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A NASPAC-Based Analysis of the Delay and Cost Effects of the Western-Pacific Region Preliminary Resectorization Effort of 1993

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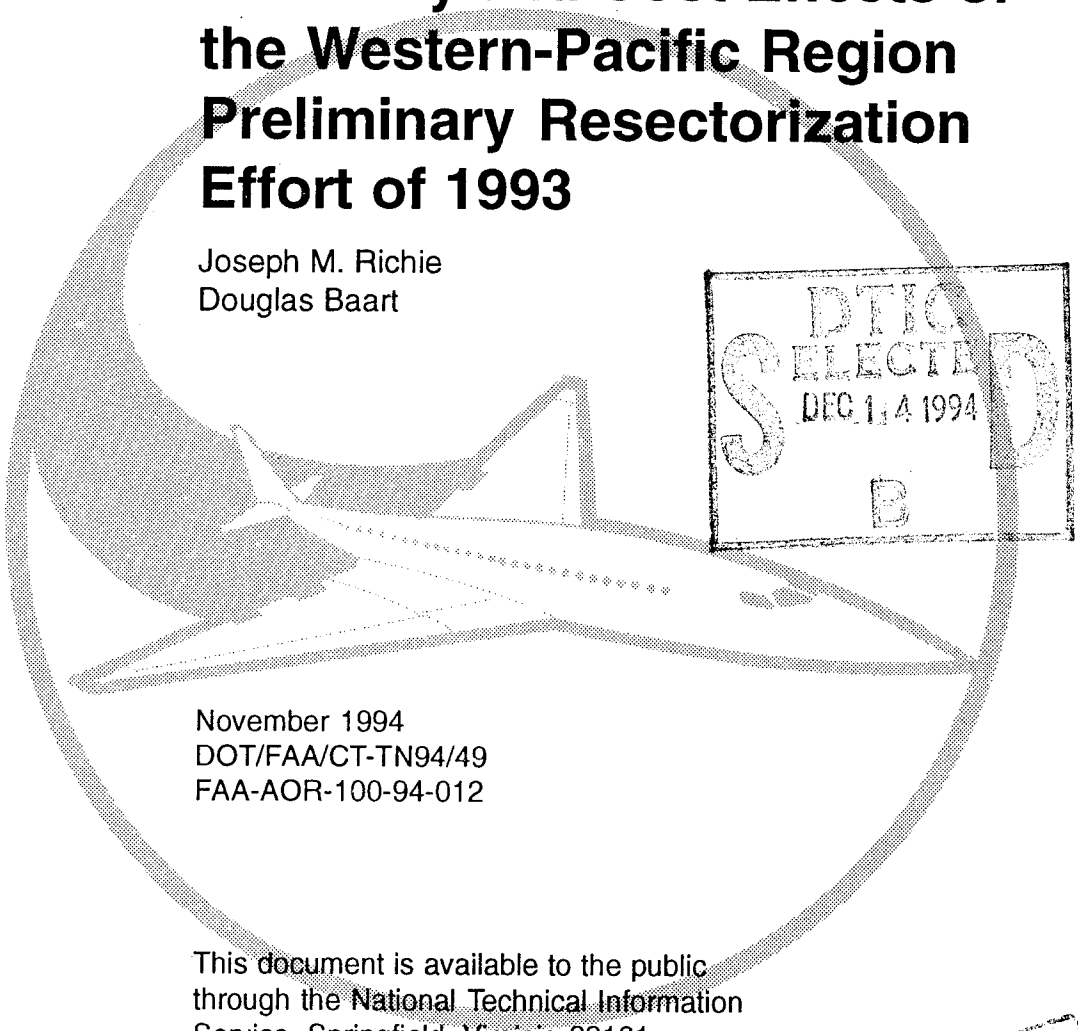

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16. Abstract

This report contains the findings and analysis of the effects of the Western-Pacific Region (AWP) Preliminary Resectorization Plan of 1993 on local (AWP airports) and system-wide traffic delays. The National Airspace System Performance Analysis Capability (NASPAC) was used to perform this task, and calculates the local and system-wide delays with and without the AWP Resectorization Plan. Cost of delay was derived using the Cost of Delay Module based on these delays, on passenger cost, and on airline and aircraft specific cost.

The results indicate that the proposed resectorization will reduce the operational delay in years 1995 and 2000 at most AWP airports and system-wide with the maximum benefit occuring in the year 2000. On the other hand, resectorization does not favor the passengers for the future years modeled. However, in year 2000, the increase in passenger delay is less than for year 1995.

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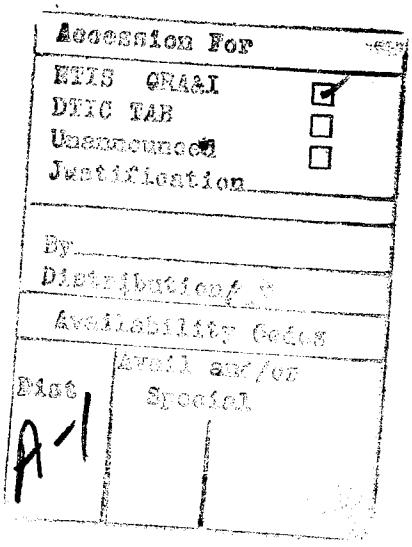

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EXECUTIVE SUMMARY

INTRODUCTION

The objective of this study is to measure the performance of the Western-Pacific Region's (AWP) preliminary Resectorization Plan of 1993. The analysis determines the differences in the operational benefits for the years 1995 and 2000, system-wide and at AWP airports.

This analysis provides a delay and cost estimate of the proposed AWP Resectorization Plan system-wide and at local airports. This was done by simulating operations at ZLA and ZOA with current and future capacity estimates, new sector designs for the high and low altitudes, new arrival and departure fixes, reversing traffic between Los Angeles Basin and the San Francisco Bay Area, and the proposed routes to and from the east and northeast of Los Angeles airports.

METHODOLOGY

The National Airspace System Performance Analysis Capability (NASPAC) was used to simulate the effects of the AWP preliminary Resectorization Plan of 1993. Annualization techniques were used to produce annual results. The AWP airport capacity estimates were provided by Los Angeles ARTCC (ZLA)-530, and Oakland ARTCC (ZOA)-530 for the purpose of this study.

The NASPAC Simulation Modeling System (SMS) was used to simulate future airspace operations. For the annualization results, 6 days in the year 1990 were selected based on the overall weather conditions in effect in the National Airspace System (NAS) for those days. Air traffic demand profiles generated at each of the 58 modeled airports were derived from the 1991 Terminal Area Forecasts (TAF) up to the year 2005.

The principal output from the model is throughput and delay for each of the 58 airports modeled, including fixes, sectors, and restrictions. The model also provides system-wide totals and averages of the throughput and delay, and converts the delay into cost using the Cost of Delay Module.

The model produces two types of delay, one is the operational (technical) delay which affects the industry, and the other is the passenger arrival (effective) delay which affects the passengers. Operational delay occurs when an aircraft has to wait to use an Air Traffic Control (ATC) resource such as a runway or a fix. Passenger arrival delay, on the other hand, measures the difference between the actual time an aircraft arrives at the gate in the simulation and its scheduled arrival time. This delay shows the lateness of an aircraft, and is carried from one leg to another.

RESULTS

With the AWP preliminary Resectorization Plan of 1993 implemented, the results of the simulation have shown that the operational delay at most of the AWP airports would be reduced for the time frame modeled.

In 2000, LAX clearly shows the most benefit with a total of 17,829 hours reduction in operational delay or 26.4 percent, followed by SFO with 2,631 hours or 5.1 percent, ONT with 154 hours or 4 percent, and SJC with 491 hours or 2.3 percent. The Plan clearly does not benefit OAK in 1995 or 2000.

The Plan also provides system-wide benefits in the operational delay.

In 2000, the system-wide benefit breakdowns are 1.4 percent in airborne delay, and 2 percent in ground delay. The total operational delay reduction will be 1.7 percent, compared to .8 percent reduction in 1995.

The simulation results show an increase in the passenger arrival delay at all of the AWP airports for both 1995 and 2000, except at LAS in 2000, where it shows a slight reduction. See appendix A for airport ID's.

The airports that have the highest traffic volume show the largest passenger arrival delay increase, such as LAX, SFO, and SNA. The preliminary Resectorization Plan of 1993 will benefit LGB more in 2000, which is a pattern also observed in the operational delay for the same time frame modeled.

The system-wide passenger arrival delay, as well as the cost, increases accordingly.

The passenger arrival delay cost will increase by $634,000,000 or 16 percent in 1995 with the Plan. In 2000, the cost estimates show an increase of $505,000,000 or 8 percent. These values represent the differences between the baseline and the resectorization cases for the years modeled.

CONCLUSIONS

The AWP Resectorization Plan, with the current design modeled in this study, will benefit only the industry.

As far as the operational delay is concerned, the results show that the Plan will provide benefits to most of the AWP airports for the time frame modeled, with maximum benefits occurring in 2000. The Plan does not favor the passengers, but in the year 2000, passenger delay decreases by 49 percent at LAX and 20 percent at SAN compared to 1995.

1. INTRODUCTION.

The Federal Aviation Administration's (FAA) Western-Pacific Region (AWP) recently completed a study by the Resectorization Committee, ZLA-3A5 [1] on internal resectorization. The main goal of this study was to improve airspace efficiency. Initial indications suggest that internal resectorization will improve the local airspace traffic flow, increase system capacity, and enhance National Airspace System (NAS) performance. The title of the study is the AWP Preliminary Resectorization Plan of 1993, to differentiate it from any future studies. It will be referred to in the rest of this report as the AWP Resectorization Plan.

The AWP Resectorization Plan's success depends on the modification of existing major traffic routes. The basic Plan calls for an agreement with the adjacent facilities to redesign the high and low altitudes. Additional sectors will be created by dividing existing sectors.

These enhancements are designed to alleviate the existing congestion problems caused by inadequate airspace capacity, unbalanced sector load, terminal airspace constraints, military special operating areas, inefficient handling of high performance turboprop aircraft, traffic management, and the limited track capacity of the LAX and SFO Automated Radar Terminal Systems (ARTS) IIIA. Please see appendix A for a list of AWP airports and their IDs.

The difficulties encountered in designing routes into and out of Los Angeles Air Route Traffic Control Center (ARTCC) (ZLA) are due to the limitation of the airspace caused by mountainous terrain and extensive military special use airspace. Due to these limitations, several bottle necks have developed. For example, the traffic between SAN/LAX and OAK Bay Area Airports has to climb and descend head-on with traffic over Avenal (AVE) Very High Frequency Omni-directional Radio Range with tactical air navigational aid (VORTAC). The LAX northeast-bound departures climbing over Daggett (DAG) have to be squeezed between R2508 Complex and opposite direction traffic descending (arrivals) to LAX over Hector (HEC). All LAX/ONT arrivals from the east are descended and sequenced over Twentynine Palms (TNP)/Palm Springs (PSP) head-on to northeast-bound climbing LAX/SAN departures, and eastbound SAN departures climbing head-on with SAN arrivals from the Southeast between active restricted areas along J2.

The Resectorization Committee developed three northbound and three southbound one-way destination-specific routes along the Bay Area/LAX corridor. Figure 1 shows ZLA-proposed jet route arrivals, and Figure 2 shows ZLA-proposed jet route departures. The arrival traffic over HEC was moved into the TNP/PSP arrival

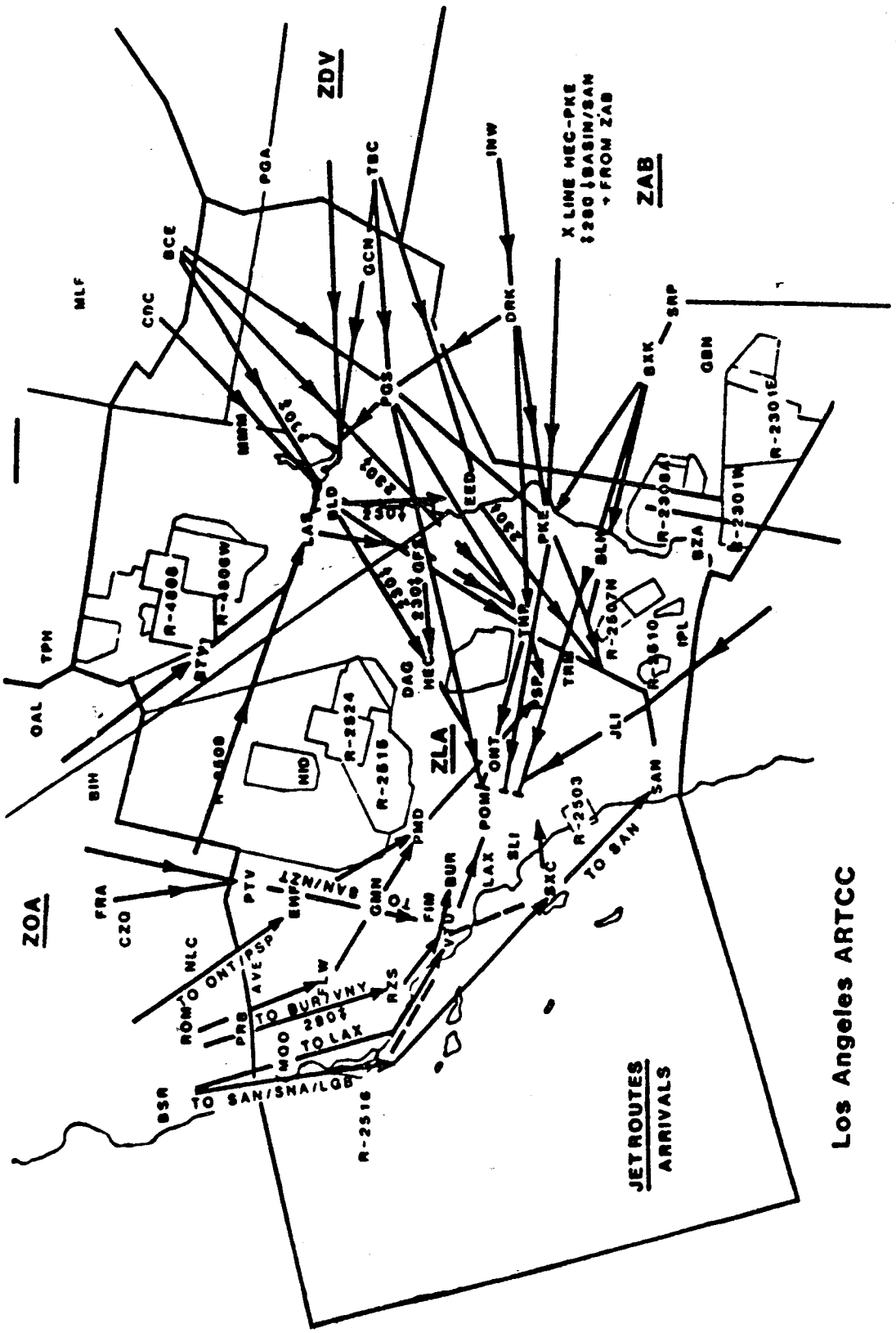


FIGURE 1. LAX JET ROUTE ARRIVALS

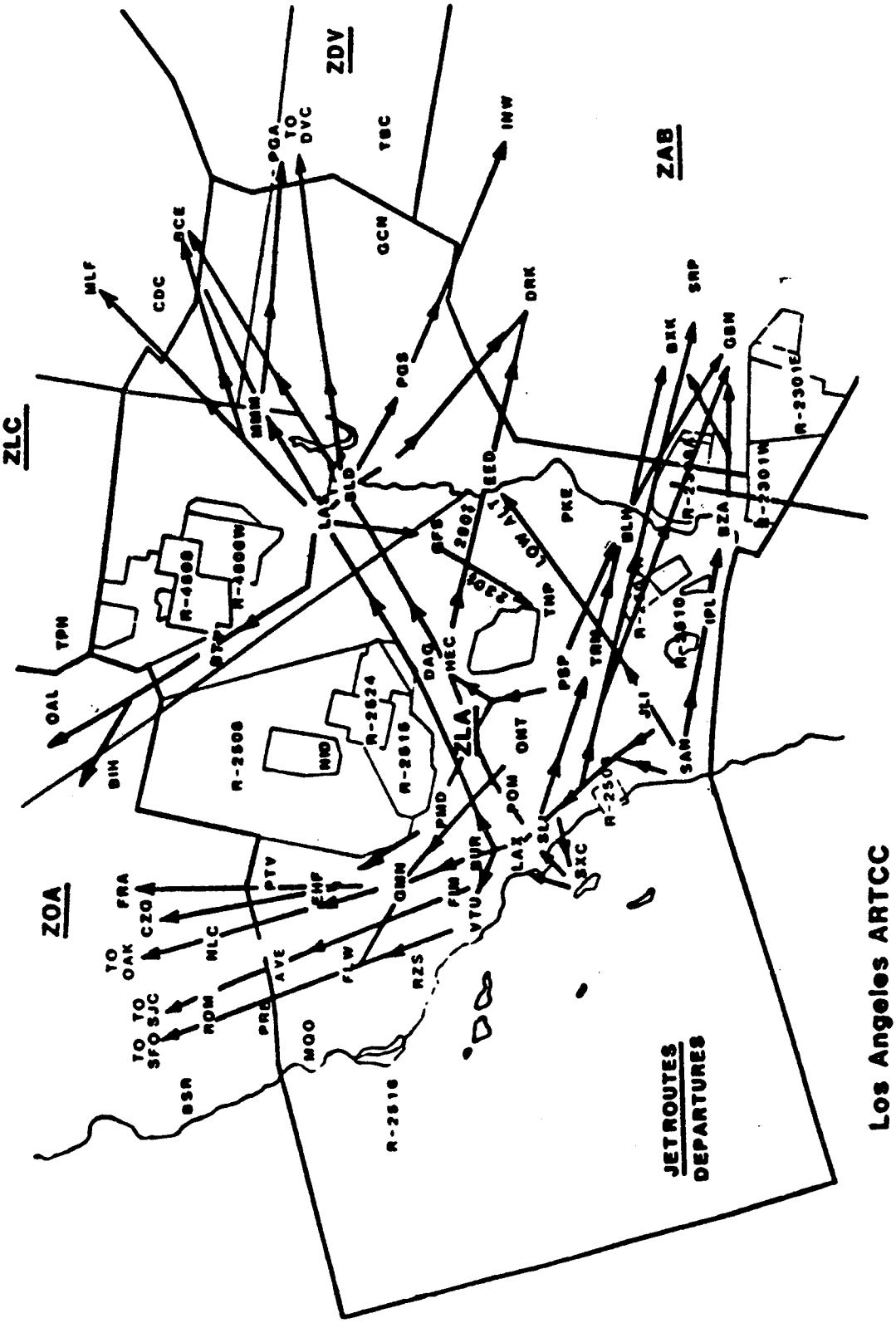


FIGURE 2. LAX JET ROUTE DEPARTURES

flow to accommodate parallel outbound tracks over DAG/HEC and points northeast. To eliminate the head-on climbing/descending conflict in the TNP/Needles (EED)/Parker (PKE) areas, all eastbound traffic was routed via LAX DAG/HEC or Oceanside (OCN)/Imperial (IPL) eastbound. The SAN arrival traffic from the east on J2 was moved north into the westbound flows over Blythe (BLH)/J212, to be sequenced into a single inbound track from the northeast. All LAX arrival traffic from the east/northeast would be segregated into two or three one-way inbound tracks over TNP/PSP/Thermal (TRM).

The National Airspace System Performance Analysis Capability (NASPAC) Simulation Modeling System (SMS) was used in the study. NASPAC is used by the FAA as a tool to evaluate the local effects and system-wide performance of the NAS. It is used to evaluate changes in procedures, such as restructuring routes of the Air Traffic Control (ATC) system. NASPAC can also be used for strategic planning, for identifying bottle necks in the system, and for evaluating alternative solutions for capacity and demand related issues. In addition to identifying delay, monetary evaluations may be made by converting delay into cost estimates, and the estimated number of passengers affected by the change may be addressed.

ZLA-3A5 will use the results of the NASPAC study to derive local and system-wide benefits in support of the AWP Resectorization Plan.

1.1 BACKGROUND.

The NASPAC study was conducted using six phases presented by the ZLA-3A5. Figure 3 shows the new layout of the ZLA high altitude areas, and figure 4 shows the low altitude areas. The six phases are:

1. Relocation of Sector 12.

   (a) Relocation of "Sector 12" from Area C to Area B
   (b) Area C split "Sector 40", creating "Sector 29"

2. Relocation of Area E Sectors.

   (a) Sectors 30, 21, and 22 realign to two sectors, all altitudes

3. San Diego Reverse Flow.

4. Northwest (Areas A & B) Reverse Flow.

5. Implement DAG/HEC Parallel Departure Routes and BUR East Arrival Routing.

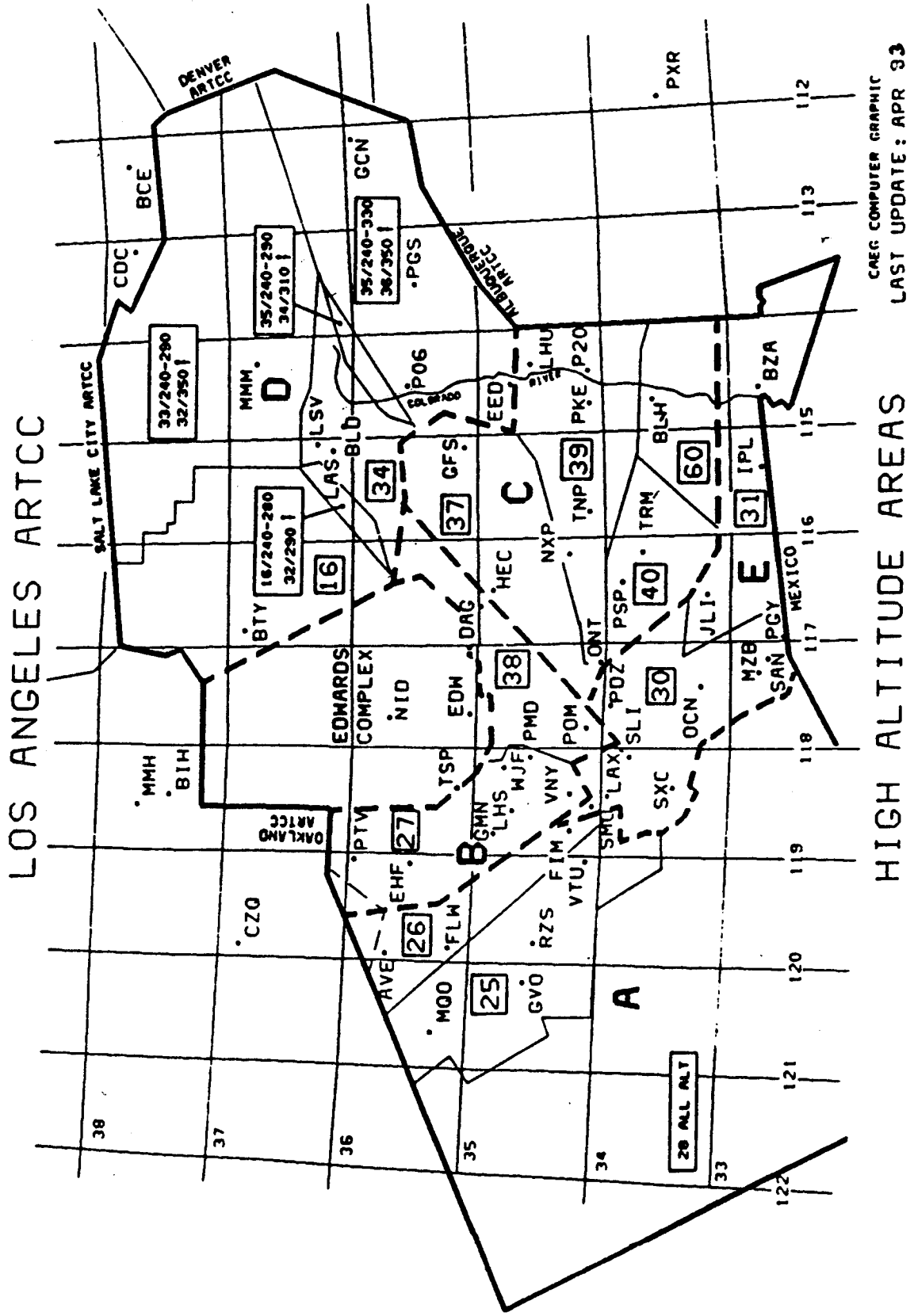


FIGURE 3. ZLA HIGH ALTITUDE NEW SECTOR LAYOUT

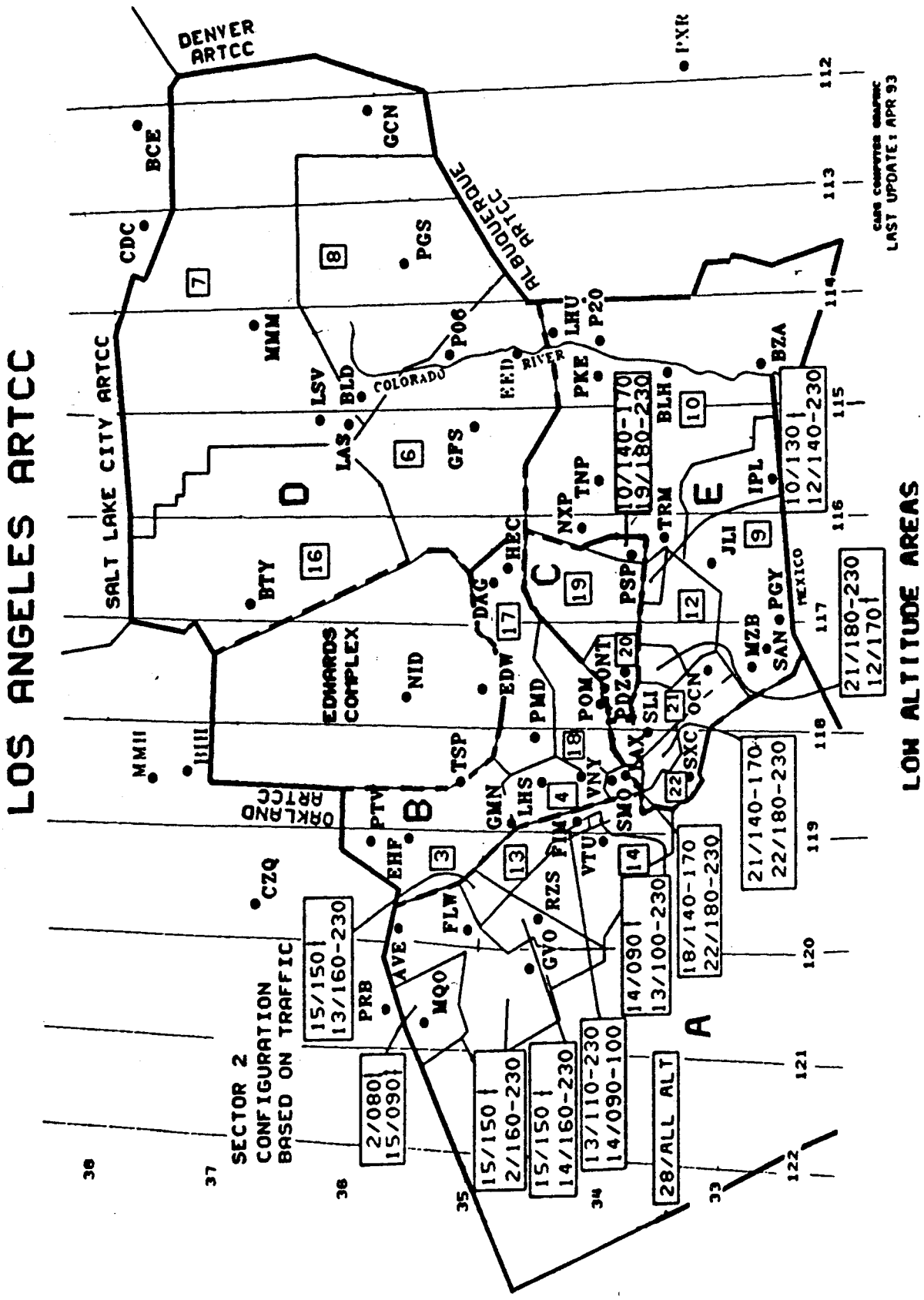


FIGURE 4. ZLA LOW ALTITUDE NEW SECTOR LAYOUT

6. LAX Dual Flow from East and Elimination of TRM PKE Drake (DRK) Departure Routing.

Area A contains sector 28 which is ZLA's most western sector, lying entirely over the Pacific Ocean. Operations at this sector are unique, since it is here that oceanic traffic makes its transition from non-radar coverage to domestic radar control. Controllers working this sector coordinate closely with ZOA. These controllers ensure that non-radar separation standards are maintained between aircraft making transition from the mainland, to and from Hawaii, and various destinations in the South Pacific track system. These are established oceanic tracks and random routes under sector 28 jurisdiction which make traffic control very difficult. Under the AWP Resectorization Plan, ZLA will retain sector 28 airspace to about 50 miles offshore; the rest of sector 28 will be allocated to ZOA.

Current operating procedures for controlling air traffic between the San Francisco Bay Area and the Los Angeles Basin include the current West Coast Plan which accounts for 95 percent of the mode of operation. As a result, this is the only plan modeled in this study. The Southeast Plan accounts for 5 percent when weather patterns dictate changes to arrival and departure streams. This corridor of airspace is one of the most heavily travelled in the world.

Forecasts of the demand for LAX and SFO and their surrounding airspace project a significant increase in traffic by the year 2000. In January 1991, a task force composed of representatives of ZLA, ZOA, Southern California TRACON, and the AWP convened to develop a plan to deal with the predicted traffic growth and the congestion problem that exists today.

The airspace design and traffic flows of the ZLA are currently outdated, and revisions are continual to accommodate changes in the system. The accumulation of these short-term fixes has resulted in an inefficient use of the airspace with little room for growth.

Optimal airspace utilization is limited by the close proximity of several major airports. In addition, the airspace congestion stems from the Special Use Airspace (SUA) parcel between the San Francisco Bay Area and the Los Angeles Basin. A different routing in this area might reduce delay to area airports and balance sector loads.

Currently, ZOA can accept a limited number of the SFO and OAK departures into the high altitude stratum between the San Francisco Area and Los Angeles Basin. Delay incurred by the users at SFO and OAK are caused by the En route Spacing Programs (ESP) designed to feed the only north-to-south jet route available over Fillmore (FIM) VORTAC. An additional north-to-

south jet route could possibly alleviate much of the congestion present in the inland route system. A north/south corridor airspace structure between the Los Angeles Basin and San Francisco Bay Area is being proposed. Traffic would be directed in a "racetrack" direction; therefore simplifying present traffic flows.

1.2 STUDY PURPOSE AND OBJECTIVES.

The study analyzes the current and proposed route changes, as outlined in the AWP Resectorization Plan, and provides a delay and cost estimate at the system-wide and airport level. To accomplish this task, operations were simulated, using the 1991 Terminal Area Forecasts (TAF) (FY 1991-2005)[2], at ZLA and ZOA with:

a. current and future capacity estimates.
b. new sector designs for the low and high altitudes.
c. new arrival and departure gates.
d. 2005 traffic demand.

The study was conducted at the request of AWP and approved by the FAA's Operations Research Service, AOR-1. The study was done for the ZLA Resectorization Program Office, ZLA-3A5 and Civil Operations, ATM-100, under the sponsorship of System Analysis Division, AOR-100.

The FAA Technical Center's ATC Technology Branch, ACD-340, conducted the study using the NASPAC SMS. The final results are analyzed and presented in this report for the AWP ZLA Resectorization Committee.

2. TECHNICAL APPROACH.

This section provides a brief overview of the NASPAC modeling system and describes the system metrics, scenario definitions, Cost of Delay Module, and the assumptions and caveats used in this study.

2.1 NASPAC SIMULATION MODEL.

NASPAC is a tool used by the FAA to analyze the impact of proposed operational and capital improvements on the performance of the NAS. It is an event-step discrete simulation model that tracks the progress of each aircraft in the system as they compete for and use ATC resources. NASPAC simulates system-wide performance and provides a quantitative base for decision making related to system improvements. The model supports strategic planning by identifying air traffic flow congestion problems and examining solutions to capacity, demand, and procedural related issues. NASPAC has been used to analyze the interaction among

components of the airspace system, and how the system reacts to projected demand and capacity changes.

NASPAC is a macro model used to estimate system-wide impacts of an ATC-proposed change. Traffic profiles consist of scheduled and unscheduled arrivals and departures for the 58 major airports in the system. Appendix A contains a list of these 58 airports and their ID. These are 50 of the nation's busiest airports and 8 other associated airports. Capacities at these 58 airports are modeled as hourly arrival and departure rates for both instrument flight rules (IFR) and visual flight rules (VFR). Scheduled demand is derived from the Official Airline Guide (OAG) and is used for predicting future growth. Unscheduled demand is derived from daily and hourly distributions taken from real world data (tower count). When using these distributions, the model randomly selects unscheduled flights for inclusion in the hourly airport arrival and departure demand. The projected traffic growth is provided by the TAF.

Among the major descriptive parameters used by the model are airport acceptance rates (AAR). Two servers are used at modeled airports; one handles arrivals and the other, departures. Each modeled airport requires two sets of values. The first represents an arrival priority strategy, and it consists of the maximum arrival rate (ARR) and its corresponding minimum departure rate (MDR). The second set represents a departure priority strategy. It consists of a maximum departure rate (DEP) and minimum arrival rate (MAR). When there is a high demand for arrivals and a low demand for departures, an arrival priority is used. The opposite will hold true when there is a high request for departures and a low request for arrivals. If the demand is between two extremes, the model calculates the service time using the ratio of the current arrival and departure queue lengths. This ratio determines the values on the capacity curve at which the servers operate.

2.2 NASPAC SIMULATION SYSTEM MEASURES.

NASPAC's key metric of performance is delay. The model calculates delay for each flight in the system, and aggregates throughput and delay for each of the 58 modeled airports. In addition, arrival and departure fixes, en route sectors, and restrictions are other modeled resources that measure delay. System metrics summarize every type of delay measured in the model.

The two types of delay that the model provides are technical (operational) and effective (passenger) delay. Technical delay is the type of delay absorbed by aircraft as they wait to use ATC resources such as runways, and fixes. Passenger delay is the difference between the scheduled arrival times published in the OAG and actual arrival times recorded in the simulation.

Operational delay is composed of arrival and departure delay. Operational arrival delay accumulates when an aircraft has arrived in the terminal area of an airport and has to wait to use a runway. Operational departure delay accumulates when an aircraft is ready to depart, but has to wait for an available runway. Sector entry delay occurs when the instantaneous aircraft count or hourly aircraft count parameters for a given sector is exceeded. An aircraft that arrives on time and accumulates no passenger delay can still accrue operational delay. Monetary assessments are estimated by converting delay into cost to the users and consumers by applying the NASPAC Cost of Delay Module. The Cost of Delay Module was incorporated into NASPAC SMS R3.1 and was used to conduct this study.

Metrics used in this study to analyze the impacts of the Resectorization Plan on the AWP and the NAS as a whole are:

1. Passenger delay
2. Operational delay
3. Throughput at airports
4. Sector throughput
5. Changes in air traffic procedures (ripple effect)
6. Cost of delay
7. Enplanements.

2.3 COST OF DELAY MODULE.

The Cost of Delay Module [3] was used to translate the delay incurred in the simulation into cost metrics in order to determine cost to the airline, and to the passengers. This study used the most recent data available, provided by the Office of Airline Statistics, Data Administration Division, DAI-20, using Form 41 as a means of obtaining operational and passenger costs. The U.S. Department of Transportation (DOT) requires all the airlines to report their cost data to DAI-20 on a quarterly basis.

The cost of delay module breaks down this data into airborne and ground delay cost by carrier and aircraft type. Operational cost consists of crew salaries, maintenance, fuel, equipment, depreciation, and amortization. Passenger delay measures the difference between the OAG scheduled arrival times and the arrival times measured by the simulation model. This metric measures the cost to passengers as a result of lost time due to delay. For example, the savings in cost would be the time savings to passengers realized from the reduction in passenger delay. The cost of passenger delay is a constant derived by the Office of Aviation Policy and Plans (APO-1), Economic Analysis Branch, APO-220. The constant ($40.50/hour), used in the Cost of Delay Module, measures the cost per hour of a delay incurred by a passenger. Passenger costs are derived from the expected number of passenger on a flight, times $40.50, times the number of hours

of delay absorbed by all passengers aboard a flight. The estimated number of passengers aboard each flight is a function of aircraft type. Form 41, Origin and Destination Survey (O&DS), was used to determine aircraft occupancy values.

The NASPAC model produces a delay trace file for every simulation run. This file contains information pertaining to the delay type, time of delay, where the delay occurred, and a tail number which uniquely defines the aircraft carrier, aircraft type, and the magnitude of the delay that was simulated. The model defines the type of delay (airborne, ground, or passenger) and references the appropriate cost of that delay from an operational cost data base, based on the carrier and aircraft type. Operational airborne, operational ground, and passenger delay are treated as separate entities, each contributing to the total delay cost accumulated in the simulation. For example, if American Airlines (AA) flight 2234 type B-727 experiences an airport arrival delay of 3 minutes, the module will define the operational cost of an airborne delay for AA type B-727 and multiply that number by 3. This is done for every type of operational delay occurring during the simulation. A report file is generated from the cost module summarizing cost estimates by delay type, air carrier, general aviation, military operations, and an estimate of missing cost information.

2.4 SCENARIO DEFINITIONS.

Scenarios used in this study are defined by several variables such as weather, airspace geometry, routes, new procedures, time-frame, capacity, and demand. Six different weather scenario days were used to model the changes. The first is based on weather observed on January 13, 1990, when most of the country was under Visual Meteorological Conditions (VMC), for 95-100 percent of the day. Under these conditions, all airports, including the West Coast, were at or near their maximum capacities. The second day's weather is similar to March 10, 1990, when most of the system was under VMC for 80-85 percent of the day, and the capacity of some airports was reduced by 15 percent due to weather conditions. The third day is the second most severe of the six days selected, with weather similar to March 31, 1990, when most of the system was under VMC for 70-80 percent of the day, and the capacity of some airports was reduced 20 percent due to weather conditions. The fourth day's weather is similar to May 16, 1990, when most of the system was under VMC for 85-90 percent of the day, and the capacity of some airports was reduced by 10 percent due to weather conditions. The fifth day has weather similar to September 27, 1990, when most of the system was under VMC for 90-95 percent of the day, and the capacity of some airports was reduced by 5 percent due to weather conditions. The sixth day was the most severe day selected, with weather similar to December 22, 1990, when most of the system was under VMC less than or equal to 70 percent of the day, and the capacity

of some airports was reduced by at least 30 percent due to weather conditions. The weights provided in Table 1 were used to annualize the results, such as delay and cost estimates.

