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AIRPORT PARKING EXPANSION PROGRAM

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DRAFT ENVIRONMENTAL IMPACT STATEMENT

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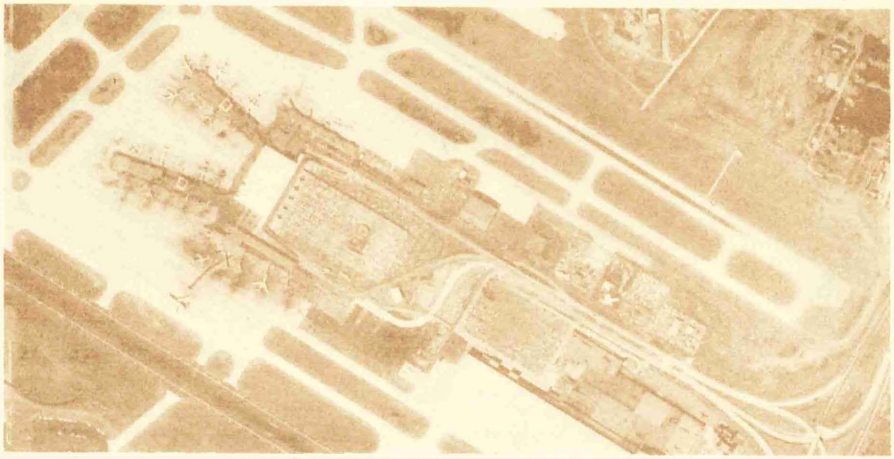
AIRPORT PARKING EXPANSION PROGRAM



DRAFT ENVIRONMENTAL IMPACT STATEMENT

Responsible Agency:
METROPOLITAN AIRPORTS COMMISSION

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Prepared By:
BRW INC.
7101 York Ave. S.
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CHAPTER 1
SUMMARY

THIS CHAPTER PRESENTS A SUMMARY DESCRIPTION OF THE PROPOSED ACTION AND IDENTIFIES ITS MAJOR ENVIRONMENTAL IMPACTS. ALTERNATIVES TO THE PROPOSED ACTION ARE ALSO DESCRIBED AND THEIR IMPACTS IDENTIFIED.

DESCRIPTION OF THE PROPOSED ACTION, ALTERNATIVES, OPTIONS

The Metropolitan Airports Commission (MAC) is proposing to expand the parking supply at Minneapolis-St. Paul International Airport by constructing two multi-level parking structures in the central parking area. The proposed construction consists of five additional supported levels over the existing ground level and deck level parking for a total of seven parking levels. It is planned to construct the parking structures in two phases with the first phase consisting of a seven level parking facility in the southwest quadrant of the central parking area and the second phase consisting of a seven level parking facility in the northwest quadrant of the central parking area. The easterly half of the central parking area will remain surface level parking. This proposed parking expansion program is illustrated in the rendering shown in Figure 1 and constitutes the Proposed Action.

Also included in the program are modified and expanded entrance/exit facilities to and from the parking area and the construction of four double-threaded helices to carry vehicles to and from the several floors of the parking structure. Pedestrian amenities are also being considered, separate from the Proposed Action, including skyway and tunnel connections between the parking facility and the terminal building.

The Proposed Action will provide approximately 9,400 total parking spaces at the airport compared with 5,200 parking spaces currently available. This expanded parking supply is sufficient to satisfy the parking demand generated by slightly more than 7 million annual enplanements. (Currently the airport is handling approximately 4 million enplanements per year.) This level of air passenger activity is expected to occur sometime in the mid 1990's. The ultimate capacity of the present terminal area has been estimated to be 10 million annual enplanements requiring approximately 13,000 parking spaces.

Several "Alternatives to the Proposed Action" are documented in the environmental analysis. A No-Build alternative, a Medium-Build alternative, and a Remote Parking alternative have been investigated relative to their feasibility in meeting the parking needs for 7 million annual enplanements and their resultant impacts upon the environment.

In addition, "Options to Provide Parking Beyond the Proposed Action" are available to the MAC and have also been documented in the environmental analysis. Construction of the seven level parking structure does not preclude any future options to serve the parking needs generated by 10 million annual enplanements. The options investigated are to provide no additional parking beyond the Proposed Action, to construct another seven level parking structure in the easterly half of the central parking area, or to construct a remote parking facility with shuttle bus connections to the main terminal.

Summary Table 1 documents the nature of the Proposed Action, identifies the alternatives to the Proposed Action, and defines the options available to provide parking beyond the Proposed Action.

SUMMARY TABLE 1

PROPOSED ACTION, ALTERNATIVES TO THE PROPOSED ACTION, FUTURE OPTIONS

Scenario	Annual Enplanements (Millions)	Parking Supply Goal*	Construction Activity**	Parking Provided	
				Terminal	Remote
PROPOSED ACTION	7	9,100	7-level structure	9,400	0
ALTERNATIVES TO THE PROPOSED ACTION					
No Build Alternative	7	9,100	None	5,200	0
Medium Build Alternative	7	9,100	5-level structure	7,400	0
On-Airport Remote Parking Alternative	7	9,100	Surface lot	5,200	3,900
OPTIONS TO PROVIDE PARKING BEYOND THE PROPOSED ACTION					
No Build Option	10	13,000	None	9,400	0
In Terminal Structured Parking Option	10	13,000	Second 7-level structure	13,000	0
On-Airport Remote Parking Option	10	13,000	Surface lot	9,400	3,600

*Based upon 1,300 parking spaces per million enplanements.

**The number of parking levels noted consists of the existing ground level parking, the existing deck level parking, and the construction of either three additional levels or five additional levels of structured parking.

ENVIRONMENTAL IMPACTS

TRAVEL DEMAND IMPACTS

The impacts of the Proposed Action upon the travel demand generated by 7 million annual enplanements will be to generate approximately 20,700 inbound vehicles per day to all uses within the main terminal complex. Of this total approximately 18,100 vehicles will be destined to air passenger service areas; either the central parking facility or the curbside areas on the upper and lower level roadways. Travel to the airport is forecasted to be allocated by mode of travel as shown in Summary Table 2. Also shown in Summary Table 2 is the forecasted mode of travel to the airport for 10 million annual enplanements assuming that no additional parking is provided beyond the Proposed Action.

SUMMARY TABLE 2

TRAVEL DEMAND IMPACTS OF THE PROPOSED ACTION

Mode	Existing – 1977 Vol. (vpd)	%	Proposed Action 7 Million Enplanements Vol. (vpd)	%	Proposed Action 10 Million Enplanements Vol. (vpd)	%
Private Auto	9,175	68.4	13,750	75.9	16,400	75.5
Rental Car	1,700	12.7	1,775	9.8	1,800	8.3
Taxi	1,275	9.5	1,300	7.2	2,120	9.8
Limousine	263	2.0	275	1.5	320	1.5
Courtesy Car	425	3.2	450	2.5	460	2.1
Bus	50	0.4	50	0.3	100	0.5
Other	512	3.8	500	2.8	500	2.3
Totals	13,400	100.0	18,100	100.0	21,700	100.0

The period of greatest impact upon traffic operations will occur during the construction of the first phase of the parking facility. Approximately 1,000 parking spaces will be lost during construction and increased congestion and delay will result, especially along the upper and lower level roadways. Alternative parking spaces will be required during this period and are proposed to be provided through joint use of the International Charter Terminal parking lot and the employee parking lot. Both of these facilities are located on 34th Avenue and will be connected to the main terminal complex by a shuttle bus. Reduced parking rates will be charged to encourage use of these facilities. Because of the short term duration of the construction period, diversion of air passengers to alternative modes of travel is expected to occur primarily to taxi and private auto pick-up and drop-off.

Major travel demand impacts of the alternatives to the Proposed Action consist of changes in total vehicle volume to the airport and mode split. These impacts are presented in Summary Table 3.

SUMMARY TABLE 3

TRAVEL DEMAND IMPACTS OF THE ALTERNATIVES TO THE PROPOSED ACTION
(7 Million Annual Enplanements)

	Alternative					
	No Build		Medium Build		Remote Parking	
Mode	Volume	%	Volume	%	Volume	%
Private Auto	11,925	68.9	12,600	71.6	13,625*	75.3
Rental Car	1,775	10.3	1,775	10.1	1,775	9.8
Taxi	2,250	13.0	1,900	10.8	1,400	7.7
Limousine	300	1.7	290	1.6	290	1.6
Courtesy Car	450	2.6	450	2.6	450	2.5
Bus	100	0.6	85	0.5	60	0.3
Other	500	2.9	500	2.8	500	2.8
Totals	17,300	100.0	17,600	100.0	18,100	100.0

*2,800 vehicles per day are attracted to the remote parking lot at 24th Avenue and I-494.

Sufficient roadway capacity is available in the proposed regional highway system to accommodate the traffic volumes generated by the Proposd Action or any of its alternatives. The public transit system would have to double existing service levels to the airport to satisfy the demands generated by the No-Build alternative. Under the MTC's current operating constraints this level of service is not likely to be provided.

Under the No-Build alternative, the possibility exists for private remote parking operations to appear. Locations for such facilities exist south of I-494 and potentially at Metropolitan Stadium. The development and use of such facilities is not under the control of the MAC and would depend, to a large extent, upon the investment risk willing to be taken by the private sector.

AIR QUALITY IMPACTS

Ambient air quality monitoring at the airport revealed that while air quality is generally good in the terminal area, high levels of carbon monoxide do exist in front of the terminal building on the upper and lower level roadways. The carbon monoxide levels frequently exceed the State Air Quality Standards when the wind has a westerly component. This problem was thoroughly investigated with a scale model of the terminal complex in an environmental wind tunnel. Based upon the wind tunnel studies, empirically desired equations describing air pollutant dispersion near the terminal were developed for the existing situation as well as the proposed alternatives. When used with estimates of future traffic and motor vehicle emissions, they indicate that constructing Phase 1 of the Proposed Action will cause a dramatic drop in CO levels, bringing the area into compliance with State standards. Construction of the Medium-Build alternative on the other hand would result in higher CO concentrations. Neither the Remote Parking alternative nor the No-Build alternative would eliminate the violations of the Air Quality Standards by 1981.

Phase 2 of the Proposed Action, however, again alters the dispersion characteristics near the terminal and is expected to cause air quality violations to recur. However, a passive wind deflector device has been developed and tested which would correct this situation and bring the CO levels down to near background levels. The Medium-Build alternative, Remote Parking alternative, and the No-Build alternative are all expected to meet air quality standards by 1988, largely because of the anticipated 80% reduction on automobile exhaust emissions. Predicted maximum CO concentrations for each of the alternatives can be compared in Summary Table 4.

SUMMARY TABLE 4

COMPARISON OF MAXIMUM EXPECTED CO CONCENTERATIONS

(Values are in Parts per Million - ppm)

	Upper Level Roadway		Lower Level Roadway	
	1-Hr. Avg.	8-Hr. Avg.	1-Hr. Avg.	8-Hr. Avg.
Existing (1977)	35.0*	23.5*	26.0	19.5*
Proposed Action Phase 1 (1981)	4.5	2.3	4.4	2.1
Proposed Action Phase 2 (1988)	17.3	10.3*	5.7	4.2
Proposed Action Phase 2 North Wind Deflector (1988)	1.5	1.0	1.5	1.0
Medium-Build Phase 1 (1981)	51.0*	31.0*	50.0*	24.0*
Medium-Build Phase 2 (1988)	14.0	8.3	4.2	3.1
Remote Lot (1981)	20.7	14.4*	13.5	10.0*
Remoe Lot (1988)	6.9	4.9	5.1	5.0
No-Build (1981)	24.7	15.6*	15.8	11.3*
No-Build (1988)	7.5	4.7	5.3	4.1

*Violation of State Standards: 1-Hour Average 30 ppm and 8-Hour Average 9 ppm not to be exceeded more than once per year.

NOISE IMPACTS

Construction Noise

The construction of the proposed parking facility will create high levels of equipment noise during the construction years of 1979 and 1987. At the passenger terminal area, about 150 feet from the nearest point of construction, noise levels will average (L50) from 67 to 79 dBA, depending on the specific construction phase. This compares with the Minnesota Pollution Control Agency L50 standard of 65 dBA for the passenger terminal and parking areas. This impact will be short term in duration and will not affect any off-airport activities. Due to background aircraft noise, however, it is doubtful that the incremental impact of the construction noise will be significant. This conclusion also applies to the future in-terminal parking option.

The remote parking alternative and future remote parking option would result in less noise impact due to its location away from major airport use areas. The noise impact of remote parking construction would also be insignificant.

The no-build scenarios would result in no construction noise impact.

Highway Traffic Noise

Summary Table 5 shows predicted noise levels along I-494 near 34th Avenue for three different situations:

- Existing traffic conditions
- Proposed Action traffic flow
- No-Build alternative traffic flow

The table illustrates that the proposed action will have little effect on traffic-related noise levels on roadways which surround the airport. First, Summary Table 5 shows that because of already high traffic flow, noise levels will increase only by 1 to 2 dBA from 1979 to 1994. Second, the high noise levels along I-494 and other highways are more related to non-airport traffic than airport-bound vehicles. Third, comparison of the No-Build alternative and the Proposed Action shows that the Proposed Action itself has no effect on highway traffic noise levels in the vicinity of the airport.

The highway noise impact of the Remote Parking alternative is similar to the Proposed Action and the No-Build alternative; there is no significant increase in noise levels due to the provision of additional parking.

The impact of highway noise is also similar for all future options. Increases in non-airport related traffic will cause increases in highway noise of 3 to 5 dBA over existing levels by the year 2009. The choice of future parking option will have no effect on highway noise in the vicinity of the airport.

SUMMARY TABLE 5

PREDICTED TRAFFIC NOISE LEVELS ALONG I-494 AT 34TH AVENUE
(Existing Conditions and 7 Million Enplanements)

Condition	Traffic	Peak Hour Volume	% Trucks	dBA at 100 ft. L10	dBA at 100 ft. L50	dBA at 500 ft. L10	dBA at 500 ft. L50
Existing	Non-airport	3,170	6	75	67	62	58
	Airport	1,800	1	67	62	56	53
	Total	4,970	4	76	68	63	59
Proposed Action (1994)	Non-airport	3,930	6	76	68	63	59
	Airport	2,270	1	68	64	57	55
	Total	6,200	4	77	70	64	61
No-Build Alternative (1994)	Non-airport	3,930	6	76	68	63	59
	Airport	2,190	1	68	63	57	54
	Total	6,120	4	77	70	64	61

Aircraft Operations Noise

Noise generated by aircraft operations currently results in L10 noise levels of 65 dBA or greater in areas within one mile of the airport and as far away as $2\frac{1}{2}$ to 3 miles in runway approach areas. Airline activity is not sensitive to the amount of parking provided at the airport due to the cost benefits of reduced travel time by air. Thus, the air traveler will come to the airport by other means (most likely via private auto pick-up or drop-off) if a parking shortage is perceived. Therefore, under the Proposed Action, aircraft noise will continue to be the predominant source of noise and will neither increase no decrease due to the operation of the Proposed Action or any of its alternatives.

The MAC has entered into a stipulation agreement with the MPCA to conduct monitoring of aircraft noise. The results of this monitoring will be used to specifically define the scope of the noise problem after which the MAC will have to develop a strategy to mitigate the aircraft noise problem to the maximum degree feasible. This activity will be required regardless of the type of parking program adopted.

WATER QUALITY IMPACTS

No adverse impacts or significant alterations to the existing water quality will occur as a result of the Proposed Action or from those alternatives which call for multi-level structured parking in the main terminal complex. Existing parking surfaces will simply be replaced with new parking surfaces on the uppermost level of the parking facility. The lower levels of the parking structure will be cleaned by dry sweepers and the collected debris will be disposed of as solid waste.

All runoff from the main terminal complex is a part of the Minnesota River North drainage area. This drainage area, along with three other drainage areas (one on airport property, one from the Fort Snelling National Cemetery, and one from I-494), are proposed to be collected and treated in a stormwater control facility located in the ravine in the southwesterly quadrant of the interchange of I-494 and Post Road. As a consequence, all runoff from the main terminal area will be treated to conform to the limits established in the NPDES permits prior to discharge into the Minnesota River.

Water quality impacts associated with the remote parking alternatives were found to result in greater runoff volumes and a lowering of the overall water quality in the Minnesota River South drainage area. Increases in grease and oil and lead concentrations were identified. However, the net affect of these changes in water quality is insignificant relative to the combined runoff characteristics of the four drainage areas which the MAC is proposing to control and treat. With or without a remote parking facility in the Minnesota River South drainage area, treatment of the total stormwater runoff is required in order to meet the requirements of the NPDES permits for total suspended solids and grease and oil. Summary Table 6 summarizes the water quality impacts of the remote parking alternatives.

SUMMARY TABLE 6

SUMMARY OF WATER QUALITY IMPACTS FOR REMOTE PARKING ALTERNATIVES

	Minnesota River South		Quality of Runoff MAC is Required to Treat (E.A. Hickok & Assoc)		NPDES Limits (Monthly
Parameter	Existing	W/Remote Pkg.	W/I-494	W/O I-494	Average)
Total Suspended Solids (mg/l)	118	117	91	87	30
Grease and Oil (mg/l)	9	12	20	14	10
BOD (mg/l)	31	29	23	27	Monitor
Lead (mg/l)	0.04	0.08	*	*	Monitor

* Values not estimated.

ENERGY IMPACTS

Significant amounts of energy are expected to be consumed as a result of the Proposed Action. Analysis of the energy impacts considered construction energy separate from the annual energy consumption associated with operating the parking ramp and the annual transportation energy consumed by travel to and from the airport. Summary Table 7 identifies the major energy impacts of the various parking scenarios.

Construction energy for the Proposed Action is expected to be 1,059 billion BTU's for both phases. This is the equivalent of 8.48 million gallons of gasoline. Construction of the Medium-Build alternative would use roughly 68 percent of this energy while the remote parking lot would require 11 percent of the energy required for the Proposed Action. Not building the ramp would, of course, require none of this energy. The construction energy is largely irretrievable since most of it is expended in the manufacture of the building materials.

The energy used to operate the lighting and miscellaneous heating of the Proposed Action will increase from 1.7 million kilowatt hours per year for the existing parking supply to 3.28 million kilowatt hours per year after completion of the second phase. The operational energy consumption of the alternatives to the Proposed Action result in significant reductions. The No-Build alternative consumes 46% of the energy consumed by the Proposed Action; the Medium-Build alternative, 75%; and the Remote Parking alternative, 49%. Energy efficient lighting is being installed at the present time such that actual reductions in energy consumption are realized by the No-Build alternative and the Remote Parking alternative when compared with the existing situation.

The largest amount of energy consumption is the annual expenditure of fuel for travel to and from the airport. At the present time 7.33 million gallons of fuel are consumed annually by this travel and is estimated to decrease to 5.78 million gallons per year in 1994 under the Proposed Action. The alternatives to the Proposed Action are estimated to require slightly less transportation energy. The No-Build alternative will consume 95% of the energy consumed by the Proposed Action; the Medium-Build alternative, 97%; and the Remote Parking alternative, 100%.

SUMMARY TABLE 7

ENERGY IMPACTS OF THE PROPOSED ACTION AND ITS ALTERNATIVES

Energy Type	Existing	Proposed Action	% of Proposed Action by Alternative		
			No-Build	Medium-Build	Remote Parking
Construction (Billions of BTU's)	None	1,059	0%	68%	11%
Parking Ramp Operation (Millions of KW-hrs./yr.)	1.7	3.28	46%	75%	49%
Transportation (Millions of gals./yr.)	7.33	5.79	95%	97%	100%

SOCIO-ECONOMIC IMPACTS

The socio-economic impacts associated with the Proposed Action and its alternatives can be viewed as three distinct units; the regional economic impact, the parking management strategies, and the socio-economic effects.

Regional Economic Impact

Information was obtained from the analysis conducted by a regional economic model (SIMLAB). The impact on direct employment, inter-industry employment and induced employment from the adoption of one of the alternative parking scenarios is as summarized in Summary Table 8.

SUMMARY TABLE 8

EMPLOYMENT IMPACTS OF THE PARKING EXPANSION SCENARIOS

Scenario	Total Worker Years
Proposed Action	360
No-Build Alternative	0
Medium Build Alternative	242
On-Airport Remote Parking Alternative	9
No-Build Option (beyond the Proposed Action)	360
In-Terminal Structured Parking Option	656
On-Airport Remote Parking Option	369

While additional construction can be viewed as positive in nature (more jobs, less unemployment, more spendable income) it is short term in duration.

Construction will be funded via revenue bonds for all actions. Hence, no negative effects will occur on any tax levy nor on any established debt limits.

From the context of regional economics the Proposed Action will have a positive impact. This is also true of the Medium-Build alternative and the On-Airport Remote Parking alternative.

Parking Management Strategies

The Proposed Action will not necessitate any changes in the parking management strategy. All other alternative actions will require new policies governing parking and terminal use and will have to address either:

- o Adjustments in parking rates to achieve a balance of supply and demand.
- o Utilization of other transportation modes to deliver and pick up air passengers.

Socio-Economics Effects

Negative socio-economic effects associated with the Proposed Action will be limited to inconvenience during the construction period.

The alternative actions will have greater impact upon both individuals and institutions using the airport. Depending upon the ultimate parking policy adopted by the MAC, major negative impacts of the alternative actions could include:

- o Higher parking rates.
- o Limited parking spaces.
- o Missed planes.
- o Frustration and inconvenience.

Most negative impacts can be mitigated by proper planning and public information and all impacts will be reduced by the passage of time and acclimation.

AESTHETIC IMPACTS

The primary aesthetic impacts of the Proposed Action and the alternatives which involve multi-level parking in the main terminal area include the following:

- Permanent storage of construction materials and major construction equipment on-site during the construction period.
- Elimination of the view of the main terminal building and its distinctive folded plate roof for travelers inbound to the airport and the intrusion of a massive structure into a generally open environment.
- Elimination of the open view outward from the main terminal building.

Parking alternatives which involve the development of remote parking will have negligible visual impact. No impact will occur to users of the main terminal and the impact upon the users of I-494 will be minimal. Users of the remote parking facility will experience the greatest impacts in terms of views and overall aesthetics.

Mitigating measures involve the incorporation of plantings and decorative elements into the site plan of both the mult-level parking structure alternatives and the remote parking alternatives. In addition, the terminal area parking structure options should be developed within an overall architectural design framework which is compatible with the existing terminal building design.

VEGETATION/WILDLIFE IMPACTS

There will be no adverse impacts on vegetation or wildlife as a consequence of the Proposed Action because the terminal area is presently devoid of any plant material or wildlife inhabitants. However, precautions are necessary during the construction and operation period to prevent water quality deterioration.

Alternatives to the Proposed Action involving construction and operation activities in the main terminal area will also have no adverse impacts upon vegetation and wildlife. This is also true of the No-Build scenarios.

Alternatives involving the development of a remote parking facility will have minimal impacts.

Thirty-two acres of timothy-brome grassland habitat will be converted to a hard surface parking lot. Runoff will be increased because of reduced permeability resulting in the need for measures to improve water quality prior to discharging run-off water into the Minnesota River. Protective vegetative cover should be allowed to remain as long as possible before application of surfacing materials.

Loss of 32 acres of grassland habitat will not significantly affect any existing airport wildlife populations. Other higher quality habitats exist in and around the airport which are designated as permanent open space and are protected by statute as either park or refuge. High quality wildlife habitat under the jurisdiction of the Metropolitan Airports Commission at the Minneaplis-St. Paul International Airport should be designated as permanent open space.

HISTORIC/CULTURAL IMPACTS

Construction of a multi-level parking structure within the main terminal complex will not have any adverse impacts upon historic or cultural resources. The construction area is currently used for parking and no historic or cultural assets will be affected by the Proposed Action or any of its alternatives which result in parking expansion in the central parking area.

Likewise no adverse impacts upon historic and cultural resources are expected to occur as a result of constructing a remote parking facility north of I-494. The proposed 32 acre site identified as a possible remote parking site has been graded in the past in preparation for construction of air cargo facilities. Since any historic or cultural resources which may have existed no longer exist, conversion of this area to a remote parking facility will not have any detrimental impacts upon historic or cultural resources.

A review of the Proposed Action and its alternatives was made by the Minnesota Historical Society which verified that no adverse impacts will result.

SIGNIFICANT FINDINGS AND CONCLUSIONS

The results of the environmental analysis indicates that there are two primary factors influencing the identification and selection of a parking solution for the airport. These factors are:

- o A serious parking shortage has developed at the airport. An unprecedented increase in enplanements has occurred during the first quarter of 1978 which has forced the MAC to publicize the lack of parking in the mass media and to adopt stop-gap measures to provide joint use parking in the International Charter Terminal. These measures have proven largely ineffective and increased congestion has resulted primarily in the curbside areas immediately in front of the terminal building.

- o While the air quality monitoring showed that most areas in the airport are within State standards, two isolated pockets of stagnant air were found to exist where carbon monoxide levels exceed State standards by substantial margins. These areas occur along the upper and lower level roadways immediately in front of the terminal building.

All other impact areas were found to be insignificantly affected by any of the parking scenarios or were independent of the parking program selected. By way of example: vegetation and wildlife impacts were found to be insignificant under a remote parking scheme and non-existent under an in-terminal parking alternative; water quality impacts were found to be insignificant and, further, all stormwater runoff from airport property will be treated prior to discharge in the Minnesota River; existing highway and aircraft noise impacts were found to be significant problems which are neither aggravated nor mitigated by the selection of any one of the proposed parking scenarios including a No-Build solution. Consequently, it became apparent that the selection of a parking program must specifically address these two distinct but highly related problems. While other potential impacts of the selected parking program remain important concerns, it is nonetheless apparent that the parking shortage, curbside congestion, and air quality violations are the over-riding issues.

As the detailed analysis of the several parking solutions indicates, the Proposed Action, in conjunction with the erection of wind deflector in front of the roof line of the terminal building, results in the provision of an adequate parking supply and an associated reduction in CO concentrations below the maximum limits established by the State. No other parking scenario resulted in the dual solution of both problems. Parking solutions which minimized the parking supply resulted in increased curbside activity and higher emissions while parking solutions which did not incorporate a wind deflector were unacceptable in terms of predicted CO levels.

Therefore, the conclusion of this Draft Environmental Impact Statement is that the MAC should proceed with the implementation of the Proposed Action in two phases:

- The first phase should consist of a seven level parking structure in the southwest quadrant of the central parking area. Wind tunnel tests demonstrated that the entrapment of CO in front of the terminal building would be eliminated as long as the structure was more than five levels high.

- The second phase should consist of a seven level parking structure in the northwest quadrant of the central parking area and include the erection of a wind deflector in front of the roof line of the terminal building.

PERMITS OUTSTANDING

The development of the Proposed Action, involving the two-phase construction of a seven level parking structure in the westerly half of the central parking area at Minneapolis-St. Paul International Airport, will require an APC-19 Permit as an Indirect Source. This permit has not been applied for as of July, 1977, but is anticipated to be submitted upon the determination of the adequacy of the Draft EIS.

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Chapter III HISTORY OF AIRPORT GROWTH AND PLANNING

Chapter IV THE ENVIRONMENTAL SETTING

Chapter V THE PROPOSED ACTION AND ITS IMPACTS

Chapter VI ALTERNATIVES TO THE PROPOSED ACTION AND THEIR IMPACTS

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CHAPTER II
INTRODUCTION

THIS CHAPTER DISCUSSES THE APPROACH UTILIZED IN THE ENVIRONMENTAL ANALYSIS AND DESCRIBES THE OVERALL ORGANIZATION OF THE DOCUMENT.

APPROACH TO THE EIS

The major factor in organizing the environmental impact statement on the proposed parking expansion at Minneapolis-St. Paul International Airport is to define the nature of the Proposed Action. The Comprehensive Master Plan for the airport indicated that the ultimate capacity of the entire airport complex is approximately 17 million air passenger enplanements per year with 10 million enplanements capable of being handled at the present terminal with appropriate modifications to the existing physical facilities. The remaining 7 million enplanements would be served with a new terminal building on the west side of the airport. Because this level of activity (five times greater than the 1975 activity levels) will not occur until well into the next century, it was considered more appropriate to analyze a level of air passenger activity which would occur within the next 20 to 25 years. Furthermore, the MAC is not committed to any specific program beyond the expansion of airside and landside facilities within the present terminal complex.

Therefore, the Proposed Action is defined as the expansion of the in-terminal parking supply to accommodate 7 million annual enplanements which represents a 75% increase over existing activity levels. The accommodation of continued growth in use of the existing terminal complex up to its ultimate capacity of 10 million annual enplanements, is treated in the EIS as a series of future options which, relative to parking needs, include both remote parking and additional in-terminal parking expansion. The impacts of the Proposed Action, alternatives to the Proposed Action, and future options for continued parking expansion beyond the Proposed Action (up to 10 million annual enplanements) are all addressed within this document. The impacts of airport expansion beyond 10 million enplanements would be the subject of another environmental review process at the time specific alternatives for such a program are put forth.

ORGANIZATION OF THE EIS

The environmental analysis of the proposed parking expansion program at the airport is organized into nine chapters. The purpose and content of each of these chapters is described below.

- Chapters I, II, and III present a summary of the EIS and sets forth the historical perspective within which the Proposed Action was developed.

- Chapter IV describes the environmental setting within which the proposed parking expansion will take place. The environmental setting is discussed in terms of the environmental concerns pertinent to the airport situation.

- Chapter V describes in detail the Proposed Action and its associated impacts. Impacts are organized by impact area and within each area direct and indirect impacts are identified and, where possible, quantified. Alternative methods for mitigating various impacts are also discussed along with qualitative assessments of the significance or nonsignificance of various impacts relative to the maintenance of the existing environmental setting.

- Chapter VI identifies alternatives to the Proposed Action and describes their impacts in the same format utilized in the presentation of the impacts of the Proposed Action.

- Chapter VII presents a summary comparison of the impacts of the Proposed Action and its alternatives.

- Chapter VIII discusses future options for continued parking expansion beyond the Proposed Action and documents their probable environmental impacts. The format utilized in this discussion conforms to the format used for the Proposed Action and its alternatives.

- Chapter IX presents additional information relative to the commitment of resources to the Proposed Action, short term uses of the environment versus long term productivity; evaluation of alternatives, impact on State government of any Federal controls associated with the project, and multi-state responsibilities.

Much of the analysis presented in this document is based upon the results of previous studies and special projects undertaken especially for this EIS. A Bibliography is included which identifies resource materials used in the preparation of the EIS including technical reports which describe various aspects of the environmental analysis in greater detail.

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CHAPTER III
HISTORY OF AIRPORT GROWTH AND PLANNING

THIS CHAPTER OUTLINES THE HISTORY OF THE GROWTH AND DEVELOPMENT OF MINNEAPOLIS - ST. PAUL INTERNATIONAL AIRPORT. THE DISCUSSION FOLLOWS THE PLANNING PROCESS THROUGH THE METROPOLITAN AIRPORT SYSTEM PLAN, THE COMPREHENSIVE MASTER PLAN FOR WOLD-CHAMBERLAIN FIELD, AND THE FUNCTIONAL STUDIES RELATING TO THE DEVELOPMENT OF THE TERMINAL COMPLEX.

AIRPORT GROWTH AND DEVELOPMENT

Minneapolis-St. Paul International Airport had its beginnings more than 50 years ago when the Aero Club of Minneapolis, in 1920, leased an old concrete race track and built a hangar in anticipation of government air mail service. While such service was eventually established in 1921, it lasted only three months. However, air mail service was finally resumed in 1926 when Northwest Airways obtained the contract to carry mail between the Twin Cities and Chicago.

Military air units quickly established themselves at the new airport. The Minnesota 109th Observation Squadron (the first Federally recognized National Guard Air Unit) established itself at the airfield in 1921 and remained active until 1930. In 1928, the Naval Reserve Air Squadron moved into a hangar provided by public spirited citizens. Growth in Naval Reserve activity was such that by 1942 the unit had become a full fledged Naval Air Station with more than 40,000 annual operations. In 1943, the U.S. Army Air Corps (predecessor of the U.S. Air Force) also built a hangar to be used by the Air Transport Command as a base for ferrying supplies to the Alaskan-Aleutian area.

The airport received its first name in 1923 when it was designated Wold-Chamberlain Field in honor of two pilots that died over France during World War I. When the Minneapolis Park Board took over the airport in 1928, they renamed it Minneapolis Municipal Airport and developed a master plan for the airport. A warming house was provided as the first terminal and scheduled passenger service was started in 1929. Northwest Airways and Universal Airlines provided passenger service to Chicago and Hanford Airlines, (the predecessor of Mid-Continent) provided passenger service to Sioux City and Omaha. Concrete runways were installed in 1936 by the WPA and U.S. Weather Bureau operations and a control tower followed in 1937 and 1938. A year later, the first radio control of air traffic was inaugurated.

By 1943, the airport was a busy place and growing rapidly. In response to this phenomenon, the Minnesota Legislature created the Minneapolis-St. Paul Metropolitan Airports Commission. Passenger traffic continued to grow from nearly 200,000 passengers in 1944 to 450,000 passengers in 1947. In 1948, the airport was again renamed as Minneapolis-St. Paul International Airport, Wold-Chamberlain Field. With this international designation growth in air passenger activity continued at a rapid rate with nearly 1.2 million passengers carried in 1954. In 1955 the decision was made to move the terminal complex to a new site and construct a new terminal building to meet the projected requirements. A Master Plan for the airport was drawn up in 1956 and the current airport configuration was established. The new terminal building with Pier B (Red Concourse) and Pier C (Blue Concourse) was opened to the public in 1962.

Beginning in 1965, airline passenger traffic grew even more dramatically. The terminal building had been designed for a projected 4 million passengers in 1975 but this figure was exceeded by 1967. From 1966 to 1969 passenger traffic grew from 2.9 million to 5.4 million. This was an increase of 87% in four years. Similarly, air carrier operations (landings and take offs) increased by 65%.

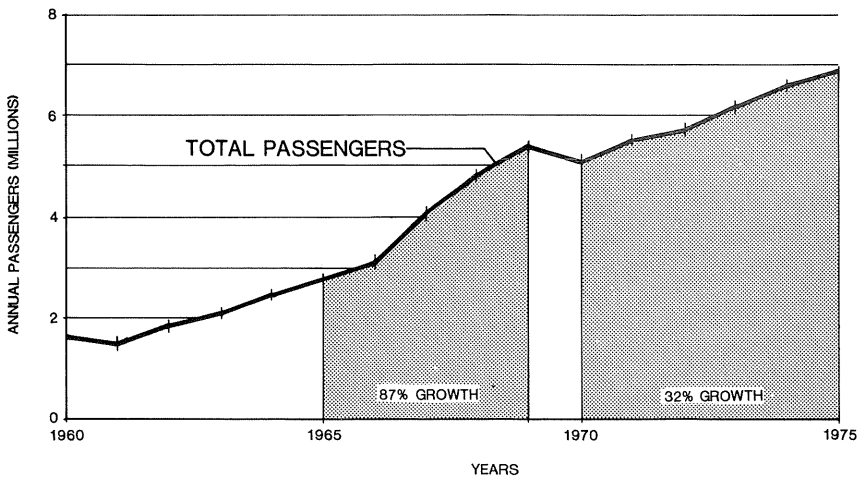
In order to cope with the increasing passenger traffic, second story additions were made to Pier B and Pier C during the period 1963 and 1968. These second level gates were designed to serve jet aircraft and permit loading through jet loader devices. Facilities to handle transient aircraft and international flights requiring Customs and Immigration processing were originally placed on the Red Concourse. However, these facilities were relocated to the end of the Green Concourse (Pier D) when it was constructed in 1968.

The 1956 master plan anticipated the need for auto parking totaling about 3,000 spaces by 1975. The terminal complex provided 1,600 public car parking spaces when it began operation in January 1962, including 225 public and 75 rental car spaces in the terminal building basement garage. By 1965 the demand for public parking escalated to a point where rental car spaces were moved out of the basement and surface parking areas were expanded to handle approximately 2,000 cars. Demand for auto parking paralleled increases in passenger traffic, which during the late 1960's averaged about 20 percent per year. Therefore, a single level parking structure above the center surface lot was completed in 1971 and expanded in 1972.

Over the next five years from 1970 to 1975 the growth rate slowed from the previous rate of 87% to 32% for air passengers and even more dramatically the airline operations growth rate slowed from 65% down to 13%. Three factors appear to be primarily responsible for this slowing of growth:

- The advent of wide body jets, which reduced the number of operations needed, because of their greater capacity.
- The advent of the energy crisis and with it fuel shortages and higher fuel prices.
- The mild recession in 1970, and a more severe recession in 1974–75.

The historical growth trends in both passenger traffic and aircraft operations since 1960 are plotted in Figure 2.



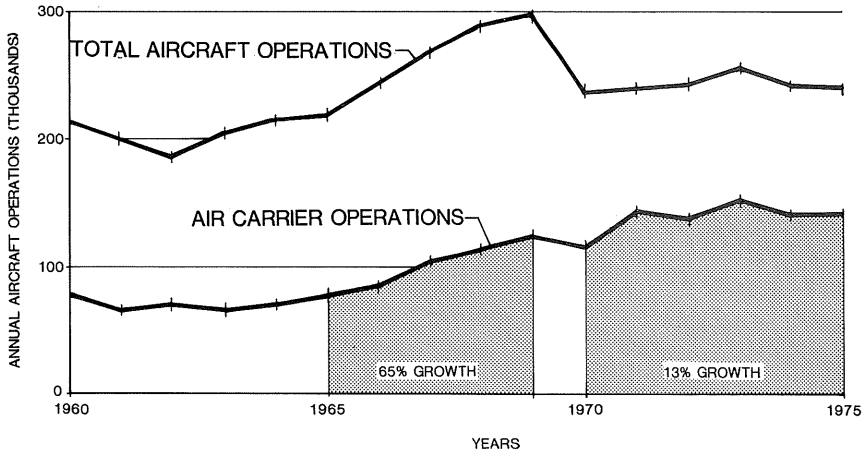


FIGURE 2

GROWTH IN PASSENGER TRAFFIC AND AIRCRAFT OPERATIONS

SOURCE: SUMMARY REPORT
MSP INTERNATIONAL AIRPORT
MASTER PLAN STUDY AUGUST 1976

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

AIRPORT PARKING
EXPANSION PROGRAM
DRAFT-EIS

BATHER.RINGROSE.WOLSFELD.JARVIS.GARDNER

In 1972 the Metropolitan Council adopted the first comprehensive Metropolitan Airports System Plan which forecasted 29 million enplanements by the year 2000 and identified the need to construct a new major airport in Anoka County. However, this proposal was later revised and Wold-Chamberlain Field was designated in the Metropolitan Development Guide to remain as the principal airport in the Twin Cities area. This decision led to a change in the preparation of the Airport Master Plan which was in progress. Subsequently, other Functional Studies investigated specific alternatives for accommodating increased airport activity at Wold-Chamberlain Field.

This sequence of planning activities: Metropolitan System Plan, Airport Master Plan, Functional Studies; is more fully described in the following sections of this document.

METROPOLITAN DEVELOPMENT GUIDE

Between 1972 and 1978, the Aviation Chapter of the Metropolitan Development Guide (MDG) underwent a significant change which greatly altered the direction and scope of long-range planning at Wold-Chamberlain Field.

The first comprehensive Metropolitan Airports System Plan for the Twin Cities area was adopted by the Metropolitan Council in 1972 as a chapter in the Metropolitan Development Guide. The metropolitan airports system, as envisioned by the 1972 plan, included twelve public and private airports. In addition, search areas were identified in the rural fringes of the Metropolitan Area for general aviation airports. Of greatest significance, was the designation of a North Search Area in Anoka County for a new major jet transport facility to replace Wold-Chamberlain Field. Thus, the development of Wold-Chamberlain Field to its full capacity was not envisioned to ever happen, and attention was focused on planning and developing a new airport somewhere in the North Search Area. The current Aviation Chapter of the MDG identifies several factors which required that the 1972 plan undergo a major reassessment. These factors include:

- "Downward revisions by the Metropolitan Council of forecast population and employment that are expected to reflect a comparable decrease in the number of commercial air passengers and general aviation aircraft owners and users. The 1972 Airports System Plan was based upon a projected 2000 population and employment of 3,200,000 and 1,900,000, respectively. The revised system plan is based upon a projected 2000 population and employment of 2,487,000 and 1,342,000, respectively.

- Continuous downward revisions of the total number of air carrier aircraft operations by the FAA since the early 1970's.

- An increased operating efficiency by the airlines in carrying more passengers per gallon of fuel in response to the increasing cost and potential scarcity of aviation fuel since 1972.

- The increasing use of larger capacity jets in commercial air traffic which has reduced the number of projected operations needed to accommodate increasing air travel demands.

- Significant progress in abating aircraft noise at the Minneapolis-St. Paul (MSP) International Airport through: (1) the reduction in the number of projected commercial air operations as the result of the increasing use of larger capacity aircraft, (2) improved aircraft engine design to reduce noise generation, combined with (3) the MAC's current comprehensive noise abatement program. These efforts have placed a new perspective upon the long-term capability of the Area's sole major airport.

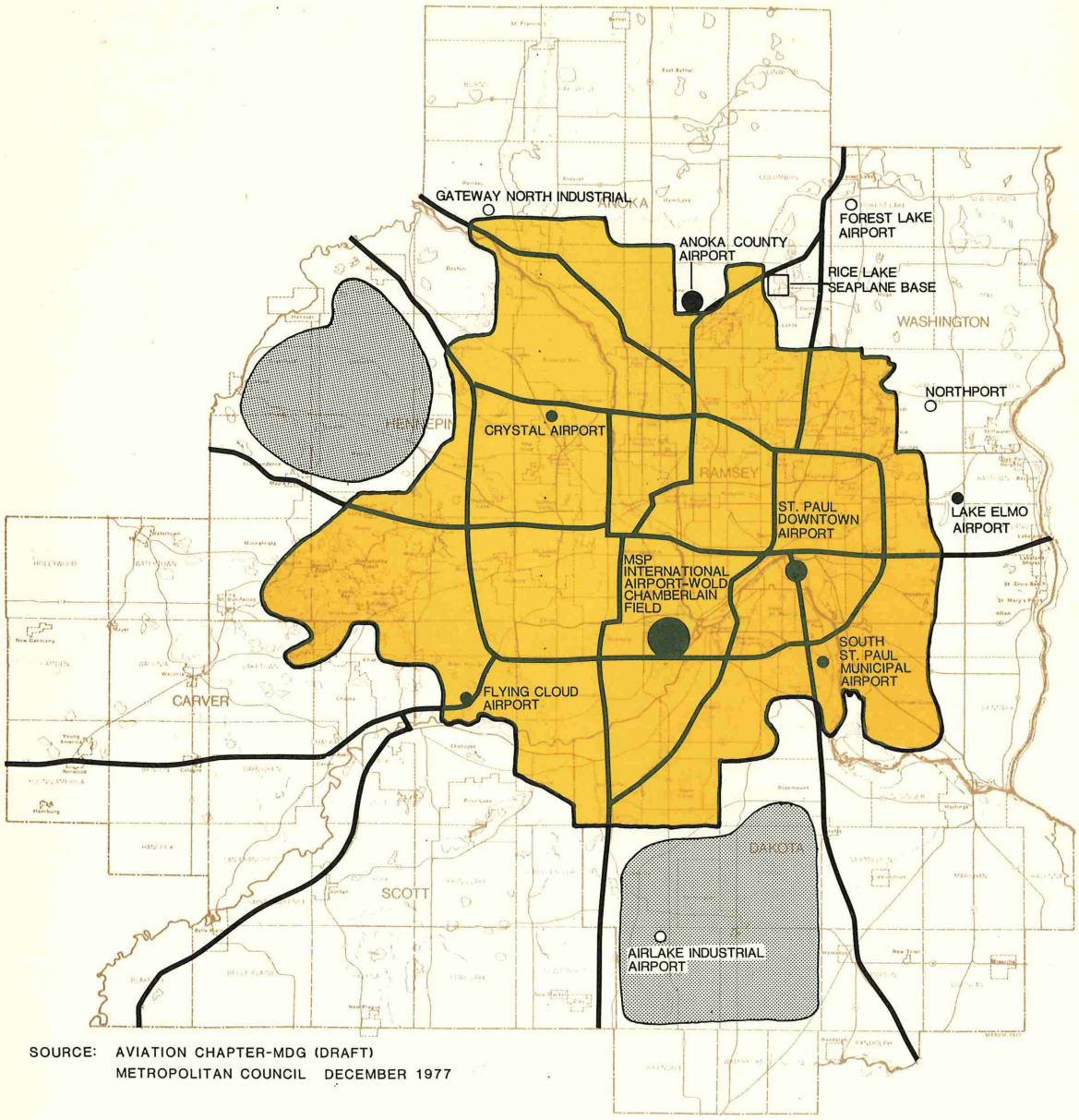
- o Establishment of federal (noise), state (noise and zoning), and metropolitan (Land Planning Act) legislation that have a direct impact on airports and their operating environment.

- o New and revised Metropolitan Development Guide chapters and the completion of several master plans for airports within the system."

As a consequence of re-evaluation of the 1972 plan, several changes were made to the Airports System Plan. The most significant of these in terms of the proposed action at Wold-Chamberlain Field, is the elimination of the North Search Area for a major new airport and the designation of Wold-Chamberlain Field as the only functionally classified major airport. This means that the policy of the Twin Cities Metropolitan Area is to optimize the use of Wold-Chamberlain Field as the major airport facility.

This basic change in the direction of growth and development of Wold-Chamberlain Field had a significant impact upon the long-range planning activities for the airport. In keeping with the aviation goals and policies of the MDG, the Metropolitan Airports Commission re-initiated efforts to maximize the capability of Wold-Chamberlain Field to serve the anticipated growth in air passenger travel and to mitigate any incompatible impacts on surrounding land uses resulting from the airport's redefined function. The results of these efforts are summarized in the next section of this report.

The current Metropolitan Airports System Plan is illustrated in Figure 3.



SOURCE: AVIATION CHAPTER-MDG (DRAFT)
METROPOLITAN COUNCIL DECEMBER 1977

FIGURE 3
METROPOLITAN AIRPORTS SYSTEM PLAN-1990

MINOR AIRPORT SEARCH AREAS
1990 PRINCIPAL ARTERIALS
METROPOLITAN URBAN SERVICE AREA

AIRPORT FACILITIES, PUBLICLY OWNED
MAJOR INTERMEDIATE MINOR

AIRPORT FACILITIES, PRIVATELY OWNED
MINOR SEAPLANE BASE

0 5 10MILES NORTH

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD
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EXPANSION PROGRAM
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AIRPORT MASTER PLAN

In June, 1976, the Minneapolis-St. Paul International Airport Comprehensive Master Plan was completed. This effort had as its primary objective to determine the ultimate practical capacity of the airport without attempting to establish the exact year in which the airport's capacity would be reached.

To achieve this objective studies were conducted in seven areas and technical supplements were prepared for each area. A synopsis of these seven technical supplements to the Comprehensive Master Plan is presented below.

- Study Background and Airport Land Use.

  This analysis developed airside and groundside requirements and alternative development schemes for the airport. In addition, recommended on-airport land uses are presented and the maximum capability of the airport runway system was analyzed.

- Airport Access.

  This study analyzed current and projected on-airport and off-airport ground access and developed a travel demand matrix to determine access constraints on airport growth.

- Passenger Terminal Area.

  This effort resulted in terminal expansion concepts based upon land availability.

- Airport Layout Plans.

  This task resulted in a proposed twenty year development program along with a staging program and estimated costs.

- Environmental Advisory Team.

  This document presents the analysis of the impact of airport development upon the natural environment.

- External Land Use.

  This study identified an off-airport land use plan along with the impacts of airport development on external land use. Coordination with local planning efforts and strategies for mitigating negative impacts are documented.

- o Financial Plan.

  This plan presented estimates of future annual revenues and expenses to determine cash flow and estimates of future debt service requirements.

Four aspects of the airport operation were found to be critical in terms of ultimate capacity. These four areas are:

- o Highway Access Capacity
- o Landside Passenger Terminal Capacity
- o Airside-Airspace and Runway Capacity
- o Environmental Impact

The analysis of the critical areas indicated that the 1975 level of activity as measured in annual passengers could be increased by approximately five times to 34 million passengers per year. To accommodate this level of activity, the following major improvements are called for in the Master Plan:

- o A new West Terminal in the northwest area of the airport with separate ground access to Cedar Avenue and/or the Crosstown Highway.

- o Expansion of the existing terminal facilities around the central parking area.

- o Expansion of the existing parking supply with elevated parking in the central parking area and separate parking at the new West Terminal.

- o Improved ground access capacity to the main Terminal including widening the main entry roadway and completing the major off-airport facilities of I-494, T.H. 55, and the Crosstown Highway.

Thus, the ultimate capacity of the airport was established at 34 million passengers per year with the present East Terminal capable of serving 20 million passengers per year.

Figure 4 depicts the Comprehensive Airport Master Plan as developed in this study.

TERMINAL AREA PARKING STUDY

In August, 1977, the Metropolitan Airports Commission received the Automobile Parking and Traffic Study which was initiated in response to the growing shortage of available parking in the terminal complex as well as the expected long range need for additional parking to serve the projected growth in air passenger activity. The objectives of the study were:

- To quantify a parking demand index in terms of parking spaces per million enplanements.
- To identify alternative parking expansion programs (both in-terminal and remote) and to evaluate these alternatives in terms of service to the public, financial feasibility, and ground accessibility.
- To make recommendations for serving both the short and long range parking needs of the airport.

The results of this study provide the basis for the proposed action to construct two multi-level parking structures in the terminal complex in a two stage program. Consequently a detailed summary of this study is presented to document not only the nature of the proposed action but also to document the parking needs and the alternatives considered to meet these needs.

PARKING DEMAND INDEX

The Metropolitan Airports Commission maintains extensive records on parking activity at the airport. This data base was researched and was used to develop estimates of future parking needs.

The Average Day of the Peak Month (ADPM) has been estalishsed as a viable planning objective which provides a reasonable balance between satisfying peak user demand and minimizing financial investments. Historical use of the airport has indicated that the ADPM is equal to 0.3% (.003) of the annual activity. In addition parking activity at the airport was found to exhibit fairly consistent characteristics which are reflected by the data shown in Table 1 for the year 1976. From Table 1 it will be noted that the Parking Demand Index is equal to approximately 1,300 spaces per million enplanements. It is also significant to note that approximately 400 of these spaces are attributable to the overnight "long-term" parkers. This point will be taken up in a subsequent section of this EIS.

TABLE 1

PARKING DEMAND CHARACTERISTICS WOLD-CHAMBERLAIN FIELD - 1976

Source: Automobile Parking and Traffic Study

Measure	Value
ADPM Conditions	
Parked Vehicles (Overnight)	2,653
New Parking Operations	5,761
Total Parked Vehicles	8,414
Daily Turnover per Space	1.732
Parking Space Demand	4,858
Daily Enplanements	11,240
Parking Space Demand per Daily Enplanement	0.432
Annual Conditions	
ADPM as Ratio of Annual Activity	0.003
Parking Space Demand per Daily Enplanement (ADPM)	0.432
Parking Space Demand per Annual Enplanement	0.001296
Parking Space Demand per Million Annual Enplanements	1,296

PARKING DEMAND FORECASTS

The forecast of future parking needs is tied directly to the forecast of future air passenger enplanements through the use of the parking demand index of 1,300 spaces per million enplanements. As was indicated in the summary discussion of the airport master plan, no forecasts of air passenger activity were made relative to a specific time frame. As a consequence, the Automobile Parking and Traffic Study developed a minimum and a maximum growth forecast of air passenger enplanements in order to estimate the approximate time period in which new parking would be needed. This range forecast is presented in Table 2 and was based upon historical growth trends at the airport.

TABLE 2

PROJECTED TIME FRAME OF AIR PASSENGER ENPLANEMENTS AND PARKING DEMAND

Source: Automobile Parking and Traffic Study

Enplanements (Millions)	Year of Occurrence		Parking Demand (Spaces)
	Maximum Growth	Minimum Growth	
4.0	1979	1979	5,200
5.0	1984	1987	6,500
6.0	1989	1994	7,800
7.0	1994	2002	9,100
8.0	1999	2009	10,400
9.0	2004	2017	11,700
10.0	2009	2024	13,000

It will be noted from Table 2 that 7.0 million enplanements are expected to occur sometime within the eight year period of 1994-2002. Beyond this point the range forecasts extend over time periods of ten years up to fifteen years. Also of significance is the fact that the enplanement forecasts prepared in the Automobile Parking and Traffic Study are lower than the downward revised forecasts in the Metrpolitan Development Guide. The MDG middle forecast anticipates that 10 million annual enplanements will occur in the year 2000 as compared to 7 to 8 million enplanements forecast by the Automobile Parking and Traffic Study. The implications of this variance are that should the faster growth rate occur, an accelerated expansion program would be required.

By way of comparison, Table 3 shows the spaces provided at seven other major airports and the ratio of spaces to million enplanements. Note that this indicates only spaces provided and not actual parking demand. While there appears to be a trend towards lower spaces per million enplanements as the magnitude of passenger traffic increases (as in the case of Chicago and Denver) this characteristic cannot be verified based upon this data alone. Both Chicago and Denver have higher than average through passenger connections which means that a high percentage of the enplanements arrive at the airport by airplane rather than by ground transportation. Thus, parking needs are correspondingly less at these airports.

TABLE 3

PROVISION OF PARKING AT SELECTED U.S. AIRPORTS

Source: Automobile Parking and Traffic Study

Airport	Enplanements (Millions)	Airport Parking Spaces	Private Off Airport Parking	Airport Spaces per Million Enplanements	Total Spaces Per Million Enplanements
Chicago	20.9	13,103	Minimal	633	633
Denver	6.9	6,000	None Yet	872	872
Detroit	4.5	7,500	4,000	1,663	2,552
Mpls.-St. Paul					
1970	3.7	4,334	None	1,166	1,166
1977	4.0	5,200	None	1,300	1,300
Seattle, Wash.	3.4	4,200	2,500	1,239	1,976
Houston	3.4	8,000	Minimal	2,365*	2,365*
St. Louis, Mo.	3.3	4,900	500	1,480**	1,631
Kansas City, Mo.	2.2	5,171	No Data	2,300	--

*Of the 8,000 spaces, 4,000 are remote and receive only 50% usage.

**Of the 4,900 spaces, 1,200 are remote and receive 60% usage.

ALTERNATIVE PARKING EXPANSION OPTIONS

The development of alternative parking expansion programs was premised upon three major influencing factors:

- Provision of sufficient parking to accommodate the projected parking demand.
- Provision of a high standard of convenience and comfort to the airport user.
- Maintenance of the current cash flow requirements of the Metropolitan Airports Commission.

