LRT

Metropolitan Council of the Twin Cities Area

Summary of Consultant Report

Light Rail Transit Feasibility Study

April 1981

Pursuant to 1980 Laws, ch 607, Art 13, section 3
(one of 5 pubns)

FOREWORD

This document summarizes a consultant's report prepared for the Metropolitan Council on the feasibility of light rail transit (LRT) in the Metropolitan Area. It summarizes the findings of Sanders & Thomas, Inc., consulting engineers of Pottstown, Penn., who were assisted by the Midwest Research Institute and the Comsis Corp.

The summary explains the purpose of the study and generally what kinds of vechicles and right-of-way are needed for light rail transit lines. It also summarizes the consultant's analysis of LRT along five alignments within four general transportation corridors--one, west and southwest of the Minneapolis central business district (CBD); a second, northwest of the Minneapolis CBD; a third, north and northeast of the St. Paul CBD; and a fourth, stretching between the Minneapolis and St. Paul CBDs.

Progress on the study was monitored by the Light Rail Transit Project Coordinating Group, an advisory committee appointed by the Metropolitan Council to involve local governmental officials and citizens in the study. Members of the LRT Coordinating Group included representatives of the two counties and 12 cities located in the transportation corridors selected for study, as well as representatives of the Council's Transportation Advisory Board (see membership list included in this summary).

The study was supervised by the Light Rail Transit Project Management Team, a group composed of two staff representatives from the Metropolitan Council, Metropolitan Transit Commission, and the Minnesota Department of Transportation.

Although the Council, the Project Management Team and the LRT Coordinating Group were involved in its preparation and review, the study report, including this summary, is the product of the consultants who carried out the study. The Council's recommendations based on the study report are contained in a separate document.

The following were involved in the preparation and review of this report:

LRT COORDINATING GROUP

Name	Representing	Name	Representing
Ken Yager, Chairman	Minnetonka		
Peter Abbey	Brooklyn Park	Richard Kremer	Hennepin County
John Bastian	Maplewood	Tony Kuefler	Brooklyn Center
James Bellus	St. Paul	George Latimer	St. Paul
Emil Brandt	Transportation Advisory Board	A. J. Lee	Hennepin County
		Phyllis McQuaid	St. Louis Park
Oliver Byrum	Minneapolis	James Miller	Minnetonka
Jeff Christensen	Robbinsdale	Harold Norgard	Ramsey County
William Craig	Hopkins	Lowell Odland	Golden Valley
Barry Evans	Maplewood	Gerald Splinter	Brooklyn Center
Milton Honsey	New Hope	William Thibault	St. Louis Park
John Irving	Crystal	Rosemary Thorsen	Golden Valley
George Isaacs	Ramsey County	Parker Trostel	Minneapolis
David Jacobs	Robbinsdale	Ron West	Brooklyn Park
Gayle Kincannon	Transportation Advisory Board	Curt Wilson	New Hope

PROJECT MANAGEMENT TEAM

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Metropolitan Council: Larry Dallam; Natalio Diaz

Metropolitan Transit Commission: Eugene Avery; Phil Braum

Minnesota Department of Transportation: Peter Fausch; Brian Vollum

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Arsen Darney, Midwest Research Institute, Inc.

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Katheryn Kozar, Midwest Research Institute, Inc.

INTRODUCTION

THE PURPOSE OF THE STUDY

The purpose of this study is to provide the information necessary to permit the Metropolitan Council to determine the feasibility of light rail transit (LRT) in the Twin Cities Metropolitan Area as mandated by the Minnesota Legislature and to provide input to the review of the Transportation Policy Plan.

A Need for Policy Change

As part of its responsibilities for coordinating metropolitan planning and development, the Metropolitan Council is required by Minnesota statute (Section 473.146, Subd. 2) to carry out a comprehensive review of the Transportation Policy Plan at least once every four years.

One element of the Policy Plan, as adopted in 1976, states that, "No fixed guideway for the exclusive use of transit (buses and automated and semi-automated technologies) is to be provided for regional and subregional service" through the year 1990. In the intervening 4 years significant changes in the price and availability of petroleum as well as patterns of development and public attitudes towards transportation warrant a reexamination of this statement.

Since 1976 transit ridership in the Twin Cities has increased from 62 million to 75 million. During the same period transit operating costs have increased from $42 million to over $80 million. A prime attribute of fixed guideway transit modes is their potential to carry higher passenger volumes more productively than is possible with highway-oriented modes such as the bus. With the sharp runup in patronage and costs, this attribute justifies consideration of fixed guideway transit as a plausible candidate for future development.

Minnesota Legislative Mandate

Several types of fixed guideway modes have been subjects of earlier studies. One that was not is light rail transit (LRT). However, because of its unique characteristics and growing popularity in North America and Europe, the time appeared appropriate to investigate the potential of LRT for the Twin Cities. Therefore, in early 1980, legislation was enacted which requested the Council to "conduct a feasibility study of the use of light rail transit in the Metropolitan Area." (Chapter 607, Minnesota Laws, 1980) The study is to become a significant input in the updating of the applicable policies, priorities and implementation guidelines.

DEFINITION OF LIGHT RAIL TRANSIT

LRT uses electrically propelled rail vehicles which operate singly or in trains on predominantly reserved, but not necessarily grade-separated, rights-of-way. It provides a wide range of passenger capacities and performance characteristics at moderate costs.

Rights-Of-Way

The feature that distinguishes LRT most sharply from other urban transit modes is the variety of options for the location and design of the guideway. For maximum benefit, LRT should operate primarily on private or reserved rights-of-way separated from traffic. However, even when this is not always possible, the overall system functions at a higher level of performance and reliability than is possible with a totally highway-oriented mode.

The virtue of LRT is that a system can perform effectively even when it consists of a mix of alignment locations: streets, pedestrian malls, highway medians, separate rights-of-way with or without grade crossings, railroad or utility rights-of-way, elevated structures or subways. Segments can then be upgraded on an incremental basis as funds become available. For example, a particularly congested and hazardous intersection can be eliminated by a short overpass or section of tunnel. Some LRT systems have been labeled "premetro," with the long range objective of total conversion to full-scale, heavy rail transit.

Vehicles

LRT vehicles range from single-unit, four-axle cars to five-unit, 12-axle cars. The vehicles can be designed to load from ground level or from high, train floor level platforms. The new cars manufactured by the Boeing Company for San Francisco have convertible steps for high loading in the subway portion and low loading on the surface portion of the system.

Passenger capacity of LRT vehicles bears a close relationship to car length, although the number of seats will affect total capacity. The new, single unit Canadian light rail vehicle has 46 seats and room for 85 standees for a total of 131 passengers. The West German designed U-2 vehicle, which has been delivered to Edmonton, Calgary and San Diego, has 64 seats plus 97 standees for a total capacity of 161 passengers. The 71 foot, two-unit Boeing light rail vehicle, which has been used as a basis for all calculations in this study, has 68 seats and a planning capacity of 140 passengers. Most light rail vehicles have couplers to permit multiple car operations. A two-car train of Boeing vehicles, operated by one crewman, would provide a total planning capacity of 280 passengers.

Relatively close station spacing requires high performance in order for LRT to provide competitive travel time. State-of-the-art vehicle technology demonstrates this performance is achieved. In addition, operating noise generated by typical, modern LRT vehicles is less than that of buses. With regard to providing full access for the elderly and handicapped, light rail vehicles can be equipped with chair lifts in conjunction with low level platforms.

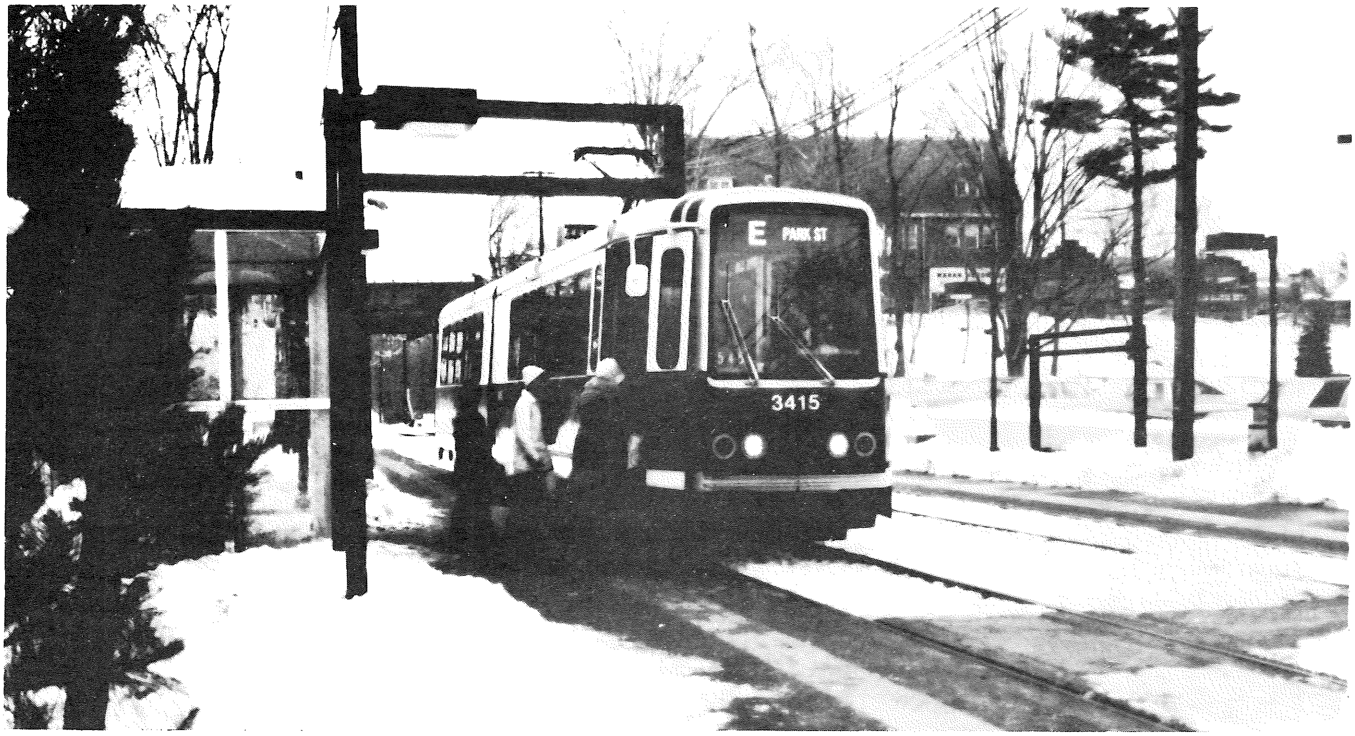
Stations

Stations for LRT need not be elaborate and do not require cashiers. In the United States, fares are usually collected on board by the operator, while in Europe there is a widespread practice of self-service fare collection whereby the operator is relieved of all responsibilities for the function. In this study, it is assumed that some form of self-service fare collection will be employed. This affects operating costs and speed assumptions.