Capacity estimates at the AWP airports, and the other modeled airports, are influenced by weather conditions. This is due to the limitation of the runway configuration enforced during periods of poor weather conditions. VMC provides the maximum capacity, mainly because of the use of visual approach procedures. The capacity decreases under IMC because arriving aircraft must use instrument approaches resulting in an increase of in-trail separation. Depending on the severity of weather conditions, capacity is also decreased due to the inability of the arriving traffic to run simultaneous approaches at some airports.

The definitions of the scenarios also include the selection of a time frame and the improvements studied. The following five cases were analyzed:

a. 1991 with present AWP airports demand and present capacity (baseline).

b. 1995 with future demand and present capacity (no resectorization) at the AWP airports.

c. 1995 with future demand and Resectorization Plan in place.

d. 2000 with future demand and present capacity (no resectorization).

e. 2000 with future demand and Resectorization Plan in place.

Table 1 shows the scenario design of the study in a 6 X 5 matrix. The left hand column represents the weather days modeled, and the column headings indicate the years modeled including the 1991 baseline, as well as the years 1995 and 2000 with and without the Resectorization Plan.

The X's represent the details for each scenario, including capacity, future demand, Estimated Departure Clearance Times (EDCT's) ground delay programs, and airspace route structure. These improvements were modeled by changing the airport capacities at LAX, OAK, SFO, and the satellite airports, and by revising the arrival and departure fix attributes, as well as the sector load. The weights applied were used for evaluation of the impact of the Plan for an entire year. Each weight represents the number of days in 1990 the NAS had experienced similar weather to that of the days modeled.

TABLE 1. SCENARIO STRUCTURE

% IN VMC	WEIGHTS APPLIED	SCENARIO DAY	1991 BL	1995 NI	1995 RESC	2000 NI	2000 RESC
95-100	80.00	JAN 13	X	X	X	X	X
90-95	127.50	SEP 27	X	X	X	X	X
85-90	86.25	MAY 16	X	X	X	X	X
80-85	23.75	MAR 10	X	X	X	X	X
70-80	17.50	MAR 31	X	X	X	X	X
<70	30.00	DEC 22	X	X	X	X	X

BL - baseline NI - no resectorization Resc - resectorization

NOTE : 1. Scenario days represent varying levels of IMC and VMC,

2. Weights used to compute annual results, assuming frequency of occurrence of similar days in a given future year.

The study focused on modeling the baseline (1991) operations, as well as the future operations for 1995 and 2000 at ZLA and ZOA, with respect to the traffic flow between the San Francisco Bay Area, the Los Angeles Basin, and OAK. Currently, weather conditions dictate that the West Coast Plan is used 95 percent of the time, with the Southeast Plan being implemented approximately 5 percent. As a result, only the West Coast Plan was modeled, with the current traffic flow reversed 180 degrees.

In this study, more emphasis was placed on the operational delay to measure the performance of AWP airports and the NAS, as a whole. Operational delay is the type of delay that accumulates when an aircraft has to wait in the system to use a resource. This type of delay is unlike passenger delay since it represents the delay generated by the actual demand placed on the system, and not by the users.

2.5 NASPAC WEATHER ANNUALIZATION.

The method used for computing annual results of this study was developed by the MITRE Corporation. Six scenario days were selected as representative of varying levels of VMC and IMC across the 58 modeled airports in the simulation. To compute the annual results, weighting factors for each scenario day were applied to reflect the relative frequency of occurrence of that day's VMC throughout the year. Table 1 lists the six days used in the NASPAC SMS weather annualization process with its percentage of visual conditions, and the relative weight used to annualize simulation results.

2.6 ASSUMPTIONS AND CAVEATS.

This study assumes that the AWP Resectorization Plan is in place, as presented by the ZLA Resectorization Committee. It also assumes that all the connecting points with the adjacent centers have been approved, including the reverse flow between ZLA and ZOA.

The standard VFRs at AWP airports vary. The following list indicates these requirements:

AIRPORT	CEILING AT MSL	VISIBILITY
BUR	3,500 feet	3 miles
LAX	2,000 feet	3 miles
LAS	5,000 feet	3 miles
LGB	2,000 feet	3 miles
OAK	2,500 feet	3 miles
ONT	3,000 feet	3 miles
SAN	2,500 feet	3 miles
SFO	2,500 feet	3 miles
SNA	2,500 feet	3 miles

Under IFR, all of the airport's ceiling and visibility is less than VFR.

The ceiling and visibility at any given airport determines the capacity for that airport. For example, in a previous NASPAC study at DFW under VMC, the maximum capacity (arrival/departure) is 296 [4] aircraft with all 5 runways operational. This is based on the acceptance rate of 160, that is, the number of arriving aircraft accepted in 1 hour. Under IFR, the maximum capacity is 180 aircraft, based on an acceptance rate of 100 aircraft per hour.

The 1991 TAF were used to project future growth. These forecasts depend on many factors which are subject to change, such as economics and advanced technology. The annualization method used for all the time frames modeled is an approximation, and is based on weather observations taken from the year 1990. The future year's weather observations are assumed to follow the same patterns as 1990. The model does not include re-routing or other methods used to minimize the impacts of adverse weather, nor does it address noise abatement or safety. All of the airport capacity estimates used in the analysis for the years 1995 and 2000 were based solely on airport improvements projected in the National Plan for Integrated Airport System (NPIAS). The EDCT's used in the simulation are estimates based on the model's acceptance rate. Table 2 displays all airport improvement projects expected to be completed by the year 2005.

NASPAC SMS contains stochastic elements that cause slight differences in results between runs with otherwise identical input. To capture the stability of these elements, three model runs were averaged.

3. METHODOLOGY.

This section describes the procedural details of the study and gives the sources of the capacity and future demand data. The method of modeling the changes to the airspace is described, followed by a discussion of the cost estimation used.

3.1 CAPACITY.

AWP airport and sector capacity values used in this study were provided by AWP-530, ZLA-530, and ZOA-530. These values are based on discussions with the towers, ZLA, ZOA, Southern California TRACON, and other experts in the field who control the West Coast traffic on a daily basis. The 1988 FAA Engineering Performance Standards (EPS) were also used as a reference, along with the FAA Airfield Capacity model [5]. The capacities used represent the maximum, minimum, and 50/50 mix of the hourly departure and arrival rates.

TABLE 2. AIRPORT IMPROVEMENTS MODELED TO BE COMPLETED 2005

Airport	Type of Improvement	Specifics
ATL	New runway	3,000 ft south (5th parallel).
BWI	New runway	10R/28L.
CLT	New runway	18W/36W, assume independent IFR.
CVG	New runway	18/36, assume independent IFR.
DEN	New Denver	airport. (DVX)
DFW	Two new runways	GA rwy 16/34, rwy 18/36.
DTW	Two new runways	9R/27L and 4/22.
FLL	Runway extension	9R/27L.
IAD	Two new runways	1W/19W and 12R/30L.
IAH	New runway	8L/26R.
MCI	Two new runways	1R/19L and 9R/27L.
MCO	New runway	17L/35R.
MEM	New runway	18L/36R.
MKE	Runway extensions	1L/19R and 7L/25R.
MSY	New runway	1L/19R.
ORD	Relocate	4L/22R and 9L/27R.
	Runway extensions	14L and 22L.
	Two new runways	14/32 (3rd parallel)
		9R/27L (3rd parallel).
PHL	Relocate	9L/27R.
	New runway	8/26.
PHX	New runway	8S/26S (3rd parallel).
PIT	New runway	parallel, assume independent IFR.
RDU	New runway	5/23. Assume independent IFR.
SDF	Two new runways	17L/35R and 17R/35L (parallels).
SJC	Runway extension	12L/30R for air carrier operation.
SLC	New runway	16W/34W.
STL	New runway	12L/30R, 4,300ft from parallel.
SYR	New parallel runway	10L/28R.
TPA	New parallel runway	18/36.

The minimum departure capacity is the hourly departure rate when arrivals are given highest priority (arrival priority). Conversely, minimum arrival capacity exists when departures are at their maximum levels (departure priority). The minimum service time between successive arrival and departure is determined from these hourly rates and the queue lengths of the arrivals and departures. The inverse of these service times is the capacity values that are furnished for each of the 58 modeled airports. Table 3 shows AWP airport capacity values under VMC, and Table 4 shows the capacity values under IMC.

The future projections of capacity have also been estimated to reflect procedural and structural improvements outlined in the 1991-1992 Aviation System Capacity (ASC) Plan and are due for implementation by the year 2000 [6]. Procedural improvements

include approach procedures and reductions of separation minima. The structural improvements are comprised mainly of the addition of concrete, specifically new runways. Never the less, ZLA and ZOA felt that the capacities for all AWP airports should be the same for 1995 and 2000.

3.2 FUTURE DEMAND FORECASTS AND INPUT DATA.

The demand used in the model consists of unscheduled demand from historical data (tower counts at modeled airports) and scheduled demand derived from the OAG. The 1991 demand levels were used as a baseline for predicting future demand. The projected growth at all West Coast airports, and other airports in the NAS, were provided by the FAA's Office of Aviation Policy and Plans (APO) through the TAF 1991-2005. This file consists of air carrier and general aviation (GA) operations.

The model also accounts for ground delay issued by Central Flow Control Facility (CFCF). These are due to adverse weather conditions at the destination airport or any en route restrictions. The EDCT's are computed and appended to the schedule for each affected flight.

The unscheduled demand is described by daily and hourly distributions taken from real world data (tower count). The primary source of the IFR GA and military flights is the "Host_Z" data. The data are collected by the ARTCCs and sent to the FAA Technical Center by satellite for each flight in the system. They are then sent to the Transportation System Center (TSC) for processing and distributed to CFCF and other users. The weather data used in the model were taken from surface observations at all of the modeled airports.

The TAF for demand at the West Coast airports (and other modeled airports) take into account the increase in capacity that accompanies airport expansion. Figure 5 shows the forecasted number of daily operations, system-wide. The growth between 1991 and 2000 without the AWP Resectorization Plan is based on the TAF (FY 1991 - 2005) [6] growth data. These values represent an estimated 14 percent growth from 1991 to 1995, and 22 percent growth from 1991 to 2000. Figure 6 shows the forecast number of daily operations at LAX and SFO. These values represent an estimated 12 percent growth between 1991 and 1995, and 19 percent between 1991 and 2000 at LAX. SFO has an estimated 20 percent growth between 1991 and 1995, and 35 percent between 1991 and 2000.

TABLE 3. AWP AIRPORTS CAPACITY UNDER VMC (VFR)

Wx & Improvements	Arr. Priority	Dept. Priority	50/50
BURBANK (BUR)			
No Resectorization Baseline (1991)	Max A 42 Min D 38	Min A 23 Max D 55	A 40 D 40
Resectorization (1995)	Max A 42 Min D 45	Min A 25 Max D 65	A 41 D 41
Resectorization (2000)	Max A 42 Min D 45	Min A 25 Max D 65	A 41 D 41
LAS VEGAS (LAS)			
No Resectorization Baseline (1991)	Max A 70 Min D 50	Min A 30 Max D 80	A 62 D 62
Resectorization (1995)	Max A 72 Min D 60	Min A 34 Max D 85	A 67 D 67
Resectorization (2000)	Max A 72 Min D 60	Min A 34 Max D 85	A 67 D 67
LOS ANGELES (LAX)			
No Resectorization Baseline (1991)	Max A 81 Min D 52	Min A 40 Max D 90	A 70 D 70
Resectorization (1995)	Max A 85 Min D 60	Min A 45 Max D 100	A 75 D 75
Resectorization (2000)	Max A 85 Min D 60	Min A 45 Max D 100	A 75 D 75

TABLE 3. AWP AIRPORTS CAPACITY UNDER VMC (VFR) (Continued)

Wx & Improvements	Arr. Priority	Dept. Priority	50/50
LONG BEACH (LGB)			
No Resectorization Baseline (1991)	Max A 80 Min D 60	Min A 40 Max D 70	A 55 D 55
Resectorization (1995)	Max A 82 Min D 68	Min A 42 Max D 78	A 65 D 65
Resectorization (2000)	Max A 82 Min D 78	Min A 42 Max D 78	A 65 D 65
OAKLAND (OAK) (NORTH & SOUTH FIELDS)			
No Resectorization Baseline (1991)	Max A 60 Min D 40	Min A 30 Max D 70	A 50 D 50
Resectorization (1995)	Max A 60 Min D 40	Min A 30 Max D 70	A 50 D 50
Resectorization (2000)	Max A 60 Min D 40	Min A 30 Max D 70	A 50 D 50
ONTARIO (ONT)			
No Resectorization Baseline (1991)	Max A 47 Min D 38	Min A 25 Max D 50	A 40 D 40
Resectorization (1995)	Max A 49 Min D 45	Min A 28 Max D 55	A 44 D 44
Resectorization (2000)	Max A 49 Min D 45	Min A 28 Max D 55	A 44 D 44

TABLE 3. AWP AIRPORTS CAPACITY UNDER VMC (VFR) (Continued)

Wx & Improvements	Arr. Priority	Dept. Priority	50/50
SAN DIEGO (SAN)			
No Resectorization Baseline (1991)	Max A 34 Min D 30	Min A 20 Max D 45	A 32 D 32
Resectorization (1995)	Max A 36 Min D 38	Min A 22 Max D 50	A 37 D 37
Resectorization (2000)	Max A 36 Min D 38	Min A 22 Max D 50	A 37 D 37
SAN FRANCISCO (SFO)			
No Resectorization Baseline (1991)	Max A 66 Min D 40	Min A 30 Max D 76	A 53 D 53
Resectorization (1995)	Max A 66 Min D 40	Min A 30 Max D 76	A 53 D 53
Resectorization (2000)	Max A 66 Min D 40	Min A 30 Max D 76	A 53 D 53
SAN JOSE (SJC)			
No Resectorization Baseline (1991)	Max A 40 Min D 20	Min A 10 Max D 50	A 30 D 30
Resectorization (1995)	Max A 40 Min D 20	Min A 10 Max D 50	A 30 D 30
Resectorization (2000)	Max A 40 Min D 20	Min A 10 Max D 50	A 30 D 30

TABLE 3. AWP AIRPORTS CAPACITY UNDER VMC (VFR) (Continued)

Wx & Improvements	Arr. Priority	Dept. Priority	50/50
ORANGE COUNTY (SNA)			
No Resectorization Baseline (1991)	Max A 50 Min D 38	Min A 32 Max D 60	A 45 D 45
Resectorization (1995)	Max A 58 Min D 43	Min A 32 Max D 60	A 55 D 55
Resectorization (2000)	Max A 58 Min D 43	Min A 32 Max D 60	A 55 D 55

TABLE 4. AWP AIRPORT CAPACITY VALUES UNDER IMC (IFR)

Wx & Improvements	Arr. Priority	Dept. Priority	50/50
BURBANK (BUR)			
No Resectorization Baseline (1991)	Max A 35 Min D 30	Min A 20 Max D 47	A 33 D 33
Resectorization (1995)	Max A 38 Min D 40	Min A 22 Max D 55	A 36 D 36
Resectorization (2000)	Max A 38 Min D 40	Min A 22 Max D 55	A 36 D 36
LAS VEGAS (LAS)			
No Resectorization Baseline (1991)	Max A 45 Min D 30	Min A 28 Max D 42	A 35 D 35
Resectorization (1995)	Max A 47 Min D 40	Min A 30 Max D 52	A 43 D 43
Resectorization (2000)	Max A 47 Min D 40	Min A 30 Max D 52	A 43 D 43

TABLE 4. AWP AIRPORTS CAPACITY UNDER IMC (IFR) (Continued)

Wx & Improvements	Arr. Priority	Dept. Priority	50/50
LOS ANGELES (LAX)			
No Resectorization Baseline (1991)	Max A 68 Min D 48	Min A 38 Max D 67	A 55 D 55
Resectorization (1995)	Max A 70 Min D 55	Min A 40 Max D 80	A 65 D 65
Resectorization (2000)	Max A 70 Min D 55	Min A 40 Max D 80	A 65 D 65
LONG BEACH (LGB)			
No Resectorization Baseline (1991)	Max A 55 Min D 40	Min A 30 Max D 60	A 45 D 45
Resectorization (1995)	Max A 57 Min D 45	Min A 32 Max D 65	A 52 D 52
Resectorization (2000)	Max A 57 Min D 45	Min A 32 Max D 65	A 52 D 52
OAKLAND (OAK) (NORTH & SOUTH FIELDS)			
No Resectorization Baseline (1991)	Max A 40 Min D 20	Min A 15 Max D 45	A 30 D 30
Resectorization (1995)	Max A 40 Min D 20	Min A 15 Max D 45	A 30 D 30
Resectorization (2000)	Max A 40 Min D 20	Min A 15 Max D 45	A 30 D 30

TABLE 4. AWP AIRPORTS CAPACITY UNDER IMC (IFR) (Continued)

Wx & Improvements	Arr. Priority	Dept. Priority	50/50
ONTARIO (ONT)			
No Resectorization Baseline (1991)	Max A 38 Min D 30	Min A 20 Max D 42	A 34 D 34
Resectorization (1995)	Max A 40 Min D 35	Min A 22 Max D 47	A 38 D 38
Resectorization (2000)	Max A 40 Min D 35	Min A 22 Max D 47	A 38 D 38
SAN DIEGO (SAN)			
No Resectorization Baseline (1991)	Max A 32 Min D 20	Min A 15 Max D 40	A 28 D 28
Resectorization (1995)	Max A 33 Min D 25	Min A 18 Max D 47	A 31 D 31
Resectorization (2000)	Max A 33 Min D 25	Min A 18 Max D 47	A 31 D 31
SAN FRANCISCO (SFO)			
No Resectorization Baseline (1991)	Max A 34 Min D 40	Min A 14 Max D 60	A 37 D 37
Resectorization (1995)	Max A 34 Min D 40	Min A 14 Max D 60	A 37 D 37
Resectorization (2000)	Max A 34 Min D 40	Min A 14 Max D 60	A 37 D 37

TABLE 4. AWP AIRPORTS CAPACITY UNDER IMC (IFR) (Continued)

Wx & Improvements	Arr. Priority	Dept. Priority	50/50
SAN JOSE (SJC)			
No Resectorization Baseline (1991)	Max A 27 Min D 23	Min A 20 Max D 30	A 25 D 25
Resectorization (1995)	Max A 27 Min D 23	Min A 20 Max D 30	A 25 D 25
Resectorization (2000)	Max A 27 Min D 23	Min A 20 Max D 30	A 25 D 25
Orange County (SNA)			
No Resectorization Baseline (1991)	Max A 33 Min D 30	Min A 20 Max D 45	A 31 D 31
Resectorization (1995)	Max A 36 Min D 35	Min A 22 Max D 48	A 34 D 34
Resectorization (2000)	Max A 36 Min D 35	Min A 22 Max D 48	A 34 D 34

3.3 RESTRUCTURING AWP AIRSPACE.

Appendix B shows the proposed changes in traffic flow between San Francisco Bay Area and the Los Angeles Basin, as well as the proposed changes to and from the east and northeast of the Los Angeles Basin. The proposed traffic changes between ZOA and ZLA are as follows:

a. Reverse Flow: the traffic flow between the Bay Area in ZOA and the Los Angeles Basin in the ZLA is reversed. The arrivals are southbound along the coastline and the departures are northbound through sector 26.

b. Arrivals (Bay Area to LAX): The primary route from SFO/OAK during the hours 0600-2300 local will be the offshore route, the "Offshore One" or the "Coast One" Standard Instrument Departures (SIDs).

LAX jet arrivals from the north and the ocean will be routed over Ventura (VTU) VORTAC via the SADDE arrivals. The prop arrivals from the north will be routed via San Marcus (RZS) VORTAC to VTU VORTAC, and sequenced by ZLA Area A. Jet arrivals from the east will be routed in two inbound streams at different altitudes to facilitate LAX TRACON's ability to blend them in traffic streams.

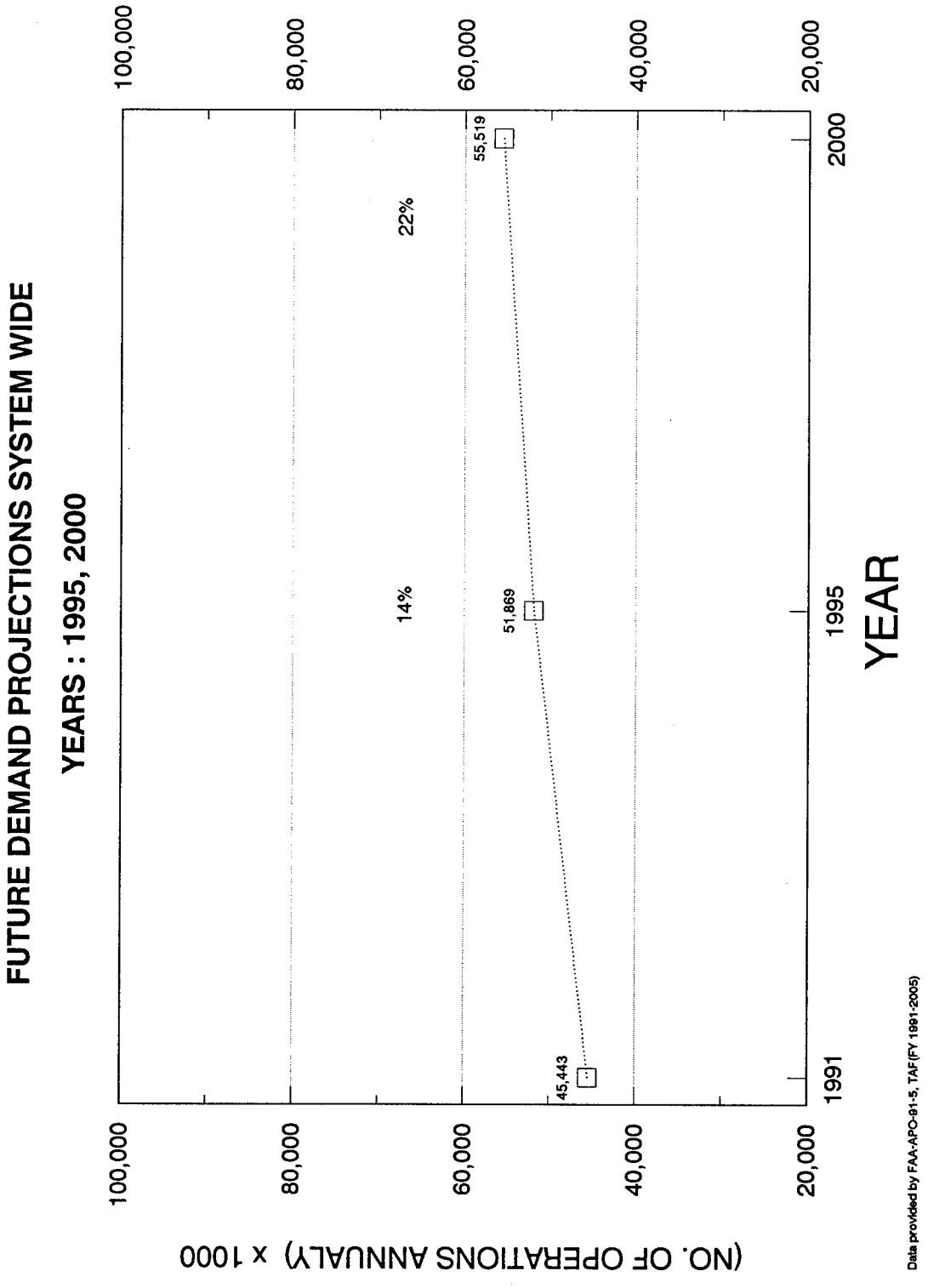


FIGURE 5. FORECASTED NUMBER OF DAILY OPERATIONS SYSTEM-WIDE FOR 1991, 1995, 2000

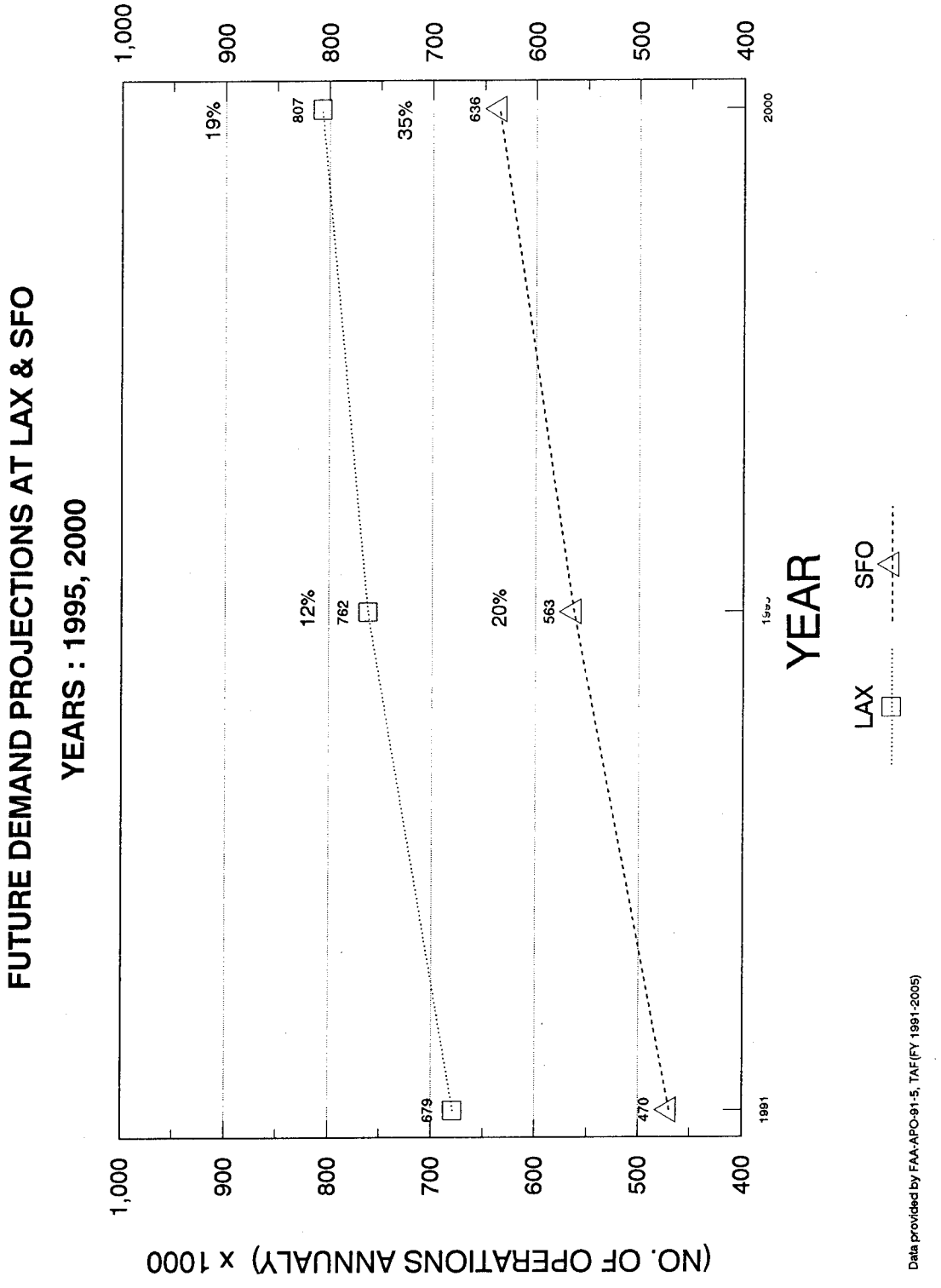


FIGURE 6. FORECASTED NUMBER OF DAILY OPERATIONS AT LAX & SFO FOR 1991, 1995, 2000

LAX jet departures to the northwest will depart with a heading of 250, then be radar vectored by LAX TRACON to a departure gate starting 5 miles northwest of VTU VORTAC and extending 15 miles to the east. Jets landing at SFO will be vectored through the gate and cleared direct of Fellows (FLW) VORTAC, climbing to 16,000 feet (ft). Jets landing at SJC will be vectored through the gate toward REYES intersection, climbing to 16,000 ft. Jets proceeding over Gorman (GMN) VORTAC will be vectored through the gate toward TNP intersection, climbing to 16,000 ft. ZLA Area A will clear aircraft on course. Turboprop to the northwest will depart heading 250, then be radar vectored through the departure gate to either FIM VORTAC or GMN VORTAC 142 radial. Those turboprop proceeding over GMN will be climbing to 8,000 ft and handed off to Burbank TRACON, who will climb the aircraft to 13,000 ft and handoff the aircraft to ZLA Area B.

These routes are parallel, with approximately 12 miles between them. The various crossover and altitude stratifications need to be coordinated with ZOA. The plan is that the crossovers are made while aircraft are in level flight or while in Approach Control Airspace where reduced separation minima can be utilized. An additional advantage to this plan is that each airport is fed in a one-stream flow, as much as it is operationally feasible, which further reduces the need for miles-in-trail and s-turns or speed assignments in the low altitude structures.

4. RESULTS.

(Additional figures are presented in appendix C.)

4.1 AWP AIRPORTS DELAY.

Table 5 shows the total hourly operational delay at AWP airports without the AWP Resectorization Plan for the baseline scenarios for years 1991, 1995, and 2000. The 1991 baseline cases pre-date the AWP Resectorization Plan. For the 1995 and 2000 baseline cases, the new sector design was used to run the simulation since it was implemented in 1992. ZLA-530 provided the Adaptation Controlled Environment System (ACES) data which reflected these changes. The proposed routes were not included, which is the main issue for this study.

These results clearly suggest that AWP airspace should be improved. As future demand increases in 1995 and 2000, the operational delay increases as well. The AWP Resectorization Plan is designed and is expected to increase the capacity at AWP airports to meet the expected growth by the year 2000. The growth is expected to be approximately 14 percent in 1995, and 22 percent in 2000, system-wide, as shown in Figure 5. The growth at LAX and SFO is expected to be 12 and 20 percent in 1995, and 19 and 35 percent in 2000, respectively, as shown in Figure 6.

TABLE 5. BASELINE TOTAL HOURLY OPERATIONAL DELAY AT AWP AIRPORTS FOR 1991, 1995, AND 2000

AIRPORTS	1991 BASELINE	1995 BASELINE	2000 BASELINE
BUR	1,461	2,343	2,517
LAS	3,369	2,997	4,979
LAX	17,361	30,255	67,503
LGB	11,405	46,722	6,992
OAK	1,269	9,421	15,249
ONT	1,011	1,762	3,893
SAN	2,568	5,055	6,734
SFO	11,300	28,774	51,828
SJC	2,430	10,490	21,264
SNA	73,011	125,662	258,236

Figures 7 and 8 present the increase in operational delay over 1991, broken down by ground and airborne delay for the 1995 and 2000 baseline cases respectively. It also shows the percent in which the delay would increase for those years without the Plan.

With the AWP Resectorization Plan implemented, the results of the simulation have shown that operational delay at most of the AWP airports would be reduced. Table 6 shows the operational delay at AWP airports with and without the AWP Resectorization Plan for the four future scenarios, where "B" denotes "baseline" or "no resectorization", and "R" denotes "resectorization".

In 1995 cases, the operational delay at LGB and SNA was observed to be much higher than the operational delay at LAX and SFO for both cases, even though LGB and SNA are not considered major airports. On May 6, 1994, the NASPAC team visited the LGB tower to observe the airport operation, and found the reason for the delay. As explained by the tower supervisor, it takes simultaneous coordination by LAX, ZLA and Coast TRACON for an aircraft to depart LGB. It also takes coordination by the entire tower crew for an aircraft to taxi to and from the gate. At SNA, AWP-530 indicated that the delay is realistic because of the limitations of the airport and the high volume of GA traffic. These findings confirmed the simulation results.

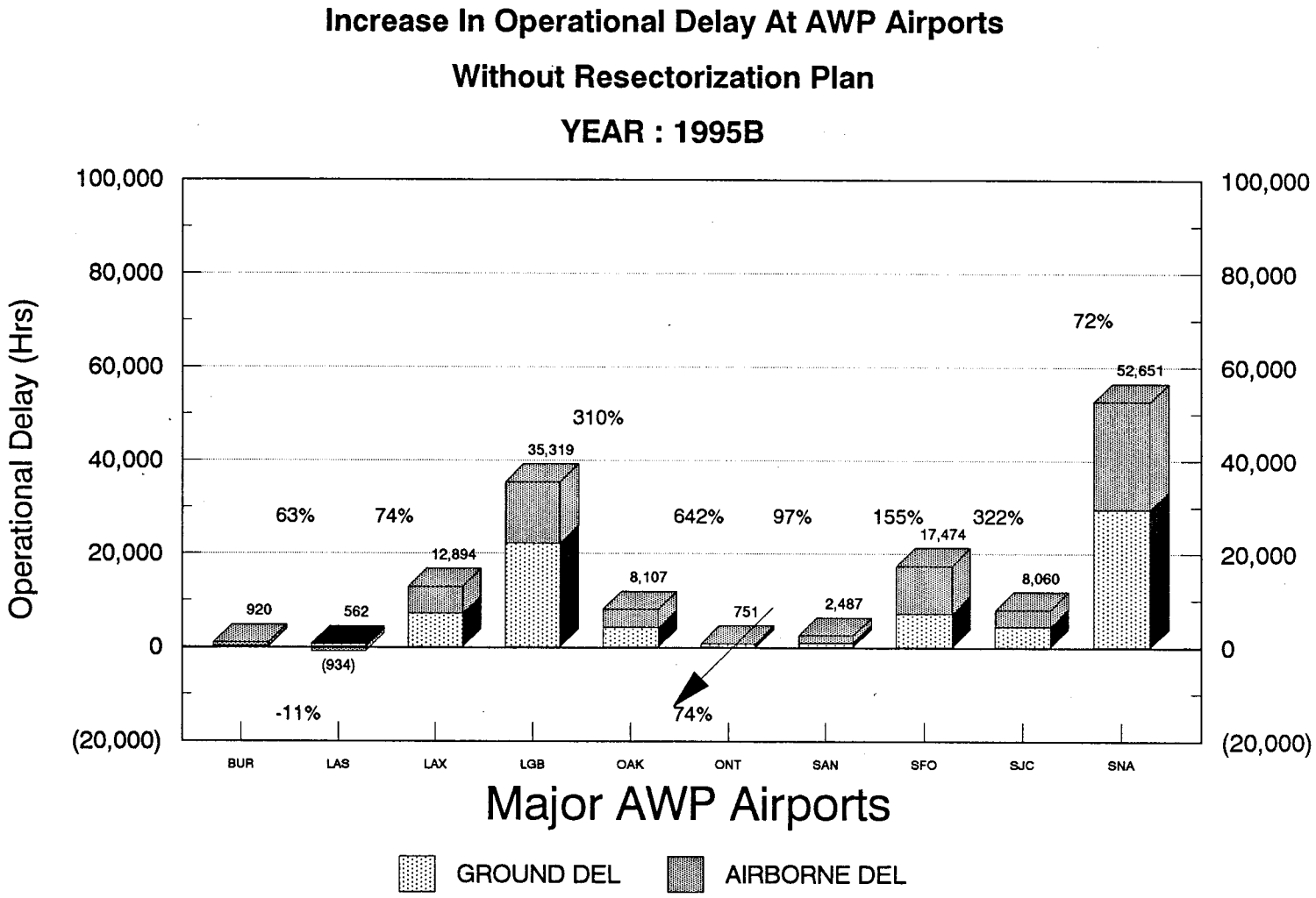


FIGURE 7. EXPECTED GROWTH IN OPERATIONAL DELAY AT AWP AIRPORTS WITHOUT RESECTORIZATION PLAN IN 1995

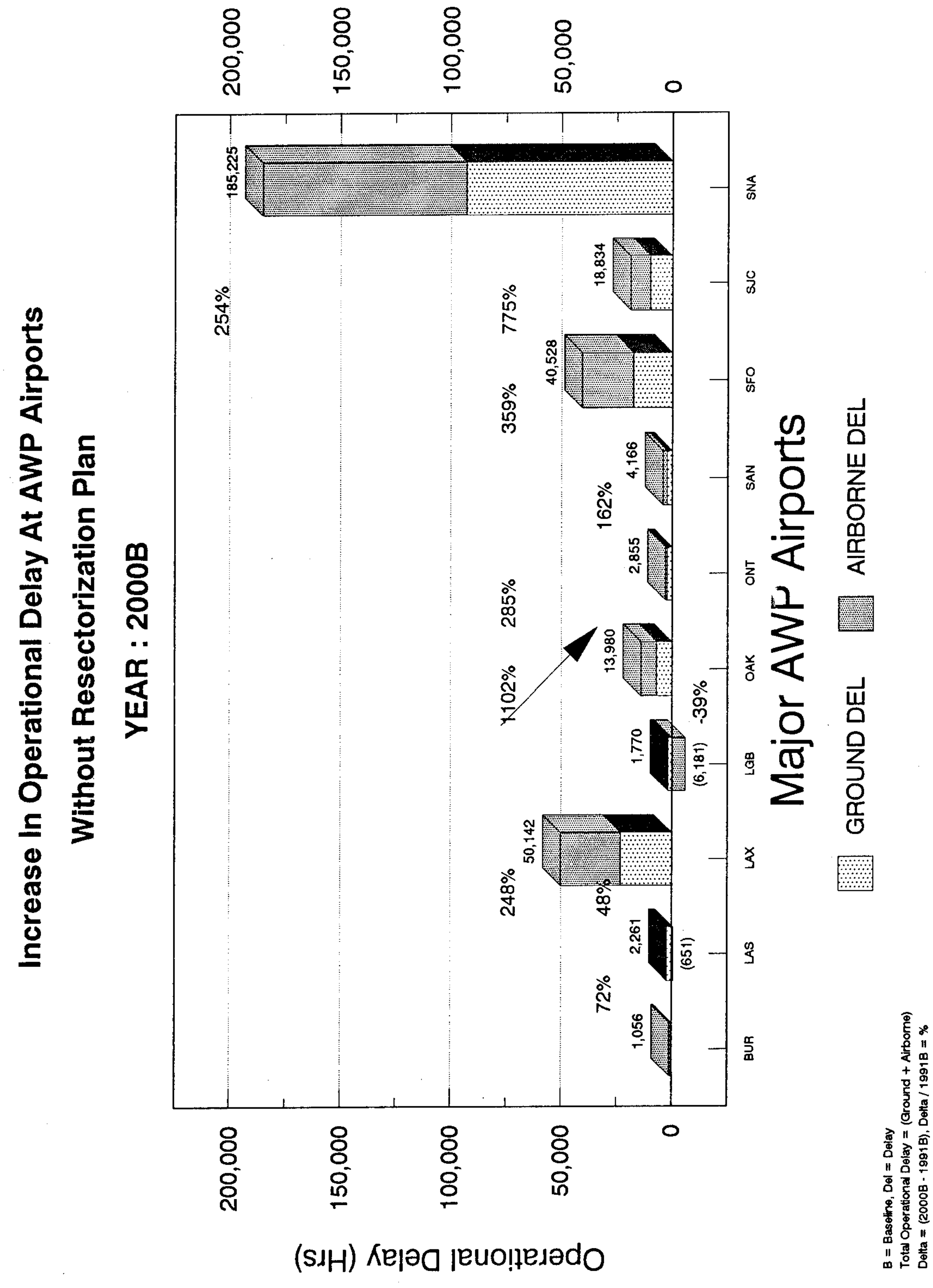


FIGURE 8. EXPECTED GROWTH IN OPERATIONAL DELAY AT AWP AIRPORTS WITHOUT RESECTORIZATION PLAN IN 2000

TABLE 6. TOTAL HOURLY OPERATIONAL DELAY FOR 1995 AND 2000 WITH AND WITHOUT RESECTORIZATION

AIRPORTS	1995B	1995R	2000B	2000R
BUR	2,343	2,212	2,517	2,517
LAS	2,997	2,974	4,979	5,055
LAX	30,255	27,461	67,503	49,674
LGB	46,722	45,661	6,992	7,102
OAK	9,421	9,681	15,249	15,782
ONT	1,762	1,781	3,893	3,739
SAN	5,055	4,678	6,734	6,655
SFO	28,774	27,893	51,828	49,197
SJC	10,490	14,182	21,264	20,773
SNA	125,662	125,072	258,236	259,508

For the 2000 baseline cases, the operational delay increases at all AWP airports, except LGB, due to the expected growth in demand. These changes are attributed to improvements in the arrival and departure times in the simulation. At LAX and SFO, delay increases considerably compared to 1995. In the 2000 resectorization cases, LAX gains the most, followed by SFO, with a substantial decrease in delay.

