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ANALYSIS OF RUNWAY OCCUPANCY TIME DATA COLLECTED AT LOS ANGELES, SAN FRANCISCO, ATLANTA, AND DALLAS-FORT WORTH AIRPORTS

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16. Abstract Due to recent increases in delays to aircraft at major airports, several concepts for increasing airport capacity have gained impetus. One of these concepts is the reduction of longitudinal separation between certain classes of aircraft in Instrument Meteorological Conditions on final approach. A demonstration program for this concept has been developed by Air Traffic Service of the Federal Aviation Administration. Prior to the start of that program, it was necessary to ascertain that runway occupancy times were low enough (below 50 seconds) to allow the decreased separations. To that end, runway occupancy time data were collected at Los Angeles, San Francisco, Atlanta, and Dallas-Fort Worth airports. This document details the analysis of that data. The actual data collected is included in Appendix A.					
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EXECUTIVE SUMMARY

Due to recent increases in delays to aircraft at major airports, several concepts for increasing airport capacity have gained impetus. One of these concepts is the reduction of longitudinal separation between certain classes of aircraft in Instrument Meteorological Conditions on final approach.

A study performed by The MITRE Corporation in 1979 indicated that, if the wake vortex problem could be resolved, a reduction in longitudinal separation to 2.5 nautical miles (nmi) would be possible, with no increase in the rate of go-arounds, if the average Runway Occupancy Time (ROT) were below 50 seconds.

In 1982, the Industry Task Force on Capacity Improvement and Delay Reduction agreed that 2.5 nmi could be demonstrated at selected sites under controlled conditions. A demonstration program for this concept was subsequently developed by Air Traffic Service of the Federal Aviation Administration.

Los Angeles, San Francisco, Atlanta, and Dallas-Fort Worth were selected as possible sites for the demonstration program. Prior to the start of that program, it was necessary to ascertain that runway occupancy times were low enough (below 50 seconds) to allow the decreased separations. ROT data were then collected at those airports. This document details the analysis of that data. The actual data collected is included in Appendix A.

The overall average ROTs (for Small and Large aircraft only) at Atlanta and Dallas-Fort Worth are well below 50 seconds. The average ROT at Los Angeles is near 50 seconds, while at San Francisco it is above 57 seconds. (The data are summarized in Tables 1 and 2.) Atlanta, Dallas-Fort Worth, and Los Angeles are all suitable sites for the demonstration.

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TABLE 1
SUMMARY OF LOS ANGELES AND SAN FRANCISCO
RUNWAY OCCUPANCY TIME DATA*

LOS ANGELES:

<u>RUNWAY</u>	<u>MEAN (seconds)</u>	<u>STD. DEV. (seconds)</u>	<u>NUMBER OF OBSERVATIONS</u>
24L	48.7	7.5	68
24R	50.3	9.4	70
25L	51.8	10.8	102
25R	52.0	7.7	43
Overall	50.7	9.4	283

SAN FRANCISCO:

1L	30.0	0.0	1
1R	45.0	11.7	9
28L	59.6	15.2	120
28R	56.2	13.3	177
Overall	57.1	14.3	307

* Small and Large aircraft only.

TABLE 2
SUMMARY OF DALLAS-FORT WORTH AND ATLANTA
RUNWAY OCCUPANCY TIME DATA*

DALLAS-FORT WORTH:

<u>RUNWAY</u>	<u>MEAN (seconds)</u>	<u>STD. DEV. (seconds)</u>	<u>NUMBER OF OBSERVATIONS</u>
17L	45.1	8.4	97
18R	46.4	7.1	55
Overall	45.6	8.0	152

ATLANTA:

8L	42.4	5.0	69
9R	40.4	5.8	106
27L	42.8	5.7	63
Overall	41.6	5.6	238

* Small and Large aircraft only.

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1. INTRODUCTION

Due to recent increases in delays to aircraft at major airports, several concepts for increasing airport capacity have gained impetus (Reference 1). One of these concepts is the reduction of longitudinal separation between certain classes of aircraft in Instrument Meteorological Conditions (IMC) on final approach.

