traffic access and parking plan for health science area

university of minnesota
twin cities campus

may 1972

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richard p. wolsfeld, jr.
vice president

May 15, 1972

Mr. Hugh G. S. Peacock
Assistant Vice-President
340 Morrill Hall
University of Minnesota
Minneapolis, Minnesota 55455

Dear Mr. Peacock:

Transmitted herein is the final report presenting a Traffic Access and Parking Plan for the Health Science Complex within the Twin Cities Campus of the University of Minnesota.

The assistance and cooperation offered by David Licht, Paul Maupin, Jerry Nelson, Jim Welty, Barb Gilbertson and Walter Johnson of the University staff is appreciated.

Sincerely,

BATHER-RINGROSE-WOLSFELD, INC.

Richard P. Wolsfeld

Richard P. Wolsfeld, P.E.

RWP:cs

Enc.

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SUMMARY

This report presents a traffic access, circulation and parking plan for the Health Science Complex. Existing and forecasted travel patterns and characteristics are analyzed. 1975 and 1985 parking space needs are projected, and a plan is recommended. Major points presented in the report are:

- A number of assumptions are required to forecast 1975 parking needs. Depending upon the assumptions made the forecasted deficiencies range from a few hundred spaces to over 5,000 spaces. The recommendation is to build a 2,000 car parking ramp to satisfy 1975 needs.

- The recommended location for the ramp is on a site bounded by Oak Street on the west, Ontario Street on the east, Essex Street on the south, and the property line approximately 150 feet north of Delaware Street on the north.

- Two alternatives for the Dartmouth Interchange Connector are presented and evaluated. The recommendation is to construct the alternative that provides for access to the parking ramp from an at-grade intersection at Essex Street. The completion of the Dartmouth Interchange Connector is most important to the satisfactory operation of the ramp; the University should support and work with the City of Minneapolis to complete the Connector.

- Within the parking ramp on the entrance level, a reception/information center for Health Science patients is proposed. Disabled patients could be discharged from the car at the entrance to this center and then be given assistance and direction to the Health Science Complex.

- The recommendation is made to provide bus service between the Health Science building entrances and the reception/information center in the ramp.

- Because of the congestion and delays being experienced on the existing loop in front of the Hospital, the proposal is made to limit the access west of Harvard to buses and emergency vehicles only. Passenger pick-up is proposed along Harvard Street.

- The implementation of a directional signing system for parking and emergency vehicles is proposed.

INTRODUCTION

BACKGROUND TO STUDY

The portion of the Twin Cities Campus of the University of Minnesota south of Washington Avenue traditionally has experienced problems related to traffic access and parking. Factors which have contributed to this situation include high intensity of development, greater availability of parking than in some other portions of the Campus, and discontinuity of the street system.

In the mid-1960's planning for a major expansion to the Health Science facilities on Campus began. Studies have been conducted to determine the future space needs for the functions involved. Based upon these studies a building program was prepared. The first building, which will house the School of Dentistry and also provide space for other functions, is presently under construction and will open by September, 1973. Construction on the second building, which will house a central service center and a cardiovascular research unit, will begin soon, with completion expected by 1974. By 1976 it is expected that three additional buildings will be completed to house the College of Pharmacy, research and admissions offices, and outpatient clinics.

Post-1980 plans include buildings for a replacement University Hospital, the School of Public Health, and for possible new Veteran's and Gillette Hospitals.

Bather-Ringrose-Wolsfeld, Inc., was retained by the University to develop a plan which would meet the traffic access and parking needs for these new developments.

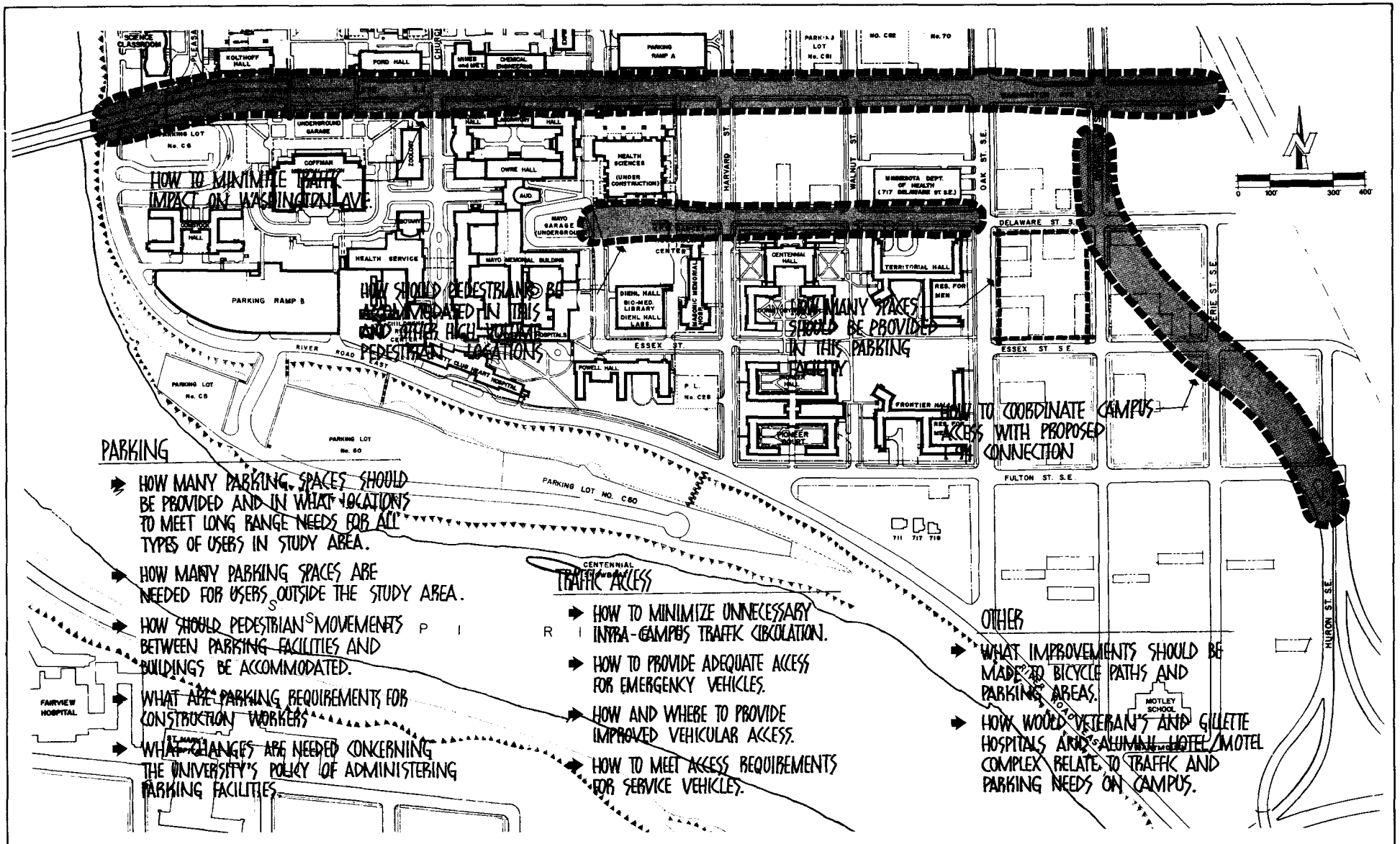
STUDY AREA AND OBJECTIVES

The area considered in this study is bounded by Washington Avenue on the north, the Mississippi River on the west and south, and the railroad tracks on the east. The objective of the study is to develop a transportation plan that documents both short-range and long-range improvements needed for:

- Traffic access and circulation
- Parking
- Service vehicle access and storage
- Bicycle circulation and parking

TRANSPORTATION ISSUES

A number of transportation issues concerning future developments in the Health Sciences area of the Campus have been defined. These issues were documented through a series of meetings with University and Health Sciences officials. A summary of these issues is shown in Figure 1. Each issue is analyzed, and, where possible, solutions are incorporated into the recommended transportation plan.



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health sciences area traffic plan

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figure 1

TRANSPORTATION ISSUES

EXISTING CONDITIONS

To understand the existing traffic and parking situation in the Study Area, information was obtained on traffic volumes, physical characteristics, parking inventory and behavior, and entrance locations. This information is presented in the following sections.

TRAFFIC VOLUMES

Traffic volumes serve as a measure of the travel demand that the street system has to satisfy. A summary of daily traffic volumes in the vicinity of the Campus is shown in Figure 2. In several locations counts were available from the City of Minneapolis 1970 survey and the 1971 University of Minnesota, "Inventory of Transportation" completed by Bather-Ringrose-Wolsfeld. A comparison of these figures indicates the fluctuation and growth in traffic volumes. One interesting comparison is on East River Road just north of Interstate Highway 94. The City of Minneapolis count is more representative of existing volumes because it was taken before the Franklin Avenue bridge was closed, whereas the count during the spring of 1971 was made while the bridge was closed.

PHYSICAL CHARACTERISTICS

To assess the capability of the street system to accommodate traffic demand information is needed on physical characteristics, namely traffic control devices, pavement widths, and the location of one-way streets. These data are summarized in Figure 3.

PARKING CHARACTERISTICS

Future parking space needs in the Study Area are related to the existing inventory of parking spaces in the Study Area and to existing space usage. From a field survey and information provided by the University an inventory of existing parking spaces was compiled (see Figure 4.) The total number of parking spaces presently available in the Study Area is 4,100 spaces.

