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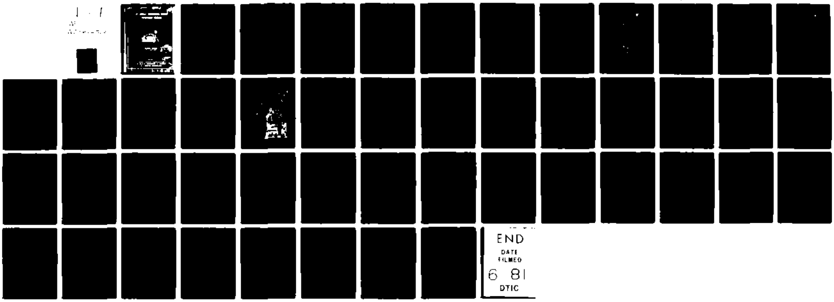

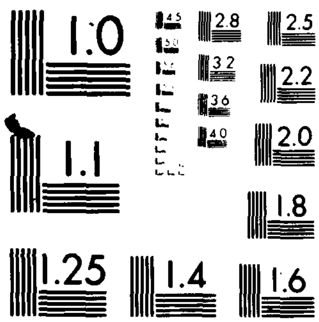

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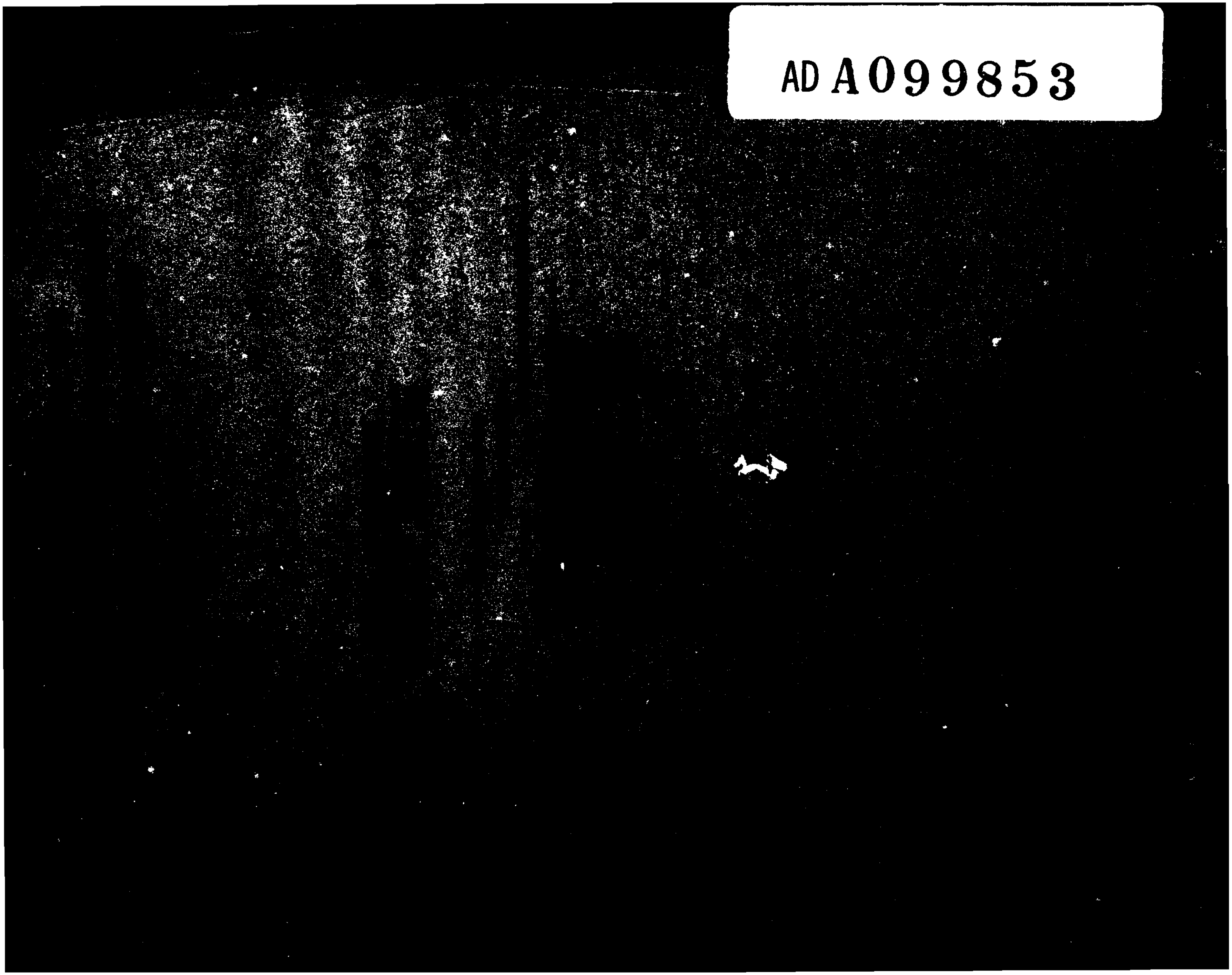

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PREPARED BY

Federal Aviation Administration
Los Angeles Department of Airports
Air Transport Association

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LOS ANGELES INTERNATIONAL AIRPORT IMPROVEMENT PROGRAM

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In addition to the team members listed above, extensive support was provided by others within the organizations represented. Those generous contributions are appreciated.

DEFINITION OF TERMS

ALS	Approach Light System
ALSF	Approach Light System with Sequence Flashers
ARTCC	Air Route Traffic Control Center
ARTS	Automated Radar Terminal System
ASDE	Airport Surface Detection Equipment
ASR	Airport Surveillance Radar
ATA	Air Transport Association
ATC	Air Traffic Control
BM&S	Basic Metering and Spacing
BRITE	Bright Radar Indicator Tower Equipment
CTA	Central Terminal Area
E&D	Engineering & Development
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
F&E	Facilities & Equipment
FL	Flight Level
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Inner Marker
LAX	Los Angeles International Airport
MALSR	Medium Intensity Approach & Rnwy Align. Light System
MSL	Mean Sea Level
RAIL	Runway Alignment Indicator Lights
R&D	Research & Development
RVR	Runway Visual Range
SALS	Shortened Approach Light System
SECRA	Secondary Radar Beacon
SID	Standard Instrument Departure Procedure
SSALR	Simplified Short Approach Light System
STAR	Standard Terminal Approach Route
TCA	Terminal Control Area
TRACON	Terminal Radar Approach Control Facility
VAS	Vortex Advisory System
VFR	Visual Flight Rules

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LOS ANGELES INTERNATIONAL AIRPORT - RUNWAY CAPACITY ANALYSIS

CHAPTER I

INTRODUCTION

This report is the product of an in-depth evaluation of Los Angeles International Airport with respect to its current and potential passenger handling capacity. It identifies the total capacity of the airport system considering access, egress, groundside movement on the airport, terminal facilities, airside movement on the airport and approach and departure. Further, the specific effect is being evaluated for each incremental improvement in procedure or hardware. This will lead to the identification of a recommended list of prioritized improvements.

The Los Angeles International Airport (LAX) Improvement Study was initiated in June of 1975. It was to provide input for a national study involving at least seven other major airports. The initial objectives of the study were to:

1. Determine and validate near-term capacity improvements.

2. Update the Airport Capacity Study — including R&D enhancement.

3. Establish current and future practical capacities.

4. Produce action plans.

It soon became apparent that such general objectives would yield results that could vary widely for different airports. What was needed by both government and industry were the immediate and future productivity increases that could be expected from specific current and anticipated programs. This is necessarily to be coupled with a realistic assessment of airside and landside growth capabilities.

In view of the need for similar information for each airport the goals of the study were restated in late October of 1975. The goals are now:

1. To determine current airport capacity and identify causes of delay associated with terminal airspace, airfield and apron-gate area operations.

2. To identify and determine the capacity increase and delay reduction benefits of alternative procedures and hardware improvement options for immediate, short term (1977-1982) and long term (1982-1990) implementation.

3. To determine relationships between air traffic demand and delay in the present and future time periods as an aid to establishing acceptable air traffic movement levels.

4. To determine airport groundside and access growth capabilities and identify areas of potential capacity constraint.

These restated goals have resulted in the following objectives:

a. The range of the current LAX capacity will be established.

b. The expected delays resulting from approaching capacity limits will be established.

c. Causes of delays will be identified.

d. Immediate and short term improvements which are cost effective will be identified.

e. If there are airspace limitations they will be identified and the impact determined.

f. The short and long term capacity improvement potential for each prospective technical and hardware change will be assessed.

g. Priorities will be established for each improvement item identified for the LAX system.

The current operational scenarios for LAX have been developed. They will be expanded to incorporate the incremental changes projected for the future. The analysis of the team will be enhanced by the use of the airport capacity model. It will permit a repeatable quantification resulting from perceived improvements.

As we move into the latter phase of the study we plan to develop the capacity/demand/delay relationships. It is anticipated that the recently developed delay model will be used in developing these relationships. We fully expect this analysis to give us new insight into the interdependence of terminal facilities, airport design, procedures, fleet mix and demand.

The Los Angeles Department of Airports has recently completed an access study for LAX. Their participation insures the integration of the groundside data with the airside data as both currently exist and are projected to evolve.

CHAPTER II

GROUND/AIRBORNE - SCENARIOS
LOS ANGELES INTERNATIONAL AIRPORT

The purpose of this chapter is to provide the operational scenarios of arrival and departure traffic for Los Angeles International Airport.

This chapter presents scenarios for arrival and departure routes for one airport configuration: Landing and departing Runways 24L/R and 25L/R. Selection of this configuration was based upon the fact that prevailing winds permit use of these runways 98 percent of the time.

This chapter is presented in four parts. The first presents a physical description of the airport and its restrictions. The second and third are airborne and ground scenarios identifying and explaining major constraints to operations. The last part presents an overview of the air traffic control procedures and requirements affecting departures and arrivals at the Los Angeles airport, the scope of which includes both center and terminal facilities.

Airport Environment

The Los Angeles International Airport has two pairs of parallel east-west runways. Distance between runway centerlines of each pair is 700 feet or greater; the distance between the two complexes/runway pairs is 4,500 feet (Figure 1). The two complexes are generally treated as separate airports, each with its own local and ground controllers. Interaction between the complexes is limited to those rare cases when an arriving aircraft is switched, by the local controllers, from one complex to the other. Additionally, coordination between the ground controllers is effected when necessary to preclude conflictions by taxiing aircraft using common taxiways. Simultaneous ILS approaches to (normally) Runways 25L and 24R are conducted when weather and traffic load warrants.

Use of the airport is somewhat restricted due to the limited load bearing capacity of some runways and taxiways. Widebodied aircraft may not use Runway 25R. Widebodied aircraft weighing more than 325,000 pounds are prohibited from using Runway 25L and taxiways which cross the Sepulveda Boulevard tunnel. Additionally, noise abatement restrictions prohibit use of Runway 24R by departing aircraft weighing more than 12,500 pounds. This restriction may be waived by the tower supervisor if significant delays are encountered or if there are runway closures elsewhere on the airport. Preferential runway priorities for noise abatement purposes are: 25R, 25L, 24L and 24R.

