APPENDIX B

2000 BASE AIRSIDE SIMULATION ASSUMPTIONS AND RESULTS

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Appendix B

2000 BASE AIRSIDE SIMULATION ASSUMPTIONS AND RESULTS

The airside performance of existing conditions at Los Angeles International Airport (LAX) was originally defined by the Master Plan based on 1994 aircraft activity. Due to changes in the volume and characteristics of aircraft operations at LAX between 1994 and 1996, the airside performance baseline was updated to reflect 1996 activity in 1998. The airside performance baseline was updated again in 2002 to reflect 2000 conditions.

The assumptions and results of the 1994 airside performance analysis were documented in Chapter II of the Draft LAX Master Plan - Existing Conditions Working Paper. The 1996 airside performance analysis was documented in Appendix D of the Draft LAX Master Plan. This appendix presents the assumptions and results of the 2000 baseline airside performance analysis for LAX.

B.1 OPERATING ASSUMPTIONS

Airside performance was defined in terms of aircraft taxi time, delay, and throughput, using simulation modeling. The FAA's SIMMOD model was used for the simulations. The assumptions about the LAX operating environment are the same as those used in the 1994 and 1996 airside simulations including the following:

- Primary Runway Operating Configurations
- Noise Abatement Procedures
- Airspace Operating Assumptions
- Airfield Operating Assumptions

These assumptions were described in detail in Chapter II of the Draft LAX Master Plan.

The design day schedule used for the 2000 baseline simulations was developed based on actual operations from August 16, 2000. This day was selected as representative of the Peak Month Average Weekday (PMAWD) in 2000. The 2000 design day schedule assumptions and activity are described in Appendix A – Existing Baseline Comparison Issues – 1996 to 2000.

B.2 METHODOLOGY FOR MEASURING PERFORMANCE

The activity in the 2000 design day flight schedule was simulated for the three primary[1] runway operating configurations at LAX:

- West Flow Visual Approaches (Visual)
- West Flow VFR Instrument Approaches (ILS)
- West Flow IMC (IFR)

Delay, taxi time, and throughput statistics were collected and summarized for each of the cases simulated and are presented in the following section. Refer to Chapter II of the Draft LAX Master Plan for detailed definitions of the performance statistics.

As with the 1994 and 1996 cases, flow control was applied for the 2000 simulations when excessive arrival airspace delays were observed. The flow control process reschedules arrivals to later hours in the day such that the anticipated demand does not exceed the hourly acceptance rate at LAX. The arrival delay that is a direct result of a flow control program is recorded as flow delay that takes place at the origin airport.

B.3 PERFORMANCE RESULTS

Tables B-1 and **B-2** provide detailed aircraft delay, unimpeded taxi time, and runway throughput statistics for arrivals and departures by runway operating configuration. In addition, annualized delay and throughput averages are also presented for VFR, IFR, and all weather. Average delay and unimpeded taxi time results are summarized in **Table B-3**.

[1] East flow performance was not modeled due to its low annual occurrence. Rather, east flow performance was estimated based on previous simulations in order to determine average annual performance.

Table B-1
Los Angeles International Airport Master Plan

AVERAGE DELAY AND UNIMPEDED TAXI TIME - YEAR 2000

		Average Delay (Minutes per Operation)										
		Arrivals				Departures			Average			
Configuration	Annual Use	Flow	Airspace	Ground	Total	Airspace	Ground	Total	Flow	Airspace	Ground	Total
VFR Visual West Flow	69.70%	0.00	3.05	1.40	4.45	0.46	6.05	6.51	0.00	1.75	3.73	5.48
VFR ILS West Flow	15.49%	2.59	7.02	1.62	11.23	0.52	6.36	6.88	1.29	3.77	3.99	9.05
VFR East Flow	5.71%	36.41	7.02	1.62	45.05	0.52	6.36	6.88	18.20	3.77	3.99	25.96
Average VFR	**90.90%**	**2.73**	**3.98**	**1.45**	**8.16**	**0.47**	**6.12**	**6.60**	**1.36**	**2.22**	**3.79**	**7.38**
IFR West Flow	9.10%	11.07	4.23	1.29	16.59	0.50	8.66	9.16	5.53	2.36	4.98	12.87
Average All Weather	**100.00%**	**3.49**	**4.00**	**1.44**	**8.92**	**0.48**	**6.35**	**6.83**	**1.74**	**2.24**	**3.90**	**7.88**