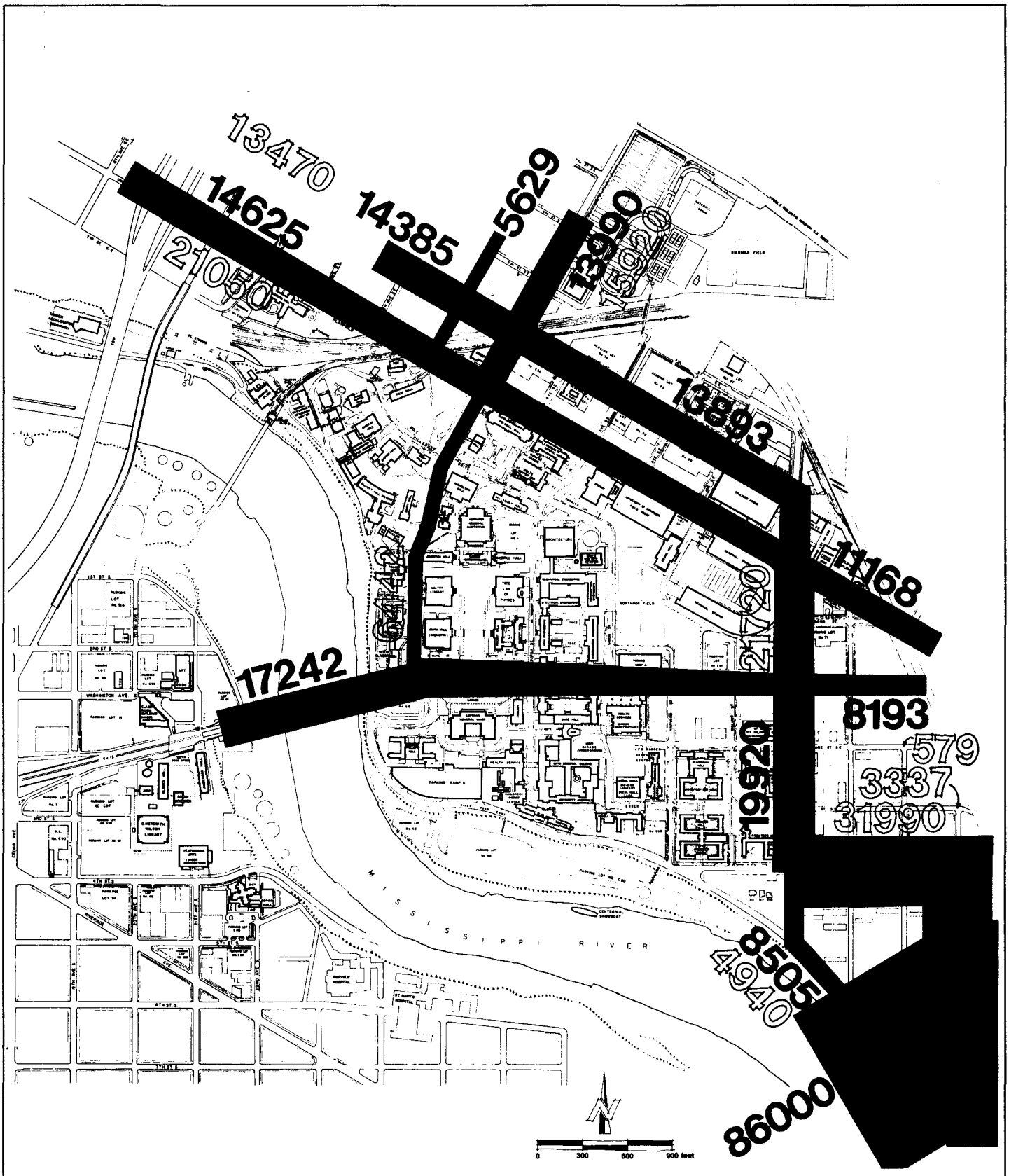

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figure 2

DAILY TRAFFIC VOLUMES

5000
10,000
20,000
30,000
50,000

VEHICLES PER DAY

568 1970 ADT FROM CITY OF MPLS PUBLIC WORKS

568 BRW COUNT TAKEN SPRING OF 1971

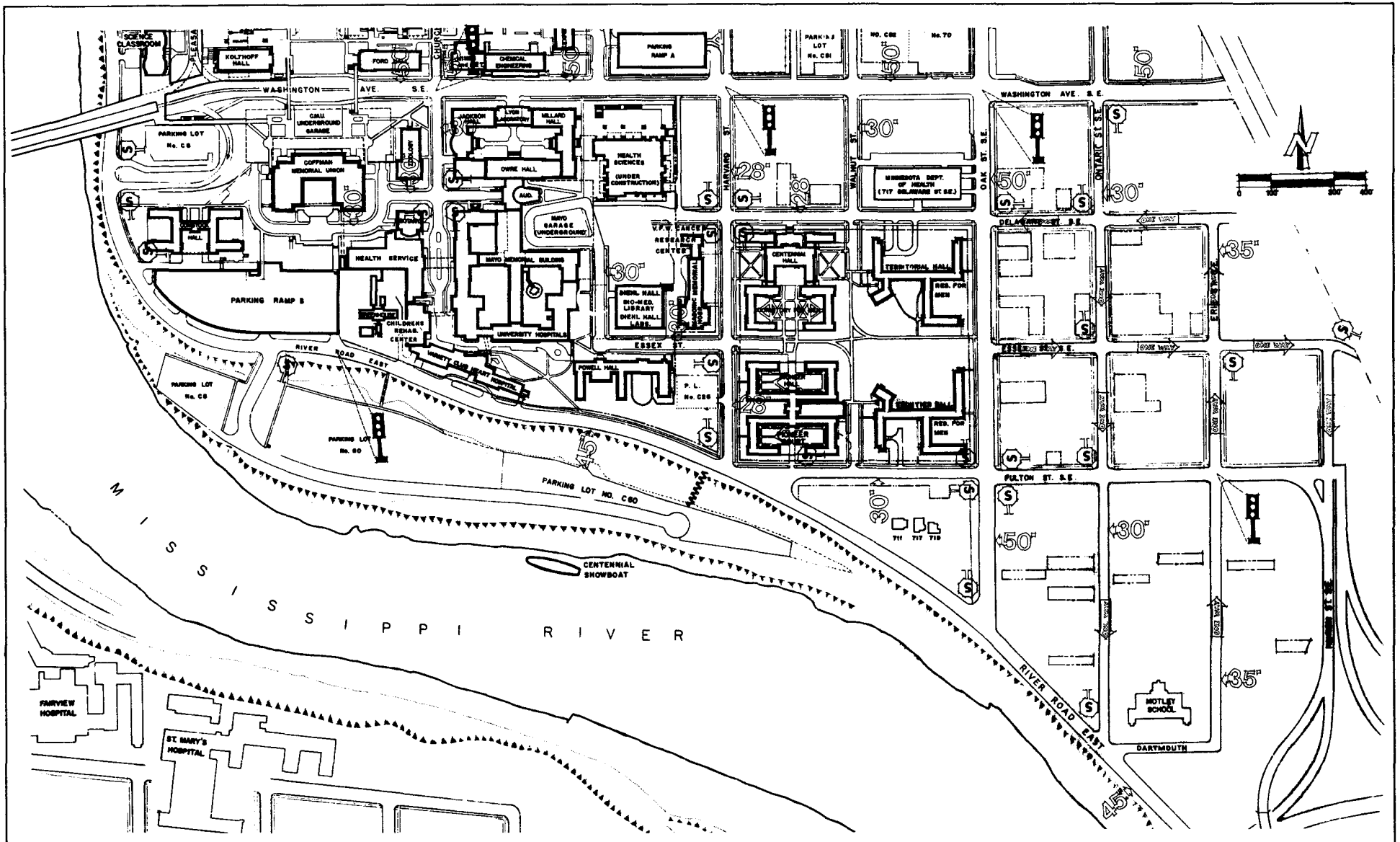

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figure 3

PHYSICAL CHARACTERISTICS

TRAFFIC SIGNAL

STOP SIGN

35" STREET WIDTH

ONE WAY

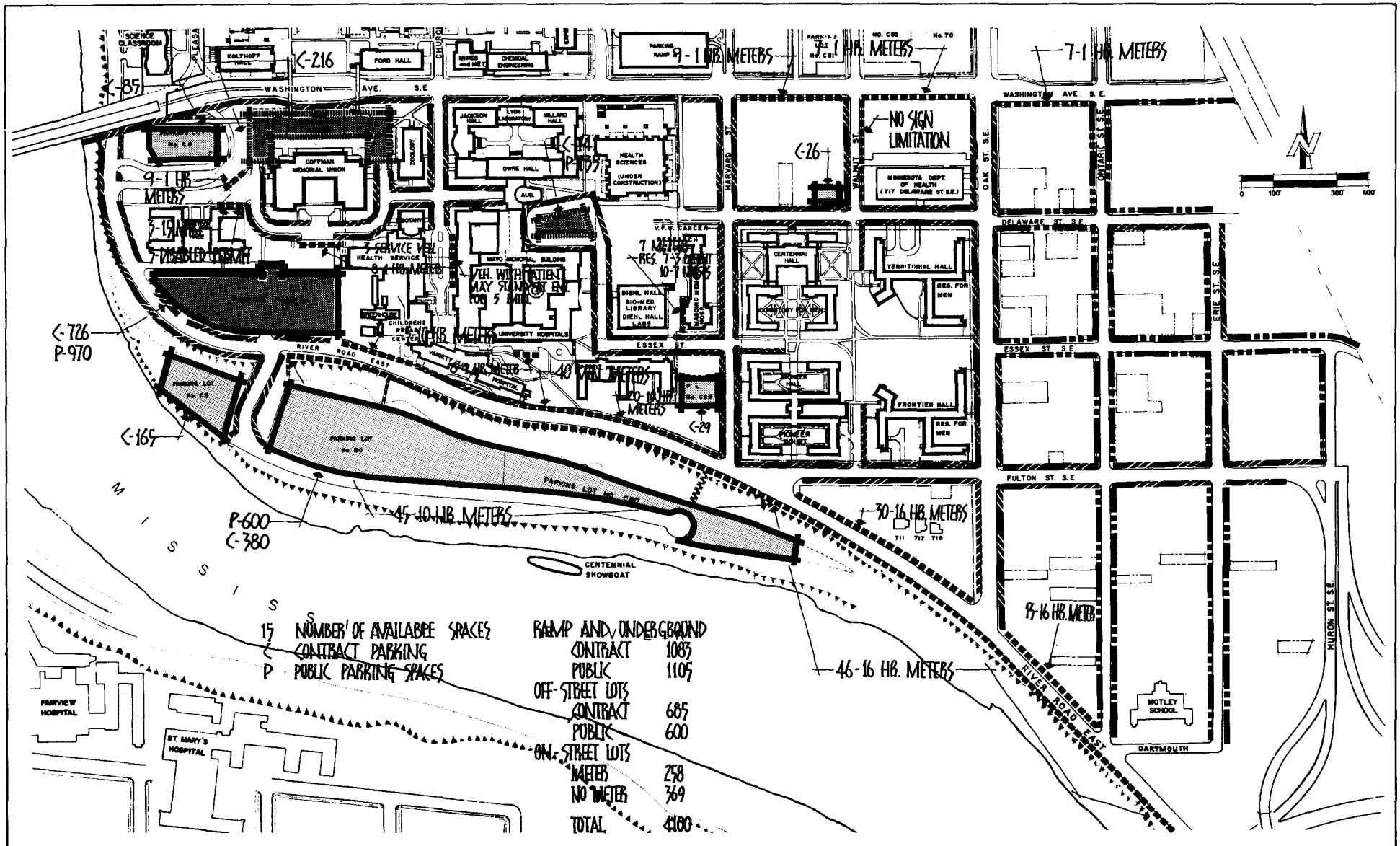

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figure 4

PARKING INVENTORY

OTHER PARKING WITH NOTE

2 HR. PARKING

15 MIN. PARKING

NO PARKING

RAMPS

UNDERGROUND

LOTS

Usage of parking spaces in the Study Area was surveyed in a previous study.[1/] One of the most important characteristics surveyed is the relationship between parking location and the first building destination within the Campus. Of particular interest are the parking locations for persons destined to the Study Area and the destination locations for persons who park in the Study Area. Figure 5 illustrates the parking locations for auto drivers destined to the Health Sciences portion of the Study Area. Destination locations for parkers in the Study Area are illustrated in Figures 6, 7, 8 and 9.

Analysis of the information presented in these figures, together with other results from the parking usage survey, revealed the following characteristics for a typical day:

- 4,370 drivers park outside the Study Area and walk in (this represents 45 percent of the total 9801 auto drivers destined to the Study Area.)
- 5,431 drivers park inside the Study Area and are destined within the Area (this represents 55 percent of the total 9801 auto drivers destined to the Study Area.)
- 1,953 drivers park inside the Study Area and walk to buildings outside the Area (this represents 26 percent of the total 7,384 auto drivers who park in the Study Area.)

ENTRANCE LOCATIONS

To understand access needs it was important to compile information on the locations of existing entrances to parking facilities and to buildings for pedestrians and service vehicles. This information as provided by the University and from a field survey is illustrated in Figure 10.

1/ "Inventory of Transportation - University of Minnesota", Bather-Ringrose-Wolsfeld, Inc., May, 1971

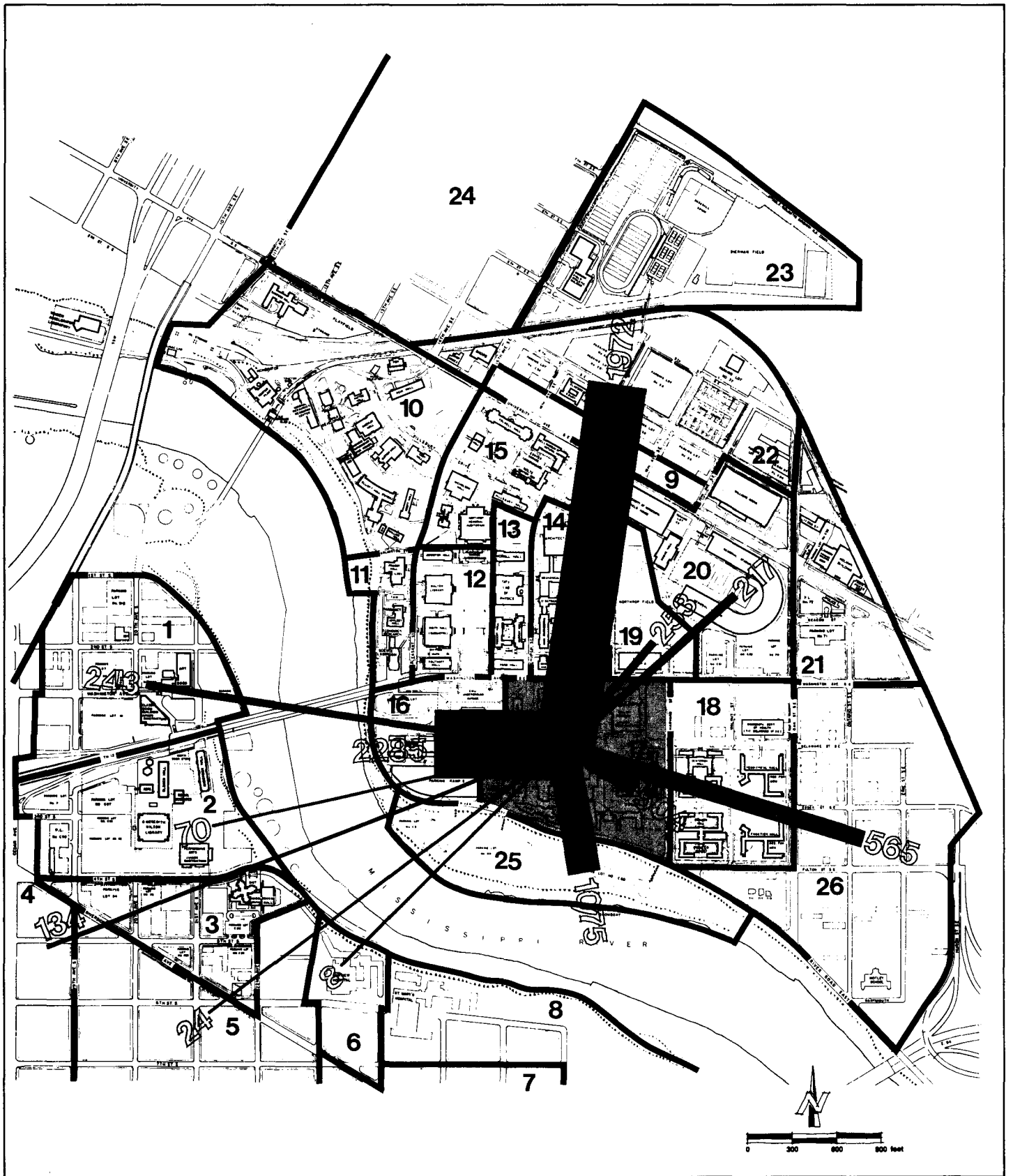

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figure 5

PARKING LOCATION FOR AUTO DRIVER TRIPS DESTINED TO HEALTH SCIENCES AREA (ZONE 17)