In addition, increments of one million enplanements were used to stage parking expansion which corresponds to approximately a 5 to 8 year interval for construction activities. This was considered to be a reasonable interval because project costs could be minimized to avoid creating an excessive debt service burden, while being of sufficient size to accommodate growth and avoid continuous disruption due to construction.

Two distinct alternatives were identified for providing the necessary parking. One alternative consisted of constructing all future parking in structures within the central parking area. The second alternative consisted of providing all future spaces in a surface parking lot remote from the terminal building and transporting parkers between the remote parking facility and the main terminal via a shuttle bus.

Terminal Area Parking Expansion

Two issues had to be resolved. First, can the existing parking facility remain in service and be modified to accept vertical expansion? Second, because the additional parking will be added in a phased manner, what manner of development is best?

- Modification of Existing Facility

  The lower level of the existing surface parking facility contains bays which are 63 feet wide, oriented in a north-south direction, and which provide 90 degree parking. The existing parking deck also provides 90 degree parking in 63' wide bays, but is oriented in an east-west direction.

  If the existing facility is to be expanded vertically, an emphasis must be placed upon ease of traffic flow and the elimination of confusion to the drivers. It is best to combine one-way traffic patterns, angle parking and narrower structural bays to achieve an "easy to understand" circulation system and greater space utilization as cars are "downsized" by the manufacturers.

With these general features in mind, it was determined that it is possible to retain the existing supported parking deck. A new column system can be "punched" through to the grade level with minimum loss of spaces. This approach will result in significant cost savings that might be spent in "rebuilding" these existing spaces. Portions of the existing facility will have to be closed during early stages of construction.

o Expansion Options

Three options were considered for detailed analysis, all of which retained most areas of the existing parking facility and resulted in an ultimate parking supply of 13,000 spaces. These options are shown in Figure 5.

Option A

1. Vertical expansion of the entire west portion of the existing parking facility in two phases.

2. Future vertical expansion of the east parking area.

Option B

1. Vertical expansion of the southwest quadrant of the existing parking facility.

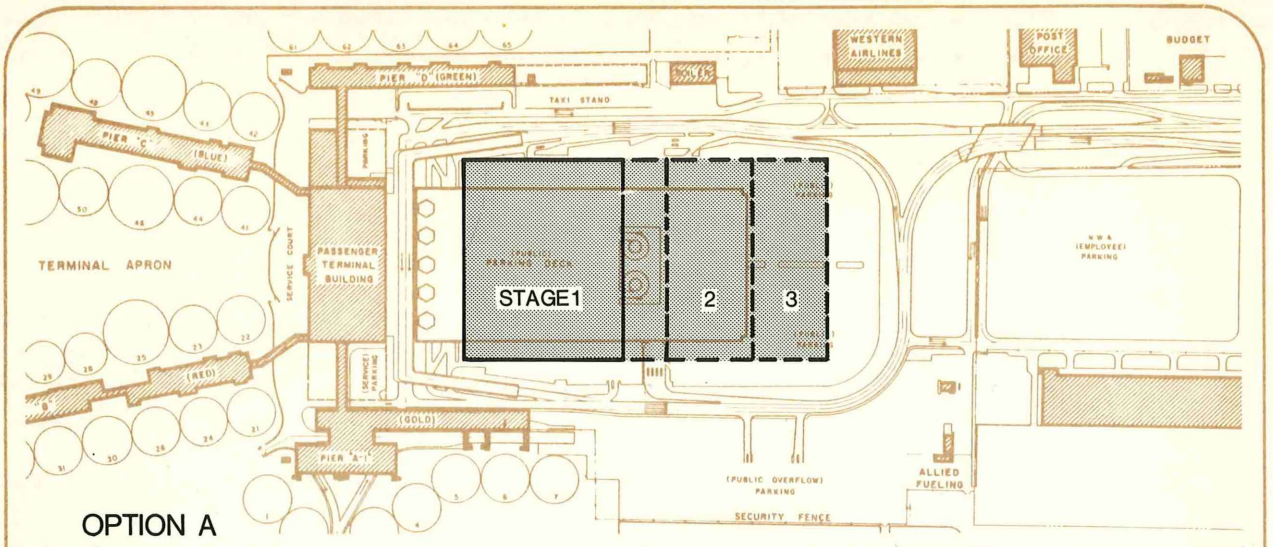
2. Vertical expansion of the northwest quadrant of the existing parking facility or continued vertical expansion of the southwest quadrant.

3. Future vertical expansion of the southeast quadrant or the northeast quadrant of the existing parking areas.

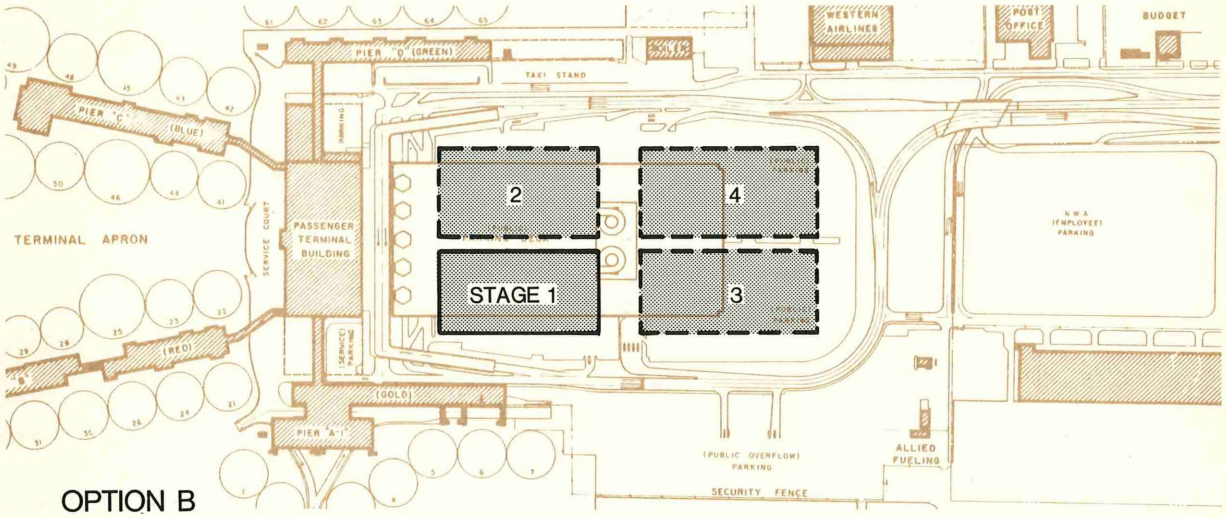
Option C

1. Vertical expansion of the east half of the existing parking area in two phases.

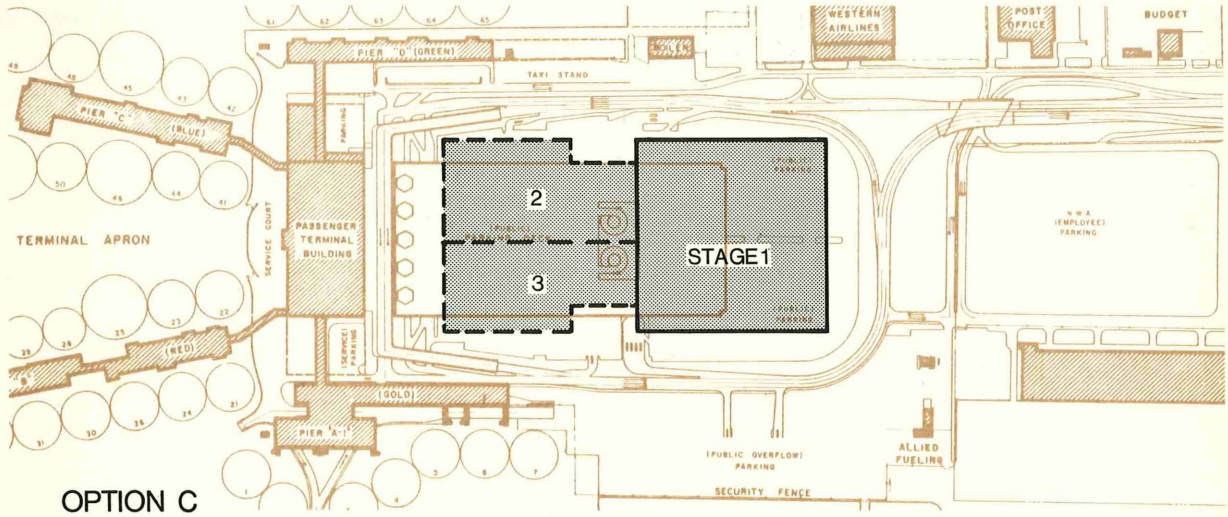
2. Future vertical expansion of the west portion of the existing parking facility.



OPTION A



OPTION B



OPTION C

FIGURE 5

TERMINAL AREA VERTICAL EXPANSION OPTIONS

SOURCE: AUTOMOTIVE PARKING AND TRAFFIC STUDY
CWA AND BRW INC. JUNE 1977.

0 125 250 500FT. NORTH

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Of these options, Option B was selected as the preferred method of in-terminal expansion for the following reasons.

- The temporary loss of grade level parking in the southwest quadrant will cause minimal disruption to existing parking usage. This area is and will continue to be used for rental autos.

- The existing entry and exit locations for traffic into and out of the parking area can remain in operation, thereby, eliminating user confusion.

- A large number of the resulting parking spaces will be "convenient" to the terminal and close to the major air traffic carrier.

- The long range vehicular traffic flow into and out of the parking areas will be established to function within the long range roadway system.

- The visual impact on the arriving driver is minimized.

There will be a number of parking spaces which cannot be used for a certain time period while construction occurs above the existing parking facility. This temporary reduction in the parking supply will be offset by the development of an "Economy Parking" lot located at the north end of 34th Avenue. An existing employee parking lot is being expanded and will provide parking space for both employees and the general public who will receive a reduced parking rate. Frequent shuttle bus service will be provided between the Economy Parking lot and the main terminal. In addition, similar reduced rate parking will be provided at the International Charter Terminal also located on 34th Avenue and served by shuttle bus.

Remote Area Parking Expansion

If remote parking can be constructed at surface level, construction costs can be significantly reduced. These economies are offset by both the costs of operating buses to shuttle patrons between the airport and the remote lots and by the reduced revenue resulting from the lower parking fees traditionally charged for remote parking. Seven sites (on airport property) were identified as having potential for remote parking. The sites are listed below and shown in Figure 6.

1. The rental car area east of the Post Office. If alternate provisions for the on-site car rental agencies could be found, this area could serve as a remote parking location.

2. The area along Post Road. This area is unused at the present time and has sufficient land area to serve as a remote parking facility.

3. The International Charter Terminal area. Although this parking area is designated for the International Charter Terminal, it is often underutilized and has the potential for use as a remote parking area.

4. The area along 26th Avenue. This large area is planned to be developed for air cargo facilities. However, because no development has occurred in several years, a portion of this area could serve as a remote parking site.

5. The area in the northeast quadrant of the I-494 and Cedar Avenue interchange. This area is adjacent to the proposed MTC bus garage and provides an opportunity to coordinate remote parking with bus service.

6. The area along East 63rd Street in the vicinity of the old terminal. This large area appears to have some potential for a remote parking facility, although it is in the area of the proposed West Terminal.

7. The area in the vicinity of the proposed West Terminal. This area is proposed to be the location of the West Terminal building. There is potential to provide remote parking in this area, with connections to the main terminal, as a first step in the development of the West Terminal complex.

Six evaluation criteria for the remote sites were chosen for a preliminary assessment of the seven sites. The criteria were:

- The site should be of sufficient size to accommodate 1,300 parking spaces and, ideally, be expandable to as many as 3,900 spaces.
- The site should have good connections to the main terminal via shuttle bus service or some type of people/baggage movement system.
- The site should have good accessibility to the regional roadway network and the ability to intercept traffic from the freeway system prior to reaching the Main terminal.
- The site should have potential for permanent use.
- The site should have characteristics which relate well to vehicle control and pedestrian movement.
- The site should be developed in a manner which preserves current capital and maintains a balanced cash flow.

The evaluation of the seven potential remote parking sites resulted in the selection of the 26th Avenue area (Site 4) as the most appropriate location for major remote parking should remote parking be selected as the preferred option.

RECOMMENDED PARKING EXPANSION PROGRAM

The Automobile Parking and Traffic Study concluded that the long range parking needs of the airport would approximate 13,000 parking spaces at an air passenger activity level of 10 million annual enplanements. This activity level corresponds to the projected ultimate capacity of the main terminal complex as identified in the Airport Master Plan. After this level of air passenger activity is reached, future growth would be accommodated with a new West Terminal.

The Automobile Parking and Traffic Study further concluded that:

- Expansion of the parking supply can occur with a surface parking lot at a remote location (26th Avenue area north of I-494) or by vertical expansion above the existing, central parking area.

- The first phase expansion should provide a minimum of 1,300 new parking spaces to accommodate a growth in air passenger activity of 1 million annual enplanements to a total of 5 million enplanements per year.

- Expansion by construction of three levels above the southwest quadrant of the existing two level parking facility was estimated to have a project cost of $6 million to provide 1,300 additional parking spaces. This parking facility expansion would operate at an accrued deficit for two to three years, based upon 30 year general obligation bonds having an interest rate of 7% per annum.

- Expansion by construction of a remote surface lot for 1,300 parking spaces was estimated to have a project cost of $1.0 million. This surface lot would operate with an accrued deficit for one to three years, based upon 30 year general obligation bonds having an interest rate of 7% per annum.

- The proportion of remote parking spaces should not exceed 20%-30% of the total parking supply. This amount of parking can be served by the existing roadway system without capacity improvements. In addition, this proportion of remote parking is compatible with use characteristics observed at other airports.

Subsequent to publication of the Automobile Parking and Traffic Study, the MAC evaluated the several alternatives available and formulated a parking expansion program.

ADOPTED MAC PARKING EXPANSION PROGRAM

The current proposed parking expansion program for the airport consists of the following elements:

- Expand parking to seven levels in the westerly half of the central parking area by constructing five supported parking levels over the existing ground level and deck parking. This will provide a parking supply sufficient to accommodate the parking demand for slightly more than 7 million annual enplanements.

- The proposed construction is to occur in two phases with the first phase located in the southwest quadrant of the central parking area and the second phase in the northwest quadrant.

- Future expansion of the parking supply beyond the two seven level structures would occur, if needed, in either a remote parking facility or by vertical expansion in the easterly half of the central parking area.

The decision to construct a new parking facility in the central parking area was based upon the objective of maximizing convenience to the airport user and also because the revenues generated by a remote parking facility and the operating costs of a shuttle bus service did not compare favorably with the annual revenues and costs associated with the parking structures in the terminal area. In addition it was determined that by constructing a seven level parking structure rather than a five level parking structure, significant reductions in the unit cost (capital dollars per new parking space) could be realized. Further, during the latter part of 1977 and early 1978, the airport experienced unprecedented increases in air passenger activity levels which indicated that an increment in the existing parking supply greater than 1,300 parking spaces was needed. At this same time, the preliminary results of the air quality analysis indicated that a seven level parking structure had very favorable aerodynamic properties which created turbulance in areas of stagnant air. Therefore, the MAC authorized the preliminary design and necessary environmental studies to proceed with the construction of two seven level parking structures in the central parking area.

Figure 7 illustrates the proposed parking expansion program relative to three different forecasts of air passenger enplanements. The highest air passenger enplanement forecast (10 million by the year 2000) comes from the aviation chapter of the MDG while the other two forecasts represent the maximum and minimum growth rates contained in the Automobile Parking and Traffic Study. For planning purposes, the middle growth rate has been selected as the determining factor in construction staging. In order to meet the parking demand associated with this growth rate, the first phase construction program should be completed in 1980 and the second phase construction program in 1987. Decisions on continued parking expansion (either remote parking or continued vertical expansion in the main terminal) will have to be made by the mid 1990's.

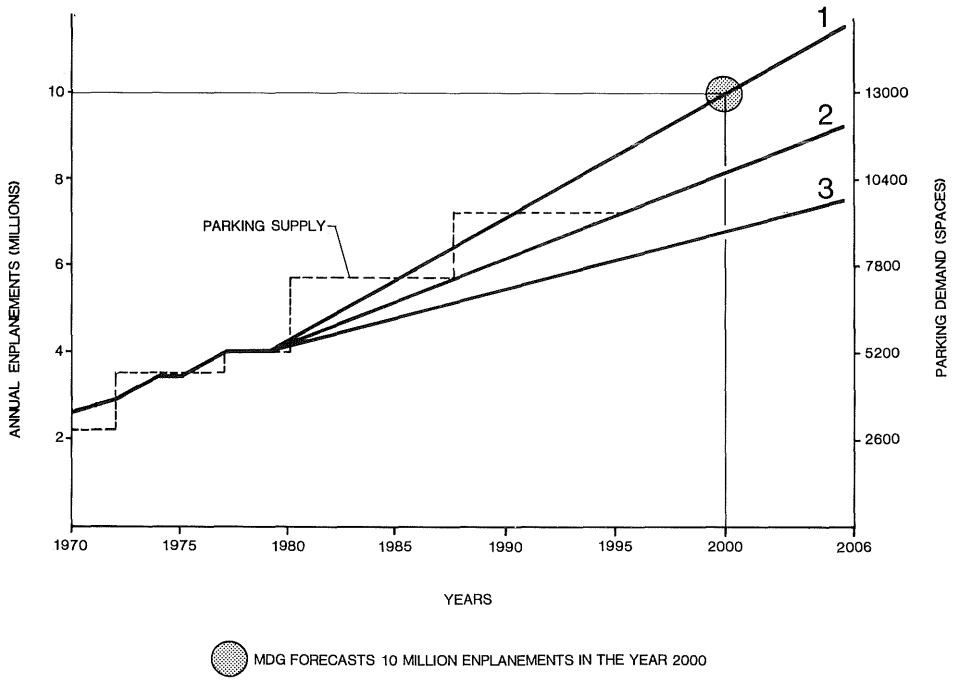

FIGURE 7

ANNUAL AIR PASSENGER ENPLANEMENT FORECASTS

1- MDG FORECAST
SOURCE: AVIATION CHAPTER - MDG (DRAFT) METROPOLITAN COUNCIL DECEMBER, 1977

2-MAXIMUM FORECAST

3-MINIMUM FORECAST
SOURCE: AUTOMOBILE PARKING AND TRAFFIC STUDY, CWA AND BRW INC. JUNE, 1977

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Chapter II INTRODUCTION

Chapter III HISTORY OF AIRPORT GROWTH AND PLANNING

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Chapter V THE PROPOSED ACTION AND ITS IMPACTS

Chapter VI ALTERNATIVES TO THE PROPOSED ACTION AND THEIR IMPACTS

Chapter VII COMPARISON OF ALTERNATIVES

Chapter VIII OPTIONS TO PROVIDE PARKING BEYOND THE PROPOSED ACTION AND THEIR IMPACTS

Chapter IX SUPPLEMENTARY INFORMATION

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CHAPTER IV
THE ENVIRONMENTAL SETTING

THIS CHAPTER DESCRIBES THE ENVIRONMENTAL SETTING WITHIN WHICH, THE MINNEAPOLIS - ST. PAUL INTERNATIONAL AIRPORT IS A SIGNIFICANT ELEMENT. THE DISUSSION ADDRESSES THE NATIONAL AND INTERNATIONAL ROLE OF THE AIRPORT, ITS SIGNIFICANCE TO THE TWIN CITIES REGION, AND ITS RELATIONSHIP TO THE PHYSICAL ENVIRONMENT ON BOTH THE AIRPORT PROPER AND THE SURROUNDING LAND USES.

SOCIAL-CULTURAL ENVIRONMENT

REGIONAL ROLE OF THE AIRPORT

The Minneapolis-St. Paul International Airport plays several important roles in the Twin Cities region. It is classified as the only major airport in the Twin Cities area which serves scheduled commercial air carriers. The eleven other public and private airports in the area serve general aviation for business, personal use, and instructional purposes. Together with the scheduled air carrier services, MSP provides a high level of accessibility to other major urban centers in the United States, which in turn is a key element in enabling the Twin Cities area to be a competitive force in national markets. Additionally, the airport and its associated industries are an important part of the local economy, providing thousands of jobs and generating millions of dollars annually.

Accessibility

The Twin Cities are geographically remote from the major population concentrations on the east and west coasts and have traditionally depended upon inter-city transportation systems to provide the accessibility to other major markets that enables the Twin Cities to truly be a part of the national economy. At their founding, goods and people moved between the Twin Cities and the rest of the nation primarily by steam boat on the Mississippi River. In fact, St. Paul grew up because it was the farthest point up-river that the steam boat could land. In the second half of the 1800's rail service replaced the steam boats as the primary inter-city mode. At their peak, more than 100 passenger trains serviced Minneapolis and St. Paul daily. Rail service, which dominated the commercial inter-city travel market in 1957, rapidly lost its position to air travel as early as 1959. Today, although private auto still carries the majority of inter-city trips, among the commercial modes of bus, rail, and air; air travel is by far the dominant mode, carrying well over 75% of commercial inter-city passengers.

The dominance of air travel, especially for trips greater than 250 miles, is due to the fact that for many people, the value of the time saved by air travel exceeds the higher out-of-pocket costs for the air fare. It is not surprising then to find that business is the most frequently reported trip purpose of air travelers since businessmen place a high value on their time. A survey of air passengers conducted in January of 1970 showed 42% of the passengers were traveling for business purposes.1/ "Other" purposes were next at 27% and personal and family affairs were third at 11%. Business executives in the Twin Cities, when asked to comment on the air services, noted that they have: "...to a great extent wiped out the competitive transportation disadvantage once assigned to this area.

1/ Alan M. Voorhees and Associates, Air Passenger Survey, Minneapolis-St. Paul International Airport. (St. Paul: Metropolitan Council, March 1970) data reprocessed for BRW.

Marketing, finance and manufacturing divisions account for a large volume of air travel. Foreign flights are vital to us."[1] They mentioned that the excellence of the airport facilities and services was one major reason they continued to have their corporate national offices in the Twin Cities area. Not only is the airport and air carrier service important to the Twin Cities businesses community for moving people, the airport also serves a growing air cargo industry. Air cargo and air mail have increased elevenfold since 1950, with more than 140,000 tons shipped in 1976. Also, 75% of air cargo shipped at the airport had an origin or destination in the seven-county metro region.[2]

Another important but unquantifiable impact of the accessibility provided by the airport and air carriers is the opportunity for recreational travel, vacations and family visits. For those who can afford it, this represents an increase in the quality of life.

It is not possible to quantify the impact the airport has on the regional economy through the provision of accessibility. However, it was reported that in 1971 34% of the $6.6 billion of the region's gross output was exported outside the region. The metro region also imports $6.1 billion of goods and services from businesses outside the region.[3] Clearly the Twin Cities air service, which makes much of the nation accessible within two hours travel time (see Figure 8), plays a role in facilitating this commerce.

1/ Experience Inc., Management Views of Metropolitan Area Business and Air Service, (St. Paul: Metropolitan Council, August, 1973), p. 18.

2/ Aviation Chapter of the Metropolitan Development Guide, Draft, October 21, 1977 (St. Paul Metropolitan Council).

3/ The Structure of the Twin Cities Economy: An Input-Output Perspective, St. Paul Metropolitan Council, March 1976.

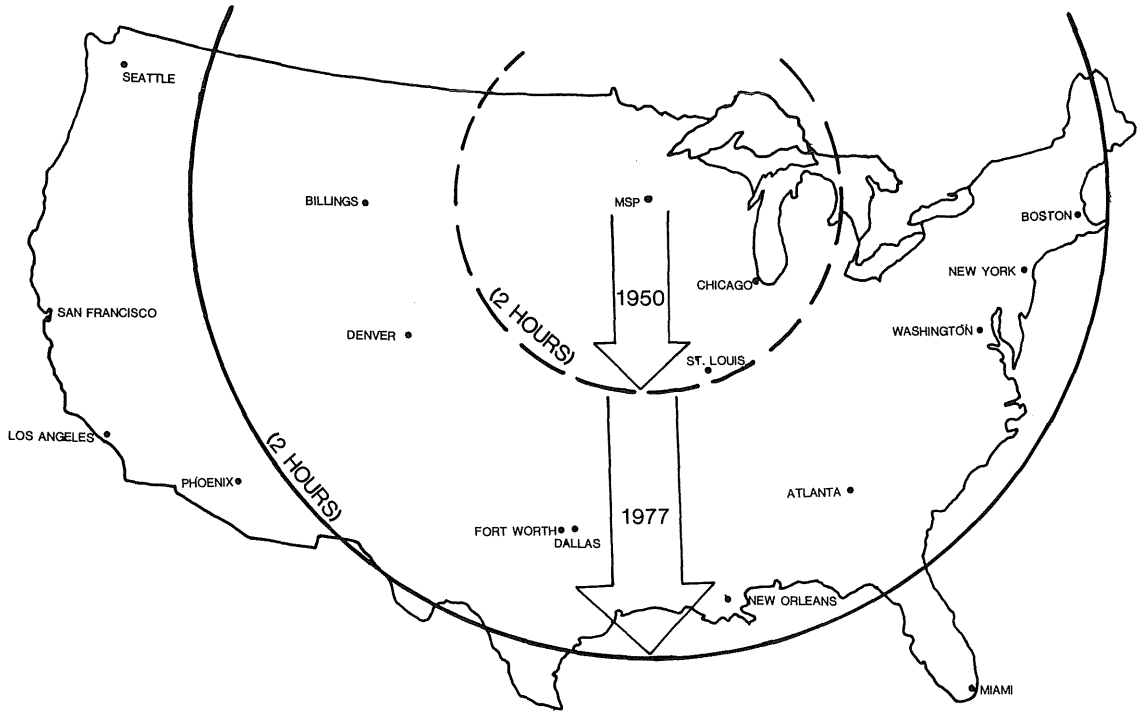

FIGURE 8
MSP AIR TRAVEL TIME AND DISTANCE

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Employment

Perhaps somewhat easier to quantify is the direct impact the airport has on the region as an employer. This is largely evidenced by the fact that two major air carriers have their home base facilities located at the airport. MSP International currently employs approximately 16,000 people with an additional 56,000 in air commerce jobs. The payroll is $10 million per week.1/ An additional 20,000 jobs are located within a two mile radius of the airport and some of the growth that has occurred in this area is probably due to the airport, especially some of the hotel and motel growth. It should be pointed out the presence of I-494 and I-35W and the proximity to both downtowns and amenity areas of south Minneapolis were other major factors in the area's growth. From data prepared in 1971 it is estimated that visitors to the Twin Cities spent $260 million in 1976, which contributed to the metropolitan economy.2/

1/ Presentation by the Metropolitan Airports Commission to the Transportation Committee of the Minnesota Legislature, January 21, 1976.

2/ Data prepared by the Metropolitan Airports Commission and the Air Transport Association in 1971 indicated that visitors to the Twin cities Area spent over $184 million. If one assumes a 7 percent inflation rate, this would likely be about 40 percent higher in 1976 or $260 million.

HISTORIC/CULTURAL RESOURCES

The MSP International Airport is surrounded by widely diverse historic and cultural resources as shown in Figure 9. Inside the adjacent freeway ring, there is the Fort Snelling National Cemetery to the south, a small residential enclave to the west, a naval air station to the north, and to the northeast, Fort Snelling itself including the historic fort. Just outside the freeway ring the airport is bordered on the east by Fort Snelling State Park in the Minnesota River Valley and the newly established Minnesota River Valley National Wildlife Refuge to the east and south. Metropolitan Stadium is south of the airport in the southeast quadrant of the intersection of I-494 and Cedar Avenue. Stretching to the west on both sides of I-494 there is a large commercial strip of hotels, motels, office buildings, restaurants and various wholesalers and suppliers. North and west of the airport the land is primarily residential.

Historic Resources

Fort Snelling is the major historic resource in the area. A large tract of land, which includes the current airport and Fort Snelling, was originally purchased from the Indians in 1805 by Lieutenant Zebulon Pike. Pike had passed through the area on his expedition and suggested that a fort be constructed on the bluff overlooking the confluence of the Mississippi and Minnesota Rivers. This strategic position would help the Americans control the fur trade and secure the area against the rival English and French claims. The fort itself was not established until 1820 and was named after Colonel Josiah Snelling, the fort's first commander. The 5th U.S. Infantry Regiment occupied the fort, which has continued to serve as a military base in some form since then. In 1839, the size of the military reservation was reduced and it was reduced again in the 1850's. In 1859 much of the land was sold to a private developer but the U.S. Government repossessed the land for non-payment in 1870, including the tract which contains the airport.

The original fort has been under archaeological excavation and restoration to its 1820-1840 condition since 1965. Restoration is expected to be substantially complete by the end of 1978. The land on which the original fort stands is now State land and administered by the Minnesota Historical Society. Most of the land had been turned back by the U.S. Army to the Veterans Administration in 1946. The airport was also given a large parcel of land after World War II.

Outside the original fort most of the complex was constructed by the Army between 1879 and 1904. This area includes a polo field, Officers Row, and a row of houses on Taylor Street constructed in 1888-1890. This part of the fort was declared surplus by the Veterans Administration in 1969 and turned over to the State of Minnesota with deed restrictions. The land is currently leased to the Army Reserve by the Minnesota Deparment of Natural Resources. Eventually the land will be put to recreational uses.

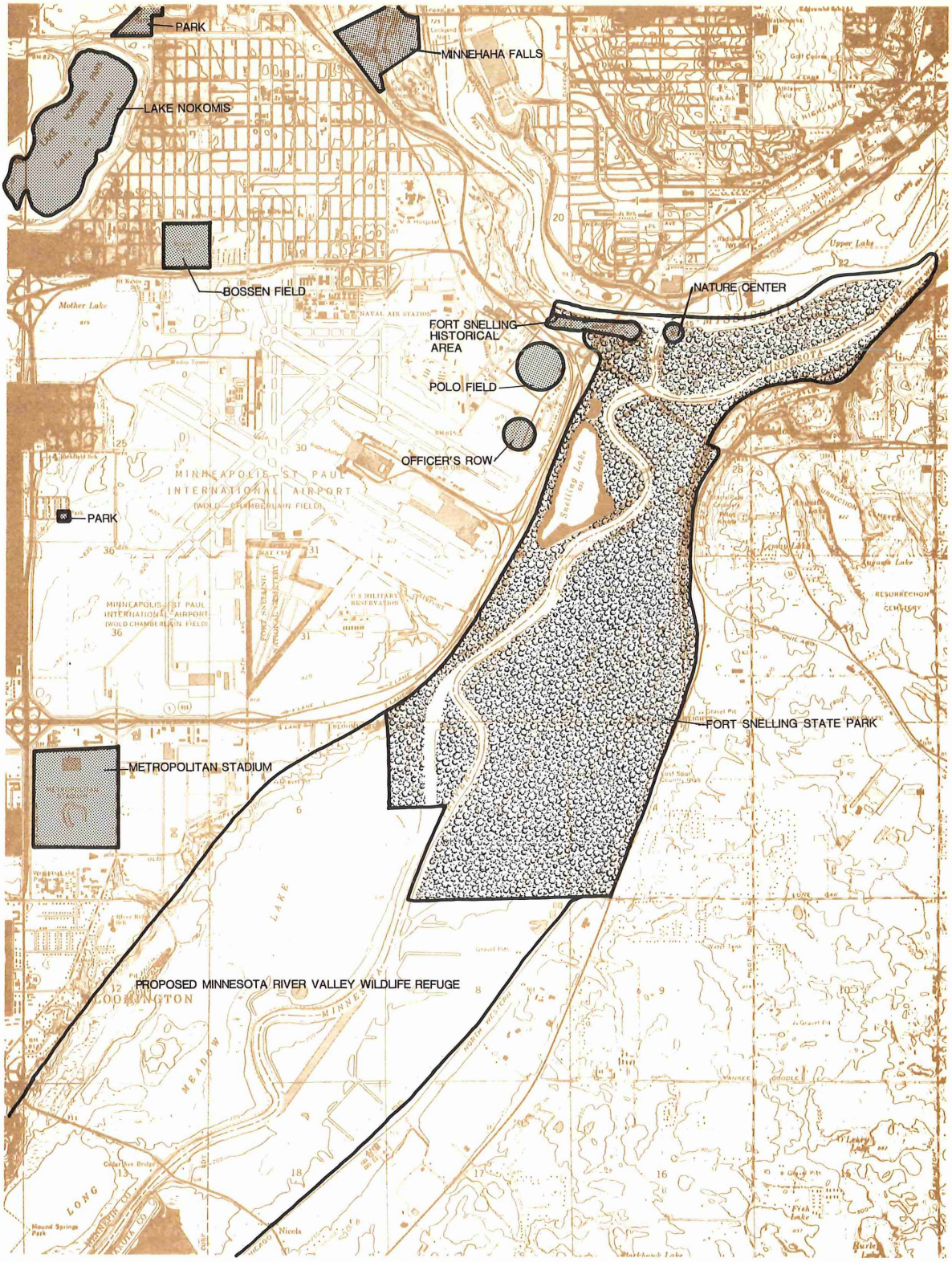

FIGURE 9
HISTORIC/CULTURAL RESOURCES

0 1000 2000 4000 FT NORTH

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Cultural Resources

Perhaps the most important cultural resources adjacent to the airport are the Fort Snelling State Park and the newly established Minnesota River Valley National Wildlife Refuge. The State Park was established in 1961 and is operated year around by the State Department of Natural Resources. The Park offers swimming and picnicing, while the Pike Island Nature Center offers interpretive activities. Eighteen miles of hiking trails, eight miles of saddle trails, four miles of snowmobile trails and a boat launch are also provided. The Minnesota River Valley Wildlife Refuge was established by an act of Congress in April 1978. It is a cooperative project of the U.S. Fish and Wildlife Service and the Minnesota Department of Natural Resources to manage a 25-mile stretch of the Minnesota River from the airport south to Jordan, Minnesota for a combination of wildlife sanctuary and recreational uses. Other noteworthy cultural resources are the Metropolitan Sports Center and Stadium which serves professional sports, rock concerts and ice skating. There are also various Minneapolis and Richfield public parks, including Lake Nokomis which provides fishing, boating, picnics, ice skating and concerts.

PHYSICAL ENVIRONMENT

As a part of the Airport Master Plan Study, an overview of the topographic drainage and geologic characteristics of the airport was prepared. The following information has been summarized from that study.

TOPOGRAPHY/DRAINAGE

Minneapolis/St. Paul International Airport is located approximately four miles southeast of the Minneapolis Central Business District and just west of the confluence of the Mississippi and Minnesota Rivers. As shown in Figure 10, the Airport is located on uplands at an elevation of 800 to 850 feet, or 100 feet above the river valleys. These valleys are rimmed by bluffs that steepen as the confluence is reached, but contain several large lakes, marshes and wooded areas. Fort Snelling State Park, just south of the Airport, contains the largest recreational wooded area in the Twin Cities Metropolitan Area. The remainder of the uplands areas surrounding the airport have been highly developed for urban uses, including industrial, commercial and residential.

The airport area is divided topographically into two major natural watersheds. The northern area drains northwest into Mother Lake, while the southern area drains southward into the Minnesota River Valley. These watersheds have been further divided into smaller areas to ensure adequate and rapid runoff from the airport. These areas are identified as Mother Lake, Minnesota River North, Minnesota River South, and Snelling Lake drainage areas. The largest volumes of runoff are associated with the Minnesota River North and South drainage areas. A more detailed discussion of the runoff characteristics at the airport is presented in the section: Water Quality.

FIGURE 10

TOPOGRAPHY

- 650-700
- 700-750
- 750-800
- 800-850
- 850-900
- 900-950
- 950+

0 1000 2000 4000 FT NORTH

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GEOLOGY

Of the eight major bedrock formations which are exposed in the Twin Cities metropolitan area, four of these appear in the airport area. These bedrock units are of the Ordovician Period and are generally flat-lying, with a slight dip to the west. The lowest exposed formation is the Prairie du Chien which is dominantly dolomitic limestone and dolomite. This formation forms the bottom of the Mississippi and Minnesota River Valleys and is an important aquifer in the metropolitan area. The Jordan Sandstone, which is another major aquifer for the region, underlies the Prairie du Chien, but is not exposed along any of the valleys in the immediate area. Since water from the Mississippi and Minnesota Rivers may infiltrate through the underlying alluvium into these aquifers, there exists the potential of changes in ground water quality in the region.

The Prairie du Chien is overlain by the St. Peter Sandstone, which is a fine-grained sandstone, varying in strength because of different levels of cementation of the grains. This material is considered to be ideal for tunneling because of its low shear strength, and has been considered both for underground water storage and parking areas under the airport. The sandstone is exposed along the slopes of the Mississippi and Minnesota River Valleys and at certain points on the uplands. As may be seen from Figure 11, this is the predominant bedrock formation underlying the airport, alghouth it is covered by approximately 100 feet of glacial drift at the western end of the airport. The Platteville formation, which is a gray to brown dolomite and sandstone, caps the St. Peter Sandstone under the terminal area. Above this lies the more recent Decorah Shale, which contains many irregularly distributed coquina lenses and thin limestone beds that increase in abundance towards the upper portions of the formation. The Platteville is exposed on the uplands near the river valleys, as is the Decorah formation.

The average thickness of the Platteville is only 35 feet, with the Decorah reaching 80 feet in some areas. The St. Peter Sandstone unit averages 150 feet, and the Prairie du Chien is about 220 feet.

FIGURE 11

GEOLOGY

- PRAIRIE DU CHIEN
- ST. PETER
- PLATTEVILLE
- DECORAH

0 1000 2000 4000 FT NORTH

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SOILS

Minneapolis/St. Paul International Airport is located within the Estherville-Dickmann soil association consisting predominantly of the Dickmann (Dn), Estherville (Et), Dakota (Da), Hubbard (Ha), Biscay (Bc,Bd), and Chaska (Ch) soil series. Other soil series appear to a lesser extent on the airport as shown in Figure 12. Hilly, excessively drained soils on outwash plains with intermingled depressions and drainageways characterize the Estherville-Dickman soil association. Table 4 lists the various soils series at the airport.

The Estherville, Dickman and Salida soils are underlain by sand and gravel relatively close to the surface. Generally speaking the Estherville, Dickman, Salida and Hubbard soils are well-suited for building construction. Foundation bearing capacity is good and the soils are not subject to frost heaving. Other factors favoring construction include low volume change as soil moisture content fluctuates, little difficulty encountered in excavating for foundations, and roadway construction costs are relatively low on slopes and under six percent.

The soils within the main terminal complex have been disrupted by previous construction activities. The site was not surveyed at the time the Hennepin County soils map was prepared. Consequently, soils data are not available.

The site proposed for the remote parking facility has been graded previously and is classed as cut-and-fill land. The grading was done several years ago to prepare the site for construction of three air cargo terminal buildings proposed for the area. Grasses were seeded to stabilize the soils.

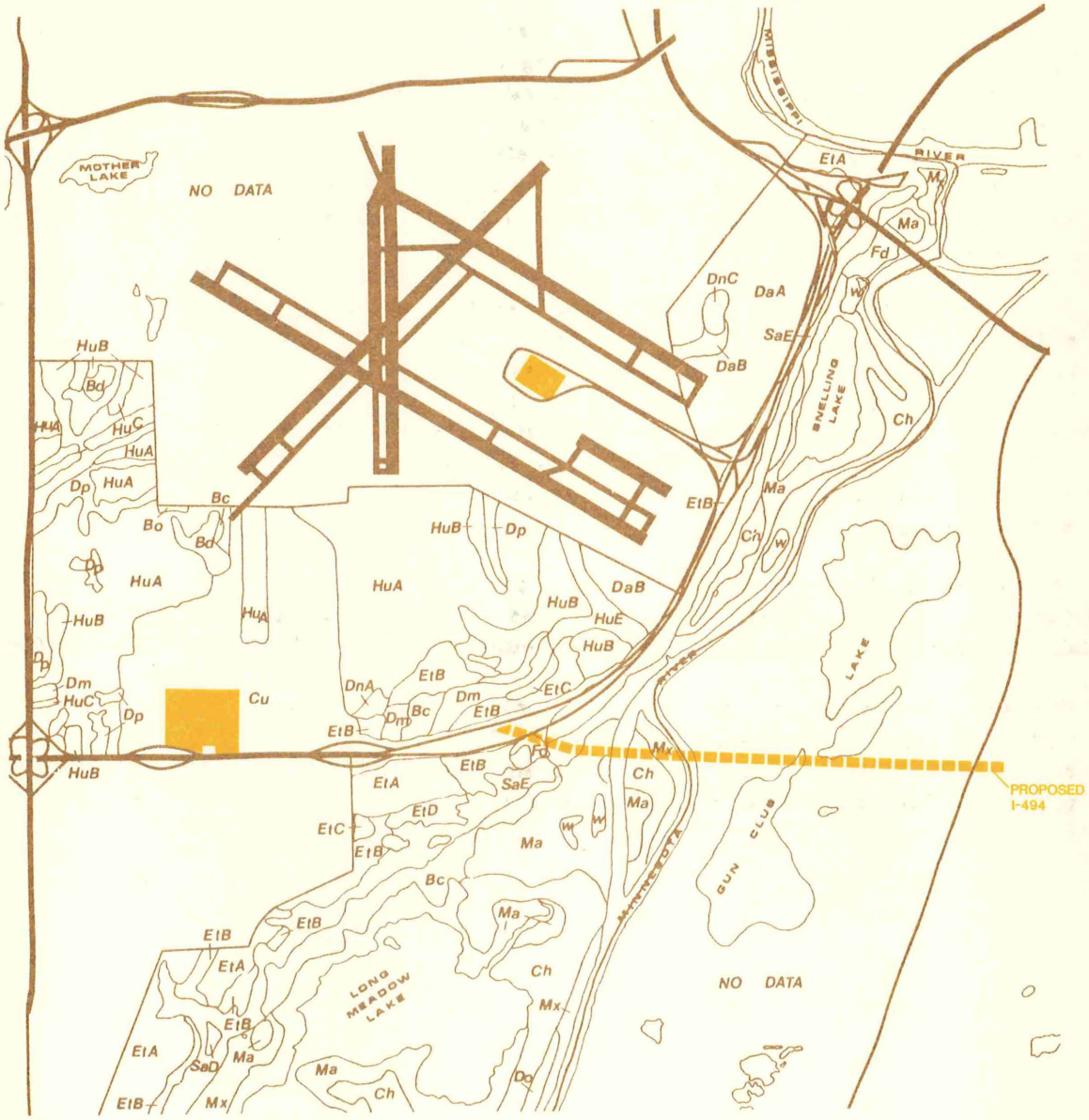

FIGURE 12

SOILS

PARKING SITES

Cu SOIL SYMBOLS REFER TO TEXT

0 800 1600 3200FT. NORTH

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TABLE 4

SOILS SERIES IN THE AIRPORT VICINITY

Source: Soil Survey - Hennepin County, Minnesota, April, 1974.

Soil Series	Map Symbol	Texture and Slope
Biscay	Bc	Loam
	Bd	Clay loam
Barrow Land	Bo	Not classified
Chaska	Ch	Clay loam
Cut - Fill land	Cu	Not classified
Dakota	DaA	Loam, 0 to 2% slopes
	DaB	Loam, 2 to 6% slopes
Dassel	Dm	Sandy loam
Dickman	Dmc	Sandy loam, 6 to 12% slopes
Dvelm	Dp	Loamy sand
Estherville	EtA	Sandy loam, 0 to 6% slopes
	EtB	Sandy loam, 2 to 6% slopes
	EtD	Sandy loam, 12 to 18% slopes
Fill land	Fd	Not classified
Hubbard	HuA	Loamy sand, 0 to 2% slopes
	HuB	Loamy sand, 2 to 6% slopes
	HuC	Loamy sand, 6 to 12% slopes
	HuE	Loamy sand, 18 to 35% slopes
Mixed Alluvial land	Mx	Not classified
Marsh	Ma	Not classified
Salida	SaE	Course sandy loam, 18 to 35% slopes

VEGETATION

Little natural vegetation remains within the Airport complex bordered by Cedar Avenue, I-494, T.H. 55, T.H. 5 and County Road 62. Virtually all of the remaining natural vegetation is concentrated along the Minnesota River Valley south and southeast of the airport, along the Mississippi River Valley northeast of the airport, and in the Mother Lake drainage area to the northwest.

The Minnesota River Valley in the airport vicinity generally consists of shallow floodplain lakes surrounded by emergent wetland vegetation dominated by cattail. Vegetation on seasonally saturated soils includes a variety of shrubs and grasses, predominantly willows and reed canary grass. Associated with localized groundwater upwellings are certain plant associations described as "small botanical paradises" which include such plant species as yellow and white lady slippers, bog birch, swamp saxifrage, wild valerian, marsh marigold and other damp meadow plants generally quite rare in this part of Minnesota.1/ These "perched bogs" as they are called are rapidly declining because of recent encroachments by various developments. These encroachments may be direct, such as filling in the site for construction purposes; or indirect, where sewer lines inland from the river intercept and carry off rainwater rather than allowing it to percolate into the soil and recharge the ground water supply. As the groundwater supply is depleted, upwelling no longer occurs, the perched bog dries out and the site is invaded by such species as reed canary grass.

Tree species in the lowland forests of the Minnesota River Valley include Cottonwood, Silver Maple, Willow and American Elm. The lower slope forests are dominated by Hard Maple, White and Red Oak. The Mississippi River, at its confluence with the Minnesota River northeast of the airport is bounded by a relatively narrow gorge as compared to the Minnesota River Valley. Consequently, floodplain lakes and marshes such as those of the Minnesota River Valley do not occur. Lowland forests as previously described are present as well as small wet, marshy areas. Table 5 lists the plant species which occur in the various vegetative zones found in the proximity of the airport.

1/ Management Plan for Fort Snelling State Park (2nd Draft), Minnesota DNR, Division of Parks and Recreation, 1977.

TABLE 5

PLANT SPECIES FOUND IN THE AIRPORT VICINITY

Source: Report of the Environmental Advisory Team Minneapolis-St. Paul International Airport Master Plan Study

Habitat Types				
Marsh	Lowland Meadows	Upland	Lowland Forest	Lower Slope Forests
Cattails	Reed canary grass	Timothy	American elm	American elm
Bulrush	Rice cut grass	Brome-grass	Boxelder	Boxelder
Burreed	Cord grass	Blue grass	Silver maple	Silver maple
Plaintain	Whitetop		Ash	Basswood
Arrowheads	Sedges		Cottonwood	Hard maple
Phragmites			Willow	Hockberry
Wild rice				White oak
Smartweed				Red oak

Within the main terminal complex, the site of the Proposed Action is devoid of any vegetation since it is the location of the present terminal parking facility.

The 32 acre site proposed for the remote parking facility has been graded in the past in preparation for construction of air cargo facilities. Timothy and brome-grass were seeded upon completion of grading to reduce soil erosion. A visit to the site did not reveal the presence of any rare or unusual plant species nor were any expected because of the previous site disturbance. Other species, such as hawksbeard, generally expected to occur on recently disturbed, low fertility sites were occasionally intermixed with the brome and timothy.

WILDLIFE

Areas suitable for wildlife occur primarily in the Minnesota and Mississippi River Valleys and in the Mother Lake area where suitable habitat remains. Most of the area to the north, west and southwest of the airport is heavily urbanized providing habitat for such urban wildlife species as robins, English sparrows, starlings, gray squirrels, pigeons and perhaps occasional mourning doves.

Wildlife habitat along the Mississippi River Valley is publicly owned and preserved as city park and open space. In the Minnesota River Valley, wildlife habitat is being protected in various ways. Much of the area immediately adjacent to the airport lies within the statutory boundaries of Fort Snelling State Park. Acquisition of park lands is over 90 percent complete.1/

Additional protection of the Minnesota River Valley exists with the newly authorized Minnesota Valley National Wildlife Refuge and Recreation Area. The creation of the unit was proposed and supported by environmental and civic groups and concerned citizens who wanted to insure the protection of the area with its natural beauty, diversity of wildlife and unique plant communities in an area so close to a major metropolitan center. This unit, presently in the acquisition stages, will have a detailed management plan prepared for it which will identify suitable activities as well as designating areas where compatible activities will be allowed. Activities currently under consideration include fishing, hiking, cross-country skiing, bicycling and bird watching to mention a few. The area will also serve as an educational resource for natural science and environmental education programs.

Wildlife management programs will be directed toward the improvement of wetland and upland habitats for all species of wildlife indigenous to the area.

As illustrated in Figure 13, a variety of wildlife habitat types occur in the vicinity of the airport. The most common being upland grass, lowland grass or wet meadow, lake, marsh and woods. Table 6 gives a partial listing of species most commonly occurring in the vicinity of the airport.

1/ Management Plan for Fort Snelling State Park (2nd Draft), Minnesota DNR Division of Parks and Recreation, 1977.

TABLE 6

WILDLIFE SPECIES IN THE AIRPORT VICINITY

Habitats			
Upland	Lowland		
Bobwhite	Bobwhite	Red-tailed hawk	Pied-billed grebe
Ring-necked pheasant	Ring-necked pheasant	Bald eagle	Great blue heron
Killdeer	Mice and shrews	Osprey	American bittern
Upland sandpiper	White-tailed deer	Bobwhite	Canada goose
Mourning dove	Black tern	Mourning dove	Mallard
Cliff swallow	Short-billed marsh wren	Blue jay	Blue-winged teal
Common crow	Bobolink	Common Crow	Wood duck
Sparrows		American robin	Common goldeneye
Moles		Various passerines	Great egret
Shrews		Woodchuck	Ring-necked pheasant
White-tailed jackrabbit		Mice and shrews	Sora
Thirteen lined ground squirrel		Raccoon	American coot
Mice and shrews		White-tailed deer	Gulls
Striped skunk		American toad	Terns
Red fox			Tree swallow
Horned lark			Bank swallow
Eastern garter snake			Muskrat
Bullsnake			Raccoon
			Mink
			Red Fox
			Common snaping turtle
			Western painted turtle
			Northern leopard frog
			Red-winged blackbird

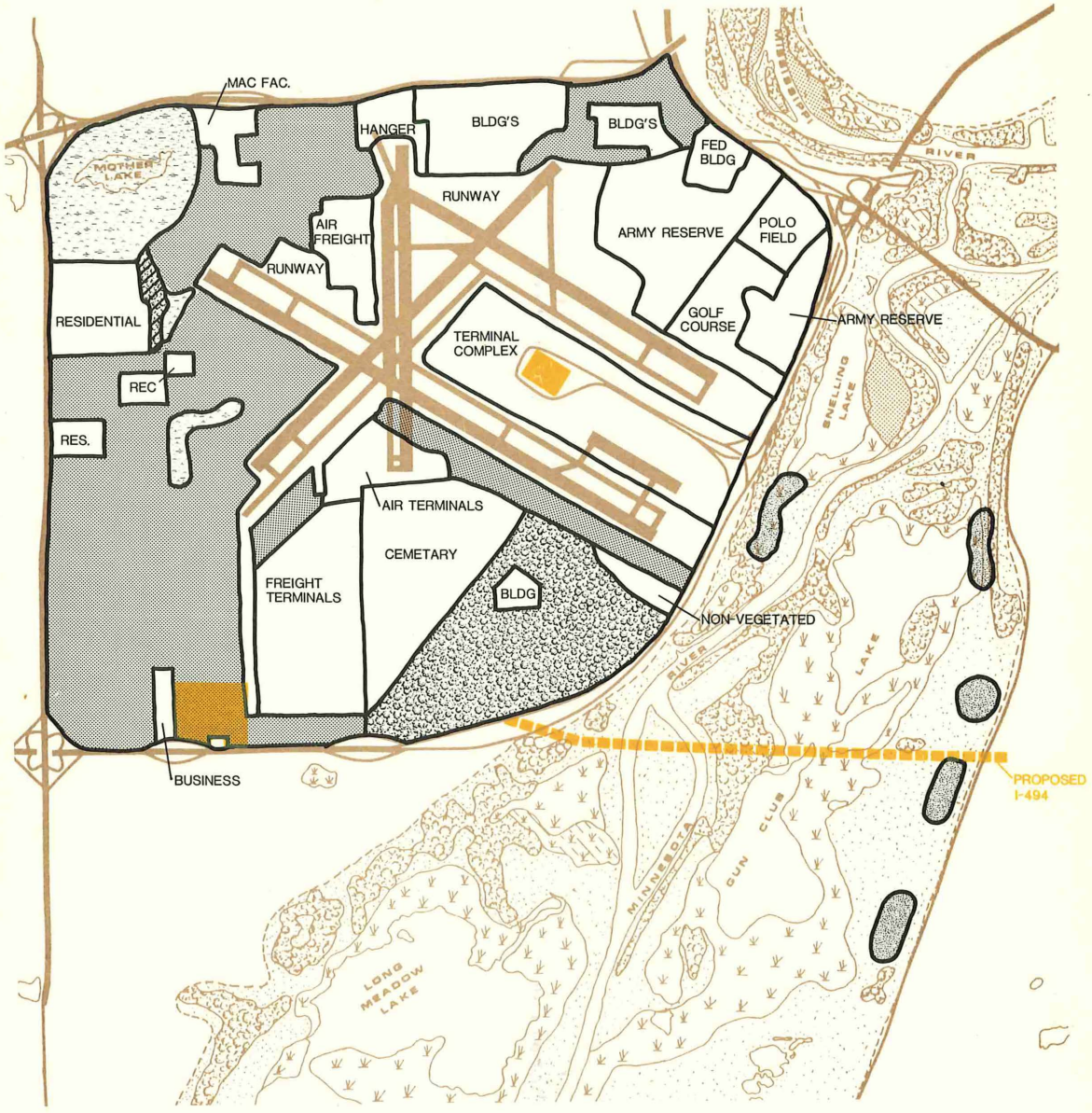

FIGURE 13

WILDLIFE HABITAT TYPES

- PARKING SITES
- MARSH
- GRASSLAND
- UPLAND WOODS
- MIXED UPLAND FOREST / GRASSLAND
- PERCHED BOGS

GRASSLANDS
MARSH & WOOD
MARSHES
SANDS & BEACH
WOODS

0 800 1600 3200FT. NORTH

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Waterfowl and other birds are the predominant wildlife species found in the area. Many species of birds feed, nest and winter in Fort Snelling State Park directly beneath Runways 29L and 29R. Waterfowl especially are attracted to the vast floodplain marshes and shallow lakes of the river valley where aquatic vegetation and organisms provide them with abundant food. Every spring and fall large concentrations of waterfowl and other avian migrants make use of the valley either as a migratory corridor or as a staging area.

In spite of the heavy use of the area by birds, and aircraft the number of bird strikes by aircraft is very low. In fact the last incident of record occurred in 1960[1/]. There have been no malfunctions of aircraft utilizing the airport which have been attributed to bird strikes since then. Marsh and lake areas also provide habitat for such mammals as muskrats, mink and a variety of species of reptiles and amphibians.

