A SUGGESTED ACTION PROGRAM FOR THE RELIEF OF AIRFIELD CONGESTION AT SELECTED AIRPORTS

SUPPLEMENT

February 19, 1970

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
AIRPORTS SERVICE & AIR TRAFFIC SERVICE

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ABSTRACT

This supplemental report separately identifies and analyzes the possible improvements needed to prevent or reduce aircraft delays at ten high density airports with pending congestion problems. The original report dated April 1969 provided analysis for eighteen of the Nation's highest density airports which were experiencing serious congestion. Discussion is presented on the causes contributing to aeronautical congestion and on the current operational status of each airport. The supplemental report is concerned primarily with physical construction projects which will enhance the particular airport's airfield capacity such as high-speed exit taxiways, parallel runways, and navigational aids. It also examines certain procedural improvements such as intersection takeoffs and part-time use of taxiways as VFR runways.

Each airport improvement, where possible, has been evaluated from a cost vs. delay benefit savings viewpoint. The result is a series of recommended actions for each surveyed airport with emphasis given to those items which can be constructed or implemented and placed in operation within one to four years.

FOREWORD

The contents of this supplemental report reflect the findings of a Task Force of the Federal Aviation Administration charged with the mission of identifying and analyzing short and intermediate range airfield improvements which will increase the aeronautical capacity and thereby reduce aircraft delays at selected high density airports.

The report does not necessarily reflect the policy of the FAA in all respects nor does it imply the commitment of Federal or local funds to the accomplishment of its recommendations.

TABLE OF CONTENTS

I. INTRODUCTION. The purpose of this supplement is to establish an inventory of specific development or improvement actions for ten airports which were not covered in the original congestion report entitled "A Suggested Action Program for the Relief of Airfield Congestion at Selected Airports" dated April 1969.

The original report represents the results of a Washington Task Force/ Field effort to provide current operational information, potential, existing airfield problems, and suggested airport construction solutions to reducing delays at eighteen major, high density locations. The approach taken in the original effort has been extended to ten additional airports and the results of this extension are included in this supplement. The general factors discussed in the first six pages of the original report are applicable to this supplement and will not be repeated.

The ten airports in this supplement were selected on the basis of forecast demand compared with present capabilities, since none of these airports are now critically congested. The basic information for each location was obtained locally including statistical data, potential congestion problem areas, and suggested solutions. A uniform analysis of these items was made by members of the Washington Task Force group that completed the initial report.

The team's general conclusions and recommendations are set forth in Section II. A discussion, analysis of improvements, specific recommendations, and a sketch are included in Section III of the report for each surveyed airport. In the analysis of improvements, each congestion relief item at an airport has been assigned a benefit rating in accordance with the following rating system:

RATING	MEANING OF RATING
1A	Work can be completed within a four-year period and has a savings/cost ratio of approximately 1:1 or greater.
1B	Work can be completed within a four-year period, has obvious congestion relief potential, but savings/cost ratio not determined.

RATING	MEANING OF RATING
2A	Work will require four-plus years to complete and has a savings/cost ratio of approximately 1:1 or greater.
2B	Work will require four plus years to complete, has obvious congestion relief potential, but savings/cost ratio not determined.
3	Work recommended but will result only in questionable or minor congestion relief.
4	Work considered but not recommended for accomplishment.

"Aircraft delay costs", as used in this report, refers only to direct operating costs of the aircraft population utilizing and forecast to utilize each specific location. The costs applied in this study are set forth as follows:

Approximate Aircraft Operating Costs
by
Aircraft Capacity Groups

Aircraft Group	General Description	Cost/Min.
A	Jet aircraft normally requiring 6,000' or more runway length for takeoff and/or landing excluding the SST (generally 4-engine jets).	$15
B	Jet aircraft not in Class A but with normal gross weight over 25,000 pounds, and piston and turboprop aircraft with a normal gross weight over 36,000 pounds (generally 2 and 3-engine jets, 4-engine piston and turboprop).	$8

Aircraft Group	General Description	Cost/Min.
C	Jet aircraft with normal gross weight of 8,000 to 25,000 pounds and piston and turboprop aircraft with normal gross weight of 8,000 to 36,000 pounds (generally executive jet and transport type twin-engine piston).	$4
D & E	All light (less than 8,000 pounds) single and twin-engine piston and turboprop aircraft not included in A, B, or C.	$.80

II. SUMMARY CONCLUSIONS AND RECOMMENDATIONS. The general remarks in the original report are applicable to the ten airports included in this supplement.

The following table reflects the repetitive pattern of work benefit-rated in this supplement as 1A or 1B and also includes the number of instances such work items received an accomplishment priority ranking of 1, 2, or 3.

Work Category	No. Rated 1A or 1B	No. Rated Priority 1	2	3
Runways (New or Extensions)	9	4	-	3
Exit Taxiways	6	1	5	-
Other Taxiways	6	-	2	2
Terminal Aprons	6	2	-	2
Holding Areas (Run-up Areas or Penalty Boxes)	1	-	-	1
Lighting and Landing Aids	7	-	1	-
Reliever Airports	8	-	-	2
Miscellaneous	6	3	2	-

III. INDIVIDUAL AIRPORT FINDINGS AND RECOMMENDATIONS. This section of the report contains a general discussion, analysis of improvements, summary of recommendations, and a sketch for each of the following airports:

Following is a key to the abbreviations used on the Analysis of Improvement pages for each airport to indicate the primary source of each suggestion:

AM - Airport manager, sponsor, or his representative
AO - Representatives of the FAA Area or Regional Office (All Services)
AT - Local Tower Chief or his representative
TF - Washington Task Force Group
ALL - General agreement by all of the above

GREATER BUFFALO INTERNATIONAL AIRPORT

BUFFALO, NEW YORK

DISCUSSION

1. Discussion on Congestion

A regional airport study is underway at this time that is considering the overall long-range plans for airports in the Buffalo area. The results of this study could have major effects on all planning aspects for Greater Buffalo International Airport. Currently, Buffalo is basically a one-runway airport (runway 5/23). Although there is a second runway, 13/31, its short length, obstructions, and local ATC procedures produce a reluctance on the part of both pilot and controller to use it. As traffic increases at Buffalo, greater use will, in all probability, be made of this second runway. Additionally, a new general aviation area is being developed on the north edge of the airport adjacent to the approach end of 13. This location will certainly result in greater use of 13/31 by general aviation traffic. The obstruction on this runway, a Westinghouse factory just off the approach end of runway 31, will continue to be a limiting factor.

Additional congestion is being experienced by aircraft taxiing on ramp and apron areas. There are gate delays, particularly on Thursdays and Fridays, during two peaks when usually one to four aircraft have to wait an average of ten minutes.

The glide path location on taxiway B is a congestion factor. Due to its proximity to taxiway A and the holding pad for runway 23, departures cannot proceed beyond the glide path whenever the weather goes below five hundred and one and one-half. In order to accommodate departures, the inbound aircraft must be spaced at ten-mile intervals.

2. Operational Considerations

Annual operations during FY 1968 totaled 154,803 and for CY 1968 totaled 163,666. The PANCAP for Buffalo with the present configuration and anticipated usage of runways in 1970 is 162,000. Forecast traffic for 1970 is 180,000.

Helicopter operations present no problems at this time at Buffalo and should remain minimal and of insignificant proportions. Buffalo would appear to be a prime candidate for STOL since 50 percent of its air carrier operations have a stage length of 300 miles or less.

Training activities constitute a rather high proportion of the total activity at Buffalo. Twenty percent of all operations are touch-and-go. The Niagara Frontier Port Authority has a new general aviation hangar under construction which, when completed, should result in a large increase in the number of based aircraft. There are now about 50 based aircraft.

There is no preferential runway system at Buffalo for noise abatement purposes. There are special noise procedures in effect but they do not contribute to congestion problems.

Flow control restrictions are seldom a factor to be considered at this location.

3. Terminal Complex

Plans are firm for terminal expansion at Buffalo. The terminal building is already handling twice the number of passengers for which it was designed. Since Greater Buffalo International will remain the primary airport for a reasonable number of years, expansion is necessary.

There are presently fourteen gates at Buffalo and expansion will increase this to eighteen. A new terminal will be constructed to the southwest of the present terminal that will provide seven additional gates. All general aviation ground facilities will be to the north of runway 5/23.

Gate usage is on an exclusive basis now but the airport management is aware of the limitations this places on ramp operations and hopes to minimize this practice.

4. Reliever Airports

There are two studies underway for an overall plan for the Buffalo area. One considers two counties and another is considering a nine-county area. Since extensive expansion is going on at Greater Buffalo to accommodate general aviation aircraft, for a reasonable period of time this airport will serve as its own reliever. Also, Niagara Falls is nearby and has relatively low utilization.

5. F & E Considerations

The location of the glide path antenna on taxiway B is undesirable yet it is estimated that it would cost two million dollars to put it on the northwest side of the runway and there is no assurance it would work.

RECOMMENDATIONS

The following priority of improvements has been developed in the order thought to be most significant in relieving present and future congestion at Greater Buffalo International Airport. It is recommended that this listing be fully considered in all future airport development.

PRIORITY RANKING	ITEM
1	Expand air carrier apron
2	Relocate glide path, runway 23
3	Parallel STOL/GA runway, 5L/23R; 3,500' x 100'
4	Relocate and expand GA apron
5	Partial parallel taxiway to runway 13/31
6	Improve exit taxiway
7	Groove runway 5/23
8	Improve IFR approach to runway 31
9	Partial parallel taxiway south of runway 13/31
10	Reliever airport improvements
11	Retain full use of holding area, runway 5

The shortage of aircraft gates at the present terminal building and delays now being experienced indicate a primary need for this expansion. In all probability, schedules will also be expanded whenever sufficient gates become available.

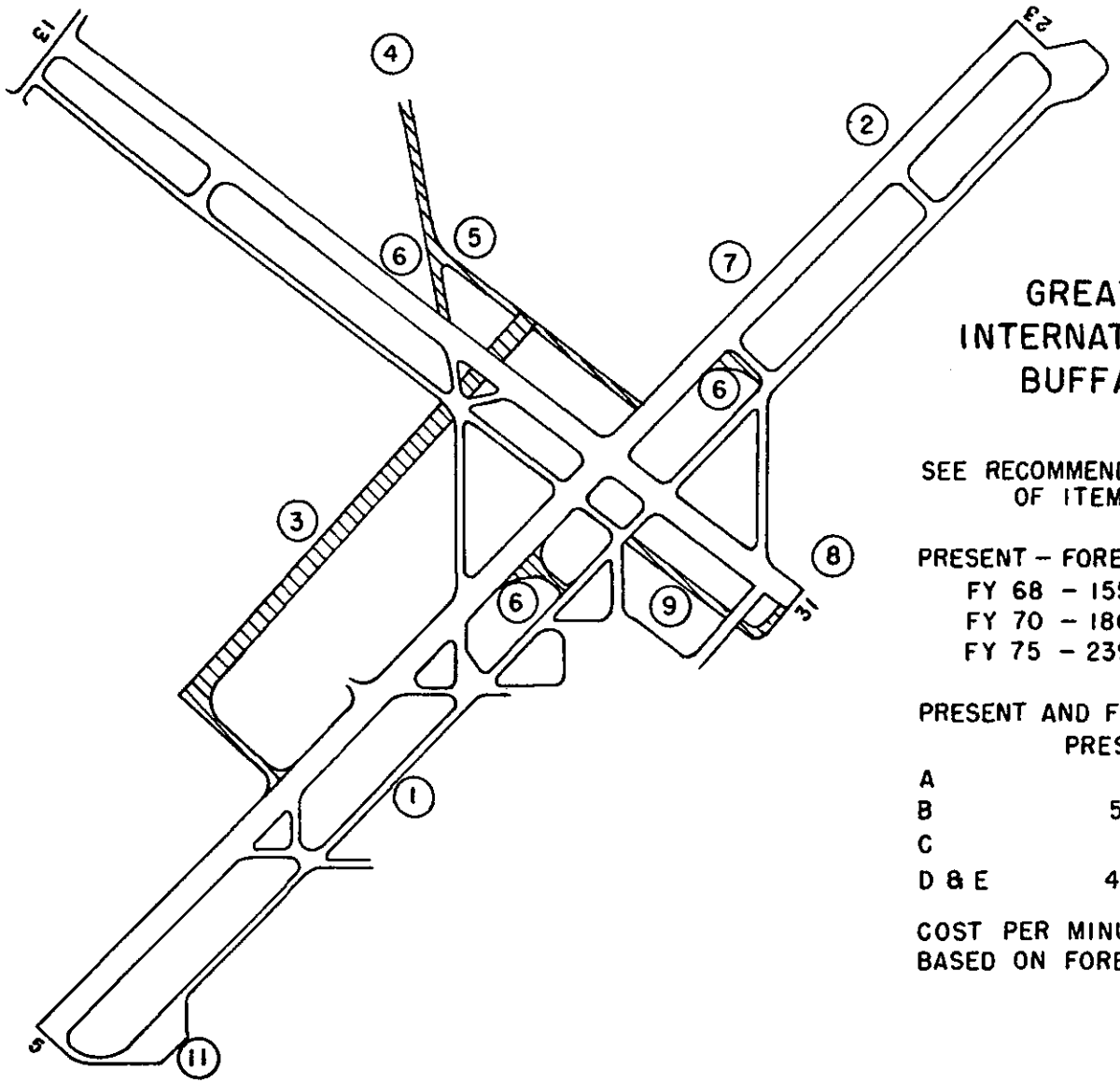
The relocation of the glide path site, although very costly, is an important consideration from an operational standpoint. The unusually high percentage of IFR weather and frequent use of this runway, when compared to the reduction of runway capacity due to present siting, make this an important improvement which should be undertaken as soon as possible.

Recommendations 3, 4, and 5 above are all related to the relocation of the general aviation area to the north side of the airport. In order to provide maximum benefits from this relocation, these improvements should receive high priority in total airport planning. The already high percentage of general aviation activity and a possible increase when facilities are improved are additional considerations.

Improving the exits from existing runways would improve the flow of traffic on these runways and should be considered in relation to future needs and aircraft mix.

Grooving of runway 5/23 has been given high priority by the ATA and is endorsed here due to high usage during wet weather conditions.

The IFR approach to runway 31 is presently poor, resulting in some missed approaches. Any aid that can be given pilots making approaches to this runway is endorsed.



GREATER BUFFALO INTERNATIONAL AIRPORT BUFFALO, NEW YORK

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (11)

PRESENT – FORECAST TRAFFIC ACTIVITY

FY 68 – 155,000
FY 70 – 180,000
FY 75 – 239,000

PRESENT AND FORECAST TRAFFIC MIX

	PRESENT	1970
A	0 %	3 %
B	50 %	54 %
C	4 %	4 %
D & E	40 %	39 %

COST PER MINUTE OF OPERATION BASED ON FORECAST MIX: ฿5.29

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER BUFFALO INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Expand air carrier apron	1A	AM	1970 (new terminal-7 gates) 1971 (old terminal improved-4 gates)	$150,000 (plus $1.4 million for building) $1,000,000 (rehab. old apron)	$15,000	5,300	--	$27,800	1.9:1	There are presently 14 airline gate positions. The new terminal building in the southwest portion of the building area will provide 7 new gates and rehabilitation and expansion of the existing terminal will provide 4 new gates for a total of 25 gate positions (plus 2 "safety valve" areas). Our rough calculations indicate about 18 gates will be needed in 1970 and 23-24 by 1975. Therefore, we agree that the new expansion appears reasonable to reduce delays in the terminal area. Even though the rehabilitation costs are high, the paving for the old terminal building must be kept in operation. The savings/cost ratio pertains to expansion but the 1A rating applies to the total program.
Glide path relocation on runway 23	1A	AT	Unknown	$2,000,000	$200,000	95,000	150,000	$495,000	2.5:1	This is the primary IFR arrival runway. When the weather is below 500-1½, departures are held back of the sight line. Detailed records not available at time of analysis so assumed of the 18% IFR weather (below 1,000-3) about 3-4% would be below 500-1½. Arrivals are spaced approximately 10 miles apart, under these conditions, in order to get departures out. This reduces the hourly IFR on runway 23 from 42/hour to about 20/hour. An extensive embankment or platform will be needed to correct the reflection problem and cost is extremely high. Delays will be severe during low IFR conditions as demand increases and diversions and cancellations will be highly probable in the 1972-74 time period.

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER BUFFALO INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Parallel GA/STOL runway 5L/23R, 3,500' x 100'	1A	ALL	Could be done by 1971	$900,000	$90,000	140,000	270,000	$580,000	6.5:1	At a forecast 1970 demand of 175,000 annual operations, the delay savings of this runway would exceed the cost within two years. No crossing problem was considered since a split terminal operation will be in use. It is assumed 40% of the aircraft at Buffalo in 1970 could use a runway 3,500' long. Access to the 23R end (fits with the recommendation concerning a partial parallel 13/31 taxiway) is not included in this cost.
Relocate and expand general aviation apron	1B	AM	1969-1970	$1,800,000	$180,000	--	--	--	--	Integral part of airline gate expansion is relocation and expansion of general aviation facilities to northern area of airport. GA is presently hampered by lack of space. Planned expansion will provide approximately 53,000 SY of apron. Now only about 50 based aircraft, but 150 aircraft are expected by 1975 and this plus itinerant would call for approximately 60,000 to 70,000 SY of apron for the type of GA aircraft at Buffalo. Thus, the expansion is obviously needed for forecast GA activity. Current area studies will play major role in confirming GA locations and facilities in Buffalo area.

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER BUFFALO INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Partial parallel taxiway to north side of 13/31- connect to new GA area by rehab. of old N/S runway	1A	TP	Unknown (but one construction season item)	$700,000 + $90,000 rehab.	$79,000	78,500	100,000	$79,000	1:1	This taxiway reduces the taxiing distance for GA aircraft to and from runways 31, 5, and 23 by about 2,400'. Although 13 will be used more once the new GA area is completed, the intersection is unfavorable with 5 or 23 and at least 90% of the GA will accrue the reduced taxiing time benefits. Cost/min. reduced to reflect GA aircraft users. Other benefits not included in analysis, such as better intersection takeoffs on 23 and intersection takeoff on 31 without crossing 31, will increase delay savings/cost ratio to over 1:1 and further justify 1A rating.
Improve exit taxiways to runways 5/23 and 13/31	3	AT	Not now planned but one construction season item	$400,000	$40,000	5,000	25,000	$26,000	.6:1	This recommendation for 5/23 consists of converting one right angled exit to an angled exit and strengthening part of old runway 9/27 for angled exit use. On 13/31, strengthening part of old N/S runway as an angled exit from 31 is the only change. The exact location could be altered later but relative improvements would still be marginal for cost involved.
Groove runway 5/23	3	-	No estimate	--	--	--	--	--	--	If grooving provides any substantial benefits in lieu of lengthening, this could be a strong future consideration. At present no length adjustments are made for grooved versus ungrooved runways, but grooving would permit full use by all arrivals in wet weather.

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER BUFFALO INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Improve IFR approach to runway 31	1B	ALL	Unknown	No estimate	--	--	--	--	--	Installation of REIL and high intensity lights would help as would a VASI. The best method would be realigning the VOR. Some missed approaches occur and potential for more as demand increases -- VOR realignment would help reduce this and circling approaches but not reduce minimums. TVOR is also a consideration.
Partial parallel taxiway to runway 31	3	TF	Unknown	$332,000	$33,200	--	--	--	--	This taxiway, located south of 31, would provide a holding area and access to 31 without interfering with expanded terminal apron. Run-ups are now only allowed on runway 23 due to noise abatement and this taxiway may therefore provide additional run-up space. Delay reduction is marginal at present.
Reliever airport improvements	1B	ALL	--	--	--	--	--	--	--	Recently, Town of Springville has sent a request through the State DOT and asked NFPA for money to build a new GA airport. Primary "reliever" is Niagara Falls Airport. Work on runway extension at Dunkirk is underway. Other NAP reliever airport recommendations are endorsed. Area airport studies will include general aviation review.