ZONE BOUNDARY

2 ZONE NUMBER

100
500
1000
2000

AUTO DRIVER TRIPS PER DAY

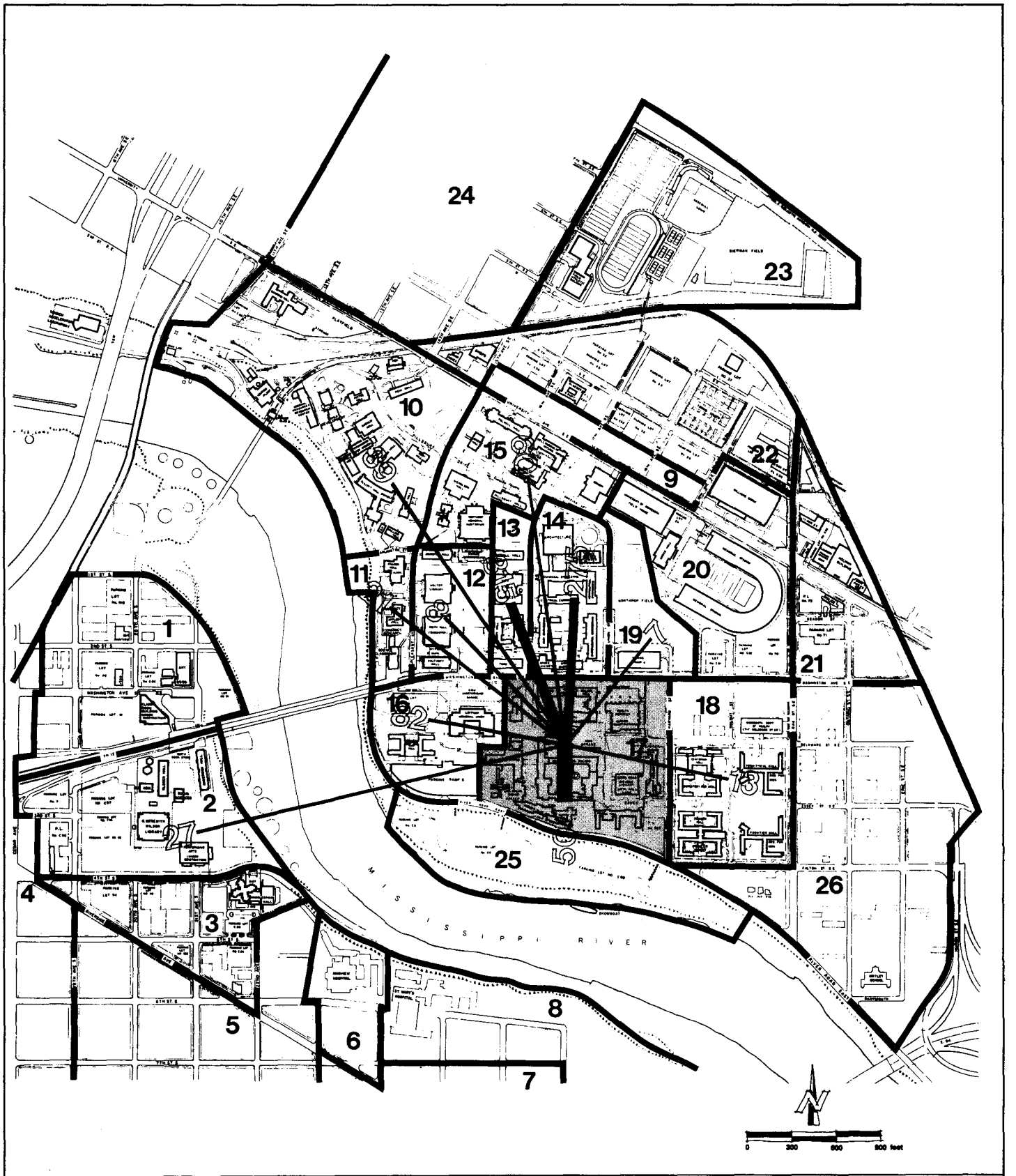

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figure 6

DESTINATION LOCATIONS FOR PARKERS IN ZONE 17

ZONE BOUNDARY

2 ZONE NUMBER

100
500
1000
2000

AUTO DRIVER TRIPS PER DAY

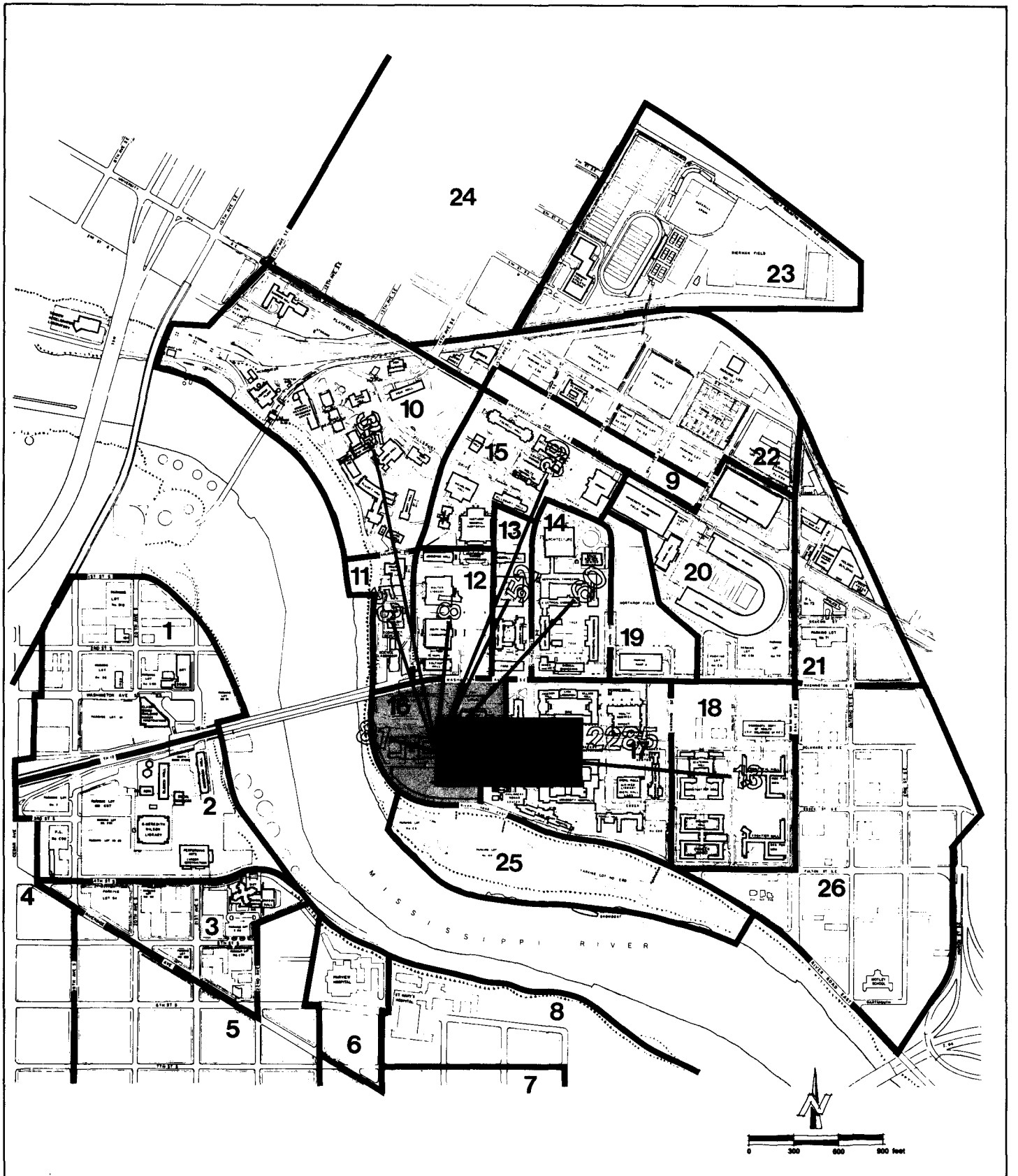

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figure 7

DESTINATION LOCATIONS FOR PARKERS IN ZONE 16

ZONE BOUNDARY

2 ZONE NUMBER

100
500
1000
2000

AUTO DRIVER TRIPS PER DAY

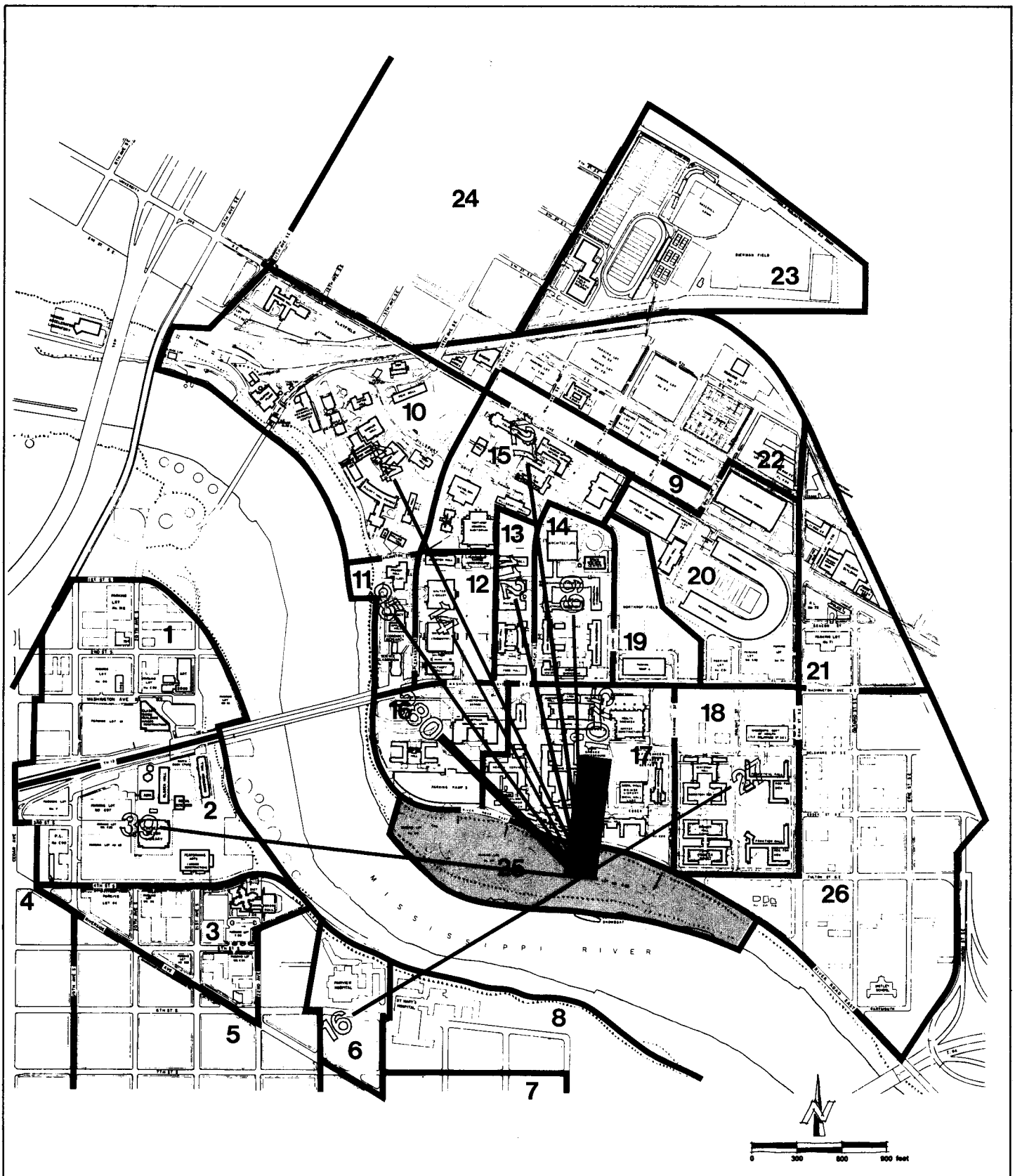

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figure 8

DESTINATION LOCATIONS FOR PARKERS IN ZONE 25

ZONE BOUNDARY

2 ZONE NUMBER

100
500
1000
2000

AUTO DRIVER TRIPS PER DAY

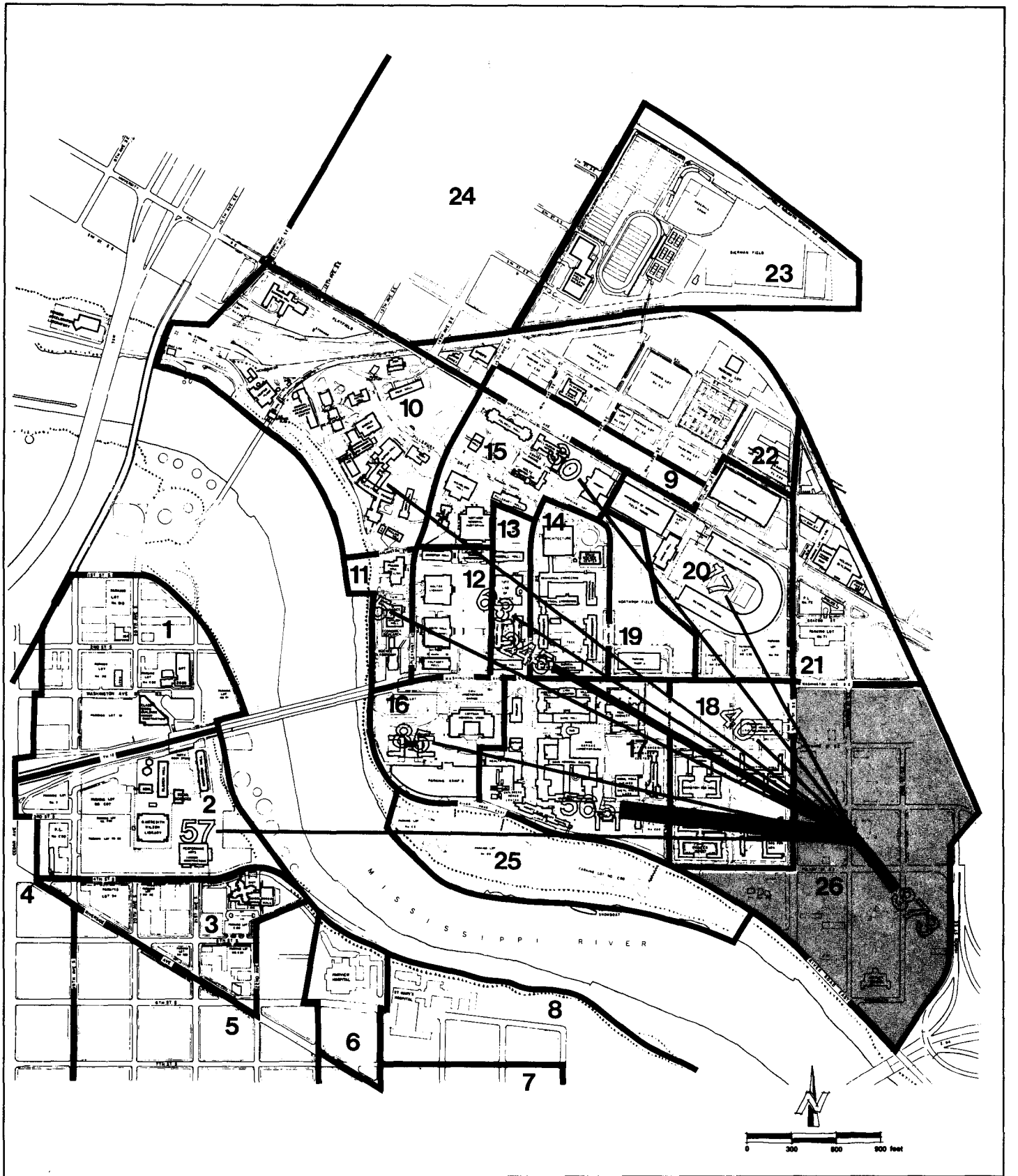

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figure 9

DESTINATION LOCATIONS FOR PARKERS IN ZONE 26

2 ZONE BOUNDARY
ZONE NUMBER

100
500
1000
2000
AUTO DRIVER TRIPS PER DAY

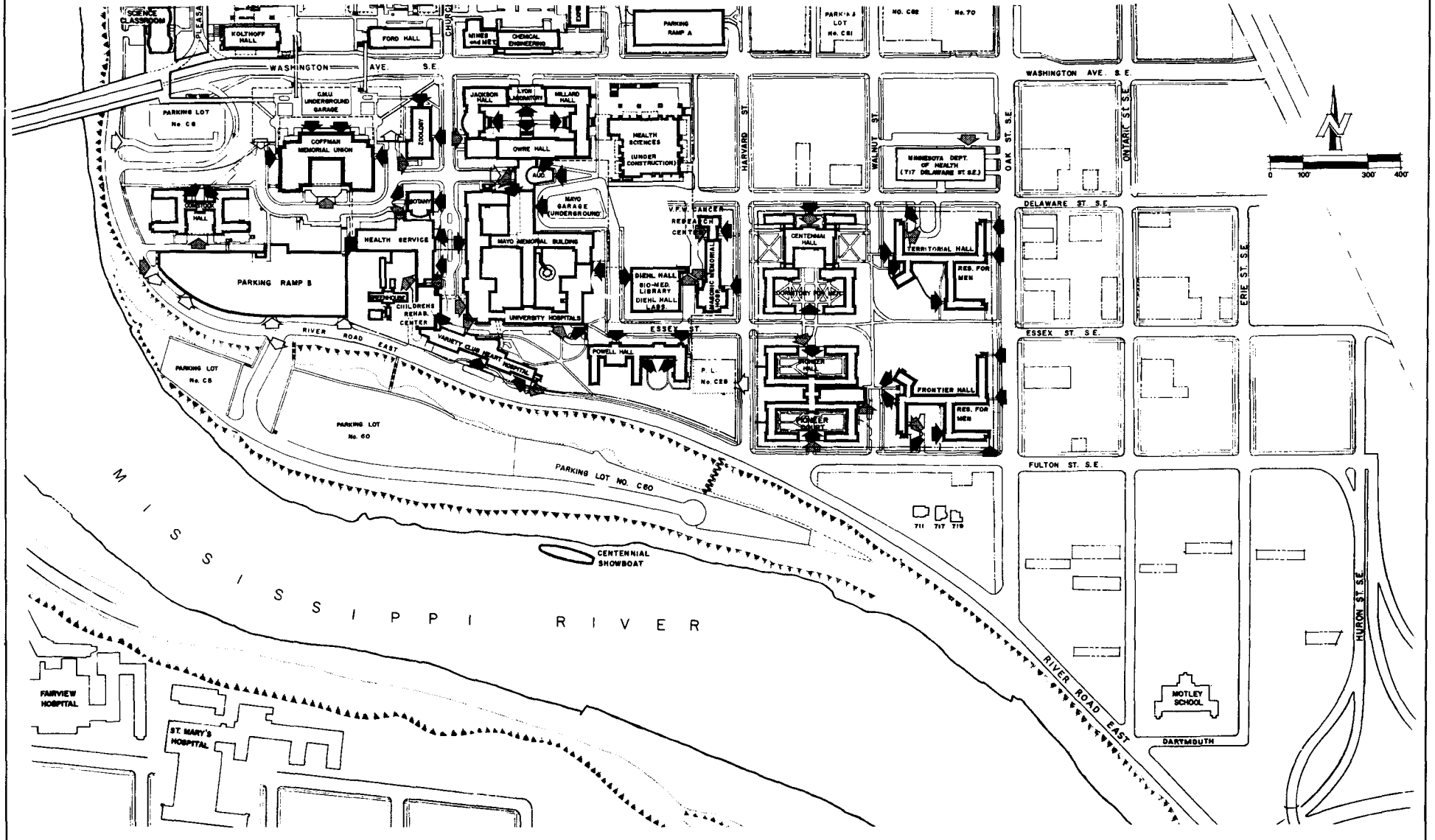

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figure 10

EXISTING ENTRANCE LOCATIONS

- PEDESTRIAN ENTRANCE
- SERVICE ENTRANCE
- PARKING ENTRANCE

FUTURE DEVELOPMENTS

A number of the transportation issues in the Study Area involve anticipated new developments. The documentation of the location of planned developments, their size and function, and their anticipated completion dates are a required input to plan development. This information was provided by the University and is summarized in Figure 11.

Unit A, which is presently under construction, will be completed in 1973, and Units K and E, on which construction is about to begin, are planned for completion by 1975. Additional developments planned for completion by 1976 are Units B, C, D and F. Other buildings under consideration for possible construction in the 1980's include a classroom/office building on the site of existing parking Lot C6, a building for the School of Public Health, a replacement University Hospital, and new buildings for Veteran's and Gillette Hospitals, which may relocate in this area.

One feature of the new Health Science developments, as shown in Figure 12, is an underground service "street," which will serve to distribute materials between the various buildings and the service center at Unit E. This "street" will obviate the need for all existing service entrances to Health Science buildings, except for the laundry service entrance in the southwest corner of the Hospital.

