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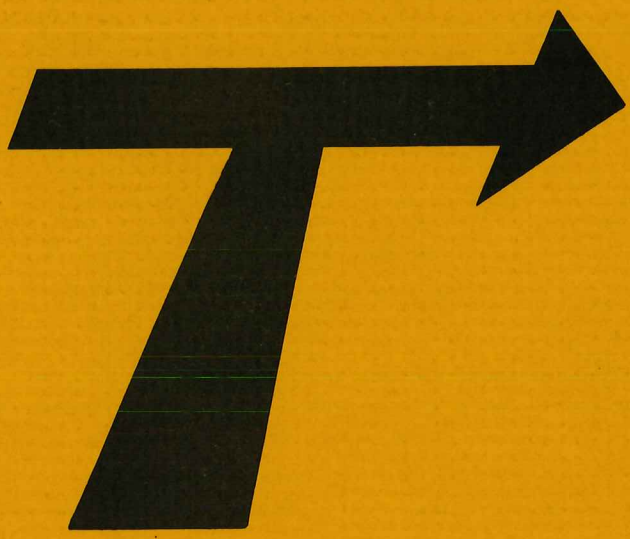
I-35W URBAN CORRIDOR DEMONSTRATION PROJECT: BUS-METERED FREEWAY SYSTEM

FINAL REPORT



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I-35W URBAN CORRIDOR DEMONSTRATION PROJECT: BUS-METERED FREEWAY SYSTEM

FINAL REPORT

SEPTEMBER, 1971

Prepared for:

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PREFACE

The documentation of the work completed under the I-35W Urban Corridor Demonstration Project is presented in three forms: Monthly Progress Reports, Technical Working Papers, and Published Reports. Previous to this document, two reports have been published, "Project Operations Manual" - December, 1970, and "Inventory of Transportation Condition of the I-35W Corridor" - February, 1971. The Technical Working Papers are contained in a separate document, "Supportive Technical Memorandum," dated September, 1971.

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SUMMARY

- The recommendation of this report is to proceed with development of the Bus-Metered Freeway System in the I-35W Corridor. Analysis of the concept, the engineering detail, the operations, and the cost indicates the feasibility of combining a freeway surveillance and control system (a proven concept) and freeway express bus system (a proven concept).

- The major benefits of the Bus-Metered Freeway System include increased accessibility to the Minneapolis CBD, reduced parking requirements in the CBD, reduced accidents and high level of service on I-35W, lower travel costs for transit riders as compared to auto users, improved mobility for corridor residents, approximately equal travel times for express transit and auto users, and increased knowledge about the factors that influence modal choice. These benefits combined with the capability to balance any required auto entrance ramp delay equally throughout the system and the minimal diversion expected to the arterial street system, help to make the system acceptable to the community.

- The capital cost for all elements of the recommended Bus-Metered Freeway System have been estimated at $4,731,000. The surveillance and control system consisting of the control center building, control center equipment, surveillance and control components, television system, and the communication system is estimated to cost $1,703,000. The recommended transit service "Plan B" consisting of exclusive bus ramps, transit vehicles, park-ride facilities, waiting shelters, and bus stop signs is estimated to cost $3,028,000.

- The operating costs of the transit service plan are estimated to be $558,800, however, a $272,000 savings would result from allowable reductions in existing local service for a net cost of $286,800. Revenue from the transit service plan is estimated at $689,700, however, $360,600 of revenue would be lost from existing local service for a net revenue of $329.100. The operating costs for the surveillance and control system are estimated at $148,000. The marketing costs, estimated at $102,150, include creative planning, advertising for metering and express bus service, and marketing coordination.

- The recommended freeway surveillance and control system is programmed to operate at lower volumes and higher speeds than systems currently in operation throughout the country. In addition, the system is unique in its combination of a digital computer

controlled system (north of Minnesota River) with an isolated traffic adjusted system (south of Minnesota River) and in its coordination with the City of Minneapolis computerized traffic signal system.

- Review of the two alternative transit service plans which were developed and evaluated in this planning phase indicates that the 12 proposed new routes presented in Plan B, together with the suggested revisions in existing corridor express service described in that plan, will most efficiently and effectively serve the residents of the corridor. It is estimated that the 12 proposed new routes and the revised existing express lines together will carry about 6,000 passengers on a typical weekday. Slightly more than one-third of these riders currently use the automobile to travel to and from downtown Minneapolis.

- Plan B will require 48 vehicles to provide the recommended level of service; this includes 34 coaches for the proposed new routes and 14 for the revised existing express lines. In addition, this transit service plan will require special bus entrance ramps at seven interchanges along I-35W (T.H.13, 98th Street, 76th Street, 66th Street, Diamond Lake Road, 46th Street and 35th Street) and one location on County Road 62 (Xerxes Avenue). Other necessary elements of the recommended transit service plan include: three new park-ride facilities, 46 bus shelters (including five in the CBD), and 400 bus stop signs.

- Marketing strategy is vital to the Demonstration Project because it is the only transit strategy concerned with creating and maintaining demand. The marketing plan recommends both market and advertising research. The marketing research is designed to measure if the system is successful and why or why not the system is successful. Advertising research is required to determine the most effective appeals and strategies. Some of the media suggested include: Press information kits, features by columnists, TV documentations, bus tour displays, and cooperation and participation with downtown merchants, environmental groups, etc.

- The work program for Phase B specifies addressing not only the engineering, operational, and marketing problem, but also the social issues associated with the project.

INTRODUCTION

PROJECT BACKGROUND

Secretary John A. Volpe of the Department of Transportation announced the Urban Corridor Demonstration Program in January, 1970. Mr. Volpe stated that the purpose of the program is "to test and demonstrate the concerted use of available tools, including the programs of the Urban Mass Transportation Administration and the Federal Highway Administration, in attacking the problem" of traffic congestion during peak hours in corridors leading to and from central business districts.

The announcement stressed the approach in attacking the problem: "There are many techniques and grant programs in the Urban Mass Transportation Administration and the Federal Highway Administration of the Department of Transportation available for addressing the problem of peak-hour congestion, but they will be most effective only if they are used in a concerted, coordinated, and systematic approach. The Urban Corridor Demonstration Program is intended to promote and facilitate such an approach to the problem." Coordination will be required both at the Federal level between the programs of UMTA and FHWA and at the local level between highway and transit officials, and between city and suburban governments.

On March 25, 1970, the Twin Cities Metropolitan Council submitted a proposal, "Application to the United States Department of Transportation to Conduct Final Planning for an Urban Corridor Demonstration Project under the Urban Corridor Demonstration Program Act of 1969". In May,1970, eleven metropolitan areas were selected by DOT for demonstration projects. Interstate 35W, south of the Minneapolis CBD,was one of the corridors chosen.

Project Planning began in October of 1970. Over the past nine months, travel surveys have been conducted, travel patterns analyzed,interim reports published, and numerous meetings have been held with the Management Board and the community. This Final Report summarizes completed work and presents the recommended plan for implementation of the Bus-Metered Freeway System.

THE TWIN CITIES CORRIDOR

The I-35W Corridor was selected by the Metropolitan Council as the demonstration project for three major reasons: the present and anticipated traffic operating problems; the existing and potential transit demand; and the potential for application of the results of the demonstration project to other urban corridors. Interstate 35W presents an opportunity to experiment with and better understand the factors that influence the relative use of transit and auto.

Figure 1 illustrates the generalized boundaries of the corridor and defines the area in which comprehensive inventory data are collected. The study boundary is extended along County Road 62 to France Avenue to include the area around the Southdale Shopping Center.

The main section of the freeway was constructed in the early 1960's while the final connection into the CBD was finished in 1967. The freeway varies from four lanes in Burnsville to eight lanes in Minneapolis near the CBD. Mainline grades are generally less than 3.5 percent and access/exit ramps are generally less than 4.0 percent. Parallel arterials north of the Minnesota River flank the freeway both on the east and west. Volume/speed/density problems occur during both the morning and afternoon peak periods.

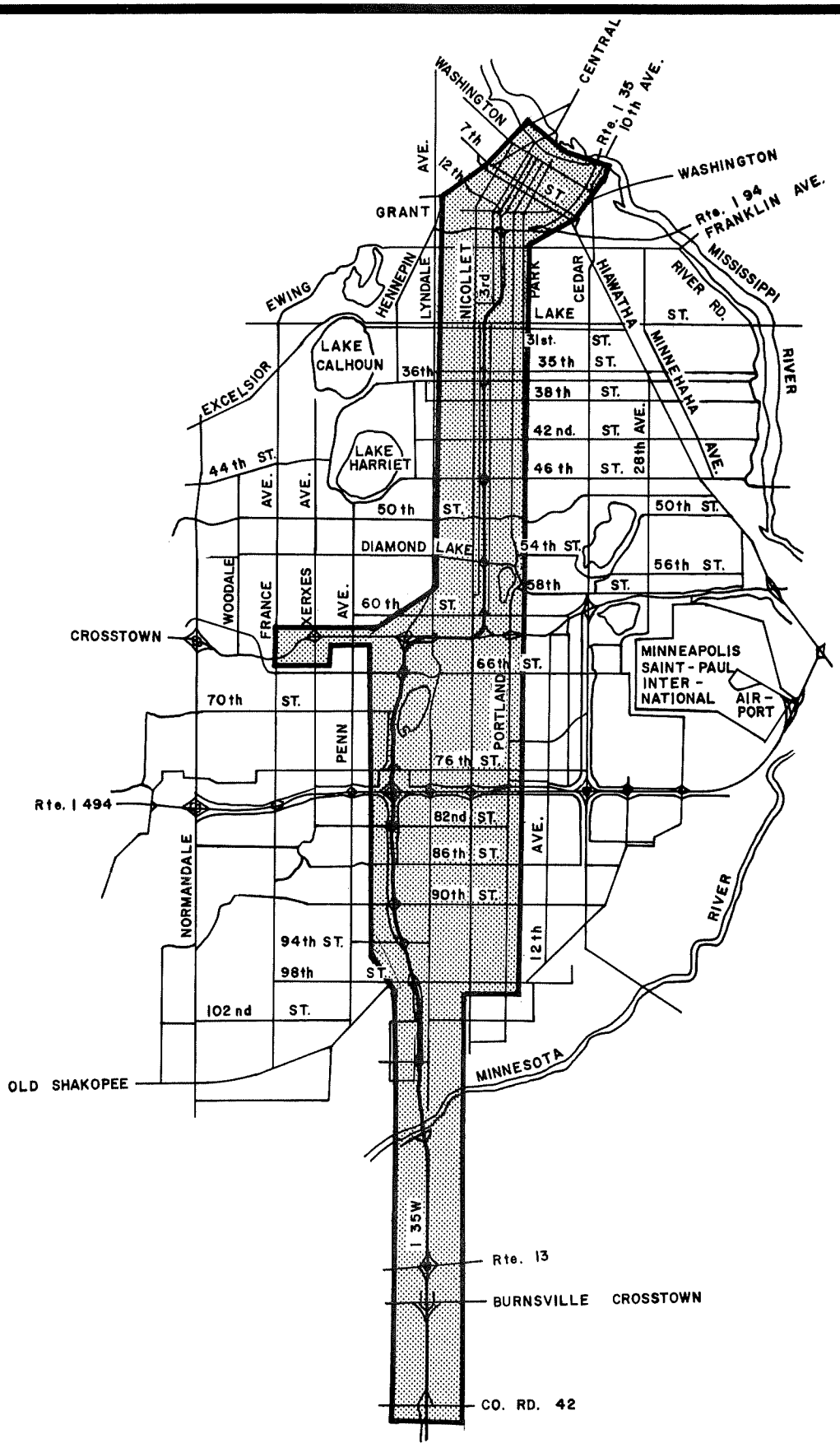


FIGURE 1

STUDY AREA

I-35W URBAN CORRIDOR DEMONSTRATION PROJECT

0 1 mile

SCALE

NORTH

DEMONSTRATION PROJECT CONCEPT

The Bus-Metered Freeway System concept was presented in a report, A System to Facilitate Bus Rapid Transit on Urban Freeways, December, 1968, prepared by Texas Transportation Institute for the Urban Mass Transportation Administration. Specifically, the report was concerned with the technical feasibility of providing priority operation for buses on urban freeways by employing freeway surveillance and control measures.

Within the Bus-Metered Freeway System, shown in Figure 2, the buses are provided priority access to the freeway via exclusive bus ramps. Automobiles are metered onto the system to use available capacity below that volume which jeopardizes the desired level of service. The report concluded that the Bus-Metered Freeway System was technically feasible and practical at each of four study sites, one of which is the Interstate 35W corridor. This concept of the "bus on a metered freeway" is to be tested and demonstrated in the Twin Cities.

DEMONSTRATION PROJECT SCOPE

The project scope ranges from Planning to Evaluation and includes the following five phases:

Phase A: Planning - specifies the design concepts to be followed in implementing the project. Included are plans for exclusive bus ramps, bus stations, parking lots, transit service, surveillance and control systems, marketing, financing and implementation, and evaluation.

Phase B: Design - involves the design of both the physical facilities and the control systems for the project.

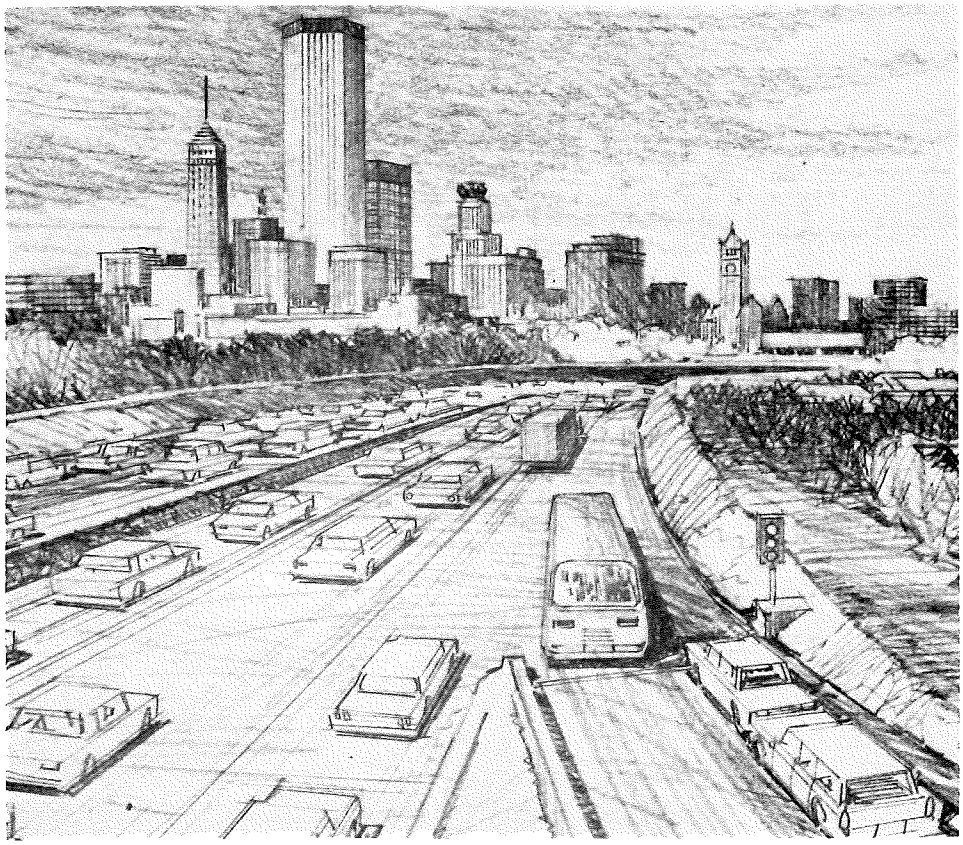
Phase C: Construction and Equipment Procurement - involves constructing the physical facilities for the project, making final plans for obtaining necessary equipment, and developing and de-bugging the computer system.

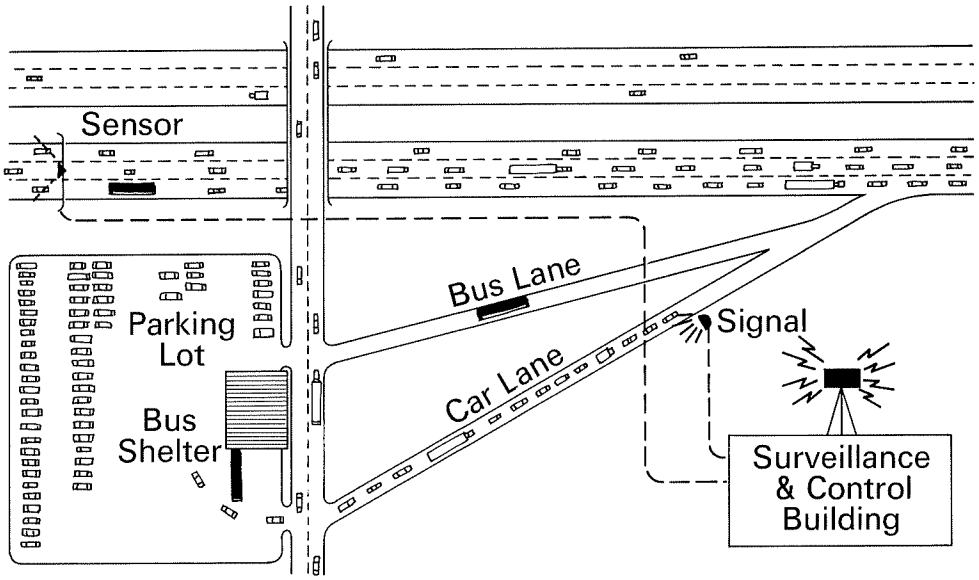
Phase D: Operation - involves the field operations of the demonstration.

Phase E: Evaluation - includes major analysis work, report writing, and recommendations as to the future application of the concept in the Twin Cities and elsewhere.

FIGURE 2

BUS-METERED FREEWAY SYSTEM CONCEPT





DEMONSTRATION PROJECT GOALS

The development of an agreed "Goals" statement is important from two standpoints:

"directions of change" and "end conditions" are clearly set forth and guide the planning, design, and implementation processes, and

an evaluation strategy can be structured to measure the degree of attainment of the elements, of the goals and objectives statement.

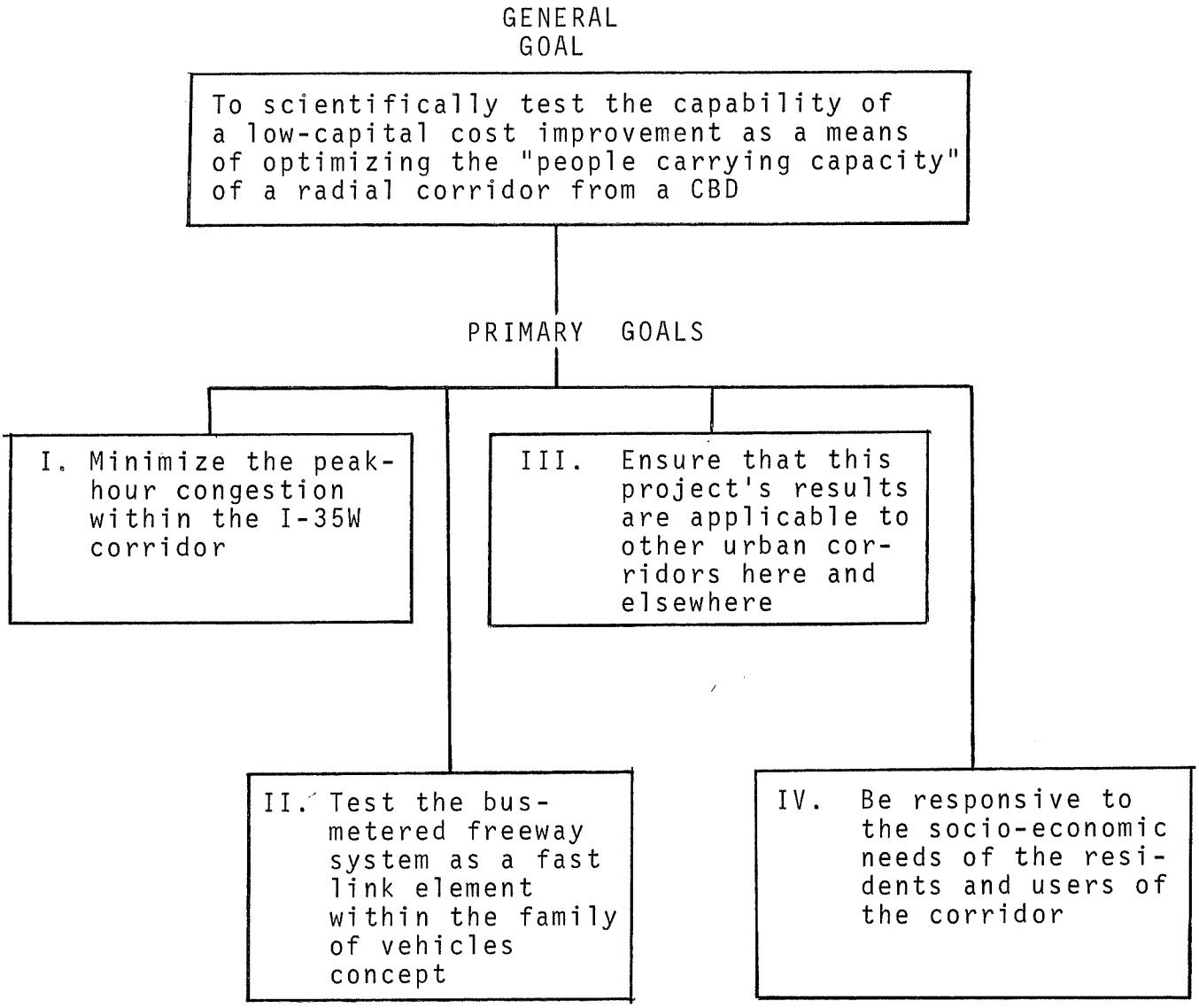
Figure 3 identifies the general goal and the primary goals of the project.

Quantified goals to be achieved after the second full year of operation include:

- People-Carrying Capacity - increase the people-carrying capacity of the I-35W corridor by 15 percent.
- Speed - maintain at least a 40 MPH speed on all metered freeway sections.
- Travel Time - achieve an 18 minute (50 MPH) travel time between County Road 42 and I-35W and the intersection of Fourth Avenue and Tenth Street during both peak periods.
- Accidents - reduce accidents in the morning and afternoon peak periods by 20 percent.
- Reaction Time to Incidents - reduce the reaction time by 20 percent.
- Transit Ridership - to capture 15 percent of the present auto drivers and auto passengers in the corridor in the peak periods.

FIGURE 3

DEMONSTRATION PROJECT GOALS



ORGANIZATION STRUCTURE

The Organizational Structure for Phase A Planning is illustrated in Figure 4. Each group mentioned on the organization chart is explained below.

Metropolitan Council - is the successor to the Metropolitan Planning Commission, and was created by the Minnesota Laws of 1967 to coordinate the planning and development of the seven county area covering Anoka, Carver, Dakota, Hennepin, Ramsey, Scott and Washington Counties.

Management Committee - a cooperative agreement between the Metropolitan Council, the Metropolitan Transit Commission, the Minnesota Highway Department, and the Metropolitan Area county and municipal government units was executed in April, 1969, designating the Metropolitan Council as the area agency responsible for establishing and maintaining a continuing, comprehensive, and cooperative transportation planning process in the Metropolitan Area. Pursuant to this action, a Transportation Planning Staff Unit was established within the Metropolitan Council to administer and coordinate the work of the Transportation Planning Program. This core staff unit is being funded by the several participating agencies which are represented on the Management Committee.

The Management Committee includes the Chairman of the Council, the Chairman of the Transit Commission, the Commissioner of Highways, a County elected official named by the Metropolitan Inter-County Council, and an elected municipal official named by the Metropolitan Section of the League of Minnesota Municipalities. Providing advice to the Committee is the Policy Advisory Committee composed of elected officials and also the Technical Advisory Committee, a group of area engineers and planners.

Project Management Board - consists of representatives of the Metropolitan Council, the Minnesota Highway Department, the Metropolitan Transit Commission, Hennepin County, and the City of Minneapolis. The Board meets regularly to review progress and provide over-all technical direction for the project. Through the Director of Transportation Planning, the Board reports to the Transportation Planning Program Technical Advisory Committee, Policy Advisory Committee, and Management Committee.

Technical Services
The Project Director is a full time staff member of the Minnesota Highway Department and is the individual responsible for dealing with the consultants and coordinating local staff participation. The Consultant Project Manager is assigned by the Consultant Team and is responsible for coordination of the team and responsible for fulfilling the contractual obligations for the study.

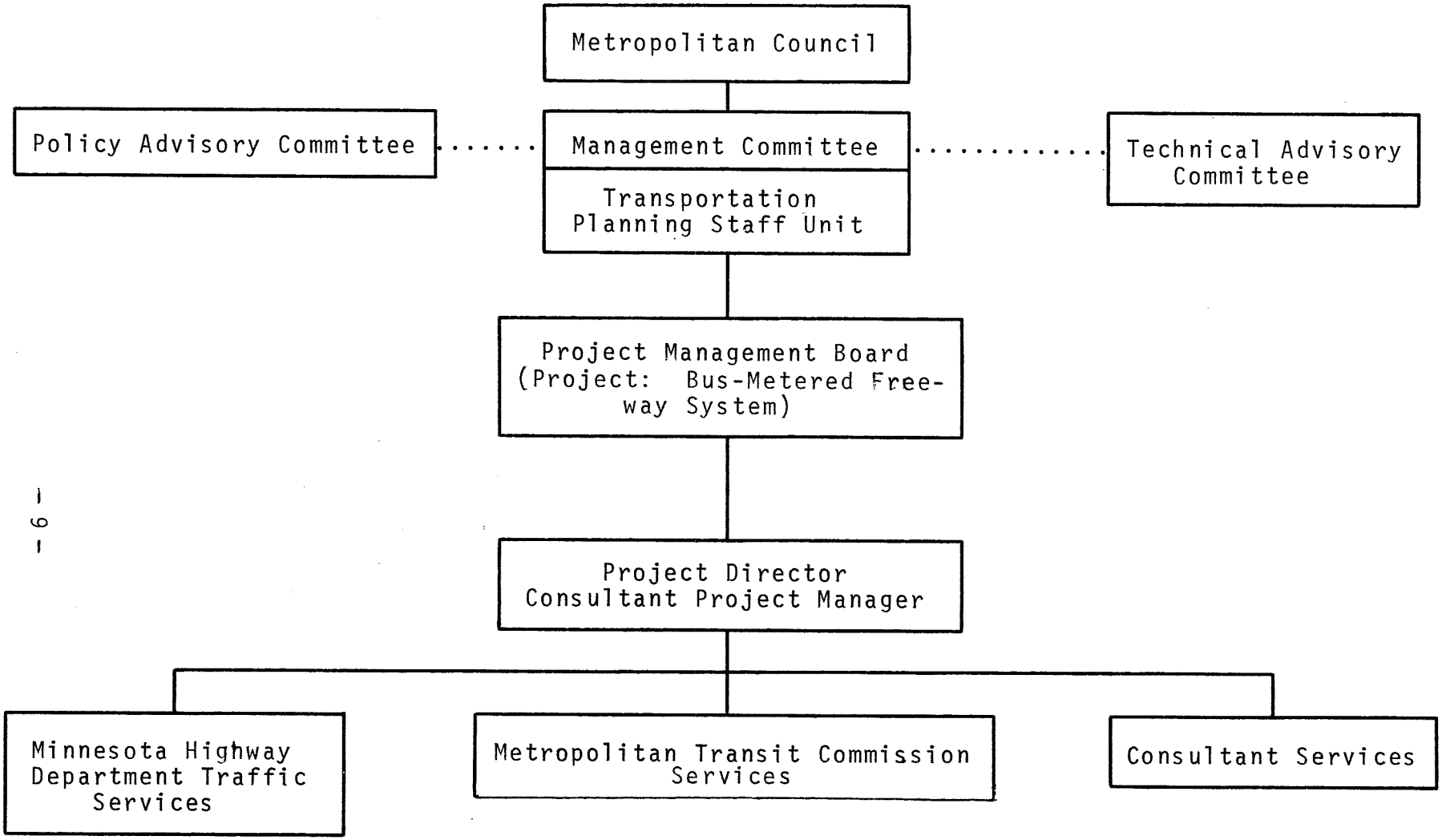


FIGURE 4

ORGANIZATION STRUCTURE
FOR PHASE A PLANNING

PHASE A WORK TASK SCHEDULE

Figure 5 depicts the history of Phase A: Planning. The major work tasks, the beginning and completion of the work tasks in relationship to time, and the planning products are listed:

The four published reports include:

- "Project Operation Manual", December, 1970,
- "Inventory of the Transportation Condition of the I-35W Corridor", February, 1971,
- "Draft of Final Report", July, 1971, and
- "I-35W Urban Corridor Demonstration Project: Final Report", September, 1971.

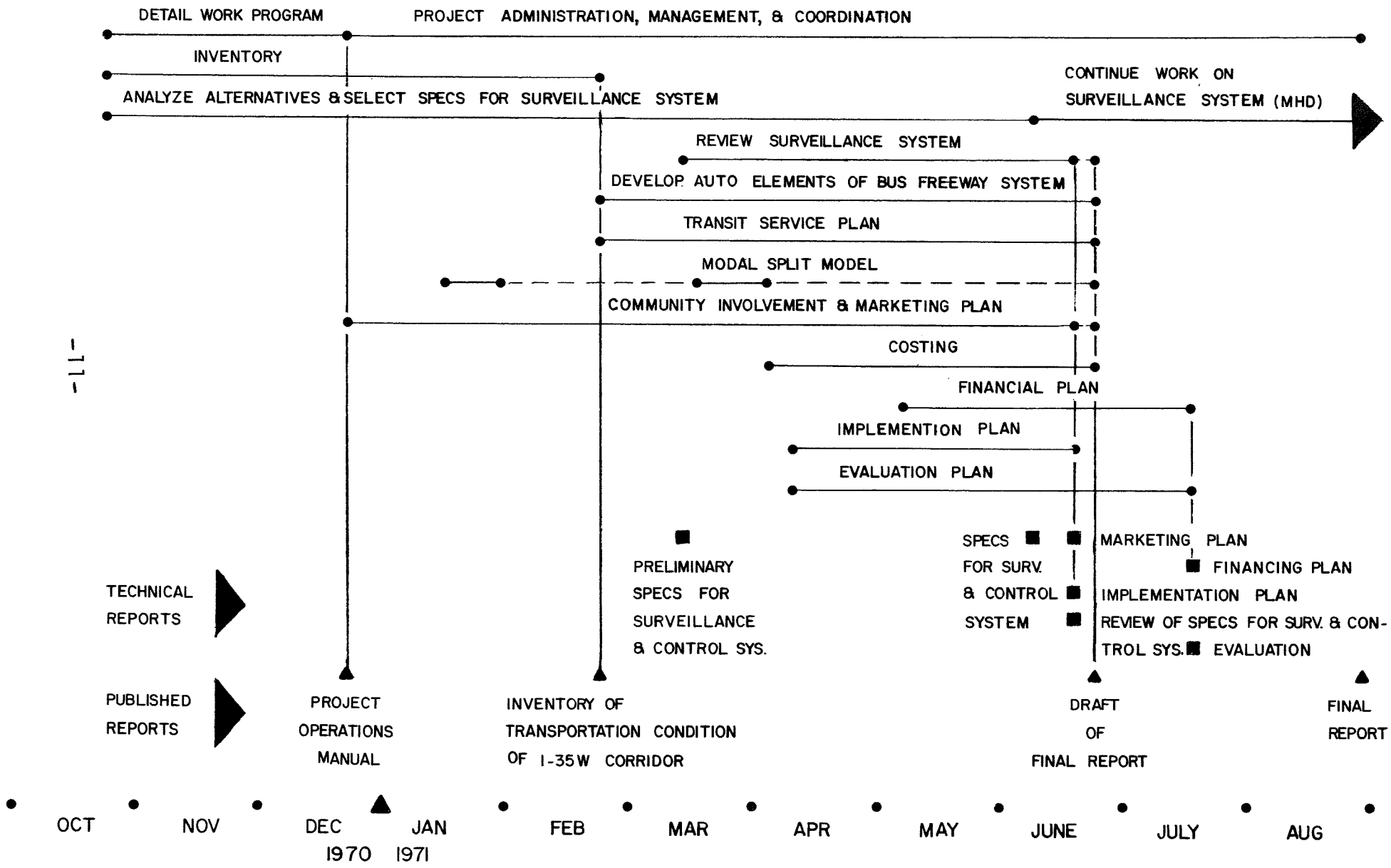
A special brochure entitled "Moving People on Interstate 35W" was published in May, 1971.

The technical reports were combined into a document entitled, "Supportive Technical Memorandum," which includes:

- Conditions and Specifications for Air-Conditioned Transit-Type Coaches of 40-Passenger Capacity,
- Summary of Inventory Data,
- Review of Surveillance and Control Specifications,
- Evaluation Plan,
- Financial and Implementation Plan,
- Agreement with Bloomington Bus Company.

FIGURE 5

I-35 W URBAN CORRIDOR DEMONSTRATION PROJECT PHASE A PLANNING
WORK TASK SCHEDULE



INVENTORY OF THE TRANSPORTATION CONDITION OF THE I-35W CORRIDOR

TRAFFIC VOLUME STUDIES

An important part of the documentation of the transportation conditions of the I-35W corridor is an assessment of the traffic demand on the existing facilities. Various traffic volume studies were conducted to document the vehicular flow within the corridor. These studies included:

- Five-minute interval counts on I-35W exit and entrance ramps and selected mainline points during the peak periods of 6:00 to 9:00 a.m. and 3:30 to 6:30 p.m.
- Twenty-four hour and peak hour counts on arterial streets parallel to I-35W.
- Five-minute interval counts of the Lane 1 volumes at northbound entrance ramps in the morning and at southbound entrance ramps in the afternoon.
- Five-minute interval counts at the intersection of the cross streets and northbound entrance ramps in the morning and the southbound exit ramps in the afternoon.

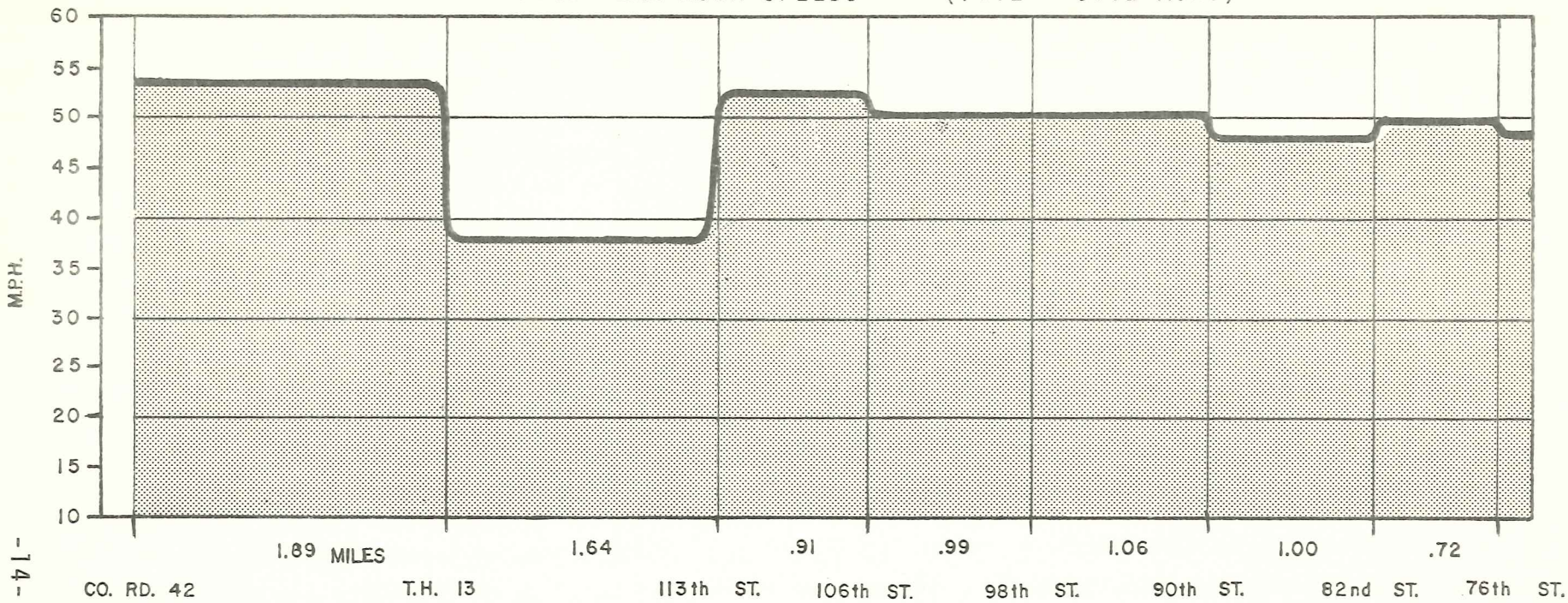
These studies are presented in the Inventory report. Table 1 relates the total entering northbound ramp volume to the entering autos that are destined to the Minneapolis Central Business District.

Of the total 8581 vehicles that entered the CBD from the 11th Street/Grant and Fifth Avenue exits between 6:00 a.m. - 9:00 a.m., 7969 or 93 percent were autos. Of these 7969 autos, 5599 or 70 percent were destined to the CBD and 2370 autos went through the CBD. A total of 7723 persons were riding in the 5599 autos for an average auto occupancy of 1.4 persons/auto. In the time period used for analysis, 7:00 - 9:00 a.m., 4326 autos entered the CBD from the freeway containing 6084 people.

TRAVEL TIME STUDIES

Figure 6 illustrates the variation of the average peak hour speeds along the I-35W Freeway. The survey period was from 6:00 - 9:00 a.m. and 3:30 - 6:30 p.m.; travel time runs were made every 12 minutes. For the three hour period the peak hour was selected and the five runs averaged. For the 16.5 mile distance between County Road 42 and the Fifth Avenue/Tenth Street intersection, the greatest morning travel time recorded was 30 minutes and the greatest afternoon travel time recorded was 26 minutes.

FIGURE 6 NORTHBOUND PEAK HOUR SPEEDS (7:12 - 8:12 A.M.)



1" = 1 mile

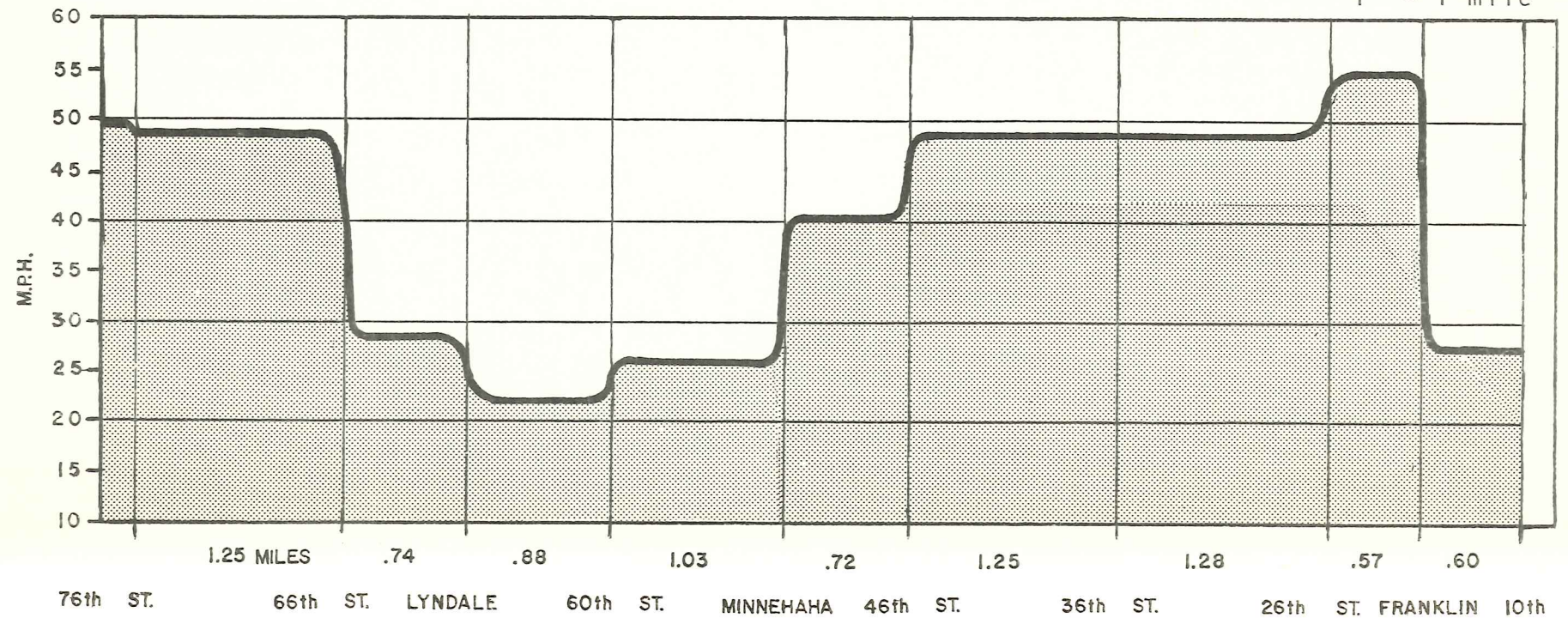


FIGURE 7 SOUTHBOUND PEAK HOUR SPEEDS (4:36 - 5:36 P.M.)

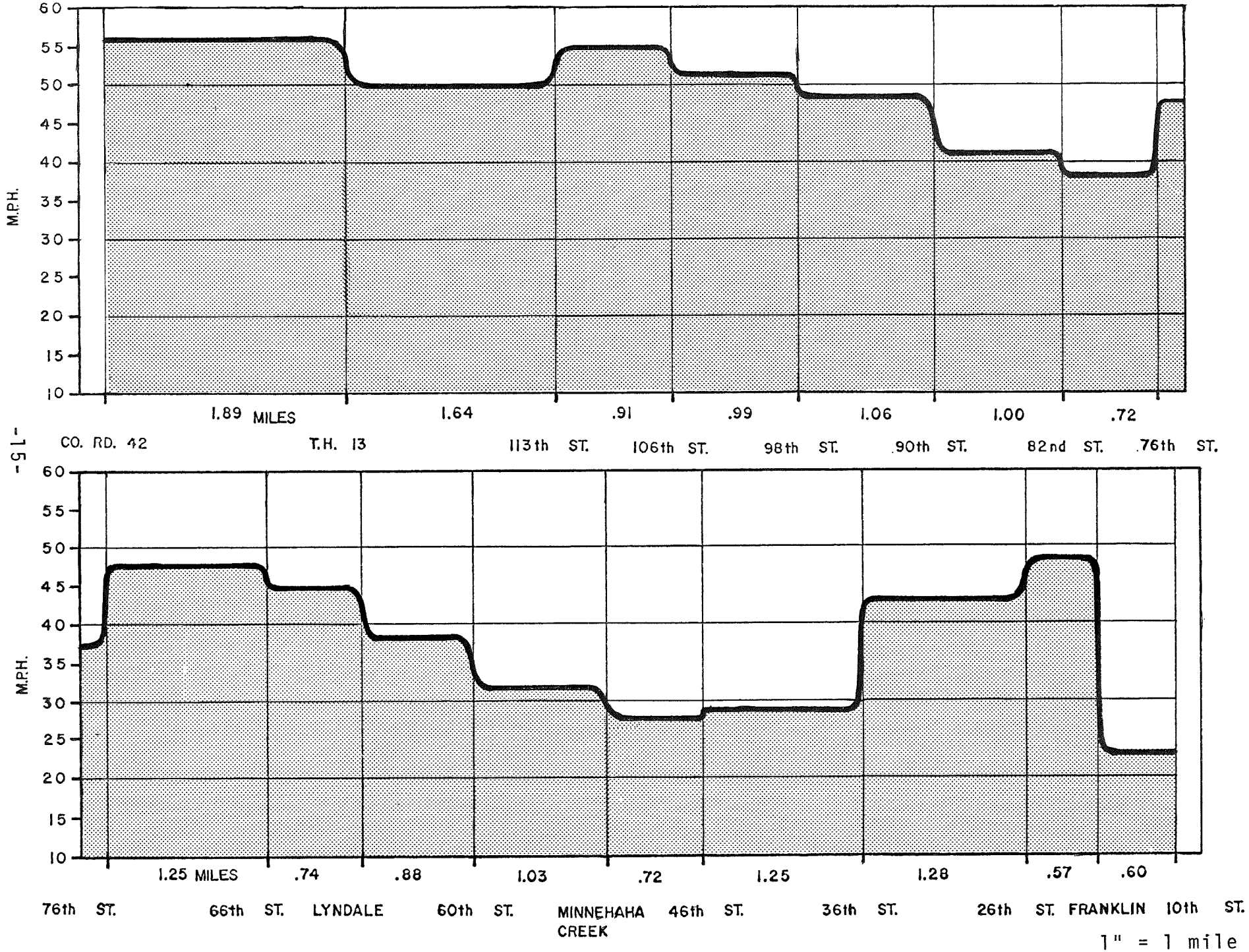


TABLE 1

LISTING OF AUTOS INBOUND TO CBD BY ENTRANCE RAMP FOR
6:00 a.m. - 9:00 a.m.

ENTRANCE RAMP	AUTOS TO CBD FROM WEST	AUTOS TO CBD FROM EAST	TOTAL AUTOS TO CBD	TOTAL RAMP VOLUME	% TO CBD
Mainline	-	-	55	2220	2
County Road 42	21	111	132	1800	7
Burnsville Crosstown	23	69	92	930	9
Trunk Highway 13	124	120	244	2250	10
122nd Street	-	6	6	535	1
113th Street	-	-	-	38	0
106th Street	102	-	102	500	20
98th Street	182	49	231	1460	15
94th Street	47	24	71	600	11
90th Street	88	51	139	790	17
82nd Street	83	51	134	780	17
I-494	215	75	290	1650	17
76th Street	134	55	189	680	27
66th Street	96	47	143	520	27
Crosstown	(South)	(North)			
Penn Avenue	73	67	140		
Xerxes Avenue	53	89	142	3120	37
Frances Avenue	193	164	357		
Crosstown E.B.	-	-	547		
Lyndale Avenue	88	26	114	1060	10
Crosstown W.B.	-	-	855	2820	30
	(West)	(East)			
60th Street	100	66	166	660	25
Diamond Lake Road	433	162	595	1440	41
46th Street	482	147	629	1550	40
36th Street	171	55	226	1220	18
	2708	1434	5599	26,623	21
EXIT RAMPS					
11th Street/Grant Street	-	-	1550	2560	60
5th Street	-	-	4049	6021	67
			5599	8581	65

OVERVIEW OF TRAVEL IN THE I-35W CORRIDOR

The travel patterns and travel characteristics of persons traveling within the I-35W corridor destined to the Minneapolis Central Business District are necessary input to the design of the elements of the Bus-Metered Freeway System. The studies undertaken to define the travel patterns include:

- I-35W Freeway Origin-Destination Study - this study was conducted between 6:00 and 9:00 a.m. on the inbound I-35W exit ramps of Fifth Avenue and Eleventh Street on Thursday, December 10, 1970. The license plate survey obtained trip information concerning origin, destination, purpose from, purpose to, auto occupancy, entering ramp to freeway system, persons per household, autos per household, age, and income.

- I-35W Corridor Transit Origin-Destination Study - The transit rider study, conducted December 9, 1970, documented socio-economic characteristics, travel characteristics, and trip patterns of current transit users. Post cards were distributed by the bus drivers on the seven regular service north-south routes operated within the I-35W corridor by the Metropolitan Transit Commission (MTC) to all inbound riders paying an adult cash fare or presenting a transfer. Also surveyed were the airport and university routes operated by the MTC and those Bloomington Bus Company lines which serve the Minneapolis CBD.

- Minneapolis CBD Cordon Study - The Minneapolis Central Business District Cordon Count is an annual count conducted by the Minneapolis Engineering Department, Traffic Division and the Minneapolis Downtown Council. The 1970 survey was conducted in conjunction with the Travel Behavior Inventory being undertaken by the Metropolitan Transportation Planning Program and included an origin-destination survey. Table 2 shows a history of vehicles and people entering and leaving the CBD during the study day for each study year.

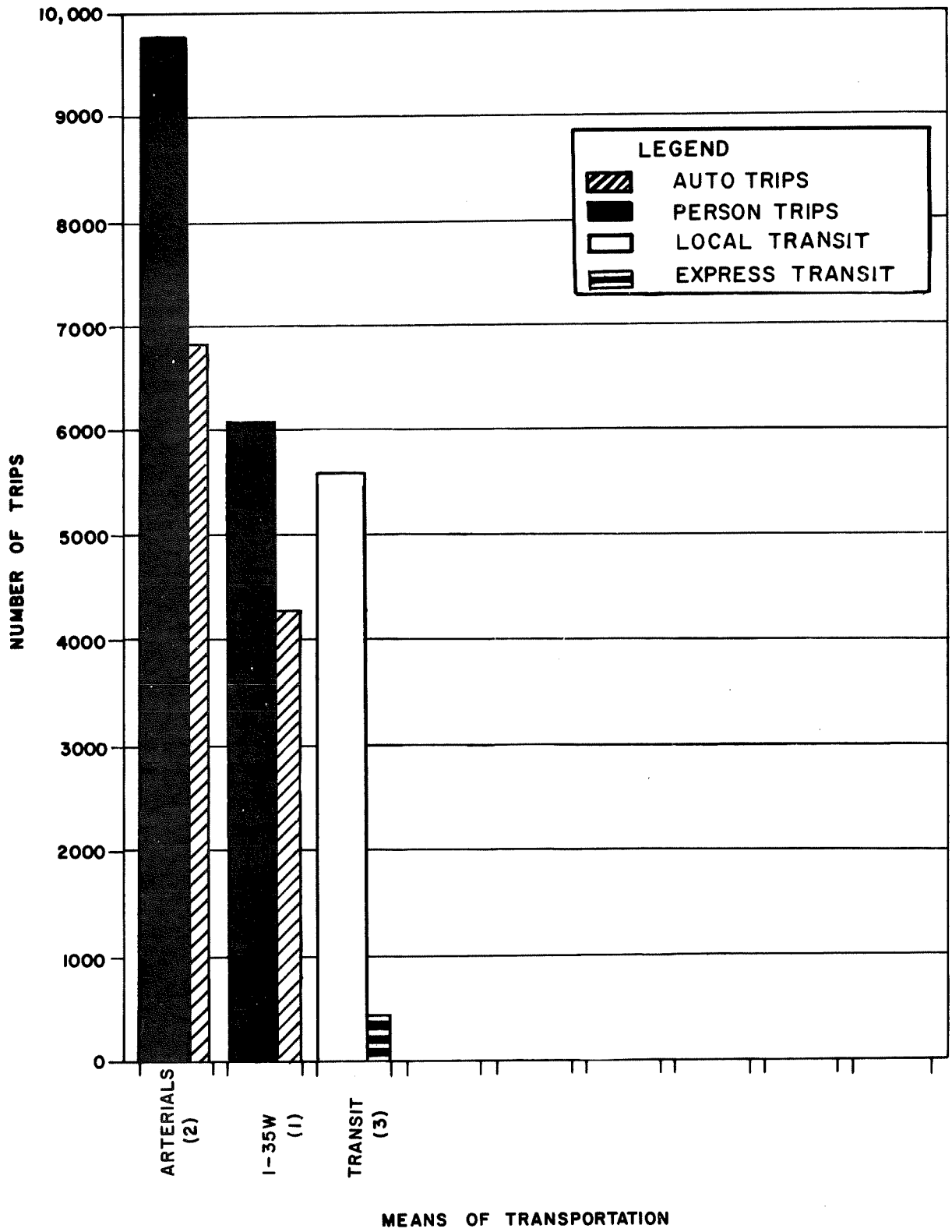
A summary of the three origin-destination surveys is shown in Figure 8. During the morning peak period of 7:00 to 9:00 a.m., a total of 21,970 persons traveled into the Minneapolis CBD from the study area. The person trips were split approximately equal between transit and freeway use, while the arterial streets (not including Park Avenue traffic, placement of the cordon line prohibited inclusion) provided access for 40 percent more people than the freeway or transit.