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER BUFFALO INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Retain full use holding area for runway 5	3	AT AM	1971	$100,000	$10,000	--	--	--	--	AT recommendation to raise the holding area would be an unusual construction item but basically results in retaining full use of an existing holding apron by eliminating a line of sight problem. The cost is high and present delay savings would be marginal. However, safety considerations may influence need for construction. Closed circuit TV is also being considered.
Extend runway 5/23	4	--	--	$12,500,000 for 2,500' to NE $4,500,000 for 900' to SW	--	--	--	--	--	Due to cost involved, this does not appear feasible at present but could be a long-range consideration.
Realign 13/31 and construct to 7,000'	4	--	--	$6,100,000 (plus $4,800,000 land cost)	--	--	--	--	--	At this length, 13/31 could be used by all "B" type aircraft and some "A" aircraft. The potential for installing an ILS on 31 and eliminating the VOR approach is desirable, but capacity benefits are marginal, particularly compared with cost. This might be a long-range consideration when decision on ultimate airline location is made.

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER BUFFALO INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Rehab. portion of old N/S runway as marshalling area	4	--	--	$1,450,000	--	--	--	--	--	The 900' portion of the old N/S runway north of 13/31 and the 300' portion between 13/31 and the parallel taxiway to 13/31 are analyzed under different item. This recommendation concerns just that part of the N/S runway south of the parallel taxiway to 13/31. While some holding area and access benefits would be available with this rehabilitation work, the cost appears excessive through 1975 forecasts and this item is not recommended.

DALLAS LOVE FIELD

DALLAS, TEXAS

DISCUSSION

1. Discussion on Congestion

Delays at Love Field are considered to be insignificant most of the time. Certain conditions prevail during some periods, however, which reduce the acceptance rate of the airport considerably and as a result cause delays. These conditions are:

Slippery conditions of parallel runways during wet weather periods.

A single north/south runway which reduces capacity tremendously when wind conditions require its use.

The wet runway problem is serious enough to cause considerable reduction in capacity. Local AT personnel indicated that the separation between arriving aircraft must be increased to about 5 miles whenever runways are wet. Although this condition exists to some extent on both runways, 31R/13L is scheduled for resurfacing with Portland cement within the very near future. The airport sponsor is also presently grooving runway 31L/13R (full length x 130' width).

Wind conditions of more than 20 knots which favor runway 18/36 require a single runway operation. However, this situation is estimated to occur less than 5 percent of the time.

Other factors causing considerable taxiing congestion on the airport are:

Pavement failure or weakness which restricts the use of certain portions of the movement area.

Construction projects in progress.

Lack of sufficient terminal apron to permit two-way taxiing of aircraft.

Lack of a sufficient number of aircraft loading gates.

Pavement failure is probably the most critical problem facing Love Field. Strengthening is necessary to runway 13L/31R and the entire apron area (exclusive of newly paved areas). The parallel taxiway on the north side of runway 31R/13L is being strengthened the entire length. This operation will cause serious problems for general aviation aircraft which utilize this area.

Taxiway 22-24, parallel to and south of runway 31R, has been closed to aircraft weighing more than 25,000 pounds. This taxiway, according to local authorities, was designed for temporary use only, during construction of the Braniff terminal and ramp areas. This limits access to 31R from the ramp area at the location of the new Braniff terminal causing congestion and delay when the 31's are in use. During IFR conditions, most landings are made on runway 31L due to the ILS on this runway, thereby making 31R the primary departure runway.

2. Operational Considerations

The total annual operations for FY 1968 at Dallas Love Field were 373,430. Of these, approximately 138,000 were general aviation and military operations, with military operations contributing less than 1 percent of the total. The 1970 forecast for this airport is 425,000. The PANCAP is approximately 380,000.

Helicopter operations are a very low percentage of the total operations and present no problems. There are no STOL operations. There are basically no training or touch-and-go operations at Love Field. The occasional training flight is an air carrier training operation.

There are some noise problems at Dallas but there is no preferential runway system. A special procedure is in effect whereby all jet departures climb to 3,000' on runway heading before commencing any turns. This keeps the aircraft over commercial areas (as opposed to residential areas) and has been reasonably efficient without having an appreciable derogating effect on air traffic flow.

Flow control restrictions have minimal impact on airport congestion. Airspace problems do not contribute significantly to traffic delays.

Love Field ranks eighth in the Nation in air carrier operations and twenty-first in total general aviation itinerant traffic (FY 1968).

3. Terminal Complex

There are 52 air carrier gates, all used on an exclusive basis. Due to the unknown duration of air carrier operations at Dallas, there are no plans for additional gates. Present delay because of lack of gates was indicated as minimum. The few delays that occur are attributed to poor planning or lack of cooperation on the part of users.

Several terminal buildings and passenger loading peninsulas have been or are being constructed at Love Field which have reduced the available taxiing area. Only one-way taxiing is possible around most of the ramp area. Contributing significantly to the problem are the "pushback" procedures in effect at all aircraft gates. Aircraft pushing back from the gates utilize the taxiing area, thereby stopping the flow of taxiing traffic.

4. Reliever Airports

Dallas Love Field has approximately 40 percent general aviation activities. This is in an area where two reliever airports already have FAA towers.

Addison Field had an FY 1968 total operations count of 198,000. This is a privately owned airport with an FAA tower. They are now in the process of runway lengthening. This airport caters to rather sophisticated aircraft and, due to its location, if there is an increase in IFR activity, there would be a serious airspace conflict with Love Field.

Redbird Airport has an FAA tower and during FY 1968 had 190,000 operations. The National Airport Plan recommends development of this airport by acquiring more land, extending runway and taxiways, and installing runway and taxiway lighting.

Two new relievers are recommended in the National Airport Plan at Garland and Mesquite.

5. F & E Considerations

VASI's and REIL's on runways 18 and 36 were recommended by all groups. Also, a REIL was recommended for runway 13R.

6. Special Considerations

Since the new Dallas/Fort Worth Regional Airport is scheduled to open in 1972-1973, present plans for Love Field are uncertain. Although it has been reported by various sources that it will remain a general aviation airport, no firm decision has been reached. Obviously, Love Field would be a rather expensive general aviation airport and local authorities question whether sufficient public local funds will be available to support both airports. These same local authorities are reluctant to even discuss any improvements to the airfield other than those absolutely necessary to maintain its present level of operation.

However, the PANCAP for Love Field is about 380,000. With a CY 1968 demand of 394,000, the average delays to operations are approximately 1.6 minutes and delays during the peak periods are five to ten times this amount or 8 to 16 minutes (7.5 to 15 is considered normal). As the demand increases to the expected 425,000 operations in 1970, delays during peak hours will average 10 to 21 minutes. Since delays rise exponentially as demand increases, a demand of 475,000 in 1975 versus a PANCAP of 380,000 will result in a typical peak hour delay of 12.5 to 25 minutes and annual delay will exceed a normal or acceptable level by 610,000 minutes. At a cost of $7.78 (based upon 1970 mix) per minute this would be an annual above-normal delay cost of $4,750,000. Obviously, some action should be taken to avoid costly delays of this magnitude if a demand figure of the order shown is anticipated. Timing of completion of the new regional airport will have a strong influence

on any improvements to Love Field since these improvements must be justified on an interim basis. That is, if a particular construction item reduces delays sufficiently within a one or two-year period to realize a delay cost savings equal to or greater than the construction cost, the item may be worthwhile. On the other hand, if many years of operation are required to obtain a plus delay savings/construction cost ratio, the Regional Airport may be opened before the investment is returned.

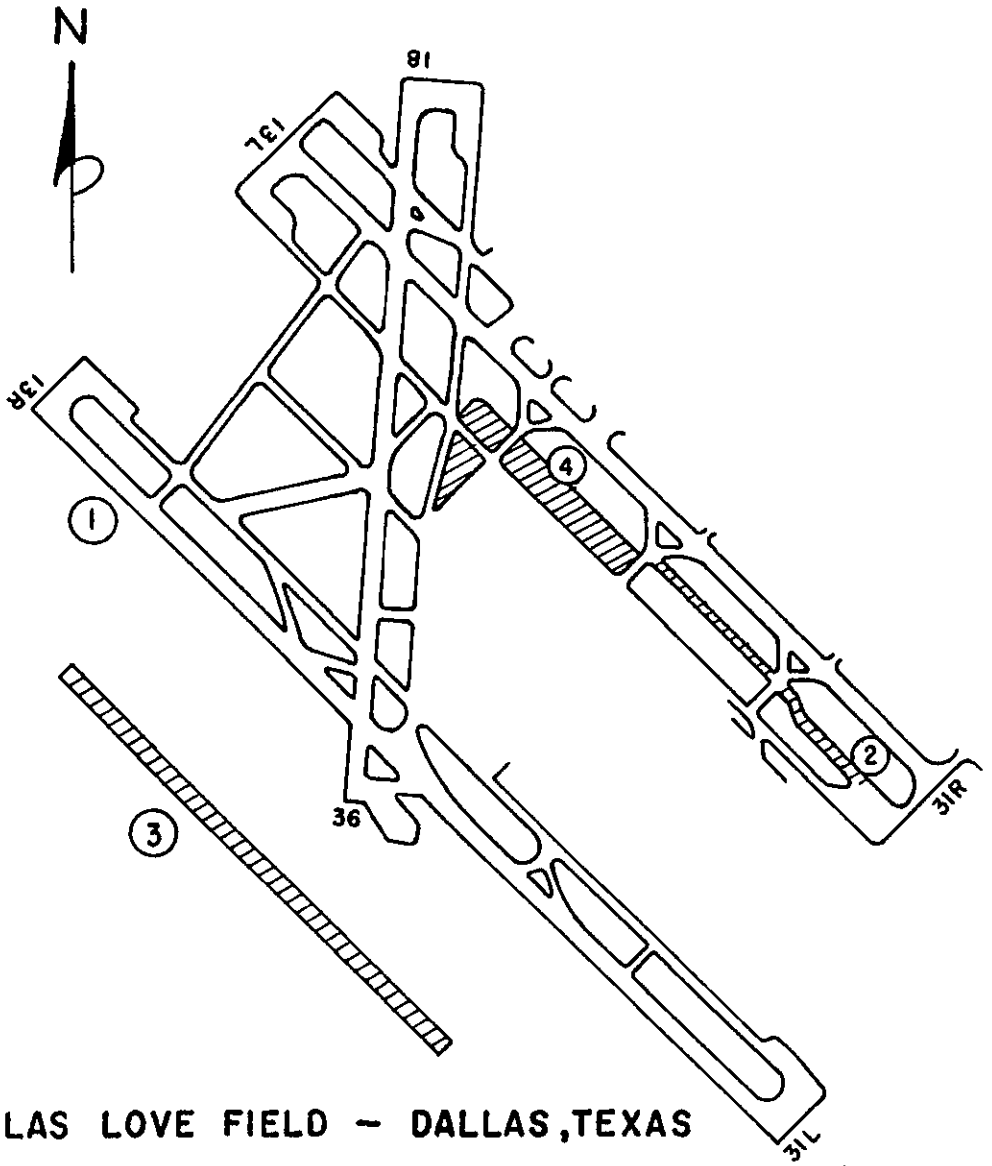
In any cost/benefit analysis, the costs and benefits should be borne by the same party. The costs of delays by the aircraft mix at the airport may be reduced by additional apron, taxiway, and runway construction. The costs of improvements will ultimately be paid for by the users, but in many cases this is a very indirect repayment. For Love Field, repayment by passengers through increased use of facilities (dining, auto parking, etc.) and by airlines and general aviation through more frequent landing fees, higher gas sales, etc., may be too slow a process. Airport management has indicated the users may simply have to live with any additional delays imposed by higher activity rates until the Regional Airport is opened. This may be a realistic approach. If, however, unforeseen problems arise in completing the new Regional Airport and Love Field must accommodate the large growth rate forecast for this area for an extended length of time, additional construction at Love Field becomes a vital consideration. Thus, several potentially beneficial ideas were received from local FAA officials and are evaluated in this report. Due to monetary considerations and the current necessary scheduled work, no suggestions were offered by local airport management.

RECOMMENDATIONS

The following priority of improvements has been developed in the order thought to be most significant in relieving possible future congestion at Love Field. It is recommended that this listing be fully considered in future airport development.

ACCOMPLISHMENT PRIORITY RANKING	ITEM
1	Groove runway 13R/31L
2	Strengthen taxiways 22 and 24 south of 31R
3	Parallel GA/STOL runway
4	Expand apron

The airport management has advised that only grooving of runway 13R/31L out of the above recommendations will be accomplished. This improvement is obviously needed, as indicated in the analysis of this item. However, additional construction at Love Field may become necessary due to considerations already discussed. If other improvements do become necessary, the above listed items should be considered.



DALLAS LOVE FIELD – DALLAS, TEXAS

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (4)

PRESENT–FORECAST TRAFFIC ACTIVITY
FY-1968 - 373,000
FY-1970 - 425,000
FY-1975 - 475,000

PRESENT AND FORECAST TRAFFIC MIX

	PRESENT	1970
A	18%	27%
B	44%	42%
C	4%	4%
D+E	34%	27%

COST PER MINUTE OF OPERATION BASED ON FORECAST MIX: $7.78

ANALYSIS OF IMPROVEMENTS

LOCATION DALLAS LOVE FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Groove Runway 13R/31L	1A	ALL	1969 (2/3 complete)	$173,000	$17,300	16,000	20,000	$124,000	7.2:1	This runway is scheduled for grooving in the spring of 1969. Slippery coating at the end of 13R causes problems to arrivals on 31L in trying to stop. During wet conditions the normal 3-mile spacing is stretched to 5 miles to safely accommodate 31L arrivals. Same problem during wet conditions and a 13L operation, but current overlay is intended to correct this. In determining improved acceptance rate, full reduction to 3 miles was not assumed from grooving, but a substantial wet weather operation capacity increase will be realized with grooving. In IFR the hourly capacity difference of a 31L, 31R use with 31L grooved and ungrooved is assumed to be about 5-8 operations while in VFR the difference is about 15 operations.
Strengthen parallel taxiways 22 and 24 on south end of 31R	1A	AT	Not planned	$315,000	$31,500	5,770		$45,000	1.4:1	This item results in a savings/cost ratio of better than 1:1 but 17% of the savings is primarily for one airline, Braniff. By strengthening this taxiway and allowing heavy aircraft to use it, the Braniff ramp area would remain more accessible to their own aircraft arriving from 31 directions. If airport loses air carrier activity in 1972-1974, recovering construction cost would then be a slow process. Runway 13L/31R will be closed during resurfacing and some of north taxiway improvement will close this runway. This would be ideal time to rebuild this taxiway.

ANALYSIS OF IMPROVEMENTS

LOCATION DALLAS LOVE FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Parallel GA/STOL runway 13RR/31LL 4200' X 75'	1B	TF	Not presently planned	No estimate		165,000	250,000	$1,310,000	--	Construction of a third parallel 13/31 runway is not now planned nor was it recommended by anyone in attendance at the meeting since it is thought costs would be prohibitive. However, this is shown to give an indication of relative benefits that could accrue from such construction. At a length only sufficient for about 30% of the aircraft now using Love Field and only during VFR conditions, there is still about a 10% increase in PANCAP and an approximate 20% reduction in annual delay. This is based on a 1970 demand of 425,000 annual operations and 1975 demand of 475,000 with no change in mix. If this airport reverts to general aviation use only when the new Regional Airport is opened, a VFR parallel of this type would give a much higher capacity increase, but cost/min. of delay would have to be reduced correspondingly.

ANALYSIS OF IMPROVEMENTS

LOCATION DALLAS LOVE FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Expand apron	3	AT AO TF	--	$943,000	$94,300	--	--	--	--	This cost is for the areas designated on the sketch as #4. Expanding the area as shown would provide two-way taxi capability. Since minimum congestion exists in this area at this time and airport management assured the Task Force this expansion would not take place, this item is not analyzed.
Penalty box to store 6 departures	4		--	$282,000	--	--	--	--	--	The need for penalty boxes was discussed. The sponsor felt this was a nice-to-have item rather than a necessity. He also advised there was plenty of space for such function on the north side of runway 13L/31R in the maintenance area. With runway 18/36 available, 95% of the time for departure delay purposes, this item does not rate a recommendation.
High speed exits on south side of runway 13L/31R	4	AT	--	$99,000 for those serving 31R $62,750 for turnoff on 13L	--	--	--	--	--	In spite of the relatively low cost of these projects, the runways already have an excellent exit capability and the improvement thereof would result in a fraction of 1% of an increase in hourly operations. The exit ratings are presently 1.2 for 13L and 1.4 for 31R.

DETROIT METROPOLITAN WAYNE COUNTY AIRPORT

DETROIT, MICHIGAN

DISCUSSION

1. Discussion on Congestion

Detroit Metropolitan Wayne County Airport is presently operating below its practical annual capacity and the forecast demand on this airport remains below its PANCAP through FY 1973. The runway capacity is adequate for both VFR and IFR demand. Delays are average and its ranking in accordance with air carrier delay reports is consistent with its ranking in accordance with air carrier operations.

The basic layout consists of parallel 3/21's and a major cross runway 9/27. The separation between the parallels is 3,800' allowing an independent IFR arrival/departure operation. The next runway to be constructed is an additional parallel 3/21 which will be to the east and separated from the westernmost 3L/21R by 5,000', allowing simultaneous IFR arrivals. The sponsors intend to keep the existing 3R/21L when the new 3/21 is finished but there is heavy pressure from the airlines to shut down this runway for terminal apron and gate expansion. The new parallel 3/21 could be completed by 1972 if a NIKE site on the airport could be eliminated now.

A parallel runway 9/27 is planned 6,550' south of the existing 9/27. When this work is completed, this airport will be well ahead of its demand into the 1980 time period.

2. Operational Considerations

Aircraft operations at Detroit Metropolitan Airport during CY 1968 totaled over 301,000. This is forecast to increase to 318,000 by 1970 and 358,000 by 1975. Total instrument operations during this same period were 304,018, which includes over 90,000 instrument operations at secondary airports. The PANCAP for this location is approximately 347,000.

Detroit has very few helicopter operations, estimated at less than one percent of the total traffic. STOL's have not been proposed in this area. As with most locations, officials in Detroit are watching the STOL developments in the Washington-New York area.

There are approximately 140 based aircraft at Detroit, many of which are owned by several flying schools located there. Most of the training, however, is accomplished at other airports in the area. There are very few (if any) touch-and-go operations.

There are no special procedures for noise abatement in effect now and no preferential runway system has been established. One of the neighboring communities, Dearborn, has an ordinance which "prohibits" aircraft from overflying it at less than 5,000'. This ordinance has not been enforced and it is questionable if, indeed, it could be. However, if such an ordinance could be and were enforced, no aircraft could land on either runways 21 since this community is immediately adjacent to the final approach courses of these runways.

Flow control restrictions to both New York and Chicago are occasionally imposed but no estimate was available as to frequency or number of aircraft affected by such restrictions.

3. Terminal Complex

There are presently 49 gates at Detroit Metropolitan Airport. Additional gates are being planned. Eight more will be provided by 1970 for a total of 57. All gates are used on an exclusive basis.

4. Reliever Airports

Pontiac, Willow Run, and Detroit City Airports serve as relievers for Detroit Metropolitan. Of these, City Airport has the most operations - 248,000 during FY 1968. Willow Run has approximately 140 based aircraft and had 163,000 total operations during this period, indicating that further growth is possible at this airport to attain maximum utilization.

Windsor Airport in Canada also serves as a reliever to Detroit Metropolitan and is very convenient to the downtown Detroit area.

The Grosse Ile NAS has recently been declared as surplus by the Navy. Local authorities are planning to develop this into a major general aviation facility.

A local privately owned airport, Berg, is expected to close soon, requiring relocation for the more than 125 aircraft based there. Another private airport, Big Beaver, is also questionable. One hundred and fifty aircraft are based at this airport.

Two new reliever airports are shown in the NAP, however, the sites have not yet been selected.

RECOMMENDATIONS

The following priority of improvements has been developed in the order thought to be most significant in relieving present and future congestion at Detroit Metropolitan Wayne County Airport. It is recommended that this listing be fully considered in all future airport development.