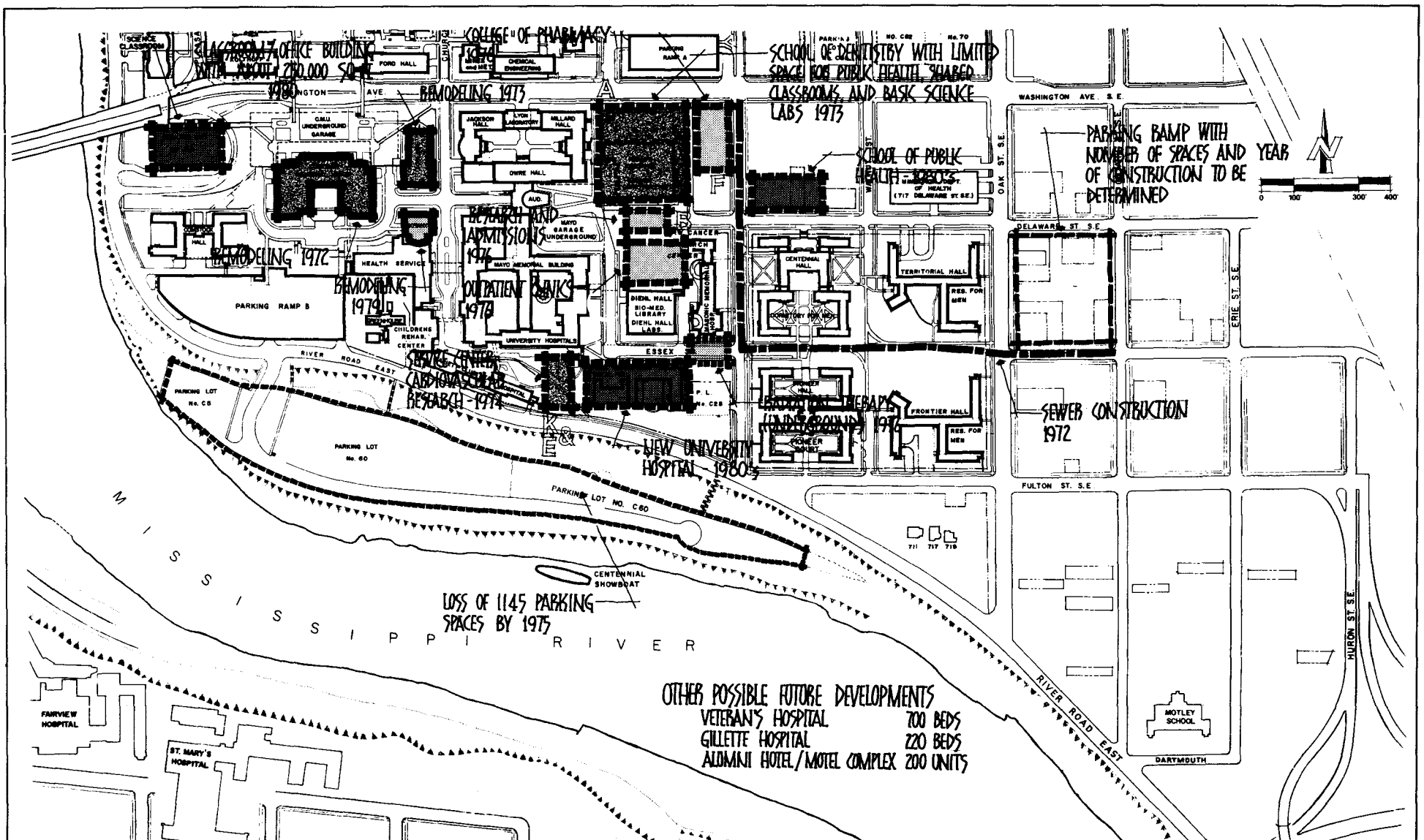

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figure 11

PROPOSED DEVELOPMENTS

1973-74

1975-79

1980's

BUILDING REMODELING

NEW BUILDING

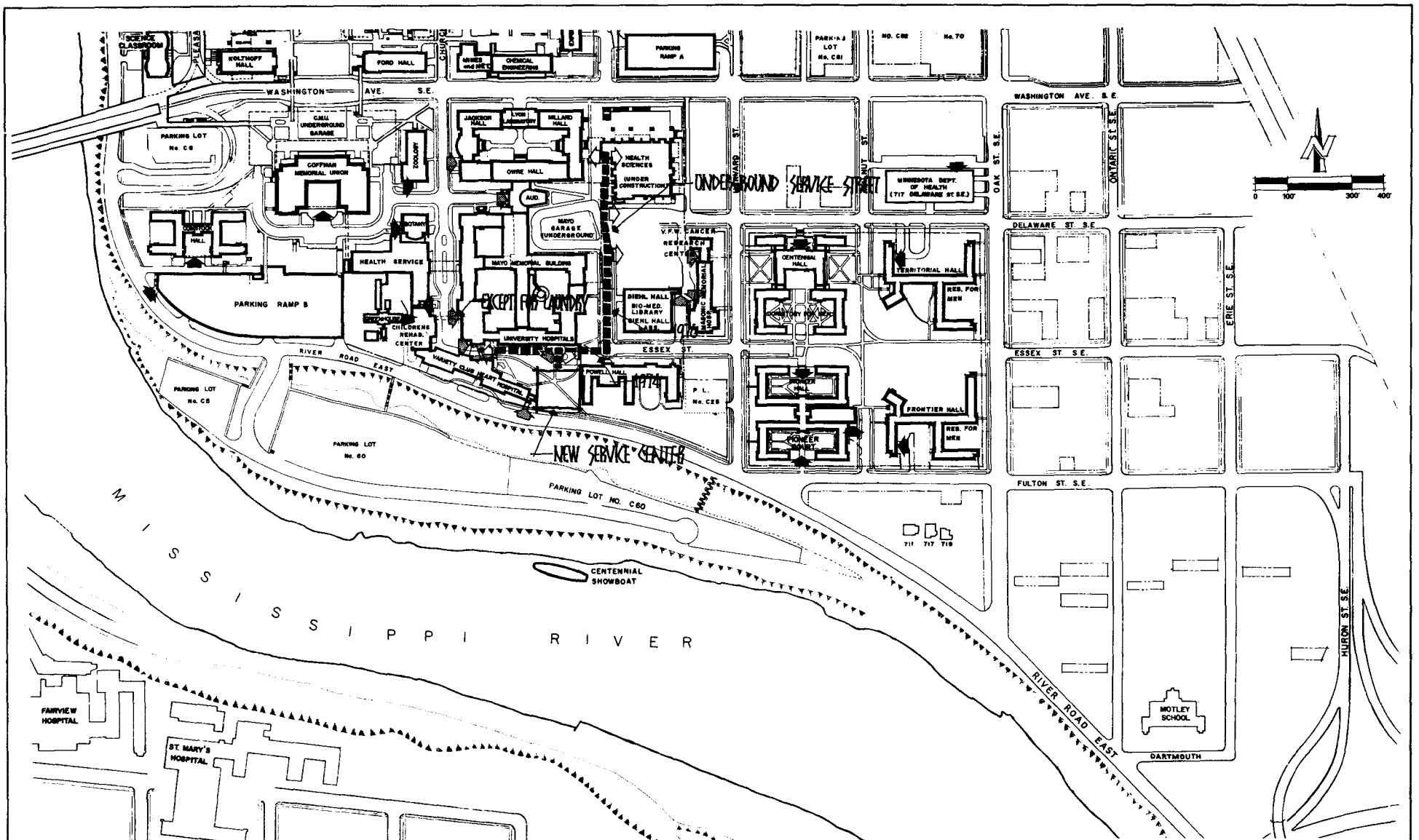

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figure 12

FUTURE SERVICE ENTRANCES

- EXISTING ENTRANCE TO REMAIN
- EXISTING ENTRANCE TO BE REMOVED
- NEW ENTRANCE
- SERVICE STREET

PARKING FORECASTING PROCEDURES AND RESULTS

DESCRIPTION OF PROCESS TO FORECAST PARKING DEMAND

The desired end product of this analysis is a determination of the additional parking spaces required to serve the Health Sciences Complex and immediate area. The number of parking spaces needed in the Study Area is dependent upon a number of factors, including:

- The number of vehicle trips generated.
- Car occupancy factors.
- Vehicular arrival/departure patterns.
- Number of walk trips to the Campus.
- University policies regarding the provision of spaces for various types of users.
- Transit service provided.

Based upon a consideration of these factors, the following procedure was established to estimate the number of additional parking spaces needed in the Study Area by 1975:

Step 1 Calculate the parking space demand for the Health Sciences portion of the Study Area through two independent methods (called "parking accumulation" and "parking standards" approaches.)

Step 2 From the results of these two methods select a set of figures that best represent the parking space demand for the Health Sciences portion of Study Area.

Step 3 Make the following corrections to the Health Science demand identified in Step 2:

- adjust for persons who park in the Study Area and are destined to non-Health Sciences portions of the Study Area.

- adjust for persons who park in the Study Area and are destined outside the Study Area.

- adjust for persons who park outside the Study Area and are destined to the Study Area.

- adjust for the loss of existing parking spaces.

As mentioned in Step 1 two independent methods are developed to forecast parking demand. The "parking accumulation" method is based on the precept that two relationships can be established and used to forecast parking demand:

Relationship 1 - between population and inbound auto trips

Relationship 2 - between inbound auto trips and parking demand

Data previously has been collected on existing population, inbound auto trips, and parking demand. Therefore, given a forecast of future population, it is possible to relate back to determine future parking demand. To utilize this method, it is therefore necessary to develop future population forecasts, derive the two relationships for existing conditions, and then to determine future inbound auto trips.

The "parking standards" method of forecasting parking demand utilizes future population projections and estimates of the peak daytime accumulation of inpatients, outpatients, and dental patients. Parking space demand is then caluclated by applying particular parking adjustment factors to each user type.

Following sections develop the travel data needed for the "parking accumulation" method and then derive the forecasts for 1975 and 1985 parking space demand.

1971 DAILY PERSON TRIPS TO STUDY AREA

Through an origin-destination survey conducted in 1971,[1/] the daily numbers of person trips to the Study Area were determined

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1/ "Inventory of Transportation, University of Minnesota," Bather-Ringrose-Wolsfeld, Inc., May, 1971

by user type and by mode, as shown in Table 1. Survey questionnaires requested the auto driver to record the place of parking and also the first building to which he was destined. The data in Table 1 represents building destination, not the parking location. Of the 15,460 person trips to the Study Area, 7.5% were made via transit. The 14,300 person trips made via the the auto had an average vehicle occupancy of 1.46 people/car which represents 9,801 auto driver trips to the Study Area.

Table 2 lists the 1971 daily person trips to the Health Science Complex which lies within the Study Area. The Health Science Complex attracts 74% (11,384/15,460) of the person trips to the Study Area.

1975 DAILY PERSON TRIPS TO STUDY AREA

Travel to the Twin Cities Campus is closely correlated with Campus population (number of students, staff, faculty, etc.) Campus population growth in the Study Area by 1975 is expected to be due almost entirely to new Health Science developments, namely the A, K and E units. Each unit is defined below:

Unit A - School of Dentistry, Basic Sciences, Public Health

Unit E - Service Center, Kitchen, Dining Facilities

Unit K - Cardiovascular Research

1975 population forecasts for each section of the Health Sciences Complex by user type have been made in a previous study and are listed in Table 3, together with the 1970 population statistics. On a combined basis faculty, students, and employees are forecasted to increase 46% by 1975.

The 1970 and 1975 population and 1971 trip data provide the base from which to forecast the 1975 daily number of trips to the Health Sciences area by user type. As per the following example:

$$\frac{\text{1975 Daily Number of Student Trips to the Health Sciences Area}}{\text{1975 Student Population}} =$$

$$\frac{\text{1971 Daily Number of Student Trips to the Health Sciences Area}}{\text{1970 Student Population}}$$

Three key assumptions inherent in this procedure are:

TABLE 1

1971 DAILY PERSON TRIPS TO STUDY AREA*

	Mode of Travel		
User	Auto	Transit	Total
Faculty	1,570	48	1,618
Staff	3,840	246	4,086
Student	5,370	776	6,146
Other	3,520	90	3,610
TOTAL	14,300	1,160	15,460

*Study Area is bounded by Washington Avenue on the north, the Mississippi River on the west and south, and the railroad tracks on the east.

TABLE 2

1971 DAILY PERSON TRIPS TO HEALTH SCIENCE AREA** WITHIN STUDY AREA

	Mode of Travel		
User	Auto	Transit	Total
Faculty	1,190	24	1,214
Staff	2,900	124	3,024
Student	4,050	390	4,440
Other	2,660	46	2,706
TOTAL	10,800	584	11,384

**The Health Science Area is bounded by Washington Avenue on the north, Howard Street on the east, East River Road on the south, and the Health Service, Botany, and Zoology buildings on the west.

TABLE 3

1970 AND 1975 HEALTH SCIENCE POPULATION STATISTICS

ORGANIZATION	FACULTY		STUDENTS (Grad.& Under)		EMPLOYEES		INPATIENTS		OUTPATIENTS		VISITORS	
	Pres. 1970	Proj. 1975	Pres. 1970	Proj. 1975	Pres. 1970	Proj. 1975	Pres. 1970	Proj. 1975	Pres. 1970	Proj. 1975	Pres. 1970	Proj. 1975
School of Dentistry	175	249	620	1125	92	220	4	10	670	1175	210	425
School of Medicine	290	423	1001	1400	977	1350	0	0	0	0	0	0
School of Mortuary Science	4	5	64	76	2	3	0	0	0	0	0	0
School of Nursing	38	90	399	540	15	22	0	0	0	0	0	0
College of Pharmacy	32	42	340	490	18	45	0	0	0	0	0	0
School of Public Health	79	134	282	443	73	110	0	0	0	0	0	0
University Hospitals	0	0	0	0	3334	4432	622	804	492	854	1320	2500
Assoc. Health Professions	56	86	324	502	105	182	0	0	0	0	0	0
New Teaching Programs	26	42	98	182	46	74	0	0	0	0	0	0
Plant Services	0	0	0	0	250	(500)*	0	0	0	0	0	0
TOTALS	700	1071	3128	4758	4912	6938	626	814	1162	2029	1530	2925

SOURCE: Memo Dated February 20, 1970, from Mark W. Wallace with Subject: "Health Sciences Population Study"

- That the 1970 population figures utilized are approximately the same as the population figures at the time the travel characteristics questionnaire survey was conducted in February, 1971.