TABLE 2

VEHICLES AND PEOPLE CROSSING MPLS CORDON

		VEHICLES		PEOPLE	
		AUTO / TAXI	BUS	AUTO / TAXI	BUS
WED. SEPT. 17 1958	TOTAL	249,185	5,530	360,709	122,605
	% TOTAL	84.4	1.9	63.8	21.7
WED. SEPT. 16 1959	TOTAL	247,473	5,278	353,649	125,104
	% TOTAL	84.6	1.8	63.7	22.5
WED. SEPT. 14 1960	TOTAL	258,924	5,328	367,747	113,661
	% TOTAL	85.8	1.8	65.9	20.4
WED. SEPT. 13 1961	TOTAL	247,040	4,899	351,607	103,361
	% TOTAL	85.8	1.7	67.4	19.8
WED. SEPT. 12 1962	TOTAL	245,212	4,944	345,525	107,427
	% TOTAL	85.6	1.7	65.7	20.4
WED. SEPT. 11 1963	TOTAL	252,078	4,963	358,014	104,132
	% TOTAL	85.8	1.7	67.2	19.6
WED. SEPT. 16 1964	TOTAL	248,734	4,595	340,275	102,895
	% TOTAL	85.7	1.6	66.1	20.0
SEPT. 1970	TOTAL	273,386	4,783	373,842	90,553
	% TOTAL	84.3	1.5	68.2	16.5

SOURCE: "CITY OF MINNEAPOLIS 1963 CORDON COUNT"
& CITY OF MINNEAPOLIS ENGINEERING DEPARTMENT



NOTE: ARTERIAL STREETS SURVEYED INCLUDE HENNEPIN AVENUE THROUGH THIRD AVENUE

DATA COLLECTED:
7-9:00 a.m.
(1) DECEMBER 10, 1970
(2) SEPTEMBER 1970
(3) DECEMBER 9, 1970

I-35W CORRIDOR TRIPS DESTINED TO MPLS. CBD

FIGURE 8

I-35W CORRIDOR TRAVEL PATTERNS

Corridor travel patterns are required for the development of transit service plans. On the basis of the location and intensity of the origins and destinations of CBD destined trips; transit routes, stops, and schedules are developed. Figure 9 is a flow map of the person trips to the CBD on I-35W. The volume builds gradually from County Road 42 in Apple Valley to 1816 person trips north of 76th Street. The eastbound Crosstown movement adds 1207 trips and the westbound Crosstown movement adds 907, for a total of 2114 person trips. This volume exceeds the total accumulated volume on I-35W south of the Crosstown.

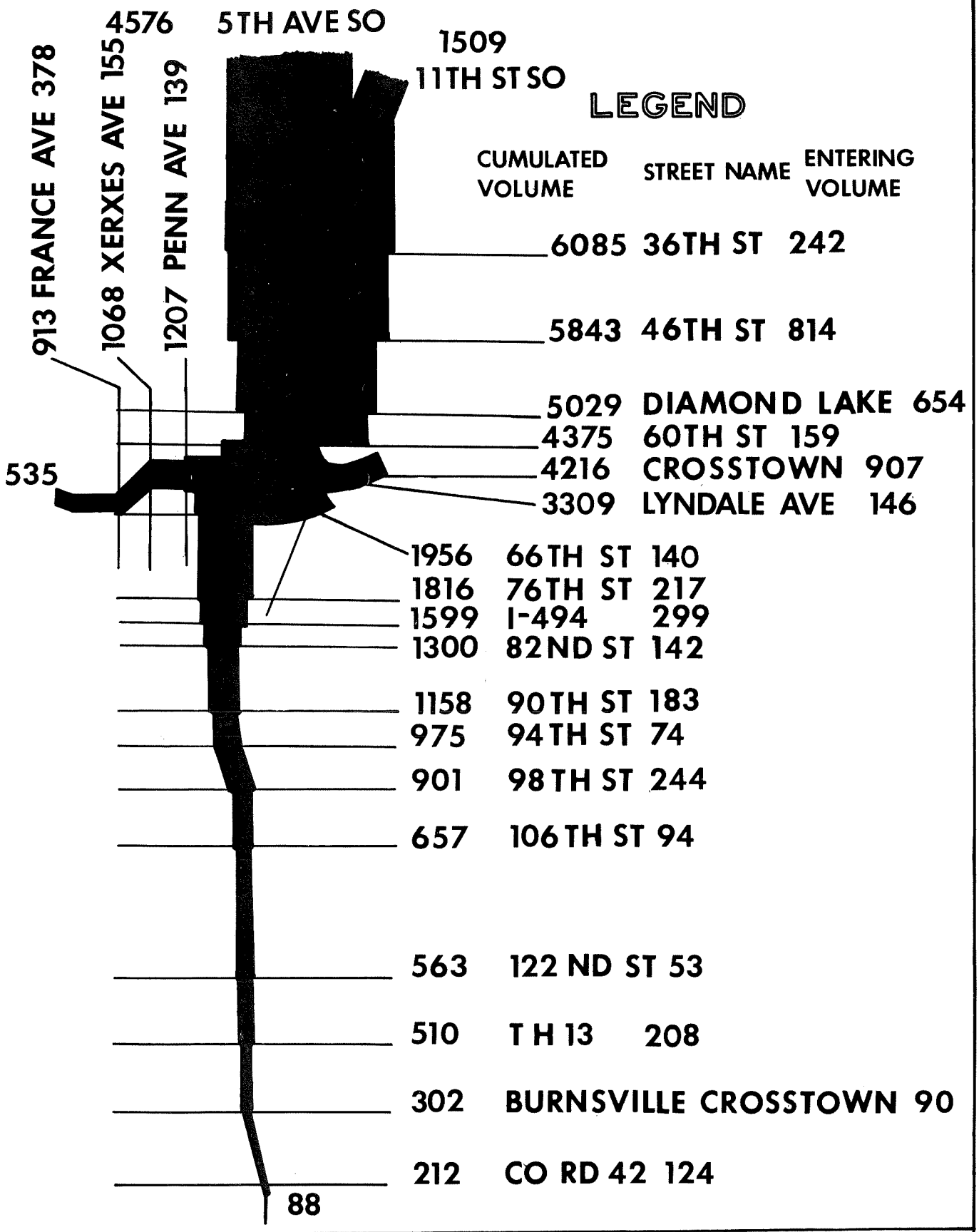
The other travel patterns illustrated are the location and intensity of different classifications of person trips, which are presented in Figure 10 - Figure 17 and include:

- Figure 10: Origin location of inbound auto person trips on I-35W - The 6100 freeway trip originations to the Minneapolis CBD are concentrated between 42nd Street and I-494 on the north and south, and Cedar Avenue and France Avenue on the east and west.

- Figure 11: Origin locations of inbound auto person trips on the arterial street system between Hennepin Avenue and Third Avenue. - As expected, the 9800 person trips on the arterials originate much closer to the CBD than the freeway trips. The heaviest intensity of origins is north of the County Road 62. The inclusion of Hennepin Avenue as the most westerly arterial resulted in the trip origins in the western suburbs.

- Figure 12: Origin locations of local transit person trips- The 5700 person trips using local transit are most intense north of 50th Street between Cedar Avenue and France Avenue. Between 50th Street and County Road 62, the intensity of travel is also high. Trips are sparce in Richfield, Bloomington and Burnsville due to the lack of service.

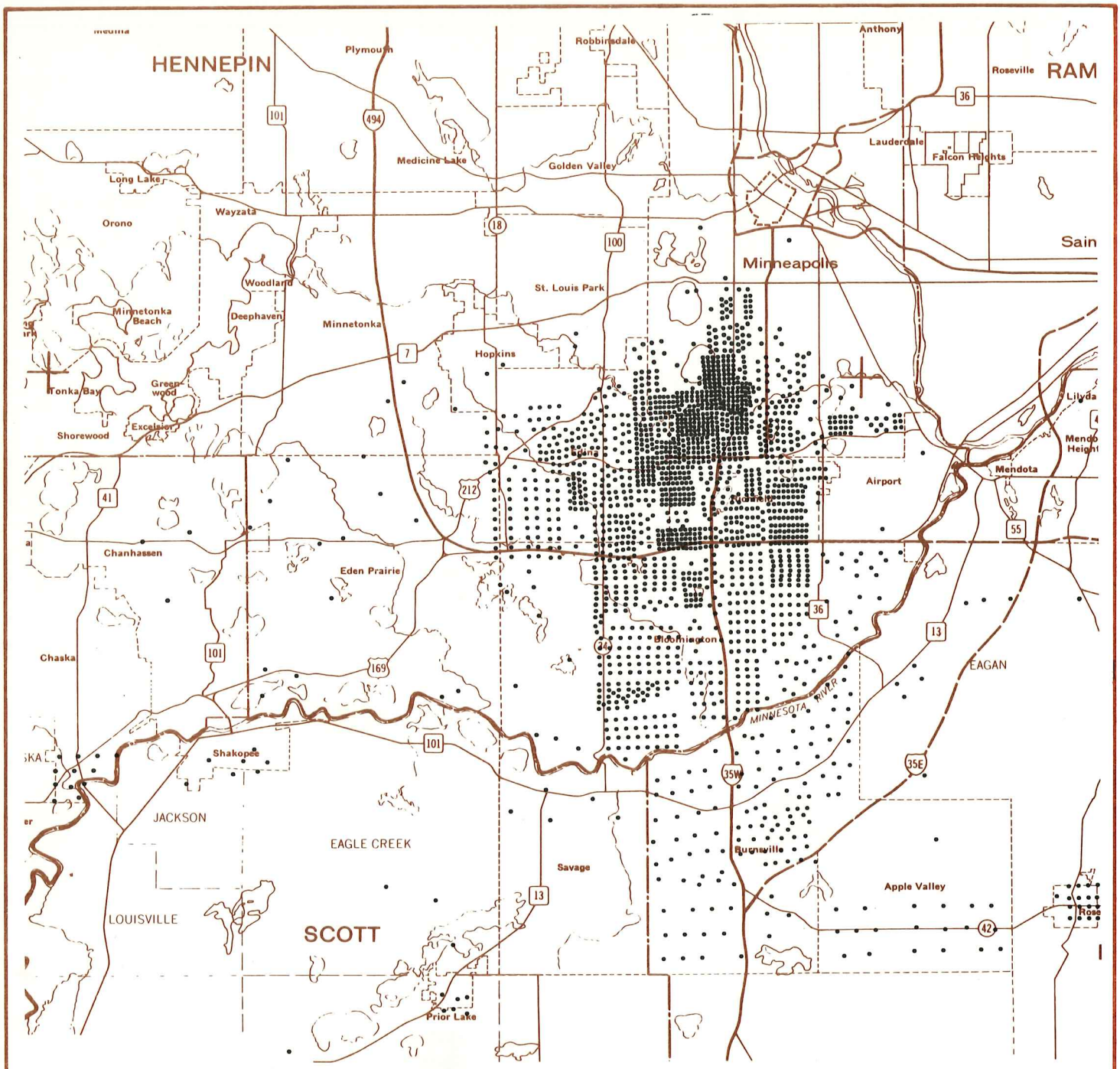
- Figure 13: Origin locations of express transit person trips - The origin locations are the true origin of the trip, thus if the express rider goes from home to a park-ride facility, the home origins are illustrated rather than the park-ride facility.



DATA COLLECTED:
7– 9:00 a.m.
DECEMBER 10,1970

FLOW MAP OF CBD DESTINED PERSON TRIPS ON I-35W

FIGURE 9



LEGEND

● THREE TRIPS

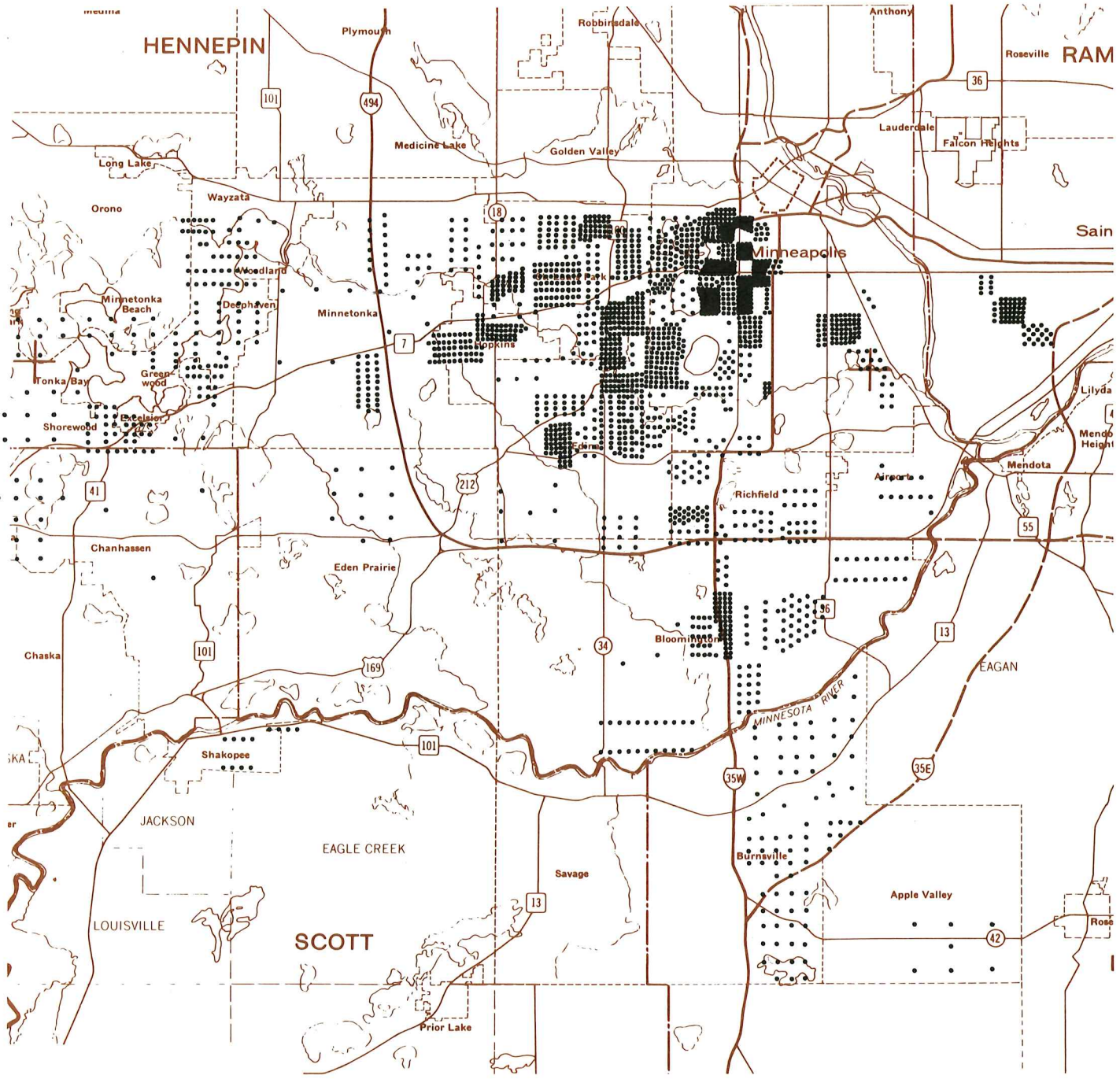
TOTAL TRIPS
6,084

N 0 2 4 MILES

FIGURE 10
PAGE 22

ORIGIN ZONES OF AUTO PERSON TRIPS INBOUND ON I-35W

DATA COLLECTED:
7-9:00 a.m.
DECEMBER 10, 1970



LEGEND

● THREE TRIPS

TOTAL TRIPS
9,822

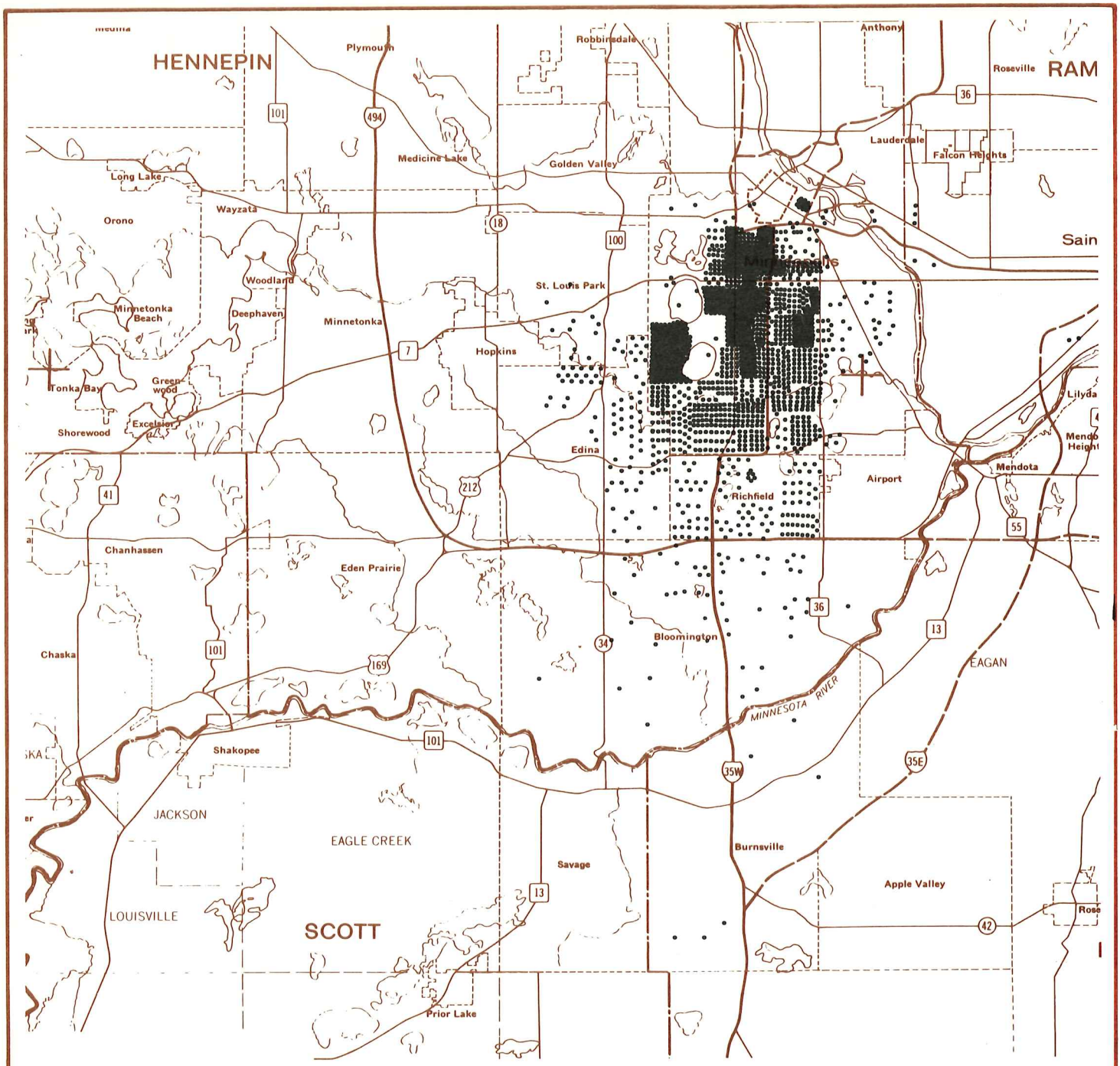
N 0 2 4 MILES

NOTE: ARTERIAL STREETS SURVEYED INCLUDE HENNEPIN AVENUE THROUGH THIRD AVENUE

DATA COLLECTED:
7-9:00 a.m.
SEPTEMBER, 1970

ORIGIN ZONES OF AUTO PERSON TRIPS INBOUND ON ARTERIAL STREETS

FIGURE 11



LEGEND

● THREE TRIPS

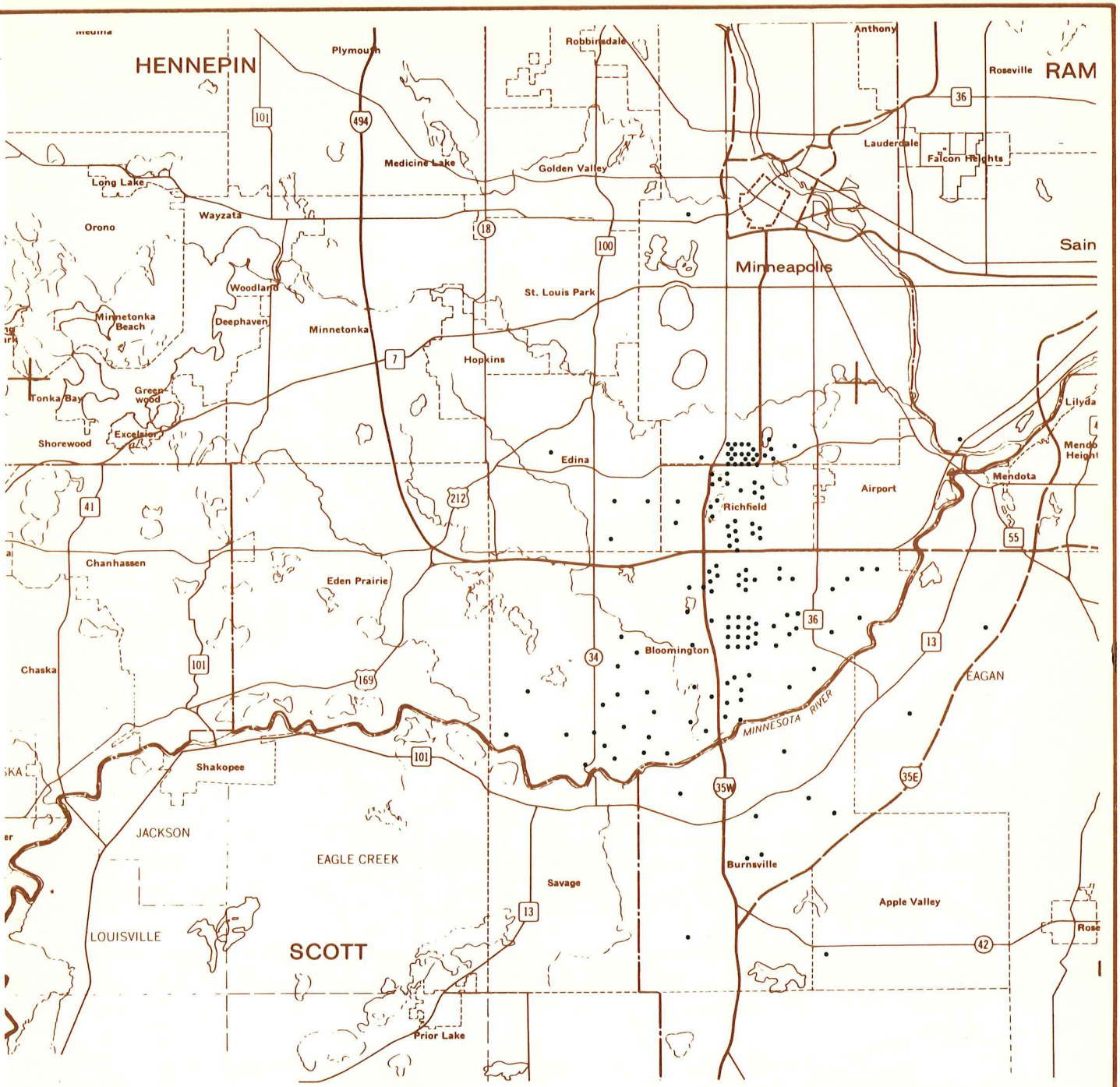
TOTAL TRIPS
5,654

N 0 2 4 MILES

FIGURE 12
PAGE 24

ORIGIN ZONES OF LOCAL TRANSIT RIDERS

DATA COLLECTED:
7 – 9:00 a.m.
DECEMBER 9,1970



LEGEND

● THREE TRIPS

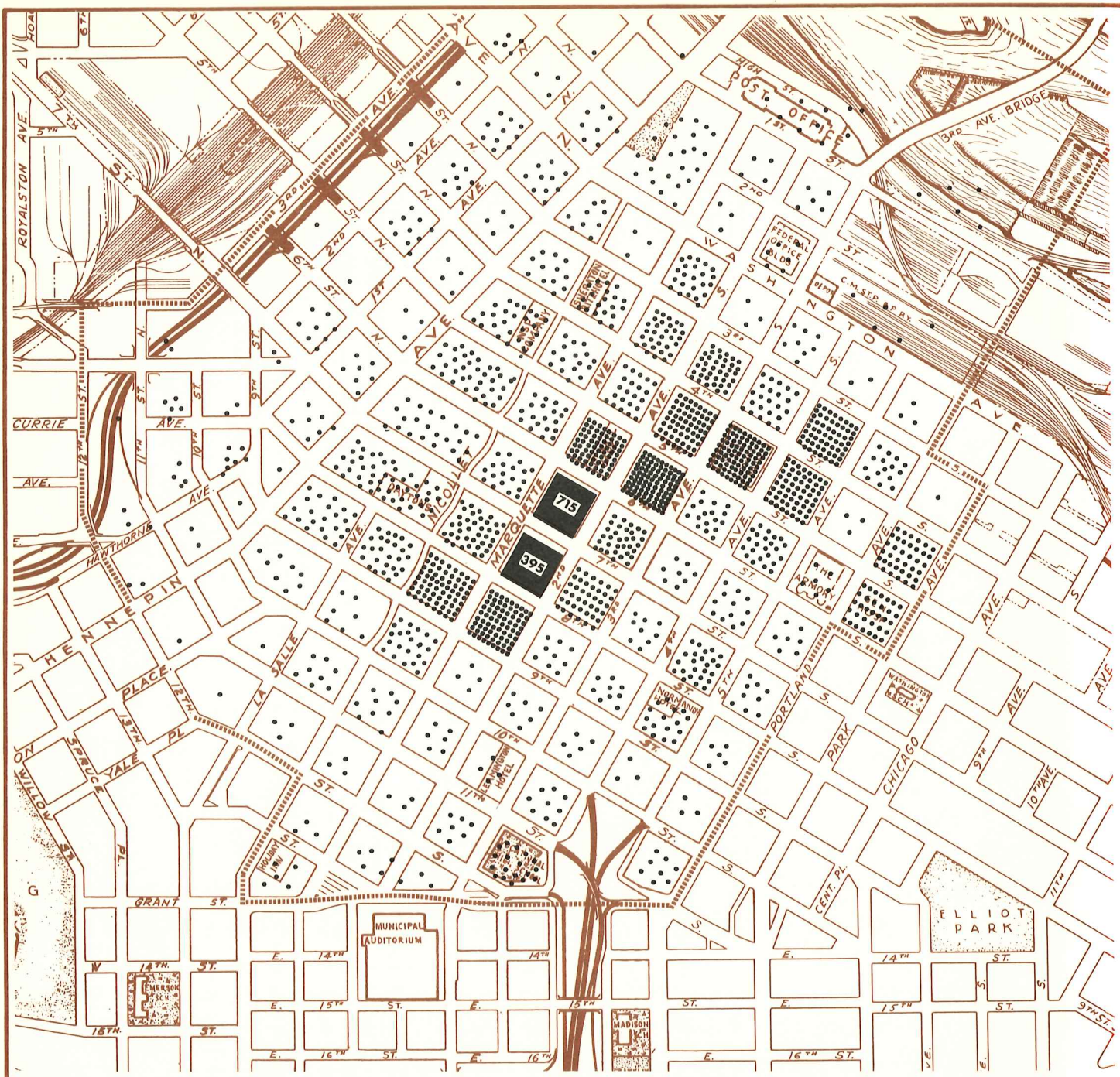
TOTAL TRIPS 410

N 0 2 4 MILES

DATA COLLECTED:
7-9:00 a.m.
DECEMBER 9, 1970

ORIGIN ZONES OF EXPRESS TRANSIT RIDERS

FIGURE 13
PAGE 25



LEGEND

● THREE TRIPS

TOTAL TRIPS 6,084

N

0 500 1000 FEET

715 NUMBER OF TRIPS

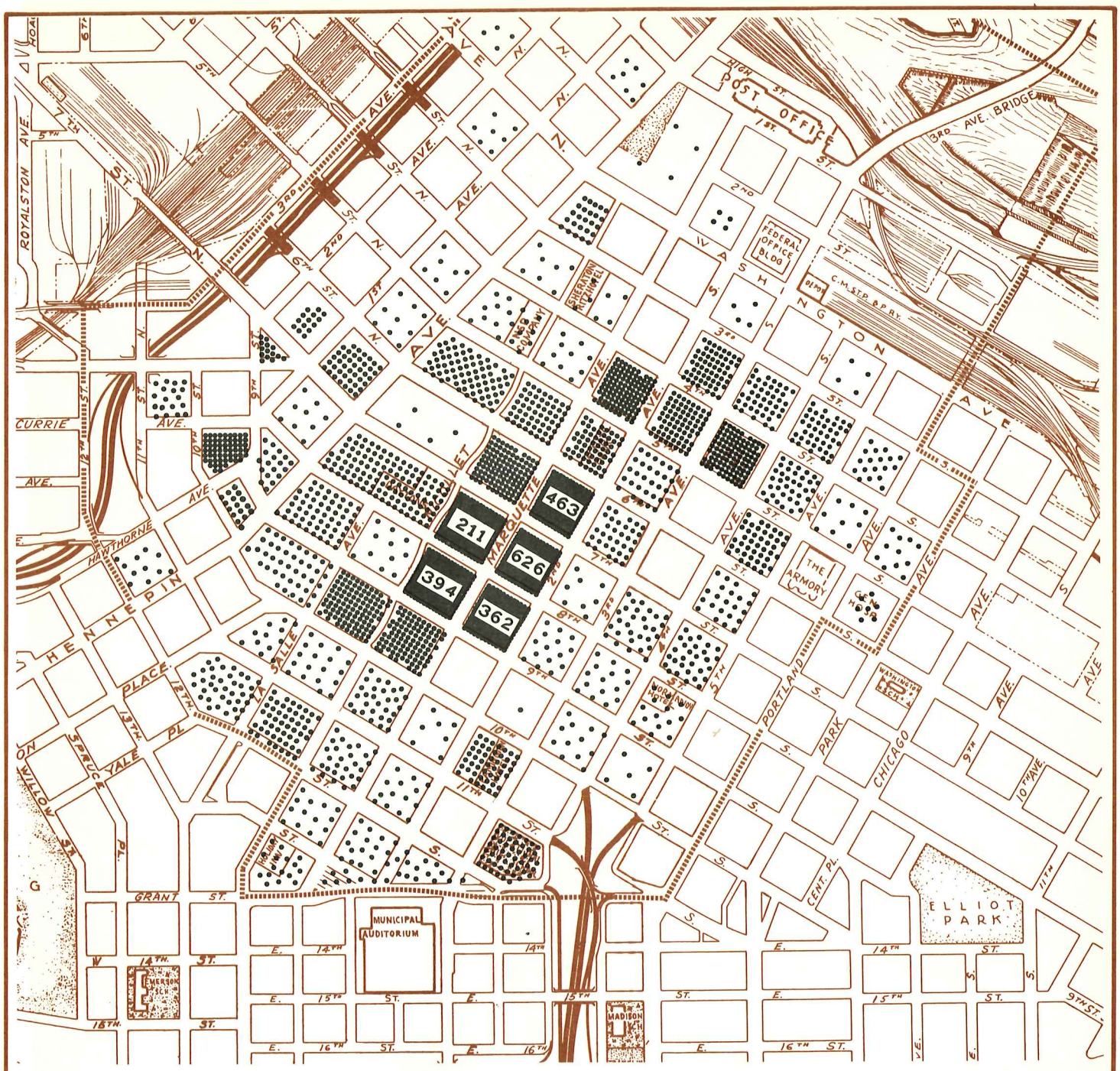
▪▪▪▪▪▪▪ MINNEAPOLIS CBD BOUNDARY

FIGURE 14

PAGE 26

MPLS. CBD DESTINATIONS OF AUTO PERSON TRIPS INBOUND ON I-35W

DATA COLLECTED:
7-9:00 a.m.
DECEMBER 10, 1970



626 NUMBER OF TRIPS

MINNEAPOLIS CBD BOUNDARY

NOTE: ARTERIAL STREETS SURVEYED INCLUDE HENNEPIN AVENUE THROUGH THIRD AVENUE

LEGEND

● THREE TRIPS

TOTAL TRIPS 9,822

N

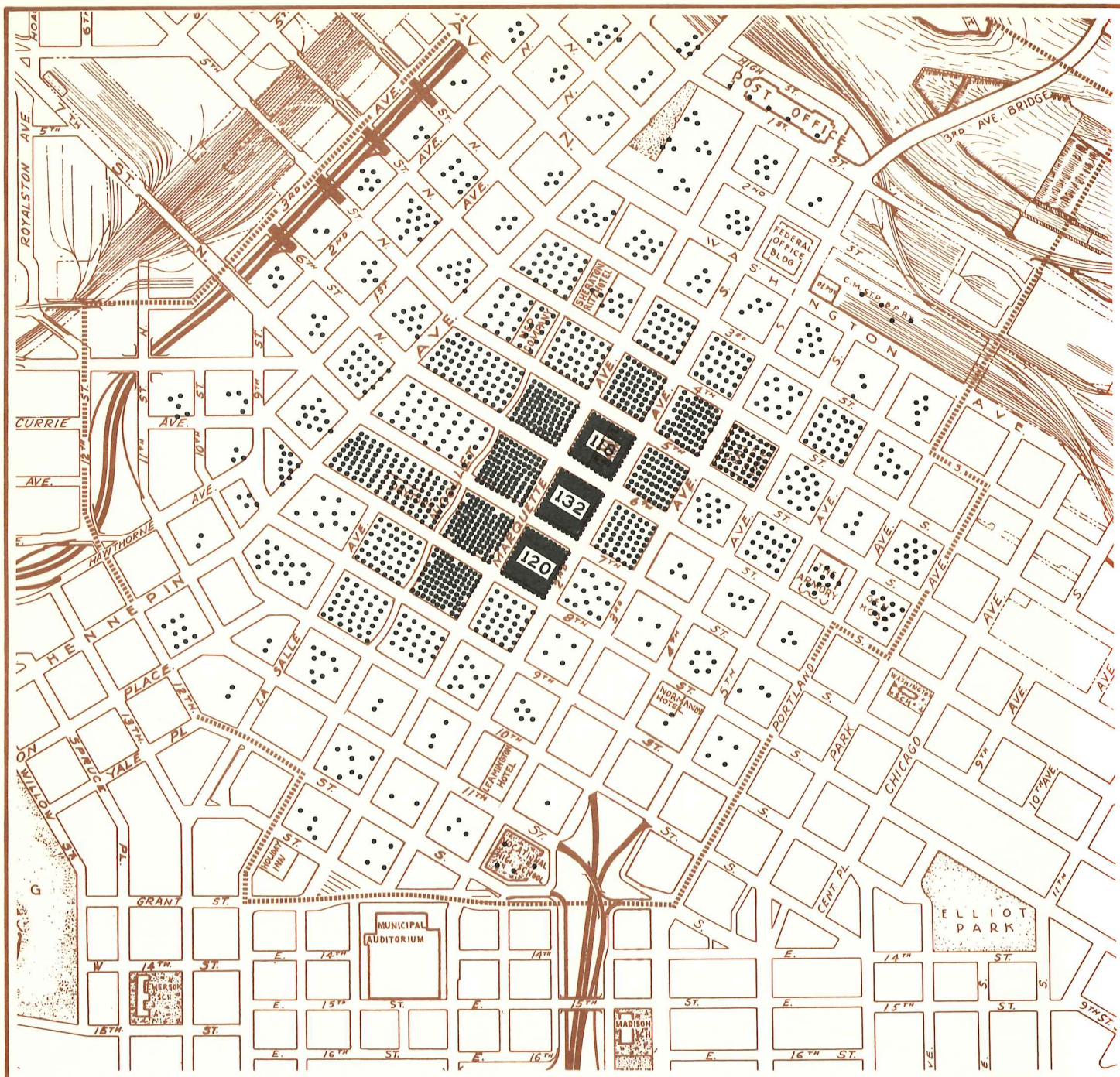
0 500 1000 FEET

DATA COLLECTED: 7-9:00a.m. SEPTEMBER, 1970

MPLS. CBD DESTINATIONS OF AUTO PERSON TRIPS INBOUND ON ARTERIAL STS.

FIGURE 15

PAGE 27



LEGEND

● THREE TRIPS

TOTAL TRIPS 5,654

N

0 500 1000 FEET

132 NUMBER OF TRIPS

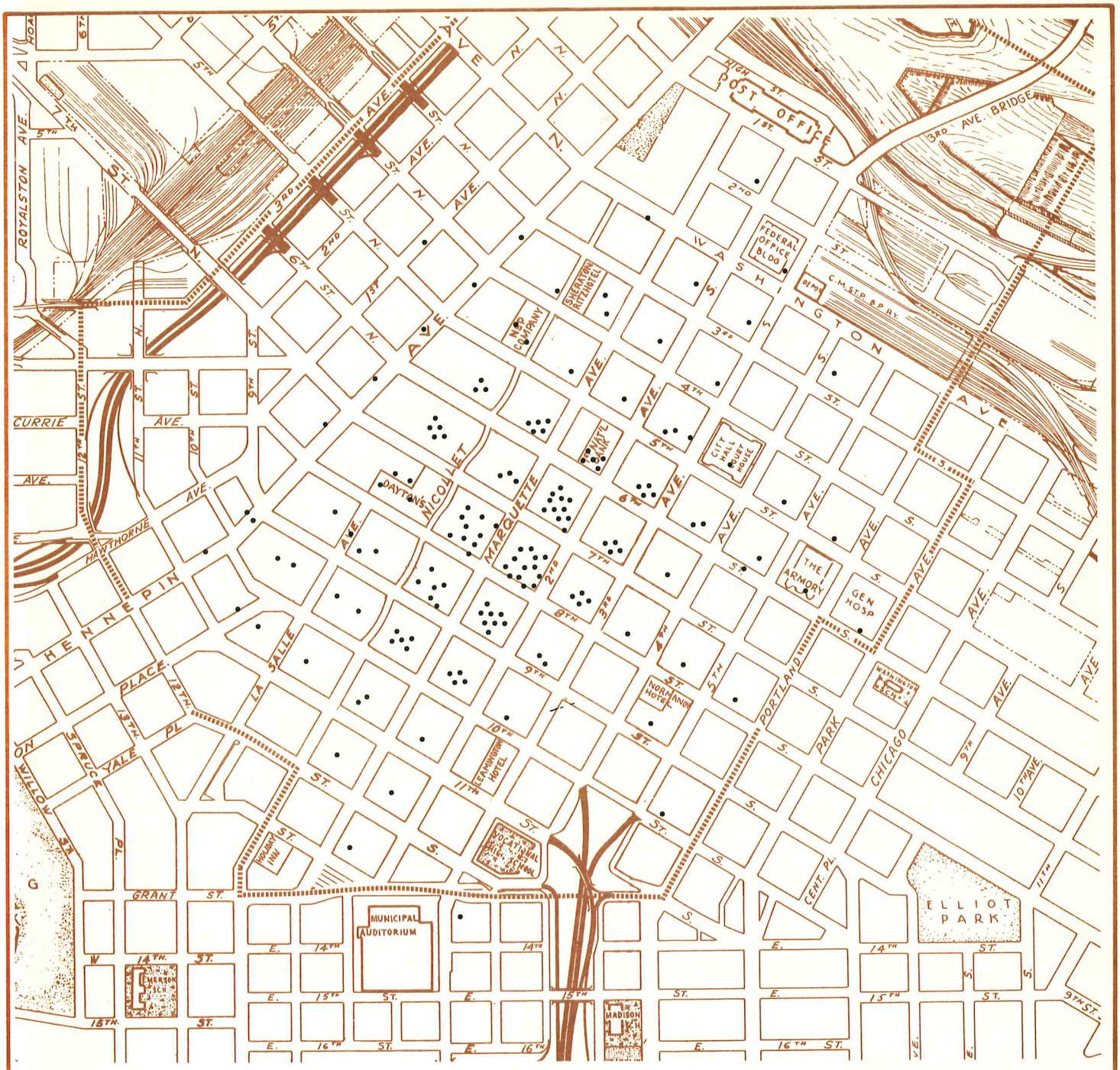
▪▪▪▪▪▪▪ MINNEAPOLIS CBD BOUNDARY

FIGURE 16

PAGE 28

MPLS. CBD DESTINATIONS OF LOCAL TRANSIT RIDERS

DATA COLLECTED:
7 - 9:00 a.m.
DECEMBER 9, 1970



LEGEND

● THREE TRIPS

TOTAL TRIPS 410

N

0 500 1000 FEET

▪▪▪▪▪▪▪ MINNEAPOLIS CBD BOUNDARY

DATA COLLECTED:
7-9:00 a.m.
DECEMBER 9, 1970

MPLS. CBD DESTINATION OF EXPRESS TRANSIT RIDERS

FIGURE 17

PAGE 29

- Figure 14: Destination locations of inbound auto person trips on I-35W.

- Figure 15: Destination locations of inbound auto person trips on the arterial street system.

- Figure 16: Destination locations of local transit person trips

- Figure 17: Destination locations of express transit person trips.

The destination patterns for all modes (auto and transit) and types (arterial/freeway and local/express) are similar. The heaviest concentration is between Second and Marquette Avenues. In addition, there is a heavy concentration between Nicollett and Marquette Avenues. The City Hall also is a high generator of travel.

I-35W CORRIDOR TRAVEL CHARACTERISTICS

Trip Purposes

The trip purposes at origins and to destinations within the I-35W corridor are shown in Figures 18 and 19 for the morning peak period. Over 95 percent of the I-35W freeway users began their trip at home as compared to 93 percent of the arterial street users. Except for the small number of trips with purpose at origin of work and to service passengers, the remaining purposes surveyed numbered less than one percent for both freeway and arterial street users. For transit riders, 97 percent of the express riders and 96 percent of the local transit riders began their trip at home. In this case, no other origin purposes were surveyed.

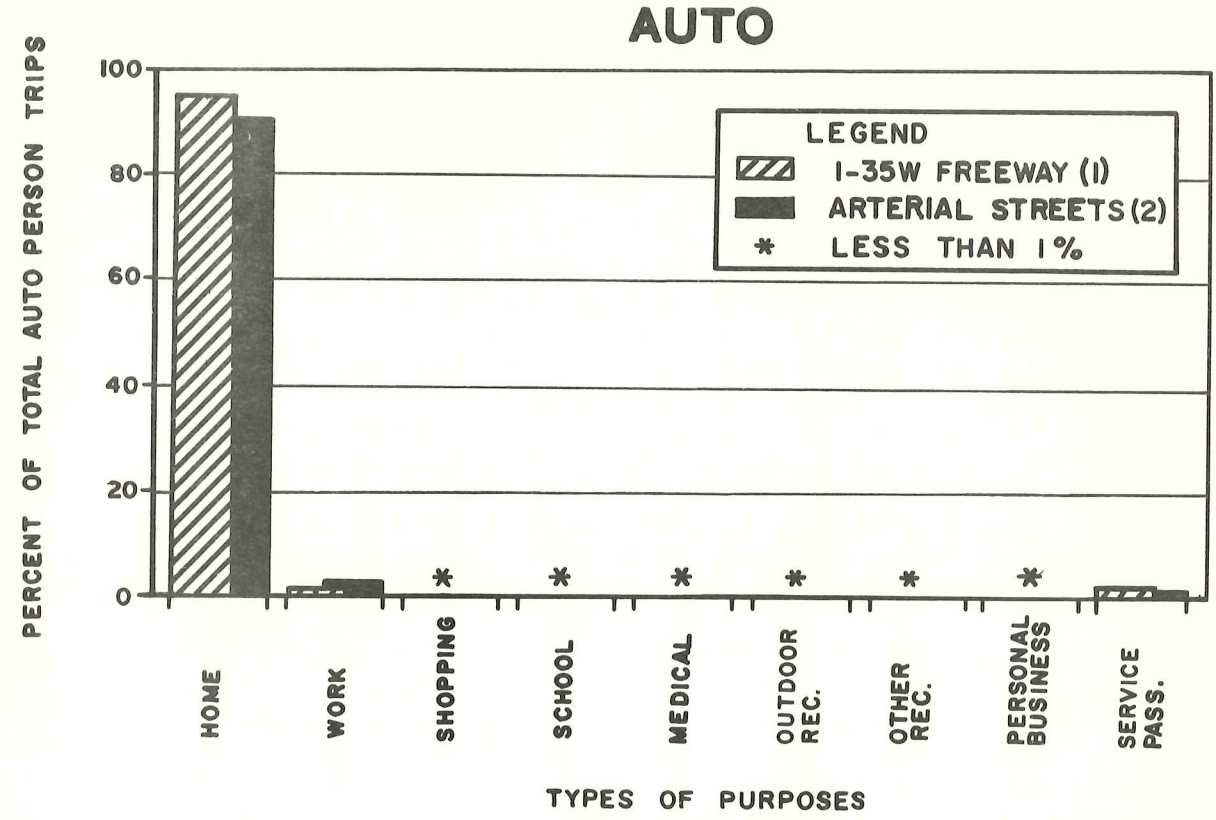
The Minneapolis Central Business District destinations surveyed included work, shopping, school, medical, types of recreation, personal business, and to serve passengers. Trips were work-oriented for 85 percent of the freeway users, 83 percent of the arterial street users, and over 95 percent of both the local and express transit riders. To service passengers and personal reasons were the purpose to destination for 13 percent of the arterial street users and ten percent of the freeway users. It is evident by comparing the purposes at origin and to destinations that the major travel pattern of corridor travelers during the peak period under study is from home to work.

Person Characteristics

The average age of all corridor associated trip making persons to the Minneapolis CBD was 37.7 years. The survey indicated that the number of persons per household averaged 3.3 persons for auto drivers on the freeway and arterial streets. Over 55 percent of the transit riders had annual incomes of less than $8000 as compared to twelve percent of auto drivers. One interesting point is the difference in annual incomes between the express and local transit riders. The income characteristics are shown in Figure 20.

Auto Characteristics

For auto trips to the Minneapolis CBD, 51 percent of the I-35W freeway users were the only occupants in their auto. As indicated in Figure 21, just under 80 percent of all auto trips had one or two persons per auto. The number of autos per household, Figure 22, indicates the availability of auto usage for both auto and transit users.