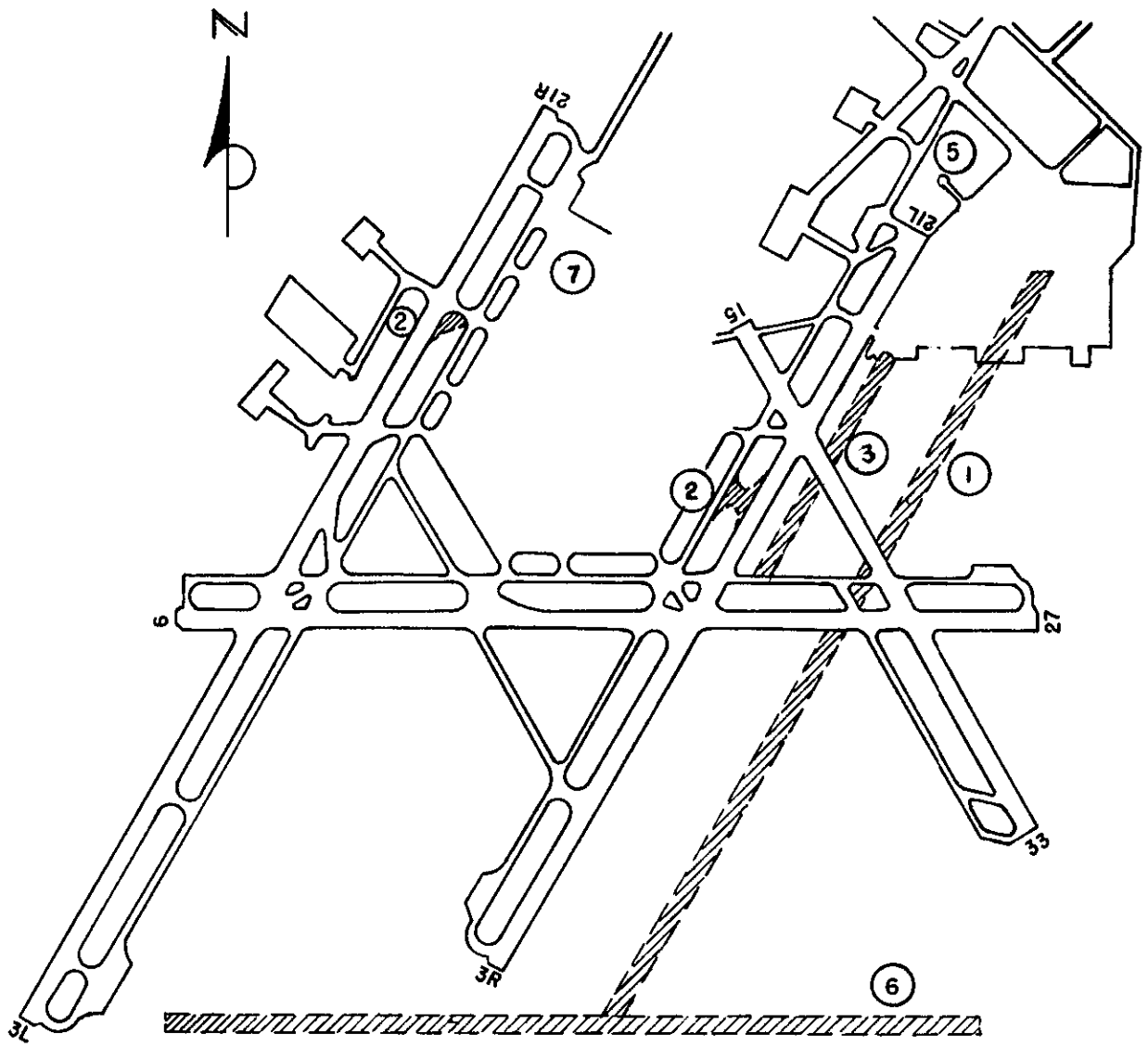
PRIORITY RANKING	ITEM
1	Construct third parallel 3/21
2	Construct high speed exits on 3R, 3L, and 21L
3	Partial parallel taxiway east of 3R/21L
4	Improve reliever airports
5	REIL and/or VASI on 21L
6	Construct parallel 9R/27L
7	Expand apron

The recommendation to construct the third parallel in the 3/21 direction is analyzed on the basis of retaining the existing 3R/21L. Benefits will accrue only to IFR traffic if the existing 3R/21L is closed when the new parallel is in operation.

The addition of high speed exits is an item that results in a favorable savings/cost ratio and can be accomplished in a relatively short time period. The parallel partial taxiway to 3R/21L results in marginal savings and is subject to question with respect to plans to move the general aviation area.

The REIL or VASI on runway 21L is a public relations item as opposed to a capacity item. The parallel runway 9R/27L is a long-range improvement and its value depends upon conditions existing at the time of its construction.

Although not analyzed in this report, local authorities should be encouraged to plan for Boeing 747 gates. Due to the narrow width of the ramp areas, these aircraft cannot be accommodated at all gate positions.



DETROIT METROPOLITAN WAYNE COUNTY AIRPORT

DETROIT, MICHIGAN

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (7)

PRESENT – FORECAST TRAFFIC ACTIVITY

FY-68	297,000
FY-70	318,000
FY-75	358,000

PRESENT & FORECAST TRAFFIC MIX (APPROXIMATE)

	PRESENT	1970
A	14%	21%
B	44%	45%
C	4%	2%
D & E	38%	32%

COST PER MINUTE OF OPERATION BASED ON FORECAST MIX # 7.09

ANALYSIS OF IMPROVEMENTS

LOCATION DETROIT METROPOLITAN WAYNE COUNTY AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Construct new parallel 3RR/21LL including taxiways, lighting, etc.	1A	ALL	1971-1972	$8,000,000	$800,000	164,000	305,000	$1,140,000	1.5:1	The cost shown does not include cost of relocating ANG or the NIKE site. Savings are overstated in 1970 since existing PANCAP exceeds 1970 demand. Savings are based upon 3 parallel runways in the 3/21 direction. Airlines favor construction of this runway, phasing out of existing 3R/21L, and expansion of the present terminal area. Airport management, however, intends to construct a new, centrally located terminal area and continue use of all 3 parallel 3/21 runways.
Construct new high speed exits, one each on 3R, 3L, and 21L and widen exits to 150' radius for 747 use.	1A	ALL	1970-1971	$400,000 standard exits $500,000 widen exit fillets	$40,000	10,000	--	$72,000	1.8:1	The new high speed exit taxiways will benefit about 45% of arrival traffic. Savings/cost ratio is favorable. Approximate locations are as recommended by AT. The widening of taxiway fillets to accommodate 747 aircraft will result in very minor improvement to airport capacity but are considered essential to the operation of 747 aircraft. The locations of exit widenings are approximate and are subject to further study.
Taxiway parallel to 3R/21L from ANG area to runway 9/27 75' x 2500'	3	AT	1970	$210,000 ($10/SY)	$21,000	2,640	--	$18,800	.9:1	This taxiway would permit better access to the GA area and help reduce some congestion which exists when 21L is in operation. Since this GA area is scheduled for relocation in about five years, the taxiway would need to be built immediately to obtain full benefits. Even then, five years will not apparently quite amortize the investment. Benefits are marginal at cost estimated. However, if lower cost paving could be used for traffic

(OVER)

ANALYSIS OF IMPROVEMENTS

LOCATION DETROIT METROPOLITAN WAYNE COUNTY AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
										to the GA area, this item might be more desirable. Delay savings are very approximate.
Improve reliever airports	1B	ALL	--	--	--	--	--	--	--	Sites have not been selected but 2 new GA relievers are recommended in the current NAP. The possibility that two local privately owned airports may close makes this recommendation very important. Willow Run has a large portion of current GA activity and improvements to this and other relievers in the NAP are endorsed non-essential. GA activity at Detroit Metropolitan Wayne County Airport is being discouraged.
REIL on 21L (and/or VASI)	1B	AT	Unknown	--	--	--	--	--	--	This item would help reduce noise impact in the Dearborn area but is not directly calculable in delay reduction. Obviously 3R/21L needs to continue in free operation and this item is endorsed.
Construct new parallel 9R/27L including taxiways, lighting, etc.	3 or 2A	AM	After 1974	$11,000,000 (including overpass)	$1,100,000	103,000	177,000	$742,000	.7:1	Savings are based upon addition of 9R/27L to existing configuration. Lateral separation of 9L & 9R is assumed at +6,000'. If 9R/27L is added to a configuration having 3 NE/SW runways, only about a 6% capacity increase is realized. Capacity increase and resultant delay savings are marginal for this suggestion, particularly with the present terminal location. However, if the main terminal facilities are relocated south of existing 9/27, the new 9R/27L becomes much more desirable.

ANALYSIS OF IMPROVEMENTS

LOCATION DETROIT METROPOLITAN WAYNE COUNTY AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Expand apron	2B	AM	After 1974	--	--	--	--	--	--	GA apron expansion for itinerant traffic in an area just east of 21R is about to be constructed and therefore not analyzed. The expansion of terminal facilities in the central portion of the field will include extensive new apron areas but is considered to be a long-range item.
Construct new close parallel 9/27 south of existing 9/27	4	--	After 1975	$8,000,000	$800,000	--	--	--	--	This item was not evaluated since airport management intends to build the far parallel 9R/27L first at a spacing of +6,000'. With 9R/27L constructed, the third parallel becomes a very long-range item. If, on the other hand, it is decided to build this close parallel first, about the same VFR capacity improvement would be obtained as for 9R/27L but only limited IFR improvements would be realized. Timing of location of main terminal facilities south of 9L/27R is the key to decision on 9R/27L versus this close parallel.

KANSAS CITY INTERNATIONAL AIRPORT

KANSAS CITY, MISSOURI

DISCUSSION

1. Discussion on Congestion

Kansas City International Airport is open but as yet there are no scheduled air carrier operations. Air carrier operations are expected to begin at this location approximately June of 1970 when there will be a turnkey operation with all air carrier activity leaving Kansas City Municipal at one time. The existing layout will be adequate to meet original demand and no immediate improvements are required for capacity purposes.

When air carrier operations commence, there will be two runways, 1/19 and 9/27, 10,800' and 9,500' long, respectively. A parallel north/south runway is planned by 1975 at a length of 12,400'. In the period 1975-1980 a parallel east/west runway is planned and beyond 1980 a third parallel north/south runway.

In April of 1970 a 4,000' by 75' runway will be constructed on the future site of the parallel taxiway to the second north/south runway. The construction of a general aviation apron at the time the GA runway goes in seemed to be a questionable item since the sponsors are not particularly anxious to encourage such activity here when Fairfax and Municipal are already available. An apron of some sort would appear to be a necessity for connecting passengers.

TWA does a great deal of training at International and apparently intends to continue to do so as long as possible. This factor will tend toward early congestion and need be carefully considered in forecasting activity here. For instance, if touch-and-go activities remain a large factor in total operations, (approximately 50 percent) and operations are 300,000 annually as opposed to 210,000, there would be an additional 390,000 minutes of annual delay. The lack of a dual parallel taxiway on runway 9/27 in the vicinity of the TWA maintenance ramp is a congestion factor that should be corrected.

This is one of the few airports visited that seemed to have good information on future 747 traffic. By 1971 they are expecting 11 such flights daily.

There are plans to extend runways 1 and 9 and have them intersect. Unless new procedures are developed that would allow independent operations on intersecting runways, this extension would actually reduce airport capacity.

2. Operational Considerations

Kansas City International Airport had 234,000 operations during CY 1968. They were almost all training flights. Counting low approaches, approximately 90 percent of the traffic is touch-and-go. The type training is split 50-50 between air carrier training and other general aviation activity. The PANCAP for this location is approximately 242,000.

The first full year of activity with scheduled air carriers involved will be 1971 and the forecast for that period is 210,000 operations. However, the sponsor and the local ATC personnel think 300,000 is a more reasonable forecast.

Helicopter or STOL activity is difficult to forecast. The rather distant location of the airport from the CBD will tend to attract such activity. However, this type traffic will not be significant as a congestion factor for some period of time.

There is no indication at this time that TWA, whose training activity accounts for 50 percent of the present traffic, will take their training elsewhere when scheduled air carriers move in.

Noise problems are nonexistent and should remain so. With proper planning and action, it should be easy to stay ahead of this bothersome factor. The sponsor is now working on a zoning ordinance that will help in this area.

Flow control restrictions into Chicago cause some delays at Municipal and this problem will transfer to International when scheduled operations begin approximately June of 1970.

3. Terminal Complex

When passenger activity commences at International, there will be three separate terminal buildings completed with a total of 50 gates. A fourth building is planned around 1980 which will increase the gates to 65-70. For comparison purposes, Municipal now has 24 gates.

Gate usage will not be exclusive. Empty gates will be made available to waiting aircraft.

4. Reliever Airports

Kansas City Fairfax is the primary general aviation airport in the area. There are about 310 based aircraft at Fairfax and a potential of 500 exists. A 3,200' north-south parallel is planned at Fairfax.

It is assumed Kansas City Municipal will gain more general aviation activity when the air carriers go to International. There are 186 based aircraft at Municipal and a potential for 400. At this time no touch-and-go operations are allowed at Municipal. This restriction will be subject to review later.

5. F & E Considerations

After the extension of 19R to the north, the local people want a full ILS installed. In addition, there is a request for a VORTAC to the north and west of International to facilitate handling and segregation of traffic from St. Joseph Airport.

RECOMMENDATIONS

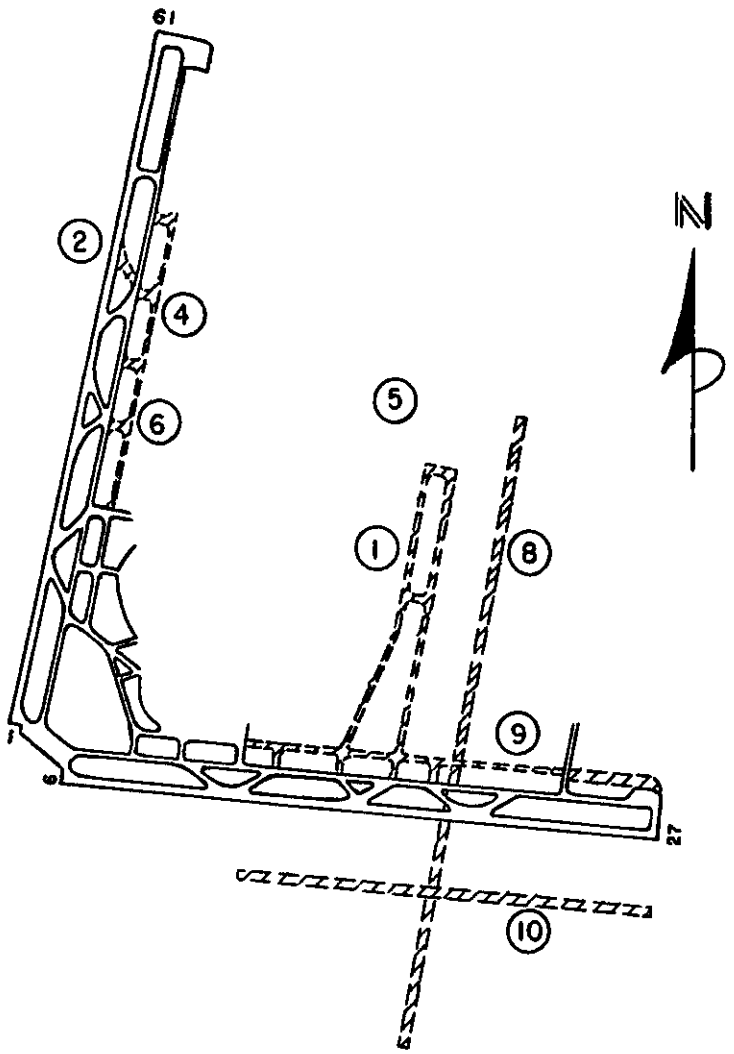
The following priority of improvements has been developed in the order thought to be most significant in relieving future congestion at Kansas City International Airport. It is recommended that this listing be fully considered in all future airport development.

PRIORITY RANKING	ITEM
1	Construct parallel N/S runway 1R/19L 4,000'x75'
2	Add high speed exit runway 19R
3	Reliever airport improvement
4	Construct cargo apron
5	Construct GA apron
6	Construct dual access to 19R
7	ILS runway 19R
8	Construct full parallel N/S 1R/19L 10,000'x150'
9	Construct dual access to 27R
10	Construct parallel 9R/27L 6,000'x150'

None of the above items is of a pressing priority, unless training activities remain at a level that immediately pushes demand above the PANCAP of 242,000. The first stage construction of the parallel north-south runway 1R/19L, 4,000'x75', would relieve training activity pressure, assuming training would continue as a 50-50 split between air carriers and general aviation.

Kansas City ranked very high in the number of all-cargo flights among the airports visited. It is assumed this activity will transfer to the new airport when the other air carrier activity does. Therefore, the cargo apron and development of associated facilities should be an early improvement. In like manner, a general aviation apron would be needed soon to accommodate connecting passengers.

All other items analyzed are of a long-range nature. One item not mentioned previously is land acquisition. Long-range plans call for a third parallel in the 1/19 direction and this runway will be required in the future. The land has not been purchased, however, and the cost is escalating at approximately two million dollars per annum. It is recommended this land be purchased at as early a date as possible.



KANSAS CITY INTERNATIONAL AIRPORT
KANSAS CITY, MISSOURI

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (10)

PRESENT - FORECAST TRAFFIC ACTIVITY

FY 1968	234,000
FY 1970	210,000
FY 1975	340,000

PRESENT & FORECAST TRAFFIC MIX (APPROXIMATE)

	PRESENT	1970
A	9%	19%
B	34%	48%
C	2%	7%
D & E	55%	26%

COST PER MINUTE OF OPERATION BASED ON FORECAST MIX #7.14

ANALYSIS OF IMPROVEMENTS

LOCATION KANSAS CITY INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Construct parallel N/S runway 1R/19L 4,000' x 75'	1A	ALL	1970-1971	$900,000	$90,000	56,000	181,000	$400,000	4:1	The annual savings for this short parallel runway (1st stage taxiway) are overstated slightly in 1970 since the PANCAP, even without this parallel, will apparently exceed the forecast demand. However, by 1973 or 1974 the short runway will definitely be justified if the forecasts are accurate. It was estimated that in 1970 about 33% of the aircraft at MCI could use a 4,000' length.
Add high speed exit to runway 19R	1A	AT	1970-1971	$55,600	$5,560	5,000	9,000	$35,600	6:1	This additional exit, located about 1,200' from 19R, will be of even more importance when 19R is extended to the north (planned for summer of 1969) but now gives a reasonable savings/cost ratio. The ratio, again, is overstated somewhat for 1970 since PANCAP already exceeds demand.
Reliever airport improvement	1B	ALL	--	--	--	--	--	--	--	Municipal is now undergoing extensive review as is Fairfax. Additional facilities for GA should be developed at these locations. Current NAP airports are all endorsed. See "Discussion" section for more details.
Construct cargo apron	1B	ALL	1970-1971	$156,000 (2 positions)	$15,600	--	--	--	--	At least two cargo aircraft parking positions will be needed when this airport opens and approximately 4 positions by 1975. Although no delay analysis is made, these gates are obviously needed to help reduce delays in the terminal area. Route changes will greatly influence the number of gates needed for all-cargo operations which now total 30/week.

ANALYSIS OF IMPROVEMENTS

LOCATION KANSAS CITY INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Construct general aviation apron	1B	AM	1971-1973	--	--	--	--	--	--	The exact location for this apron has not been selected, but it should be convenient for itinerant and connecting flights. Timing of construction is also not yet definite. An FBO may not locate here for quite some time, not only because demand will be low for GA but also because of the convenient and adequate facilities of Fairfax and Municipal. Need for a minimum apron area for GA is, however, obvious.
Construct dual access to 19R	3	ALL	1970-1971	$400,000	$40,000	2,160	--	$15,400	.4:1	This item is for construction of a two-way taxiway access to 19R. The additional lane, to the first turnoff from 19R, would cost the amount shown. Carrying this lane out to the end of 19R (as extended) depends upon the air cargo activity growth in the area adjacent to 19R. Delay savings shown are very approximate but benefits are marginal until cargo becomes an important consideration.
Relocate ILS from 1L to 19R (or provide new ILS on 19R)	3 (1970) 1B (1975)	AM	New	--	--	--	--	--	--	Airport management prefers a new ILS installation on 19R with 1L ILS continued. A new ILS for 19L is in agency planning for 1976 and the two runways are spaced in such a way to provide dual arrivals with full instrumentation available. Dual arrival capability by 1975 is endorsed and therefore ILS installation on both 19's is endorsed. However, current delay savings would not be great. The decision on whether to provide a new ILS or relocate the existing ILS needs detailed investigation on salvage value, % use in the 1 direction, new installation cost, etc., which is beyond the scope of this report.