- That the 1975 population projections are accurate.

- That the daily number of trips per person in each user category is the same in 1975 as it was in 1971.

Since all growth anticipated in the Study Area by 1975 will occur in the Health Sciences, it is assumed that person trips to non-Health Science portions of the Study Area will be the same in 1975 as in 1971. For each user category, this number may then be added to the 1975 trip projection for the Health Science area to determine the total number of 1975 daily person trips to the Study Area. 1975 trip forecasts by user type are listed for both the Health Science area and the entire Study Area in Table 4. The categorization of these trips by mode is completed in a later section, which develops the parking space needs.

1985 DAILY PERSON TRIPS TO STUDY AREA

Population figures for the Study Area were not forecast beyond 1975. However, space needs have been projected to 1986, as shown in Table 5. By interpolating between 1973 and 1986 it is possible to derive space needs for 1975 and 1985.

Since trip generation is correlated with building area in people per 1,000 square feet), it is possible to project total 1985 trips to the Health Sciences area through the following relationship:

$$\frac{\text{1985 Daily Number of Trips to Health Sciences Area}}{\text{1975 Daily Number of Trips to Health Sciences Area}} = \frac{\text{1985 Space Needs}}{\text{1975 Space Needs}}$$

In addition to these trips to the Health Science area, other trips which will be made to the Study Area in 1985 include:

- Trips to existing non-Health Science developments that will remain. From the 1971 questionnaire survey, this travel amounts to 4,110 person trips per day.

TABLE 4

1975 DAILY PERSON TRIPS TO HEALTH SCIENCE AREA AND STUDY AREA

User	1975 Daily Person Trips To Health - Science Area	1975 Daily Person Trips To Study Area
Faculty	1860	2240
Staff	4270	5210
Student	6750	8070
Others	3560	4420
Total	16440	19940

TABLE 5

PROJECTED LONG - RANGE SPACE

REQUIREMENTS FOR HEALTH SCIENCE PROGRAMS

Program	1966 Space Provided (Sq. Ft.)	1973 Space Needs (Sq. Ft.)	1986 Space Needs (Sq. Ft.)
Clinical Medicine and Ancillary Teaching Programs	238,378	511,208	699,023
School of Dentistry	63,190	291,529	386,515
School of Nursing	12,482	50,465	66,384
School of Public Health	40,520	102,000	165,000

SOURCE: "Future Planning for the Health Sciences; Part III - Subcommittee Program and Space Reports," University of Minnesota, February 1967.

- Trips to a new classroom/office building on the site of existing Parking Lot C6. Based upon an estimated floor area of 225,000 square feet, it is projected that this building will attract 3,300 person trips per day to the Study Area.

- Trips to the Veteran's and Gillette Hospitals that are under consideration to be located in the Study Area by 1985. Assuming that these two facilities provide a total of 920 beds, it is estimated that they will attract a total of 4,600 person trips per day.

The total projected 1985 person trips to the Study Area per day, determined by summing the four above categories, is 33,210 trips.

Assuming that the proportions of total trips made by faculty, staff, students, and others are the same in 1985 as in 1975, the total number of person trips to the Study Area in 1985 may be apportioned as follows:

User	1985 Daily Number of Person Trips
Faculty	3,760
Staff	8,630
Students	13,620
Others	7,200
TOTAL	33,210

The categorization of these trips by mode is discussed later.

SUMMARY OF TRIP FORECASTS

The preceding section of this chapter discussed procedures for forecasting future trips to the Study Area and presented the results of the 1975 and 1985 trip forecasts. For these two time periods the projected daily number of person trips to the Health Science area and the Study Area are summarized in Table 6, together with the 1971 trip-making statistics.

DEVELOPMENT OF 1975 PARKING DEMAND

Following the three step process previously described, 1975 parking space needs are calculated as follows:

Step 1

The calculation of parking space needs in the Health Sciences area through the "parking accumluation" method is based on the precept that the relationship between peak parking accumulation and the daily number of vehicular trips is constant over time and between the Study Area and the Health Sciences area. One other key assumption is that peak parking accumulation may be estimated by complete utilization of spaces available in the Study Area.

With these assumptions, 1975 parking space demand in the Health Sciences area (i.e., estimated peak parking accumulation) may be estimated through the following relationship:

$$\frac{\text{1975 parking space demand for Health Sciences}}{\text{1975 daily auto trips to Health Sciences}} = \frac{\text{1971 peak parking accumulation in Study Area}}{\text{1971 daily auto trips to Study Area}}$$

By applying a modal split to the 1975 person trip forecasts, the 1975 daily auto trips to the Campus can be estimated. Several factors, particularly proposed transit improvements and large new residential developments being planned near the West Bank Campus, should serve to increase the percentage of total travel to the East Bank Campus by transit. The specific manner in which these factors affect transit ridership is dependent upon policy decisions related to transit usage. To allow planning flexibility, 1975 auto trips to the Health Sciences area have been estimated based upon assumptions of existing transit usage and an increased transit usage considered feasible under present plans. This information is presented in Table 7.

TABLE 7

1975 DAILY TRIPS BY MODE TO HEALTH SCIENCES AREA

Category	1975 Total Person Trips	Existing Transit Usage				Maximum Transit Usage			
		Transit %	Transit Person Trips	Auto Person Trips	Auto Vehicle Trips	Transit %	Transit Person Trips	Auto Person Trips	Auto Vehicle Trips
Faculty	1860	2.0	37	1823	1250	5	93	1767	1210
Staff	4270	4.1	175	4095	2800	10	427	3843	2640
Student	6750	8.8	595	6155	4200	25	1690	5060	3470
Other	3560	1.7	60	3500	2400	5	178	3382	2320
Totals	16,440	5.0%	867	15,573	10,670	15%	2,388	14,052	9,640

Based upon this information, the 1975 parking space demand for the Health Sciences area, as calculated through the "parking accumulation" method, is as follows for the two transit assumptions:

Transit Assumption	1975 Parking Space Demand for Health Sciences Area
Existing Transit Usage	3,560
Maximum Transit Usage	3,220

The second method for estimating parking space demand in the Health Sciences area is called the "parking standards" method. This procedure utilizes 1975 population estimates and estimates of the peak daytime accumulation of inpatients, outpatients, and dental patients. Parking space demand is then calculated by applying particular parking adjustment factors to each user type. The factors applied are based upon user characteristics and University policies. Table 8 documents this procedure, together with the calculated parking space demand for the two transit assumptions.

Step 2 -

Table 9 compares the 1975 parking space demand for the Health Sciences are as calculated through the "parking accumulation" and "parking standards" methods. The "parking standards" method best represents true demand, while "parking accumulation" method represents provision of spaces in the same relationship between demand and supply as presently provided. As such, "parking standards" values are larger primarily because peak parking demand is probably greater than the number of available parking spaces. It is concluded that the results of the "parking standards" method best represent the 1975 parking space demand for the Health Sciences area.

Step 3 -

This step serves to expand the results of Step 2 to include all other persons who need to park in the Study Area. According to the previously referenced 1971 transportation survey, 1,019 auto drivers per day park in the Study Area and are destined to non-Health Science portions of the Study Area. Assuming that 80 percent of these motorists are on Campus at the time of peak accumulation, the parking space demand in the Study Area would be increased by 815 spaces.

TABLE 8

1975 PARKING SPACE DEMAND FOR HEALTH SCIENCES AREA
FROM "PARKING STANDARDS" METHOD

Category	1975 Population	Parking Adjustment Factor: Walk Trips	Auto Passenger Trips	Peak Accumulation Factor	Transit: Existing Usage %	Existing Usage Trips	Max. Usage %	Max. Usage Trips	1975 Pkg. Space Demand w/Existing Transit Usage	1975 Pkg. Space Demand w/Max. Transit Usage
Faculty[1]	1071	150	-	-	2.0	21	5	53	900	868
Staff[1]	6938	375	1135	60%	4.1	170	10	415	2470	2225
Student[1]	4758	1750	545	80%	8.8	335	25	953	1180	562
Inpatient	52[2]	-	-	-	1.7	1	5	3	51	49
Outpatient	365[2]	-	-	-	1.7	6	5	18	359	347
Visitor	804[3] beds	-	-	-	1.7	2	5	7	132	127
Dental Patient	276[4]	-	-	-	1.7	5	5	14	271	262
TOTALS		2275	1680			540		1463	5363	4440

[1] 1975 parking space demand = (1975 population x peak accumulation factor) - walk trips - auto passenger trips - transit trips
[2] peak daytime accumulation as derived from 1970 figures provided by University Hospital
[3] assumed that one parking space needed per six beds at time of peak parking demand in area
[4] peak daytime accumulation as derived from average daily number of dental patients

TABLE 9

COMPARISON OF 1975 PARKING SPACE DEMAND IN HEALTH SCIENCES AREA BY TWO METHODS

Method	Parking Space Demand with Existing Transit Usage	Parking Space Demand with Maximum Transit Usage
Parking Accumulation[1/]	3560	3220
Parking Standards	5363	4440

1/ using peak parking accumulation ratio for study area

Also according to the survey, 1,953 auto drivers who are destined outside the Study Area, park in the Study Area per day. These parkers occupy a large percentage of the available spaces in the Study Area, thereby limiting usage of those spaces by people in the Study Area. Serious consideration should be given to satisfying these parking needs closer to their destinations. It is assumed that this situation will not change by 1975 and that parking spaces will continue to be needed in the Study Area for these 1,953 auto drivers. Assuming that 80 percent of those motorists are on Campus at the time of peak accumulation, the parking space demand in the Study Area would be increased by 1,560 spaces.

According to the survey 4,370 auto drivers, who are destined to the Study Area, park outside the area per day. Assuming an 80 percent accumulation at the time of peak parking demand, the parking space demand is 3,500 spaces. Most of these motorists park in the large lots north of Fourth Street S.E. It would be desirable to accommodate some of these parkers in the Study Area. For the purposes of forecasting parking demand, the assumption is made that 1/3 of these parkers should be satisfied within the Study Area. Changes in this assumption would greatly change the forecasted parking needs.

Application of the adjustments identified in Steps 3 to the results of Step 2 gives the following 1975 parking space needs for the Study Area:

Transit Assumption	1975 Parking Spaces Needed in the Study Area
Existing Transit Usage	5,404
Increased Transit Usage	4,481

These needs compare with a present availability of 4,100 parking spaces in the Study Area. Of these spaces, approximately 100 will be eliminated in the Mayo Garage during 1972 and 200 spaces will be eliminated by construction of the Dartmouth Interchange Connector, 1,145 spaces will be eliminated on the river flats by 1975, leaving only 2,655 spaces. Therefore, the anticipated 1975 parking space deficiency ranges from 1826 to 2749 spaces, depending upon transit utilization.

DEVELOPMENT OF 1985 PARKING DEMAND

The three step procedure used to calculate 1975 parking space needs could not be used to estimate 1985 parking requirements due to the lack of 1985 population projections. Instead, a preliminary estimate of 1985 parking space needs was made through the following relationship:

$$\frac{\text{1985 parking space needs}}{\text{1975 parking space needs}} = \frac{\text{1985 daily person trips to the study area}}{\text{1975 daily person trips to the study area}}$$

This method assumes that travel modes and arrival/departure patterns are the same in 1985 as in 1975. which is dependent upon numerous factors. Therefore, this forecast is only approximate and should be revised when 1985 population figures become available.

The number of daily person trips to the Study Area were projected to be 16,440 in 1975 and 33,210 in 1985. The 1975 parking space needs utilized were 4,481 spaces (increased transit usage.) This information resulted in an estimated need for 9,030 parking spaces in the Study Area by 1985, which represents an increase of 7,375 spaces over the number of spaces presently available. This figure could be reduced substantially if new regional and distribution transit systems are implemented, which increase transit usage above that assumed in the 1975 maximum transit usage condition.

Table 10 summarizes parking supply, demand, and space deficiencies for 1975 and 1985.