A rigorous study of the requirements for reducing the minimum longitudinal separation to 2.5 nautical miles (nmi) and 2.0 nmi was performed by The MITRE Corporation in 1979 (Reference 2). It concluded that, if the wake vortex problem could be resolved, a reduction to 2.5 nmi would be possible if the average Runway Occupancy Times (ROTs) were below 50 seconds.

In 1982 the Industry Task Force on Capacity Improvement and Delay Reduction reached agreement among its members that 2.5 nmi separations could be demonstrated at selected sites under controlled conditions. One of those conditions was that the average ROT be determined at each potential site prior to the start of the demonstration program and that the average must be less than 50 seconds.

In 1984, MITRE performed a study of ROTs at New York La Guardia (LGA), Boston (BOS), and Newark (EWR), airports (Reference 3). The following average ROTs (in seconds) were determined in that study:

Aircraft Type	LGA	BOS	EWR
Small	43.5	48.7	40.1
Large	46.0	52.1	42.2
Heavy	50.5	56.7	45.6

As a result of that study and continued support of the concept by the Industry Task Force, a demonstration program was developed by the Federal Aviation Administration's (FAAs) Terminal Procedures Branch of Air Traffic Service and The MITRE Corporation. This program was designed to demonstrate the feasibility of using 2.5 nmi separations between certain pairs of aircraft on final approach.

Prior to the start of the program, ROT data were collected at Los Angeles, San Francisco, Atlanta, and Dallas-Fort Worth airports, sites under consideration for the demonstration program. The results of the data collection efforts are detailed in this report.

1.1 Purpose and Scope

The purpose of the data-collection effort and subsequent analysis was to obtain ROT information at the four airports mentioned above operating under the current rules. The scope of the effort was limited to runway occupancy time since it is a critical element of the reduced longitudinal separation demonstration program.

2. THE DATA COLLECTION EFFORTS

2.1 Los Angeles and San Francisco Data Collection

The Los Angeles and San Francisco data were collected using a portable computer. The computer's built-in clock allowed a single observer to collect data on up to four runways simultaneously. The data were stored on cassette tapes and later transferred to a mainframe computer for statistical analysis.

The data were collected at Los Angeles on January 8, 1985 from 7:17 am until 2:00 pm and on January 9, 1985 from 7:39 am until 10:27 am under the following conditions:

Weather Conditions:	Visual Meteorological Conditions (VMC)
Runway Conditions:	Dry
Ceiling:	Unlimited
Visibility:	15 to 35 nmi
Wind Direction:	70 to 220 degrees
Wind Speed:	6 to 15 miles per hour (mph)
Temperature:	62 to 75 degrees Fahrenheit

Figure 2-1 illustrates the runway/taxiway layout at Los Angeles.

The data were collected at San Francisco on January 9, 1985 from 2:29 pm until 5:07 pm, on January 10, 1985 from 2:44 pm until 7:50 pm, and on January 11, 1985 from 10:00 am until 1:57 pm under the following conditions:

Weather Conditions:	VMC (except for fog on Jan 11)
Runway Conditions:	Dry
Ceiling:	3000 feet to unlimited (except for fog conditions)
Visibility:	1 (in fog) to 10 nmi
Wind Direction:	70 to 180 degrees
Wind Speed:	Calm to 7 mph
Temperature:	65 to 75 degrees Fahrenheit

Figure 2-2 illustrates the runway/taxiway layout at San Francisco.

Data were collected for Small and Large aircraft types and can be found in Appendix A.

2.2 Dallas-Fort Worth and Atlanta Data Collection

Air traffic personnel from Dallas-Fort Worth and Atlanta collected the data using a MITRE-developed form shown in Figure 2-3.