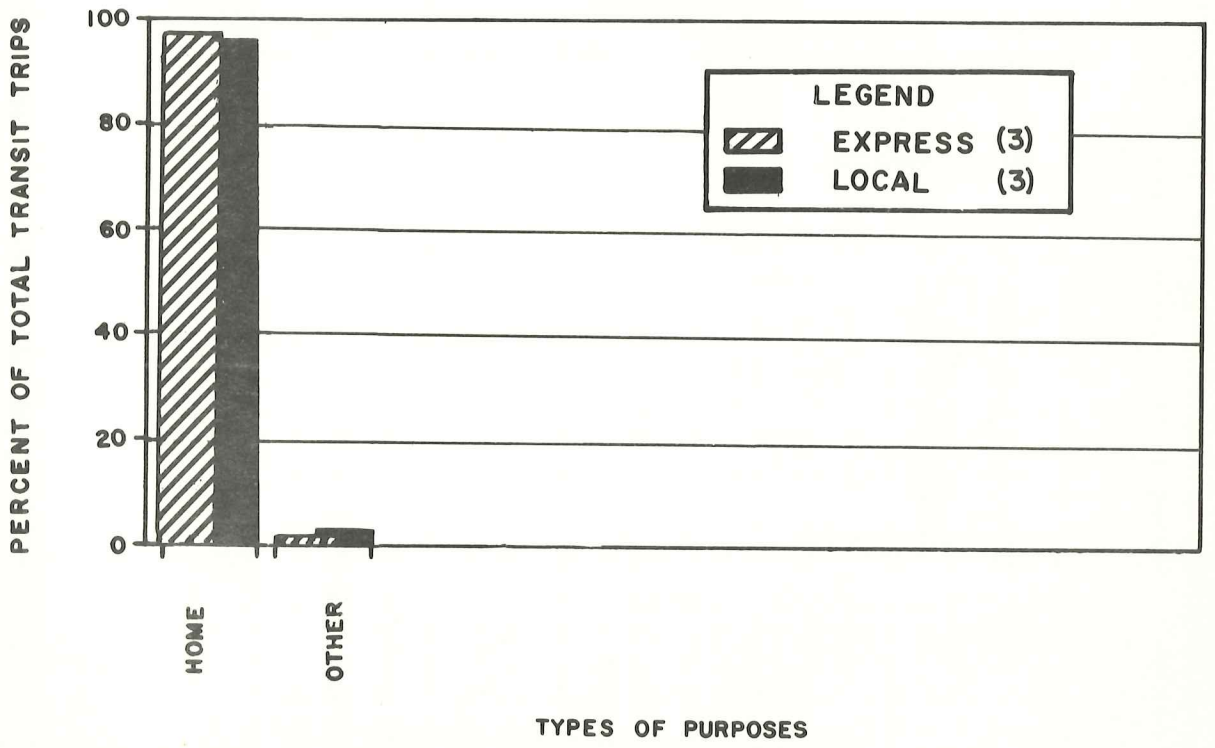
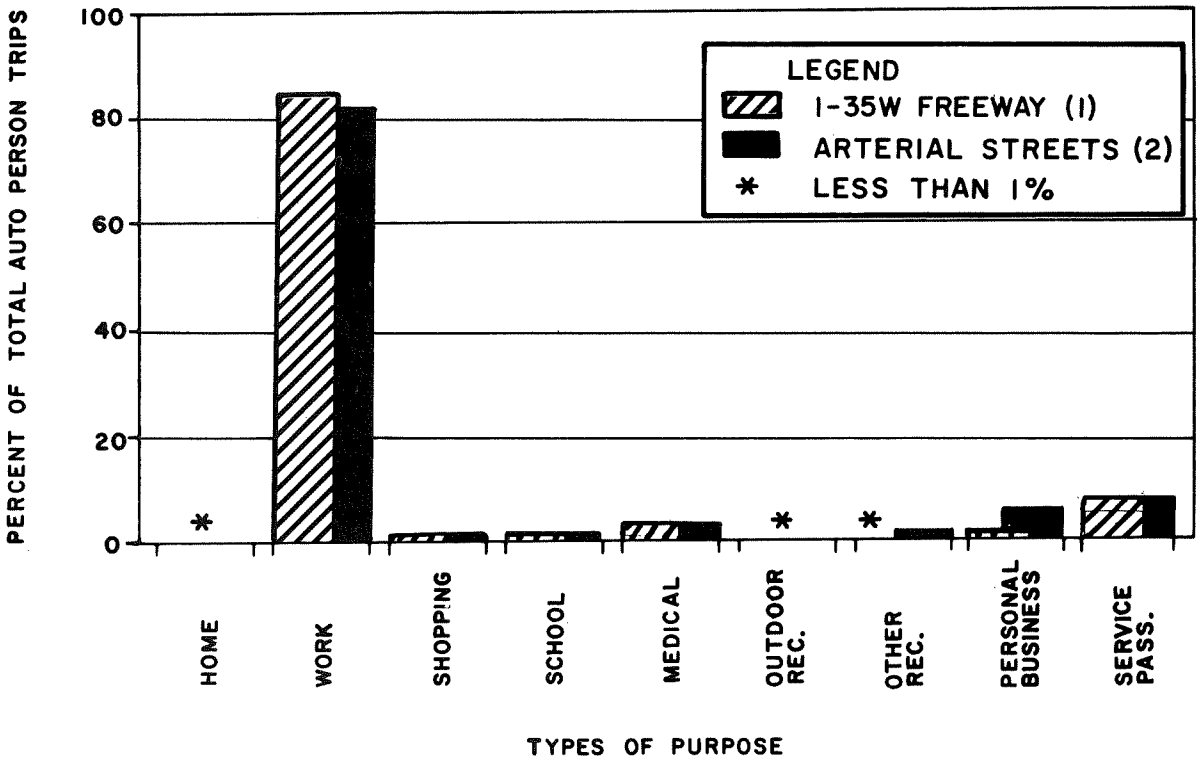


FIGURE 18
PAGE 32

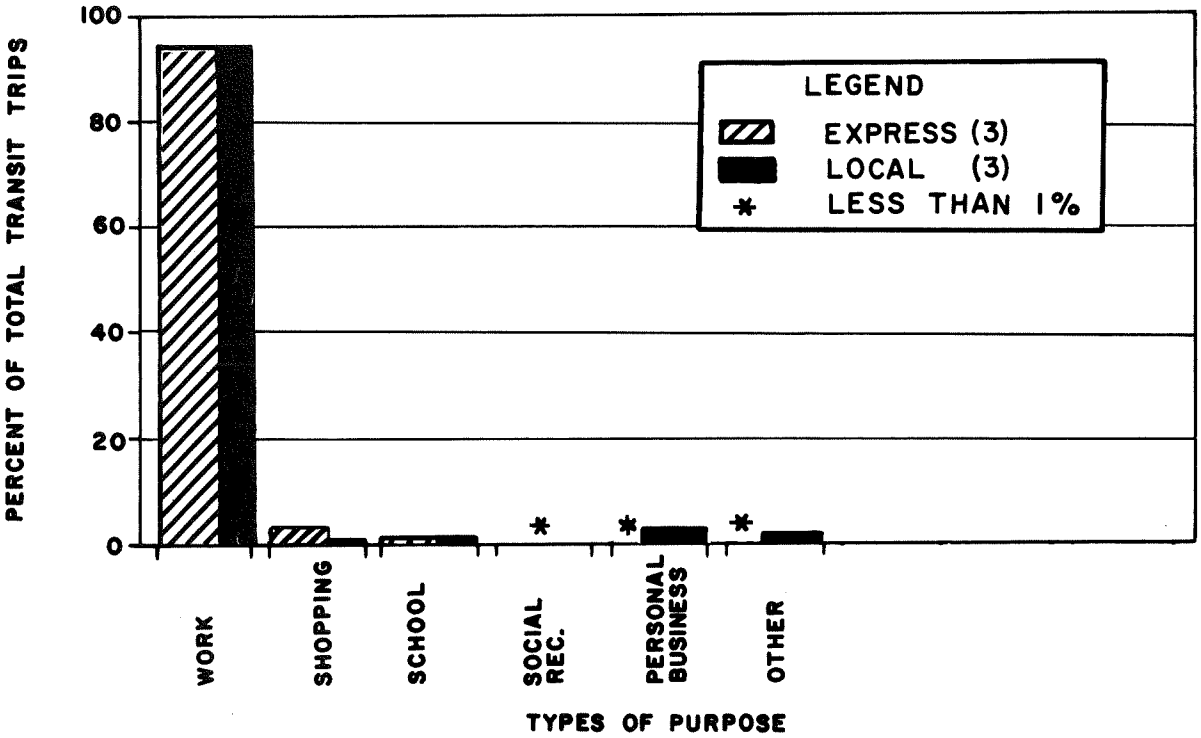
TRIP PURPOSE AT ORIGIN

DATA COLLECTED:
7-9:00 a.m.
(1) DECEMBER 10, 1970
(2) SEPTEMBER 1970
(3) DECEMBER 9, 1970

AUTO



TRANSIT

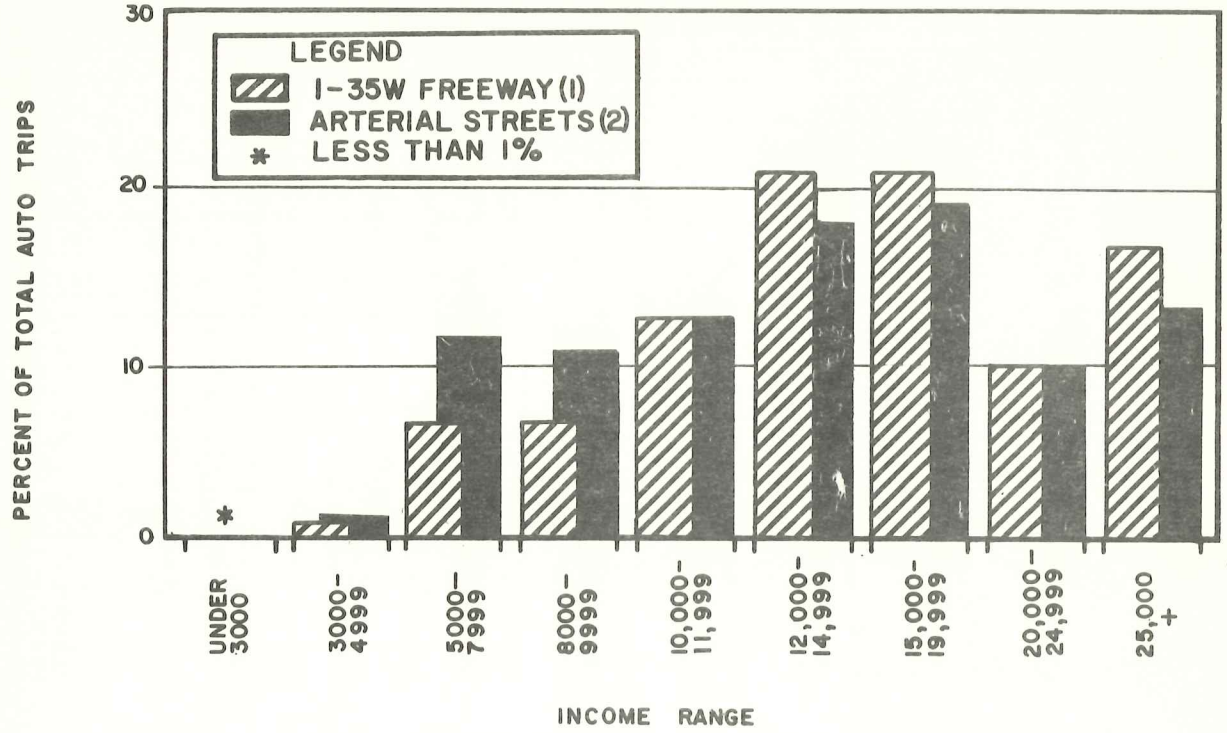


DATA COLLECTED:
7-9:00 a.m.
(1) DECEMBER 10, 1970
(2) SEPTEMBER 1970
(3) DECEMBER 9, 1970

TRIP PURPOSE TO MPLS. CBD DESTINATION

FIGURE 19

AUTO



TRANSIT

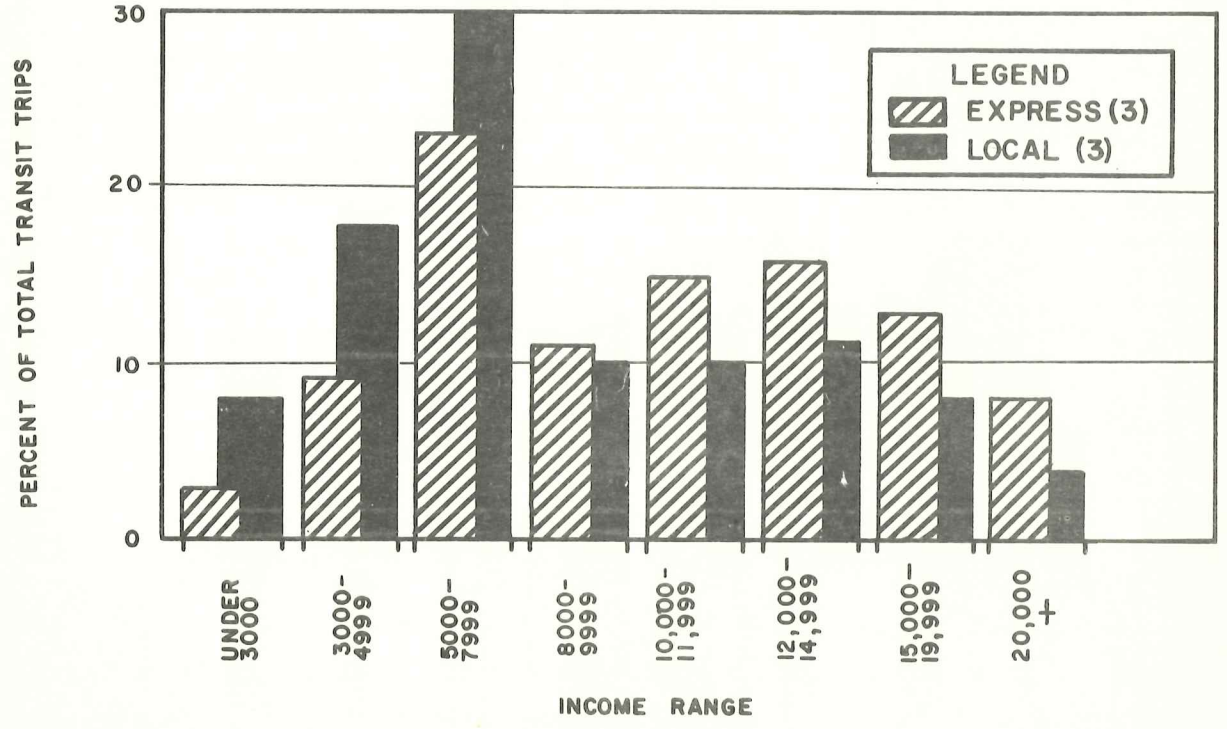
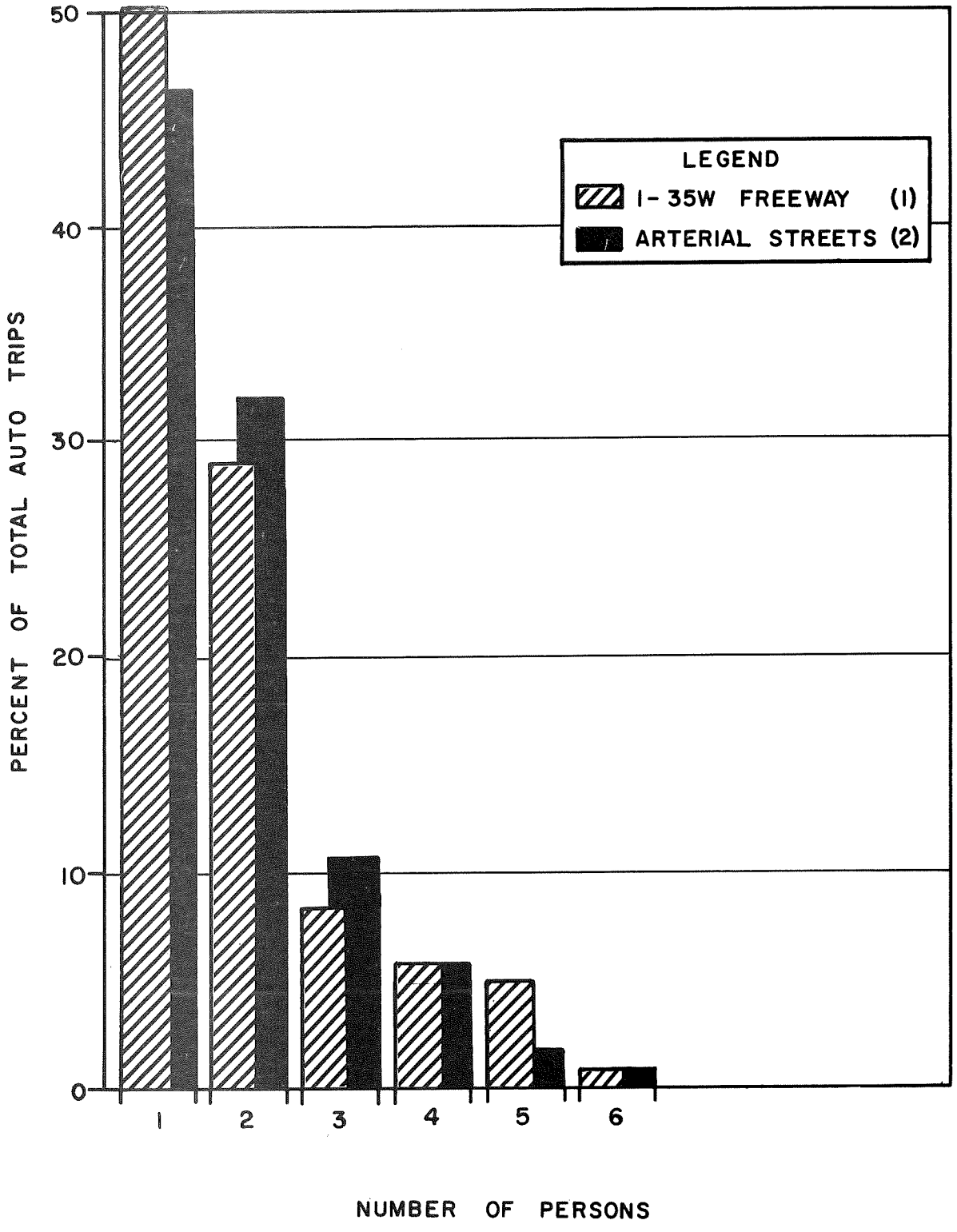


FIGURE 20
PAGE 34

INCOME VARIATIONS

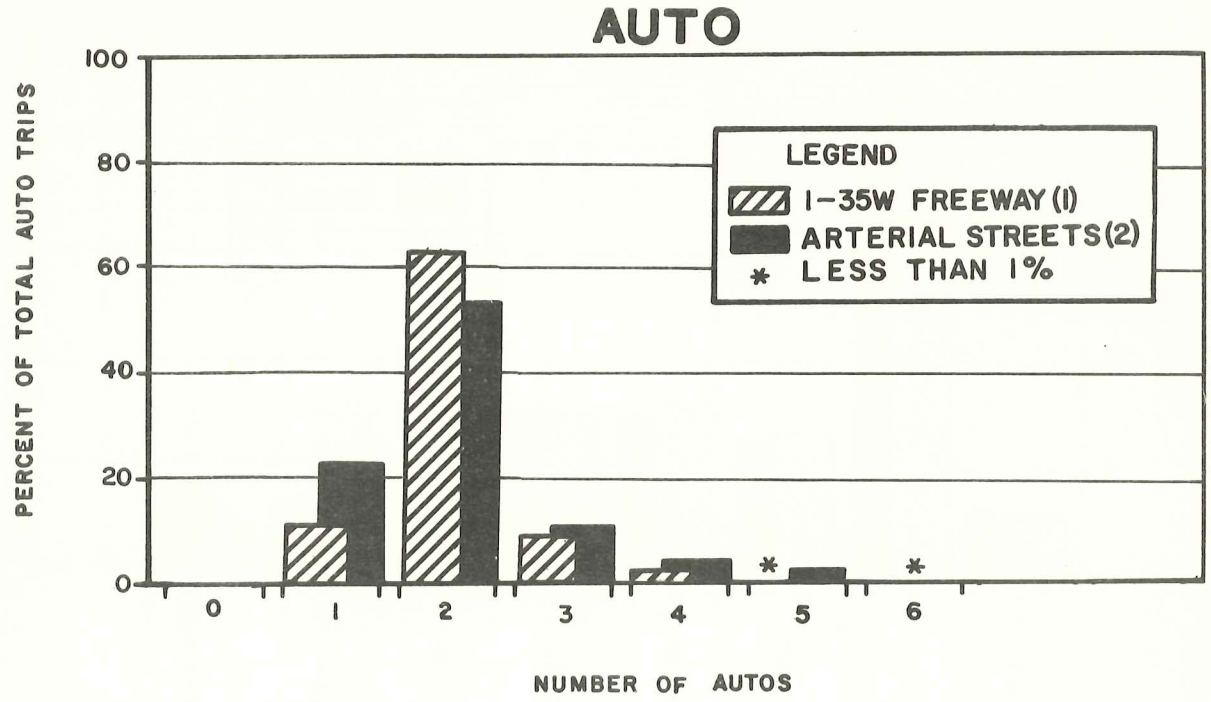
DATA COLLECTED:
7-9:00 a.m.
(1) DECEMBER 10, 1970
(2) SEPTEMBER 1970
(3) DECEMBER 9, 1970



DATA COLLECTED:
7 - 9:00 a.m.
(1) DECEMBER 10, 1970
(2) SEPTEMBER 1970

AUTO OCCUPANCY

FIGURE 21



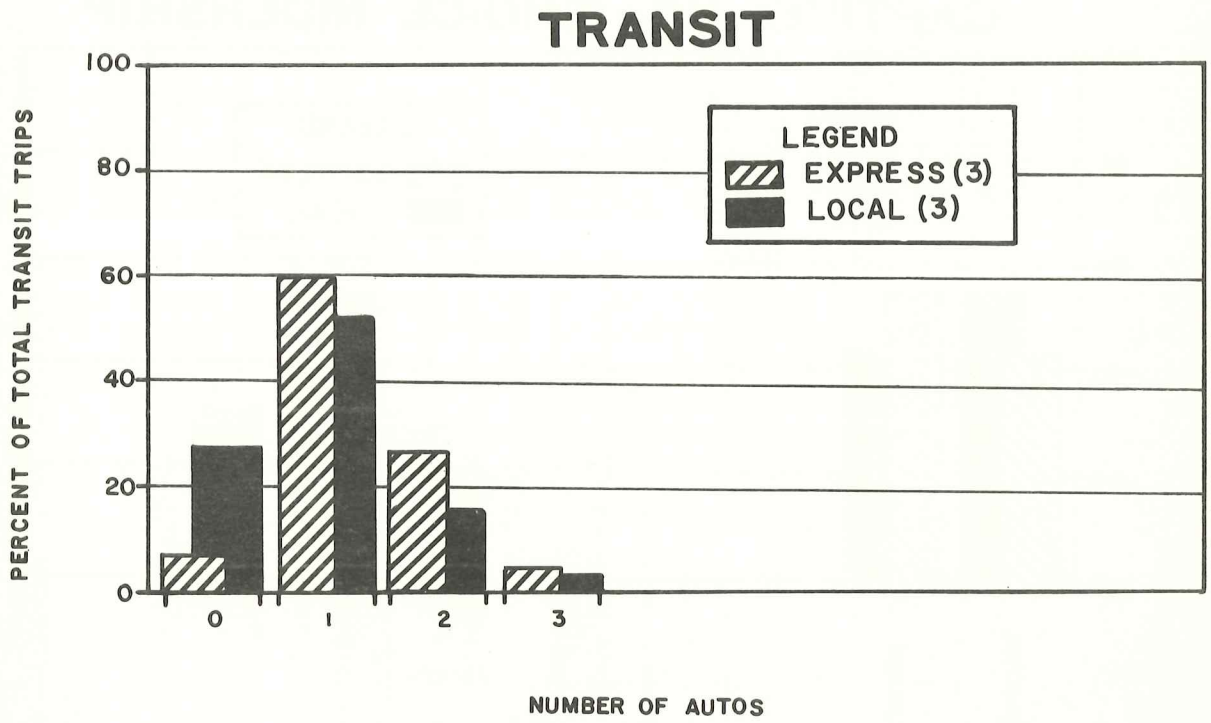
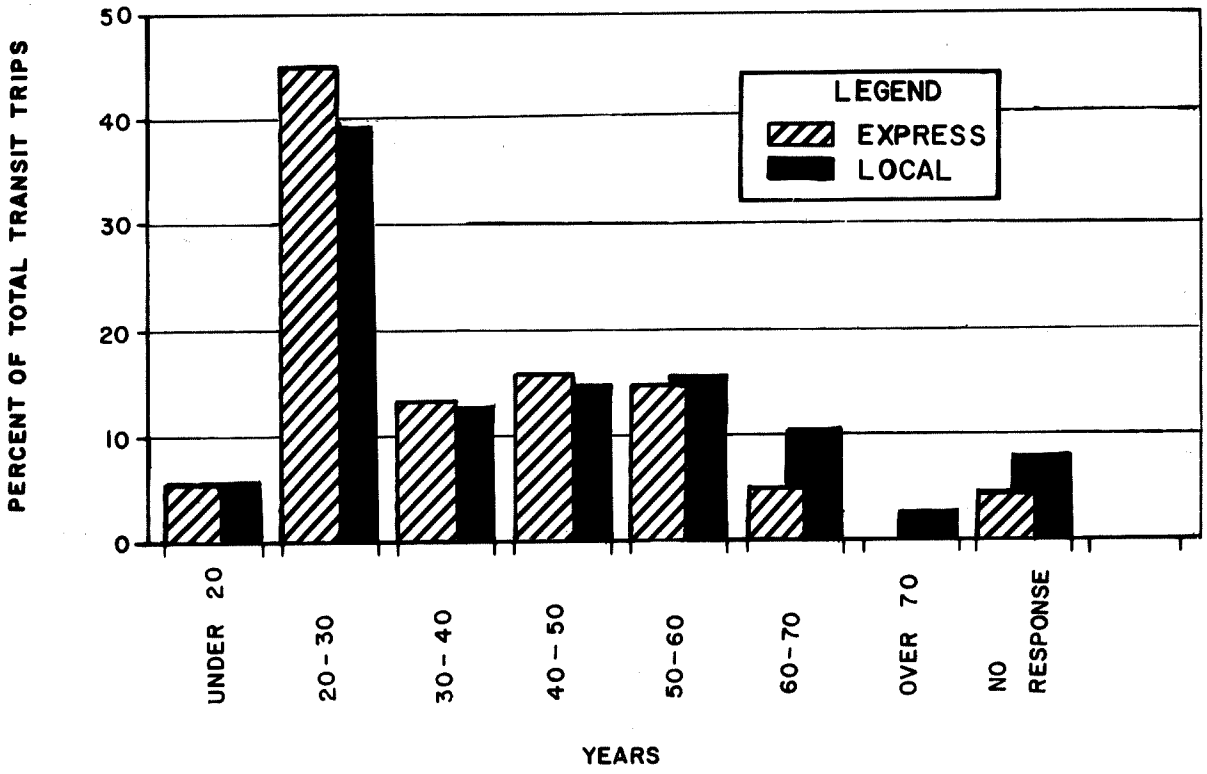


FIGURE 22
PAGE 36

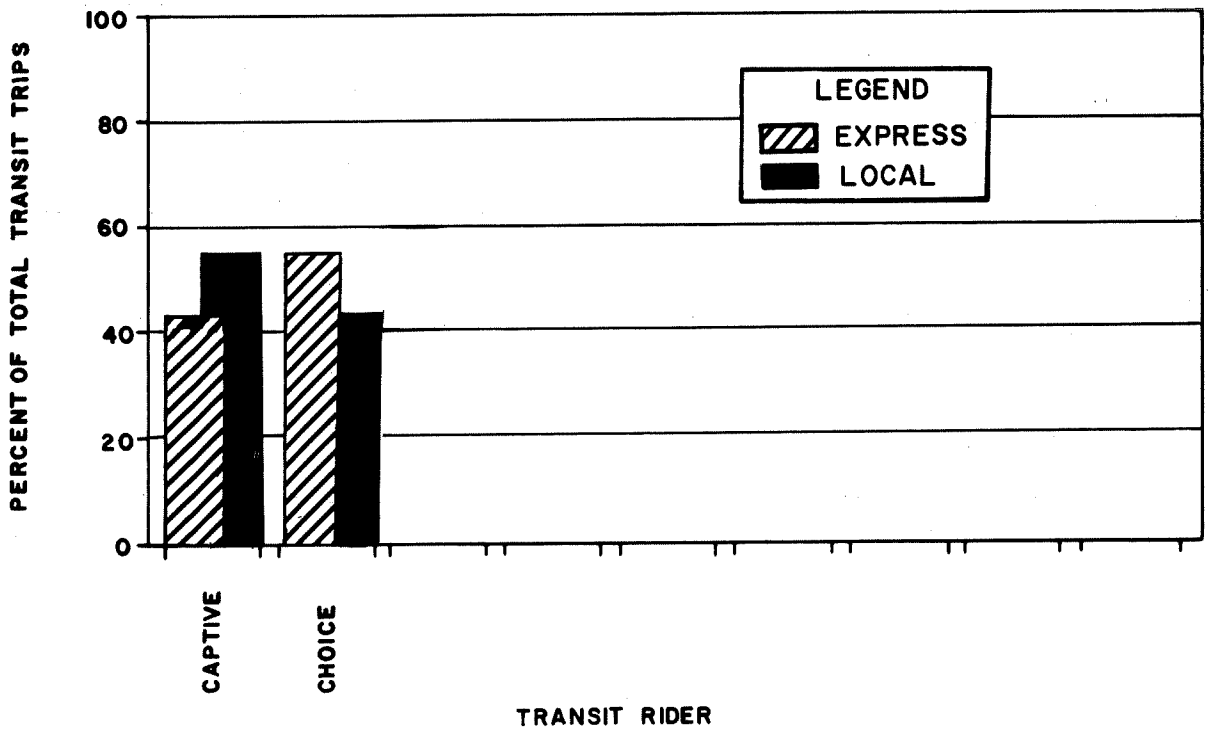
AUTOS PER HOUSEHOLD

DATA COLLECTED
7-9:00 a.m.
(1) DECEMBER 10, 1970
(2) SEPTEMBER 1970
(3) DECEMBER 9, 1970

AGE



CAPTIVE VS. CHOICE RIDERSHIP

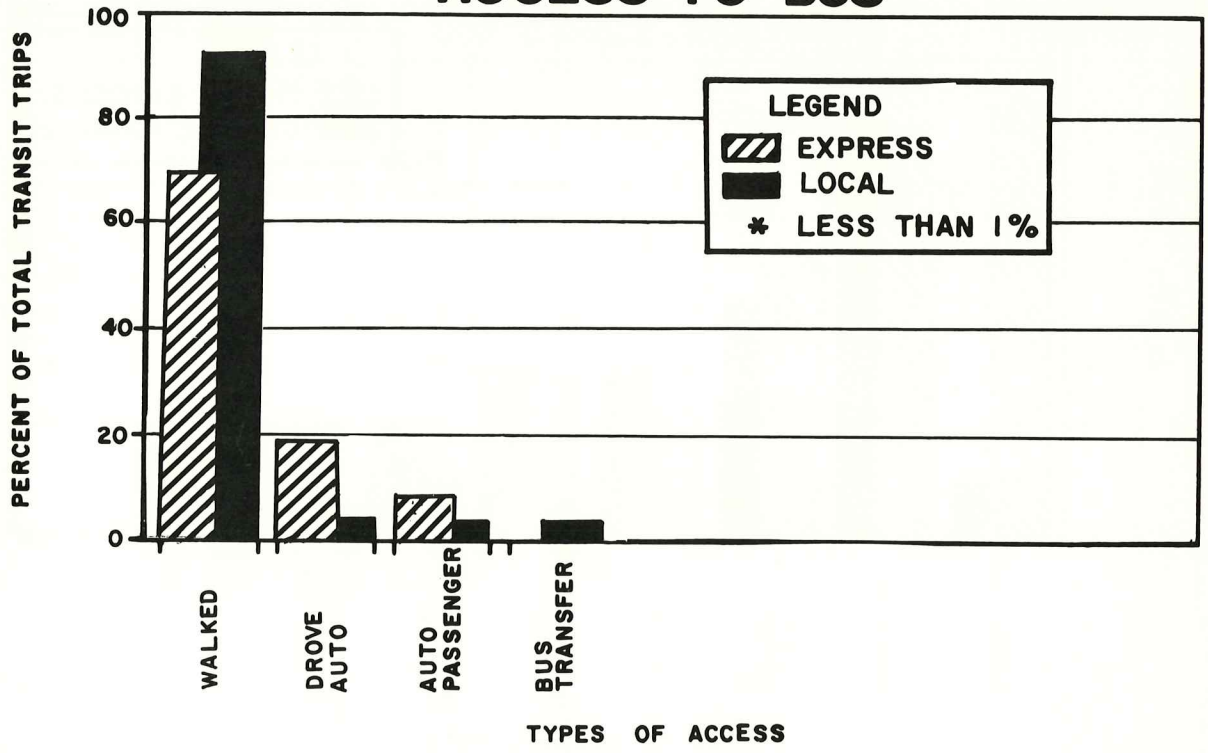


DATA COLLECTED:
7-9:00 a.m.
DECEMBER 9, 1970

TRANSIT RIDER CHARACTERISTICS

FIGURE 23

ACCESS TO BUS



DISTANCE WALKED TO BUS

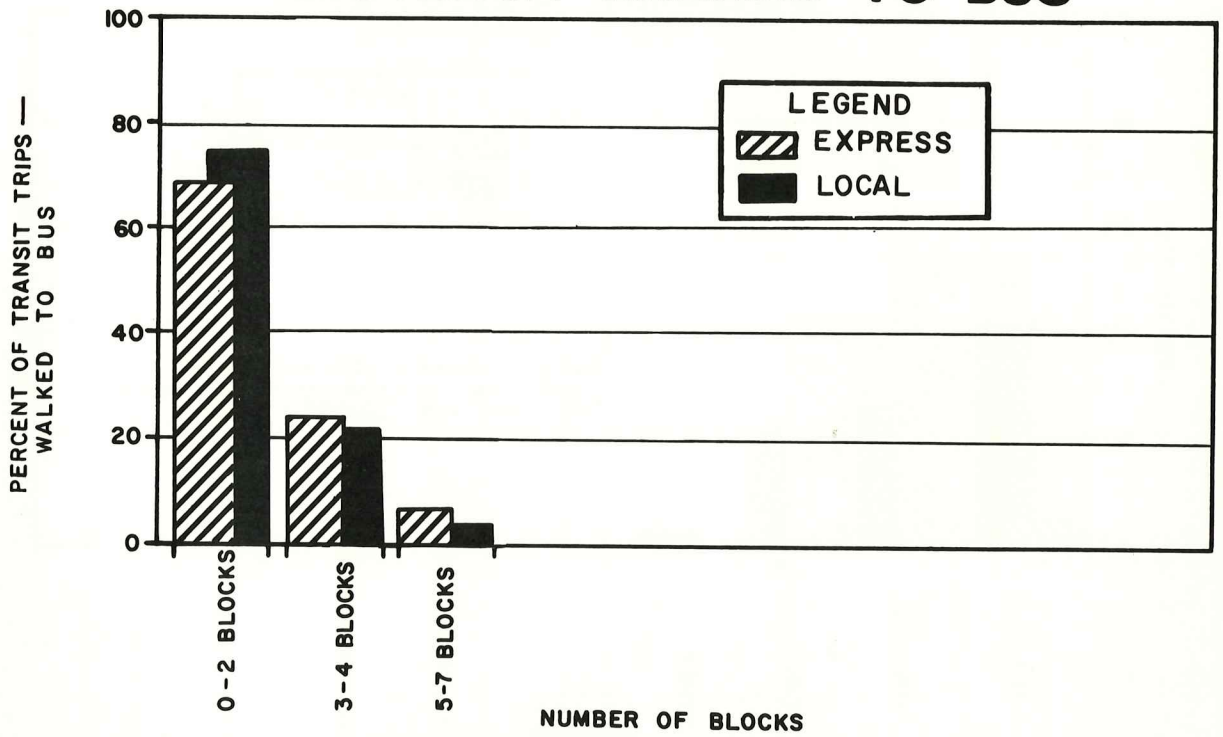
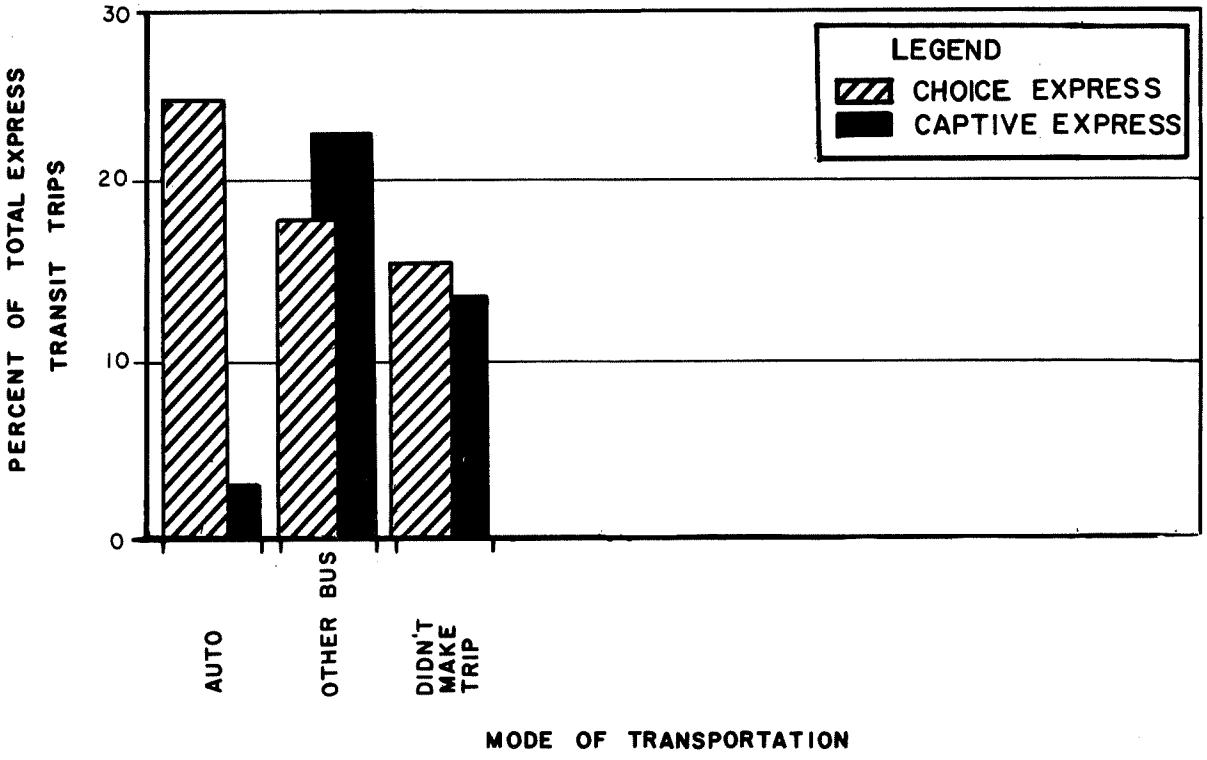


FIGURE 24
PAGE 38

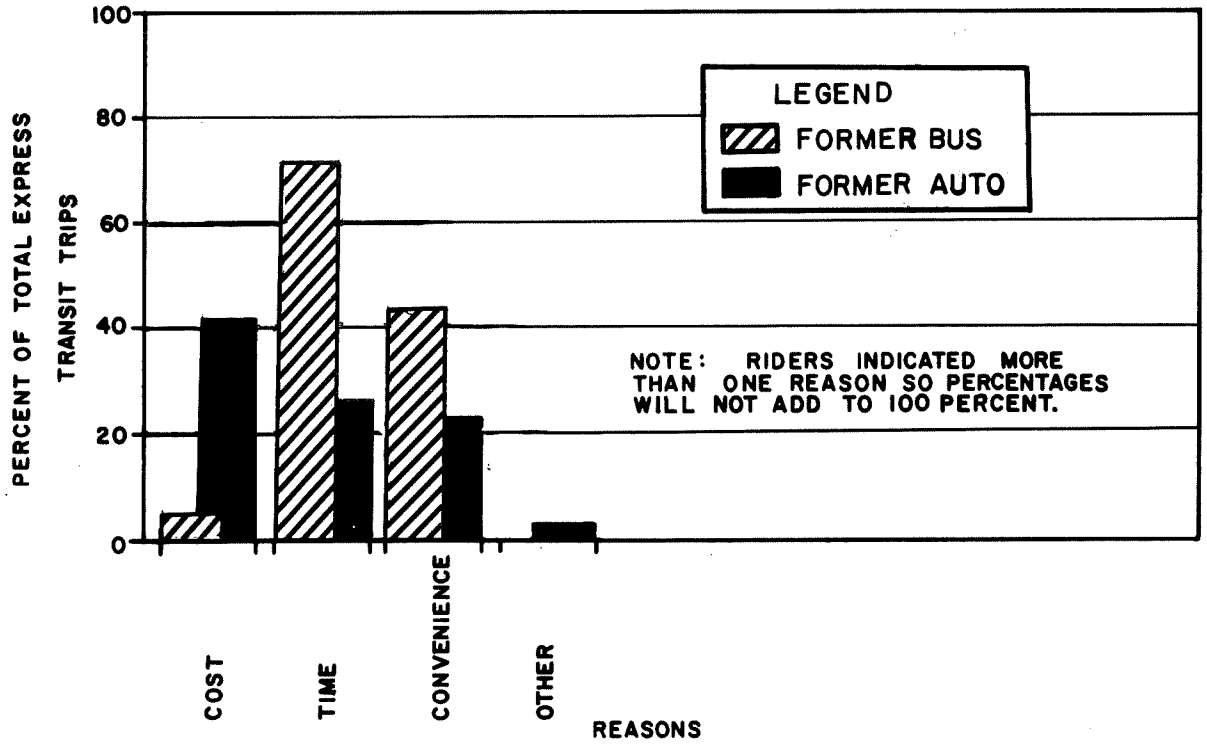
TRANSIT RIDER CHARACTERISTICS

DATA COLLECTED:
7-9:00 a.m.
DECEMBER 9, 1970

PREVIOUS MEANS OF TRAVEL



REASONS FOR SWITCH



DATA COLLECTED:
7-9:00 a.m.
DECEMBER 9, 1970

EXPRESS TRANSIT RIDER CHARACTERISTICS

FIGURE 25

Transit Rider Characteristics

Approximately six of every ten local service bus patrons currently traveling to downtown Minneapolis from an origin within the corridor during the morning peak period are 'captives' of the system in that they have no auto available for their trip (Figure 23). In contrast, only about four of every ten present express service riders are in the 'captive' category. More than nine of every ten local service transit riders and about seven of every ten express patrons walked to the bus (Figure 24). About one of every five express service riders drove to the bus and another nine percent traveled to the bus stop as an auto passenger. In comparison, only five percent of the local service riders reached the bus via auto (either as driver or passenger) and another two percent transferred from another bus.

A set of questions aimed specifically at the express rider determined the previous mode of travel and the reason for the switch to the express bus service. As illustrated in Figure 25, about 30 percent of the express bus patrons formerly used the auto to make their trip, about 40 percent were merely diverted from local service transit lines and about another 30 percent did not make the trip at all prior to the institution of express bus service. Cost, time and convenience were the three major factors listed as the reason for mode switch. Cost savings were more important to former auto users, while time and convenience were cited by former local transit service riders.

FORECASTED VOLUMES IN CORRIDOR

Ramp volumes projected for 1985 (MHD System 16) on I-35W are generally higher than can be accommodated on the mainline. Unless additional lanes are constructed, mainline demands during the morning and evening peak hour will exceed practical capacity at all points between downtown and the Minnesota River. The excess demand will have to be diverted to alternate routes and modes and also spread over time. Unless substantial numbers of peak hour person trips can be diverted to alternate modes, congestion will be severe on both the mainline and on alternate alterial routes in the corridor. Rather than minor congestion during short time periods as we have now, congested traffic conditions will prevail for two or three hours during each peak period.

LOCATION ON I-35W AT	AVERAGE DAILY TRAFFIC - 1971	1975	1985	PEAK HOUR VOLUME/LANE 1971	1975	1985
Lake Street	103,500	111,900	122,000	1,505	1,625	1,950
Minnehaha Creek	98,000	107,000	115,000	1,866	2,000	2,387
I-494	60,500	73,000	76,000	1,400	1,600	2,200
Minnesota River	45,000	52,700	72,000	1,598	1,700	2,000

ALTERNATE ROUTE - AVERAGE DAILY TRAFFIC - EXISTING AND FORECASTED

Location	1970	1985
Portland/Park @ Lake Street	24,247	27,200
Portland/Park @ 64th Street	12,200	19,800
Portland/Park @ I-494	12,800	14,400
Nicollet @ Lake Street	9,000	16,600
Nicollet @ Henn. Co. 62	12,200	18,300
Nicollet @ I-494	13,100	15,600
Lyndale @ Lake Street	13,733	24,300
Lyndale @ Henn. Co. 62	12,829	16,700
Penn @ 66th Street	15,200	18,200
Penn @ I-494	18,800	22,800

As another indication of the expected growth, the employment in the Minneapolis CBD is forecasted to increase to 111,400 by 1985 as compared with 83,100 in 1970.

THE SURVEILLANCE AND CONTROL SYSTEM

INTRODUCTION

The Texas Transportation Institute in their report on the feasibility of A System to Facilitate Bus Rapid Transit on Urban Freeways cited extensive research that has been conducted on freeway surveillance and control systems in Chicago, Houston and Detroit. Additionally, other cities such as Dallas, Los Angeles, New York, Seattle, San Diego and Milwaukee have systems either in operation or planned. Experience from these cities has shown that freeway surveillance and control has moved beyond the experimental stage and is now considered to be an effective traffic engineering tool. Extensive studies have demonstrated that this type of system is cost-effective from the standpoint of reducing travel time, delay and accidents.

While other surveillance and control systems are programmed to optimize flow, the I-35W system will operate at lower volumes and higher speeds, providing a desired level-of-service for transit vehicles. Special ramps will be provided to permit transit vehicles to by-pass the queue at ramp meter signals and enter the freeway without being delayed. Automobiles will be stopped on the entrance ramp and allowed to enter the freeway only when their presence will not reduce the desired transit level-of-service.

The Minnesota Highway Department has entered into an agreement with the Texas Transportation Institute for review of the surveillance and control system design. As part of this agreement, cost information has been provided from the North Central Expressway Surveillance and Control System in Dallas. It is anticipated that further design review will be made by T.T.I. in the near future.

ANALYSIS OF EXISTING TRAFFIC CONDITIONS

Analysis of the inventory data and the volume trends on I-35W leads to the conclusion that a system of freeway surveillance and control is needed whether buses are incorporated into the system or not. Unless control measures are taken, conditions will continue to deteriorate to a point where I-35W will lesson its desirability as a practical route connecting the CBD and the University of Minnesota with the southern half of the City of Minneapolis and the southern suburbs.

In analyzing the traffic inventory data for the I-35W corridor, the major bottlenecks are identifiable by examination of the volumes, travel times, and accident experience. The inbound problems occur between 82nd Street and I-494, in the I-35W common section with C.S.A.H. 62, in the Minnehaha Creek Area, and, to a lesser degree, in the Minnesota River area.

Outbound bottlenecks are located at the Central Interchange, the 46th Street lane drop, the Minnehaha Creek area, the common section, and the I-494 Interchange area.

Inbound Characteristics

High volumes and lane changing in the 82nd Street - I-494 area result in congestion during peak flow periods. The proximity of the 82nd Street entrance complicates the eastbound exit movement. The weaving maneuver problems inherent in cloverleaf designs are accentuated by the high volume on the westbound exit loop and contribute to the overall volume problem upstream.

The I-35W - Hennepin County Highway 62 common section is characterized by two two-lane vertical and horizontal curves combined with "drop lane" and "add lane" geometrics. Substantial volumes are added from County 62 eastbound that must weave and merge with I-35W trafiic. The geometrics of the curve on the east end of the common section are such that speeds must be reduced slightly, setting up shock waves in peak flow periods. Numerous accidents of the type related to congestion occur in this area.

The I-35W bridges over Minnehaha Creek are not full width, creating a "psychological" bottleneck because of the apparent lateral restriction. Subsequently, congestion is created upstream due to drivers consciously or unconsciously slowing down while crossing the bridge. The restriction is doubly critical because the freeway is running at or very near capacity for substantial periods at this location and the shockwaves can very quickly travel into the common section curves.

In the Minnesota River area, slow moving trucks on occasion cause congestion on the northbound grade. It is anticipated that a climbing lane will be constructed in the near future so that this area should not be a problem.

Several favorable characteristics of the inbound traffic keep conditions from being worse than they are and will facilitate the ramp metering system. They are as follows:

1. The inbound demand over time is not cumulative (i.e., ramp volumes south of I-494 peak later than ramp volumes closer to the CBD).

2. The system has relatively balanced demand from several sub-systems.

3. There is a net reduction of inbound peak hour traffic at the I-494 interchange (800 fewer peak hour vehicles north of the interchange than south of it).

4. The parallel arterial streets are operating well below capacity in most cases.

5. The City of Minneapolis is planning to computerize its traffic control signal system, thus further increasing system efficiency on the arterial street system.

Outbound Characteristics

Problems in the Central Interchange are due in large part to the surges of traffic fed into the system from the adjacent signalized intersections. Complicating matters further is the lane loss where I-35W southbound traffic joins the CBD outbound traffic. Although total volume is well within per lane capacity, distribution by lane is not balanced creating an overload on the CBD side when the surges arrive.

Again at 46th Street, the loss of one lane creates a problem. The exit at 46th Street carries only about 875 vehicles per peak or about a half-lane of capacity. Consequently, mainline volumes per lane jump from 1470 before to 1670 after the lane is dropped. The resulting high number of lane changes coupled with the surges of traffic can contribute to congestion.

The problems at 46th Street are on occasion heightened by shockwaves generated at the Minnehaha Creek bridge which is not full width and which acts as a psychological restriction. Congestion at the bridge in turn is sometimes the result of congestion in the C.S.A.H. 62 common section.

As was the case for the inbound traffic movement, the combination of geometrics, weaving and lane volume unbalance results in congestion. The lane dropped to eastbound C.S.A.H. 62 does not carry a full lane of traffic with it, resulting in lane changing and increased lane volume on the two lane curve. Traffic entering the common section via the westbound C.S.A.H. 62 ramp and wishing to exit at Lyndale or continue westbound must weave through the I-35W mainline traffic.

Conditions in the I-35W and I-494 interchange in the evening are similar to the morning problems with excessive volumes the main factor. As is the case elsewhere in the corridor, volumes for the full hour are not excessive, rather the peak five and peak fifteen minute surges create the congestion.

Several favorable characteristics of the outbound traffic keep conditions from being worse than they are and will facilitate the ramp metering system. They are as follows:

1. Generally, entrance ramp volumes are relatively low, permitting flexibility in operation and reducing ramp delay for any individual driver.

2. Peaking characteristics are such that the extremes are rather short lived, making it easier to smooth demands over the hour.

3. The parallel arterial streets are operating well below capacity in most cases.

Summary

In comparison to other major urban areas, congestion in the I-35W corridor is virtually non-existent. In the absence of accidents, rain storms or snowy pavement, traffic seldom slows to a complete stop. Any stoppages are of a few seconds as compared to many minutes in Chicago, Los Angeles, or New York. Rather than peak periods of two or three hours, we have only 30 or 45 minutes of peak volumes. Individual ramp volumes are such that there need be little diversion to alternate routes and delays to individual drivers will not be excessive.

The impact of the controlled access will be greater on future demands than on present users. The effect will be to spread demand over a longer period of time at lower rates than would develop naturally and without restraints. While other cities are installing surveillance and control devices just to keep vehicles moving, the I-35W system will keep vehicles moving at a specified level of service. If the system were to be delayed for several years, the resulting inconvenience and delay to freeway users would be of such a magnitude to detract from the appeal of the express bus system.

CONTROL CONCEPTS

The basic objectives of the freeway management system operation will be as follows:

1. Maintain a high level of service on the freeway. This will mean controlling ramp demand to operate the system at lower volumes and higher speeds than are prevalent on freeway surveillance and control systems currently in operation.

2. Provide express buses with priority access to the freeway over passenger vehicles. This will be accomplished with special slip ramps or widened ramp sections which will permit buses to by-pass the queues at ramp meter signals and enter the freeway without delay.

3. Quickly detect and react to incidents occuring on the freeway. Incident detection will be accomplished by the detector system and the proper response will be determined through the use of the closed circuit television system.

4. Be sensitive to weather conditions. This will mean incorporating special control logic when there is inclement weather.

The computer and peripheral equipment in the control center will monitor vehicular flow on all ramps and will sample main line flow at numerous locations to determine to what extent access control be applied. A modified capacity-demand mode will be utilized with the control system establishing an "artificial" capacity that will provide a higher quality of flow, with preferential treatment for express buses shifting the emphasis from "vehicle" movement to "people" movement.

Volume and lane occupancy (the percent of time the detector records a vehicle presence) will be used as parameters in the control system. The system will be divided into several sub-systems and the output from each sub-system will be controlled to provide an acceptable input into the next sub-system. In addition to maintaing the desired system and sub-system level of service, the ramp control will smooth out the merging process at each entrance ramp by spacing entering traffic and allowing one vehicle at a time to merge.

Mainline vehicle detectors will be used to detect incidents as well as provide control parameter information. By comparing volume and lane occupancy levels, the difference between adjacent detectors can be used to locate problems. A closed circuit television system that will provide complete coverage between the CBD and I-494 will be utilized to determine the response necessary.

In addition to mainline detection, each ramp meter will have three associated detectors. A combination queue and gap detector will be placed at the ramp entrance to permit turn-on at a safe time and to detect back up to the cross street. A merge area detector will sense operational problems and override the meter cycle as necessary. A demand detector at the meter will bring up the green light in accordance with cycle time requirements, with passage being assumed.

Detectors on the exit ramps will provide volume information and will serve as system output detectors. It may also be necessary to utilize exit ramp detectors as queue detectors at certain signalized diamond interchanges to pre-empt normal signal operation when ramp traffic is backed up to the freeway. The merge area detectors will serve as system input detectors.

