-trips shifts from automobile to transit. However, the TSM alternative would attract much fewer new riders than any of the fixed-guideway alternatives. The difference from 600 auto diversions for the TSM alternative to 5,200 - 6,600 for the fixed-guideway alternatives is due to significant improvements in travel times along University Avenue while maintaining similar levels of accessibility for the residents along the corridor. In other words, fixed guideway alternatives in general are effective in reducing travel times and therefore in producing shifts from auto to transit.

The difference in auto diversions among the various fixed-guideway alternatives are due to differences in travel times or in levels of accessibility to the transit line along University Avenue. LRT-1 results in the highest number of auto diversions because of significant improvements in travel time with respect to the Null, direct service to the core of the University of Minnesota and frequent stops along the route. The busway alternative which follows the same route than LRT-1 would originate fewer auto diversions because of higher travel times. LRT-2 would also result in lower diversions than LRT-1 mainly because

TABLE S-1
SUMMARY OF SIGNIFICANT IMPACTS FOR THE UNIVERSITY AVENUE CORRIDOR

CRITERIA	UNIVERSITY AVENUE ALTERNATIVES						
	NULL	TSM	BUS-1	LRT-1	LRT-2	LRT-3	LRT-3S
Year 2000 Ridership							
Corridor Ridership (Includes Bus)							
Daily (Linked Trips)	37,200	39,200	44,800	46,300	42,900	46,100	46,100
Annual (Million)	10.97	11.56	13.22	13.66	12.66	13.60	13.60
New Transit Riders (Auto Diversions)							
Daily	--	600	6,000	6,600	5,400	5,200	5,200
Annual (Million)	--	.177	1.773	1.938	1.581	1.516	1.516
Guideway Ridership							
Daily	--	--	37,300	39,500	35,700	46,100	46,100
Annual (Million)	--	--	11.00	11.65	10.53	13.60	13.60
Costs ($1984 Million)							
Total Capital Cost	13.9	16.1	36.8	113.8	105.1	110.7	226.1
Annual Capital Cost	2.1	2.3	4.58	12.5	11.6	12.06	24.30
Annual O & M Cost	8.44	8.66	8.37	7.55	7.75	7.08	7.08
Equivalent Annual Cost	10.39	10.70	12.82	20.10	19.50	19.23	31.04
Travel Time Savings (Existing Transit Riders)							
Daily Hrs	--	181	4,111	4,644	4,057	6,609	6,609
Annual Hrs (Million)	--	.053	1.213	1.376	1.197	1.950	1.950
Annual Value ($1984 Million)	--	.20	4.49	5.10	4.43	7.22	7.22
Revenues ($1984 Million)							
Annual Farebox Revenues	6.17	6.49	7.48	7.74	7.16	8.03	8.03
Operating Ratio	.73	.75	.89	1.02	.92	1.13	1.13
Annual Operating Deficit or Surplus							
Corridor Operating Deficit or Surplus	-2.27	-2.17	-.89	+.19	-.59	+.95	+.95
Operating Cost Per Corridor Pass.	.78	.75	.63	.60	.61	.52	.52
Operating Deficit or Surplus Per Corr. Pass.	-.21	-.19	-.07	+.01	-.05	+.07	+.07
Cost Effectiveness Ratios							
(EAC[a] - Value of Travel Time Savings)/New Riders[b]	--	--	-1.36	2.56	3.25	1.13	9.95
EAC Per Hour Saved[c]	--	5.85	2.00	7.06	7.61	4.53	10.59
EAC Per Corridor Passenger[c]	.95	.93	.97	1.47	1.54	1.41	2.28
EAC Per New Transit Rider[c]	--	1.75	1.37	5.01	5.76	5.83	13.62
EAC Per Guideway Passenger	--	--	1.17	1.73	1.85	1.41	2.28
Accessibility: (% Trip Opportunities)[d]							
St. Paul CBD	18.4%	18.4%	20.6%	21.8%	21.8%	21.2%	21.2%
Central/Dale	10.0	10.1	14.2	15.0	15.0	19.3	19.3
Snelling/University	13.8	13.9	17.6	18.6	18.9	20.0	20.0
University of Minnesota	18.0	19.1	21.1	22.4	22.1	24.5	24.5
Minneapolis CBD	29.2	29.4	29.1	30.0	29.9	29.7	29.7

[a]EAC: Equivalent Annual Cost [b]Incremental change compared to TSM alternative [c]Incremental change with respect to Null Alternative
[d]Within 45 Minutes of Door-to-Door Travel Time (For Selected Zones)

it provides less direct service to the core of the University of Minnesota and the two downtowns.