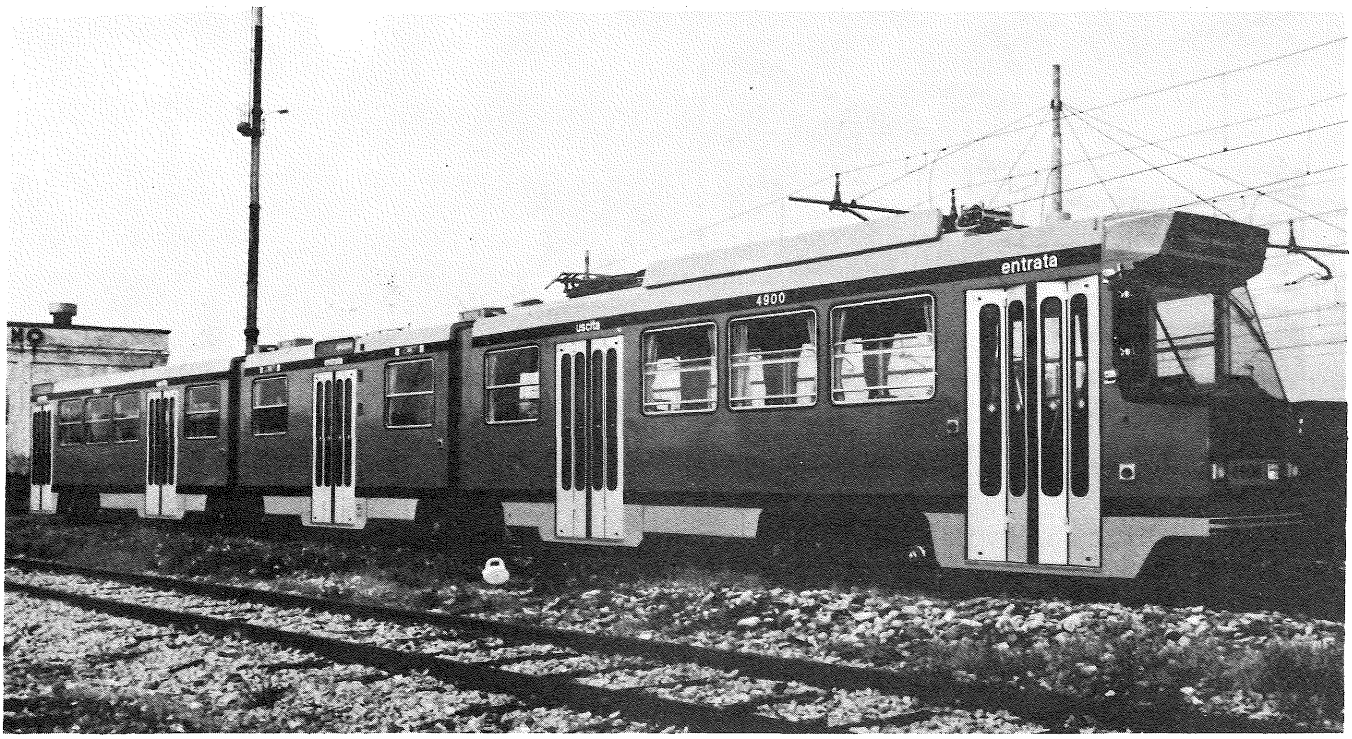
Platforms are usually 75 to 250 feet in length. They can be as simple as a loading area that is delineated by pavement markings in a city street to a full, high-level platform of the type that is found in heavy rail transit systems. Designs can be tailored to the site and can incorporate simplicity and low-cost characteristics. In the study, a uniform station design has been adopted for all locations: a 150 foot, low-level platform with two off-the-shelf bus shelters.

Operations and Control

The separation of LRT lines from general traffic permits higher running speeds and more reliable schedules. However, more positive control of vehicle movement is required. On the street the operation may be under total control of the driver, while on separated rights-of-way where higher speeds are practical some form of automatic train control is advisable. The study provides for manual, line-of-sight operation on the downtown, street-running segments. For the private rights-of-way, which comprise more than 90 percent of the total alignments, a conventional electric block signal system has been incorporated into the hypothetical lines. The system includes an automatic stop to bring the train to a halt if the driver does not respond to the red indication.

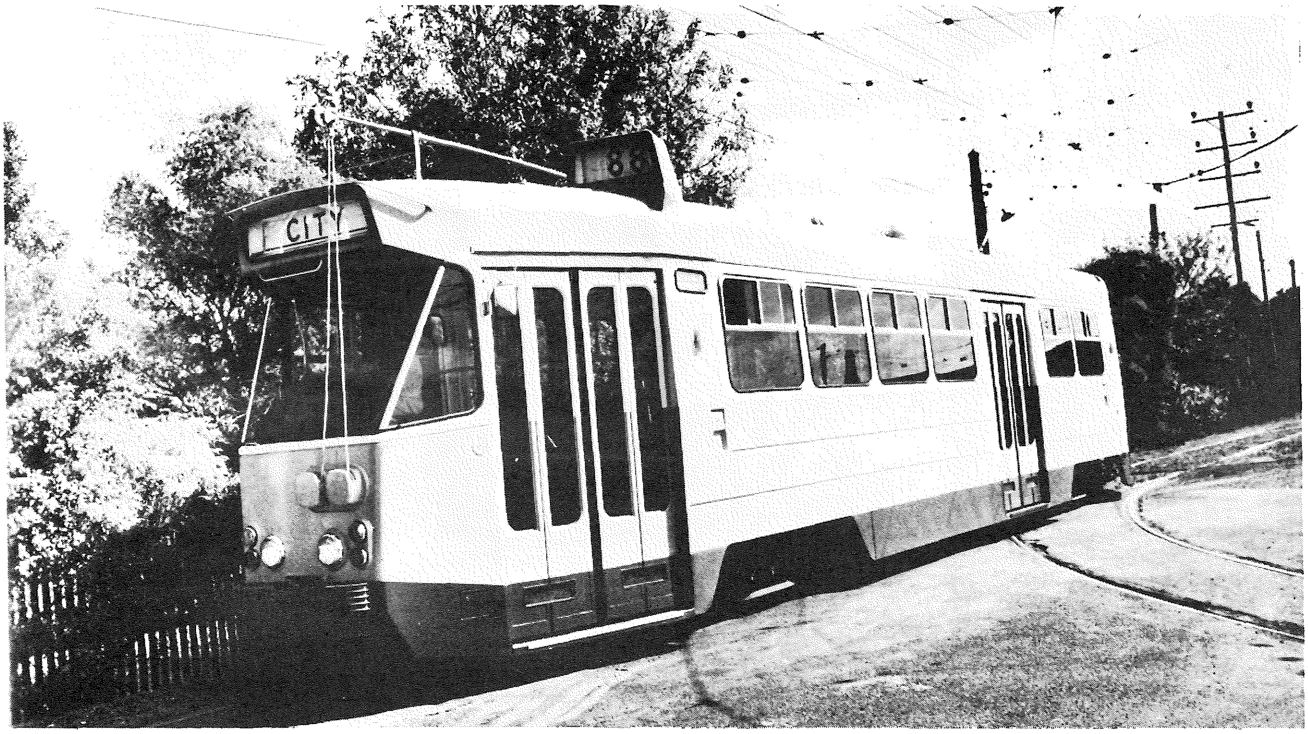


The United States Standard Light Rail Vehicle, manufactured by the Boeing Company, has been acquired by the transit systems in San Francisco and Boston, where it is seen here on the upgraded Riverside Line.



One of the longest (95 ft) urban light rail vehicles, this eight-axle car operates in Milan, Italy. It has 80 seats and a standee capacity of 210.

FIGURE 1 VEHICLES.