White-tailed jackrabbits are generally abundant on the airport proper. Observations involving 20 or more rabbits in a group are not uncommon.

During the course of the site-inspection on June 16, 1978, an upland sandpiper with three recently hatched young was observed south of East 69th Street in the proposed golf course area. Three other mature upland sandpipers were observed in the immediate area as well.

Deer have also been known to frequent the area immediately to the southeast of Fort Snelling National Cemetary and road kills are known to occur as the deer cross I-494 to and from the Minnesota River bottoms. A herd of 20 to 40 deer winter in Fort Snelling State Park each year. Red fox have been observed on the airport proper in the past but in recent years observations are infrequent possibly due to the overall decline in the fox population.

Because of the developed nature of the main terminal complex, utilization by wildlife is non-existent. It is possible that the bridges and ramps near the terminal could provide roosting and nesting cover for pigeons if a nearby food supply became available.[2/]

The site of the proposed remote parking lot provides habitat primarily for white-tailed jackrabbits which are abundant on the airport. During the site inspection jackrabbits were flushed. Deer use the area only infrequently with an observation frequency of one deer per year or less.

1/ Report of the Environmental Advisory Team for the MSP International Airport, 1976.

2/ Planning for Wildlife in Cities and Suburbs. USDI Fish and Wildlife Service, 1978.

PUBLIC TRANSPORTATION SERVICES

Public transportation refers to the several varieties of non-private automobile transportation services available to the airport user. These services include:

- o Bus Service
- o Taxi Service
- o Limousine Service
- o Courtesy Car Service
- o Rental Car Services

Public bus service to the airport is provided by the Metropolitan Transit Commission (MTC) which operates an airport express bus to the CBD's of Minneapolis and St. Paul as well as limited local service. In general a 20 to 40 minute service frequency is provided. Other bus service is provided by Greyhound and Jefferson Lines which provide scheduled service between the airport and Rochester. In addition, charter buses and tour groups come to the airport via the bus.

Taxi service is provided by several cab companies which operate in four service areas. These service areas are Minneapolis, St. Paul, Minneapolis suburban and St. Paul suburban. Eight parking spaces are available at the terminal for taxi stands with two spaces allotted to each service area. Additional cabs wait in a "bull pen" area, away from these parking spaces, until an opening occurs.

Limousine service to the airport is provided by two companies--Yellow Cab Company and Suburban Airport Limousine. The Yellow limousine service is a scheduled service operating between the airport and specific hotels in the Minneapolis and St. Paul CBD's at half hour intervals. The Suburban Airport Limousine provides service between the airport and suburban hotels and motels, primarily along I-494.

Courtesy cars are provided by several hotels and motels as a convenience to their patrons. These courtesy cars generally operate on demand and travel only between the airport and the respective hotel or motel.

Rental car service is provided by five agencies which have facilities on the airport to deliver vehicles directly to the customer. In addition several other rental car agencies pick-up customers at the airport and take them to their off-airport offices.

ROAD SYSTEM/TRAVEL DEMAND

There are two distinct elements of the existing road system which serves the Minneapolis-St. Paul International Airport. One element consists of the major highways connecting the airport to the metropolitan region and the second element is the system of on-site circulation roadways serving the airport proper. Both of these roadway networks carry significant traffic volumes having different operational characteristics.

Regional Road System

The existing highway network serving the airport includes several primary Interstate, State Trunk Highway, and Hennepin County facilities as shown in Figure 14. The highways immediately adjacent to the airport are:

- o T.H. 5 on the southeast.
- o I-494 on the south.
- o T.H. 36 (Cedar Avenue) on the west.
- o Hennepin County Road 62 (Crosstown Highway) on the north.
- o T.H. 55 (Hiawatha Avenue) on the northeast.

Primary and secondary access to the airport is provided at several points on these circumferential roadways. The following access points now serve the airport complex.

- o Main Terminal Area.

  Directional interchange at T.H. 5.

- o Southern Portion of Airport Complex.

  Diamond interchange at T.H. 5 and Post Road.
  Diamond interchange at I-494 and 34th Avenue.
  Diamond interchange at I-494 and 24th Avenue.

- o Western Portion of Airport Complex.

  Modified diamond interchange at T.H. 36 and 66th Street. No southbound exit ramp from T.H. 36 is provided.

  Half diamond interchange at T.H. 36 and 63rd Street. No southbound entrance ramp and northbound exit ramp are provided.

- o Northern Portion of Airport Complex.

  Diamond interchange at Hennepin County Road 62 and 28th Avenue.

  Modified diamond interchange at Hennepin County Road 62 and 34th Avenue.

The existing circumferential highway system around the airport complex is built to freeway standards with one exception. The east end of Hennepin County Road 62 between 46th Avenue and T.H. 55 operates with at-grade access and signal control at the intersection of Hennepin County Road 62 and T.H. 55. This intersection presently provides two lanes on each approach with special left and right turn lanes for major turn movements.

Regional travel patterns to the airport are documented in terms of the minimum travel time paths which exist between the airport and various points in the metropolitan area. Figure 15 depicts the existing regional travel patterns to the airport and indicates that the primary regional access routes are:

- o I-494 to the west.
- o I-35W to the south.
- o T.H. 55 to the southeast.
- o U.S. 12 to the east.
- o I-35E to the northeast.
- o I-35W/U.S. 10 to the north/northwest.

Planned additions and upgradings to the regional roadway network which will affect the existing regional travel patterns to the airport include the following:1/

- o Hennepin County Road 62 east to T.H. 55.
- o I-494 across the Minnesota River.
- o I-35E from I-35W to the St. Paul CBD.
- o T.H. 55 (Hiawatha Avenue) to the Minneapolis CBD.
- o T.H. 36 (Cedar Avenue) bridge across the Minnesota River.

While overall travel time to the airport would be improved and certain travel paths would be altered, the net effect of these changes to the regional roadway system are minimal upon the airport proper. This is because nearly all vehicles destined to the terminal area must utilize the interchange of T.H. 5 with the inbound and outbound roadways.

1/ Metropolitan Development Guide – Transportation Chapter, 1976.

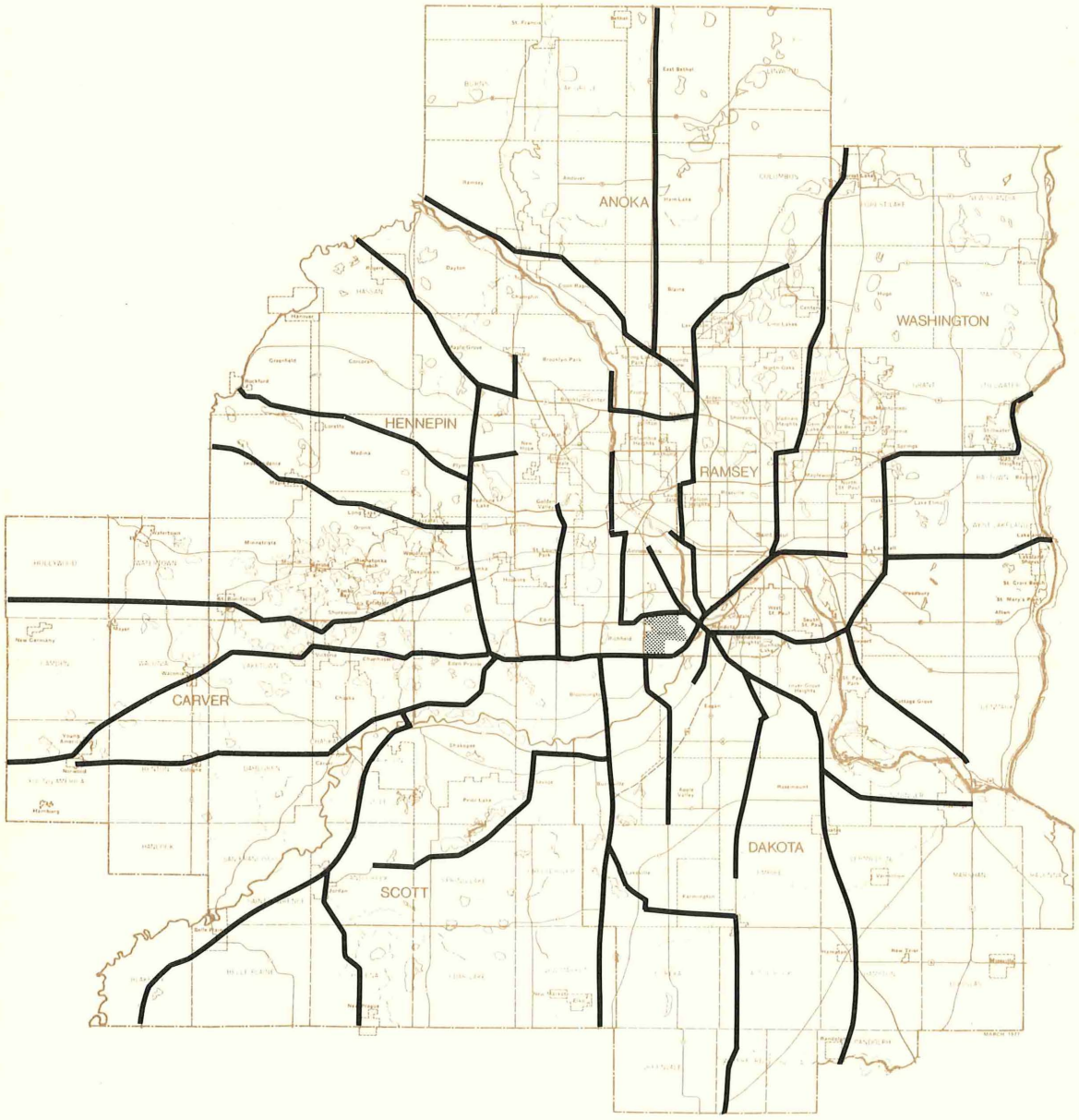

FIGURE 15

MAJOR REGIONAL TRAVEL PATTERNS-
EXISTING HIGHWAY SYSTEM

AIRPORT

MINIMUM TRAVEL TIME PATH TO THE AIRPORT

0 5 10MILES NORTH

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Regional Travel Demand

The existing regional travel demand characteristics are illustrated in Figure 16 for the major roadways adjacent to the airport. The distribution of travel to and from the airport is such that approximately 50% of the total travel utilizes T.H. 5 to the southwest toward I-494 and the other 50% utilizes T.H. 5 to the northeast toward T.H. 55 and the Mendota Bridge. The traffic volumes on T.H. 5 past the airport entrance are nearly 50,000 vehicles per day of which slightly more than 36% is associated with the airport. The airport related traffic quickly disperses and constitutes a lesser proportion of the regional traffic flow beyond the immediate vicinity of the airport. Table 7 identifies key points on the regional road system and lists daily traffic volumes, corresponding daily capacities, and the proportion of existing daily traffic which is associated with the airport. It will be noted that two areas exhibit capacity deficiencies; the T.H. 55 intersection with the Crosstown and the Mendota Bridge. Both of these deficiencies have also been identified in the MDG Transportation Chapter.

TABLE 7

1977 AIRPORT TRAVEL ON THE REGIONAL ROAD SYSTEM
Source: Mn/DOT 1976 State Flow Map-BRW Traffic Counts, 1977.

Roadway	Location	Daily Traffic (vph)	ADT Capacity* (vph)	Airport Traffic (vph)	% Airport Traffic
T.H. 5 (North)	Airport Entrance	49,600	90,000	18,000	36
T.H. 5 (South)	Airport Entrance	49,700	60,000	18,000	36
Mendota Bridge		39,500	25,500	4,500	11
T.H. 5	North of T.H. 55	45,300	60,000	9,000	20
T.H. 55	North of Crosstown	16,800	25,500	900	5
T.H. 55	South of Crosstown	31,600	60,000	4,500	14
Crosstown	West of T.H. 55	31,300	25,500	3,600	12
Crosstown	West of Cedar	48,500	60,000	3,600	7
I-494	East of Cedar	46,200	90,000	18,000	39
I-494	West of Cedar	56,200	90,000	16,200	29
Cedar Avenue	North of I-494	24,900	60,000	900	4

*Roadway capacities estimated based upon 1,650 vehicles per hour per lane for free flow conditions and 700 vehicles per hour per lane for interrupted flow conditions. Peak hour percentage is assumed to be 10% and directional split 55%-45%.

On-Site Roadway System

The existing on-airport road system serving the main terminal complex is illustrated in Figure 17. The basic circulation pattern consists of one-way traffic flow moving in a counterclockwise direction which fulfills the following functions:

- Ingress to and egress from the main parking facilities including, the short term and long term parking lots in the central parking area, the terminal building garage, the overflow parking lot, and other special purpose parking lots adjacent to the concourses.
- Access to the curbside pick-up and drop-off areas next to the terminal building.
- Access to the terminal building for auto rental cars (both on-airport and off-airport), taxis, limousines, hotel/motel vans, buses, and other related vehicles.
- Connections to the two-way service roads which provide access to the terminal buildings, post office, auto rental make-up areas, and other buildings on the airport.
- Ingress to and egress from the Northwest Airlines main base.

There are several other on-site roadways which serve a local access and circulation function. These facilities are segmented into distinct areas due to the location of runways and designated clear zones also shown in Figure 17.

In the southern portion of the airport complex Post Road, East 70th Street, and 34th Avenue are the primary circulation facilities. These facilities carry traffic to an employee parking lot, the International Charter Terminal and airline maintenance facilities along 34th Avenue. A vehicular tunnel connects the employee parking lot with the main terminal building. Employees are transported to and from the terminal building by bus. Local access is also provided by 24th Avenue to a freight handling area from I-494. A local roadway connects this area to 34th Avenue.

The northern portion of the airport is served by a series of local roadways which are extensions of streets interchanging with the circumferential highways. East 63rd Street and East 66th Street enter the airport complex from Cedar Avenue on the west while 28th Avenue and 34th Avenue enter the area via Hennepin County Road 62 from the north. This area includes U.S. Navy and U.S. Air Force property in addition to maintenance buildings of the Metropolitan Airports Commission and office buildings. Residential land uses are also served by local streets along Cedar Avenue.

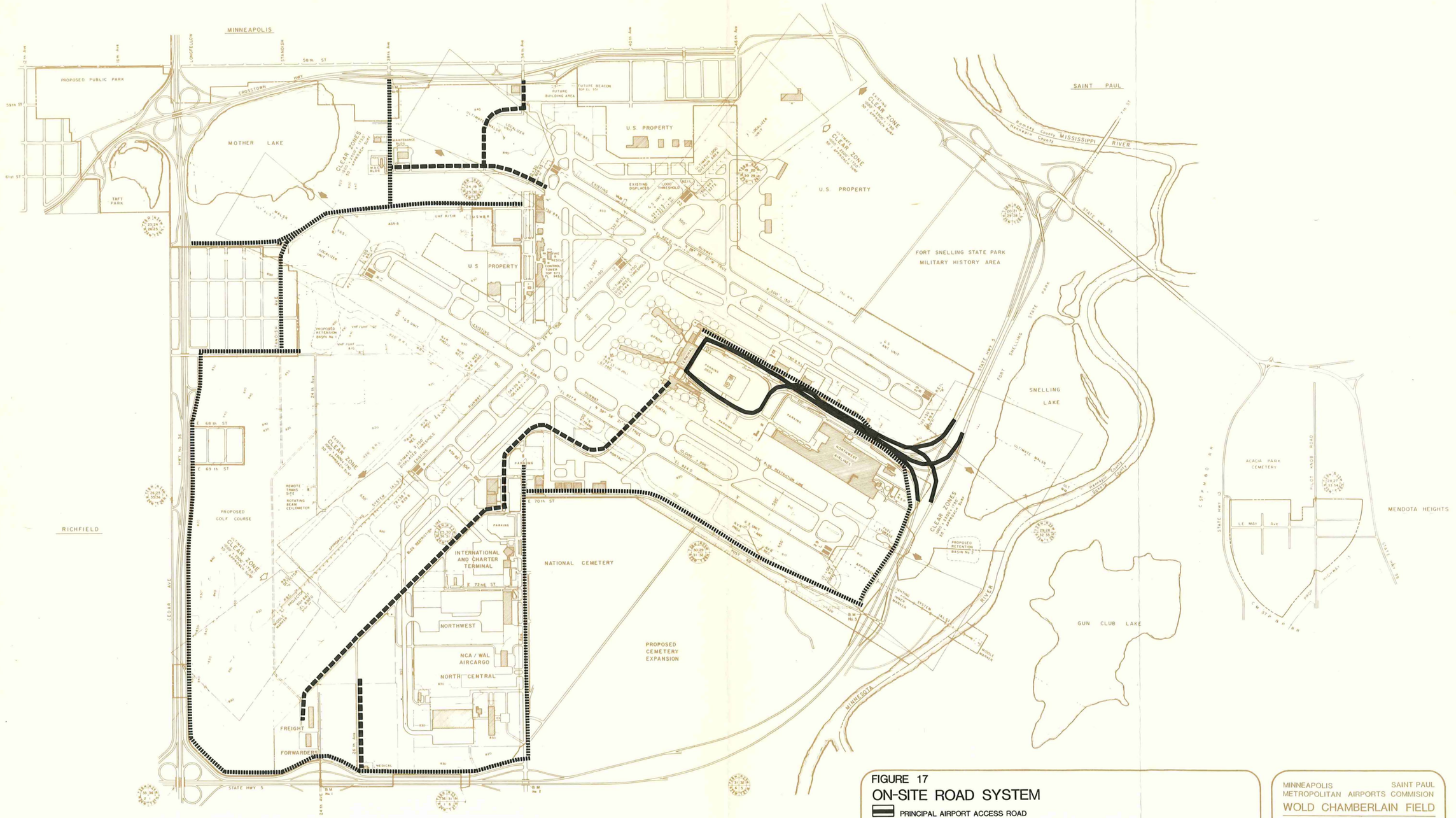

FIGURE 17

ON-SITE ROAD SYSTEM

- PRINCIPAL AIRPORT ACCESS ROAD
- OTHER AIRPORT ACCESS FACILITIES
- RESTRICTED ON-SITE ROADWAYS

0 400 800 1600FT. NORTH

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AIRPORT PARKING EXPANSION PROGRAM DRAFT-EIS

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On-Site Travel Demand

A detailed analysis of the on-site travel patterns reveals several significant aspects of the terminal area traffic operations. These include the driver destinations within the airport, the hourly distribution of daily traffic to the airport, and the average vehicle occupancy by mode of travel.

Daily traffic volumes on the local airport roadways are most significant within the main terminal complex. Figure 18 presents the 1977 daily traffic volumes in this area.

The typical allocation of traffic to various destinations within the airport complex is summarized in Table 8. It will be noted that the aggregate of the various destinations exceeds the total inbound traffic volume by approximately 32% due to multiple driver destinations (e.g. curbside to parking, parking to curbside, etc.). In addition, it will be noted that the total curbside activity on the upper level and the lower level is approximately double the total parking related vehicle activity. This phenomenon is consistent with the results of the air passenger survey of 1970 which indicated that approximately 80% of the arriving and departing air passengers interfaced with ground transportation at the curbside levels and that slightly more than half of this curbside activity is related to the private automobile.

TABLE 8

SUMMARY OF DRIVER DESTINATIONS WITHIN THE AIRPORT COMPLEX
Source: BRW Traffic Counts December, 1977.

Driver Destination	Vehicles Per Day	% of Inbound Traffic
Long-Term Parking	3,000	16.6
Short-Term Parking	2,500	13.9
Garage Parking	1,000	5.6
Overflow Parking	200	1.1
Upper Level Curbside	6,000	33.3
Lower Level Curbside		
Inner Roadway	4,000	22.2
Outer Roadway	2,500	13.9
Northwest Airlines	2,100	11.7
Service Road	2,500	13.9
Total Driver Destinations	23,800	132.2
Recirculation Roadway	3,700	20.5
Other Recirculation	2,100	11.7
Total Recirculation	5,800	32.2
Total Inbound Traffic	18,000	

The hourly distribution of traffic flow at the airport is significant in terms of the peak loadings on various segments of the on-site road system. Figure 19 depicts the hourly distribution of traffic on the inbound and outbound roadways. A comparison of the charcteristics of the inbound and outbound roadways identifies the typical accumulation of vehicles on the airport during the day. An examination of other hourly distributions indicated that the hourly distribution of traffic to parking closely follows the inbound traffic variation. On the other hand, curbside activity remains relatively low in the early morning and sustains a higher level later in the day. This reflects the predominance of business related travel early in the morning which typically involves little or no luggage and consequently a lesser demand on curbside space. Employee related travel, on the other hand, exhibits typical high peaks both in the morning and afternoon. This is primarily related to Northwest Airlines which has major access to its employee parking lot from the main terminal roadway.

Mode of travel and vehicle occupancy characteristics are important traffic parameters at the airport which directly relate to parking space requirements and curbside length needs. Numerous surveys have been conducted which determined the percent usage of various modes of travel to the airport and the number of air passengers in each mode. The most comprehensive survey of air passengers was conducted in 1970 which surveyed individuals on the plane to determine their ground travel habits to and from the airport. Table 9 presents the results of this survey broken down by flight arrivals and departures and also residents and non-residents of the Twin Cities area.

Non-residents are more likely to use public means of transport (rented auto, taxi, limousine and courtesy car) than are residents. The residents, as might be expected, are more likely to have access to private cars. For non-residents, slight differences exist between arriving and departing. However, in all categories the effect of pooling arriving and departing passengers does not change the relative importance of the different modes of transportation to the airport.

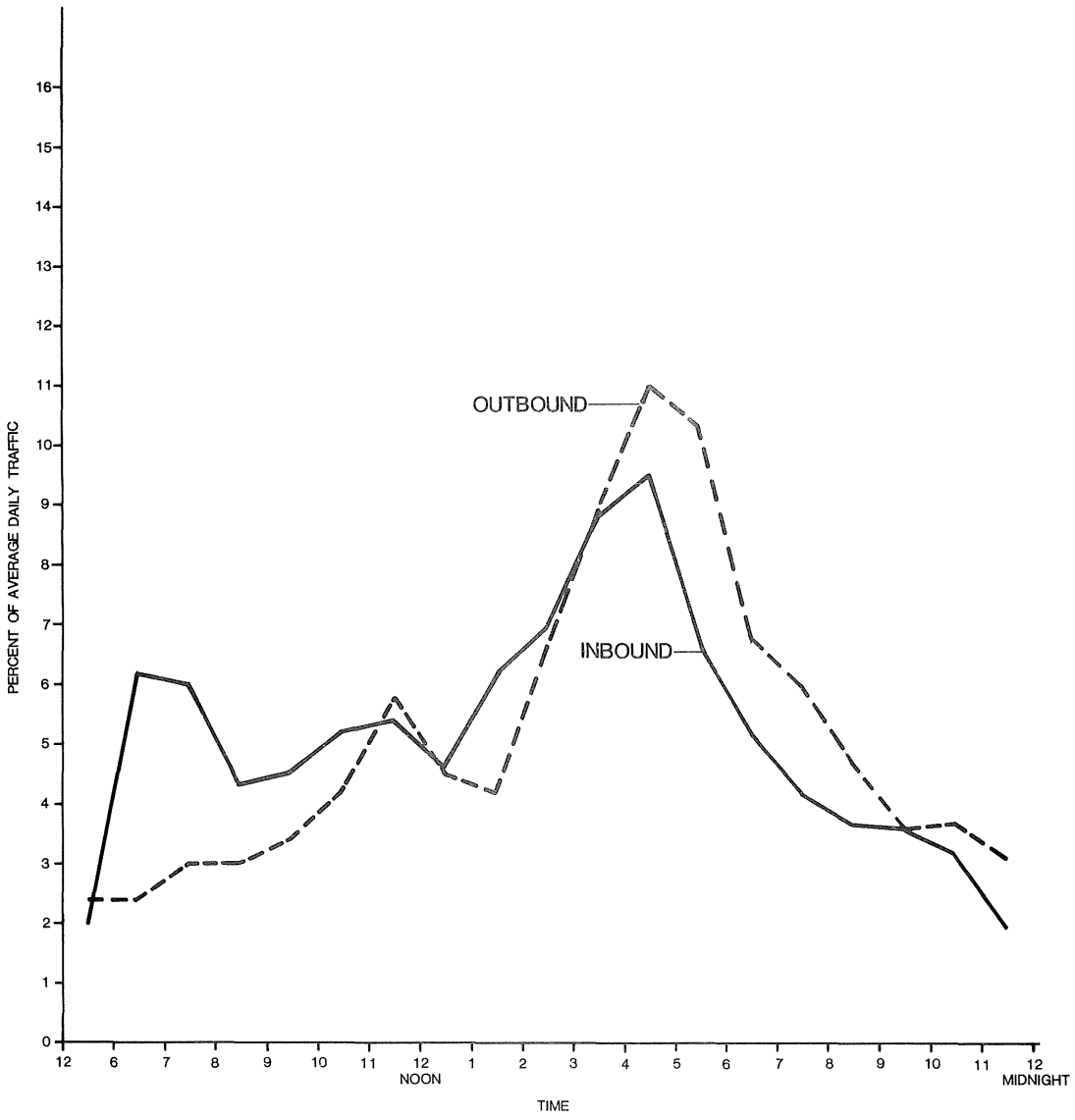

FIGURE 19

HOURLY DISTRIBUTION OF AIRPORT TRAFFIC

SOURCE: BRW TRAFFIC COUNTS, DECEMBER 1977

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The differences between arriving and departing residents are all in the use of private auto-driven away and the use of taxis. Except for these two categories, all differences are less than one percent. Pooling of arriving and departing passengers does not change the relative importance of the different modes of travel.

TABLE 9

PERCENT USAGE OF VARIOUS MODES OF TRAVEL TO ACCESS THE AIRPORT

Source: Air Passenger Survey, A.M. Voorhees, 1970.

Mode	Arriving Air Passengers		Departing Air Passengers	
	Residents	Non-Residents	Residents	Non-Residents
Rental Car	0.6%	19.1%	0.6%	16.5%
Taxi	16.7%	20.2%	11.0%	14.0%
Limousine	2.9%	19.6%	2.0%	16.8%
Courtesy Car	0.0%	4.7%	0.1%	2.3%
Public Bus	0.5%	0.3%	0.3%	0.8%
Private Auto (driven away)	47.4%	30.5%	53.0%	41.9%
Private Auto (parked)	31.0%	3.3%	31.7%	4.7%
Other/Unknown	0.9%	2.3%	1.3%	3.0%
	100.0%	100.0%	100.0%	100.0%

Vehicle occupancy data is summarized in Table 10 and is based upon field observations made by MAC staff. Drivers of public transportation vehicles and other persons (e.g. rental car employees, "greeters and well-wishers", etc.) have been removed from the tabulation such that the reported vehicle occupancies reflect only air passengers per vehicle. It will be noted that both rental cars and taxis operate at occupancies less than 1.0. The highest vehicle occupancies occur for buses, limousines, and courtesy cars but these modes constitute the lowest vehicular volume. The private auto carries nearly 2/3 of the air passengers with private autos utilizing the curbside areas exhibiting the highest vehicle occupancy. The occupancy of private autos which park directly is very similar to vehicle occupancies of the typical urban work trip and reflects a high proportion of single occupant, business related travelers.

TABLE 10

AVERAGE AIR PASSENGERS PER VEHICLE BY MODE OF TRAVEL

Source: MAC Lower Level Roadway Survey, May, 1977
MAC Public Ground Transportation Assessment, Feb., 1976

Mode	Total Vehicles	Air Passengers	Air Passengers Per Vehicle
Rental Car	1,338	991	0.74
Taxi	590	512	0.87
Limousine	120	505	4.21
Courtesy Car	230	389	1.69
Public Bus	54	376	6.96
Private Auto (Curbside)	2,513	3,771	1.50
Private Auto (Direct Park)	1,441	1,616	1.12
Totals	6,286	8,160*	1.30

*This total reflects the average air passenger activity during the five day period of May 23, to May 27, 1977. Data collected during other time periods has been adjusted upward or downward relative to air passenger activity levels.

AIR QUALITY

Regulated Pollutants

National Ambient Air Quality Standards have been established for the following air pollutants: total suspended particulates (TSP), sulfur oxides (SO_x), carbon monoxide (CO), photochemical oxidants (O_x), nitrogen dioxide (NO_2), non-methane hydrocarbons (NMHC), and, recently, lead. The State of Minnesota also has set ambient air quality standards for these pollutants as well as for hydrogen sulfide (HS). The standards are usually defined in two parts: a primary standard which represents a level of exposure designed to protect human health, and a secondary standard, usually more stringent, designed to protect against undesirable effects on livestock, plants and other property. None of these pollutants are routinely monitored at the airport. For the other pollutants, a generaly measure of their concentrations is available by examining monitoring data from nearby sampling stations. For this EIS and the Indirect Source Permits required to expand parking at the airport, ambient levels of carbon monoxide were measured at several sites on the airport during November and December of 1977.

The state standards for each of the regulated pollutants, except lead are shown in Table 11. The concentrations of pollutants measured at the nearest monitoring station and the station locations are shown on the map in Figure 20. Each of the regulated pollutants, their effects, sources and concentrations near the airport are discussed below.

Particulates. Particulate matter may be liquid or solid in a finely divided state with sizes ranging from 1 molecule to 500 microns in size. Particulates may vary widely in their chemical composition and in their health effects. Particulates may be toxic by themselves or toxic chemicals may be absorbed onto their surfaces and then carried deep into the lung. Bronchitis, asthma, and emphysema have been related to particulate matter. Particulates also soil and degrade property, reduce visibility and may cause climatic changes. The particulate sampling station nearest the airport is located at Lincoln High School in Bloomington.

During the years 1971 to 1976, the annual geometric mean for particulates at the Bloomington site averaged 45 micrograms per cubic meter, compared to the primary standard of 75 micrograms per meter and the secondary standard of 60 micrograms per meter. During those years one violation of the primary standard for the 24 hour average (260 ug/m3) occurred in 1975 and a violation of the secondary standard (150 ug/m3) occurred during 1971, twice during 1972, and once during 1975. In general, the air quality with respect to particulates could be characterized as good.

Sulfur Oxides. Sulfur oxides are produced by combustion of sulfur containing fuels such as coal and oil, by smelting operations, petroleum refining, and chemical plants. Ninety-eight percent of sulfur oxides are sulfur dioxide (SO_2). Sulfur dioxide irritates the

TABLE 11

MINNESOTA AMBIENT AIR QUALITY STANDARDS

Source: Minnesota Air Quality - 1974,
Minnesota Pollution Control Agency, June, 1975

Pollutant	Standard (Micro-gm/Cubic Meter) Primary	Secondary	Wording
Carbon Monoxide (CO)	10,000 (9 PPM)	10,000	Max. 8-Hr. Conc. - not to be exceeded more than once per year.
	35,000 (30 PPM)	35,000	Max. 1-Hr. Conc. - not to be exceeded more than once per year.
Hydrocarbons (HC)	160	160	Max. 3-Hr. Conc. (6-9 a.m.) not to be exceeded more than once per year.
Nitrogen Oxides (NOx)	100	100	Max. Annual Arithmetic Mean
Particulates (Part)	75	75	Max. Annual Geometric Mean
	260	150	Max. 24-Hr. Conc. - not to be exceeded more than once per year.
Sulfur Oxides (SO2)	60	60	Max. Annual Arithmetic Mean
	260	260	Max. 24-Hr. Conc. - not to be exceeded more than once per year.
	655	655	Max. 3-Hr. Conc. - not to be exceeded more than once per year.
Oxidants (OX)	130	130	Max. 1-Hr. Conc. - not to be exceeded more than once per year.
Hydrogen Sulfide (H2S)	70,000,000		1/2-Hr. Avg. - not to be exceeded more than twice per year.
		42,000,000	1/2-Hr. Avg. - not to be exceeded more than twice in five consecutive days.

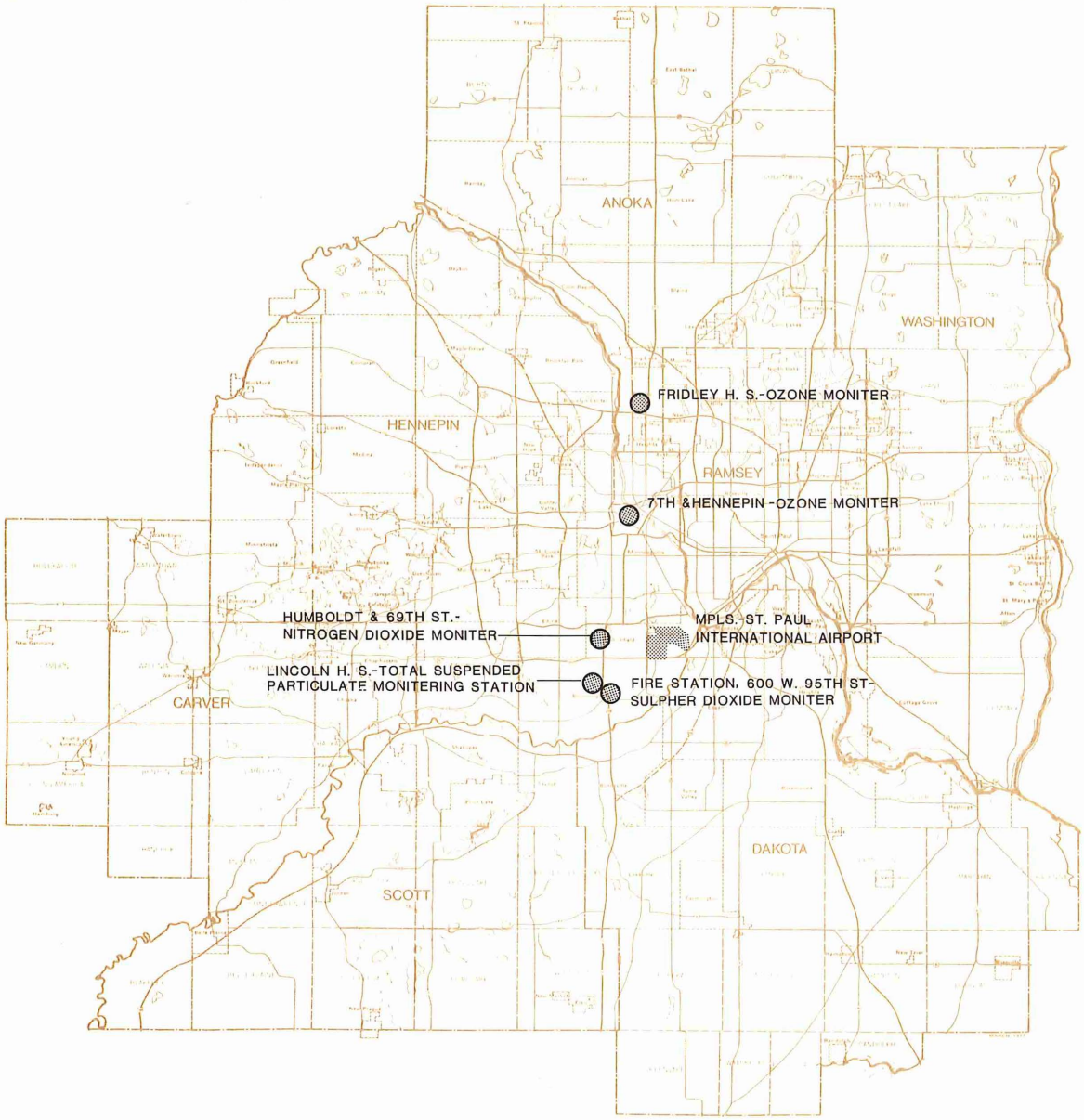

FIGURE 20

PERMANENT AMBIENT AIR MONITERING STATIONS FOR VARIOUS POLLUTANTS

SOURCE: MINNESOTA POLLUTION CONTROL AGENCY

0 5 10MILES NORTH

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dioxide irritates the mucus membranes and constricts the pulmonary blood flow. SO_2 acts synergistically with particulates, lowering the threshold for health effects. Episodes of high SO_2 levels have been associated with an increase in the death rate as well as increased illness. SO_2 is oxidized in the atmosphere to form SO_3, which in turn forms both sulfuric mist and sulfates. Sulfur oxides together with particulates corrode steel and other metals, attack slates, mortar, marble, limestone, cotton, rayon, nylon and leather and severely fade dyed fabrics. All this has a substantial economic impact. Sulfur oxides are largely responsible for the so called "acid rain" which has caused acidification of lakes and decreases productivity in forests.

The SO_2 monitoring station nearest the airport is at the fire station at 600 West 95th Street in Bloomington. During the period from 1973 to 1976 no violations of the 24 hour standard, the 3 hour standard, or the annual average standard for SO_2 were recorded at this site. Violations are regularly recorded at the stations in St. Paul Park and Pine Bend which reflect activity at the refinery and chemical complex there. The air quality near the airport is relatively good with respect to SO_2.

Nitrogen Oxides. There are several possible oxides of nitrogen. Of these nitric oxide (NO) and nitrogen dioxide (NO_2) are the most important forms from an air pollution standpoint. NO is a colorless, ordorless gas and NO_2 is a pungent reddish-orange-brown gas, both of which are formed primarily at high temperatures and/or high pressures such as are found in fossil fuel combustion. Major sources are automobiles, power plants, incinerators and chemical processes. NO often often undergoes chemical reactions with other air pollutants to form NO_2. NO_2 exposure increases one's susceptibility to bacterial invasions by interferring with some of the body's defense mechanisms. There is some epidemiological evidence of increased rates of respiratory illnesses in populations exposed to NO_2. At present the only standard for NO_2 is 0.05 parts per million for the annual arithmetic mean of the 24 hour values. The need for a short term exposure standard is generally recognized by the scientific community and may be forthcoming soon.

The nearest NO_2 monitoring station to the airport is at Humboldt and 69th Street in Richfield. That station did not show any violations of the standard during the years from 1973 to 1976. There has been a trend towards increasing levels of NO_2 from 0.027 ppm in 1973 to 0.033 ppm in 1976. NO_2 levels may be different at the airport because the airplanes and auto traffic there produce significant amounts of oxides of nitrogen. NO_2 was not measured directly at the airport.

Hydrocarbons. Hydrocarbons are a large class of organic compounds whose primary constituents are hydrogen and carbon. Included in this class are gasoline, oil and solvents. Automobiles are the major source of hydrocarbons in the Twin Cities. Not only does gasoline

Cities. Not only does gasoline evaporate from the fuel tank and carburetor but hydrocarbons are present in the exhaust, representing incompletely burned fuel. Little is known about the health effects of hydrocarbons as a class. Several individual hydrocarbons are known to be toxic and carcinogenic. The national standard for hydrocarbons is not based on health effects but on the role that hydrocarbons play in producing another class of pollutants called photochemical oxidants. There are no hydrocarbon monitoring stations near the airport. The airplanes, automobiles and fuel shortage at the airport are significant sources of hydrocarbons.

Photochemical Oxidants. Photochemical oxidants are a class of highly reactive chemicals that are formed in the atmosphere in a chemical action involving primarily oxides and nitrogen, hydrocarbons and sunlight. For this reason they are referred to as secondary pollutants. Ozone (O_3) is the predominant chemical in the family of oxidants. All the oxidants damage vegetation. Ozone is responsible for up to 90% of pollution injury to vegetation. Ozone also causes watering of the eyes and drying of the mucus membrane. Higher concentrations cause headaches, irritation, pulmonary congestion, edema, and hemorrhage. The National Ambient Air Quality Standard of 0.08 parts per million (ppm) 1 hour average is not sufficient to protect the most sensitive species of plants but is currently deemed adequate to protect human health. Ozone has been shown to induce chromosonal changes which may implicate it as a potential carcinogen or nitrogen.

The sampling network for Ozone can best be described as sparse. Due to the fact that nitrogen oxide temporarily destroys Ozone (NO emissions utlimately create more O_3 through a series of several reactions), O_3 levels are usually lower in central cities than in the surrounding area. An Ozone monitor at 7th and Hennepin in downtown Minneapolis has not shown any violations of the O_3 standard in the last two years. However, another monitor at Fridley High School has shown several violations and the worst situation has been found outside the cities downwind from the cloud of pollution where the hydrocarbons and NO_x have had a chance to mix and react. It would be misleading to estimate O_3 levels at the airport on the basis of the scanty information available.

Carbon Monoxide. Carbon monoxide (CO) is a colorless, odorless, tasteless gas produced by incomplete combustion. It has been estimated that 86% of CO in the Twin Cities comes from transportation sources, primarily automobiles. CO binds tightly to the hemoglobin in the blood reducing its capacity to carry oxygen to the rest of the body. It also combines with certain enzymes and disrupts body cell chemistry. Low levels of CO product deterioration of visual sensitivity and deterioration of the mental and physco-motor responses. Higher levels produce headache, drowsiness, coma and death. CO has been implicated in heart attacks and chronic exposure may accelerate hardening of the arteries which in turn causes strokes and heart attacks. The standard for CO is 9 ppm for an 8 hour average not to be exceeded once per year and 30 ppm for a 1 hour average also not be exceeded once per year. CO concentrations vary widely, being highest in the vicinity of highways and intersections.

Airport CO Monitoring Program

Carbon Monoxide concentrations were measured at the airport from November 12, 1977 to December 30, 1977, by MMT Environmental , Inc. Two CO monitors were used. One monitor was stationed the entire time at a spot roughly 550 feet southwest of the centerline of runway 11R-29L or 3,000 feet southeast of the main terminal and designated Station S1 as shown in Figure 21. This monitor was located far enough away from any of the airport CO sources such that it would indicate background CO concentrations. The second monitor was placed in each of four different locations for two weeks each and monitored the CO impacts of specific operations at the airport. Wind direction was also recorded continuously at each of these four locations which were designated M1, M2, M3, and M4 (See Figure 21). Station M1 was located next to the terminal building on the lower level on the sidewalk. This location was expected to give the highest CO readings because of the large numbers of idling vehicles present and because the roadway above was expected to trap and retard the dispersion of automobile exhaust. This location is also characterized by significant pedestrian activity which would expose many people to the air pollution.

Station M2 was located on the upper level roadway on one of the bridges that connects the upper roadway to the terminal building. Because traffic congestion is not as severe on the upper level roadway and because the area is more open, CO levels were not expected to be as high as those on the lower level.

Station M3 was located near the exit booths at the edge of the long term parking area. This location was of concern because the parking lot cashiers are exposed to pollution for a full work shift and because the cars waiting in line to exit, are emitting CO at very high rates and are not fully warmed up.

Station M4, located next to the post office, was intended to measure the impact of traffic on the service road. This is also a location of where workers are exposed for eight hours or more at a time.

CO Monitoring Results

The overall results of the CO monitoring indicated that the airport was generally within State standards. However, two monitoring sites were found which did exceed State CO standards. Both of these locations are immediately in front of the main terminal building. The detailed monitoring results at each station are presented below.

Monitoring Station S1 resulted in maximum CO concentrations of 5.1 ppm for the one hour average and 3.8 ppm for the eight hour average. In addition, it was noted that northwest winds generally resulted in higher CO concentrations due to the presence of downtown Minneapolis northwest of the airport. No other pollution source was found which could have resulted in this phenomenon.

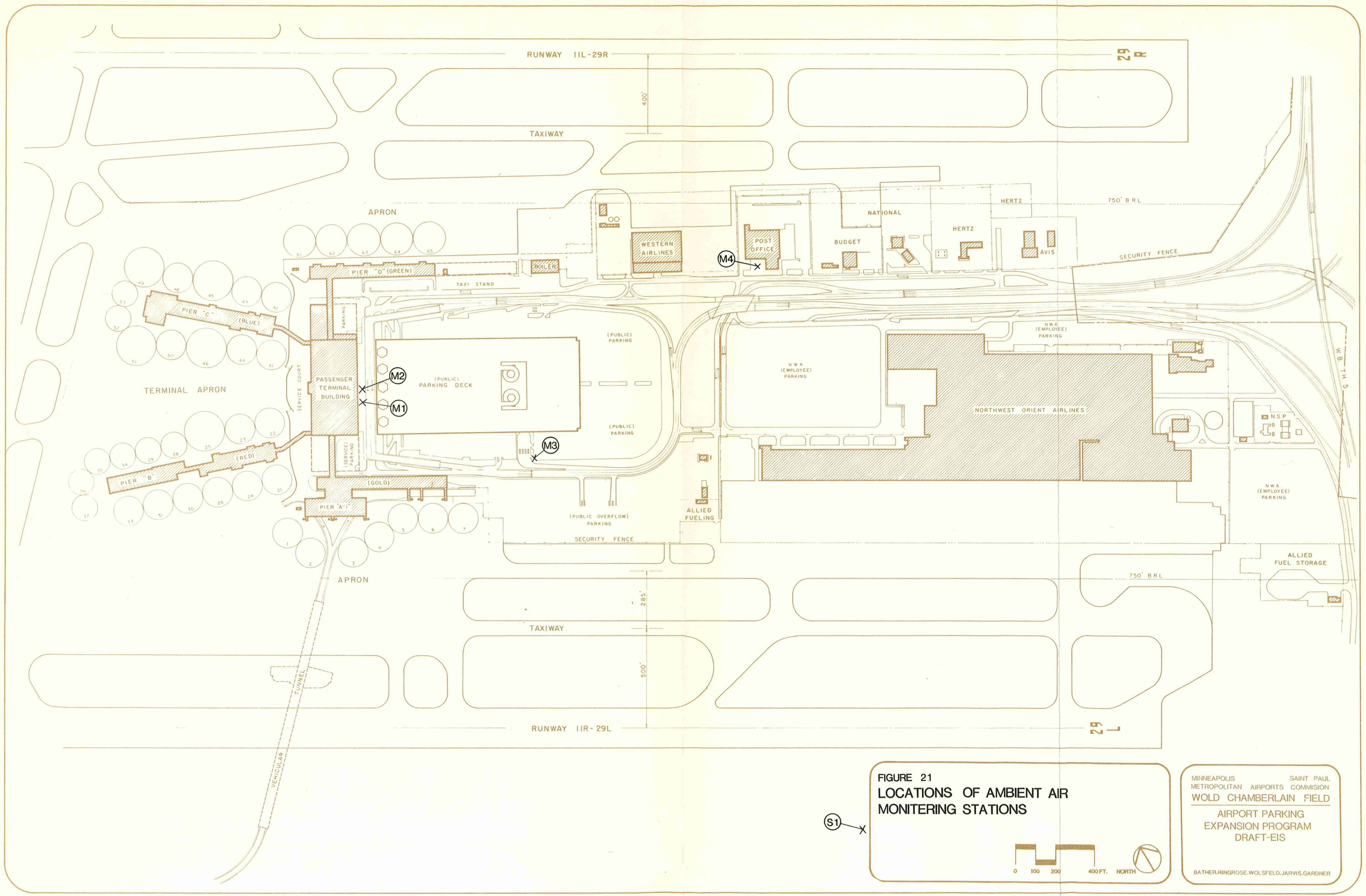

FIGURE 21

LOCATIONS OF AMBIENT AIR MONITERING STATIONS

0 100 200 400 FT. NORTH

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Station M1, the lower level roadway exhibited high CO levels as expected. The highest one hour average recorded between November 11 and November 28, 1977 was 26 ppm and the highest eight hour average recorded was 19.5 ppm. The one hour standard of 30 ppm is not exceeded while the eight hour standard of 9 ppm is exceeded by a factor greater than 2 . Median values for station M1 were 2.8 PPM and 3.4 PPM for one hour and eight hour averages respectively. Violations of the eight hour standard occurred on Friday, November 11; Wednesday, November 16; Thursday, November 17; Friday, November 18; Wednesday, November 23; and Sunday, November 27.

Unexpectedly, Station M2, on the upper level roadway, resulted in higher CO levels than the lower level roadway. Despite what was believed to be better ventilation and lower emissions, the highest one hour average at Station M2 was 35 ppm and the highest eight hour average was 23.5 ppm. This is a significant departure from both the one hour and eight hour standards. Station M2 was monitored between November 28 and December 6, 1977. The violations of the 8-hour standard were recorded at Station M2 on Wednesday, November 30 from 7 pm to midnight; December 1 from 11 a.m. to 8 pm.; Friday, December 2, from 8 am to 11 pm; Saturday, December 3, from 8 am to 9 pm; Monday, December 5, from 6 am to 8 pm and Tuesday, December 6 from 8 am to 10 am.

During the period of December 6 through December 21, 1977, station M3 at the cashier's booth for the long term parking exit recorded the maximum one-hour CO concentration of 15 parts per million and a maximum eight hour average concentration of 7.5 ppm. The second highest values recorded were 11 ppm and 7.4 ppm, one eight-hour averages, respectively. The medium CO levels station M3 were 1.8 ppm and 3.1 ppm, one and eight hour averages. The highest levels occurred when the wind was either from the terminal area or the parking area to the northeast and winds from moderate to light. Very light to calm winds with variable directions produced only moderate levels of CO at this monitoring station. Because the values measured represent what is to be considered the worse case and were still below the standards, it can be concluded that the CO levels in the parking area are not a problem.

Station M4, the post office station, operational from December 21 to December 30, 1977, recorded a maximum one-hour CO concentration of five parts per million (ppm) and a maximum eight hour average concentration of 3.3 ppm well below the one hour and eight hour standards. These values occurred when the wind blew from the main roadway towards the station. The medium values for station M4 were 0.8 ppm for both a one and eight hour averages. Wind direction at the M4 monitoring station was nearly identical to that measured at the airport tower while wind speeds were about one-half those at the tower. This was because the monitoring site wind measurements were taken at a lower elevation than those of the airport tower. Carbon monoxide levels were not a problem at Station M4.

The monitoring results are summarized for all stations in Table 12.

TABLE 12

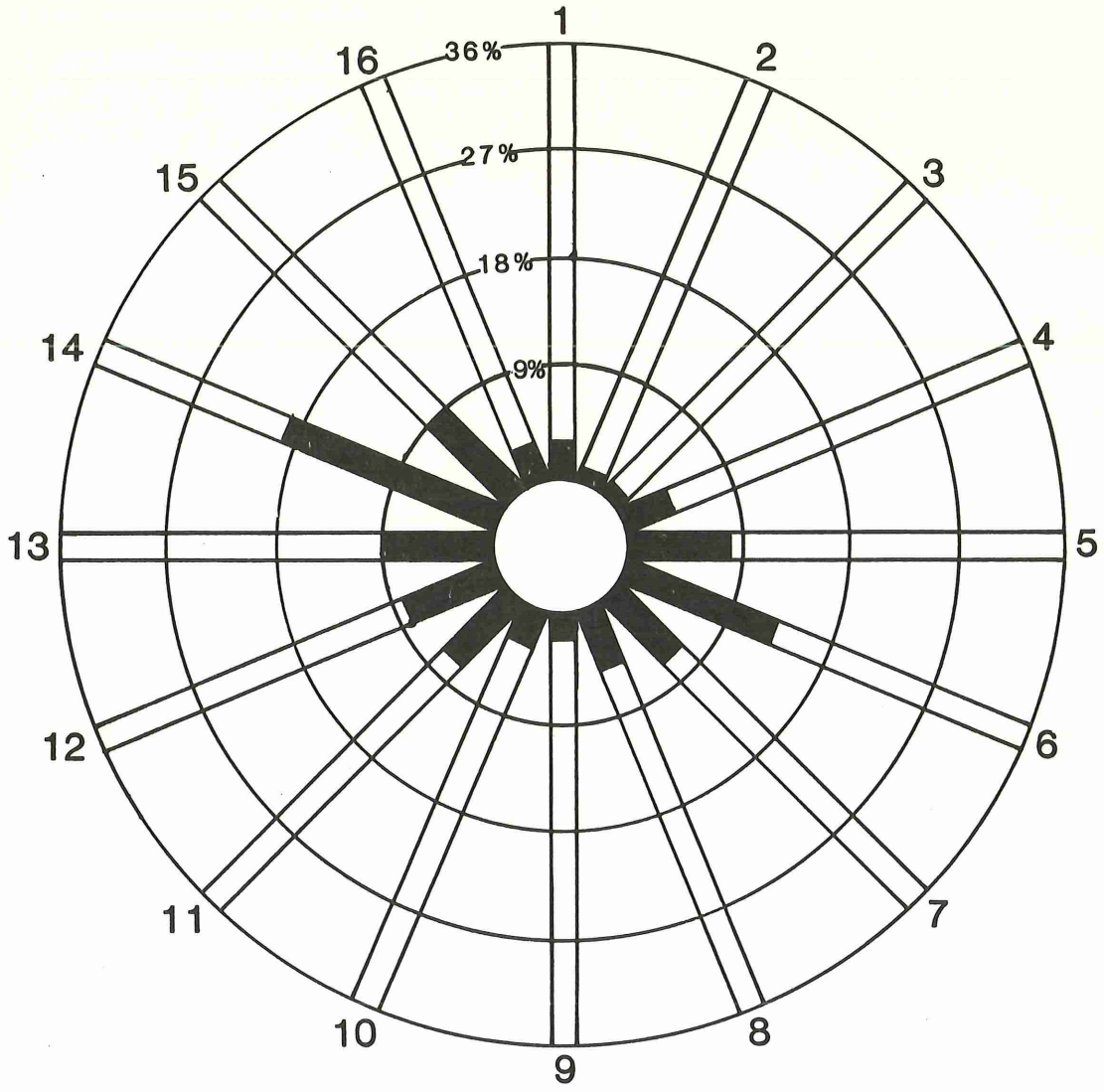
AIRPORT CO MONITORING RESULTS

Source: Ambient Air Monitoring for CO and Wind at MSP, MMT Environmental, Inc.

	Carbon Monoxide Concentration, PPM					
	1-Hour Average			8-Hour Average		
Location	Maximum Observed	50% ile	99% ile	Maximum Observed	50% ile	99% ile
Permanent (S-1)	5.1	0.6	3.6	3.8	0.36	2.7
Lower Level (M-1)	26.0	2.8	21.0	19.5	3.4	18.5
Upper Level (M-2)	35.0	4.8	30.0	23.5	7.0	21.0
Parking Exit (M-3)	15.0	1.8	8.5	7.4	2.1	6.0
Post Office (M-4)	5.0	0.8	4.7	3.3	0.8	3.5
Minnesota Air Quality Standard	30.0			9.0		

While there exists a serious CO problem on both the upper and lower level roadways near the terminal building the pattern of high CO levels was very peculiar. One of the highest CO days was a Saturday when traffic to the airport is about one-half the peak level on Fridays. All violations occurred on days when the wind was moderate, 5-13 mph; conditions which usually favor low concentrations of CO. Also, nearly all of the high CO levels occurred when the wind was from the northwest or west-northwest; the direction that would have been expected to carry CO away from the monitors. When the wind was from the southeast where it could be expected to bring the most CO to the terminal, the monitor levels were low. Figure 22 is a wind rose which shows the percent frequency of winds by direction as measured at the National Weather Station at the airport. Direction 1 is north, 5 is east, 9 is south, and 13 is west. During the monitoring period winds from the west-northwest were the most frequent (19 %) and winds from the east-southeast were next most frequent (13 %).