The LRT-3 alternatives would also result in fewer auto diversions because of travel time increases for downtown to downtown transit travel due to the elimination of the faster express bus service. It would also be less accessible for some residents further away from the transit stops along the route due to the greater station spacing, even though this is partially compensated by better feeder service.

- Corridor Ridership

All alternatives would produce corridor ridership increases with respect to the Null ranging from 5 percent (TSM Alternative) to 25 percent (LRT-1 and LRT-3). Most of the new riders are auto diversions, but some are attracted to the guideway from other transit routes outside the corridor. Express bus ridership is much smaller for LRT-1, LRT-2 and the busway alternative because the express bus service is discontinued during off-peak hours. This factor contributes to increases in guideway ridership. For the LRT-3 alternative, all the express bus service is eliminated and therefore all corridor trips are shown as guideway trips. In other words, former express bus riders would be forced into the guideway under LRT-3.

- Travel Time Savings

Travel time savings for existing transit riders represent an important benefit. Such transit users are now provided better service and associated benefits. This measure is estimated by comparing changes in door-to-door travel time for each alternative, as compared to the Null, and assigning a dollar value to the time savings. Table S-1 includes a summary of travel time savings for the University Avenue Corridor.

Travel time savings for fixed guideway alternatives in the University Avenue Corridor, calculated in relation to the Null alternative, ranged from $4.4 million to $7.2 million. A modest travel time savings of $.2 million was estimated for the TSM alternative. The LRT-3 alternative saved more than $2 million more in travel time compared to LRT-1 or Busway, reflecting the faster average travel speeds which it is able to achieve. This occurs in spite of the fact that downtown to downtown riders during peak-hours experience a 7 minute travel time increase. LRT-1 and Busway were in turn estimated to save more travel time than the longer LRT-2. In summary, all fixed guideway alternatives are effective in terms of travel time reductons, with LRT-3 being the most effective.

- Congestion

Fixed guideway alternatives on University Avenue would result in relatively modest reductions of auto travel (i.e. about 2% during peak hours) along I-94 but no significant differences would exist among the various alternatives. These changes would still produce a positive impact on traffic along the freeway.

LRT alternatives would result in fewer transit vehicles in the downtown areas than the bus alternatives (i.e. 36-48 vehicles for the LRT alternatives versus 63-66 vehicles for the bus alternatives).

Some isolated traffic problems were also identified for the fixed-guideway alternatives along Washington Avenue at the University of Minnesota and along University Avenue between Bedford Street and Washington Avenue. Those problems, however, could be mitigated by several solutions such as diverting auto traffic in the University of Minnesota area.

o Economic Measures

- Revenue/cost comparisons

Table S-1 summarizes the annual farebox revenues estimated for each alternative in the University Avenue corridor. The table also contains the operating ratio, that is, annual farebox revenues divided by annual operating costs, for all corridor transit services (both guideway transit, feeder bus, and other supplementary corridor bus services). This measure indicates what portion of the operating costs is paid for by farebox revenues. An operating ratio greater than 1 means that revenues outweight costs. Conversely, an operating ratio smaller than 1 means that costs are greater than revenues. The annual operating deficits implied by these farebox revenues, at the corridor level are also shown.

Every fixed guideway alternative is effective in improving the operating ratio in comparison to either the Null or the TSM. Two alternatives, LRT-1 and LRT-3, actually show a surplus of farebox revenues over operating costs, with an operating ratio of 1.02 and 1.13 respectively. LRT-2 and Busway also display significantly improved operating ratios of .92 and .89, respectively. These operating ratios are reflected in corridor-level operating deficit as high as $860,000 for Busway, to a surplus as high as $910,000 for LRT-3. The Null and TSM alternatives experience, in comparison, deficits of $2.18 million and $2.08 million, respectively.