Figure 9 compares 1995B to 1995R, and figure 10 compares 2000B to 2000R. Both show the annual hourly and percent reduction in delay due to the implementation of the AWP Resectorization Plan. In 1995, the negative percentages at OAK, ONT, and SJC indicate that operational delay has increased with resectorization. The delay at SJC has increased by 35 percent due to the changes in the arrival and departure times. OAK delay increased by approximately 3 percent. At ONT, where there are numbers on the top and bottom of the bar, it indicates that the ground delay increased by 30 hours, and the airborne delay decreased by 11 hours in 1995. Therefore, the total operational delay at ONT has increased by one percent.

In 2000, LAX clearly shows the most benefit with a total of 17,829 hours reduction in operational delay or 26.4 percent, followed by SFO with 2,631 hours or 5.1 percent, ONT with 154 hours or 4 percent, and SJC with 491 hours or 2.3 percent. The AWP Resectorization Plan does not benefit OAK in either year, but

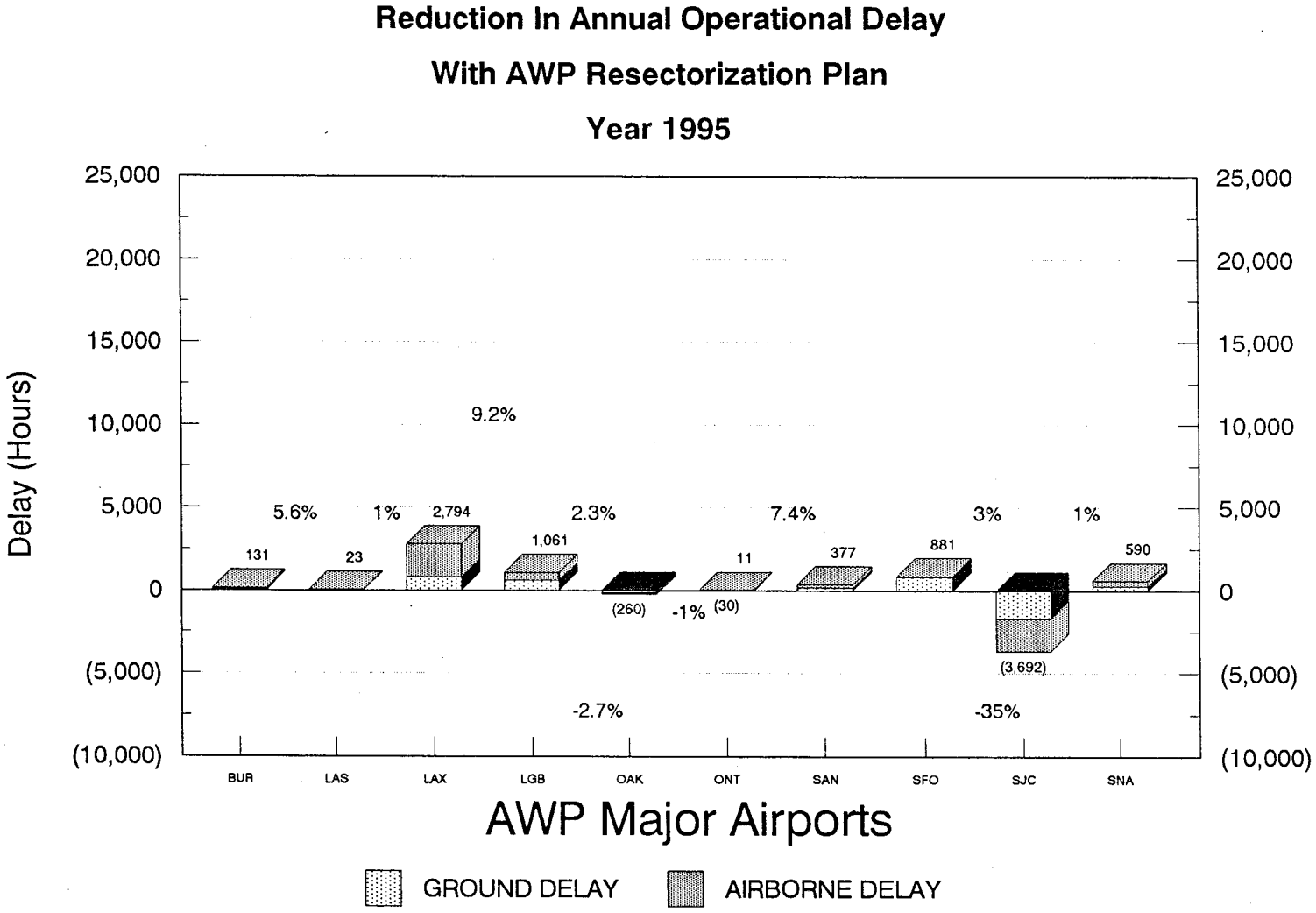
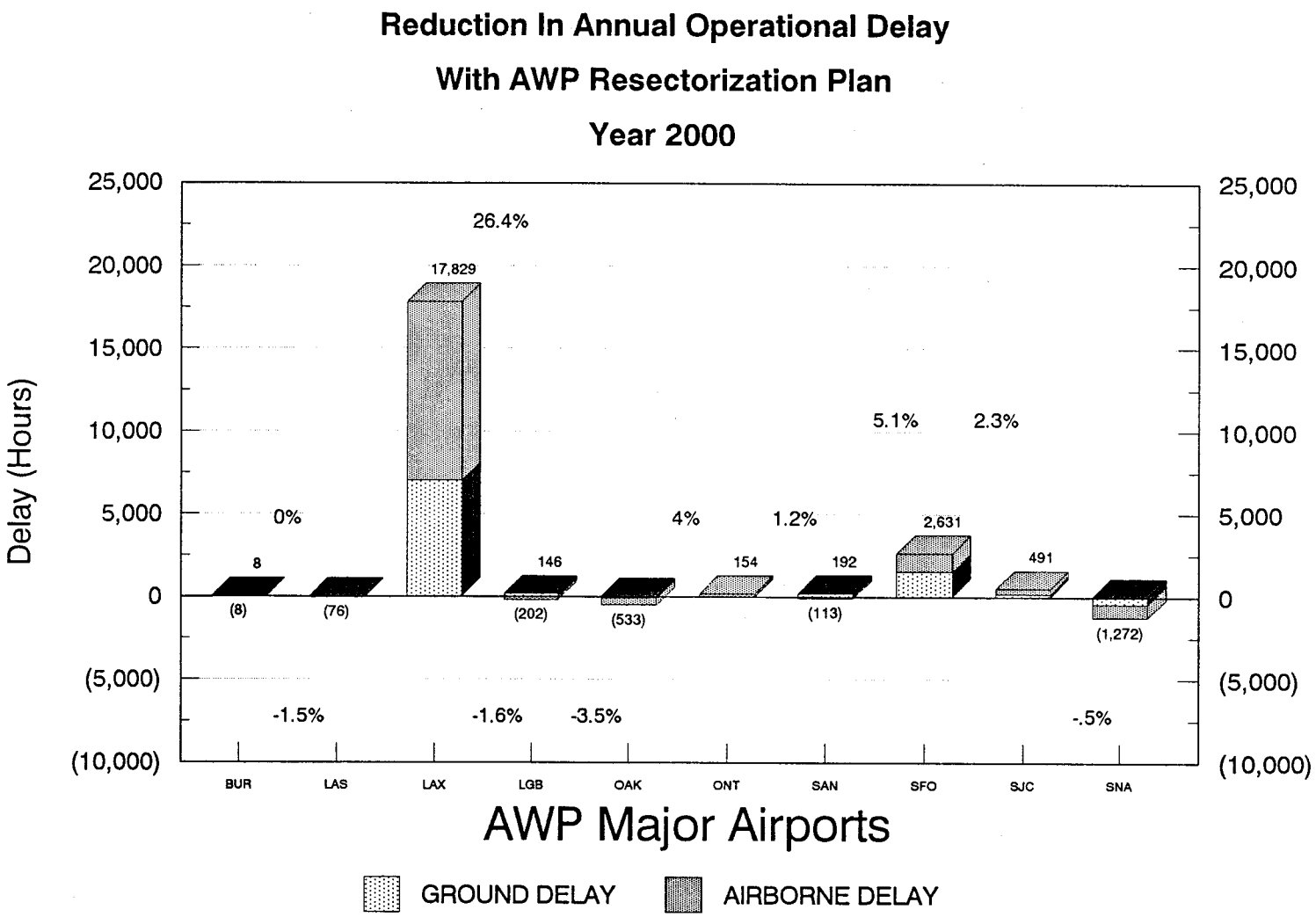


FIGURE 9. REDUCTION IN ANNUAL OPERATIONAL DELAY AT AWP AIRPORTS WITH THE RESECTORIZATION PLAN IN 1995



2000B = Baseline, 2000R = Resectorization
Delta = (2000B - 2000R), % = Delta/2000B

FIGURE 10. REDUCTION IN ANNUAL OPERATIONAL DELAY AT AWP AIRPORTS WITH THE RESECTORIZATION PLAN IN 2000

it does benefit SJC in 2000, where the operational delay shows a decrease of 2.3 percent compared to an increase of 35 percent in 1995. The changes at BUR, LAS, SAN, and SNA are minimal. As far as the operational delay is concerned, the AWP Resectorization Plan provides maximum benefits in year 2000 with the proposed routes in place, including all the slated system improvements.

Table 7 shows the daily average minutes of operational delay at the AWP airports for the time frame modeled. Operational delay has shown slight reductions at LAX, SFO and most of the AWP airports.

TABLE 7. DAILY AVERAGE MINUTES OF OPERATIONAL DELAY AT AWP AIRPORTS

AIRPORTS	1991B	1995B	1995R	2000B	2000R
BUR	.8	1.2	1.1	1.1	1.2
LAS	1.3	1.0	1.0	1.5	1.6
LAX	3.1	4.8	4.3	10.0	7.4
LGB	2.9	11.0	10.7	1.5	1.5
OAK	.5	2.6	2.6	3.8	4.0
ONT	.9	1.1	1.1	1.8	1.7
SAN	1.3	2.2	2.0	2.6	2.6
SFO	2.8	6.1	6.0	9.8	8.3
SJC	.8	2.7	3.7	4.7	4.6
SNA	16.0	24.0	23.8	46.6	46.8

4.2 AWP AIRPORTS OPERATIONAL DELAY COST.

Section 2.3 briefly summarized how the air carriers cost data are obtained from the Office of Airline Statistics, Data Administration Division, DAI-20. The NASPAC Cost of Delay Module translates delay incurred in the simulation into cost based on operational and passenger delay with 1992 dollars.

The savings at AWP airports are attributed to the reduction in operational delay from added airport capacity due to the AWP Resectorization Plan. Table 8 shows the operational delay cost at AWP airports for the time frame modeled.

TABLE 8. AWP AIRPORTS COST OF OPERATIONAL DELAY ($1992)

AIRPORT	1995B	1995R	2000B	2000R
BUR	$3,452,142	$2,892,770	$3,509,997	$3,555,847
LAS	3,328,899	3,377,140	5,064,113	5,138,559
LAX	46,173,976	39,274,153	109,196,849	76,650,417
LGB	57,777,123	56,901,321	9,835,856	10,404,350
OAK	13,146,215	14,063,931	24,505,342	26,030,058
ONT	1,933,136	2,077,946	4,278,606	3,828,736
SAN	7,232,291	6,479,780	9,027,140	9,130,654
SFO	45,587,107	45,118,380	81,833,541	78,649,361
SJC	5,623,761	5,901,344	10,801,745	10,390,205
SNA	27,532,346	28,054,507	59,299,482	59,502,640

Table 9 shows the operational delay savings at AWP airports due to the AWP Resectorization Plan for 1995 and 2000. In some cases, the delay cost has increased due to the Plan, and will be denoted by "-" for these airports. At LAS and SNA, the 1995 simulation results show a reduction in operational delay of one percent, but the actual operational cost increases slightly. This is due to a change in the fleet mix at these two airports. Future demand shows that larger aircraft, such as the B757 which NASPAC uses as a model, are being used and cost more to operate.

In 2000, the results show that the operational delay at BUR remained the same, but the operational delay cost increases by 1.3 percent. SAN shows a reduction in operational delay of 1.2 percent, but an actual delay cost increase of 1.1 percent. LAS, LGB, and OAK show an increase in the delay cost over 1995, but the delay cost at ONT and SNA decreases, due to changes in the fleet mix.

TABLE 9. ANNUAL OPERATIONAL DELAY SAVINGS AT AWP AIRPORTS WITH AWP RESECTORIZATION PLAN

AIRPORTS	1995	2000
BUR	$559,372	-$45,870
LAS	-48,241	- 74,446
LAX	6,899,823	32,546,432
LGB	875,802	-568,494
OAK	-971,716	-1,524,716
ONT	-144,810	449,870
SAN	752,511	-103,514
SFO	468,727	3,234,180
SJC	-277,583	411,540
SNA	-522,161	-203,158

4.3 SYSTEM-WIDE OPERATIONAL DELAY.

Table 10 shows the total hourly operational delay system-wide without the AWP Resectorization Plan, for all the baseline cases modeled (1991, 1995, and 2000). Delay increases over time with or without the Plan, but the increase in delay is smaller with the Plan. System-wide operational delay reduction for any given year is roughly equal to the operational delay reduction at AWP airports. This is not unusual, since the proposed routes are mostly in West Coast airspace.

Without the AWP Resectorization Plan, simulation results have shown that the operational delay in the NAS will increase by an estimated 48 percent in year 1995, and an estimated 128 percent in year 2000.

TABLE 10. TOTAL HOURLY OPERATIONAL DELAY SYSTEM-WIDE

1991 BASELINE	1995 BASELINE	2000 BASELINE
1,102,534	1,637,165	2,519,254

Table 11 shows the total hourly operational delay system-wide, with and without the AWP Resectorization Plan for the years 1995 and 2000, where "D" denotes "delay", "TOT" denotes "total", and "OPER" denotes operational. For 1995 and 2000 baseline cases, the new sector design was used to run the simulation since it was implemented in 1992, but not the proposed routes changes. ZLA-530 provided the ACES data, which reflected these changes. For 1995 and 2000 resectorization cases, the new sector design was used to run the simulation, as well as the proposed routes, which are the main issue for this study.

In 1995, the results clearly show that the AWP Resectorization Plan does not provide the NAS as a whole, the same magnitude of benefits gained by AWP airports, as expected.

TABLE 11. TOTAL HOURLY OPERATIONAL DELAY SYSTEM-WIDE WITH AND WITHOUT RESECTORIZATION FOR FUTURE YEARS

COMPONENTS	1995B	1995R	2000B	2000R
GROUND D	711,921	702,294	1,122,805	1,099,740
AIRBORNE D	925,244	921,644	1,396,449	1,376,429
TOT OPER D	1,637,165	1,623,938	2,519,254	2,476,168

Figure 11 shows the reduction in operational delay system-wide to be 0.8 percent. Reducing the operational delay to ground and airborne delay shows that the ground delay benefited by 1.4 percent compared to 0.4 percent reduction in the airborne delay. This means that departures had the greatest benefit. This is due to improvements in the departures at AWP airports, and changes in arrival times at airports that are located to the north and northeast of the Los Angeles Basin, where the proposed route changes took place system-wide.

In 2000, the results show some improvement over 1995, as shown in Figure 12. The breakdown in benefits are 1.4 percent in airborne delay and 2 percent in ground delay, with total operational delay reduction of 1.7 percent in 2000 compared to 0.8 percent in 1995. These benefits are also attributed to system-wide improvements slated to be completed by 2000.

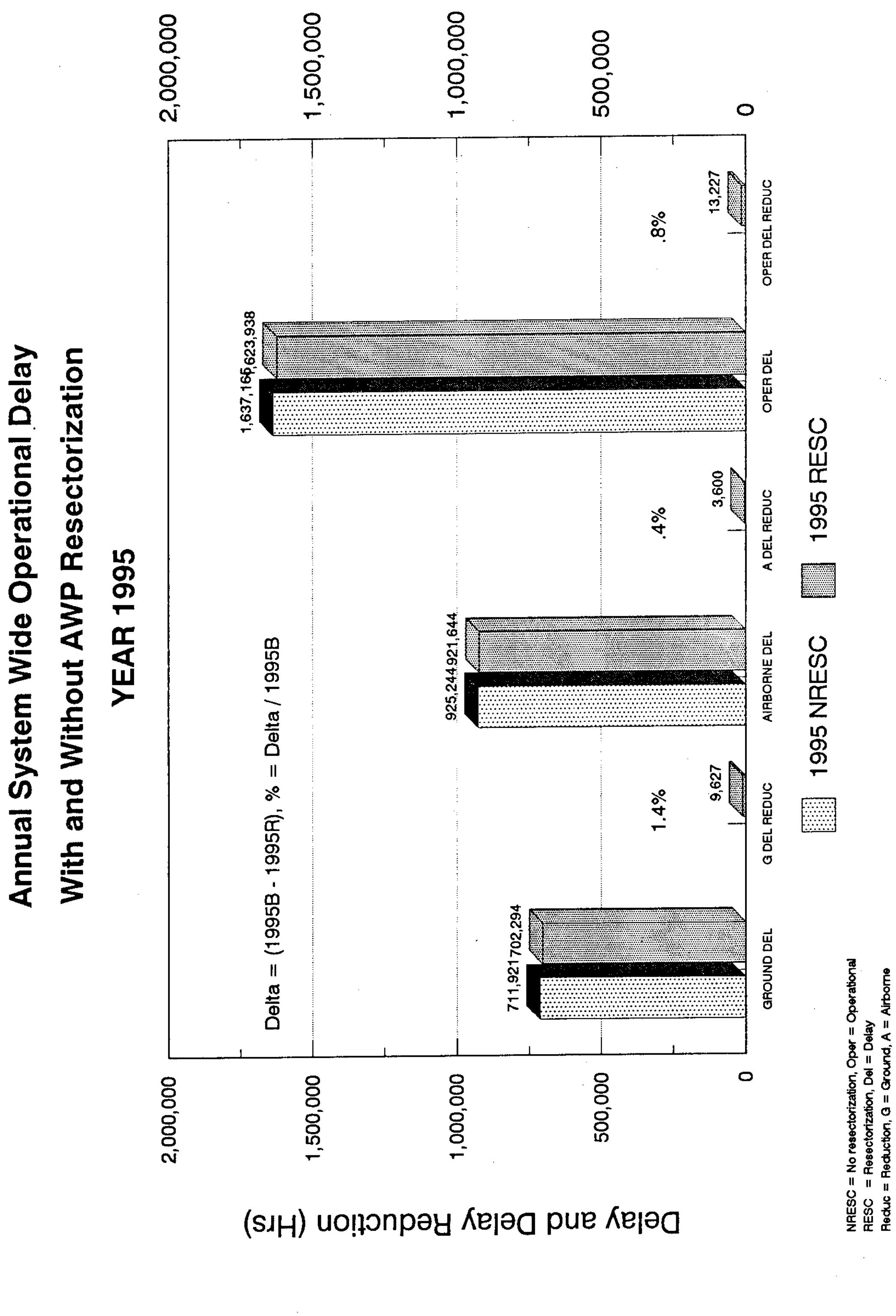


FIGURE 11. 1995 SYSTEM-WIDE OPERATIONAL DELAY AND REDUCTION

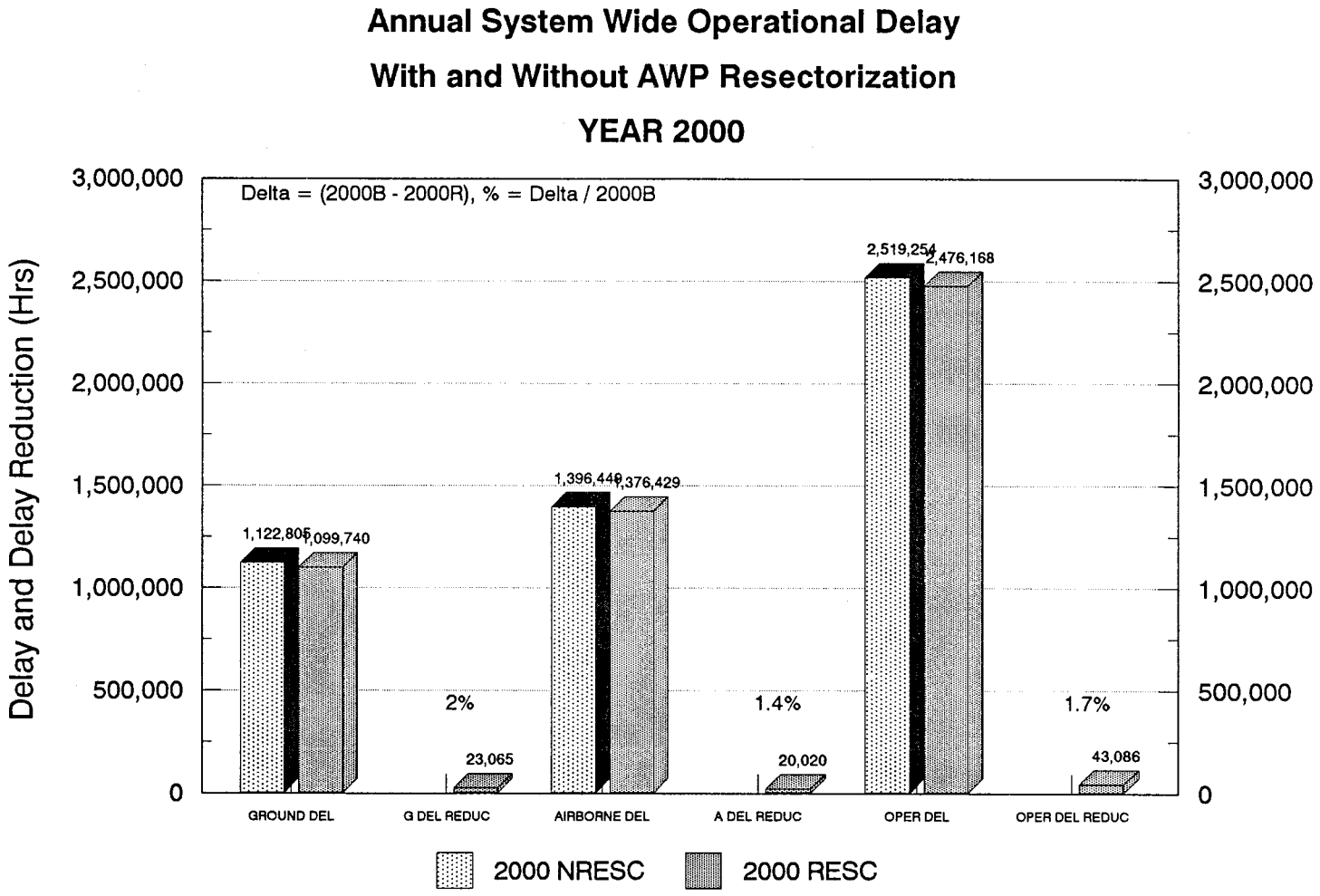


FIGURE 12. 2000 SYSTEM-WIDE OPERATIONAL DELAY AND REDUCTION

4.4 SYSTEM-WIDE OPERATIONAL DELAY COST.

System-wide operational delay costs were estimated for the years 1995B, 1995R, 2000B, and 2000R as shown in table 12.

TABLE 12. SYSTEM-WIDE OPERATIONAL DELAY COST ($1992)

1995B	1995R	2000B	2000R
$3,190,810,793	$3,178,781,195	$4,973,641,388	$4,922,600,930

The operational delay savings, system-wide for 1995, due to the AWP Resectorization Plan, is $12,029,598 ($1992) or 0.4 percent saving. For 2000, the estimated operational delay savings is $51,040,455 or one percent reduction in delay cost. Figure 13 shows delay savings and percent of cost reduction for the years 1995 and 2000.

4.5 AWP AIRPORTS PASSENGER DELAY.

As far as the operational delay is concerned, the results have shown that the AWP Resectorization Plan is beneficial locally and system-wide. Exploring the benefits to the passengers looks somewhat different. As expected, the travel times for the proposed routes between San Francisco Bay Area and the Los Angeles Basin are actually longer because the routes are located offshore to avoid cross over traffic, head-ons, and noise. See figures 14 through 17.

Table 13 shows the total annual hourly passenger arrival delay at AWP airports for all future scenarios modeled. These results clearly indicate that the AWP Resectorization Plan does not favor the passengers, and as the demand grows in 1995 and 2000, the passenger delay will increase at a greater rate. This is due to the ripple effect in the system, where the passenger delay propagates throughout the system and only shows at the destination airports.

The simulation results show an increase in the passenger delay across the board for both 1995 and 2000, except at LAS in 2000, where they show a slight reduction. The airports that have the highest traffic volume show the largest passenger delay increase, such as LAX, SFO, and SNA. The AWP Resectorization Plan benefits LGB more in 2000, which is the pattern observed in the operational delay for the same time frame.

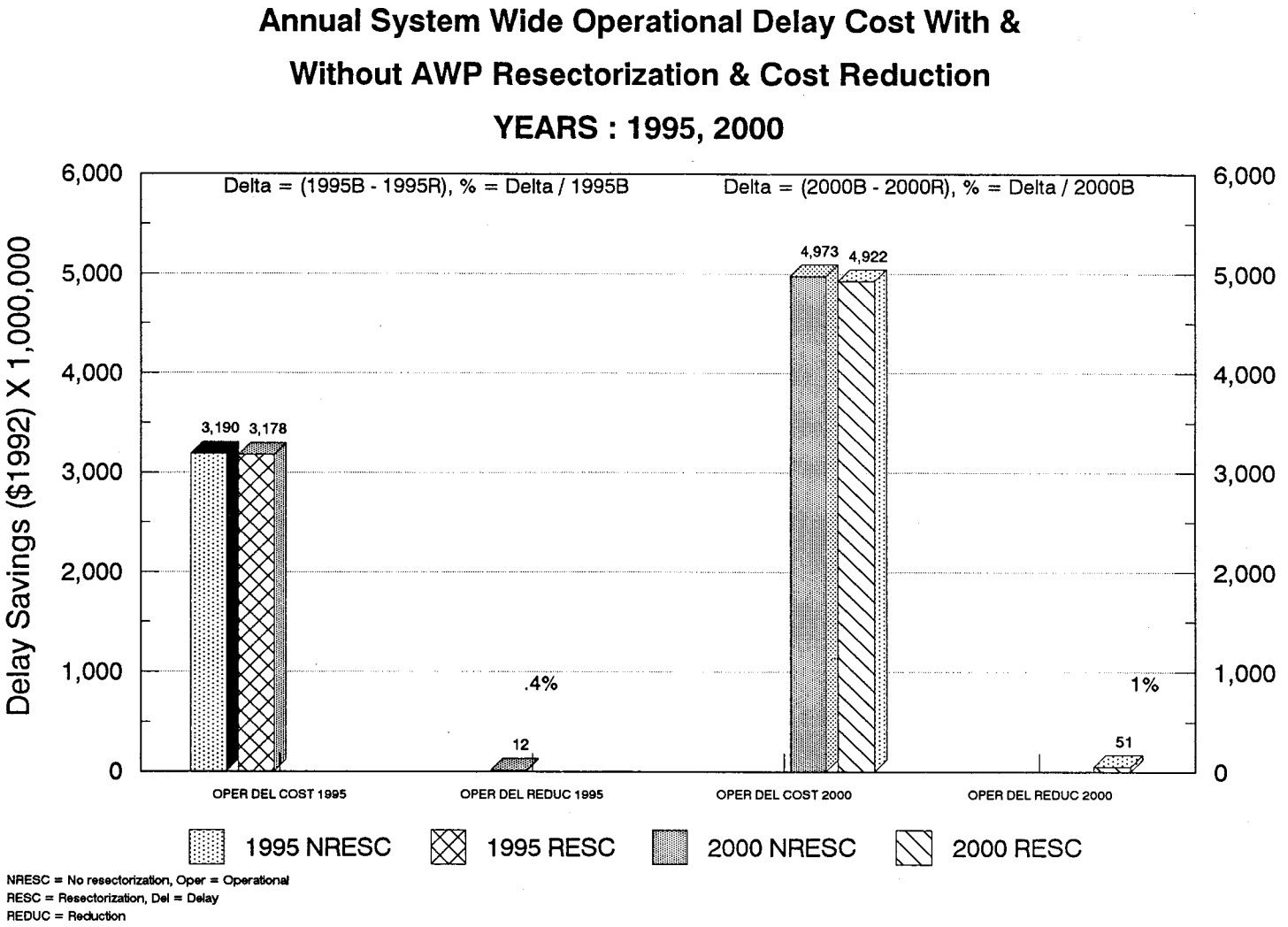
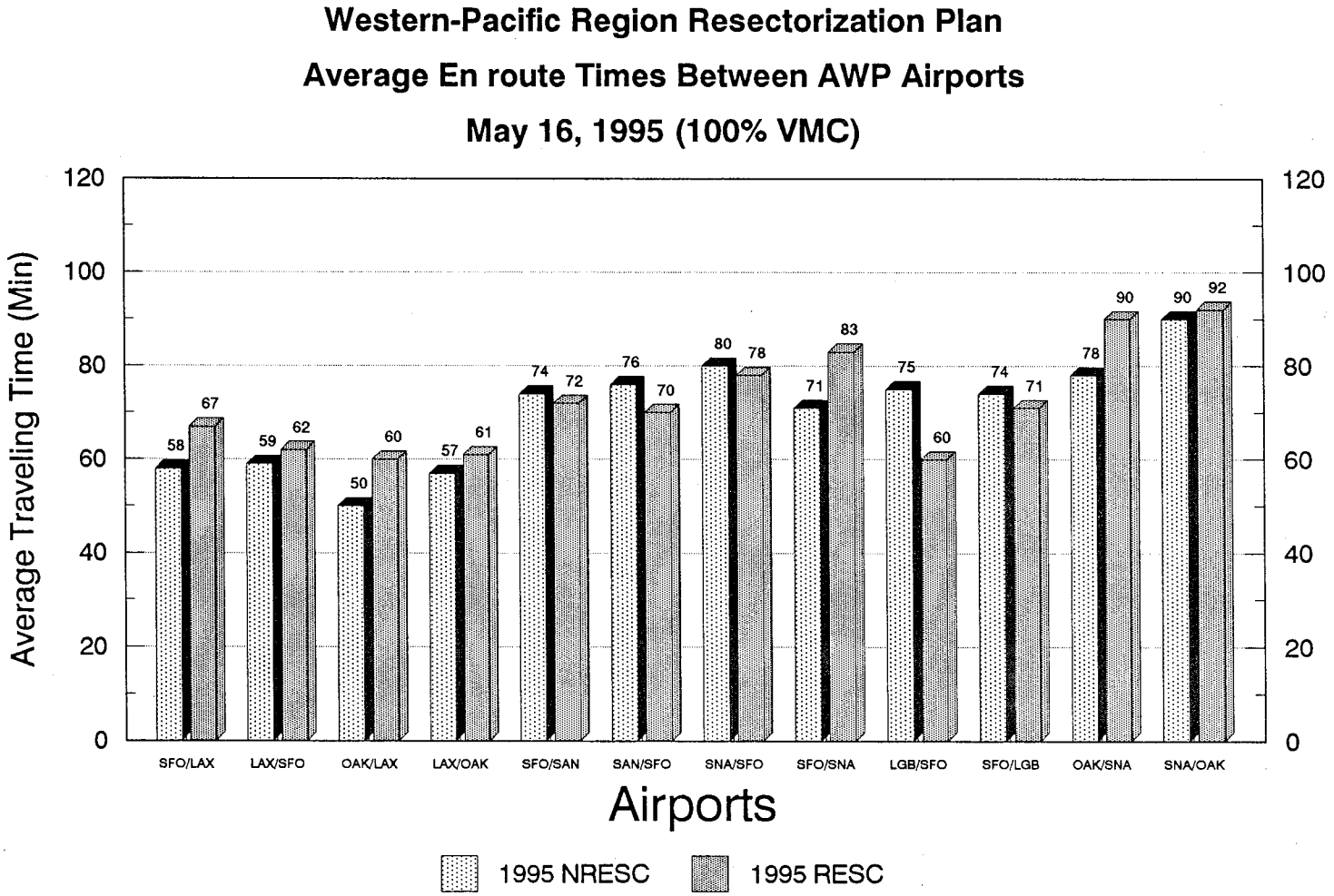


FIGURE 13. ANNUAL SYSTEM-WIDE OPERATIONAL DELAY COST WITH AND WITHOUT RESECTORIZATION AND REDUCTION



NRESC = No resectorization
RESC = Resectorization
SFO/LAX = Depart SFO/Arrive LAX