ANALYSIS OF IMPROVEMENTS

LOCATION KANSAS CITY INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Construct full parallel N/S runway 1R/19L 10,000'x 150'	2A	ALL	After 1975	$10,000,000	$1,000,000	--	246,000 (151,000) 1975	$1,910,000 ($1,170,000) 1975	1.9:1 (1.2:1) 1975	Due to the cost of this runway, it is not recommended for construction until about 1975. The figures on savings are based upon 1975 demand and a cost per minute of $7.75 for the 1975 mix. The figures in parentheses show the improvement the long runway gives even if the short runway is built. If the full length parallel is shifted north sufficiently to avoid intersecting with 9L/27R, capacity is improved slightly but cost of shifting is estimated at $3-4 million and taxiing delays would be slightly higher. Thus, the current location on the ALP appears to be best.
Construct dual access to 27R	2B	AM	1974	$200,000	$20,000	--	--	--	--	The first portion of this taxiway is needed for access to the short parallel 1R/19L. However, the demand for 27R does not apparently now justify construction. This is recommended for future development (to coincide possibly with construction of 9R/27L). Two-way connection to TWA area may increase the need for this taxiway, at least to taxiway "T", before the 1974 time period.

ANALYSIS OF IMPROVEMENTS

LOCATION KANSAS CITY INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Construct parallel runway 9R/27L 6,000' x 150'	2B	ALL	After 1975	--	--	--	--	--	--	This runway was compared with construction of the 4,000' N/S runway and is not as desirable for immediate construction for three reasons: (1) crossing problem reduces VFR capacity by about 10% compared with 1R/19L, (2) IFR capacity for close parallel E/W runways is at least 20% less than the N/S runways, (3) taxiing distances would generally be greater. This runway is endorsed for future construction.
Expand A/C apron	4	--	--	--	--	--	--	--	--	In 1975, rough calculations indicate 34 gate positions of appropriate size will be needed. There are now 24 gates at Municipal and some double parking does occur during peak periods. It is recommended that initial construction of at least 30 "mutual-use" gates be accomplished, including 2-3 of sufficient size to handle the forecast 11 daily operations by 747 traffic. Current construction at MCI is for more gates than this, therefore, additional expansion is not now recommended.
Construct V/STOL runway	4	--	--	--	--	--	--	--	--	The potential for STOL and MCI is currently thought to be poor. Most STOL activity will be into Municipal although some connections or shuttle service operations may be conducted at MCI. At any rate, the parallel 4,000' N/S runway could serve initially and has been recommended previously in this analysis. No additional, separate STOL facility is recommended.

ANALYSIS OF IMPROVEMENTS

LOCATION KANSAS CITY INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Third parallel N/S runway Extend existing 9L/27R Extend 1L/19R (from 10,800' to 12,000')	4	--	--	--	--	--	--	--	--	These are long-range items that were only discussed briefly and are not analyzed in this report.

GENERAL MITCHELL FIELD

MILWAUKEE, WISCONSIN

DISCUSSION

1. Discussion on Congestion

The primary causes of congestion at Milwaukee's Mitchell Field are:

Location in relation to Chicago O'Hare

"Unparallel" parallel runways

Lack of a sufficient number of aircraft loading gates

Forced mix of air carrier and general aviation due to lack of parallel N/S runway

Mitchell Field is located approximately 50 miles north of Chicago's O'Hare Airport. Additionally, about 40 percent of the total air carrier departures from Mitchell are destined for O'Hare. Because of the closeness to Chicago, these departures are dependent strictly upon the traffic situation there and all experience some delay. This delay may be from several minutes to up to two hours. This delay is the major factor in reported delays at Mitchell Field.

All of these flights, incidentally, are handled by the ARTCC since tower enroute control is considered impractical due to distance and volume.

Runways 7/25 at Mitchell Field are considered to be parallel but are not. The extended centerlines of the runways converge about two miles southwest of the airport. Constant surveillance of this area and constant effort by the control tower are necessary in order to keep aircraft on 7L "tight" enough to remain clear of traffic on 7R. Since students are flying most of the 7L aircraft, this is very difficult.

Two fixed-base operators are located at General Mitchell in contrast to just one at Timmerman, the major general aviation airport (see following). Touch-and-go's comprise about 30 percent of the total operations. Touch-and-go's are discontinued by the tower whenever necessary due to heavy traffic or a single runway operation required by wind or closures.

The terminal complex now has 21 gates, all of which are exclusive use only. One of these is reserved for itinerant aircraft. Northwest Airlines experiences daily delays due to a shortage of

gates; however, local FAA and county sources feel this problem exists chiefly due to poor peaking of schedules.

Lawrence J. Timmerman Airport is the major general aviation public airport in Milwaukee. This airport is extremely well equipped with a control tower, VOR, two paved runways with parallel taxiways, and three turf landing strips. The airport is also conveniently located, just 6 miles northwest of the city. Unfortunately, Timmerman is not being utilized to its full capacity, as indicated by its constantly falling activity count (down to less than 122,000 in CY 1968). One possible reason for this situation may be that there is only one FBO located here, the owner of which is also the airport manager. County authorities plan to permit at least one more FBO at Timmerman but due to existing lease and contractual agreements, change may take some time to be accomplished (to the disadvantage of all aviation interests in the area).

2. Operational Considerations

Total aircraft operations at General Mitchell Field were 272,563 during CY 1968. 74,000 of these were air carrier operations. Activity is forecast for 306,000 in 1970 and 345,000 by 1975. Of this total, air carrier operations will only total approximately 40 percent. Obviously, the situation at Timmerman and other relievers could affect the forecast and mix considerably. The PANCAP for this location is estimated as 288,000. When runway 1R/19L (under construction) is completed, PANCAP will be approximately 310,000.

Helicopter traffic is minimal, less than 1 percent of the total, and not considered a problem. A helicopter school is located here and its operations last summer caused some congestion. Current procedures should minimize the problem this year, however.

American Airlines is conducting an evaluation of STOL utilization in the Chicago/Milwaukee area. This study will be quite important to the area. These flights will be primarily operating on runway 13/31. The evaluation will involve one or two flights per day, three or four days per week.

Noise abatement procedures or regulations have not been established at Milwaukee. A housing development adjacent to runway 7R has made some complaints. The sponsor, however, is presently buying this land area for future development. There have also been noise complaints from residents in the approach area to runway 25R.

Flow control restrictions, as previously stated, cause a major part of the delays being experienced. Almost all of the flow control restrictions are imposed on O'Hare bound aircraft.

3. Terminal Complex

There are presently 21 gates available and 2 more are under construction. One of these is strictly for itinerant aircraft. All gates are exclusive use. The master plan calls for 47 gates ultimately in the present terminal area. There are 3 cargo gates in addition to the above. One or more additional FBO operations have been proposed, one south of runway 7R and one east of runway 19L.

4. Reliever Airports

As stated earlier, Timmerman is the major reliever airport in the Milwaukee area and all possible effort should be exerted to utilize it to its fullest capacity. Waukesha Airport is also county owned and currently has about 160 based aircraft. Total itinerant operations are an estimated 30,000 and total operations an estimated 98,000 per year. There are numerous general aviation airports in the Milwaukee hub area designated as relievers for planning purposes and a total activity of 1,161,000 operations by 1975 is forecasted.

However, two small privately owned airports in the area, Hales Corner and Rainbow, may close due to increasing land values in these areas.

Consideration has also been given to acquiring and developing Richard E. Bong Air Force Base, located 25 miles south, into a second major air carrier airport. This is long range, however, and poses many problems, particularly from an airspace point of view. This location is only 30-35 miles north of O'Hare Airport.

5. F & E Considerations

According to local authorities, a control tower at Waukesha would make this airport much more attractive to general aviation traffic, thereby relieving General Mitchell to some extent. Local activity is estimated at 135,000 operations for CY 1968 but Waukesha does not now meet minimum tower establishment criteria (50,000 itinerant operations for a general aviation airport).

A VASI system on runway 25L is recommended to avoid possible future noise problems from the area northeast of the airport.

Many missed approaches occur whenever back course ILS approaches are being conducted to runway 19. In order to assist aircraft making these approaches, a REIL/RAIL is recommended for this runway, rather than the VASI presently programmed.

RECOMMENDATIONS

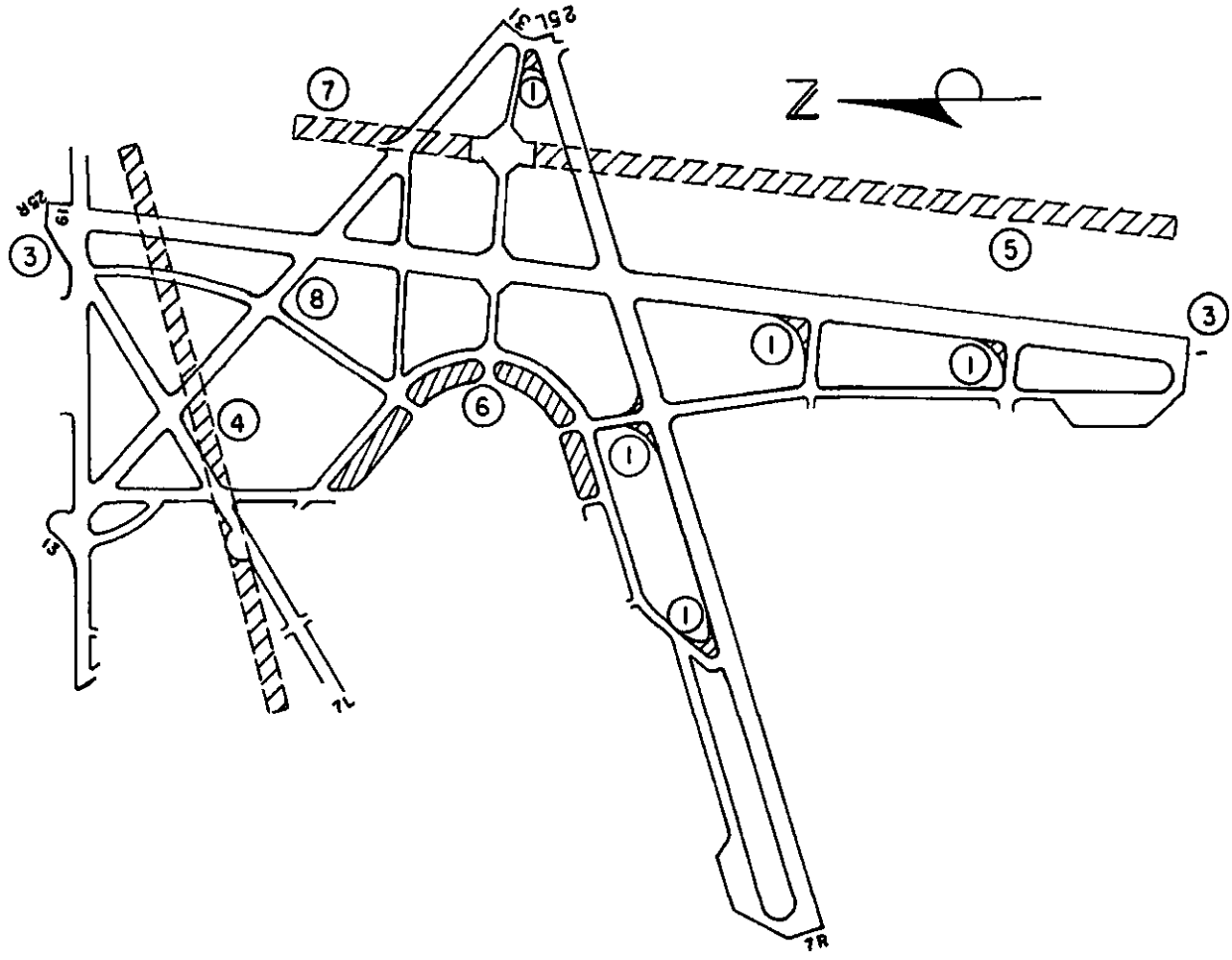
The following priority of improvements has been developed in the order thought to be most significant in relieving present and future congestion at General Mitchell Field. It is recommended that this listing be fully considered in all future airport development.

PRIORITY RANKING	ITEM
1	Fillets and exit taxiway improvements
2	Improve reliever airports
3	Rehabilitate HIRL on 1L/19R
4	Realign 7L/25R parallel to 7R/25L and construct to 5,000' x 150'
5	Install Navaids
6	Apron and cargo area expansion and strengthening
7	Extend 1R/19L to 7,600'
8	Rehabilitate 13/31, full length 5,800'

The most important improvement at General Mitchell Field is now under construction and not analyzed in this study. This is the construction of the parallel runway 1R/19L at a stage length of 4,200'. With the aircraft mix at Milwaukee, this length increases the PANCAP by about 22,000 operations.

Milwaukee is somewhat unique in having parallel runways 7/25 that converge in near proximity to the field. As general aviation traffic increases, the use of these runways as parallels is creating an increasing control workload and on occasion must be restricted due to congestion. If 7L/25R were reconstructed truly parallel, greater efficiency would be realized.

The majority of other items analyzed is an improvement or expansion of existing facilities.



GENERAL MITCHELL FIELD
MILWAUKEE, WISCONSIN

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS 1 THRU 8

PRESENT – FUTURE TRAFFIC ACTIVITY

FY 1968 – 270,480
FY 1970 – 306,000
FY 1975 – 345,000

PRESENT & FORECAST TRAFFIC MIX

	PRESENT	1970
A	3%	4%
B	31%	37%
C	8%	9%
D+E	58%	50%

COST PER MINUTE OF OPERATION BASED UPON FORECAST MIX: $4.58

ANALYSIS OF IMPROVEMENTS

LOCATION GENERAL MITCHELL FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Fillets and exit taxiway improvements	1A	AM TF	After 1971	$290,000	$29,000	32,000	--	$146,000	5:1	Widening of some fillets will be needed for the 747 by about 1971-72 and may produce some side benefits by improving 90° exits to equivalent 45° exits. A detailed study is intended in this regard but for illustration purposes several exits and fillet improvements have been added to 1L/19R and 7R/25L. The results are shown here in delay savings and on the sketch. This shows that present exit ratings can definitely be improved with good return in delay reduction.
Improve reliever airports	1B	ALL	--	--	--	--	--	--	--	There is presently a substantial amount of touch-and-go activity at this airport. If airline activity rises sharply, this training should be relocated and adequacy of relievers is now planned to undergo a detailed study. A new control tower is desired at Waukesha, a county-owned airport, and it is deemed desirable, locally, to increase the use of Timmerman Airport, which has a 16-hour operation tower. The proposed study will include Bong AFB, Waukesha, Timmerman, and all NAP airports. Due to the high amount of general aviation activity at Mitchell Field, relievers are of special importance.

ANALYSIS OF IMPROVEMENTS

LOCATION GENERAL MITCHELL FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Rehabilitate HIRL on 1L/19R	1B	ALL	1970	$104,000	$10,400	--	--	--	--	This is in the current request for FAAP. According to AM, the current system is obsolete, the runway is designated as CAT II, and the lights obviously need replacement. An RVR is now being installed on 1L/19R.
Realign runway 7L/25R to parallel exactly 7R/25L and construct to 5,000' x 150'	3	AT TF	After 1975 (A study now underway may change this as well as some other items)	$2,000,000	$200,000	10,000	20,000	$45,800	.2:1	Although this item does not show a good savings/cost ratio for several years, it is still worthy of consideration since apparently it represents the only solid IFR improvement potential for this airport. Independent arrival/departure capability would be possible if 7L/25R is actually made parallel to 7R/25L and hourly IFR could be increased by about 20%. Marginal congestion relief at this time but GA, STOL, and cargo aircraft could use it to better advantage if parallel. Obstructions to the northeast and to the southwest limit length. If only 3,200' is constructed, the item is less beneficial but still would increase efficiency.
Install Navaids REILS - 19R and 25L VASI - 19R and 25L TVOR or DME on ILS for IL	1B	AT	1970-1973	--	--	--	--	--	--	VASI would not be quite as helpful as a REIL on 19R according to local AT since there are presently some missed approaches on back course ILS. The closeness of the ILS compounds the problem. A VASI on 25L would help noise abatement and is included in current F & E budget. Although these items are not strong delay relief considerations at present, they are strongly endorsed to enhance safety and speed of control.

ANALYSIS OF IMPROVEMENTS

LOCATION GENERAL MITCHELL FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Apron expansion and repair including cargo area	1B	AM	After 1971	$2,000,000 (filling in all esplanade areas in front of present terminal apron plus additional taxiway)	$200,000	--	--	--	--	There are now 21 gates with 2 additional gates under construction. Rough estimates indicate that 24 mutual-use gates will be needed in 1980, but these would be substantially larger in total area than the gates in present use. Some expansion, by filling of esplanade areas, is planned on a periodic basis until all the islands are filled and an additional taxiway is built around the front of the terminal apron as ultimate expansion in 1990. Repair of the apron in the area where UAL is located would also help the FBO, ANG, and corporate aircraft parking and is recommended. Some air carrier delays are being experienced now during peak periods but this is mainly due to poor scheduling. Delay savings are hard to calculate, but repair and conservative expansion of apron area are endorsed. There are presently 6 daily scheduled all-cargo flights and cargo apron area improvement is needed.
Extend runway 1R/19L to 7,600' including parallel taxiway, lights, etc.	2A	AM AT	1973-1974	$2,600,000 (plus land-$1,500,000)	$260,000	--	--	--	--	Unless there is a drastic change in aircraft mix, extension will not be needed until after 1975 since more than 50% of the aircraft will be able to operate on the first stage length of 4,200' (now under construction). The additional length would be a desirable item from the standpoint of flexibility of use and for periods of maintenance on 19R/1L. However, due to cost and current mix,

(cont'd)

ANALYSIS OF IMPROVEMENTS

LOCATION GENERAL MITCHELL FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
										extension of 19L/1R is not recommended until beyond 1975. The present 4,200' construction is obviously beneficial and will increase the PANCAP to about 310,000.
Rehabilitate 13/31 to full 5,800'	3	AM	1970	$500,000	--	--	--	--	--	The need for this runway from the standpoints of wind coverage or capacity will be very limited when parallel runway 1R/19L (now under construction) is completed. However, the center portion of 13/31 is to be rebuilt under the current airport program and it is recommended that the entire length be rehabilitated as required to keep the runway in service. It is used to good advantage in conjunction with the operation of runway 25L.

MINNEAPOLIS/ST. PAUL INTERNATIONAL AIRPORT

WOLD CHAMBERLAIN FIELD

MINNEAPOLIS, MINNESOTA

DISCUSSION

1. Discussion on Congestion

There is presently very little air traffic congestion at Wold Chamberlain Field. Several problem areas do exist, however, and will cause increasing delays as forecast traffic increases occur. These are:

Runways operating close to capacity due to noise abatement restrictions or inadequate length.

Inadequate number of aircraft parking gates, a problem further complicated by permitting general aviation aircraft to use specific gate areas at the main terminal.

Local authorities are planning a new major air carrier airport, feeling that the capacity of Wold Chamberlain will be reached within seven to eight years. The function of the present airport has not as yet been determined although it will be retained as a major facility in the Minneapolis area.

2. Operational Considerations

Total operations at Wold Chamberlain during FY 1968 were 290,000. The FAA forecast for this airport is 311,000 operations in 1970 and 340,000 by 1975. Local forecasts received from representatives of the Metropolitan Airports Commission (MAC) were higher. Their forecasts predicted 335,000 operations by 1970 and 435,000 by 1975. PANCAP will be approximately 255,000 when the extension to runway 11L/29R (under construction) is completed. The present and forecast aircraft mix at Wold Chamberlain is also debatable. As noted on the accompanying sketch, "C" class aircraft presently comprise 16 percent of the total mix and are forecast to maintain 16 percent through 1975. This figure is much higher than any other airport in the country. One reason for this may be the high rate of DC-3 activity which is now being phased out. Since marginal change to this category of aircraft would have minimal effect on the analysis of this report, no change to the forecast is made.

General aviation activity comprises approximately 40 percent of the total activity at Wold Chamberlain even though minimal facilities are available. Local authorities, however, feel general aviation has a definite place in the hub area and are attempting to balance general aviation/air carrier traffic by providing additional general aviation airports rather than imposing landing fees or restrictions.

Helicopter traffic is minimal and presents no problems.

Considerable training is done by Northwest Airlines, whose home base is located here. Also for this reason, Boeing 747 aircraft will be operating at this airport very soon.

The most critical noise-sensitive areas are located on the final approaches to runways 11R and 22. These areas extend about five miles from the airport. Because of the close-in location of Wold Chamberlain, the entire south Minneapolis, southwest St. Paul and Bloomington areas report noise problems. Although no formal preferential system is used, runways 11R and 22 are seldom assigned unless wind conditions dictate.