Figure 23 is a CO pollution rose for Station M1 on the lower level roadway. It shows the relative percent distribution of hourly CO levels that were greater than or equal to 9 ppm according to the airport wind direction at the time of the occurrence. The 9 ppm hourly average is required if the average for eight consecutive hours is to meet or exceed the 9 ppm 8-hour average standard. Likewise, Figure 24 is a pollution rose for Station M2 on the upper level roadway. By comparing these two pollution roses to the wind rose, the high CO levels are seen to occur when the wind is between Sectors 10 and 1 or when the wind is blowing with a westerly component. Most of the high levels occur with the wind from Sections 14 and 15 or west-northwest and northwest. The monitoring data indicated that the effect of downtown Minneapolis and airplane activity could not account for these high CO levels.



PERCENT FREQUENCY BY DIRECTION MPLS./ST. PAUL AIRPORT NOV. 11, 1977 - DEC.30, 1977

FIGURE 22

AIRPORT WIND ROSE

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METROPOLITAN AIRPORTS COMMISION

WOLD CHAMBERLAIN FIELD

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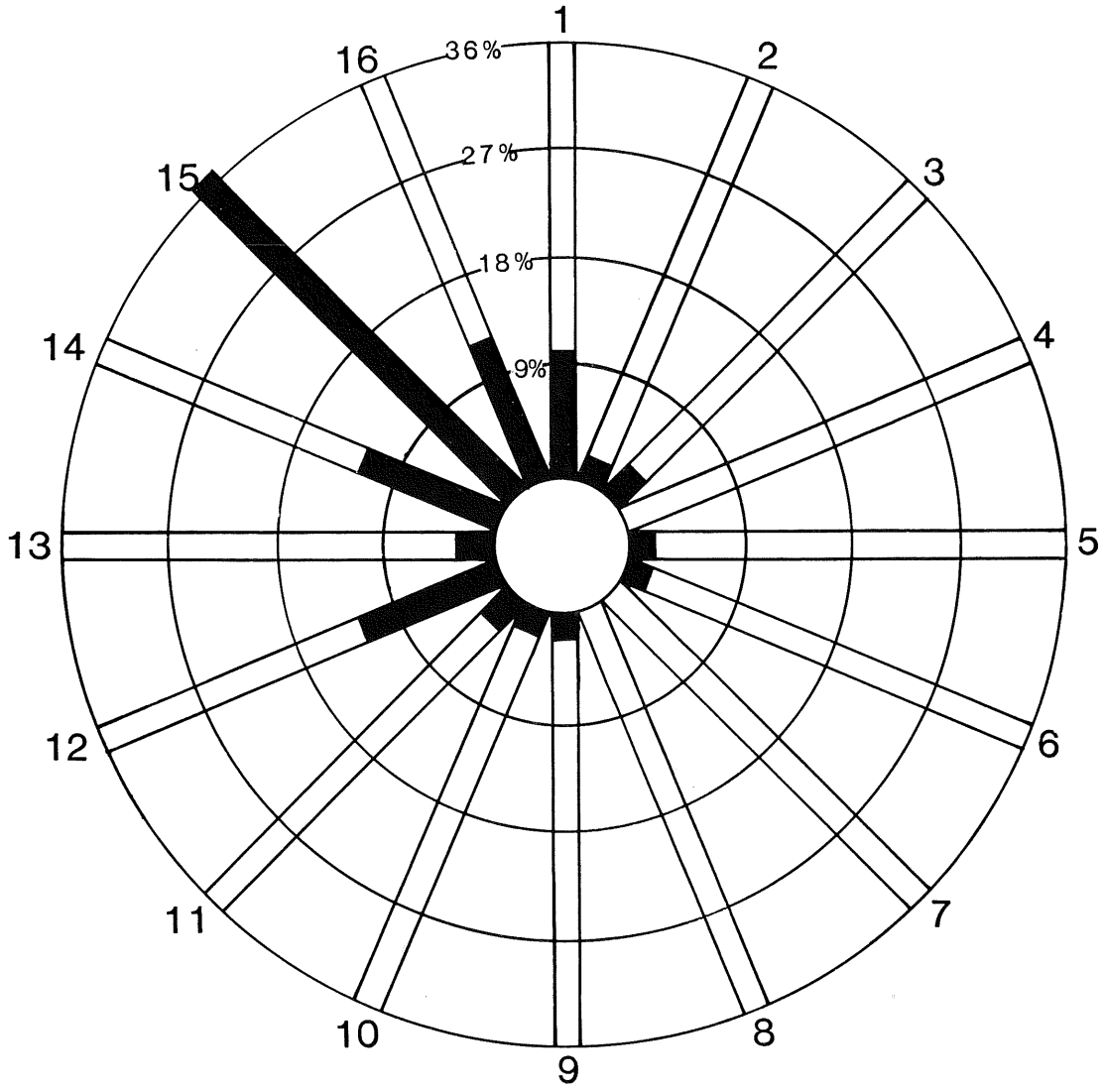

PERCENT FREQUENCY OF CO LEVELS GREATER THAN OR EQUAL TO 9 PARTS PER MILLION - 1 HR. AVG. BY AIRPORT WIND DIRECTION

FIGURE 23
CARBON MONOXIDE-POLLUTION ROSE
(LOWER LEVEL ROADWAY)
AIR MONITERING SITE M-1

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD
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It was then hypothesized that the terminal building itself was interferring with the wind flow in such a way that at ground level the wind was actually blowing in the opposite direction and carrying pollutants from the parkng lot towards the terminal when it should have been taking them away. The principle for such an occurrence is illustrated in Figure 25 for a theoretical building. Wind coming from the left is forced up and over the building in the displacement zone. This creates an area of low pressure behind the building much like that created on an airplane wing. In order to attempt to balance the pressures, air is drawn in the opposite direction at ground level trying to fill the cavity. At the top of the cavity, wind is carried along in the prevailing direction. An air circulation system is set up on the down wind side of the building such that pollutants emitted in the cavity area will be recirculated and trapped by this wind flow.

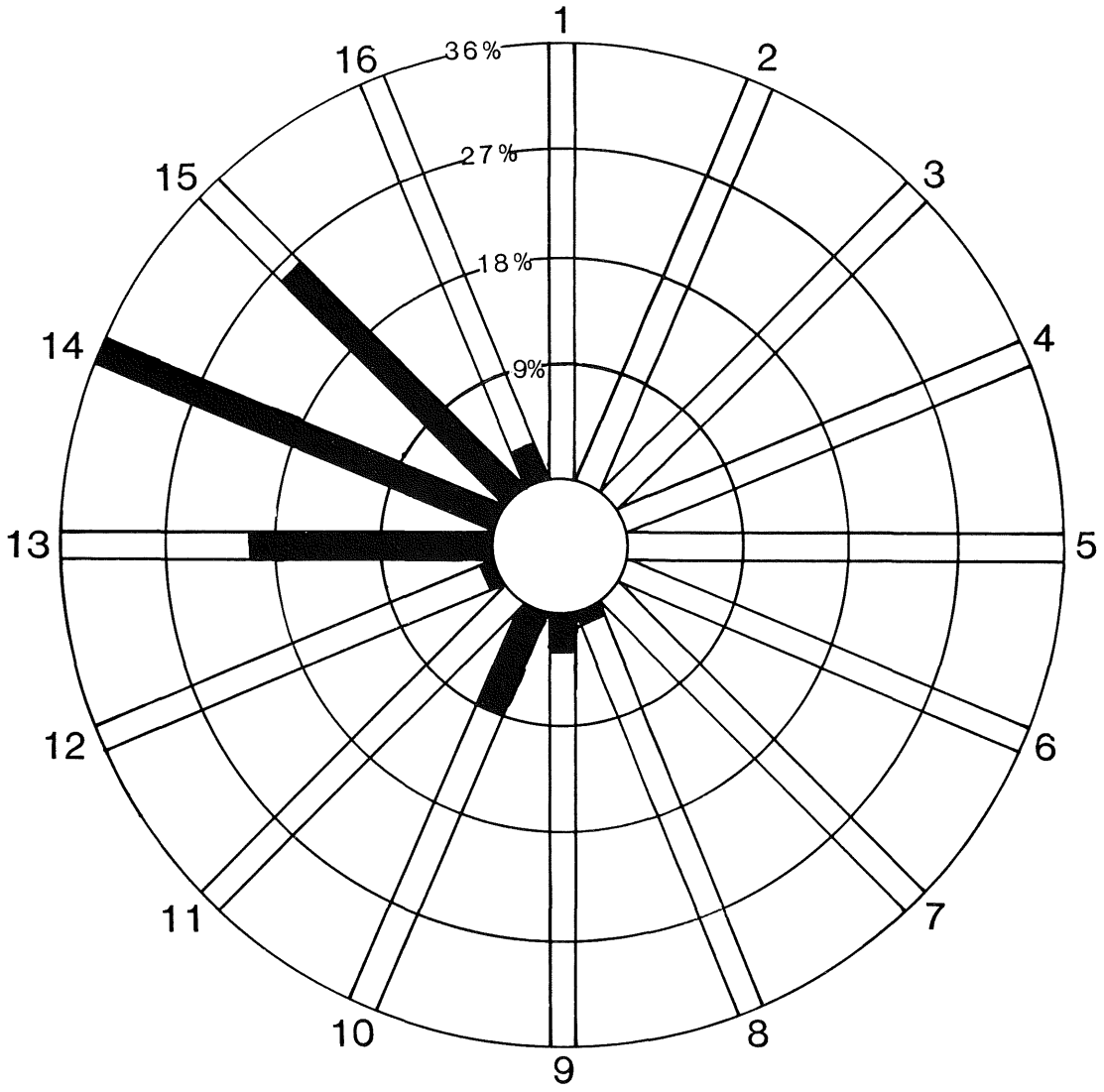
Wind Tunnel Studies

The University of Houston conducted a series of wind tunnel studies on the airport in order to address three specific issues:

- Document the existing air flow characteristics at the airport and determine the cause or causes of the monitored CO violations.
- Determine the relative contribution of the various CO sources to the monitored concentrations.
- Conduct studies on various methods by which the CO problem could be eliminated both now and in the future.

In order to confirm the hypothesis of CO entrapment on the downwind side of the terminal building, a scale model of the airport was constructed and tested in an environmental wind tunnel by the University of Houston. The studies at the University of Houston wind tunnel not only confirmed the hypothesis that a cavity was created in the down wind side of the terminal building, but they also showed that the folded plate roof of the terminal building tended to steer the wind so that any winds with a westerly component would be the roof trough creating the cavity and reverse flow situation. When smoke was used in the wind tunnel to visualize the wind flow patterns, it was found that a northwestly wind created a helix-like circulation pattern in the front of the terminal (see Figure 26). The low pressure area thus created draws pollutants from under the second level parking deck towards the terminal area. Air actually goes down through the large hexangular openings on the second level deck in front of the terminal as part of the circulation system.

Studies conducted to determine which sources contributed to the high CO levels showed that under northwest winds, short term parking and rental car areas were the major contributors to the CO levels measured at Station M1 with lower level roadway traffic and upper level roadway traffic also contributing significant amounts of CO. Cars on the second level parking deck and the airplanes parked along the Blue concourse also made minor contributions.



PERCENT FREQUENCY OF CO LEVELS GREATER THAN OR EQUAL TO 9 PARTS PER MILLION - 1 HR. AVG. BY AIRPORT WIND DIRECTION

FIGURE 24
CARBON MONOXIDE-POLLUTION ROSE
(UPPER LEVEL ROADWAY)
AIRPORT MONITERING SITE M-2

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

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The high levels observed at Station M2 were principally caused by emissions from the upper level roadway, rental and short term parking areas and the lower level roadway. Both stations had minor contributions from aircraft parked along the Blue Concourse but the contribution was inversely proportional to the wind speed; whereas the contribution from the other sources was independent of the wind speed.

Wind tunnel test of several proposed modifications to the terminal complex including the proposed parking ramp additions were also performed. These results are discussed in detail under "Impacts of the Proposed Action" and Impacts of the Alternatives". However, it was determined that through the proper construction phasing and the construction of a passive wind deflector, the CO problems could be eliminated.

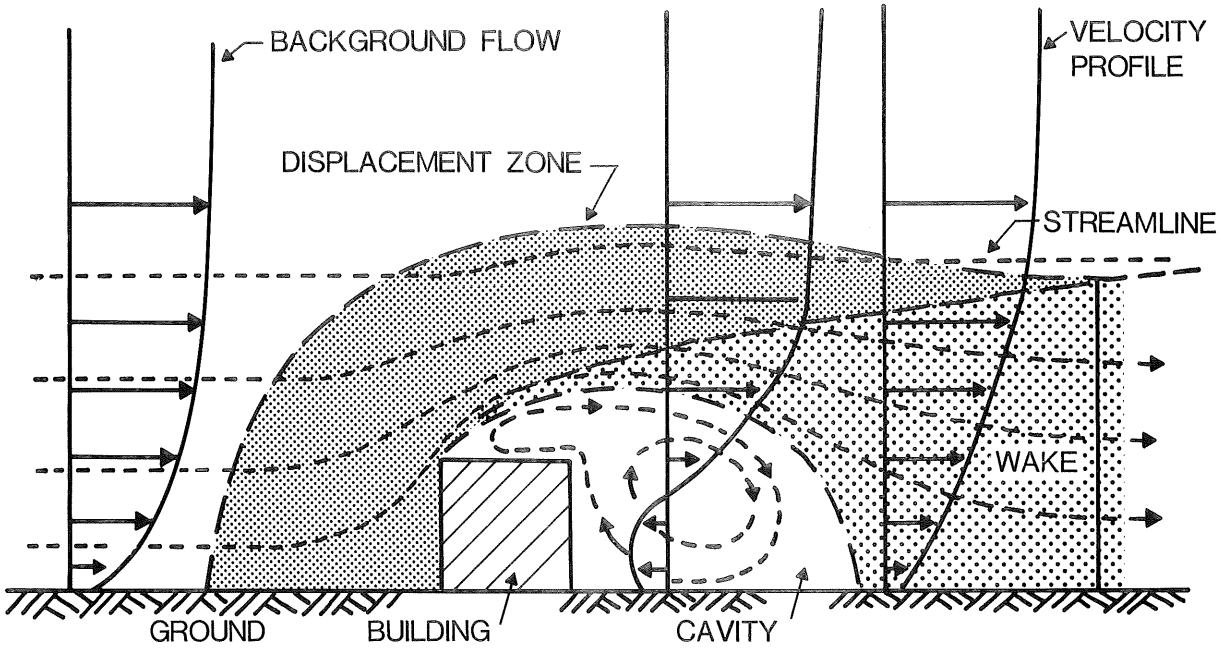

FIGURE 25

MEAN WIND FLOW AROUND A CUBICAL BUILDING

SOURCE: 'PREDICTION OF DISPERSION OF AIRBORNE EFFLUENT' 1968 (ASME)

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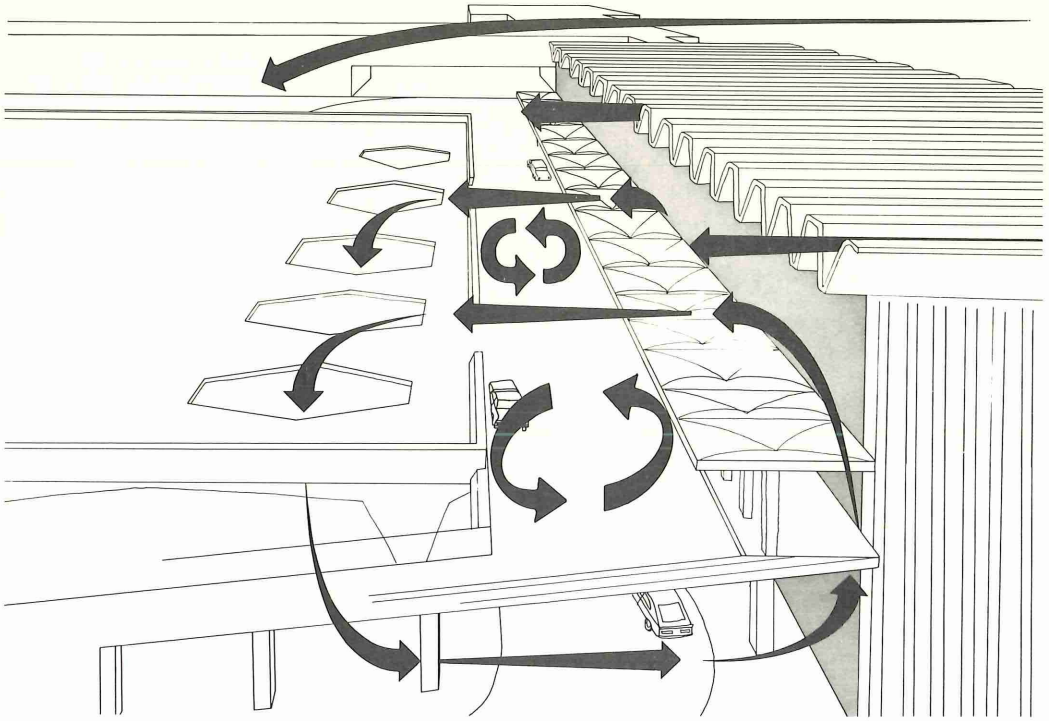
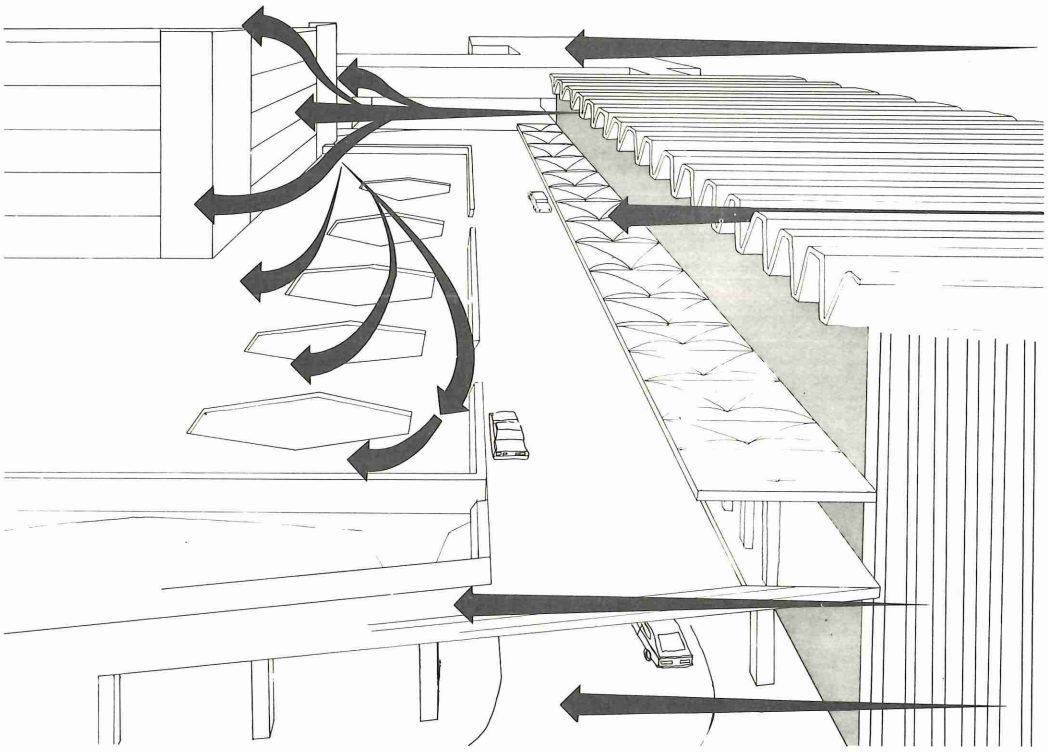


EXISTING AIR FLOW



PHASE 1 AIR FLOW

FIGURE 26

FLOW VISUALIZATION OF UPPER LEVEL ROADWAY

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WATER QUALITY

The existing water quality at the airport is discussed in terms of the drainage areas on the airport, the runoff volumes and the quality of the stormwater runoff.

Drainage Areas

There are four drainage areas at the airport and two additional drainage areas which affect the treatment and control methodologies available to the MAC. These drainage areas are shown in Figure 27. The MAC is in the process of planning and constructing stormwater control facilities and treatment facilities for each of the four drainage areas under its jurisdiction. Data compiled on each of these areas by E.A. Hickok and Associates is summarized in Table 13.

TABLE 13

AIRPORT DRAINAGE AREA CHARACTERISTICS
Source: E. A. Hickok and Associates

Drainage Area	Area (Acres)	% Sewered	% Impervious Soil
Minnesota River - North	1,025	91	54
Minnesota River - South	999	30	12
Snelling Lake	210	88	38
Mother Lake	225	25	26

The two most important drainage areas, relative to the Proposed Action, are the Minnesota River North and Minnesota River South areas. The Snelling Lake and Mother Lake drainage areas neither affect nor are they affected by the Proposed Action and its alternatives. However, two other drainage areas have been identified by E.A. Hickok and Associates as being important in terms of the overall control and treatment of stormwater at Wold Chamberlain Field.

Storm drainage along I-494, from I-35W in Bloomington, is carried by storm sewer to the Minnesota River. This storm sewer terminates in the Minnesota River North drainage area. In addition to freeway drainage, small tracts of land adjacent to the freeway drain into this storm sewer. A total of approximately 390 acres contributes to this drainage system, which is comprised of extensive impermeable surfaces and is estimated to generate peak flows as high as 500 cubic feet per second. This Minnesota Department of Transportation storm sewer crosses beneath the box culvert serving the Minnesota River South watershed near the interchange of 34th Avenue and I-494.

According to present policy of the Minnesota Pollution Control Agency, stormwater from I-494 does not require treatment, while the storm runoff from the airport must be treated. However, in its present discharge location, the I-494 runoff comprises a portion of the flow for which the Metropolitan Airports Commission has treatment responsibility in their NPDES permit.

The Fort Snelling National Cemetery comprises approximately 476 acres and is located in the southeast area of the airport complex. Drainage from this area is also combined with the Minnesota River North drainage resulting in increased volumes of runoff to be controlled and treated. A ravine, approximately 90 feet deep at its maximum depth and covering approximately 18 acres is located in the eastern portion of the cemetery. I-494 is constructed on an embankment across the southern end of the ravine and stormwater flows from the ravine through a 72-inch culvert under the freeway.

A portion of the cemetery drainage (126 acres) flows to a four acre stormwater pond. Stormwater that collects in this pond generally evaporates or seeps into the soil with very infrequent overflows. The cemetery Master Plan envisions this pond as becoming a permanent amenity for the cemetery.

Stormwater Runoff Volumes

Total runoff estimates for the two airport drainage areas (Minnesota River North and South) and the two contributory drainage areas (I-494 and the National Cemetery) have been made by E. A. Hickok and Associates. Discussions with the Minnesota Pollution Control Agency led to the selection of a 10 year, 24 hour rainfall as the design parameter and the resultant runoffs under this condition are tabulated in Table 14.

TABLE 14

ESTIMATED STORM RUNOFF 10-YEAR 24-HOUR RAINFALL WOLD-CHAMBERLAIN FIELD
Source: E.A. Hickok and Associates

Drainage Area	Contributing Area (Acres)	Composite Runoff Coefficient	Runoff (Acre Feet)
Minnesota River North	1,025	0.549	194
Minnesota River South	999	0.286	99
I-494	390	0.680	91
National Cemetery	350	0.250	30
Total			414

The preferred method of runoff control is to impound the runoff from all four drainage areas into the cemetery ravine. This necessitates diverting the Minnesota River south drainage from its present discharge point south of the ravine. Sufficient size is available to store the runoff from all four of the drainage areas thus allowing stormwater treatment to occur at one point and under gravity flows.

Stormwater Quality

The quality of stormwater runoff at the airport has been determined from an extensive water sampling program beginning in 1971. The results of this sampling program are presented in Table 15 for the airport drainage areas and the I-494 drainage area as well.

The NPDES permits issued to the Metropolitan Airports Commission relate to total suspended solids, grease and oil, biochemical oxygen demand, and lead. Limitations on total suspended solids are 30 mg/l (monthly average) and 45 mg/l (daily maximum). For grease and oil these limits are 10 mg/l (monthly average) and 15 mg/l (daily maximum). No limits have been established for Biochemical Oxygen Demand or lead but are to be routinely monitored by the MAC. It will be noted that the NPDES limits for suspended solids are exceeded in all four of the drainage areas impacted by the Proposed Action and the grease and oil concentrations in all but the Minnesota River South drainage area exceed the NPDES limits.

This has led to the proposal that the MAC should construct a single stormwater treatment system consisting of flow equalization in the cemetery ravine followed by treatment in a 21 mgd microscreen treatment plant. Stormwater runoff from the Minnesota River North, Minnesota River South, I-494, and National Cemetery drainage areas would be treated in this facility in order to conform to the requirements of the NPDES permits.

TABLE 15

AVERAGE STORMWATER QUALITY FROM AIRPORT AND CONTRIBUTING DRAINAGE AREAS

Source: E. A. Hickok and Associates

Parameter	MN River No. National Cemetery	MN River So.	I-494	Snelling Lake	Mother Lake
Biochemical Oxygen Demand (mg/l)	30	31	7	18	12
Chemical Oxygen Demand (mg/l)	76	106	8*	46	33
Total Organic Carbon (mg/l)	25	60	--	--	--
Fecal Coliform (MPN/100 ml)	1,855	1,800	138	309	132
Grease and Oil (mg/l)	20	9	40	10	7
Total Suspended Solids (mg/l)	72	118	109	95	28
Turbidity (JTU)	60	131	77	48	29
Chlorides** (mg/l)	45	61	121	--	--
Total Kjeldahl Nitrogen (mg/l)	8.2	8.8	--	4.5	4.0
Ammonia Nitrogen (as N)	1.7	3.0	--	--	--
Lead (mg/l)	0.06	0.04	0.86	0.1	0
Total Phosphorus (mg/l)	0.41	0.48	0.08*	0.23	0.30

*Results from one sampling event.
** Average value for samples collected between November and May of each year.

NOISE

Background

The impact of environmental noise is based on at least three factors:

- o Sound pressure level (measured in decibels - dBA).
- o Frequency or duration of the noise (measured in the percent of time a given decibel level is exceeded, e.g. L10, L50).
- o The sensitivity of the land use at the noise receptor (such as residential or industrial).

Standards promulgated by the Minnesota Pollution Control Agency (MPCA) in 1974 (Minn. Reg. NPC 1-2) recognize each of these factors in establishing acceptable levels of noise. As shown in Table 16, permitted noise levels vary with the Noise Area Classification (NAC), with lower levels allowed in residential areas, and higher noise allowed in industrial zones. The standards also recognize time of day, with lower levels allowed in residential areas during the night. The standard most frequently used as a general index in noise analyses is the L10 daytime level for residential areas of 65 dBA.

TABLE 16

MPCA NOISE STANDARDS

NAC	Day (0700-2200) L50	Day (0700-2200) L10	Night (2200-0700) L50	Night (2200-0700) L10
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Noise Area Classification

Figure 28 illustrates the Noise Area Classifications in the vicinity of the airport. NAC 1 is composed of primarily residential uses, but also includes hotels, churches, and cultural facilities. NAC 2 consists of mainly commercial uses, but also includes passenger terminal, parking areas, and recreational areas. NAC 3 represents industrial uses, and also includes aircraft transportation and agriculture. NAC 4 (for which no noise standards exist) consists of undeveloped land and water areas.

Most of the area to the west and north of the airport is classified as NAC 1 due to its residential character. The majority of the land adjoining I-494 to the south consists of commercial and hotel use. Sensitive land uses include the Fort Snelling Historic Site east of the airport, and the Fort Snelling National Cemetery to the south.

Existing Noise Levels

The two major sources of noise in the airport area are aircraft operations and traffic-related noise. Field investigations by the Minnesota Pollution Control Agency show that the airport itself and areas within one mile of the airport are exposed to L10 noise levels of 65 dBA or greater, primarily due to aircraft operations. In areas which are within runway approach zones, noise exposures of 65 dBA or greater extend up to 2½ to 3 miles from the airport.

In addition to aircraft-related noise, areas which parallel the major highways are locally affected by traffic noise. Figure 29 shows the location of two noise monitoring sites which are primarily affected by traffic noise.[1/] Site 1 is located approximately 100 feet east of Cedar Avenue at 69th Street. This location monitored noise levels for one hour (12:30 -1:30 p.m.) prior to a well-attended event at Metropolitan Stadium. Table 17 shows that a noise level of 65 dBA was exceeded 44% of the time (The applicable MPCA standard allows for 65 dBA to be exceeded no more than 10% of the time for a one hour survey.), and a level of 60 dBA was exceeded 86% of the time (The standard allows for 60 dBA to be exceeded no more than 50% of the time.).

Site 2 is located 600 feet south of I-494 near 34th Avenue. This site was monitored for one hour (10:00 p.m. to 11:00 p.m.) during normal late evening traffic conditions. As shown in Table 17, both applicable MPCA standards for night time noise were exceeded 100% of the time. Noise levels at Site 2 would exceed even the less stringent daytime standards.

TABLE 17

EXISTING HIGHWAY TRAFFIC NOISE LEVELS

	% Time Over Standard							
	Day		Night					
	65	60	55	50	Lmax.	L10	L50	L90
Site 1 Cedar Avenue	44	86	—	—	89	71	64	59
Site 2 I-494	—	—	100	100	81	68	63	60

1/ The noise data for the two monitoring sites was taken from Twin Cities Metropolitan Sports Facilities Draft EIS Technical Appendix, David Braslau Associates for the Minnesota State Planning Agency, December, 1977.

In summary, the airport area is a relatively high level noise environment. Aircraft operations expose a large area adjacent to the airport to generally unacceptable noise levels. In addition, the major highways surrounding the airport are operating at near-design level traffic flows, causing high noise levels in adjacent areas, especially during peak traffic periods.

ENERGY

Minnesota's Energy Situation

Minnesota is an energy dependent State since it has no naturally occurring traditional energy resources and depends upon other States and countries for its supply of coal, natural gas, and petroleum. The demand for energy has steadily risen in the past and is expected to continue to rise. The Minnesota Energy Agency predicts that even if energy users respond to high energy prices by reducing consumption or switching to lower priced fuels and assuming the reduction in demand due to Federal Automobile Fuel Economy Standards and the Minnesota Energy Code for New Buildings, Minnesota's energy demand will outstrip supply by 1988. By 1995 the short fall will be 220 trillion BTU's, or 13% of the demand (see Figure 30). Natural gas and petroleum will be the fuels in shortest supply. Electrical energy is not limited by coal supplies but is limted by the amounts of coal that can be transported and burned with an acceptable environmental impact. Without increased conservation and development of new energy sources, the projected shortage will cause a reversal of economic growth and a decline in employment. By 1990 energy constraints could cause a 5% increase in unemployment and by 1995 more than one-half million jobs would be lost.

Energy Usage at the Airport

Terminal Area. Residual oil and interruptible gas for space heating and electricity for cooling, lighting and ventilation are the major energy uses at MSP Airport, aside from the fuel used for the airplanes and fuel for the automobiles. In 1977 the Airport used 477 million gallons of residual oil, 106.5 million cubic feet of natural gas, and 22.4 million kilowatt hours of electricity. Several measures have been undertaken or are planned which will reduce electricity consumption at the Airport. These include replacing the outdoor mercury vapor lights with more efficient high pressure sodium lights on the roadway and parking ramps. This is estimated to save 337,260 kilowatt hours annually. Correction of the power factor at three Airport substations will reduce the power demand for electric motors and is estimated to save an additional 1,250,000 kilowatt hours per year. The MAC has established a permanent staff committee to investigate potential energy saving measures around the airport and make recommendations.

Parking Ramp. Electricity is the energy form used at the existing parking ramp and comprises roughly 8% of the total terminal area electrical demand. Major uses are for lighting, electrical pavement heaters, snow melters, and drain heaters. Minor uses include heating and cooling the cashier booths and operating the ticket spitters. Lighting under the parking deck is on 24 hours per day while lights on the lot and the upper level of the parking deck are controlled by photocells and are estimated to be on an average of 12 hours per day. Lighting use is estimated to account for 1,400,000 kilowatt hours per year, or approximately 80% of the parking lot total load.

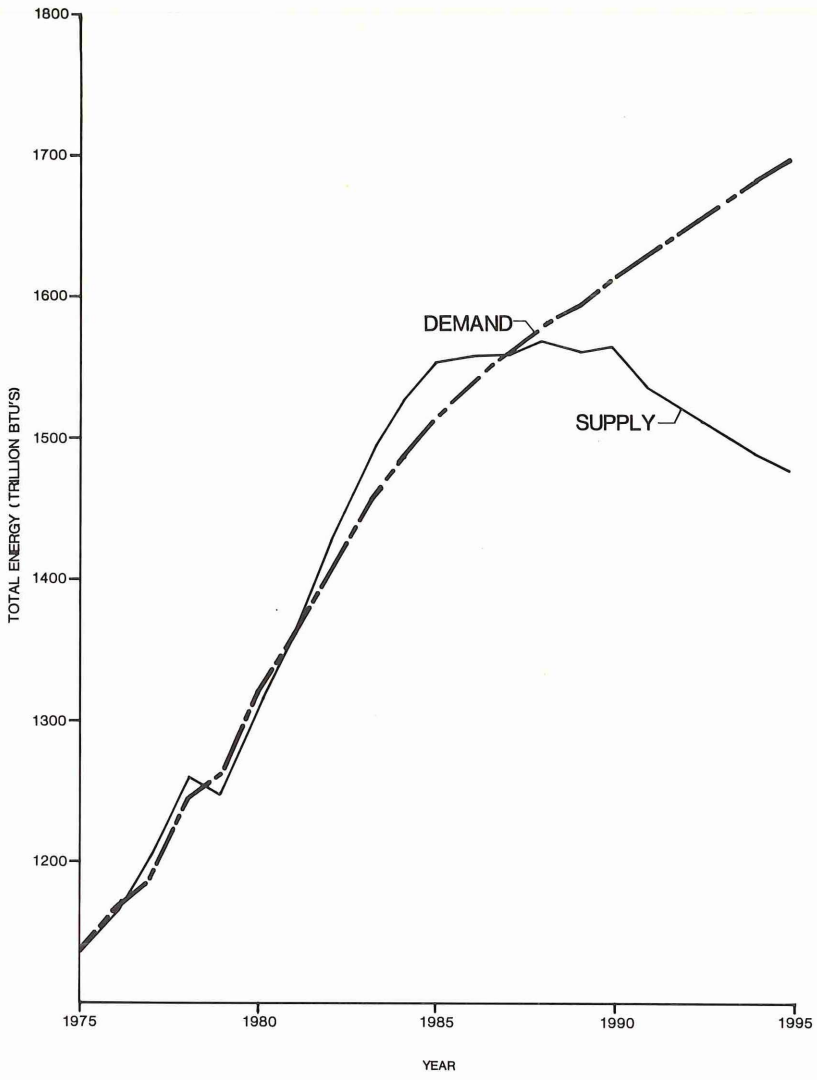

FIGURE 30

MINNESOTA ENERGY
BASELINE SUPPLY AND DEMAND FORECAST TO1995

SOURCE: MINNESOTA ENERGY AGENCY

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

AIRPORT PARKING
EXPANSION PROGRAM
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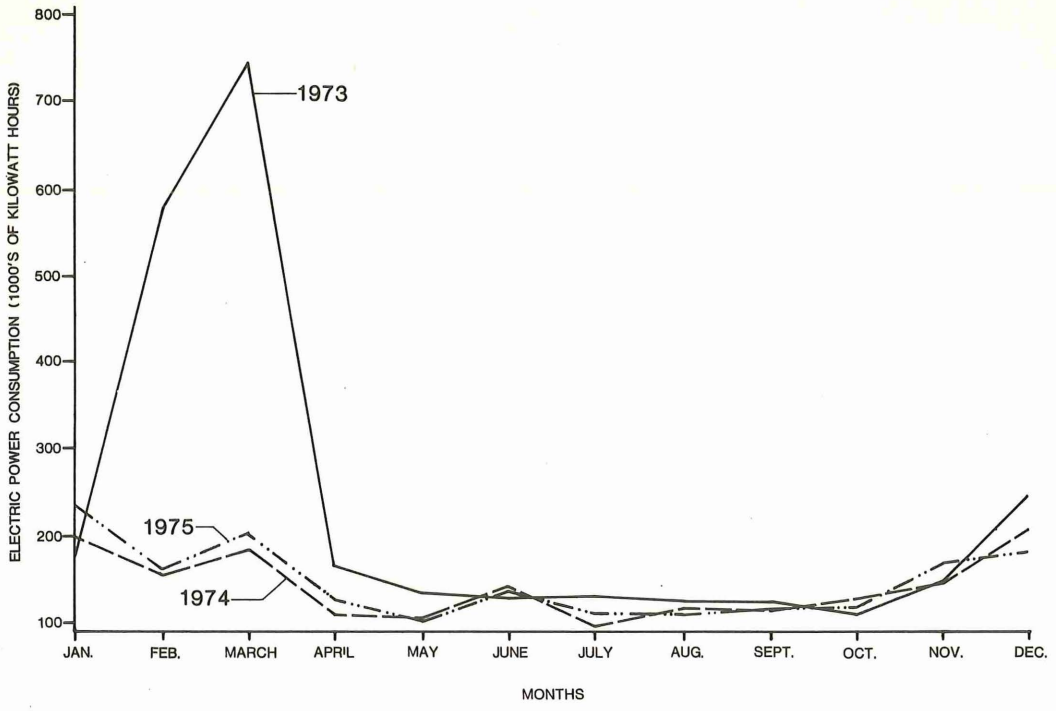
Meter readings from the two substations serving the parking ramp were obtained from 1973, 1974, and 1975, and the monthly usage patterns are shown in Figure 31. Generally electricity consumption rises in the winter as the days get shorter and the pavement heaters and snow melters are in use; then it falls off in the summer. The high power consumption in early 1973 is probably explained by the fact that this was the first winter of operation for the new parking deck and extensive use was made of the snow melters the first year. During that time it was learned that most of the snow melters worked unsatisfactorily. Their use has been severely curtailed since then.

Transportation Energy. Because it takes energy to travel to and from the airport and because the mode of travel may be influenced by the parking supply, it seems appropriate to examine current travel patterns and their energy consumption. Estimates of fuel consumption associated with travel to and from the airport on an average day of each month are shown in Table 18. These estimates were based upon recent traffic data, the results of a January, 1970, survey of air passengers, and U.S. Environmental Protection Agency estimates of fuel consumption.

In the 1970 air passenger survey, air passengers were asked how they got to or planned to leave the airport and their origin or destination in the Twin Cities. Ech of the origins or destinations was coded into one of 756 Traffic Analysis Zones. Rings of equal road miles away from the airport were constructed and the zones which fell into each ring were noted. The percent of air travelers in each ring was counted for each mode and the weighted average distance from the airport was calculated. The results showed that in 1970, air passengers who traveled by taxi were an average of 10.83 miles from the airport; limousine riders, 10.78 miles; hotel-motel courtesy car riders, 7.14 miles; and private and rental car drivers and passengers, 12.82 miles. Despite the fact that the Twin Cities bus system was at its lowest service level in 1970, 0.45% of the air passengers came by bus from an average of 11.45 miles away. Although the Twin Cities area has experienced continued outward urban expansion since 1970, which has probably caused the average distance from the airport to rise slightly, these figures (except the bus travel estimates) were used as representative of 1977 and the future years for the energy analysis.

The numbers of each type of vehicle entering the airport were counted in 1976 and 1977 and total vehicle counts were taken during November and December of 1977. These traffic volumes were multiplied times the average trip lengths by mode of travel to obtain vehicle miles of travel (VMT).



KILOWATT HOURS

	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1973	181,500	578,600	741,300	164,300	134,000	128,900	130,600	126,000	125,400	109,700	149,500	245,300
1974	199,400	154,900	183,900	109,200	105,300	140,600	96,500	116,900	112,100	126,800	147,400	207,300
1975	236,400	161,800	201,100	127,500	101,800	137,600	110,500	108,800	115,400	117,400	169,000	181,000

FIGURE 31
EXISTING PARKING RAMP
MONTHLY ELECTRIC POWER CONSUMPTION
SOURCE: METROPOLITAN AIRPORTS COMMISION

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METROPOLITAN AIRPORTS COMMISION
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TABLE 18
EXISTING TRANSPORTATION ENERGY CONSUMPTION
AVERAGE DAY OF PEAK MONTH (ADPM) 1977

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Used (Gallons)	Energy Consumed (Millions of BTU's) *
Taxi	1,581	21.66	34,240	15.9	2,154	269
Bus	40	8.5	340	4.6**	74**	10
Limousine	141	21.56	3,040	15.8	192	24
Hotel/Motel Courtesty Car	228	14.28	3,255	15.8	206	25
Private Auto & Rental Cars	11,410	25.64	292,552	15.1	19,374	2,421
	13,400		333,431		22,000	2,750

Annual Fuel and Energy Consumption = ADPM/.003
7,330,000 Gallons
916,600,000 BTU's

* 1 Gallon of Gasoline = 124,950 BTU's
** 1 Gallon of Diesel Fuel = 136,000 BTU's

In calculating the vehicles miles of travel and energy consumption for public bus passengers, the average trip length of 11.54 miles was not used because the buses currently serving the airport carry most of their passengers to and from non-airport destinations. Instead, the average excess bus miles, or miles that a bus has to go out of its way to carry air passengers, was used to calculate energy consumption. This average is 4.25 miles one way.

Fuel consumption was calculated by multiplying the number of vehicles times the average round trip miles and dividing by the fuel economy. Transit buses (diesel) are reported as currently getting an average of 4.6 miles per gallon of diesel fuel. The limousine and courtesy cars were assumed to have a fuel economy equivalent to an average 1978 light duty 4,500 pound van, or 15.8 miles per gallon. Determining the fuel economy of the private and rental autos and taxis is somewhat more complex as the average fuel economy of these vehicles has changed from year to year. U.S. EPA tests the fuel economy of automobiles and light duty trucks and reports their results. Figures on the average miles per gallon of all cars sold in the U.S., weighted by the fraction of total annual sales, are also reported. This so called "sales-weighted miles per gallon", (SWMPG) values are shown in Table 19. Also shown in Table 19 is the fraction of annual travel attributed to each mode. year. These two sets of figures were used to calculate the composite fuel economy of all in-use vehicles, which was 15.1 miles per gallon in 1977. Taxis were assumed to be no more than five years old so a figure of 15.9 miles per gallon was chosen for them. The estimates of annual fuel consumption were derived by assuming that the average day of the peak month constitutes 0.3% of the annual travel.

Transportation Fuel Supply

Minnesota's transportation sector accounts for 28% of the State's total energy consumption and over half of the state's petroleum consumption. Energy used in the transportation sector breaks down into automobile - 59%, trucks - 27%, aircraft - 7%, rail - 4%, and others 3%. Despite the fact that in 1975 the U.S. Congress set mandatory miles per gallon targets that represent a substantial savings over current fuel economy, petroleum demand is expected to outstrip supply by 1986 and minor shortages may occur between now and 1982 (see Figure 32). Transportation demand for fuel is expected to rise even with improved fuel economy and a projected 14% decrease in demand due to higher prices (Figure 33). The Minnesota Energy Agency has recommended policies to strengthen land use control, encourage planned development and support better driver education, increased transit use and ride sharing in the hopes of reducing transportation energy demands. Whether or not sufficient fuel will be available for air passengers who drive to the airport after 1986 will depend on the State's response to the petroleum shortfall.

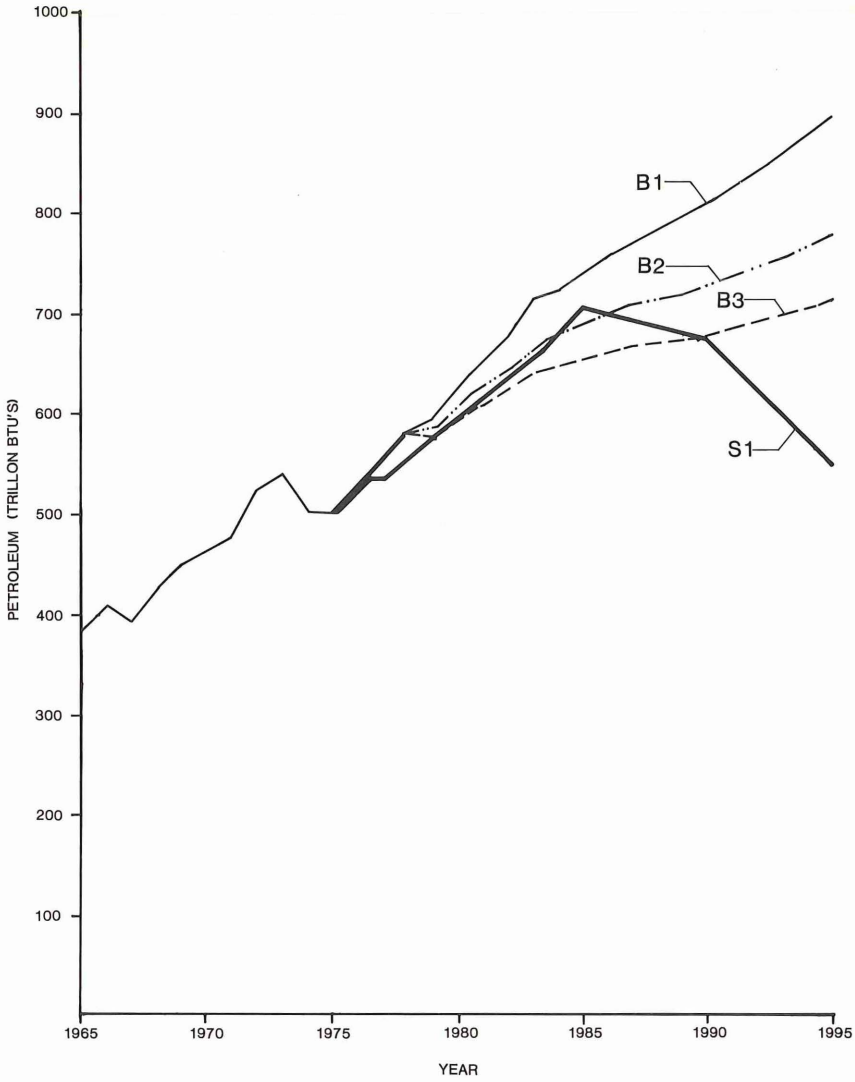

FIGURE 32

MINNESOTA PETROLEUM
SUPPLY AND DEMAND FORECAST TO 1995

S1 SUPPLY

B1 DEMAND: BUSINESS AS USUAL

B2 DEMAND: EXISTING CONSERVATION PROGRAMS AND PRICE EFFECTS

B3 DEMAND: SUBSTANTIAL CONSERVATION EFFORTS SOURCE: MINNESOTA ENERGY AGENCY

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TABLE 19

DERIVATION OF COMPOSITE AUTOMOBILE FUEL ECONOMY

Model Year	Vehicle Age	Fraction Of Annual Travel	EPA Combined City/Highway Sales-Weighted Miles Per Gallon
1977	1	0.106	18.6
1976	2	0.142	17.8
1975	3	0.133	15.6
1974	4	0.125	13.9
1973	5	0.108	14.0
1972	6	0.092	14.5
1971	7	0.077	16.7
1970	8	0.064	15.1
1969	9	0.050	14.7
1968	10	0.035	15.0
1967	11	0.023	15.5
1966	12	0.016	15.5
1965	13	0.010	15.6
1964	14	0.007	16.2
1963	15	0.004	15.1
1962	16	0.003	16.8
1961	17	0.002	16.3
1960	18	0.002	18.0
1959	19	0.002	16.6
1958	20	0.002	16.8
		1.000	15.1*

*Weighted Average miles per gallon

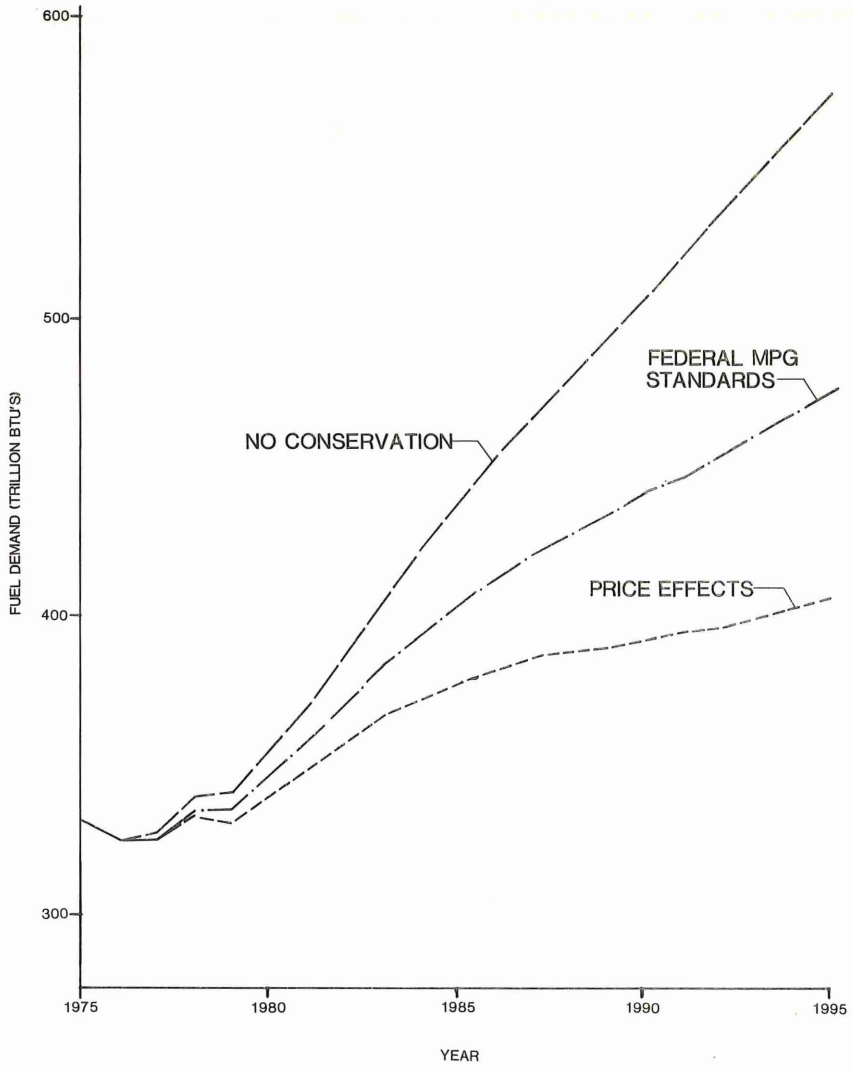

FIGURE 33

MINNESOTA TRANSPORTATION
FUEL DEMAND FORECAST TO 1995

SOURCE: MINNESOTA ENERGY AGENCY

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Chapter III HISTORY OF AIRPORT GROWTH AND PLANNING

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Chapter V THE PROPOSED ACTION AND ITS IMPACTS

Chapter VI ALTERNATIVES TO THE PROPOSED ACTION AND THEIR IMPACTS

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CHAPTER V
THE PROPOSED ACTION AND ITS IMPACTS

THIS CHAPTER DESCRIBES IN DETAIL THE PHYSICAL AND OPERATING CHARACTERISTICS OF THE PROPOSED ACTION AND IDENTIFIES THE IMPACTS IT WILL HAVE UPON THE SURROUNDING ENVIRONMENT. THE ANALYSIS COVERS A TIME PERIOD OF APPROXIMATELY FIFTEEN YEARS UP TO AN AIR PASSENGER ACTIVITY LEVEL OF SEVEN MILLION ANNUAL ENPLANEMENTS.

DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action for expanding parking at Wold-Chamberlain Field consists of the following elements:

- Construction of a seven level parking facility consisting of the erection of five additional parking levels over the existing parking deck in the southwest quadrant of the main terminal parking area for a total of six supported levels in addition to the surface parking level. This constitutes Phase 1.

- Construction of a seven level parking facility consisting of the erection of five additional levels over the existing parking deck in the northwest quadrant of the main terminal parking area for a total of six supported levels in addition to the surface parking level. This constitutes Phase 2.

- Construction of four double threaded helices at the easterly end of the new parking facilities. Two will be constructed in each phase.

- Provision of additional entry gates and exit booths to accommodate the increased parking demand.

The final parking supply at the airport will be approximately 9,400 parking spaces to serve an air passenger activity level of 7 million annual enplanements. The breakdown of these 9,400 spaces is presented below in Table 20. Figure 34 presents the plan view and elevations of the proposed construction.

TABLE 20
PROPOSED TERMINAL AREA PARKING SUPPLY

	Existing March, 1977	Proposed After: Phase 1	Phase 2
Terminal Building Garage	460	460	460
Short Term Parking Lot	312	312	246
Long Term Parking Lot			
Surface Level	2,008	1,801	1,594
Supported Levels	1,315	3,777	6,070
Overflow Parking Lot	803	803	803
Rental Car Lot	249	196	196
Pier D Parking Meters	31	31	31
Total	5,178	7,380	9,400

The impacts of the Proposed Action are documented in ten separate "impact areas". Each impact area has been evaluated in terms of construction related impacts and impacts resulting from the long-term operation of the Proposed Action.

TRAVEL DEMAND IMPACTS

RELATIONSHIP BETWEEN ENPLANEMENTS AND INBOUND TRAFFIC

The Proposed Action is designed to satisfy the parking needs of the airport to serve an enplanement level of 7 million passengers per year. An analysis of the historical traffic volume data and growth in air passenger activity indicates that the ratio of enplaned passengers to inbound traffic is generally increasing. This long-term trend is documented in Table 21 and graphically displayed in Figure 35. Adjustments have been made to the inbound traffic volumes to eliminate employee traffic to NWA and to non-passenger uses along the service road. ADPM values are obtained by using the previously established 0.003 factor times annual enplanements. While the ratio of enplanements to inbound vehicle has leveled off in the past two years, it is anticipated that the long term trend is to gradually increase the ratio. This is a consequence of the increased emphasis on reduced air fares for pleasure travel (family orientation) relative to business travel (individual orientation). In addition, as the airport continues to increase in activity, higher congestion levels will tend to increase average vehicle occupancy. The forecasted travel demand generated by 7 million enplanements is, therefore, a function of the anticipated ratio of enplanements per vehicle in 1994. As indicated in Figure 35 this ratio is projected to reach 1.16 which, for 7 million annual enplanements yields 18,100 inbound passenger-related vehicle trips. When non-passenger related vehicle trips are included the forecasted inbound (and outbound) travel demand is 22,700 vehicles per day in the year 1994.