At the overall regional system level, the TSM alternative would increase the annual operating deficit in comparison to the Null by about $3.3 million, to a total of $71.1 million. Each of the fixed guideway alternatives would, however, actually reduce this annual operating deficit in comparison to the TSM alternative. In other words major improvements in fixed guideway transit in the corridor would actually result in less annual operating deficit. This would be due to a combination of higher ridership levels and reduced operating costs that would be achieved in comparison to the TSM alternative.

- Induced Development

Experience in other regions suggests that fixed-guideway rail alternatives can have a positive impact in the reallocation of regional growth to land areas adjacent to stations. Around 10,000 reallocated jobs and as many as 2,000 reallocated dwelling units could be associated with stations (especially CBD stations). This reallocation would be consistent with regional goals regarding efficient land development.

o Environmental Measures

The alternatives proposed would be very effective in terms of minimizing environmental impacts. Minimum amounts of land acquisition would be required and no residential or industrial land uses would be displaced. During construction of fixed-guideway alternative, temporary and short term impacts

could be expected. However, these impacts would not have major consequences because alternatives use an existing transportation right-of-way.

Some visual impacts could exist at sensitive sites, such as the Capitol Area. Design treatments and public involvement in design of the selected alternative could mitigate negative impacts. Another possible environmental concern is the air quality at the intersection of University and Snelling Avenues, where standards are presently violated but measures are to be taken to alleviate the problem in the next few years. A third concern is possible removal of parking along University Avenue, but loss of parking would likely only occur at station areas and could be offset by providing off-street parking facilities.

o Efficiency Measures

Capital and operating/maintenance costs have been converted into equivalent annual costs to permit a more consistent comparison and evaluation. Equivalent annual costs allow capital-intensive and labor-intensive alternatives to be compared over a longer-range time horizon, so that amortized capital costs can be matched against annual operating costs.

For the University Avenue Corridor, equivalent annual costs oscillate from a low of $10.39 million for the Null alternative to a high of $31.04 million for the LRT-3S. The busway and TSM alternatives show a lower EAC than the LRT alternatives mainly because of the influence of lower capital costs.

The "cost-effectiveness ratios" also included in Tables S-1 and S-2 represent summary comparison measures for assessing the different alternatives. These ratios permit the "payoff" or "return" on investment, for various measures of capital and/or operating costs, to be determined. Such output or efficiency measures are calculated in terms of cost per passenger, where passengers may be defined as only auto diversions, as guideway passengers, or as overall corridor transit passengers. These summary "output" measures provide a useful index of the "productivity" of each alternative.

Depending upon the cost measure chosen, as well as the ridership measure chosen, such efficiency indices reflect different perspectives on the performance of different alternatives.

The first measure listed in Table S-1 and S-2 as a "cost-effectiveness ratio" represents a relative index of the net direct benefits delivered by each alternative developed by the Urban Mass Transportation Administration. It measures these benefits both in terms of the number of new riders diverted from their automobiles (appearing as the denomination in the index), and for former transit riders who are provided better service (reflected in terms of travel time savings accrued by these riders). These travel time benefits are subtracted from equivalent annual costs, to derive an economic measure, and then divded by auto diversions or new transit riders. Equivalent annual costs include both equivalent annual capital costs and annual operating costs.

Because it represents a balancing of two measures of benefits against two measures of cost (capital and operating), this is the single most useful efficiency measure in the table. However, it should be utilized with judgement, and is not by itself a sufficient measure to form conclusions about each alternative.

The other cost-effectiveness ratios provide unit costs by dividing the EAC or

the incremental EAC with respect to the Null Alternative by different measures such as travel time savings, corridor passengers or guideway passengers.

Equivalent Annual Cost Minus Value of Travel Time Savings, Per New Transit Riders. The busway alternative display a travel time savings that exceeds equivalent annual cost, giving this index a minus sign. These represent the best performing alternatives, and reflect both lower equivalent annual costs and lower travel time savings than other options. LRT-3 shows the next highest performance, reflecting particularly its high level of travel time savings. It is followed by LRT-1 and then LRT-2.