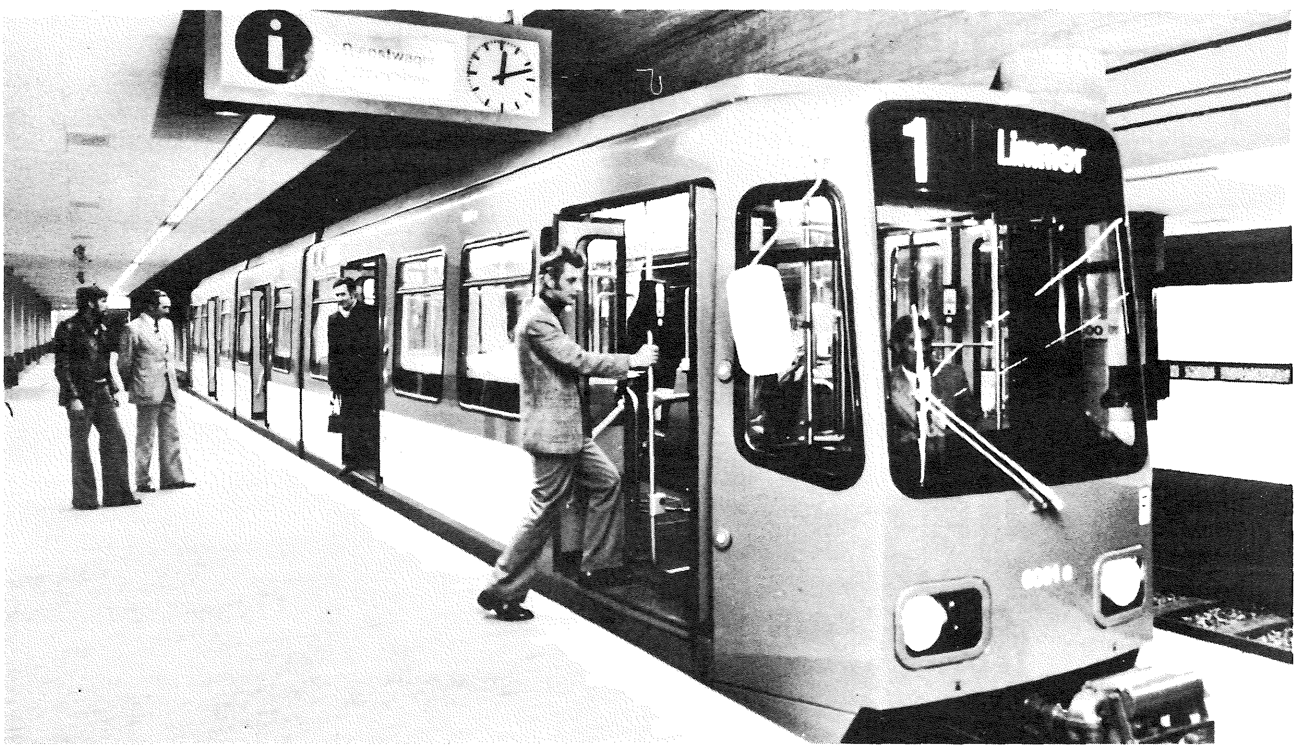


This single-unit vehicle is one of an original fleet of 115 placed in service by the Melbourne, Australia transit system in 1975. A second order for 100 of these double-ended cars is now being delivered.

These three-unit vehicles were manufactured in Belgium for the expanding Brussels "premetro" light rail transit system. All trucks are powered.

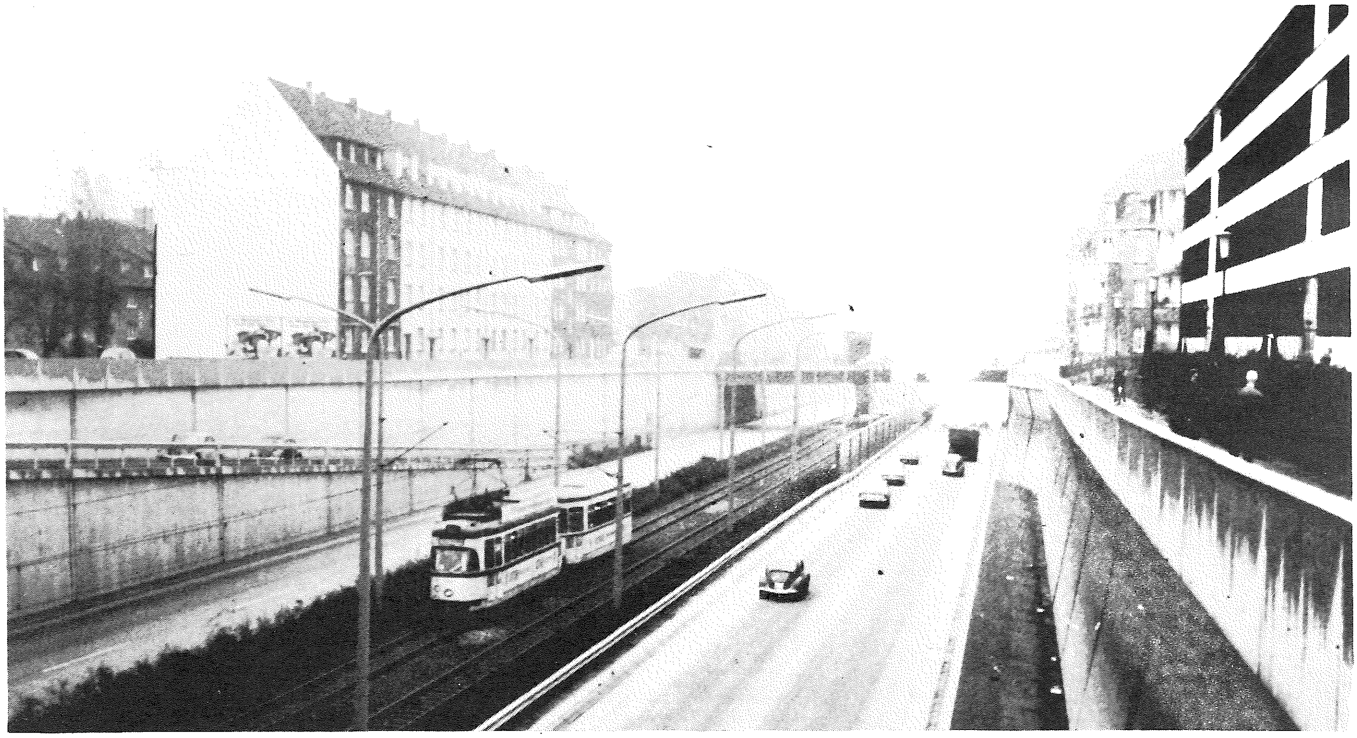
FIGURE 2. VEHICLES.

Light rail transit reaches the highest level of performance when located on its own right-of-way as demonstrated by this Frankfort, West Germany suburban line. The U-2 type vehicle has also been delivered to Edmonton, Calgary and San Diego.

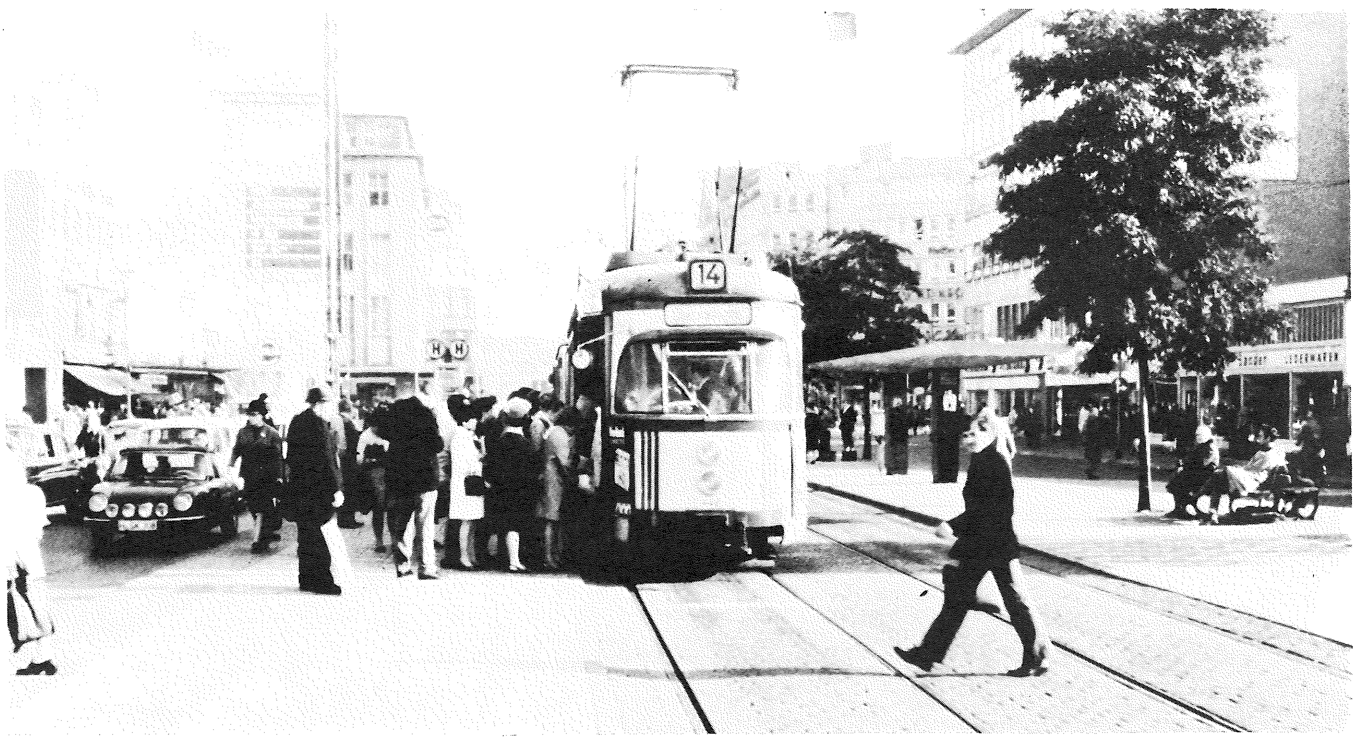


More than a score of cities have modernized their street railway systems by placing certain segments in subway. The upgrading process can occur on an incremental basis as financial resources become available.

FIGURE 3. RIGHTS-OF-WAY.



Expressway medians are ideal locations for high speed LRT operations as seen in this view of West Germany's Autobahn through the Ruhr metropolis of Essen.



Downtown alignments in street medians or pedestrian malls provide the highest degree of passenger access at minimal cost. Operations can be speeded by LRT preemption of traffic signals.

FIGURE 4. RIGHTS-OF-WAY.