At bus ramp locations, a special detector could be used to sense the bus arrival and override the ramp meter until the bus has passed. An alternative to this would be an opticom system which would pre-empt the ramp meter cycling via a device located in the bus. Use of detectors, an opticom system, or a combination of the two will be determined in the design phase.

It is anticipated that a real time information signing system and a motorist aid call system will be needed in the future. The "State of the Art" is such that inclusion of these systems at the present time is not practical. Provisions will be made in the communications system, however, to accommodate future addition of these services.

Appendix A illustrates the location of the surveillance and control equipment in the I-35W corridor. All surveillance and control elements north of the Minnesota River will be monitored and controlled from the Surveillance and Control Center via a Department owned hardwire interconnect system. The ramps south of the river will be controlled independently by local, traffic responsive, traffic adjusted controllers. The France Avenue, Xerxes Avenue, and Penn Avenue ramps on Hennepin County Highway 62 will be controlled from the control center via leased telephone lines.

The following factors were taken into consideration in arriving at the decision to use isolated, traffic adjusted ramp metering south of the Minnesota River:

1. It would be very costly to hardwire interconnect the interchanges south of the river due to the distance involved (over two miles between 106th Street and 122nd Street).

2. Crossing the Minnesota River Bridge with conduit and cable would be very expensive.

3. Interconnect via leased telephone lines would be expensive due to mileage charges for crossing numerous telephone exchanges between the interchanges south of the river and the CBD.

4. The interchange at Dakota County Highway 42 is in a private telephone exchange, further detracting from the desirability of leased telephone line interconnect.

5. Isolated metering has worked successfully in other locations, such as on inbound I-94 in Milwaukee and I-35E in St. Paul, and should work very well for the metered ramp system in Burnsville.

Inbound Strategy

As shown in Appendix A, all inbound ramps on I-35W from Dakota County Highway 42 to the CBD are metered with the exception of the 113th Street ramp and the I-494 ramps. The volume on the 113th Street ramp is too low (25 vehicles in the morning peak hour) to warrant metering. At I-494, the aforementioned reduction in inbound traffic makes it unnecessary to meter this interchange, also, there is some question as to the desirability of metering freeway-to-freeway ramps. Although I-494 is not metered, there will be provisions made in the communications system to meter these ramps in the future should the need arise.

In addition to metering the inbound ramps on I-35W, it will be necessary to meter the France, Xerxes, Penn and Portland Avenue ramps on Hennepin County Highway 62 to control the input to the critical "common section".

To achieve a balanced operation of the freeway management system in meeting the objectives outlined above, the system will be divided into several subsystems. It is anticipated that subsystem boundaries will be at the Minnesota River, 76th Street, and 60th Street.

By metering as far out as Burnsville and controlling the throughput in each subsystem, it will be possible to balance system delays and avoid showing favoritism to motorists living in one location over those living in another. It is expected that ramp delays to drivers entering the system in the suburbs, for instance, will be about the same as delays to those entering closer to the CBD. Maximum delays should not exceed several minutes and will be of less significance as the trip length increases.

The individual driver who does not want to wait for access to the freeway will have several alternatives as listed below:

1. Use the ramp he normally does but arrive earlier before the control period begins, or before a large queue builds up.

2. Divert to another on-ramp where queues and delays are shorter.

3. Divert to one of the parallel arterial streets.

4. Switch modes to use the express bus service being provided.

Since the freeway is being metered to provide a high level of service and provide express buses with a desired travel time, there will be, by necessity, some diversion to alternate routes. With a balanced demand system, some diversion to express buses, and a good parallel arterial street system, however, the traffic that diverts should not have any adverse effects on the surface street system.

Delays should be minimal for buses and autos at the downtown end of the inbound trip. The freeway terminals are controlled by traffic signals at Fifth Avenue/Tenth Street, and at Fourth Avenue/Eleventh Street. These traffic signals are presently operating below capacity, and their efficiency should increase with the computerization of the City of Minneapolis traffic signal system.

Vehicles with destinations other than the CBD will receive the same benefits as those destined for the CBD until they leave the section of freeway in the surveillance and control system. Future expansion of the system, however, should provide additional benefits for vehicles with other destinations.

Outbound Strategy

Buses leaving the CBD will enter the freeway via a slip ramp bypassing the ramp meter signal at Grant Street. The key to successful outbound operation will be to prevent stoppages at 46th Street and the "common section", and to maintain desired speeds throughout the system.

As shown in Appendix A, all outbound ramps from the CBD to 106th Street are metered with the exception of the Fourth Avenue/Tenth Street connector, I-94 eastbound to I-35W southbound, and I-494.

The Fourth Avenue/Tenth Street connector to I-35W is not metered because the traffic signal at this intersection is presently operating at or near capacity for much of the afternoon peak hour. Metering at this location under present volume conditions would back traffic up through several adjacent signalized intersections and cause serious problems in the area. The I-94 eastbound to I-35W southbound ramp is not metered due to the relatively low volume and prevailing high speeds on this ramp. I-494 is not metered because the net gain in volume at this interchange is not high enough to warrant metering the freeway to freeway ramps. Although the above ramps are not metered, spare capacity in the communications system will make it possible to meter them at a later date should the need arise.

Analysis of the inventory data reveals that the stoppages occurring in the Central Interchange area, near 46th Street, and in the "common section" area are due to sharp peaking characteristics rather than high peak hour volumes. The present peak hour volume of just over 5,000 vehicles near 46th Street, for example, is below capacity, but "surges" of traffic from the Grant Street ramp and Fourth Avenue/Tenth Street connectors cause the sharp peaking which creates a problem near 46th Street as well as at other points in the system.

By metering the outbound ramps at Grant, 31st, and 36th Streets (over 2,000 vehicles in the afternoon peak hour), it will be possible to more evenly space entering traffic and to control the input to the system in order to maintain the desired level of service. At Grant Street, the metering operation will have to be carefully programmed to ensure that traffic leaving the CBD is properly spaced. To accomplish this it may be necessary to monitor the traffic signal cycling at Fourth Avenue/ Tenth Street.

It is anticipated that the opening of the I-94 Lowry Hill Tunnel in the near future may somewhat change the traffic patterns leaving the CBD. There may be some diversion of motorists from the northwest side of the CBD to use the tunnel route rather than Fourth Avenue, Tenth Street, or Grant Street to gain access to the freeway. If this should occur in significant numbers it may be necessary to meter the I-94 eastbound to I-35W southbound ramp.

When I-35W opens to the north of the CBD there may be some additional diversion of motorists from the Fourth Avenue, Tenth Street, and Grant Street ramps. This diversion, combined with expected diversion to the Lowry Hill Tunnel, may make it possible to meter the Fourth Avenue/Tenth Street connector.

Outbound subsystem boundaries will be the same as the inbound boundaries. By controlling the outbound throughput in each subsystem it will be possible to provide the desired level of service for the length of the system, from the CBD to 106th Street. Beyond 106th Street, the volumes are not high enough to warrant ramp control at the present time. It is anticipated that an isolated system similar to the inbound system would be used south of the Minnesota River should the outbound volumes increase significantly.

CONTROL CENTER

Consideration other than the requirements of the I-35W Urban Corridor Demonstration Project determine the location and size of the central control facility envisioned by the Texas Transportation Institute in their report on the feasibility of A System to Facilitate Bus Rapid Transit on Urban Freeways.

In reviewing the results of national and local experience, it is apparent that optimization of flow on urban freeways requires extensive surveillance and control systems coordinated and supervised by computers. Locally, this means that the Demonstration Project is but one corridor in the Minneapolis area freeway system that is controlled and monitored from a Control Center. The nature and extent of this surveillance and control system has been outlined in a "Prospectus" prepared by the Department. Consequently, it was determined that a control center location in the vicinity of the Central Interchange would be nearest the centroid of the Minneapolis network as opposed to a site central to the I-35W Corridor. This location will conveniently serve the I-94 Lowry Hill Tunnel Surveillance Project and will facilitate communication with the proposed City of Minneapolis' computer controlled signal system.

Based on the experiences of the Chicago, Houston, and Dallas projects, it is anticipated that a two level building approximately 65 feet wide by 80 feet deep (10,400 square feet gross area) would fulfill the current requirements and accommodate the expected network development for the design life (because the "State of the Art" is changing rapidly, it is not possible to design realistically for more than ten years). This building would house the central control computer, the peripheral equipment, the telemetry and communication terminal facilities, the television monitors, detection and control displays, and control devices necessary to operate the freeway management system. Additionally, office and work space for administration, operation and research staff is included. It is expected that initially seven people will be needed to operate the system on a fifteen hour per day basis and that a research staff of three people will be assigned to evaluate the system design and operation. The building design incorporates expansion provisions should such alterations become necessary due to unforseen growth or staff requirements.

Several considerations led to a decision to construct a building solely for surveillance and control activity rather than lease office space:

1. Because of the time elements involved in this project, there is no certainty that space would be available when needed.

2. Lease space available now at $7.00 per square foot per year would cost $700,000 for 10,000 square feet for ten years as compared to the estimated construction cost of $385,000.

3. Legal limitations for State Departments of two years on building leases detract from desirability of a build-lease arrangement. Land costs of $15 - $20 per square foot in this area would probably result in a short term lease cost considerably higher than $7.00 per square foot.

4. The uncertainties of leasing might require moving at a later date. The technical and economic cost of moving the communications system could be great.

5. Three parcels of land near the Central Interchange, already owned by the State, are available as control center sites.

Three parcels of excess right of way were considered as possible building sites. Site 1 located at I-94 and Groveland Avenue is a triangular lot on a hill overlooking the Lowry Hill Tunnel. This site was rejected because of neighborhood incompatibility and increased construction cost due to the need for under-site parking.

Site 2 is a wedge shaped lot adjacent to the I-94 eastbound ramp to southbound I-35W at 18th Avenue South. While technically acceptable, the lack of room for expansion and parking and the need for multi-story construction make the site less than optimum without acquiring the adjacent property.

Site 3 is located on Fourth Avenue between Eleventh and Twelfth Streets adjacent to T.H. 190 on the south side of the CBD. The parcel is large enough to permit parking and expansion as needed. Of all sites observed, this is the best overall and is recommended as the location for the control center.

It is anticipated that the control center building design will be completed by late fall of 1971. Construction could start in the spring of 1972 with the building being available for occupancy sometime late in 1972. This time schedule will make it possible to move the control center equipment in as it becomes available, and conforms with the overall project schedule.

SURVEILLANCE AND CONTROL COMPONENTS

Control Center Equipment

A digital computer will be used to analyze the input data from the detectors, make system-wide decisions based on control strategy, perform research functions, and store information on traffic conditions. The computer and peripheral equipment will be housed in the control center and will also serve the I-94 Lowry Hill Tunnel Surveillance and Control System as well as other projects as the system is expanded. Lead time for delivery of the computer control equipment should be ten to twelve months which means that a letting date of March or April, 1972, should be met to provide time for system de-bugging prior to placing the system in operation in the fall of 1973.

Display panels will be used to provide control system operators with a visual representation of traffic conditions and the status of traffic control devices in the system.

Individual 19-inch television monitors for each camera location will be provided in the control center, with secondary connections to a video tape recorder and monitor for research purposes. The CCTV monitors will assist in determining the cause of stoppages and response necessary to incidents, provide a means of subjective evaluation, assist in data collection, and provide a documentation of accidents and other significant events.

Detectors

The configuration and flexibility and known reliability of induction loop detectors best satisfy the needs of this project. Therefore, the mainline detectors, queue-gap detectors and demand detectors will generally be loops. Magnetometer type detectors will be used where the lead-in length exceeds manufacturers recommendations for loops and where area coverage is not needed, generally at the exit ramps and merge points.

Ramp Meter Signals

The ramp meter signals will consist of a three section (R-Y-G) head with eight-inch indications mounted on five foot pedestals. Low speed ramps with good sight distance will have single signals on the left side of the roadway. Loops, high approach speed ramps, and ramps with inadequate sight distance will have dual signals and advance warning flashers.

Closed Circuit Television System

After reviewing possible camera locations in the field with portable CCTV equipment and an aerial lift truck to simulate camera placement, it was found that twelve television cameras with remotely controlled pan, tilt and zoom capability will provide surveillance of the roadway between the control center and I-494. Generally, the cameras will be mounted on 40 foot light poles, on bridges or in protected areas. Where possible, existing poles will be used. Environmentally controlled housing will be used to reduce adverse climatic effects.

The accident rate is significantly lower south of I-494 and for this reason, as well as reasons of economy (cost varies directly with the distance from the control center and the number of cameras), the CCTV system terminates at 76th Street. Conduit installed south of I-494, however, will be sized to accommodate future extension of the CCTV system.

Communications System

Anticipated long term use, multi-access requirements and extensive interchange conduit systems indicate that the individual surveillance and control elements should be connected to the control center by means of a department owned and maintained duct system to be installed within the right of way. Communication along this duct and cable system will be accomplished by means of frequency division multiplex devices. Co-axial cable will be used to transmit video information and will be installed in the same duct system.

Spacings of the television cameras and ramp control installations generally coincide, making it possible to combine all components in a limited number of common enclosures, simplifying environment control requirements and maintenance.

A minimum number of additional leased telephone lines in the periphery of the system may be necessary at a later date.

COST ESTIMATES

Following are the estimated capital and annual costs for the surveillance and control system components. The total capital cost of this system is significantly larger than that proposed by the Texas Transportation Institute due to the proposed construction of the control center, purchase of the computer and peripheral equipment and installation of the Department owned communication system.

A. Capital Costs

1.	Control Center Building		$385,000
	a) Ground Level: 5200 sq.ft. x $35/sq.ft.	$182,000	
	b) Basement Level: 5200 sq.ft. x $25/sq.ft.	$130,000	
	Estimated Base Price	$312,000	
	c) Site Development	25,000	
	d) Parking Facilities	19,500	
	e) 8% Design Fee	28,500	
2.	Control Center Equipment		$264,370
	a) Computer (32 K storage)	$ 95,740	
	b) Peripheral Equipment	117,330	
	c) Telemetry (342 x 150)	51,300	
3.	Surveillance and Control Components		$504,000
	a) Detector Installations (310)	$ 74,400	
	b) Signal Installations (34)	10,200	
	c) Local Cabinet Installations (54)	59,400	
	d) Interchange Conduit	246,600	
	e) Interchange Handholes	64,800	
	f) Interchange Cable	48,600	
4.	Television System		$219,000
	a) Cameras and Accessories (12)	$180,000	
	b) Monitors (12)	3,000	
	c) Video Line Amplifiers (40)	30,000	
	d) Camera Control Devices	6,000	
5.	Communications		$330,400
	a) Surveillance and Control		
	i) Interconnect Conduit	$152,000	
	ii) Interconnect Cable	88,400	
	b) Video Coaxial Cable	90,000	
	Estimated Total Capital Cost:		$1,702,770

B. Annual Costs

1.	Personnel (10)		$100,000
2.	Maintenance		46,000
	a) Building and Grounds	$ 5,000	
	b) S. & C. Devices	41,000	
3.	Utilities		$ 900
	Estimated Total Annual Costs:		$146,900

THE TRANSIT SERVICE PLAN

REVIEW OF EXISTING TRANSIT SITUATION

Transit service within the I-35W corridor and the adjacent study area is currently provided by the Metropolitan Transit Commission (MTC) Operating Division and the Bloomington Bus Company. As illustrated in Figure 26, the combined service provided by both operations is extensive and offers reasonably good transit access to most residents of the corridor between downtown Minneapolis and the Minnesota River.[1]

However, as shown in Figure 26, there is relatively little use of I-35W by downtown-oriented bus routes currently operating within the corridor. Only MTC Route 50 (Airport Express), four morning and evening peak period runs of MTC Route 18 (Nicollet), and the main-line service provided by the Bloomington Bus Company (actually three separate routes) currently use I-35W to reach downtown Minneapolis. With the exception of Route 50, the other downtown-oriented routes which use the freeway operate a substantial portion of their service over local streets and, in fact, travel as far north as 60th Street (Route 18 via Nicollet Avenue and the Bloomington lines via Lyndale Avenue) before entering I-35W to continue north to the CBD.

The 'Phase I' studies for the MTC,[2] which were aimed at the development of an immediate-action program to improve the existing bus transit system, resulted in a number of proposals for transit service improvements within the I-35W corridor study area. These included recommendations for establishment of several park-ride sites and installation of a number of bus shelters. Various revisions to the existing route structure within the corridor were also proposed including:

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(1) A more complete description of the various transit routes currently operating within the corridor is included in Interim Report No. 2, Inventory of the Transportation Condition of the I-35W Corridor, January, 1971.

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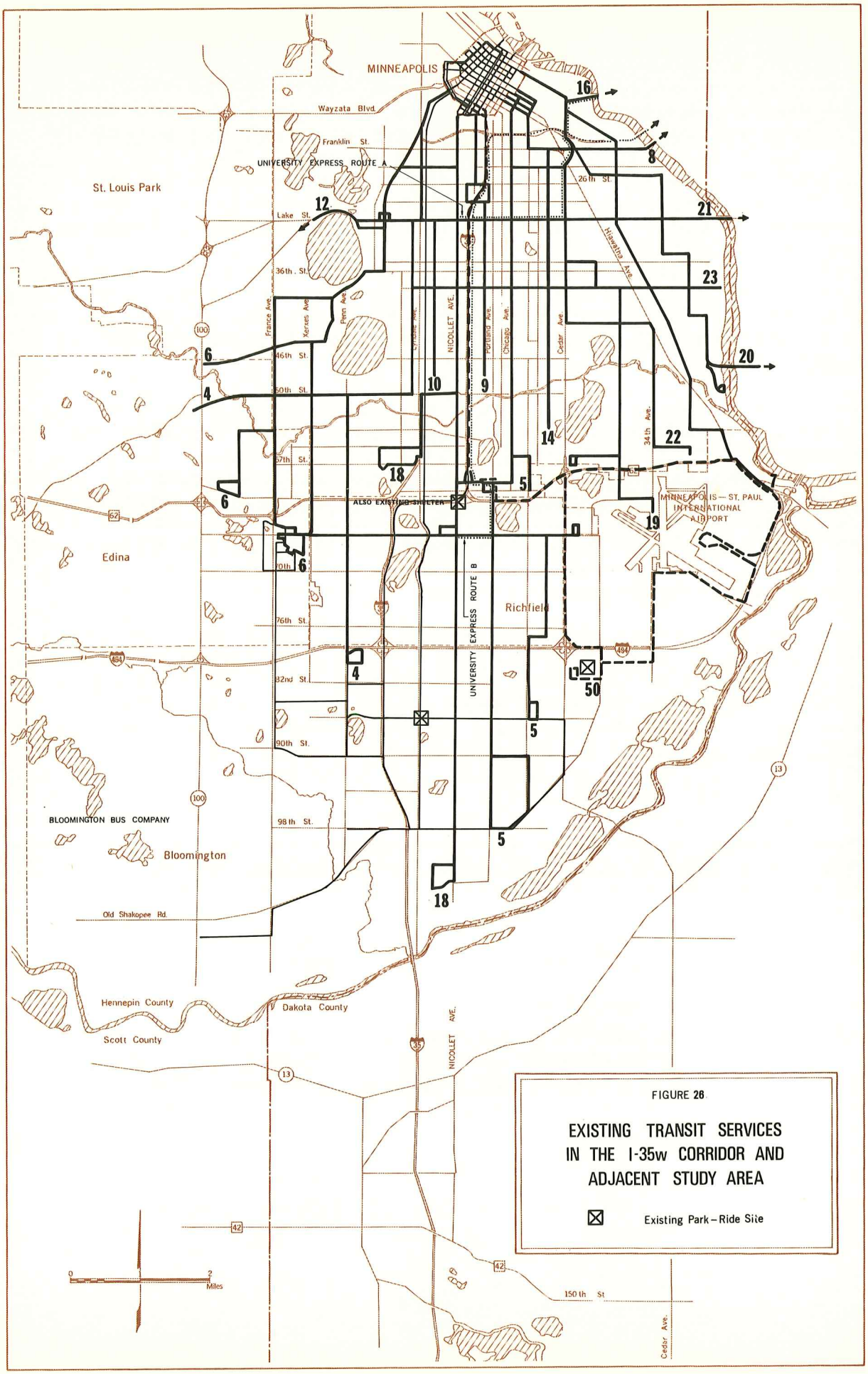
(2) Simpson & Curtin, Interim Reports 1-7, prepared for Twin Cities Area Metropolitan Transit Commission. See Appendix C for complete list.

- Creation of two new express branches on Route 4--one would operate locally from the vicinity of Highway 100 and Eden Avenue along 50th Street, Bryant Avenue and 46th Street to I-35W and north to downtown, while the second express branch would provide local service along Penn Avenue between 102nd and 62nd Streets and then enter I-35W and travel north to downtown Minneapolis.

- Operation of some express service (via I-35W to 62nd Street) on the branches of Route 5 which terminate at Portland Avenue and 98th Street and 12th Avenue and 86th Street, respectively.

- Initiation of some express service on the Southdale branch of Route 6 (via County Road 62 and I-35W).

In addition, a number of relatively minor route revisions and extensions were also suggested. Due to other more pressing problems, none of the specific route proposals concerning the corridor study area has yet been implemented.


MINNEAPOLIS
Wayzata Blvd.
Franklin St.
UNIVERSITY EXPRESS ROUTE A
St. Louis Park
Lake St.
26th St.
Hiawatha Ave.
36th St.
France Ave.
Xerxes Ave.
Penn Ave.
Lyndale Ave.
NICOLLET AVE.
Portland Ave.
Chicago Ave.
Cedar Ave.
46th St.
50th St.
34th Ave.
57th St.
ALSO EXISTING SHELTER
MINNEAPOLIS — ST. PAUL INTERNATIONAL AIRPORT
Edina
70th St.
Richfield
EXPRESS ROUTE B
UNIVERSITY
76th St.
82nd St.
90th St.
BLOOMINGTON BUS COMPANY
98th St.
Bloomington
Old Shakopee Rd.
Hennepin County
Dakota County
Scott County
NICOLLET AVE.
150th St.
Cedar Ave.
0
2
Miles
FIGURE 28
EXISTING TRANSIT SERVICES IN THE I-35w CORRIDOR AND ADJACENT STUDY AREA
Existing Park-Ride Site

THE SERVICE CONCEPT

Two alternative service concepts were examined for potential applicability to this demonstration project. The first concept is that of a trunkline transit service which would operate on the freeway from a specific outlying interchange location to downtown Minneapolis where the bus would exit the freeway and loop the downtown to permit the majority of riders to walk to their destination. Patrons at the residential end of the route would have to travel -- via authomobile or feeder bus line or by walking -- to a park-ride site located immediately adjacent to a specific interchange and then transfer to the trunkline route.

The other service concept which was examined and the one finally chosen is a modification and extension of the first and includes residential pickup, express service via the freeway to the CBD and downtown delivery. The express bus would operate as a local service line in residential areas south of downtown Minneapolis, then enter I-35W at a specific interchange point (perhaps after one final stop at a park-ride site located near the interchange) and travel north to downtown where it would leave the freeway and make a loop via downtown streets.

This second concept provides a major advantage over the other alternative in that it minimizes the need to transfer from one bus to another or, for that matter, from one mode to another.(3) At the same time, however, some caution must be exercised in developing route plans or the local segments of the route might be so lengthy as to minimize the impact of the express operation. If motorists are to be persuaded to leave their automobiles at home and avail themselves of the demonstration service, that service must operate at a speed sufficient to result in comparable travel times to the CBD. Further examination of this particular point indicated that, in general, at least two-thirds of the total route length should be via freeway if average bus operating speeds and resultant travel times are to be comparable with the automobile.

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(3) The need to transfer between buses has been cited as a major deterrent to transit usage in the Twin Cities (see Interim Report 4, prepared by Simpson & Curtin, cited in Appendix C).

CBD Distribution and Collection - If it is important that some consideration be given to minimizing the transfer requirements at the residential end of the trip, it is no less important that similar consideration be given to the downtown end of the trip. An examination of the CBD trip destination patterns illustrated in Figures 14 through 17 indicates that the great majority of auto users and bus riders currently traveling to downtown Minneapolis from an origin within the I-35W corridor during the morning peak period are destined for a 12-square block area bounded by the Nicollet Mall and Second Avenue on the west and east, respectively, and by Fourth and Tenth Streets on the north and south. In light of these trip end patterns, some thought was given to operating the downtown portion of the demonstration service along the Nicollet Mall, but this proposal was rejected for several reasons, including:

- The demonstration service will be oriented more to work trips than other trip purposes since it will operate during peak periods and, as indicated in Figures 14 through 17, it appears that Marquette Avenue better serves such trips than does the Mall.

- The present peak period bus volumes along the Mall approximate capacity levels and it is possible that the addition of the demonstration service would cause severe operational problems along the Mall.

In view of these facts and in light of the significant role of Marquette and Second Avenues in the existing transit service picture, it is recommended that the buses providing demonstration service loop the downtown area via these two streets. It is also suggested that the possibility of creating exclusive bus lanes on Marquette and Secong Avenues be thoroughly examined prior to project implementation with full consideration not only of the demonstration service routes, but also of existing local service bus volumes on these two streets. Some possibility of providing the buses with "signal override" capability also exists and this too should be investigated.

There are four alternatives for routing the express buses into the CBD and distributing the riders during the morning peak and collecting the riders and exiting the CBD during the afternoon peak period:

via 31st Street - Under this alternative the express buses would exit I-35W at 31st Street and use either the Park/Portland or First/Blaisdell one way pairs into the CBD. Potential congestion at the CBD freeway exits would be avoided under this plan. The disadvantage is that the express buses would leave the freeway about two miles from the CBD with a resultant increase in the proportion of time on the local street system and possible decrease in overall average operating speed.

via Third Avenue and New Access to I-35W near 28th Street - Under this alternative, buses exiting the CBD would be routed along Third Avenue to a new exclusive bus ramp in the vicinity of 28th Street. Potential congestion at the existing entrance ramps would be avoided as in the previous alternative but, once again, the proportionate use of the local streets would increase with a possible decrease in overall average operating speeds. Another problem with this alternative is that additional access of any sort in the vicinity of 28th Street is very difficult to provide because of existing geometrics.

via Fifth Avenue - Express buses would exit at Fifth Avenue under this alternative and then distribute passengers along an east-west or west-south axis. There are three major disadvantages to this alternative: Fifth Avenue is the most heavily used exit (6,000 vehicles between 6:00 - 9:00 a.m. vs. 4,200 vehicles at Eleventh Street during the same period); widening of the existing exit for exclusive bus use is difficult because of existing geometrics; and, as previously noted, examination of CBD destinations indicates a strong north-south axis of trip demand which is difficult to serve via the Fifth Avenue ramp.

via Eleventh Street/Grant Street - Under this alternative, buses would exit at Eleventh Street, proceed to Marquette Avenue and turn north to Washington Avenue. The bus would turn on Washington Avenue to Second Avenue and south to Twelfth Street where it would turn down to Grant Street and enter I-35W. Advantages of this alternative include the use of the least travelled exit ramp and an existing one-way loop. In addition, the route provides direct transit access to the great majority of potential users.

In view of the noted advantages and other service possibilities, it is recommended that the latter alternative be chosen as the CBD route for the demonstration service. All subsequent patronage, revenue and cost estimates presented in this report are based upon this downtown routing which is illustrated in Section 1 of Appendix A.

Although beyond the scope of this study, it is possible that some demonstration service might operate through the Minneapolis CBD to the University and other activity centers within the region. In addition, it is important that full consideration be given to coordination between the demonstration service and existing downtown circulation systems including the recently inaugurated minibus service and the system of downtown 'skyways'.

TRANSIT SERVICE PLAN A

Review of existing transit service within the corridor, examination of 'Phase I' corridor service proposals and analysis of the transit and highway travel data described earlier in the report resulted in the development of a transit service plan for the corridor (Plan A). As illustrated in Figure 27, Plan A includes 15 new express routes within the corridor which range in length from 5.3 miles to 21.9 miles and serve various sections of the City of Minneapolis as well as several suburban communities.

Routes A and L, the two shortest routes, serve the area between 35th and 46th Streets in Minneapolis while Routes K and J provide service to the sections of the city just south of Lake Harriet. Route B operates in the area south of 46th Street and east of I-35W. The community of Edina is served by Routes H and I which also serve the area in the vicinity of the Southdale Center, the Southdale-Fairview Hospital and the major apartment complex adjacent to the Hospital. Richfield is also served by two routes, C and G, the latter of which provides direct service to some substantial apartment development in the vicinity of Penn Avenue and 76th Street. Under Plan A, Bloomington would be served by three routes (D, E, and F) while the communities south of the Minnesota River would also receive service from three lines (M, N and O). The three existing express routes in the corridor - - MTC Routes 18 and 50 and the three separate lines which comprise the main-line route service of the Bloomington Bus Company - - would remain unchanged under this service plan.

Table 4 shows that this plan would add a total of almost 191 miles of new express routes to the transit system, about two-thirds of which would operate via expressway. Average operating speeds on the new routes would range from 16 miles per hour (on the two shortest routes which also make the least use of I-35W) to about 30 miles per hour (on those routes operating south of the Minnesota River and using I-35W for substantial portions of the total route length). Total run time would approximate 20 minutes for those routes serving the sections of Minneapolis closest to the CBD and would range up to about 40 to 45 minutes for Routes M, N and O which operate south of the Minnesota River.

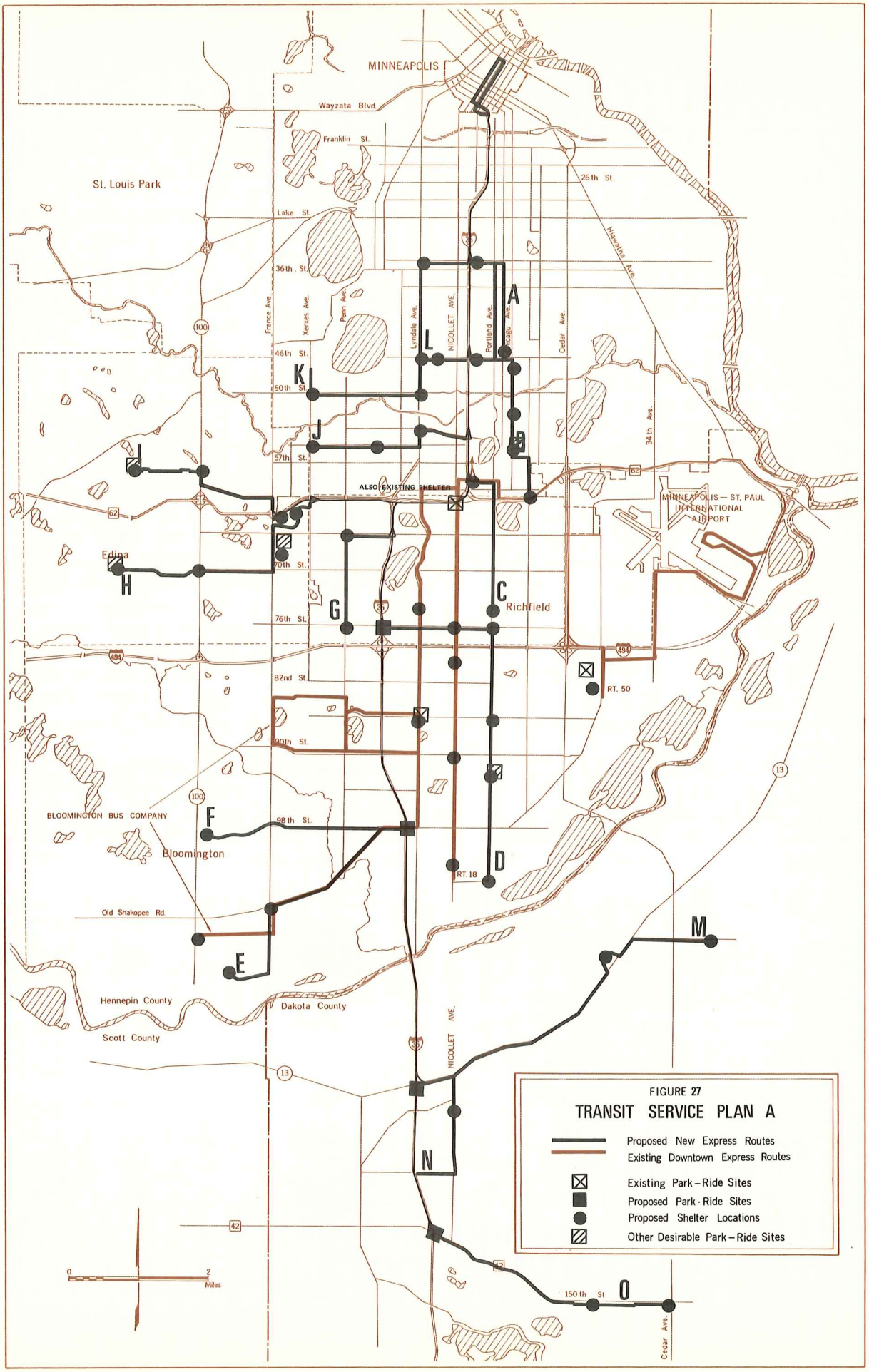
MINNEAPOLIS
Wayzata Blvd.
Franklin St.
St. Louis Park
26th St.
Lake St.
36th St.
Hiawatha Ave.
France Ave.
Xerxes Ave.
Penn Ave.
Lyndale Ave.
NICOLLET AVE.
Portland Ave.
Chicago Ave.
Cedar Ave.
A
L
K
46th St.
50th St.
J
57th St.
B
34th Ave.
ALSO EXISTING SHELTER
MINNEAPOLIS — ST. PAUL INTERNATIONAL AIRPORT
Edina
70th St.
H
G
C
Richfield
76th St.
82nd St.
RT. 50
90th St.
BLOOMINGTON BUS COMPANY
F
98th St.
Bloomington
RT. 18
D
Old Shakopee Rd.
M
E
Hennepin County
Dakota County
Scott County
NICOLLET AVE.
N
150th St
O
Cedar Ave.
0
2
Miles
FIGURE 27
TRANSIT SERVICE PLAN A
Proposed New Express Routes
Existing Downtown Express Routes
Existing Park-Ride Sites
Proposed Park-Ride Sites
Proposed Shelter Locations
Other Desirable Park-Ride Sites

TABLE 4

SUMMARY OF EXISTING AND PROPOSED EXPRESS BUS SERVICE

I–35W CORRIDOR

PLAN A

Route	Route Terminal	On I–35W At	Length (miles) Total	Express	Local	% Express	Average Speed (mph)	Run Time (minutes) Total	Express	Local
A	Portland Avenue and E. 46th Street	35th St.	5.3	2.2	3.1	41.5%	16.0	20	3	17
B	12th Avenue South and Loren Drive	46th St.	7.7	3.6	4.1	46.8	17.8	26	5	21
C	Portland Avenue and E. 74th Street	60th St.	8.7	5.4	3.3	62.1	20.6	25	8	17
D	Portland Avenue and E. 104th Street	76th St.	14.9	8.5	6.4	57.0	24.8	36	12	24
E	Overlook Drive and Palmer Road	98th St.	16.6	11.5	5.1	69.3	27.3	37	16	21
F	W. 98th Street In Bloomington	98th St.	15.6	11.5	4.1	73.7	27.1	35	16	19
G	Penn Avenue S. and W. 76th Street	66th St.	10.4	7.2	3.2	69.2	22.6	28	11	17
H	Antrim Road and W. 70th Street	Xerxes Ave. *(a)*	14.2	9.1	5.1	64.1	23.9	36	14	22
I	Valley View Road and Tracy Avenue	France Ave. *(a)*	13.4	9.7	3.7	72.4	25.3	32	15	17
J	Xerxes Avenue S. and W. 56th Street	Diamond Lake Rd.	8.4	4.7	3.7	56.0	20.7	24	7	17
K	Xerxes Avenue S. and W. 47th Street	46th St.	8.0	3.6	4.4	45.0	18.2	26	5	21
L	Lyndale Avenue S. and W. 46th Street	35th St.	5.5	2.2	3.3	40.0	15.9	21	3	18
M	C. R. 30 and Emerald Lane	T.H. 13	21.3	15.2	6.1	71.4	32.5	39	20	19
N	136th Street in Burnsville	T.H. 13	18.8	15.2	3.6	80.9	28.4	40	20	20
O	Cedar Avenue and 150th Street	Co. Road 42	21.9	17.3	4.6	79.0	30.9	43	23	20
	TOTAL		190.7	126.9	63.8	66.5%		468	178	290
18	Nicollet Avenue and 104th Street	60th St.	12.5	5.4	7.1	43.2%	22.1	34	8	26
50	24th Avenue S. and E. 83rd Street	60th St.	15.8	5.4	10.4	34.2	27.4	35	16	19
B1	Normandale Blvd. and W. 110th Street	60th St.	16.3	5.4	10.9	33.1	19.4	50	8	42
B2	France Avenue S. and W. 90th Street	60th St.	15.6	5.4	10.2	34.6	19.7	48	8	40
B3	Penn Avenue S. and W. 90th Street	60th St.	12.4	5.4	7.0	43.5	19.5	38	8	30
	TOTAL		72.6	27.0	45.6	37.2%		205	48	157
	GRAND TOTAL		263.3	153.9	109.4	58.5%		673	226	447

(a) On C. R. 62

Patronage Potential - The service area covered by the 15 proposed new routes includes a patronage potential (4) of about 9,400 persons of which approximately 62 percent are currently auto users (Table 5). The existing express transit services in the corridor account for another 1,896 potential patrons (three-fourths auto users). As indicated earlier in this report, a total of about 20,600 trips are made to the Minneapolis CBD from an origin within the corridor study area between the hours of 7:00 a.m. and 9:00 a.m. on a typical weekday. In other words, the 15 proposed routes would provide reasonably accessible express transit service to slightly less than half of the total potential trip makers within the corridor. However, in considering this coverage statistic, it should be noted that a substantial number of the more than 20,000 persons currently traveling to the CBD during the morning peak period from a point within the corridor were immediately eliminated from consideration in this analysis because their origin is north of 35th Street within two and one-half miles of downtown, and therefore, too close to the CBD to be regarded as potential users of any new express service -- existing local routes serve this area very well.

More than nine of every ten current transit users within the corridor making an inbound CBD trip during the morning peak period are potential users of the 15 new routes or the existing corridor express service while about 46 percent of the approximate 15,900 persons now using the auto to reach downtown are potential to either the proposed new routes or the existing express service.

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(4) A potential rider was considered to be a person who currently makes a trip to downtown Minneapolis (via transit or automobile) on a typical weekday between the hours of 7:00 a.m. and 9:00 a.m. and who lives within one-quarter mile of the proposed route. Persons who currently made the trip by auto or are 'choice' transit riders and who live outside the one-quarter mile limit were also considered potential if they reside within the area of influence of one of the proposed park-ride sites serving the new routes.

The area of influence for the new park-ride sites north of the Minnesota River along I-35W is generally defined as an area five miles to the west of the site, and approximately one mile in each of the other three directions from the site. The limits to the north and south resulted from the fact that other facilities were proposed along the freeway and would, therefore, constrain the limits of the area of influence in those directions. The relatively limited area to the east results from the fact that a number of express routes operate in that general area and also from the fact that the stadium park-ride site has an area of influence that covers much of the area from Nicollet Avenue east to the stadium. Below the river, the same north-south limits of about one mile each were used, but the east-west limits were about five miles each; there were no constraints on the easterly part of the area of influence south of the river since there are no competing routes in that area.

TABLE 5

POTENTIAL TRANSIT PATRONAGE

EXISTING AND PROPOSED BUS SERVICE

I–35W CORRIDOR

PLAN A

Route	Route Terminal	On I–35W At	Present Transit Riders	Auto Users	Total Potential Patronage
A	Portland Avenue and E. 46th Street	35th St.	441	77	518
B	12th Avenue S. and Loren Drive	46th St.	421	194	615
C	Portland Avenue and E. 74th Street	60th St.	124	145	269
D	Portland Avenue and E. 104th Street	76th St.	205	1,062	1,267
E	Overlook Drive and Palmer Road	98th St.	34	441	475
F	W. 98th Street in Bloomington	98th St.	31	374	405
G	Penn Avenue S. and W. 76th Street	66th St.	82	252	334
H	Antrim Road and W. 70th Street	Xerxes Avenue *(a)*	62	190	252
I	Valley View Road and Tracy Avenue	France Avenue *(a)*	112	872	984
J	Xerxes Avenue S. and W. 56th Street	Diamond Lake Road	445	348	793
K	Xerxes Avenue S. and W. 47th Street	46th St.	635	605	1,240
L	Lyndale Avenue S. and W. 46th Street	35th St.	956	586	1,542
M	C. R. 30 and Emerald Lane	T. H. 13	16	332	348
N	136th Street in Burnsville	T. H. 13	4	150	154
O	Cedar Avenue and 150th Street	Co. Road 42	10	209	219
	TOTAL		3,578	5,837	9,415
18	Nicollet Avenue and 104th Street	60th St.	82	293	375
50	24th Avenue S. and and E. 83rd Street	60th St.	11	554	565
B1	Normandale Blvd. and W. 110th Street	60th St.	196	295	491
B2	France Avenue S. and W. 90th Street	60th St.	78	204	282
B3	Penn Avenue S. and W. 90th Street	60th St.	58	125	183
	TOTAL		425	1,471	1,896
	GRAND TOTAL		4,003	7,308	11,311

(a) *On C. R. 62*

Estimated Patronage - Travel data and other tripmaker information collected from the transit rider and automobile user surveys which were conducted in the latter part of 1970 were analyzed and evaluated and factors affecting mode choice were identified. This analysis led to the development of a mode split procedure which was used to prepare patronage estimates for each of the proposed new express routes.(5)

As indicated in Table 6, the 15 proposed new routes are expected to attract a total of 2,555 riders on a typical weekday (inbound to the CBD between the hours of 7:00 a.m. and 9:00 a.m.). Approximately two-thirds of these riders are presently using the bus (either local or express service) to make their trip and will merely be diverted to the new service. While the 858 current auto users who are expected to shift to the new transit service represent only one-third of total expected patronage, it should be noted that they also represent about 15 percent of the total number of auto users who are potential to the service

Of the 15 proposed new routes, Route J, which operates along W. 56th Street and Diamond Lake Road, is expected to carry the largest number of riders but more than 85 percent of these patrons are already bus riders (mainly MTC Routes 4, 6 and 18). The two other routes expected to carry more than 300 riders inbound during the two-hour morning peak period are Routes D (335 riders) and K (315 riders). More than one of every five riders on each of these two routes now use the automobile to travel downtown. In fact, of the 15 proposed routes, Route D carries the largest number of former auto users -- 134.

The three routes with the highest proportion of former auto users are those operating south of the Minnesota River where no transit service is currently provided (the few people from this area who now use the bus are apparently driven to a bus stop somewhere north of the river). Between them, the three new routes are expected to attract a total of 210 former auto users (as compared to 30 persons who currently use the bus).

As shown in Figure 27, Plan A includes provision for four new park-ride sites within the corridor. These would be located adjacent to the following interchanges along I-35W:

- 76th Street
- 98th Street
- Highway 13
- County Road 42

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(5) The patronage estimating procedure is described in detail in Appendix B.

TABLE 6

PATRONAGE ESTIMATES

EXISTING AND PROPOSED EXPRESS BUS SERVICE

I–35W CORRIDOR

Average Weekday – Inbound – Peak Period (7:00 A.M. to 9:00 A.M.)

PLAN A

Route	Route Terminal	On I–35W At	Patronage	Present Bus Riders			Former Auto Users	Percent Former Auto	Park Ride Patronage
				Total	Local	Express			
A	Portland Avenue and E. 46th Street	35th St.	100	92	92	0	8	8%	
B	12th Avenue S. and Loren Drive	46th St.	235	205	193	12	30	13	
C	Portland Avenue and E. 74th Street	60th St.	150	121	109	12	29	19	
D	Portland Avenue and E. 104th Street	76th St.	335	201	110	91	134	40	54
E	Overlook Drive and and Palmer Road	98th St.	115	35	12	23	80	70	46
F	W. 98th Street in Bloomington	98th St.	95	32	21	11	63	66	46
G	Penn Avenue S. and W. 76th Street	66th St.	130	81	76	5	49	38	
H	Antrim Road and W. 70th Street	Xerxes Avenue *(a)*	90	60	55	5	30	33	
I	Valley View Road and Tracy Avenue	France Avenue *(a)*	150	105	104	1	45	30	
J	Xerxes Avenue S. and W. 56th Street	Diamond Lake Road	400	348	346	2	52	13	
K	Xerxes Avenue S. and W. 47th Street	46th St.	315	246	246	0	69	22	
L	Lyndale Avenues and W. 46th Street	35th St.	200	141	141	0	59	30	
M	C. R. 30 and Emerald Lane	T. H. 13	115	16	0	16	99	86	80
N	136th Street in Burnsville	T. H. 13	50	4	0	4	46	92	22
O	Cedar Avenue and 150th Street	C. R. 42	75	10	0	10	65	87	39
	TOTAL		2,555	1,697	1,505	192	858	34%	287
18	Nicollet Avenue and 104th Street	60th St.	125	82	44	38	43	34%	
50	24th Avenue S. and E. 83rd Street	60th St.	90	6	0	6	84	93	
B1	Normandale Blvd. and W. 110th Street	60th St.	180	138	69	69	42	23	
B2	France Avenue S. and W. 90th Street	60th St.	110	79	54	25	31	28	
B3	Penn Avenue S. and W. 90th Street	60th St.	75	57	32	25	18	24	
	TOTAL		580	362	199	163	218	38%	0
	GRAND TOTAL		3,135	2,059	1,704	355	1,076	34%	287

(a) *On C. R. 62*

In addition, patrons would continue to make use of the three existing park-ride facilities within the corridor:

- Metropolitan Stadium (served by Route 50)
- Nicollet Avenue and 62nd Street (served by a Route 18)
- Lyndale Avenue and 86th Street (served by the three Bloomington Bus Co. lines)

There were several other locations within the corridor that would appear, from a transit operations and service viewpoint, to merit consideration as park-ride sites. However, field examination of these locations indicated that sufficient land is not currently available for such use. If this situation should change in the course of the demonstration project it is recommended that park-ride facilities be provided at these following locations:

- Chicago Avenue and 56th Street
- Southdale Center
- Antrim Road and W. 70th Street
- Tracy and Benton Avenues
- Portland Avenue and 92nd Street

Route Operating Statistics - Operating statistics for each of the proposed new routes as well as the five existing express lines within the corridor are presented in Table 7. Headways for each route were computed through analysis of estimated patronage demand and buses were scheduled on the basis of average trip run time and the assumption that they would carry a capacity seated load of 40 persons.(6) Examination of current mode choice patterns within the corridor indicate that variation of the average service frequency within an acceptable range for the type of express service proposed (e.g. from about 10 minutes to 60 minutes) will not significantly affect ridership so long as the service is dependable and the particular service level is sufficient to provide a seat for the majority of users.

As shown in Table 7, suggested average headways on the 15 proposed new routes range from a minimum of 12 minutes (Route J) to a maximum of 60 minutes (Routes A, F, N and O). It should be noted that the headways listed in Table 7 represent average headways only and it is possible that as many as two or three buses may run only minutes apart on selected routes within the peak travel period. Even though peak demand is spread over a

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(6) Vehicle specifications have been prepared and are included in a separate technical memorandum. It is assumed that a maximum of 40 seats per coach would provide for additional passenger comforts not now available in most express buses.

TABLE 7

SUMMARY OF PEAK PERIOD OPERATING RESULTS
EXISTING AND PROPOSED EXPRESS BUS ROUTES
I–35W CORRIDOR
PLAN A

Route	Route Terminal	On I–35W At	Headway (minutes)	Buses Required	Vehicle Miles	Vehicle Hours (minutes)	Patronage	Revenue ($)	Operating Cost ($)	Difference Deficit or Profit
A	Portland Avenue and E. 46th Street	35th St.	60	1	21.2	99.8	100	35.00	17.31	$ 17.69
B	12th Avenue S. and Loren Drive	46th St.	20	3	92.4	336.0	235	82.25	64.89	17.36
C	Portland Avenue and E. 74th Street	60th St.	30	2	69.6	221.6	150	66.00	45.52	20.48
D	Portland Avenue and E. 104th Street	76th St.	15	5	238.4	526.1	335	167.00	137.48	29.52
E	Overlook Drive and Palmer Road	98th St.	40	2	99.6	226.0	115	63.25	55.42	7.83
F	W. 98th Street in Bloomington	98th St.	60	2	62.4	138.0	95	52.25	34.34	17.91
G	Penn Avenue S. and W. 76th Street	66th St.	40	2	61.2	190.4	130	58.50	39.93	18.57
H	Antrim Road and W. 70th Street	Xerxes Avenue *(a)*	60	2	56.8	142.4	90	37.50	33.05	4.45
I	Valley View Road and Tracy Avenue	France Avenue *(a)*	30	3	107.2	280.8	150	66.35	63.66	2.69
J	Xerxes Avenue S. and W. 56th Street	Diamond Lake Road	12	4	168.0	486.0	400	144.00	104.66	39.34
K	Xerxes Avenue S. and W. 47th Street	46th St.	15	4	128.0	451.2	315	110.25	88.37	21.88
L	Lyndale Avenue S. and W. 46th Street	35th St.	24	2	55.0	226.8	200	70.00	41.48	28.52
M	C. R. 30 and Emerald Lane	T. H. 13	40	2	127.8	237.2	115	80.50	65.50	15.00
N	136th Street in Burnsville	T. H. 13	60	2	75.2	158.8	50	35.00	40.59	(5.59)
O	Cedar Avenue and 150th Street	C. R. 42	60	2	87.6	170.0	75	52.50	45.68	6.82
	TOTAL			38	1,450.4	3,891.1	2,555	$1,120.35	$877.88	$242.47
18	Nicollet Avenue and 104th Street	60th St.	40	2	75.0	215.8	125	61.90	46.60	15.30
50	24th Avenue S. and E. 83rd Street	60th St.	60	2	63.2	138.4	90	44.50	34.63	9.87
B 1	Normandale Blvd. and W. 110th Street	60th St.	30	4	130.4	403.2	180	79.25	84.00	(4.75)
B 2	France Avenue S. and W. 90th Street	60th St.	40	3	93.6	285.0	110	56.50	59.83	(3.33)
B 3	Penn Avenue S. and W. 90th Street	60th St.	60	2	49.6	152.6	75	37.35	31.87	5.48
	TOTAL			13	411.8	1,195.0	580	$ 279.50	$256.93	$ 22.57
	GRAND TOTAL			51	1,862.2	5,086.1	3,135	$1,399.85	$1,134.81	$265.04

(a) On C. R. 62

two-hour period, there are times within that period when demand is maximuzed and this demand can best be serviced by scheduling several buses within a relatively short time frame (however, the average headway for the route would be that listed in Table 7).

Suggested headways on the existing express lines within the corridor range from 30 to 60 minutes on the average, though again, it is possible that some buses would be scheduled more closely while others might be less frequent.

A total of 38 coaches will be required to operate the 15 proposed new routes at the suggested average service frequency. An additional 13 buses will be needed to operate the existing express lines within the corridor at the average service levels specified in Table 7 and therefore, the total vehicle requirement for Plan A is 51 coaches.