As a result of these constraints, the normal mode of operation is to land non-widebodies on the south complex (25L/R) and widebodies on

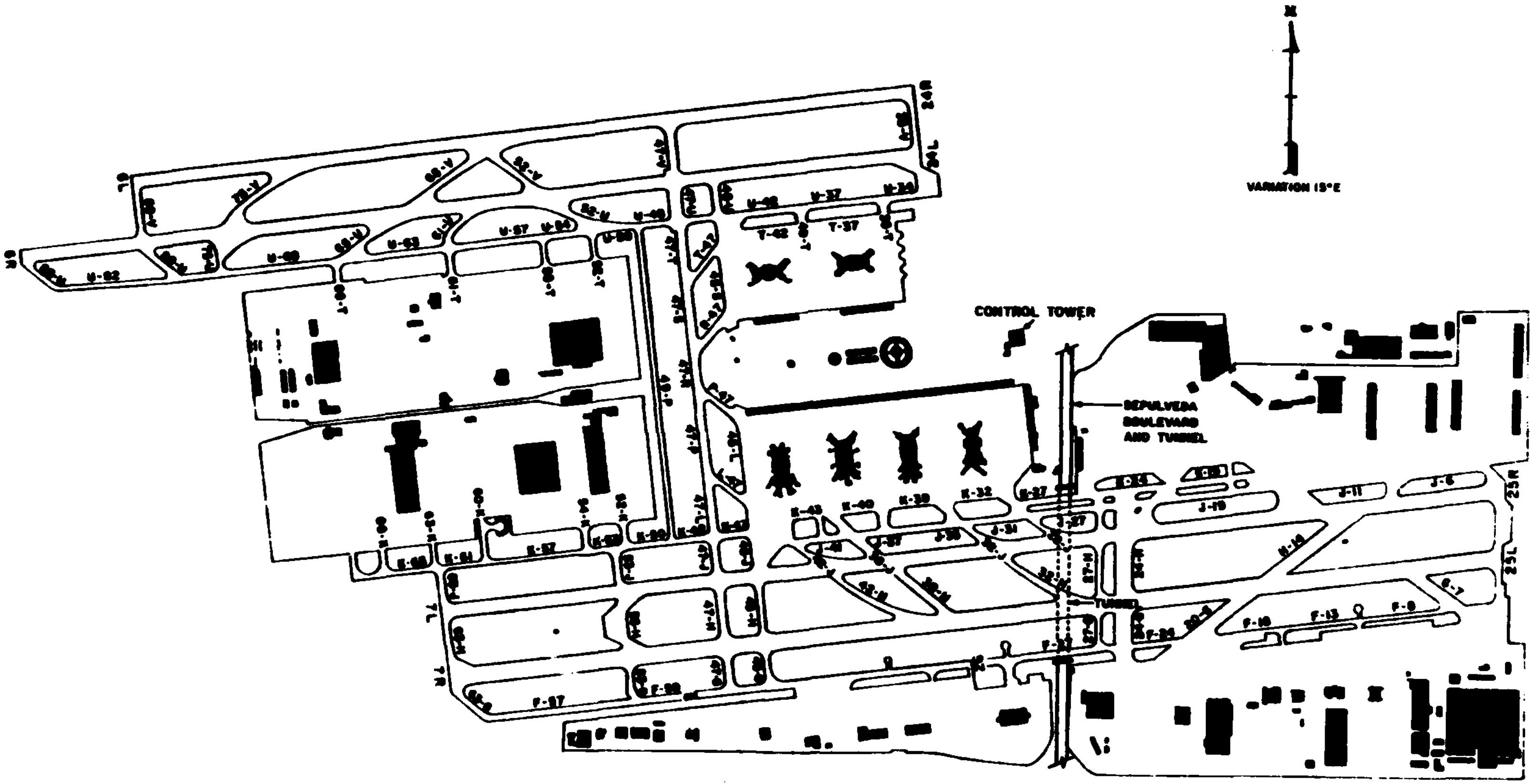


FIGURE 1 LOS ANGELES INTERNATIONAL AIRPORT

the north complex (24L/R) or on 25L providing they meet the weight criteria.

The desirable runway assignment for departures is predicated upon the route of flight after takeoff, i.e., northeast and northbound flights use the north complex; west, southeast and southbound flights use the south complex. Because of the previously mentioned constraints, however, this is not always possible. Heavyweight departures must use the north complex regardless of direction of flight. Noise abatement considerations restricting use of Runway 24R result in a single file sequence for Runway 24L. This problem is particularly significant during the normal morning departure rush which consists primarily of widebodied aircraft.

This brings us to what is considered the most serious problem with Los Angeles departures — the "crossover." Heavy aircraft departing from the north complex and crossing into the departure airspace of the south complex are considered crossovers. (The opposite situation, i.e., south to north, is also crossover, but the problem is controllable since south to north crossovers are only tolerated during periods of light traffic density to preclude extensive taxi routes.) Crossovers significantly increase the possibility of error and require more coordination.

Airborne Scenario

The preferential runway system dictates that the north complex be limited, whenever practicable, to use by aircraft arriving weighing less than 12,500 pounds and widebodies weighing more than 325,000 pounds. As a result, during periods when visual approaches are being conducted, approximately 75 percent of all traffic use the south complex. Widebodied aircraft over 325,000 pounds execute either visual or ILS approaches to the north complex. Widebodies under the weight limit and non-widebodies normally execute visual or ILS approaches to the south complex. The Stadium approach controller vectors his non-widebodied aircraft for visual approach to Runway 25R while the Downey approach controller vectors for straight-in ILS approaches to Runway 25L. After assuming control of the arrivals at approximately 6 miles from the runway, the tower local controller has the option, if he finds it necessary, to change landing runways, i.e., from 25L to 25R or 24L to 24R. Although permissible under unusual circumstances, changing from one complex to the other is rare.

During IFR weather conditions the same preferential runway priorities exist; however, if traffic load warrants, simultaneous ILS approaches may be conducted to Runways 25L and 24R. The approaches are radar monitored to ensure that the no-transgression zone between the final approach paths is not violated.

Departing aircraft are assigned runways that permit simultaneous departures. Traffic northeast and northbound is assigned Runways 24L/R while west, south, and southeast bound traffic is assigned Runways 25L/R.

The exception to this is the case of heavyweight departures which must depart from the north complex regardless of their route after takeoff. All departures must remain below 2,500 feet until passing the shoreline to avoid the VFR corridor which crosses the airport. Altitude restrictions are used to ensure separation between departures and arrivals and other Terminal Control Area (TCA) traffic. Departure Control ensures at least 5 miles separation between departures at the handoff point.

Ground Scenarios (Figure 2)

The ground controller requires a wide degree of latitude in routing taxiing aircraft to and from parking areas because of the numerous physical restrictions. There are no fixed taxi routes on the Los Angeles airport and the following description is very generalized.

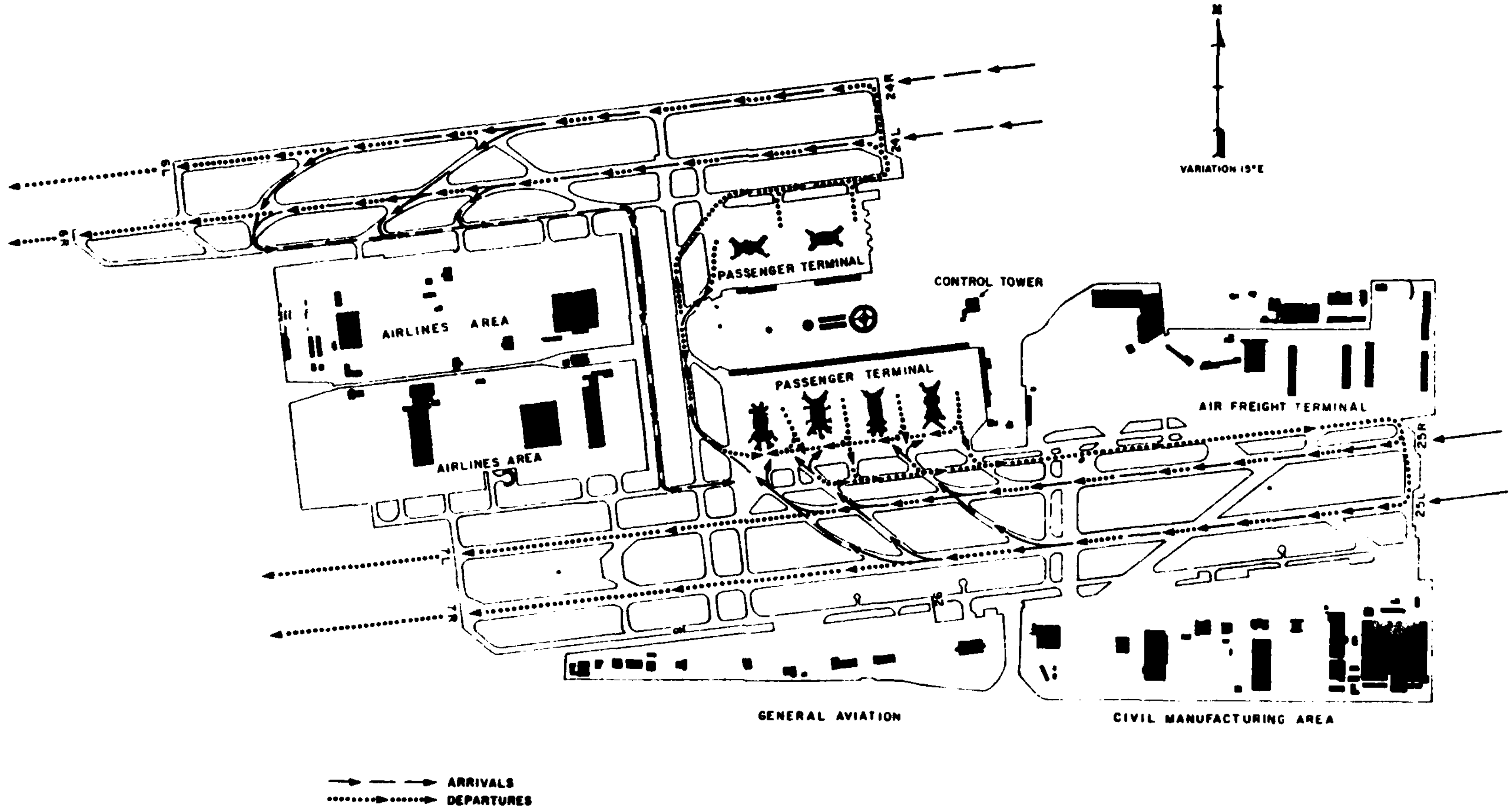
Arrivals: Traffic arriving Runway 25L/R destined for terminals in the south complex uses taxiways 32, 38, and 42. Aircraft going to the north terminal complex taxi via Taxiways 42 and 47. Arrivals destined for the south ramp generally exit the runway at Taxiway 47. Aircraft arriving on Runway 24L/R exit the runway at Taxiways 61, 65, or 68, then taxi east on the parallel taxiway to the north terminal complex or proceed via Taxiway 47 or 49 to the south terminal complex.

Departures: Those aircraft going from the south complex to Runway 25L/R make a left turn on Juliet (outer taxiway) and proceed to the runup area. Those going to Runway 24L/R normally make right turns on the ramp (inner taxiway), then proceed north on Taxiway 47 to the parallel taxiway and thence the runup area. Traffic proceeding from the north complex to Runway 25L/R reverse the procedure, traffic permitting. If Taxiway 47 is occupied, they taxi south on 49. Traffic departing the north complex for Runway 24L/R simple proceeds from the nearest ramp exit to the runway.