This particular index, for the University Avenue corridor, shows that the busway and LRT-1 each offer a combination of new riders and net costs which are superior to the combinations offered by LRT-2 and LRT-3.

Equivalent Annual Costs Per Hour Saved. This index represents a partial cost/benefit ratio for exising transit users. Two alternatives--LRT-3 and Busway--show the lowest index values, falling within seven percent of one another. LRT-1 and LRT-2 show higher index values, followed by TSM which has a very high index value. The latter indicates that relatively little travel time savings are achieved, for the cost required, for the TSM alternative.

Equivalent Annual Cost Per Corridor Passenger. The TSM, Null, and Busway alternatives perform somewhat better than the LRT-3 alternatives.

Equivalent Annual Cost Per New Passenger. All fixed guideway alternatives perform better than the TSM alternative here, due largely to the higher number of automobile diversions which they achieve. The Busway, and LRT-1 alternatives perform best.

Equivalent Annual Cost Per Guideway Passenger. The busway performs best here followed by LRT-3.

Two other criteria, listed under the "Revenues" section of Table S-1, also represent efficiency measures in relation to annual operating costs.

Operating Cost Per Corridor Passenger. All fixed guideway alternatives perform better than the Null or TSM alternatives along this criterion. LRT-3 achieved the lowest operating cost per corridor passenger, followed by LRT-1 and Busway.

Operating Deficit Per Corridor Passenger. All fixed guideway alternatives perform better than the Null or TSM alternatives. LRT-3 provides a surplus of farebox revenues over operating cost, as does LRT-1.

o Equity

No major "lumpiness" was found for any of the alternatives. That is, no geographic or socio-economic sub-group received disproportionate benefits or disbenefits. Environmental impacts are relatively slight in nature. No significant dislocation impacts due to right-of-way acquisition are expected, since existing transportation rights-of-way are utilized almost exclusively.

The Central/Dale neighborhood represents the highest concentration of household members under the poverty income level within the corridor. Accessibility measured in terms of percent of work and non-work trip attractions within 45 minutes travel time would be significantly improved by all fixed guideway

alternatives, compared to the TSM option. This improvement would range from a relative gain of 41 percent (Busway) to 91 percent (LRT-3). Such improvements can be considered a more equitable distribution of benefits.

o Tradeoffs

This section summarizes the major advantages (benefits) and disadvantages (costs or disbenefits) of the alternatives in each corridor, proceeding from the least costly to the most costly transit improvement. The general intent is to give an understanding of what would be gained or lost by implementing one alternative rather than another. Important considerations here are the tradeoffs between direct benefits (to former and new transit users), indirect benefits and costs, capital costs, and operating costs.

Null Alternative. In the University Avenue Corridor, the Null Alternative would offer the same level of transit services that are available--local and express buses operating in mixed traffic. No significant improvement in accessibility through improved level of service and better speeds would be offered. At the same time, capital cost requirements would be the lowest of any alternative. Transit ridership and operating ratios would be the lowest of any alternative.

TSM Alternative. This alternative offers very little improvement over the or the Null Alternative. This alternative achieves a modest gain of new transit riders, but with correspondingly low capital costs. Travel time savings are also small because only very slight accessibility gains are offered. The incremental equivalent annual cost per new passenger is lower than for the other alternatives except the busway.

Busway Alternative. For about double the capital cost of the TSM alternative, the Busway option offers noticeable accessibility improvements and travel time reductions for the corridor. This correspondingly yields a signficantly increased number of automobile diversions to transit. The operating ratio is also signficantly improved over TSM, and the incremental equivalent annual cost per new transit rider is the lowest of any alternative except the TSM.

LRT-1. This alternative provides further improvements in accessibility, travel time savings and the highest automobile diversions, but also requires the highest level of total capital cost with the exception of the LRT-3S alternative which includes a subway solution for downtown Minneapolis. Farebox revenues will approximately equal operating costs, though equivalent annual costs per new passenger is higher than for the busway alternative. A potential for induced development at station areas, especially in both CBDs, applies as well to the other fixed-guideway alternatives.