Operating cost estimates for each route were developed on the basis of vehicle miles and hours of service required to complete a round-trip and recent (early 1971) operating cost statistics obtained from the MTC Operating Division. Revenue estimates for each route were computed on the basis of the transit pricing concept now in effect in the Twin Cities -- that is, express bus riders pay an additional five cents over the basic local service fare for the improved service. This concept is fair and reasonable and in any event, analyses completed as part of this study indicate that relatively minor (five or ten cents) changes in the fare structure will have little impact on demonstration project patronage. Therefore, for the purposes of this planning phase of the demonstration project, no detailed analysis of alternate fare levels was completed.

Fares on the three routes operating south of the Minnesota River were established at 70 cents -- 15 cents more than an express bus trip between downtown Minneapolis and Bloomington.

The comparison of revenue and cost statistics presented in Table 7 can be somewhat misleading if it is not kept in mind that the majority of patrons using the proposed new express routes are, to a substantial degree, already bus riders utilizing existing transit service within the corridor who will merely be diverted from existing routes.

Impact on Existing Routes - The transit service proposals presented in Plan A will have obvious impact on ridership of existing bus routes within the I-35W corridor. As indicated earlier, about two-thirds of the 2,555 persons expected to make use of the 15 proposed new routes during the morning peak period on a typical weekday currently use the bus to reach downtown Minneapolis. These people would merely be diverted from existing local service routes to the new express service.

Analysis of the travel patterns of current bus riders in the I-35W corridor and review of patronage estimates for each of the proposed new routes included in Plan A indicate that MTC Route 5 will experience the greatest passenger loss, approximately 490 riders (inbound to the Minneapolis CBD during the morning peak period on a typical weekday). MTC Routes 4 and 6, with expected ridership losses of about 335 persons each, and MTC Route 18, with about 290 riders lost to proposed new routes, will also experience substantial decreases in ridership. MTC Route 9, with an expected loss of 110 riders, and Route 10, which is expected to lose 80 riders, are the other MTC routes subject to patronage losses of more than 25 patrons.

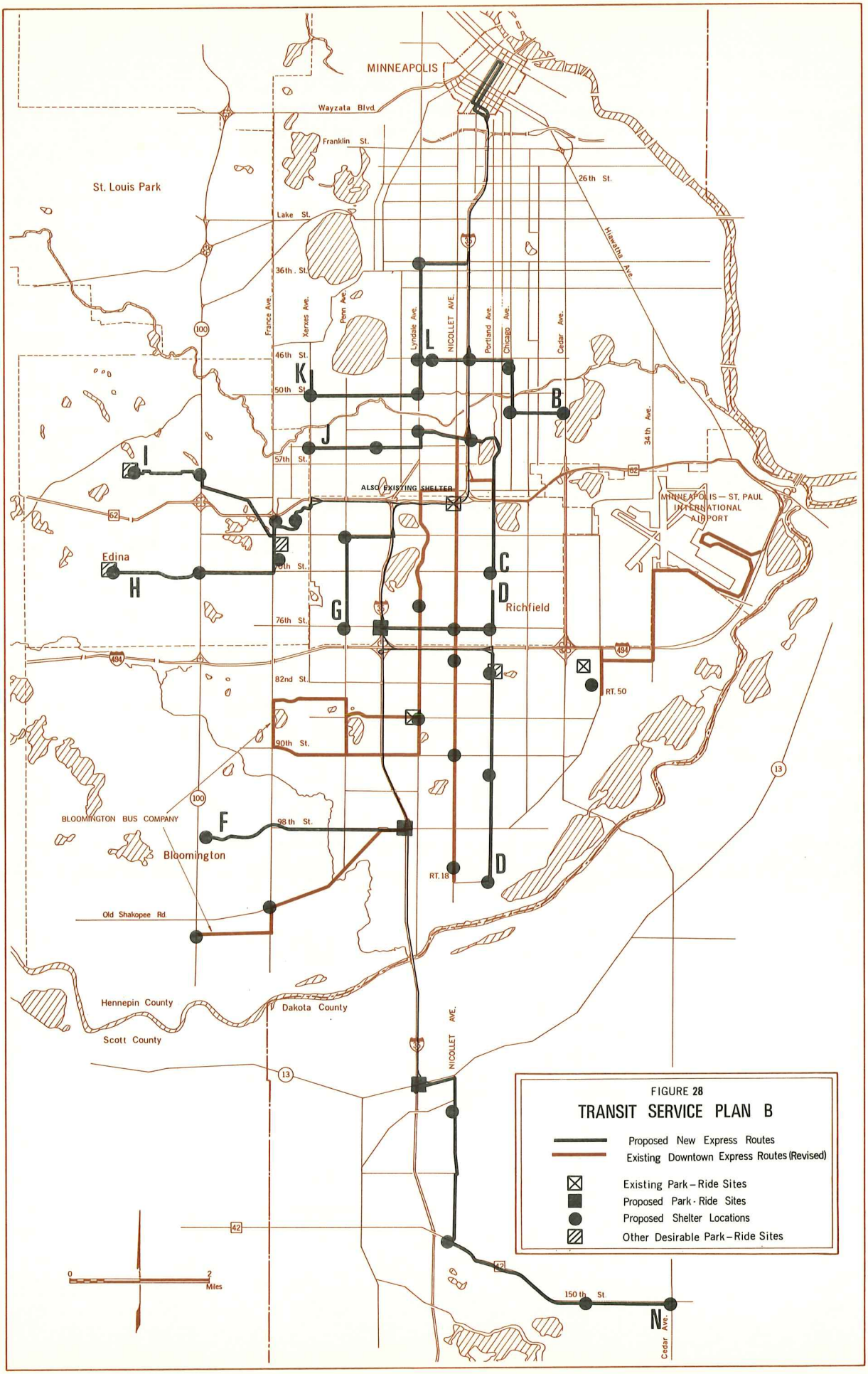
TRANSIT SERVICE PLAN B

Review of the Plan A corridor transit service proposal and evaluation of the various individual route operating statistics indicates some possible service revisions and route alternatives worthy of consideration. This resulted in the development of a second transit plan (Plan B) for the corridor.

As illustrated in Figure 28, Plan B includes 12 new proposed express routes within the corridor ranging in length from 5.5 miles to 22.2 miles. A number of routes including F, G, H, J, K and L, remain the same as in Plan A. Route I is revised slightly so that it too, along with Route H, will serve the Southdale-Fairview Hospital and nearby apartments and then enter County Road 62 via Xerxes Avenue (rather than via France Avenue as in Plan A). Route B is revised so that it travels south from 46th Street along Chicago Avenue and then turns east on 52nd Street to Cedar Avenue. Route C is shortened at its southern end (from 74th Street to 70th Street) and extended in the north so that it continues to run along Portland Avenue to Diamond Lake Road before turning west to I-35W. In Plan B, Route D has been divided into two separate routes; one will run north along Portland Avenue from 104th Street and enter I-494 (then west to I-35W) while the other will originate at 72nd and Portland, run south to 76th Street and then west to I-35W. Route N in Plan B is actually a combination of Routes N and O which were presented in Plan A. The route would run west along County Road 42 to Nicollet Avenue, then north to Highway 13 and onto I-35W at that interchange (after stopping at a park-ride lot adjacent to the interchange).

Three routes presented in Plan A are completely eliminated from Plan B. Route A was eliminated because it serves an area relatively close to the CBD and more than nine of every ten expected riders are already transit users. (Route L is somewhat similar but serves a greater proportion of auto users and has, therefore, been retained in Plan B.) Route E was eliminated because it basically follows a route already served by an express line operated by the Bloomington Bus Company. The third route eliminated was Route M which served the Burnsville area via Highway 13. The majority of patrons expected to be attracted to this route would make use of the park-ride lot at Highway 13 and I-35W and would therefore still be served by revised Route N.

In Plan B, the existing downtown-oriented express routes within the I-35W corridor are also revised for two primary reasons:


MINNEAPOLIS
Wayzata Blvd.
Franklin St.
St. Louis Park
26th St.
Lake St.
Hiawatha Ave.
36th St.
France Ave.
Xerxes Ave.
Penn Ave.
Lyndale Ave.
NICOLLET AVE.
Portland Ave.
Chicago Ave.
Cedar Ave.
46th St.
50th St.
34th Ave.
57th St.
ALSO EXISTING SHELTER
MINNEAPOLIS — ST. PAUL INTERNATIONAL AIRPORT
Edina
66th St.
Richfield
76th St.
82nd St.
RT. 50
90th St.
BLOOMINGTON BUS COMPANY
98th St.
Bloomington
RT. 18
Old Shakopee Rd.
Hennepin County
Dakota County
Scott County
NICOLLET AVE.
150th St
Cedar Ave.
0
2
Miles
FIGURE 28
TRANSIT SERVICE PLAN B
Proposed New Express Routes
Existing Downtown Express Routes (Revised)
Existing Park – Ride Sites
Proposed Park · Ride Sites
Proposed Shelter Locations
Other Desirable Park – Ride Sites

- the physical alignment and geometrics of the existing I-35W interchange at 60th Street do not permit the construction of a special bus ramp and all existing express lines now enter the freeway at that interchange.(7)

- with the exception of MTC Route 50, a significant proportion of the other existing express routes actually provides local service along arterial streets with the result that average operating speed on these routes approximate only 19 to 22 miles per hour.

In view of these considerations, the Route 18 express runs have been split into two separate lines with both terminating at Nicollet Avenue and 104th Street. One line provides local service along Nicollet Avenue only as far north as I-494 and then enters the freeway and turns west to I-35W while the other line continues north to Diamond Lake Road before turning east to enter I-35W. The Bloomington Bus Company line operating along Old Shakopee Road in Bloomington would enter I-35W at 98th Street rather than continuing north along Lyndale Avenue to 60th Street. The two other Bloomington Bus Company express lines serving the area around Penn Lake would travel north on Lyndale Avenue to Diamond Lake Road and then turn east to I-35W.

As indicated in Table 8, Plan B would add a total of about 139 miles of new express routes to the transit system (slightly less than two-thirds of this mileage via expressway). At the same time, it would add about 14 route miles to the existing express transit lines in the corridor while increasing the average express portion of these routes from 37 percent to 53 percent.

Average operating speeds on the new routes in Plan B would range from 16 miles per hour (Route C) to 26 miles per hour (Route N). Speeds on the Route 18 express runs would be increased slightly and an even greater increase would result on the Bloomington Bus Company line which uses Old Shakopee Road (due to its shortened local service seqment and greater use of the freeway). Average operating speed on the other two Bloomington Bus Company lines and the MTC Route 50 remain about the same as at present.

Patronage Potential - The 12 proposed new routes which are included in Plan B serve a total patronage potential of about 1,000 persons fewer than the 15 routes presented in Plan A -- 8,446 vs. 9,415 (Table 9). The 12 proposed routes serve about 400 fewer current transit patrons and approximately 600 fewer auto users.

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(7) This is also the major reason for the revision to Route C.

TABLE 8

SUMMARY OF EXISTING AND PROPOSED EXPRESS BUS SERVICE

I–35W CORRIDOR

PLAN B

Route	Route Terminal	On I–35W At	Length (miles)				Average Speed (mph)	Run Time (minutes)		
			Total	Express	Local	% Express		Total	Express	Local
B	Cedar Avenue and E. 52nd Street	46th St.	6.9	3.6	3.3	52.2%	18.2	23	6	17
C	Portland Avenue and E. 70th Street	Diamond Lake Rd.	8.1	4.7	3.4	58.0	19.6	25	7	18
D_1	Portland Avenue and E. 72nd Street	76th St.	11.7	8.5	3.2	72.6	25.5	27	12	15
D_2	Portland Avenue and E. 104th Street	Portland Avenue *(a)*	14.6	10.2	4.4	69.9	27.1	32	14	18
F	West 98th Street - Bloomington	Old Shakopee	15.6	11.5	4.1	73.7	27.1	35	16	19
G	Penn Avenue S. and W. 76th Street	66th St.	10.4	7.2	3.2	69.2	22.6	28	11	17
H	Antrim Road and W. 70th Street	Xerxes Avenue *(b)*	14.2	9.1	5.1	64.1	23.9	36	14	22
I	Valley View Road and Tracy Avenue	Xerxes Avenue *(b)*	13.7	9.1	4.6	66.4	24.2	34	14	20
J	Xerxes Avenue S. and W. 56th Street	Diamond Lake Rd.	8.4	4.7	3.7	56.0	20.7	24	7	17
K	Xerxes Avenue S. and W. 47th Street	46th St.	8.0	3.6	4.4	45.0	18.2	26	5	21
L	Lyndale Avenue S. and W. 46th Street	35th St.	5.5	2.2	3.3	40.0	15.9	21	3	18
N	Cedar Avenue and 150th Street W.	T. H. 13	22.2	15.2	7.0	68.5	26.0	51	20	31
	TOTAL		139.3	89.6	49.7	64.3%		362	129	233
18	Nicollet Avenue and 104th Street	Diamond Lake Rd.	12.1	4.7	7.4	38.8%	23.5	31	7	24
18–A	Nicollet Avenue and 104th Street	Nicollet Avenue *(a)*	14.0	9.7	4.3	69.3	26.7	32	14	18
50	24th Avenue S. and E. 83rd Street	Co. Road 62	15.8	10.4	5.4	65.8	27.4	35	16	19
B1	Normandale Blvd. and W. 110th Street	98th Street	16.4	11.5	4.9	70.1	27.4	36	16	20
B2	France Avenue S. and W. 90th Street	Diamond Lake Rd.	15.6	4.7	10.9	30.1	19.0	49	7	42
B3	Penn Avenue S. and W. 90th Street	Diamond Lake Rd.	12.4	4.7	7.7	37.9	18.6	40	7	33
	TOTAL		86.3	45.7	40.6	53.0%		223	67	156
	GRAND TOTAL		225.6	135.3	90.3	60.0%		585	196	389

(a) *On I–494*

(b) *On C.R. 62*

TABLE 9

POTENTIAL TRANSIT PATRONAGE

EXISTING AND PROPOSED BUS SERVICE

I–35W CORRIDOR

PLAN B

Route	Route Terminal	On I–35W At	Present Transit Riders	Auto Users	Total Potential Patronage
B	Cedar Avenue and E. 52nd Street	46th St.	428	105	533
C	Portland Avenue and E. 70th Street	Diamond Lake Road	154	156	310
D_1	Portland Avenue and E. 72nd Street	76th St.	134	952	1,086
D_2	Portland Avenue and E. 104th Street	Portland Avenue *(a)*	113	175	288
F	West 98th Street in Bloomington	Old Shakopee	31	374	405
G	Penn Avenue S. and W. 76th Street	66th St.	82	252	334
H	Antrim Road and W. 70th Street	Xerxes Avenue *(b)*	62	190	252
I	Valley View Road and Tracy Avenue	Xerxes Avenue *(b)*	112	830	942
J	Xerxes Avenue S. and W. 56th Street	Diamond Lake Road	445	348	793
K	Xerxes Avenue S. and W. 47th Street	46th St.	635	605	1,240
L	Lyndale Avenue S. and W. 46th Street	35th St.	956	586	1,542
N	Cedar Avenue and 150th Street W.	T.H. 13	30	691	721
	TOTAL		3,182	5,264	8,446
18	Nicollet Avenue and 104th Street	Diamond Lake Road	59	194	253
18–A	Nicollet Avenue and 104th Street	Nicollet Avenue *(a)*	23	99	122
50	24th Avenue S. and E. 33rd Street	Co. Road 62	11	554	565
B 1	Normandale Blvd. and W. 110th Street	98th Street	59	508	567
B 2	France Avenue S. and W. 90th Street	Daimond Lake Road	164	254	418
B 3	Penn Avenue S. and W. 90th Street	Diamond Lake Road	144	173	317
	TOTAL		460	1,782	2,242
	GRAND TOTAL		3,642	7,046	10,688

(a) *On I-494*

(b) *On C.R. 62*

However, this decrease in patronage potential is accounted for in part by the revisions to the existing express transit lines within the corridor which provide transit service to an additional 300 current auto users while serving about the same number of present bus riders.

Estimated Patronage - As indicated in Table 10, the 12 proposed new routes are expected to attract a total of 2,290 riders on a typical weekday (inbound to the CBD between the hours of 7:00 a.m. and 9:00 a.m.). This is about 300 fewer riders than the total carried by the 15 new routes presented in Plan A. As in the case of the previous transit service plan, about two-thirds of the total riders expected to be attracted to the 12 new routes are already transit users. The 768 current auto users who will be attracted to the new service represent about 15percent of the total number of auto users who are potential to the routes -- about the same proportion as in Plan A.

Patronage estimates for each of the six unchanged routes (F, G, H, J, K and L) remain the same as in Plan A. Route J, with a total estimated ridership of 400 persons, is still the heaviest travelled route, though also one of the two routes attracting the smallest proportion of former auto users (Route B is the other). Route K, with 315 riders, is the second heaviest travelled route and, as in the case of Plan A, slightly more than one of every five riders on this route is a former auto user.

The combining of Routes N and O into a single route (Route N) results in a longer route that will carry 240 riders in the morning peak period (and almost nine of every ten riders on that route are former auto users). The splitting of Route D into two separate lines and the slight extension of Route D (north on Portland Avenue to 72nd Street) results in a total patronage for the two routes of 390 riders as compared to the Plan A estimate of 335 riders for the single line. Patronage on Routes B and C decrease somewhat due to the cutback in route length and the slight decrease in average operating speed on both routes resulting from the minor route revisions. Patronage estimates for Route I remain the same despite the slight route revision; however, it is possible that there may be some trade-off in ridership between Routes H and I where they follow the same route in the vicinity of the Southdale-Fairview Hospital.

The revisions suggested in the existing corridor express service result in an increase of 120 riders (from 580 to 700) with most of the additional transit patrons being attracted to the Bloomington Bus Company routes. The route operating along Old Shakopee Road will pick up a number of additional riders from the park-ride lot at 98th Street as well as patrons who were assigned to

TABLE 10

PATRONAGE ESTIMATES

EXISTING AND PROPOSED EXPRESS BUS SERVICE

I–35W CORRIDOR

Average Weekday – Inbound – Peak Period (7:00 A.M. to 9:00 A.M.)

PLAN B

Route	Route Terminal	On I–35W At	Patronage	Present Bus Riders			Former Auto Users	Percent Former Auto	Park Ride Patronage
				Total	Local	Express			
B	Cedar Avenue and E. 52nd Street	46th Street	160	144	140	4	16	10%	
C	Portland Avenue and E. 70th Street	Diamond Lake Road	120	89	71	18	31	26	
D_1	Portland Avenue and E. 72nd Street	76th Street	235	131	112	19	104	44	54
D_2	Portland Avenue and E. 104th Street	Portland Avenue *(a)*	155	115	39	76	40	26	
F	West 98th Street in Bloomington	Old Shakopee	95	32	21	11	63	66	46
G	Penn Avenue S. and W. 76th Street	66th Street	130	81	76	5	49	38	
H	Antrim Road and W. 70th Street	Xerxes Avenue *(b)*	90	60	55	5	30	33	
I	Valley View Road and Tracy Avenue	Xerxes Avenue *(b)*	150	105	104	1	45	30	
J	Xerxes Avenue S. and W. 56th Street	Diamond Lake Road	400	348	346	2	52	13	
K	Xerxes Avenue S. and W. 47th Street	46th Street	315	246	246	0	69	22	
L	Lyndale Avenue S. and W. 46th Street	35th Street	200	141	141	0	59	30	
N	Cedar Avenue and 150th Street W.	T. H. 13	240	30	0	30	210	87	141
	TOTAL		2,290	1,522	1,351	171	768	34%	241
18	Nicollet Avenue and 104th Street	Diamond Lake Road	90	59	39	20	31	34%	
18–A	Nicollet Avenue and 104th Street	Nicollet Avenue *(a)*	40	23	5	18	17	43	
50	24th Avenue S. and E. 83rd Street	Co. Road 62	90	6	0	6	84	93	
B 1	Normandale Blvd. and W. 110th St.	98th Street	170	50	7	43	120	71	46
B 2	France Avenue S. and W. 90th Street	Diamond Lake Road	170	134	78	56	36	21	
B 3	Penn Avenue S. and W. 90th Street	Diamond Lake Road	140	115	59	56	25	18	
	TOTAL		700	387	188	199	313	45%	46
	GRAND TOTAL		2,990	1,909	1,539	370	1,081	36%	287

(a) *On I–494*

(b) *On C.R. 62*

Route E in the previous service plan. At the same time, the other two Bloomington Bus Company lines will pick up a number of riders who formerly boarded the Lyndale Avenue local service portion of the Old Shakopee Road route.

Only three park-ride locations are proposed in Plan B since the route operating along County Road 42 will now turn north on Nicollet Avenue and enter I-35W via Highway 13. However, total expected park-ride usage remains the same as in Plan A since it is anticipated that all potential users of the park-ride lot at County Road 42 will be diverted to the Highway 13 location. Therefore, park-ride usage at this latter site is expected to increase from the 102 patrons estimated in Plan A to 141 persons under the Plan B service proposal. Estimated usage of the 98th Street and 76th Street park-ride sites is expected to remain the same as in Plan A -- 92 and 54 patrons, respectively.

Even though the Plan B service proposals include some revisions in the existing express service within the corridor, patrons using these lines will still be able to make use of the three existing park-ride facilities that serve these lines. Route 50 remains basically the same as in Plan A (i.e., only some minor route revision in the vicinity of I-35W) and will continue to serve the park-ride site at Metropolitan Stadium. The park-ride site at Nicollet Avenue and 62nd Street will be served by the portion of Route 18 which will enter I-35W at Diamond Lake Road while the facility at Lyndale Avenue and 86th Street will be served by two of the three Bloomington Bus Company lines (the third route enters I-35W at 98th Street under Plan B).

There are four additional sites that appear to be desirable park-ride locations, but as in the case of Plan A, land is not now available for such use. Three of the sites were listed in Plan A -- Southdale Center, Antrim Road and W. 70th Street and Tracy and Benton Avenues. The fourth desirable park-ride site is located at Portland Avenue and 81st Street and would serve patrons of Route D, which enters I-494 just north of that intersection. If Plan B is implemented and if land should become available at any of these locations during the course of the demonstration project, it is recommended the park-ride facilities be provided.

Route Operating Statistics - Operating statistics for each of the 12 proposed new routes comprising Plan B as well as the revised existing express service are presented in Table 11.

Headways and bus requirements were determined on the same basis as in Plan A. As shown in the table, suggested average headways on the new routes range from a minimum of 12 minutes (Route J) to a maximum of 60 minutes (Routes F and H).

A total of 34 new buses (four less than those required in Plan A) will be required to operate the 12 proposed new routes at the suggested service frequency. An additional 14 buses (one more than required under Plan A) will be required to operate the revised existing express lines within the corridor.

Costs of operating the service were estimated on the basis of the same data used in Plan A and revenue estimates were also based upon the same fare structure assumptions underlying that plan. A comparison of route operating costs (only for the two-hour peak morning period) with total expected route revenues shows that all 12 of the proposed new routes would operate at a profit though Route I is a marginal case. Of the six separate express lines representing the revised existing express service within the corridor, only two lines -- the Bloomington Bus Company lines providing service along 90th Street -- would operate at a deficit during the peak morning period.

Impact on Other Existing Routes - As in the case of Plan A, almost two-thirds of the expected users of the Plan B transit service currently use the bus to make their trip to downtown Minneapolis. The pattern of ridership losses on existing MTC routes is about the same as that anticipated under Plan A with two major exceptions. The loss in ridership on MTC Route 5 would be reduced from the expected 490 in Plan A to about 370 under this plan (mainly because of the deletion of Route A and changes in three proposed new routes: B, C and D). In addition, the anticipated decrease in patronage on MTC Route 9 would also be reduced -- from 110 under Plan A to about 60 riders under this service proposal. This latter change in ridership patterns is mainly due to the proposed revision to Route B and the elimination of Route A from the transit service plans.

TABLE 11

SUMMARY OF PEAK PERIOD OPERATING RESULTS

EXISTING AND PROPOSED EXPRESS BUS ROUTES

I–35W CORRIDOR

PLAN B

Route	Route Terminal	On I–35W At	Headway (minutes)	Buses Required	Vehicle Miles	Vehicle Hours (minutes)	Patronage	Revenue ($)	Operating Cost ($)	Difference Deficit or Profit
B	Cedar Avenue and E. 52nd Street	46th St.	30	2	55.2	211.0	160	56.00	39.86	$ 16.14
C	Portland Avenue and E. 70th Street	Diamond Lake Road	40	2	48.6	139.2	120	50.75	30.13	20.62
D_1	Portland Avenue and E. 72nd Street	76th St.	20	3	140.4	345.3	235	105.75	80.98	24.77
D_2	Portland Avenue and E. 104th Street	Portland Avenue *(a)*	30	3	116.8	253.8	155	85.25	63.80	21.45
E	West 98th Street in Bloomington	Old Shakopee	60	2	62.4	138.0	95	52.25	34.34	17.91
G	Penn Avenue S. and W. 76th Street	66th St.	40	2	62.4	190.4	130	58.50	39.93	18.57
H	Antrim Road and W. 70th Street	Xerxes Avenue *(b)*	60	2	56.8	142.4	90	39.30	33.05	6.25
I	Valley View Road and Tracy Avenue	Xerxes Avenue *(b)*	30	3	109.6	293.7	150	66.35	65.79	0.56
J	Xerxes Avenue S. and W. 56th Street	Diamond Lake Road	12	4	168.0	486.0	400	144.75	104.66	40.09
K	Xerxes Avenue S. and W. 47th Street	46th St.	15	4	128.0	451.2	315	110.25	88.37	21.88
L	Lyndale Avenue S. and W. 46th Street	35th St.	24	2	55.0	298.8	200	70.00	49.15	20.85
N	Cedar Avenue and 150th Street W.	T.H. 13	20	5	266.4	614.4	240	168.00	149.31	18.69
	TOTAL			34	1,269.6	3,564.2	2,290	$1,007.15	$779.37	$227.78
B	Nicollet Avenue and 104th Street	Diamond Lake Road	60	1	48.4	121.8	90	43.10	28.21	14.89
B–A	Nicollet Avenue and 104th Street	Nicollet Avenue *(a)*	1 trip	1	28.0	62.9	40	21.25	15.52	5.73
O	24th Avenue S. and E. 83rd Street	Co. Road 62	60	2	63.2	138.4	90	44.50	34.63	9.87
1	Normandale Blvd. and W. 110th Street	98th Street	30	3	131.2	305.4	125	93.50	73.84	19.66
2	France Avenue S. and W. 90th Street	Diamond Lake Road	30	4	124.8	394.0	170	79.75	81.26	(1.51)
3	Penn Avenue S. and W. 90th Street	Diamond Lake Road	30	3	99.2	329.7	140	63.20	66.36	(3.16)
	TOTAL			14	494.8	1,352.2	655	$ 345.30	$ 299.82	$ 45.48
	GRAND TOTAL			48	1,764.4	4,916.4	2,945	$1,352.45	$1,079.19	$273.26

a) *On I–494*

b) *On C. R. 62*

COMPARISON OF SERVICE PLANS AND RECOMMENDATIONS

Review of the two alternate transit service plans and thorough examination of individual route operating results indicate that the 12 proposed new routes presented in Plan B, together with the suggested revisions in existing corridor express service described in that plan, will more effectively and efficiently serve the residents of the I-35W corridor than would the transit service proposals presented in Plan A. For example, Plan B serves a total potential patronage of about 10,700 persons, only about 600 fewer persons than served by Plan A, despite the fact that Plan B includes 40 fewer miles of total express route length than does Plan A (actually 50 fewer miles of proposed new routes). In addition, the 12 proposed new routes included in Plan B are expected to carry 2,290 riders to downtown Minneapolis during the morning peak period on a typical weekday; this is only 265 persons less than the total expected to be attracted to the 15 proposed new routes that comprise Plan A. When the estimated patronage on the revised existing express routes in the corridor as described in Plan B is compared to the number of riders expected to be carried by the five existing express lines included in Plan A, the total patronage difference between the two plans is further decreased -- the Plan B revised existing service is expected to carry 700 riders as compared to only 580 estimated in Plan A (with existing express service remaining unchanged). A comparison of total number of current auto users expected to be attracted to the demonstration service again points up the superiority of Plan B which is estimated to divert 1,081 current auto users versus 1,076 expected to be diverted to the Plan A routes. Plan B also requires fewer vehicles to provide the recommended levels of service -- 48 (34 for the proposed new routes plus 14 for the revised existing express routes) vs. 51 (38 for the proposed new routes plus 13 for the existing express service).

An analysis of the Plan B route operating statistics and patronage estimates indicates that nine of the 12 proposed new routes included in the plan appear to be essential to the plan's success; initiation of service on the other three lines could be postponed until a later stage of the demonstration project without seriously affecting project results.[8] The nine top priority routes in order of their importance are: D_1, D_2, K, I, H, N, J, G and C.

(8) Order of importance was determined on basis of total patronage estimates, expected auto diversions, area served and other route operating statistics.

The two 'D' routes are expected to carry relatively substantial patronage as well as a significant proportion of former auto users. In addition, these two-route proposals correspond very closely to the recommendations for MTC Route 5 developed in the 'Phase I' transit studies.[9] Route K, expected to carry the second largest number of total riders and the second highest number of former auto users, is also similar to that presented in the 'Phase I' studies (for MTC4). Routes I and H will provide service to the Edina area, the Southdale regional center, the Southdale-Fairview Hospital and the adjacent apartment development. About one of every three riders on both routes is expected to be diverted from an automobile (these route proposals also incorporate some of the 'Phase I' recommendations for MTC Route 6).

Route N will provide express service to the communities south of the Minnesota River and is expected to carry the largest number of former auto users. Route J will carry the greatest number of passengers of all of the 12 proposed new routes although about nine of every ten are already transit users; this route will provide improved service to these riders. Routes G and C both are expected to carry more than 100 inbound riders during the morning peak period and more than one of every four riders on both routes is expected to be diverted from the automobile.

The three non-essential routes (again in decreasing order of importance) are B, L and F. The two former routes are the shortest in terms of total route length and would operate at relatively slow average operating speeds (compared to the other express routes). However, both serve fairly substantial potential patronage totals and consideration should be given to early implementation of service on these lines. Route F appears to be less important in that its patronage potential ranks only third from last of the 12 routes and would be even less if the effect of the proposed park-ride lot at 98th Street and I-35W (which is also served by one of the

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(9) Simpson & Curtin, Evaluation of Alternative Service Improvements: Proposed Routes, Interim Report No. 6a, prepared for the Twin Cities Area Metropolitan Transit Commission (Philadelphia, Pa.; Simpson & Curtin, July, 1969).

Bloomington Bus Company routes) were not considered. In fact, almost half of the riders expected to use Route F would board at the park-ride site and these people would merely divert to the Bloomington Bus Company route if service is not initiated on Route F.

The proposed revisions in existing corridor express service which are described in Plan B appear essential to project success and should be implemented upon initiation of service on the proposed new routes (either the modified nine-route or the full 12-route plan). Other wise, the buses operating along these lines will not be able to take full advantage of the special bus ramps, park-ride sites and other project features.

Vehicle requirements would be reduced from 48 coaches (34 for the new routes plus 14 for the revised existing service) to 43 coaches if only nine of the new routes are implemented. A total of six buses are required to provide service on Routes B, F, and L and these would obviously no longer be needed if service is not operated on these lines, thereby, reducing the total vehicle requirement to 28 for the nine remaining new routes. However, as indicated previously, a substantial number of Route F patrons would merely divert to the Old Shakopee Road route operated by the Bloomington Bus Company, if service is not initiated along the former route. In light of this, vehicle requirements for the revised existing express service have been estimated at 15 coaches (rather than the previous 14) so that the total buses required to operate the modified Plan B service proposals would be 43.

BUS RAMP LOCATION AND DESIGN

The demonstration project concept described earlier in the report calls for the provision of priority access to the I-35W freeway for express buses via exclusive bus ramps while automobiles are to be metered onto the highway so that demand volumes will not jeopardize the desired level of freeway service. Field examination of the various interchanges along I-35W indicated that there are three possible ramp design concepts (Figure 29) which will permit priority bus access:

- One concept involves the flaring of the ramp entrance and the widening of the existing ramp to provide an additional 'bus only' lane which would permit the bus to bypass any ramp queue and enter the freeway unimpeded.

- A second possibility involves the construction of a special 'bus only' ramp directly from the frontage road to the freeway slightly upstream from the existing interchange.

- The third design concept which was considered has only limited applicability in that it would be implemented only at 'cloverleaf' interchanges (i.e., Highway 13) and would provide for a special 'bus only' ramp that would merge with the existing on-ramp beyond the metering point.

The Plan A route proposals involve nine specific entries to I-35W: 35th Street, 46th Street, Diamond Lake Road, 60th Street, 66th Street, 76th Street, 98th Street, T.H. 13 and County Road 42. Initial examination of these interchanges indicated that priority access could be provided at all locations through application of one of the three design concepts. However, subsequent investigation and preliminary design work showed that it would not be possible to provide a 'bus only' ramp at 60th Street because of existing physical conditions and interchange geometrics. Therefore, if proposed Route C as presented in that service plan and the existing corridor express transit routes are to take full advantage of the project, it will be necessary to change the I-35W entry point for those bus lines. In addition to the I-35W interchanges, Plan A also includes two routes that enter County Road 62 - - Route H via Xerxes Avenue and Route I via France Avenue. Examination of these locations indicated that priority bus access can be provided by flaring and widening of the existing ramps.

The route proposals presented in Plan B include provisions for bus entry to I-35W at seven of the nine locations included in Plan A: 35th Street, 46th Street, Diamond Lake Road, 66th Street, 76th Street, 98th Street and T.H. 13. In addition,

two routes (H and I) will enter County Road D_2 via Xerxes Avenue and two other routes will enter I-494 (D2 at Portland Avenue and 18-A at Nicollet Avenue. No priority access will be provided at these latter two locations since there will be no metering of these ramps. Priority access would be provided at all other freeway entry locations under this service Plan.(10)

If the modified Plan B service proposals are implemented, the special ramp at 35th Street would not be required, but all other ramps provided for in Plan B would still be needed.

Under all service plans there would be some required modification to the Grant Street on-ramp in downtown Minneapolis to provide priority access for buses leaving the CBD. These modifications are shown in Appendix A.

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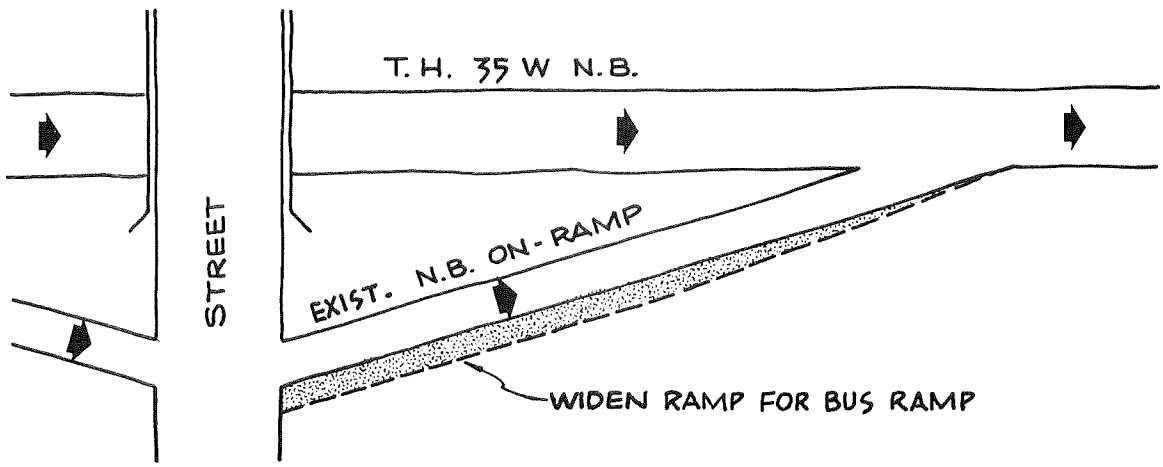
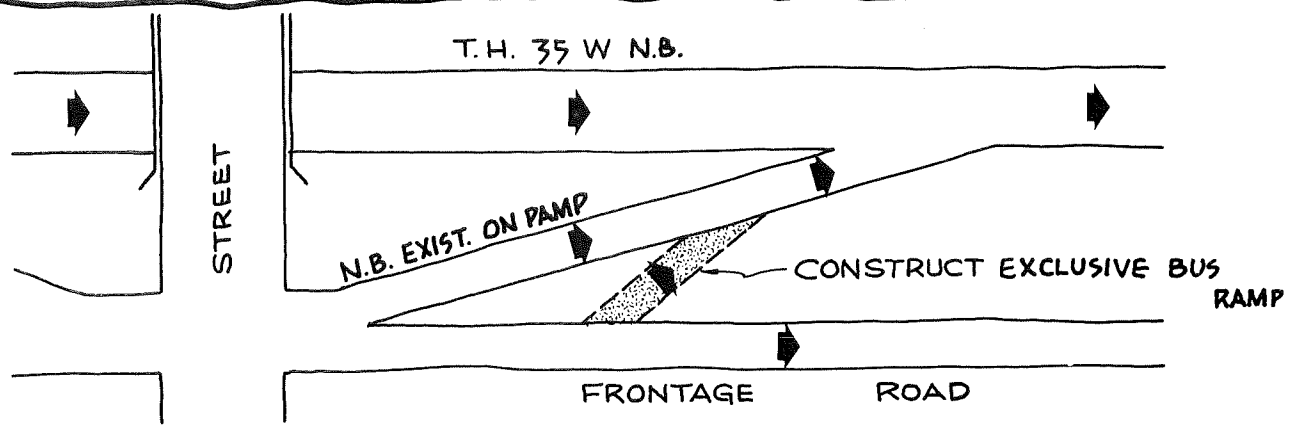
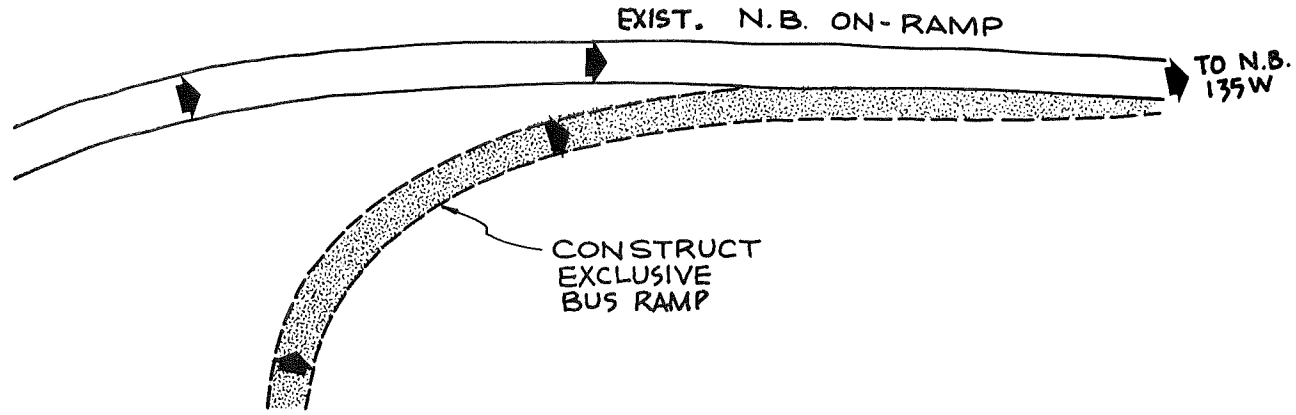
(10) Appendix A illustrates the proposed bus ramps at all I-35W interchange locations.



FLARE RAMP ENTRANCE & WIDEN RAMP



EXCLUSIVE BUS RAMP FROM FRONTAGE ROAD



NEW EXCLUSIVE BUS RAMP AT CLOVERLEAF INTERCHANGES

PAGE 91	**BUS RAMP DESIGN CONCEPT**	FIGURE 29

PASSENGER WAITING FACILITIES

An important element of a complete corridor transit service plan is the proposed type and location of passenger waiting facilities along the bus routes. If the service concept offered by the demonstration project is to be considered attractive and convenient to potential patrons it is essential that they be aware of stop location and service frequency and that, whenever reasonably possible, they be provided with some protection from the elements (especially the Twin Cities' winters when average temperatures range from 13^{o} to 30^{o}).

In light of these considerations, three categories of passenger boarding facilities are proposed for this project:

- regular bus stops
- major boarding locations
- park-ride sites

At regular stops where perhaps fewer than five to ten persons may board the express bus, a distinctive sign identifying the stop and including route and schedule information would be provided. These would be located approximately 750 feet apart on the average and would account for the majority of boarding locations along the demonstration routes.

At major boarding locations, such as route terminals and stops located near areas of concentrated activity where greater numbers of riders would normally board the bus, waiting shelters would be provided for the riding public.(11) Waiting shelters envisioned for this program would provide a minimum of 50 square feet of area and at least two entrances. Shelters would be set on a concrete base and would be designed to permit easy transfer of the shelter to another location with only the concrete base being lost in relocation. Shelters would be heated and lighted and would include posted schedule information and telephone service.

It is also recommended that waiting shelters be provided at key boarding locations along Second Avenue in downtown Minneapolis. As in the case of the other proposed shelters, the downtown shelters could also be used by regular service patrons as well as demonstration service riders. A total of five shelters would be adequate and these would be somewhat larger than the other shelters and would also include heat, light, schedule information and telephones. The actual size and location of the shelters would depend to some degree upon cooperation of downtown merchants; however, the five proposed shelters would provide for

(11) On those streets where proposed new express routes will Operate along with existing local service lines, both express riders as well as local service patrons would make use of the shelters and schedule information would be provided for both types of service.

an average downtown spacing of every two blocks which should be sufficient to split the boarding loads somewhat while providing protection from the elements to the majority of demonstration service patrons (as well as a number of local service riders).

Park-ride lots would be located at interchanges along I-35W where express buses would enter the freeway and where sufficient land is available for lot construction. These locations would not only include parking lots for 'park-ride' patrons and drop-off points for 'kiss-ride' transit users but would also incorporate some form of structure which would serve as a bus station and provide protection from the elements as well as include such services as ticket selling facilities and other passenger amenities (telephone, newspaper stand, etc.).

An examination of the two alternative transit service plans and a review of the modified (from 12 routes to nine) Plan B service proposals indicate that the following number of passenger boarding facilities would be required with each plan:

	Park-Ride Sites	Shelters[12]		Bus Stops
		CBD	Outlying	
Plan A	4	5	46	525
Plan B (12 routes)	3	5	41	400
Plan B (9 routes)	3	5	35	350

(12) Includes requirements for proposed new routes plus existing corridor express transit services.

CAPITAL COSTS OF THE TRANSIT SERVICE PLAN

There are five elements of the transit service plan that will require some capital expenditure. These are:

- Special bus ramps,
- Demonstration vehicles,
- Park-ride facilities (including parking lot and bus station),
- Passenger waiting shelters, and
- Bus stop identification.

Special Bus Ramps - Estimates of the costs involved in providing special bus ramps at the various proposed locations suggested in the alternative transit service plans have been developed. No estimated ramp construction costs have been prepared for the 60th Street interchange since, as previously noted, it does not appear possible to construct such a ramp in light of existing conditions. It has been assumed that the routes which are proposed to use that interchange in Plan A would be revised so as to enter I-35W at one of the other interchange locations or would merely wait in the queue with other vehicles at the 60th Street ramp until metered onto I-35W.

As indicated in Table 12, the total ramp construction cost associated with the Plan A proposals approximates $556,000 as compared to a total cost of $486,000 associated with the Plan B needs (two fewer ramps -- the I-35W - County Road 42 interchange and the County Road 62 - France Avenue interchange). Modified Plan B (with only nine proposed new routes) would not require the special ramp at the 35th Street interchange and total ramp construction costs for that reduced service plan would equal $446,000.

Demonstration Vehicles - As indicated earlier in this report, a total of 51 vehicles would be required to operate the 15 proposed new routes and the existing corridor express service as described in Plan A. The Plan B service proposals require a total of 48 coaches to operate at the suggested levels of service and the Modified Plan B proposals require a total of 43 vehicles to meet suggested service levels. The coach contemplated for this service would have a total of 40 seats that would provide for passenger comforts not now available in most typical transit vehicles. A detailed set of vehicle specifications have been prepared and are included in a separate technical memorandum. It is estimated that the cost of such a vehicle might approximate $43,000 each and that the total capital expenditure is estimates as follows:

Plan A	-	$2,193,000
Plan B (12 routes)	-	$2,064,000
Plan B (9 routes)	-	$1,849,000

Park-Ride Facilities - The Plan B service proposals require park-ride facilities at only the first three locations. However, as discussed earlier in this report, there are a number of additional sites under both transit service plans that appear to be desirable locations for park-ride facilities. Since land is not currently available at these locations for construction of park-ride facilities, no cost estimates have been prepared. If land should become available at any of these locations in the course of the demonstration project, it is recommended that consideration be given to early construction of park-ride facilities at those sites.

In preparing cost estimates for park-ride facilities at the four interchanges along I-35W, it was assumed that the number of parking spaces required would equal 125 percent of the expected park-ride patronage indicated earlier in Tables 6 (Plan A) and 10 (Plan B). This built-in expansion factor would account for short-term increases in patronage that might result from the demonstration program. On the basis of this assumption, it is estimated that the following space requirements will result:

	Parking Space Requirements	
Park-Ride Location	Plan A	Plan B (13)
76th Street	68 spaces	68 spaces
98th Street	115 spaces	115 spaces
Highway 13	128 spaces	177 spaces
County Road 42	49 spaces	---
TOTAL	360 spaces	360 spaces

Costs of the park-ride facilities (including land purchase and construction expense for both parking lot and bus station) at the various locations have been based upon these space requirements and the previously developed patronage estimates. The cost estimates are summarized in Table 13.

Passenger Waiting Shelters - Passenger waiting shelters located at major boarding stops along the residential portion of the various demonstration routes will provide some protection from the elements and help to make the service more attractive to

(13) Both the twelve-route and modified nine-route plan.

TABLE 12

ESTIMATED COST OF SPECIAL BUS RAMPS

Ramp Location	ESTIMATED COST Plan A	Plan B	Plan B (Modified)
Grant Street	$56,000	$56,000	$56,000
35th Street	40,000	40,000	-
46th Street	51,000	51,000	51,000
Diamond Lake Road	25,000	25,000	25,000
66th Street	56,000	56,000	56,000
76th Street	25,000	25,000	25,000
98th Street	56,000	56,000	56,000
T.H. 13	152,000	152,000	152,000
Co. Rd. 42	45,000	-	-
Sub Total I-35W	$506,000	$461,000	$421,000
France Avenue	$25,000	-	-
Xerxes Avenue	25,000	25,000	25,000
Sub Total Co. Rd. 62	$50,000	$25,000	$25,000
TOTAL	$556,000	$486,000	$446,000

TABLE 13

ESTIMATED COST OF PARK-RIDE FACILITIES

Park-Ride Facility Location	Estimated Capital Cost	
	Plan A	Plan B[a]
76th Street		
Land	$50,000	$50,000
Lot Construction	10,000	10,000
Station Construction	10,000	10,000
TOTAL	$70,000	$70,000
98th Street		
Land	$100,000	$100,000
Lot Construction	15,000	15,000
Station Construction	13,000	13,000
TOTAL	$128,000	$128,000
Highway 13		
Land	$ 50,000	$65,000
Lot Construction	15,000	20,000
Station Construction	13,000	15,000
TOTAL	$ 78,000	$100,000
County Road 42		
Land	$ 15,000	NA
Lot Construction	7,000	NA
Station Construction	8,000	NA
TOTAL	$ 30,000	NA
TOTAL		
Land	$215,000	$215,000
Lot Construction	47,000	45,000
Station Construction	44,000	38,000
GRAND TOTAL	$306,000	$298,000

(a) Both the twelve-route and the modified nine-route plan.

potential users. It is estimated that the average cost of passenger waiting shelters contemplated for this project would approximate $3,000 each. The five downtown shelters (required under all three service plans) are expected to be somewhat larger and may require some unique design to properly accommodate them in the overall street scene. In view of this, it is estimated that these shelters would cost an average of $7,500 each.

On the basis of the previously discussed shelter requirements for each transit service plan, the following cost estimates result:

	Number of Outlying Shelters	Estimated Cost	Number of CBD Shelters	Estimated Cost	Total Cost
Plan A	46	$138,000	5	$37,500	$175,500
Plan B (12 routes)	41	$123,000	5	$37,500	$160,500
Plan B (9 routes)	35	$105,000	5	$37,500	$142,500

Bus Stop Identification - Another important element of the demonstration project is the identification of bus stops along the demonstration routes so that potential patrons will be aware of the service and informed as to route location and service frequency. It is estimated that the average cost of an installed bus stop sign would approximate $50.00 and this results in the following cost estimates.

	Number of Signs	Estimated Cost
Plan A	525	$26,250
Plan B (12 routes)	400	$20,000
Plan B (9 routes)	350	$17,500

Summary - The capital costs of the alternative transit service plans are summarized in Table 14. As shown in that table, total required capital expenditure ranges from a maximum of $3,256,750 with Plan A to a minimum of $2,753,000 with the modified (i.e., reduced) Plan B proposals. The greatest proportion (about two-thirds) of the capital cost is associated with vehicle purchase and this item also represents the major difference in costs between the plans. The cost of special bus ramps and park-ride facilities represents slightly less than 30 percent of total costs while shelters and bus stop signs represent approximately five percent of the total required capital expenditures.

TABLE 14

SUMMARY OF CAPITAL EXPENDITURES

TRANSIT SERVICE PLANS

	Plan A	Plan B (12 Routes)	Modified Plan B (9 Routes)
Bus Ramps	$556,000	$486,000	$446,000
Vehicles	2,193,000	2,064,000	1,849,000
Park-Ride Facilities	306,000	298,000	298,000
Shelters	175,500	160,500	142,500
Bus Stop Signs	26,250	20,000	17,500
TOTAL	$3,256,750	$3,028,500	$2,753,000

SUMMARY OF OPERATING RESULTS

Estimates of demonstration project transit operating results have been prepared for the assumed initial year of operation under each of the three previously discussed transit service proposals -- Plan A, Plan B and Plan B (Modified). The estimation of first year operating results was in each case predicated upon a number of key assumptions including:

- All transit operating costs are based upon data provided by the MTC Operating Division which reflect operating expenses as of early 1971. Since the demonstration project is to be a short-range program, the use of these recent cost statistics is appropriate for this planning phase. However, it is recommended that up-to-date operating cost information be obtained prior to actual project implementation and that the estimates presented in this report be revised accordingly at that time.

- The operating results reflect only peak period operation of demonstration service (two hours in the morning and two hours in the afternoon on a typical weekday). It would appear desirable to at least experiment with some off-peak service, however, data constraints inherent in this study make it impossible to develop reasonable estimates of patronage, revenue and costs that might be associated with such service.

- As previously noted, a significant proportion of demonstration service users are currently bus riders who would be diverted from existing routes within the corridor. Revenues generated by these riders for the demonstration service will be lost to existing routes and must be subtracted from existing system revenues. At the same time, this reduction in ridership on existing routes within the corridor will permit some reduction in existing service and result in some cost savings. Both of these factors have been taken into account in analyzing project operating results.