Terminal Airspace Scenario

The Los Angeles Air Route Traffic Control Center (ARTCC) controls IFR air traffic arriving and departing the Los Angeles area with the exception of tower enroute operations. The ARTCC operates in conjunction with Los Angeles Approach Control (TRACON) which is responsible for the terminal portion of the flight. Figure 3 depicts a portion of the low altitude sectorization of the Los Angeles ARTCC. Sectors 4, 13, 14, 18, 20, 21, and 22 overlie the terminal airspace and are the primary ARTCC sectors for completing the transition of arriving aircraft from the enroute to the terminal phase of their flight.

In general, the preferred routes from origins to the north of Los Angeles, such as San Francisco, Portland, Seattle, etc., terminate in a common enroute segment and approach fix or clearance limit. This is also true for traffic from the east, south, and west. Flights destined for satellite airports in the Los Angeles terminal area are handled by ARTCC in


VARIATION 15°E
24R
24L
25R
25L
6L
6R
7L
7R
PASSENGER TERMINAL
PASSENGER TERMINAL
CONTROL TOWER
AIRLINES AREA
AIRLINES AREA
AIR FREIGHT TERMINAL
GENERAL AVIATION
CIVIL MANUFACTURING AREA
ARRIVALS
DEPARTURES

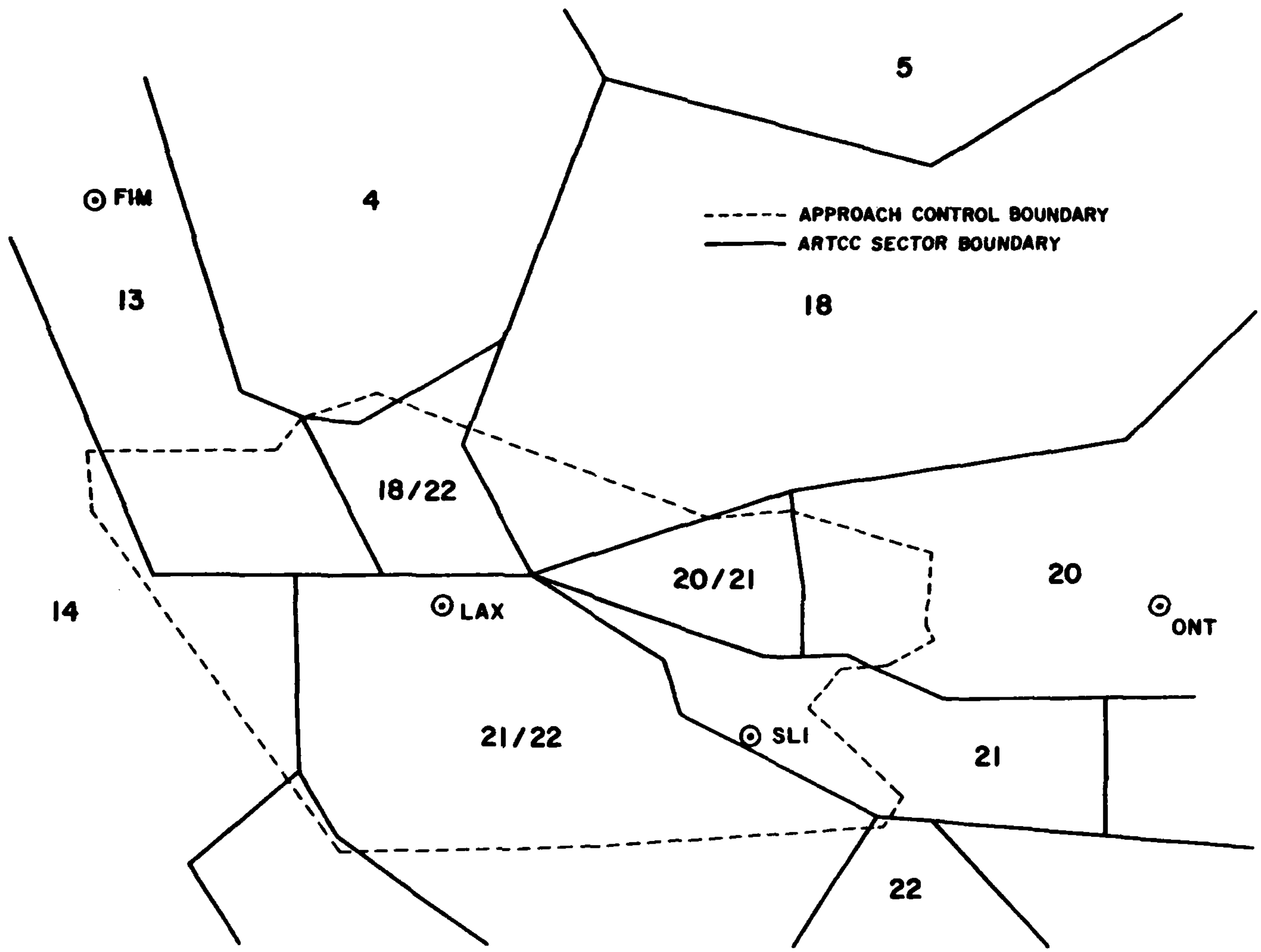


FIGURE 3 LOS ANGELES CENTER LOW ALTITUDE SECTORS

the same manner. The interfaces between the enroute transition controllers and the Los Angeles Approach Controllers are depicted in Figure 3. Each aircraft must be transitioned, in altitude, from the enroute phase (usually above FL180) to the terminal phase (7,000 to 8,000 feet), and sequenced with other aircraft before handoff to Approach Control. Arriving traffic is usually routed via one of three arrival fixes depending upon the inbound route of the aircraft. Arrival traffic is established in-trail over the handoff points at minimum intervals of 5 miles before being handed off to the Los Angeles Approach Controller.

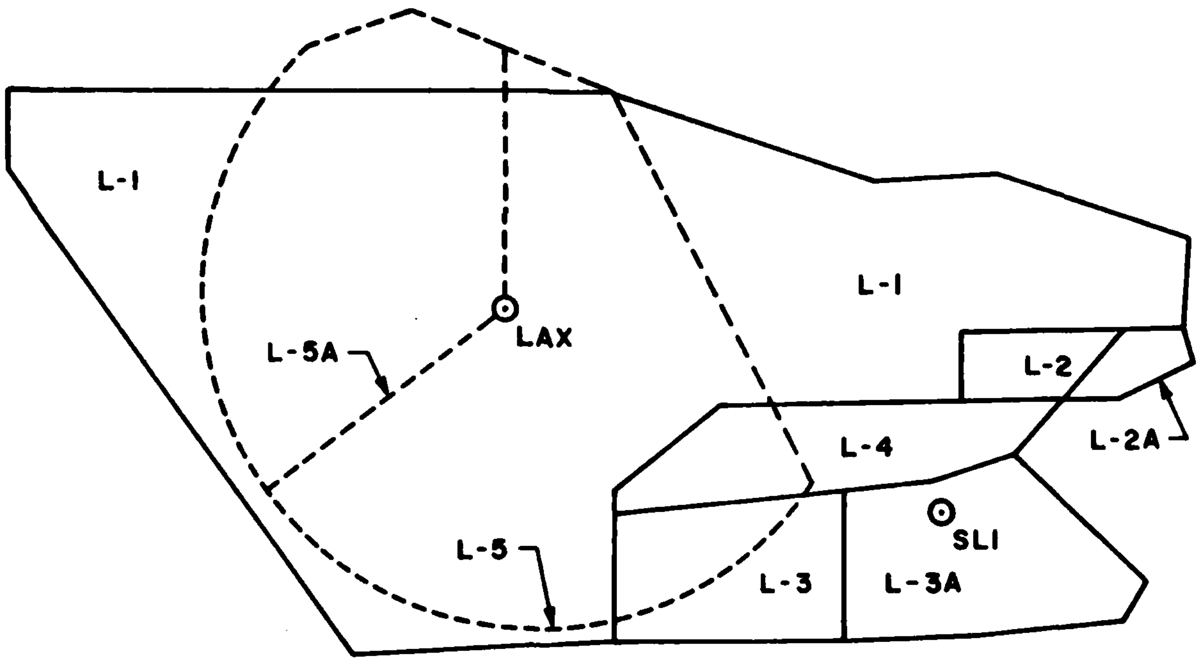
The Los Angeles terminal airspace in generally described as a rectangular area extending 25 miles east and west of the airport, 10 miles north, and 20 miles south (Figure 4). The area is a highly complex one in that it adjoins several other approach control areas and the altitudes of jurisdiction vary from one sector to another. In addition to Los Angeles International, Los Angeles Approach Control provides service to four other airports: Santa Monica, Hughes Culver City, Hawthorne, and Torrance.

The approach control area is divided into two sectors — Downey, for traffic from the east and south, and Stadium for traffic from the north and northwest. Arriving aircraft are vectored, from the handoff point to the final approaches, as depicted in Figure 5. The technique of speed control is the primary method used to effect proper separation; therefore, path-stretching vectors are rarely required. The two approach controllers sit at adjacent radar scopes and, through a flow controller, coordinate, when necessary, to merge their traffic on common final approaches. Each controller lands aircraft on both complexes, as dictated by the preferential runway system requirements. Arrival routes and handoff points are independent of the preferential runway system, e.g., some heavies arrive from the south and are handed off to the south complex (Downey) approach controller, although runway weight bearing restrictions may require they be landed on the north complex. Therefore, the primary role of the flow controller is determination of the proper landing runway for each arrival and coordination between the approach controllers to ensure a safe and orderly merging of arriving traffic. Arrivals are turned over to the control tower approximately 6 miles from the runway for landing clearance.

A considerable amount of air traffic is also controlled through the Tower Enroute structure (6,000 feet and below) between Los Angeles and Burbank, Coast, and Ontario. TRACONs.

Additionally, a TCA is in effect in the Los Angeles area (Figure 6).

LIMA - 1	7000 FEET MSL AND BELOW
LIMA - 2	4000 THRU 7000 FEET MSL
LIMA - 2A	5000 THRU 7000 FEET MSL
LIMA - 3	6000 THRU 7000 FEET MSL
LIMA - 3A	7000 FEET MSL ONLY
LIMA - 4	5000 THRU 7000 FEET MSL
LIMA - 5	9000 FEET MSL AND BELOW
LIMA - 5A	13000 FEET MSL AND BELOW