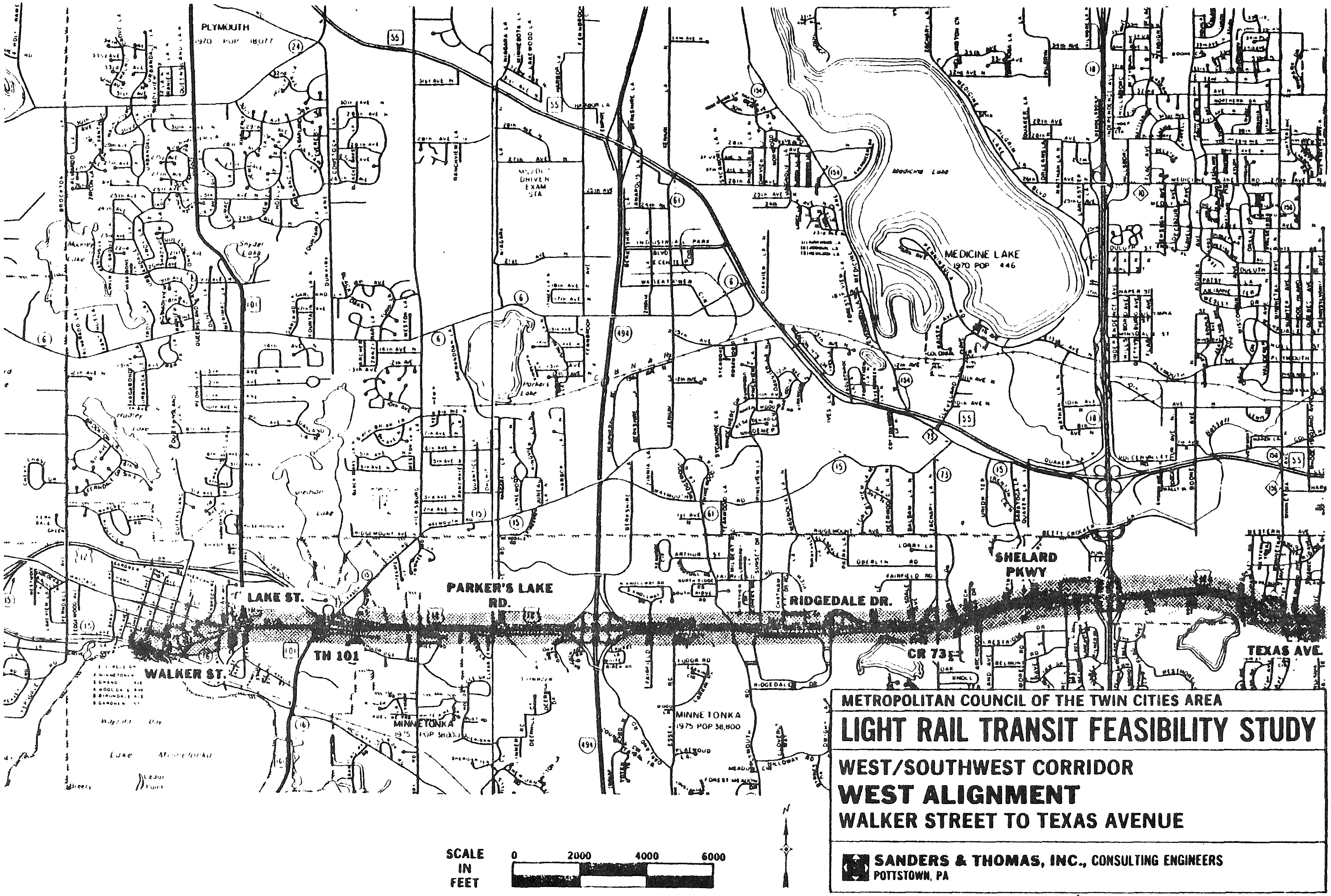
DATA SHEET - WEST ALIGNMENT

	LRT	Non-LRT (HOV)*
Length: miles	12.5	9.5
Route:	TH 12	TH 12 HOV Lanes
Stops	20	Up to 4
Average Speed	21 MPH	45 MPH
Headways-Peak	5 MIN	5 MIN
Entrances	NA	5
Annual Passengers (000's)	8,187	7,421
Daily Passengers	27,800	25,200
Peak Passengers	2,800	2,940
Daily Passengers/Route Mile	2,224	2,653
Express Vehicle Miles (000's)	888	1,778
Express Vehicle Requirements	28	45
Passengers/Express Vehicle Mile	8.9	4.2
Construction Cost	85.4	44.6
Capital Cost	138.9	77.2
Capital Cost/Mile	11.1	8.1
Annualize Capital Cost	13.6	8.0 (Revised)
Express Operating & Maintenance Cost ($ million)	2.42	2.98
Total Operating & Maintenance Cost ($ million)	6.33	6.89

*"HOV" means "high-occupancy vehicles."

	LRT	Non-LRT (HOV)*
Annual Passenger Revenues ($ million)	4.1	3.71
Annual Surplus/(Deficit) without Capital Costs ($ million)	(2.23)	(3.18)
Annual Surplus/(Deficit) with Capital Costs ($ million)	(15.8)	(11.2)
Transit Induced Development & Redevelopment 1990-2000 (acres)	136.4	NA
Total Corridor New Development 1990-2000 (acres)	1,904	1,904
Annual Air Pollution (000's lbs.)	1,313.4	968.8
Annual Water Pollution (000's lbs.)	27.9	58.7
Annual Solid Waste (000's lbs.)	1,858.2	33.4
Annual Petroleum Consumed (000's gal.) by Transit in Corridor	505	1,060
Annual Petroleum Consumed by all Modes in Corridor (000's gal.)	27,534	28,090
Annual Total Energy Consumed (MBTV's)	171,150	166,200