- It is possible in the course of the demonstration project that some changes in fare structure and operating schedules may appear worthy of trial. However, as previously mentioned, revenues presented in this section of the report are based upon the existing fare structure and operating costs are estimated on the basis of the previously presented average headways and suggested service levels.

- It has been assumed that parking at the park-ride sites would be provided free of charge.

As indicated in Table 15, the cost of operating the demonstration service in the I-35W corridor during the first year would range from $496,300 with Plan B modified to include only nine new express routes to $550,400 for the full 12-route Plan B proposal to a maximum of $578,700 for the Plan A service proposals. These expenses would be offset to substantial and varying degrees by savings resulting from reduced local service within the corridor.

One additional element of the operating cost not directly associated with operation of the transit service is the maintenance of the park-ride sites and stations as well as the passenger waiting shelters and bus stop signs. As shown in Table 15, it is estimated that this would range from about $7,500 under Modified Plan B (fewest park-ride sites and shelters) to approximately $9,700 under Plan A which includes four park-ride sites and a total of 51 shelters.

Expected revenues from the demonstration service will range from a maximum of $713,900 (under Plan A) to approximately $612,100 (under the modified version of Plan B). However, a substantial portion of these revenues will be earned at the expense of local service routes now operating in the corridor. When the impact of this revenue loss is considered, the resultant revenue differential is reduced considerable. The statistics presented in Table 15 show that the service on local routes can not be cut-back sufficiently to totally cover the expected patronage drop (without affecting other riders who will remain on the local service lines).

However, in total, all three plans are expected to yield an operating profit for the first year of the demonstration program. Profit is maximized under the nine-route version of Plan B, but it must be kept in mind that fewer persons would be served by this plan than by the complete 12-route Plan B proposal. The smallest profit is yielded by Plan A and this is somewhat expected in light of the previously presented plan comparisons.

TABLE 15

SUMMARY OF ANNUAL OPERATING RESULTS

CORRIDOR DEMONSTRATION SERVICE

FIRST YEAR OF OPERATION

	PLAN A	PLAN B	MODIFIED PLAN B
Demonstration Project Operating Costs			
Proposed New Routes	$447,700	$397,500	$334,600
Existing Express Routes[a]	131,000	152,900	161,700
Sub Total	$578,700	$550,400	$496,300
Decreased Operating Costs Resulting from Reductions in Existing Service	-$289,800	-$272,000	-$264,300
Operating Cost Differential	$288,900	$278,400	$232,000
Park-Ride and Shelter Maintenance Cost	$ 9,700	$ 8,400	$ 7,500
Total Operating Cost Differential	$298,600	$286,800	$239,500
Demonstration Project Passenger Revenue			
Proposed New Routes	$571,400	$513,600	$422,700
Existing Express Routes[a]	142,500	176,100	189,400
Sub Total	$713,900	$689,700	$612,100
Decreased Revenue on Existing Routes	-$392,000	-$360,600	-$309,600
Revenue Differential	$321,900	$329,100	$302,500
PROFIT	$ 23,300	$ 42,300	$ 63,000

(a) Operating on revised schedules as proposed in Plan A or on both revised routes and schedules as suggested in Plan B and Modified Plan B.

THE MARKETING PLAN

INTRODUCTION

The automobile industry recognizes the necessity to market its product. Automobile manufacturers and national automobile accessories firms are currently spending over one billion dollars annually to advertise the auto and its use. Locally, new car agencies are spending an estimated four million dollars a year to sell the public on the auto mode. The auto marketing program has been so overwhelmingly successful that the public is willing to ignore air and noise pollution, congestion, loss of life and personal injury, growing road costs, and other problems in order to use their preferred mode. So it is clear that an aggressive educational and promotional campaign must be initiated if this project's sophisticated express-type transit is to attract a significant share of the total transportation market of the I-35W corridor. It must also be remembered that when asking people to switch travel modes, they are being asked to alter their life-style in a significant way.

In this respect, transit marketing strategy assumes vital importance because it is the only transit strategy which concerns itself almost exclusively with creating and maintaining demand.

A marketing approach to mass transit should utilize all aspects of the "marketing mix". These marketing elements include market research, product planning, price policy, advertising and promotion and public relations. Only price policy will not be discussed in this marketing presentation.

Most American transit systems have no marketing strategy, no marketing personnel, and do not advertise. They are organized to produce -- but not to sell what they produce. A few systems advertise, apparently with good results, but hardly any have ever used market and creative research to increase effectiveness. Fortunately, this project provides for a comprehensive marketing approach to transit. Rigorous procedures will be utilized to answer questions such as which creative appeals, advertisements and levels of advertising will be most effective. This information could be of tremendous value to transit systems all over the country.

ATTITUDES OF USERS

The only data currently available regarding attitudes is contained in a study conducted for the Twin Cities Area Metropolitan Transit Commission in early 1969 by Simpson and Curtin. The survey consisted of a carefully selected stratified random sample representative of a cross section of persons living in those portions of the Twin Cities area then served by transit.

The following is a summary of this study insofar as data gathered which might be relevant to the corridor demonstration project.

Regarding general community benefits,

- Eight out of ten persons felt that the demand for downtown parking facilities can be greatly reduced with more and better bus service.
- Seven out of ten persons stated that good bus service increases property values.
- Five out of ten persons stated that more and better bus service will not eliminate crowded highways in the Twin Cities.

When a comparison was made of people's attitudes toward cost and time saving, auto vs. bus, the bus was felt to be less expensive and take more time by the majority of users of both auto and bus. Therefore, the credibility of time saving in promotion of express buses to auto users must be established, even though it is truly time saving. On the other hand, express buses can readily be promoted to local bus users as being time saving.

Table 16 shows the relative importance of several factors relating to the work trip. In order to be most meaningful in the present application, this kind of data should be examined in future studies of auto users vs. express and local bus users.

TABLE 16

FACTORS RELATING TO THE WORK TRIP

	RATING				
	Very Important	Of Some Importance	Very Little Importance	Not at All Important	No Opinion
The cost of the trip	26.0%	36.2%	23.2%	13.6%	0.3%
The travel time	55.1%	26.0%	13.6%	5.0%	0.3%
Your comfort	36.8%	41.8%	14.9%	6.5%	-
Your safety	83.3%	13.0%	2.8%	0.9%	-
The need not to transfer from one bus to another	54.2%	25.1%	11.1%	6.2%	3.4%
The cleanliness of the bus or car	31.9%	52.9%	10.6%	4.3%	0.3%
Getting to work on time	91.6%	5.6%	1.5%	1.3%	-
Having your mind free while going to and from work	39.0%	40.9%	12.4%	5.9%	1.9%

MARKETING OPPORTUNITIES AND PROBLEMS

Opportunities to be Exploited

- The principle marketing fact is that a large and growing potential exists for express bus service. This is true whether such service is a part of a metered freeway project or not.

- As the cost of auto use continues to increase, this factor (the prime motivating factor in switching auto users to express buses) will play an enlarging role in making the express bus a more preferred mode.

- The increasing shortage and rising cost of parking in the CBD is a factor which can be exploited.

- The time saving factor will also tend to increasingly favor the express bus mode at the expense of the auto. This is so because after metering goes into effect, some motorists will be delayed in entering the freeway. At that time, the express buses with their ready access to a fast flowing freeway can be said to be a faster mode than autos traveling on arterials and as fast, or nearly as fast as autos traveling on I-35W.

  The increasing concern of the public over environmental problems will also come into play. Intelligent use of mass transit is a powerful force for preserving our environment and this fact should be clearly communicated to auto users. Indeed, a technical case can be made for stating that one bus emits up to 1/160 less dangerous pollutants than the number of autos (at 1.4 people per car) it takes to carry the same number of people. The fact that the educational level of our primary market is well above average should make the environmental factor more significant than it otherwise might be.

- The project will certainly create better accessibility to the CBD. This will have a positive effect on real estate values in the corridor. This improved accessibility will also make possible the development of areas further removed from the CBD.

- Finally, the product itself will be a positive factor in marketing of express bus service. Our market will have access to convenient park and ride facilities, transit shelters and superb air-conditioned, high-speed buses with comfortable leatherette seats.

These selling points represent a level of service which has not previously been available to users of the I-35W corridor (although it is probable that some service similar to this will have been initiated by the MTC prior to the beginning of this project).

Problems to be Overcome or Recognized

- It is evident that the market for express bus useage consists largely of commuters having higher than average incomes. These are the same people who are most likely to have two or more autos and thus have a choice of mode. Likewise, they are less likely to be influenced by the cost of auto vs. transit.

- Metering the freeway is undoubtedly going to create some adverse reaction on the part of motorists who are delayed and choose to divert to arterial streets. It is imperative that these people be informed of the reasons why the freeway will be metered and how to use the metered freeway.

CREATIVE PLANNING

Creative planning studies are required prior to use of advertising to determine most effective appeals and strategies. Additional studies are conducted after the advertising has run to determine ability to change attitudes and accomplish desired objectives.

Identification Of Best Strategy

When proposed advertisements for two or three alternative campaign themes have been developed, these can be shown to respondents in their own homes and extensive interviews administered. Such factors as believability, comprehension, clarity and memorability (to a degree) can be measured by such a technique. This will permit identification of the best of the alternatives in advance of producing final advertisements or commercials.

Selection Of Best Finished Advertisements And Commercials

When finished print advertisements (if print media used), and/or broadcast commercials are developed, they can be subjected to standard recall-testing techniques, in order to identify the most memorable. This will enable the bulk of the media budget to be placed behind the most effective advertising.

Advertising And Development Of Creative Material

Facts produced through marketing research will play an important role in the development of advertising. Development of themes will come in part from information obtained from focused group depth interviews. Different themes will be used to reach various market segments.

For example, situations which will motivate a person in the lower socio-economic scale may have little relevancy to a professional person in the upper-middle or upper income levels for whom different appeals will be relevant.

The procedure to be followed for creative development is:

1. Development of advertising which implements creative strategies.
2. Testing of alternative advertising.
3. Preparation of advertising in final forms.
4. Use of advertising in the market.
5. Measurement of the relative effectiveness of different advertising themes when actually used.

ADVERTISING

- The primary objective of the advertising campaign will be to develop and maintain a strong demand for express bus service. That is, the advertising must convince people to change modes -- from autos to express buses and from local to express transit.

- The advertising must also communicate to motorists the procedures for proper use of the metered freeway (and to disseminate information about alternative arterial routes).

- Community benefits must also be advertised in order to generate support among non-users residing in the corridor and throughout the community as a whole. Presenting the project as a community benefit will therefore tend to neutralize potential opposition from various citizens groups or neighborhoods.

- Since the project will concern itself primarily with moving people to and from the CBD during peak hours, business management and employers must be encouraged to use and to support the project's facilities.

Creative Strategy (Express Buses)

- In regard to promotion of express buses, an analysis of the marketing facts indicates that the strongest appeals would be money saving and time saving. The comparative costs and travel times of the alternate modes should be carefully documented, then presented as fact in informative, hard-hitting advertising.

- Convenience is another potential appeal, but it is difficult to measure and to define ("time saving" might also be convenient). For our purposes, it should relate to park and ride (and kiss and ride) facilities, waiting shelters, neighborhood feeder bus service and a downtown small vehicle distribution system. The advertising must also describe the physical appeal and comfort of the product. Modern, air-conditioned express buses with special seats may be instrumental in getting many prospects to switch modes. We recommend that the new express service offer a guaranteed seat to every rider as a matter of policy. People might be reluctant to switch from their comfortable car to standing room on a high speed bus. But from their car to a comfortable upholstered seat on a new bus -- well, that's another matter.

Because of our market's demonstrated affection for automobiles and because of the image of mass transit, it is essential that advertising be created which will make use of the express bus, the acceptable --- the smart thing to do. Perhaps this appeal can best be communicated in the form of testimonial advertising by actual users of the service.

At any rate, this technique as well as several others will be pre-tested prior to implementation of the campaign. Procedures for pre-testing of ads and appeals will be described later in this report. Group depth interview (also described later) will also be used to help develop the strongest possible advertising messages.

- The project's product claims should be credible and should be presented in a direct manner. All advertising and sales promotion materials should be easy to understand, attractive and representative of the best possible contemporary graphics (after all, our prospect is being bombarded with up to 1400 advertising messages per day).

- A route map showing the express routes, feeder bus routes, park and ride facilities and timetables should be widely distributed. A Pittsburg Transit Authority Demonstration showed that distribution of route maps to be one of the most effective forms of transit advertising.

- Seattle has the "Blue Streak" and Milwaukee the "Freeway Flyer". This project, too, will need a name for it's express service.

  Hopefully, the name will connote all or many of the benefits of the service...speed, comfort, convenience and status. It is not the function of this report to settle on a name...only the need for one. Nevertheless, we offer a few possibilities.

  Commuter Express

  Red Liner

  Freeway Express

  Metro Liner

  Metro Express

  Freeway Flyer

- Many of the first customers of the freeway express will be former users of local transit who will have switched

to an obviously more attractive mode. The primary objective of the project is to get people out of automobiles, but this potential market should not be ignored. Analysis of people who have already switched from local to express service indicates that time saving is the primary reason. This market should be aggressively pursued using appropriate appeals.

Creative Strategy (Metered Freeway)

- The metering of the freeway should also be presented as a benefit, both to the individual motorist and to the community. The purpose of metering is to enable the freeway to function at optimal level, thus enabling those people who continue to use their cars on the freeway to travel at higher average speeds. The freeway will also become a much safer place to drive. In the beginning, many potential users of the freeway will be denied access, but as more and more people switch modes, those who stay with automobiles will be much better off.

- At any rate, a public information campaign (to include advertising) must be directed at the motorists to explain the new system. Alternative arterial routes should also be given to motorists, probably in map form. Creative strategy in regard to metering will especially benefit from group depth interviews.

- Potential resentments and objections will surface here. These could later be neutralized by implementation of appropriate public information strategies. Metering will preceed express service, and potential demand for express service should build as a result of many drivers being frustrated in their attempts to get on. Therefore, the new express service can be pre-sold to potential users at the same time that the metering itself is being marketed.

Media Strategy

The origin-destination studies which have been conducted as a part of this project provide invaluable information for formulating a highly efficient advertising media strategy. Analysis of the data tells us the following:

- Our market is highly concentrated geographically, encompassing as it does, neighborhoods and communities in or adjacent to the single I-35W corridor. This concentration lends itself to efficient use of suburban newspapers and zone editions of the daily newspaper.

- Our primary market - auto users of the corridor - have been pinpointed and can be reached by direct marketing methods such as direct mail.

  In fact, knowledge of the market is so comprehensive that we can create and distribute specific messages to specific sub-markets (such as auto users of the freeway, auto users of arterials, users of local transit, etc.).

- We also know where our market travels (on the freeway, on specific arterials and in buses) and we can reach them during their daily transportation "experience" via outdoor posters and commercials broadcasted on car radios. At present, there are six large so-called "painted panels" available right on I-35W. Use of at least one of these panels at all times during the demonstration would be very effective. However, a policy decision must first be made regarding the use of outdoor advertising on this Interstate freeway.

- All of our prospects spend their work day in the CBD. They can be reached here by more efficient uses of media. The downtown paper "Skyway News" is one example. Outdoor postings exclusively in the Loop is another. House organs and newsletters of businesses located downtown is still another. Posters in offices can also be utilized, as well as brochures which might be distributed by businesses and government agencies to their employees (a recent excellent example of business cooperation was the dissemination of 700,000 "mini bus" brochures by the Minneapolis Downtown Council).

- Our total market is relatively small in number. The 16,000 primary prospects is not so large a group that direct mail activity would be in overwhelmingly expensive.

- Due to the highly concentrated nature and limited size of our market, radio and television advertising would normally not be considered efficient. Their rates are based on coverage that reaches a metropolitan market of two million people. However, radio can be used to reach our prospects in their cars during work trips. It is also a very personal medium on which testimonials can be used with powerful effect. Therefore, limited use of radio during peak "drive time" should be considered.

- Route maps and brochures might also be given to suburban developers and landlords to distribute to new residents who will be moving into the target market area during the operational phase of the project. Neighborhood "Welcome Wagon" efforts could similarly be utilized.

PUBLICITY AND COMMUNITY RELATIONS

The new express service will be big news in the areas directly affected and in the community as a whole. Mass media and public officials will be anxious to cooperate in the dissemination of information about the new service. Therefore it is imperative that sufficient staff and resources be allocated to accomplish the following public relations tasks:

Advance Preparation

- Prepare a brief, factual information kit to be sent to area thought leaders providing them with advance information on the new service to help gain their support and the possibility of their mention of it in public situations. These individuals would include key radio, TV and newspaper personalities, governmental, civic and business leaders, and various environmental and government groups.

- Begin to work with a newspaper reporter to develop an effective in-depth article or series on commuting --its adverse effects on the individual and society and what can be done to minimize those effects. A reporter could interview authorities ranging from traffic engineers who tell about their problems to psychologists who explain how commuting exhausts an individual.

- Begin to work with a local television station on a documentary or feature piece on Minneapolis problems of mass transportation/commuting and what is being done about them. (Of course, the new service is one solution being offered.)

- Work with a leading newspaper columnist to reach housewives in one-car families who are in effect stranded until their husbands come home. A columnist could point out all the activities a housewife could pursue during the day if she had the family car -- she could shop more conveniently, go to the library or art gallery, join a club, an organization, etc.

- Consider working in advance with the promotion department of the daily newspapers to prepare promotional material on subscription service or pick-up posts in conjunction with the new commuter bus.

· General Press Work

-Develop a concise, factual press kit for distribution to all newspapers, TV, radio and magazines announcing and outlining the new service. (These media would include dailies, suburban, downtown paper and magazines, etc.)

-Also develop an effective portfolio of black and white and color transparency photographs for use with the press kits as well as advance placement with selected publications. Black and white with suburban press, color with the daily paper and transparencies to television. These photos would naturally attempt to highlight the spacious, comfortable features of the new buses.

· Community

-Organize a schedule of bus tour display days at the various park and ride locations or major shopping center parking lots. Invitations should be sent via mail and an announcement ad in the local newspaper. Offer an attractive program of refreshments, visual presentations, something for the children and possibly on-the-hour rides around the community. This activity -- in advance of the service introduction could also garner some press coverage.

-Work with local volunteer groups (Scouts, ecology groups, church youth groups) to enlist their support and aid in promoting the introduction of the bus service. One group might hand out promotional leaflets to all motorists stoping at lights or signs, or entering the freeway from suburban locations. Naturally this activity would conform to safety and smooth traffic flow considerations. Another group might directly distribute flyers to homes. Another might stage a bike day or walk day to dramatize the need to lessen the use of the automobile.

-There might be a way to coordinate an advance informational or promotional campaign with suburban merchants or agencies that would be interested in reaching housewives and families who would have the family car in the event the fathers took the bus.

- Downtown

  -Work in conjunction with major downtown businesses and companies to promote the new bus service. We might organize introductory bus tour days for each company -- for example; a noontime bus tour/box lunch for interested employees (Maybe we'd give free box lunches). We would also provide bulletin board materials and the use of the visual presentation for use by the company.

  -Set up the visual presentation or multi-media show at key downtown locations for heavy, pedestrian traffic. The presentation would be the same one used in the community and at other locations when the service is being introduced.

- Opening Day

  -Invite television and newspaper coverage of introduction of service. Photograph first rider, first bus load, bus leaving lot, dignitaries. TV film men could accompany bus riders downtown -- shooting entire story from start to finish.

  -Give promotional button or bumper sticker to all first riders. This would indicate they switched; that they are riding the bus to work. (i.e., they are making their contribution to the environment in this small way). We should develop an ear-catching slogan for this. The bumper sticker might say, "This Car Doesn't Commute." The general idea is that the car is helping make the freeways less clogged.

  -As an added technique, all first-day riders should be given special preferential, first-class treatment. Seat reservations, coffee service, stewardesses would all add to the luxury of the first commuter ride.

  -A leading local radio station can broadcast live on the first commuter bus ride. Announcers can talk about the ride, interview riders, give the weather, etc. This could be an innovative opportunity for a station to be on-the-scene, and it would be a unique and possibly humorous broadcast.

Advertising

The announcement ads, route maps, posters and radio commercials proposed here will utilize existing MTC formats and advertising style. The appeals used in those ads and brochures, however, will be directed at implementing the specific marketing objectives of this Demonstration.

- A week prior to the beginning of service a combination route map, timetable and promotion piece will be direct mailed into areas to be served by the new routes. Each area will have its own tailor-made piece with the one specific route map and time-table. However, the different route promotion pieces will all have the same basic look and format.

- The present users of local transit will be informed of the upcoming availability of express service via a brochure to be distributed by bus drivers a week prior to the beginning of the new express service.

- A large, two-color announcement ad will run in appropriate suburban and the zone edition of the daily newspaper. The ad will feature a map showing all the new express routes in the corridor, as well as the presentation of appeals directed at inducing auto users to switch modes.

- Use of radio spots during peak driving times for the first four weeks of service.

- Placement of 22x28 posters in schools, churches, stores and shopping centers in the areas to be served by express and wherever possible in the CBD.

- Follow-up zone and suburban newspaper ads presenting basic appeals, A follow-up jumbo post card mailing to all prospects would also be desirable, but the high cost of direct mail to such large numbers might be prohibitive.

- Each express bus should be equipped with a colorful pennant or decal. The pennant which will be merchandised in the advertising, would make the bus easily recognizable on the freeway, in collection areas and in the CBD.

- Each route would be given a name... such as the Southdale Metro Liner, the Portland Metro Liner, etc. The name would be posted on the bus and would be merchandised in ads and in route maps and timetables.

SUMMARY OF MARKETING COST ESTIMATES

CREATIVE PLANNING	
Focused Group Depth Interviews	$ 2,400.00
Creative Planning	12,000.00
Pre-Test of Advertising	8,750.00
Sub-Total	$ 23,150.00
METERING ADVERTISING	
Newspaper	$ 8,500.00
Brochure and Direct Mail	4,000.00
Radio	3,000.00
Sub-Total	$ 15,500.00
EXPRESS BUS ADVERTISING	
Initial Newspaper Announcement	$ 4,000.00
Follow-up newspaper - 1st Month	4,000.00
Follow-up in 4th & 8th Month	16,000.00
Newspaper Production	3,500.00
Brochures and Direct Mail	11,500.00
Follow-up Postcards	6,000.00
Radio	12,000.00
Posters	1,500.00
Sub-Total	$ 58,500.00
MARKETING COORDINATION	
Monitoring of Advertising and Community Relations	$ 2,500.00
Attendance at Meetings	2,000.00
Preparation of Reports	500.00
Sub-Total	$ 5,000.00
TOTAL COSTS	$102,150.00

FINANCIAL AND IMPLEMENTATION SUMMARY

COSTS AND REVENUES

There are five cost elements involved in the implementation of demonstration project service:

- Capital Costs - including the design and purchase of required capital equipment for the transit service plan and the surveillance and control system.
- Operating Costs - including the expenses involved in operating the demonstration project transit service and the cost of operating and maintaining the surveillance and control system.
- Marketing Costs - including the costs of research to develop the marketing program and the actual marketing and advertising.
- Administrative Costs - including management and administrative costs involved in planning and design of the project through implementation and evaluation.
- Evaluation Costs - involving the cost of 'before' and 'after' studies of the corridor and complete evaluation of the project performance throughout the life of the program.

The capital costs previously presented in this report are summarized in Table 17. The operating costs and marketing costs, also previously discussed, are summarized in Table 18. Estimates of the cost of administration and evaluation are presented in a separate technical memorandum dealing with the financing and implementation plan.

TABLE 17

SUMMARY OF CAPITAL COSTS
I-35W URBAN CORRIDOR DEMONSTRATION PROJECT

TRANSIT SERVICE PLAN

	PLAN B (12 routes)
Special Bus Ramps	$ 486,000
Vehicles	2,064,000
Park-Ride Facilities	298,000
Waiting Shelter	160,000
Bus Stop Signs	20,000
TOTAL	$3,028,000

SURVEILLANCE AND CONTROL SYSTEM

Control Center Building	$ 385,000
Control Center Equipment	265,000
Surveillance and Control Components	504,000
Television Systems	219,000
Communications	330,000
TOTAL	$1,703,000

TOTAL PRODUCT CAPITAL COSTS $4,731,000.00

TABLE 18

SUMMARY OF OPERATING RESULTS FOR PLAN B (12 ROUTES)
I-35W URBAN CORRIDOR DEMONSTRATION PROJECT
INITIAL YEAR OF OPERATION

TRANSIT SERVICE PLAN COSTS	PLAN B (12 ROUTES)
Service Plan Operating Costs	$558,800
Savings Resulting from Local Service Reductions	-272,000
Cost Differential	$286,800
TRANSIT SERVICE PLAN REVENUES	
Passenger Revenues	$689,700
Revenues Lost to Local Service	-360,600
Cost Differential	$329,100
TRANSIT SERVICE PLAN RESULTS	
Net Revenue	$329,100
Net Operating Costs	-286,800
Surplus	$ 42,300
SURVEILLANCE AND CONTROL SYSTEM COSTS	
Personnel	$100,000
Maintenance	46,000
Utilities	+ 2,000
Cost	$148,000
MARKETING COSTS	
Creative Planning	$ 23,150
Advertising for Metering	15,500
Advertising for Express Bus Service	58,500
Marketing Coordination	+ 5,000
Cost	$102,150

BENEFITS

Quantifiable Benefits

Three different benefits of the I-35W Urban Corridor Demonstration Project are quantified: accident reduction; travel time savings; and travel cost savings. Each is discussed below:

- Accident Reduction - Accident history for the past three years revealed that 38 percent of the accidents on I-35W between County Road 42 and the Minneapolis CBD occurred in the morning and afternoon peak periods. Assuming that the goal of 20 percent accident reduction in the peak periods is achieved, 95 fewer accidents per year would occur. Texas Transportation Institute has placed a value of $700.00 on the average accident. Thus, the annual accident reduction benefit is estimated at $66,500.00 (95 accidents per year @ $700.00 per accident).

- Travel Time Savings - Assuming that the goal of a minimum speed of 40 MPH on all sections of the metered freeway and a goal of an 18 minute travel time on the freeway in the Study Area is achieved, savings in travel time to the auto drivers, auto passengers, and express transit riders will occur. This benefit was computed by calculating the vehicle hours of time saved in the peak periods under the assumption the above speed and travel time goals are achieved. This total of 310 vehicle hours was then multiplied by 1.4 people per vehicle to arrive at people hours. Texas Transportation Institute recommends using $2.70 per person per hour for a time value. Assuming 250 days of service, the annual travel time savings is $293,000.00 (310 vehicle-hours x 1.4 people per vehicle x $2.70 per person per hour x 250 days per year).

- Travel Cost Savings - For the corridor users that switch from their autos to express transit service, a travel cost reduction will occur. Data developed for use in the modal choice model revealed that the average out-of-pocket auto round trip cost was $2.40 ($1.71 per person assuming 1.4 people/auto) and that the average transit round trip cost was $0.90 (Table 11). Therefore, the average travel cost savings per person is $0.81 ($1.71 - $0.90). The Patronage Estimates in Table 10 for Plan B indicate that 1081 of the 2990 transit patrons would be former auto users. Thus, the annual travel cost savings would be $219,000.00 (1081 patrons x $0.81 x 250 days per year).

Qualitative Benefits

The major qualitative benefits of the project include:

- Increased CBD accessibility,
- Reduced parking demand in CBD,
- Reduced reaction time to incidents on freeway,
- Elimination of need for second or third car in certain families,
- Increased opportunity for second job-holder of same family,
- Improved mobility for corridor residents,
- Reduced air pollution, and
- Affected impacts on land use and land values adjacent to bus terminal facilities.

SUMMARY OF TOTAL ANNUAL BENEFITS

ITEM	COST SAVING
ACCIDENT REDUCTION	$ 66,500.00
TRAVEL TIME SAVINGS	293,000.00
TRAVEL COST SAVINGS	219,000.00
TOTAL	$ 578,500.00

IMPLEMENTATION

Figure 30 shows the timing for Phases B through E of the corridor demonstration project incorporating the "Step-Start" operation. The "Step-Start" plan calls for three basic steps in the implementation of the bus-on-metered freeway project: initiation of express bus service; installation of fixed facilities, i.e. park-ride -- kiss-ride sites, shelters and signs; and finally the opening of bus ramps and metering of the freeway. The step-start programming permits better evaluation of the impact on the corridor of the various major components of the project.

Bus operations on the proposed new Plan B express routes were initiated during the summer of 1971 and should be in full operation in the second quarter of 1972. The second step would be completed in the third quarter of 1972, with the provision of park-ride lots and waiting shelters along the express bus routes (TaskB4.0 and Task C5.0). The third step is the implementation of freeway metering and provision of preferential bus access during the second quarter of 1973.

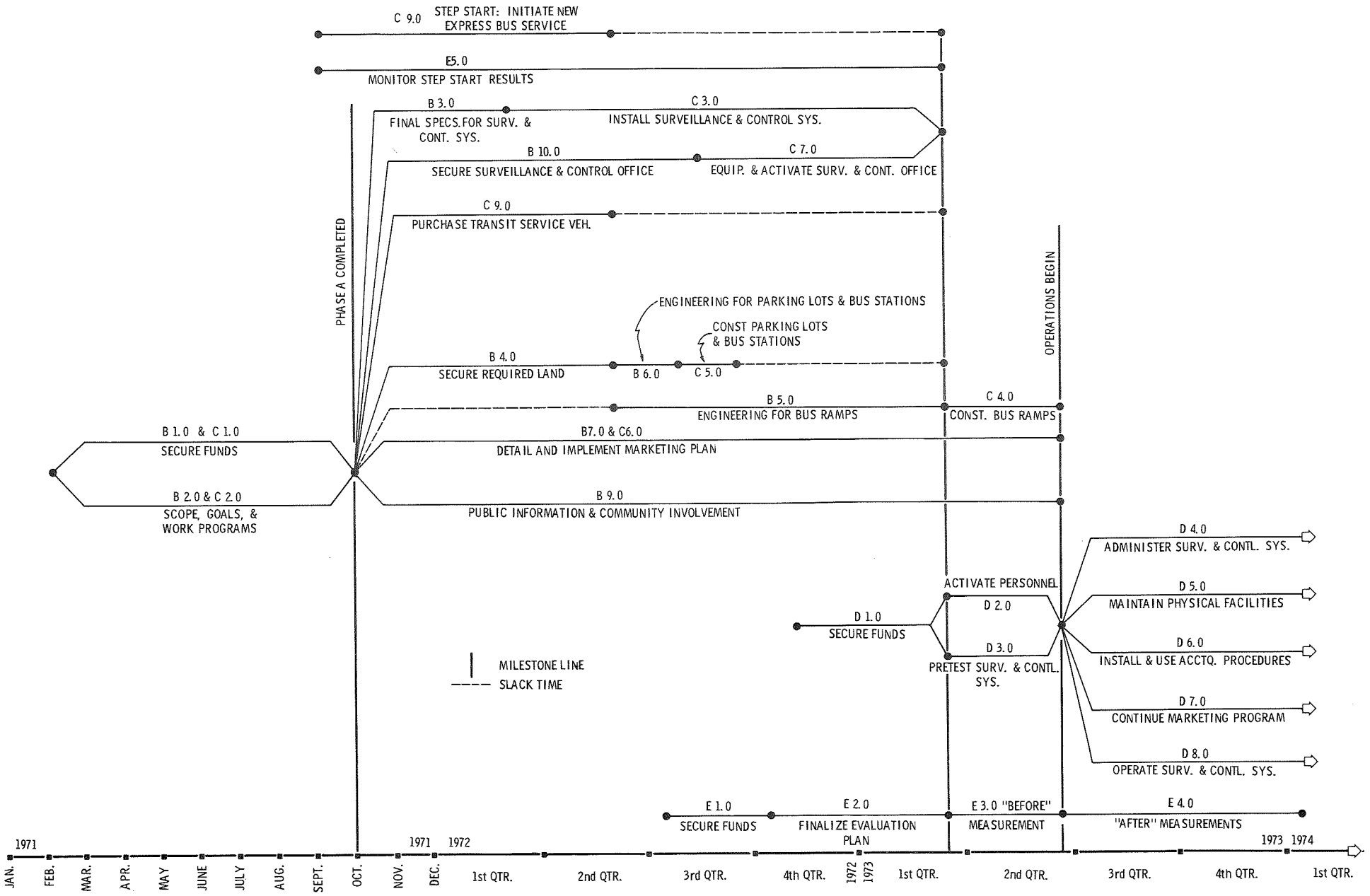
This report identifies the existing express bus routes within the corridor; express service was added in August, 1971, on two of the proposed Plan B routes. It is expected that other routes will be added as the project proceeds to the planned level of activity. This approach to the initiation of express bus service on I-35W will improve evaluation of results and permit the development of an effective bus service marketing program.

Along with bus procurement, marketing and engineering work tasks to be completed in Phase B, there are certain social issues which must be addressed. Successful implementation of the bus-metered freeway project will require solution of the engineering, marketing, and community involvement problems. A strategy for approaching these problems is developed in the detailed technical memorandum on the Marketing Plan.

FIGURE 30

I 35 W URBAN CORRIDOR DEMONSTRATION PROJECT

PHASE B - PHASE E FLOW DIAGRAM

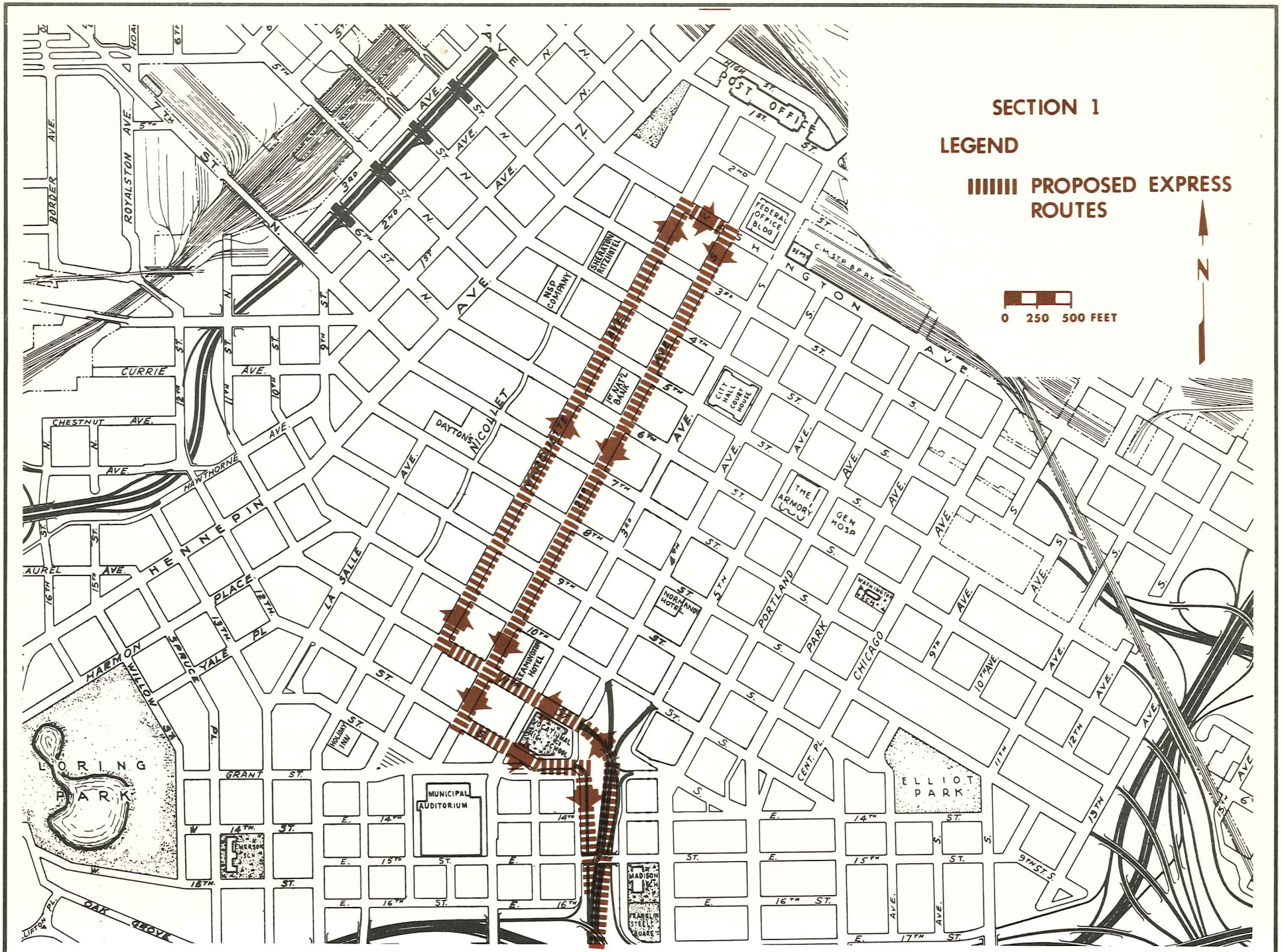


APPENDIX A

BUS-METERED FREEWAY SYSTEM ELEMENTS

LEGEND

Ⓣ	TV CAMERA
Ⓜ	RAMP METER SIGNAL
D2	DETECTOR AND NUMBER OF DETECTORS
Ⓕ	FLASHERS
	PROPOSED BUS RAMPS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PROPOSED EXPRESS ROUTES
0 250 500 FEET
N
POST OFFICE
FEDERAL OFFICE BLDG
C.M.STD.R.R.
NSP COMPANY
SHERATON RITZ HOTEL
CITY HALL COURT HOUSE
THE ARMORY
GEN HOSP
WASHINGTON SCH.
NORMANDY HOTEL
LEAMINGTON HOTEL
HOLIDAY INN
MUNICIPAL AUDITORIUM
EMERSON SCH.
MADISON SCH.
FRANKLIN STEELE SQUARE
ELLIOT PARK
LORING PARK
HENNEPIN
NICOLLET
LA SALLE
PORTLAND
CHICAGO
PARK
AVE.
PLACE
CURRIE
HAWTHORNE
CHESTNUT
AUREL
HARMON
SPRUCE
YALE
WILLOW
GRANT
OAK GROVE
LIFTON PL.
CENT. PL.
BORDER AVE.
ROYALSTON AVE.
HIGH ST.
1ST ST.
2ND ST.
3RD ST.
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7TH ST.
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9TH ST.
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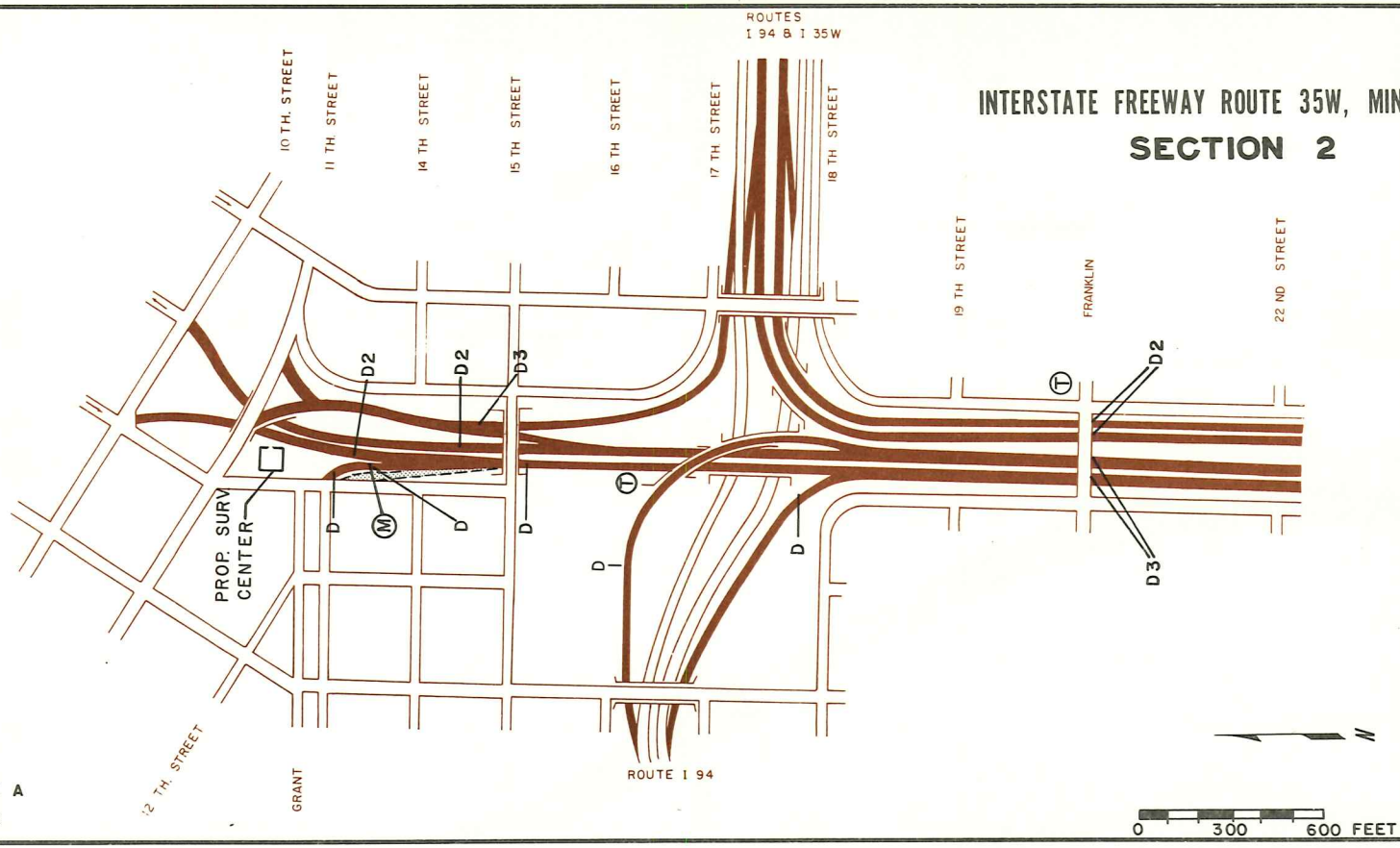
INTERSTATE FREEWAY ROUTE 35W, MINNEAPOLIS

SECTION 2



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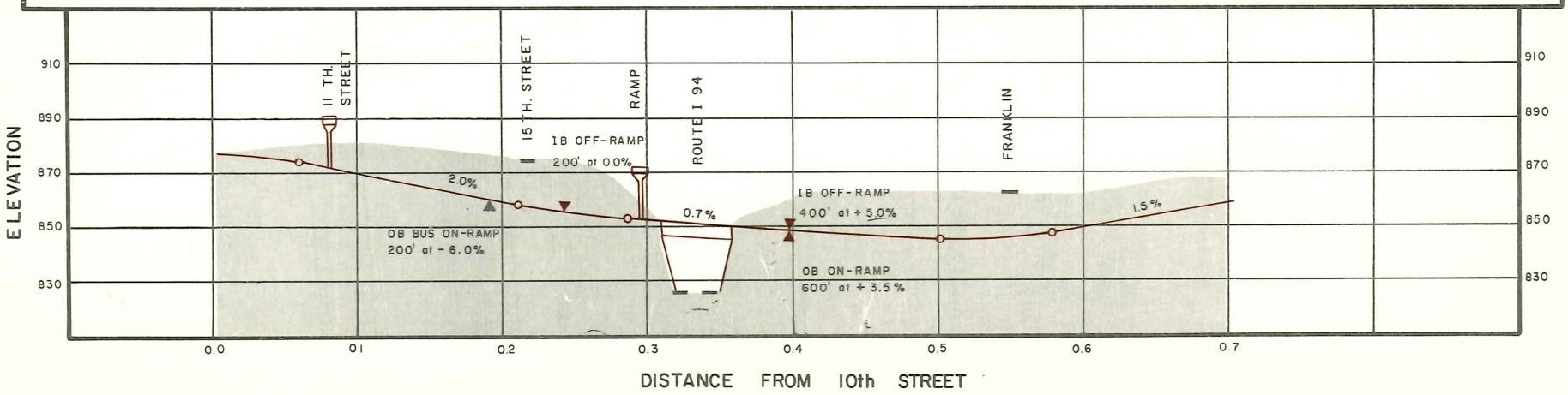

INTERSTATE FREEWAY ROUTE 35W, MINNEAPOLIS

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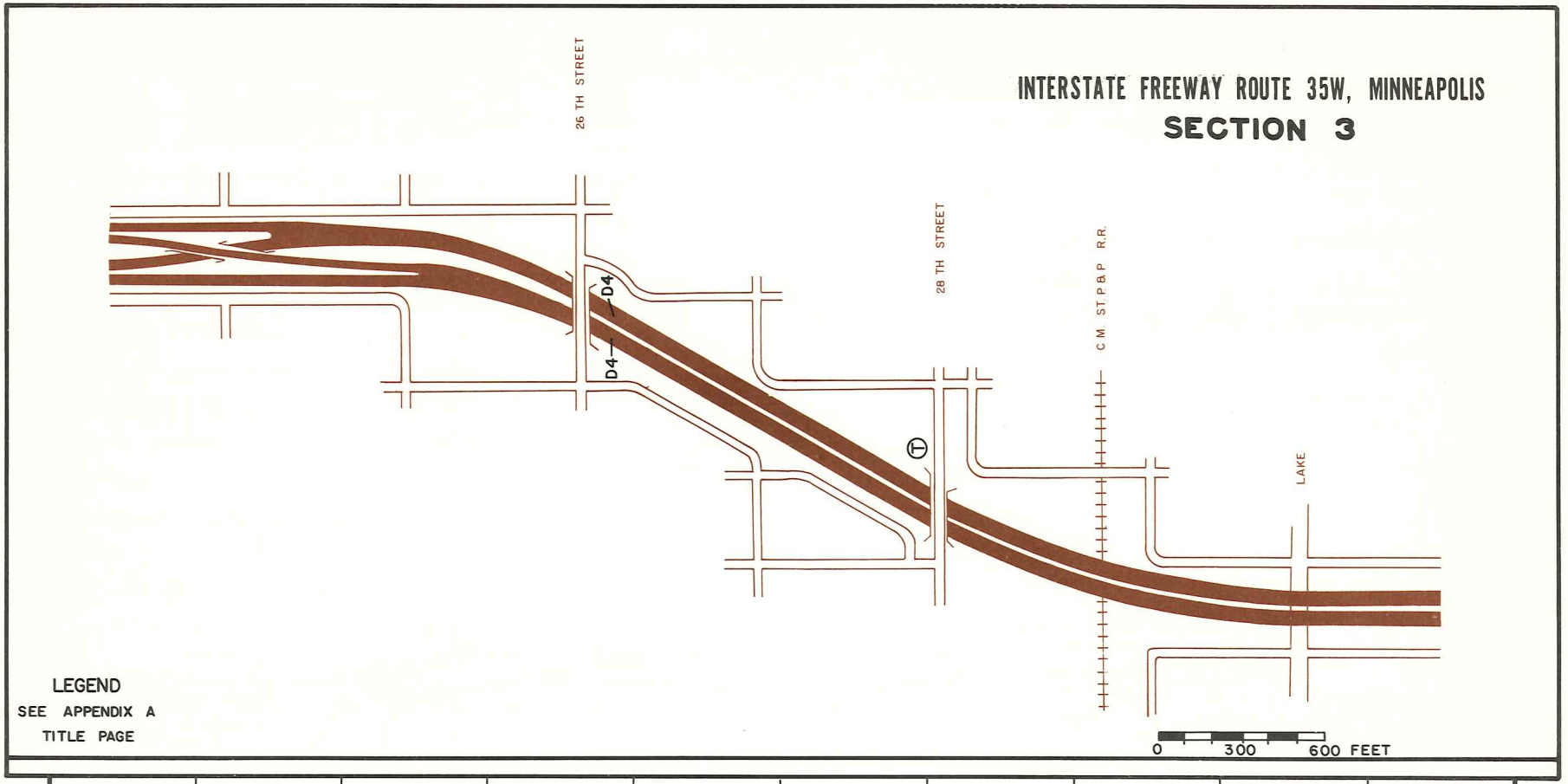

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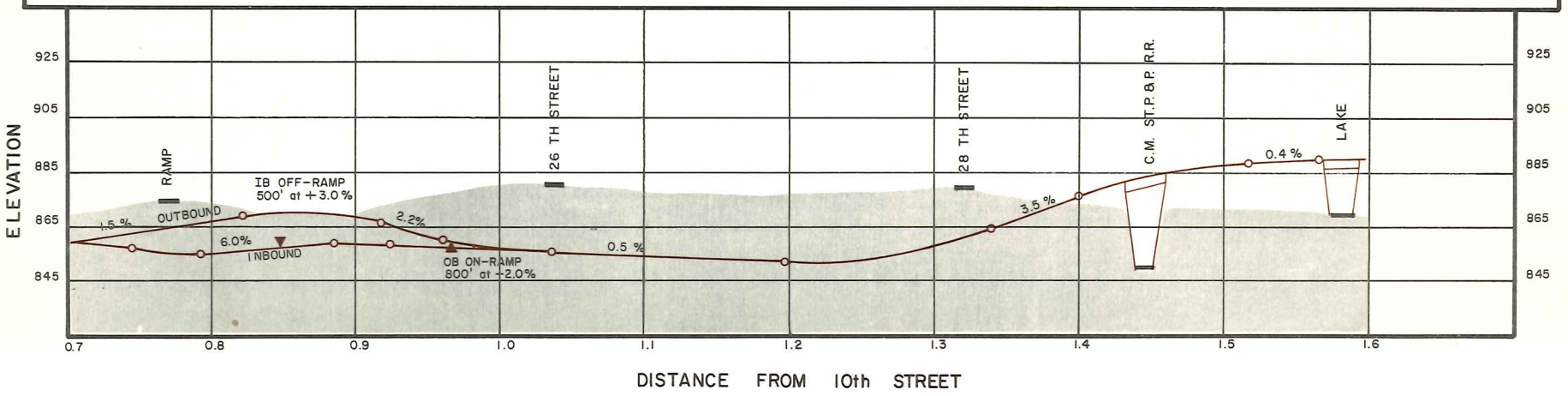