LOS ANGELES APPROACH CONTROL AIRSPACE

FIGURE 4

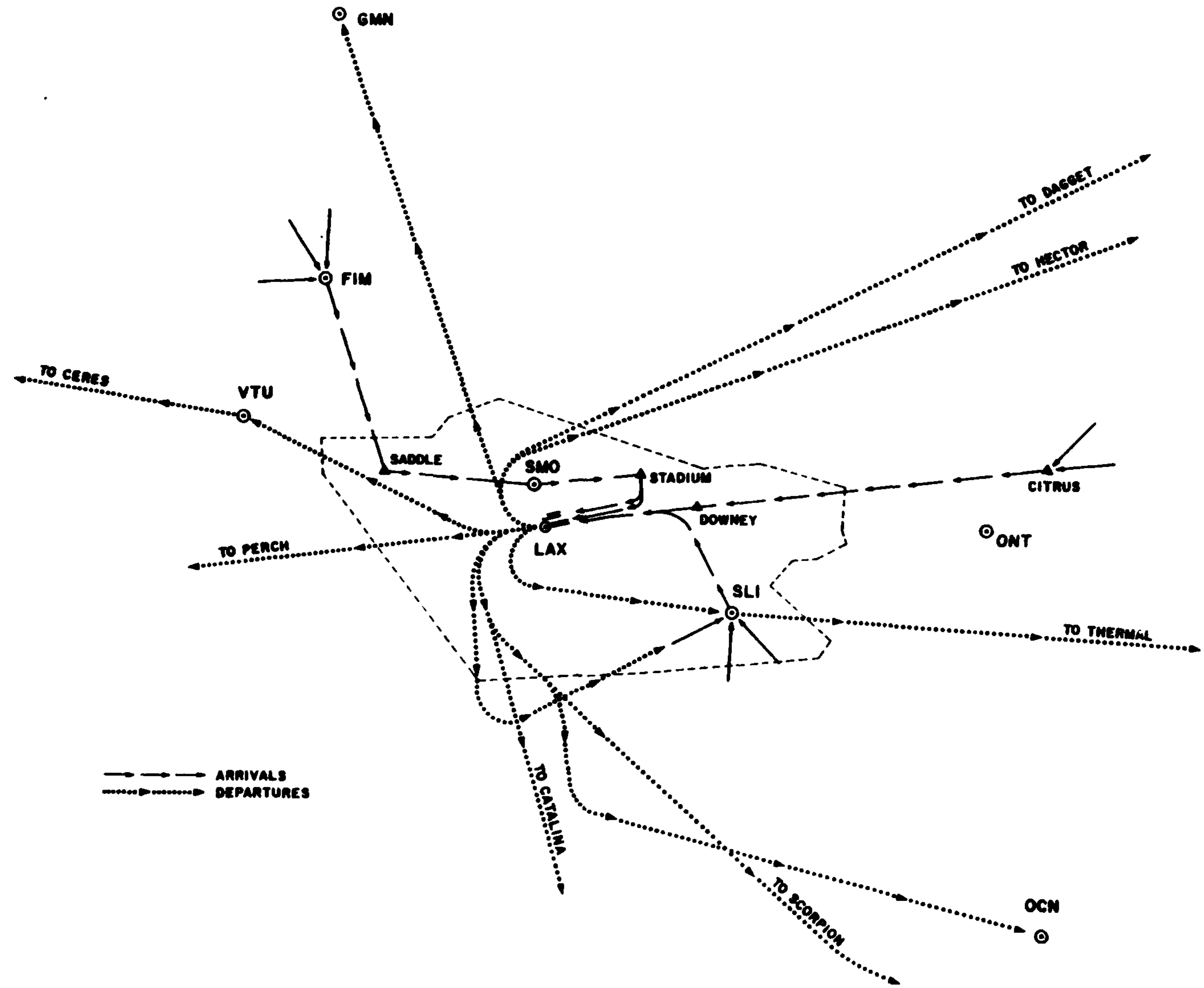


FIGURE 5 ARRIVAL/DEPARTURE VECTOR ROUTES

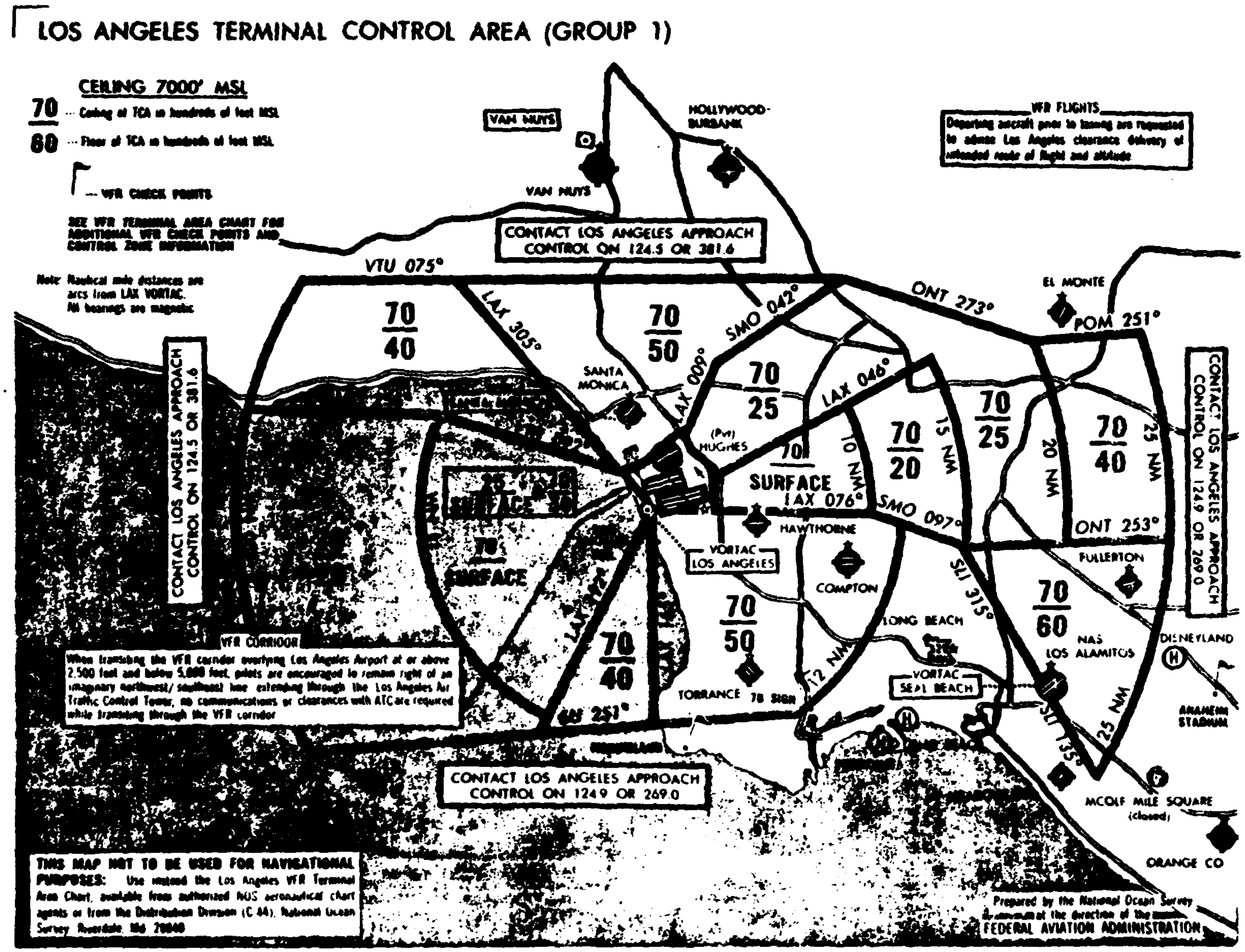

LOS ANGELES TERMINAL CONTROL AREA (GROUP 1)
CEILING 7000' MSL
VFR CHECK POINTS
CONTACT LOS ANGELES APPROACH CONTROL ON 124.5 OR 381.6
CONTACT LOS ANGELES APPROACH CONTROL ON 124.9 OR 269.0
VAN NUYS
HOLLYWOOD-BURBANK
VFR FLIGHTS
SANTA MONICA
HUGHES
HAWTHORNE
VORTAC LOS ANGELES
COMPTON
LONG BEACH
TORRANCE
VORTAC SEAL BEACH
EL MONTE
FULLERTON
NAS LOS ALAMITOS
DISNEYLAND
ANAHEIM STADIUM
MCOLF MILE SQUARE (closed)
ORANGE CO
VTU 075°
LAX 305°
LAX 009°
SMO 042°
LAX 046°
ONT 273°
POM 251°
ONT 253°
SMO 097°
SLI 315°
SLI 135°
LAX 076°
SURFACE
10 NM
12 NM
15 NM
20 NM
25 NM
VFR CORRIDOR
THIS MAP NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Prepared by the National Ocean Survey
FEDERAL AVIATION ADMINISTRATION

FIGURE 6

CHAPTER III

WHERE LAX IS FORECAST TO BE IN 1982

The purpose of this chapter is to provide a realistic 1982 forecast as applied to scheduled air carrier and commuter traffic. No attempt has been made to include supplemental carrier or general aviation movements.

The 1982 Los Angeles aircraft movement forecast represents an airline consensus based on interpolation of the latest macro-forecast.

It should be noted that this forecast does not reflect any impact that the current fuel/energy situation may have on scheduled airline operations or changes in travel habits by passengers. Therefore, it may be subject to revision at such time as adequate information concerning the effect of government regulations, fuel availability and other related factors becomes available.

TABLE III-1

Los Angeles International Airport
1982 Aircraft Movement Forecast

Annual Movements - 350,000

A/C TYPE CAPACITY	AVG DAY/ PK MONTH	AVG DAY PK MONTH/PK HOUR
B-747 (300 - 500 Seats)	70	7
DC-10/L-1011 (200 - 299 Seats)	266	20
B 727-200/DC-9-50/DC-8/707 (120 - 199 Seats)	416	30
B 727-100/DC 9-30/B-737/DC 9-10	290	17
Total Passenger Aircraft Movements	1042	74
Cargo (707/DC-8/747)	72	1
Total Scheduled	1114	75
Commuter	226	15
Total Movements	1340	90

CHAPTER IV

MAJOR ACCOMMODATION PROBLEMS AND NEEDS NOW THROUGH 1982

This chapter provides an insight into the existing capacity at Los Angeles of both the airside arrival and departure operations and groundside activity involving not only aircraft operations but also passenger vehicular traffic arriving and departing the air terminal area. For continuity the chapter is divided into two main sections.

Groundside Capacity

The purpose of this section is to define the current groundside capacity at LAX and to further define the essential elements needed to maintain an adequate level of service through 1982.

The Department of Airports' capital expenditures program anticipates no construction increasing capacity beyond the 40 million annual passenger limit recently adopted by the Los Angeles City Council. However, the planning of airside improvements providing an improved level of service need not be constrained by groundside capacity estimates.

Terminal/Gate Area

The following table is a summary of the existing terminal gate positions, areas and estimated annual passenger capacity of each terminal.

TABLE IV-1

Current Statistics

Terminal	Gross Area (SF)	Total Gates	Wide Body Gates	Capacity (Million Annual Passengers)
2 Remote		3	3	
2	260,247	10	7	2.5
3	159,039	13	7	5
4	175,283	10	5	5
5	216,302	13	4	6
6	233,388	17	11	6
7-8	297,431	16	7	6.5
	1,341,690	82	44	31

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Construction of Terminal I (estimated at 200,000 S.F. and 12 gates) by 1982 would add capacity of approximately 5.5 million annual passengers providing a total of 36.5 million annual passenger capacity to meet the 1982 forecast 35 million annual passenger demand. Beyond this level, there are a number of possibilities for increasing capacity an additional 7.5 million annual passengers, including (1) a major west terminal facility with 18 aircraft gates, (2) a bus terminal facility in the west terminal area with remote aircraft parking or (3) remote aircraft parking only in the west terminal area with major improvements made to the existing terminal buildings. As identified in other studies, the ultimate terminal/gate capacity could exceed the designated 40 million annual passenger capacity.

Automobile Parking

The 17,000+ automobile parking spaces in both the Central Terminal Area (CTA) and the peripheral lots can readily be increased to serve 35 million annual passengers, meeting the 1982 forecast. Currently there are four new parking structures planned for the CTA. In addition, up to 7,000 more automobile parking spaces will be added to the two peripheral lots.

Access

A. Internal Roadway Capacity

With the recent completion of the World Way Widening Project, the internal roadway system at LAX has a capacity of approximately 27 million annual passengers. Several options have been identified in previous studies which can raise this capacity to 30 million annual passengers. Additional capacity will require a grade-separated access system from peripheral lots. The planning program anticipated for the Intra-Airport Transportation System will define ultimate capacity, requirements and timing of this system.