Runway 11L/29R is further restricted because of length and is limited to CV 240 aircraft and below. Although this runway is to be lengthened later this year, noise considerations may limit its use. Local airport authorities, however, are planning full utilization of this runway by all aircraft after the extension is complete.

Flow control restrictions are seldom imposed - perhaps only ten times a year - and are not considered a problem.

3. Terminal Complex

There is presently daily delay because of an insufficient number of aircraft gates. There are now 28 gates, all exclusive use except the new North (Green) Finger. Seven additional gates will be provided in the Red Concourse in spring of 1971. The ultimate plan is for 64-65 gates but lack of space may limit expansion to fewer gates. The planned relocation of general aviation operations to the area north of the intersection of runways 4R/22L and 11R/29L will provide some relief to gate use at the main terminal.

4. Reliever Airports

On January 2, 1969, the Minneapolis/St. Paul Metropolitan Airports Commission released a plan for a Proposed Airport System in the years 1970-1980. This plan recommends a new major air carrier airport, improvement of existing secondary airports, and development of three new satellite airports during this period.

Minimum general aviation services are presently available at Wold Chamberlain. The Metropolitan Airports Commission is trying to further reduce general aviation activity at this airport. In line with this policy, the Commission plans to upgrade existing satellite airports and has recommended new reliever airports at three locations within their 25-mile jurisdiction from the downtown area. These new airports will be needed within the 1970-1980 period to relieve activity at existing facilities, to serve the increasing demand for both flight evaluation and normal general aviation activity, and to accommodate population and commercial growth in the Minneapolis-St. Paul area.

RECOMMENDATIONS

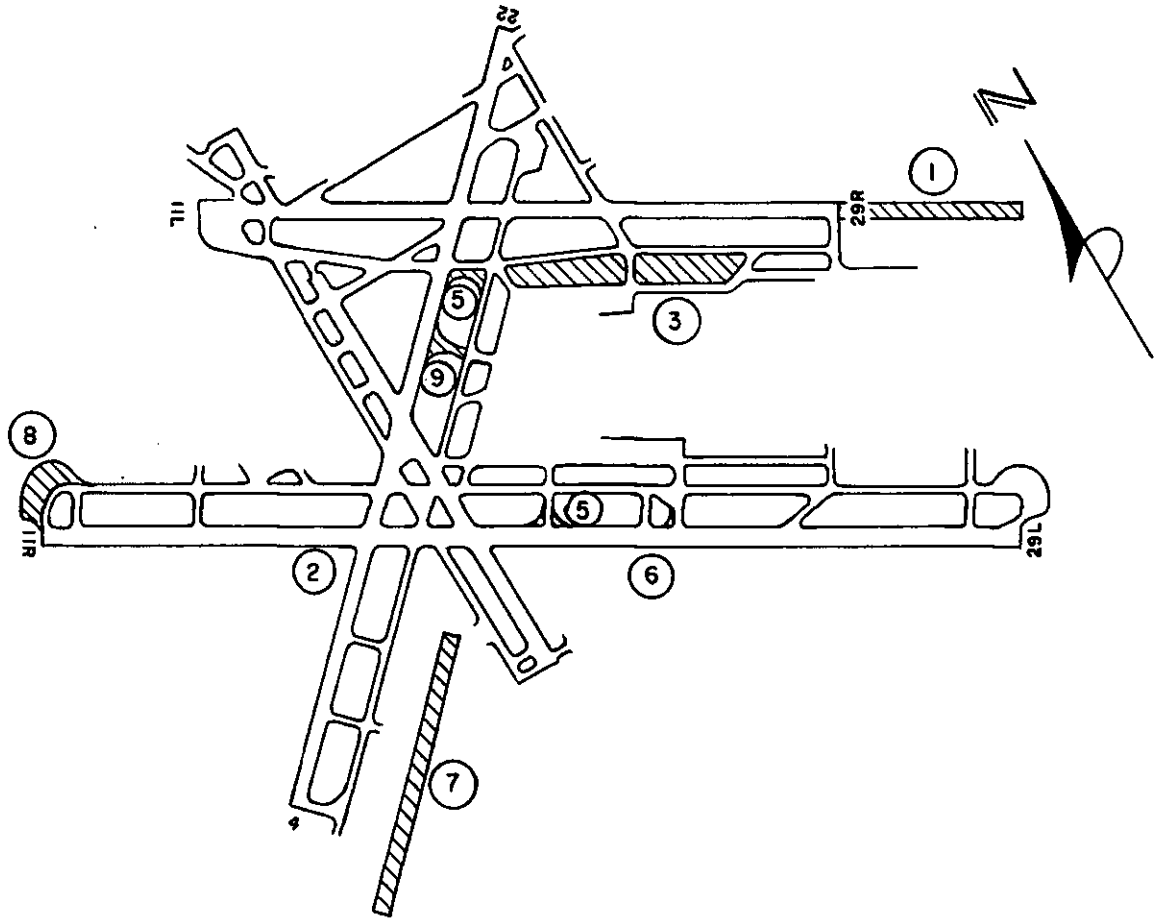
The following priority of improvements has been developed in the order thought to be most significant in relieving airfield congestion at Wold Chamberlain Field, Minneapolis, Minnesota. It is recommended that this listing be fully considered in future airport development.

PRIORITY RANKING	ITEM
1	Extend 29R to 8,200'
2	Rehabilitate intersection of 4/22 and 11R/29L
3	Expand apron
4	Reliever airport improvements
5	Widen fillets
6	Rehabilitate 11R/29L and replace HIRL
7	Construct parallel 4/22 for simultaneous VFR use
8	Holding apron for 11R
9	Improve exit taxiways

The number one priority item must be completed prior to action being taken to rehabilitate the runway intersection, as indicated in the number two priority item. When this intersection is closed, the majority of aircraft will have to use the extended 11L/29R. An increase in complaints due to noise may be expected at that time.

Reliever airport improvements are ranked quite high, yet the Minneapolis/St. Paul area already has an excellent, aggressive program for general aviation facilities. This item endorses continuance of its forward planning for non-air carrier aviation activities. The construction of a parallel 4/22 runway for smaller aircraft use is dependent, to a reasonable degree, upon the progress made in reliever airports and the disposition of general aviation aircraft in the future.

Present HIRL on runways 11R and 4 are obsolete and are very difficult to maintain and should be replaced.



MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
WOLD CHAMBERLAIN FIELD
MINNEAPOLIS, MINN.

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (9)

PRESENT - FORECAST TRAFFIC ACTIVITY
FY 1968 - 291,000
FY 1970 - 311,000
FY 1975 - 340,000

PRESENT & FORECAST TRAFFIC MIX (APPROXIMATE)

	PRESENT	1970
A	13%	14%
B	38%	45%
C	16%	16%
D + E	33%	25%

COST PER MINUTE OF OPERATION BASED UPON FORECAST MIX $5.87

ANALYSIS OF IMPROVEMENTS

LOCATION: MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT - WOLD CHAMBERLAIN FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Extend 29R 2,000' to 8,200'	1A	ALL	1969	$2,000,000	$200,000	150,000	155,000	$890,000	4.5:1	Grading has already begun for this extension. It is possible noise restrictions could cut down on indicated benefit. The savings/cost ratio rises slightly by 1975. Yet the delay in 1975 would be greater with the extension than the 1970 delay would be without the extension. This tends to bear out the necessity for an additional airport for air carriers at Minneapolis-St. Paul if no major construction can be economically accomplished at Wold Chamberlain.
Rehabilitate intersection of 4/22 to 11R/29L	1B	ALL	1970	$83,000	$8,300	--	--	--	--	The paving at this intersection is failing badly. If allowed to fail, the airport would have to use the 6,000' to the east of the intersection on runway 29L and use runway 18/36 (now used as a taxiway) as much as possible. This work is obviously needed. With the intersection closed, delays will be increased by a factor of 10. Thus, extended closure would result in intolerable delays. If runway 11R/29L is completely lost due to the construction of a proposed tunnel to a proposed south cargo area, the delay will be even greater.
Expand apron	1A	ALL	1971	$770,000	$77,000	--	54,000	$350,000 (1975)	4.5:1 (1975)	According to rough calculations, about 31 mutual use gates will be needed by 1975. Plans are to expand the present 28 gate positions to 35. This expansion is endorsed since 1980 demand indicates a need for approximately 39 airline gates and 9 cargo gates. Savings are based upon a rough local estimate.

ANALYSIS OF IMPROVEMENTS

LOCATION MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT - WOLD CHAMBERLAIN FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Reliever airport improvement	1B	ALL	--	--	--	--	--	--	--	Local airport management considers this a very important recommendation. Five airports are controlled by MAC. All NAP recommendations on relievers are endorsed. (See "Discussion").
Widen fillets for 747	1B	ALL	1970	No estimate	--	--	--	--	--	Since this airport is the home base for Northwest Airlines, the Boeing 747 will be delivered here. The need for the fillet improvements is obvious and some delay savings will result in improved exit ratings for smaller aircraft.
Rehabilitate runway 11R/29L and replace high intensity runway lights	2B	AM	1973	No estimate available	--	--	--	--	--	Present life expectancy of this runway is about 4 years. Obviously needed item. Lights on runways 11R/29L and 4/22 are both obsolete. Could replace lights on 11R/29L and use salvaged lights for maintaining 4/22.
Parallel VFR runway 4/22 4,000' long separated for simultaneous VFR use	2A	ALL	1973	$3,000,000	$300,000	--	472,000	$3,100,000 (1975)	10:1	This recommendation could not be carried out prior to 1972-73 and, therefore, is not analyzed on a 1970 basis. If reliever airports diminish the percentage of smaller aircraft using Wold Chamberlain, the benefits would drop accordingly. The savings shown are based on comparison with a layout which includes an extended 11L/29R. Although sketch location for this runway agrees with current ALP, positioning may be changed in future. This runway's parallel taxiway could also serve as access to SW cargo area.

ANALYSIS OF IMPROVEMENTS

LOCATION MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT - WOLD CHAMBERLAIN FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Holding apron for 11R	3	AT TF	One season item	$135,000	$13,500	3,000	--	17,700	1.3:1	This is presently a marginal congestion relief item but if flow control problems increase and military run-up delays increase, it becomes more important. Delay savings are very approximate.
Improve exit taxi-ways on runways	3	--	One construction season	$15 SY	--	--	--	--	--	The runways already have a very good exit rating and any additional exits would be of marginal capacity benefit. New suggested exit locations are roughly noted on the sketch.
Runway grooving	4	--	--	--	--	--	--	--	--	Although grooving may be worthwhile from a safety standpoint, airport management does not now think this is a necessary item. No apparent congestion or delay relief would be provided since slippery runway conditions do not produce restrictions to operations.
Extend runway 4/22	4	--	--	--	--	--	--	--	--	This extension would be for use by future long-haul jets. However, the anticipated extension is only 700' and there is already some noise problem to the NE. Therefore, this item is not now recommended.

ANALYSIS OF IMPROVEMENTS

LOCATION MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT - WOLD CHAMBERLAIN FIELD

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Taxi access across runway 4 to runway 11R	4	AT	--	--	--	--	--	--	--	This item is not analyzed due to its minimum benefit. There are already numerous entrances to the parallel taxiway to 11L/29R. If combination use of 11 and 4 becomes more common and traffic increases a substantial amount, this item would become more beneficial.

(63 and 64)

MOISANT INTERNATIONAL AIRPORT

NEW ORLEANS, LOUISIANA

DISCUSSION

1. Discussion on Congestion

The primary causes of congestion at Moisant International Airport are insufficient aircraft loading gates and an inadequate taxiway system, particularly exit taxiways from the primary landing runway, runway 10. Congestion and aircraft delays, however, are minimal at the present time although most of the facilities serving the airport, other than runways and taxiways, are saturated. These include the terminal space, aircraft loading gates, roadway system, and parking facilities. New Orleans is planning major construction improvements to the present terminal complex which should alleviate many of these problem areas.

Determining the overall economic feasibility of expansion of Moisant, as compared with developing a replacement air carrier airport, is beyond the scope of this report. The City and Regional Planning Commissions are jointly sponsoring extensive studies in this regard, and results of the studies could greatly influence the savings/cost ratios herein.

2. Operational Considerations

Moisant had approximately 150,000 total operations during FY 1968. Present forecasts predict 173,000 operations by 1970 and 223,000 by 1975. The PANCAP for Moisant is approximately 193,000.

There are very few helicopter operations presently at Moisant. The maximum estimate is approximately 1,500 per year. Helicopter Airways recently received approval to operate a downtown shuttle service. They will soon begin operating with 4-place "Bell Ranger" type aircraft. No operational problems are anticipated by local air traffic representatives.

There is no indication of any type of STOL activity at Moisant within the near future.

There is very little training activity at Moisant. Touch-and-go's are insignificant, accounting for less than 1 percent of the total operations. Delta and TACA Airlines do some pilot training here.

There are no general aviation aircraft based at Moisant and this policy will continue, according to local airport authorities.

Although rather heavily populated areas border the airport to the east, there are no real noise problems at Moisant according to local authorities. Several reasons were given for this:

An active program on the part of airport officials to inform the local population of the contribution of Moisant to the economy of the area has been quite successful. Pamphlets and public speaking engagements are the primary methods by which this program is accomplished.

An "informal" preferential runway use system apparently has been quite effective in alleviating noise problems. This program utilizes runway 10 for landings and 01 for takeoffs whenever possible. Takeoffs on 10 and landings on 28 are only used whenever wind conditions demand.

Almost all of the residential areas surrounding the airport came after the airport was established; therefore, residents were well aware of the problems prior to moving to the area.

3. Terminal Complex

There are presently 23 aircraft loading gates at the Moisant terminal, all of which are used on a "preferential" (nonexclusive) basis. Some "doubling up" of aircraft on a single gate is approved in some instances, thereby increasing the utilization of the available gates. Even with doubling up and nonexclusive use, delays still occur on a daily basis due to an insufficient number of aircraft gates. Present planned construction will increase the number of available gates to 46; these will not be available for some time, however, since many problems exist concerning when this work may begin. It was estimated that two years will be required to complete the planned expansion, although some gates will be available prior to that time.

It is interesting to note that the gates are nonexclusive use at Moisant with little difficulty, although many other locations of comparable size say that such a system is completely unmanageable.

4. Reliever Airports

Lakefront Airport is presently the only general aviation airport serving as a reliever to Moisant. Activity at Lakefront is quite high having had over 265,000 total operations in FY 1968. A new airport is presently being constructed in Hancock County at Bay St. Louis, Mississippi, which hopefully will attract general aviation activity from the New Orleans area. Its distance, however, may be a deterrent to effective relief for New Orleans.

The policy of not permitting based aircraft at Moisant should continue to limit general aviation traffic generally to corporate type aircraft since air taxi operations are insignificant.

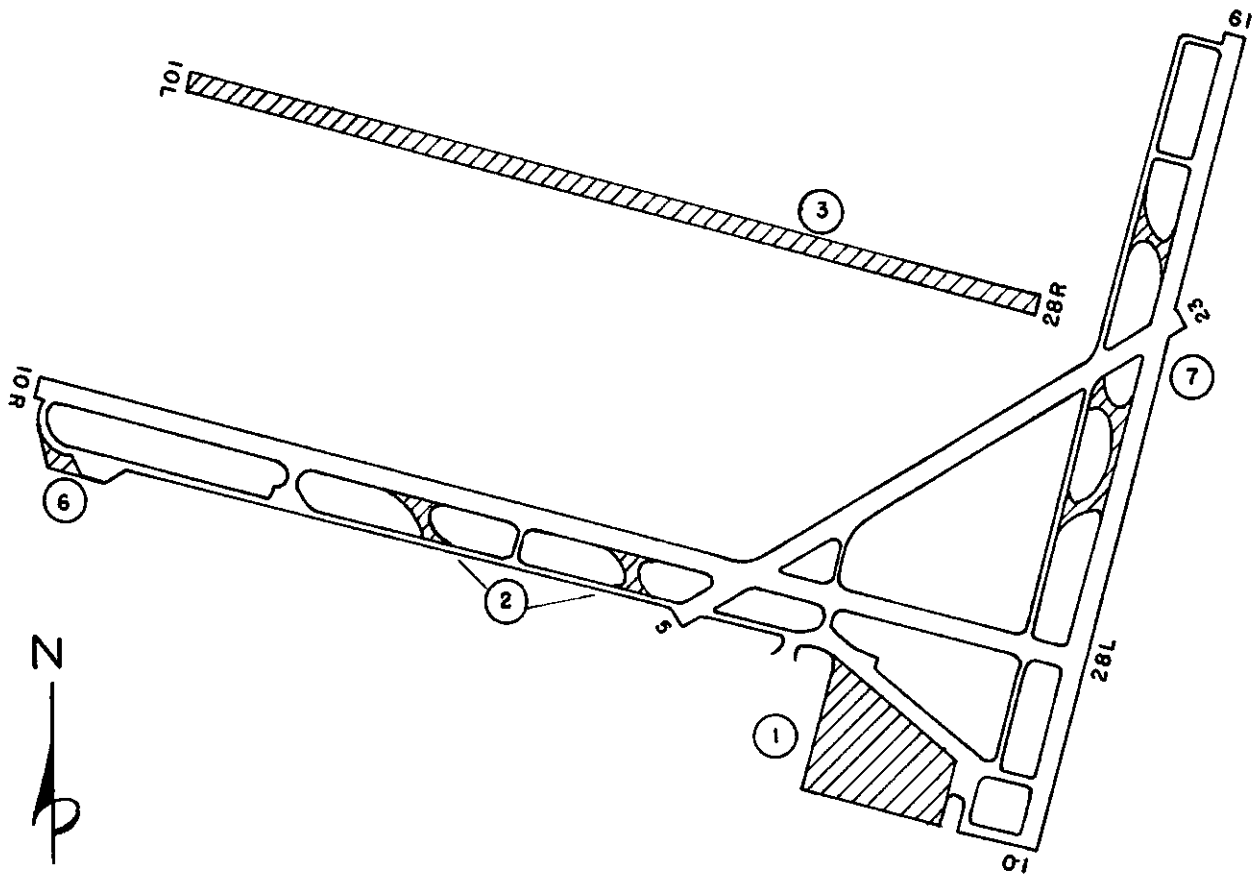
RECOMMENDATIONS

The following priority of improvements has been developed in the order thought to be most significant in relieving present and future congestion at New Orleans International Airport. It is recommended that this listing be fully considered in all future airport development.

PRIORITY RANKING	ITEM
1	Expand apron areas
2	Improve exits on 10/28
3	Construct parallel runway 10/28 (3 options given in analysis)
4	Reliever airports
5	Navigational aids
6	Expand holding aprons for runway 10
7	Improve exits on 1/19

Apron expansion has been given a high priority rating since the airport already has ramp congestion. The third ranked item, construction of a parallel runway 10/28, has been analyzed with three alternates. These are (1) spaced 1,500' laterally and 6,000' long, (2) spaced 1,500' laterally and 8,500' long, and (3) spaced 3,500' laterally and 8,500' long. The number 1 option is the cheapest but since it will not serve all aircraft due to its shorter length is of less benefit. This option is given a 2A benefit rating since its restricted use would keep it below a 1:1 savings/cost ratio until beyond a four-year period. The other two options are both given a 1A rating. Land costs are higher for the two options involving the 8,500' length and in the case of the 3,500" lateral spacing the land cost estimate is almost triple the land cost estimate for the short runway more closely spaced.

An item was discussed at New Orleans that has not appeared so far in this study but should be seriously considered. Moisant has a crosswind runway 5/23 that serves as an important safety valve for smaller aircraft during peak periods. Due to planned terminal construction into the clear zone, it is the intention of the local management personnel to close this runway. It is recommended that this runway remain open since it does contribute to capacity and the only expense involved is routine maintenance.



NEW ORLEANS INTERNATIONAL AIRPORT (MOISANT FIELD), NEW ORLEANS, LA.