FIGURE 14. AVERAGE EN ROUTE TIMES BETWEEN AWP AIRPORTS FOR 1995

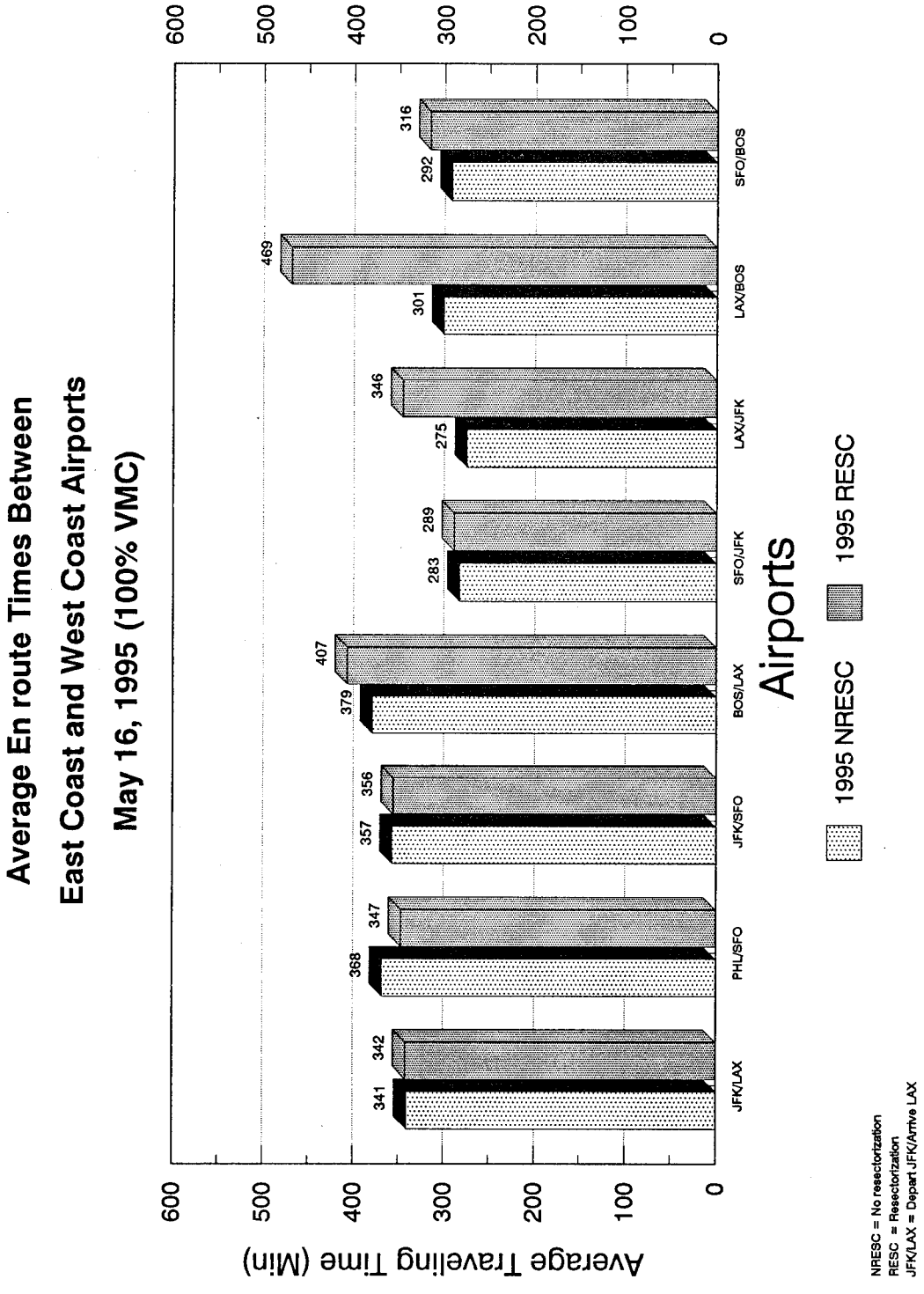


FIGURE 15. AVERAGE EN ROUTE TIMES BETWEEN EAST AND WEST COAST AIRPORTS FOR 1995

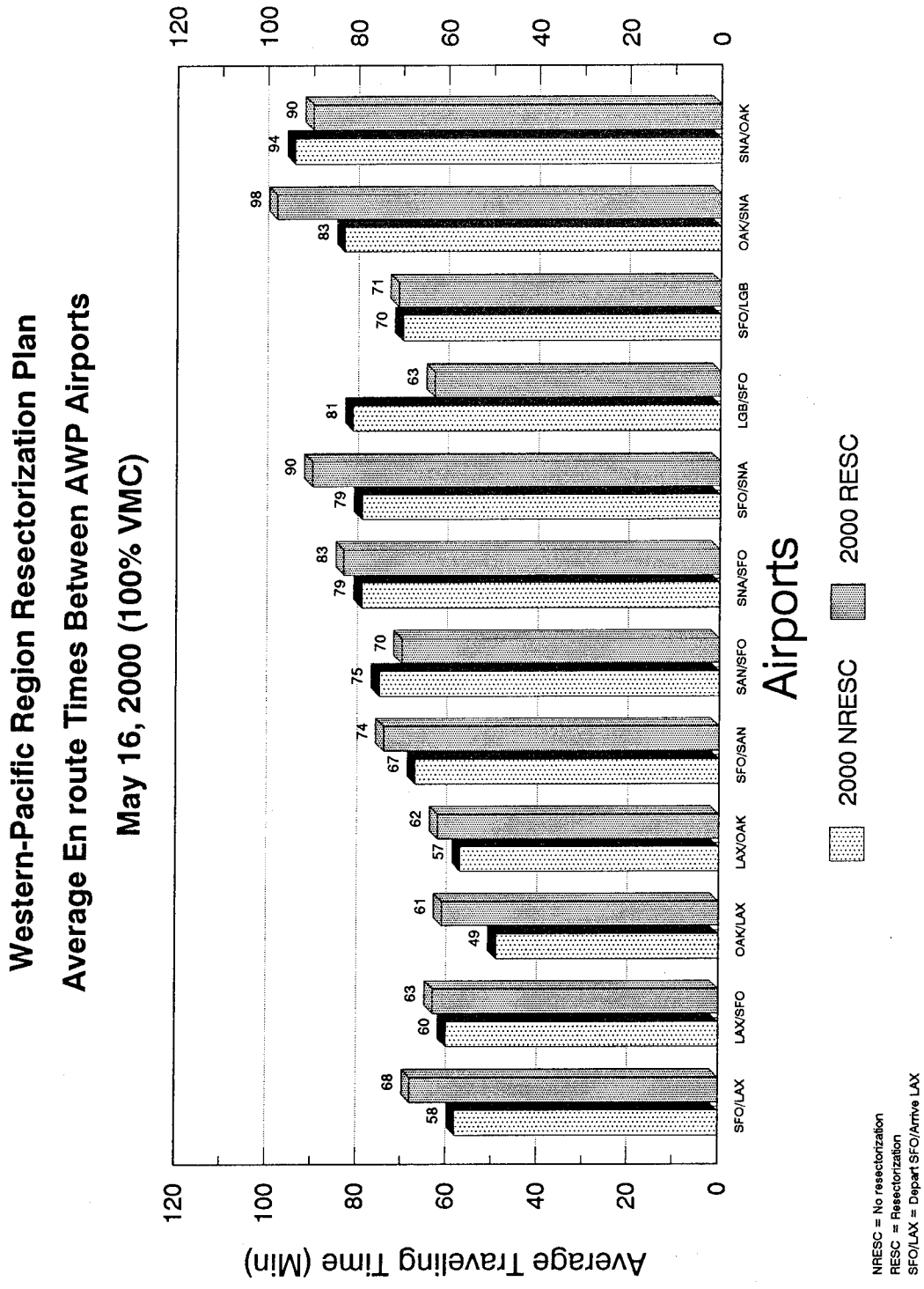


FIGURE 16. AVERAGE EN ROUTE TIMES BETWEEN AWP AIRPORTS FOR 2000

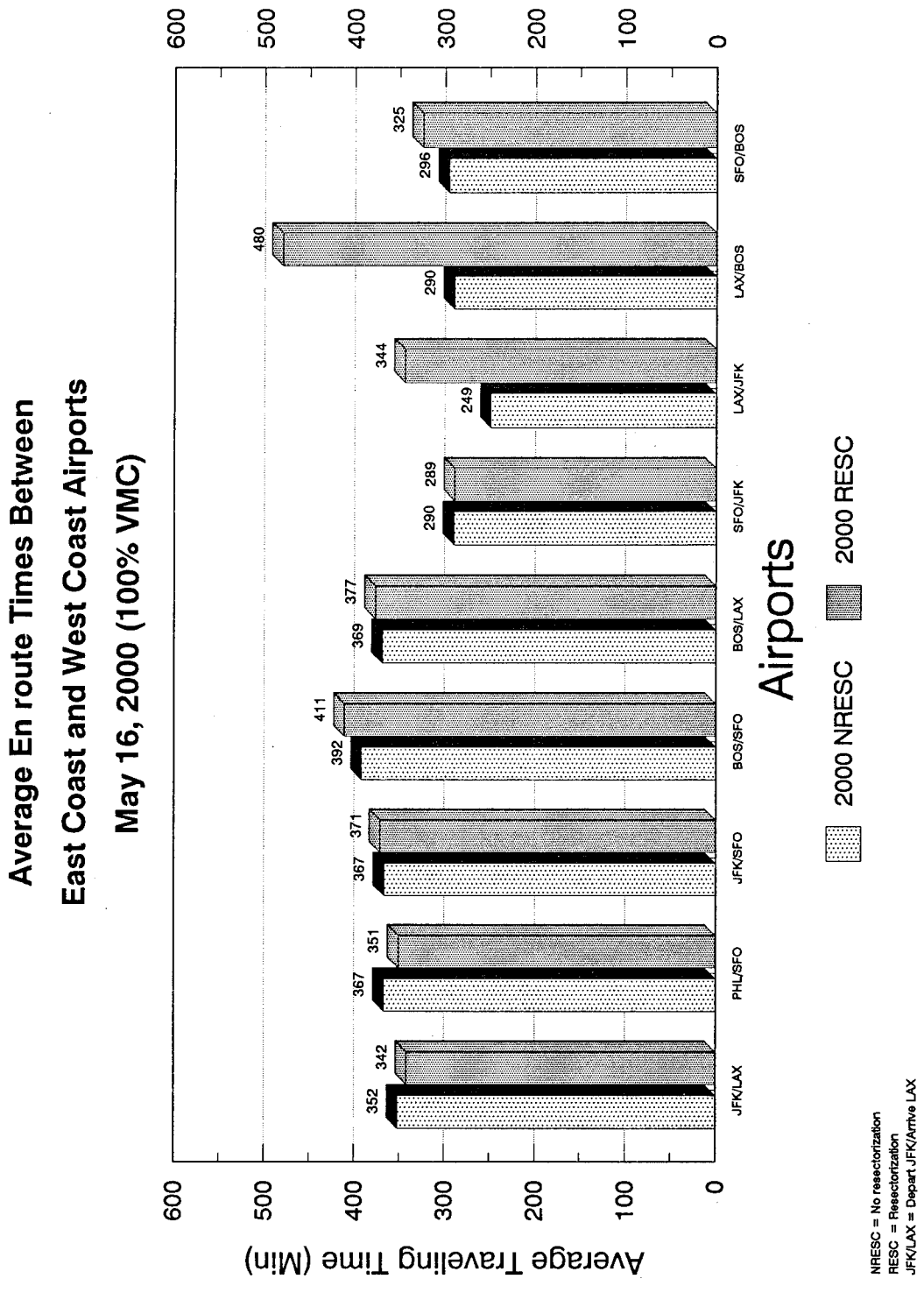


FIGURE 17. AVERAGE EN ROUTE TIMES BETWEEN EAST AND WEST COAST AIRPORTS FOR 2000

TABLE 13. TOTAL HOURLY PASSENGER ARRIVAL DELAY FOR 1995 AND 2000 WITH AND WITHOUT RESECTORIZATION

AIRPORTS	1995B	1995R	2000B	2000R
BUR	11,089	13,113	13,535	16,056
LAS	35,440	36,037	47,413	47,006
LAX	52,332	99,562	93,629	131,733
LGB	43,362	43,685	26,384	27,165
OAK	37,214	39,600	46,945	49,934
ONT	19,895	21,187	31,314	32,820
SAN	18,894	29,543	29,168	39,608
SFO	46,288	51,033	81,955	86,737
SJC	22,303	25,546	35,571	36,667
SNA	100,104	103,107	180,100	184,951

Table 14 shows the increase in passenger arrival delay at AWP airports due to the AWP Resectorization Plan for 1995 and 2000. This is the difference between the baseline and the resectorization cases for each year modeled. It is denoted by "delta" on all the graphs where it is used. The "-" sign means an increase in the passenger arrival delay, and a "+" sign means that the delay has decreased for that particular airport and time frame.

Table 15 shows the daily average minutes of passenger arrival delay at AWP airports for the time frame modeled. Each value represents the daily average passenger arrival delay per aircraft with and without the AWP Resectorization Plan.

In 1995 cases, there was no drastic increase or decrease in the average delay, except at LAX, where the average delay increased by 7.5 minutes, and at SAN with an increase of 4.8 minutes. The only reduction in the average delay due to the Plan was observed at LAS, in 2000, but LGB benefits the most with a reduction of 4.2 minutes compared to 1995.

In 2000, with the Plan scenario, SNA shows the largest increase with 13.7 minutes in the daily average delay compared to 1995. LAX shows an increase of 5.8 minutes, with the rest of the airports showing a large daily average delay increase, especially LAS, OAK, ONT, SAN, and SFO.

TABLE 14. ANNUAL PASSENGER ARRIVAL DELAY INCREASE AT AWP AIRPORTS FOR 1995, 2000

AIRPORTS	1995	2000
BUR	-2,024	-2,521
LAS	-597	+407
LAX	-47,230	-38,104
LGB	-323	-781
OAK	-2,386	-2,989
ONT	-1,292	-1,506
SAN	-10,649	-10,440
SFO	-4,745	-4,782
SJC	-3,243	-1,096
SNA	-3,003	-4,851

TABLE 15. DAILY AVERAGE MINUTES OF PASSENGER ARRIVAL DELAY AT AWP AIRPORTS FOR TIME FRAME MODELED

AIRPORTS	1991B	1995B	1995R	2000B	2000R
BUR	4.2	5.5	6.5	6.4	7.6
LAS	9.1	12.2	12.4	15.0	14.9
LAX	5.8	8.3	15.8	14.0	19.8
LGB	7.0	10.2	10.3	5.9	6.1
OAK	8.6	10.2	10.9	11.9	12.7
ONT	9.9	11.5	12.3	14.2	14.9
SAN	6.2	8.5	13.3	11.5	15.7
SFO	5.5	9.9	10.9	15.5	16.4
SJC	4.3	5.8	6.6	7.9	8.1
SNA	15.4	19.2	19.8	32.6	33.5

The results clearly show that SNA has the highest daily average passenger delay. The delay shows 15.4 minutes in 1991, 19.2 minutes in 1995, and 32.6 minutes in 2000. This is due to a high volume of GA traffic and to the physical limitation of the airport.

Figure 16 compared 1995B to 1995R, and figure 17 compared 2000B to 2000R. Both figures showed the annual hourly increase in passenger arrival delay and the percent increase due to the AWP Resectorization Plan.

The 1995 results show that the airports with the most impact are LAX with 90 percent increase, SAN with 56 percent, BUR with 18 percent, SJC with 15 percent, and SFO with 10 percent. At OAK and ONT, the increase is 6 percent, SNA has 3 percent, and LGB has only one percent. The simulation results show that the airports with the largest operational delay reduction have the largest passenger delay increase. This is reasonable because these airports have the highest traffic volume. Passenger delay reflects the ripple effects of delay at a given airport.

In 2000, the results show that the airports affected the most are LAX with 41 percent, SAN with 36 percent, BUR with 19 percent, and the rest of the airports with 6 percent or less. LAX shows 49 percent improvement over 1995 with the Resectorization Plan, and SAN shows 20 percent, but at BUR, the passenger arrival delay increases by one percent. The results indicate, as shown in figures 18, 19 and 20, that the AWP Resectorization Plan provides the most benefits in 2000. The same pattern was observed in the operational delay at local level and system-wide.

4.6 AWP AIRPORTS PASSENGER ARRIVAL AND SYSTEM-WIDE DELAY COST.

Section 4.2 explained the operational delay cost obtained using the Cost of Delay module. The passenger arrival delay cost was calculated in the same manner.The increase in the passenger arrival delay cost at AWP airports follows the same pattern observed for the passenger arrival delay, and is attributed to ripple effects. The cost of delay and rate at each airport varies, depending on the fleet mix. Table 16 shows the total passenger arrival delay cost at AWP airports with and without the AWP Resectorization Plan for the years 1995 and 2000.

Table 17 shows the passenger arrival delay cost increase at AWP airports due to the AWP Resectorization Plan for 1995 and 2000. The cost increase represents the difference in cost between each of the future years with and without resectorization. The "-" sign denotes an increase in the cost, and "+" sign indicates a decrease in the cost.

System-wide passenger arrival delay costs, estimated for the years 1995B, 1995R, 2000B, and 2000R, are shown in table 18.

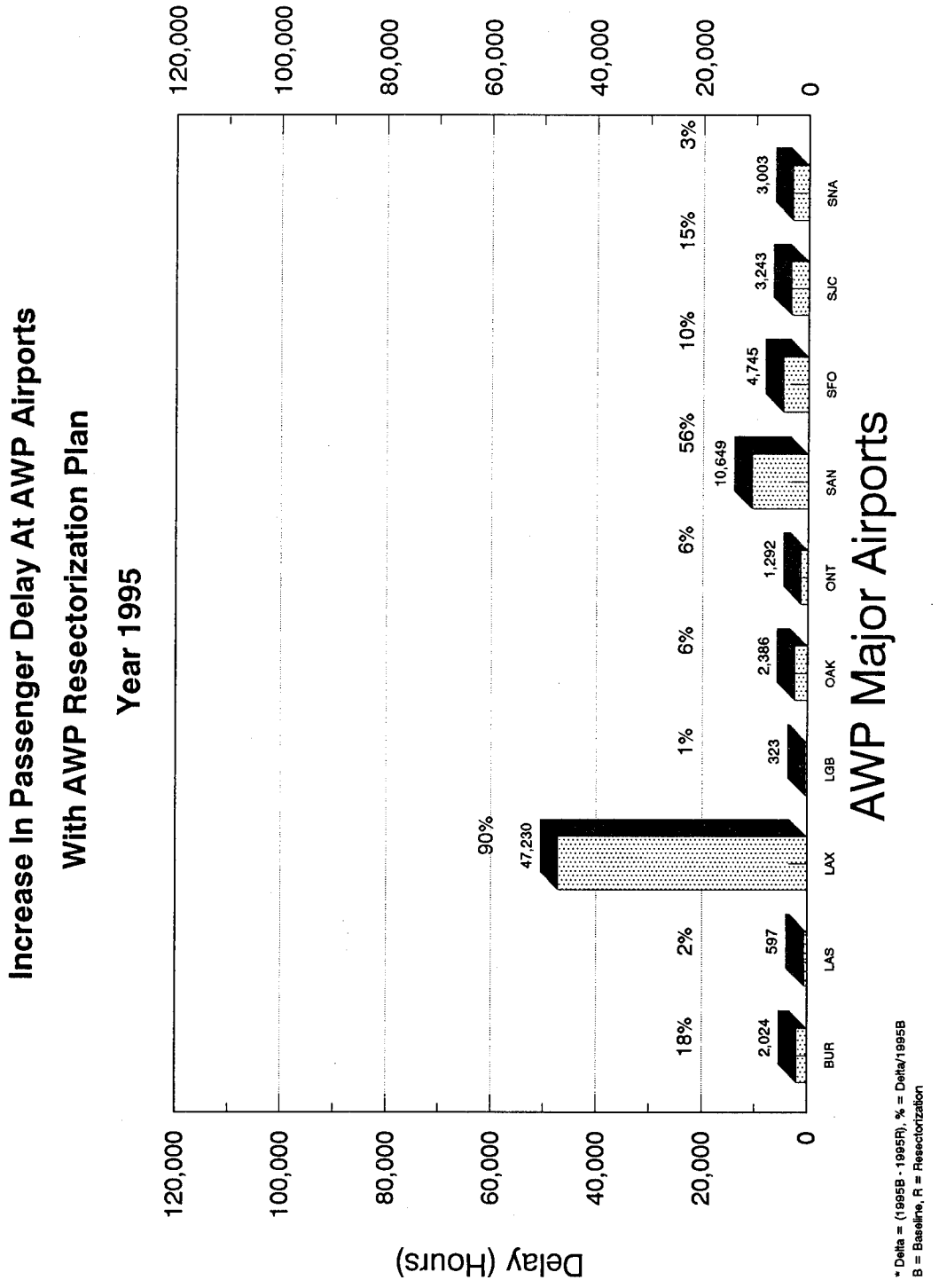


FIGURE 18. PASSENGER ARRIVAL DELAY INCREASE WITH RESECTORIZATION AT AWP AIRPORTS FOR 1995

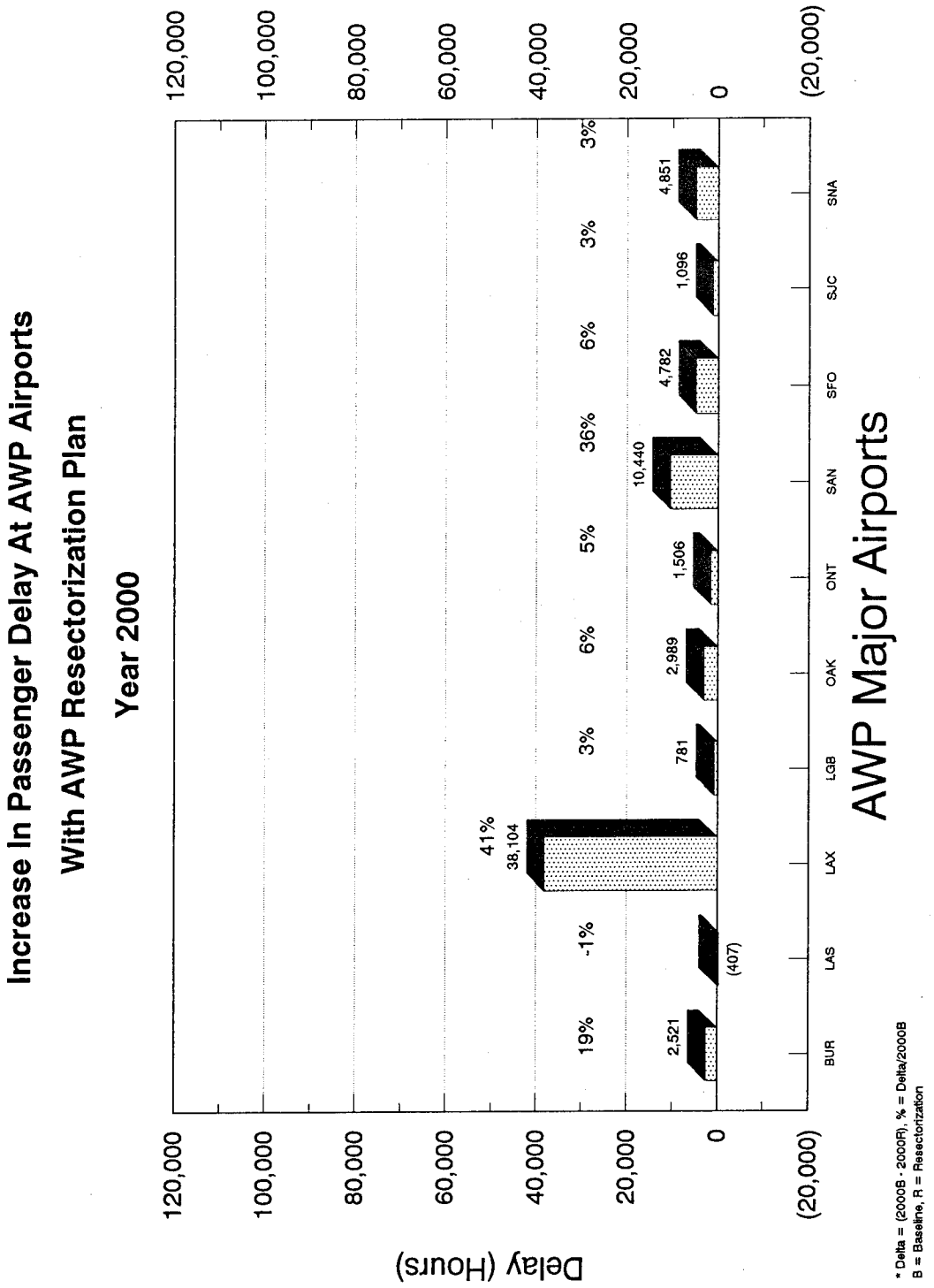


FIGURE 19. PASSENGER ARRIVAL DELAY INCREASE WITH RESECTORIZATION AT AWP AIRPORTS, 2000

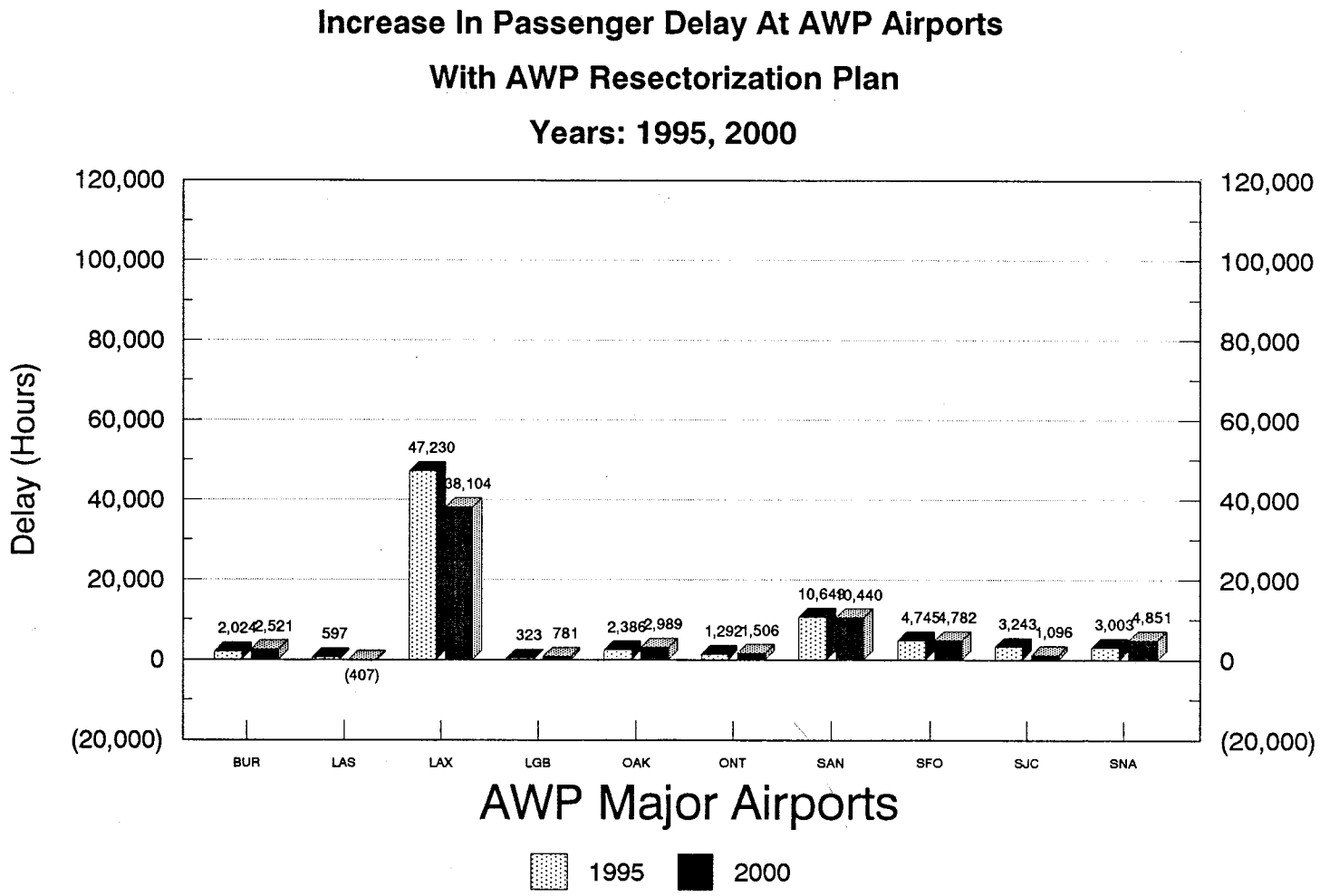


FIGURE 20. INCREASE IN PASSENGER ARRIVAL DELAY IN 1995 AND 2000

TABLE 16. ANNUAL PASSENGER ARRIVAL DELAY COST FOR 1995 AND 2000

AIRPORTS	1995B	1995R	2000B	2000R
BUR	$16,810,163	$21,142,682	$20,130,882	$25,367,206
LAS	85,225,160	83,079,931	116,518,954	114,957,428
LAX	122,395,560	284,623,235	216,709,579	359,241,925
LGB	71,465,521	73,299,953	43,674,674	44,874,405
OAK	76,853,341	81,353,135	97,924,205	104,039,738
ONT	43,945,810	48,490,613	73,929,410	77,694,497
SAN	43,743,503	70,415,263	66,190,450	92,772,360
SFO	94,463,690	105,307,586	173,860,001	185,089,041
SJC	17,838,536	20,687,024	35,953,421	38,577,105
SNA	37,590,065	42,004,134	78,576,110	82,970,468

TABLE 17. ANNUAL PASSENGER ARRIVAL DELAY COST INCREASE AT AWP AIRPORTS WITH RESECTORIZATION ($1992)

AIRPORTS	1995	2000
BUR	-$4,332,519	-5,236,324
LAS	+2,145,229	+1,561,526
LAX	-162,227,675	-142,532,346
LGB	-1,834,432	-1,199,731
OAK	-4,499,794	-6,115,533
ONT	-4,544,803	-3,765,087
SAN	-26,671,760	-26,581,910
SFO	-10,843,896	-11,229,040
SJC	-2,848,488	-2,632,684
SNA	-4,414,609	-4,394,358

TABLE 18. SYSTEM WIDE PASSENGER ARRIVAL DELAY COST FOR 1995 2000 WITH AND WITHOUT RESECTORIZATION ($1992)

1995B	1995R	2000B	2000R
$3,851,702,138	$4,486,247,904	$6,069,966,153	$6,575,674,250

The results in this table show that the passenger arrival delay cost will increase by $634,545,000 or 16 percent in 1995 with the Plan. In 2000, the passenger arrival delay cost estimate shows an increase of $505,708,000 or 8 percent. These values represent the differences between the baseline and the resectorization cases for the years modeled. This shows that the AWP Resectorization Plan provides the most benefits in 2000.

5. CONCLUSIONS.

It is extremely difficult to increase capacity and reduce delay at an airport without a major construction project to improve the terminal area or build a new runway. The task becomes more difficult trying to improve Western-Pacific Region's (AWP's) 10 major airports simultaneously without drastically increasing delay somewhere else in the system, especially when most of the airports are already at maximum capacity. See appendix A for a list of AWP's 58 airports and IDs. The Los Angeles ARTCC (ZLA) Resectorization Committee, ZLA-3A5, nearly accomplished its objectives with mere hard work, research, coordination, and without any major construction. The results indicate that the increased capacity provided by the AWP Preliminary Resectorization Plan of 1993 (particularly the proposed routes and new sector design) results in a significant reduction in operational delay at most of the major AWP airports. The reduction in delay with resectorization was evident despite the additional demand placed on AWP airports for future years.

A comparison of the percent reduction in annual operational delay at AWP airports with resectorization in place is given in table 19, where the "-" sign denotes an increase.

Table 20 shows the operational delay cost saving estimates at LAX and SFO for a 5-year period (1995-2000), with the AWP Resectorization Plan in place. The work on this study has generated reasonable and conservative estimates of the cost of operational delay under a variety of possible conditions. Linear interpolation was used to estimate the savings for the years that were not modeled.

TABLE 19. PERCENT REDUCTION IN OPERATIONAL DELAY AT AWP AIRPORTS WITH RESECTORIZATION

AIRPORTS	1995	2000
BUR	5.6%	0.0%
LAS	1.0%	-1.5%
LAX	9.2%	26.4%
LGB	2.3%	-1.6%
OAK	-2.7%	-3.5%
ONT	-1.0%	4.0%
SAN	7.4%	1.2%
SFO	3.0%	5.1%
SJC	-35.0%	2.3%
SNA	1.0%	-0.5%

TABLE 20. LAX AND SFO OPERATIONAL DELAY COST SAVINGS FOR A 5-YEAR PERIOD

YEAR	LAX	SFO	TOTAL COST
1995	$6,899,823	$468,727	$7,368,550
1996	12,029,145	1,036,218	13,065,363
1997	17,158,466	1,585,709	18,441,175
1998	22,287,787	2,135,200	24,422,987
1999	27,417,108	2,684,691	30,101,799
2000	32,546,432	3,234,180	35,780,612
TOTALS	118,338,761	11,144,725	129,483,486

Table 21 shows the operational delay savings for a 5-year period (1995-2000) for the entire NAS, which encompasses 58 of the busiest airports in the system. Linear interpolation was used, as well, to estimate the savings for the years that were not modeled.

TABLE 21. SYSTEM-WIDE OPERATIONAL DELAY COST SAVING ESTIMATES FOR 5-YEAR PERIOD WITH RESECTORIZATION

YEAR	OPERATIONAL COST
1995	$12,029,598
1996	19,831,769
1997	27,633,940
1998	35,436,111
1999	43,238,281
2000	51,040,455
TOTALS	189,210,154

A comparison of the percent increase in annual passenger arrival delay at AWP airports, with resectorization in place, is given in table 22. LAS is the only airport to show passenger arrival delay reduction in year 2000 with one percent, as indicated with a "-" sign.

TABLE 22. PERCENT INCREASE IN ANNUAL PASSENGER ARRIVAL DELAY AT AWP AIRPORTS WITH RESECTORIZATION

AIRPORTS	1995	2000
BUR	18.0%	19.0%
LAS	2.0%	-1.0%
LAX	90.0%	41.0%
LGB	1.0%	3.0%
OAK	6.0%	6.0%
ONT	6.0%	5.0%
SAN	56.0%	36.0%
SFO	10.0%	6.0%
SJC	15.0%	3.0%
SNA	3.0%	3.0%

Table 23 shows the annual passenger arrival delay cost increase estimates at LAX and SFO for 5-year period (1995-2000) with the AWP Resectorization Plan in place. The results indicate that LAX shows a steady reduction in cost for each of the future years, with maximum benefit occurring in 2000. Linear interpolation was used to estimate the savings for the years that were not modeled.

TABLE 23. LAX AND SFO PASSENGER ARRIVAL DELAY COST INCREASE FOR A 5-YEAR PERIOD

YEAR	LAX	SFO	TOTAL COST
1995	$162,227,675	$10,843,896	$173,071,571
1996	158,288,609	10,920,925	169,209,534
1997	154,349,543	10,997,954	165,347,497
1998	150,410,477	11,074,983	161,485,460
1999	146,471,411	11,152,012	157,623,423
2000	142,532,346	11,229,040	153,761,386
TOTALS	914,280,061	66,218,810	980,498,871

Table 24 shows the system-wide annual passenger arrival delay cost increase for a 5-year period (1995-2000). The results clearly show that the AWP Resectorization Plan provides the maximum benefits in 2000 as well, with the benefits increasing for each of the future years. Linear interpolation was used to estimate the savings for the years that were not modeled.

TABLE 24. SYSTEM-WIDE PASSENGER ARRIVAL DELAY COST ESTIMATES INCREASE FOR 5-YEAR PERIOD WITH RESECTORIZATION

YEAR	PASSENGER COST
1995	$634,545,000
1996	608,778,000
1997	583,011,000
1998	557,244,000
1999	531,477,000
2000	505,710,000
TOTALS	3,420,765,000

6. DISCUSSION.

As far as the operational delay is concerned, the results show that the AWP Resectorization Plan will benefit most of AWP airports for the time frame modeled, with maximum benefits occurring in 2000. LAX shows an impressive 26.4 percent reduction in operational delay with the Plan, as shown in table 19, followed by SFO with 5.1 percent, ONT with 4.0 percent, SJC with 2.3 percent, and SAN with 1.2 percent. The delay reduction at LAX and SFO will translate into monetary savings of $118,338,761, and $11,144,725, respectively, for a total of $129,483,486, for a 5-year period (1995-2000), as shown in table 20.

The AWP Resectorization Plan will provide system-wide benefits with maximum gain occurring in year 2000, with a 1.7 percent reduction in operational delay. The monetary savings for the 5-year (1995-2000) period will be approximately $189,210,154, as shown in table 21.

The AWP Resectorization Plan does not favor the passengers for the future years modeled, but in the year 2000, the passenger arrival delay decreases by 49 percent at LAX compared to 1995, and by 20 percent at SAN. The monetary increase in passenger arrival delay cost at LAX will be approximately $914,280,061 for the 5-year (1995-2000) period, and SFO $66,218,810 for a total of $980,498,871, as shown in table 23. The system-wide passenger arrival delay will be approximately $3,420,765,000 as shown in table 24.