B. External Roadway Capacity

The current external capacity of the roadways surrounding LAX is approximately 27 million annual passengers. A combination of the proposed north arterial roadway, expansion of automobile parking in East Westchester to 9,000 spaces and a highway interchange at Arbor Vitae and the San Diego Freeway will increase the external capacity to 33 million annual passengers. The construction of the Route 105 Freeway on the south side of the airport will increase this capacity to approximately 37 million annual passengers. To reach the ultimate capacity of 40 million annual passengers will require either a reduction in the present level of service on the ground or an increase in the number of passengers per vehicle coming into LAX. This latter concept could be achieved by either the gathering of people at remote terminals some distance from the airport with bus transportation to the Central Terminal Area or achieving a greater efficiency in the use of the existing freeways by means such as bus lanes, car pooling, etc.

Recommendations

Near-term groundside improvements required to meet forecast demand through 1982 include:

1. Construction of Terminal 1.

2. Additional auto parking.

3. Additional internal roadway improvements.

4. Completion of a planning study and implementation of the first phase of a grade-separated intra-airport transportation system.

5. Pursuance of the planning, funding, and construction of a northside arterial roadway with a new interchange at Arbor Vitae and the San Diego Freeway.

6. Pursuance of the completion of the Route 105 Freeway in the vicinity of the airport.

Airside Capacity

The purpose of this section is to define the current airside capacity, and to define the essential elements needed to maintain an adequate level of service through 1982.

Further, this section identifies the improvements attainable in the near-term period but does not attempt to develop cost-benefit justification for each individual improvement. The near term is considered to extend through 1982.

Background and Methodology

To establish the background for isolating the essential elements for the near-term improvements, a complete description and evaluation of the current traffic flow system was developed. The current system description is condensed in Chapter II of this report.

The current scenario information was used to provide a baseline for three critical ingredients. These three items are evaluated in the Baseline Demand, Baseline Capacity and Baseline Delay, and the data used for input into the computer analysis models.

Near-term improvements were initially identified for the Los Angeles International Airport by the team members most familiar with the airport. In addition to their individual expertise, these team members called upon the resources of their respective organizations. A preliminary set of improvements resulted which reflected current, anticipated and needed projects. After considerable evaluation, this list was narrowed to the eleven improvements perceived to be the most important. These improvements were then categorized according to the organization having responsibility for initiating the required actions. The deleted items were eliminated for reasons of impracticality or because they did not provide apparent substantial near-term improvement.

Runway Capacity Assessment

Summary

- Baseline - existing operating conditions.
- Modified Operations - increase in use of Runway 24L.
- Near-Term Improvements - strengthening Sepulveda Tunnel, extending Runway 24R, and constructing a high speed exit on Runway 25L.
- Future ATC Systems - an assessment of two FAA Engineering and Development (E&D) products, Basic Metering and Spacing and the Vortex Advisory System.

Baseline runway capacity is approximately 115 operations per hour in VFR conditions and 95 operations per hour in IFR conditions. Modifying the operation by increasing the use of Runway 24L can increase capacity to 145 and 125 operations per hour in VFR and IFR conditions, respectively.

The near-term improvements will yield approximately a 10% increase in capacity in VFR conditions and up to 10% increase in IFR conditions. The future ATC systems assessed for Los Angeles, Basic Metering and Spacing and Vortex Advisory Systems may yield capacity increases of 5% in VFR conditions and 15% during IFR conditions.

Introduction

Hourly runway capacity is defined as the maximum number of aircraft operations that can take place on the runways under specific operating conditions.

Capacity estimates for Los Angeles were obtained by operating the FAA capacity model with inputs established by the Los Angeles Task Force. Capacity estimates were developed for VFR and IFR weather conditions with a west flow operation (i.e., Runways 24L, 24R, 25L and 25R) in use.

Further details of the capacity analysis, including model inputs, are contained in Appendix A. The results of the analysis are given below.

Baseline

Runway capacities were computed assuming that current operational restrictions on the use of Runways 24L and 24R are in effect. (Inputs indicate that (1) in VFR conditions Runway 24L is utilized to about one-third of its capability, and Runway 24R is used for not more than 6% of total airfield operations, and (2) in IFR conditions, Runways 24L and 24R are utilized to about one-half of their capability.) With these current operational restrictions, VFR runway capacity is approximately 115 operations per hour, and IFR runway capacity is approximately 95 operations per hour.

Modified Operations

If the airfield operations are modified such that Runway 24L is fully utilized, then a significant capacity increase is obtained to 145 and 125 operations per hour in VFR and IFR conditions, respectively. (The restriction in VFR conditions on Runway 24R operations to 6% of total airfield operations is maintained in this case.)

Near-Term Improvements

Three near-term improvements were considered for possible implementation by 1982 that impact on airfield capacity:

- Strengthening Sepulveda Tunnel under Runways 25L and 25R to accept all aircraft.
- Extending Runway 24R to 10,285 feet.
- Constructing a high-speed exit on Runway 25L 4700 feet from threshold.

Runway capacity was calculated assuming that these improvements are in place, and that all aircraft types can use all runways. (The restriction in VFR conditions on Runway 24R operations in maintained.)

With the improvements, runway capacity increases by 9% in VFR conditions. In IFR conditions, a 10% capacity gain is obtained during departure peaks only.

Future ATC Systems

Runway capacity was estimated for two FAA air traffic control improvements that are planned for implementation by 1985. These capacity estimates are approximations based on preliminary data on the expected performance of each item performing as a system.

The Vortex Advisory System (VAS) will operate in the following manner: Vortex and meterological data will be continually input into the VAS dedicated mini-computer. Stored within the mini-computer will be the vortex behavior algorithm and aircraft spacing criteria. Spacing between various aircraft types will be specified as a function of the vortex behavior algorithm and the hazard associated with each aircraft type. A spacing matrix is generated and provided to the ARTS III computer where it will be used along with metering and sequencing criteria to establish minimum spacings in the terminal area compatible with safety and operational requirements. The predicted information should be provided to ARTS III with a lead of about 10-15 minutes to allow for proper metering and handoff procedures in the terminal areas. The spacing provided must also be sufficiently insensitive to minor meterological variations so that the spacing matrix is not continually changing since this would prevent orderly sequencing and metering operations.

The Basic Metering and Spacing (BM&S) is designed to decrease the delivery error of aircraft at the gate of the final approach in order to provide higher precision for the aircraft separations uniformly over time. BM&S will be based on the ARTS III A system and will be oriented toward controlling traffic for a single airport. The system will incorporate the ability of handling changes in runway configurations. The controller will be required to manually input the desired separation between arriving aircraft to obtain appropriate departure gaps, and make appropriate changes based on the traffic situations. The interface with VAS is also conducted manually through appropriate Red/Green VAS indication of vortex problems on the final approach path. BM&S is expected to decrease the inter-arrival error between aircraft from the current 18 seconds to 11 seconds. It is estimated that the Vortex Advisory System (VAS) combined with Basic Metering and Spacing (BM&S) will favorably impact today's separation standards as shown in Appendix A, Page 13.

To obtain a fair evaluation of these two combined improvements, capacity estimates were based on projections of future aircraft mix, which show an increase in the percent of heavy jets from 31% in 1976 to 50% in 1985 when these improvement systems are estimated to become implementable. This increase in heavy jets causes a 6% reduction in capacity in VFR conditions and 4% in IFR conditions. With Basic Metering and Spacing and the Vortex Advisory System in place at Los Angeles Airport, estimated capacity increases of approximately 5% and 15% in VFR and IFR conditions, respectively, may be possible.

Additional FAA engineering and development capacity oriented items will be assessed and their impact on LAX throughput runway capacity will be evaluated in the latter phases of this study.

Baseline Delay Evaluation

Available airline aircraft delay records indicate that, despite the undercapacity condition existing currently at LAX, many scheduled operations encounter airborne and ground delays, especially during peak hours. However, because of important differences in the manner in which aircraft delay is recorded by the air carriers, it is not possible at this time to accurately establish the level of baseline delay at LAX.

For example, one airline records delay as the excess over calculated flight plan and ground taxi times, without attempting to categorize the various causes of airborne and ground delay. Based upon this methodology the cost of aircraft delay due to the interaction of capacity and demand at LAX is estimated to have been $13.0 million in CY 1975 for scheduled air carrier operations.

A second airline also defines delay as the excess travel time over calculated flight plan and ground taxi times. However, this airline records aircraft delay on the basis of pilot interpretation of causative factors. As a result of the human input, this airline receives accurate information in most cases as to major delay problem areas. However, again as a result of the human input, aircraft delays based upon this reporting system are lower than actual because of the tendency to overlook delays that are of a daily repetitive, or routine nature. Based upon this methodology, the cost of aircraft delays due to the interaction of capacity and demand at LAX is estimated to have been $1.5 million in CY 1975 for scheduled air carrier operations.

Because of the need to develop a uniform airline delay reporting system, a more accurate determination of LAX baseline delay will be conducted in the follow-on phases of this study, with the assistance of computer simulation techniques.

Nevertheless, it is possible to state at this time that aircraft operating delays occur at LAX as a result of the interaction between current demand levels and the existing airfield layout and operating restrictions. The probable primary causes of delay are the following factors to varying degrees:

Airfield Operating Restrictions

1. Restricted use of Runway 24R for landings due to the informal noise abatement and preferential runway use program.

2. Aircraft weight restrictions on the South Runway Complex due to the Sepulveda Boulevard underpass.

Aircraft Demand Characteristics

3. Intra-hourly aircraft volume and arrival/departure ratio peaking.

The extent to which each of these probable primary factors contribute to baseline aircraft delay will be determined in the follow-on phases of the study.

Itemized Listing of Near Term Improvements

The eleven most important near-term improvements are listed below followed by the identification of the organization(s) having the initiating responsibility. The list is in no particular order. The organization codes are AL-Airlines; LAX-Los Angeles Department of Airports; and FAA-Federal Aviation Administration.

1. Upgrade to Category II or better the runway environment and electronic installations for all runways - LAX and FAA

2. Provide high speed taxiway off of Runway 25L to the south - FAA and LAX

3. Strengthen the Sepulveda tunnel - FAA and LAX

4. Simplify Standard Instrument Departure Procedures (SIDs) - FAA

5. High speed taxi exit off Runway 7? - LAX and FAA

6. Fog dispersal system for Runway 24R - LAX

7. High speed taxi exit to Taxiway 47 from Runway 6R - LAX and FAA

8. Bypass area on the north side of Runway 7L - FAA and LAX

9. Extend Runway 24R to 10,285 feet - FAA and LAX

10. Improvement of Taxiways - FAA and LAX

    a. Relocate Taxiway 47 to the west

    b. Extend Taxiways 47 and 49 to the south to connect with Taxiways J and K

    c. Extend Taxiways J and K to the west to connect with Taxiways 47 and 49

    d. Build Two Taxiways to connect Taxiway 45 with Taxiway 49 west of Satellites 3 and 4

    e. Reconstruction of Taxiway F

11. Build temporary holding areas on present Taxiway 47 west of Satellites 3 and 4 - LAX and FAA

Discussion

The following paragraphs outline the justification and probable funding of each prioritized improvement. The improvements are grouped according to the responsible initiating organization. Priorities have been indicated for the two most critical items.

Initially the desire was to present approximate costs and benefits for each recommended improvement so as to provide a measure of the economic gain anticipated from the project. The request was then made to the

Airports and Airway Facilities Division of the FAA to provide "ball park" estimates of the costs involved in the construction, operation and maintenance of the various capital improvements recommended. At the same time the Air Transport Association agreed to attempt an estimate of the benefits, in terms of delay cost savings, expected to be derived from the improvements.