		Average Unimpeded Taxi Time (Minutes per Operation)		
		Arrivals	Departures	Average
VFR Visual West Flow	69.70%	6.83	10.16	8.50
VFR ILS West Flow	15.49%	6.94	9.96	8.45
VFR East Flow	5.71%	8.51	12.86	10.69
Average VFR	**90.90%**	**6.95**	**10.30**	**8.62**
IFR West Flow	9.10%	6.75	10.01	8.38
Average All Weather	**100.00%**	**6.94**	**10.27**	**8.60**

		Average Delay and Unimpeded Taxi Time (Minutes per Operation)		
		Arrivals	Departures	Average
VFR Visual West Flow	69.70%	11.28	16.67	13.98
VFR ILS West Flow	15.49%	18.17	16.84	17.50
VFR East Flow	5.71%	53.56	19.74	36.64
Average VFR	**90.90%**	**15.11**	**16.89**	**16.00**
IFR West Flow	9.10%	23.34	19.17	21.25
Average All Weather	**100.00%**	**15.86**	**17.10**	**16.48**

Note: Flow delay for east flow is based on the flow control process using the same acceptance rate applied in 1996. Airspace and ground delays for east flow are estimated based on the VFR ILS west flow configuration. Taxi times are estimated based on previous simulations.

Source: SIMMOD simulation output

Table B-2
Los Angeles International Airport Master Plan

PEAK HOUR THROUGHPUT - YEAR 2000

Configuration	Annual Use	Peak Arrival Throughput Hour Arrivals	Departures	Total	Hour
VFR Visual West Flow	69.70%	82	64	146	10:00-11:00
VFR ILS West Flow	15.49%	70	68	138	10:00-11:00
VFR East Flow	5.71%	70	68	138	10:00-11:00
Average VFR	**90.90%**	**79**	**65**	**144**	
IFR West Flow	9.10%	69	63	132	12:00-13:00
All Weather Average	**100.00%**	**78**	**65**	**143**	

		Peak Departure Throughput Hour Arrivals	Departures	Total	Hour
VFR Visual West Flow	69.70%	52	77	129	08:00-09:00
VFR ILS West Flow	15.49%	53	72	125	08:00-09:00
VFR East Flow	5.71%	53	72	125	08:00-09:00
Average VFR	**90.90%**	**52**	**76**	**128**	
IFR West Flow	9.10%	67	73	140	15:00-16:00
All Weather Average	**100.00%**	**54**	**76**	**129**	

		Peak Total Operations Throughput Hour Arrivals	Departures	Total	Hour
VFR Visual West Flow	69.70%	76	71	147	11:00-12:00
VFR ILS West Flow	15.49%	69	71	140	15:00-16:00
VFR East Flow	5.71%	69	71	140	15:00-16:00
Average VFR	**90.90%**	**74**	**71**	**145**	
IFR West Flow	9.10%	67	73	140	15:00-16:00
All Weather Average	**100.00%**	**74**	**71**	**145**	

Note: East flow throughputs are assumed to be equivalent to VFR ILS west flow.
Source: SIMMOD simulation output

Table B-3

2000 AVERAGE DELAY AND UNIMPEDED TAXI TIME SUMMARY

	Average Minutes Per Operation		
Configuration	**Delay**	**Unimpeded Taxi Time**	**Total Delay and Taxi Time**
VFR Visual West Flow	5.48	8.50	13.98
VFR ILS West Flow	9.05	8.45	17.50
VFR ILS East Flow	25.96	10.69	36.64
IFR West Flow	12.87	8.38	21.25
All Weather Annual Average	7.88	8.60	16.48

Source: SIMMOD Simulation Output

VFR visual west flow has the lowest delay of all the configurations at 5.48 minutes per operation. VFR ILS east flow has the highest delay of 25.96 minutes per operation. Unimpeded taxi time is very similar for all the west flow configurations as would be expected. Unimpeded taxi time for east flow operations is approximately two minutes higher than for west flow operations due mostly to the length of the departure taxi route to Runways 6R and 7L.

The VFR ILS west flow, IFR west flow, and VFR ILS east flow cases yielded unreasonably high arrival airspace delays, which required the application of flow control. The flight schedule for these cases was submitted through a flow control process before running the airside simulations with the SIMMOD model.

Peak throughput is highest for VFR visual west flow. The peak arrival throughput hour has 82 arrivals and the peak departure throughput hour has 77 departures in VFR visual west flow. The peak total operations throughput hour has 147 operations.

Figure B-1 compares the performance of the 2000, 1996, and 1994 airside baselines. Average delays were just over six minutes per operation in 1994. Average delays increased over 50 percent from 1994 to 1996 while daily operations increased by only 10 percent. In the year 2000, the average delay per operation decreased to 7.9 minutes per operation. This decrease occurred because the airlines made adjustments to their flight schedules, such as de-peaking operations and not increasing the total number of commercial flights[2], that allowed delays to be minimized. Although commercial operations levels remained constant from 1996 to 2000, the airlines were able to serve more passengers in 2000 because they increased aircraft size, reduced commuter service, and increased domestic and international air carrier service.