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Appendix A

Airports Modeled by NASPAC

Airport ID	Airport Name	Airport ID	Airport Name
ABQ	Albuquerque	MCI	Kansas City
ATL	Atlanta	MCO	Orlando
BDL	Bradley	MDW	Chicago Midway
BNA	Nashville	MEM	Memphis
BOS	Boston	MIA	Miami
BUR	Burbank	MKE	Milwaukee
BWI	Baltimore/Washington	MSP	Minneapolis St. Paul
CLE	Cleveland	MSY	New Orleans
CLT	Charlotte	OAK	Oakland
CVG	Cincinnati	ONT	Ontario
DAL	Dallas Love	ORD	Chicago O'Hare
DAY	Dayton	PBI	West Palm Beach
DCA	Washington National	PDX	Portland
DEN	Denver	PHL	Philadelphia
DFW	Dallas/Fort Worth	PHX	Phoenix
DTW	Detroit	PIT	Pittsburgh
EWR	Newark	RDU	Raleigh Durham
FLL	Fort Lauderdale	SAN	San Diego
HOU	Houston	SAT	San Antonio
HPN	White Plains	SDF	Louisville
IAD	Washington Dulles	SEA	Seattle
IAH	Houston	SFO	San Francisco
IND	Indianapolis	SJC	San Jose
ISP	Islip	SLC	Salt Lake City
JFK	New York	SNA	Santa Ana
LAS	Las Vegas	STL	St. Louis
LAX	Los Angeles	SYR	Syracuse
LGA	New York La Guardia	TEB	Teterboro
LGB	Long Beach	TPA	Tampa

Appendix B
AWP Proposed Routes

```
1 depart arpt = SFO   arrival aprt = LAX   num_fix =        15
SFO       37.6194   122.3728
BRINY     37.3048   122.6617
SEGUL     36.9631   122.5722
CYPRS     36.4222   122.4322
TP1       35.5000   121.1333
MQO       35.2522   120.7583
GVO       34.5311   120.0900
GOLET     34.2811   119.8633
SHELL     34.1531   119.2392
VTU       34.1000   119.0300
SADDE     34.0389   118.7636
BAYST     34.0294   118.6625
SMO       34.0158   118.4500
TP2       34.0364   118.2833
LAX       33.9419   118.4056
2 depart arpt = SFO   arrival aprt = LAX   num_fix =        13
SFO       37.6194   122.3728
PORTE     37.4898   122.4746
PESCA     37.2682   122.3287
WAGES     36.9814   121.7325
TP1       35.6167   120.5500
RZS       34.5094   119.7700
SHELL     34.1531   119.2392
VTU       34.1000   119.0300
SADDE     34.0389   118.7636
BAYST     34.0294   118.6625
SMO       34.0158   118.4500
TP2       34.0364   118.2833
LAX       33.9419   118.4056
1 depart arpt = OAK   arrival aprt = LAX   num_fix =        14
OAK       37.7197   122.2197
SEGUL     36.9631   122.5722
CYPRS     36.4222   122.4322
TP1       35.5000   121.1333
MQO       35.2522   120.7583
GVO       34.5311   120.0900
GOLET     34.2811   119.8633
SHELL     34.1531   119.2392
VTU       34.1000   119.0300
SADDE     34.0389   118.7636
BAYST     34.0294   118.6625
SMO       34.0158   118.4500
TP2       34.0364   118.2833
LAX       33.9419   118.4056
1 depart arpt = SJC   arrival aprt = LAX   num_fix =        12
SJC       37.3647   121.9292
MOONY     36.1386   121.5722
TP1       35.6167   120.5500
```

```
GVO       34.5311  120.0900
GOLET     34.2811  119.8633
SHELL     34.1531  119.2392
VTU       34.1000  119.0300
SADDE     34.0389  118.7636
BAYST     34.0294  118.6625
SMO       34.0158  118.4500
TP2       34.0364  118.2833
LAX       33.9419  118.4056
1 depart arpt = SFO   arrival aprt = BUR   num_fix =          12
SFO       37.6194  122.3728
PORTE     37.4898  122.4746
PESCA     37.2686  122.3287
TP        37.1100  122.9000
WAGES     36.9814  121.7325
TP        35.6167  120.5500
RZS       34.5094  119.7700
OHIGH     34.4314  119.3108
CANYN     34.3911  119.0783
FIM       34.3500  118.8700
TOAKS     34.2027  118.7786
BUR       34.2000  118.3497
1 depart arpt = OAK   arrival aprt = BUR   num_fix =          12
OAK       37.7197  122.2197
PORTE     37.4898  122.4746
PESCA     37.2682  122.3287
TP        37.1100  122.9000
WAGES     36.9814  121.7325
TP        35.6167  120.5500
RZS       34.5094  119.7700
OHIGH     34.4314  119.3108
CANYN     34.3911  119.0783
FIM       34.3500  118.8700
TOAKS     34.2027  118.7786
BUR       34.2000  118.3497
1 depart arpt = SJC   arrival aprt = BUR   num_fix =           9
SJC       37.3647  121.9292
MOONY     36.1386  121.5722
TP        35.6167  120.5500
RZS       34.5094  119.7700
OHIGH     34.4314  119.3108
CANYN     34.3911  119.0783
FIM       34.3500  118.8700
TOAKS     34.2027  118.7786
BUR       34.2000  118.3497
1 depart arpt = SFO   arrival aprt = SNA   num_fix =           9
SFO       37.6194  122.3728
BRINY     37.3048  122.6617
SEGUL     36.9631  122.5722
CYPRS     36.4222  122.4322
TP1       35.5000  121.1333
TP2       34.2500  120.1667
```

```
SXC       33.3750  118.4189
SLI       33.7700  118.0497
SNA       33.6756  117.8667
1 depart arpt = SFO   arrival aprt = LGB   num_fix =          8
SFO       37.6194  122.3728
SEGUL     36.9631  122.5722
CYPRS     36.4222  122.4322
TP1       35.5000  121.1333
TP2       34.2500  120.1667
SXC       33.3750  118.4189
SLI       33.7700  118.0497
LGB       33.8200  118.1500
1 depart arpt = OAK   arrival aprt = SNA   num_fix =          8
OAK       37.7197  122.2197
SEGUL     36.9631  122.5722
CYPRS     36.4222  122.4322
TP1       35.5000  121.1333
TP2       34.2500  120.1667
SXC       33.3750  118.4189
SLI       33.7700  118.0497
SNA       33.6756  117.8667
1 depart arpt = OAK   arrival aprt = LGB   num_fix =          8
OAK       37.7197  122.2197
SEGUL     36.9631  122.5722
CYPRS     36.4222  122.4322
TP1       35.5000  121.1333
TP2       34.2500  120.1667
SXC       33.3750  118.4189
SLI       33.7700  118.0497
LGB       33.8200  118.1500
1 depart arpt = SJC   arrival aprt = SNA   num_fix =          7
SJC       37.3647  121.9292
MOONY     36.1386  121.5722
TP1       35.6167  120.5500
TP2       34.2500  120.1667
SXC       33.3750  118.4189
SLI       33.7700  118.0497
SNA       33.6756  117.8667
1 depart arpt = SJC   arrival aprt = LGB   num_fix =          7
SJC       37.3647  121.9292
MOONY     36.1386  121.5722
TP1       35.6167  120.5500
TP2       34.2500  120.1667
SXC       33.3750  118.4189
SLI       33.7700  118.0497
LGB       33.8200  118.1500
1 depart arpt = SFO   arrival aprt = SAN   num_fix =         11
SFO       37.6194  122.3728
BRINY     37.3048  122.6617
SEGUL     36.9631  122.5722
CYPRS     36.4222  122.4322
TP1       35.5000  121.1333
```

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TP2       34.2500  120.1667
SXC       33.3750  118.4189
CATLY     33.2208  117.9083
JOBOW     32.8461  117.9888
MZB       32.7819  117.2244
SAN       32.7333  117.1861
1 depart arpt = OAK   arrival aprt = SAN   num_fix =          10
OAK       37.7197  122.2197
SEGUL     36.9631  122.5722
CYPRS     36.4222  122.4322
TP1       35.5000  121.1333
TP2       34.2500  120.1667
SXC       33.3750  118.4189
CATLY     33.2208  117.9083
JOBOW     32.8461  117.9888
MZB       32.7819  117.2244
SAN       32.7333  117.1861
1 depart arpt = SJC   arrival aprt = SAN   num_fix =           9
SJC       37.3647  121.9292
MOONY     36.1386  121.5722
TP1       35.6167  120.5500
TP2       34.2500  120.1667
SXC       33.3750  118.4189
CATLY     33.2208  117.9083
JOBOW     32.8461  117.9888
MZB       32.7819  117.2244
SAN       32.7333  117.1861
1 depart arpt = LAX   arrival aprt = SAN   num_fix =           6
LAX       33.9419  118.4056
SXC       33.3750  118.4189
CATLY     33.2208  117.9083
JOBOW     32.8461  117.9888
MZB       32.7819  117.2244
SAN       32.7333  117.1861
1 depart arpt = OAK   arrival aprt = ONT   num_fix =          13
OAK       37.7197  122.2197
PORTE     37.4897  122.4747
PESCA     37.2887  122.3286
TP        37.1100  122.9000
WAGES     36.9814  121.7325
AVE       35.6469  119.9775
EHF       35.4844  119.0961
PMD       34.6292  118.0833
TP        34.4242  117.3792
HITOP     34.2997  117.3417
PASKO     34.2053  117.3139
ZIGGY     34.1197  117.2883
ONT       34.0497  117.5997
1 depart arpt = SFO   arrival aprt = ONT   num_fix =          12
SFO       37.6194  122.3728
PORTE     37.4897  122.4747
PESCA     37.2887  122.3286
```

```
WAGES     36.9814  121.7325
AVE       35.6469  119.9775
EHF       35.4844  119.0961
PMD       34.6292  118.0833
TP        34.4242  117.3792
HITOP     34.2997  117.3417
PASKO     34.2053  117.3139
ZIGGY     34.1197  117.2883
ONT       34.0497  117.5997
1 depart arpt = LAX   arrival aprt = SFO   num_fix =          10
LAX       33.9419  118.4056
VTU       34.1000  119.0300
REYES     34.6586  119.1333
AVE       35.6469  119.9775
BSR       36.1811  121.6408
CARME     36.4550  121.8786
ANJEE     36.7464  121.9650
SKUNK     37.0075  122.0331
MENLO     37.4636  122.1536
SFO       37.6194  122.3728
1 depart arpt = BUR   arrival aprt = SFO   num_fix =           9
BUR       34.2000  118.3497
FIM       34.3500  118.8700
AVE       35.6469  119.9775
BSR       36.1811  121.6408
CARME     36.4550  121.8786
ANJEE     36.7464  121.9650
SKUNK     37.0075  122.0331
MENLO     37.4636  122.1536
SFO       37.6194  122.3728
1 depart arpt = LAX   arrival aprt = SJC   num_fix =           8
LAX       33.9419  118.4056
VTU       34.1000  119.0300
FIM       34.3500  118.8700
GMN       34.7997  118.8497
TP        35.8500  119.9333
SNS       36.6625  121.6028
GILRO     37.0311  121.5700
SJC       37.3647  121.9292
1 depart arpt = BUR   arrival aprt = SJC   num_fix =           7
BUR       34.2000  118.3497
FIM       34.3500  118.8700
GMN       34.7997  118.8497
TP        35.8500  119.9333
SNS       36.6625  121.6028
GILRO     37.0311  121.5700
SJC       37.3647  121.9292
1 depart arpt = LAX   arrival aprt = OAK   num_fix =           6
LAX       33.9419  118.4056
VTU       34.1000  119.0300
GMN       34.7997  118.8497
EHF       35.4844  119.0961
```

```
PXN       36.7153   120.7775
OAK       37.7197   122.2197
1 depart arpt = BUR   arrival aprt = OAK   num_fix =          5
BUR       34.2000   118.3497
GMN       34.7997   118.8497
EHF       35.4844   119.0961
PXN       36.7153   120.7775
OAK       37.7197   122.2197
1 depart arpt = SAC   arrival aprt = LAX   num_fix =         12
SAC       38.5131   121.4917
FRA       37.1000   119.5797
AVE       35.6469   119.9775
FLW       35.0931   119.8644
RZS       34.5094   119.7700
GOLET     34.2811   119.8633
SHELL     34.1531   119.2392
SADDE     34.0389   118.7636
BAYST     34.0294   118.6625
SMO       34.0158   118.4500
TP2       34.0364   118.2833
LAX       33.9419   118.4056
1 depart arpt = RNO   arrival aprt = LAX   num_fix =         12
RNO       39.4975   119.7667
FRA       37.1000   119.5797
AVE       35.6469   119.9775
FLW       35.0931   119.8644
RZS       34.5094   119.7700
GOLET     34.2811   119.8633
SHELL     34.1531   119.2392
SADDE     34.0389   118.7636
BAYST     34.0294   118.6625
SMO       34.0158   118.4500
TP2       34.0364   118.2833
LAX       33.9419   118.4056
1 depart arpt = SEA   arrival aprt = LAX   num_fix =         12
SEA       47.4356   122.3083
LIN       38.0700   121.0000
AVE       35.6469   119.9775
FLW       35.0931   119.8644
RZS       34.5094   119.7700
GOLET     34.2811   119.8633
SHELL     34.1531   119.2392
SADDE     34.0389   118.7636
BAYST     34.0294   118.6625
SMO       34.0158   118.4500
TP2       34.0364   118.2833
LAX       33.9419   118.4056
1 depart arpt = PDX   arrival aprt = LAX   num_fix =         12
PDX       45.5889   122.5917
LIN       38.0700   121.0000
AVE       35.6469   119.9775
FLW       35.0931   119.8644
```

```
RZS       34.5094   119.7700
GOLET     34.2811   119.8633
SHELL     34.1531   119.2392
SADDE     34.0389   118.7636
BAYST     34.0294   118.6625
SMO       34.0158   118.4500
TP2       34.0364   118.2833
LAX       33.9419   118.4056
1 depart arpt = YVR   arrival aprt = LAX   num_fix =          12
YVR       49.0775   123.1481
LIN       38.0700   121.0000
AVE       35.6469   119.9775
FLW       35.0931   119.8644
RZS       34.5094   119.7700
GOLET     34.2811   119.8633
SHELL     34.1531   119.2392
SADDE     34.0399   118.7636
BAYST     34.0294   118.6625
SMO       34.0158   118.4500
TP2       34.0364   118.2833
LAX       33.9419   118.4056
1 depart arpt = SFO   arrival aprt = MEX   num_fix =           8
SFO       37.6194   122.3728
SEGUL     36.9631   122.5722
CYPRS     36.4222   122.4322
TP        36.5833   121.1333
MQO       35.2522   120.7583
LAX       33.9419   118.4056
MZB       32.7819   117.2244
MEX       32.1000   165.0800
1 depart arpt = OAK   arrival aprt = MEX   num_fix =           8
OAK       37.7197   122.2197
SEGUL     36.9631   122.5722
CYPRS     36.4222   122.4322
TP        35.5000   121.1333
MQO       35.2522   120.7583
LAX       33.9419   118.4056
MZB       32.7819   117.2244
MEX       32.1000   165.0800
1 depart arpt = ABQ   arrival aprt = LAX   num_fix =          10
ABQ       35.0417   106.6056
ZUN       34.9658   109.1545
PYRIT     34.8696   110.5114
DRK       34.7025   112.4794
PKE       34.1000   114.6700
TNP       34.1294   115.9389
PIONE     34.0945   116.7388
RUSTT     34.0492   117.2404
CIVET     34.0350   117.3889
LAX       33.9419   118.4056
1 depart arpt = ATL   arrival aprt = LAX   num_fix =          19
ATL       33.6392    84.4250
```

```
WETWO     33.7286   85.1239
VUZ       33.6700   86.8797
ZTL       33.5927   87.6006
IGB       33.4855   88.5136
GRW       33.4638   90.2773
SUTTN     33.5059   92.3746
ZME       33.5079   92.5646
WOOTN     33.5109   92.9158
SPS       33.9797   98.5797
TURKI     34.2933  100.9947
ZFW       34.4609  102.5070
TXO       34.4950  102.8392
SJN       34.4241  109.1435
CHEAR     34.3699  110.4712
PAYSO     34.3658  110.7942
TNP       34.1294  115.9389
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = BOS   arrival aprt = LAX   num_fix =          15
BOS       42.3500   70.9800
CAM       42.9797   73.3297
SYR       43.1497   76.2000
DEN       39.8003  104.8867
LAWSN     39.5178  106.4763
DBL       39.4393  106.8947
ZDV       38.6211  109.9833
HVE       38.4168  110.6997
BCE       37.6892  112.3039
ZLC       37.5009  112.5984
BLD       35.9958  114.8636
HEC       34.7970  116.4629
RESOR     34.3901  116.9613
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = BNA   arrival aprt = LAX   num_fix =          21
BNA       36.1197   86.6700
MEM       35.0497   89.9697
LIT       34.6775   92.1803
ZME       35.0628   94.9977
KLUBB     35.1202   95.4669
DWINE     35.2027   96.1691
IRW       35.3586   97.6092
SERTS     35.3543   98.8699
ZFW       35.3333  100.0000
AMA       35.2875  101.6393
TCC       35.1821  103.5985
ABQ       35.0438  106.8163
ZUN       34.9658  109.1545
PYRIT     34.8696  110.5114
DRK       34.7025  112.4794
PKE       34.1000  114.6700
TNP       34.1294  115.9389
```

```
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = BWI   arrival aprt = LAX   num_fix =          19
BWI       39.1750   76.6694
BAL       39.1700   76.6500
GORDO     39.8757   88.4965
ZID       39.8684   88.1482
VHP       39.8147   88.1482
CAP       39.8919   89.6253
IRK       40.0922   92.5417
PWE       40.2000   96.2000
ZMP       39.8246   98.9785
GLD       39.3800  101.6800
HGO       38.8150  103.6261
DVC       37.8086  108.9306
PGS       35.6197  113.5300
ABREE     34.7189  115.7184
DIKES     34.6029  115.9870
EMMEY     34.4160  116.4152
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = CMH   arrival aprt = LAX   num_fix =          18
CMH       39.9797   82.8797
VHP       39.7997   86.3700
ZID       39.8684   88.1482
GORDO     39.8757   88.4965
CAP       39.8919   89.6253
IRK       40.0922   92.5417
PWE       40.2000   96.2000
ZMP       39.8246   98.9785
GLD       39.3800  101.6800
HGO       38.8150  103.6261
DVC       37.8086  108.9306
PGS       35.6197  113.5300
ABREE     34.7189  115.7184
DIKES     34.6029  115.9870
EMMEY     34.4160  116.4152
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = CVG   arrival aprt = LAX   num_fix =          26
CVG       39.0489   84.6639
JUDDI     38.7594   86.4402
ZID       38.8133   87.9382
CAROL     38.8392   88.9712
JIGSY     38.8422   89.1198
STL       38.8607   90.4824
TRAKE     38.6919   91.7428
ELSTO     38.6362   92.1309
```

```
SCAWT     38.3553    93.9779
BUM       38.2700    94.4800
FRACA     38.1823    96.7591
PEABO     38.1503    97.3752
GCK       37.9191   100.7251
ZKC       37.7966   102.0114
ALS       37.3491   105.8156
FMN       36.7483   108.0981
COCAN     36.3125   110.3520
TBC       36.1213   111.2696
ZDV       36.0291   111.7096
PGS       35.6197   113.5300
ABREE     34.7189   115.7184
DIKES     34.6029   115.9870
EMMEY     34.4160   116.4152
RUSTT     34.0492   117.2404
CIVET     34.0350   117.3889
LAX       33.9419   118.4056
1 depart arpt = DAY   arrival aprt = LAX   num_fix =          18
DAY       39.9017    84.2194
VHP       39.7997    86.3700
ZID       39.8684    88.1482
GORDO     39.8757    88.4965
CAP       39.8919    89.6253
IRK       40.0922    92.5417
PWE       40.2000    96.2000
ZMP       39.8246    98.9785
GLD       39.3800   101.6800
HGO       38.8150   103.6261
DVC       37.8086   108.9306
PGS       35.6197   113.5300
ABREE     34.7189   115.7184
DIKES     34.6029   115.9870
EMMEY     34.4160   116.4152
RUSTT     34.0492   117.2404
CIVET     34.0350   117.3889
LAX       33.9419   118.4056
1 depart arpt = DEN   arrival aprt = LAX   num_fix =          13
DEN       39.8003   104.8867
LAWSN     39.5178   106.4763
DBL       39.4393   106.8947
ZDV       38.6211   109.9833
HVE       38.4168   110.6997
BCE       37.7064   112.1447
BLD       35.9639   114.8514
GFS       35.1311   115.1756
TNP       34.1294   115.9389
PIONE     34.0945   116.7388
RUSTT     34.0492   117.2404
CIVET     34.0350   117.3889
LAX       33.9419   118.4056
1 depart arpt = DFW   arrival aprt = LAX   num_fix =          17
```

```
DFW       32.8964   97.0333
WORTH     32.8392   99.5994
ABI       32.4697   99.8497
INK       31.8748  103.2436
ZFW       31.8884  103.6228
CONNE     31.9342  105.3295
EWM       31.9497  106.2697
SSO       32.2692  109.2631
BXK       33.4534  112.8246
MESSI     33.7998  113.8031
ZAB       33.8682  114.0000
PKE       34.1020  114.6821
TNP       34.1122  115.7699
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = DTW   arrival aprt = LAX   num_fix =          22
DTW       42.2186   83.3472
DUNKS     42.4272   84.1942
ALPHE     42.4356   84.4966
ZOB       42.4473   85.0000
PMM       42.4655   86.1059
BAE       43.1197   88.2800
DBQ       42.4028   90.7083
ZAU       42.5538   93.0977
FOD       42.6112   94.2948
ONL       42.4703   98.6864
ZMP       42.3581   99.3123
CYS       41.2000  104.7697
EKR       40.0700  107.9200
ZDV       39.2636  110.0237
BCE       37.7064  112.1447
BLD       35.9639  114.8514
GFS       35.1311  115.1756
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = ELP   arrival aprt = LAX   num_fix =          12
ELP       31.8072  106.3861
EWM       31.9497  106.2697
SSO       32.2692  109.2631
BXK       33.4534  112.8246
MESSI     33.7998  113.8031
ZAB       33.8682  114.0000
PKE       34.1020  114.6821
TNP       34.1122  115.7699
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
```

```
LAX       33.9419  118.4056
1 depart arpt = EWR   arrival aprt = LAX   num_fix =          36
EWR       40.6944   74.1667
RBV       40.2000   74.4800
SUZIE     40.4533   75.9727
RAV       40.5534   76.5994
VALLO     40.6268   77.4384
BURNI     40.6568   77.8039
ZNY       40.6706   77.9761
EWC       40.8252   80.2116
MAINE     40.8934   81.6880
MORES     40.8984   81.8179
GONER     40.9657   84.2008
ZOB       40.9735   84.7008
FWA       40.9697   85.1800
WHETT     41.1602   86.5841
BDF       41.1597   89.5879
YOUDO     41.0544   90.5221
BURKK     40.9691   91.2308
ALBRT     40.8414   92.2283
JAVAS     40.7656   92.7888
ZAU       40.6631   93.5148
LMN       40.5967   93.9676
PWE       40.2004   96.2063
ZMP       39.5962   98.8644
HLC       39.2588  100.2259
PUB       38.2943  104.4294
FMN       36.7484  108.0989
COCAN     36.3125  110.3520
TBC       36.1213  111.2696
ZDV       36.0291  111.7096
PGS       35.6197  113.5300
EED       34.7500  114.4697
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = IAH   arrival aprt = LAX   num_fix =          14
IAH       29.9497   95.3297
FST       30.9167  102.9167
FIGMO     31.5908  105.3819
ELP       31.8072  106.3861
SSO       32.2692  109.2622
BXK       33.4534  112.8246
MESSI     33.7998  113.8031
ZAB       33.8682  114.0000
PKE       34.1020  114.6821
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
```

```
LAX       33.9419  118.4056
1 depart arpt = IAD   arrival aprt = LAX   num_fix =          12
IAD       38.9436   77.4528
IHD       39.9742   79.3586
CAP       39.8919   89.6253
IRK       40.0922   92.5417
GLD       39.3800  101.6800
DVC       37.8086  108.9306
PGS       35.6197  113.5300
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = IND   arrival aprt = LAX   num_fix =          15
IND       39.7197   86.2697
ROCKY     39.5879   88.8336
CAP       39.8919   89.6253
IRK       40.0922   92.5417
PWE       40.2000   96.2000
ZMP       39.8246   98.9785
GLD       39.3800  101.6800
DVC       37.8086  108.9306
PGS       35.6197  113.5300
ABREE     34.7189  115.7184
DIKES     34.6029  115.9870
EMMEY     34.4160  116.4152
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = JFK   arrival aprt = LAX   num_fix =          13
JFK       40.6197   73.7697
RAV       40.5497   76.5797
PUB       38.2943  104.4294
FMN       36.7484  108.0989
COCAN     36.3125  110.3520
TBC       36.1213  111.2696
ZDV       36.0291  111.7096
PGS       35.6197  113.5300
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = MCI   arrival aprt = LAX   num_fix =          18
MCI       39.2992   94.7167
STJ       39.7711   94.9083
PWE       40.2000   96.2000
ZMP       39.8246   98.9785
GLD       39.3800  101.6800
HGO       38.8150  103.6256
PUB       38.2800  104.4200
```

```
FMN       36.7484  108.0989
COCAN     36.3125  110.3520
TBC       36.1213  111.2696
ZDV       36.0291  111.7096
PGS       35.6197  113.5300
ABREE     34.7189  115.7184
DIKES     34.6029  115.9870
EMMEY     34.4160  116.4152
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = MDW   arrival aprt = LAX   num_fix =          15
MDW       41.7858   87.7500
OBH       41.3756   98.3531
ZMP       41.3467   99.0304
SNY       41.0967  102.9830
VIKNN     40.9670  103.6758
EKR       40.0675  107.9249
CISCO     39.3033  109.3981
ZDV       38.9898  109.9833
BCE       37.7064  112.1447
BLD       35.9639  114.8514
DIKES     34.6029  115.9870
EMMEY     34.4160  116.4152
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = MEM   arrival aprt = LAX   num_fix =          16
MEM       35.0497   89.9697
LIT       34.6775   92.1803
ZME       35.0628   94.9977
KLUBB     35.1202   95.4669
DWINE     35.2027   96.1691
IRW       35.3586   97.6092
SERTS     35.3543   98.8699
ZFW       35.3333  100.0000
AMA       35.2875  101.6393
TCC       35.1821  103.5985
ABQ       35.0438  106.8163
ZUN       34.9658  109.1545
PYRIT     34.8696  110.5114
DRK       34.7025  112.4794
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = MIA   arrival aprt = LAX   num_fix =          28
MIA       25.8000   80.2833
NEPTA     28.6108   87.6433
ZJX       28.6978   88.0066
SANTI     28.8502   88.6587
LEV       29.1752   90.1040
PEKON     29.6230   92.9242
WEEVE     29.8402   94.4597
```

```
IAH       29.9569   95.3457
PUFER     30.2144   97.0988
AUS       30.2975   97.7033
SPURS     30.3935   98.3513
JCT       30.5980   99.8175
KEMPL     30.7204  100.8318
ZHU       30.8789  102.2602
FST       30.9521  102.9757
FIGMO     31.5908  105.3819
ELP       31.8072  106.3861
ALIBY     31.9214  107.7789
SSO       32.2692  109.2622
BXK       33.4534  112.8246
MESSI     33.7998  113.8031
ZAB       33.8682  114.0000
PKE       34.1020  114.6821
TNP       34.1122  115.7699
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = MKE   arrival aprt = LAX   num_fix =          14
MKE       42.9478   87.8944
BAE       43.1197   88.2800
MCW       43.1578   93.3306
DEN       39.8003  104.8867
LAWSN     39.5178  106.4763
DBL       39.4393  106.8947
ZDV       38.6211  109.9833
HVE       38.4168  110.6997
BCE       37.7064  112.1447
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = MSP   arrival aprt = LAX   num_fix =          15
MSP       44.8842   93.2139
FSD       43.5786   96.7389
DEN       39.8003  104.8867
LAWSN     39.5178  106.4763
DBL       39.4393  106.8947
ZDV       38.6211  109.9833
HVE       38.4168  110.6997
BCE       37.7064  112.1447
BLD       35.9639  114.8514
GFS       35.1311  115.1756
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
```

```
1 depart arpt = MSY   arrival aprt = LAX   num_fix =         16
MSY       30.0294    90.1719
ACT       31.6108    97.2278
INK       31.8748   103.2436
ZFW       31.8884   103.6228
CONNE     31.9342   105.3295
EWM       31.9517   106.2724
SSO       32.2692   109.2631
BXK       33.4534   112.8246
MESSI     33.7998   113.8031
ZAB       33.8682   114.0000
PKE       34.1020   114.6821
TNP       34.1294   115.9389
PIONE     34.0945   116.7388
RUSTT     34.0492   117.2404
CIVET     34.0350   117.3889
LAX       33.9419   118.4056
1 depart arpt = ORD   arrival aprt = LAX   num_fix =         16
ORD       41.9822    87.9056
JOT       41.5461    88.3183
MZV       41.3208    90.6378
DEN       39.8003   104.8867
LAWSN     39.5178   106.4763
DBL       39.4393   106.8947
ZDV       38.6211   109.9833
HVE       38.4168   110.6997
BCE       37.7064   112.1447
BLD       35.9639   114.8514
GFS       35.1311   115.1756
TNP       34.1294   115.9389
PIONE     34.0945   116.7388
RUSTT     34.0492   117.2404
CIVET     34.0350   117.3889
LAX       33.9419   118.4056
1 depart arpt = PHL   arrival aprt = LAX   num_fix =         10
PHL       39.8697    75.2300
BURNI     40.6568    77.8039
ZDV       36.0291   111.7096
TBC       36.1213   111.2696
ABREE     34.7189   115.7184
DIKES     34.6029   115.9870
EMMEY     34.4160   116.4152
RUSTT     34.0492   117.2404
CIVET     34.0350   117.3889
LAX       33.9419   118.4056
1 depart arpt = PHX   arrival aprt = LAX   num_fix =         10
PHX       33.4200   111.8797
BXK       33.4250   112.6806
MESSI     33.7998   113.8031
ZAB       33.8682   114.0000
PKE       34.1020   114.6821
TNP       34.1122   115.7699
```

```
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = PIT   arrival aprt = LAX   num_fix =          19
PIT       40.4936   80.2306
AIR       40.0200   80.8197
WINTS     40.0111   81.2309
ZOB       40.0047   81.5953
EMPTY     39.9633   83.1869
CREEP     39.9209   84.3087
VHP       39.8147   86.3676
ZID       39.8684   88.1482
GORDO     39.8757   88.4965
CAP       39.8919   89.6253
IRK       40.0922   92.5417
GLD       39.3800  101.6800
DVC       37.8086  108.9306
PGS       35.6197  113.5300
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = SAT   arrival aprt = LAX   num_fix =          11
SAT       29.6436   98.4608
DILLI     31.7769  104.6956
BXK       33.4250  112.6806
MESSI     33.7998  113.8031
ZAB       33.8682  114.0000
PKE       34.1020  114.6821
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = SLC   arrival aprt = LAX   num_fix =          14
SLC       40.8500  111.9697
MLF       38.4267  113.0111
GEGEE     37.9664  113.3313
BERYL     37.9001  113.8557
ZLC       37.6599  113.5760
NORRA     36.7593  114.2811
OVETO     36.4605  114.5079
BLD       35.9639  114.8514
GFS       35.1311  115.1756
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = STL   arrival aprt = LAX   num_fix =          11
```

```
STL       38.8606   90.4822
FMN       36.7483  108.0981
COCAN     36.3125  110.3520
TBC       36.1213  111.2696
ZDV       36.0291  111.7096
PGS       35.6197  113.5300
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = TPA   arrival aprt = LAX   num_fix =          13
TPA       27.9736   82.5306
MSY       30.0294   90.1719
ALIBY     31.9214  107.7789
SSO       32.2692  109.2622
BXK       33.4534  112.8246
MESSI     33.7998  113.8031
ZAB       33.8682  114.0000
PKE       34.1020  114.6821
TNP       34.1122  115.7699
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = TUS   arrival aprt = LAX   num_fix =          10
TUS       32.1181  110.9417
CULTS     33.5842  113.5112
MESSI     33.7998  113.8031
ZAB       33.8682  114.0000
PKE       34.1020  114.6821
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = YYZ   arrival aprt = LAX   num_fix =          29
YYZ       43.6822   79.6428
DJB       41.3500   82.1500
MAYZE     41.4386   83.6641
NAPOL     41.4604   84.1521
ASHEN     41.4805   84.6468
ZOB       41.4895   84.8883
GSH       41.5252   86.0280
HOBAR     41.5418   87.2086
JOT       41.5464   88.3184
VORIN     41.5480   89.3364
IOW       41.5190   91.6133
CNOTA     41.4341   92.4901
ZAU       41.3227   93.5465
LNK       40.9238   96.7420
DRABS     40.7592   98.3747
```

```
ZMP       40.6847   99.0441
HCT       40.4541  100.9236
DEN       39.8003  104.8867
LAWSN     39.5178  106.4763
DBL       39.4393  106.8947
ZDV       38.6211  109.9833
HVE       38.4168  110.6997
BCE       37.7064  112.1447
BLD       35.9639  114.8514
TNP       34.1294  115.9389
PIONE     34.0945  116.7388
RUSTT     34.0492  117.2404
CIVET     34.0350  117.3889
LAX       33.9419  118.4056
1 depart arpt = LAX   arrival aprt = ABQ   num_fix =          11
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4330  111.9702
BOLIC     34.0112  110.3517
VERNO     34.2607  109.6272
SJN       34.4241  109.1435
LAVAN     34.9084  107.3424
ABQ       35.0417  106.6056
2 depart arpt = LAX   arrival aprt = ABQ   num_fix =           6
LAX       33.9419  118.4056
DAG       34.8539  116.7861
EED       34.7500  114.4697
ZUN       34.9500  109.1500
LAVAN     34.9083  107.3417
ABQ       35.0417  106.6056
3 depart arpt = LAX   arrival aprt = ABQ   num_fix =           9
LAX       33.9419  118.4056
HEC       34.7800  116.4500
EED       34.7660  114.4741
ZAB       34.7503  113.8722
DRK       34.7026  112.4802
PYRIT     34.8696  110.5114
ZUN       34.9658  109.1545
LAVAN     34.9083  107.3417
ABQ       35.0417  106.6056
1 depart arpt = LAX   arrival aprt = ATL   num_fix =          14
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4330  111.9702
BOLIC     34.0112  110.3517
VERNO     34.2607  109.6272
```

```
SJN        34.5208   109.3778
CNX        34.3670   105.6780
TXO        34.4951   102.8397
ZFW        34.9515   100.2594
IRW        35.3583    97.6089
ATL        33.6392    84.4250
2 depart arpt = LAX    arrival aprt = ATL    num_fix =          17
LAX        33.9419   118.4056
DAG        34.8539   116.7861
EED        34.7500   114.4697
ZAB        34.7503   113.8722
DRK        34.7026   112.4802
PYRIT      34.8696   110.5114
ZUN        34.9658   109.1545
ABQ        35.0438   106.8163
TCC        35.1821   103.5985
AMA        35.2875   101.6393
ZFW        35.3333   100.0000
SERTS      35.3543    98.8699
IRW        35.3586    97.6092
FSM        35.3883    94.2717
MEM        35.0497    89.9697
RMG        34.3506    85.1556
ATL        33.6392    84.4250
3 depart arpt = LAX    arrival aprt = ATL    num_fix =          14
LAX        33.9419   118.4056
HEC        34.7800   116.4500
EED        34.7660   114.4741
ZAB        34.7503   113.8722
DRK        34.7026   112.4802
PYRIT      34.8696   110.5114
ZUN        34.9658   109.1545
ABQ        35.0438   106.8163
TCC        35.1821   103.5985
AMA        35.2875   101.6393
ZFW        35.3333   100.0000
SERTS      35.3543    98.8699
IRW        35.3583    97.6089
ATL        33.6392    84.4250
1 depart arpt = LAX    arrival aprt = BOS    num_fix =          31
LAX        33.9419   118.4056
DAG        34.8539   116.7861
CLARR      35.6758   115.6796
LAS        36.0797   115.1598
NORRA      36.7593   114.2811
ZLC        37.6599   113.5760
BERYL      37.9001   113.3857
GEGEE      37.9664   113.3313
MLF        38.4267   113.0111
OCS        41.5902   109.0153
ZDV        42.6606   107.0880
DDY        43.0909   106.2770
```

```
RAP       43.9761  103.0123
ZMP       44.4848  101.4668
ABR       45.4172   98.3683
GEP       45.1300   93.3700
GRB       44.4878   88.1278
PECOK     44.0078   85.7210
ZOB       43.6896   84.4019
DIRKS     43.4993   83.6480
ECK       43.2500   82.7197
ZOB       43.2030   82.3213
ZOB       42.9507   79.0582
BUF       42.9290   78.6463
HANKK     42.8954   77.1714
ZBW       42.8796   76.6673
AUDIL     42.8719   76.4431
FABEN     42.8533   75.9522
ALB       42.7469   73.8036
GDM       42.5300   72.0497
BOS       42.3500   70.9800
2 depart arpt = LAX   arrival aprt = BOS   num_fix =          38
LAX       33.9419  118.4056
HEC       34.7800  116.4500
EED       34.7660  114.4741
ZAB       34.7503  113.8722
DRK       34.7025  112.4794
ZDV       35.7086  110.3965
FMN       36.7484  108.0989
HBU       38.4521  107.0397
ELBEC     38.6928  106.5051
ACREE     38.9056  106.0249
SHREW     39.1691  105.6948
BYSON     39.3708  105.4393
DEN       39.8003  104.8867
RAP       43.9697  103.0000
ZMP       43.9254  101.4245
VIVID     43.8605   99.9876
FSD       43.5786   96.7389
HAYNS     43.4291   95.3229
MCW       43.0947   93.3299
ZAU       43.1302   91.3218
SABBO     43.1315   91.1687
SIBER     43.1347   90.3927
DUTYS     43.1306   89.3350
BAE       43.1169   88.2844
GRUBB     43.2243   85.3398
ZOB       43.2317   85.0000
EJOYS     43.2533   83.4836
ECK       43.2559   82.7179
ZOB       43.2030   82.3213
ZOB       42.9507   79.0582
BUF       42.9290   78.6463
HANKK     42.8954   77.1714
```

```
ZBW       42.8796   76.6673
AUDIL     42.8719   76.4431
FABEN     42.8533   75.9522
ALB       42.7473   73.8032
GDM       42.5300   72.0497
BOS       42.3500   70.9800
1 depart arpt = LAX   arrival aprt = BNA   num_fix =          16
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4330  111.9702
BOLIC     34.0112  110.3517
VERNO     34.2607  109.6272
SJN       34.5208  109.3778
CNX       34.3670  105.6780
TXO       34.4951  102.8397
ZFW       34.9515  100.2594
IRW       35.3583   97.6089
ARG       36.1250   90.9250
KIMEL     36.1278   90.0825
BNA       36.1197   86.6700
2 depart arpt = LAX   arrival aprt = BNA   num_fix =          16
LAX       33.9419  118.4056
HEC       34.7800  116.4500
EED       34.7660  114.4741
ZAB       34.7503  113.8722
DRK       34.7026  112.4802
PYRIT     34.8696  110.5114
ZUN       34.9658  109.1545
ABQ       35.0438  106.8163
TCC       35.1821  103.5985
AMA       35.2875  101.6393
ZFW       35.3333  100.0000
SERTS     35.3543   98.8699
IRW       35.3583   97.6089
ARG       36.1250   90.9250
KIMEL     36.1278   90.0825
BNA       36.1197   86.6700
1 depart arpt = LAX   arrival aprt = BWI   num_fix =          20
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
```

```
ANGEY     39.3035   96.6660
MKC       39.2794   94.5914
SAAGS     39.4612   93.2931
TWAIN     39.6911   91.4653
BAYLI     39.7393   91.0492
CAP       39.8919   89.6253
MGW       39.5497   79.8497
EMI       39.4797   76.9697
BWI       39.1750   76.6694
2 depart arpt = LAX   arrival aprt = BWI   num_fix =        22
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
ANGEY     39.3035   96.6660
MKC       39.2794   94.5914
SAAGS     39.4612   93.2931
TWAIN     39.6911   91.4653
BAYLI     39.7393   91.0492
CAP       39.8919   89.6253
ROD       40.2800   84.0300
MGW       39.5497   79.8497
EMI       39.4797   76.9697
BWI       39.1750   76.6694
1 depart arpt = LAX   arrival aprt = CLE   num_fix =        21
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3879  101.6923
ZMP       40.2417   99.0531
LNK       40.9238   96.7420
ZAU       41.3227   93.5465
CNOTA     41.4341   92.4901
IOW       41.6392   91.5444
VORIN     41.5480   89.3364
JOT       41.5461   88.3183
GIJ       41.7686   86.3184
PLAIN     41.7777   85.2067
ZOB       41.7988   84.8551
GERBS     41.7775   84.4250
VWV       41.4514   83.6386
```

```
WAKEM     41.2800   82.4772
CLE       41.4103   81.8472
2 depart arpt = LAX   arrival aprt = CLE   num_fix =          23
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3879  101.6923
ZMP       40.2417   99.0531
LNK       40.9238   96.7420
ZAU       41.3227   93.5465
CNOTA     41.4341   92.4901
IOW       41.6392   91.5444
VORIN     41.5480   89.3364
JOT       41.5461   88.3183
GIJ       41.7686   86.3184
PLAIN     41.7777   85.2067
ZOB       41.7988   84.8551
GERBS     41.7775   84.4250
VWV       41.4514   83.6386
PLAER     41.2282   82.6876
WAKEM     41.2800   82.4772
CLE       41.4103   81.8472
1 depart arpt = LAX   arrival aprt = CLT   num_fix =          20
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4330  111.9702
BOLIC     34.0112  110.3517
VERNO     34.2607  109.6272
SJN       34.4241  109.1435
LAVAN     34.9084  107.3424
ABQ       35.0417  106.6056
TCC       35.1821  103.5985
AMA       35.2875  101.6393
ZFW       35.3333  100.0000
SERTS     35.3543   98.8699
IRW       35.3583   97.6089
FSM       35.3361   94.3667
ARG       36.1250   90.9250
TYS       35.8125   83.9917
CLT       35.2025   80.9558
1 depart arpt = LAX   arrival aprt = CMH   num_fix =          22
LAX       33.9419  118.4056
HEC       34.7800  116.4500
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
```