FIGURE III-1



METROPOLITAN COUNCIL OF THE TWIN CITIES AREA

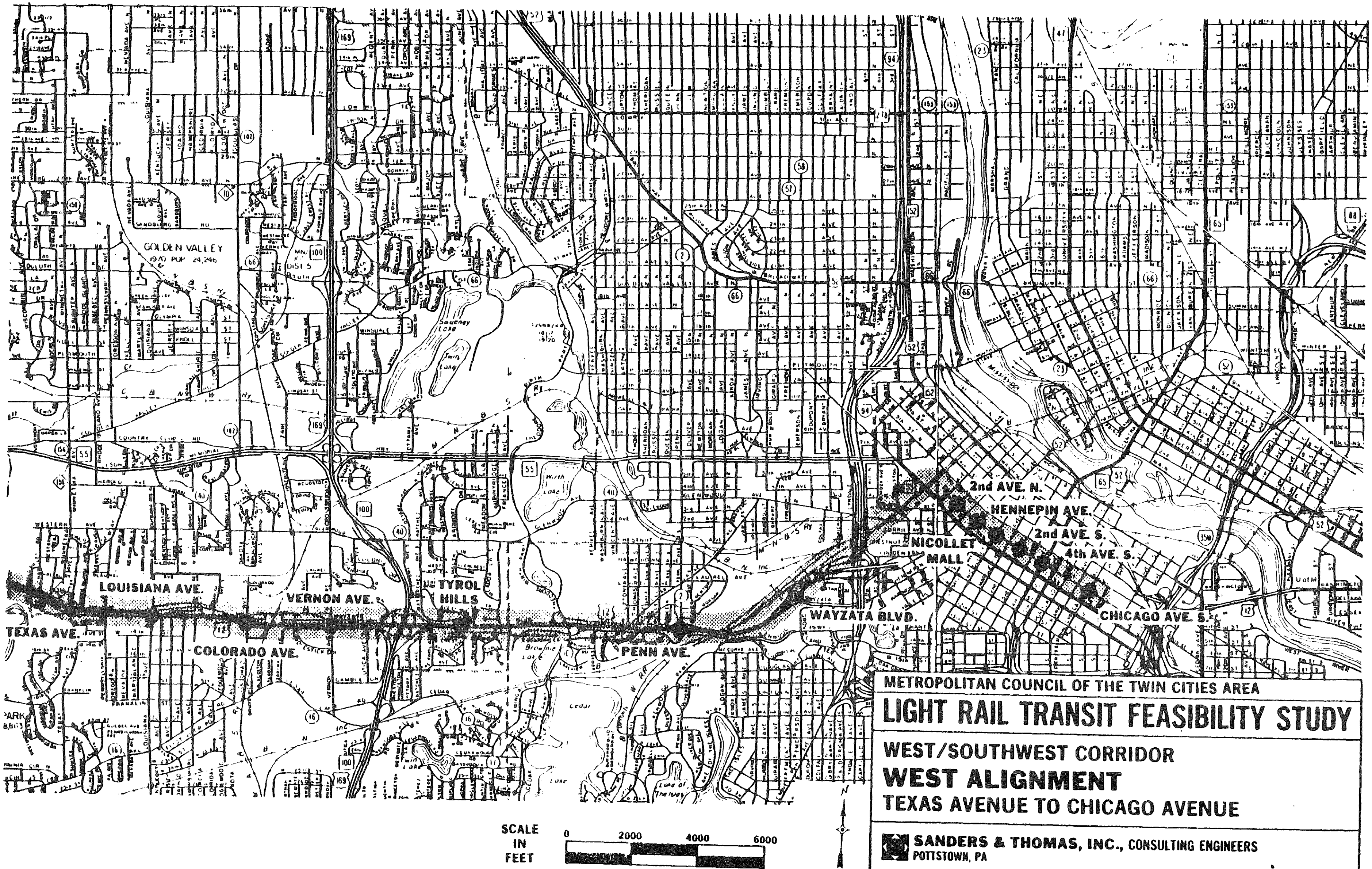
LIGHT RAIL TRANSIT FEASIBILITY STUDY

WEST/SOUTHWEST CORRIDOR

WEST ALIGNMENT

WALKER STREET TO TEXAS AVENUE

SANDERS & THOMAS, INC., CONSULTING ENGINEERS
POTTSTOWN, PA



METROPOLITAN COUNCIL OF THE TWIN CITIES AREA

LIGHT RAIL TRANSIT FEASIBILITY STUDY

WEST/SOUTHWEST CORRIDOR

WEST ALIGNMENT

TEXAS AVENUE TO CHICAGO AVENUE

SANDERS & THOMAS, INC., CONSULTING ENGINEERS
POTTSTOWN, PA

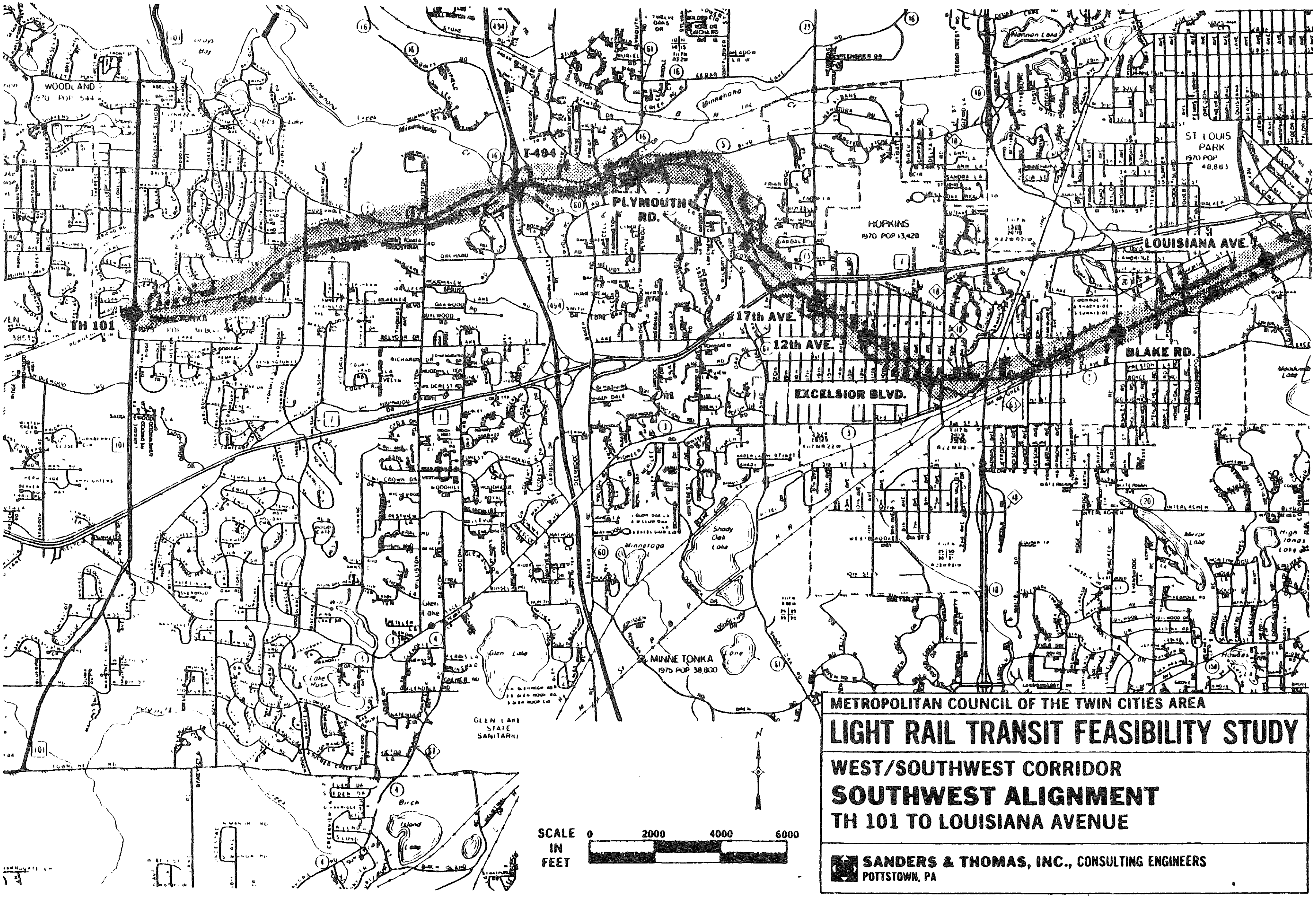
FIGURE III-2

DATA SHEET - SOUTHWEST ALIGNMENT

	LRT	Non-LRT (Improved Bus)
Length: miles	14.10	N/A
Route:	C & NW RR	Improved Bus Service
Stops	20	N/A
Average Speed	24 MPH	12 MPH
Headways-Peak	5 MIN.	N/A
Annual Passengers (000's)	7,480	5,978
Daily Passengers	25,400	20,300
Peak Passengers	2,700	N/A
Daily Passengers/Route Mile	1,801	N/A
Express Vehicle Miles (000's)	1,014	N/A
Express Vehicle Requirements	23	N/A
Passengers/Express Vehicle Mile	7.4	N/A
Construction Cost	83.7	0.0
Capital Cost	133.8	22.8
Capital Cost/Mile	9.5	N/A
Annualize Capital Cost	12.9	3.0 (Revised)
Express Operating & Maintenance Cost ($ million)	2.59	N/A
Total Operating & Maintenance Cost ($ million)	5.42	6.75

	LRT	Non-LRT (Improved Bus)
Annual Passenger Revenues ($ million)	3.74	2.99
Annual Surplus/(Deficit) without Capital Costs ($ million)	(1.68)	(3.76)
Annual Surplus/(Deficit) with Capital Costs ($ million)	(14.2)	(6.8) (Revised)
Transit Induced Development & Redevelopment 1990-2000 (acres)	82.8	Not Available
Total Corridor New Development 1990-2000 (acres)	2,431	2,431
Annual Air Pollution (000's lbs.)	1,254.4	875.2
Annual Water Pollution (000's lbs.)	17.0	48.5
Annual Solid Waste (000's lbs.)	1,892.5	27.6
Annual Petroleum Consumed (000's gal.) by Transit in Corridor	308	876
Annual Petroleum Consumed by all Modes in Corridor (000's gal.)	28,554	29,122
Annual Total Energy Consumed (MBTV's)	142,000	136,700

FIGURE IV-1



WOODLAND
1970 POP 544
TH 101
I-494
PLYMOUTH RD.
HOPKINS
1970 POP 13,428
ST LOUIS PARK
1970 POP 48,883
LOUISIANA AVE.
17th AVE.
12th AVE.
EXCELSIOR BLVD.
BLAKE RD.
MINNETONKA
1975 POP 38,800
Glen Lake
GLEN LAKE STATE SANITARIU
Shady Oak Lake
Minnetoga Lake
Birch Island Lake
Mirror Lake
N
SCALE IN FEET
0
2000
4000
6000
METROPOLITAN COUNCIL OF THE TWIN CITIES AREA
LIGHT RAIL TRANSIT FEASIBILITY STUDY
WEST/SOUTHWEST CORRIDOR
SOUTHWEST ALIGNMENT
TH 101 TO LOUISIANA AVENUE
SANDERS & THOMAS, INC., CONSULTING ENGINEERS
POTTSTOWN, PA

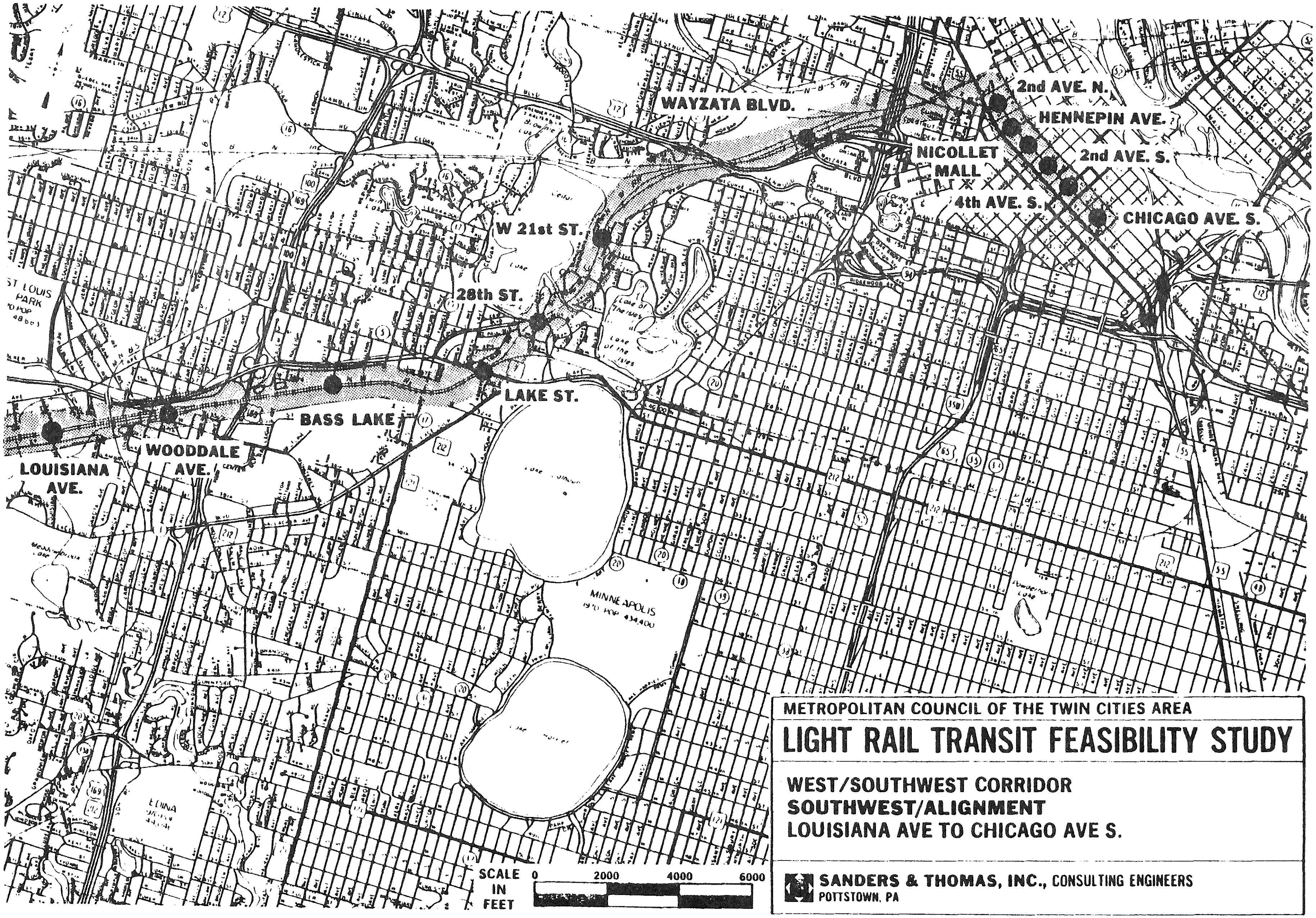

2nd AVE. N.
HENNEPIN AVE.
NICOLLET MALL
2nd AVE. S.
4th AVE. S.
CHICAGO AVE. S.
WAYZATA BLVD.
W 21st ST.
28th ST.
LAKE ST.
BASS LAKE
WOODDALE AVE.
LOUISIANA AVE.
ST LOUIS PARK
MINNEAPOLIS
EDINA
SCALE IN FEET
0
2000
4000
6000
METROPOLITAN COUNCIL OF THE TWIN CITIES AREA
LIGHT RAIL TRANSIT FEASIBILITY STUDY
WEST/SOUTHWEST CORRIDOR
SOUTHWEST/ALIGNMENT
LOUISIANA AVE TO CHICAGO AVE S.
SANDERS & THOMAS, INC., CONSULTING ENGINEERS
POTTSTOWN, PA