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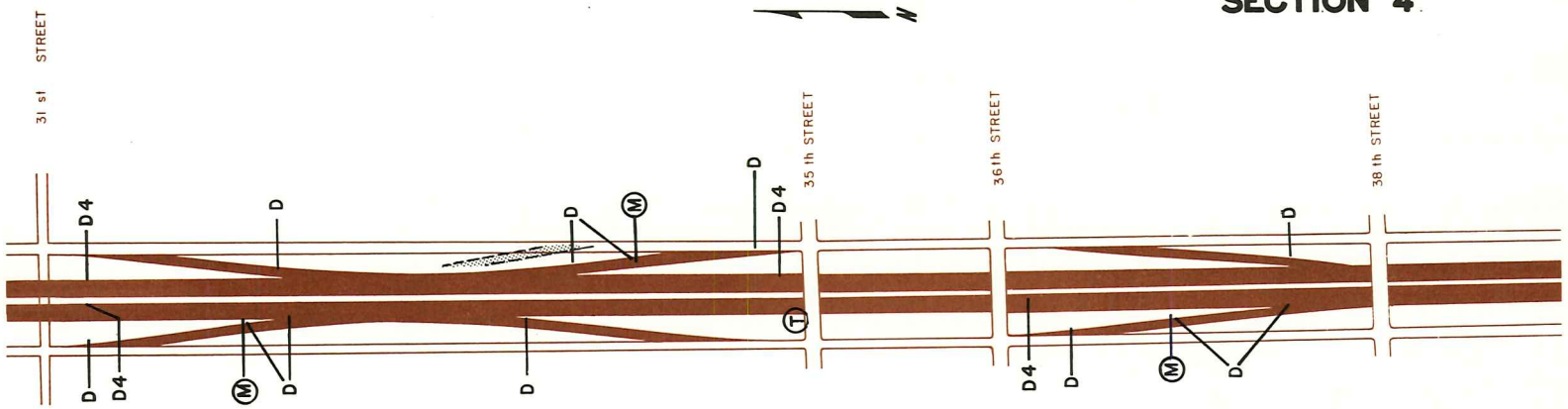

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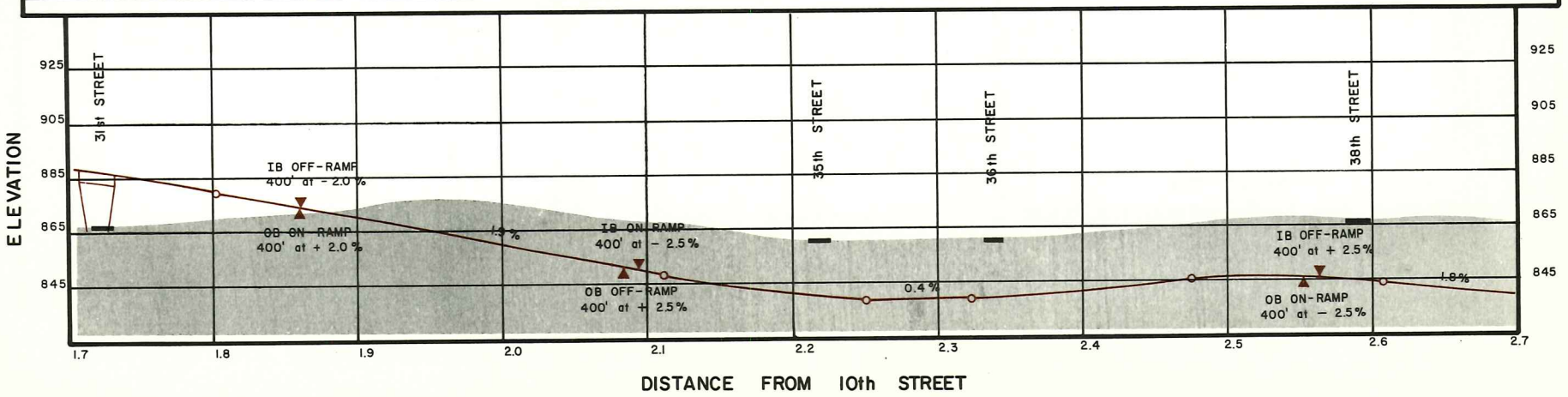

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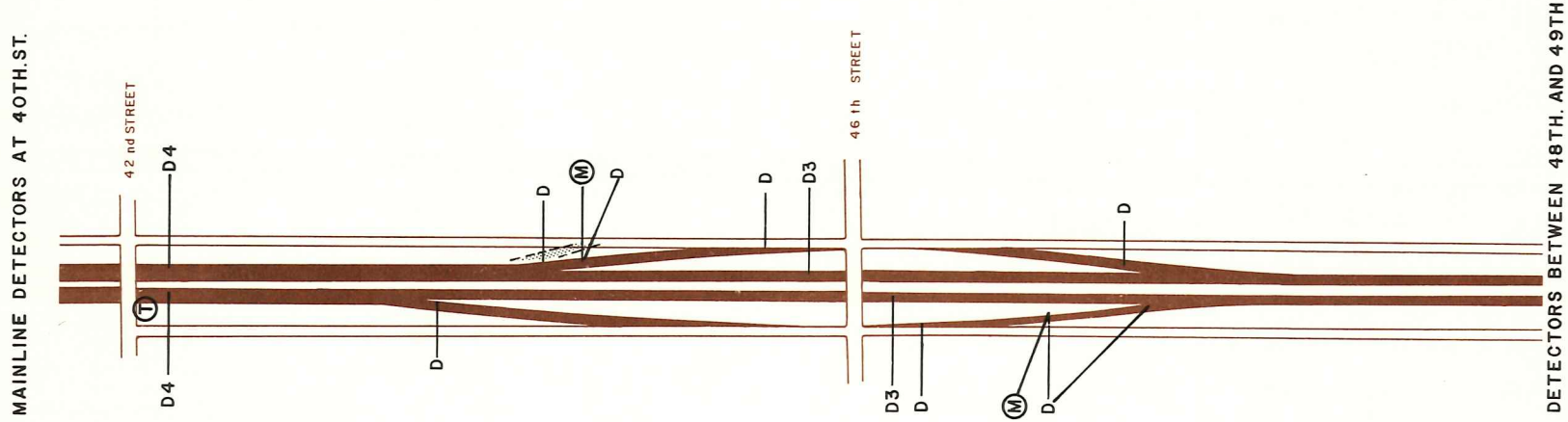

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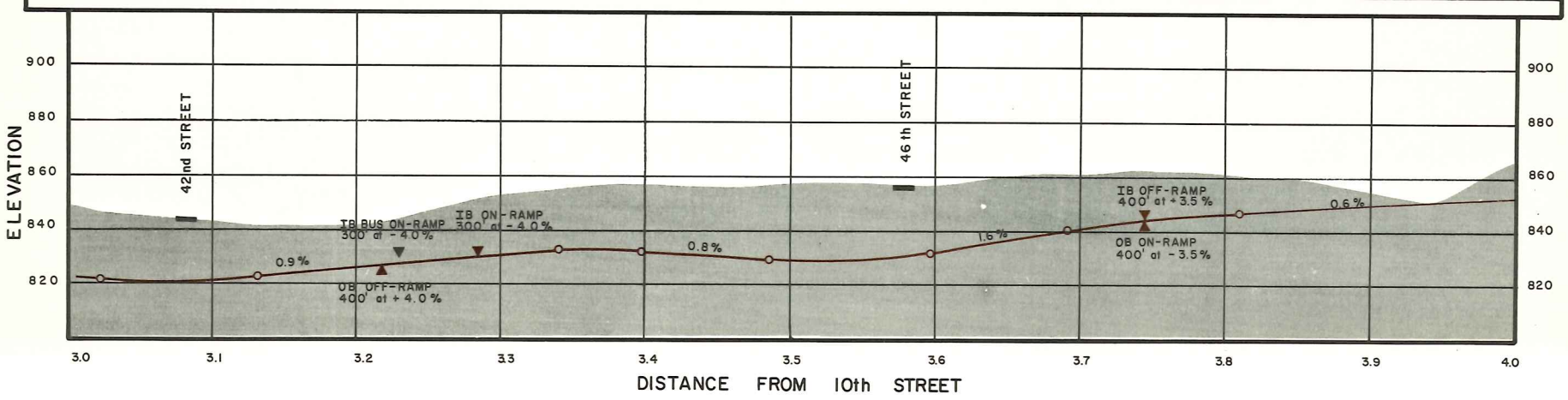

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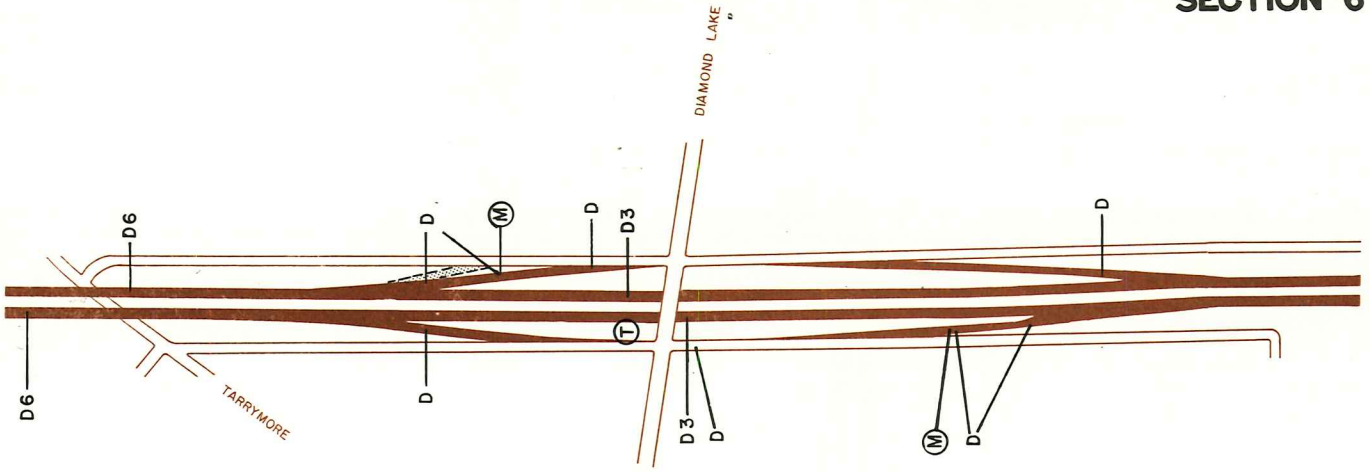

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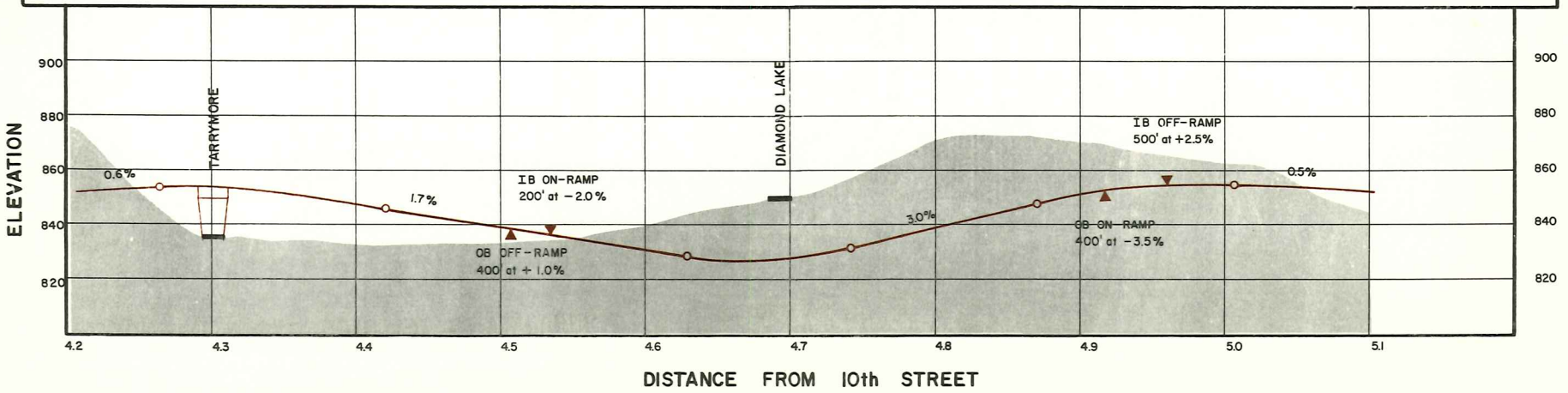

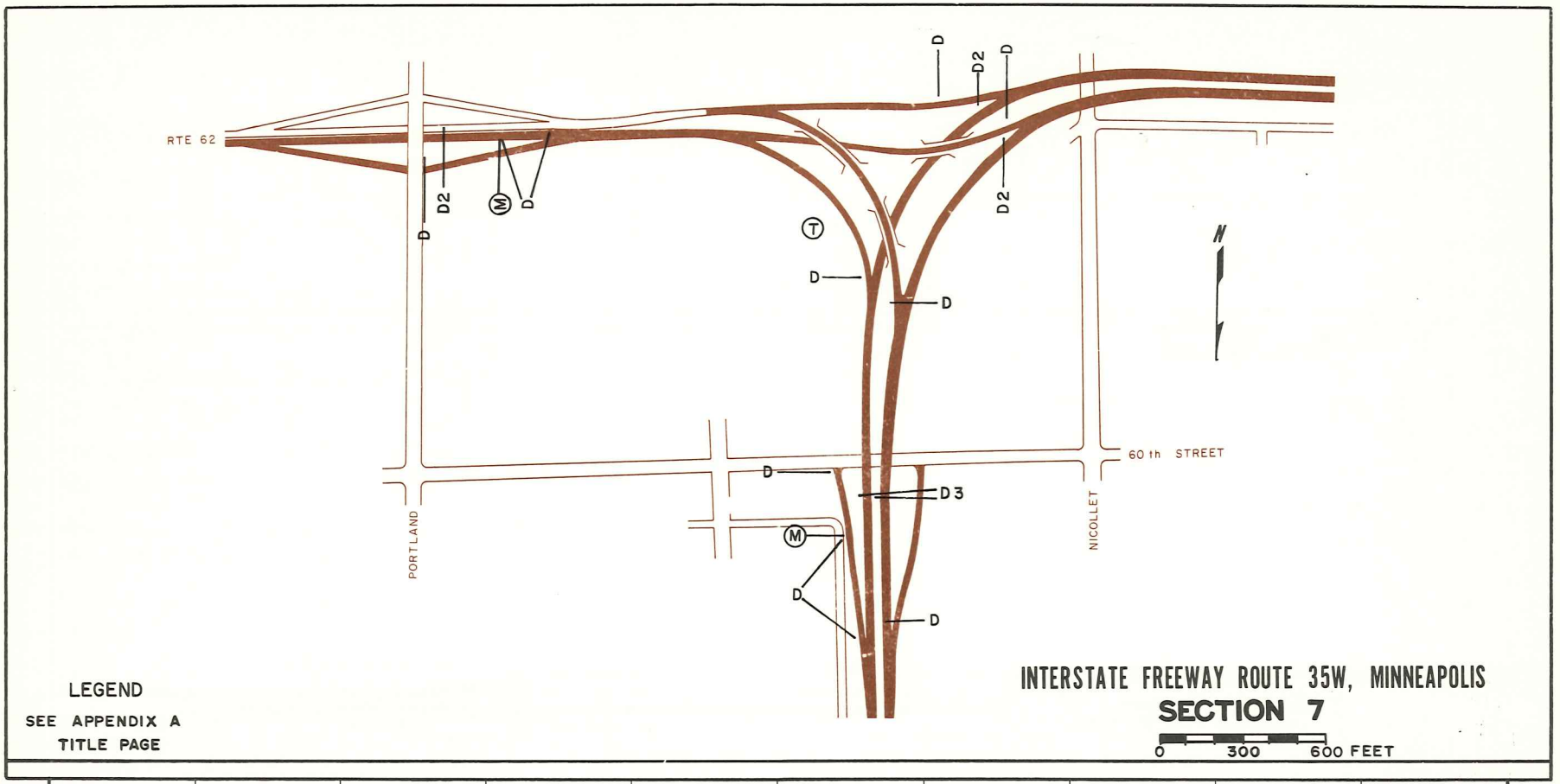
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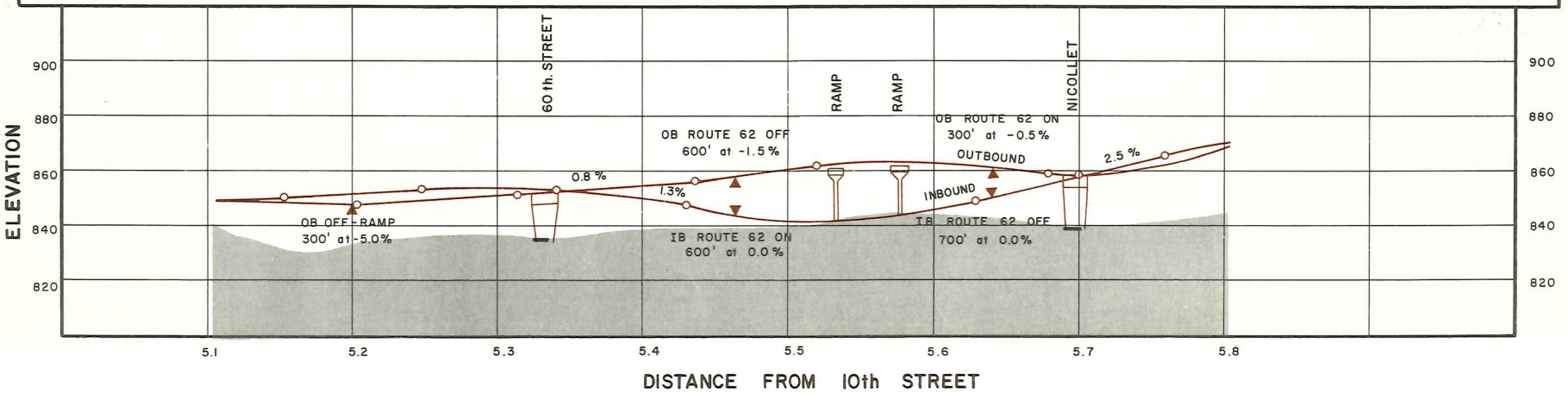
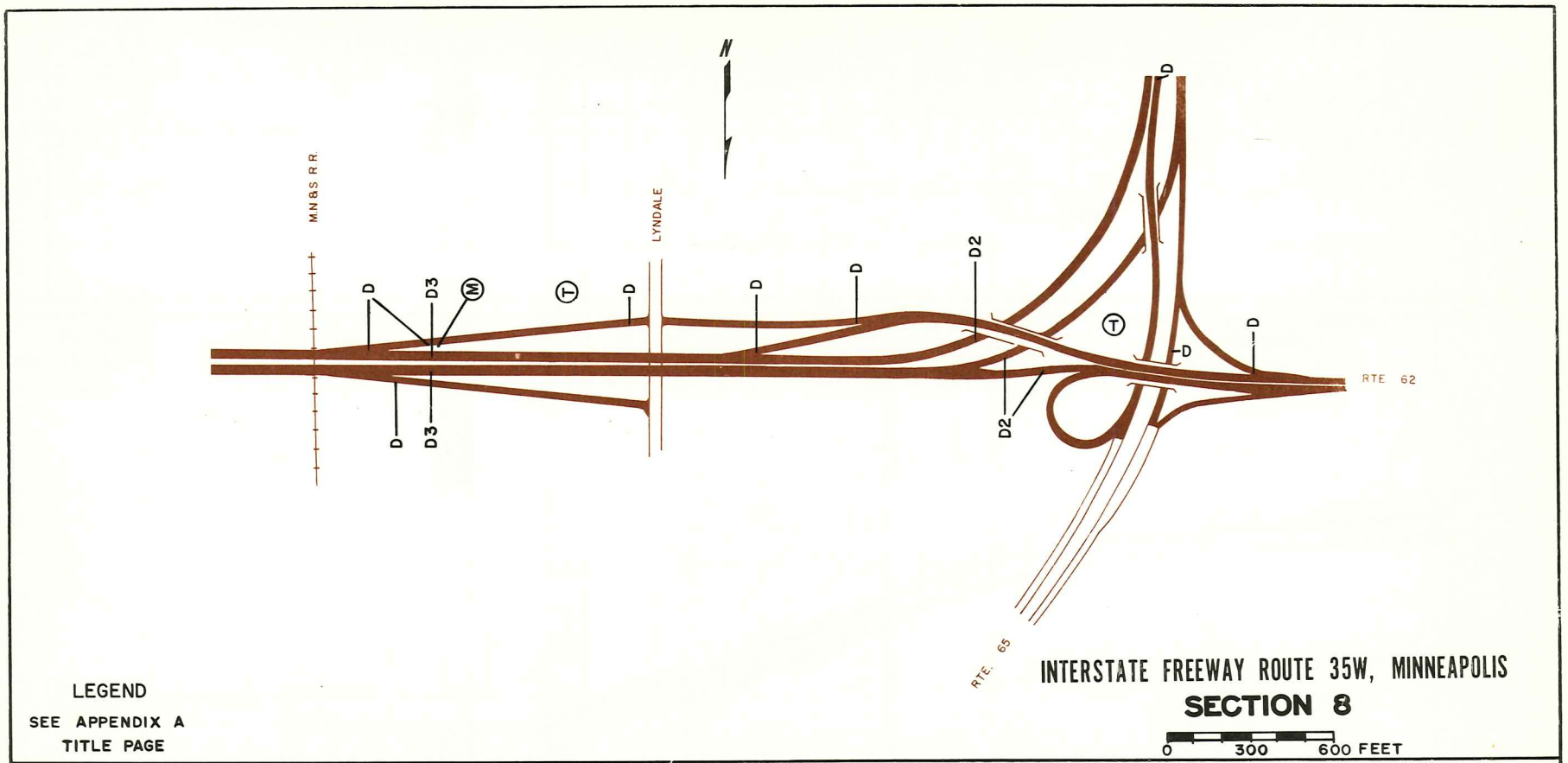

ELEVATION
900
880
860
840
820
60 th. STREET
RAMP
RAMP
NICOLLET
OB ROUTE 62 OFF
600' at -1.5%
OB ROUTE 62 ON
300' at -0.5%
OUTBOUND
INBOUND
0.8 %
1.3%
2.5 %
OB OFF-RAMP
300' at -5.0%
IB ROUTE 62 ON
600' at 0.0%
IB ROUTE 62 OFF
700' at 0.0%
5.1
5.2
5.3
5.4
5.5
5.6
5.7
5.8
DISTANCE FROM 10th STREET



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INTERSTATE FREEWAY ROUTE 35W, MINNEAPOLIS

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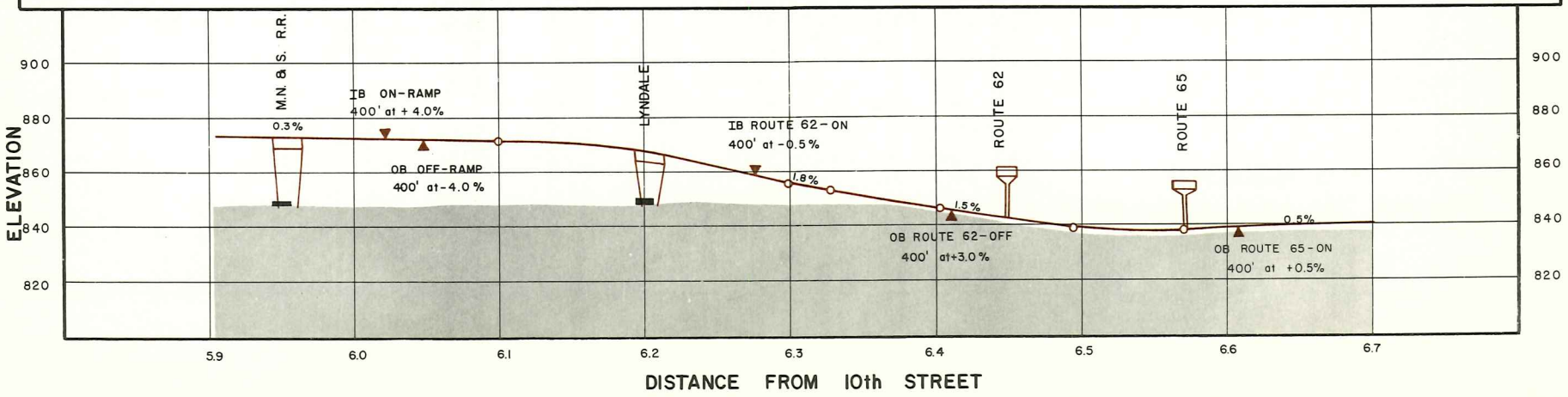

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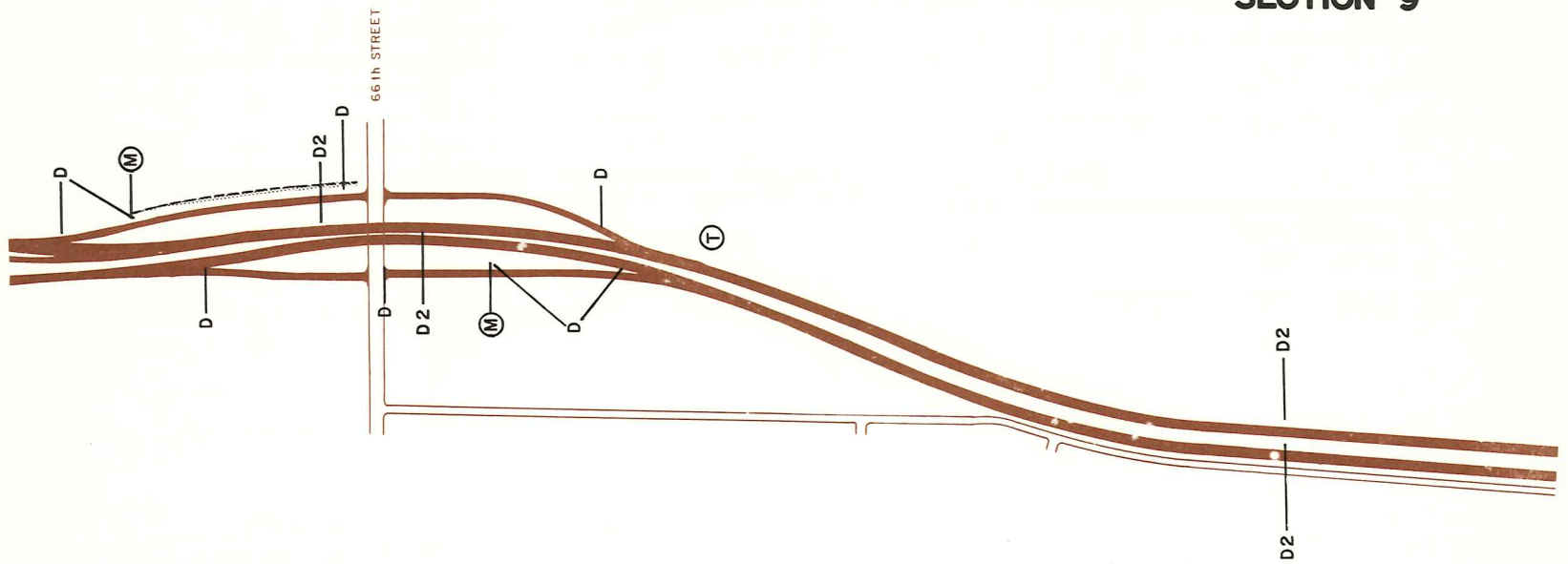

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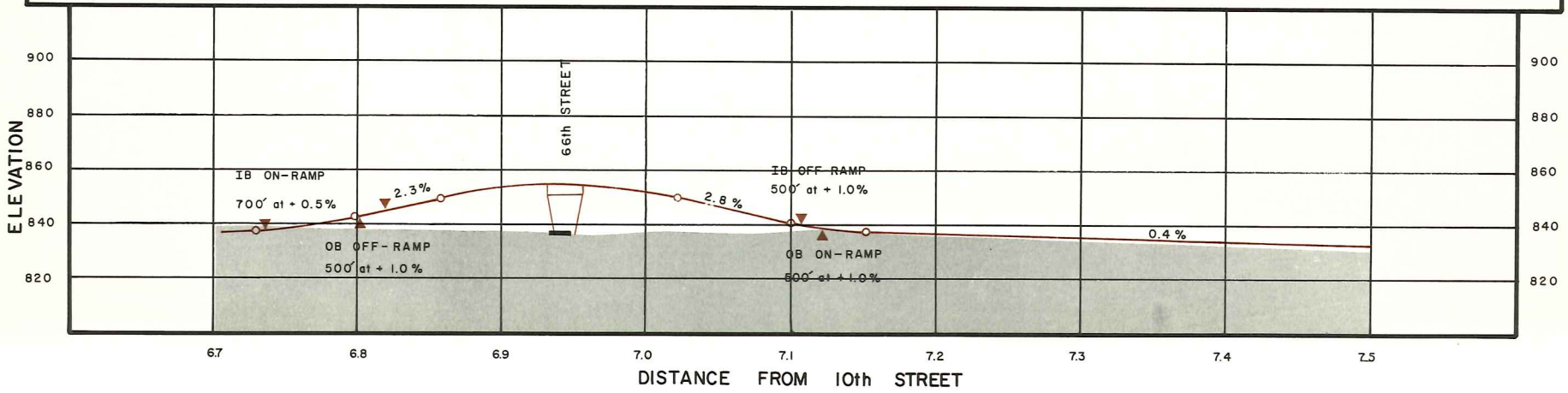

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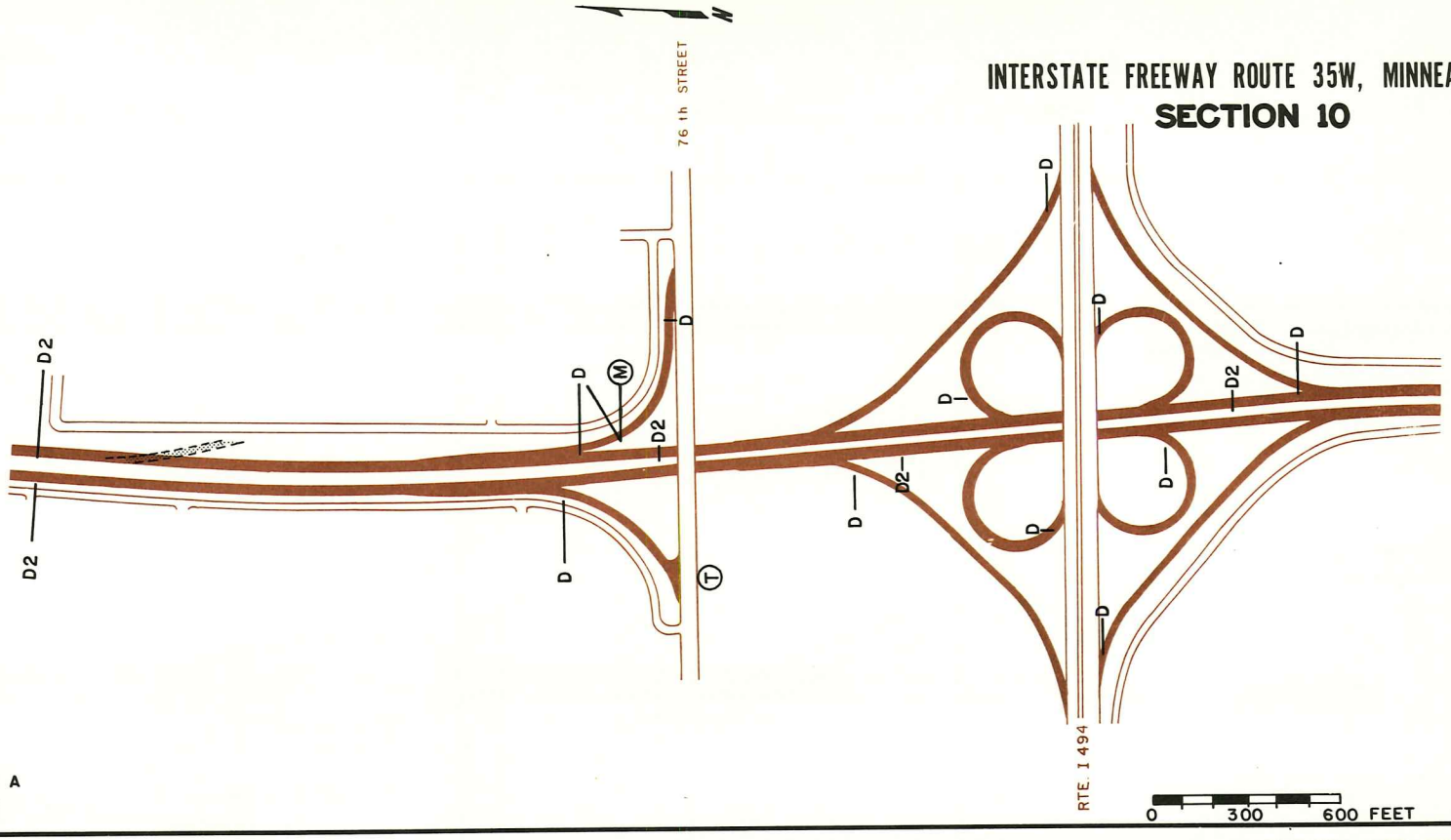

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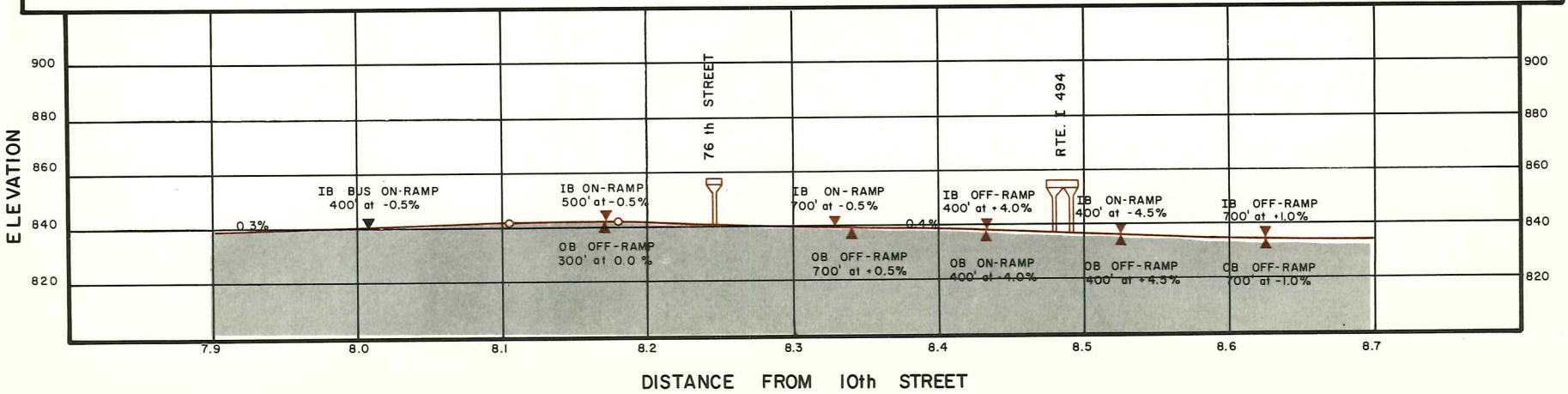

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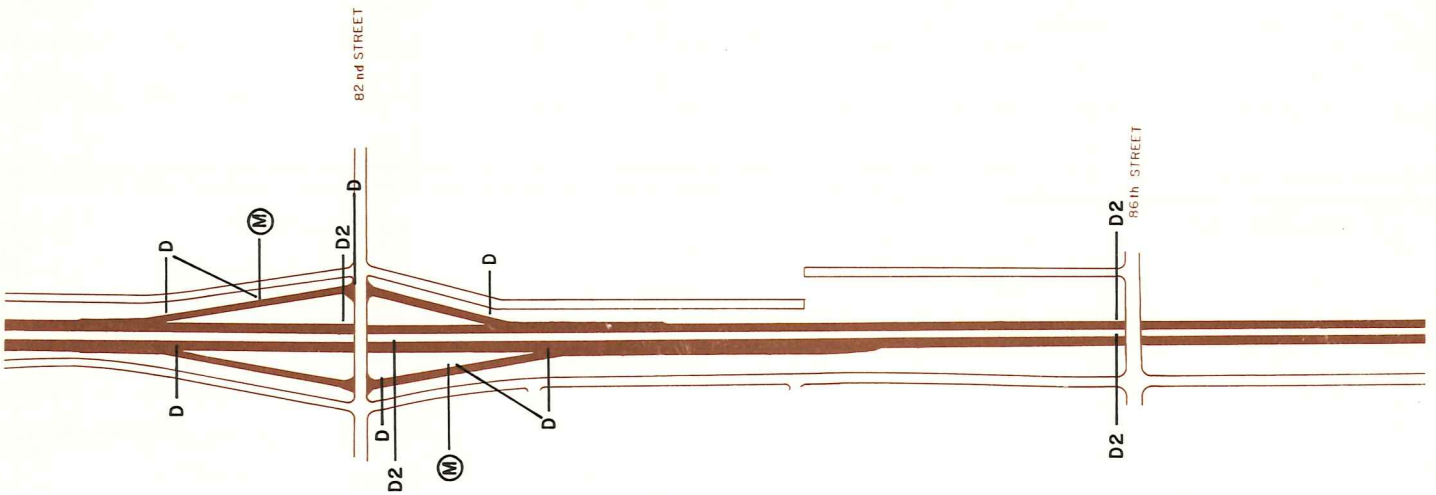

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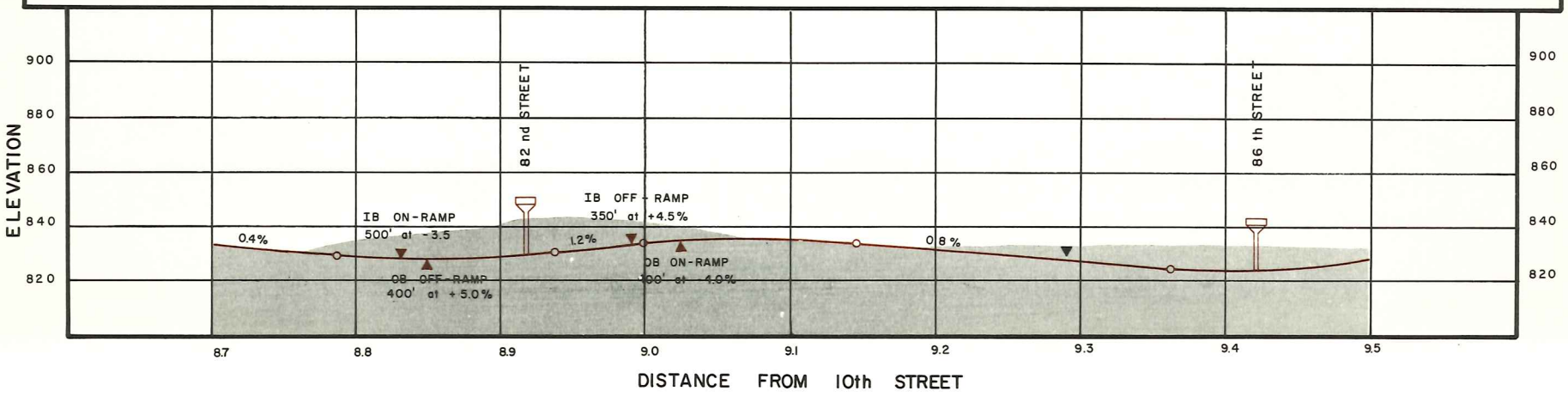

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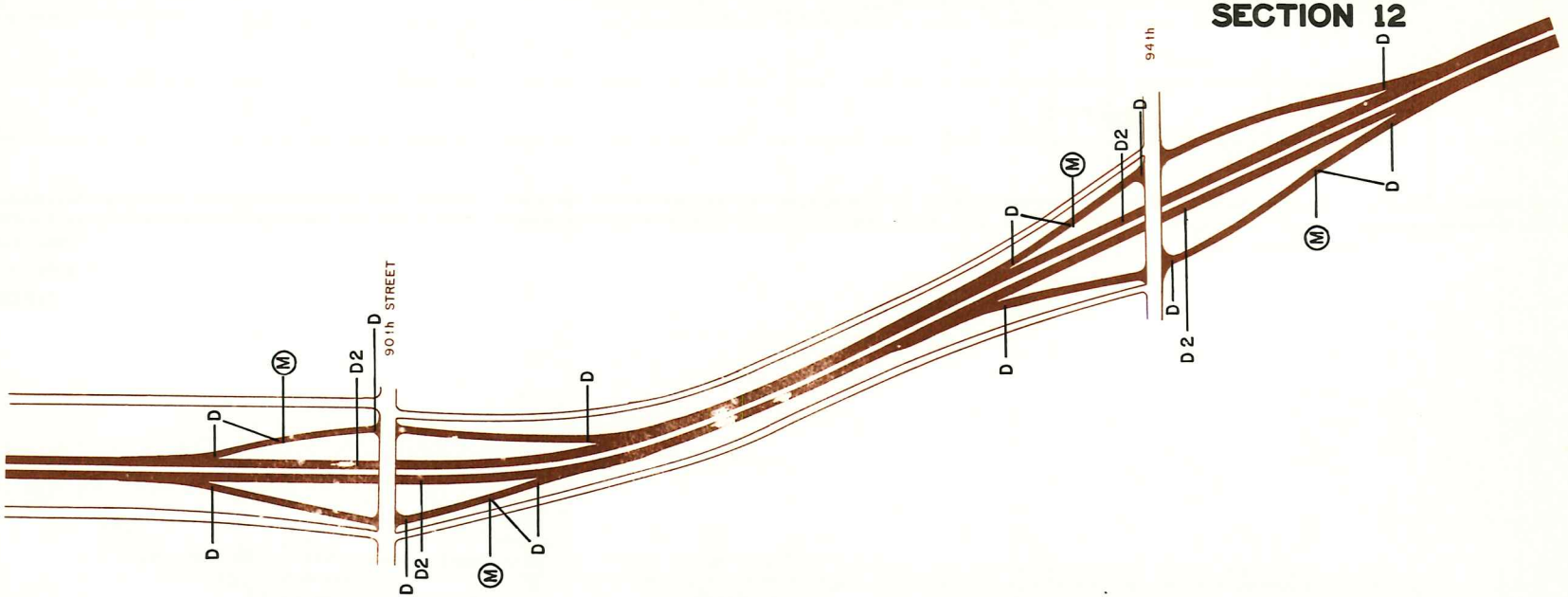

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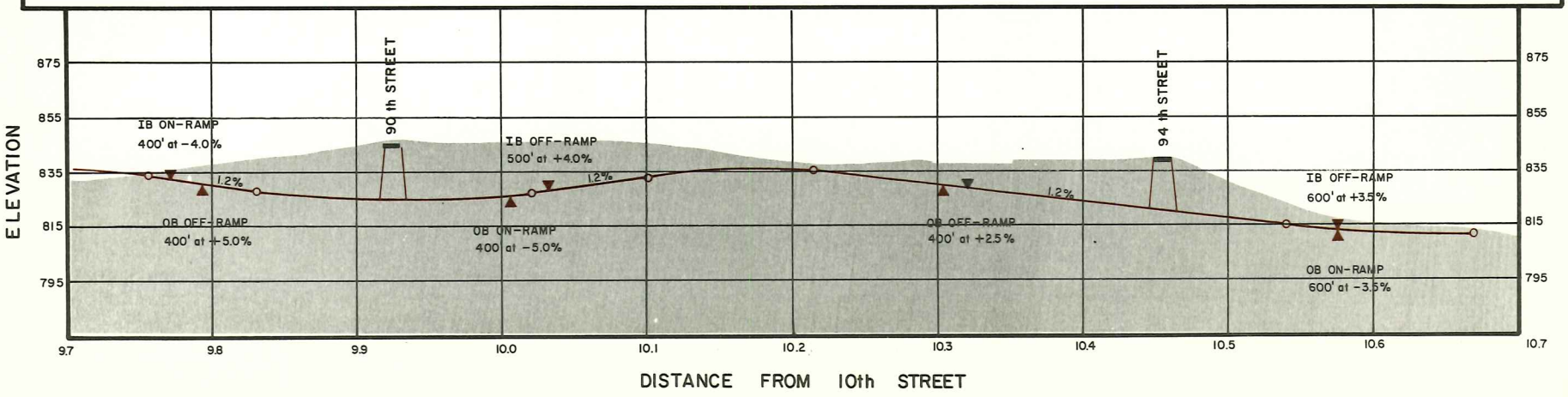

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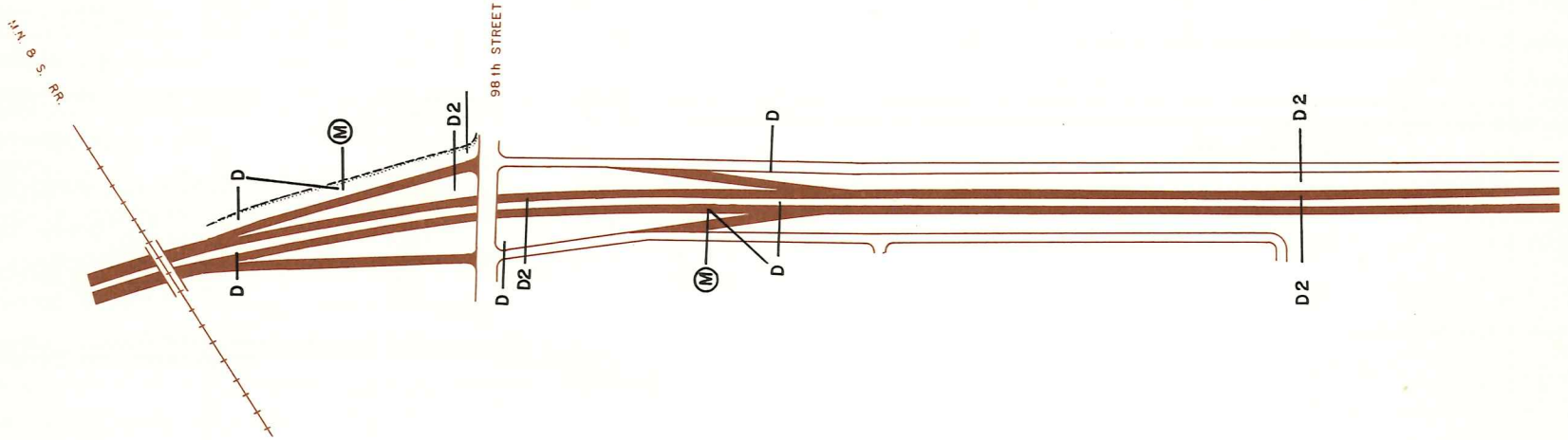

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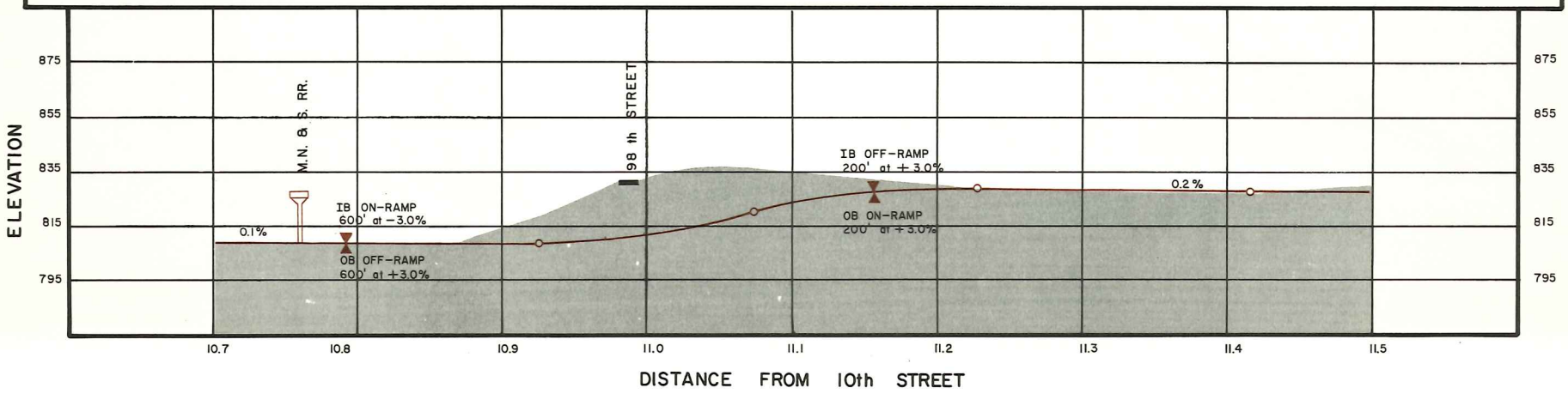

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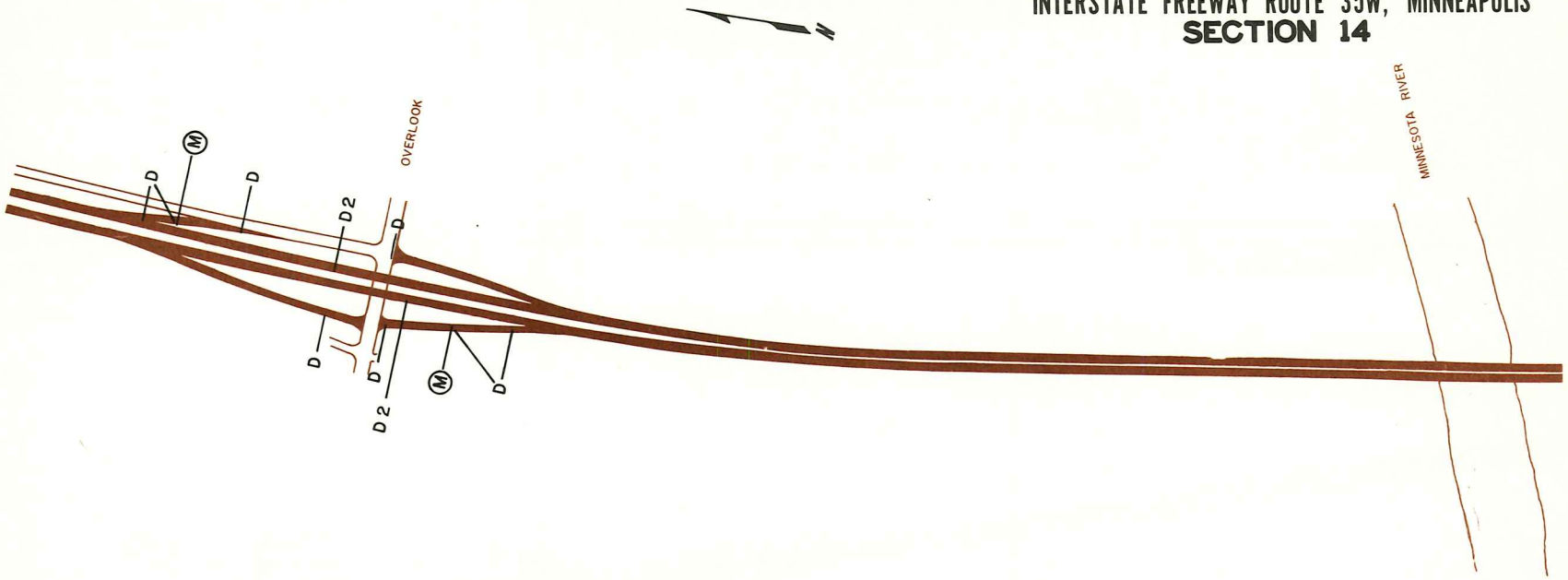