```
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
AGNEY     39.3035   96.6660
MKC       39.2794   94.5914
SAAGS     39.4612   93.2931
TWAIN     39.6911   91.4653
BAYLI     39.7373   91.0492
CAP       39.8919   89.6253
BVT       40.5558   87.0692
ROD       40.2800   84.0300
GUNNE     40.3636   83.2328
CMH       39.9797   82.8797
2 depart arpt = LAX   arrival aprt = CMH   num_fix =          22
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
ANGEY     39.3035   96.6660
MKC       39.2794   94.5914
SAAGS     39.4612   93.2931
TWAIN     39.6911   91.4653
BAYLI     39.7393   91.0492
CAP       39.8919   89.6253
BVT       40.5558   87.0692
ROD       40.2800   84.0300
GUNNE     40.3636   83.2328
CMH       39.9797   82.8797
1 depart arpt = LAX   arrival aprt = CVG   num_fix =          23
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4578  111.9922
BOLIC     34.0112  110.3517
VERNO     34.2607  109.6272
SJN       34.4241  109.1435
LAVAN     34.9084  107.3424
```

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ABQ       35.0438  106.8163
LVS       35.6576  105.1356
ZKC       37.1586  102.2740
DRAWL     37.4854  101.6173
GCK       37.9300  100.7250
PEABO     38.1503   97.3752
FRACA     38.1823   96.7591
BUM       38.2721   94.4882
SCAWT     38.3553   93.9779
ELSTO     38.6362   92.1309
TRAKE     38.6919   91.7428
STL       38.8606   90.4822
QUEEN     37.0819  115.0761
2 depart arpt = LAX   arrival aprt = CVG   num_fix =          14
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8086  108.9306
PUB       38.2800  104.4200
HYS       38.8461   99.2722
SLN       38.9264   97.6212
JUDGE     39.0153   96.9212
MKC       39.2794   94.5914
DRIVL     39.1893   93.5709
WELTS     39.0081   91.7711
STL       38.8606   90.4822
CVG       39.0489   84.6639
3 depart arpt = LAX   arrival aprt = CVG   num_fix =          15
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8086  108.9306
PUB       38.2800  104.4200
HYS       38.8461   99.2722
SLN       38.9264   97.6212
JUDGE     39.0153   96.9212
MKC       39.2794   94.5914
DRIVL     39.1893   93.5709
WELTS     39.0081   91.7711
STL       38.8606   90.4822
CVG       39.0489   84.6639
1 depart arpt = LAX   arrival aprt = DAY   num_fix =          20
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
```

```
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
ANGEY     39.3035   96.6660
MKC       39.1231   94.5917
DRIVL     39.1893   93.5709
WELTS     39.0081   91.7711
STL       38.8606   90.4822
BIB       38.9203   88.4817
SHB       39.6197   85.8197
RID       39.7564   84.8417
DAY       39.9017   84.2194
2 depart arpt = LAX   arrival aprt = DAY   num_fix =          21
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
ANGEY     39.3035   96.6660
MKC       39.1231   94.5917
DRIVL     39.1893   93.5709
WELTS     39.0081   91.7711
STL       38.8606   90.4822
BIB       38.9203   88.4817
SHB       39.6197   85.8197
RID       39.7564   84.8417
DAY       39.9017   84.2194
1 depart arpt = LAX   arrival aprt = DEN   num_fix =          11
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4519  107.0389
ELBEC     38.6928  106.5051
ACREE     38.9056  106.0249
SHREW     39.1691  105.6948
BYSON     39.3706  105.4386
DEN       39.8003  104.8867
2 depart arpt = LAX   arrival aprt = DEN   num_fix =          17
LAX       33.9419  118.4056
IPL       32.7486  115.5075
BZA       32.7681  114.6028
ZAB       32.7756  114.0000
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MOHAK     32.7759   113.9724
GBN       32.9563   112.6743
PXR       33.4578   111.9922
INW       35.0616   110.7950
DILCO     35.5313   110.0654
ZDV       35.8024   109.6370
FMN       36.7483   108.0981
HBU       38.4521   107.0397
ELBEC     38.6928   106.5051
ACREE     38.9056   106.0249
SHREW     39.1691   105.6948
BYSON     39.3708   105.4393
DEN       39.8003   104.8867
3 depart arpt = LAX   arrival aprt = DEN   num_fix =          11
LAX       33.9419   118.4056
DAG       34.8539   116.7861
CLARR     35.6758   115.6796
LAS       36.0797   115.1598
ZDV       37.0778   111.7451
DVC       37.8088   108.9313
HBU       38.4519   107.0389
ELBEC     38.6928   106.5051
ACREE     38.9056   106.0249
SHREW     39.1691   105.6948
DEN       39.8003   104.8867
1 depart arpt = LAX   arrival aprt = DFW   num_fix =          16
LAX       33.9419   118.4056
TRM       33.6281   116.1592
BLH       33.5961   114.7612
ZAB       33.5267   114.0000
SALOM     33.5162   113.8889
KOFFA     33.4636   113.3489
TFD       32.8856   111.9078
TOTEC     32.8266   111.6422
ITEMM     32.5865   110.5898
SSO       32.2692   109.2622
EWM       31.9517   106.2724
CONNE     31.9342   105.3295
ZFW       31.8884   103.6228
INK       31.7792   103.2028
AQN       32.4344    97.6636
DFW       32.8964    97.0333
2 depart arpt = LAX   arrival aprt = DFW   num_fix =          16
LAX       33.9419   118.4056
IPL       32.7486   115.5075
BZA       32.7681   114.6028
ZAB       32.7756   114.0000
MOHAK     32.7759   113.9724
GBN       32.9500   112.6700
TFD       32.8859   111.9087
TOTEC     32.8266   111.6422
ITEMM     32.5865   110.5898
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SSO       32.2692  109.2622
EWM       31.9517  106.2724
CONNE     31.9342  105.3295
ZFW       31.8884  103.6228
INK       31.7792  103.2028
AQN       32.4344   97.6636
DFW       32.8964   97.0333
3 depart arpt = LAX   arrival aprt = DFW   num_fix =          15
LAX       33.9419  118.4056
HEC       34.7800  116.4500
EED       34.7660  114.4741
ZAB       34.7503  113.8722
DRK       34.7026  112.4802
PYRIT     34.8696  110.5114
ZUN       34.9658  109.1545
ABQ       35.0417  106.6056
MIERA     34.9569  106.1141
TXO       34.4951  102.8397
ZFW       34.4609  102.5072
TURKI     34.2933  100.9947
SPS       33.9873   98.5935
BATIK     33.4876   97.8876
DFW       32.8964   97.0333
4 depart arpt = LAX   arrival aprt = DFW   num_fix =          15
LAX       33.9419  118.4056
DAG       34.8539  116.7861
EED       34.7500  114.4697
ZAB       34.7503  113.8722
DRK       34.7026  112.4802
PYRIT     34.8696  110.5114
ZUN       34.9658  109.1545
ABQ       35.0417  106.6056
MIERA     34.9569  106.1141
TXO       34.4951  102.8397
ZFW       34.4609  102.5072
TURKI     34.2933  100.9947
SPS       33.9873   98.5935
BATIK     33.4876   97.8876
DFW       32.8964   97.0333
1 depart arpt = LAX   arrival aprt = DTW   num_fix =          30
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
NORRA     36.7593  114.2811
ZLC       37.5008  112.7142
BCE       37.6892  112.3039
ZDV       38.9898  109.9833
CISCO     39.3033  109.3981
EKR       40.0675  107.9249
VIKNN     40.9670  103.6758
SNY       41.0967  102.9830
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ZMP       41.3467   99.0304
OBH       41.3757   98.3536
DEFIN     41.8423   95.3587
ASTRO     42.0865   93.5258
ZAU       42.1167   93.2809
DBQ       42.4028   90.7083
BAE       43.1197   88.2800
MKG       43.1692   86.0392
CLOCK     43.1457   85.5961
GIBER     43.1216   85.1729
ZOB       43.1113   85.0000
PALOW     43.1051   84.8986
TP        43.1001   84.8180
CUTTY     43.0880   84.7169
LUGGS     43.0547   84.4431
OWOSO     43.0118   84.0990
POLAR     42.8372   83.7353
DTW       42.2186   83.3472
2 depart arpt = LAX   arrival aprt = DTW   num_fix =        17
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
ZMP       40.9856   99.0379
OBH       41.3756   98.3531
DEFIN     41.8423   95.3587
ASTRO     42.0865   93.5258
ZAU       42.1167   93.2809
DBQ       42.4028   90.7083
BAE       43.1197   88.2800
MKG       43.1692   86.0392
DTW       42.2186   83.3472
3 depart arpt = LAX   arrival aprt = DTW   num_fix =        14
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
ZMP       40.9856   99.0379
OBH       41.3756   98.3531
DEFIN     41.8423   95.3587
ASTRO     42.0865   93.5258
ZAU       42.1167   93.2809
DBQ       42.4028   90.7083
DTW       42.2186   83.3472
1 depart arpt = LAX   arrival aprt = ELP   num_fix =        10
```

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LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5961  114.7612
ZAB       33.5267  114.0000
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
GBN       32.9500  112.6700
SSO       32.2692  109.2622
ALIBY     31.9214  107.7789
ELP       31.8072  106.3861
1 depart arpt = LAX   arrival aprt = EWR   num_fix =          30
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
NORRA     36.7593  114.2811
ZLC       37.5008  112.7142
BCE       37.6892  112.3039
ZDV       38.9898  109.9833
CISCO     39.3033  109.3981
EKR       40.0675  107.9249
VIKNN     40.9670  103.6758
SNY       41.0967  102.9830
ZMP       41.3467   99.0304
OBH       41.3756   98.3531
DSM       41.4376   93.6486
ZAU       41.4444   93.5064
IOW       41.6392   91.5444
VORIN     41.5480   89.3364
JOT       41.5461   88.3183
GIJ       41.7697   86.3194
BENJO     41.8798   85.2091
ZOB       41.9066   85.0000
CRL       42.0300   83.4500
BUYKK     41.9551   82.2677
KEEHO     41.9176   81.8310
BEELR     41.8654   81.2517
DORET     41.8016   80.5846
BRIAR     41.5393   78.1892
SLT       41.5125   77.9703
EWR       40.6944   74.1667
2 depart arpt = LAX   arrival aprt = EWR   num_fix =          32
LAX       33.9419  118.4056
HEC       34.7800  116.4500
EED       34.7660  114.4741
ZAB       34.7503  113.8722
DRK       34.7025  112.4794
ZDV       35.7086  110.3965
FMN       36.7484  108.0989
HBU       38.4521  107.0397
ELBEC     38.6928  106.5051
ACREE     38.9056  106.0249
```

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SHREW     39.1691  105.6948
BYSON     39.3708  105.4393
DEN       39.8003  104.8867
HCT       40.4541  100.9236
ZMP       41.1395   99.0348
OBH       41.3756   98.3531
DSM       41.4376   93.6486
ZAU       41.4444   93.5064
IOW       41.6392   91.5444
VORIN     41.5480   89.3364
JOT       41.5461   88.3183
GIJ       41.7697   86.3194
BENJO     41.8798   85.2091
ZOB       41.9066   85.0000
CRL       42.0300   83.4500
BUYKK     41.9551   82.2677
KEEHO     41.9176   81.8310
BEELR     41.8654   81.2517
DORET     41.8016   80.5846
BRIAR     41.5393   78.1892
SLT       41.5125   77.9703
EWR       40.6944   74.1667
3 depart arpt = LAX   arrival aprt = EWR   num_fix =          36
LAX       33.9419  118.4056
IPL       32.7486  115.5075
BZA       32.7681  114.6028
ZAB       32.7756  114.0000
MOHAK     32.7759  113.9724
GBN       32.9563  112.6743
PXR       33.4578  111.9922
INW       35.0616  110.7950
DILCO     35.5313  110.0654
ZDV       35.8024  109.6370
FMN       36.7483  108.0981
HBU       38.4521  107.0397
ELBEC     38.6928  106.5051
ACREE     38.9056  106.0249
SHREW     39.1691  105.6948
BYSON     39.3708  105.4393
DEN       39.8003  104.8867
HCT       40.4541  100.9236
ZMP       41.1395   99.0348
OBH       41.3756   98.3531
DSM       41.4376   93.6486
ZAU       41.4444   93.5064
IOW       41.6392   91.5444
VORIN     41.5480   89.3364
JOT       41.5461   88.3183
GIJ       41.7697   86.3194
BENJO     41.8798   85.2091
ZOB       41.9066   85.0000
CRL       42.0300   83.4500
```

```
BUYKK     41.9551   82.2677
KEEHO     41.9176   81.8310
BEELR     41.8654   81.2517
DORET     41.8016   80.5846
BRIAR     41.5393   78.1892
SLT       41.5125   77.9703
EWR       40.6944   74.1667
1 depart arpt = LAX   arrival aprt = IAD   num_fix =          22
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8086  108.9306
HGO       38.8150  103.6256
BOYET     38.8277  103.0932
OATHE     38.8549  101.7943
ZKC       38.8535  100.0165
HYS       38.8476   99.2768
SLN       38.9264   97.6212
JUDGE     39.0153   96.9212
MKC       39.2794   94.5914
DRIVL     39.1893   93.5709
WELTS     39.0081   91.7711
STL       38.8606   90.4822
BOSIE     38.6625   89.0506
ELIOE     38.4985   87.9568
ZID       38.4931   87.9221
IMPEL     38.3596   87.0830
IIU       38.1033   85.5775
IAD       38.9436   77.4528
2 depart arpt = LAX   arrival aprt = IAD   num_fix =          24
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
ZMP       39.8246   98.9785
PWE       40.2000   96.2000
LMN       40.5967   93.9676
ZAU       40.6631   93.5148
JAVAS     40.7656   92.7888
ALBRT     40.8414   92.2283
BURKK     40.9691   91.2308
YOUDO     41.0544   90.5221
BDF       41.1597   89.5879
WHETT     41.1600   86.5839
ZID       40.7012   84.6833
APE       40.1511   82.5883
OTMAN     39.9470   81.9043
ZOB       39.8443   81.5667
```

```
LUISE     39.5742    80.6985
BUCKO     39.2936    79.8253
IAD       38.9436    77.4528
3 depart arpt = LAX   arrival aprt = IAD   num_fix =          25
LAX       33.9419   118.4056
DAG       34.8539   116.7861
CLARR     35.6758   115.6796
LAS       36.0797   115.1598
ZDV       37.0778   111.7451
DVC       37.8088   108.9313
HBU       38.4521   107.0397
GLD       39.3800   101.6800
ZMP       39.8246    98.9785
PWE       40.2000    96.2000
LMN       40.5967    93.9676
ZAU       40.6631    93.5148
JAVAS     40.7656    92.7888
ALBRT     40.8414    92.2283
BURKK     40.9691    91.2308
YOUDO     41.0544    90.5221
BDF       41.1597    89.5879
WHETT     41.1600    86.5839
ZID       40.7012    84.6833
APE       40.1511    82.5883
OTMAN     39.9470    81.9043
ZOB       39.8443    81.5667
LUISE     39.5742    80.6985
BUCKO     39.2936    79.8253
IAD       38.9436    77.4528
1 depart arpt = LAX   arrival aprt = IAH   num_fix =          19
LAX       33.9419   118.4056
TRM       33.6281   116.1592
BLH       33.5797   114.7500
ZAB       33.5267   114.0000
SALOM     33.5162   113.8889
KOFFA     33.4636   113.3489
GBN       32.9563   112.6743
TFD       32.8859   111.9087
TOTEC     32.8266   111.6422
ITEMM     32.5865   110.5898
SSO       32.2692   109.2622
ELP       31.8072   106.3861
FIGMO     31.5908   105.3819
FST       30.9521   102.9757
ZHU       30.8789   102.2602
KEMPL     30.7204   100.8318
JCT       30.5083    99.7667
CUGAR     30.2847    95.6010
IAH       29.9497    95.3297
1 depart arpt = LAX   arrival aprt = IND   num_fix =          21
LAX       33.9419   118.4056
HEC       34.7800   116.4500
```

```
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
ANGEY     39.3035   96.6660
MKC       39.2794   94.5914
SAAGS     39.4612   93.2931
TWAIN     39.6911   91.4653
BAYLI     39.7393   91.0492
CAP       39.8922   89.6254
GORDO     39.8757   88.4965
ZID       39.8684   88.1482
VHP       39.7997   86.3700
IND       39.7197   86.2697
2 depart arpt = LAX   arrival aprt = IND   num_fix =          22
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3800  101.6800
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
ANGEY     39.3035   96.6660
MKC       39.2794   94.5914
SAAGS     39.4612   93.2931
TWAIN     39.6911   91.4653
BAYLI     39.7393   91.0492
CAP       39.8922   89.6254
GORDO     39.8757   88.4965
ZID       39.8684   88.1482
VHP       39.7997   86.3700
IND       39.7197   86.2697
1 depart arpt = LAX   arrival aprt = JFK   num_fix =          31
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
NORRA     36.7593  114.2811
ZLC       37.5008  112.7142
BCE       37.6892  112.3039
ZDV       38.9898  109.9833
CISCO     39.3033  109.3981
```

```
EKR       40.0675  107.9249
VIKNN     40.9670  103.6758
SNY       41.0967  102.9830
ZMP       41.3467   99.0304
OBH       41.3757   98.3536
DEFIN     41.8423   95.3587
ASTRO     42.0865   93.5258
ZAU       42.1167   93.2809
DBQ       42.4015   90.7091
COTON     42.3197   89.3091
OBK       42.2197   87.9500
UNBAR     42.0484   85.2131
ZOB       42.0319   85.0000
CRL       42.0300   83.4500
COHOW     42.1566   80.6942
SURLY     42.1631   80.4463
JHW       42.1797   79.1200
HOXIE     41.8650   77.8526
ZNY       41.7684   77.4864
AVP       41.2700   75.6800
LENDY     40.9147   74.1356
JFK       40.6197   73.7697
2 depart arpt = LAX   arrival aprt = JFK   num_fix =          36
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4578  111.9922
INW       35.0616  110.7950
DILCO     35.5313  110.0654
ZDV       35.8024  109.6370
FMN       36.7483  108.0981
HBU       38.4521  107.0397
ELBEC     38.6928  106.5051
ACREE     38.9056  106.0249
SHREW     39.1691  105.6948
BYSON     39.3708  105.4393
DEN       39.8003  104.8867
HCT       40.4541  100.9236
ZMP       41.1395   99.0348
OBH       41.3757   98.3536
DEFIN     41.8423   95.3587
ASTRO     42.0865   93.5258
ZAU       42.1167   93.2809
DBQ       42.4015   90.7091
COTON     42.3197   89.3091
OBK       42.2197   87.9500
UNBAR     42.0484   85.2131
ZOB       42.0319   85.0000
CRL       42.0300   83.4500
COHOW     42.1566   80.6942
```

```
SURLY     42.1631    80.4463
JHW       42.1797    79.1200
HOXIE     41.8650    77.8526
ZNY       41.7684    77.4864
AVP       41.2700    75.6800
LENDY     40.9147    74.1356
JFK       40.6197    73.7697
3 depart arpt = LAX   arrival aprt = JFK   num_fix =          37
LAX       33.9419   118.4056
IPL       32.7486   115.5075
BZA       32.7681   114.6028
ZAB       32.7756   114.0000
MOHAK     32.7759   113.9724
GBN       32.9563   112.6743
PXR       33.4578   111.9922
INW       35.0616   110.7950
DILCO     35.5313   110.0654
ZDV       35.8024   109.6370
FMN       36.7483   108.0981
HBU       38.4521   107.0397
ELBEC     38.6928   106.5051
ACREE     38.9056   106.0249
SHREW     39.1691   105.6948
BYSON     39.3708   105.4393
DEN       39.8003   104.8867
HCT       40.4541   100.9236
ZMP       41.1395    99.0348
OBH       41.3757    98.3536
DEFIN     41.8423    95.3587
ASTRO     42.0865    93.5258
ZAU       42.1167    93.2809
DBQ       42.4015    90.7091
COTON     42.3197    89.3091
OBK       42.2197    87.9500
UNBAR     42.0484    85.2131
ZOB       42.0319    85.0000
CRL       42.0300    83.4500
COHOW     42.1566    80.6942
SURLY     42.1631    80.4463
JHW       42.1797    79.1200
HOXIE     41.8650    77.8526
ZNY       41.7684    77.4864
AVP       41.2700    75.6800
LENDY     40.9147    74.1356
JFK       40.6197    73.7697
4 depart arpt = LAX   arrival aprt = JFK   num_fix =          25
LAX       33.9419   118.4056
DAG       34.8539   116.7861
CLARR     35.6758   115.6796
LAS       36.0797   115.1598
ZDV       37.0778   111.7451
DVC       37.8086   108.9306
```

```
HGO       38.8150  103.6261
GLD       39.3800  101.6800
ZMP       40.2417   99.0531
LNK       40.9238   96.7420
ZAU       41.3227   93.5465
CNOTA     41.4341   92.4901
IOW       41.5190   91.6133
VORIN     41.5480   89.3364
JOT       41.5464   88.3184
GIJ       41.7697   86.3194
BENJO     41.8798   85.2091
ZOB       41.9066   85.0000
CRL       42.0481   83.4576
COHOW     42.1566   80.6942
SURLY     42.1631   80.4463
JHW       42.1797   79.1200
AVP       41.2700   75.6800
LENDY     40.9147   74.1356
JFK       40.6197   73.7697
5 depart arpt = LAX   arrival aprt = JFK   num_fix =         26
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8086  108.9306
HGO       38.8150  103.6261
GLD       39.3800  101.6800
ZMP       40.2417   99.0531
LNK       40.9238   96.7420
ZAU       41.3227   93.5465
CNOTA     41.4341   92.4901
IOW       41.5190   91.6133
VORIN     41.5480   89.3364
JOT       41.5464   88.3184
GIJ       41.7697   86.3194
BENJO     41.8798   85.2091
ZOB       41.9066   85.0000
CRL       42.0481   83.4576
COHOW     42.1566   80.6942
SURLY     42.1631   80.4463
JHW       42.1797   79.1200
HOXIE     41.8650   77.8526
ZNY       41.7684   77.4864
AVP       41.2700   75.6800
LENDY     40.9147   74.1356
JFK       40.6197   73.7697
1 depart arpt = LAX   arrival aprt = MCI   num_fix =         14
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5961  114.7612
ZAB       33.5267  114.0000
SALOM     33.5162  113.8889
```

```
KOFFA     33.4636  113.3489
TFD       32.8859  111.9087
TOTEC     32.8266  111.6422
ITEMM     32.5865  110.5898
SSO       32.2692  109.2622
EWM       31.9497  106.2697
SJT       31.3581  100.4944
CLL       30.6000   96.4200
MCI       39.2992   94.7167
1 depart arpt = LAX   arrival aprt = MDW   num_fix =          20
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8086  108.9306
HGO       38.8150  103.6256
BOYET     38.8277  103.0932
OATHE     38.8549  101.7943
ZKC       38.8535  100.0165
HYS       38.8476   99.2768
SLN       38.7914   97.6500
AGENT     39.6357   94.8023
KIDER     39.7817   94.1783
IRK       40.0922   92.5417
COLIE     40.2806   92.1839
LOAMY     40.4245   91.7843
KEOKK     40.5534   91.4037
ZAU       40.6137   91.2282
BDF       41.2308   89.6156
MDW       41.7858   87.7500
2 depart arpt = LAX   arrival aprt = MDW   num_fix =          21
LAX       33.9419  118.4056
DAG       34.9624  116.5782
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8086  108.9306
HGO       38.8150  103.6256
BOYET     38.8277  103.0932
OATHE     38.8549  101.7943
ZKC       38.8535  100.0165
HYS       38.8476   99.2768
SLN       38.7914   97.6500
AGENT     39.6357   94.8023
KIDER     39.7817   94.1783
IRK       40.0922   92.5417
COLIE     40.2806   92.1839
LOAMY     40.4245   91.7843
KEOKK     40.5534   91.4037
ZAU       40.6137   91.2282
BDF       41.2308   89.6156
MDW       41.7858   87.7500
```

```
1 depart arpt = LAX   arrival aprt = MEM   num_fix =         18
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4578  111.9922
BOLIC     34.0112  110.3517
VERNO     34.2607  109.6272
SJN       34.4241  109.1435
LAVAN     34.9084  107.3424
ABQ       35.0417  106.6056
TCC       35.1821  103.5985
AMA       35.2875  101.6393
ZFW       35.3333  100.0000
SERTS     35.3543   98.8699
IRW       35.3583   97.6089
FSM       35.3361   94.3667
MEM       35.0497   89.9697
2 depart arpt = LAX   arrival aprt = MEM   num_fix =         16
LAX       33.9419  118.4056
HEC       34.7800  116.4500
EED       34.7660  114.4741
ZAB       34.7503  113.8722
DRK       34.7026  112.4802
PYRIT     34.8696  110.5114
ZUN       34.9658  109.1545
ABQ       35.0438  106.8163
TCC       35.1821  103.5985
AMA       35.2875  101.6393
ZFW       35.3333  100.0000
SERTS     35.3543   98.8699
IRW       35.3583   97.6089
FSM       35.3361   94.3667
GQE       35.3469   90.4781
MEM       35.0497   89.9697
1 depart arpt = LAX   arrival aprt = MIA   num_fix =         30
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5961  114.7612
ZAB       33.5267  114.0000
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
TFD       32.8856  111.9078
TOTEC     32.8266  111.6422
ITEMM     32.5865  110.5898
SSO       32.2692  109.2631
ALIBY     31.9214  107.7789
ELP       31.8072  106.3861
FIGMO     31.5908  105.3819
FST       30.9521  102.9757
ZHU       30.8789  102.2602
```

```
KEMPL     30.7204  100.8318
JCT       30.5980   99.8175
SPURS     30.3935   98.3513
AUS       30.2975   97.7033
PUFER     30.2144   97.0988
IAH       29.9569   95.3457
WEEVE     29.8402   94.4597
PEKON     29.6230   92.9242
LEV       29.1752   90.1040
SANTI     28.8502   88.6587
ZJX       28.6978   88.0066
NEPTA     28.6108   87.6412
ZMA       27.9898   84.9619
COVIA     27.9358   84.7361
MIA       25.8000   80.2833
1 depart arpt = LAX   arrival aprt = MKE   num_fix =          23
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
NORRA     36.7593  114.2811
ZLC       37.5008  112.7142
BCE       37.6892  112.3039
ZDV       38.9898  109.9833
CISCO     39.3033  109.3981
EKR       40.0675  107.9249
VIKNN     40.9670  103.6758
SNY       41.0967  102.9830
ZMP       41.3467   99.0304
OBH       41.3757   98.3536
DEFIN     41.8423   95.3587
ASTRO     42.0865   93.5258
ZAU       42.1167   93.2809
DBQ       42.4028   90.7083
JVL       42.6197   89.0389
JAYBE     42.6442   88.6388
TRUDO     42.6840   88.4198
VEENA     42.7047   88.3036
MKE       42.9478   87.8944
1 depart arpt = LAX   arrival aprt = MMPR  num_fix =           4
LAX       33.9419  118.4056
MZB       32.7819  117.2244
TIJ       32.5344  116.9506
MMPR      20.0000  107.0000
1 depart arpt = LAX   arrival aprt = MSP   num_fix =          17
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
NORRA     36.7593  114.2811
ZLC       37.5008  112.7142
BCE       37.6892  112.3039
```

```
ZDV       38.9898   109.9833
CISCO     39.3033   109.3981
EKR       40.0700   107.9200
CYS       41.2000   104.7697
ZMP       42.3581    99.3123
ONL       42.4703    98.6864
FSD       43.5786    96.7389
RWF       44.5458    95.0806
BUNKR     44.7117    94.3106
MSP       44.8842    93.2139
2 depart arpt = LAX   arrival aprt = MSP   num_fix =          17
LAX       33.9419   118.4056
HEC       34.7800   116.4500
BLD       35.9958   114.8636
ZDV       37.0778   111.7451
DVC       37.8088   108.9313
HBU       38.4519   107.0389
PARLI     38.5793   106.8429
DEN       39.8003   104.8867
KEANN     40.0993   104.2612
SMITY     40.3111   103.8094
PONNY     40.7518   102.8214
ZMP       42.2585    99.2297
ONL       42.4705    98.6869
FSD       43.5786    96.7389
RWF       44.5458    95.0806
BUNKR     44.7117    94.3106
MSP       44.8842    93.2139
3 depart arpt = LAX   arrival aprt = MSP   num_fix =          18
LAX       33.9419   118.4056
DAG       34.8539   116.7861
CLARR     35.6758   115.6796
LAS       36.0797   115.1598
ZDV       37.0778   111.7451
DVC       37.8088   108.9313
HBU       38.4519   107.0389
PARLI     38.5793   106.8429
DEN       39.8003   104.8867
KEANN     40.0993   104.2612
SMITY     40.3111   103.8094
PONNY     40.7518   102.8214
ZMP       42.2585    99.2297
ONL       42.4705    98.6869
FSD       43.5786    96.7389
RWF       44.5458    95.0806
BUNKR     44.7117    94.3106
MSP       44.8842    93.2139
1 depart arpt = LAX   arrival aprt = MSY   num_fix =          24
LAX       33.9419   118.4056
TRM       33.6281   116.1592
BLH       33.5961   114.7612
ZAB       33.5267   114.0000
```

```
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
TFD       32.8856  111.9078
TOTEC     32.8266  111.6422
ITEMM     32.5865  110.5898
SSO       32.2692  109.2631
ALIBY     31.9214  107.7789
ELP       31.8072  106.3861
FIGMO     31.5908  105.3819
FST       30.9521  102.9757
ZHU       30.8789  102.2602
KEMPL     30.7204  100.8318
JCT       30.5980   99.8175
SPURS     30.3935   98.3513
AUS       30.2975   97.7033
PUFER     30.2144   97.0988
IAH       29.9497   95.3297
LCH       30.1256   93.2222
AWDAD     30.0794   90.9033
MSY       30.0294   90.1719
1 depart arpt = LAX   arrival aprt = ORD   num_fix =          17
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1500
NORRA     36.7593  114.2811
ZLC       37.5008  112.7142
BCE       37.7064  112.1447
MTU       40.1450  110.1269
OCS       41.5900  109.0144
ZDV       41.6713  107.9272
SIRLY     41.7393  106.8831
BFF       41.8942  103.4820
ZMP       42.4033   99.3499
ONL       42.4703   98.6864
MCW       43.1578   93.3306
JVL       42.6197   89.0389
ORD       41.9822   87.9056
2 depart arpt = LAX   arrival aprt = ORD   num_fix =          31
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
ZLA       33.5267  114.0000
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4578  111.9922
BOLIC     34.0112  110.3517
VERNO     34.2607  109.6272
SJN       34.4241  109.1435
LAVAN     34.9084  107.3424
ABQ       35.0438  106.8163
LVS       35.6576  105.1356
```

```
ZKC       37.1586  102.2740
DRAWL     37.4854  101.6173
GCK       37.9191  100.7251
SLN       38.7914   97.6500
AGENT     39.6357   94.8023
KIDER     39.7817   94.1783
IRK       40.0922   92.5417
COLIE     40.2806   92.1839
LOAMY     40.4245   91.7843
KEOKK     40.5534   91.4037
ZAU       40.6137   91.2282
BDF       41.2308   89.6156
OWENA     41.3448   89.1939
KELSI     41.4390   88.9914
AHMED     41.4977   88.8644
SHOOZ     41.5546   88.7409
PLANO     41.6125   88.6147
ORD       41.9822   87.9056
3 depart arpt = LAX   arrival aprt = ORD   num_fix =          31
LAX       33.9419  118.4056
IPL       32.7486  115.5075
BZA       32.7681  114.6028
ZAB       32.7756  114.0000
MOHAK     32.7759  113.9724
GBN       32.9563  112.6743
PXR       33.4330  111.9702
BOLIC     34.0112  110.3517
VERNO     34.2607  109.6272
SJN       34.4241  109.1435
LAVAN     34.9084  107.3424
ABQ       35.0438  106.8163
LVS       35.6576  105.1356
ZKC       37.1586  102.2740
DRAWL     37.4854  101.6173
GCK       37.9191  100.7251
SLN       38.7914   97.6500
AGENT     39.6357   94.8023
KIDER     39.7817   94.1783
IRK       40.0922   92.5417
COLIE     40.2806   92.1839
LOAMY     40.4245   91.7843
KEOKK     40.5534   91.4037
ZAU       40.6137   91.2282
BDF       41.2308   89.6156
OWENA     41.3448   89.1939
KELSI     41.4390   88.9914
AHMED     41.4977   88.8644
SHOOZ     41.5546   88.7409
PLANO     41.6647   88.5719
ORD       41.9822   87.9056
1 depart arpt = LAX   arrival aprt = PHL   num_fix =          27
LAX       33.9419  118.4056
```

```
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3879  101.6923
ZMP       40.2417   99.0531
LNK       40.9238   96.7420
ZAU       41.3227   93.5465
CNOTA     41.4341   92.4901
IOW       41.6392   91.5444
VORIN     41.5480   89.3364
JOT       41.5464   88.3184
HOBAR     41.5418   87.2086
GSH       41.5252   86.0280
ZOB       41.4895   84.8883
ASHEN     41.4805   84.6468
NAPOL     41.4604   84.1521
MAYZE     41.4386   83.6641
DJB       41.3581   82.1619
PHATY     41.3016   81.5342
HAGUD     41.1921   80.4161
GRACE     40.8569   79.8006
JST       40.3164   78.8333
BUCKS     40.0803   75.7239
PHL       39.8697   75.2300
2 depart arpt = LAX   arrival aprt = PHL   num_fix =         29
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
ZAB       33.5267  114.0000
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4578  111.9922
CHEAR     34.3699  110.4712
ZUN       34.9500  109.1500
CIM       36.4797  104.8700
ZKC       37.3553  102.4327
GCK       37.9191  100.7251
SLN       38.7914   97.6500
JUDGE     39.0153   96.9212
MKC       39.1231   94.5917
SAAGS     39.4612   93.2931
TWAIN     39.6911   91.4653
BAYLI     39.7393   91.0492
CAP       39.8922   89.6254
GORDO     39.8757   88.4965
ZID       39.8684   88.1482
VHP       39.7997   86.3700
ROD       40.2800   84.0300
BLISS     40.3274   81.9727
ZOB       40.3300   81.6775
```

```
AVERE     40.3310   80.0573
JST       40.3164   78.8333
BUCKS     40.0803   75.7239
PHL       39.8697   75.2300
3 depart arpt = LAX   arrival aprt = PHL   num_fix =          28
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3879  101.6923
ZMP       40.2417   99.0531
LNK       40.9238   96.7420
ZAU       41.3227   93.5465
CNOTA     41.4341   92.4901
IOW       41.6392   91.5444
VORIN     41.5480   89.3364
JOT       41.5464   88.3184
HOBAR     41.5418   87.2086
GSH       41.5252   86.0280
ZOB       41.4895   84.8883
ASHEN     41.4805   84.6468
NAPOL     41.4604   84.1521
MAYZE     41.4386   83.6641
DJB       41.3581   82.1619
PHATY     41.3016   81.5342
HAGUD     41.1921   80.4161
GRACE     40.8569   79.8006
JST       40.3164   78.8333
BUCKS     40.0803   75.7239
PHL       39.8697   75.2300
1 depart arpt = LAX   arrival aprt = PHX   num_fix =           7
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
PXR       33.4578  111.9922
PHX       33.4200  111.8797
2 depart arpt = LAX   arrival aprt = PHX   num_fix =           6
LAX       33.9419  118.4056
IPL       32.7486  115.5075
BZA       32.7681  114.6028
ZAB       32.7756  114.0000
MOHAK     32.7756  113.9714
PHX       33.4200  111.8797
3 depart arpt = LAX   arrival aprt = PHX   num_fix =           6
LAX       33.9419  118.4056
DAG       34.8539  116.7861
EED       34.7500  114.4697
```

```
ZAB       34.7503  113.8722
DRK       34.7025  112.4794
PHX       33.4200  111.8797
1 depart arpt = LAX   arrival aprt = PIT   num_fix =         24
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8088  108.9313
HBU       38.4521  107.0397
GLD       39.3879  101.6923
ZMP       40.2417   99.0531
LNK       40.9238   96.7420
ZAU       41.3227   93.5465
CNOTA     41.4341   92.4901
IOW       41.6392   91.5444
VORIN     41.5480   89.3364
JOT       41.5461   88.3183
GIJ       41.7686   86.3184
PLAIN     41.7777   85.2067
ZOB       41.7988   84.8551
GERBS     41.7777   84.4251
IDEAS     41.7714   83.5518
DJB       41.3500   82.1500
ACO       41.1078   81.2017
DEFOE     41.0437   81.0458
CUTTA     40.8761   80.6433
PIT       40.4936   80.2306
1 depart arpt = LAX   arrival aprt = SAT   num_fix =         18
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
ZAB       33.5267  114.0000
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
GBN       32.9563  112.6743
TFD       32.8859  111.9087
TOTEC     32.8266  111.6422
ITEMM     32.5865  110.5898
SSO       32.2692  109.2622
ELP       31.8072  106.3861
FIGMO     31.5908  105.3819
FST       30.9167  102.9167
ZHU       30.7738  102.2887
SHUCK     30.5076  101.2929
CSI       29.9222   99.2139
SAT       29.6436   98.4608
1 depart arpt = LAX   arrival aprt = SLC   num_fix =         11
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
```

```
NORRA     36.7593   114.2811
ZLC       37.6599   113.5760
BERYL     37.9001   113.3857
GEGEE     37.9664   113.3313
MLF       38.3604   113.0132
FFU       40.2700   111.9300
SLC       40.8500   111.9697
1 depart arpt = LAX   arrival aprt = STL   num_fix =          19
LAX       33.9419   118.4056
TRM       33.6281   116.1592
BLH       33.5797   114.7500
SALOM     33.5162   113.8889
KOFFA     33.4636   113.3489
PXR       33.4578   111.9922
BOLIC     34.0112   110.3517
VERNO     34.2607   109.6272
SJN       34.4241   109.1435
LAVAN     34.9084   107.3424
ABQ       35.0438   106.8163
LVS       35.6539   105.1417
ZKC       36.9025   102.0689
LBL       37.0444   100.9712
ICT       37.7452    97.5838
DOSOA     38.1867    95.0276
BUM       38.2700    94.4800
TRAKE     38.6917    91.7425
STL       38.8606    90.4822
2 depart arpt = LAX   arrival aprt = STL   num_fix =          17
LAX       33.9419   118.4056
DAG       34.8539   116.7861
CLARR     35.6758   115.6796
LAS       36.0797   115.1598
ZDV       37.0778   111.7451
DVC       37.8088   108.9313
HBU       38.4521   107.0397
GLD       39.3800   101.6800
HLC       39.2588   100.2259
ZKC       39.2834    99.1685
ZARDO     39.3024    97.5688
SLOWR     39.3032    97.3821
ANGEY     39.3035    96.6660
MKC       39.1231    94.5917
DRIVL     39.1893    93.5709
WELTS     39.0081    91.7711
STL       38.8606    90.4822
3 depart arpt = LAX   arrival aprt = STL   num_fix =          14
LAX       33.9419   118.4056
HEC       34.7800   116.4500
BLD       35.9958   114.8636
ZDV       37.0778   111.7451
DVC       37.8088   108.9313
HBU       38.4521   107.0397
```

```
GLD       39.3800  101.6800
HLC       39.2588  100.2259
ZKC       39.2834   99.1685
ZARDO     39.3024   97.5688
SLOWR     39.3032   97.3821
ANGEY     39.3035   96.6660
MKC       39.2794   94.5914
STL       38.8606   90.4822
1 depart arpt = LAX   arrival aprt = TPA   num_fix =          8
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5797  114.7500
BXK       33.4250  112.6806
SSO       32.2692  109.2622
ALIBY     31.9214  107.7789
ELP       31.8072  106.3861
TPA       27.9736   82.5306
1 depart arpt = LAX   arrival aprt = TUS   num_fix =          9
LAX       33.9419  118.4056
TRM       33.6281  116.1592
BLH       33.5961  114.7612
ZAB       33.5267  114.0000
SALOM     33.5162  113.8889
KOFFA     33.4636  113.3489
GBN       32.9500  112.6700
ALMON     32.3836  111.4948
TUS       32.1181  110.9417
2 depart arpt = LAX   arrival aprt = TUS   num_fix =          8
LAX       33.9419  118.4056
IPL       32.7486  115.5075
BZA       32.7681  114.6028
ZAB       32.7756  114.0000
MOHAK     32.7759  113.9724
GBN       32.9500  112.6700
ALMON     32.3836  111.4948
TUS       32.1181  110.9417
1 depart arpt = LAX   arrival aprt = YYZ   num_fix =          7
LAX       33.4919  118.4056
DAG       34.8539  116.7861
EKR       40.0700  107.9200
CYS       41.2000  104.7697
MCW       43.1578   93.5430
ECK       43.2500   82.7197
YYZ       43.6822   79.6428
2 depart arpt = LAX   arrival aprt = YYZ   num_fix =         10
LAX       33.9419  118.4056
HEC       34.7800  116.4500
BLD       35.9958  114.8636
ZDV       37.0778  111.7451
DVC       37.8086  108.9306
HGO       38.8150  103.6261
GLD       39.3800  101.6800
```

```
ZMP       40.2417   99.0531
LNK       40.8506   96.7583
YYZ       43.6822   79.6428
3 depart arpt = LAX   arrival aprt = YYZ   num_fix =          16
LAX       33.9419  118.4056
DAG       34.8539  116.7861
CLARR     35.6758  115.6796
LAS       36.0797  115.1598
ZDV       37.0778  111.7451
DVC       37.8086  108.9306
HGO       38.8150  103.6261
GLD       39.3800  101.6800
ZMP       40.2417   99.0531
LNK       40.8506   96.7583
DSM       41.5347   93.6583
ZAU       41.4894   93.4984
DBQ       42.4028   90.7083
BAE       43.1197   88.2800
ECK       43.2500   82.7197
YYZ       43.6822   79.6428
1 depart arpt = SAN   arrival aprt = OAK   num_fix =           9
SAN       32.7333  117.1861
MZB       32.7819  117.2244
PACIF     33.2858  117.7469
BIGJO     33.3833  117.9833
LAX       33.9419  118.4056
GMN       34.7997  118.8497
EHF       35.4844  119.0961
PXN       36.7153  120.7775
OAK       37.7197  122.2197
1 depart arpt = SAN   arrival aprt = SJC   num_fix =          11
SAN       32.7333  117.1861
MZB       32.7819  117.2244
PACIF     33.2858  117.7469
BIGJO     33.3833  117.9833
LAX       33.9419  118.4056
FIM       34.3500  118.8700
GMN       34.7997  118.8497
TP        35.8500  119.9300
SNS       36.6625  121.6028
GILRO     37.0311  121.5700
SJC       37.3647  121.9292
1 depart arpt = SAN   arrival aprt = SFO   num_fix =          12
SAN       32.7333  117.1861
MZB       32.7819  117.2244
PACIF     33.2858  117.7469
BIGJO     33.3833  117.9833
LAX       33.9419  118.4056
AVE       35.6469  119.9775
BSR       36.1811  121.6408
CARME     36.4550  121.8786
ANJEE     36.7464  121.9650
```

```
SKUNK     37.0075   122.0331
MENLO     37.4636   122.1536
SFO       37.6194   122.3728
1 depart arpt = SAN   arrival aprt = BOS   num_fix =          32
SAN       32.7333   117.1861
MZB       32.7819   117.2244
PACIF     33.2858   117.7469
BIGJO     33.3833   117.9833
POM       34.0783   117.7861
DAG       34.8539   116.7861
CLARR     35.6756   115.6786
LAS       36.0797   115.1500
NORRA     36.7592   114.2803
ZLC       37.6600   113.5761
BERYL     37.9000   113.3847
GEGEE     37.9664   113.3303
MLF       38.4267   113.0111
DDY       43.0917   106.2772
RAP       43.9697   103.0000
ZMP       44.4847   101.4667
ABR       45.4172    98.3683
GEP       45.1300    93.3700
GRB       44.4878    88.1278
PECOK     44.0078    85.7208
ZOB       43.6897    84.4019
DIRKS     43.4992    83.6481
ECK       43.2500    82.7197
ZOB       43.2031    82.3214
ZOB       42.9508    79.0583
BUF       42.9392    78.7333
HANKK     42.8953    77.1714
AUDIL     42.8717    76.4433
FABEN     42.8531    75.9525
ALB       42.7469    73.8036
GDM       42.5300    72.0497
BOS       42.3500    70.9800
1 depart arpt = SAN   arrival aprt = DEN   num_fix =          15
SAN       32.7333   117.1861
MZB       32.7819   117.2244
PACIF     33.2858   117.7469
BIGJO     33.3833   117.9833
POM       34.0783   117.7861
DAG       34.8539   116.7861
CLARR     35.6756   115.6786
LAS       36.0797   115.1500
ZDV       36.0292   111.7083
DVC       37.8086   108.9306
HBU       38.4519   107.0389
ELBEC     38.6928   106.5044
ACREE     38.9056   106.0242
SHREW     39.1689   105.6942
DEN       39.8003   104.8867
```

```
1 depart arpt = SAN   arrival aprt = DFW   num_fix =          14
SAN       32.7333  117.1861
IPL       32.7486  115.5075
BZA       32.7700  114.5997
ZAB       32.7756  114.0000
MOHAK     32.7756  113.9714
TFD       32.8856  111.9078
TOTEC     32.8264  111.6414
ITEMM     32.5844  110.5897
SSO       32.2692  109.2622
EWM       31.9497  106.2697
CONNE     31.9339  105.3289
ZFW       31.8883  103.6228
AQN       32.4344   97.6636
DFW       32.8964   97.0333
1 depart arpt = SAN   arrival aprt = DTW   num_fix =          20
SAN       32.7333  117.1861
MZB       32.7819  117.2244
PACIF     33.2858  117.7469
BIGJO     33.3833  117.9833
POM       34.0783  117.7861
DAG       34.8539  116.7861
CLARR     35.6756  115.6786
LAS       36.0797  115.1500
ZDV       36.0292  111.7083
DVC       37.8086  108.9306
HBU       38.4519  107.0389
GLD       39.3800  101.6800
OBH       41.3756   98.3531
DEFIN     41.8422   95.3583
ASTRO     42.0864   93.5256
ZAU       42.1167   93.2808
DBQ       42.4028   90.7083
BAE       43.1197   88.2800
MKG       43.1692   86.0392
DTW       42.2186   83.3472
1 depart arpt = SAN   arrival aprt = EWR   num_fix =          33
SAN       32.7333  117.1861
MZB       32.7819  117.2244
PACIF     33.2858  117.7469
BIGJO     33.3833  117.9833
POM       34.0783  117.7861
DAG       34.8539  116.7861
CLARR     35.6756  115.6786
LAS       36.0797  115.1500
NORRA     36.7592  114.2803
ZLC       37.5008  112.7142
BCE       37.7064  112.1447
CISCO     39.3033  109.3972
EKR       40.0700  107.9200
VIKNN     40.9669  103.6758
SNY       41.1011  102.9833
```

```
ZMP       41.3467    99.0303
OBH       41.3756    98.3531
DSM       41.5347    93.6583
ZAU       41.4444    93.5064
IOW       41.6392    91.5444
VORIN     41.5478    89.3361
JOT       41.5461    88.3183
GIJ       41.7697    86.3194
BENJO     41.8797    85.2089
ZOB       41.9067    85.0000
CRL       42.0300    83.4500
BUYKK     41.9550    82.2678
KEEHO     41.9178    81.0831
BEELR     41.8653    81.2517
DORET     41.8014    80.5847
BRIAR     41.5392    78.1894
SLT       41.5125    77.9703
EWR       40.6944    74.1667
1 depart arpt = SAN   arrival aprt = SLC   num_fix =          15
SAN       32.7333   117.1861
MZB       32.7819   117.2244
PACIF     33.2858   117.7469
BIGJO     33.3833   117.9833
POM       34.0783   117.7861
DAG       34.8539   116.7861
CLARR     35.6756   115.6786
LAS       36.0797   115.1500
NORRA     36.7592   114.2803
ZLC       37.6600   113.5761
BERYL     37.9000   113.3847
GEGEE     37.9664   113.3303
MLF       38.4267   113.0111
FFU       40.2700   111.9300
SLC       40.8500   111.9697
1 depart arpt = SAN   arrival aprt = JFK   num_fix =          32
SAN       32.7333   117.1861
MZB       32.7819   117.2244
PACIF     33.2858   117.7469
BIGJO     33.3833   117.9833
POM       34.0783   117.7861
DAG       34.8539   116.7861
CLARR     35.6756   115.6786
LAS       36.0797   115.1500
NORRA     36.7592   114.2803
ZLC       37.6600   113.5761
CISCO     39.3033   109.3972
EKR       40.0700   107.9200
VIKNN     40.9669   103.6758
SNY       41.1011   102.9833
ZMP       41.3467    99.0303
OBH       41.3756    98.3531
DEFIN     41.8422    95.3583
```

```
ASTRO     42.0864    93.5256
ZAU       42.1167    93.2808
DBQ       42.4028    90.7083
COTON     42.3194    89.3089
OBK       42.2197    87.9500
UNBAR     42.0483    85.2131
ZOB       42.0319    85.0000
CRL       42.0300    83.4500
COHOW     42.1564    80.6942
SURLY     42.1631    80.4464
JHW       42.1797    79.1200
HOXIE     41.8975    77.8417
AVP       41.2700    75.6800
LENDY     40.9147    74.1356
JFK       40.6197    73.7697
1 depart arpt = SAN   arrival aprt = PHX   num_fix =          7
SAN       32.7333   117.1861
IPL       32.7486   115.5075
BZA       32.7700   114.5997
ZAB       32.7756   114.0000
MOHAK     32.7756   113.9714
GBN       32.9500   112.6700
PHX       33.4200   111.8797
1 depart arpt = SAN   arrival aprt = ORD   num_fix =         19
SAN       32.7333   117.1861
MZB       32.7819   117.2244
PACIF     33.2858   117.7469
BIGJO     33.3833   117.9833
POM       34.0783   117.7861
DAG       34.8539   116.7861
CLARR     35.6756   115.6786
LAS       36.0797   115.1500
NORRA     36.7592   114.2803
ZLC       37.5008   112.7142
BCE       37.7064   112.1447
MTU       40.1450   110.1269
OCS       41.5900   109.0144
SIRLY     41.7392   106.8825
BFF       41.8942   103.4814
ZMP       42.4033    99.3500
ONL       42.4703    98.6864
JVL       42.6197    89.0389
ORD       41.9822    87.9056
2 depart arpt = SAN   arrival aprt = ORD   num_fix =         30
SAN       32.7333   117.1861
IPL       32.7486   115.5075
BZA       32.7700   114.5997
ZAB       32.7756   114.0000
MOHAK     32.7756   113.9714
PXR       33.4439   111.9722
BOLIC     34.0278   110.3517
VERNO     34.2569   109.6214
```

```
SJN       34.5208   109.3778
LAVAN     34.9083   107.3417
ABQ       35.0417   106.6056
LVS       35.6539   105.1417
ZKC       37.1586   102.2739
DRAWL     37.4853   101.6167
GCK       37.9300   100.7250
SLN       38.7914    97.6500
AGENT     39.6197    94.7925
KIDER     39.7678    94.1808
IRK       40.0922    92.5417
COLIE     40.2806    92.1836
LOAMY     40.4244    91.7839
KEOKK     40.5533    91.4036
ZAU       40.6108    91.2283
BDF       41.2308    89.6156
OWENA     41.3447    89.1939
KELSI     41.4431    89.0219
AHMED     41.5667    88.7717
SHOOZ     41.5544    88.7408
PLANO     41.6647    88.5719
ORD       41.9822    87.9056
1 depart arpt = SAN   arrival aprt = STL   num_fix =          19
SAN       32.7333   117.1861
MZB       32.7819   117.2244
PACIF     33.2858   117.7469
BIGJO     33.3833   117.9833
POM       34.0783   117.7861
DAG       34.8539   116.7861
CLARR     35.6756   115.6786
LAS       36.0797   115.1500
ZDV       37.0778   111.7450
DVC       37.8086   108.9306
HBU       38.4519   107.0389
HLC       39.2500   100.2197
SKC       39.2833    99.1686
ZARDO     39.3025    97.5689
SLOWR     39.3031    97.3817
ANGEY     39.3031    96.6008
MKC       39.1231    94.5917
WELTS     39.0081    91.7708
STL       38.8606    90.4822
1 depart arpt = EWR   arrival aprt = SAN   num_fix =          34
EWR       40.6944    74.1667
RBV       40.2000    74.4800
SUZIE     40.4531    75.9731
RAV       40.5497    76.5797
VALLO     40.6267    77.4383
BURNI     40.6569    77.8039
ZNY       40.6706    77.9761
WEC       40.8253    80.2117
MAINE     40.8931    81.6881
```