FIGURE IV-2

Revised March 30, 1981

DATA SHEET - UNIVFRSITY ALIGNMENT

	LRT	Non-LRT (Trolley Bus)
Length: miles	9.46	9.46
Route:	Univ./Wash.	Univ./Wash. Trolley Buses
Stops	27	N/A
Average Speed	16 MPH	14 MPH
Headways-Peak	7 MIN.	4 MIN.
Annual Passengers (000's)	12,854	10,260
Daily Passengers	43,600	34,900
Peak Passengers	12,300	8,700
Daily Passengers/Route Mile	4,609	3,689
Express Vehicle Miles (000's)	704	1,341
Express Vehicle Requirements	21	45
Passengers/Express Vehicle Mile	18.2	7.65
Construction Cost	80.7	4.3
Capital Cost	101.0	15.0
Capital Cost/Mile	10.7	1.6
Annualize Capital Cost	9.6	1.6 (Revised)
Express Operating & Maintenance Cost ($ million)	1.87	3.75
Total Operating & Maintenance Cost ($ million) *	1.87	3.75

*No feeder bus system was costed for either alternative in the University Avenue Corridor.

	LRT	Non-LRT
Annual Passenger Revenues ($ million)	6.42	5.13
Annual Surplus/(Deficit) without Capital Costs ($ million)*	4.55	1.38
Annual Surplus/(Deficit) with Capital Costs ($ million) *	(5.1)	(0.3) (Revised)
Transit Induced Development & Redevelopment 1990-2000 (acres)	21.1	Not Available
Total Corridor New Development 1990-2000 (acres)	22	22
Annual Air Pollution (000's lbs.)	708.5	951.2
Annual Water Pollution (000's lbs.)	0	6.7
Annual Solid Waste (000's lbs.)	1,307.6	1,216.7
Annual Petroleum Consumed (000's gal.) by Transit in Corridor	0.0	119
Annual Petroleum Consumed by all Modes in Corridor (000's gal.)	17,486	17,605
Annual Total Energy Consumed (MBTV's)	64,800	77,300

*No feeder bus system was costed for either alternative in the University Avenue Corridor.

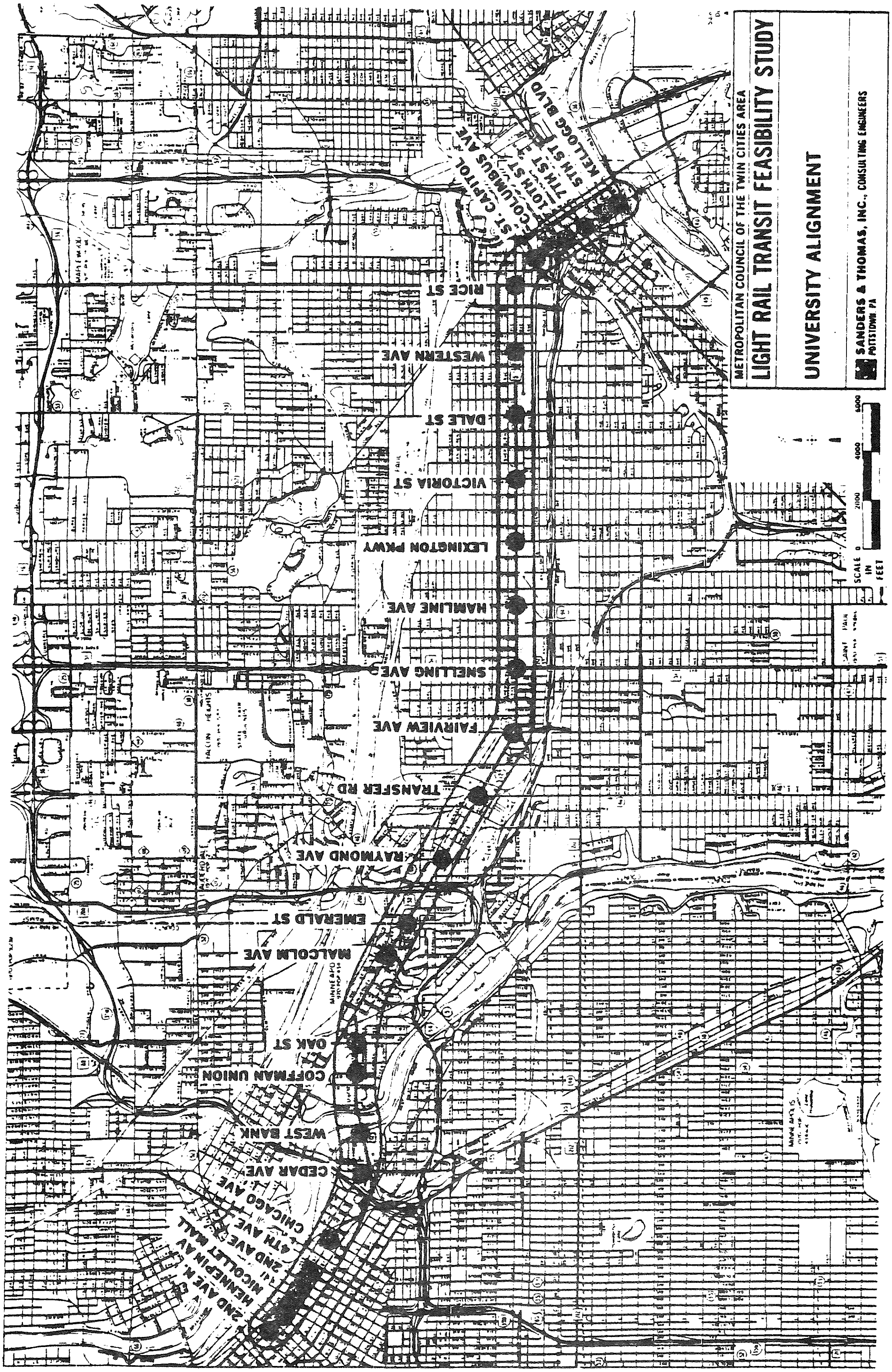

METROPOLITAN COUNCIL OF THE TWIN CITIES AREA
LIGHT RAIL TRANSIT FEASIBILITY STUDY
UNIVERSITY ALIGNMENT
SANDERS & THOMAS, INC., CONSULTING ENGINEERS
POTTSTOWN PA
SCALE IN FEET
0
2000
4000
6000
KELLOGG BLVD
5TH ST
7TH ST
10TH ST
COLUMBUS AVE
ST. CAPITOL
RICE ST
WESTERN AVE
DALE ST
VICTORIA ST
LEXINGTON PKWY
HAMLINE AVE
SNELLING AVE
FAIRVIEW AVE
TRANSFER RD
RAYMOND AVE
EMERALD ST
MALCOLM AVE
OAK ST
COFFMAN UNION
WEST BANK
CEDAR AVE
CHICAGO AVE
4TH AVE
2ND AVE
NICOLLET MALL
HENNEPIN AV
2ND AVE N.

FIGURE V-I

Revised March 30, 1981

DATA SHEET - NORTHEAST ALIGNMENT

	LRT	Non-LRT (Bus Bypass of Ramp Metering)
Length: miles	877	8.00
Route:	BN RR	I-35E Bus Bypass of Metered Ramps
Stops	17	None
Average Speed	19 MPH	40 MPH
Headways-Peak	8 MIN	N/A
Entrance Ramp	N/A	6
Annual Passengers (000's)	5,301	4,116
Daily Passengers	18,000	14,000
Peak Passengers	4,500	3,400
Daily Passengers/Route Mile	2,052	1,750
Express Vehicle Miles (000's)	401	1,059
Express Vehicle Requirements	17	50
Passengers/Express Vehicle Mile	13.2	3.9
Construction Cost	55.8	2.8
Capital Cost	81.0	18.9
Capital Cost/Mile	9.2	2.4
Annualize Capital Cost	7.9	2.4 (Revised)
Express Operating & Maintenance Cost ($ million)	1.35	2.20
Total Operating & Maintenance Cost ($ million) *	1.63	2.55

*Only a portion of the feeder system or non-express routing required to feed the LRT or non-LRT alternative was costed in the Northeast analysis.

	LRT	Non-LRT	
Annual Passenger Revenues ($ million)	2.65	2.06	
Annual Surplus/(Deficit) without Capital Costs ($ million)*	1.3	(0.49)	
Annual Surplus/(Deficit) with Capital Costs ($ million)*	(6.8)	(2.8)	(Revised)
Transit Induced Development & Redevelopment 1990-2000 (acres)	63.0	Not Available)	
Total Corridor New Development 1990-2000 (acres)	2,274	2,274	
Annual Air Pollution (000's lbs.)	424.4	477.3	
Annual Water Pollution (000's lbs.)	1.6	22.7	
Annual Solid Waste (000's lbs.)	745.3	12.9	
Annual Petroleum Consumed (000's gal.) by Transit in Corridor	29	410	
Annual Petroleum Consumed by all Modes in Corridor (000's gal.)	18,686	19,066	
Annual Total Energy Consumed (MBTV's)	41,400	63,400	

*Only a portion of the feeder system or non-express routing required to feed the LRT or non-LRT alternative was costed in the Northeast analysis.