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (7)

PRESENT – FORECAST TRAFFIC ACTIVITY

FY–68	149,000
FY–70	213,000
FY–75	295,000

PRESENT AND FORECAST TRAFFIC MIX (APPROXIMATE)

	PRESENT	1970
A	24%	29%
B	44%	40%
C	6%	7%
D+E	26%	24%

COST PER MINUTE OF OPERATION BASED ON FORECAST MIX: $ 8.02

ANALYSIS OF IMPROVEMENTS

LOCATION MOISANT INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Expand apron areas	1A	ALL	1971	$2,500,000 (17 gates @$17/SY)	$250,000	11,200	160,000	$1,280,000 (1975)	5:1 (1975)	The expansion of the general aviation apron area is endorsed, but, since it is now under construction it is not included in our analysis. There are now 23 airline gates and plans are to expand to a total of 46 gates plus 6 new cargo parking positions. According to our rough calculations, about 40 gate positions will be needed at Moisant by 1975. Delays will be extreme if only 23 gates are available in 1975 and the proposed expansion definitely seems reasonable in terms of gate spaces. A detailed analysis of configuration, access, etc., was not made. The cost/SY figure was obtained from the city. Cargo apron expansion to provide six parking positions is planned but not included in this analysis. There is presently an average of 5 all-cargo flights/day.
Improve exits to runway 10/28	1A	ALL	1970	$370,000	$37,000	20,000	42,000	$160,000	4.3:1	Runway 10 is the primary arrival runway and the existing exit rating can be improved greatly by addition of 2 angled exits. Since arrivals will probably not use the new exits at speeds greater than 40 knots, due to the parallel taxiway proximity, delay savings may be overstated. However, this is still a very desirable improvement. Exact location of exits requires local coordination with management, users, and tower.

ANALYSIS OF IMPROVEMENTS

LOCATION MOISANT INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Construct parallel runway 10L/28R, 3,500' lateral separation and 8,500' long	1A	TF	Unknown	$7,950,000	$795,000	70,000	167,000	$560,000	.7:1	This runway would provide all VFR benefits plus an independent IFR capability between an arrival and departure. The land cost is estimated as $9,300,000. About 1/2 of the clear zone area to the east of this runway is already clear zone for runway 5/23. Thus, almost $1 million loss in land cost would be involved than initially expected. The savings/cost ratio on this runway becomes greater than 1:1 in about 1971-1972; thus the 1A benefit rating.
Construct parallel runway 10L/28R, 1,500' lateral separation and 6,000' long	2A	AM	1972	$5,753,000	$575,300	29,000	82,000	$232,000	.4:1	Separation assumed is 1,000' to 1,500', wide enough for simultaneous VFR use. Length is approximately 6,000' or sufficient to accommodate "B" type aircraft for landings. Land cost is estimated at $3,260,000. Construction costs shown include runway, taxiway, exit taxiways, and holding areas. A reduction in capacity has been included to account for arrivals on the short runway crossing the active departure runway, and because all aircraft could not use the 6,000' length. The savings/cost ratio on this runway becomes greater than 1:1 in about 1974-1974; thus, the 2A benefit rating.

ANALYSIS OF IMPROVEMENTS

LOCATION MOISANT INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Construct parallel runway 10L/28R 1,500' lateral separation and 8,500' long	1A	AT	Unknown	$7,735,000	$773,500	59,000	139,000	471,000	.6:1	Separation same as previous item. Length of 8,500' will handle 100% of aircraft. Land costs in this instance (which must include extra clear zone) is $5,120,000. The crossing problem is not as great with an 8,500' length for 10L/28R since arrivals can be conducted on 10R/28L and the crossing point shifted. Also greater flexibility with this length for 10L/28R. The savings/cost ratio on this runway becomes greater than 1:1 in 1972-1973; thus the 1A benefit rating.
Reliever airports	1B	ALL	--	--	--	--	--	--	--	A study is now underway which will analyze total aviation needs of the area including general aviation airport requirements. One major item of improvement now endorsed is installation of an MSY-compatible ILS at Lakefront Airport. Localizer at Lakefront is now programmed. NAP reliever airports are also endorsed.
Navigational Aids										
a. VASI runway 28	3	--	--	--	--	--	--	--	--	A VASI on runway 28 would facilitate arrivals according to AT and AM and would reduce possible noise problems.
b. VASI or REIL on runway 19	3	--	--	--	--	--	--	--	--	Although a REIL on runway 19 is optional from a delay savings standpoint, operations could be expedited and missed approaches reduced by it. Present REIL on runway 1 is very helpful according to local AT.

ANALYSIS OF IMPROVEMENTS

LOCATION MOISANT INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Navigational Aids										
c. ILS on runway 1	1B	--	--	--	--	--	--	--	--	Local studies have indicated location and other problems with this installation. A "low cost" ILS would definitely increase the IFR acceptance rate of this fairly active arrival runway.
Expand holding apron to runway 10	3	AT	1973	$200,000	$20,000	--	1200	--	--	Presently this holding apron will accommodate 2-3 aircraft. Flow control restrictions are not a problem now but both by-pass capability and an increase in holding area for runway 10 will be desirable in the near future. Estimated delay reduction very approximate based upon future use.
Improve exits to runway 1/19	3	ALL	1970	$550,000	$55,000	4000	17,000	$32,000	.6:1	Runway end 1 receives an estimated 15% of the arrivals at MSY and exits could be improved. Not as desirable as improving 10/28 exits, but recommended. Three angled exits are included in this analysis. Exact location of exits should be determined locally through coordination with tower, airport management, and users.

ANALYSIS OF IMPROVEMENTS

LOCATION MOISANT INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Groove runway 10/28	4	--	--	$250,000	--	--	--	--	--	Presently there is no evidence of hydroplaning effects on this runway when wet conditions exist. This is attributed by airport management to the 1.5% transverse grade of the runway surface and rapid runoff of water. Grooving might be beneficial if it offsets the slipperiness of the rubber deposits on the runway touchdown area. However, this is not presently thought a major problem at Moisant.

GREATER PITTSBURGH AIRPORT

PITTSBURGH, PENNSYLVANIA

DISCUSSION

1. Discussion on Congestion

Greater Pittsburgh Airport does not have serious congestion problems with the present demand and peaking characteristics. However, the forecast demand indicates improvements are needed in the future if the airport is to continue at its present degree of efficiency.

The parallel runway 10L/28R has a partial parallel taxiway leaving 4,400 feet of the runway with no taxiway access at the west end. There are three angled taxiway exits on this runway, all angled in the same direction to favor the landings on 10L. Present plans call for extending the taxiway an additional 1,500 feet and putting fillets in the angled exits to facilitate 28R arrivals. This is the last choice arrival runway.

When an easterly configuration is used, runway 10L is the primary arrival runway, and runways 14 and 10R are primary departure runways. Arrivals on 10L have no exit for the last 3,800 feet of this runway, and the departures on 14 and 10R have a single access to the runways from the holding aprons. Runway 14 is very convenient to the apron for departures, but its length is insufficient for the heavier jets which then have to taxi across this runway to reach 10R. Runway extensions at Pittsburgh are expensive due to the rugged terrain that requires vast quantities of fill.

A long-range plan has a completely new terminal placed between the parallel runways. A difference in elevation of the planned ramp area and the approach end of 10R will probably necessitate a lowering of a portion of the runway. A closing or restriction on this runway at the time planned would be a serious congestion problem.

2. Operational Considerations

The FY 1968 and CY 1968 operations at Greater Pittsburgh Airport were 251,000 and 267,000, respectively. The forecast demand is 285,000 for FY 1970 and 345,000 for FY 1975.

Helicopter operations are negligible and are not expected to present any problems in the near future.

Allegheny Airlines conducts training operations at this airport. Pittsburgh also has military training with over ten percent of its total operations being military aircraft. It is estimated that five percent of the overall operations are touch-and-go. The PANCAP for Pittsburgh is approximately 330,000.

Noise does not present a major problem, and there is neither a preferential runway system nor are there any special noise procedures in effect. There is a noise-sensitive area to the northeast that could feel a noise problem if runway 28R becomes a primary landing runway. This usage seems unlikely due to airport configuration.

Flow control restrictions from other facilities do not contribute to congestion at this time. Gate and apron expansion is currently under construction and should prevent these problems for a reasonable period of time.

3. Terminal Complex

There are 25 gates in the present terminal configuration and there are plans for expansion to 39-40 gates in the near future. The long-range plan places the terminal between the parallels. There will be an ultimate capacity of 108 gates if push-back operation is used, and 72 on a power-in, power-out operation.

The existing terminal apron is being extended at this time and will eliminate bottlenecks from push-back operations and allow dual taxi capability around the existing terminal.

Gate usage is exclusive but there is a reasonable cooperation among the users when space is available.

4. Reliever Airports

A study by Landrum and Brown has been recently completed which includes a six-county area and includes general aviation activity. The primary reliever is Allegheny County Airport.

5. F & E Considerations

There is a REIL on runway 32. It was felt that an additional REIL on runway 10R would be beneficial under heavy arrival conditions when aircraft are broken off from a 10L approach to land 10R.

The ILS on 10L has been very expensive due to terrain problems. If 10L is extended, the cost of relocating the ILS would be an important factor to be considered.

An extension to runway 27 at Allegheny County to a length of 6,500 feet will put the Allegheny County ILS out of service this summer. This may well result in increased general aviation IFR activity at Greater Pittsburgh during the outage period.

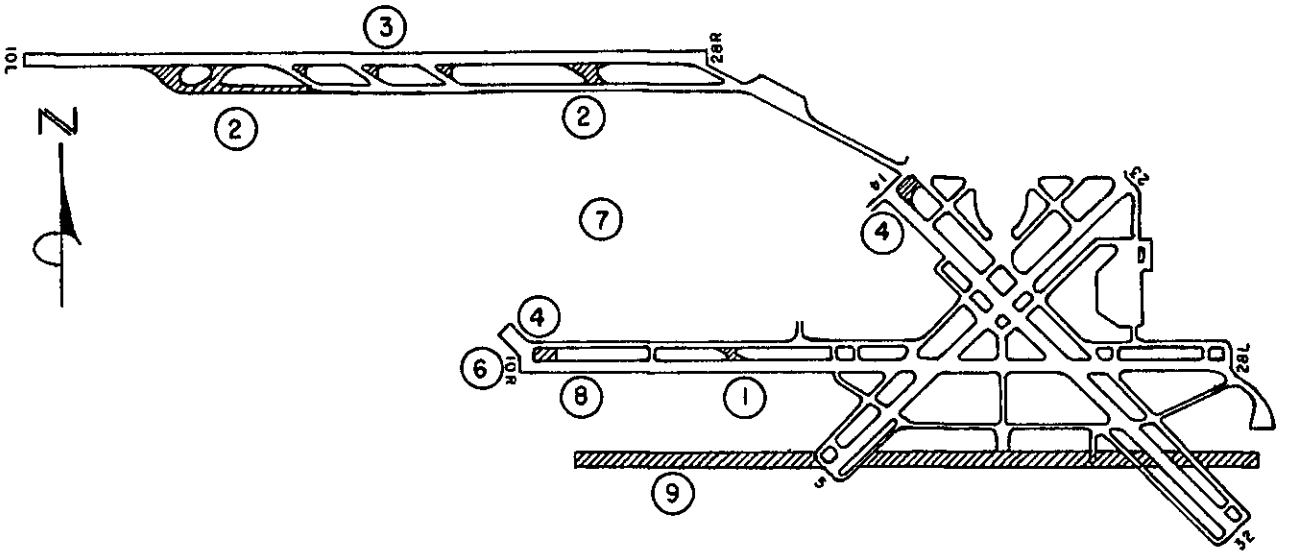
RECOMMENDATIONS

The following priority of improvements has been developed in the order thought to be most significant in relieving future congestion at Greater Pittsburgh Airport. It is recommended that this listing be fully considered in future airport development.

PRIORITY RANKING	ITEM
1	Exit taxiway on 28L
2	Extend parallel taxiway on 10L/28R a length of 1,500' and add 2 exits
3	Add fillets on 28R
4	Holding apron or improved bypass for 10R and 14
5	Reliever airports
6	REIL on 10R
7	Air carrier apron expansion
8	Lower west end of 10R
9	Construct third parallel 10/28

Since Greater Pittsburgh Airport is not subject to congestion problems at this time, only two items fall in a rating of 1A or 1B indicating a four-year improvement period. These are: one additional exit 28L, and pursuit of the reliever airport program.

Several other items could be accomplished within the four-year period but, due to the relatively low demand with respect to capacity, are not pressing. The last three items on the priority listing are related to the construction of the new terminal area between the existing parallel runways.



GREATER PITTSBURGH AIRPORT – PITTSBURGH, PENNSYLVANIA

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (9)

PRESENT AND FORECAST TRAFFIC ACTIVITY

FY 1968	251,000
FY 1970	285,000
FY 1975	345,000

PRESENT AND FORECAST TRAFFIC MIX (APPROXIMATE)

	PRESENT	1970
A	9%	11%
B	59%	51%
C	12%	12%
D + E	20%	26%

COST PER MINUTE OF OPERATION BASED ON FORECAST MIX $6.42

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER PITTSBURGH AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Add exit on 28L	1A	AM AT	1970	$70,000	$7,000	7,000	10,000	$45,000	6.4:1	28L is the primary landing runway. The runway has good exits already and an additional desirable exit is being added this summer. The second exit only is included in this analysis. Although these exits combined would increase capacity less than 2%, a good savings cost ratio is still apparent for the second exit.
Extend parallel taxiway on 10L/28R a length of 1,500' and add 2 exits	3	AM	1970	$310,000	$31,000	1,000	1,000	--	.2:1	This extension would serve arrivals on 28R primarily and would also have a secondary purpose of serving some arrivals of small aircraft on 10L since the taxiway will tie in 3,000' from the approach end of this runway. The exit would serve 28R arrivals better than the fillets planned on the existing exits. Savings are based upon improving the exit rating of 10L and will be important after 1975. Access to 10L and the added eastern exit will be quite valuable when new terminal is in existence.
Add fillets on 28R	3	AM	1970	$240,000	$24,000	--	--	---	--	This would improve turnoff capability for 28R landings. 28R is the last choice for landings at Pittsburgh, so the benefit would be minimal. Under unusual conditions (28L closed for maintenance or high VFR arrival demand) these fillets will provide some benefits, particularly when the future terminal is completed.

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER PITTSBURGH AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Holding apron or improved by-pass for 10R and 14	4 2A	TF & AT	1969-1970	$130,000	$13,000	--	3,600	--	1.7:1 (1975)	Both these runways have a single-throat access. 10R accommodates approximately 4% of departures, and 14 handles about 13% of departures. The 10R by-pass is of marginal benefit and is not recommended, but the 14 by-pass will help eliminate future conflict between arrivals on 10L and departures on 14. Present work now underway is roughly estimated to relieve 90% of conflicts, but even 10% help in this area is apparently worth the cost of paving by the 1975 time period. It is possible the improved access to 14 could be included in projects underway this summer.
Reliever airports	1B	ALL	--	--	--	--	--	--	--	Allegheny County Airport is undergoing modernization with an extension of 1,000' on runway 9/27. This work will cause temporary shut down of ILS and probably increase IFR demand at Greater Pittsburgh during this period. Landrum and Brown has recently finished a study of a six-county area and relievers will be covered in their report. NAP relievers are strongly endorsed at this location.
REIL on 10R	3	ALL	--	--	--	--	--	--	--	10R is a low use arrival runway but during heavy arrival periods, traffic is broken off from a normal 10L pattern to use 10R. The low percentage use (primarily at night) makes this a marginal delay reduction item but may have safety implications.

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER PITTSBURGH AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
A/C apron expansion	2A	AM	1974-1976	--	--	--	--	--	--	The new air carrier terminal will provide 60 gate positions with an expansion to 75 gates being possible in a relatively short period. 90 gates can be attained by the year 2000, and an ultimate of 108 gates can be constructed in the area planned.
Lower west end of 10R to make compatible with prepared terminal ramp	2B	ALL	1974-1975	$1,700,000 (lowering only) $3,500,000 (lowering and repaving, lighting, etc.)	--	--	--	--	--	Higher cost estimate includes lowering and repaving west 2,000 of 10R/28L to meet new apron grade. This lowering is obviously needed to meet future expansion plans, but repaving in place is much less desirable than using this same paving money as part of construction of a third parallel 10/28 about 1,500' south of 10R/28L. The airport would then have three parallel 10/28's, with the two outboard runways spaced greater than 5,000' and at lengths of +10,000', and the center runway used primarily for arrivals at a length of 8,000'. Though long range, the three parallels are analyzed separately in this section.
Construct third parallel runway 10/28	2A	TF AM	After 1975	$18,000,000	$1,800,000	--	284,000	$1,940,000	1:1	This is a very long-range item unless the decision is made not to replace the 2,000' of the west end of 10R/28L when it is lowered to meet the future apron grade. With this decision, construction should begin on a third parallel runway and the repaving cost that would have been used to replace the 2,000' section can be applied as savings to the third parallel. Thus, 10,000' @ $1,800/LF = $18 million - $2 million not used on repaving 10R/28L (cont'd)

ANALYSIS OF IMPROVEMENTS

LOCATION GREATER PITTSBURGH AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
										= $16 million. In 1975-77 this third parallel will begin to be very advantageous assuming the new terminal site is developed and operating. The PANCAP is increased by about 25% and delays would be reduced substantially. Delay savings shown are those obtained by comparing three parallels (including one 8,000' parallel) to two parallels (including one 8,000' parallel).
Runway 14/32 extension 1,300' to a length of 8,000'	4	AM	1971-1972	$2,600,000	$260,000	12,500	15,500	$79,000	.3:1	This extension would permit full use of runway 14 for departures and reduce by 5% total aircraft departures now taxiing 6,600' to runway 10R. The value of this extension would decrease greatly when the new terminal is in use. The taxiway extension required would be on the north side of runway 32 initially, since the present terminal will be in use for a number of years. However, the capacity increase is extremely small and taxiing savings alone are not sufficient from a delay reduction standpoint to justify this extension.
Extend runway 10L	4	--	--	--	--	--	--	--	--	This item was discussed but is not in current plans. The idea is not analyzed but if seriously considered, the ILS on the extension would be a major expense due to terrain problems.

SAN JOSE MUNICIPAL AIRPORT

SAN JOSE, CALIFORNIA

DISCUSSION

1. Discussion on Congestion

San Jose Municipal Airport was visited as an ancilliary to the studies made at San Francisco International and Oakland International. San Jose generates over 400,000 operations annually and the air carrier activity is increasing constantly. The airport is located in the southern part of the Bay Area which is increasing rapidly in population. The San Jose area provided around 30 percent of the total Bay Area passengers in 1967.

Unlike most of the airports analyzed in this supplement, San Jose primarily serves general aviation aircraft with 372,000 general aviation operations out of a total of 412,000 operations in CY 1968. This constitutes 90 percent of all operations. In addition, 50 percent of total operations are touch-and-go.

Air carrier stage lengths are increasing at San Jose. The long runway 30L has a displaced threshold and a by-pass taxiway around 30R that is in poor condition. These items, and a lack of a holding area on this runway, will contribute to congestion. Also, additional gates are required if San Jose is to meet its potential demand.

The great majority of small aircraft operate on 30R and the lack of a wide turnoff area in the vicinity of taxiways C through E inhibits traffic flow. The high percentage of touch-and-go operations on one of the two primary runways also causes congestion.

2. Operational Considerations

As stated previously, San Jose had 412,000 operations in CY 1968. Of these, less than 2 percent were helicopter operations. It is interesting to note that San Jose ranks as a non-hub since the hub designation is based on enplaned passengers with respect to interstate operations. Seventy-five percent of the passengers handled at San Jose are intrastate on Pacific Southwest Airlines or Air California, and these passengers do not contribute to the statistics determining hub designation. When new parallel touch-and-go runway is completed in the summer of 1969, PANCAP will be approximately 440,000.

At San Jose, 85 percent of all operations are on runways 30R and 30L. Seventy-five percent of the general aviation operations are on runway 30R, and 92 percent of air carrier operations are on runway 30L.

Training activities constitute a great percentage of all operations at San Jose. There are approximately 500 based aircraft and 13 fixed-base operators.

Noise abatement is not, as yet, a problem at this location, although there are some minor complaints. There is no preferential runway system, and noise abatement procedures are not in effect. There is a city ordinance requiring 3 degrees or more on approach.

3. Terminal Complex

There are presently four to six gates at San Jose depending upon usage. A south concourse expansion this year will add an additional eight gates. A new north apron is approved. The existing long-range plans call for forty-three to forty-eight gates.

4. Reliever Airports

In spite of the 500 based aircraft at San Jose, there is a three-year waiting list for additional aircraft owners. Reid Hillview Airport is a good reliever but already has about 400 based aircraft. A strong economy and excellent weather result in a high aircraft per capita ratio and additional airports are "a must" in this area.

5. F & E Considerations

In considering F & E items, the city ordinance requiring a minimum approach slope of 3 degrees was discussed with respect to VASI's. All agreed that a VASI system on 30L and 30R would help and possibly keep the noise complaints from reaching major proportions. It was pointed out that 30L has an ILS.