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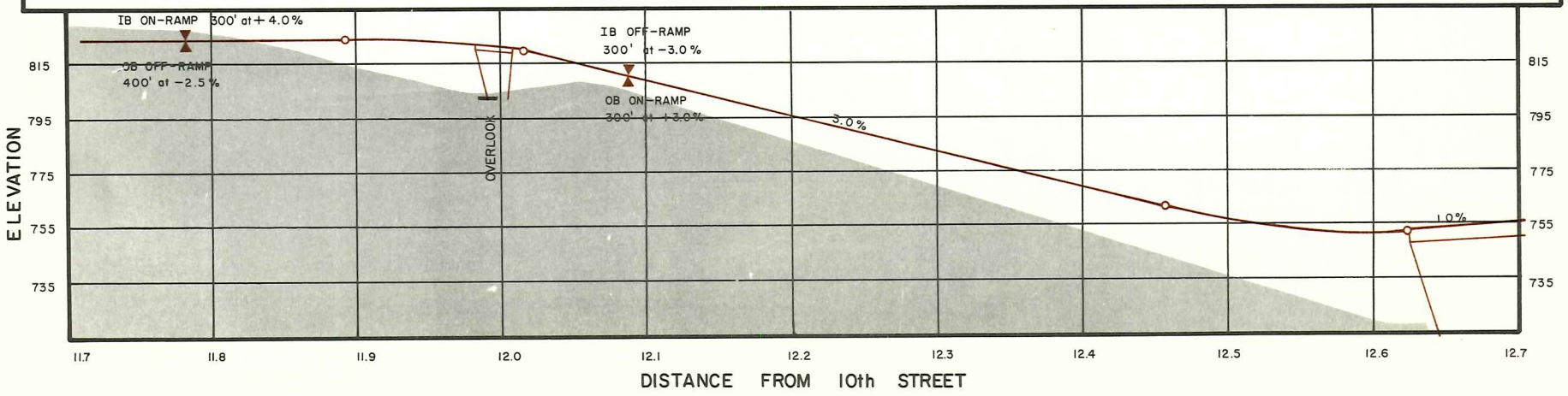

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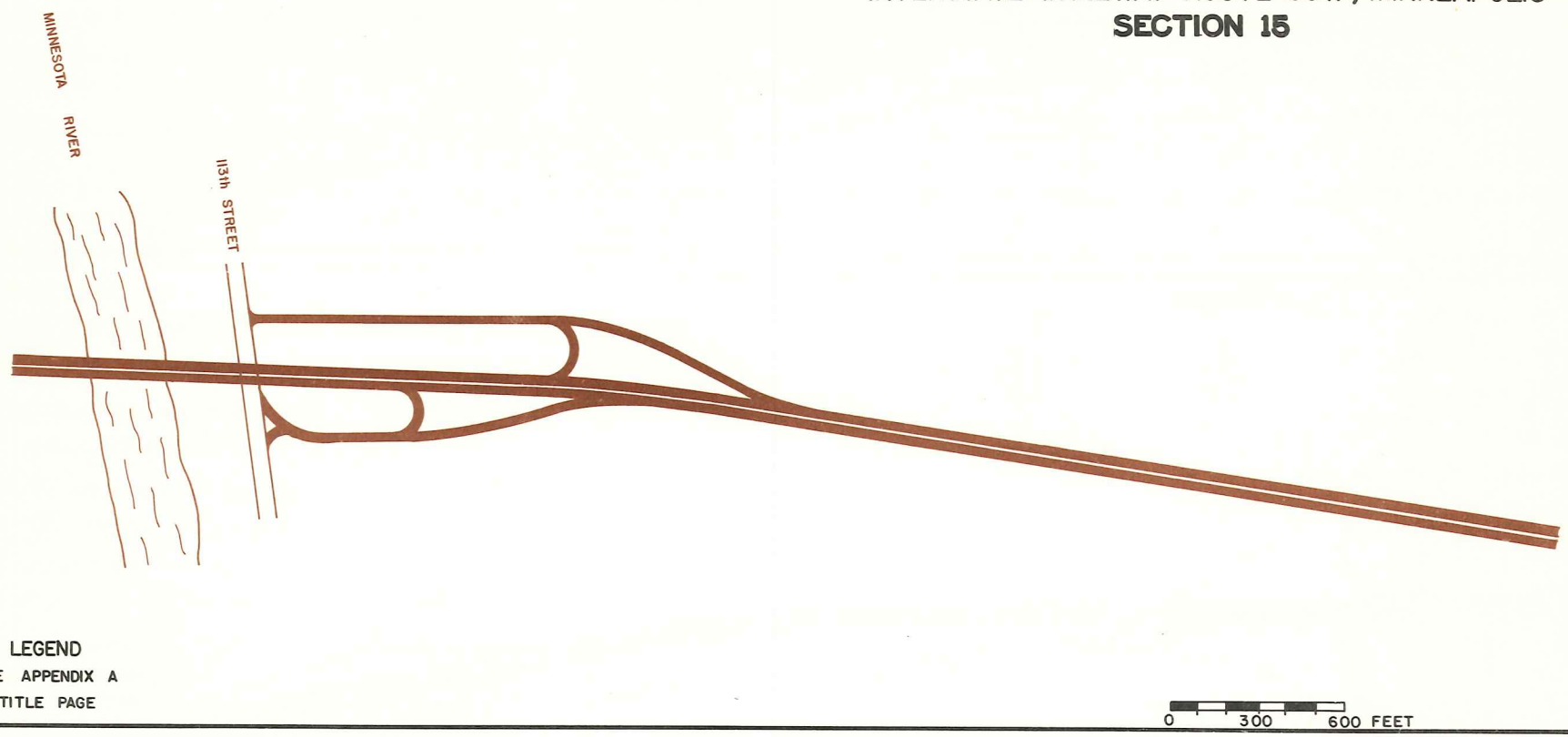

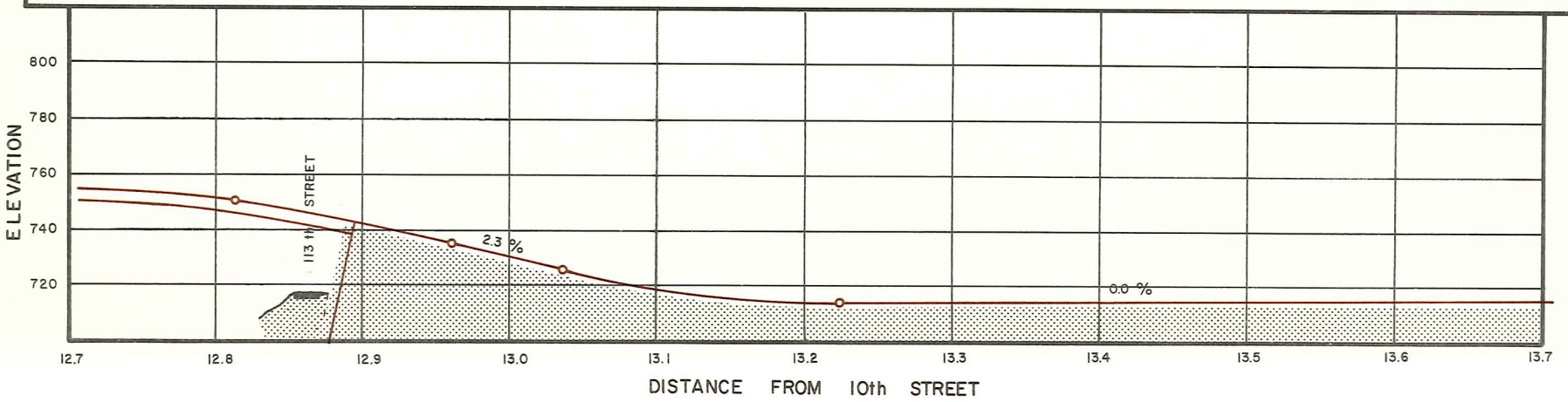

INTERSTATE FREEWAY ROUTE 35W, MINNEAPOLIS
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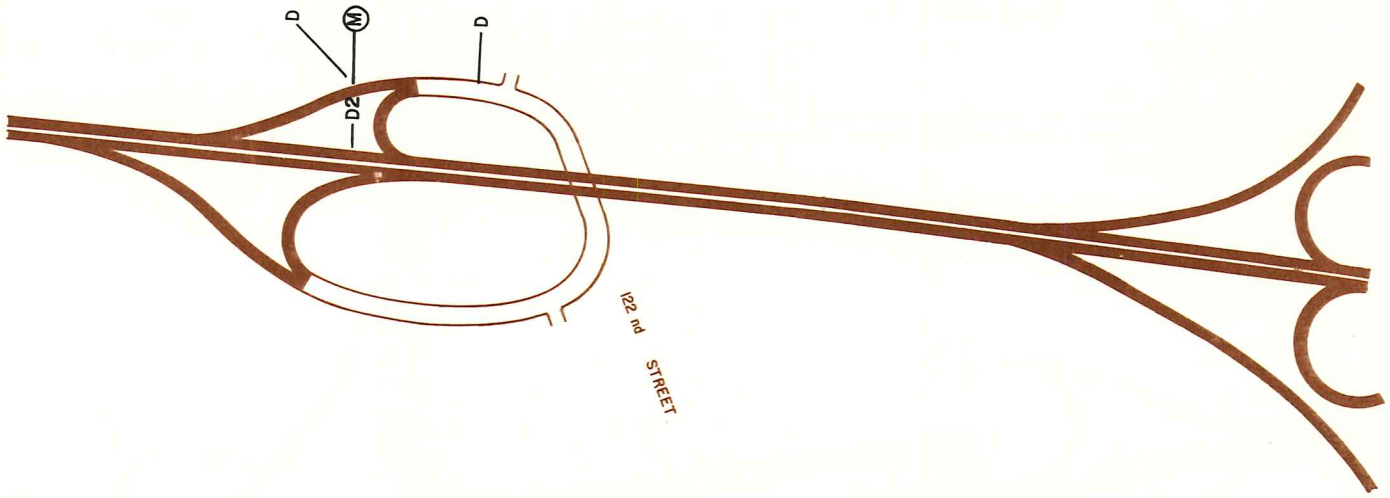

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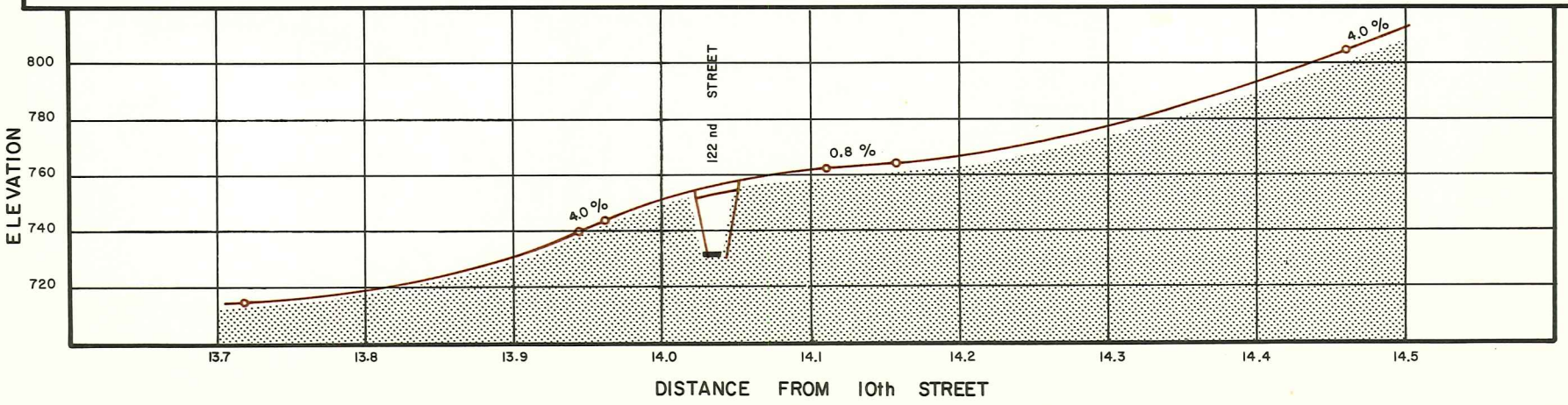

INTERSTATE FREEWAY ROUTE 35W, MINNEAPOLIS
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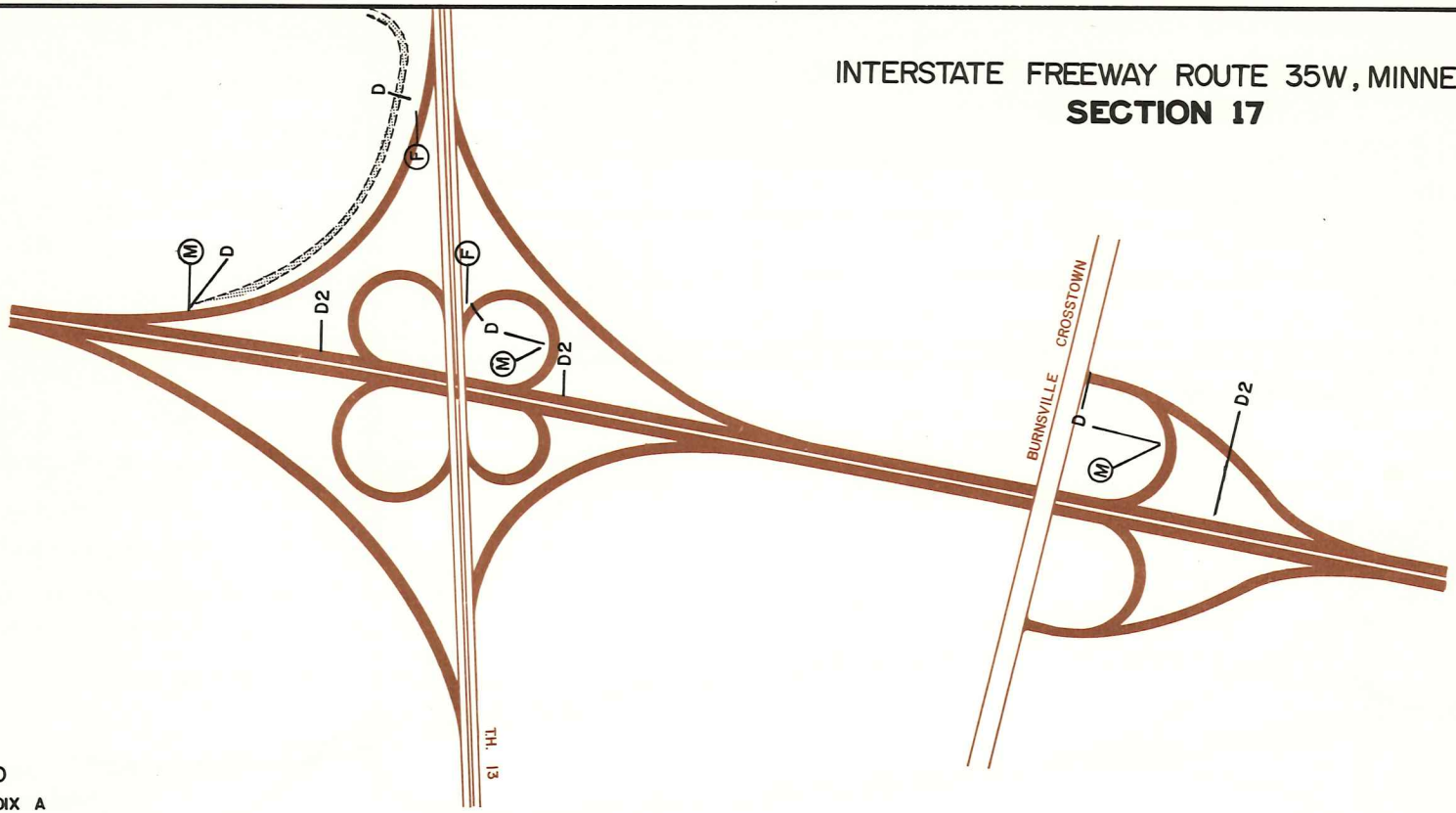

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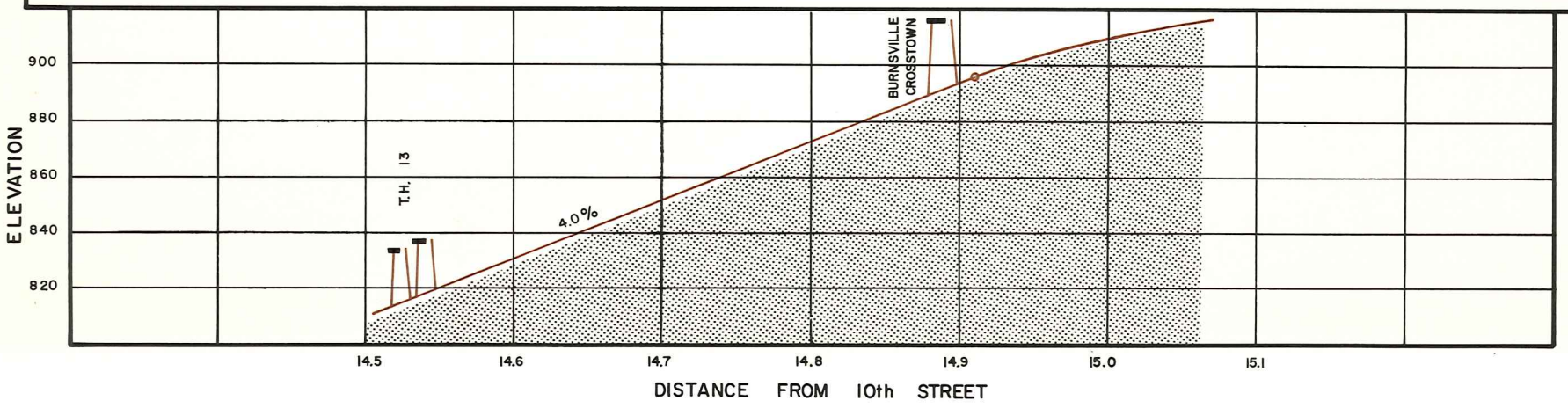
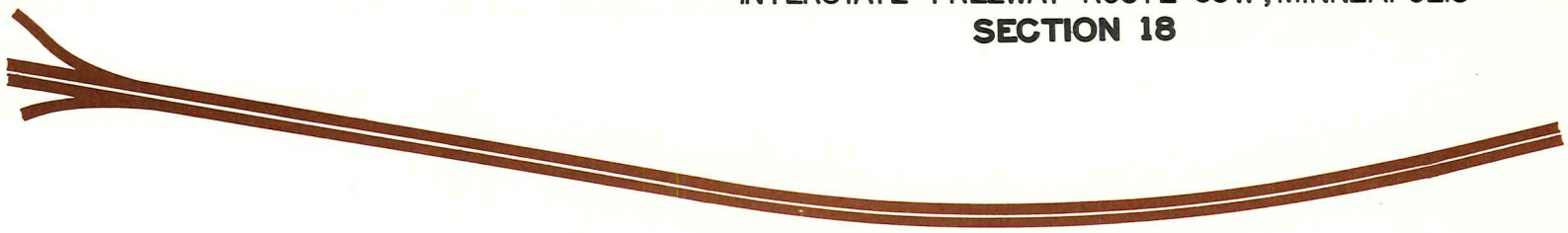


INTERSTATE FREEWAY ROUTE 35W, MINNEAPOLIS

SECTION 18



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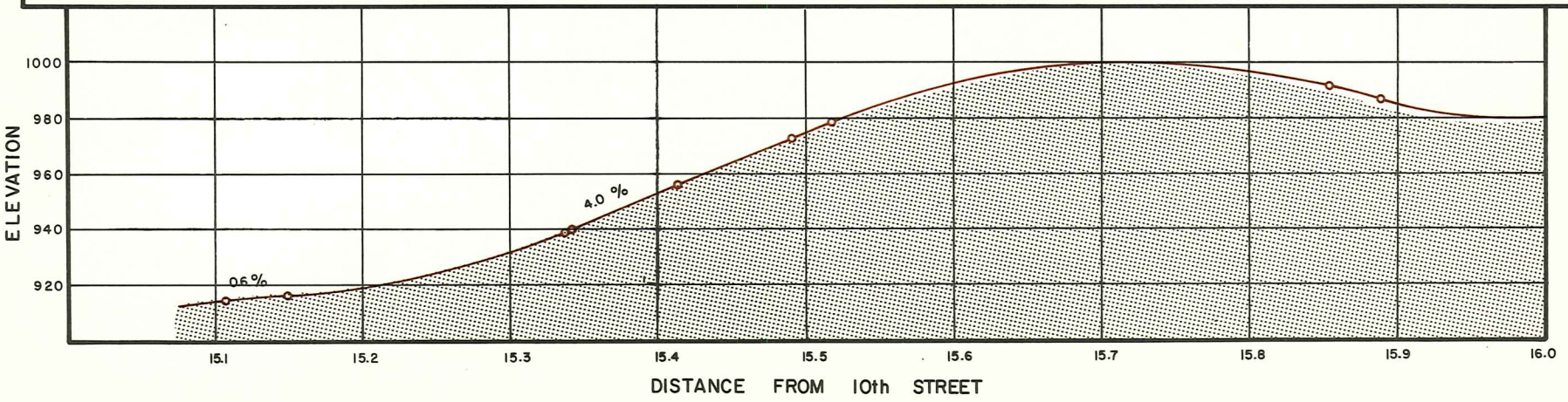

INTERSTATE FREEWAY ROUTE 35W, MINNEAPOLIS

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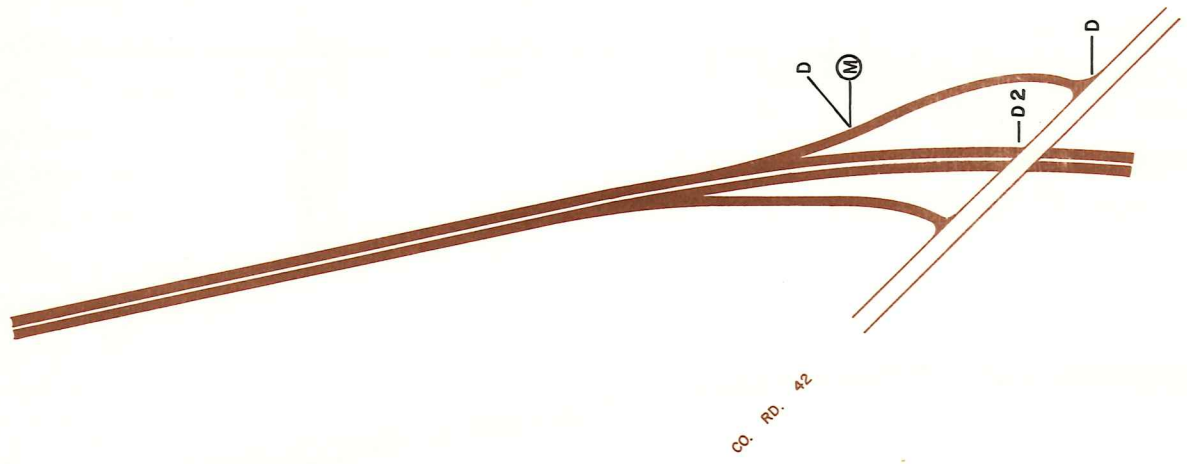

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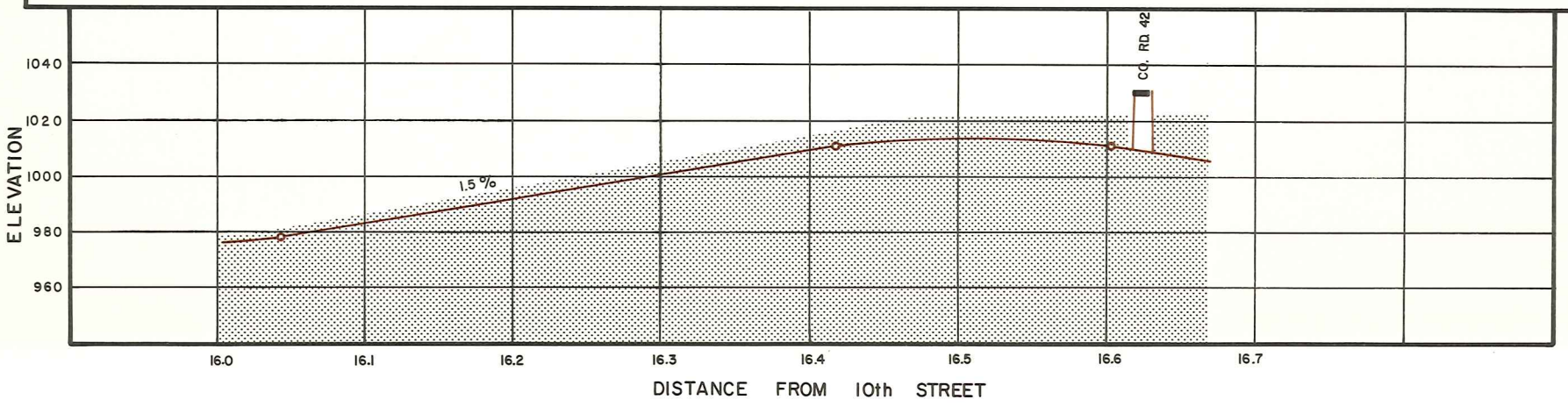


APPENDIX B

MODAL SPLIT MODEL AND PATRONAGE ESTIMATING PROCEDURE

The approach to the development and application of the modal split model in this particular study was substantially different from that followed in most other transit planning projects. The model required for this study need only predict mode choice within a major travel corridor (i.e., the I-35W corridor) rather than an entire urban area and, in addition, the trip estimates developed from the model will be prepared for only a short-term period, approximately two to three years, rather than the 20- to 25-year time span usually considered in longer-range urban planning studies.

One of the primary assumptions in the development and application of the modal split model was that travel patterns within the corridor would remain relatively unchanged between the latter part of 1970 (when the various travel surveys which provide the basis for model development were conducted and the date of implementation of express bus service within the corridor. This appears reasonable when it is considered that some express bus service associated with the corridor demonstration program may be initiated prior to the end of 1971 (though without the metering of automobile traffic on I-35W and the special bus access ramps which would be provided at a later date) and full service implementation is possible by 1973.

Another important assumption underlying the model concept is that the great majority of trips on the proposed express bus routes will be carried during the peak travel periods and in the peak direction. This assumption is based upon analysis of the December, 1970, transit rider survey returns as well as express bus operations experience in other cities. In view of this, the model was developed on the basis of inbound CBD-oriented trips (e.g., origins within the corridor and destinations in the Minneapolis CBD) which occur between the hours of 7:00 a.m. and 9:00 a.m. on a typical weekday. Afternoon return trips occurring during the peak afternoon travel period are assumed to replicate the morning pattern in reverse.

In addition to assuming that corridor travel patterns would remain basically the same over the short term, it was also assumed that socio-economic characteristics of corridor residents would also be relatively unchanged during that period. Therefore, any shift in mode choice that occurs within the corridor over a short-range period will primarily result from changes in the level of service provided by each mode (e.g., automobiles vs. transit). If indeed the level of service is to play such a key role in mode choice and, if the model is to be sensitive to changes in service levels, then a 'trip interchange' type modal split model which apportions total trips between any two zones by mode would be most appropriate. Therefore, primary effort was aimed at the development of such a model.

DATA INPUT

The basic travel data used in the development of the model were obtained from the three surveys described earlier: the on-board transit rider survey and the I-35W auto driver survey conducted in December, 1970, and the CBD cordon survey conducted in the fall of last year. Transit system data including routes, schedules, and fares were obtained from the Metropolitan Transit Commission and the Bloomington Bus Company. Highway system information, such as travel times and route distances, was obtained from surveys conducted in conjunction with the inventory phase of this study and supplemented by data provided by the Twin Cities Transportation Planning Program.

The data from the three travel surveys were coded to data collection zones used in the Transportation Planning Program and keypunched onto data cards. From these files, records of inbound corridor trips taking place between 7:00 a.m. and 9:00 a.m. and oriented to the Minneapolis CBD (data collection zones 1 to 128) were extracted for further analysis. In order to limit the number of individual trip interchanges to be examined, the 128 zones within the CBD were aggregated to four districts (Figure B1). In establishing district boundaries, consideration was given to homogeneity of land use (to the extent possible), and differences in parking costs and terminal times (the motorist's time involved in parking his automobile and walking to his destination). The origin zones within the corridor and south of the CBD remained unchanged.

Transit and highway travel times were determined for each corridor zone-to-CBD district interchange. Transit travel time was divided into several components: walk time (or access time to the bus), time spent waiting for the bus, transfer time (if applicable), local bus run time and express bus run time. Highway travel times include actual automobile travel time plus terminal time.

Travel costs were also determined for each zone-to-district movement with transit cost represented by the current bus fare and auto costs including parking expense (depending upon the CBD destination) and a per mile cost representative of average out-of-pocket operating expenses (gasoline, oil, etc.).

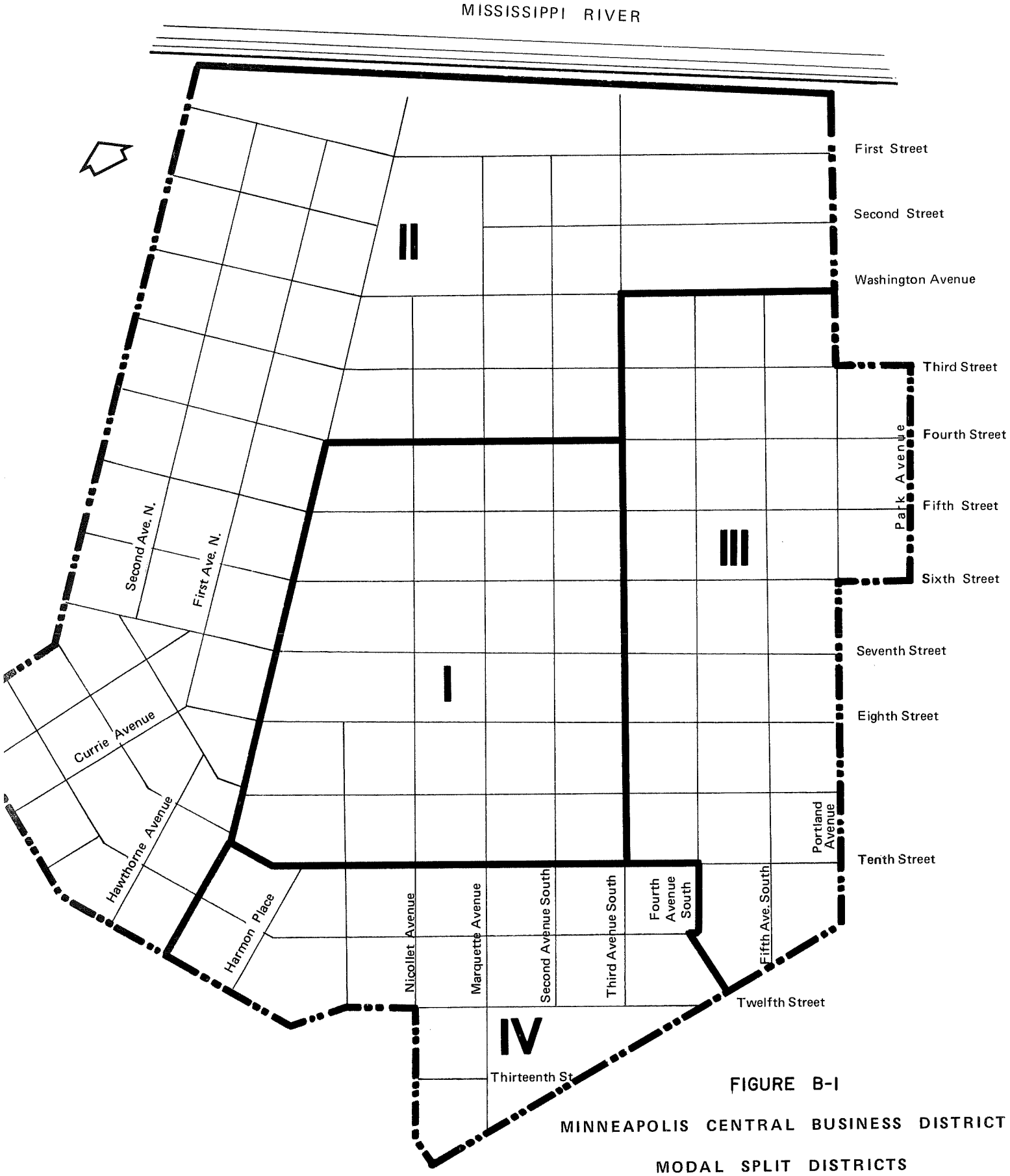


FIGURE B-I

MINNEAPOLIS CENTRAL BUSINESS DISTRICT

MODAL SPLIT DISTRICTS

MODEL DEVELOPMENT

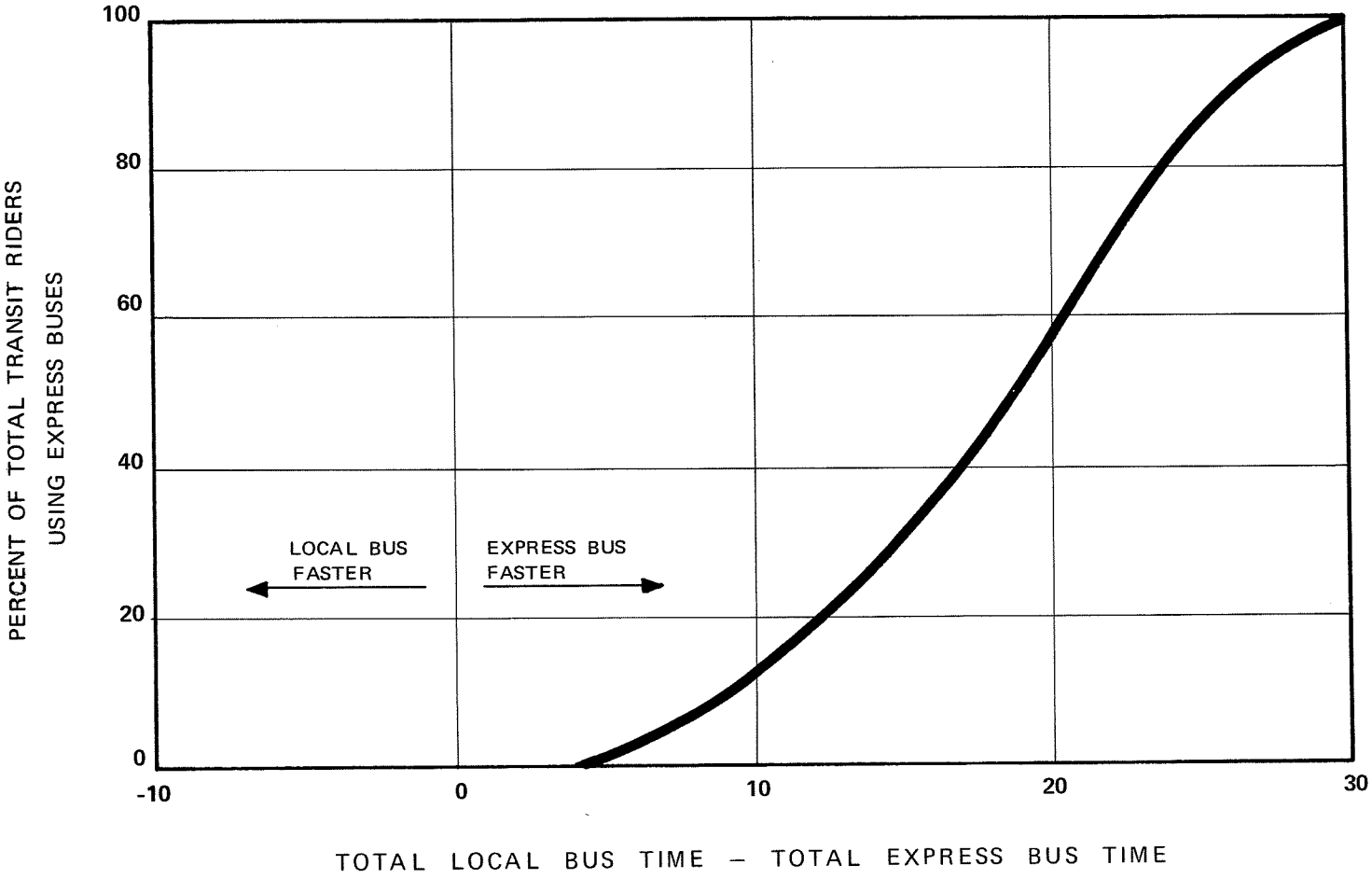
Review of existing transportation services provided within the I-35W corridor and analysis of present travel patterns and trip habits of corridor residents indicated that two separate modal split models would probably provide the most reliable basis for predicting patronage on the proposed new express bus routes. The one model would basically be a 'sub-modal split' equation designed to predict the proportion of total transit riders within any given zone who would choose the new express service rather than existing local service routes. The basis for the sub-mode choice would be the comparable service levels offered by each. The second model developed for application in this study would be a 'choice modal split' model which would predict the percentage of persons who, having a true choice between auto and transit, would choose to use transit.

The 'sub-modal split' model was developed on the basis of the existing split between express and local bus service in those areas where both types of service are currently provided. An attempt to correlate the dependent variable, 'percent express bus', with several independent variables describing service levels (e.g., ratio of travel time -- local vs. express) proved unsuccessful mainly because of the small number of existing inbound express transit trips in the corridor which are oriented to the Minneapolis CBD and take place between 7:00 a.m. and 9:00 a.m. on a typical weekday.

However, the data did provide a sufficient number of points to permit the plotting of several curves which could be used to predict the 'sub-modal split.' Travel time ratios, differences in various components of total travel time and various other combinations were analyzed in respect to effect on the proportion of transit riders who would choose express service. The curve shown in Figure B2 which relates proportion of total transit riders who would use express bus service to the difference in total travel time, express vs. local, is the most reliable and realistic of the several which were plotted and analyzed. Although the curve does not represent the results of regression analysis, it does permit a more realistic approach to the 'sub-modal split' question.

FIGURE B-2

SUB–MODAL SPLIT MODEL



The 'choice modal split' model which was developed was based on the concept of utility difference. This method was employed because of its relative ease of calibration and its particular applicability to this project where transportation system variables will be the major determinant in mode choice. The utility of a mode is defined as follows:

U = Run Time + (2.3) Excess Time + (F) Out of Pocket Costs

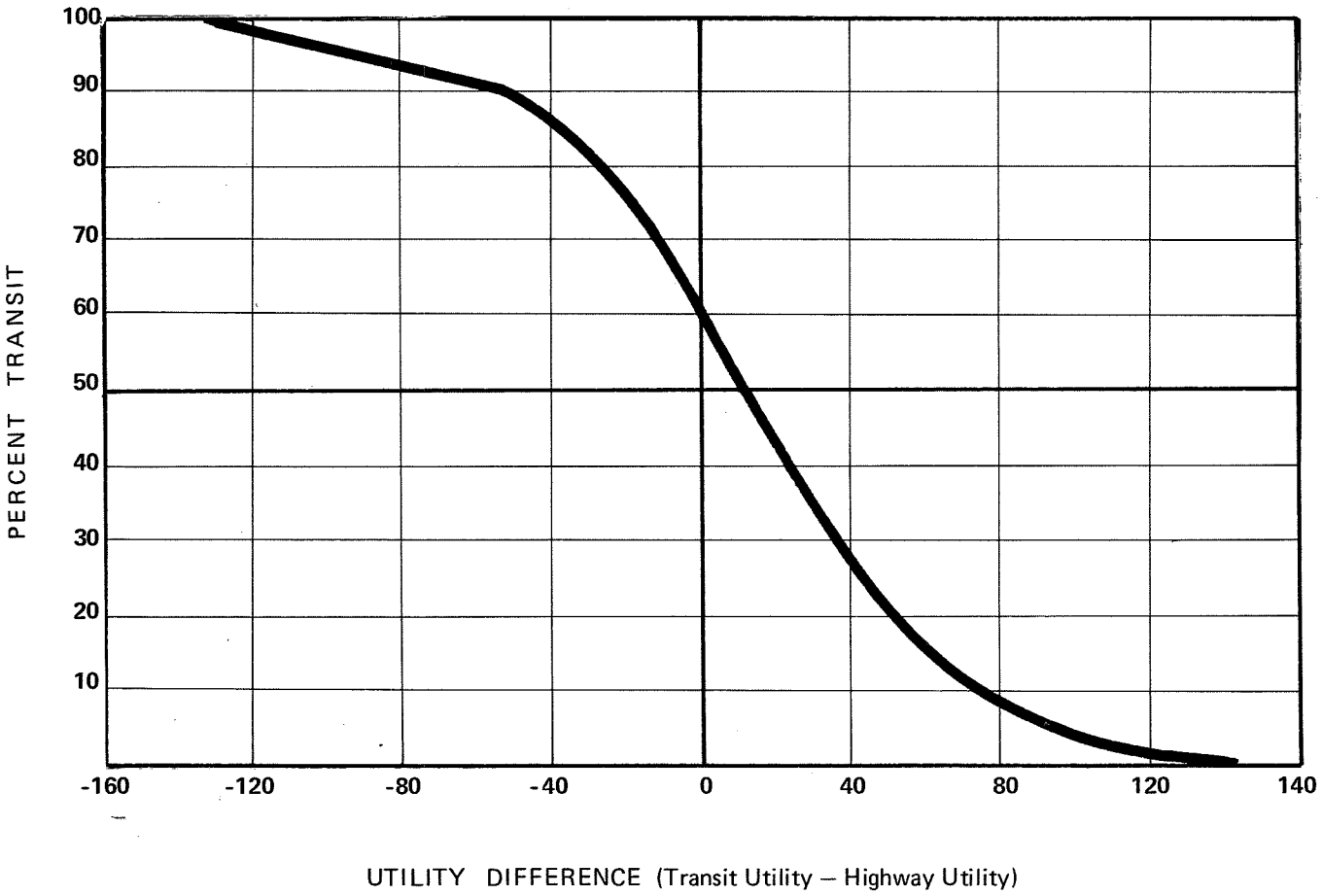
where: U = Utility
Run Time = Time spent on vehicle (Car or Bus)
Excess time = Time spent getting to or from vehicle or waiting for vehicle
Out of Pocket Costs = Transit fare, gas and oil expense and parking costs
F = 3600/Annual Income

The factor, 'F', converts the costs into equivalent minutes based on the average annual income. This is based on 1,200 working hours a year and the value of time to the traveler being worth one-third of what he is paid for that time. The weighting factor of 2.3 was based on previous experience which indicated that the range for this factor should be between 2.0 and 3.0 and the fact that 2.3 achieved the best calibration.

Figure B3 indicates the curve developed by the concept of utility difference.

FIGURE B-3

CHOICE MODAL SPLIT MODEL



MODEL APPLICATION

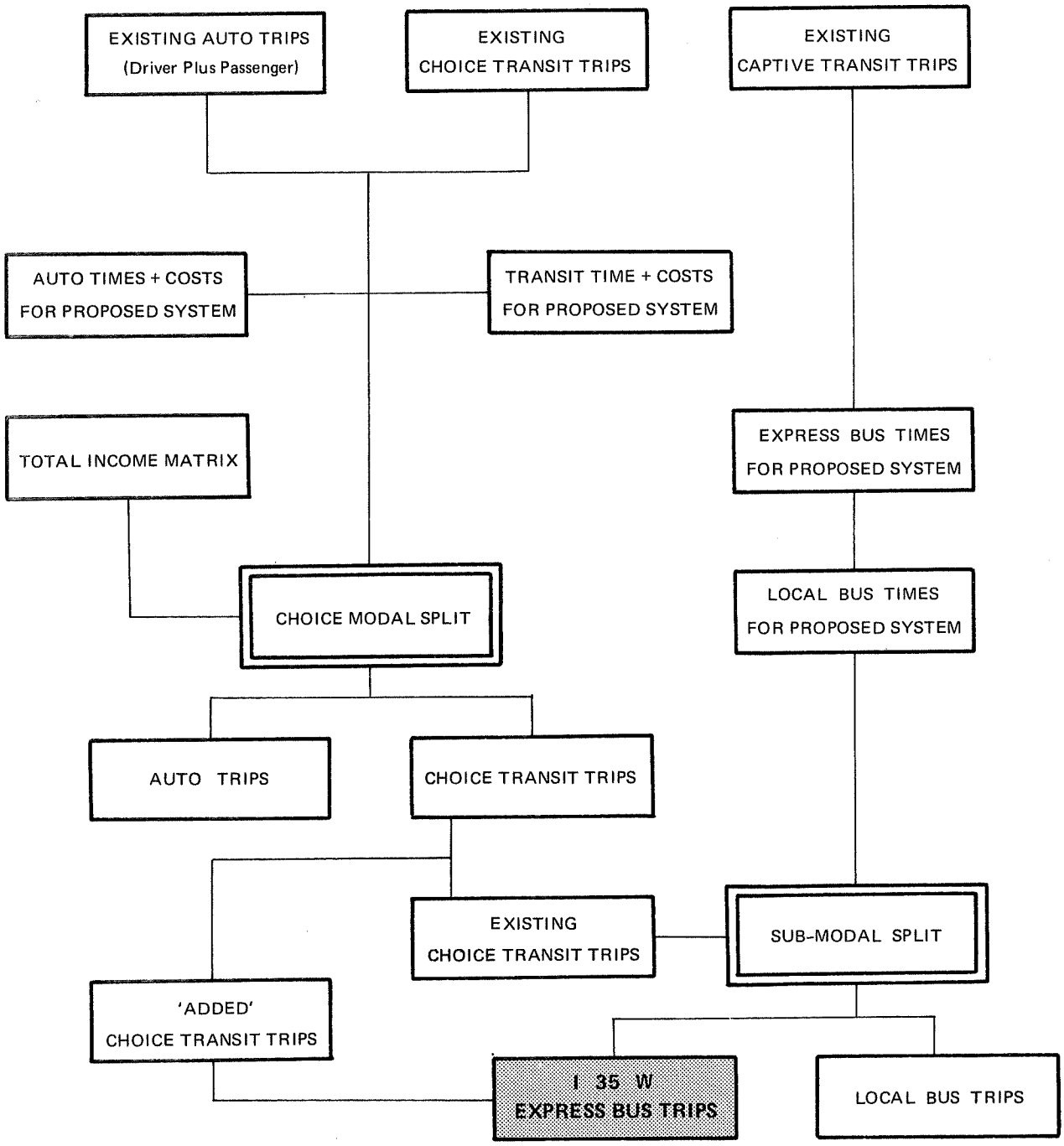
Estimation of patronage on the proposed new express routes involved a two-step procedure. First, the 'sub-modal split' model was used to estimate the proportion of existing bus riders within a given geographic area who would switch to the new express service, if given the opportunity. This model was applied only in those cases where the new express routes will serve areas that currently produce some CBD-oriented, peak period transit trips and was used to apportion the total number of trips between local and express services.

The 'choice modal split' model was used to estimate the number of auto drivers within the corridor who would be attracted to transit by the new express service. Travel times and costs were determined for both highway and transit and these data, together with information concerning the tripmaker's average income, were used to develop highway and transit utilities. The 'percent transit' determined by the model was then applied to the number of total trips (auto driver and passenger trips plus transit trips) between all sets of corridor zone and CBD-district combinations to obtain a new estimate of choice transit trips. The difference between this new estimate and the present number of choice transit trips represents the number of auto driver and/or passenger trips that are expected to be diverted to the new express bus service.

Addition of the two express transit trip estimates -- present local service transit riders diverted to the new express service and auto users attracted to the new service -- provides an estimate of total expected patronage on the corridor express routes. The total application is schematically portrayed in Figure B4.

FIGURE B-4

MODEL APPLICATION



APPENDIX C

RELATIONSHIPS OF I-35W URBAN CORRIDOR DEMONSTRATION PROJECT TO OTHER PROJECTS AND MAJOR GENERATORS IN THE AREA

One of the major objectives in structuring the I-35W Project Management Board was to assure proper coordination at the local, county, metropolitan, and State level. The theory is that through membership of the City of Minneapolis, Hennepin County, Metropolita. Council, Metropolitan Transit Commission, and Minnesota Highway Department, other past, current and future projects under each jurisdiction would be properly coordinated. Mentioned below are five projects or generators that have an important relationship to the I-35W Urban Corridor Demonstration Project.

Surveillance and Control System for the I-94 Lowry Hill Tunnel

Concurrent with the design of the Bus-Metered Freeway System, a design for a surveillance and control system for the I-94 Lowry Hill Tunnel is being prepared by the Minnesota Highway Department. This system of vehicle detectors, television cameras, lane control signals, and changeable message signs will be used to detect stoppages in the tunnel and to advise approaching traffic of congested conditions ahead. This system will be housed in the same control center as the demonstration system and interconnected with it.

While emphasis is on the demonstration project and Lowry Hill Tunnel systems at this time, it is anticipated that in the future, all freeways within the Metropolitan Area will be placed under surveillance and control to move a maximum number of people during peak periods. The Minneapolis Area freeway network will be controlled from the control facility.

Computer-Controlled Signal System - City of Minneapolis

The highest priority improvement in the TOPICS Plan and Report for the Central Business District of the City of Minneapolis recommended for implementation was a computer-controlled signal system. Currently IBM is under contract to the City of Minneapolis to prepare specifications for the system. Current plans are to connect the surface street computer-controlled system to I-35 Surveillance and Control System. The coordination of these systems will help to maximize acceptance of incoming traffic and the feeding of the outbound traffic.

Transit Study Within Model Cities Area

The City of Minneapolis is conducting a transit study in the Model Cities Area. The contract is between the City of Minneapolis and the Metropolitan Council under a HUD Demonstration Project.

Meetings with the Staff people lead to the conclusion that the I-35W Urban Corridor Demonstration Project would supply imput and information to the Transit Study, but the reverse was not true. The outbound transit service question is being studied under the Transit Study and is being coordinated as one of a number of continuing MTC Projects.

University of Minnesota Express Bus Service

The University of Minnesota initiated a two-year experiment with "express bus" service in September, 1970. The 1970-1971 routes in the I-35W Corridor are shown in Figure 26 of this report. The 1971-1972 routes were jointly developed by the Office of Physical Planning and Design of the University of Minnesota and Bather-Ringrose-Wolsfeld. The routes in the corridor are located to maximize the use of the I-35W freeway. If the I-35W Project is implemented, these routes in the corridor would benefit with decreased travel times.

Southdale Regional Shopping Center

Next to the Minneapolis CBD, Southdale is the largest generator of travel in the corridor; this regional center is included in the I-35W Study Area. One of the two express routes implemented in August, 1971, uses Southdale as a park-n-ride facility. Thus the I-35W Project is being coordinated with this generator.

Wold Chamberlain Airport Express Bus Service

Currently the Airport Express Bus Service uses I-35W to serve the Minneapolis CBD. This service would have preferential access to the metered-freeway and thus reduce the travel time in the peak periods.

A P P E N D I X D

'PHASE I' STUDIES INTERIM REPORTS

PREPARED BY SIMPSON & CURTIN

FOR THE

TWIN CITIES METROPOLITAN TRANSIT COMMISSION

Interim Report No.	Title	Date
1	The Transit Rider - 1968	September, 1968
2	Transit Services - 1968	December, 1968
2a	Transit Services - 1968: Appendix	December, 1968
3	Operating Results - 1968	March, 1969
4	Public Attitudes Toward Transit	April, 1969
5	Alternatives for Improved Service	April, 1969
6	Evaluation of Alternative Service Improvements	July, 1969
6a	Evaluation of Alternative Service Improvements: Proposed Routes	July, 1969
7	Implementation of Transit Improvements	October, 1969