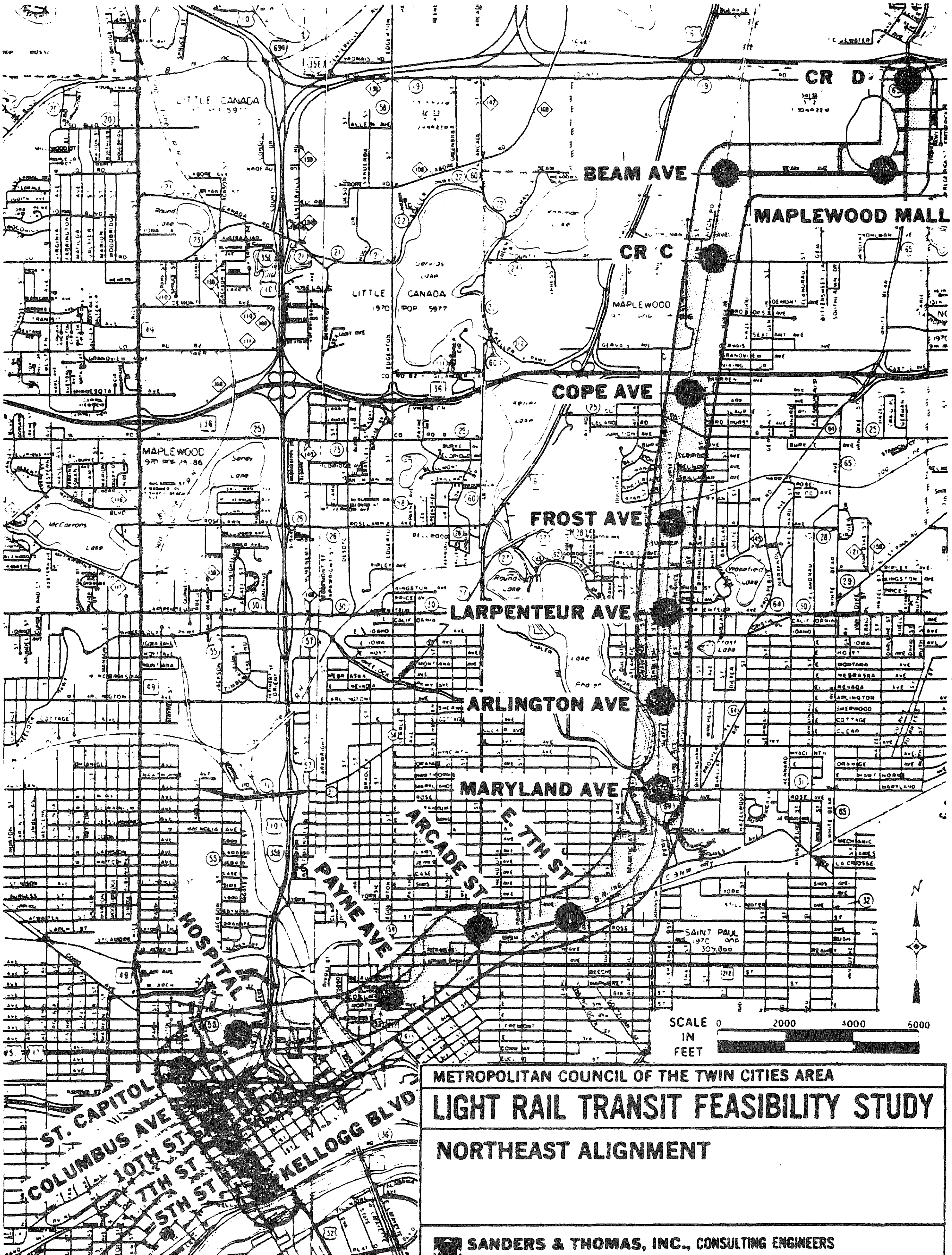

CR D
BEAM AVE
MAPLEWOOD MALL
CR C
LITTLE CANADA
1970 POP 5977
MAPLEWOOD
COPE AVE
FROST AVE
LARPENTEUR AVE
ARLINGTON AVE
MARYLAND AVE
ARCADE ST
E. 7TH ST
PAYNE AVE
HOSPITAL
ST. CAPITOL
COLUMBUS AVE
10TH ST
7TH ST
5TH ST
KELLOGG BLVD
SAINT PAUL
SCALE IN FEET
0
2000
4000
6000
N
METROPOLITAN COUNCIL OF THE TWIN CITIES AREA
LIGHT RAIL TRANSIT FEASIBILITY STUDY
NORTHEAST ALIGNMENT
SANDERS & THOMAS, INC., CONSULTING ENGINEERS
POTTSTOWN, PA

FIGURE VI-1

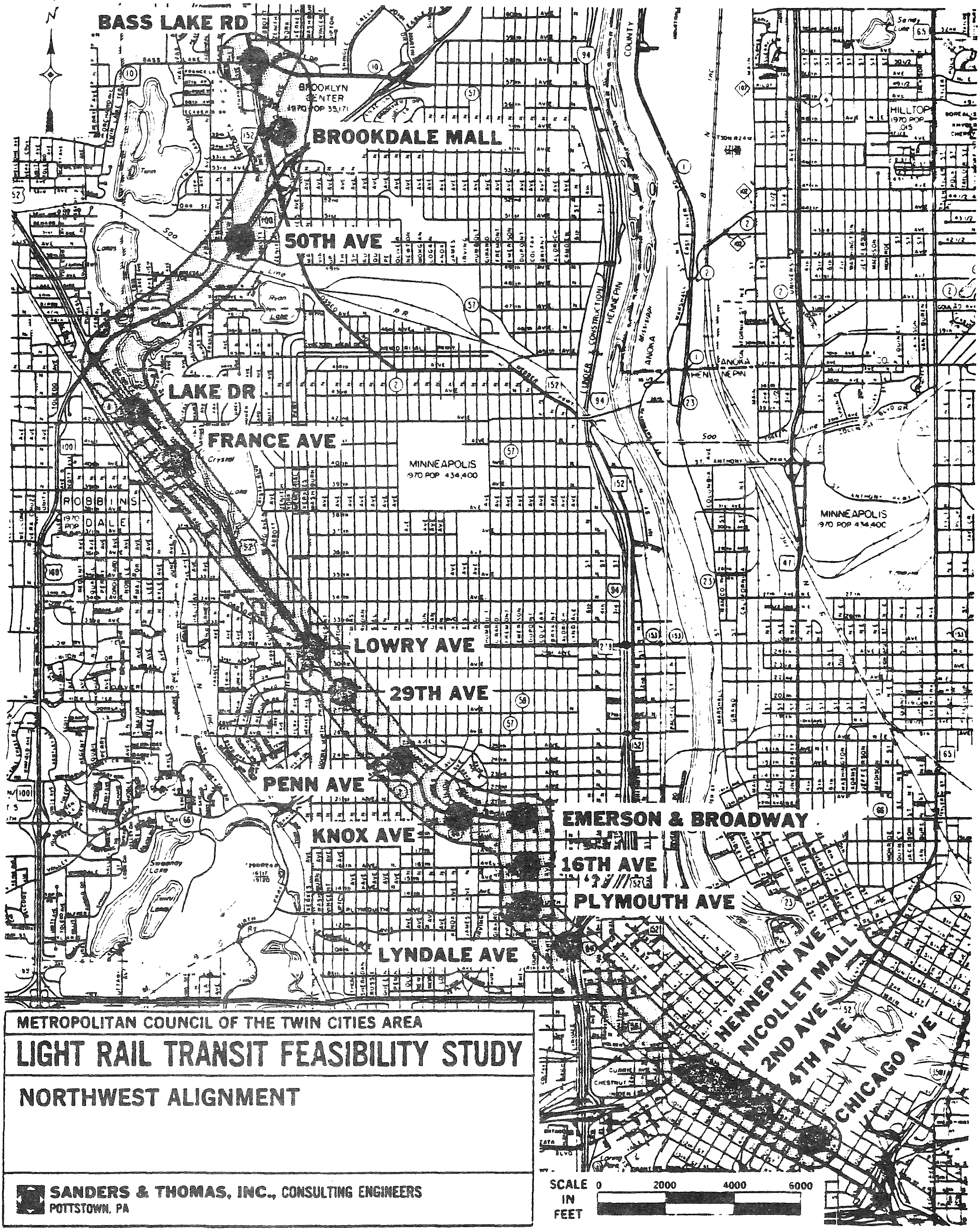
DATA SHEET - NORTHWEST ALIGNMENT

	LRT	Non-LRT
Length: miles	8.3	8.3
Route:	TH52, TH100, TH152	TH52, TH100, TH152
Stops	18	N/A
Average Speed	17 MPH	14 MPH
Headways-Peak	5 MIN.	5 MIN.
Annual Passengers (000's)	10,202	6,527
Daily Passengers	34,700	22,200
Peak Passengers	8,700	5,600
Daily Passengers/Route Mile	4,181	2,675
Express Vehicle Miles (000's)	572	1,143
Express Vehicle Requirements	29	52
Passengers/Express Vehicle Mile	17.8	5.7
Construction Cost	51.0	0.6
Capital Cost	96.7	12.7
Capital Cost/Mile	11.7	1.5
Annualize Capital Cost	9.4	1.7 (Revised)
Express Operating & Maintenance Cost ($ million)*	1.87	2.76
Total Operating & Maintenance Cost ($ million)*	2.21	3.13

*Only a portion of the feeder bus system or non-express routing required to feed the LRT or non-LRT alternative was costed in the Northwest analysis.