LRT-2. This alternative is the lowest in cost of the three light rail options, though all are significantly more costly than the busway alternatives. New transit riders are lowest among the light rail options, as is daily guideway ridership because it does not serve as well a major trip generator such as the main campus of the University of Minnesota. Daily guideway ridership and travel time savings are also lower than for the busway alternative.

LRT-3. This alternative offers improved travel time for corridor riders but penalizes downtown to downtown riders. This alternative is only slightly lower than LRT-1 in terms of total capital cost, but also has alower level of new transit riders diverted from their automobile. It has the highest level of

total corridor transit ridership, however mainly because downtown to downtown riders are forced into the guideway. The one mile station spacing would also penalize some short-trip riders even though additional feeder bus service has been provided to improve accessibility to stations (not counting transfers). If offers the highest operating ratio for any alternative, with a surplus of farebox revenues over operating costs. It is lowest in terms of equivalent annual costs per hour saved, and yields significantly higher travel time savings than any other fixed guideway alternatives. The LRT-3S alternative accomplished similar benefits than the LRT-3 but would require a more than double capital investment.

Southwest Corridor

o Transportation Measures

- Auto Diversions

All alternatives in the Southwest Corridor would produce person-trip shifts from automobile to transit. These shifts range from a minimum of 1,000 auto diversions for the TSM alternative to a maximum of 5,800 new transit riders for an LRT line starting in Minnetonka and following the Milwaukee/Nicollet alignment (LRT-1B).

No major differences occur within the group of LRT alternatives or within the busway alternatives. LRT alternatives range from 5,300 to 5,800 new transit riders whereas busway alternatives oscillate from 2,700 to 3,200 auto diversions. In other words, changes in length among alternatives of the same type do not result in major shifts in attracting new riders. Furthermore, the route along the Milwaukee Road alignment versus the CNW alignment does not alter the number of new riders significantly, either. Loss in new suburban riders is compensated by gains in inner city riders.

The difference between LRT and busway alternatives are mainly due to higher speeds and more frequent stops along the guideway which provide greater intra-corridor accessibility.

- Corridor Ridership

All guideway alternatives would be effective in producing significan tridership gains at the corridor level with respect to the Null and TSM alternatives. Extension of the fixed-guideway alternatives to TH 101 does not generate a significant amount of additional ridership. Even the busway ending at Wooddale Avenue generates ridership levels similar to the other busway alternatives.

LRT alternatives generate approximately 10 percent more corridor trips then the corresponding busway alternatives because of higher speeds on the guideway and better intra-corridor accessibility.

Milwaukee Road alignment alternatives have also a higher ridership than the corresponding CNW alternatives. The higher densities of the area adjacent to the Milwaukee/Nicollet alignment more than offset the losses of a suburban riders due to longer travel time.