[2] The year 2000 does have additional cargo flights but these operations occur mostly at night, during off-peak times.

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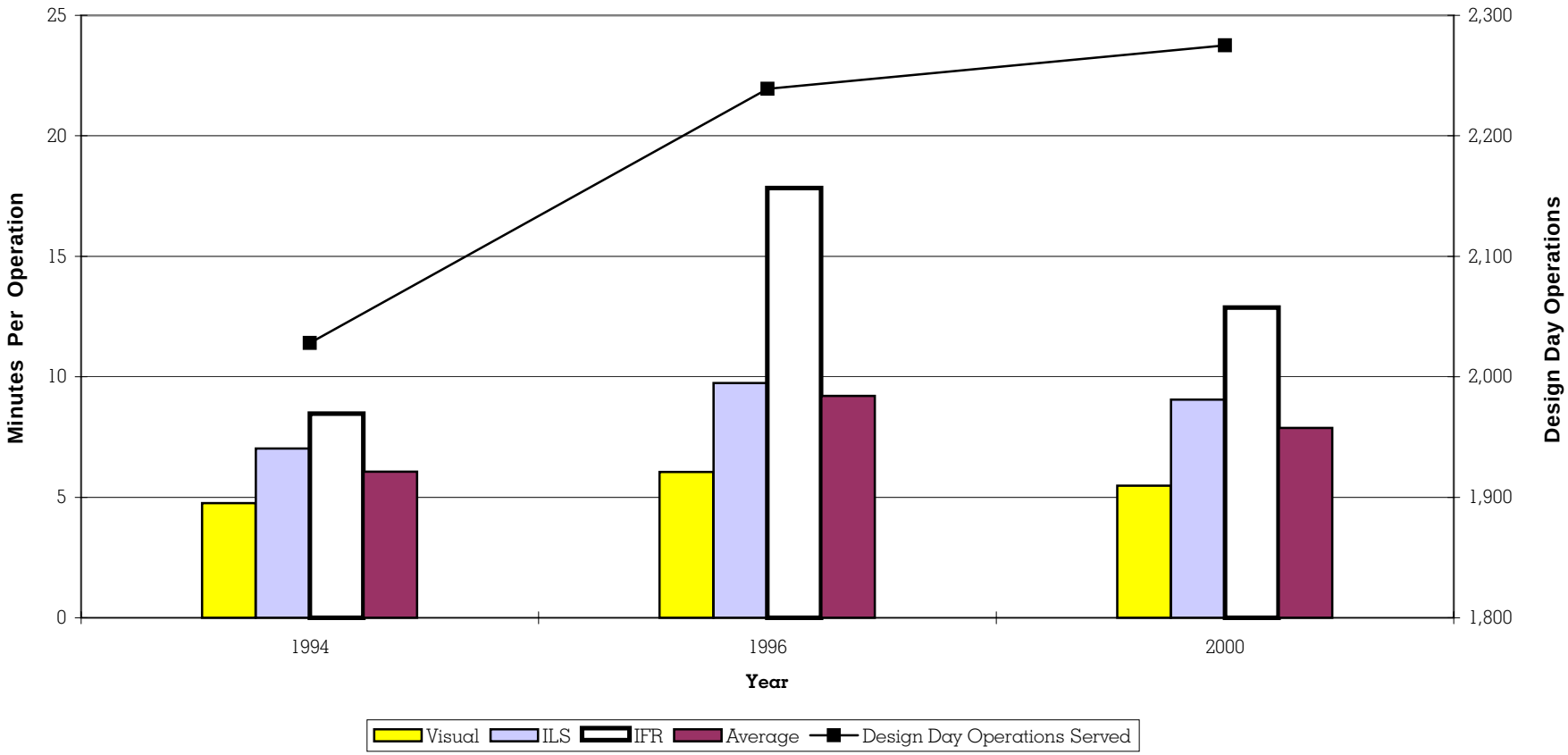

Note: East flow performance was estimated based on previous simulations.

Year	Delay (Minutes Per Operation) Visual	ILS	IFR	Average	Design Day Operations
1994	4.76	7.02	8.47	6.06	2,028
1996	6.05	9.74	17.83	9.21	2,239
2000	5.48	9.05	12.87	7.88	2,275

Source: SIMMOD simulation output
Prepared by: Landrum & Brown
Draft: 11/15/02

Los Angeles International Airport Master Plan	Delay and Operations Served Comparison	Figure B-1