Runway 12R approach area was described as a "dark hole" and it was felt a VASI or a REIL would be helpful in this location. The standard requiring a runway length of 5,000 feet for the installation of an ILS was questioned at a location where the great majority of aircraft are in the D and E classification. This subject will gain more importance as the smaller aircraft become more fully instrumented.

RECOMMENDATIONS

The following priority of improvements has been developed in the order thought to be most significant in relieving future congestion at San Jose Municipal Airport. It is recommended that this listing be fully considered in all future development.

PRIORITY RANKING	ITEM
1	Construct parallel touch-and-go runway
2	Strengthen taxiways and construct holding apron to 30L
3	Expand apron at satellite finger
4	Reliever airports
5	Extend runway 12L/30R to 7,400 feet and strengthen existing pavement
6	Expand apron north of terminal
7	Install VASI's
8	Improve exits, runway 12L/30R

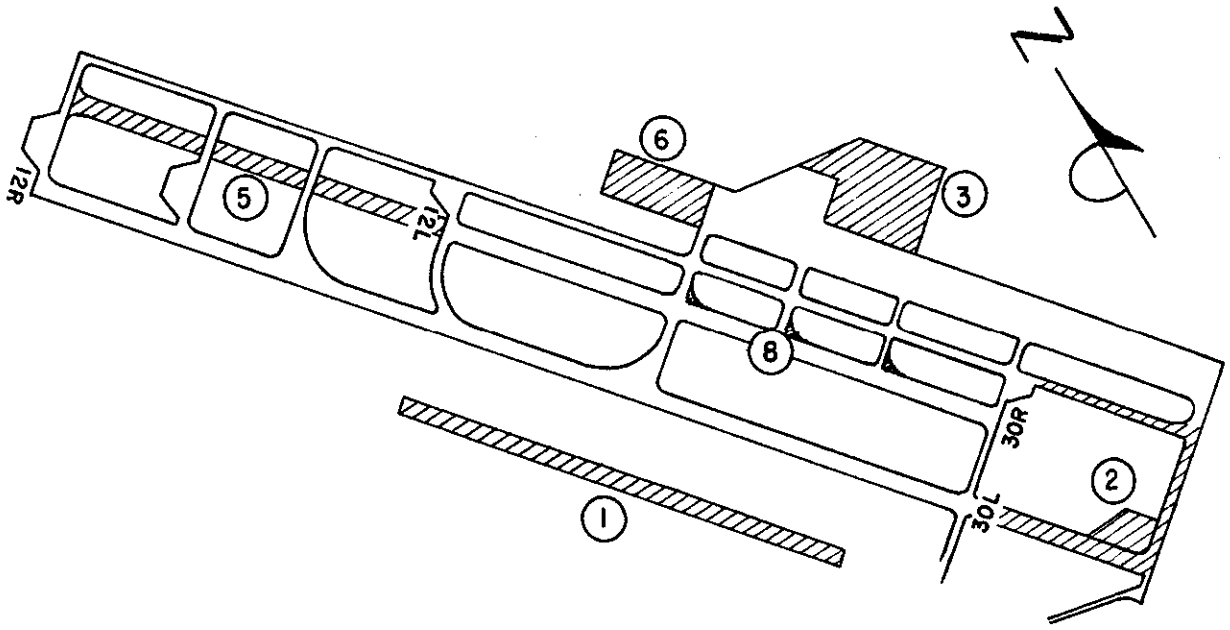
Five of the eight items listed have 1A or 1B benefit ratings. They are very important to the further development of San Jose Airport.

Item 1 will be completed in the summer of 1969 and brings the calculated PANCAP up to the demand level. This touch-and-go runway is a low cost item and has an excellent savings/cost ratio.

Items 2 and 5 provide for the improvement of runways and taxiways, which is necessary for full utilization of the airfield by larger aircraft. These items have good savings/cost ratios and are important to development of air carrier operations.

Item 3 provides aircraft gate positions which are essential to the construction of the proposed satellite finger. They will also eliminate the need for bussing passengers to aircraft at remote apron locations.

Item 4 recommends additional reliever airport facilities. This item will become increasingly important as air carrier activity at the airport increases.



SAN JOSE MUNICIPAL AIRPORT
SAN JOSE, CALIFORNIA

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (8)

PRESENT – FORECAST TRAFFIC ACTIVITY

FY 1968	438,000
FY 1970	500,000
FY 1975	600,000

PRESENT AND FORECAST TRAFFIC MIX (APPROXIMATE)

	PRESENT	1970
A	—	5%
B	10%	20%
C	10%	5%
D + E	80%	70%

COST PER MINUTE OF OPERATION BASED UPON FORECAST MIX # 3.11

ANALYSIS OF IMPROVEMENTS

LOCATION SAN JOSE MUNICIPAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Construct parallel touch-and-go runway (3,000' x 100')	1B	ALL	August 1969	$30,000	$3,000	--	--	--	over 100:1	Current touch-and-go activity accounts for 50% of operations. It is estimated that 80% of touch-and-go operations will be conducted on this improvement and will increase PANCAP by approximately 25%. The touch-and-go runway will be located for incorporation in ultimate taxiway system indicated on airport layout plan. It will be completed in the summer of 1969.
Strengthen taxiway A and east end of 30L (access around end of 30R) and construct holding apron for 30L	1A	ALL	1970	$300,000	$30,000	--	--	$259,000	8.5:1	Because of strength deficiency of taxiway A and east end 30L (displaced threshold area), air carrier aircraft must use taxiway B for access to runway 30L. Taxiway B is also used by general aviation aircraft as access to runway 30R. Strengthening of these pavements will provide by-pass for large aircraft to 30L, thereby reducing delays and mixing of general aviation and air carrier aircraft now encountered on taxiway B. Construction of holding apron for 30L will further facilitate movement of air carrier aircraft. Increase in route lengths will require increased use of 30L by air carrier aircraft. Capacity will be increased due to lessening of taxiway crossing problems. Project will also require installation of ALS flushlights on 30L.

ANALYSIS OF IMPROVEMENTS

LOCATION SAN JOSE MUNICIPAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
Expand apron to provide 8 gate positions at proposed satellite finger	1B	ALL	1970	$300,000	--	--	--	--	--	Apron expansion is required to serve satellite finger which will increase gates from 4 to 12. Lack of gates has required bussing passengers to aircraft due to insufficient apron in terminal area. While passenger forecast data is insufficient for accurate calculation of gates, the need for these gates is obvious.
Reliever airports Construct new South County general aviation airport. Add parallel runway at Reids Hillview Airport and increase facilities for based aircraft	1B	ALL	---	$2,500,000	--	--	--	--	--	Anticipated increase in air carrier operations at San Jose Municipal makes need for improvement in reliever airports very important. Now have 500 based aircraft with three-year waiting list at San Jose Municipal. Also Reids Hillview Airport has 400 based aircraft and construction of runway and apron would take 50 to 100 more based aircraft and increase general aviation operations. If new South County general aviation airport is constructed, (estimated cost $2.5 million), an estimated 200 based aircraft would relocate from San Jose.
Extend runway 12L/30R to 7,400' (now 4,419') and strengthen existing pavement	1A	ALL	1970	$330,000	$63,000	$185,000	--	$576,000	9:1	92% of air carrier operations are on 30L because of 30R length and weight restrictions. Improvements will permit use of 30R by 90% of all aircraft for takeoff and use by all aircraft for landing. If 12L/30R is used for arrivals and

(cont'd)

ANALYSIS OF IMPROVEMENTS

LOCATION SAN JOSE MUNICIPAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY 1970	REDUCTION IN ANNUAL MINUTES OF DELAY 1975	ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
										12R/30L for departures, theoretically, taxiway crossing problems will be minimized with resultant increase in capacity required to meet 1970 demand. Will also provide flexibility needed for increased air carrier activity anticipated by 1975.
Expand apron to north to provide four gates	1B	ALL	1970	$300,000	--	--	--	--	--	Additional gates will be required by 1974 to prevent aircraft delays at gate positions. Since bussing of passengers to aircraft will be discontinued after construction of satellite finger, relief must be obtained by this improvement.
VASI 30L 30R 12R 12L	3	AT & SPON-SORS	--	--	--	--	--	--	--	VASI's needed on 30L and 30R to facilitate noise abatement procedures. VASI's also recommended by AT and sponsor to improve 12R and 12L approaches. REIL's could be used in lieu of VASI's on 12R and 12L.
Construct wide turnoff areas between 30R and taxiway 2, and taxiways C and E	3	AT	--	$155,000	$15,500	--	--	--	--	Primary benefit of this improvement would be easy turnoff area for training flights. 75% of general aviation operations are on 30R. Capacity increase will result from improved taxiway exit ratings. Benefits would be marginal since taxiway crossing problems of the parallel runway system will not be reduced.

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TAMPA INTERNATIONAL AIRPORT

TAMPA, FLORIDA

DISCUSSION

1. Discussion on Congestion

There is presently very little congestion evident at the Tampa International Airport. Some delay, however, results from:

Lengthy taxi routes to and from primary runways

Ramp congestion at present terminal area

Noise abatement restrictions and procedures

The Hillsborough County Aviation Authority has recently begun a major construction program at Tampa International. The feature of this program is an entirely new terminal complex, located between the parallel runways (see sketch). This terminal will utilize a modern concept in design by providing a large, central Landside Terminal to and from which passengers will be transported by a monorail-like system to Airside Terminals serving as the aircraft gates. Completion of the first phase of construction is scheduled for October 1970.

Most of the present congestion at Tampa will be corrected with the opening of the new terminal. Its more central location will reduce taxiing distances considerably and also relieve congestion on the present ramp area.

Noise abatement regulations, particularly the preferential runway system, will cause additional delay and congestion as activity increases. Presently, under normal VFR circumstances, landings are not permitted on runway 36R, nor takeoffs on 18L for aircraft weighing more than 12,500 pounds. The arrival/departure ratio is now fairly equal; however, as traffic increases, these runway use restrictions will create delays during VFR weather conditions. The present poor condition of runway 18L/36R will further reduce the effectiveness of the parallels as more aircraft refuse to use it due to its rough, deteriorating surface.

Additional inconvenience has been caused by the loss of the east/west taxiway "D" between the parallel runways due to construction of a new post office building immediately adjacent to the taxiway. A new taxiway has been constructed north of runway 9/27. The closing of taxiway "D" now requires aircraft taxiing to runway 9 for takeoff to cross that runway and taxi an additional 1,000'.

2. Operational Considerations

During CY 1968, Tampa had slightly more than 160,000 total operations. The forecast for FY 1970 is 218,000; for FY 1975, 280,000. Based on current information, the PANCAP for the Tampa International Airport is calculated as 250,000 with the present terminal facility and 265,000 when the new terminal is occupied.

This PANCAP is considerably lower than an estimated figure received from local sources (350,000). The reason for the difference is assumed to be a greater weight applied to restrictive factors and a peaking factor which is currently about 9 percent. As air traffic activity increases, a flattening of the peak period operations will tend to increase the PANCAP. For example, a 7 percent peaking factor results in a PANCAP of 310,000 for Tampa.

Helicopter operations total approximately 2,000 operations per year, and therefore cause no operational problem. There are no STOL operations and no known plans of a STOL operation at this location.

There is very little training activity conducted at Tampa. Touch-and-go operations comprise less than 1 percent of the total operation.

Current runway use priorities are as follows:

	Landing	Departing
#1	36L-18L-18R	36R-36L-18R
#2	9	27
#3	27	9
#4	36R	18L

Flow control restrictions to north bound departures, particularly to Chicago and New York, are imposed on an almost daily basis. This is usually more of a problem when runway 18R is being used due to the lack of a by-pass capability at this runway and associated taxiways.

3. Terminal Complex

At present, there are 17 aircraft gates and a certain amount of congestion occurs daily on the ramp areas. More congestion is experienced on the south ramp due to aircraft push-back procedures. Eastern Air Lines is the predominant user of the east ramp and utilizes aircraft power in/out procedures.

The new terminal complex will provide 40 DC-8 size gates at 4 "Airside" Terminal units after Phase I construction is complete. Two additional Airside Terminals will be completed when it becomes necessary, providing 20 additional gates. Indications are that sufficient gates will be available for quite some time when Phase I is complete.

4. Reliever Airports

General aviation traffic is estimated as comprising 43 percent of the activity at Tampa. Some segregation of traffic is possible which helps reduce the mixing problem considerably.

While St. Petersburg/Clearwater Airport is the primary general aviation airport in the area, other general aviation airports in the Tampa area appear to provide ample backup at present. These are the other two airports operated by the Hillsborough County Aviation Authority, Peter O. Knight and Plant City, and the other three general aviation airports in the two-county area - Albert Whitted, Clearwater, and Vanderburg Airports.

As air carrier traffic continues to increase at Tampa, however, additional general aviation facilities may be required.

5. Special Considerations

Due to the construction programs previously discussed, controller personnel will lose visual reference in several critical areas of the airport. The largest and most severely affected area will include a portion of the final approach to, and the first 2,500' of, runway 18R up to an altitude of approximately 270'. As previously noted, runway 18L/36R is in poor condition and will require closure for resurfacing very shortly, thereby forcing additional traffic onto runway 18R/36L. The closure plus the lack of vision to this runway will reduce capacity.

After the new terminal complex is completed, another serious problem will be the blinding effect of the entrance roadway, terminal driveway, and terminal complex lighting during hours of darkness. Much of this lighting will be above the level of the present control tower line of sight, and will cover nearly all of the length of the runway 18R/36L, in addition to approach/departure areas.

The FAA and the Hillsborough County Aviation Authority have been negotiating concerning the construction of a new control tower within the new terminal complex. At this writing, no decision has been reached as to who should provide the funds necessary for the construction of a new tower. A serious condition will exist, however, as construction continues. It is recommended therefore that the region examine every possible solution to the funding problem so that work may begin on a new tower. In the interim, a closed circuit TV system will be installed in an attempt to reduce the tower visibility problem created by the new terminal building construction.

RECOMMENDATIONS

The following priority of improvements has been developed in the order thought to be most significant in relieving future congestion at Tampa. It is recommended that this listing be fully considered in all future airport development.

PRIORITY RATING	ITEM
1	Strengthen runway 18L/36R
2	Improve exits to runways 18L and 36L
3	Maintain portion of taxiway "D"
4	Taxiway signs
5	By-pass taxiway around north side of new terminal
6	Access taxiway to 18R
7	Strengthen runway 9/27
8	Parallel 18/36 GA/STOL runway
9	Holding aprons
10	Strengthen taxiways
11	REIL on runway 9/27

The single most important item to be accomplished at Tampa is the strengthening of runway 18L/36R. Already a few aircraft have refused to use it and closure will become necessary within a year if this work is not accomplished. Improving the exit taxiways should also be completed during the runway closure.

It would be of great advantage to have the GA/STOL runway available during the 18L/36R closure (recommendation 8 above), and this item is being added to the master plan.

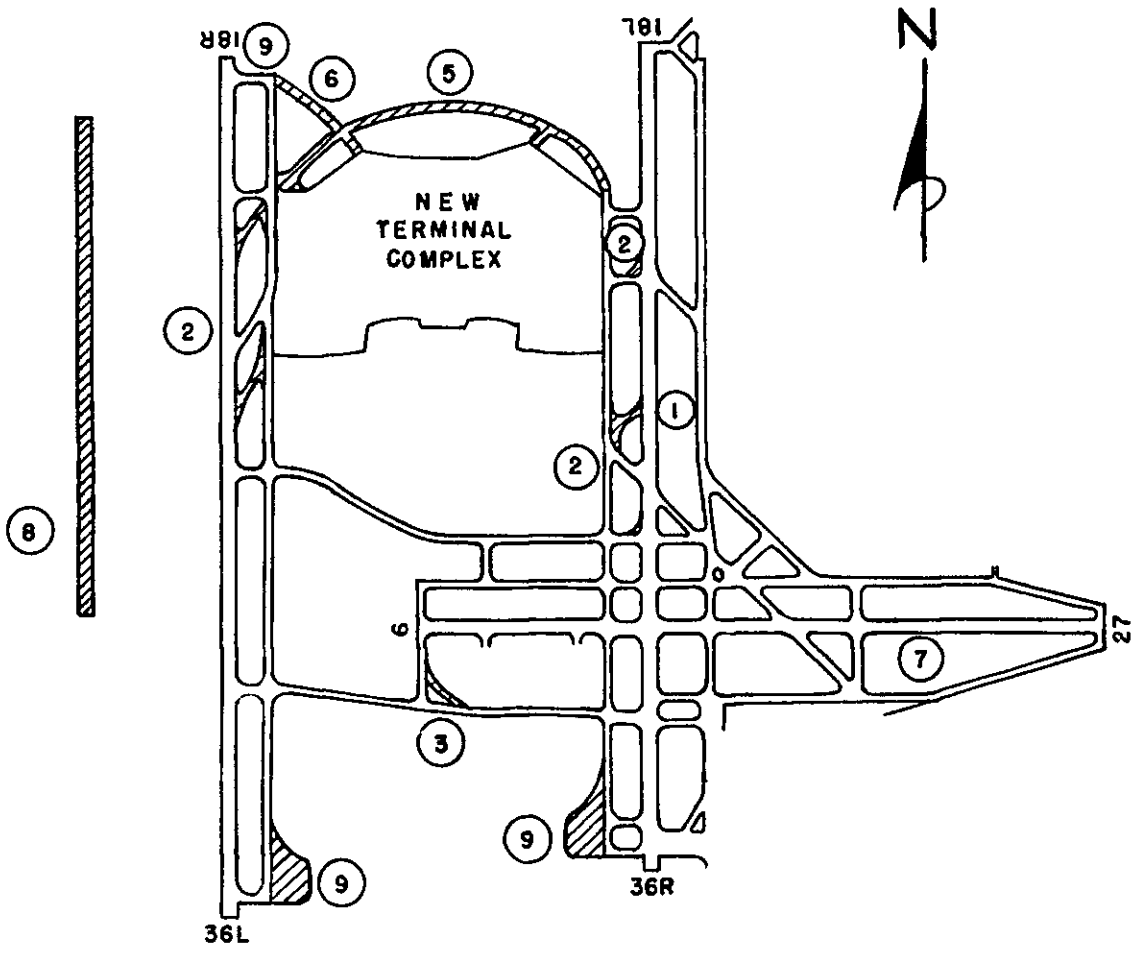
The addition of the short taxiway to by-pass the post office is also recommended, not only due to its obvious operational advantages but to preserve a large section of valuable taxiway which is already in place.

As in many locations, the taxiway signs are inadequate. According to local authorities, these signs will be improved greatly upon completion of the new terminal complex. Again, better standardization by the FAA is recommended.

Recommendations 5 and 6 above are also interrelated and should be considered together in a single package. Although, as indicated, the annual savings are marginal, operational convenience would result in completion of these items, particularly in view of the "push-back" jet procedures being planned.

Strengthening of runway 9/27 is difficult to properly analyze due to present limited use. Under strong crosswind conditions this runway will be required and should be maintained to proper strength. The only recommended holding or runup area is located at runway 18R since this is the primary departure runway. Location and type of run-up area are not included and should be locally determined to provide the best possible relief. Item 6 in the above list of recommendations is an additional consideration when determining type of improvement desired.

Two items included in the analysis section but not in the recommendations - runway extensions and fillet widening - are dependent upon use of the "jumbo jets" at Tampa. At present, the air carriers are planning to begin using these aircraft at Tampa in January 1971.