TABLE 21

HISTORICAL ADPM ENPLANEMENTS AND PASSENGER RELATED INBOUND TRAFFIC

Source: Metropolitan Airports Commission

Year	ADPM Enplanements	Inbound Passenger Traffic (Veh/Day)	Enplanements Per Vehicle
1966	4,800	7,000	0.69
1968	7,200	8,400	0.86
1973	9,600	9,500	1.01
1974	10,200	10,000	1.02
1975	10,200	11,100	0.92
1976	11,100	10,800	1.03
1977	12,000	11,600	1.03

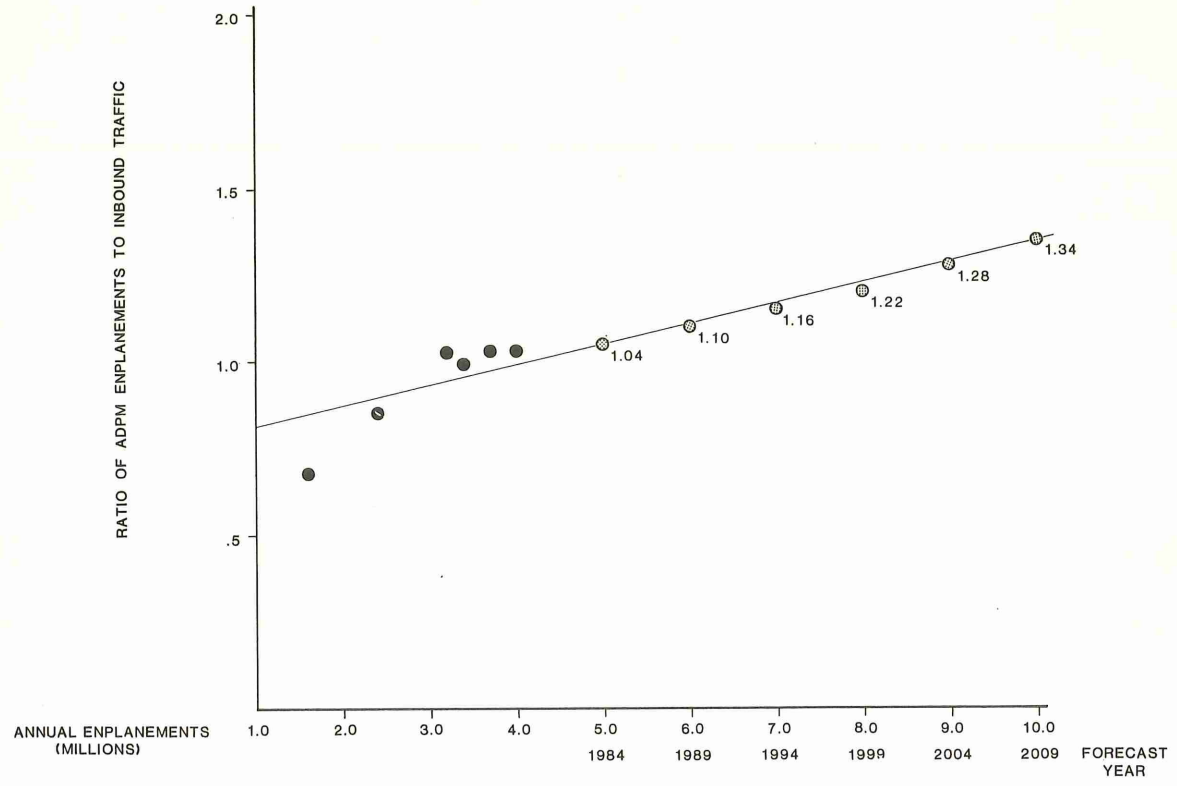

FIGURE 35

FORECASTED RATIO OF ADPM ENPLANEMENTS TO INBOUND TRAFFIC

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SENSITIVITY OF AIR TRAVEL DEMAND TO PARKING SUPPLY

The Proposed Action and the No-Build Alternative have the greatest potential for impacting air travel decision making. Under the Proposed Action, sufficient parking is provided such that the air traveler will not consider parking a hindrance to his air trip unless the cost of parking increases dramatically. Under the No-Build alternative the potential air traveler might decide, based upon lack of parking at the airport, to opt for another mode of travel to his ultimate destination. Such a decision would be based upon relative cost and time savings that would accrue to the potential air traveler.

For the business traveler, the single most important element, is the cost of the additional travel time spent on another mode of travel as compared to the travel time by air. This added travel time would be weighed against the added cost (out of pocket plus travel time) of taking a taxi or a bus to the airport due to lack of sufficient parking. For the pleasure trip, on the other hand, a more complex decision making process is involved since the value of time is more subjective and because other costs such as lodging and meals for a family could become a significant factor.

At the present time North Central Airlines accounts for approximately 12% of the total airline activity at Wold-Chamberlain. Much of North Central's service is oriented to the short commute business traveler which would be the most likely type of trip diverted from air to another mode of travel. In order to quantify the likelihood of such a diversion occurring, a hypothetical comparison has been made between air travel and auto travel for a resident of a northern Twin Cities suburb to travel to Duluth, Minnesota. Two distinct elements make up the costs associated with each mode of travel:

- Out-of-pocket travel costs include the price of a round trip airline ticket and cab fare to the airport versus the cost of operating an automobile.

- Non-productive time includes time spent traveling to and from the airport (in both cities) versus the time spent driving the entire trip. It is assumed that time in flight is productive time.

Travel time is assumed to be $40 per hour; automobile travel costs, 20¢ per mile; cab fare, $40; and plane fare, $78. Table 22 summarizes the comparative costs of the two modes of travel.

TABLE 22

COMPARISON OF AUTO VERSUS PLANE TRAVEL BETWEEN DULUTH AND MINNEAPOLIS - ST. PAUL

Item	Auto	Plane
Out-of-Pocket Travel Costs	275 mi. @ 20¢ $55	Round Trip Ticket $78 Cab Fares $40
Non-Productive Travel Time	5 hrs. @ $40 $200	2.5 hrs. @ $40 $100
Totals	$255	$218

Even accounting for other costs such as tips and incidentals, it would appear that the economic breakpoint between flying and driving is for a distance slightly over 100 miles one way. The proportion of air trips out of Minneapolis-St. Paul International Airport approaching this distance is negligible and, as a consequence, no reduction in air travel demand can reasonably be attributed to a lack of parking. Therefore, 7 million annual enplanements in 1994 is the basic demand parameter for the Proposed Action and all alternatives to the Proposed Action.

CONSTRUCTION PERIOD

The most critical time period relative to travel demand impacts is the construction period for the first phase parking facility. Although travel demand is forecasted to generally increase over time such that the lowest traffic volumes will occur during the construction of the first phase; the airport is currently experiencing shortages in parking supply, curbside availability, and an unprecedented upturn in air passenger activity. Therefore, the relationship between traffic demand and the supply of facilities to handle that demand is most critical during the first phase construction period.

The estimated inbound traffic volume into the airport during the 1979 construction period is 18,600 vehicles per day with a volume of 14,000 vehicles per day entering the passenger terminal area. At this same time approximately 1,000 parking spaces will be lost or disrupted during construction. This situation is unavoidable during the construction phase and will require the provision of alternative parking or the shifting of air passengers to alternative travel modes. Because the shortage in the parking supply would be a short term impact under the Proposed Action, the shifting of air passengers to an alternative mode of travel could only occur with the existing public transportation services now serving the airport. This would include primarily taxis along with some increased usage of MTC bus service. However, because of the relatively high cost of taxi service and the generally inadequate network of public bus access to the airport, mode changes are not expected to provide significant relief for the short term deficiencies in parking.

The MAC has the capability of providing alternative parking during the first phase construction period by utilizing the existing parking supply at the International Charter Terminal on 34th Avenue as well as the existing employee parking lot at the north end of 34th Avenue. These facilities can provide approximately 1,000 to 1,200 parking spaces for the general public and would require shuttle bus service to the main terminal. The MAC has publicized these areas for alternative parking in the past and has implemented a reduced rate parking program utilizing these parking facilities as of July 1, 1978.

OPERATION PERIOD

The daily traffic flow generated by 7 million annual enplanements is carried to the airport by the regional road system shown in Figure 36. Also shown are the capacities of the roadway links adjacent to the airport. The major changes incorporated into this network include the completion of I-494 across the Minnesota River, upgrading of the Hiawatha Corridor, and the upgrading of Cedar Avenue south across the Minnesota River. Traffic forecasts on the regional network (developed by the Metropolitan Council) are shown on Figure 36 along with the proportion of that travel associated with the airport. Table 23 summarizes these values. It will be noted that the primary change from the existing situation is in the traffic composition on T.H. 5 immediately adjacent to the airport entrance.

Neither the regional road system nor the on-site airport roads are anticipated to experience any serious capacity deficiencies. Only the segment of T.H. 5 across the Mississippi River is forecasted to operate over capacity by slightly more than 1%. The most critical new element on the regional road network as it relates to airport access, is the extension of I-494 across the Minnesota River. Should this link not be constructed by 1994, peak period congestion on T.H. 5 past the airport entrance road would operate at unacceptable service levels. This would be in addition to the existing level of service deficiencies experienced on the Mendota Bridge during peak commuter hours.

TABLE 23

REGIONAL TRAVEL DEMAND PROPOSED ACTION (7 Million Enplanements)

Roadway	Location	Daily Traffic (vph)	ADT Capacity (vph)	Airport Traffic (vph)	% Airport Traffic
T.H. 5 (No.)	Airport Entrance	44,300	90,000	19,700	44
T.H. 5 (So.)	Airport Entrance	41,900	30,000	25,700	61
Mendota Bridge	--	34,600	60,000	2,700	8
T.H. 5	North of T.H. 5	60,800	60,000	11,300	19
T.H. 55	North of Crosstown	38,700	60,000	2,100	5
T.H. 55	South of Crosstown	46,700	60,000	5,700	12
Crosstown	West of T.H. 55	21,000	60,000	3,600	17
Crosstown	West of Cedar	35,800	60,000	5,300	15
I-494	East of Cedar	78,400	90,000	22,700	29
I-494	West of Cedar	76,300	90,000	18,100	24
Cedar Ave.	North of I-494	32,100	60,000	2,300	7
I-494 Bridge	--	35,000	90,000	3,000	9

AIR QUALITY IMPACTS

CONSTRUCTION IMPACTS

During construction relatively small amounts of additional air pollution will be generated from the operation of construction equipment, from dust generated by punching the new columns through the existing deck and from the drilling of holes for the ramp foundation. Because most of the new ramps will be prefabricated off-site, air pollution from the construction operations will be minimal. Potentially more significant is the temporary loss of parking space and the possible resultant traffic congestion. During the construction period the MAC will attempt to eliminate this problem by promoting the use of remote parking at the International Charter Terminal with regular shuttle bus service to the main terminal. Because the new ramp is largely prefabricated, considerable time will be saved in erection of the structure, thereby minimizing the time that traffic congestion and resultant air pollution would occur. Construction impacts for Phase 2 of the proposed action are expected to be similar to those for Phase 1. The major exception is that a loss of short-term parking wou'd occur during Phase 2 whereas the major loss in parking during Phase 1 is in the rental car area.

OPERATION IMPACTS - PHASE 1

Typically air pollution levels do not drop when the number of vehicles and parking capacity are increased. However, a dramatic drop in carbon monoxide levels will indeed occur following the construction of the Proposed Action of Phase 1. The reasons for the drop are twofold. First, the emission rates of automobiles are being reduced to meet the revised emission standards set by Congress in the 1977 Clean Air Act Amendment. Carbon monoxide per vehicle mile in 1981 (one year after Phase 1 completion) is expected to be only 60% of the 1977 levels. By 1988 (one year after the projected completion of Phase 2) CO emissions per vehicle mile for in-use vehicles are expected to be 20% of the 1977 levels. If Minnesota implements a periodic motor vehicle inspection program, emissions will be even lower.

Perhaps even more important than the reduction of CO exhaust emission levels is the effect the new structure will have on air circulation patterns and consequently on the dispersion of pollutants. It was indicated previously that high CO levels at the terminal on both the upper and lower level roadways were a result of a vortex-like or helix shaped air circulation system, which is created whenever the wind has a westerly component. This circulation system traps air pollutants and retains them for abnormally long periods of time, allowing the CO concentrations to build up. Construction of Phase 1 of the Proposed Action, a seven-level parking ramp in the southwest quadrant of the in-terminal parking area, destroys this circulation system and allows pollutants to be ventilated into the main wind stream, preventing the build-up of high CO concentrations. By protruding above the roof of the

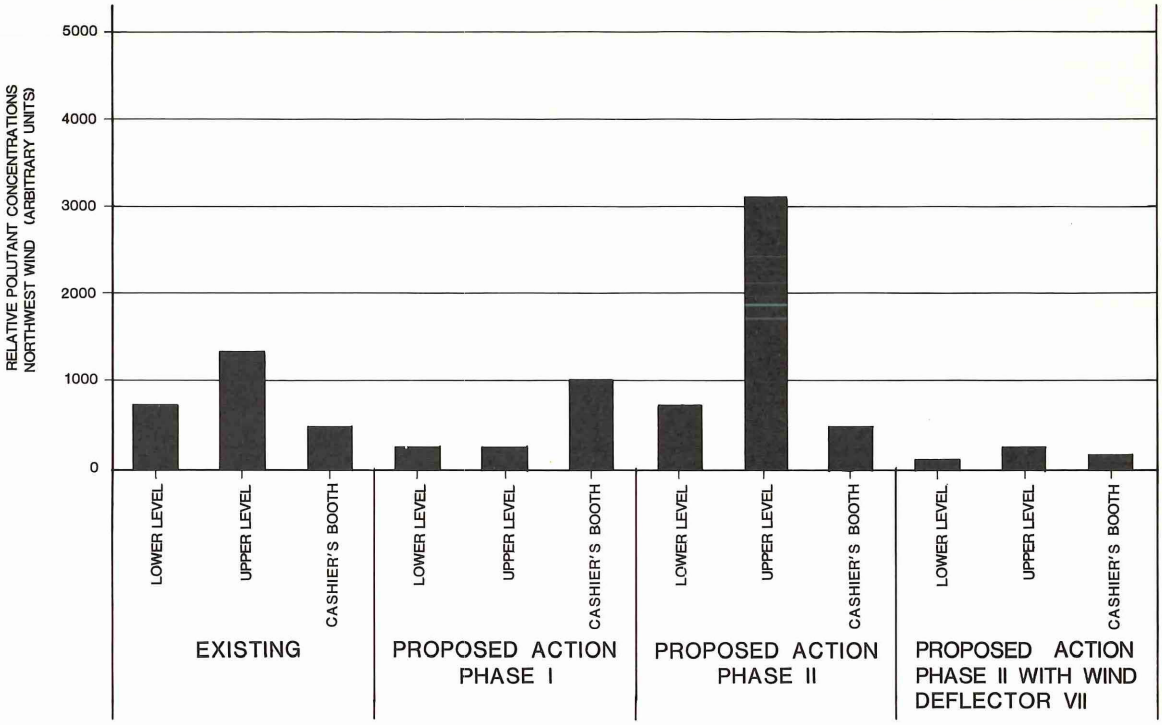
terminal, the upper floors of the parking ramp deflect some of the air downward to relieve the low pressure area that normally forms immediately downwind of the building. Since the parking structure is semi-porous, wind and pollutants can blow through it as well as around the sides. The effect of the Phase 1 parking structure alone, on air pollutant concentrations can be seen in Figure 37. This information is from the experimental data generated in the wind tunnel. The units are arbitrary and do not reflect the relative differences between the emission rates of the various sources, nor do they reflect the change in emission levels from 1977 to 1981. However, the dramatic drop in concentrations on the lower level and upper level roadways is significant. Although there is an increase in concentrations at the cashiers' booths, under existing conditions this area was not a problem. The effects of cleaner auto exhaust and the variation in emission sources is taken into account in Table 24 which shows the maximum expected 1981 CO concentrations at both receptor sites. The new parking ramp does not contribute to CO levels on the upper and lower level roadways when the wind is from the northwest. When the wind is from the southeast, it blows through the ramp carrying some of the emissions to the terminal. Predicted maximum CO levels for the southeast wind conditions are also shown in Table 24.

OPERATION IMPACTS - PHASE 2

By 1988, one year after the projected opening of Phase 2, available CO emission levels will have dropped by approximately 80%. Under the Proposed Action, traffic will have increased about 15% over the 1977 levels. Construction of Phase 2 again alters the air flow patterns around the terminal. The addition of the second phase creates a larger building mass which inhibits air flow around the structures, one of the mechanisms that helped disperse the pollutants under Phase 1. The effect of the Phase 2 structure alone is shown in Figure 37. As can be seen, when the effects of decreasing emissions are ignored, Phase 2 produces pollutant concentrations more than three times the existing levels for the upper level roadway. The lower level roadway is unchanged from the existing but both are worse than for Phase 1. Expected CO concentrations for Phase 2 are also shown in Table 24.

MITIGATING MEASURES

As part of the wind tunnel studies at the University of Houston, the analysts were instructed to design and test passive devices that would break up the vortex flow in front of the terminal. Several designs were tested and a device that worked was found. It is designated as WD-7 for wind deflector 7, the seventh device of this sort that was tested. WD-7 is a rectangular plate extending along the front of the terminal building, rising slightly above the roof line of the terminal and suspended over the front edge of the sidewalk canopy. This device splits the wind blowing over the terminal roof, forcing it down over the sidewalk canopy where it is split again.



EMISSIONS SOURCES: UPPER LEVEL, LOWER LEVEL,
PARKING DECK, SHORT TERM
PARKING & RENTAL CARS
ALL EMISSION SOURCES ASSUMED EQUAL

FIGURE 37
IMPACTS OF THE PROPOSED ACTION ON AIR POLLUTANT DISPERSION

SOURCE: EXPERIMENTAL DATA
UNIVERSITY OF HOUSTON

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

AIRPORT PARKING
EXPANSION PROGRAM
DRAFT-EIS

BATHER,RINGROSE,WOLSFELD,JARVIS,GARDNER

TABLE 24

MAXIMUM EXPECTED CO CONCENTRATIONS PROPOSED ACTION

	Northwest Wind			
	Upper Level Roadway		Lower Level Roadway	
	1-Hr. Avg.	8-Hr. Avg.	1-Hr. Avg.	8-Hr. Avg.
Proposed Action Phase 1 (1981)	4.5	2.3	4.4	2.1
Proposed Action Phase 2 (1988)	17.3	10.3*	5.7	4.2
Proposed Action Phase 2 Plus Wind Deflector (1988)	1.5	1.	1.5	1.0
Existing (1977)	35.0*	23.5*	26.0	19.5*

*Violation of State Standards.

it down over the sidewalk canopy where it is split again. Some of the wind goes to the lower level and some to the upper level. So directed, the wind tends to flush out pollutants from various roadway areas. The effect of the WD-7 is to reduce pollutant concentrations so dramatically as to reduce them below those for Phase 1 if an equal emissions rate is assumed. (See Figure 37.) Anticipated 1987 CO levels with the WD-7 device are also given in Table 24.

NOISE IMPACTS

CONSTRUCTION PERIOD

The construction period of each phase of the proposed seven level parking facility would require one year. The constructon of the Phase 1 facility is proposed to occur during 1979, while Phase 2 is scheduled for 1987. During both construction periods, several types of heavy construction machinery will operate on site, creating high noise levels. The critical receptors in the vicinity of the proposed parking facility are the passenger terminal and existing parking areas, both classified as NAC-2 uses by the MPCA (the daytime L50 standard is 65 dBA).

Construction of the parking facility will require the hoisting of precast concrete piers, and welding of structural members. Construction equipment will include heavy trucks, cranes, excavation equipment and compressors. The only equipment which will emit impact sound will be jack hammers; these will be required to open holes in the existing second level deck to allow for pier construction.

The passenger terminal is about 150 feet from the proposed parking facility. At a distance of 50 feet from the construction site, the average construction noise level is estimated to vary from 77 to 89 dBA for erection of a typical parking garage facility.1/ At 150 feet, the L50 noise level is estimated at 67 to 79 dBA, depending on the specific construction phase. This compares with an L50 standard of 65 dBA for air passenger terminals.

While no noise monitoring data is available for the airport terminal area, this zone is obviously exposed to very high levels of existing aircraft sound. The operation of construction equipment may have some effect on noise levels, but the incremental effect should be negligible.

1/ Noise from construction Equipment and Operations, Building Equipment, and Home Appliances, U.S. Environmental Protection Agency, NTID300.1, Washington, D.C., 1971.

OPERATION PERIOD

Highway Traffic Noise

The purpose of the traffic noise impact analysis is to determine the amount of additional highway noise which will be attributable to the construction of the Phase 1 and Phase 2 parking ramps. A critical receptor area south of I-494 near 34th Avenue was chosen to determine the future impact. This area parallel to I-494 was chosen for several reasons:

1) Of all the highways which surround the airport, I-494 carries a significant percentage of airport-related traffic. If the construction of additional parking will have any impact on traffic noise levels, it would be along I-494.

2) The area near I-494 and 34th Avenue is not within a runway approach pattern, and is less subject to aircraft noise than areas to the west or east. Highway related noise is more critical at this location than is aircraft-related noise.

3) The zone south of I-494 near 34th Avenue contains both NAC 1 (residential and motel) and NAC 2 (commercial) uses. NAC 1 areas are at least 500 feet from the roadway, while NAC 2 uses are as close as 100 feet.

To analyze noise impacts, a predictive model based on peak hour traffic volumes was used.1/ Table 25 illustrates predicted noise levels along I-494 for three different conditions: 1) existing traffic flow 2) the Proposed Action (1994), and 3) the No-Build alternative (1994). For each condition, the noise attributable to non-airport, airport, and total traffic flow was estimated.

It can be concluded from Table 25 that the noise impact attributable to the addition of Phase 1 and Phase 2 parking is negligible. There are three separate ways to examine this future impact using Table 25.

First, by comparing total existing traffic noise to total future traffic noise, there is little increase. Even though peak hour traffic is expected to increase by approximately 25% between 1978 and 1994, noise levels along I-494 will be only slightly greater. Because the highway is already operating at high flow levels, future traffic increases will result only in imperceptible changes in noise (1 to 2 dBA increase). For NAC-2 uses at 100 feet from the highway, MPCA noise standards are already exceeded by 3 to 7 dBA due to existing traffic. For NAC-1 areas at 500 feet, present levels are just below MPCA standards, while future noise levels will be below or just slightly above the standards. Thus, the total increase in traffic noise along I-494 over the next fifteen years will be insignificant.

1/ Highway Noise - A Design Guide for Highway Engineers, NCHRP Report 117, Highway Research Board, 1971.

TABLE 25

PREDICTED TRAFFIC NOISE LEVELS ALONG I-494 AT 34TH AVENUE

Condition	Traffic	Peak Hour Volume	% Trucks	dBA at 100 ft. L10	dBA at 100 ft. L50	dBA at 500 ft. L10	dBA at 500 ft. L50
Existing	Non-airport	3,170	6	75	67	62	58
	Airport	1,800	1	67	62	56	53
	Total	4,970	4	76	68	63	59
Proposed Action (1994)	Non-airport	3,930	6	76	68	63	59
	Airport	2,270	1	68	64	57	55
	Total	6,200	4	77	70	64	61
No-Build Alternative (1994)	Non-airport	3,930	6	76	68	63	59
	Airport	2,190	1	68	63	57	54
	Total	6,120	4	77	70	64	61

Second, the amount of noise attributable to airport-related traffic is not significant. Because non-airport related traffic consists of a much greater percentage of truck and other heavy commercial traffic, it is this non-airport traffic which controls the local noise environment. This can be seen under any of three conditions in Table 25. The non-airport traffic accounts for nearly all of the noise; the addition the airport-related traffic in each case adds only 1 to 2 dBA to total noise levels.

Finally, by comparing the Proposed Action and the No-Build alternative, the actual impact of the proposed parking facilities can be determined. As noted in the previous analysis of future traffic volumes, it is projected under the No-Build alternative that there would be a deficiency of 3,700 parking spaces. This will divert about 4,100 air passengers to other means of transportation, resulting in a decrease of 800 vehicle trips per day (80 vehicles in the peak hour) along I-494. This is only a 1% decrease in peak hour flow along I-494, and it results in no decrease in total noise levels. The conclusion can be made that the Proposed Action will not have a discernable impact on noise levels along I-494. Further, the impact of the Proposed Action on noise along other highways in the vicinity of the airport will also be insignificant, as these highways carry much lower percentages of airport-related traffic than does I-494.

However, the importance of traffic noise impacts in the vicinity of the airport should not be ignored. High traffic volumes already create noise levels which exceed MPCA standards along most of the highways surrounding the airport. The major conclusion is that highway noise in the area is already high, but the provision of additional parking at the airport will create no incremental noise impact in the area.

To bring highway noise in compliance with MPCA standards, noise barriers would be required along the major highways, especially near NAC-1 land uses. Currently neither the Minnesota Department of Transportation nor Hennepin County has any near term plans for highway noise barrier construction for roadways in the airport vicinity.

Some further highway noise mitigation may also result in the future due to better noise emission control technology. The MPCA has promulgated noise emission standards for motor vehicles (6 MCAR 4.2004).

Aircraft Operations Noise

Field investigations conducted by the Minnesota Pollution Control Agency were discussed previously and indicate that the airport and areas within one to three miles of the airport are exposed to L10 noise levels of 65 dBA or greater due to aircraft operations. Under the Proposed Action, aircraft operations will continue to be the predominant source of noise, while other sources will be either short-term in duration or insignificant. In addition, it was demonstrated in the travel impacts section that air travel demand is virtually independent of the parking supply at the airport since alternative

ground access choices are not cost competitive with the time savings afforded by air travel. Thus, the impact of the Proposed Action upon aircraft noise is negligible. Noise problems created by expanded aircraft operations will have to be addressed by the MAC as a special problem whether or not the terminal area parking supply is increased.

WATER QUALITY IMPACTS

CONSTRUCTION PERIOD

During construction of the Proposed Action, very little change in runoff volume and water quality is expected. Both phases of the construction operation will be primarily the assembly of pre-cast components manufactured off-site. No major earth movement is planned and, thus, the overall runoff characteristics of the Minnesota River North drainage area will not be changed.

OPERATION PERIOD

Impacts on runoff volume and the quality of the stormwater runoff as a consequence of the operation of the Proposed Action will be negligible. This is because the total impervious surface area in the terminal area will not be increased and the nature of these impervious surfaces will not be altered. The uppermost level of the parking deck will replace current ground level parking and deck parking surfaces which now generate surface runoff identical to the runoff expected from the Proposed Action. In the long run overall runoff might be slightly improved since the uppermost level of the parking structure is expected to receive significantly less use than the existing ground level and deck level parking areas. Under this situation less grease and oil, litter and other contaminants would be introduced to stormwater runoff by the Proposed Action.

Current maintenance activities relative to cleaning the existing parking facilities consist of dry sweepers which pick up debris and other materials from the parking areas which are then removed from the site as solid waste. This method of cleaning will also be used in the new parking structure such that no increase in stormwater pollutants will result.

ENERGY IMPACTS

CONSTRUCTION PERIOD

The energy required to construct the proposed parking additions goes far beyond the small amounts of fuel used by the construction machinery on the job site. Energy is not only required to operate the cranes that erect the precast components; it is required to truck the components to the site, to produce the precast beams, to produce the cement and steel that go into them and even to build the steel mills and cement plants. The energy not consumed directly on site by the construction process is referred to as indirect energy. Indirect energy is by no means negligible.

Direct and indirect construction energy has been estimated using a technique called input-output (I-O) analysis. I-O analysis, introduced by Wassily Leontief in 1941 to study the American economy, divides the entire U.S. economy into 368 sectors each producing a unique good or service. Extensive data has been collected on the inputs and outputs of each sector and this information is characterized by a network of equations which indicate the energy intensity or energy per unit of output required to produce the product. The basic form of the model can be used to study dollar flows, energy intensity, labor intensity, or even pollution intensity of production. Detailed data on the coal, crude oil, refined oil products, electricity, natural gas and total primary energy required by each sector have been gathered by the U.S. Bureau of Mines and the U.S. Department of Commerce's, Bureau of Economic Analysis. The particular form of the model and data used are contained in ERDA - 77-61[1/].

The accuracy of the energy consumption estimates depends largely upon the degree to which the facility or activity under study is typical of activity in that sector. Construction of the parking ramp was assumed to be represented by Sector 11.04 - New Construction of Highways, because the parking ramp will be primarily concrete and steel reinforcing rods much like highway construction. Since the model gives energy required per dollar of construction cost in 1967 dollars (the year the data was collected), the 1978 estimated construction costs were converted to 1967 dollars using the construction cost price index for the Twin Cities[2/]. This index showed that in early 1978, 237 dollars were required to construct facilities that would have cost only 100 dollars in 1967. The energy cost per 1967 construction dollar was computed in BTU's for coal, crude oil, refined oil products, electricity,

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1/) Energy Analysis: A Handbook for Combining Process and Input - Output Analysis. October, 1976, Energy Research and Development Administration, NTIS No. ERDA-77-61.

2/ Engineering News Record, May, 1978.

natural gas and net primary energy. The BTU values (except for net primary energy) have been converted to other measures using the following conversion factors:

- Coal – 25 Million BTU's Per Ton
- Crude Oil – 5.6 Million BTU's Per Barrel (42 Gallons)
- Refined Oil Products – 5.5 Million BTU's per Barrel
- Electricity – 3.413 million BTU's per megawatt (1,000 kilowatts) hour
- Natural Gas (dry) – 1,031 BTU's per cubic foot

Total direct and indirect energy consumption for both Phases 1 and 2 of the proposed construction (two seven level parking structures near the terminal) is estimated to be greater than 1 trillion BTU's. On site fuel consumption is estimated to be roughly 1% of the total. The amount of fuel by type in both BTU values and other measures for each phase is given in Table 26. The net primary energy does not equal the sum of each of the energies by fuel type since this would include some double counting, such as coal used for producing electricity.

Generally speaking the energy impacts reported in the table are unavoidable and irretrievable commitments of resources. Once consumed the energy is not recoverable except for minor amounts which may be recovered through recycling of the steel used in the construction of the parking ramp. Since so much of the energy is tied up in the long chain of suppliers and in the capital equipment used to produce the materials for the parking ramp, there is little that can be done to mitigate the energy impact of the this alternative.

TABLE 26

DIRECT AND INDIRECT CONSTRUCTION ENERGY CONSUMPTION PROPOSED ACTION

Fuel Type	Phase I	Phase II	Total
Coal			
BTU's	9.7×10^{10}	9.3×10^{10}	19.0×10^{10}
Tons	3,900	3,700	7,600
Crude Oil			
BTU's	4.3×10^{11}	4.13×10^{11}	8.43×10^{11}
Barrels	77,000	74,000	151,000
Refined Oil Products			
BTU's	3.1×10^{11}	3.97×10^{11}	7.07×10^{11}
Barrels	56,000	54,000	110,000
Electricity			
BTU's	1.6×10^{10}	1.57×10^{10}	3.17×10^{10}
Megawatt Hrs.	4,800	4,600	9,400
Natural Gas			
BTU's	1.1×10^{11}	1.02×10^{11}	2.12×10^{11}
Million Cu.Ft.	102.9	98.7	201.6
Net Primary Energy			
BTU's	5.4×10^{11}	5.19×10^{11}	10.59×10^{11}

PARKING RAMP OPERATION

During construction of Phase 1, existing lights under the first deck will be replaced with efficient sodium lights and rewired. The new parking levels will also be lighted with high-pressured sodium lamps and all the lighting will be on a sophisticated control system designed to minimize energy use. The upper floors and parking areas exposed to the open air will be lighted only when natural lighting is insufficient -- an average of 12 hours per day. The other levels of the parking ramp will be lighted an average of 12 hours per day around the perimeter where natural light is available. The next row inside the perimeter will be lighted an average of 16 hours per day since less light penetrates this area, and the innermost areas will be lighted 20 hours per day. The stair towers, lobby, and elevators which will be lighted 24 hours a day. Preliminary estimates indicate that the total annual electric power consumption from Phase 1 lighting will be approximately 2.33 million kilowatt hours per year.

As previously indicated, several areas of the existing structure are electrically heated to control ice and snow accumulation. Snow accumulation on the upper deck is currently dumped into electric snow melters and the melt water is carried away in electrically heated drains. The potential electric load of the existing structure heaters is 632 kilowatts. In the new structure, the heating of the south helix will be removed as will heating of some of the drain line. The new helix will be covered to prevent snow accumulation. Most of the electric snow melters will also be removed and snow will be dumped down the center of the helix and trucked away. Electric space heaters will be added in the machinery room, the elevator tower, and the elevator lobbies. There will be no heating in the stair towers. Heating will be used to maintain a 65 degree farenheit temperature and no air conditioning will be used. Of the existing heaters, only 361 kilowatts will be retained in Phase 1 and 145 kilowatts of new load will be added. Based on past experience, this should result in the heating demand being reduced from 400,000 kilowatt hours to 320,000 kilowatt hours per year. No estimate has been made of the additional energy required to truck away the snow. The net annual electric power consumption of Phase 1 is expected to be 2.65 million kilowatt hours or a 52% increase over existing levels.

Phase 2 of the Proposed Action would add another 770,000 kilowatt hours of lighting load while removal of the north helix heaters and the remaining snow melters and some of the drain heaters would reduce the heater loads by an estimated 146,800 kilowatt hours annually. The net Phase 2 addition would be 623,400 kilowatt hours per year. Phase 1 and Phase 2 would require 3.278 million kilowatt hours per year or an 87% increase over the existing power consumption.

TRANSPORTATION ENERGY

The Energy Policy Conservation Act of 1975 set mandatory fuel economy standards for the EPA combined city/highway mileage on a sales weighted measure of each car manufacturers new car production. The standards were set for 1978, 1979, 1980, and 1985 model years and the Secretary of Transportation was given authority to set 1981-1984 interim standards. The standards, and an estimate of the interim standards, are:

1978	-	18.0 mpg
1979	-	19.0 mpg
1980	-	20.0 mpg
1981	-	22.0 mpg
1982	-	24.0 mpg
1983	-	26.0 mpg
1984	-	27.0 mpg
1985	-	27.5 mpg

In 1979 standards of 17.2, SWMPG for non-passenger autos and 15.8 SWMPG for general utility vehicles were also set with the Secretary of Transportation to set more strict engine standards for 1980 and 1981 model years.

The new fuel economy standards will have a dramatic impact on fuel consumed in travel to and from the airport. The weighted fuel economy of in-use automobiles in 1987 is expected to be 24.6 miles per gallon, rising to 26.2 miles per gallon by 1994. Taxis (assumed to be five years old or less) will climb from a current 15.9 mpg to 27.1 mpg in 1987 and to 27.5 mpg in 1994.

Very modest improvements are expected for transit buses (from 4.6 to 5 mpg) while limousines and courtesy cars are assumed to improve from the 15.8 mpg to 20.5 mpg in 1987. Their fuel economy is not expected to improve thereafter. Despite the fact that vehicle miles traveled (VMT) are expected to be up 20% in 1987, fuel consumption is predicted to go down 25%. By 1994 VMT will be up nearly 36% over existing, but annual fuel consumption will have risen slightly from 1987 and will be down about 21% from existing. The number of vehicle miles traveled, fuel consumption, and equivalent BTU's are given in Table 27 for 1987 and 1994 corresponding with full operation of Phase 1 and Phase 2 of the Proposed Action.

TABLE 27

TRANSPORTATION ENERGY CONSUMPTION PROPOSED ACTION
(Phase 1 1987 ADPM)

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Consumed (Gallons)	Equivalent Energy (Millions 1/ of BTU's)
Taxi	1,570	21.66	34,000	27.1	1,255	15.7
Bus	38	8.5	323	5.0	65 2/	8.8
Limousine	132	21.56	2846	20.5	139	17.3
Hotel/Motel Courtesy Car	213	14.28	3042	20.5	148	18.5
Private & Rental Cars	14,147	25.64	362,729	24.6	14,745	1846.4
Totals	16,100		402,940		16,355	2048.0

Annual Consumption: $\frac{(ADPM)}{(.003)}$

5.45 Million Gallons

682.6 Billion BTU's

1/ 1 Gallon of Gasoline = 124,950 BTU's
1 Gallon of Diesel Fuel = 136,000 BTU's

2/ Diesel Fuel

TABLE 27 (Con't)

TRANSPORTATION ENERGY CONSUMPTION PROPOSED ACTION
(Phase 2 1994 ADPM)

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Consumed (Gallons)	Equivalent Energy (Millions 1/ of BTU's)
Taxi	1,765	21.66	38,230	27.1	1,390	173.7
Bus	42	8.5	357	5.0	71	9.7
Limousine	148	21.56	3,190	20.5	156	19.4
Hotel/Motel Courtesy Car	240	14.28	3,427	20.5	167	20.9
Private & Rental Cars	15,904	25.64	407,778	26.2	15,564	1944.7
Totals	18,099		452,982		17,348	2168.4

Annual Consumption: $\frac{(ADPM)}{(.003)}$

5.78 Million Gallons

722.8 Billion BTU's

1/ 1 Gallon of Gasoline = 124,950 BTU's
1 Gallon of Diesel Fuel = 136,000 BTU's

2/ Diesel Fuel

SOCIO-ECONOMIC IMPACTS

REGIONAL ECONOMIC IMPACT

The socio-economic considerations associated with the Proposed Action to build additional parking spaces for the Minneapolis-St. Paul International Airport can be viewed as three distinct units for each of the seven scenarios that are analyzed.

First there is the regional economic impact of building the spaces and the jobs associated with the construction. Secondly, the social and fiscal implications of various parking management strategies, and thirdly, the possible socio-economic effects of parking (or no parking) on the modes of transportation used to get to and from the airport.

From a regional context, the alternatives to the Proposed Action will not have any adverse economic effects. On a larger scale, the economics of air pollution, public carriers, mass transit, and the socio-economics of parkers could perceivably be affected depending on the ultimate course of action adopted by the Metropolitan Airports Commission.

The proposed construction of additional parking spaces to serve the Minneapolis-St. Paul International Airport is to be financed by the sale of revenue bonds offered by the MAC and amortized by revenues received from parking fees. Providing that revenues equal or exceed the debt schedule the issuance will not affect any regional tax levy nor impact any established debt limits.

The single most important economic consideration that the Proposed Action will have on the region is the short-term effects of the new construction. There are three sources of economic impacts related to construction.

1. The direct employment in the construction sector resulting from construction of the ramp. As the ramp is to be built in two phases, each lasting one year, these impacts occur over the two year construction period.

2. The employment created through the local production and distribution of construction materials used in the ramp, locally produced inputs used by these manufacturers and distributors, locally produced inputs used by these latter firms, and so on. This ripple effect is termed the inter-industry effect. It lasts over the two year construction period.

3. The employment created by local spending which results from the increased personal earnings generated in (1) and (2). Only part of the increased earnings are spent, and only a part of this increased spending goes for goods and services produced locally, thereby increasing local employment. This employment is termed an induced effect of the increased local spending. This impact is also spread over the two year construction period.

A regional economic model of the seven county metro area, called SIMLAB, was used to estimate these three effects. SIMLAB uses a technique called input-output analysis to estimate an industry by industry breakdown of the three effects. The total employment impact is then found by adding across industries (of which there are thirty-five in the current SIMLAB implementation) and then adding across the three effects.

The input-output table of the SIMLAB was derived from the 1971 Metropolitan Council Input-Output Study[1/], and the 1980 labor productivity (output per worker) estimates (by industry) used by SIMLAB to convert output impacts into employment impacts come from forecasts provided by the U.S. Department of Commerce[2/]. Earnings impacts (in 1970 constant dollars) are then computed from employment impacts using earnings per worker data for each of the thirty-five industries derived from publications of the U.S. Department of Commerce[3/]. These earnings increases are then adjusted downward by estimated average taxes, savings, and expenditures on goods and services produced outside the metro area to obtain an estimate of the increased local spending caused by the project. This increased spending is then apportioned across the thirty-five industries using household consumption data provided in the landmark study of Houthakker and Taylor[4/], to permit the estimation of the induced effects.

The SIMLAB analysis was run using an estimated construction value of $20 million for the Proposed Action, $12.7 million for the Medium-Build alternative, and $2 million for the Remote Parking alternative.

The factored results for the Proposed Action assuming no technological changes in construction are listed in Table 28.

TABLE 28
EMPLOYMENT IMPACTS OF THE PROPOSED ACTION

Employment Type	Worker Years in: 1979-80	1986-87
Direct Construction Employment	88	88
Inter-industry Employment	38	38
Induced Employment	54	54
Total Employment	180	180

1/ Metropolitan Council Input-Output Study, Jack Faucett and Associates, 1971.

2/ Adopted from The Structure of the U.S. Economy in 1980 and 1985, U.S. Department of Labor, Bureau of Labor Statistics and U.S. Department of Commerce, 1970 Input-Output Tapes.

3/ Personal Incomes and Earnings Tape, 1929-1975, U.S. Department of Commerce, Bureau of Economic Research, 1970.

4/ Adopted from Consumer Demand in the U.S., Houthakker and Taylor, National Bureau of Economic Research, 1970.

PARKING MANAGEMENT STRATEGIES

It is assumed that the management strategy currently used by the MAC for the existing 5,200 spaces will continue to be used with the Proposed Action. (Details can be found in Automobile Parking and Traffic Study, August, 1977, by Carl Walker and Associates, Inc. and Bather-Ringrose-Wolsfeld-Jarvis-Gardner, Inc.) Basically the strategy calls for convenient low price parking to meet the demands generated by the number of enplanements and the average day of the peak month parking needs. The intent is to assure the airline passengers and visitors that they will not be turned away from the terminal because of lack of parking spaces.

In 1976 this strategy yielded $4,003,164 in revenue up from the $3,359,831 experienced in 1975. On a per enplaned passenger basis, 1975 yielded $.9776 per passenger while in 1976 the figure was $1.0767 per passenger. (The increase was partially due to an increase in parking usage and to a mid-year rate increase.) On the other side the ledger, expenses associated with the operations of the airport parking facilities, less any debt service, totaled $1,524,406 in 1975 and $1,656,968 in 1976. The surplus of $1,835,425 and $2,167,729 in 1975 and 1976, respectively, was allocated to debt service and to subsidize other Commission functions. Holding other variables constant, this 1976 surplus of $417 per parking space per year could exceed $3,794,000 with the completion of the Proposed Action after the payment of the debt.

Based on the relationship of parking income of $3.53 million in 1977 to the net operating budget of $15.16 million for that year, parking represents 23 percent of the budget. Given the Proposed Action and assuming no additional increase in cost penalties or savings associated with scale, the existing fiscal relationship should remain constant once the bond debt is paid.

SOCIO-ECONOMIC EFFECTS

A transportation study done in 1970 by Bather-Wolsfeld, Inc. indicated that 55 percent of all the Twin Cities air trips had an origin at a housing unit. The geographical center of the house-based trips was approximately six miles to the north and west of the present air terminal. During the same time period 12 percent of the non-house based air passengers were generated from the Minneapolis Central Business District (CBD). While the current distribution has most likely remained similar over the past eight years, the general population trend has tended to move south and away from the central core areas. The Proposed Action should have no effect on the existing profile of passenger type or generation as this is primarily a function of airline use rather than parking.

Additionally, the Proposed Action should have no effect on ground mode of transportation to and from the airport. In 1970 taxis, bus, and limousine travel made up only 25 percent of the total ground trips, while passengers who drove their own cars accounted for 62 percent. Today there may be a slight shift towards public carriers due to the limited supply of spaces but once the Proposed Action is completed the personal car will again be catered to.

One area in which the public carrier could be affected by the Proposed Action would be to set-back (because of less demand) some of the proposed actions for private park and ride and expanded limousine services. At present both major cab companies characterize the commitment to public transit as "bad" and the additions of more parking spaces and priority to the private car would most likely exacerbate that feeling.

Negative social impacts such as missed planes and inconvenience could occur if during the construction period existing spaces are reduced to allow for building. For the most part this impact, if planned for, could be mitigated by proper public information.

AESTHETIC IMPACTS

CONSTRUCTION PERIOD

During construction of the Proposed Action, the obvious visual impacts will result. Construction equipment will be apparent to both the inbound automobile traveler as well as the visitor to the Twin Cities leaving the terminal building. In addition, pre-cast items manufactured off-site will be stored on site until they are ready to be installed. These storage piles as well as certain pieces of construction equipment will be permanent visual features during nearly the entire length of the one year construction period. Efforts should be made to shield or cover storage areas from view as much as possible and to move construction equipment to remote areas during idle periods to mitigate the visual impacts which are unavoidable during the construction period.

OPERATION PERIOD

The Proposed Action consists of a seven story parking structure immediately in front of the existing main terminal building. Probably the most important consequence of this construction will be the permanent loss of the view of the terminal building and its distinctive folded plate roof to the inbound automobile traveler. In addition the view from the terminal building will be blocked by the parking structure which now looks out over the existing central parking area. While this existing view over the parking deck (from the upper level) is not particularly attractive to most people, it does provide a sense of openess and a view of the sky which will be permanently lost.

The primary method of mitigating the aesthetic and visual impacts of the Proposed Action is to incorporate into the parking structure aesthetic features which will serve to replace those elements permanently lost. Such features could include an overall architectural treatment of the parking structure to make it compatible with the main terminal building and the incorporation of low level plantings and other decorative treatments in the plaza area between the parking structure and the main terminal building.

VEGETATION IMPACTS

CONSTRUCTION PERIOD

There will be no adverse impacts to vegetation resulting from the construction of the Proposed Action. This is because the site is presently developed for parking purposes and is devoid of any vegetation. Surface runoff from this area is a part of the Minnesota River North drainage area and will be treated prior to discharge into the Minnesota River. However, precautions should still be taken to ensure that construction materials and sediments are not permitted to enter the storm sewer system.

OPERATION PERIOD

Parking ramp runoff will carry with it hydrocarbon chemical and other chemical oxygen demanding substances (litter, etc.). Runoff water may also be warmer than the receiving waters depending on the ambient temperature, storm intensity and other factors. Each of these conditions could adversely affect the water quality of the receiving body and consequently habitat quality. Again, however, all runoff from the central parking area at the main terminal will be treated prior to discharge into the Minnesota River.

Stormwater runoff impacts are less for a parking ramp than for a surface lot serving the same number of vehicles. A parking ramp constructed to serve the same number of vehicles as a surface lot has a significantly smaller surface area to intercept precipitation. Therefore, if other levels of the ramp are not washed, the only stormwater to be carried from the site would be that which fell on the uppermost deck. In contrast, all stormwater, hydrocarbon chemicals and litter accumulated on a surface lot would be carried off and discharged into the stormwater drainage system and consequently into the receiving body of water.

WILDLIFE IMPACTS

CONSTRUCTION PERIOD

The terminal area is presently intensively developed with no known wildlife use occurring. Comments made earlier in the vegetation section regarding stormwater runoff and degrading the quality of the Minnesota River apply here also.

OPERATION PERIOD

In view of possible conflicts between wildlife (especially birds) and aircraft, creation of areas where wildlife might be attracted is strongly discouraged. Any sheltered holes, cavities or overhangs which could possibly provide nesting or roosting shelter for sparrows, starlings or pigeons should be eliminated in the design stages of the facility. Comments relevant to stormwater runoff made in the preceding section on vegetation apply here as well. Runoff which has not been adequately or properly treated could deteriorate the water quality of the Minnesota River thus affecting aquatic organisms and those species of fish and wildlife dependent upon them as a source of food.

HISTORIC/CULTURAL IMPACTS

The most significant historic/cultural resources within the influence of the airport have been identified as Fort Snelling, Fort Snelling State Park, and the Minnesota River Valley National Wildlife Refuge. The Proposed Action will not have any direct impacts upon these or other historic/cultural resources based upon the findings of the Minnesota Historical Society which concluded that:

"The project described above has been reviewed pursuant to responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the National Advisory Council on Historic Preservation (36CFR800).

This review reveals the location of no sites of historic, architectural, cultural, or archaeological significance within the area of the proposed project. There are no sites in the area which are on the National Register or eligible for inclusion on the National Register, and, therefore, none which may be affected by your proposal."1/

1/ Letter from Mr. Russell W. Fridley, State Historic Preservation Officer, at the Minnesota Historical Society dated December, 1977.

Chapter I SUMMARY

Chapter II INTRODUCTION

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Chapter VIII OPTIONS TO PROVIDE PARKING BEYOND THE PROPOSED ACTION AND THEIR IMPACTS

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CHAPTER VI
ALTERNATIVES TO THE PROPOSED ACTION AND THEIR IMPACTS

THIS CHAPTER DEFINES THE ALTERNATIVES TO THE PROPOSED ACTION AND DOCUMENTS THEIR IMPACTS UPON THE SOCIAL-CULTURAL AND THE PHYSICAL ENVIRONMENTS. THE ANALYSIS OF ALTERNATIVES COVERS THE SAME FIFTEEN YEAR TIME FRAME AS WAS USED FOR THE PROPOSED ACTION. THIS CORRESPONDS TO AN AIR PASSENGER ACTIVITY LEVEL OF SEVEN MILLION ENPLANEMENTS PER YEAR.

DESCRIPTION OF THE ALTERNATIVES

The Proposed Action has been identified as the construction of two seven-level parking structures located in the southwest and northwest quadrants of the central parking area. Five supported levels are proposed to be constructed over the existing surface level and deck parking and will accommodate approximately 9,400 vehicles. This parking supply would satisfy air passenger activity of approximately 7.3 million annual enplanements. This level of construction falls slightly above the desired parking supply of 9,100 spaces for 7 million annual enplanements. Three alternatives to the Proposed Action have been identified as described below.

- o No Build Alternative. This alternative consists of retaining the existing parking supply of 5,200 spaces to serve 7 million annual enplanements.

- o Medium Build Alternative. This alternative consists of constructing two five level parking structures in the northwest and southwest quadrants. Approximately 7,400 parking spaces are provided to serve air passenger activity up to 7 million annual enplanements. This alternative is identical to the Proposed Action except in size.

- o On-airport Remote Parking Alternative. This alternative consists of constructing 3,900 surface parking spaces outside of the main terminal complex on airport property. Thus, 9,100 parking spaces are provided for 7 million annual enplanements. Construction of a new 3,900 space surface parking lot would occur on the vacant property in the vicinity of the Medical Clinic immediately north of I-494 at 26th Avenue. This area is shown in Figure 38.

Within each impact area, the effects of the three alternatives are quantitifed and compared with the other alternatives as well as the Proposed Action. The time period analyzed covers the forecast period to reach 7 million annual enplanements; to approximately 1994.

The analysis of remote parking has focused upon the airport proper since this is the only method by which the MAC can maintain control over parking fees, shuttle bus service, and patron security. This does not preclude, however, the development of private off-airport remote parking facilities which might be located south of I-494 or potentially at Metropolitan Stadium. The impacts of such a facility would be nearly identical to the airport site in terms of travel demand impacts and parking demand within the airport. However, the mitigation of other environmental impacts, such as water quality, would not be under the control of the MAC. Therefore, the adverse effects of an off-airport remote parking facility would have to be identified and mitigated by the proponent of such an action.

TRAVEL DEMAND IMPACTS

The travel demand impacts of the three alternatives to the Proposed Action revolve around two primary issues:

> What is the effect of the three alternatives upon the mode of travel used to access the airport and overall vehicle occupancy at Wold-Chamberlain Field?
>
> Can the regional transportation system (primarily highways and public transit) accommodate the travel demand generated by the three alternative scenarios?

SENSITIVITY OF TRAVEL MODE TO PARKING SUPPLY

Mode of travel to the airport is a function of the relative availability of time and cost competitive travel alternatives. At the present time the airport has available minimal transit service and is primarily oriented to the private automobile, taxis, and rental cars. In recent years hotel/motel vans have increased their relative share of the travel market while limousine service has declined.

The general impact of the three alternatives upon mode selection is to increase average overall vehicle occupancy as the overall parking supply is reduced. This is documented in Table 29 which lists, for each alternative, the variation in total traffic demand and the relative percent share of this traffic by mode of travel for 7 million enplanements. In general, the shift in mode split is from private auto to taxi, bus, and private auto with a curbside destination. The most significant variation from the Proposed Action is the No-Build alternative which results in a mode shift for 3,700 parkers per day. The differences between the Proposed Action and the Medium Build alternative and the Remote Parking alternative are less significant in that both of these alternatives provide a parking supply comparable to the parking supply of the Proposed Action.

TABLE 29

MODE SPLIT FORECASTS FOR ALTERNATIVES TO THE PROPOSED ACTION
(7 Million Enplanements)

Mode	Proposed Action		Alternatives					
			No Build		Medium Build		Remote	
	Vol.	%	Vol.	%	Vol.	%	Vol.	%
Private Auto	13,750	75.9	11,925	68.9	12,600	71.6	13,625	75.3
Rental Car	1,775	9.8	1,775	10.3	1,775	10.1	1,775	9.8
Taxi	1,300	7.2	2,250	13.0	1,900	10.8	1,400	7.7
Limousine	275	1.5	300	1.7	290	1.6	290	1.6
Courtesy Car	450	2.5	450	2.6	450	2.6	450	2.5
Bus	50	0.3	100	0.6	85	0.5	60	0.3
Other	500	2.8	500	2.9	500	2.8	500	2.8
Totals	18,100	100.0	17,300	100.0	17,600	100.0	18,100	100.0

TRANSPORTATION SYSTEM CAPACITY

As was indicated previously relative to the Proposed Action, the regional highway system has sufficient capacity to accommodate the future traffic demand providing that the planned improvements to the regional system are implemented. Both the medium build and remote parking alternatives provide a parking supply similar to the Proposed Action such that the private auto will be the primary mode of ground access. The no-build alternative, on the other hand, will result in a greater emphasis upon other modes of travel primarily taxi, bus, and the private auto driven to curbside for passenger pick-up and drop-off.

Figures 39, 40, and 41 depict the daily traffic flow generated by 7 million annual enplanements for the No-Build alternative, Medium Build alternative, and the Remote Parking alternative respectively. Tables 30, 31, and 32 summarize this information for major roadway links on the regional road system along with the proportion of airport related traffic for each alternative. It will be noted that the major difference in airport traffic on the regional road system is for the Remote Parking alternative which results in lower airport related traffic on T.H. 5 in the vicinity of the airport entrance.

Another major impact of the Remote Parking alternative is the cost to the MAC of providing shuttle bus service between the parking lot and the terminal building at a frequency which will make remote parking attractive to the air passenger. This type of service will require frequencies of five to ten minutes operating over a period of at least twenty-one hours per day. The cost of this service is estimated to be in the range of $280,000 to $470,000 per year.[1/] Also the remote parking facility would create problems for airport security since air passengers would be tranpsorted through secured areas. To avoid going through any secured area would make the costs of the shuttle bus service prohibitive.