As a result of the above request, "ball park" figures were provided as estimated costs for each prioritized improvement. These "ball park" costs are included in this report, but it must be kept in mind that they could change significantly depending upon the final operational requirements. Also, approximate dates when funds are expected to be available have been included.

As the benefits were being estimated it was found that even "ball park" figures were difficult to determine due to the number of variables which have not been quantified. It was, therefore, decided not to include benefit estimates in this report, but to wait for the completion of the delay model computations.

Priority Items

Priority 1 — Strengthen the Sepulveda tunnel and remove the widebody restrictions now in effect.

Initiating Responsibility — FAA and LAX

The major cause of departure delays at LAX is the inability to distribute the traffic efficiently on the two runway complexes. The removal of these restrictions would enable the tower to direct departing aircraft to the runway most compatible with their route of flight or originating terminal location. LAX departure delays are compounded by southbound aircraft departing the north complex and then crossing the path of those waiting to depart off Runway 25L/R.

In addition, remove the restrictions on all runway use and allow an uninhibited flow to occur, both for arrivals and departures.

When visual approaches are in progress, the approach controller normally sequences all inbound aircraft to the south complex unless they are widebodies and weigh more than 325,000 pounds. This effectively causes 83% of the traffic to land on the south complex. The resultant buildup on this side of the airport has obvious disadvantages. The local controller is extremely busy, normally with backed up departures and the ground controller has the great majority of his traffic concentrated between the four high speed turn-offs and adjacent terminals. Since there are twice as many unit terminals on the south side, congestion is inevitable. If inbound traffic was sequenced to the runway most compatible with the aircraft route and/or to the runway nearest the destination terminal, most of this difficulty could be avoided.

Additionally, Runway 24R is inhibited for departures due to noise abatement. This restriction is lifted when a closure of some other runway affects the traffic flow. This means that all departures off this complex must depart 24L, reducing the local controller's flexibility and causing significant delay. (Aircraft weighing less than 12,500 pounds may depart 24R.) During periods of serious delay, it is the supervisor's option to authorize departures off 24R.

Although LAX has four full service runways and adequate airspace, the same congestion occurs daily at certain portions of the airport. If we used our facilities according to the requirements of the traffic, the delays would be drastically minimized. A system that very often requires 83% of its traffic to use 50% of the runways and taxiways creates delays.

* New procedures would naturally be written to take full advantage of the removal of all restrictions on the runways.

The Los Angeles Department of Airports already includes the tunnel reconstruction and closely related work in their planning for 1978-1980.

The estimated cost of the Sepulveda upgrading project if $16,075,000. Removal of other current restrictions to full use of the LAX runways requires a change of policy.

Alternative to Priority #1 - Extend Runway 24R to 10,285 feet

Initiating Responsibility - FAA and LAX

Since widebody aircraft weighing more than 325,000 pounds may only use the north complex, any time that Runway 24L is closed, Runway 24R is their only remaining departure runway. This causes serious problems for those aircraft too heavy for the shorter runway, although this is normally confined to long haul westbound operations (Honolulu, Tokyo) or transcontinental flights. These aircraft have no alternative but to reduce takeoff weight through payload and/or fuel restrictions. If the Sepulveda tunnel is strengthened and the widebody restrictions are removed there would be three runways of adequate length for the long haul flights.

The Department of Airports presently includes this improvement in their planning for 1980-1982, however, extension of Runway 24R is not presently listed in the ATA Survey of Airports.

The estimated cost of the project is $2,068,000.

Additional Recommended Improvements

High Speed Taxiway Off of Runway 25L to the South

At present, there is no exit of this type. This would be a prerequisite for any expansion of facilities on the south ramp area. Presently, if traffic is a factor, any aircraft that does not make the Sepulveda turnoff is given a right turn off the runways and recrossed by the ground controller. Obviously, any increase in traffic would make this procedure impractical. This also is included in the Department of Airports' planning for 1978-1980 and the project is included in the strengthening of the Sepulveda tunnel.

Simplify Standard Instrument Departures (SIDs) Procedures

This adoption would significantly reduce the number of pages in the pilot's instrument approach book as well as result in a considerable monetary saving to the carriers by reducing the number of SID revisions they must pay for.

In view of the fact that for many years the departure environment at Los Angeles has been the "radar drive" concept, with the SIDs for all practical value being only a lost communications back-up, we feel the common SID should be adopted. Two major airports already have a common SID (DEN/ORD). SID/STAR procedures are currently undergoing review at the Washington level.

High Speed Exit Off Runway 7

With the advent of the over-ocean approach for sound abatement, plus the normal requirements of east traffic, this exit is necessary. Without adequate high speed turnoffs, the approach interval must necessarily be increased. This improvement is also included in the Department of Airports' plans.

High Speed Taxi Exit to Taxiway 47 from Runway 6R

At present, the turnoff is a 90° turn. Installation of a high speed exit will permit a quicker clearing of the runway by aircraft required to land on Runway 6R during an east traffic configuration. An improved smoother uninterrupted flow of aircraft off of the runway will increase capacity.

Improvement of Taxiways

This is necessary to permit simultaneous two-way taxi operations for north and southbound aircraft. This will also permit two-way taxiing for east/westbound aircraft.

Temporary Holding Areas

Temporary holding areas are needed for aircraft that do not have a gate assignment.

Current and Approved Projects - See AD-A099876

Electronic and Runway Environment Improvements

The following is a list of the F&E programs for Los Angeles International Airport that are current projects either in progress or approved for start at some future date:

A. Runway 24R

1. ALSF - Convert from ALSF-1 to ALSF-2 (to be compatible with CAT IIIA ILS)

2. ILS - Convert CAT II to CAT IIIA

B. Runway 24L

1. SSALR - Modify SALS - add RAIL lights ([illegible])*

2. Modify localizer antenna (COMPLETED)*

C. Runway 25L

1. ALS - Convert to CAT II

2. ILS - Convert to CAT II (complete). IM is complete but awaiting CAT II operational capability.

3. RVR - Add midfield.

D. Runway 25R

1. Replace obsolete glide slope

E. Runway 06L

1. ILS CAT I establish (COMPLETED)*

2. MALSR establish (COMPLETED)*

F. Runway 06R

1. MALSR - Provide frangible towers

2. Modify localizer antenna (COMPLETED)*

G. Runway 07L

1. MALSR - Provide frangible towers

* [illegible] MEMO DATED OCT 23, [illegible]

H. Runway 07R

1. ILS CAT I establish

2. MALSR establish (COMPLE[illegible])*

I. ASR

1. Various technical modifications to improve performance

J. ASDE

1. Add BRITE 4 (ADD NI CRITE)*

2. Add improvement modifications (COMPLETE)*

K. ARTS

1. Provide additional memory ([illegible] - UPGRADE TO [illegible])*

2. Various other technical improvements

L. SECRA

1. Modify or replace antenna (VARIOUS MODIFICATIONS TO IMPROVE PERFORMANCE)*

CHAPTER V

MAJOR ISSUES

Air Service

Various studies clearly indicate that air traffic demand for the Southern California basin area for passengers and air freight will continue to grow through the year 2000. While there are some variances in projections of passenger demand, nevertheless, the total volume of passengers in the most pessimistic study clearly exceeds the cumulative capacity of all of the airports in the region. This is especially true now that certain airports have held the volume of traffic they can handle politically constrained. There is also the possibility that a major airline facility could be closed unless it is purchased by some governmental agency. Such activity places additional traffic loads into LAX at a time period earlier than would normally be expected and advances the time when the airport reaches its saturation point.

The efficiency level at which LAX handles its ultimate traffic will depend upon the extent of improvements in the airside, terminal/street side facilities of the airport as well as the improvements in the access facilities outside of the airport boundaries.

Environment

Environmental issues at LAX have separated themselves into two major categories. The first is concerned with studies of environmental impact of flight activity as well as new construction and land acquisition to support the air transportation industry. Various alternatives in these areas must also be a part of these studies.

The second environmental issue involves legal activity primarily for noise in areas adjacent to the airport. Lawsuits are under way associated with inverse condemnation, loss of property value as well as for harm to people for nuisance damage.

While the cost of the many environmental studies is very high, the major problem with these studies is the serious delays they create. The LAX Airport Master Plan environmental impact assessment has been under way for over three years. At this point, there is still no resolution in sight. While the public hearings have recently been completed, the study needs to be revised to accommodate new input that resulted from the hearings. After the revision, it will be reviewed by over fifty governmental agencies at various levels. In view of this, the final EIS will probably not receive final approval for a year to eighteen months. In the meantime, construction cannot proceed.

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Financing

It is obvious that there are many demands upon the available financial resources of the Department of Airports. Demands exist for new facilities construction, land acquisition and various legal and environmental requirements. The Airport Development Aid Program funds seem to be limited to approximately $10 million per year with the balance of available monies coming from airport revenue and the issuance of revenue bonds. The amount of revenue bonds that may be issued is subject to airline approvals required by the landing fee agreements with the scheduled air carriers. The Department has no taxing power and must operate totally within its own revenues.

In view of the great variety of demand, difficult management decisions must be made regarding the extent and the time of new facilities construction. These decisions must be based upon a master plan for improvements from a plan that is flexible enough to easily adapt to unexpected changes caused by financial demands in other areas. The legal demand for payments resulting from lawsuits with the resulting demand against revenue bonding capacity of the airport is actually unknown. This obviously could divert money from needed capital improvements, needed to improve the operational efficiency of the airport.

Aesthetics

It is recognized that the airport serves as a point of interest for citizens and visitors in much the same manner as a park. It is important that these visitors not compete with travelers to further aggravate the groundside access problem. It is recommended, therefore, that certain areas be devoted to this purpose at peripheral sites which can be reached without significant interference with genuine airport access and provide a safe view of airport operations. Areas such as the hill on Imperial Boulevard south of the airport, and the sand dune hills in the "island area" west of the airport should be dedicated to this purpose. These areas are being used for this purpose now, but they need to be improved for reasons of safety, efficiency, and aesthetic considerations. It will provide the real owners with an opportunity to appreciate their airport, and should be a genuine airport improvement item.

CHAPTER VI

SUMMARY

We consciously limited our considerations to the near term for this interim report. We anticipate full consideration of the needed and probable improvements beyond 1982 as we complete the LAX improvement study. We anticipate the availability and use of the FAA delay model in our further analysis.

The eleven critical near term improvements which we identified in the report are all related to the airside of the airport. The two priority projects are the strengthening of the Sepulveda tunnel and lengthening of Runway 24R. The Sepulveda tunnel strengthening would make operational changes physically possible.

It is probable that our final report will show airport access and intra-airport groundside circulation to be the critical constraints for LAX. The current external roadway capacity of 27 million can be increased to over 30 million by expanding the East Westchester parking lot and constructing the Arbor Vitae exit from the 405 Freeway and constructing the connecting north side arterial. The parking lot and part of the north side arterial is on airport property thus giving more control over those projects. However, the 405 exit to Arbor Vitae must meet the test of full public exposure and environmental analysis. Similarly, the schedule for the I-105 Freeway may be optimistic considering its history. The best planning and analysis available will be given to the complementing nature of these projects and LAX improvements as we complete this study.

The interim report did not address programs involving new and evolving technology. The latter phases of the study will consider wake vortex avoidance or alleviation, microwave landing systems, metering and spacing, and airport surface traffic control. We anticipate the study resulting in a quantitative analysis of each potential improvement specifically applied to LAX. In addition, the additive effects of compatible improvements will be determined to the extent possible.