- Travel Time Savings

Travel time savings for the Southwest Corridor fixed guideway alternative (see

TABLE S-2
SUMMARY OF SIGNIFICANT IMPACTS FOR THE SOUTHWEST CORRIDOR

CRITERIA	NULL Alt.	TSM Alt.	CNW Alignment Alternatives: LRT-1A To Minnetonka	BUS-1A To Minnetonka	LRT-2A To Hopkins	BUS-2A To Hopkins	BUS-3A To Wooddale	Milwaukee/Nicollet Alignment Alternatives: LRT-1B To Minnetonka	BUS-1B To Minnetonka	LRT-2B To Hopkins	BUS-2B To Hopkins	BUS-3B To Wooddale
Year 2000 Ridership												
Corridor Ridership (Includes Bus)												
Daily (Linked Trips)	18,500	19,500	24,000	21,100	23,800	21,000	20,700	27,800	23,500	27,600	23,400	23,100
Annual (Million)	5.46	5.75	7.08	6.22	7.02	6.20	6.11	8.20	6.93	8.14	6.90	6.81
New Transit Riders (Auto Diversions)												
Daily	--	1,000	5,500	2,600	5,300	2,500	2,200	5,800	2,500	5,600	2,400	2,100
Annual (Million)	--	.295	1.623	.767	1.564	.738	.649	1.711	.738	1.652	.708	.620
Guideway Ridership												
Daily	--	--	17,000	15,100	16,700	14,900	14,600	23,500	20,200	23,200	20,000	19,700
Annual (Million)	--	--	5.01	4.45	4.93	4.40	4.31	6.93	5.96	6.84	5.90	4.93
Costs ($1984 Million)												
Total Capital Cost	9.0	13.4	89.4	63.2	75.3	53.2	38.3	105.5	77.2	89.8	67.4	51.8
Annual Capital Cost	1.32	1.89	10.09	7.30	8.59	6.18	4.60	11.85	8.83	10.16	7.72	6.04
Annual O & M Cost	7.50	8.53	8.20	8.36	8.55	8.11	8.06	8.06	8.58	8.27	8.45	8.21
Equivalent Annual Cost	8.73	10.32	18.11	15.50	16.97	14.15	12.53	19.71	17.24	18.25	16.01	14.11
Travel Time Savings (Existing Transit Riders)												
Daily Hrs	--	321	4,106	4,483	3,788	4,136	3,706	3,867	3,730	3,567	3,441	3,011
Annual Hrs (Million)	--	.095	1.211	1.322	1.117	1.220	1.093	1.141	1.100	1.052	1.015	.888
Annual Value ($1984 Million)	--	.35	4.47	4.89	4.14	4.51	4.05	4.22	4.08	3.90	3.75	3.29
Revenues ($1984 Million)												
Annual Farebox Revenues	3.35	3.46	5.39	4.38	5.38	4.34	4.29	6.10	4.81	6.06	4.78	4.72
Operating Ratio	.45	.41	.66	.46	.63	.47	.47	.76	.49	.65	.49	.49
Annual Operating Deficit												
Corridor Operating Deficit	4.15	5.07	2.81	3.98	3.17	3.77	3.77	1.96	3.77	2.21	3.67	3.49
Operating Cost Per Corridor Pass.	1.39	1.48	1.15	1.34	1.22	1.31	1.32	1.00	1.24	1.02	1.22	1.21
Operating Deficit Per Corr. Pass.	.76	.88	.40	.64	.45	.61	.62	.24	.54	.27	.53	.51
Cost Effectiveness Ratios												
(EAC[a] - Value of Travel Time Savings)/New Riders[b]	--	--	2.76	1.36	2.25	-0.74	-4.21	3.90	7.20	3.23	5.54	2.62
EAC Per Hour Saved[c]	--	16.74	7.75	5.12	7.38	4.44	3.48	9.62	7.74	9.05	7.17	6.06
EAC Per Corridor Passenger	1.60	1.80	2.56	2.49	2.42	2.28	2.05	2.40	2.49	2.24	2.32	2.07
EAC Per New Transit Rider[c]	--	5.39	5.78	8.83	5.27	7.34	5.86	6.42	11.53	5.76	10.28	8.68
EAC Per Guideway Passenger	--	--	3.62	3.48	3.44	3.22	2.91	2.84	2.89	2.67	2.71	2.86
Accessibility: (% Trip Opportunities)[d]												
Minneapolis CBD	29.2%	29.4%	31.6%	31.2%	31.7%	31.3%	31.4%	31.0%	31.0%	31.1%	31.1%	31.2%
Lake/Nicollet	22.2	22.3	22.3	22.8	22.0	22.5	22.2	23.4	23.4	23.1	23.1	22.8
France Ave.	13.7	14.0	21.5	19.5	19.1	17.3	15.0	20.2	20.2	17.9	17.9	15.6
Hopkins	3.4	11.4	11.9	9.3	12.9	10.1	11.0	11.4	11.4	12.4	12.4	13.3
Deephaven	.2	1.9	8.3	2.8	2.1	.7	.1	4.7	4.7	1.2	1.2	.5

[a] EAC: Equivalent Annual Cost

[c] Incremental change with respect to Null Alternative

Table S-2) range from $3.3 million (Busway-3B) to $4.9 million (Busway-1A). Again the TSM alternative achieves a more modest travel time savings of $.35 million. The alternatives along the CNW alignment show greater time savings than those following the Milwaukee Road/Nicollet Avenue alignment, reflecting the faster service they provide between suburban communities and the Minneapolis CBD. However, the Milwaukee Road alternatives provide travel time savings for Minneapolis patrons which partly balance the additional travel time which suburban commuters would experience (5 minutes longer per suburban trip to reach the Minneapolis CBD).