While the variations among the alternatives and the Proposed Action are insignificant relative to the highway system, there does exist one major deficiency in the public transit system relative to the No-Build alternative. Since the Proposed Action, the Medium Build alternative and the Remote Parking alternative provide substantial levels of parking, public transit is not a significant mode of travel to the airport. However, the No-Build alternative requires the greatest mode shift which results in not only higher taxi usage but also a demand for public transit service more than double the current level of bus service. The ability of the terminal area to accommodate these many buses and the ability of the MTC to allocate this level of bus service to the airport is doubtful. The MTC is currently operating under a "performance funding" strategy which has resulted in reduced bus service in outlying areas of the MTC's service area. In addition, the ability to attract air passengers to conventional bus service has been historically difficult due to scheduling problems and the need to transport luggage conveniently.

As a consequence, the viability of a No-Build alternative is highly dependent upon the ability of the public transit system to deliver large numbers of people to the airport conveniently and on a schedule comparable to airline activity. This will require a high level of service and a high capacity system which also is accessible to the greater metropolitan region. This is necessary since the public transit system must not only serve non-residents but also residents of the area who are the ones who would otherwise bring their private automobile to the airport. Under these conditions, the long range expectation is that this metropolitan area will not be able to provide the necessary type of public transit capable of diverting air passengers away from the private automobile prior to 1994. The current from the private automobile prior to 1994. The current policy of the Metropolitan Council[2/] is to emphasize subregional local transit service and express bus service between subregions of the metropolitan area. As a result fixed guideway systems, light rail, and other automated line haul systems are not expected to be available prior to 1994. This factor seriously jeopardizes the feasibility of the No-Build alternative. All other alternatives to the Proposed Action generate a demand for public transportation within the capabilities of the MTC's existing and planned system of services.

1/ Automobile Parking and Traffic Study, Carl Walker and Associates and BRW, Inc., 1977.

2/ Metropolitan Development Guide, Transportation Chapter, 1976.

TABLE 30

REGIONAL TRAVEL DEMAND NO-BUILD ALTERNATIVE
(7 Million Enplanements)

Roadway	Location	Daily Traffic (vph)	ADT Capacity (vph)	Airport Traffic (vph)	% Airport Traffic
T.H. 5 (No.)	Airport Entrance	43,700	90,000	19,100	44
T.H. 5 (So.)	Airport Entrance	40,900	90,000	24,700	60
Mendota Bridge	--	34,500	60,000	2,600	8
T.H. 5	North of T.H. 5	60,500	60,000	11,000	18
T.H. 55	North of Crosstown	38,600	60,000	2,000	5
T.H. 55	South of Crosstown	46,500	60,000	5,500	12
Crosstown	West of T.H. 55	20,900	60,000	3,500	17
Crosstown	West of Cedar	35,700	60,000	5,200	15
I-494	East of Cedar	77,500	90,000	21,900	28
I-494	West of Cedar	75,700	90,000	17,500	23
Cedar Ave.	North of I-494	32,100	60,000	2,200	7
I-494 Bridge	--	34,800	90,000	2,800	8

TABLE 31

REGIONAL TRAVEL DEMAND MEDIUM-BUILD ALTERNATIVE
(7 Million Enplanements)

Roadway	Location	Daily Traffic (vph)	ADT Capacity (vph)	Airport Traffic (vph)	% Airport Traffic
T.H. 5 (No.)	Airport Entrance	44,100	90,000	19,500	44
T.H. 5 (So.)	Airport Entrance	41,600	90,000	25,400	61
Mendota Bridge	--	34,600	60,000	2,700	8
T.H. 5	North of T.H. 5	60,700	60,000	11,200	18
T.H. 55	North of Crosstown	38,700	60,000	2,100	5
T.H. 55	South of Crosstown	46,600	60,000	5,600	12
Crosstown	West of T.H. 55	20,900	60,000	3,500	17
Crosstown	West of Cedar	35,700	60,000	5,200	15
I-494	East of Cedar	78,200	90,000	22,500	29
I-494	West of Cedar	76,100	90,000	17,900	24
Cedar Ave.	North of I-494	32,100	60,000	2,300	7
I-494 Bridge	--	34,900	90,000	2,900	8

TABLE 32

REGIONAL TRAVEL DEMAND ON-AIRPORT REMOTE PARKING ALTERNATIVE
(7 Million Enplanements)

Roadway	Location	Daily Traffic (vph)	ADT Capacity (vph)	Airport Traffic (vph)	% Airport Traffic
T.H. 5 (No.)	Airport Entrance	44,300	90,000	19,700	44
T.H. 5 (So.)	Airport Entrance	36,300	90,000	20,100	55
Mendota Bridge	--	34,600	60,000	2,700	8
T.H. 5	North of T.H. 5	60,800	60,000	11,300	19
T.H. 55	North of Crosstown	38,700	60,000	2,100	5
T.H. 55	South of Crosstown	46,700	60,000	5,700	12
Crosstown	West of T.H. 55	21,000	60,000	3,600	17
Crosstown	West of Cedar	35,800	60,000	5,300	15
I-494	East of Cedar	78,400	90,000	22,700	29
I-494	West of Cedar	76,300	90,000	18,100	24
Cedar Ave.	North of I-494	32,100	60,000	2,300	7
I-494 Bridge	--	35,000	90,000	3,000	9

AIR QUALITY IMPACTS

NO BUILD ALTERNATIVE

With the No-Build alternative there are, of course, no construction impacts on air quality. Even with the reduction in vehicle emissions, CO standards would continue to be violated well past 1981. The addition of the WD-7 device could considerably improve the situation, reducing the concentrations by slightly more than half for the lower level roadway and slightly less than half for the upper level roadway under certain wind conditions. This would probably not be sufficient to meet the CO standards by 1982, the compliance date set in the 1977 Clean Air Act Amendment. Estimated CO levels for the No-Build alternative for 1981 and 1987 are given in Table 33 below.

TABLE 33

EXPECTED MAXIMUM CO CONCENTRATIONS - NO-BUILD ALTERNATIVE

(Northwest Winds - Concentrations in Parts Per Million)

	Upper Level Roadway		Lower Level Roadway	
	1-Hr. Avg.	8-Hr. Avg.	1-Hr. Avg.	8-Hr. Avg.
No Build Alt. - 1981	24.7	15.6*	15.8	11.3*
No Build Alt. - 1988	7.5	4.7	5.3	4.1
Existing (1977)	35.0*	23.5*	26.0	19.5*

*Violation of State Standards.

MEDIUM BUILD ALTERNATIVE

Construction Period

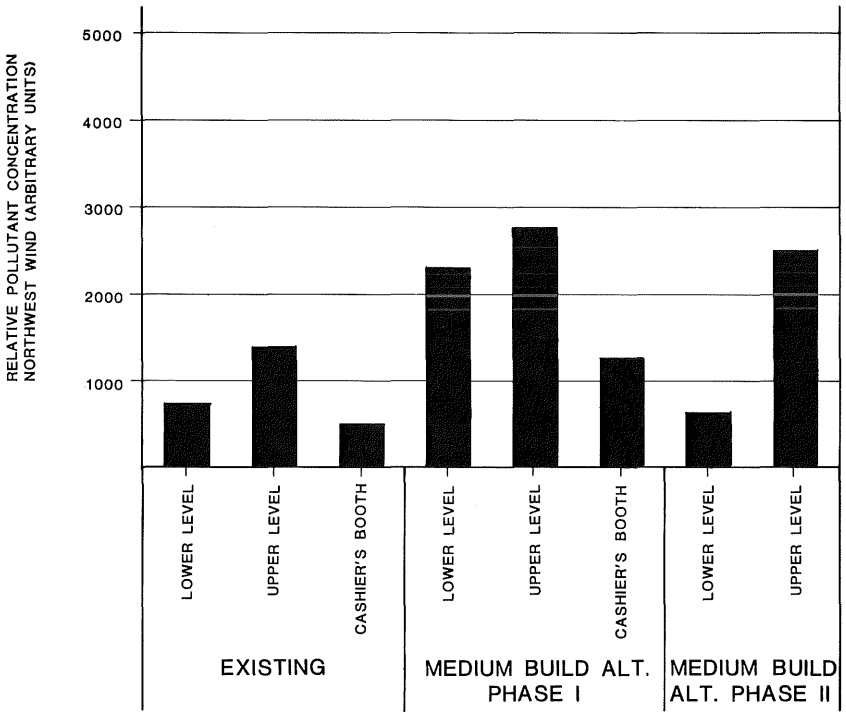
Air quality impacts during the construction period for the Medium-Build alternative would be nearly identical to those for the Proposed Action. The same amount of foundation work and the same disruption of parking areas would occur. Erection time for the smaller structure would be slightly less. The MAC again could be expected to promote remote parking and shuttle service at the International Charter Terminal.

Operation Period Phase 1

The impact of a single five-story parking ramp would be to hinder pollutant dispersion. If emissions remained unchanged and were equal from all sources the effect would be to more than double the lower level concentrations and double the upper level concentrations. (See Figure 42.) The Medium-Build alternative was originally the proposed course of action while the seven-level garage was not seriously being considered. However, during the course of the wind tunnel studies it became clear that a five-level ramp could not be built because it would worsen the already existing serious CO problem. The tremendous improvement in pollution levels from the seven-level garage, as indicated by the wind tunnel experimental data, caused the Airports Commission to change their proposed course of action. Predicted maximum concentrations from Phase 1 of the Medium-Build alternative are shown in Table 34.

Operation Period Phase 2

Addition of Phase 2 of the Medium-Build alternative would leave pollutant levels at about the same high level as would Phase 1 for the upper level roadway, if emissions were to remain the same. Pollutant levels on the lower level roadway would drop under Phase 2, again assuming equal emissions. This is illustrated in Figure 42. The expected CO concentrations, assuming the 1987 emission levels, are shown in Table 34.



EMISSION SOURCES: UPPER LEVEL, LOWER LEVEL, PARKING DECK, SHORT TERM PARKING & RENTAL CARS. ALL EMISSION SOURCES ASSUMED EQAUL

FIGURE 42

IMPACTS OF THE MEDIUM BUILD ALTERNATIVE ON AIR POLLUTANT DISPERSION

SOURCE: EXPERIMENTAL DATA
UNIVERSITY OF HOUSTON

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

AIRPORT PARKING
EXPANSION PROGRAM
DRAFT-EIS

BATHER,RINGROSE,WOLSFELD,JARVIS,GARDNER

TABLE 34

EXPECTED MAXIMUM CO CONCENTRATIONS - MEDIUM-BUILD ALTERNATIVE

(Northwest Winds - Concentrations in Parts Per Million)

	Upper Level Roadway		Lower Level Roadway	
	1-Hr. Avg.	8-Hr. Avg.	1-Hr. Avg.	8-Hr. Avg.
Medium Build Alt. Phase 1 (1981)	51.0*	31.0*	50.0*	24.0*
Medium Build Alt. Phase 2 (1988)	14.0	8.3	4.2	3.1
Existing (1977)	35.0*	23.5*	26.0	19.5*

*Violation of State Standards.

ON-AIRPORT REMOTE PARKING ALTERNATIVE

In-terminal air quality would be much the same under this alternative as under the No-Build alternative. Construction activity at the remote lot would have little impact on the air quality at the terminal. More dust could be expected to be generated at the remote site as grading took place. Since some of the cars would be shifted to the remote lot, the air pollution emissions from those autos would also be shifted to the remote lot and the 24th Avenue interchange area. Because of the open, unrestricted nature of this area, pollutant dispersions would not be a problem. In-terminal predicted CO levels are given below in Table 35. If a remote parking lot is to be constructed, additional air quality analysis at the remote site is recommended.

TABLE 35

EXPECTED MAXIMUM CO CONCENTRATIONS - ON-AIRPORT REMOTE PARKING ALTERNATIVE

(Northwest Winds - Concentrations in Parts Per Million)

	Upper Level Roadway		Lower Level Roadway	
	1-Hr. Avg.	8-Hr. Avg.	1-Hr. Avg.	8-Hr. Avg.
Remote Lot Alt. 1981	20.7	14.4*	13.5	10.0*
Remote Lot Alt. 1989	6.9	4.9	5.1	5.0
Existing (1977)	35.0*	23.5*	26.0	19.5*

*Violation of State Standards.

NOISE IMPACTS

NO-BUILD ALTERNATIVE

The No-Build alternative would result in slightly less absolute noise impact than the Proposed Action; however, even the Proposed Action will result in an insignificant noise impact. The No-Build alternative would create no additional noise in the airport terminal area due to construction activity. The No-Build alternative would also slightly decrease airport-related highway traffic levels (due to increased overall vehicle occupancy); however, highway traffic-related noise would not be significantly different from the Proposed Action. Finally, aircraft operations, and therefore aircraft noise, are independent of airport ground access decisions. Thus, the No-Build alternative has no effect on aircraft noise.

MEDIUM-BUILD ALTERNATIVE

There are no discernible differences in noise impact between the Proposed Action and the Medium-Build alternative. The impacts associated with either action due to construction, aircraft, and highway-related noise are nearly identical since the Medium-Build alternative closely resembles the Proposed Action in terms of physical and operational characteristics. Thus, the noise impacts of the Medium-Build alternative are also insignificant.

ON-AIRPORT REMOTE PARKING ALTERNATIVE

There are no significant differences in noise impact between the Proposed Action and the Remote Parking alternative. The remote parking lot would expose the airport medical clinic to construction noise (primarily grading and surfacing). However, due to nearby aircraft operations, it is expected that the incremental construction noise impact would not be significant. The remote parking alternative will decrease traffic levels along I-494 between the main airport entry road and 24th Avenue, but this reduction in traffic has no effect on highway noise levels. Finally, the noise related to aircraft operation is the same for the Remote Parking alternative as it is for the Proposed Action and the other alternatives.

WATER QUALITY IMPACTS

NO-BUILD ALTERNATIVE

The No-Build Alternative will not have any impact upon stormwater runoff or the quality of the runoff water.

MEDIUM-BUILD ALTERNATIVE

In terms of water quality impacts the Medium-Build alternative would have the same impacts as the Proposed Action. No major ground disruption will occur during construction such that existing runoff characteristics will be only minimally disrupted. Stormwater runoff volumes and water quality will also remain unchanged during the operation period. No net increase in impervious surfaces will be created as a result of the Proposed Action. Current maintenance practices of the MAC, which involves the use of dry sweepers, would be continued under the Medium-Build alternative. Thus all debris and litter collected on the interior levels of the parking facility will be disposed of as solid waste.

REMOTE-PARKING ALTERNATIVE

The Remote Parking alternative is located in the Minnesota River South drainage areas which is ultimately planned to be diverted to a treatment facility which will also collect stormwater from the Minnesota River North drainage area, I-494 drainage area, and runoff from the Fort Snelling National Cemetary.

The impact of the increased runoff from the 32 acre surfaced remote parking lot is documented in Table 36. It will be noted that the remote parking lot accounts for only a 2% increase in runoff.

TABLE 36
IMPACT OF REMOTE PARKING ON RUNOFF VOLUMES

Drainage Component	Runoff in Acre-Feet from: 10 Yr.-24 Hr. Storm (4.14")	Annual Percipitation (25.44")
Composite Airport Drainage Area	414	2,546
Remote Parking Lot Increment	7	42
Totals	421	2,588

The water quality impact of the Remote Parking alternative is shown in Table 37. Runoff quality for the remote parking lot was assumed to be equivalent to the quality of the I-494 runoff and resulted in increases in grease and oil concentrations and lead. The water quality of the runoff which the MAC is required to treat is presented for comparison purposes. It is evident that the change in water quality caused by the remote parking facility has no impact upon the quality of the runoff which will be treated to conform to the NPDES limits.

TABLE 37
IMPACT OF REMOTE PARKING ON RUNOFF QUALITY

Parameter	Minnesota River South: Existing	Minnesota River South: With Remote Pkg.	Quality of Runoff to be Treated*	NPDES Limits (Monthly Average)
Total Suspended Solids (mg/l)	118	117	91	30
Grease and Oil (mg/l)	9	12	20	10
BOD (mg/l)	31	29	23	Monitor
Lead (mg/l)	0.04	0.08	N.A.	Monitor

*Source: E.A. Hickok and Associates

ENERGY IMPACTS

NO-BUILD ALTERNATIVE

Construction Energy

Since there would be no construction under this alternative, it follows that there will be no energy consumption in the construction process. The more than 1 trillion BTU's of direct and indirect energy estimated for construction of the Proposed Action would be saved.

Parking Ramp Operation

Under the No-Build alternative, no new additional lighting or heating loads will be added. It is also likely that under the No-Build alternative that the MAC would still replace the mercury vapor lamps with high pressure sodium lamps, resulting in an annual savings of roughly 250,000 kilowatt hours. It is not clear when such a change would take place, but if all the lights were replaced prior to 1987, the estimated total annual airport electric power consumption should drop from 1.75 million kilowatt hours to 1.5 million kilowatt hours, a decrease of 14%.

Transportation Energy

If no additional parking were built, air passengers would have to shift modes and increase vehicle occupancies. This means more taxis, buses, limousines, and courtesty cars than under the Proposed Action and fewer private autos. The net impacts compared to the Proposed Action, is a savings in transportation fuel of roughly 230,000 gallons annually by 1987 and rising to 880,000 gallons annually by 1994. Table 38 shows the average day of the peak month transportation fuel requirements for the No-Build alternative.

TABLE 38
TRANSPORTATION ENERGY CONSUMPTION NO-BUILD ALTERNATIVE

(1987 ADPM)

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Consumed (Gallons)	Equivalent Energy (Millions 1/ of BTU's)
Taxi	2,195	21.66	47,543	27.1	1,754	219.2
Bus	176	8.5	1,496	5.0	299 2/	40.7
Limousine	184	21.56	3,967	20.5	194	24.2
Hotel/Motel Courtesy Car	298	14.28	4,255	20.5	208	25.9
Private & Rental Cars	12,970	25.64	324,858	24.6	13,205	1,650.0
Totals	15,523		382,119		15,660	1,960.0

Annual Consumption: $\frac{(\text{ADPM})}{(.003)}$

5.22 Million Gallons

653. Billion BTU's

1/ 1 Gallon of Gasoline = 124,950 BTU's
1 Gallon of Diesel Fuel = 136,000 BTU's

2/ Diesel Fuel

TABLE 38 (Con't)
TRANSPORTATION ENERGY CONSUMPTION NO-BUILD ALTERNATIVE

(1994 ADPM)

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Consumed (Gallons)	Equivalent Energy (Millions 1/ of BTU's)
Taxi	2,465	21.66	53,391	27.5	194	242.6
Bus	197	8.5	1,674	5.0	335 2/	45.5
Limousine	207	21.56	4,463	20.5	217	27.2
Hotel/Motel Courtesy Car	335	14.28	4,784	20.5	233	29.2
Private & Rental Cars	14,095	25.64	361,395	26.2	13,793	1,723.5
Totals	17,229		425,707		16,519	2,068.0

Annual Consumption: $\frac{(ADPM)}{(.003)}$

5.51 Million Gallons

689.33 Billion BTU's

1/ 1 Gallon of Gasoline = 124,950 BTU's
1 Gallon of Diesel Fuel = 136,000 BTU's

2/ Diesel Fuel

MEDIUM-BUILD ALTERNATIVE

Construction Energy

Direct and indirect energy costs of constructing the Medium-Build alternative were estimated using the same input-output methodology as was used for the Proposed Action. Direct and indirect net primary energy and energy consumption by fuel type for the two phases of the medium build alternative are listed in Table 39. As would be expected the smaller parking expansion requires proportionately less energy to construct representing a savings over the Proposed Action of roughly 340 billion BTU's or about 35% of the Proposed Action's energy cost.

TABLE 39

DIRECT AND INDIRECT CONSTRUCTION ENERGY CONSUMPTION THE MEDIUM BUILD ALTERNATIVE

Energy Type	Phase I	Phase II	Total
Coal			
BTU's	6.5×10^{10}	6.4×10^{10}	12.9×10^{10}
Tons	2,600	2,575	5,175
Crude Oil			
BTU's	2.89×10^{11}	2.89×10^{11}	5.75×10^{11}
Barrels	51,500	51,000	102,500
Refined Oil Products			
BTU's	2.07×10^{11}	2.05×10^{11}	4.12×10^{11}
Barrels	37,700	37,300	74,300
Electricity			
BTU's	1.1×10^{10}	1.09×10^{10}	2.19×10^{10}
Megawatt Hrs.	3,225	3,196	6,521
Natural Gas			
BTU's	7.1×10^{10}	7.04×10^{10}	14.14×10^{10}
Million Cu.Ft.	69.0	68.3	137.3
Net Primary Energy			
BTU's	3.63×10^{11}	3.59×10^{11}	7.22×10^{11}

Parking Ramp Operations

Under the Medium-Build alternative, only three additional levels of parking would be added. This means roughly three-fifths of the lighting added for the Proposed Action would be necessary. It is anticipated that existing lights under the first deck would be replaced by high-pressure sodium lamps as in the proposed action. Total annual lighting power consumption for Phase 1 is estimated at 1.919 million kilowatt hours with Phase 2 lighting power consumption rising to 2.323 million kilowatt hours. As under the Proposed Action, the heating loads would be substantially decreased by removal of pavement heaters in the helices. Even with lobby space heaters, power per heat is expected to drop from 400,000 kilowatt hours to 277,000 kilowatt hours with Phase 1 and then the drop further due to the removal of the second helix to 125,000 kilowatt hours when Phase 2 is implemented. The total annual heating and lighting loads should result in 2.146 million kilowatt hours for the years Phase 1 is in operation, then rise to 2.449 million kilowatt hours after Phase 2 is completed. This represents a 23 and 40% increase respectively over the present power consumption levels.

Transportation Energy

Construction of the Medium Build alternative would bring some temporary relief from the present parking shortages, but by 1987 the demand would again outstrip supply forcing some air passengers to change modes. It might be expected, therefore that the 1987 fuel consumption for transportation would be down slightly from that of the Proposed Action. The estimated fuel consumption for the Medium-Build alternative is 5.31 million gallons annually as compared to the 5.45 million gallons under the Proposed Action. By 1994, when Phase 2 would be fully operational, the estimated fuel consumption is 5.59 million gallons for the Medium-Build alternative versus the 5.78 million gallons for the Proposed Action. Average day of the peak month vehicle miles traveled and fuel consumed under the Medium-Build alternative are shown below in Table 40.

TABLE 40
TRANSPORTATION ENERGY CONSUMPTION MEDIUM-BUILD ALTERNATIVE

PHASE 1 1987 ADPM

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Consumed (Gallons)	Equivalent Energy (Millions 1/ of BTU's)
Taxi	1,923	21.66	41,652	27.1	1,536	192
Bus	46	8.5	391	5.0	78 2/	10.6
Limousine	162	21.56	3,493	20.5	170	21.3
Hotel/Motel Courtesy Car	262	14.28	3,741	20.5	182	22.8
Private & Rental Cars	13,384	25.64	343,165	24.6	13,950	1,743.4
Totals	15,777		392,442		15,916	1989.7

Annual Consumption: $\frac{(ADPM)}{(.003)}$

5.31 Million Gallons

663.2 Billion BTU's

1/ 1 Gallon of Gasoline = 124,950 BTU's
1 Gallon of Diesel Fuel = 136,000 BTU's

2/ Diesel Fuel

TABLE 40 (Con't)
TRANSPORTATION ENERGY CONSUMPTION MEDIUM-BUILD ALTERNATIVE

(PHASE 2 1994 ADPM)

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Consumed (Gallons)	Equivalent Energy (Millions 1/ of BTU's)
Taxi	2,156	21.66	46,699	27.5	1,698	212.2
Bus	52	8.5	442	5.0	88 2/	12.8
Limousine	181	21.56	3,902	20.5	190	23.8
Hotel/Motel Courtesy Car	293	14.28	4,184	20.5	204	25.5
Private & Rental Cars	14,918	25.64	382,497	26.2	14,599	1,824.2
Totals	17,600		437,724		16,779	2,097.7

Annual Consumption: $\frac{(ADPM)}{(.003)}$

5.59 Million Gallons

699.2 Billion BTU's

1/ 1 Gallon of Gasoline = 124,950 BTU's
1 Gallon of Diesel Fuel = 136,000 BTU's

2/ Diesel Fuel

ON-AIRPORT REMOTE PARKING ALTERNATIVE

Construction of a remote parking lot on the airport property would consume less construction energy than either the Proposed Action or the Medium-Build alternative. Estimates of energy costs for the Remote Parking alternative were prepared in the same manner as was used to estimate construction energy for the Proposed Action and the Medium-Build alternative. In the case of the Proposed Action and Medium-Build alternative, the accuracy of the energy estimates are a function of how much parking ramp construction deviates from the typical or average U.S. highway construction energy intensiveness. Despite this variability, the comparison of energy consumption (Proposed Action versus the Medium-Build alternative) is reasonable. In the case of the remote lot, the construction of a bituminous, paved, at-grade lot differs from the multi-level, pre-cast, steel-reinforced concrete structure of the other two alternatives. The remote lot may therefore differ from the others not only in the dollar cost, but in its energy intensiveness as well. The data and the model used to estimate energy consumption is not sensitive to the differences in construction types within the highway construction sector. As a result, some discrepancies may be introduced in the comparison of alternatives. The estimated energy consumption of the Remote Parking alternative is presented in Table 41.

TABLE 41

DIRECT AND INDIRECT CONSTRUCTION ENERGY CONSUMPTION
ON-AIRPORT REMOTE PARKING ALTERNATIVE

Energy Type	Energy Consumption
Coal	
BTU's	2.0×10^{10}
Tons	801
Crude Oil	
BTU's	8.88×10^{10}
Barrels	15,900
Refined Oil Products	
BTU's	6.38×10^{10}
Barrels	11,600
Electricity	
BTU's	3.39×10^{9}
Megawatts hours	992
Natural Gas	
BTU's	2.19×10^{10}
Million Cubic Feet	21.2
Net Primary Energy - BTU's	1.12×10^{11}

Parking Ramp Operations

Under the Remote Parking alternative, the existing lighting load is anticipated to be reduced due to the replacement of mercury vapor lamps with more efficient high pressure sodium lamps, as was assumed for the other alternatives. Additional lighting will be needed for the 32 acre remote lot. Remote lot lighting should add only 87,600 kilowatt hours annually to the total load. An additional 18,960 kilowatt hours are estimated to be used for the heating of the cashier's booth at the remote lot. This would bring the total annual consumption for parking up to 1.607 million kilowatt hours, slightly more than 8% reduction from the present levels.

Transportation Energy

Under the Remote lot alternative, shuttle bus service from the remote lot to the terminal is added to the vehicle miles traveled associated with getting to and from the airport. The shuttle bus was assumed to be a typical diesel powered transit bus with a fuel economy of 5 miles per gallon. The option is assumed to have more taxis, lines, courtesy cars and fewer private cars and rental cars than the Proposed Action but the shuttle bus fuel consumption balances off these effects making the Remote alternative nearly identical to the Proposed Action. Minor changes in fuel economy assumed for any of the vehicles could change the outcome. The vehicles, VMT, and fuel consumed under the Remote alternative are shown on Table 42 below.

TABLE 42
TRANSPORTATION ENERGY CONSUMPTION ON-AIRPORT REMOTE PARKING ALTERNATIVE

(1987 ADPM)

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Consumed (Gallons)	Equivalent Energy (Millions 1/ of BTU's)
Taxi	1,658	21.66	35,912	27.1	1,325	165.6
Bus	43	8.5	365	5.0	73 2/	9.9
Shuttle Bus	103	6.0	615	5.0	123	16.7
Limousine	151	21.56	3,255	20.5	159	19.8
Hotel/Motel Courtesy Car	245	14.28	3,499	20.5	170	21.3
Private & Rental Cars	13,858	25.64	355,319	24.6	14,444	1,804.8
Totals	16,058		430,452		16,294	2,038.1

Annual Consumption: (ADPM) / (.003)

5.43 Million Gallons

679.4 Billion BTU's

1/ 1 Gallon of Gasoline = 124,950 BTU's
1 Gallon of Diesel Fuel = 136,000 BTU's

2/ Diesel Fuel

TABLE 42 (Con't)
TRANSPORTATION ENERGY CONSUMPTION ON-AIRPORT REMOTE PARKING ALTERNATIVE

(1994 ADPM)

Mode	No. of Vehicles	Average Round Trip (Miles)	Vehicle Miles Traveled	Fuel Economy (mph)	Fuel Consumed (Gallons)	Equivalent Energy (Millions 1/ of BTU's)
Taxi	2,027	21.66	43,904	27.5	1,597	199.5
Bus	49	8.5	417	5.0	83 2/	11.3
Shuttle Bus	153	6.0	915	5.0	183	24.8
Limousine	170	21.56	3,665	20.5	179	22.3
Hotel/Motel Courtesy Car	276	14.28	3,941	20.5	192	24.0
Private & Rental Cars	13,858	25.64	355,319	24.6	14,444	1,804.8
Totals	18,139		449,339		17,367	2,172.8

Annual Consumption: $\frac{(ADPM)}{(.003)}$

5.79 Million Gallons

724.3 Billion BTU's

1/ 1 Gallon of Gasoline = 124,950 BTU's
1 Gallon of Diesel Fuel = 136,000 BTU's

2/ Diesel Fuel

SOCIO-ECONOMIC IMPACTS

NO-BUILD ALTERNATIVE

Regional Economic Impact

The No-Build alternative will have no major regional economic impact unless it is combined with an alternative management strategy.

Parking Management Strategies

The effects of a No-Build alternative should cause a major impact on the present parking management strategy as practiced by the Metropolitan Airports Commission. The curent policy is to assure that passengers and visitors will not be turned away from the terminal because of lack of parking. This policy is accomplished by providing convenient low price parking that meets the demand. If enplanements do, in fact, increase as projected, this policy will be unattainable in very short order. New policies that reflect the thought that an airport is really a transportation mode switching station rather than a parking lot for airplane users will have to be developed. Additional consideration will have to be given to pricing policies as they reflect on the revenues needed to offset other MAC functions.

For purposes of this Environmental Impact Statement, three general parking strategies have been developed and reviewed.

- Continuation of the current strategy that calls for convenient low price parking so that no one will be turned away from the terminal because of lack of parking.
- Adjustments in parking rates to achieve a balance of supply and demand.
- Utilization of other transportation modes to deliver and pick up air passengers.

Socio-Economic Effects

The impact of the first strategy, the status quo, will be significant during the short run especially for the sociological related factors. As enplanements increase (demand) and parking supply stays static many travelers and visitors will not be able to park as illustrated in Figure 43. This unmet expectation will, over the short run, manifest itself as missed planes, dissatisfaction with the MAC and general confusion. In the long run the most frequent users of the airport will adjust and rely on other modes of transportation to get to and from the airport. Obviously this condition will not be consistent with current parking policy.

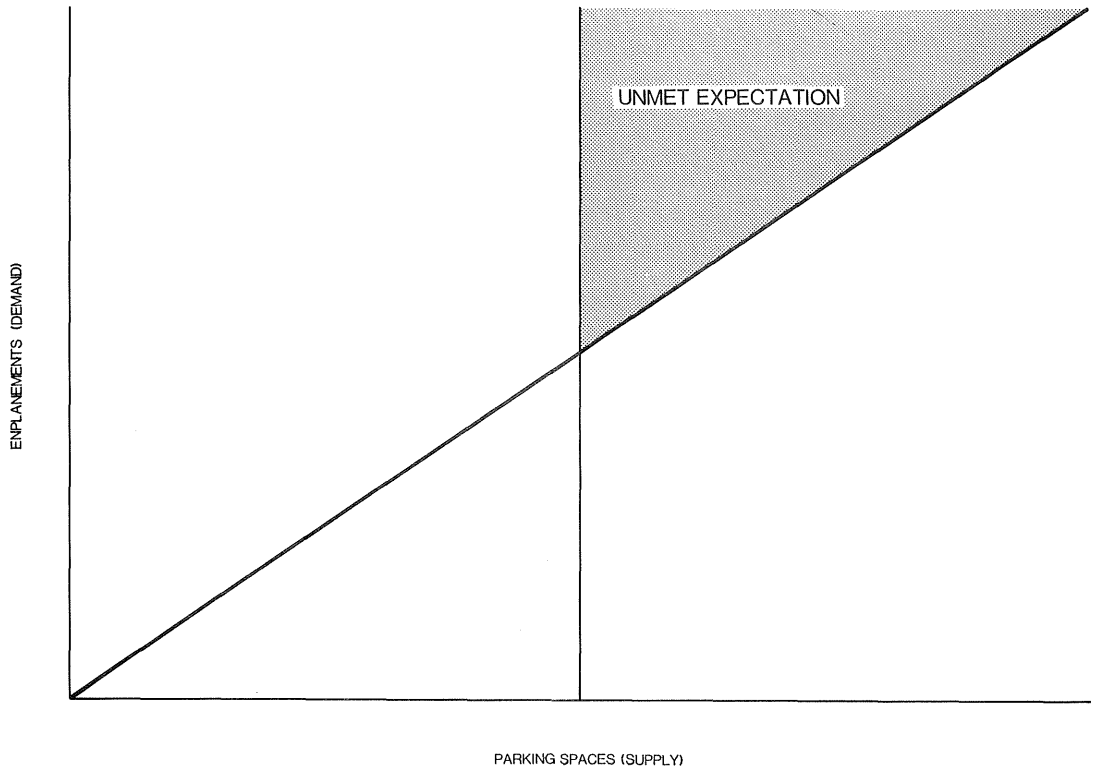


FIGURE 43
HYPOTHETICAL SUPPLY/DEMAND CURVE

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

AIRPORT PARKING
EXPANSION PROGRAM
DRAFT-EIS

BATHER.RINGROSE.WOLSFELD.JARVIS.GARDNER

If the status quo leads to incompatibility with current policy, then a logical choice is to modify the policy or change the strategy so as to be consistent. This new policy would be of little consolation to the infrequent user who may not have an understanding of the parking problem and has just missed a plane. Under the No-Build alternative the existing policy will have to be changed.

The second strategy centers around changes to achieve a balance of supply and demand. The MAC is a parking monopoly (producer of a product that has no close substitute). The current parking problem is akin to that of the public electric utility that must build to peak load except the peak parking demand is not generally controlled by the market place. (The electric utility peak load can be changed by the user doing more tasks at other than peak times.) Peak time at the airport is more a function of flight times and schedules than the convenience of user. Therefore, it appears that the MAC is somewhat limited in its options that would affect parking rates and turnover.

The current parking strategy calls for the allocation of 2,633 spaces to what is called long term parking and 438 spaces for short term parking. New rates went into effect July 1, 1978, which call for $1.00 per hour with no maximum in the short term lot and $4.00 per day maximum in the long term parking lot. The long term rates are an almost negligible expense as compared to the average plane fare, and hence, offer an area for strategy change.

One method of meeting the policy that no one be turned away is to transform the long term parking to short term parking thereby encouraging pick-up and drop-off and discouraging long term over night parking. High parking fees would be needed to accomplish this change since the 1970 Transportation Study indicated that 63 percent of all trips are for business purposes (most costs can be passed on) and that 40 percent of the air patrons had a 1970 income in excess of $20,000.

Information on parking and automobile usage suggests that personal usage is very insensitive to the imposition of higher rates. Data from a number of studies indicate a demand elasticity of around -0.3 for most work trips. If for example, parking rates were $2.00 per day, an increase of $2.00 per day would result in only a 22 percent drop in the utilization of spaces. Over the history of the airport, this premise seems to hold true as documented in Table 43.

Only in 1969 did any significant changes occur after a rate change and that may be a function of a enplanements as documented in Table 44 or the effects of a higher fee in a pre-inflation economy.

Indications from both major cab companies are that even a doubling of the current rate would not cause a mode switch. Therefore, it may be appropriate to adjust rates on a scale that severely penalizes the parker after 3 hours. Fees such as $.50 for the first one-half hour and $1.00 for each half-hour up to three, or $5.50 for 3 hours, and doubling each hour thereafter would, while being controversial, probably achieve the desired results.

TABLE 43

IMPACT OF RATE CHANGES ON PARKING DEMAND AT
MINNEAPOLIS-SAINT PAUL INTERNATIONAL AIRPORT

Source: Metropolitan Airports Commission

Month and Year	General Parking Lot	24-Hr. Fee	Terminal Garage	24-Hr. Fee	Overflow Parking Lot	Short Term Parking Lot	24-Hr. Fee
September, 1969	92,413	$1.50	11,098	$2.50	2,542	Not in Operation	
November, 1969 Rate Change	65,029	$2.25	11,171	$4.50	10,467	Not in Operation	
June, 1974	89,136	$2.25	15,175	$4.50	2,869	57,155*	$6.00
July, 1974 Rate Change	89,691	$2.75	13,676	$4.50	1,549	56,671	$6.00
June, 1976	84,608	$2.75	13,597	$4.50	2,118	67,546	$6.00
July, 1976 Rate Change	88,352	$3.00	12,721	$5.40	1,827	72,175	$6.00

*Opened 7/1/73 at same rates as July 1, 1974.

TABLE 44

NET ENPLANED PASSENGERS DURING PARKING RATE CHANGES
Source: Metropolitan Airports Commission

Month and Year	Enplanements
September, 1969	224,111
November, 1969	202,767
June, 1974	316,068
July, 1974	301,435
June, 1976	334,123
July, 1976	335,795

While there are many ways of achieving the same results, all methods should be structured so as to reduce long-term parking and to encourage short-term parking. Some short-term negative socioeconomic effects would be felt under this method but over time experience and the market place should accommodate the appropriate adjustments.

The third strategy attempts to promote alternative modes of travel to and from the airport. While it is most likely that this strategy would be done in conjunction with a change in short-term/long-term parking, it could be promoted under the status quo. While there are a number of alternative modes that could be considered, the most likely are:

- o Taxi cab service.
- o MTC bus service.
- o MAC supported bus service.
- o Light rail transit from the two CBD's.

The economic impacts of alternative modes would be quite high given a No-Build alternative. Additional purchases would be required for new equipment and new jobs would be created, all adding to the Metropolitan economic base. On the negative side, economic and social disinvestment could occur if additional land were to be purchased for the light rail right-of-way. Most of the negative social impacts would be limited to the period of transition and would tend to be reduced over time.

Indications are that the increase in taxi cab service would require the least public cost to implement. Based on the 1970 study by Bather-Wolsfeld, the five zones with the highest number of house-based air passenger trips were Hopkins, Wayzata, Southwest Edina and two zones in West Bloomington. Figure 44 presents the existing one-way taxi fare between the airport and locations in the Metropolitan area. Four of the five zones are within $12.00, current cab fare from the Airport. Wayzata is in the $16.00 current cab fare range. Non-house based trips likewise are within reasonable cab fares from the airport and both Central Business Districts are within the $8.00 cab fare from the airport. Any of these fares could be considered within the "trade off" range when compared to the option of higher parking rates.

The other alternatives; MTC bus service, MAC bus service and light rail transit, would all require significant public support. While it is likely that any one of the modes would require public spending in excess of the cost for the parking ramp they may prove cost effective in the long run. As the costs of energy, air quality and time become more of a factor in transportation, alternatives will become cost effective. If, in fact, enplanements continue to increase, they may prove to be the only realistic way to meet the airport's transportation needs in the future. Consideration should be given to them as long-range solutions to the problem, especially since the projection of need was done prior to the approval of overseas flights and a general reduction of domestic air fares.

Any parking management strategy associated with the No-Build alternative will have negative short-term socio-economic impacts. However, missed planes, delays, and confusion can be mitigated by proper planning and public information.

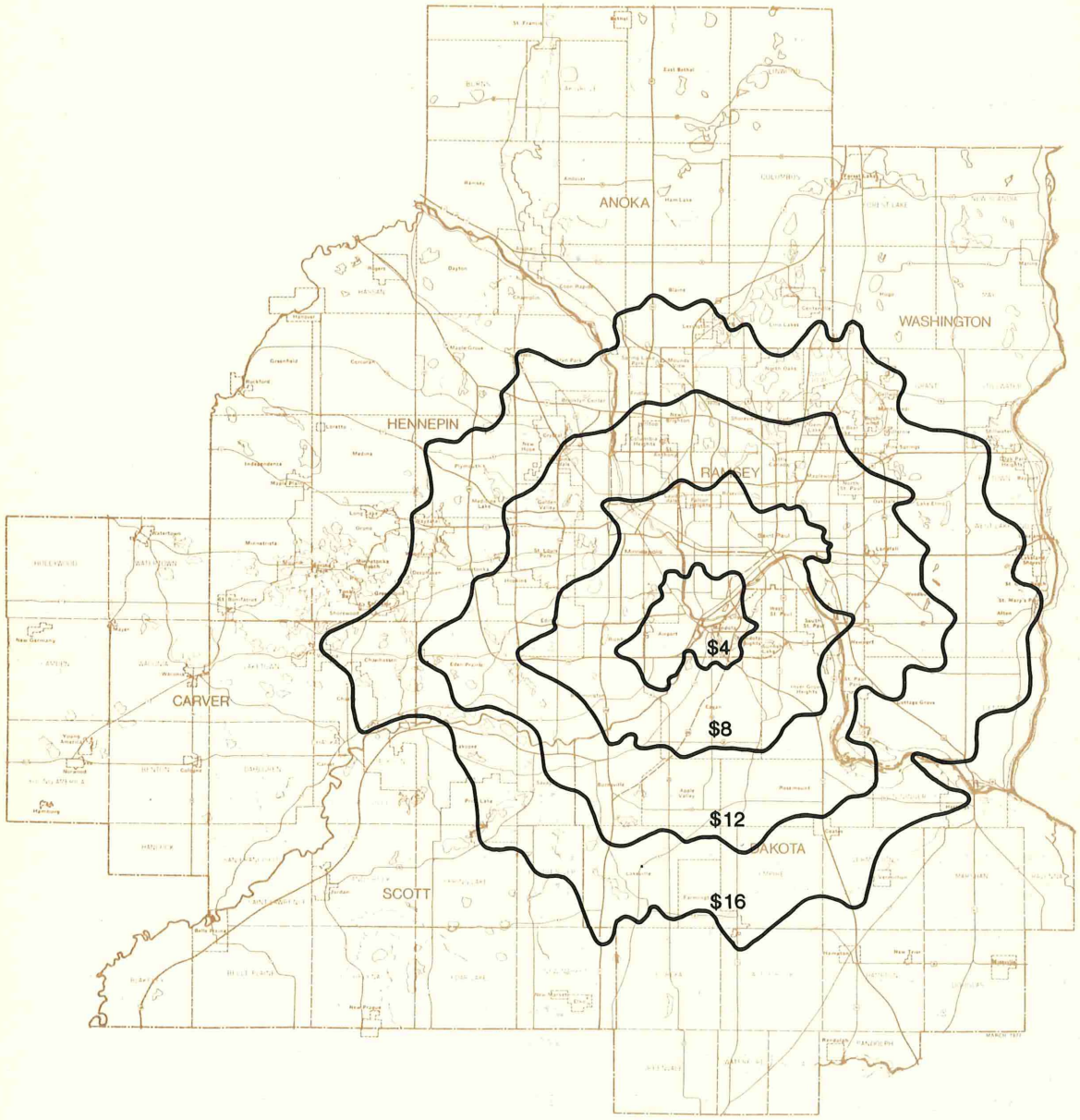


FIGURE 44

1978 CAB FARE ZONES

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

AIRPORT PARKING
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MEDIUM BUILD ALTERNATIVE

Regional Economic Impact

The Medium-Build alternative consists of two phases of construction valued at 12.7 million dollars. As stated in the evaluation of the Proposed Action the single most important economic consideration is the short-term effects of the new construction.

The SIMLAB analysis yielded the estimates of employment impacts as shown in Table 45.

TABLE 45

EMPLOYMENT IMPACTS OF THE MEDIUM BUILD ALTERNATIVE

Employment Type	Worker Years in: 1979-80	1981-82
Direct Construction	59	59
Inter-industry	26	26
Induced	36	36
Total Employment	121	121

As the Medium-Build alternative is to be financed by the sale of revenue bonds, no negative impacts will be incurred on any regional tax levy nor on any established debt limits.

Parking Management Strategies

The Medium Build alternative will require some degree of strategy change. Limited on-site expansion will ultimately necessitate policies similar to those reviewed under the No-Build alternative.

Socio-Economic Effects

Like the parking management strategies the socio-economic effects of a Medium-Build alternative will be somewhere between the No-Build alternative and the Proposed Action. The primary effect of the Medium-Build alternative is that it does not solve the ultimate parking problem.

REMOTE PARKING ALTERNATIVE

Regional Economic Impact

The regional impact of the Remote Parking alternative as obtained from the SIMLAB model yields the results shown in Table 46 based upon the estimate of $2 million dollars of construction.

TABLE 46

EMPLOYMENT IMPACTS OF THE ON-AIRPORT REMOTE PARKING ALTERNATIVE

Employment Type	Worker Years
Direct Construction	4.5
Inter-industry	2.0
Induced	2.5
Total Employment	9.0

Like the other alternatives, revenue bonds will be sold to finance the construction and therefore will not affect any regional tax levy nor any established debt limits.

Parking Management Strategies

Remote parking will require policy changes that take into account the need for a shuttle mode of transportation between the lots and the terminal. This new policy will likely have a fiscal impact on the MAC as it will require additional vehicles, personnel, and maintenance.

Socio-Economic Effects

The primary effect of the Remote Parking alternative from the socio-economic perspective will be in the inconvenience caused by the change from the current parking habits to the new scheme. As with the other alternatives, most negative impacts will be mitigated by planning, public information, and the passage of time.

AESTHETIC IMPACTS

NO-BUILD ALTERNATIVE

The No-Build alternative will create no change in the existing aesthetics at the airport and, as a consequence, no adverse impacts will result.

MEDIUM-BUILD ALTERNATIVE

The Medium-Build alternative will have virtually the same aesthetic impact as the Proposed Action except at a slightly reduced scale. The primary impacts will be construction related in the short term and the permanent loss of views both toward the terminal building and out from the terminal building. These impacts can be mitigated through attention to architectural design details and the development of a landscaping program to enhance the pedestrian environment around the terminal.

ON-AIRPORT REMOTE PARKING ALTERNATIVE

Very minimal aesthetic disruption will be caused by the Remote Parking alternative. The major impacts will be in the immediate vicinity of the parking lot itself. However, the parking lot is within the secured area of the airport and will not be generally apparent to anyone except the parking lot user.

VEGETATION / WILDLIFE IMPACTS

NO-BUILD ALTERNATIVE

The terminal area presently has no vegetation or wildlife of any ecological significance. Maintaining the status quo will not change that. The only concern is the quality and treatment of stormwater runoff which is presently being studied.

MEDIUM BUILD ALTERNATIVE

Construction and operational impacts will be essentially similar to those discussed under the Proposed Action. However, with only five levels rather than seven the construction period would be shortened and less demand would be placed on stormwater treatment facilities. Operational impacts would be similar to those discussed under the Proposed Action but would be somewhat less because of fewer parking stalls.

ON-AIRPORT REMOTE PARKING ALTERNATIVE

Construction of a surface parking lot wil. convert 32 acres of grassland to a hard surface parking facility. Even though the site has been graded in the past, surface runoff is reduced by the presence of vegetated soil. Conversion to hard-surfaced parking will increase runoff. Issues addressed in the Proposed Action regarding hydrocarbon chemicals and litter in storm-water runoff apply equally well here. Presently runoff from this sector of the airport discharges directly into the Minnesota River but will be diverted to a treatment facility in the near future.

During construction, since a large area of soil will be temporarily exposed to the erosive forces of rain, precautionary measures will be needed to prevent large quantities of sediment from entering the storm water drainage system. Use of temporary barriers to confine runoff should be used where appropriate. Construction should be phased so that vegetative cover can be mainained as long as possible before grading and application of hard-surfacing materials.

It is recommended that the monotony of the large flat parking surface be broken up by the use of landscaping materials. The use of trees and shrubs would provide visual refreshment to users of the parking lot. Eventually as the trees grew larger they would also provide shade which would keep the interior temperature of the car cooler making for a more comfortable environment when the owner returns.

The site, while generally a low quality wildlife habitat, provides food and cover primarily for white-tailed jackrabbits; some of the grassland-nesting sparrows may also utilize the site but none were observed.

At the time of the site inspection (June 16, 1978) the grass was 12 to 16 inches high. Cover density of the grasses was light though continuous. MAC employees reported that the grass is mowed approximately once per month.

During a visit to the site, four jackrabbits were flushed. Construction of a hard surface parking lot would convert the grassland to uses which are non-productive for wildlife. However, in terms of wildlife productivity loss of this habitat is not significant. Other higher quality habitat exists southeast of Fort Snelling National Cemetery, northwest of Runway 4 and in the vicinity of Mother Lake. The MAC should strive to maintain and conserve the existing open space within its jurisdiction in these areas. Grassland within 1/4 mile of any wetlands should not be moved until July 1 and preferably not until July 15 to prevent destruction of nests.

Landscaping the parking lot would not only provide shade for vehicles left there but could provide minimal habitat for some of the songbirds. Development of such minimal habitat should not have any effect on aircraft safety since comparable habitat exists between 63 and 66th Streets at the end of Runway 11R/29L and there have been no reported problems concerning bird strikes by aircraft reported since 1960.

During the operation period, some animals stray onto the parking lot but since traffic generally moves slowly through such areas, wildlife mortality is expected to be negligible.

HISTORIC / CULTURAL IMPACTS

The three alternatives to the Proposed Action will not have any adverse impacts upon any historic or cultural resources in the vicinity of the airport. As was indicated for the Proposed Action, a review of the proposal was made by the Minnesota Historical Society which determined that no sites of historic, architectural, cultural, or archaeological significance exist within the area of the Proposed Action or its alternatives.

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CHAPTER VII
COMPARISON OF ALTERNATIVES

THIS CHAPTER SUMMARIZES THE IMPACTS OF THE PROPOSED ACTION AND COMPARES THEM WITH THE CORRESPONDING IMPACTS OF THE ALTERNATIVES CONSIDERED. THE MOST SIGNIFICANT IMPACTS AND THE MAJOR DIFFERENCES BETWEEN ALTERNATIVES ARE EMPHASIZED.

PURPOSE

Presented in Table 47 is a comparison matrix of the significant impacts of the Proposed Action and the alternatives to the Proposed Action. The tabulated information is intended to provide an overview of the detailed analysis presented previously and to assist in evaluating the trade-offs inherent in the alternative solutions to the airport parking problem.

MAJOR FINDINGS

A review of the summary data presented in Table 47 indicates that there are generally three types of impacts. The first group of impacts are minor or generally insignificant in terms of their adverse effects. These include the socio-economic, aesthetics, vegetation, wildlife and historic/cultural impacts.

The second group of impacts include those areas which are of particular concern but which are only partially the result of providing additional parking at the airport or which will be mitigated by other activities currently being pursued. These impacts include travel demand, noise, water quality, and energy. The impacts upon travel demand result in moderate shifts in mode split and minimal changes in traffic volumes on the regional road system. However, the whole issue of the future of mass transit, future highway capacity needs, and growth in air travel are intimately related to much broader issues such as Metropolitan Policy, transportation funding capabilities, and the national economy. This is also true relative to energy consumption, especially transportation energy, which is affected by the national balance of trade and a national energy policy. Noise impacts and water quality impacts which are directly attributable to the provision of parking at the airport are insignificant. The larger issue of mitigating aircraft noise and of controlling pollutant discharges into the area's natural waterways are of sufficient magnitude as to warrant special studies and specific mitigating measures. The aircraft noise problem is being addressed cooperatively by the MAC and the MPCA and special stormwater treatment facilities are being planned in order to conform to NPDES limits.

The third impact group involves those impacts which are both significant and which relate directly to the existing and planned parking program at the airport. Such impacts relate solely to air quality which has been identified as a serious problem for which a satisfactory mitigating measure must be found. Based upon extensive wind tunnel tests it has been determined that in order for the MAC to proceed with a parking expansion program, a wind deflector must be erected in front of the terminal building roof line prior to the second phase construction.

TABLE 47

COMPARISON MATRIX OF SIGNIFICANT IMPACTS
(7 Million Annual Enplanements)

Impact Area	Proposed Action	Alternatives		
		No Build	Medium-Build	Remote Parking
Travel Demand				
Inbound Airport Traffic (vpd)	18,100	17,300	17,600	18,100
% Private/% Public	75.9/24.1	68.9/31.1	71.6/28.4	75.3/24.7
Capacity Restraints	None	None	None	None
Air Quality (CO) Violations				
Phase 1	None	1 Hr. and 8 Hr. Violations	1 Hr. and 8 Hr. Violations	1 Hr. and 8 Hr. Violations
Phase 2	None - with Erection of wind Deflector Device in Front of Terminal Roof during Phase 2 Construction	None	None	None
Noise				
Construction Impacts	Significant-Short Term	None	Significant-Short Term	Insignificant
Highway Traffic	Highway Traffic Noise is a Significant, Existing Impact under all Actions. None of the Actions Significantly Alter the Existing Situation.			
Aircraft Operations	Aircraft Operations Noise is a Significant, Existing Impact under all Actions. None of the Actions Significantly Alter the Existing Situation.			
Water Quality				
Additional Runoff	None	None	None	Insignificant
Runoff Quality	Existing Runoff from the Airport Requires Treatment to Meet NPDES Permit Limits. None of the Actions Alter this Requirement.			

TABLE 47 (Con't)
COMPARISON MATRIX OF SIGNIFICANT IMPACTS
(7 Million Annual Enplanements)

Impact Area	Alternatives			
	Proposed Action	No Build	Medium-Build	Remote Parking
Energy				
Construction (BTU's)	1.06×10^{12}	None	7.2×10^{11}	1.1×10^{11}
Parking Operations (KWH/Yr.)	3.3×10^{6}	1.5×10^{6}	2.5×10^{6}	1.6×10^{6}
Transportation (Gals/Yr.)	5.8×10^{6}	5.5×10^{6}	5.6×10^{6}	5.8×10^{6}
Socio-Economics				
Worker Years	360	None	242	9
Duration of Negative Social Impacts	Short Term	Long Term	Long Term	Long Term
Social Acceptance of Airport Access	Yes	Requires Significant Mode Switch	Requires Significant Mode Switch	Requires Acceptance of Shuttle Bus Service
Aesthetics	Loss of View of Main Terminal Building Folded Plate Roof Loss of Open View out from the Terminal Building	None	Loss of View of Main Terminal Building Folded Plate Roof Loss of Open View out from the Terminal Building	Insignificant
Vegetation	None	None	None	Insignificant Loss of 32 Acres of Timothy and Brome Grass
Wildlife	None	None	None	Insignificant Loss of 32 Acres of Marginal Wildlife Habitat
Historic/Cultural	None	None	None	None

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CHAPTER VIII
OPTIONS TO PROVIDE PARKING BEYOND THE PROPOSED ACTION AND THEIR IMPACTS

THIS CHAPTER EXPLORES THE VARIOUS OPTIONS AVAILABLE TO PROVIDE ADDITIONAL PARKING BEYOND THE NEEDS FORECASTED FOR SEVEN MILLION ANNUAL ENPLANEMENTS. THE ANALYSIS COVERS A TIME PERIOD OF APPROXIMATELY THIRTY YEARS WHICH CORRESPONDS TO THE ULTIMATE CAPACITY OF THE EXISTING MAIN TERMINAL COMPLEX OF TEN MILLION ANNUAL ENPLANEMENTS.