APPENDIX A

LOS ANGELES INTERNATIONAL AIRPORT

RUNWAY CAPACITY ANALYSIS

Baseline Demand

TABLE 1

LAX Aircraft Operations
July 1976 through June 1977

	ITINERANT					LOCAL	TOTAL
	AC	AT	GA	MI	SUB TOTAL	LOCAL	TOT OPNS
(1976) JUL	32,961	5,532	4,114	318	42,925	580	43,505
AUG	33,140	5,790	4,343	331	43,604	600	44,204
SEP	29,864	5,561	4,211	301	39,937	630	40,567
OCT	29,646	5,611	4,565	360	40,182	554	40,736
NOV	27,409	5,289	4,473	327	37,498	612	38,110
DEC	29,832	5,567	4,407	256	40,062	464	40,526
(1977) JAN	29,649	5,384	4,820	303	40,156	564	40,720
FEB	26,374	4,782	4,560	315	36,031	619	36,650
MAR	29,512	5,916	5,210	331	40,969	718	41,687
APR	28,971	5,721	4,802	323	39,817	622	40,439
MAY	30,016	5,965	4,678	288	40,947	654	41,601
JUN	30,723	5,921	5,044	307	41,995	606	42,601
TOTALS	358,097	67,039	55,227	3,760	484,123	7,223	491,346

TABLE 2

Observations

Average Day, June 1976

Itinerant					Local			
AC	AT	GA	MI	TOTAL	GA	MI	TOTAL	TOTAL OPNS
1009	189	146	11	1355	23	0	23	1378

Peak Day, June 1976 (June 18, 1976 - Friday)

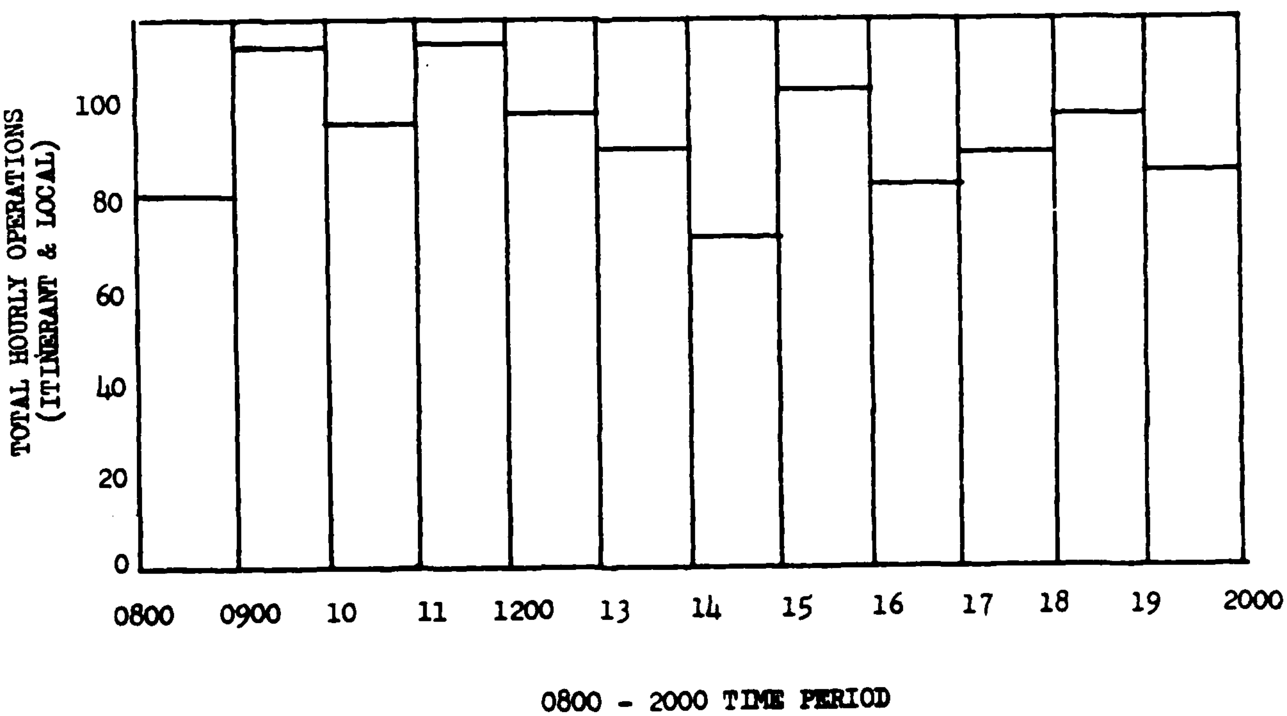
AC	AT	GA	MI	TOTAL	GA	MI	TOTAL	TOTAL OPNS
1071	226	210	11	1518	28	0	28	1546

Peak Hour, June 1976 (1100-1200, Friday, June 18, 1976)

AC	AT	GA	MI	TOTAL	GA	MI	TOTAL	TOTAL OPNS
82	13	11	3	109	4	0	4	113

FIGURE 1

Distribution of Hourly Operations @ LAX (June 18, 1976)



Baseline Capacity Input

Weather

VFR - Ceiling at least 2,500 feet
- Visibility at least 3 miles

IFR - RVR at least 2,400 feet

Runway Use

VFR - Mixed Operations all runways

IFR - Arrivals 25L, 24R
- Departures 25R, 24L

Runway Restriction

24R - VFR not more than 6% of airfield operations
- IFR no restriction

Airfield Mix

%A	%B	%C	%D
9	3	57	31

Approximate Runway Specific Aircraft Mix

		%A	%B	%C	%D
VFR	25L	7	3	50	40
	25R	6	2	82	10
	24L	15	5	20	60
	24R	15	5	20	60
IFR	24L/25R	6	2	72	20
	24L/24R	15	5	20	60

Percent Arrivals - 40%, 45%, 50%, 55%, 60%

Percent Touch-and-Go - 0

Airspace Restriction - 10% departure capacity loss due to crossover departure paths
- No arrival airspace constraints

Common Approach Path Length
(Nautical Miles)

	A	B	C	D
VFR	3	6.5	6.5	6.5
IFR	6.5	6.5	6.5	6.5

Approach Speed
(Ground Speed, Knots)

A	B	C	D
120	120	130	140

Effective Arrival Runway Occupancy Time (Seconds)

VFR	Runway	Aircraft Class A	B	C	D
	25L	43	47	47	52
	25R	44	45	45	52
	24L	44	47	47	50
	24R	42	50	50	56

IFR - 10 seconds more than VFR values above

Standard Deviation 6 seconds

Effective Departure Runway Occupancy Time (Seconds)

A	B	C	D
20	34	39	39

Standard Deviation 8 seconds

Note:

Aircraft Classification as follows:

Class		Description
A	Small	($<$ 12,500 LBS GTW plus learjets)
B	Large	(12,500 to 90,000 LBS GTW)
C	Large	(90,000 to 300,000 LBS GTW, -737, DC-9 and Larger)
D	Heavy	($>$ 300,000 LBS GTW)

Arrival-Arrival Separation (nautical miles)

Mean of achieved minimum separation on approach path.

VFR		Trail Aircraft Class A	B	C	D
	A	2.2	2.2	2.3	2.5
Lead	B	4.0	2.8	3.1	3.1
Aircraft	C	3.7	2.3	3.1	3.1
Class	D	5.1	3.7	4.6	4.1

IFR		Trail Aircraft Class A	B	C	D
	A	3.0	3.0	3.3	3.5
Lead	B	4.5	3.0	3.3	3.3
Aircraft	C	4.5	3.0	3.3	3.3
Class	D	6.5	5.5	5.5	4.5

Standard Deviation = 18 seconds (VFR), 15 seconds (IFR)

Departure-Departure Separation (seconds)

Mean of achieved minimum separation at threshold.

VFR		Trail Aircraft Class A	B	C	D
	A	40	45	45	50
Lead	B	45	55	55	60
Aircraft	C	45	55	55	60
Class	D	120	120	120	90

IFR		Trail Aircraft Class A	B	C	D
	A	60	60	60	60
Lead	B	60	60	60	60
Aircraft	C	60	60	60	60
Class	D	120	120	120	90

IFR Departure arrival Separation

2 nautical miles.

Baseline Capacity Evaluation

Runway specific aircraft mixes were obtained from field data collected during periods that were not necessarily saturated, i.e., demand may have been less than capacity.

During computation of baseline capacity, it became evident that with the given runway specific mixes and airfield mix, operations levels on Runways 24L and 24R could not be at capacity. Specifically, the following % saturation resulted from the calculations:

Weather	Runway	% Saturation
VFR	25L, 25R	100%
	24L	33%
	24R	(6% of airfield operations)
IFR	25L, 25R	100%
	24L, 24R	47%

These results imply that manipulation of runway specific mix (as may result from change of controller operating strategy with increasing demand) could increase operations levels on Runways 24L and 24R, hence increasing airfield capacity.

Therefore two sets of baseline capacities were computed:

- o With observed runway specific mix
- o With modified runway specific mix

The modified runway specific mixes used were as follows:

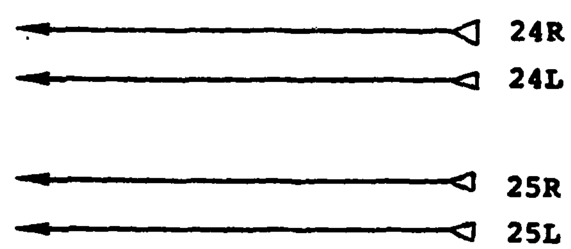
		%A	%B	%C	%D
VFR	25L	6	3	61	30
	25R	6	2	82	10
	24L	14	4	32	50
	24R	14	4	32	50
IFR	25L/25R	5	2	75	18
	24L/24R	13	4	36	47

Note that, when compared with observed runway specific mixes, these modified runway specific mixes reduce the percent heavy aircraft operations (Class D) and increase the percent large aircraft operations (Class C) to achieve higher capacities.