TAMPA INTERNATIONAL AIRPORT — TAMPA, FLORIDA

SEE RECOMMENDATIONS FOR DESCRIPTION OF ITEMS (1) THRU (9)

PRESENT - FORECAST TRAFFIC ACTIVITY

FY-1968	165,000
FY-1970	218,000
FY-1975	280,000

PRESENT AND FORECAST TRAFFIC MIX

	PRESENT	1970
A	18%	16%
B	35%	45%
C	4%	4%
D+E	43%	35%

COST PER MIN. OF OPERATION BASED ON FORECAST MIX: $ 6.00

ANALYSIS OF IMPROVEMENTS

LOCATION TAMPA INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Strengthen runway 18L/36R	1A	AM	1971 (construction time 6-8 mos.)	$760,000	$76,000	223,000*	500,000	$1,340,000	18:1	This is a very high priority item as far as airport management is concerned. Closure of the runway for repairs (about 6 months) will result in approximately 110,000 minutes of delay. However, if no work is done on this runway, local estimates show only one more year of use before required closure. *In 1970 additional delay without 18L/36R in operation will result in annual delay "savings" shown for strengthening The PANCAP without 18L/36R is 190,000.
Improve exits to runways 18L and 36L	1A	ALL	1971 (to serve new terminal area)	$288,000 ($15/SY)	$28,000	18,000	100,000	$108,000	3.7:1	These are the primary arrival runways, and exits can be greatly improved to new terminal area. Locations on sketch are schematic only. Exact locations should be coordinated with local users and tower chief. Generally, the angled exits should tie in with apron access taxiways.
Maintain part of taxiway D operation	1A	AT	1969	$30,000	$3,000	6,300	--	$37,800	12:1	Installation of new post office facilities caused closure of west 1,600' of taxiway D. Recommendation is to "round" corner of taxiway D to permit access to runway 9 without crossing 9 when it is in use. This would reduce delays to operations on runway 9 and would reduce the total taxiing distance to runway 9 from the present terminal. Even though the ratio reduces substantially in 1971 when the new terminal is in operation, direct access to 9 will give good savings now and is endorsed. Eventually it is anticipated parallel taxiway C will be (cont'd)

ANALYSIS OF IMPROVEMENTS

LOCATION TAMPA INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
										constructed to the end of runway 9. This would give the same delay savings as continued use of taxiway D, and would free additional acreage for cargo expansion; however, the cost would be about $400,000.
Taxiway signs	1B	ALL	1970	$15,000	$1,500	--	--	--	--	New taxiway signs will be needed for night operations to the new terminal area. Airport management recommends FAA review of standards on guidance signs due to expense involved. Not evaluated, but obvious delay savings to night operations.
By-pass taxiway around north end of new terminal apron complex	3	AT AM	1970	$500,000 (excluding overpasses)	$50,000	4,100	6,100	$24,600	.5:1	The 1970 minutes of delay do not include an increased annual savings for estimated 3/4 year closure of runway 18L/36R and resultant conflict reduction provided by two-way taxiing capability. In 1971, during 18L/36R shutdown, the ratio of savings to cost is 1.5:1. At rate of increase in demand and associated delay savings total cost could be recovered by 1978-79 through reduced delays. However, overpasses would increase cost considerably and thus overall delay savings would be marginal.

ANALYSIS OF IMPROVEMENTS

LOCATION TAMPA INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Access taxiway to 18R	3	AT	1970	$160,000	$16,000	1,500 (1971)	2,300	$9,000 (1971)	.5:1	This taxiway provides two-way access to a primary departure runway. Push-backs from terminal building No. 4 will cause congestion in this area. Terminal apron expansion might accomplish the same thing but due to drainage problems the taxiway is thought more reasonable.
Strengthen runway 9/27	2A	AM	1973-1974 (construction time 6-8 mos.)	$720,000	$72,000	--	270,000	$1,620,000 (1975)	22:1 (1975)	Approximately 2-4% of the time, 9/27 must be used due to wind velocities in excess of 15 knots. Therefore, 5,000 to 9,000 operations annually will be affected and cancellations and diversions will occur if 9/27 cannot be used. Delay per operation is difficult to calculate with 9/27 shut down completely, but "saturation" delay of 30-60 minutes per peak hour operation results in estimated 270,000 minutes of delay in 1975. Cost does not include cost of rehabilitation and strengthening of parallel taxiway G, which is now restricted to 25,000# gross load.
Parallel 18/36 GA/STOL runway 75' X 4,000' including parallel taxiway and lights	2A	AM TF	After 1974	$400,000	$40,000	82,000	310,000	$92,000*	2:1	*Cost/minute adjusted for mix. Exact location not yet selected for this parallel but assumed west of 18R/36L, space for independence VFR use. Convenience to GA hangar area key factor in use and benefits shown may be worthwhile.

ANALYSIS OF IMPROVEMENTS

LOCATION TAMPA INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Holding aprons for 36L, 36R, 18R	3 (18R only see remarks)	AT	1971-1972	No estimate	--	--	--	--	--	Runway 36L is used mainly for arrivals, and 36R for departures due to noise. Queues of 5-6 aircraft now build up on 36R due to flow control, but adequate holding area available to east of 36R. New terminal will require crossing of 36R to get to holding area and eventually 36R holding area to west appears desirable. Also, if two-way taxiing is not provided to 18R, a holding area will eventually be desirable. The need for a holding apron on 36L to serve light aircraft is marginal, since intersection takeoffs are now allowed. Since a by-pass taxiway is now U/C for 36L only, 18R improvement is endorsed. Specific improvement (i.e., by-pass, two-way taxiway, or holding area) should be examined closely for cost and "fit" with total plan.
Strengthen taxiways	2B	AM	1974-1975	$450,000	$45,000	--	--	--	--	The overpass taxiway and new apron areas have 16" paving. Other taxiways are 12". Eventual need for larger aircraft is apparent but not now a major problem.
REIL on runway 9/27	3	ALL	1970	--	--	--	--	--	--	This is included on present F&E plan and will facilitate road crossing by aircraft. It will help from noise standpoint. Marginal congestion item. A VASI might be substituted if the primary problem is noise.

ANALYSIS OF IMPROVEMENTS

LOCATION TAMPA INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Extend runways 18R (1,600') and 27 (1,000')	4	AM	Unknown	$1,450,000 (18R) $965,000 (27)	--	--	--	--	--	These expensive extensions to accommodate the critical aircraft are not evaluated due to uncertainty of need. Currently no restrictions are imposed on nonstop flight to SFO when 36L is used for takeoff. Extensions are in accordance with ALP, and, if economic constraints on airline use are imposed with opening of new terminal and use of larger aircraft, extensions should be evaluated.
Widen fillets	4	AM	1971-1972	--	--	--	--	--	--	Although airport management and FAA regional personnel believe additional provisions should be made for handling B-747's or L-1011's, airlines presently have stated no improvement requirements at Tampa. Probably re-evaluation by airlines will show need for some improvements, but congestion relief will be marginal - particularly if exits are widened and improved, as in previous recommendation. Thus, not presently recommended.
TDZ lights on runway 36L	4	AM	Unknown	--	--	--	--	--	--	The ILS for this runway is now programmed but presently Category I is planned. Thus, TDZ lights would not affect minimums. The ILS is justified for noise abatement. Paving has "leave out" spaces for TDZ lights. Although these lights enhance safety, no major congestion relief is now apparent.

ANALYSIS OF IMPROVEMENTS

LOCATION TAMPA INTERNATIONAL AIRPORT

IMPROVEMENTS	BENEFIT RATING	PRIMARY SOURCE OF SUGGESTION	ESTIMATED COMPLETION	ESTIMATED TOTAL COST (NO LAND)	10% OF TOTAL COST	REDUCTION IN ANNUAL MINUTES OF DELAY		ANNUAL SAVINGS (1970 DEMAND)	RATIO OF ANNUAL SAVINGS/COST (1970 DEMAND)	REMARKS
						1970	1975			
Parallel runway 9/27	4	--	--	No estimate	--	--	--	--	--	Although 9/27 presently has about 12% total annual use, this is expected to drop substantially when the new terminal is opened. Actual required use (over 15 m.p.h. crosswind component) is about 2-3% annually. Therefore, this runway is a very long-range item assuming the use of 9/27 will drop to about 3% in 1970.

APPENDIX 1

LISTING OF PEOPLE CONTACTED

The general information and procedures described in Appendix 1 and 2 of the original report are applicable to this supplement. Therefore, the material contained in the appendix of this supplement has been limited to the listing of people contacted during the survey of the ten additional airports.

BUFFALO, NEW YORK, GREATER BUFFALO INTERNATIONAL AIRPORT

March 20, 1969

NAME	AFFILIATION
Mr. W. M. Cronan	Boston Area Office, FAA
Mr. T. Duggan	Niagara Frontier Port Authority
Mr. A. Fallon	Niagara Frontier Port Authority
Mr. W. McLean	Buffalo Airport Tower, FAA
Mr. M. McSherry	Buffalo Airport Tower, FAA
Mr. L. Olmstead	Niagara Frontier Port Authority
Mr. R. Rebadow	Niagara Frontier Port Authority
Mr. H. Zimmerman	Boston Area Office, FAA

DALLAS, TEXAS, DALLAS LOVE FIELD

February 17, 1969

NAME	AFFILIATION
Mr. B. Boswell	Fort Worth Area Office, FAA
Mr. C. F. Davis	Fort Worth Area Office, FAA
Mr. F. M. Lambert	Dallas Love Field Tower, FAA
Mr. D. E. Lee	Fort Worth Area Office, FAA
Mr. H. Megredy	City of Dallas
Mr. A. N. Mitchell	Dallas Love Field Tower, FAA
Mr. J. B. Tapp	City of Dallas

DETROIT, MICHIGAN, DETROIT METROPOLITAN AIRPORT

March 18, 1969

NAME	AFFILIATION
Mr. N. A. Amundsen	Chicago Area Office, FAA
Mr. W. A. Colby	Michigan Aeronautics Commission
Mr. M. J. Finchon	Central Region, FAA
Mr. G. H. Niles	Detroit Metropolitan Control Tower, FAA
Mr. D. J. Norton	Wayne County Roads Commission
Mr. J. T. Popp	Chicago Area Office, FAA
Mr. J. P. Reed	Detroit Metropolitan Airport, FAA
Mr. R. F. Roche	Chicago Area Office, FAA
Mr. R. Tashjian	Wayne County Roads Commission
Mr. L. N. Underwood	Chicago Area Office, FAA
Mr. M. S. Zolik	Wayne County Roads Commission

KANSAS CITY, MISSOURI, MID-CONTINENT INTERNATIONAL AIRPORT

April 9, 1969

NAME	AFFILIATION
Mr. E. Capps	Mid-Continent Airport Tower, FAA
Mr. W. Clark	Kansas City Area Office, FAA
Mr. M. Fischer	Central Region, FAA
Mr. H. Kading	Kansas City Department of Aviation
Mr. J. R. Kennedy	Kansas City Municipal Tower, FAA
Mr. W. C. Knoepfle	Central Region, FAA
Mr. B. D. Myers	Kansas City Department of Aviation
Mr. H. E. Protzman	Kansas City Department of Aviation
Mr. E. Samuelson	Kansas City Area Office, FAA
Mr. H. W. Willoughby	Kansas City Department of Aviation

MILWAUKEE, WISCONSIN, GENERAL MITCHELL FIELD

April 3, 1969

NAME	AFFILIATION
Mr. D. Buckman	General Mitchell Field Tower, FAA
Mr. R. Evans	General Mitchell Field Tower, FAA
Mr. J. E. Foley	Milwaukee County
Mr. R. Michael	Milwaukee County
Mr. W. Pearson	Minneapolis-St. Paul Area Office, FAA
Mr. K. Whitney	Minneapolis-St. Paul Area Office, FAA

MINNEAPOLIS, MINNESOTA, MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT WOLD CHAMBERLAIN FIELD

April 2, 1969

NAME	AFFILIATION
Mr. A. W. Carlson	Minneapolis-St. Paul Area Office, FAA
Mr. R. B. Hansen	Metropolitan Airport Commission
Mr. L. A. Johnson	Metropolitan Airport Commission
Mr. F. McLeod	Minneapolis-St. Paul Int. Tower, FAA
Mr. W. R. Pearson	Minneapolis-St. Paul Area Office, FAA
Mr. C. W. Peterson	Metropolitan Airport Commission
Mr. A. F. Sutton	Metropolitan Airport Commission
Mr. K. R. Whitney	Minneapolis-St. Paul Area Office, FAA

NEW ORLEANS, LOUISIANA, NEW ORLEANS INTERNATIONAL AIRPORT MOISANT FIELD

March 6, 1969

NAME	AFFILIATION
Mr. W. N. Dale	Houston Area Office, FAA
Mr. G. R. Brenner	New Orleans International Tower, FAA
Mr. W. E. Peterson	Houston Area Office, FAA
Mr. O. L. Sands	New Orleans International Airport, Manager

PITTSBURGH, PENNSYLVANIA, GREATER PITTSBURGH AIRPORT

April 16, 1969

NAME	AFFILIATION
Mr. C. Barbarow	Greater Pittsburgh Airport Tower, FAA
Mr. J. Bushee	Cleveland Area Office, FAA
Mr. M. J. Griffin	Greater Pittsburgh Airport
Mr. E. Jones	Greater Pittsburgh Airport
Mr. V. Krumins	Cleveland Area Office, FAA
Mr. S. Lardas	Greater Pittsburgh Airport
Mr. D. Martin	Cleveland Area Office, FAA
Mr. K. McMechon	Greater Pittsburgh Airport Tower, FAA
Mr. A. L. McLaughlin	Greater Pittsburgh Airport
Mr. J. Miller	Greater Pittsburgh Airport
Mr. A. W. Nicola	Greater Pittsburgh Airport

SAN JOSE, CALIFORNIA, SAN JOSE MUNICIPAL AIRPORT

September 27, 1968

NAME	AFFILIATION
Mr. F. E. Davis	San Francisco Area Office, FAA
Mr. C. G. Hand	San Francisco Area Office, FAA
Mr. M. Henkel	San Jose Municipal Airport Tower, FAA
Mr. L. Hopkins	San Francisco Area Office, FAA
Mr. J. M. Nissen	San Jose Municipal Airport
Mr. D. A. Short	San Francisco Area Office, FAA
Mr. R. J. Stockton	Western Region, FAA
Mr. V. Troup	San Jose Municipal Airport

TAMPA, FLORIDA, TAMPA INTERNATIONAL AIRPORT

March 11, 1969

NAME	AFFILIATION
Mr. G. J. Bean	Hillsborough County Aviation Auth.
Mr. R. G. Crouch	Hillsborough County Aviation Auth.
Mr. R. L. Haury	Hillsborough County Aviation Auth.
Mr. R. B. Maguire	Hillsborough County Aviation Auth.
Mr. S. D. Mast	Hillsborough County Aviation Auth.
Mr. J. C. Orman	Hillsborough County Aviation Auth.
Mr. R. W. Peach	Miami Area Office, FAA
Mr. R. J. Potts	Tampa International Airport Tower, FAA
Mr. J. D. Seale	Tampa International Airport Tower, FAA
Mr. W. A. Yearra	Hillsborough County Aviation Auth.

AIRPORT ENVIRONMENTAL CONCERNS.

FAA-RD-71-71
Migration Corridors of Waterfowl in the United States
AD-736 628 72-06 6C PCA02/MFA01

FAA-RD-71-84
Measurement and Analysis of Noise from Four Aircraft during Approach and Departure Operations (727, KC-135, 707-320B, and DC-9)
AD-740 563 72-11 20A PCA09/MFA01

FAA-RD-71-112
Analysis of Operational Noise Measurements in Terms of Selected Human Response Noise Evaluation Measures
AD-741 149 72-12 20A PCA04/MFA01

FAA-RD-71-117
Noise Measurements During Approach Operations on Runway 21R at Detroit Metropolitan Airport
AD-740 642 72-11 20A PCA05/MFA01

FAA-EQ-72-1
Land Use Control Strategies for Airport Impacted Areas
AD-759 865 73-13 13B PCA09/MFA01

FAA-EQ-72-3-VOL-1
A Community/Airport Economic Development Model, Volume I, General Concept and Application
AD-752 627 73-02 1E PCA05/MFA01

FAA-EQ-72-3-VOL-2
A Community/Airport Economic Development Model, Volume II, Appendices to Volume I
AD-753 836 73-04 13B PCA10/MFA01

FAA-EQ-72-3-VOL-3
A Community/Airport Economic Development Model, Volume III, User's Manual
AD-754 174 73-05 1E PCA10/MFA01

FAA-EQ-72-3-VOL-4
A Community/Airport Economic Development Model, Volume IV, Programmers' Manual
AD-751 932 73-02 1E MFA01

FAA-RD-72-72
Evaluation of Hearing Levels of Residents Living Near a Major Airport
AD-747 129 72-19 6S PCA06/MFA01

FAA-RD-72-145
The Effects of Local Meteorological Factors upon Aircraft Noise Measurements
AD-754 270 73-05 20A PCA03/MFA01

FAA-EQ-73-2
Comparison of Mobile Source Emission from Aircraft, Automobiles, Buses, Trucks, Railroads, and Electric Trains (Project Eagle)
AD-758 587 73-11 13B PCA04/MFA01

FAA-RD-73-113
Airport Vicinity Air Pollution Study
AD-780 049 74-16 13B PCA13/MFA01

FAA-RD-74-72
The Effect of Short-Term Weather Conditions on the Migration of Waterfowl
AD-786 044 74-24 6C PCA03/MFA01

FAA-RD-74-114
Aircraft Taxiing Noise Measurements
AD-787 235 74-26 1C PCA07/MFA01

FAA-RD-74-132
Airport Vicinity Air Pollution Study, Model Application and Validation and Air Quality Impact Analysis at Washington National Airport
AD-A001 584 75-02 13B PCA09/MFA01

FAA-RD-74-212
Airport Vicinity Air Pollution Study The Impact of Modified Aircraft Taxi Procedures on Airport Air Quality
AD-A009 882 75-14 13B PCA08/MFA01

FAA-AS-75-1
Developing Noise Exposure Contours for General Aviation Airports
AD-A023 429 PCA10/MFA01

FAA-RD-75-100
Effect of Temperature and Humidity on Aircraft Noise Propagation
AD-A014 644 75-23 20A PCA06/MFA01

FAA-RD-75-118
Analysis of the Effect of Concorde Aircraft Noise on Historic Structures
AD-A017 082 76-01 20A PCA05/MFA01

AIRPORT ENVIRONMENTAL CONCERNS. (Con't)

FAA-RD-75-179
Air Quality Impact Analysis of a Proposed North/South Runway at Anchorage International Airport
AD-A020 169 76-07 13B PCA05/MFA01

FAA-RD-75-182
Review of Studies Investigating Human Response to Commercial Aircraft Noise
AD-A022 356 76-10 6S PCA08/MFA01

FAA-RD-75-211
Establishing Noise Criteria for Residential Living in Areas Surrounding Commercial Aviation Airports
AD-A021 683 76-09 20A PCA04/MFA01

FAA-RD-75-216
Airport Noise Monitoring Systems
AD-A028 511 76-22 1E PCA13/MFA01

FAA-RD-75-230
Airport Vicinity Air Pollution Model User Guide
AD-A020 352 76-07 13B PCA12/MFA01

FAA-DF-76-001
Airport Vicinity Air Pollution Model Computer Source Code
AD-A031 027 76-26 13B GP, T06

FAA-RD-76-1
Human Response to Sound: The Calculation of Perceived Level, PldB (Noisiness or Loudness) Directly from Physical Measures
AD-A035 677 5J PCA03/MFA01

FAA-EQ-76-2
FAA Integrated Noise Model User's Guide
AD-A035 062 20A PCA06/MFA01

FAA-EQ-76-6
FAA Integrated Noise Model Data Base
AD-A036 723 1C PCA06/MFA01

FAA-AP-77-1
Environmental Assessment of Airport Development Actions
AD-A039 274 1E PCA16/MFA01

FAA-AP-77-1A
Environmental Assessment of Airport Development Actions, Appendix Volume
AD-A039 465 1E PCA15/MFA01

FAA-AAP-78-2-1
Environmental Impact Statement for Bicentennial International Airport Northeast, America, Model Environmental Impact Statement Number 1
AD-A049 171 13B PCA16/MFA01

FAA-AAP-78-2-2
Environmental Impact Statement for Freedom Airport, Southeast, America (Model Environmental Impact Statement Number 2)
AD-A049 300 13B PCA12/MFA01

FAA-AAP-78-2-3
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AD-A049 172 13B PCA09/MFA01

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Negative Declaration Section 16(c)(4) Coordination for Liberty Airport, Northwest, America (Model Environmental Impact Statement Number 4)
AD-A049 299 13B PCA05/MFA01

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AD-A052 790 78-14 20A PCA06/MFA01

FAA-EQ-78-12
Impact of Noise on People
AD-A056 752 78-22 13B PCA03/MFA01

FAA-EQ-78-15
Planning for the Airport and Its Environs: The Sea-Tac Success Story
AD-A058 381 78-25 1E PCA06/MFA01

FAA-RD-78-36
Commercial Airport Operations and Community Noise Criteria
AD-A057 451 78-23 1E PCA05/MFA01

FAA-EQ-78-14
The Feasibility, Practicality, and Cost of Soundproofing of Schools, Hospitals, and Public Health Facilities located near Airports
AD-A056 529 78-21 13M PCA03/MFA01