DESCRIPTION OF OPTIONS

ANALYSIS TIME FRAME

The Proposed Action, and the alternatives to the Proposed Action, have been analyzed within a time frame covering approximately 15 years. The air passenger activity forecast compatible with this time period is 7 million annual enplanements. As identified in the Comprehensive Master Plan for Wold-Chamberlain Field, the ultimate capacity of the main terminal area is 10 million annual emplanements which is forecasted to occur in the year 2009.

LONG TERM VARIABILITY OF EXISTING DEMAND MEASURES

During the recent study of airport parking characteristics, it was determined that the parking demand index for Minneapolis - St. Paul International Airport is 1300 parking spaces per million annual enplanements. This conclusion was based upon data which also indicated that approximately 32% of the daily parking demand was generated by long term, overnight parkers. In addition, daily turnover per parking space was reported to be 1.732. To further expand upon the existing parking characteristics, data relative to 1977 parking durations was obtained for each parking subarea as listed in Table 48.

TABLE 48

PARKING DURATION CHARACTERISTICS WOLD-CHAMBERLAIN FIELD - 1977

Source: Metropolitan Airports Commission

Parking Subarea	% Parkers by Duration Period		
	0-4 Hours	4-24 Hours	Over 24 Hours
Short Term Lot	97.5	1.4	1.1
Long Term Lot	62.9	11.6	25.5
Overflow Lot	63.4	5.8	30.8
Garage	56.5	15.4	28.1
Internation Charter Lot	94.9	2.2	2.9
Composite	77.8	7.1	15.1

It will be noted that between 25% and 30% of the long-term parkers stayed more than 24 hours and that a proportion of long term parkers that parked from 4 to 24 hours would also result in some additional overnight parking. It is apparent from the data that the high proportion of long term, overnight parkers is limiting the daily turnover per space parameter (1.732) from increasing and alos preventing the parking demand index (1300 spaces per million enplanements) from decreasing. If their long term parkers can be shifted to alternative ground access modes or if alternative parking locations can be found away from the main terminal complex, fewer parking spaces would be required in the central parking area. These possiblities led to the definition of the three future options to provide parking beyond the Proposed Action as described below.

- o No Build Option. This option consists of retaining the parking supply of the Proposed Action to serve 10 million annual enplanements. Under this option the future air passenger travel demand would be allocated to other modes of travel including private auto pickup and drop-off.

- o In-Terminal Structural Parking Option. This option consists of constructing additional parking spaces in the central parking area in two multi-level parking structures. The total parking supply provided under this option is 13,000 parking spaces in keeping with the existing parking demand index of 1300 parking spaces per million enplanements.

- o On-Airport Remote Parking Option. This option is identical to the On-Airport Remote Parking alternative to the Proposed Action. approximately 3600 remote parking spaces would be constructed as a surface parking lot on the vacant property in the vicinity of the Medical Clinic immediately north of I-494 at 26th Avenue. This option reflects the desire to provide reduced rate parking for long term parkers away from the main terminal complex.

Each of these options are analyzed in terms of the impact areas previously analyzed relative to the Proposed Action and its alternatives. In many cases the impacts of the future options are identified to the impacts of the Proposed Action or one of its alternatives and are so noted. Where significant differences occur, a detailed discussion is presented.

TRAVEL DEMAND IMPACTS

TRAFFIC FORECASTS AND MODE SPLIT

Travel demand forecasts have been made for each of three options along with mode split estimates. This information is presented in Table 49 and indicates the relative impact of providing various amounts of parking and in alternative locations. Also presented in the tabulation is a forecasted travel demand and mode split for the existing 5200 space parking supply serving 10 million enplanements. This provides a basis for comparing the values listed for the various options with a scenario of no additional parking at the airport beyond the 1977 parking supply.

TABLE 49

MODE SPLIT FORECASTS FOR OPTIONS TO PROVIDE PARKING BEYOND THE PROPOSED ACTION

(10 Million Enplanements)

	Options							
	No-Build		In-Terminal		Remote		Existing 5200 Spaces	
Mode	Vol.	%	Vol.	%	Vol.	%	Vol.	%
Private Auto	16,400	75.5	18,000	80.4	17,900	79.9	13,600	69.1
Rental Car	1,800	8.3	1,800	8.0	1,800	8.0	1,800	9.1
Taxi	2,120	9.8	1,310	5.8	1,380	6.2	2,850	14.5
Limousine	320	1.5	280	1.3	300	1.3	360	1.8
Courtesy Car	460	2.1	460	2.1	460	2.1	460	2.3
Bus	100	0.5	50	0.2	60	0.3	130	0.7
Other	500	2.3	500	2.2	500	2.2	500	2.5
Totals	21,700	100.0	22,400	100.0	22,400	100.0	19,700	100.0

TRANSPORTATION SYSTEM CAPACITY

No-Build Option

The No-Build option is characterized by a parking supply of approximately 9400 parking spaces serving an alternative air passenger travel demand of 10 million annual enplanements. The most significant impacts of the no-build option are to increase taxi and transit (bus) requirements by approximately double their existing levels and to provide parking in the terminal area at a rate of approximately 940 parking spaces per million enplanements. In addition, while total private auto travel to the airport is reduced relative to the in-terminal structured parking option, a significant increase in private auto curbside activity results.

The consequences of increasing the demand for taxi and transit service will be to increase the taxi market throughout the metropolitan area while the transit demand will require an expansion of existing service levels in terms of additional bus vehicles and bus miles of service. The existing transit services to the airport have operating ratios (route revenue divided by the cost of service) ranging from 0.20 to 0.42. 1/ The recent trend has been for this ratio to decrease due to escalating costs relative to fixed fares. Under the present performance funding legislation the MTC has had to reduce service rather than expand service. However, the 5 year Transportation Development Program 2/ calls for modest service increases in the future which could result in increased service to the airport if ridership levels warrant. Beyond these short term plans, the long range transit plan (beyond the year 2000) is not well defined. Proposals for automated, fixed guideway systems (e.g. light rail in the Hiawatha corridor) have not received formal approvals or committments. However, in view of the thirty year time frame before 10 million annual enplanements are reached, transit options other than the conventional bus may prove feasible. Thus, the viablity of the no-build option beyond the proposed action should not be foreclosed at this time.

Should a viable taxi/transit mode of travel develop which is accessible by air passengers, the expectation is that the primary market served would be former long term parkers. As a result, the parking demand index of 1300 parking spaces per million enplanements could be reduced to approximately 900 parking spaces per million enplanements. This translates into a parking demand of 9000 spaces in the year 2009 to serve an air passenger activity level of 10 million enplanements.

1/ Existing Transit Service, South Hennepin Route Ridership Improvement Project, June, 1976.

2/ Transportation Development Program (Draft), MTC, March, 1978.

The added demand on curbside space as a result of the increased use of taxis and private autos for pick-up and drop-off functions is not expected to be a problem. The MAC, in order to meet the landside requirements of 10 million annual enplanements has plans to expand the Green and Gold concourses in order to provide the necessary ticketing and baggage claim facilities. As a part of this expansion, curbside area will be expanded also.

The regional traffic volume forecasts for the No-Build option are shown in Figure 45 and Table 50 along with the proportion of traffic attributable to the airport. In addition the capacity of the regional road system is indicated and documents that the future volumes cannot be accommodated at an acceptable level of service on all segments of the surrounding highway system. The most significant deficiencies occur on the TH 5 over the Mississippi River, TH 55 between the Crosstown and Mendota Bridge, and on I-494 in the vicinity of Cedar Avenue.

These capacity deficiencies are not critical in terms of overall airport accessibility since they relate more directly to metropolitan transportation needs than to airport needs. Further, the base forecasts depicted are from system forecasts developed by the Metropolitan Council and are subject to further refinement and adjustment. One area of refinement which is yet to be incorporated into the metropolitan system assignments is the way in which airport related traffic assignment zones are loaded onto the network. This refinement will result in a revised set traffic volumes on the roadway links in the vicinity of the airport. Another factor which could affect the magnitude of the assigned traffic volumes in the airport area is the total travel attributable to the airport itself. The metropolitan system assignments allocate more than 80,000 vehicles per day to and from the main terminal complex while the analysis contained within this EIS projects approximately 60,000 vehicles per day at 10 million annual enplanements. If all airport related traffic is removed from the road system, capacity deficiences would remain of I-494 at Cedar Avenue and TH 5 across the Mississippi River.

TABLE 50

REGIONAL TRAVEL DEMAND NO-BUILD OPTION

(10 Million Enplanements)

Roadway	Location	Daily Traffic (vph)	ADT Capacity (vph)	Airport Traffic (vph)	% Airport Traffic
T.H. 5 (No.)	Airport Entrance	78,500	90,000	23,700	30
T.H. 5 (So.)	Airport Entrance	66,600	90,000	29,600	44
Mendota Bridge	--	41,600	60,000	3,800	9
T.H. 5	North of T.H. 5	80,000	60,000	13,300	17
T.H. 55	North of Crosstown	58,000	60,000	2,800	5
T.H. 55	South of Crosstown	70,200	60,000	6,600	9
Crosstown	West of T.H. 55	23,500	60,000	3,800	16
Crosstown	West of Cedar	43,100	60,000	5,900	14
I-494	East of Cedar	120,000	90,000	26,700	22
I-494	West of Cedar	105,100	90,000	21,300	20
Cedar Ave.	North of I-494	41,500	60,000	2,700	7
I-494 Bridge	--	62,600	90,000	2,900	5

In-Terminal Structured Parking Option

This option is characterized by the provision of 13,000 parking spaces in the central parking area to serve the ultimate air passenger activity levels of 10 million annual enplanements. This option is a continuation of the Proposed Action in that the parking ratio of 1300 parking spaces per million annual enplanements is extended to the ultimate capacity of the airport.

The consequences of this option are to expand the general usage of the private auto for airport access including both general parking and curbside pick-up and drop-off. Slightly more than 80% of the vehicular traffic associated with the airport under this option is private auto. The total vehicular traffic forecasted to access the terminal complex area is 22,400 vehicles per day. The impact of this traffic upon the roadway system is documented in Figure 46 and further summarized in Table 51. As was the case with the No-Build Option, the forecasted traffic volumes exceed the capacity of the adjacent road system in three places. TH 5 across the Mississippi River is approximately 33% over capacity, TH 55 south of the Crosstown is approximately 17% over capacity. As was discussed relative to the No-Build option, these capacity deficiencies are subject to modification based upon adjustments to the regional travel assignment model. In any event, these capacity deficiencies have been determined to be only partially the result increased travel to the airport. In fact, if all airport traffic is removed from the roadway system, capacity deficiencies would continue to exist at I-494 and Cedar Avenue and on TH 5 across the Mississippi River.

TABLE 51

REGIONAL TRAVEL DEMAND IN-TERMINAL STRUCTURED PARKING OPTION

(10 Million Enplanements)

Roadway	Location	Daily Traffic (vph)	ADT Capacity (vph)	Airport Traffic (vph)	% Airport Traffic
T.H. 5 (No.)	Airport Entrance	78,800	90,000	24,000	30
T.H. 5 (So.)	Airport Entrance	67,000	90,000	30,000	45
Mendota Bridge	--	41,600	60,000	3,800	9
T.H. 5	North of T.H. 5	80,100	60,000	13,400	17
T.H. 55	North of Crosstown	58,100	60,000	2,900	5
T.H. 55	South of Crosstown	70,400	60,000	6,800	10
Crosstown	West of T.H. 55	23,600	60,000	3,900	17
Crosstown	West of Cedar	43,200	60,000	6,000	14
I-494	East of Cedar	120,300	90,000	27,000	22
I-494	West of Cedar	105,400	90,000	21,600	20
Cedar Ave.	North of I-494	41,500	60,000	2,700	7
I-494 Bridge	--	62,700	90,000	3,000	5

On-Airport Remote Parking Option

This option is characterized by the provision of 9400 parking spaces in the main terminal complex plus another 3600 remote parking spaces located along 26th Avenue just north of I-494. The remote parking spaces would be reduced rate parking spaces which are intended to attract long term parkers away from the central parking area.

In order to make the remote parking facility attractive to the air passenger, it is necessary to provide frequent shuttle bus service between the parking lot and the terminal building. Such a service must operate a minimum of twenty-one hours per day and on a frequency of five or ten minutes. This type of bus service is expected to cost the MAC approximately per year. 1/

The most significant impact of the Remote Parking Option is to reduce traffic flow in TH 5 in front of the airport entrance by approximately 9%. This is documented by Figure 47 which shows the forecasted traffic volumes on the regional road system. Table 52 summarizes this information and indicates that the three capacity problems identified under the No-Build option and the In-Terminal Structured Parking option also exist with the Remote Parking option. The fact that these capacity deficiencies occur independently of the parking option selected, indicates that these deficiencies are indeed metropolitan in scale and are not a direct consequence of airport activity.

1/ Automobile Parking and Traffic Study, Carl Walker and Associates and BRW, Inc., 1977.

TABLE 52

REGIONAL TRAVEL DEMAND ON-AIRPORT REMOTE PARKING OPTION

(10 Million Enplanements)

Roadway	Location	Daily Traffic (vph)	ADT Capacity (vph)	Airport Traffic (vph)	% Airport Traffic
T.H. 5 (No.)	Airport Entrance	78,800	90,000	24,000	30
T.H. 5 (So.)	Airport Entrance	60,800	90,000	23,800	39
Mendota Bridge	--	41,600	60,000	3,800	9
T.H. 5	North of T.H. 5	80,100	60,000	13,400	17
T.H. 55	North of Crosstown	58,100	60,000	2,900	5
T.H. 55	South of Crosstown	70,400	60,000	6,800	10
Crosstown	West of T.H. 55	23,600	60,000	3,900	17
Crosstown	West of Cedar	43,200	60,000	6,000	14
I-494	East of Cedar	120,300	90,000	27,000	22
I-494	West of Cedar	105,400	90,000	21,600	20
Cedar Ave.	North of I-494	41,500	60,000	2,700	7
I-494 Bridge	--	62,700	90,000	3,000	5

AIR QUALITY IMPACTS

By the time parking demand has reached the parking supply in 1994, no violations of air quality standards are expected due to the 90% reduction in auto exhaust emission rates. Automobile emission rates are not projected to drop significantly after 1990. If, traffic continues to increase around the airport after that, CO levels could begin to rise again. The excellent dispersion of pollutants from the wind deflector with Phase 2 of the Proposed Action should prevent this from becoming a problem. Since the Remote and No-Build Future Options would not alter the dispersion characteristics of the area, these options would likely not cause any future air quality problems. Additional in-terminal parking expansion could change the dispersion characteristics of the area. The additional parking might create problems with southeasterly winds. The future In-Terminal Structured Parking option was not tested in the wind tunnel and consideration of such an option would require it. However, at this time it seems unwise to study it since many other factors might change dramatically before the decision on additional expansion has to be made.

NOISE IMPACTS

NO-BUILD OPTION

Construction Noise

The No-Build option would have no adverse noise impact due to construction activity.

Highway Traffic Noise

Table 53 presents the predicted highway noise levels along I-494 for two future options. Peak hour traffic volume on I-494 near 34th Avenue in the year 2009 is projected at 10,590 vehicles if the In-Terminal Structured Parking option is implemented. If no additional airport parking is provided (beyond the existing 5,200 parking spaces), it is estimated that peak hour flow on I-494 would be 10,360 vehicles, due higher airport-related vehicle occupancy. Under both the No-Build or In-Terminal Structured Parking options, L10 noise levels are predicted to increase by 3 to 4 dBA, and L50 levels are predicted to increase by 5 dBA. This amount of sound increase represents a significant impact when compared to existing noise levels. However, it should be noted that the impact is not related to increased airport traffic volumes. Rather, the impact is largely related to non-airport traffic, especially heavy truck movement. Most important, there is no difference in highway noise impact between the No-Build and In-Terminal Structured Parking options.

Aircraft Operation Noise

Aircraft operations and aircraft noise impacts have been demonstrated to be independent of ground access and parking options. Aircraft noise levels will depend on other decisions made by government and industry to control aircraft sound levels and operations.

IN-TERMINAL STRUCTURED PARKING OPTION

Construction Noise

The In-Terminal Structured Parking option will have the greatest noise impact due to construction activity. The erection of an additional 3,600 spaces between the years 1994 and 2009 would create two one-year periods of construction activity, potentially exposing the terminal and existing parking areas to high noise levels. The incremental impact of construction noise will be minimal, however, due to high levels of noise related to aircraft operation.

Highway Traffic Noise

Table 53 has shown that highway noise levels will significantly increase along highways surrounding the airport for either the In-Terminal Structured Parking Option or the No-Build option. There is no difference in highway noise between the two options because the future noise impact is largely related to non-airport traffic levels.

Aircraft Operation Noise

Aircraft operations and aircraft noise have been demonstrated to be independent of ground access and the parking option selected. The future options for airport parking will have no effect on aircraft noise.

ON-AIRPORT REMOTE PARKING OPTION

Construction Noise

The Remote Parking option would expose the airport medical clinic to construction noise. This clinic is used for airport emergencies and for flight crew examinations. The additional impact of this construction noise would be insignificant due to the noise related to nearby aircraft operations and traffic already on I-494.

Highway Traffic Noise

The Remote Parking option could slightly decrease traffic flow on I-494 between the main airport access road and 24th Avenue. However, this reduction would have no effect on highway-related noise levels. Highway traffic noise will be the same for roadways surrounding the airport regardless of which future parking option is implemented because of the already high base noise level.

Aircraft Operation Noise

Aircraft operations and aircraft noise are independent of ground access and the parking options. The future airport parking options will have no effect on the aircraft noise.

TABLE 53

PREDICTED TRAFFIC NOISE LEVELS ALONG I-494 AT 34TH AVENUE

(10 Million Enplanements)

Condition	Traffic	Peak Hour Volume	% Trucks	dBA at 100 Ft. L10	dBA at 100 Ft. L50	dBA at 500 Ft. L10	dBA at 500 Ft. L50
Existing	Non-airport	3,170	6	75	67	62	58
	Airport	1,800	1	67	62	56	53
	Total	4,970	4	76	68	63	59
*No-Build Option (2009)	Non-airport	7,890	5	79	73	67	64
	Airport	2,470	1	68	64	58	55
	Total	10,360	4	79	73	67	64
In-Terminal Option (2009)	Non-airport	7,890	5	79	73	67	64
	Airport	2,700	1	68	64	58	55
	Total	10,590	4	79	73	67	64

*For purposes of the noise analysis, the No-Build option assumed that no additional parking beyond the existing 5,200 spaces will be constructed.

WATER QUALITY IMPACTS

NO-BUILD OPTION

The No-Build option will not have any impact upon stormwater runoff or water quality beyond those impacts identified for the Proposed Action.

IN-TERMINAL STRUCTURED PARKING OPTION

The impacts upon water quality of full parking expansion in the main terminal are identical to the impacts of the Proposed Action. Construction operations would not involve any soil exposure such that existing runoff characteristics would not be significantly altered. During operation of the facility runoff volumes and the quality of the runoff would not be impacted by the parking facility. No net increase in impervious surface area would be created and cleaning of the parking facility would be done with dry sweepers.

ON-AIRPORT REMOTE PARKING OPTION

The option to develop remote parking as a method of expanding the airport parking supply beyond the Proposed Action is identical to the Remote Parking alternative to the Proposed Action except in terms of date of implementation. The Remote Parking alternative would be constructed in 1979 while the Remote Parking option to provide parking beyond the Proposed Action would not be constructed until approximately 1995. During this time period, several changes could occur at the airport which would affect stormwater runoff and the quality of the runoff. These changes might include new buildings, runway extensions, or expansion of air cargo facilties. Changes in the stormwater runoff characteristics during this period will not impact the Minnesota River since all runoff will be controlled and treated prior to discharge.

The increased runoff from the 32 acre surfaced lot has been shown previously to amount to 7 acre-feet annually. This is less than a 2% increase in runoff. The most significant impact upon the quality of the runoff water is to increase grease and oil concentrations and lead concentrations. Because treatment and monitoring will be required under the NPDES permits, the Remote Parking option will not adversely impact water quality.

ENERGY IMPACTS

CONSTRUCTION ENERGY

The current energy situation may make future expansion beyond the Proposed Action questionable. The projected shortage of petroleum may force a severe curtailment of the use of private autos. On the other hand, development of synthetic fuels and energy savings in other sectors may make it possible for our current use of the auto to continue, thus creating pressure for more parking expansion. Construction energy requirements for the future In-Terminal expansion will be the same as those for the Proposed Action, roughly 1,060 billion BTU's for full expansion. If the remote parking option were to be pursued at this time, this would involve an estimated expenditure of 112 billion BTU's. The No-Build option would, of course, require no construction energy expenditures.

PARKING RAMP OPERATION

Operation of a fully expanded In-Terminal parking ramp would require an estimated 3.47 million additional kilowatt hours of electricity, or the equivalent of 11.85 billion BTU's, which would bring the total parking facility electric requirements to 8.45 million kilowatt hours annually. This demand would continue for the life of the facility. Pursuing your remote option on the other hand, would only require an addition 1.065 million kilowatt hours annually for the life of the lot operation. No-Build, of course, would save the most electricity.

TRANSPORTATION ENERGY

It is not possible to accurately anticipate what regulatory or technological changes may take place by the time the proposed facility is fully operational and additional parking expansion is considered. Short of technological changes, there is no reason to expect significant improvements in gasoline mileage beyond the 27.5 miles per gallon standard set for 1985 autos. Thus, any additional efforts to accommodate private autos which might encourage their use would entail additional energy consumption at those rates. Both the remote lot and full In-Terminal expansion options would provide more parking and thus stimulate more vehicle miles of travel, consuming more precious petroleum in the process. The No-Build option, on the other hand, would discourage additional private auto use for trips to and from the airport and would save the most petroleum and energy.

SOCIO-ECONOMIC IMPACTS

NO-BUILD OPTION

This option will produce the same general impacts that were documented for the No-Build alternative to the Proposed Action. However, the time of occurrence of these impacts would be delayed by approximately 15 years. As a consequence, the significance of the impacts could be greatly altered if major changes occurred in urban travel patterns, housing location choices, or air travel demand. In addition, under this scenario the available parking supply is approximately 80% greater than the existing parking supply such that the consequences of the No-Build option would, initially at least, be less severe than a No-Build alternative adopted in 1977.

IN-TERMINAL STRUCTURED PARKING OPTION

Regional Economic Impact

The In-Terminal Structured Parking option calls for a total expenditure for construction of $35.5 million dollars by the year 2003. Assuming no changes in construction technology the SIMLAB model yields impact above the Proposed Action as shown in Table 54.

TABLE 54

EMPLOYMENT IMPACTS OF THE IN-TERMINAL STRUCTURED PARKING OPTION

Employment Type	Worker Years 1994-95	2002-03
Direct Construction	72	72
Inter-industry	32	32
Induced	44	44
Total Employment	148	148

A total of 656 worker years would accrue under this option in conjunction with the Proposed Action.

Socio-Economic Effects

The socio-economic effects of the In-Terminal Structured Parking option are generally the same as those discussed for the Proposed Action. This option is not expected to alter the profile of passenger types nor is it expected to alter the ground mode of transportation used to access the airport with emphasis placed on the private automobile.

ON-AIRPORT REMOTE PARKING OPTION

Regional Economic Impacts

The regional impact of the Remote Parking Option is the same as the impact for the Remote Parking alternative. However, when aggregated with the Proposed Action the total impact is equal to employment of 379 worker years.

Socio-Economic Effects

The principal effect of the Remote Parking option will be the inconvenience to the air passenger as a result of the necessity to use the shuttle bus service from the remote site. This impact will be mitigated by planning, public information, and the passage of time.

AESTHETIC IMPACTS

NO-BUILD OPTION

The No-Build option will not result in any change in the airport aesthetics beyond the impacts imposed by the Proposed Action. Thus, this option will not create any additional impacts upon the airport setting and image.

IN-TERMINAL STRUCTURED PARKING OPTION

This option will have the same general impact upon aesthetics as the Proposed Action except that the expanded parking facility will not be viewed as a new element in the landscape. The Proposed Action represents a major departure from the existing physical arrangement of the airport while the added parking levels will be interpreted as an incremental change. As a consequence, the aesthetic impacts will be less severe. The primary effect of the expanded parking facility will be to increase the massiveness of the parking structure and to introduce a "street canyon" feeling around the entire central parking area. The views toward the terminal and the views out from the terminal will have been permanently altered as a result of the Proposed Action.

The expanded parking facility should incorporate and expand upon the basic architectural design framework established for the Proposed Action. This also includes the expansion of any landscaping and decorative themes initiated to mitigate the impacts of the Proposed Action.

ON-AIRPORT REMOTE PARKING OPTION

Only minimal aesthetic disruption will be caused by the Remote Parking option. The major aesthetic impacts will be apparent only to the user of the parking facility since the remote parking area is generally inconspicuous and within the secured area of the airport.

VEGETATION/WILDLIFE IMPACTS

NO-BUILD ALTERNATIVE

There would be no effects of vegetation or wildlife since the site is highly developed and little exists in the way of wildlife habitat.

IN-TERMINAL STRUCTURED PARKING

Outside the construction association impacts discussed earlier, loss of habitat or wildlife species would not occur because the site is already highly developed.

ON-AIRPORT REMOTE PARKING ALTERNATIVE

Assuming that the same 32 acre site would still be available for the development of a parking lot and that grounds-keeping practices had not changed, the site would still be grassland with generally the same complement of grassland species. Development of the site in the future perhaps might be more critical because continued growth and development of the metropolitan area in general will make any remaining open space, regardless of its quality, valuable as wildlife habitat. If the area becomes too isolated because of development and the overall size of contiguous open space falls below a certain critical level (which varies from one species of wildlife to the next) then certain wildlife species will become extirpated.

The same precautions would need to be applied during construction and operations phases as were discussed in the earlier section for development of a remote on-airport site.

HISTORIC/CULTURAL IMPACTS

The three options to provide parking beyond the Proposed Action will not have any adverse impact upon any historic or cultural resources in the vicinity of the airport. As was indicated for the Proposed Action and the alternatives to the Proposed Action, a review of the proposal was made by the Minnesota Historical Society. The Society determined that no sites of historic, architectural, cultural, or archaeological significance exist within the vicinity of the Proposed Action or its alternatives.

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CHAPTER IX
SUPPLEMENTARY INFORMATION

THIS CHAPTER PRESENTS ADDITIONAL MATERIAL RELATIVE TO THE PROPOSED ACTION, ALTERNATIVES, AND FUTURE OPTIONS. SUPPLEMENTAL INFORMATION RELATING TO THE ANALYTICAL PROCESS AND THE ENVIRONMENTAL REVIEW PROCESS IS ALSO PRESENTED.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

There are two major categories of non-renewable resources which will be utilized by the Proposed Action. Largely, these resources will be permanently committed to the project, with some opportunity for alternative uses and the recycling of certain materials.

ENERGY RESOURCES

The construction of the Proposed Action will require the consumption 7600 tons of coal, 261,000 barrels of oil and oil products, 9400 megawatt-hours of electricity, and 202 million cubic feet of natural gas. This energy consumption is an irretrievable commitment of resources. Once consumed the energy is not recoverable except for minor amounts which may be recovered through recycling of the steel used in the construction of the parking facility.

CONSTRUCTION MATERIALS

The Proposed Action will result in approximately $20 million worth of construction of which $10 million will be for construction materials. These materials represent a largely irretrievable commitment of natural resources. The primary materials used consist of steel, cement, sand, aggregate, and water.

SHORT TERM USES OF THE ENVIRONMENT VERSUS THE MAINTENANCE OF LONG TERM PRODUCTIVITY

From one perspective, the construction of the parking facility will cause short-term disruption of normal parking operations, air quality, noise, and construction employment impacts. These impacts, both positive and negative, are balanced by longer term benefits of improved parking operations and user convenience. The long term negative factors are largely indirect impacts that result from such things as the production and distribution of electric power to operate the facility, distribution and consumption of transportation energy to access the airport, and the associated effects of the air pollution resulting from these activities. Long term damage to agricultural and natural vegetation, acid rains, and other phenomena are known to occur as a result of the accumulation of relatively minor environmental impacts. On the other hand, it is difficult, if not impossible, to attribute these effects to this project because airport parking causes only a small proportion of the areas demand for electric power and petroleum. Nevertheless, this action is a part of the overall development pattern which has real and significant long-term effects.

Compared to most other actions in the Twin Cities area, however, the expansion of the existing parking supply at the airport has very few and insignificant long-term effects. This project is not the cause of increased air passenger activity and it is not expected to stimulate any future development nor does it foreclose any future options. It may temporarily relieve some of the pressure for developing new transit facilties because it makes travel by private auto more attractive. In the broader view, however, auto travel to the airport does not preclude the development of new transit facilities. On the whole, the Proposed Action results in very minor short-term versus long term trade-offs.

ALTERNATIVES TO THE PROPOSED ACTION

Three alternatives to the Proposed Action have been analyzed in detail as summarized below:

- o No-Build Alternative. This alternative addresses the impacts of maintaining the status quo and its overall applicability toward satisfying increased air passenger activity.

- o Medium-Build Alternative. This alternative addresses the impacts of providing a parking supply which is slightly less than what the current parking demand index indicates.

- o On-Airport Remote Parking Alternative. This alternative addresses the feasibility of providing additional parking at the airport at a remote site and carrying air passengers to the terminal via a shuttle bus.

The most significant environmental concern, relative to the exsting airport layout and the future physical configuration of parking at Wold-Chamberlain Field, is air quality. The air monitoring conducted as a part of the EIS process indicated that the airport as a whole was within State standards. However, CO concentrations in excess of air quality standards were found to exist in front of the terminal building. No other environmental factor analyzed in this Environmental Impact Statement resulted in any significant impact of short term or long term consequence. As a result, the primary factor in assessing the feasibility of the Proposed Action or one of its alternatives is its ability to resolve the air quality problem.

The No-Build alternative does nothing to eliminate the CO problem. In fact continued increases in air passenger enplanements and increases in ground access traffic attracted to the curbside areas would result in further degradation of the ambient air quality in front of the terminal building. Therefore, this alternative is not acceptable to the MAC in terms of satisfying increased parking demand nor would it be acceptable to the MPCA in eliminating the documented CO violations.

The Medium-Build alternative also fails to eliminate the CO problem in front of the terminal building. Wind tunnel tests conducted for the MAC by the University of Houston indicated that a five level parking structure would not improve the air quality situation and would likely result in even higher CO concentrations. Therefore, the Medium-Build alternative is also unacceptable in terms of satisfying the projected parking needs and reducing CO levels.

The Remote Parking alternative, by its very nature, does not alter the existing physical characteristics in the main terminal complex. Therefore, while the resultant parking supply is adequate to meet the projected parking demand, the CO concentrations in front of the terminal building would not be brought into compliance with State standards. Therefore, this alternative is also unacceptable.

Only the Proposed Action was found to satisfy both the projected parking demand and the State air quality standards. The first phase of the Proposed Action was found to create the necessary air turbulence to break up the vortex formed in front of the terminal building under northwest winds. It is this vortex, which was identified in the wind tunnel experiments, that traps the vehicle emissions and creates the high concentrations of CO in front of the terminal. When the second phase of the Proposed Action is implemented, the vortex reappears and requires that a wind deflector be erected in front of the folded plate roof of the terminal building to assist in deflecting northwest winds downward to break up the vortex. By proceeding with the two phase construction of the Proposed Action, the high CO concentrations can be immediately reduced to acceptable levels, and design and construction of the wind deflector device can be initiated for erection when the second phase of the Proposed Action is constructed.

IMPACT ON STATE GOVERNMENT OF ANY FEDERAL CONTROLS ASSOCIATED WITH THE PROPOSED ACTION

There are no known Federal controls associated with the Proposed Action. All known governmental controls associated with the project are being administered by State and local agencies.

MULTI-STATE RESPONSIBILITIES

There are no identifiable multi-state responsibilities which occur as a result of the Proposed Action. All impacts and their mitigation are the responsiblity of agencies within the State of Minnesota.

ORGANIZATIONS AND PERSONS CONTACTED

1. Mr. Charles Kenow
   Environmental Quality Board
   Capitol Square Building
   St. Paul, Minnesota

2. Mr. Deane Wenger
   Ms. Jane Pinchot
   Metropolitan Council
   Transportation Division
   Metro Square Building
   St. Paul, Minnesota

3. Mr. Brad Beckham
   Ms. Julie Sparks
   Mr. Al Perez
   Minnesota Pollution Control Agency
   1935 County Road B2
   Roseville, Minnesota

4. Mr. Russell Fridley
   State Historic Preservation Officer
   Minnesota Historical Society
   690 Cedar Street
   St. Paul, Minnesota

5. Mr. Norm Wenck
   E.A. Hickok and Associates
   Wayzata, Minnesota

6. Mr. Jeff Hamiel
   Mr. Mark Fuelling
   Metropolitan Airports Commission
   6040-28th Avenue South
   Minneapolis, Minnesota

7. Ms. Lorrie MacDonald
   Mr. Robert Hawbaker
   Planning Department
   Bloomington, Minnesota

8. Mr. Gordon Gust, Area Wildlife Manager
   Mr. James Dustrude, Planner
   Minnesota DNR
   St. Paul, Minnesota

9. Mr. John Tietz, Refuge Planner
Mr. Micheal Vanderford, Biologist
Mr. Ken Karr
U.S. Fish and Wildlife Service
St. Paul, Minnesota

10. Mr. Rich Staffon, Wildlife Biologist
Mr. James Halvorson, Air Quality Analyst
Mr. Robert Winters, Noise Analyst
Minnesota DOT
St. Paul, Minnesota

11. Mr. Don Monahan
Carl Walker and Associates
Golden Valley, Minnesota

12. Mr. Art Johnson, Supervisor
Blue and White Cabs
Minneapolis, Minnesota

13. Mr. Feldman, General Manager
Yellow Cabs
Minneapolis, Minnesota

14. Mr. Michael Stutzer, Economist
University of Minnesota
Minneapolis, Minnesota

15. Dr. F. L. Worley
University of Houston
Houston, Texas

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CHAPTER X
BIBLIOGRAPHY

THIS CHAPTER LISTS THE REFERENCE MATERIALS AND DATA RESOURCES USED IN THE IMPACTS ANALYSIS AND ALTERNATIVES EVALUATION.

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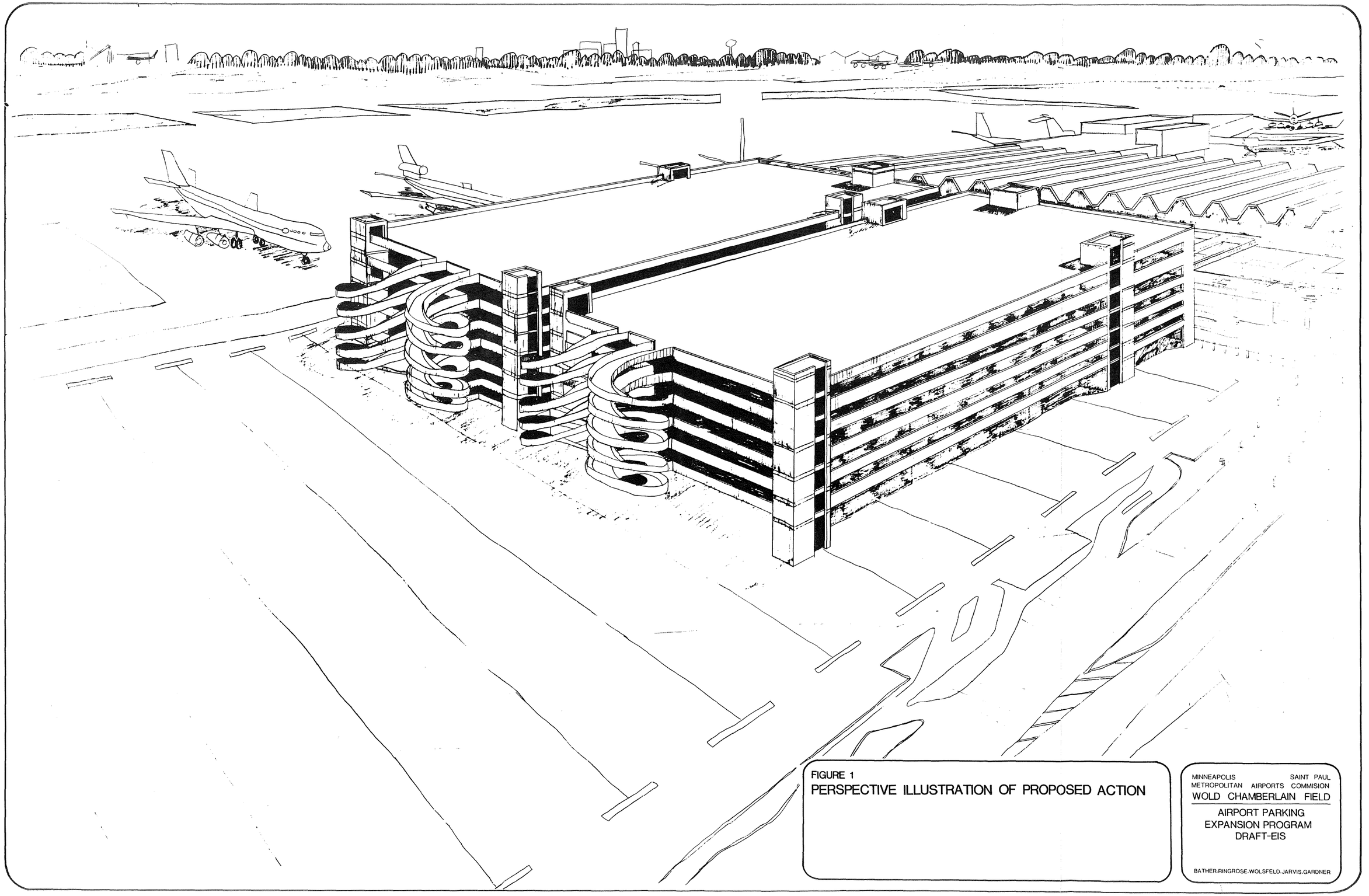

FIGURE 1
PERSPECTIVE ILLUSTRATION OF PROPOSED ACTION

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

AIRPORT PARKING
EXPANSION PROGRAM
DRAFT-EIS

BATHER.RINGROSE.WOLSFELD.JARVIS.GARDNER

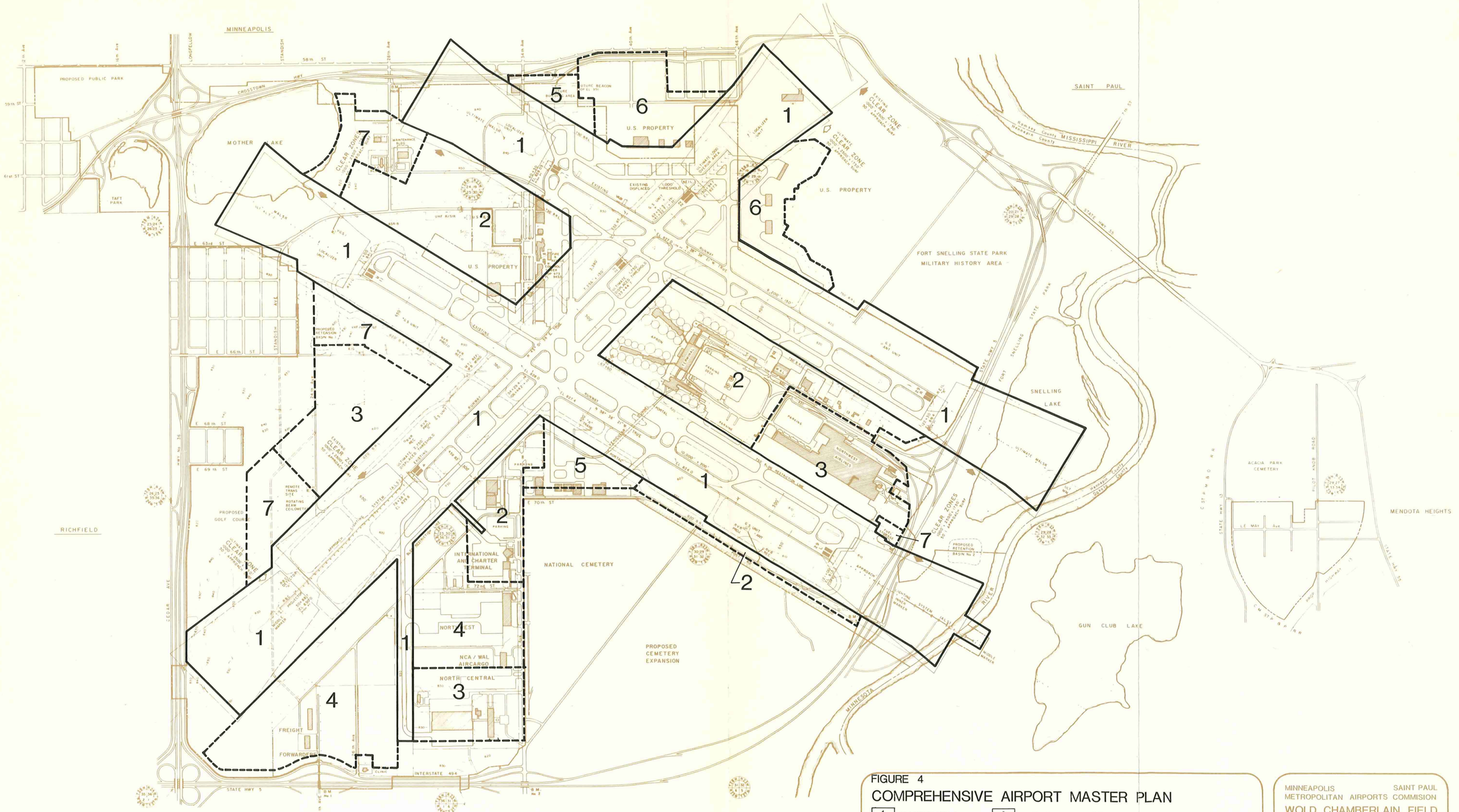

FIGURE 4

COMPREHENSIVE AIRPORT MASTER PLAN

1 AIR OPERATIONS	6 MILITARY
2 TERMINALS	7 OTHER FACILITIES
3 AIRLINE MAINTENACE	
4 AIR CARGO	
5 GENERAL AVIATION	

SOURCE: STUDY BACKGROUND AND AIRPORT LAND USE REPORT MSP INTERNATIONAL AIRPORT MASTER PLAN STUDY AUGUST 1976

0 400 800 1600FT. NORTH

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION

WOLD CHAMBERLAIN FIELD

AIRPORT PARKING EXPANSION PROGRAM DRAFT-EIS

BATHER, RINGROSE, WOLSFELD, JARVIS, GARDNER

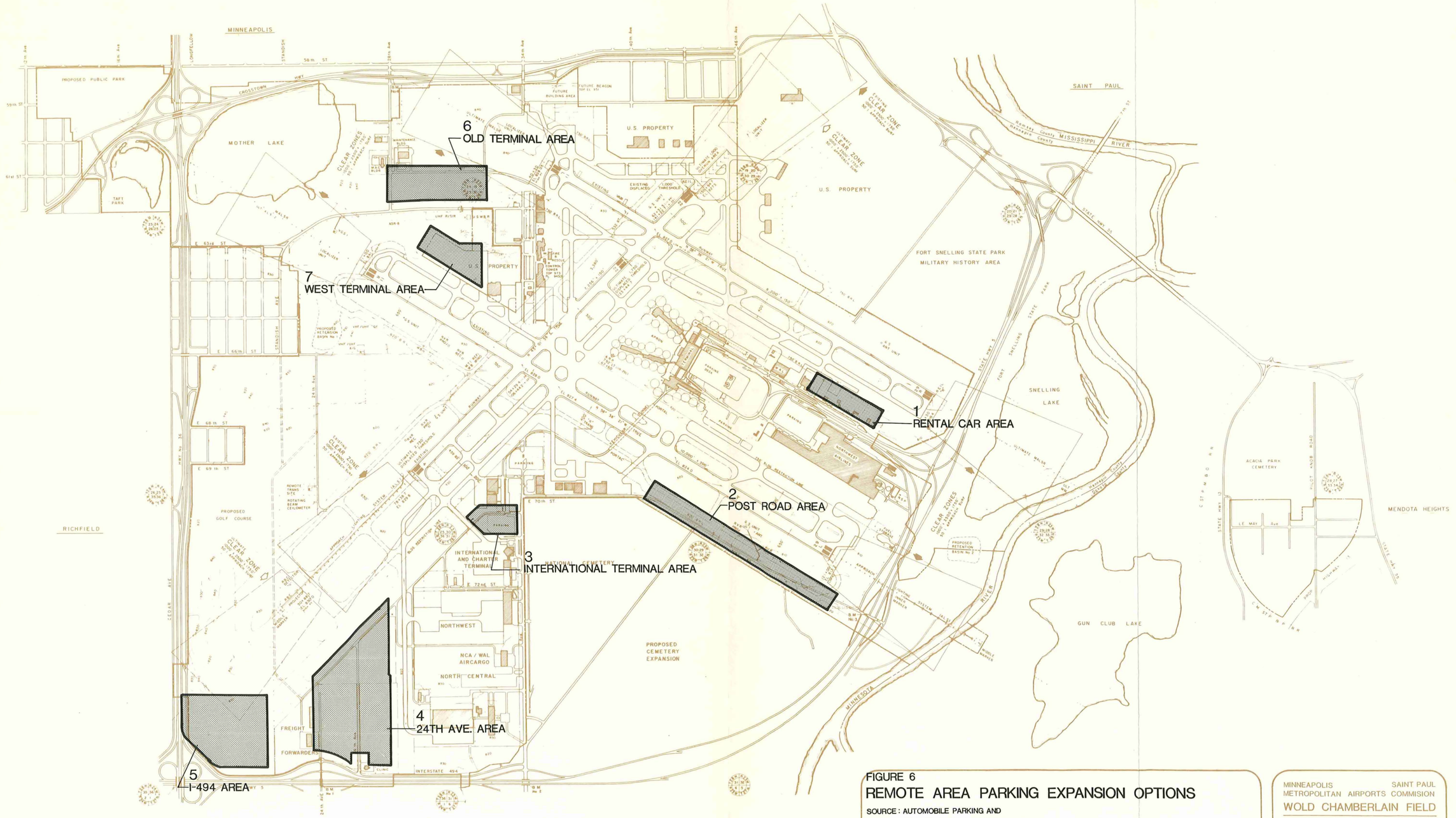

FIGURE 6

REMOTE AREA PARKING EXPANSION OPTIONS

SOURCE: AUTOMOBILE PARKING AND TRAFFIC STUDY, CWA AND BRW INC. JUNE, 1977

0 400 800 1600FT. NORTH

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WOLD CHAMBERLAIN FIELD
AIRPORT PARKING EXPANSION PROGRAM
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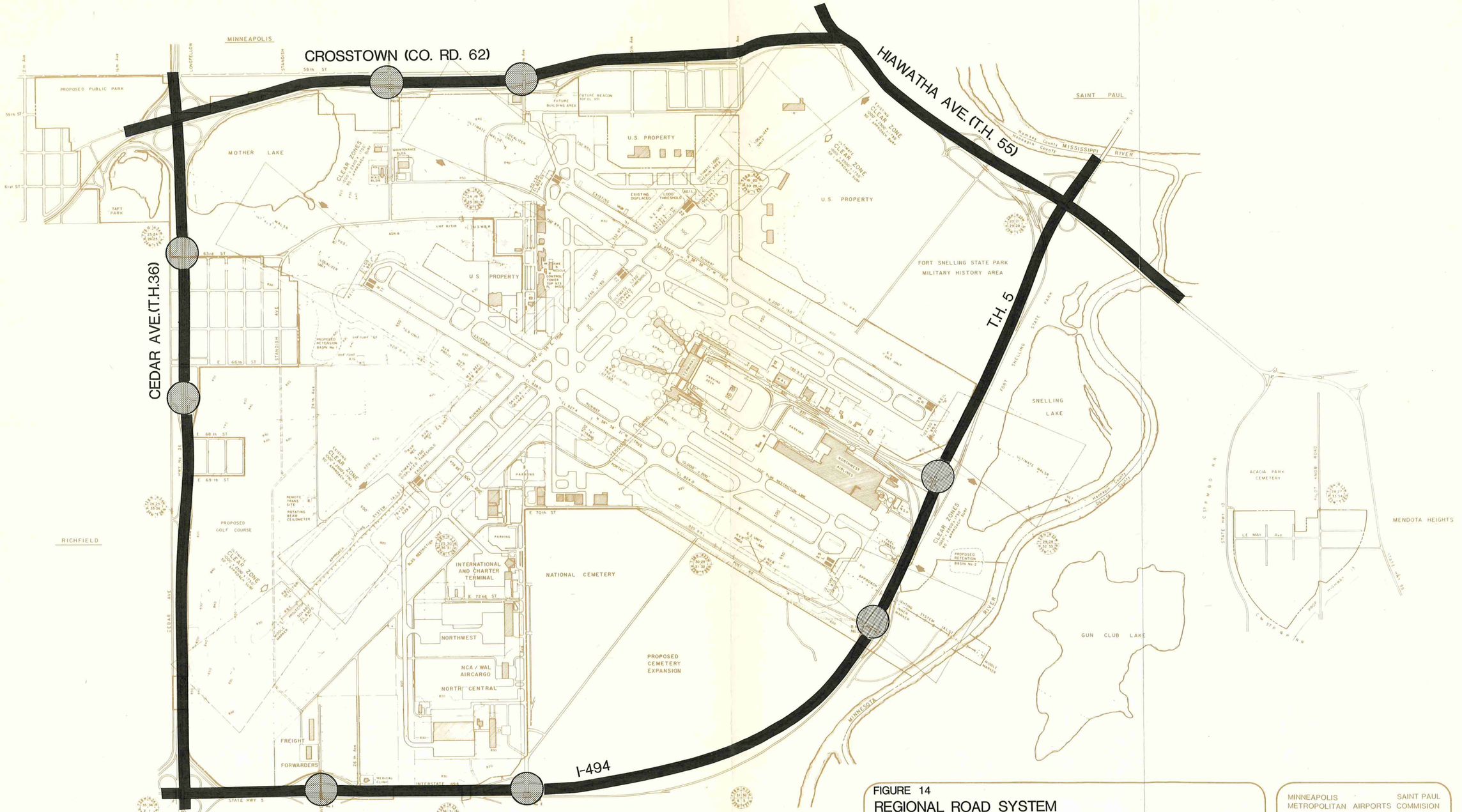

FIGURE 14

REGIONAL ROAD SYSTEM

AIRPORT ACCESS

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WOLD CHAMBERLAIN FIELD

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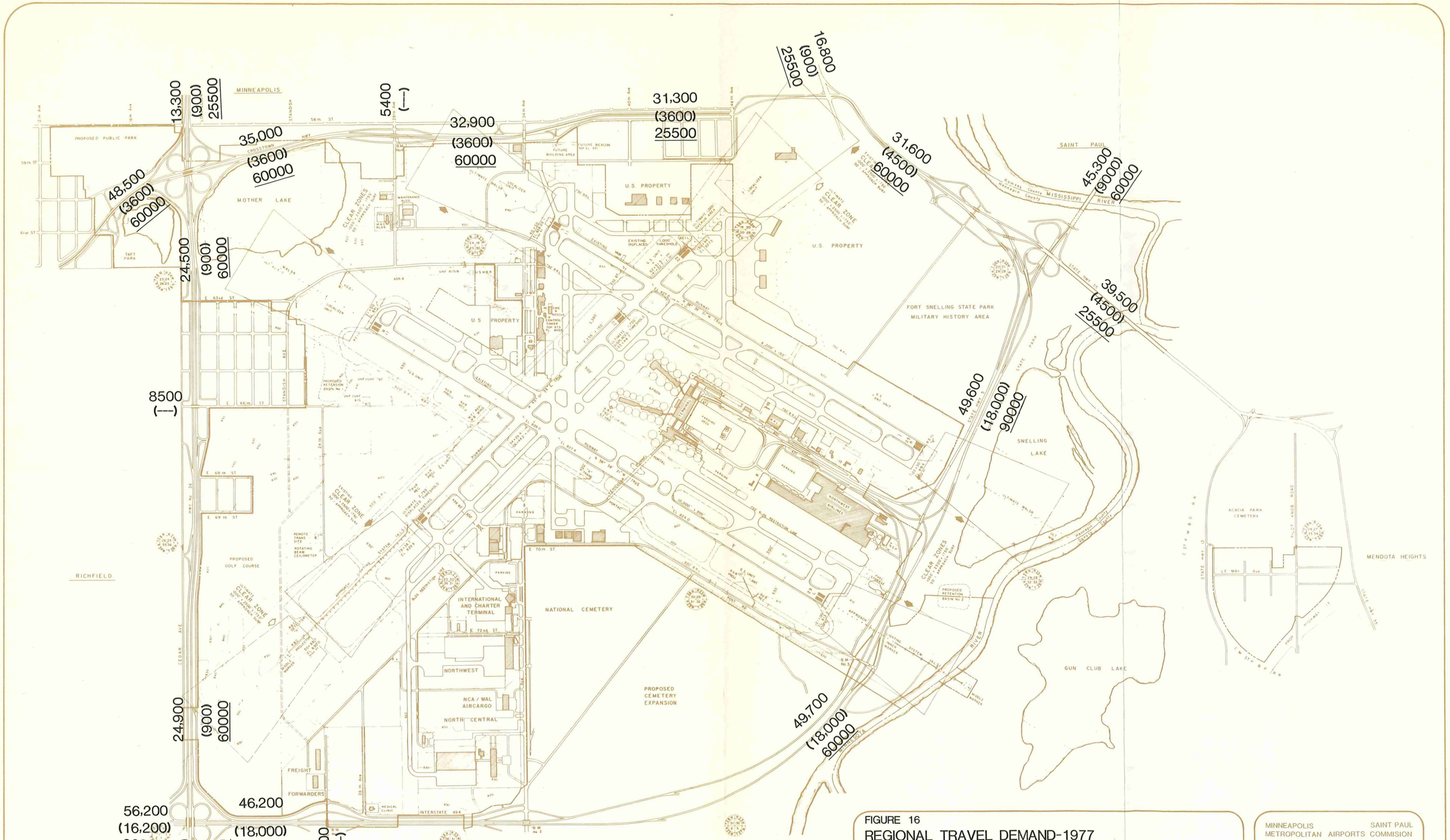