	LRT	Non-LRT
Annual Passenger Revenues ($ million)	5.10	3.26
Annual Surplus/(Deficit) without Capital Costs ($ million)*	2.89	.13
Annual Surplus/(Deficit) with Capital Costs ($ million)*	(6.5)	(1.5) (Revised)
Transit Induced Development & Redevelopment 1990-2000 (acres)	34.5	Not Available
Total Corridor New Development 1990-2000 (acres)	3,590	3,590
Annual Air Pollution (000's lbs.)	602.6	426.8
Annual Water Pollution (000's lbs.)	2.0	22.3
Annual Solid Waste (000's lbs.)	1,063.0	12.6
Annual Petroleum Consumed (000's gal.) by Transit in Corridor	37	401
Annual Petroleum Consumed by all Modes in Corridor (000's gal.)	19,404	19,767
Annual Total Energy Consumed (MBTV's)	58,500	62,400

*Only a portion of the feeder bus system or non-express routing required to feed the LRT or non-LRT alternative was costed in the Northwest analysis.



BASS LAKE RD
BROOKDALE MALL
BROOKLYN CENTER
1970 POP 35,171
50TH AVE
LAKE DR
FRANCE AVE
ROBBINSDALE
MINNEAPOLIS
1970 POP 434,400
LOWRY AVE
29TH AVE
PENN AVE
KNOX AVE
EMERSON & BROADWAY
16TH AVE
PLYMOUTH AVE
LYNDALE AVE
HENNEPIN AVE
NICOLLET MALL
2ND AVE
4TH AVE
CHICAGO AVE
HILLTOP
METROPOLITAN COUNCIL OF THE TWIN CITIES AREA
LIGHT RAIL TRANSIT FEASIBILITY STUDY
NORTHWEST ALIGNMENT
SANDERS & THOMAS, INC., CONSULTING ENGINEERS
POTTSTOWN, PA
SCALE IN FEET
0
2000
4000
6000

FIGURE VII-1

SUMMARY

This summary includes the major conclusions of the LRT Feasibility Study grouped in the following manner:

- o Operational Characteristics
- o Ridership/Productivity
- o Interface with Other Modes
- o Capital Costs
- o Operating and Maintenance Costs
- o Impact on Land Use
- o Impact on Energy
- o Impact on the Environment

Operational Characteristics

1. All LRT alignments analyzed would operate at higher average speed than the corresponding non-LRT alternative with the exception of buses operating on HOV lanes or on a metered freeway.

2. An LRT line on an exclusive right-of-way with grade separation would achieve greater operating speeds than one for which the right-of-way is part of an existing roadway.

Ridership/Productivity

1. Each LRT line analyzed would generate more daily patronage than its corresponding non-LRT alternative. The HOV

lane option, however, produced ridership estimates similar to those of the LRT line.

2. LRT productivity, in terms of passengers per vehicle-mile, would be at least twice the productivity of the non-LRT alternative in each corridor considered.

3. LRT productivity, in terms of passengers per route-mile, increases as the population densities of areas contiguous to the alignment increases.

4. LRT can serve peak loads in all corridors analyzed with adequate ability to carry additional passengers.

Interface with Other Modes

1. Substantial realignments of existing bus routes to feed into an LRT line would be required except where the LRT line would exactly replace an existing bus route.

2. In areas presently not well served by transit, LRT requires major improvements in the local transit system to adequately serve the line.

3. All alignments analyzed that serve suburban areas would require a substantial number of park/ride spaces.

Capital Costs

1. Capital cost per mile ranges from 9 to 12 million dollars on all LRT alignments considered. Any right-of-way requiring major relocation or grading would result in higher unit costs.

2. Construction cost per mile would be generally lower along an existing railroad right-of-way than a highway right-of-way as a result of saving in excavation, paving and structural costs.

3. Construction costs would be strongly affected by the amount of right-of-way on downtown streets where utility relocation could be a major expense.

4. The capital cost per mile of each LRT alignment analyzed is substantially higher than the cost per mile of its corresponding non-LRT alternative.

Operating and Maintenance Costs

1. The extent of the additional bus service required to feed into an LRT line would have a major impact on the overall operating cost of the system serving a corridor.

2. Although an LRT line by itself could operate at a surplus, the overall operation would usually result in a deficit if the cost of providing the required feeder service were added.

3. The operating cost per passenger in each LRT alignment analyzed was lower than that of the non-LRT alternative. When annualized capital costs were added, however, the non-LRT alternative would be substantially less expensive than the LRT line, at least during the first few years of operation.[1]

4. Farebox revenues would cover a greater proportion of the operating cost in high density alignments where the LRT operation would be more productive than in low-density alignments.

Impact on Land Use

1. Induced development because of the construction of an LRT line would be limited unless substantially expanded land use controls and development incentives were utilized by local units of government.

2. A modest increase in density of development around LRT stops would likely occur if an LRT line were built.

3. In each alignment analyzed, the non-LRT alternative would not have a measurable impact on land development.

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[1] Operating costs increase with inflation whereas annualized capital costs remain constant over the financial lifetime of a project. Therefore, persistently high inflation rates could accentuate over time any operating cost advantage of an LRT line over its non-LRT alternative. This could in turn at least partially offset the higher annualized capital cost of the LRT option.

Impact on Energy

1. The overall energy consumption, measured in BTU's, of the LRT and non-LRT alternatives in each alignment analyzed would be approximately the same.

2. The petroleum consumed by the LRT alternative would be substantially lower than in the non-LRT option in each alignment analyzed.

3. Petroleum saved by the LRT alternative would be less than 2 percent of the total petroleum consumed in the corridor, for each of the alignments analyzed.

Impact on the Environment

1. The total pollution produced by the LRT alternative would be higher than the amount produced by the non-LRT alternative (with the exception of electric buses) in each of the alignments analyzed.

2. The amount of pollution produced within the corridor by the LRT alternative would be lower than the amount produced by the non-LRT alternative in each alignment analyzed, since most of the pollution generated by the LRT alternative is at the mine or electrical generating plant.

3. Noise pollution from LRT is less than noise pollution from most other modes and can be screened.

SUMMARY TABLE

	WEST ALIGNMENT		SOUTHWEST ALIGNMENT		UNIVERSITY ALIGNMENT		NORTHEAST ALIGNMENT		NORTHWEST ALIGNMENT	
	LRT	HOV	LRT	Improved Bus	LRT	Electric Trolley Bus	LRT	Bus Bypass of Ramp Metering	LRT	Bus Lanes
Annual Express Passengers (000's)	8,187	7,421	7,480	5,978	12,845	10,260	5,301	4,116	10,202	6,527
Daily Express Passengers	27,800	25,200	25,400	20,300	43,600	34,900	18,000	14,000	34,700	22,200
Express Length (miles)	12.50	9.5	14.10	n.a.	9.46	9.46	8.77	8.00	8.30	8.30
Daily Express Passengers/Route Mile	2,224	2,653	1,801	n.a.	4,609	3,689	2,052	1,750	4,181	2,675
% Daily Travel in Corridor	2.6	2.4	2.3	1.9	6.0	4.9	2.9	2.2	5.0	3.2
% of Transit in Corridor	63.4	64.8	46.9	40.5	32.2	27.1	22.6	18.0	37.9	24.6
Construction Cost ($ millions)	85.4	44.6	83.7	n.a.	80.7	4.3	55.8	2.8	51.0	0.6
Capital Cost ($ millions)	138.9	77.2	133.8	22.8	101.0	15.0	81.0	18.9	96.7	12.7
Capital Cost/Mile ($ millions)	11.1	8.1	9.5	n.a.	10.7	1.6	9.2	2.4	11.7	1.5
Annualized Capital Cost ($ millions)	13.0	7.40	11.38	3.01	7.63	1.54	6.17	2.29	9.17	1.66
Express Line Annual Oper. & Maintenance Cost ($ millions)	2.42	2.98	2.59	n.a.	1.87	3.75	1.35	2.20	1.87	2.76
Total Annual Oper. & Maintenance Cost ($ millions)	6.33	6.89	5.42	6.75	1.87[1]	3.75[1]	1.63[1]	2.55[1]	2.21[1]	3.13[1]
Annual Passenger Revenues ($ millions)	4.1	3.71	3.74	2.99	6.42	5.13	2.65	2.06	5.10	3.26
Annual Surplus/(Deficit) without Capital Cost ($ millions)	(2.23)	(3.18)	(1.68)	(3.76)	4.55[1]	1.38[1]	1.3[1]	(0.49)[1]	2.89[1]	.13[1]
Annual Surplus/(Deficit) with Capital Cost ($ millions)	(15.23)	(10.58)	(13.05)	(6.77)	(3.08)[1]	(2.37)[1]	(5.14)[1]	(2.78)[1]	(6.28)[1]	(1.53)[1]
Transit Induced Development & Redevelopment 1990-2000 (acres)	136.4	N/A	82.8	N/A	21.1	N/A	63.0	N/A	34.5	N/A
Transit Induced Residential Development & Redevelopment 1990-2000 (housing units)	1,175	N/A	1,245	N/A	480	N/A	650	N/A	500	N/A
Total Corridor Development 1990-2000 (acres)	1,904	1,904	2,431	2,431	22	22	2,274	2,274	3,590	3,590
Annual Air Pollution (000's lbs.)	1313.4	968.8	1245.4	875.2	708.5	951.2	424.4	477.3	602.6	426.8
Annual Water Pollution (000's lbs.)	27.9	58.7	17.0	48.5	0	6.7	1.6	22.7	2.0	22.3
Annual Solid Waste (000's lbs.)	1858.2	33.4	1892.5	27.6	1307.6	1216.7	745.3	12.9	1063.0	12.6
Annual Petroleum Consumed (000's gallons)	505	1,060	308	876	0	119	29	410	37	401
Annual Petroleum Consumed in Corridor by all Modes (000's gallons)	27,534	28,090	28,554	29,122	17,486	17,605	18,686	19,066	19,404	19,767
Annual Energy Consumed (MBTU's)	171,150	166,200	142,000	136,700	64,800	77,300	41,400	63,400	58,500	62,400

[1] Differences in the methodologies employed in the analysis of alignments make comparisons among all LRT alternatives or all non-LRT alternatives inappropriate. Comparisons of the LRT alternative with its corresponding non-LRT alternative are appropriate for each alignment.