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MORES     40.8983    81.8181
GONER     40.9656    84.2008
ZOB       40.9736    84.7008
FWA       40.9697    85.1800
WHETT     41.1600    86.5839
BDF       41.2308    89.6156
YOUDO     41.0542    90.5217
BURKK     40.9692    91.2308
ALBERT    40.8414    92.2283
JAVAS     40.7656    92.7886
ZAU       40.6631    93.5147
LMN       40.5967    93.9672
PWE       40.2000    96.2000
ZMP       39.5961    98.8644
HLC       39.2500   100.2197
PUB       38.2947   104.4292
FMN       36.7483   108.0981
COCAN     36.3125   110.3511
TBC       36.1211   111.2689
EED       34.7500   114.4697
MOMAR     33.5650   115.9345
PILLO     32.7703   116.4687
I-UBR     32.6600   116.8885
SWATT     32.6792   116.9662
SAN       32.7333   117.1861
1 depart arpt = DEN   arrival aprt = SAN   num_fix =          13
DEN       39.8003   104.8867
LAWSN     39.5178   106.4764
DBL       39.4392   106.8939
ZDV       38.6211   109.9833
HVE       38.4167   110.6989
BCE       37.7064   112.1447
BLD       35.9639   114.8514
TNP       34.1294   115.9389
MOMAR     33.5650   115.9345
PILLO     32.7703   116.4687
I-UBR     32.6600   116.8885
SWATT     32.6792   116.9662
SAN       32.7333   117.1861
1 depart arpt = DFW   arrival aprt = SAN   num_fix =          15
DFW       32.8964    97.0333
WORTH     32.8392    99.5994
ABI       32.4697    99.8497
INK       31.7792   103.2028
ZFW       31.8883   103.6228
CONNE     31.9339   105.3289
EWM       31.9497   106.2697
SSO       32.2692   109.2622
BXK       33.4250   112.6806
DECAS     33.8233   115.4558
MOMAR     33.5650   115.9345
PILLO     32.7703   116.4687
```

```
I-UBR     32.6600  116.8885
SWATT     32.6792  116.9662
SAN       32.7333  117.1861
1 depart arpt = IAH   arrival aprt = SAN   num_fix =          12
IAH       29.9497   95.3297
FST       30.9167  102.9167
FIGMO     31.5908  105.3819
ELP       31.8072  106.3861
SSO       32.2692  109.2622
BXK       33.4250  112.6806
DECAS     33.8233  115.4558
MOMAR     33.5650  115.9345
PILLO     32.7703  116.4687
I-UBR     32.6600  116.8885
SWATT     32.6792  116.9662
SAN       32.7333  117.1861
1 depart arpt = IAD   arrival aprt = SAN   num_fix =          13
IAD       38.9436   77.4528
IHD       39.9742   79.3586
CAP       39.8919   89.6253
IRK       40.0922   92.5417
GLD       39.3800  101.6800
DVC       37.8086  108.9306
PGS       35.6197  113.5300
TNP       34.1294  115.9389
MOMAR     33.5650  115.9345
PILLO     32.7703  116.4687
I-UBR     32.6600  116.8885
SWATT     32.6792  116.9662
SAN       32.7333  117.1861
1 depart arpt = MSP   arrival aprt = SAN   num_fix =          16
MSP       44.8842   93.2139
FSD       43.5786   96.7389
ONL       42.4703   98.6864
DEN       39.8003  104.8867
LAWSN     39.5178  106.4764
DBL       39.4392  106.8939
ZDV       38.6211  109.9833
HVE       38.4167  110.6989
BCE       37.7064  112.1447
BLD       35.9639  114.8514
TNP       34.1294  115.9389
MOMAR     33.5650  115.9345
PILLO     32.7703  116.4687
I-UBR     32.6600  116.8885
SWATT     32.6792  116.9662
SAN       32.7333  117.1861
1 depart arpt = ORD   arrival aprt = SAN   num_fix =          16
ORD       41.9822   87.9056
JOT       41.5461   88.3183
MZV       41.3208   90.6378
DEN       39.8003  104.8867
```

```
LAWSN     39.5178   106.4764
DBL       39.4392   106.8939
ZDV       38.6211   109.9833
HVE       38.4167   110.6989
BCE       37.7064   112.1447
BLD       35.9639   114.8514
TNP       34.1294   115.9389
MOMAR     33.5650   115.9345
PILLO     32.7703   116.4687
I-UBR     32.6600   116.8885
SWATT     32.6792   116.9662
SAN       32.7333   117.1861
1 depart arpt = JFK   arrival aprt = SAN   num_fix =          14
JFK       40.6197    73.7697
RAV       40.5497    76.5797
PUB       38.2947   104.4292
FMN       36.7483   108.0981
COCAN     36.3125   110.3511
TBC       36.1211   111.2689
ZDV       36.0292   111.7083
PGS       35.6197   113.5300
TNP       34.1294   115.9389
MOMAR     33.5650   115.9345
PILLO     32.7703   116.4687
I-UBR     32.6600   116.8885
SWATT     32.6792   116.9662
SAN       32.7333   117.1861
1 depart arpt = MIA   arrival aprt = SAN   num_fix =          25
MIA       25.8000    80.2833
NEPTA     28.6108    87.6433
SANTI     28.8519    88.6675
LEV       29.1700    90.0997
PEKON     29.6361    92.9175
WEEVE     29.8397    94.4594
IAH       29.9497    95.3297
PUFER     30.2144    97.0989
AUS       30.2983    97.7000
SPURS     30.3936    98.3514
JCT       30.5083    99.7667
KEMPL     30.7200   100.8314
ZHU       30.8789   102.2603
FST       30.9167   102.9167
FIGMO     31.5908   105.3819
ELP       31.8072   106.3861
ALIBY     31.9214   107.7789
SSO       32.2692   109.2622
BXK       33.4250   112.6806
DECAS     33.8233   115.4558
MOMAR     33.5650   115.9345
PILLO     32.7703   116.4687
I-UBR     32.6600   116.8885
SWATT     32.6792   116.9662
```