FIGURE 16

REGIONAL TRAVEL DEMAND-1977

16,800 DAILY TRAFFIC VOLUMES (VEH/DAY)

(900) AIRPORT RELATED TRAFFIC (VEH/DAY)

60000 CAPACITY (VEH/DAY)

SOURCE: 1976 HENNEPIN COUNTY FLOW MAP

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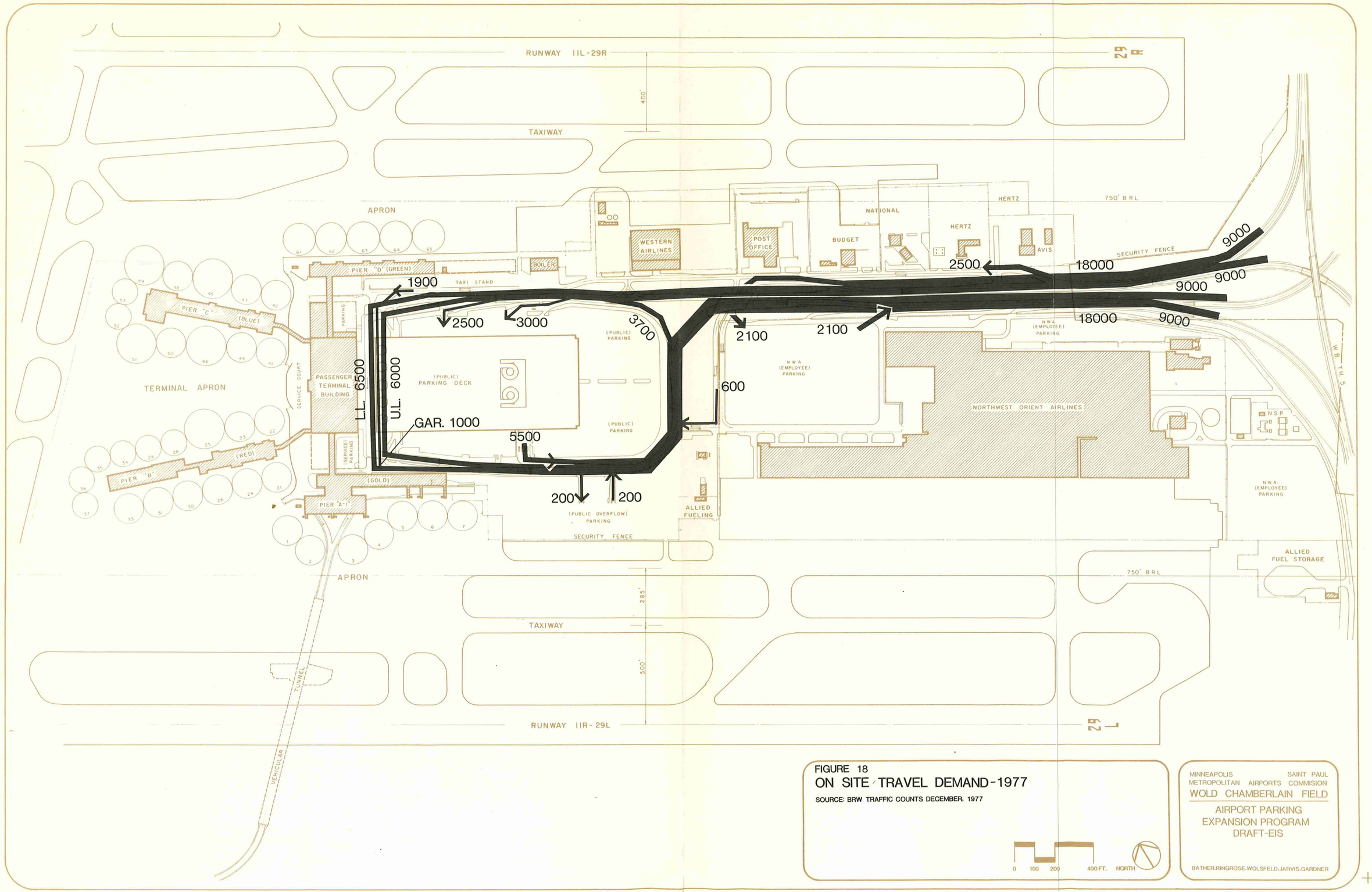

FIGURE 18

ON SITE TRAVEL DEMAND-1977

SOURCE: BRW TRAFFIC COUNTS DECEMBER, 1977

0 100 200 400 FT. NORTH

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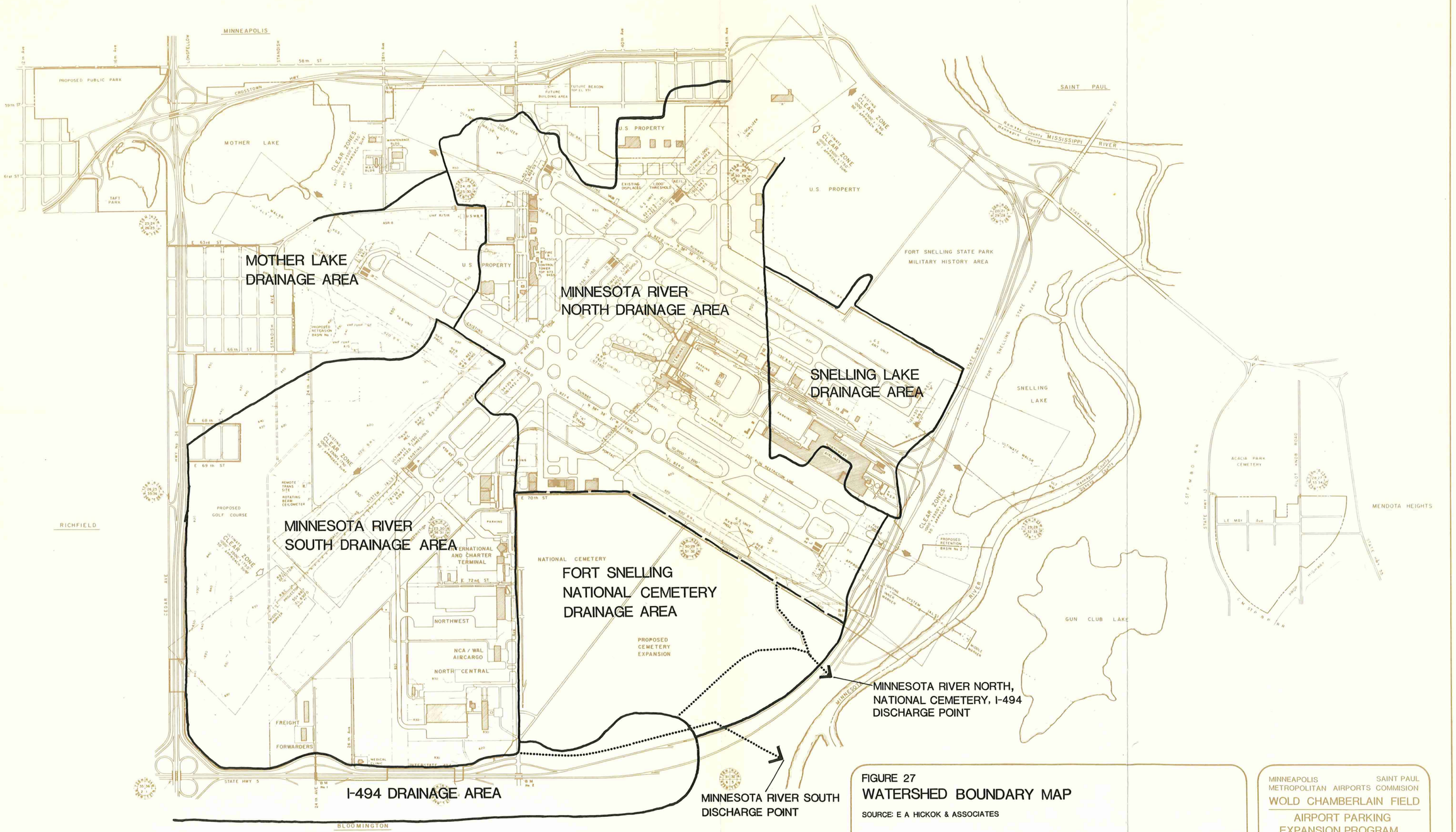

FIGURE 27
WATERSHED BOUNDARY MAP

SOURCE: E A HICKOK & ASSOCIATES

0 400 800 1600FT. NORTH

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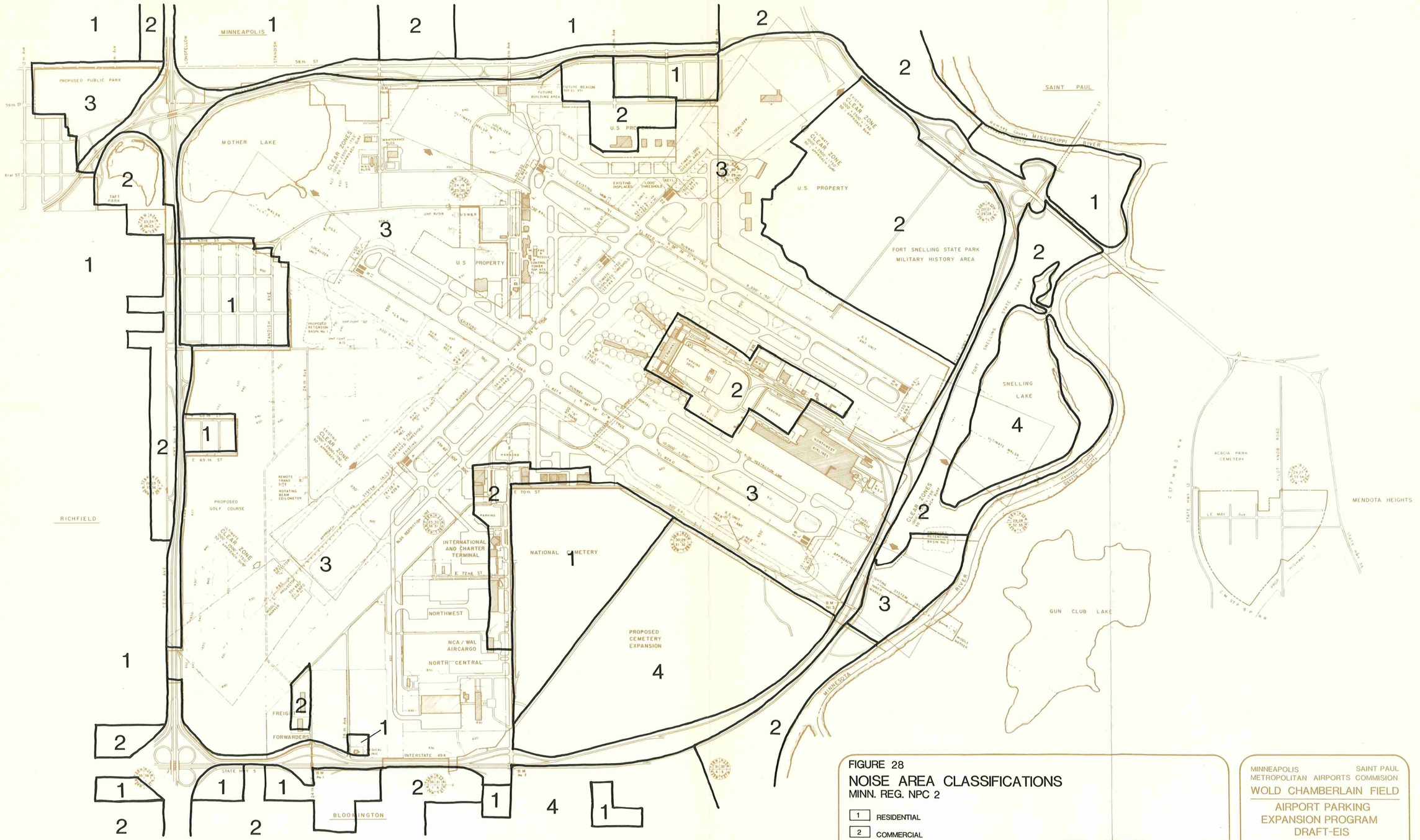

FIGURE 28

NOISE AREA CLASSIFICATIONS

MINN. REG. NPC 2

1 RESIDENTIAL
2 COMMERCIAL
3 INDUSTRIAL
4 VACANT

0 400 800 1600FT. NORTH

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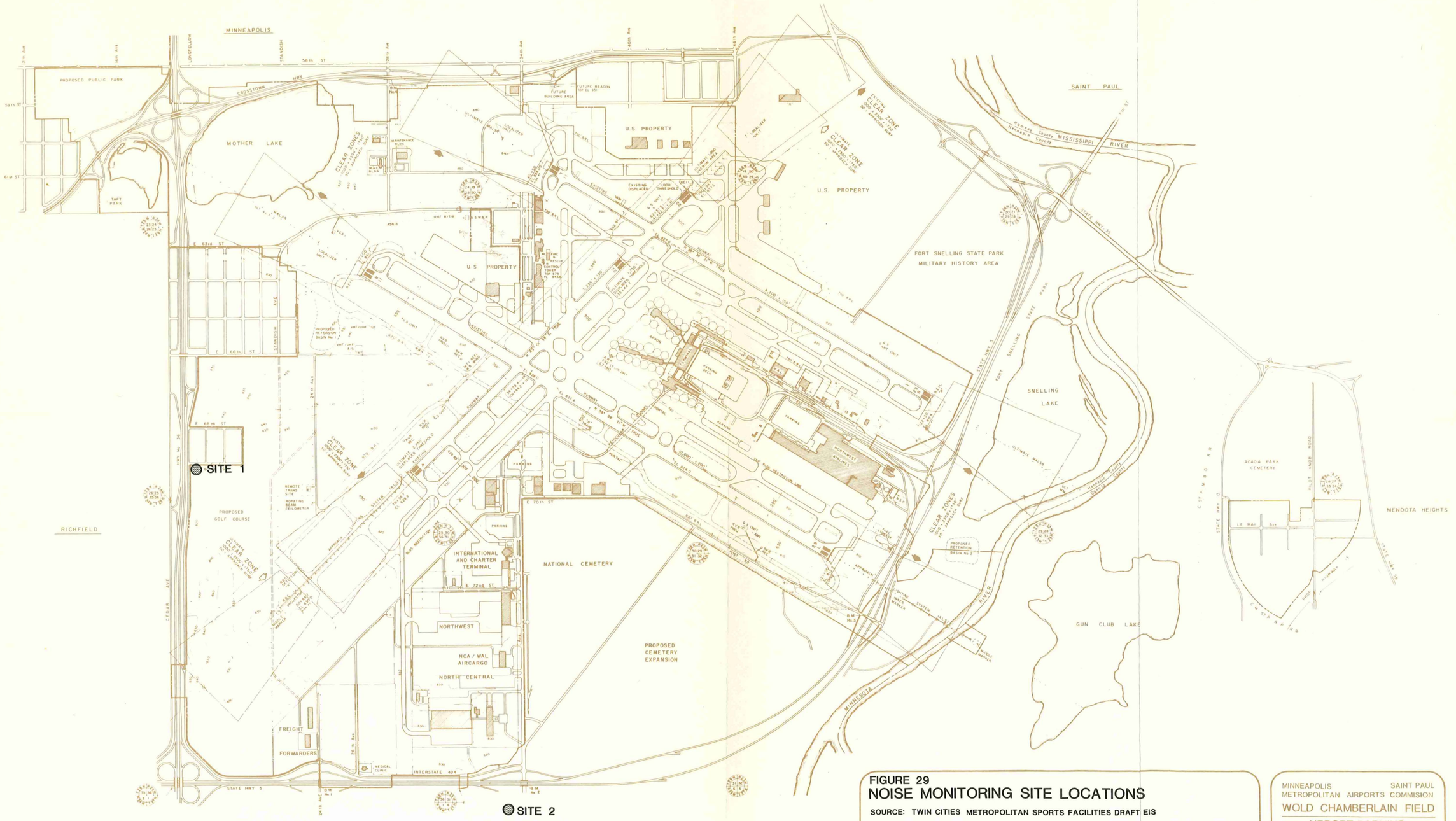

FIGURE 29
NOISE MONITORING SITE LOCATIONS

SOURCE: TWIN CITIES METROPOLITAN SPORTS FACILITIES DRAFT EIS

0 400 800 1600FT. NORTH

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WOLD CHAMBERLAIN FIELD
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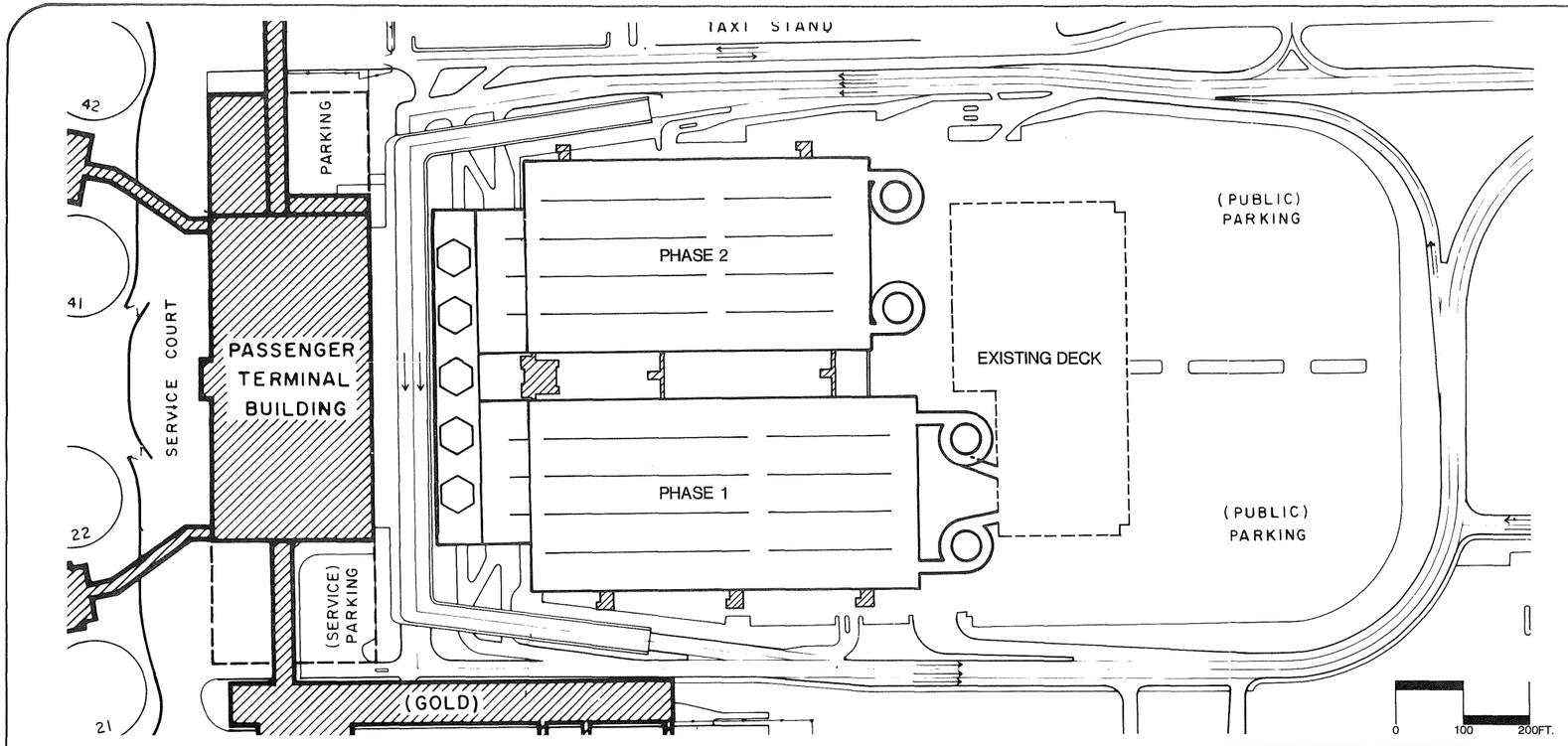
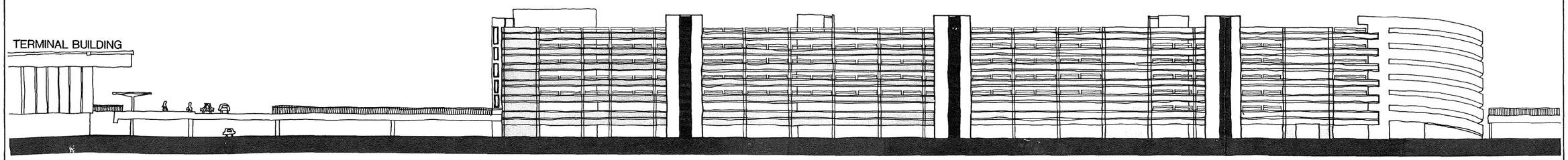
PLAN VIEW



ELEVATIONS



0 30 60FT.

FIGURE 34

PROPOSED ACTION PLAN VIEW AND ELEVATIONS

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METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD

AIRPORT PARKING
EXPANSION PROGRAM
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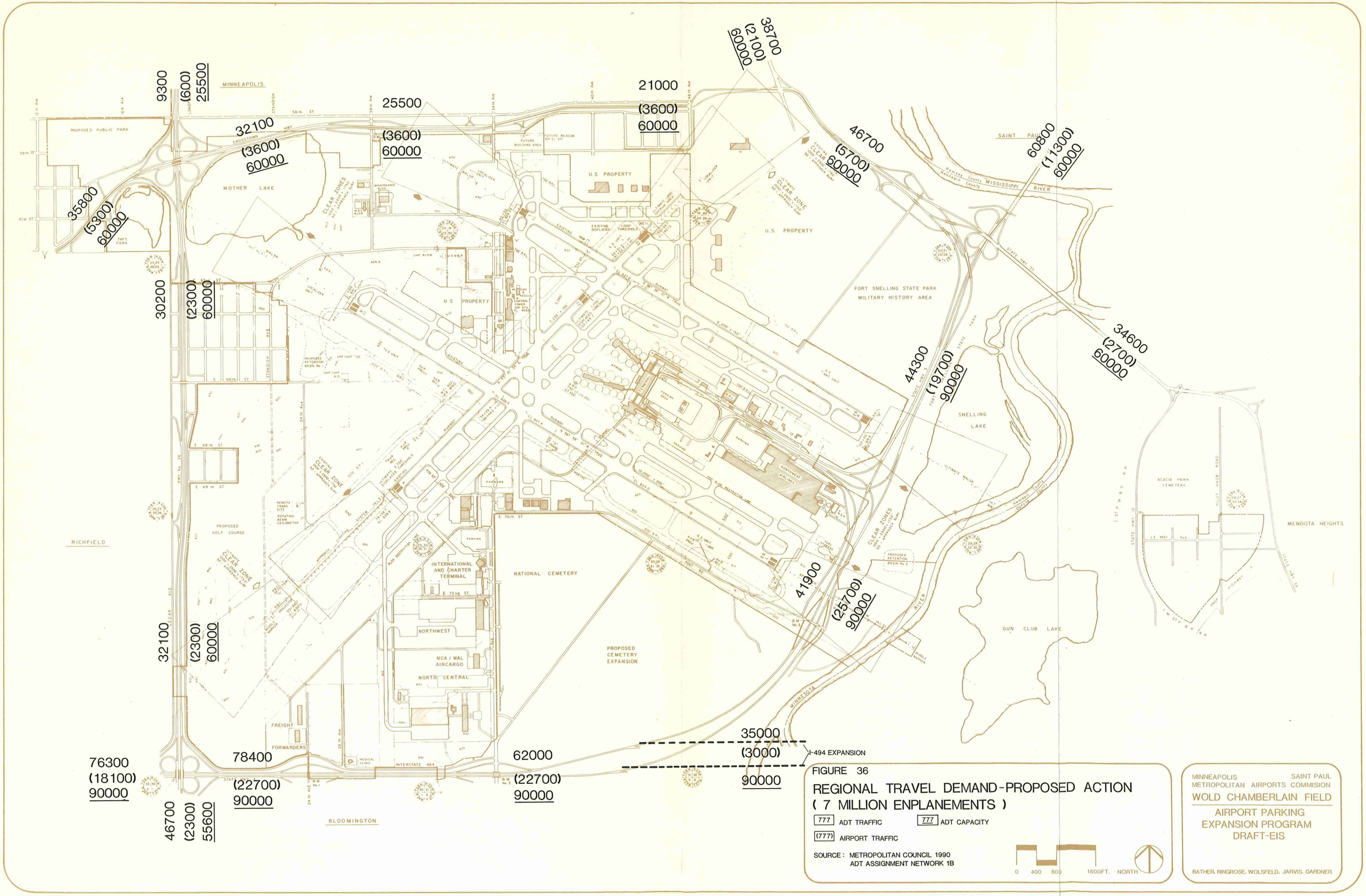

FIGURE 36

REGIONAL TRAVEL DEMAND - PROPOSED ACTION
(7 MILLION ENPLANEMENTS)

777 ADT TRAFFIC 777 ADT CAPACITY

(777) AIRPORT TRAFFIC

SOURCE : METROPOLITAN COUNCIL 1990
ADT ASSIGNMENT NETWORK 1B

0 400 800 1600FT. NORTH

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WOLD CHAMBERLAIN FIELD

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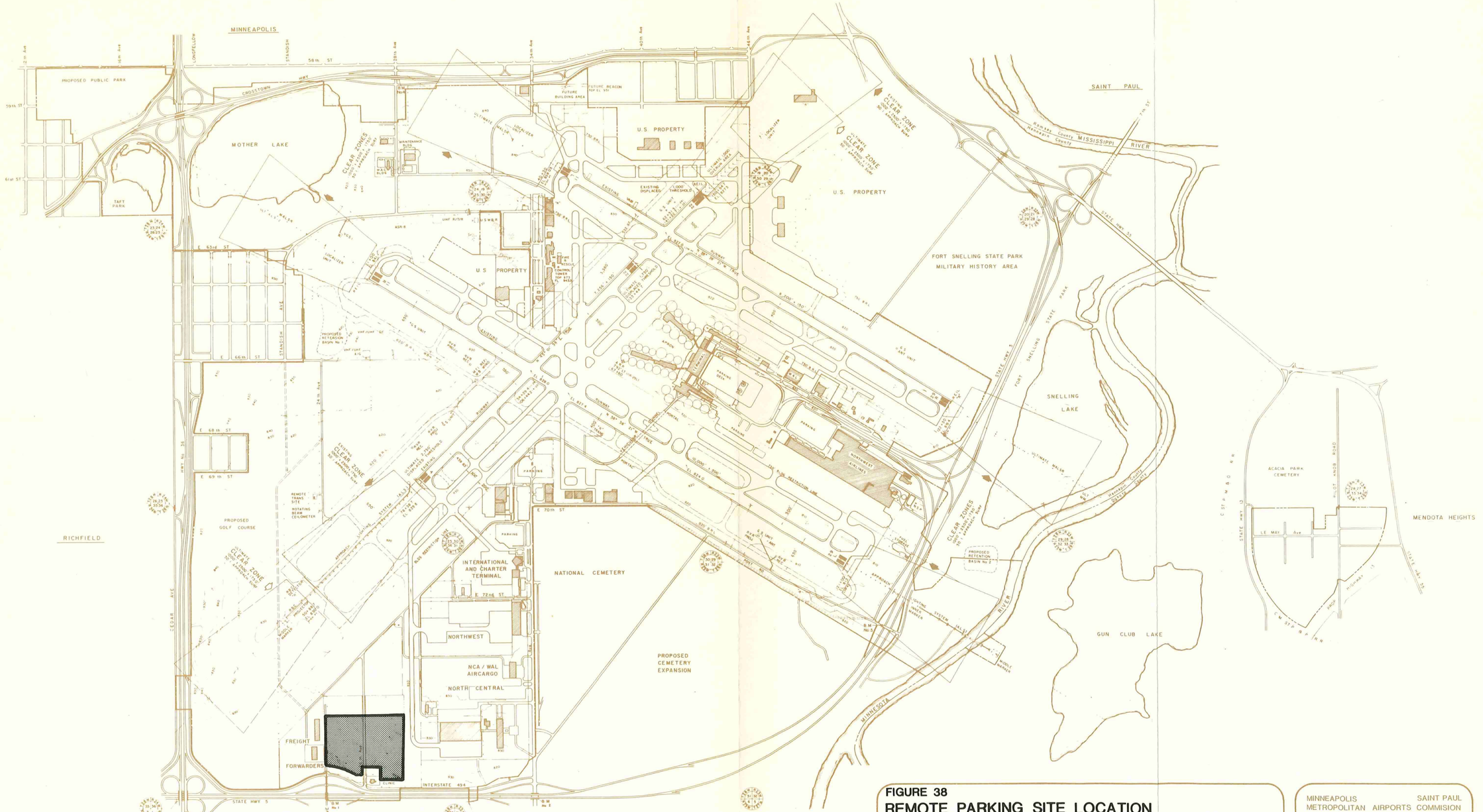

FIGURE 38
REMOTE PARKING SITE LOCATION

0 400 800 1600FT. NORTH

MINNEAPOLIS SAINT PAUL
METROPOLITAN AIRPORTS COMMISION
WOLD CHAMBERLAIN FIELD
AIRPORT PARKING
EXPANSION PROGRAM
DRAFT-EIS

BATHER, RINGROSE, WOLSFELD, JARVIS, GARDNER

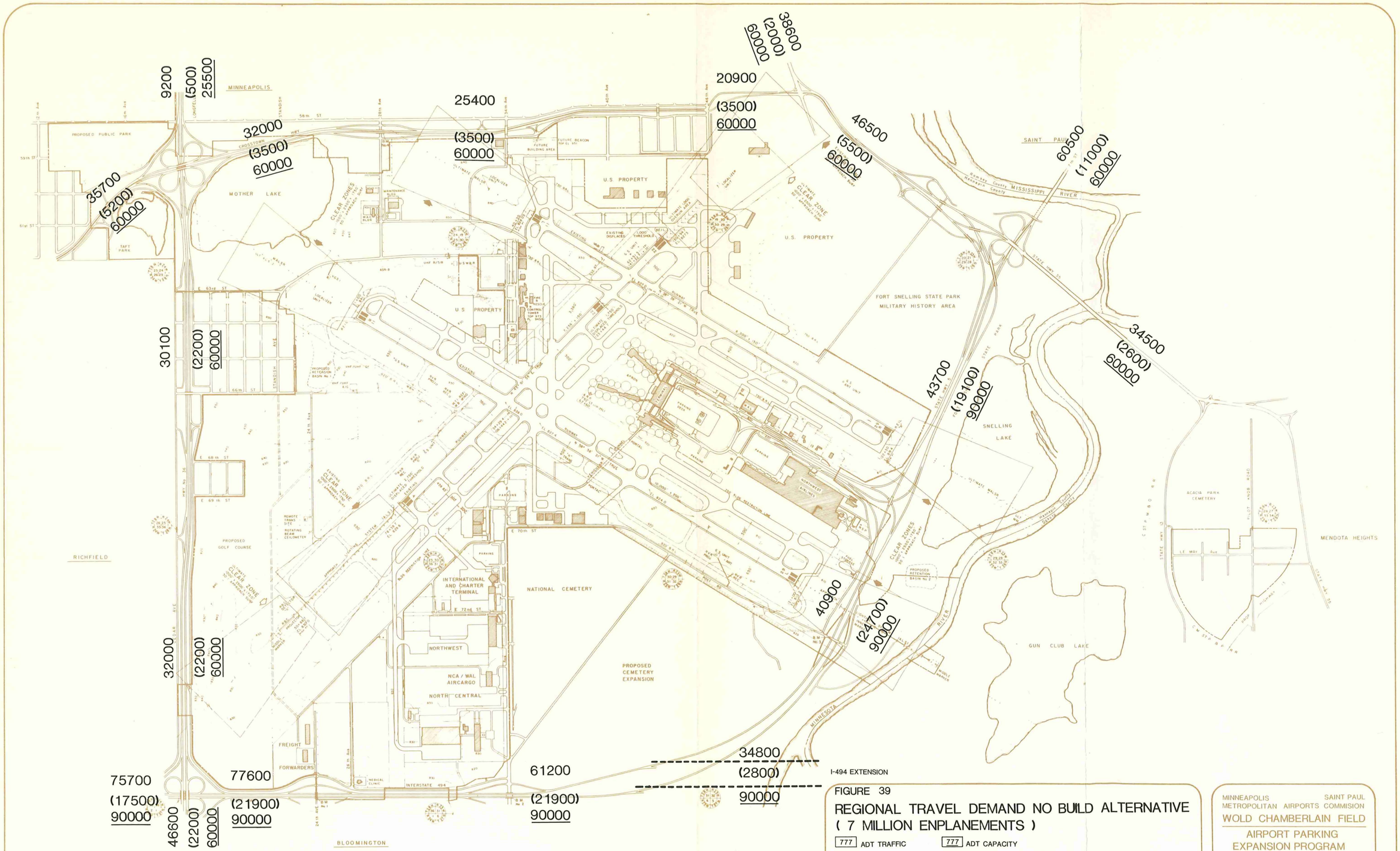

FIGURE 39

REGIONAL TRAVEL DEMAND NO BUILD ALTERNATIVE (7 MILLION ENPLANEMENTS)

777 ADT TRAFFIC 777 ADT CAPACITY

(777) AIRPORT TRAFFIC

SOURCE: METROPOLITAN COUNCIL 1990 ADT ASSIGNMENTNETWORK 1B

0 400 800 1600FT. NORTH

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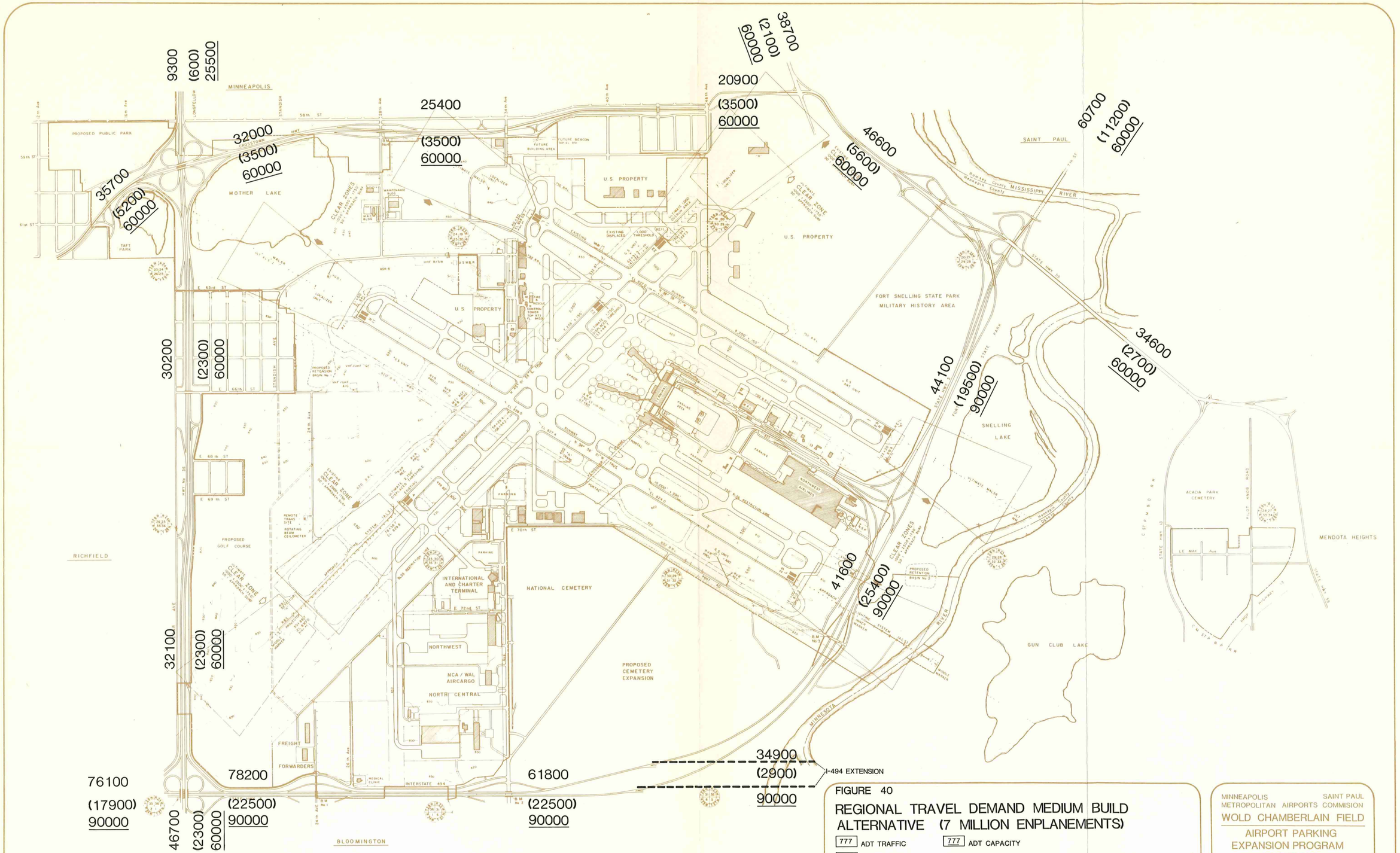

FIGURE 40

REGIONAL TRAVEL DEMAND MEDIUM BUILD ALTERNATIVE (7 MILLION ENPLANEMENTS)

777 ADT TRAFFIC 777 ADT CAPACITY

(7771) AIRPORT TRAFFIC

SOURCE : METROPOLITAN COUNCIL 1990 ADT ASSIGNMENT NETWORK1B

0 400 800 1600FT. NORTH

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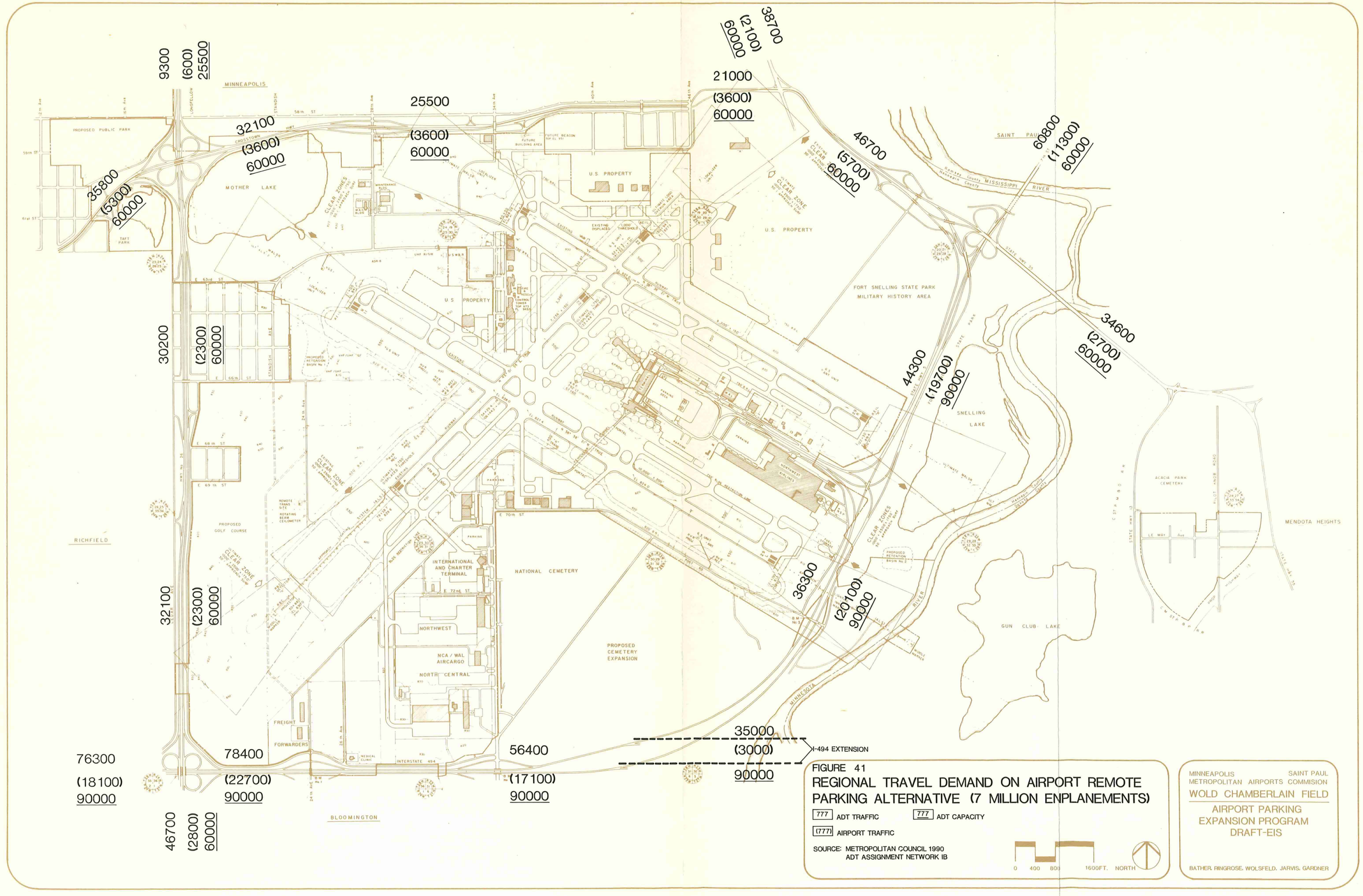

FIGURE 41

REGIONAL TRAVEL DEMAND ON AIRPORT REMOTE PARKING ALTERNATIVE (7 MILLION ENPLANEMENTS)

777 ADT TRAFFIC 777 ADT CAPACITY

(777) AIRPORT TRAFFIC

SOURCE: METROPOLITAN COUNCIL 1990 ADT ASSIGNMENT NETWORK IB

0 400 800 1600FT. NORTH

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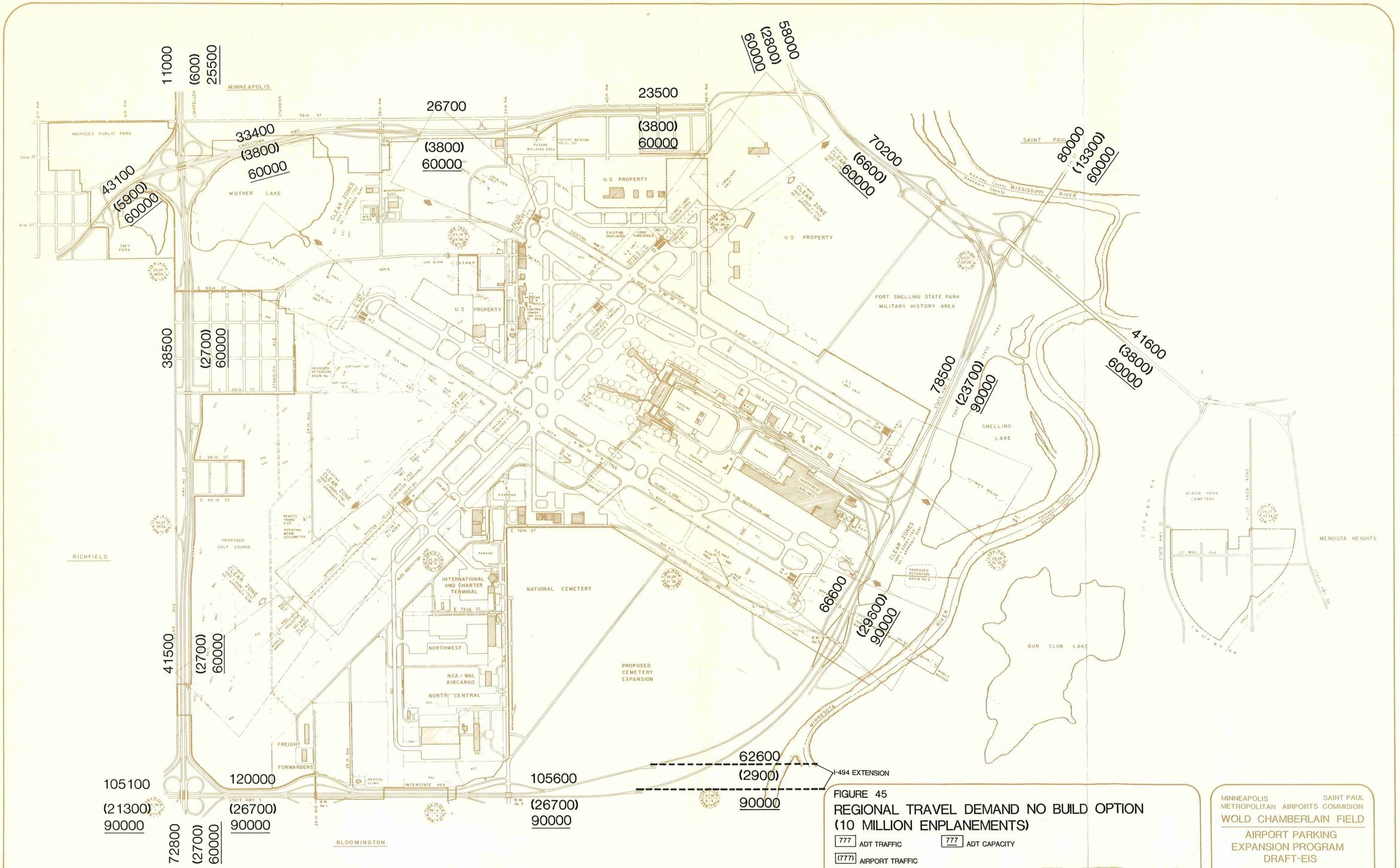

FIGURE 45

REGIONAL TRAVEL DEMAND NO BUILD OPTION (10 MILLION ENPLANEMENTS)

777 ADT TRAFFIC

777 ADT CAPACITY

(777) AIRPORT TRAFFIC

SOURCE: METROPOLITAN COUNCIL 2000
ADT ASSIGNMENT - NETWORK 1C

0 400 800 1600FT. NORTH

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WOLD CHAMBERLAIN FIELD

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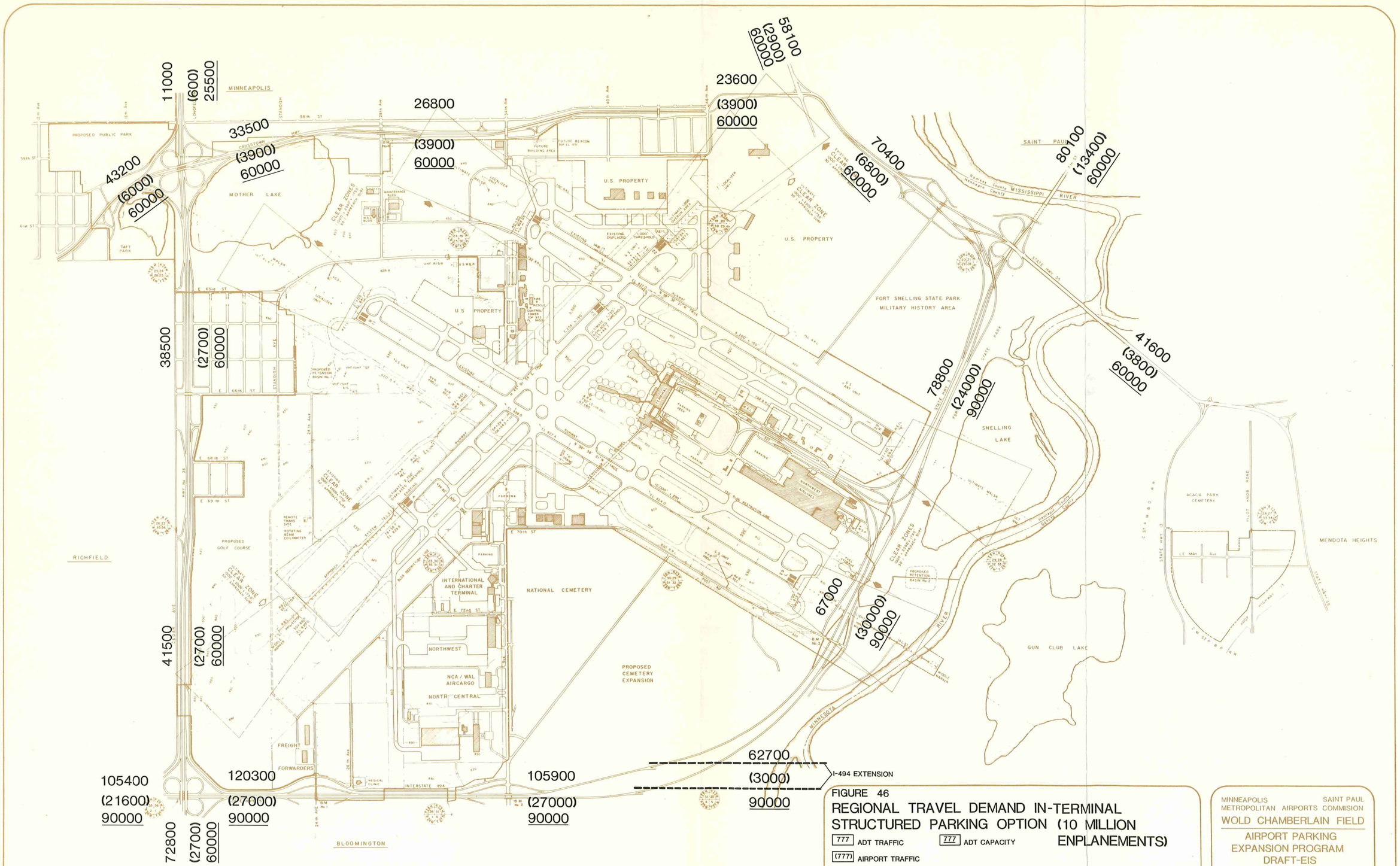

FIGURE 46

REGIONAL TRAVEL DEMAND IN-TERMINAL STRUCTURED PARKING OPTION (10 MILLION ENPLANEMENTS)

777 ADT TRAFFIC 777 ADT CAPACITY

(777) AIRPORT TRAFFIC

SOURCE: METROPOLITAN COUNCIL 2000 ADT ASSIGNMENT - NETWORK 1C

0 400 800 1600FT. NORTH

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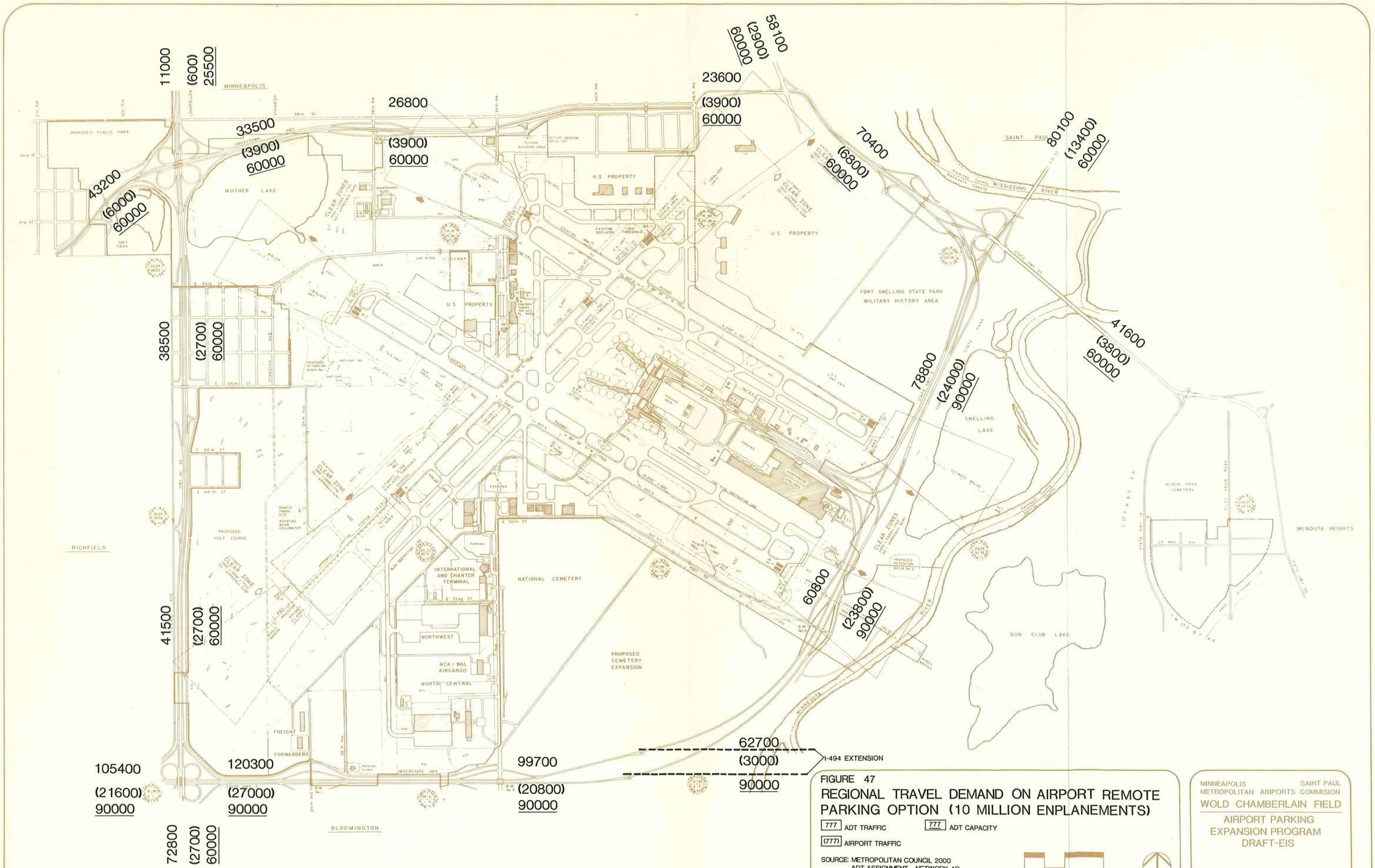

FIGURE 47

REGIONAL TRAVEL DEMAND ON AIRPORT REMOTE PARKING OPTION (10 MILLION ENPLANEMENTS)

777 ADT TRAFFIC 777 ADT CAPACITY

(777) AIRPORT TRAFFIC

SOURCE: METROPOLITAN COUNCIL 2000
ADT ASSIGNMENT - NETWORK 1C

0 400 800 1600FT. NORTH

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