- Congestion

One of the major concerns regarding the Southwest Corridor was the bottleneck east of France Avenue that forced through traffic into the neighborhoods and the accumulation of buses on Hennepin Avenue and in the downtown areas. All of the fixed-guideway alternatives would relieve these problems. Reductions in auto traffic of about 6 percent during peak hours would take place in those areas east of France Avenue.

Bus requirements for the busway alternatives would remain approximately the same than for the Null alternative but would not be routed along Hennepin Avenue which is the most conflictive arterial. They would either use the CNW right-of-way or Nicollet Avenue. LRT alternatives would require a much smaller number of vehicles than the Null, TSM and corresponding busway alternative. For instance, alternative Busway-1A uses 38 guideway buses whereas LRT-1A uses only 10 vehicles. In summary, guideway alternatives would produce modest but positive reductions in neigborhood and downtown traffic. LRT alternatives would reduce the number of vehicles entering the area east of France Avenue and downtown Minneapolis.

o Economic Measures

- Revenue/Cost Comparisons

Annual farebox revenues, associated operating ratios and annual operating deficits for the Southwest Corridor are summarized in Table S-2. Operating ratios reflect both low-density distribution of transit passengers (and consequently the higher operating costs necessary to serve them), as well as the high proportion of background bus and feeder bus services necessary to provide complete corridor service coverage. Operating ratios for the supporting bus services are lower than those achieved for the fixed guideway alternatives, lowering the overall corridor average which is indicated in the table. The TSM alternative offers a slightly lower operating ratio of .41 in comparison to the Null. All fixed guideway alternatives provide higher operating ratios, from a slight improvement of .47 for Busway-1A to .76 for LRT-1B. In general, the light rail alternatives have higher operating ratios than the busway alternatives. All busway and the TSM alternatives increase the corridor deficit somewhat, since increased operating efficency is more than offset by increased transit service and cost. The LRT alternatives lower the deficit slightly.

- Induced Development

The fixed-guideways alternatives are estimated to induce a regional reallocation of up to 10,000 jobs to station areas along the corridor, as well as up to 2,000 dwelling units. Much of this reallocation, associated with the

Minneapolis CBD, would achieve regional goals with regard to efficient land development.

o Environmental Measures

The proposed alternatives would be very effective in terms of minimizing environmental impacts. One possible impact of significance would be noise violations that could occur in Hopkins due to the proximity of the guideway to residential development; up to 35 residences could be affected. Mitigating measures proposed, such as noise barriers and engineering technigues could be used to eliminate violations of noise standards. Visual intrusion and parking removal are concerns in specific areas, and could be mitigated as discussed above for the University Avenue corridor.

o Efficiency Measures

The different cost-effectiveness indexes for the Southwest Corridor are summarized in Table S-2.

In the Southwest corridor, the Null and TSM alternatives have the lowest EACs. For the fixed-guideway alternatives, the differences are relatively small among alternatives of the same length and with the same routing. Shorter alternatives (i.e. less capital-intensive) exhibit lower EACs.

Equivalent Annual Cost Minus Value of Travel Time Savings, Per New Passenger. Two of the busway options (Bus 2A and Bus 3A) exhibit negative values for this index. This indicates that when compared to the TSM alternatives, the benefits, in terms of travel time savings more than offset the total annual cost. The options following the CNW alignment show greater cost-effectiveness than those using the Milwaukee Road alignment. The shorter fixed-guideways also exhibit greater cost-effectiveness than the longer ones.

The LRT alternatives along the CNW alignment show greater cost-effectiveness than the corresponding busway alternatives. The reverse is true for the Milwaukee Road alignment.

Equivalent Annual Cost Per Hour Saved. The incremental EAC per hour saved (i.e. travel time savings, unit costs) shows a similar distribution than the previous index. For this index, shorter alternatives perform better than longer ones. The CNW alignment alternatives perform better than the corresponding Milwaukee Road alternatives. The busway alternatives perform better than the corresponding LRT alternatives.