TABLE 10

PROJECTED 1975 AND 1985 PARKING SPACE DEFICIENCIES
IN STUDY AREA

Existing Spaces with Removal of Spaces in Mayo, on River Flats, and on Streets	1975 Parking Space Needs[1] w/Existing Transit Usage	1975 Parking Space Needs[1] w/ Transit Usage	1985 Parking Space Needs[2]	Parking Space Deficiencies 1975 w/Existing Transit	Parking Space Deficiencies 1975 w/Max. Transit	Parking Space Deficiencies 1985
2655	5404	4481	9030	2749	1826	7375

[1] from "parking standards" method and assuming

- same number of persons park in study area and are destined to non-Health Science portions of study area as today (815 additional spaces)
- same number of persons park in study area and are destined outside study area as today (1560 additional spaces)
- same number of persons park outside study area and are destined to study area as today (3500 fewer spaces)

[2] based on relationship of 1985 trips/1975 trips and assuming maximum transit usage as per 1975.

SUMMARY OF 1975 AND 1985 PARKING SPACE NEEDS

A number of assumptions were made in determining the 1975 parking space needs; they included assumptions on:

- % transit trips
- car occupancy
- % walk trips
- % of total users on Campus at peak accumulation
- the number of Study Area users who would park outside the area and walk in
- the number of parkers within the Study Area who walk out
- the method, "parking standards" or "parking accumulation" which best forecasts need

Depending upon what assumptions are made, the 1975 forecasted space needs range from a few hundred spaces to over 5,000 spaces. One of the key assumptions is the number of existing "out of Study Area" parkers to be satisfied within the Study Area; the assumption made was that 1/3 of the out-of-area parkers should be provided spaces.

The forecasted deficiency in 1975 parking needs, given a continuation of existing 5% transit usage is 2,749. The forecasted deficiency in 1975 parking needs, given an increase to 15% transit useage, is 1,826 spaces. The recommendation is to provide 2,000 car parking ramp to serve the 1975 needs of the Health Science Complex and the immediate area.

To project 1985 parking space needs is complicated by the following points:

- future regional and circulation/distribution transit
- change in residential choice of Campus users; Cedar River Associates alone is building 12,500 new dwelling units by 1985
- 1985 population projections for the Health Science Complex are vague.

The decision as to whether to provide additional structural capacity in the 2,000 car ramp should be made when detailed cost differential figures are available.

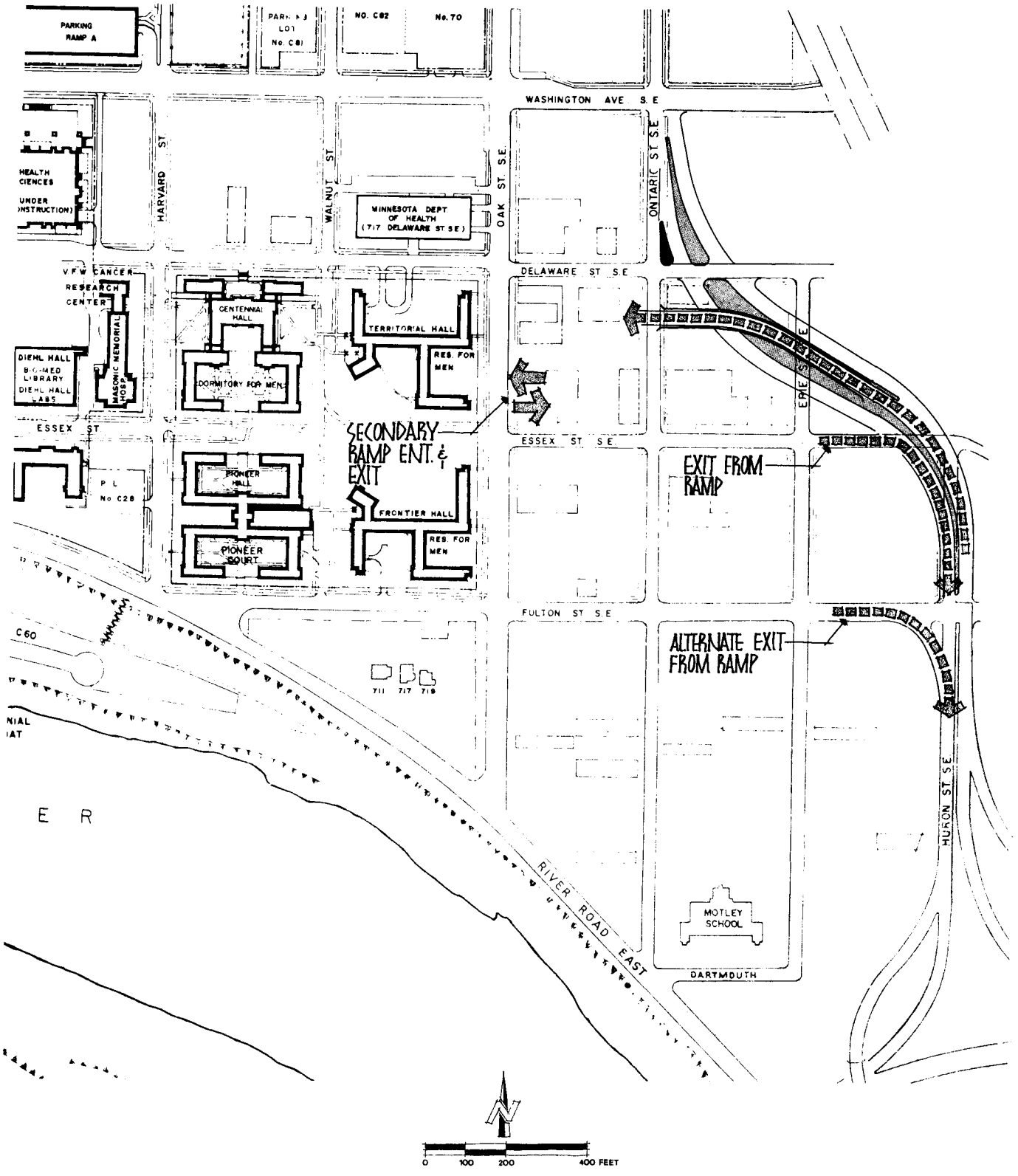
DARTMOUTH INTERCHANGE CONNECTOR

A key transportation element in the Study Area is the proposed Dartmouth Interchange Connector, which would link the I-94 entrance and exit ramps at Fulton Street to Washington Avenue at Ontario Street. The serious need for this link has been recognized by the University and the City. When constructed, it will provide a connection between I-94 and the proposed parking ramp east of Oak Street; it will provide a direct arterial link between I-94 and Washington Avenue (and, eventually, University Avenue and 4th Street S.E.); it will reduce traffic volumes on local streets in the University area, and it will improve safety through a reduction in turning movements.

Several design concepts have been developed for the Dartmouth Interchange Connector. Due to constraints imposed by existing developments in the area, the number of feasible alternative concepts has been reduced to two. One alternative is shown in Figure 13. A major feature of this plan, which was developed by the City of Minneapolis, is that it provides a direct, overhead ramp from the connector into the proposed parking garage. A second alternate, which has evolved through meetings with University officials, is shown in Figure 14. This plan is different from Alternate 1 in that it accommodates the left turn from the south into the proposed parking garage with a "jug handle" design. Alternate 2 is entirely at grade whereas Alternate 1 involves construction of a bridge structure for the ramp leading to the garage.

To evaluate these two alternatives for the Dartmouth Interchange Connector, six criteria were selected - capacity, relationship to movements within the parking garage, options available to the motorist, cost, right-of-way requirements, and environmental impact. An evaluation of the two alternatives with regard to these criteria is provided in Table 11. The results show that Alternate 2, with the "jug handle" left turn, satisfies the criteria better than Alternate 1.

The recommendation is made that the design of the Dartmouth Interchange Connector follow the concept shown as Alternate 2. It is anticipated that this concept would provide convenient traffic access to all nearby parcels of land. For example, the Longyear Company could be served by its present access point at the intersection of Delaware and Erie Streets and by a possible new access point off Essex Street east of the Connector.



university of minnesota

health sciences area traffic plan

bather ringrose wolsfeld inc.

figure 13

DARTMOUTH INTERCHANGE CONNECTOR ALTERNATE 1

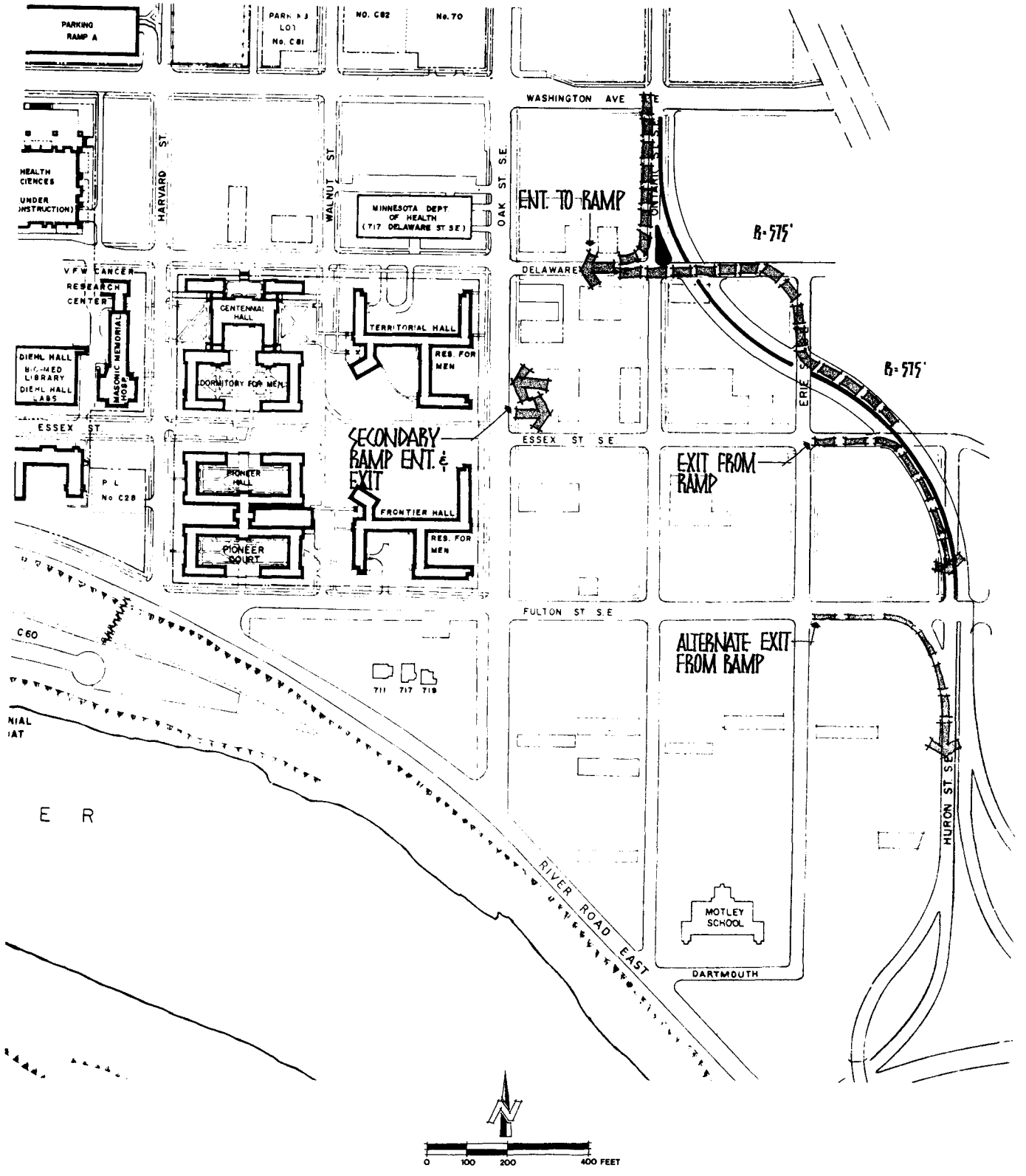


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figure 14

DARTMOUTH INTERCHANGE CONNECTOR ALTERNATE 2

TABLE 11

EVALUATION OF ALTERNATIVES FOR DARTMOUTH INTERCHANGE CONNECTOR

Evaluation Criteria	Alternate 1 w/elevated ramp to garage	Alternate 2 w/"jug handle" left turn
Capacity	Free flow ramp with capacity of garage entrance being capacity constraint	Entrance to garage controlled by traffic signal at intersection of connector and Delaware Street with three lanes on east approach and green time for Delaware Street comparable to that required for Washington Avenue at its intersection with the connector. Intersection would provide more than sufficient capacity for movements to ramp. Again, capacity of garage entrance would control.
Relationship to Movements With Parking Garage	Entrance at second level means that all persons would have to travel vertically at least one level to relate to ground level transportation facilities. This could pose difficulties for handicapped patients.	Entrance at ground level adjacent to terminus of proposed Health Science transportation facility would require no vertical movement and minimal lateral movement.
Options Available to Motorist	Once on the ramp, the motorist would be committed to entering the parking garage.	Until he enters the garage structure, the motorist has the option of whether to park in the garage.
Construction Cost	Would require new bridge structure approximately 600 feet long. Rough cost estimate is $300,000.	Would utilize portions of existing Erie and Delaware Streets, with minor widening and channelization.
Environmental Impact	Elevated structure would create higher noise level and visual obstruction.	As a fully at-grade facility, this alternate does not create any vertical sight obstructions.
Right-of-Way Requirement	Requires more land area than Alternate 2.	