FIGURE 2

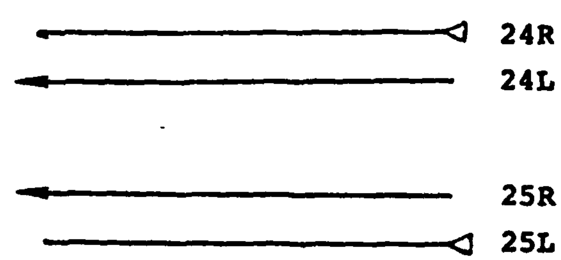
BASELINE CAPACITY
OBSERVED RUNWAY SPECIFIC MIX
Los Angeles International Airport

VFR



Percent Arrivals	40%	45%	50%	55%	60%
Baseline Capacity	111	112	114	115	116

IFR



Percent Arrivals	40%	45%	50%	55%	60%
Baseline Capacity	92	98	94	86	79

FIGURE 3

VARIATION OF BASELINE CAPACITY WITH PERCENT ARRIVALS

OBSERVED RUNWAY SPECIFIC MIX

LOS ANGELES INTERNATIONAL AIRPORT

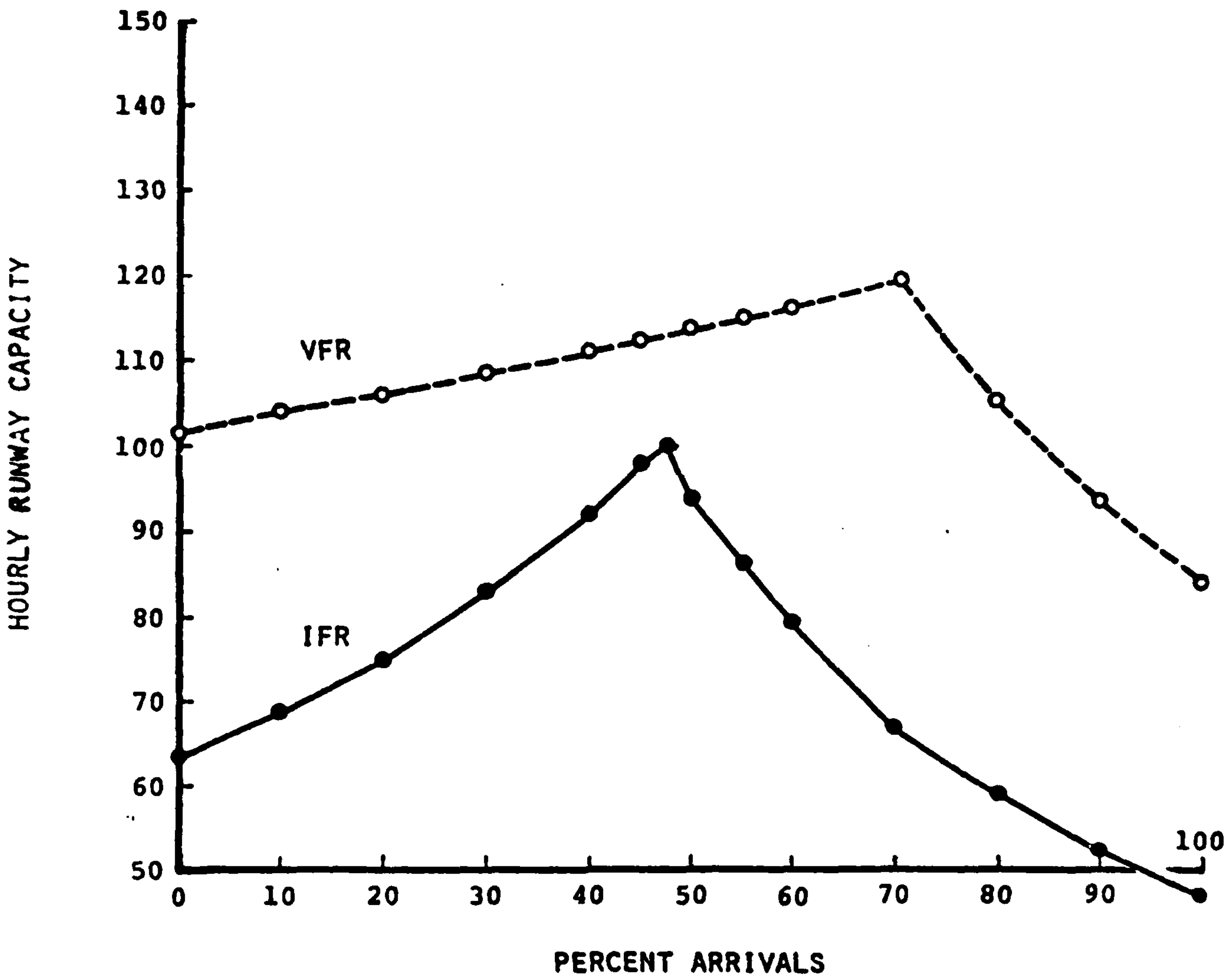
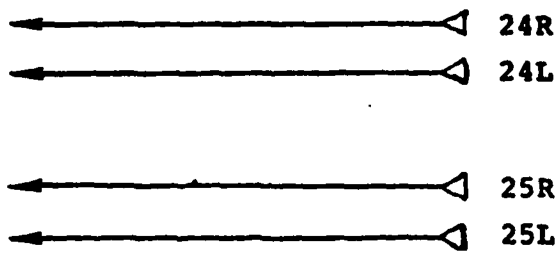


FIGURE 4

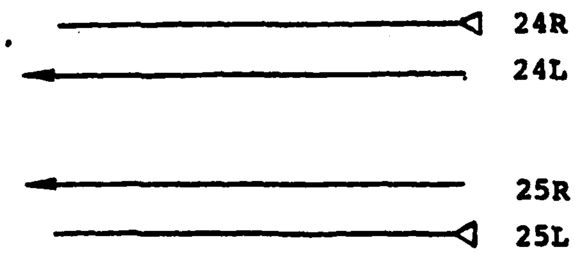
BASELINE CAPACITY
MODIFIED RUNWAY SPECIFIC MIX
Los Angeles International Airport

VFR



Percent Arrivals	40%	45%	50%	55%	60%
Baseline Capacity	145	146	147	148	149

IFR



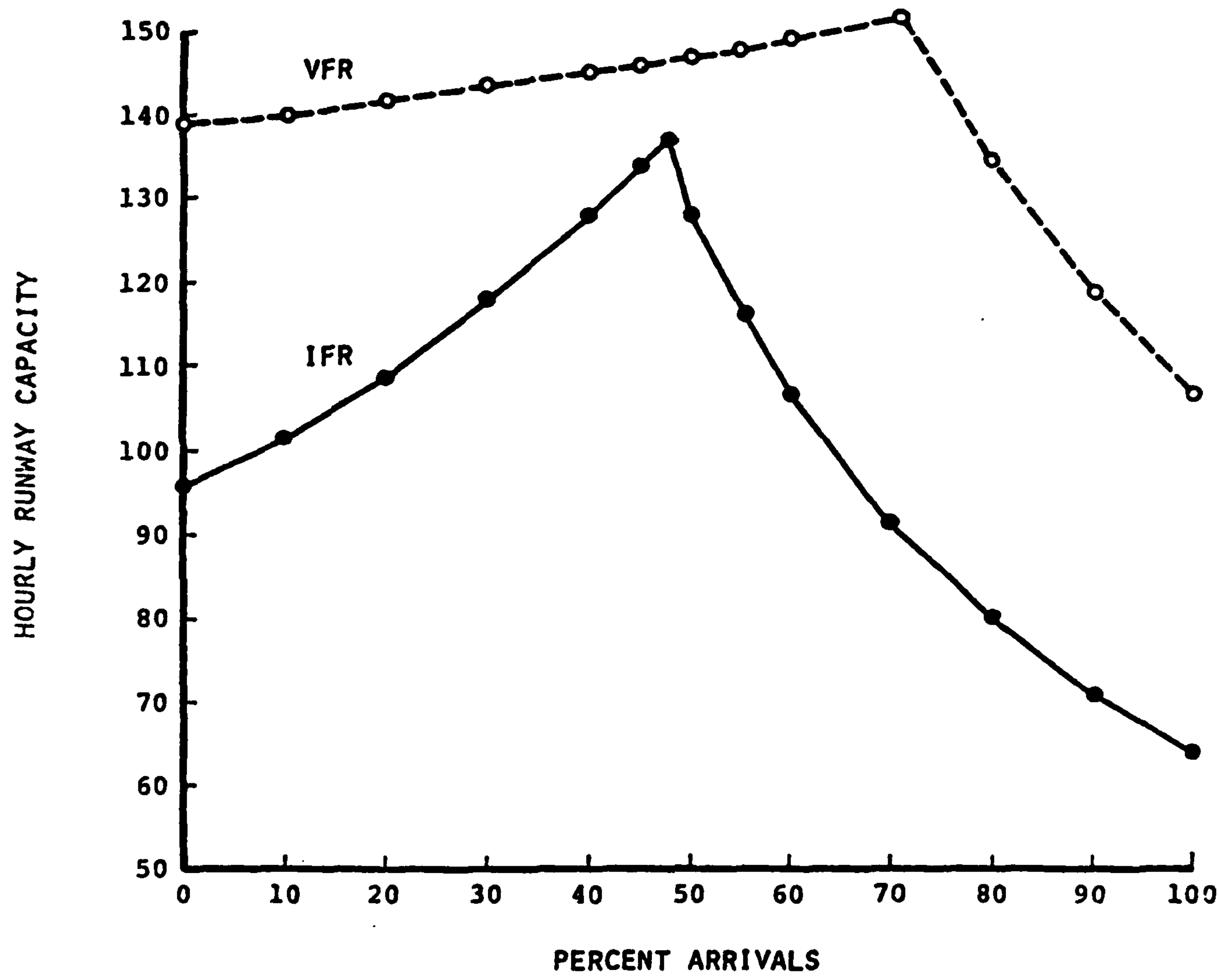
Percent Arrivals	40%	45%	50%	55%	60%
Baseline Capacity	128	134	128	116	107

FIGURE 5

VARIATION OF BASELINE CAPACITY WITH PERCENT ARRIVALS

MODIFIED RUNWAY SPECIFIC MIX

LOS ANGELES INTERNATIONAL AIRPORT



NEAR TERM IMPROVEMENTS

Near Term Improvement Input

The following Near-Term Improvement items that have an impact on Los Angeles capacity are shown with projected model input changes. These items were analyzed using the FAA capacity model to determine their effects on runway capacities.

Improvement Item No. 1 - Strengthening of the Tunnels on Runway 25

Effect on model input: Overcomes runway restricted use, i.e., all runways have the same mix as the airfield mix.

	Aircraft Class			
	%A	%B	%C	%D
Aircraft mix	9	3	57	31

Improvement Item No. 2 - Extend Runway 24R to 10,285 Feet

Effect on model input: Allows allocation of departures by departure route, thereby relieving the existing 10% departure capacity loss due to crossovers.

Improvement Item No. 3 - Construct a High Speed Exit on 25L at 4,700 Feet from Threshold

Effect on model input: Reduces effective arrival runway occupancy times on 25L.

	VFR				IFR			
Aircraft Class	A	B	C	D	A	B	C	D
Effective Arrival Runway Occupancy Time	43	43	43	49	53	53	53	59

Los Angeles International Airport

NEAR-TERM IMPROVEMENT RESULTS

Hourly Runway Capacity (operations per hour)

			Percent Arrivals				
			40%	45%	50%	55%	60%
I.	VFR	Baseline	145	146	147	148	149
		Near-Term	154	155	156	157	159
		Capacity Gain	9	9	9	9	10
		% Gain	6.2	6.2	6.1	6.1	6.7
II,	IFR	Baseline	128	134	128	116	107
		Near-Term	138	141	128	116	107
		Capacity Gain	10	7	0	0	0
		% Gain	7.8	5.2	0	0	0

SEPARATION STANDARDS

VFR

APPROACH SEPARATION STANDARDS
(Nautical Miles)

1976

Lead \ Trail	S	L	H
S	1.9	1.9	1.9
L	2.7	1.9	1.9
H	4.5	3.6	2.7

1985
(VAS AND BM&S)

Lead \ Trail	S	L	H
S	1.9	1.9	1.9
L	2.7	1.9	1.9
H	4.5	3.6	2.7

IFR

APPROACH SEPARATION STANDARDS
(Nautical Miles)

1976

Lead \ Trail	S	L	H
S	3	3	3
L	4	3	3
H	6	5	4

1985

Lead \ Trail	S	L	H
S	3	3	3
L	3.5	3	3
H	5	4	3

DEPARTURE SEPARATION STANDARDS
(Seconds)

1976

S	60
L	90
H	120

1985

S	60
L	60
H	90

S - Small: 12,500 pounds or less certificated gross takeoff weight and Learjets
L - Large: Between 12,500 pounds and 300,000 pounds certificated gross takeoff weight (except Learjets)
H - Heavy: 300,000 pounds or more certificated gross takeoff weight

DATE
ILMED

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