```
SAN       32.7333  117.1861
1 depart arpt = DTW   arrival aprt = SAN   num_fix =          21
DTW       42.2186   83.3472
DUNKS     42.4272   84.1942
ALPHE     42.4353   84.4967
ZOB       42.4472   85.0000
PMM       42.4653   86.1058
DBQ       42.4028   90.7083
ZAU       42.5539   93.0978
FOD       42.6000   94.2800
ONL       42.4703   98.6864
ZMP       42.3581   99.3122
CYS       41.2000  104.7697
EKR       40.0700  107.9200
ZDV       39.2636  110.0236
BCE       37.7064  112.1447
BLD       35.9639  114.8514
TNP       34.1294  115.9389
MOMAR     33.5650  115.9345
PILLO     32.7703  116.4687
I-UBR     32.6600  116.8885
SWATT     32.6792  116.9662
SAN       32.7333  117.1861
1 depart arpt = BOS   arrival aprt = SAN   num_fix =          17
BOS       42.3500   70.9800
CAM       42.9797   73.3297
SYR       43.1497   76.2000
DEN       39.8003  104.8867
LAWSN     39.5178  106.4764
DBL       39.4392  106.8939
ZDV       38.6211  109.9833
HVE       38.4167  110.6989
BCE       37.7064  112.1447
ZLC       37.5008  112.5983
BLD       35.9639  114.8514
TNP       34.1294  115.9389
MOMAR     33.5650  115.9345
PILLO     32.7703  116.4687
I-UBR     32.6600  116.8885
SWATT     32.6792  116.9662
SAN       32.7333  117.1861
1 depart arpt = BNA   arrival aprt = SAN   num_fix =          20
BNA       36.1197   86.6700
MEM       35.0497   89.9697
ZME       35.0200   89.8400
KLUBB     35.1200   95.4667
DWINE     35.2025   96.1686
IRW       35.3583   97.6089
SERTS     35.3542   98.8689
ZFW       35.3333  100.0000
AMA       35.2872  101.6386
TCC       35.1800  103.6028
```

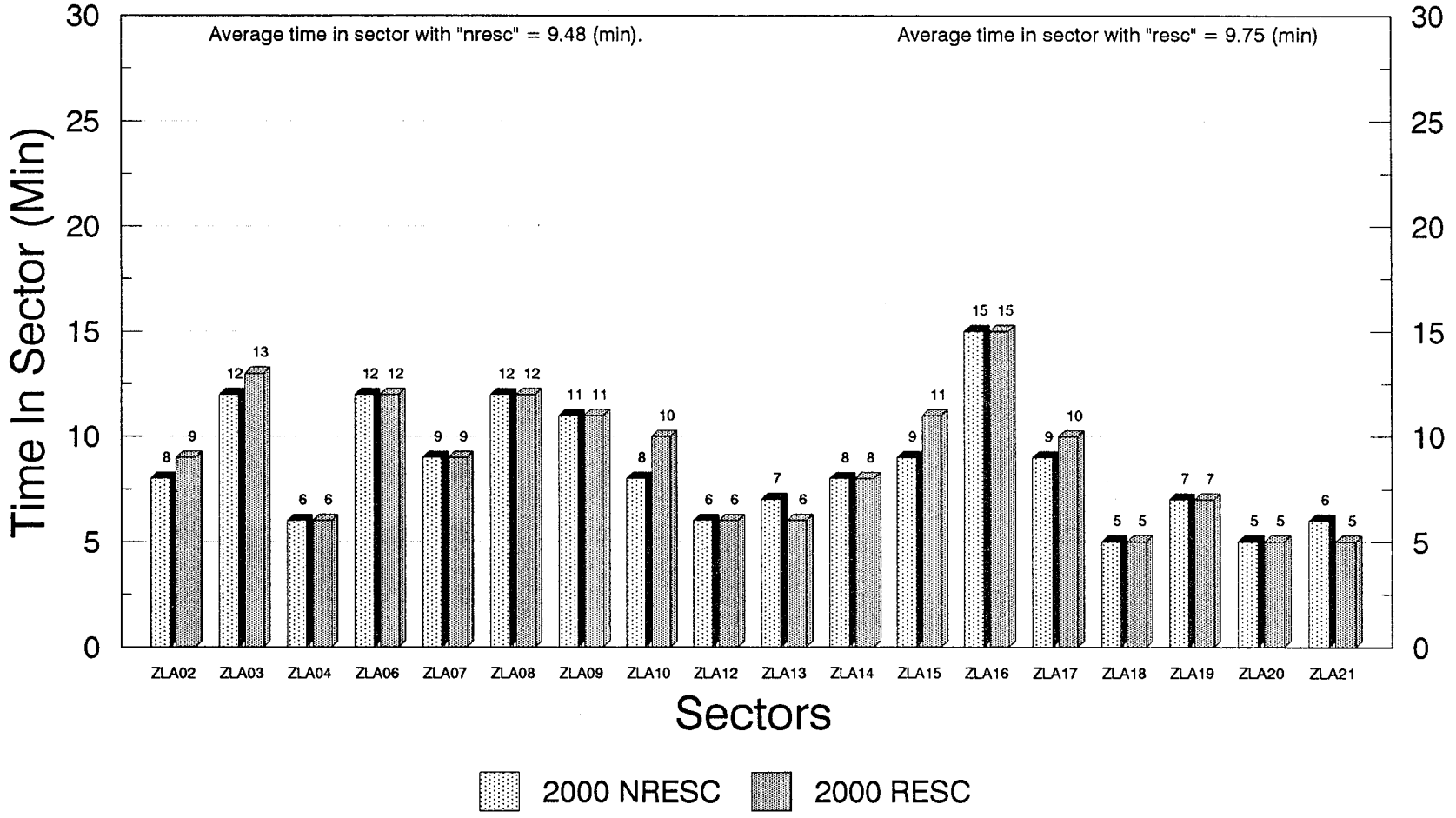
```
ABQ       35.0417  106.6056
ZUN       34.9500  109.1500
PYRIT     34.8694  110.5106
DRK       34.7025  112.4794
PKE       34.1000  114.6700
MOMAR     33.5650  115.9345
PILLO     32.7703  116.4687
I-UBR     32.6600  116.8885
SWATT     32.6792  116.9662
SAN       32.7333  117.1861
1 depart arpt = SLC   arrival aprt = SAN   num_fix =          12
SLC       40.8500  111.9697
MLF       38.4267  113.0111
GEGEE     37.9664  113.3303
BERYL     37.9000  113.3847
NORRA     36.7592  114.2803
OVETO     36.4606  114.5069
TNP       34.1294  115.9389
MOMAR     33.5650  115.9345
PILLO     32.7703  116.4687
I-UBR     32.6600  116.8885
SWATT     32.6792  116.9662
SAN       32.7333  117.1861
```

APPENDIX C

RESULTS IN GRAPHICAL FORM

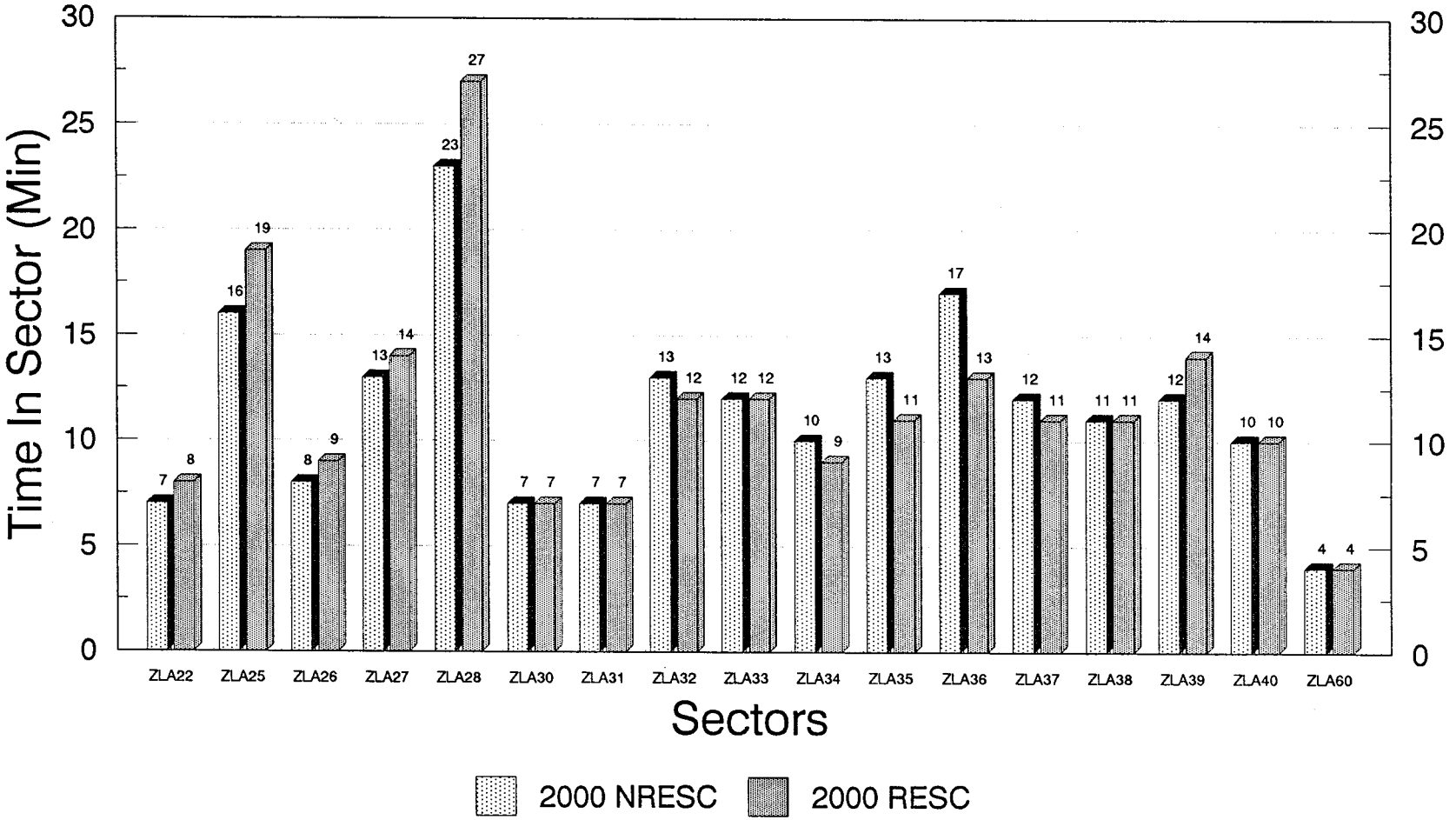
This appendix shows the results presented in section 4 graphically. The plotted values are exact, and may not precisely match the rounded values presented throughout this report.

ZLA Sector Crossing Times
May 16, 2000 (100% VMC)
Graph 1 of 2



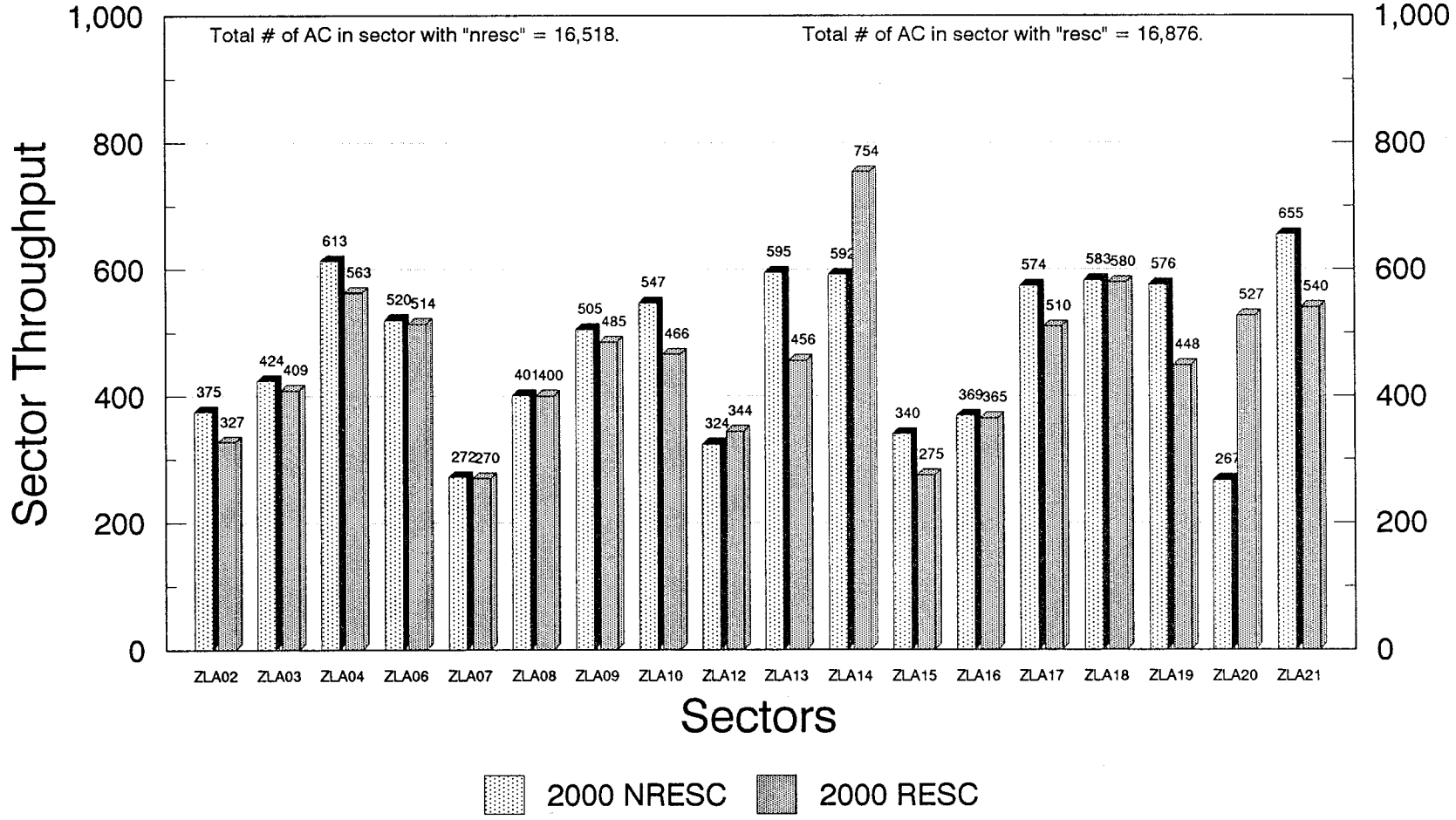
NRESC = No resectorization
RESC = Resectorization

ZLA Sector Crossing Times (Continue)
May 16, 2000 (100% VMC)
Graph 2 of 2



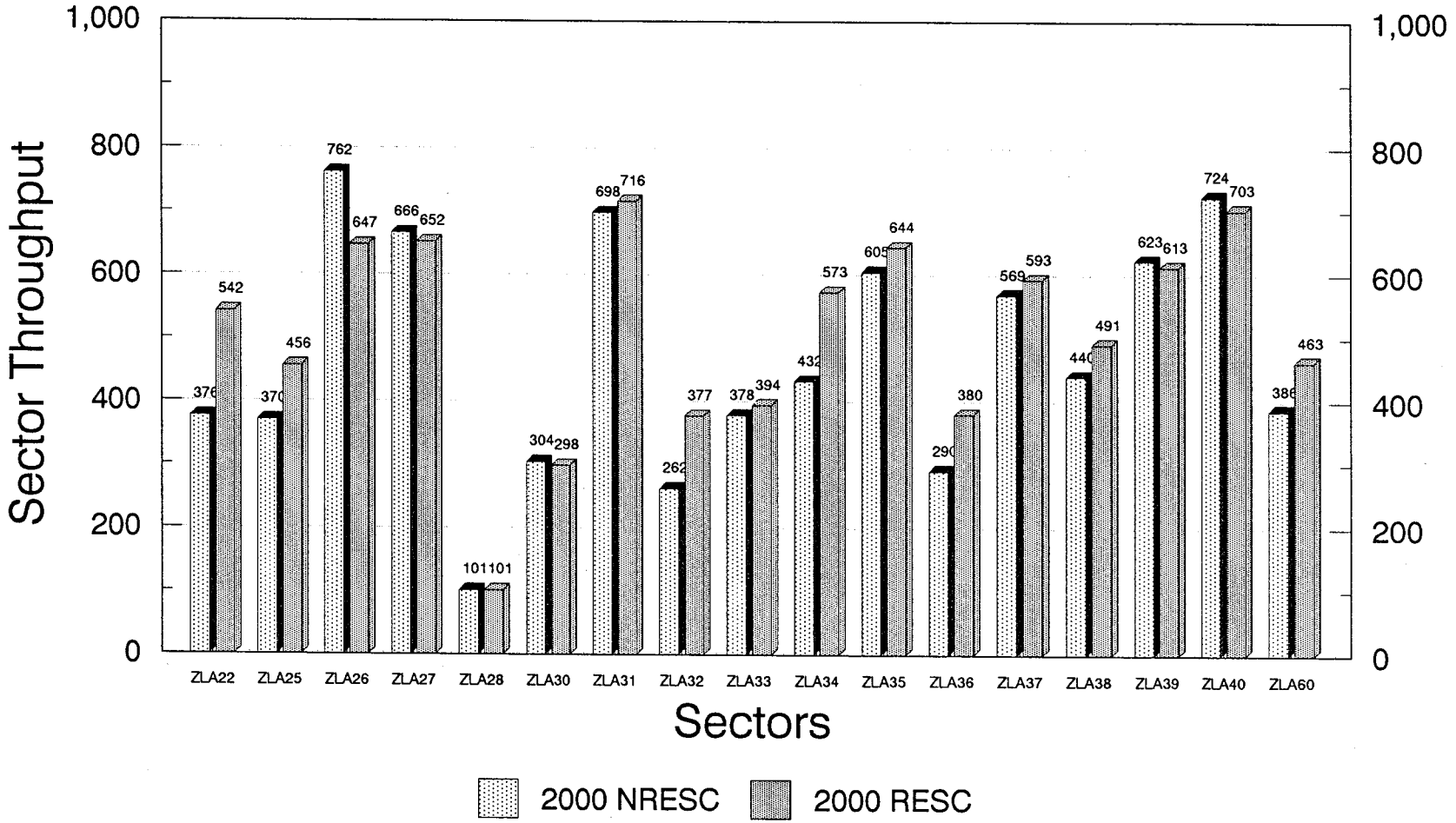
NRESC = No resectorization
RESC = Resectorization

ZLA Sector Load
May 16, 2000 (100% VMC)
Graph 1 of 2



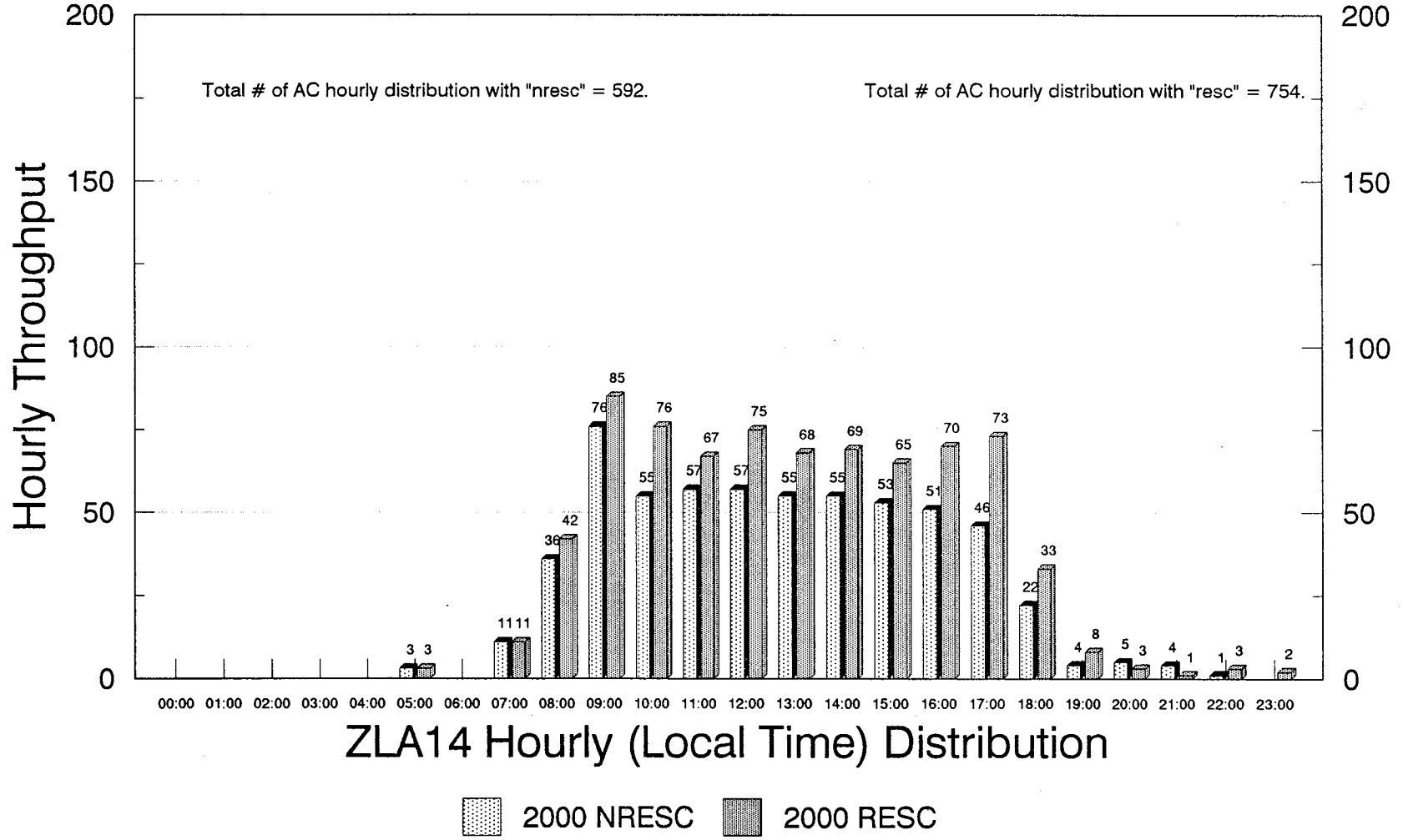
NRESC = No resectorization
RESC = Resectorization

ZLA Sector Load (Continue)
May 16, 2000 (100% VMC)
Graph 2 of 2



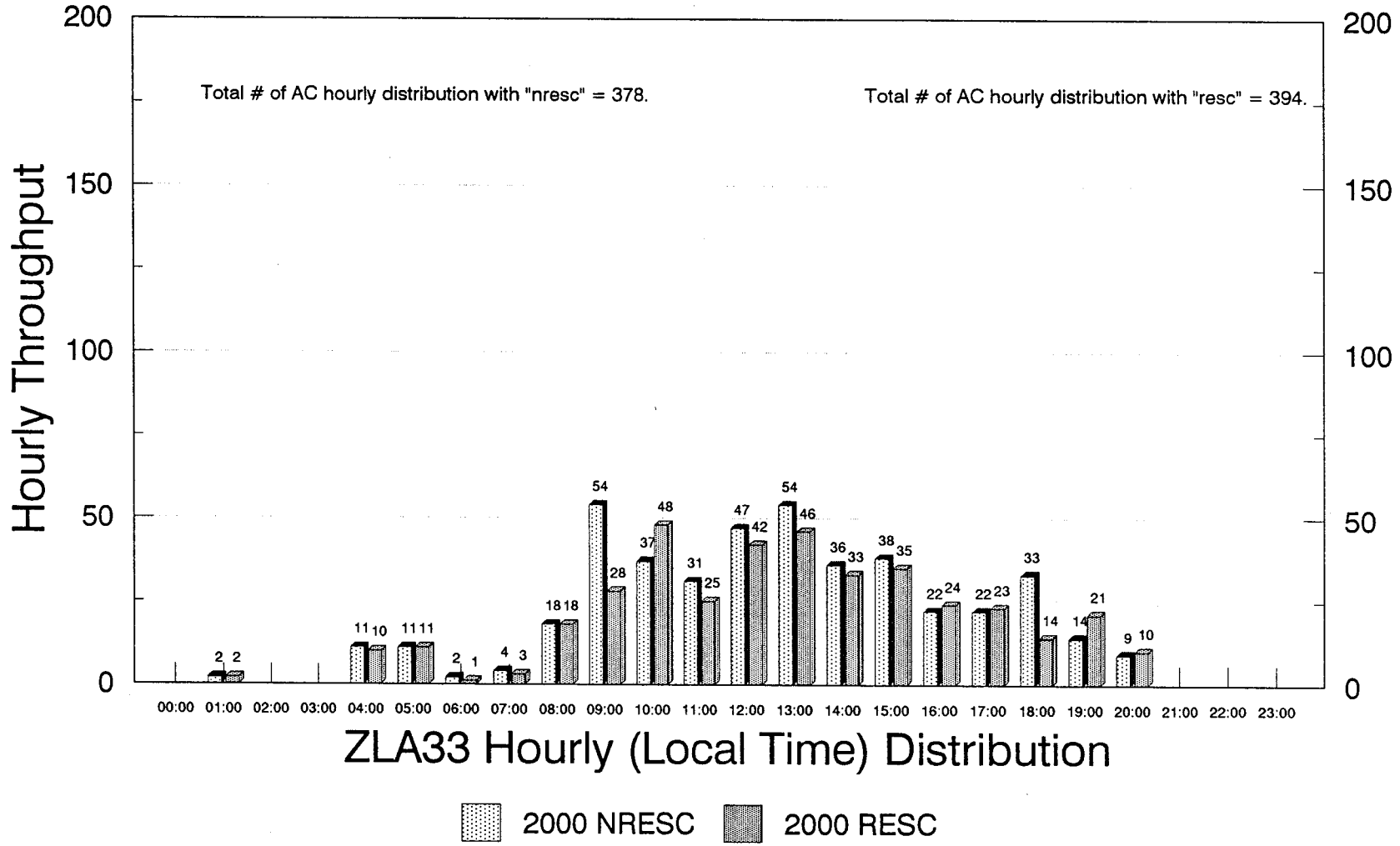
NRESC = No resectorization
RESC = Resectorization

ZLA14 With And Without Resectorization
May 16, 2000 (100% VMC)



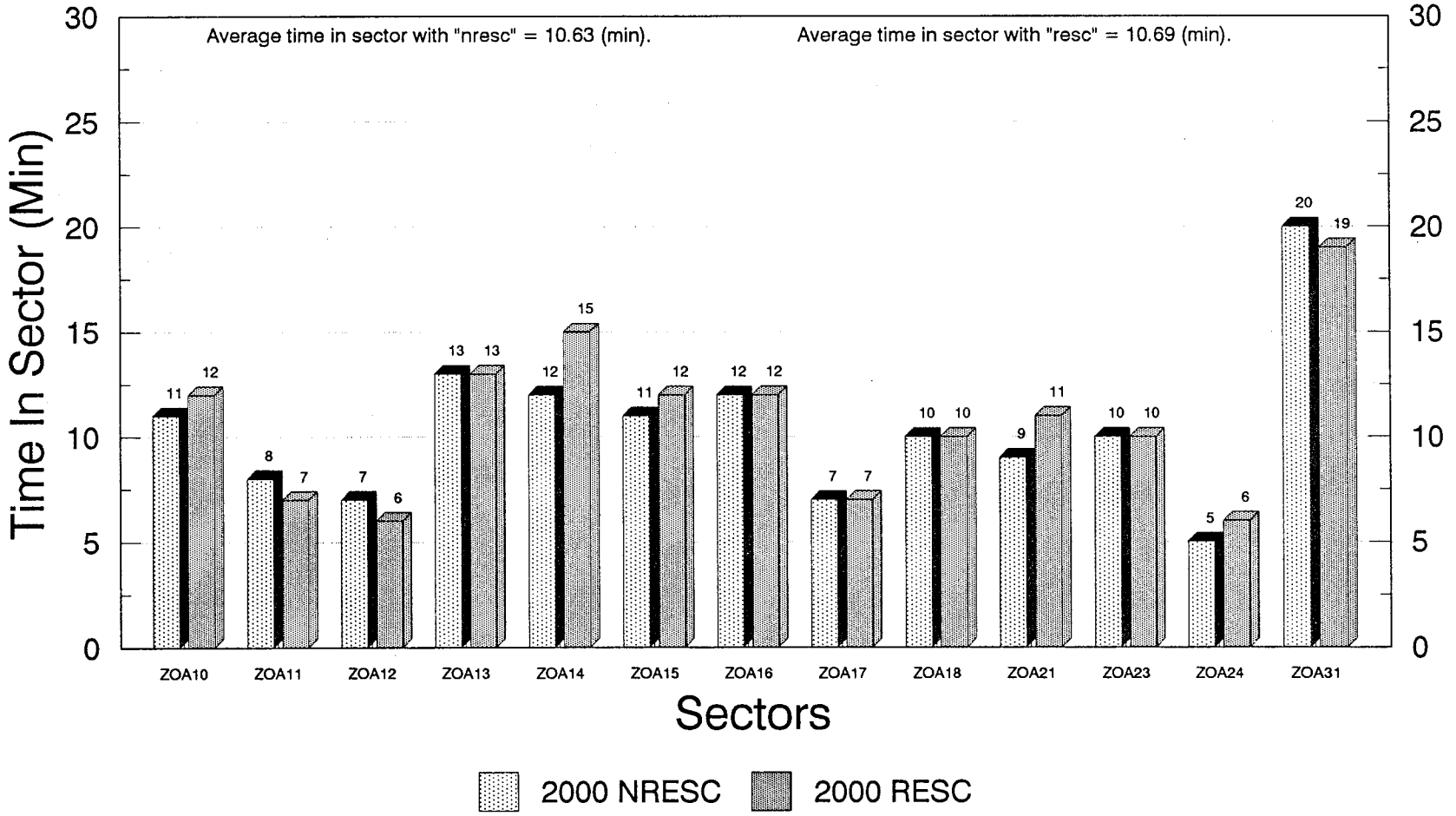
NRESC = No Resectorization
RESC = Resectorization

ZLA33 With And Without Resectorization
May 16, 2000 (100% VMC)



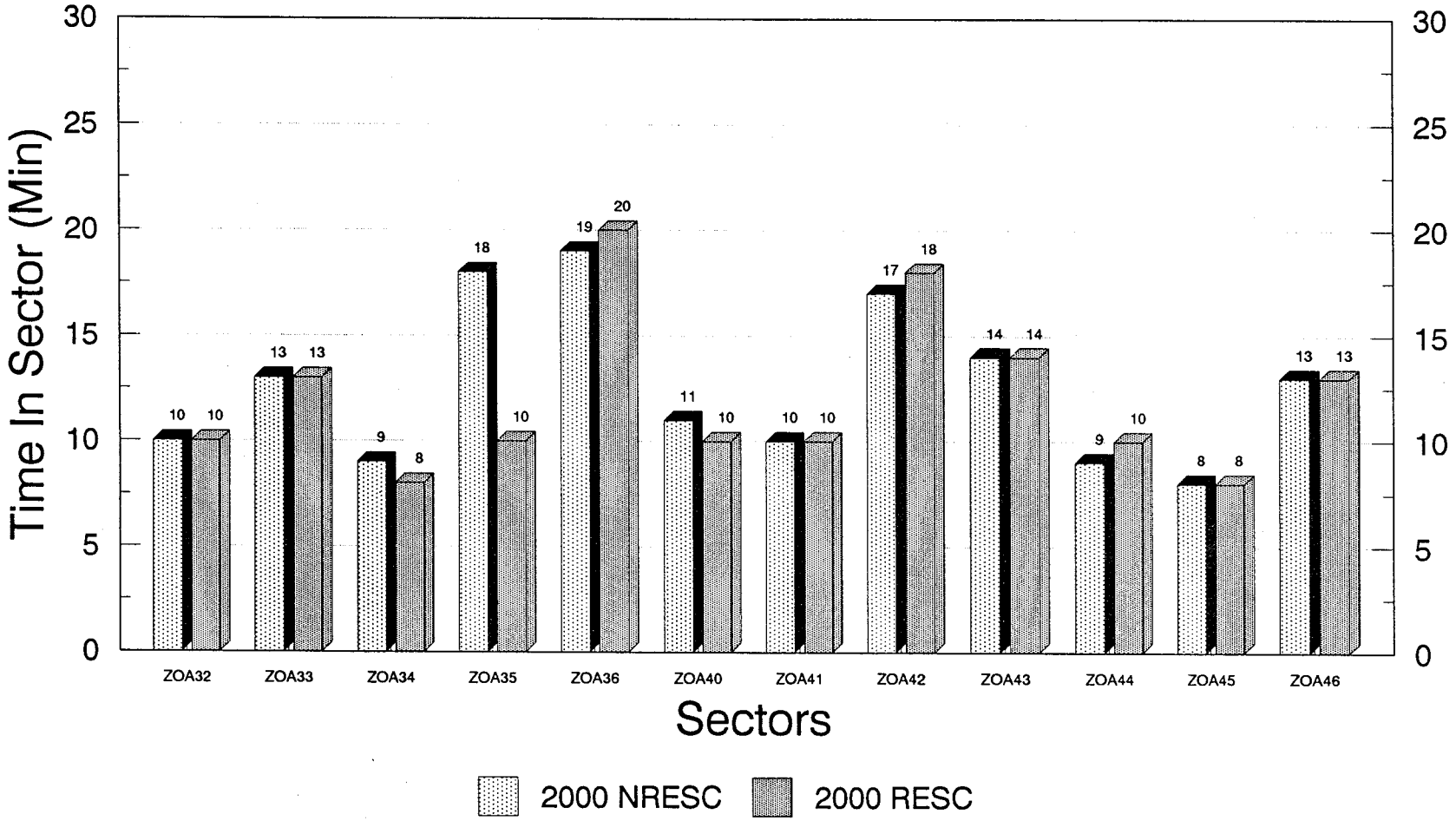
NRESC = No Resectorization
RESC = Resectorization

ZOA Sector Crossing Times
May 16, 2000 (100 % VMC)
Graph 1 of 2



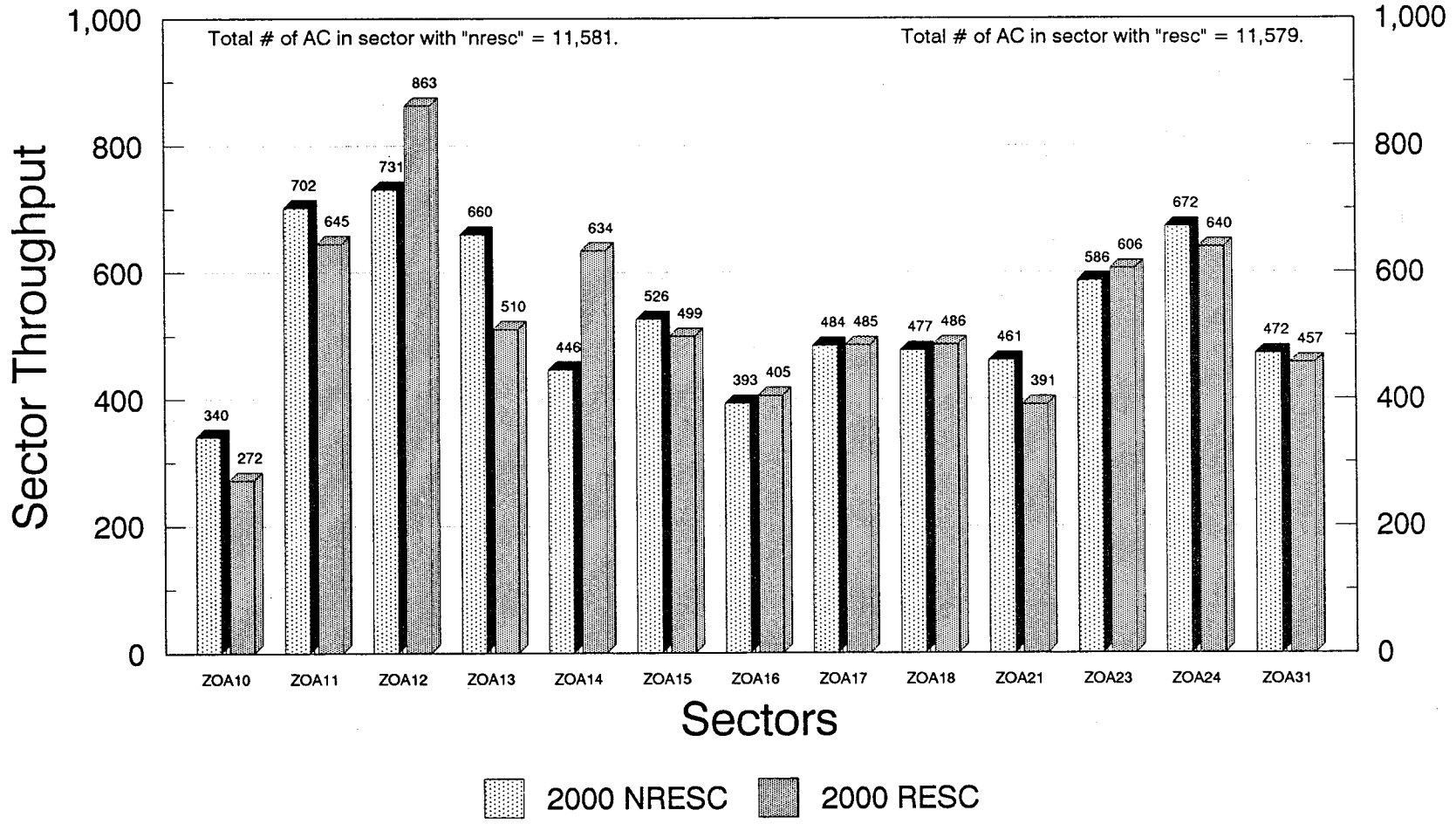
NRESC = No resectorization
RESC = Resectorization

ZOA Sector Crossing Times (Continue)
May 16, 2000 (100 % VMC)
Graph 2 of 2



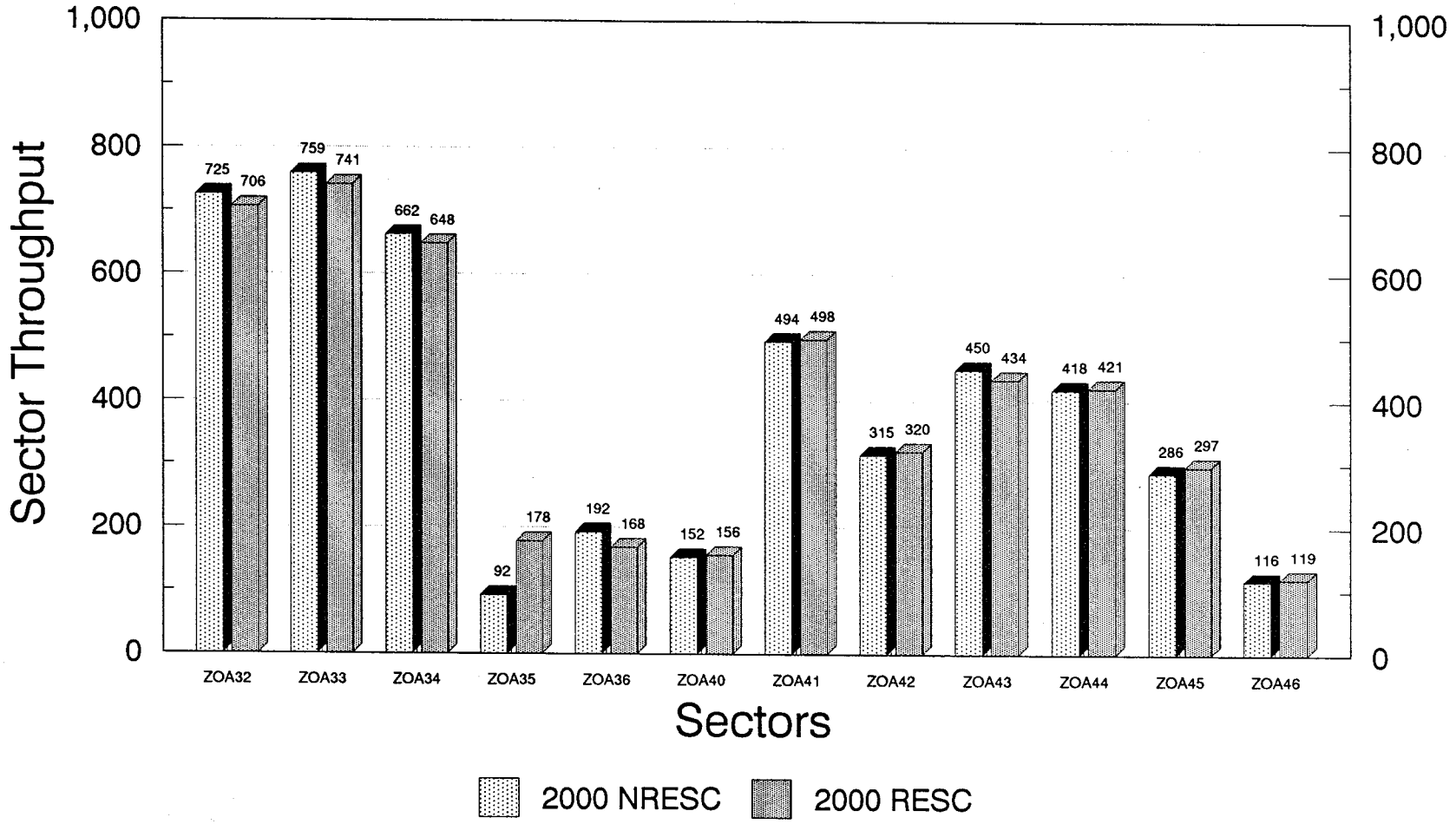
NRESC = No resectorization
RESC = Resectorization

ZOA Sector Load
May 16, 2000 (100% VMC)
Graph 1 of 2



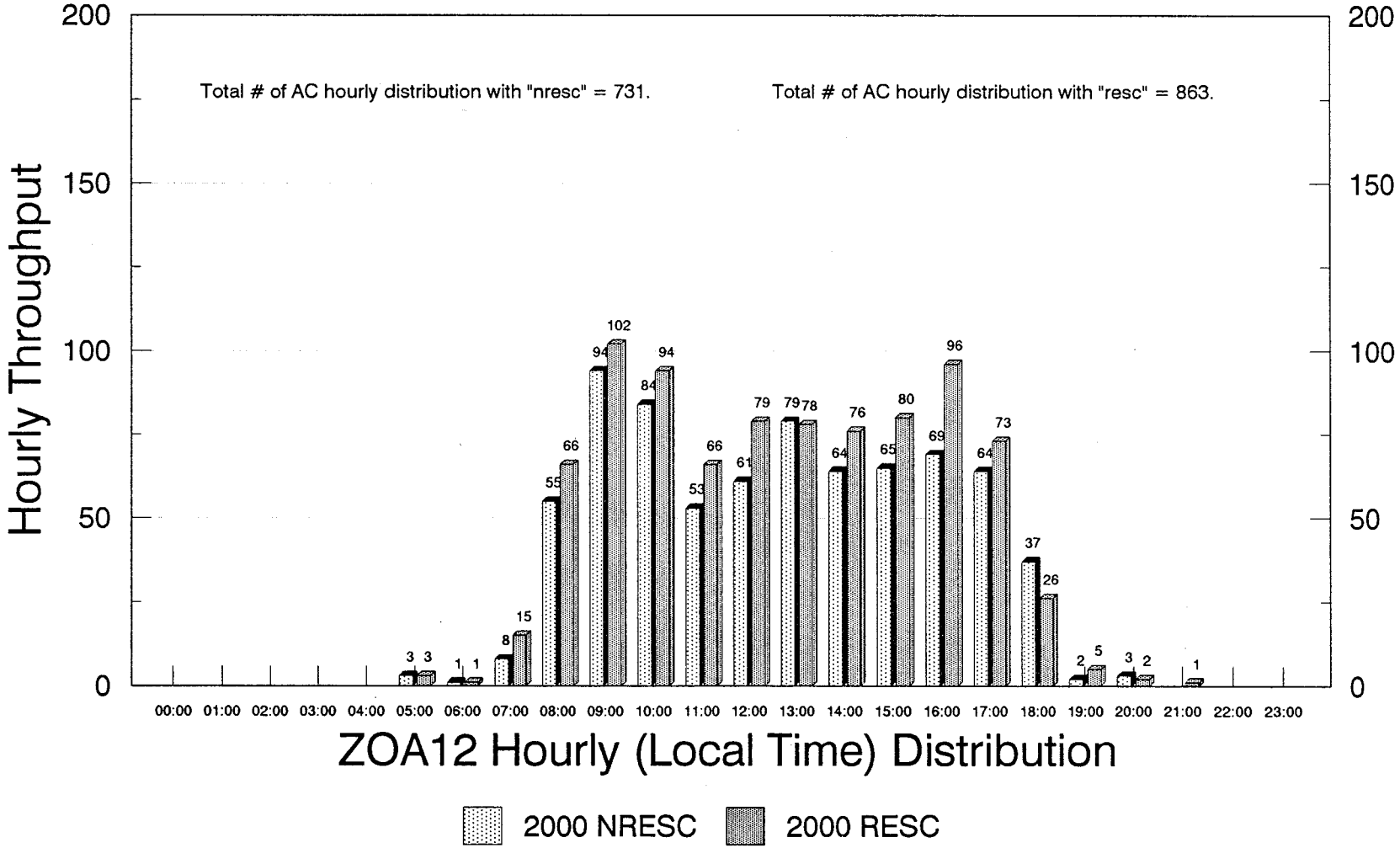
NRESC = No resectorization
RESC = Resectorization

ZOA Sector Load (Continued)
May 16, 2000 (100% VMC)
Graph 2 of 2



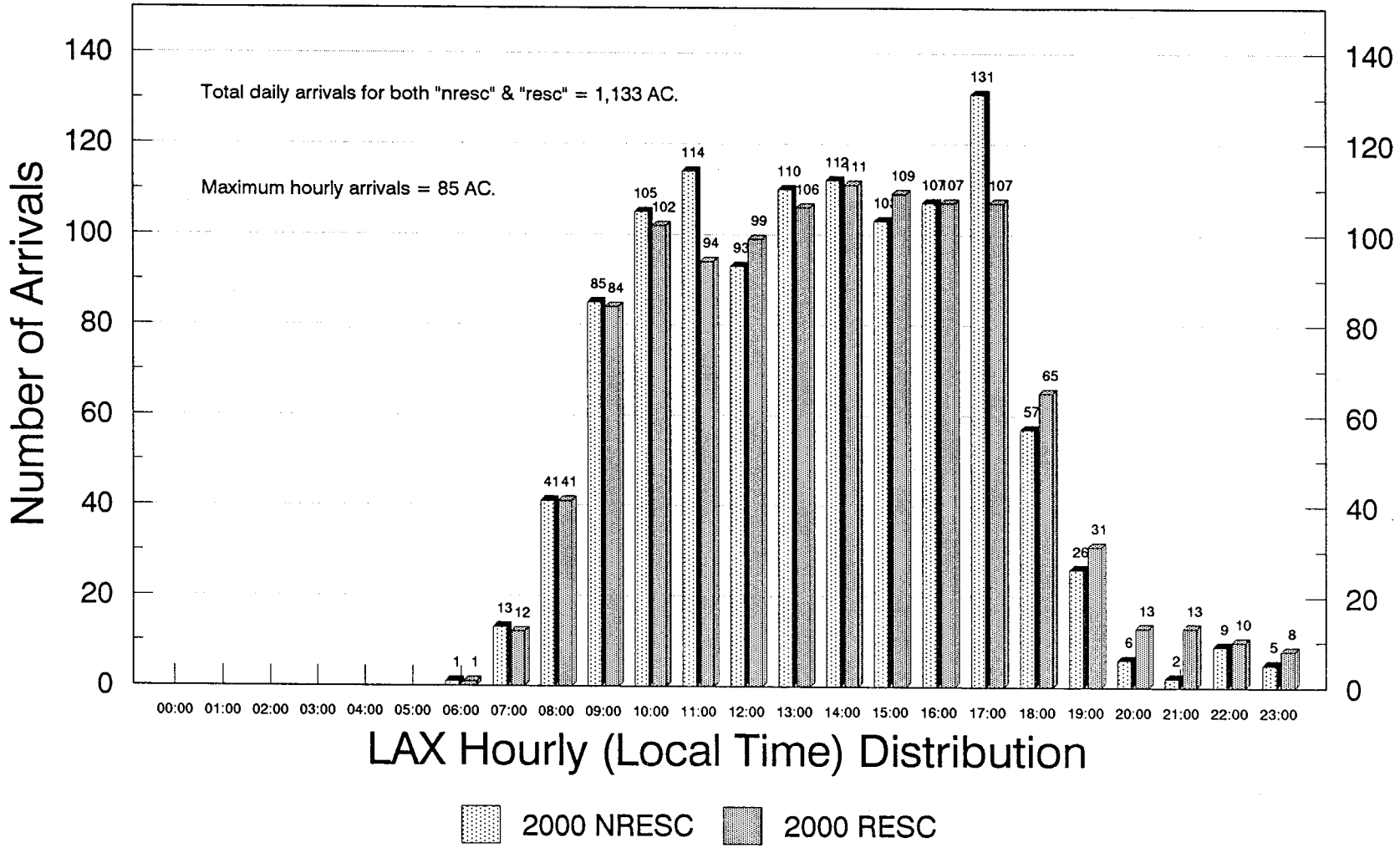
NRESC = No resectorization
RESC = Resectorization

ZOA12 With And Without Resectorization
May 16, 2000 (100% VMC)



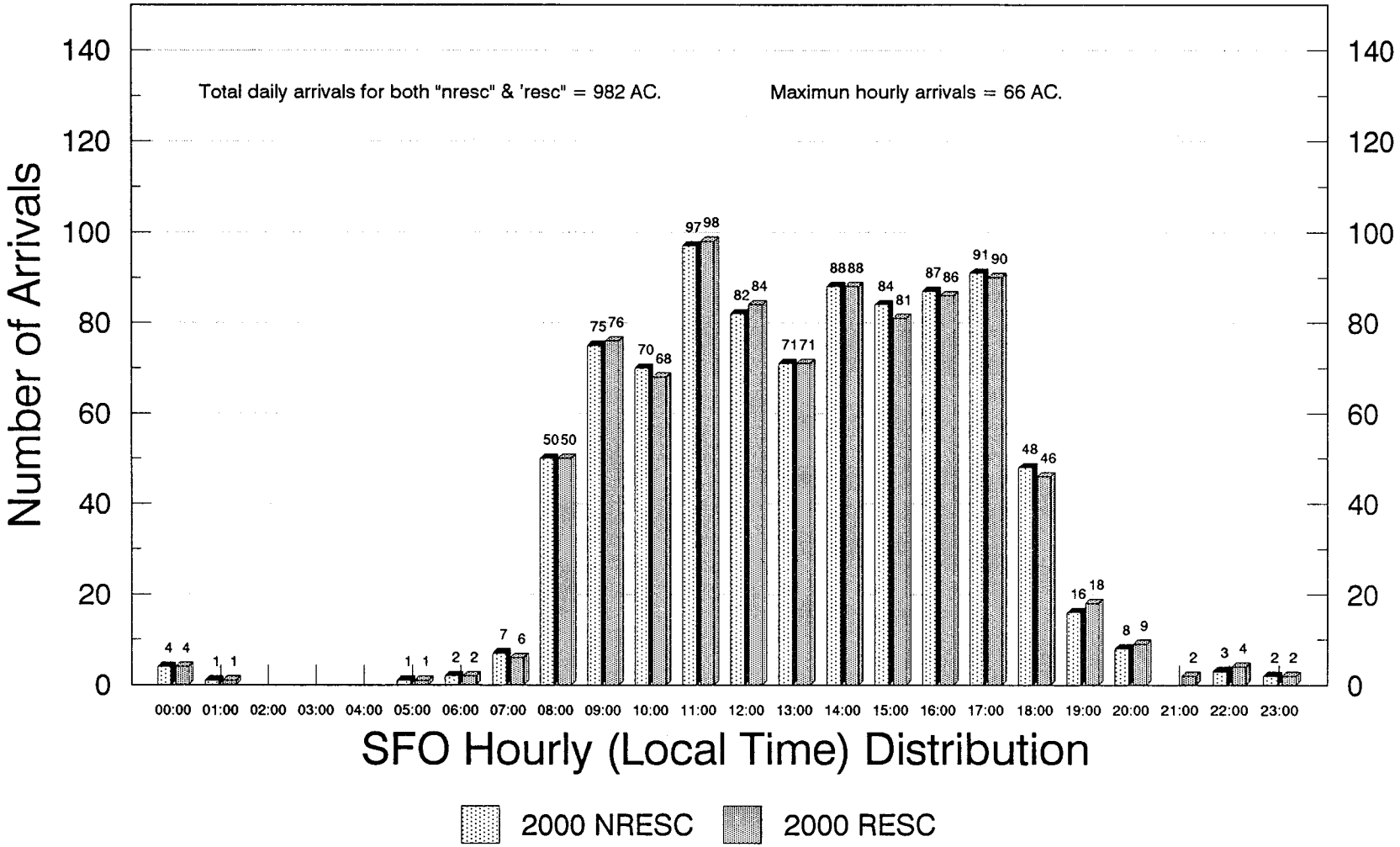
NRESC = No Resectorization
RESC = Resectorization

LAX Arrivals With And Without Resectorization
May 16, 2000 (100% VMC)



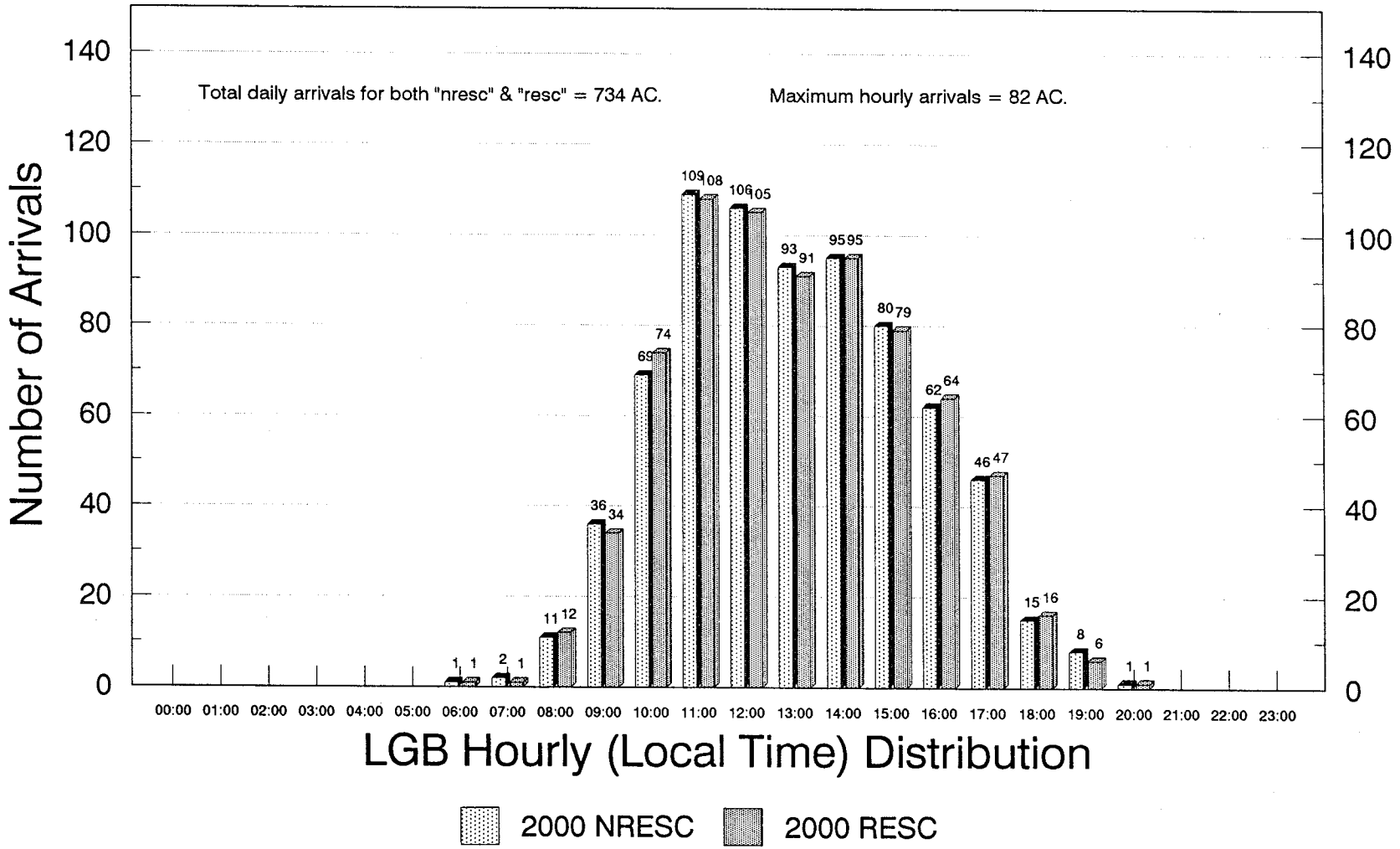
NRESC = No Resectorization
RESC = Resectorization

SFO Arrivals With And Without Resectorization
May 16, 2000 (100% VMC)



NRESC = No Resectorization
RESC = Resectorization

LGB Arrivals With And Without Resectorization
May 16, 2000 (100% VMC)



NRESC = No Resectorization
RESC = Resectorization