RECOMMENDED TRANSPORTATION PLAN

SUMMARY OF RECOMMENDATIONS

In the context of the existing conditions, planned developments, parking forecasts, and the proposed Dartmouth Interchange Connector a series of recommendations are presented to resolve the transportation issues previously identified. These recommendations are integrated into a transportation plan for the Study Area and are shown in Figure 15. Descriptions of the specific recommendations follow.

PARKING RECOMMENDATIONS

- To construct a four level garage with approximately 2,000 spaces on the site bounded by Oak Street on the west, Ontario Street on the east, Essex Street on the south and the property line approximately 150 feet north of Delaware Street

  The decision to locate the ramp in the above-defined area is based on the following factors:

  - The transit connection between the Health Science Complex and the ramp most logically runs along Delaware; by extending the ramp north of Delaware the bus turnaround is easily facilitated and is focused closer to the center of the ramp; and the interface with the reception center, ramp entrance, discharge of invalids, and transit stop is well accommodated.

  - The centroid of the ramp is close to Delaware, the further south the ramp is located the greater the distance to walk or provide transit service.

  - The land provides a good balance between number of levels and land requirements

  - By going north of Delaware, the ramp is somewhat closer to Memorial Stadium.

  This garage would have its primary entrance off Delaware Street and its primary exit onto Essex Street, with a secondary entrance and exit on Oak Street. To meet long-range parking needs, consideration should be given to the possibility of vertical or horizontal expansion to this parking facility.

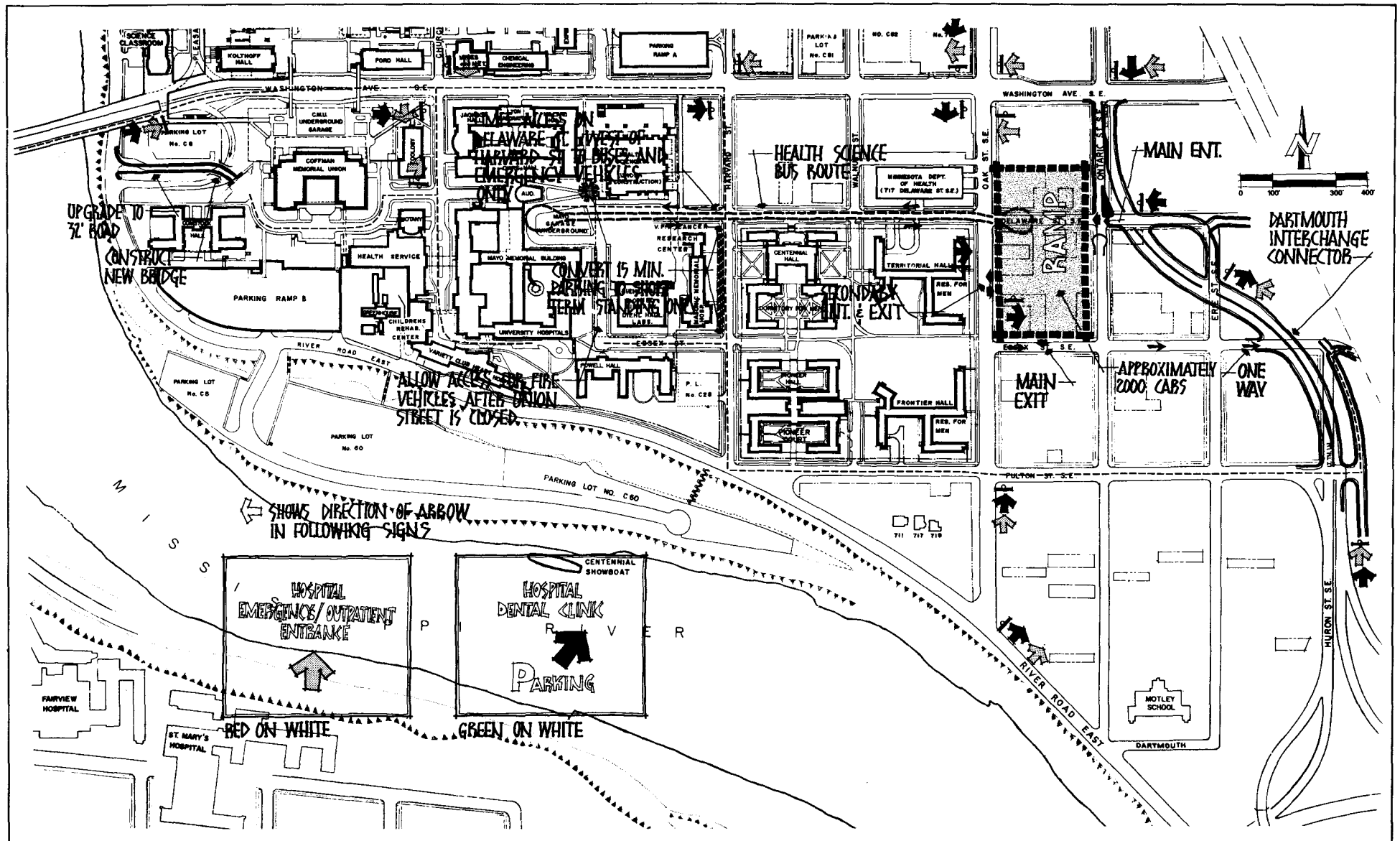

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figure 15

RECOMMENDED TRANSPORTATION PLAN

----- PROPOSED BICYCLE ROUTE

PROPOSED BICYCLE PARKING AREA

PROPOSED DIRECTIONAL SIGNING

- To convert the existing 15 minute parking regulation on the west side of Harvard Street between Delaware and Essex Streets to permit standing only

  This change is needed to serve the pick-up and delivery function presently served by the loop in front of the University Hospital.

- To provide parking spaces for handicapped persons that are at least 12 feet wide and are readily accessible to entry points

RECOMMENDATIONS CONCERNING THE RELATIONSHIP BETWEEN PROPOSED PARKING GARAGE AND HEALTH SCIENCE ENTRANCES

- To design the parking garage to include a reception/information center for Health Science patients

  Problems presently exist concerning access to the Hospital entrances and congestion on the loop in front of the Hospital. With additional developments and a planned reduction in the size of the loop, these problems would intensify in the future. To alleviate this situation, a number of steps are needed, one of which is to consider the parking garage as the main Hospital entrance. A typical patient would approach the Campus on an arterial roadway, would follow a clearly marked route to the parking garage and would be received, informed and directed to the transit system which would deliver him to the appropriate Health Science building entrance.

- To provide bus service between the parking garage and the Health Science building entrances

  As previously mentioned, some form of personal conveyance is needed between the parking garage and the Health Science building entrances. In addition to bus service, several other possible systems were considered, including a moving pedestrian sidewalk. Based on present unit costs, this type of system is estimated to cost $2,250,000, not including the cost of the enclosure, with annual power costs of $55,000. By comparison, bus service is estimated to cost $30 - $40,000 per year depending upon the time period in which service is provided. For the near future, bus service is recommended due to its lower expense and easy implementation. For the long-range future, consideration should continue to be given for other means of person conveyance.

- Close Delaware Street west of Harvard Street, including the loop in front of the Hospital, to all vehicular traffic except buses and emergency vehicles

  This is the third step needed to complete the link between the parking garage and the Health Science building entrances. Elimination of congestion caused by other vehicular traffic would significantly enhance the efficiency and safety of the bus operation. Closure of this section of Delaware Street would also improve pedestrian safety and accessibility to the Health Science Complex for emergency vehicles.

OTHER RECOMMENDATIONS

- To construct a roadway bridge over the ramp that connects Washington Avenue to East River Road, thereby providing a direct roadway connection between Coffman Memorial Union and East River Road

  Serious problems presently exist concerning access to Coffman Union and Comstock Hall since all traffic must enter and exit along Church Street, passing through the intersection at Washington Avenue. Congestion occurs due to parking and maneuvering problems where the access road presently ends behind Coffman Union. Provision of access to East River Road by constructing the recommended bridge would greatly reduce these problems, by providing an additional two-way outlet/inlet. In addition to providing an access "outlet" for normal traffic and emergency vehicles, the proposed connection would enable a number of short-term parking spaces for users of Comstock Hall or Coffman Union to be provided in Lot C-6.

- To continue to allow fire vehicle access on Union Street, after its closure, for at least 100 feet north of Essex Street

  This access is needed to provide adequate fire protection for the Hospital building and future Unit C.

- To install directional signing as shown in Figure 15 to guide motorists to the proposed parking garage and the Hospital emergency entrance

  This proposed signing system, which follows on signing suggestions made by University officials, is needed to reduce motorist confusion, to eliminate unnecessary

intra-Campus circulation, and to minimize the traffic impact on Washington Avenue.

- To provide bicycle routes as shown in Figure 15 and a new bicycle parking area near Unit A

To accommodate bicycles, which are becoming increasingly numerous on the University Campus, a series of recommendations were developed in an earlier study.[1/]

Bicycle routes shown in Figure 15 differ from those recommended in the earlier study only in the usage of Fulton Street instead of Essex Street due to the difficulty in crossing the proposed Dartmouth Interchange Connector at Essex Street and in the usage of Harvard Street rather than Union Street as a consequence of the closure of Union Street.

1/ "Bicycle Circulation and Parking Study," Office of Physical Planning and Design, University of Minnesota, October, 1971.

APPENDIX

CAPACITY ANALYSIS AT INTERSECTION OF DARTMOUTH INTERCHANGE CONNECTOR AND ACCESS DRIVEWAY TO PROPOSED HEALTH SCIENCES PARKING RAMP - "JUG HANDLE" DESIGN ALTERNATE

- Peak Hour Traffic Demand for Access to Ramp from South on Dartmouth Interchange Connector

  Assume: *3,000 car ramp. This is 1,000 spaces (50%) greater than the recommended ramp capacity.

  *Peak hour vehicular arrivals constitute 60 percent of the ramp's capacity (1,800 vehicles.) Considering that a large portion of the ramp's capacity will be reserved for Health Science patients, this percent peak hour demand volume is a very conservative estimate. Experience indicates 20 percent is the normal inbound peak hour demand.

  *70 percent of vehicular arrivals approach the ramp from the south on the Dartmouth Interchange Connector. This percentage is derived from an origin/destination study conducted on the East Bank/West Bank Campus.[1/]

  Result: The peak hour demand for access to the ramp from the south on the Dartmouth Interchange Connector is 1,800 x 0.70 = 1,260 vehicles/hour.

- Capacity of Proposed "Jug-Handle" Left Turn Roadway at Intersection with Dartmouth Interchange Connector

  Assume: *36 foot approach on the jug-handle left turn roadway.

  *G/C ratio of 0.45. In the future, this signal would be coordinated with the signal at the intersection of the Connector and Washington Avenue. It is anticipated that

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1/ "Inventory of Transportation, University of Minnesota," Bather-Ringrose-Wolsfeld, Inc., May, 1971.

Washington Avenue would require a G/C ratio of at least 0.45, enabling this proportion of green time to also be provided for the jug-handle approach.

*Zero percent trucks. It is anticipated that the number of trucks, i.e., vehicles with a minimum of six tires, would be negligible.

*Zero percent left turns and right turns. The volume of traffic on this approach not destined to the ramp is expected to be negligible.

*Peak hour factor = 0.75. Although peak hour factors in this area are generally higher (An a.m. peak hour factor of 0.93 was calculated from a Fulton Street westbound count in February, 1971.), this value has been selected to give a conservative estimate.

*No parking on the approach.

Result: According to procedures specified in the Highway Capacity Manual (ref. Chart 8 in "Public Roads," August, 1967), the design capacity of this approach is 1,550 vehicles/hour. The level of Service A volume is 1,460 vehicles/hour.

Conclusion

This analysis shows that under the very conservative assumptions, the "jug-handle" design alternate with a 36-foot approach provides level of Service A operation during the peak hour.