Equivalent Annual Cost Per Corridor Passenger. The EAC per total corridor passenger exhibit small differences between the Milwaukee Road and the CNW alignments. Shorter alternatives, however, also perform better under this index than longer alternatives. The LRT alternatives exhibit slightly higher values than their corresponding busway alternatives along the CNW alignment. The reverse is true for the Milwaukee Road alignment.

Equivalent Annual Cost Per New Passenger. Again, the CNW alignment alternatives exhibit a better performance under this index than the Milwaukee Road alternatives. Also, shorter alternatives perform better than longer ones. The LRT alternatives exhibit greater cost-effectiveness than the corresponding busway alternatives.

Equivalent Annual Cost Per Guideway Passenger. The EAC per guideway passenger is more favorable for shorter alternatives, for those following the Milwaukee Road alignment. The busway alternatives perform better thhan the corresponding LRT alternatives for the CNW alignment. Along the Milwaukee Road, both kind of alternatives perform almost the same.

o Equity

In the Southwest Corridor the Lake/Nicollet neighborhood represents the highest level of persons below the poverty level in this sector of the region. Because of its close proximity to the Minneapolis CBD, improvements in accessibility as compared to the Null or TSM alternatives are slight, for any of the fixed guideway options. The percentage of attractions within 45 minutes travel time of this neighborhood would at best increase by only 5 percent in comparison to the TSM option.

o Tradeoffs

Null Alternative. In the Southwest Corridor the Null Alternative involves significant expansion in service (reduced headways) over existing routes, to keep pace with population growth projected for the corridor. It includes both local and express buses operating in mixed traffic, as well as limited use of HOV lanes along I-394. For some passengers, improvements in accessibility may be provided via reduced wait times (or in-vehicle time along I-394), but increasing congestion along arterial streets will lengthen travel times.

TSM Alternative. This alternative offers a modest level of service improvements which result in few new riders diverted from their automobiles, and low travel time savings for existing riders. Its capital and operating costs are correspondingly higher than for the Null. Accessibility improvements are modest. Equivalent annual costs for new passengers is the highest of any alternative, while the operating ratio is approximately the same as for the Null.

Busway Alternatives. The busway alternatives represent significant service improvements for existing riders as evidenced by the travel time savings. The length of the guideway, however, does not result in major changes in benefits. In other words, extending the guuideway from Wooddale Avenue to TH 7 or TH 7 to TH 101 does not result in major ridership gains or travel time savings.

The busway alternatives along the CNW alignment afford greater travel time savings for suburban riders than those following the Milwaukee Road alignment, and are also less expensive to build. The CNW alignment alternatives attract fewer guideway riders but attract almost as many new transit riders as the Milwaukee Road alternatives.

Light rail alternatives have differences among themselves similar to those discussed above for the several busway alternatives.

Differences in costs and benefits exist between light rail and busway alternatives having comparable lengths and routings. In general the LRT alternatives provide a better service, as measured by the number of new transit riders. Operating ratios are better for light rail alternatives, primarily because of higher farebox revenues since operating costs for all fixed guideway alternatives are within the range of $8.1 to $8.6 million. The major

difference between busway and LRT alternatives is a somewhat more costly capital investment needed for LRT of about $2 to $3 million dollars on an annualized basis.

Financial Feasibility

Financial feasibility has been examined from two perspectives. First, four scenarios demonstrating the potential of various combinations of federal, state, and local funding sources for the capital cost of the system were developed. Federal sources considered are the UMTA Section 3 and Section 9 funds. A possible source of state funds is the portion of the Motor Vehicle Excise Tax that has been dedicated to transit. The use of public/private coventure sources such as tax increment financing and benefit assessment districts are also considered. Each source and scenario has advantages and disadvantages that need to be weighed.

The stability of existing sources of operating funds for the regional system, and the potential impact of the alternatives on the overall regional operating deficits is another consideration. All alternatives in the University Avenue Corridor would reduce the regional deficit, up to 4.5 percent with any of the fixed guideway alternatives.

Southwest Corridor fixed guideway alternatives would similarly result in a small reduction in the regional operating deficit. The TSM alternative, however, would increase the deficit slightly.

DE324C