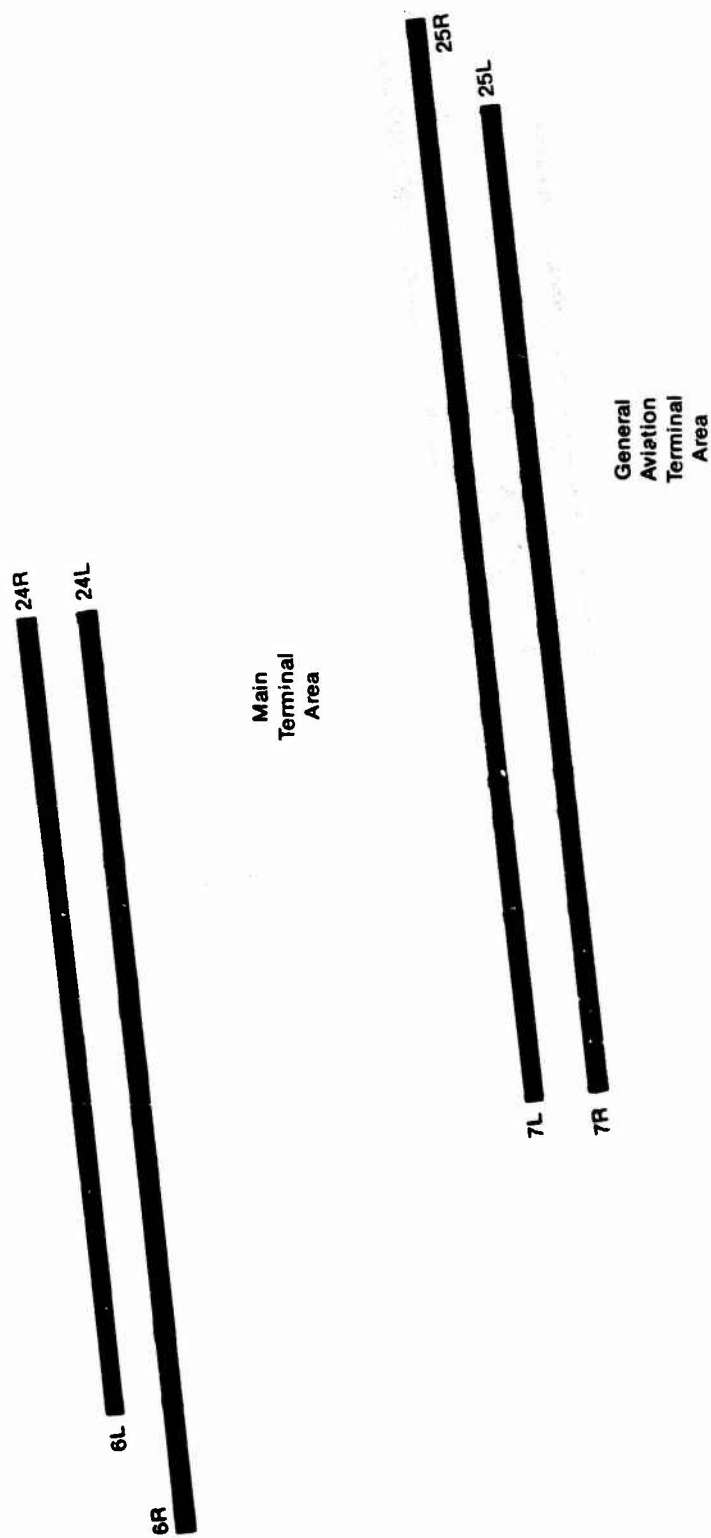


FIGURE 2-1
LOS ANGELES INTERNATIONAL AIRPORT

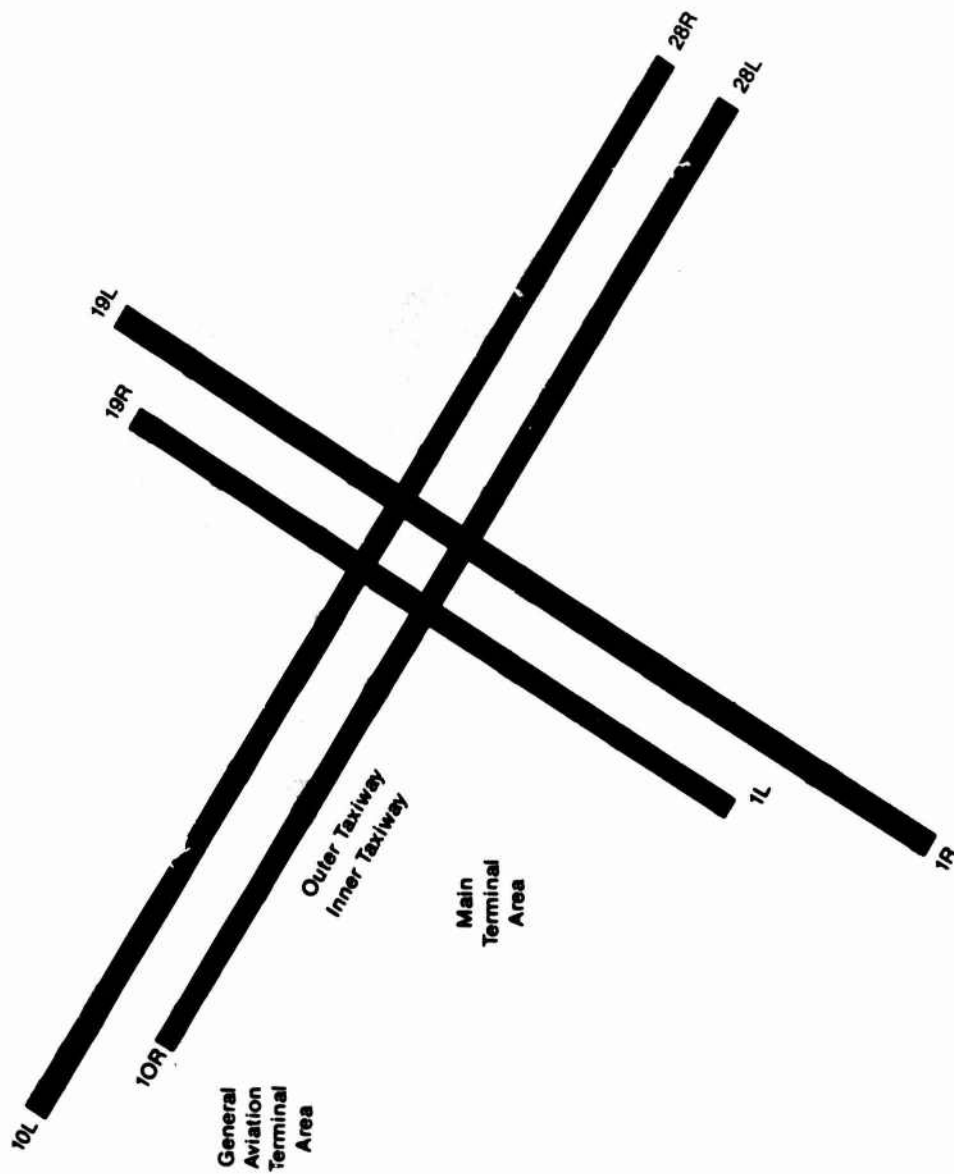


FIGURE 2-2
SAN FRANCISCO INTERNATIONAL AIRPORT

RUNWAY OCCUPANCY TIME DATA (ARRIVALS)

MAIN ARRIVAL RUNWAY_____

Airport_____

CEILING _____
VISIBILITY _____
WIND DIRECTION _____
WIND SPEED _____

—Check (✓) if runway used for crossing by taxiing or departure from crossrunway after this arrival

[illegible]

FIGURE 2-3
DATA COLLECTION FORM FOR
ARRIVAL RUNWAY OCCUPANCY TIME DATA

The data were collected at Dallas-Fort Worth on April 19, 1985 from 2:33 pm until 8:08 pm under the following conditions:

Weather Conditions:	VMC
Runway Conditions:	Dry
Ceiling:	Varied from 2200 feet/overcast to 3200 feet/broken
Visibility:	Varied from 8 to 12 nmi
Wind Direction:	160 to 170 degrees
Wind Speed:	11 to 18 mph, with gusts up to 24 mph
Temperature:	70 to 74 degrees Fahrenheit.

Figure 2-4 illustrates the runway/taxiway layout at Dallas-Fort Worth.

The data were collected at Atlanta on April 22, 1985 from 1:50 pm until 8:48 pm and on April 23, 1985 from 1:24 pm until 6:06 pm under the following conditions:

Weather Conditions:	VMC
Runway Conditions:	Dry
Ceiling:	Varied from 25,000 feet/broken to clear
Visibility:	10 to 15 nmi
Wind Direction:	110 to 210 degrees
Wind Speed:	5 to 18 mph
Temperature:	unknown

Figure 2-5 illustrates the runway/taxiway layout at Atlanta.

Data were collected for all aircraft types and can be found in Appendix A.

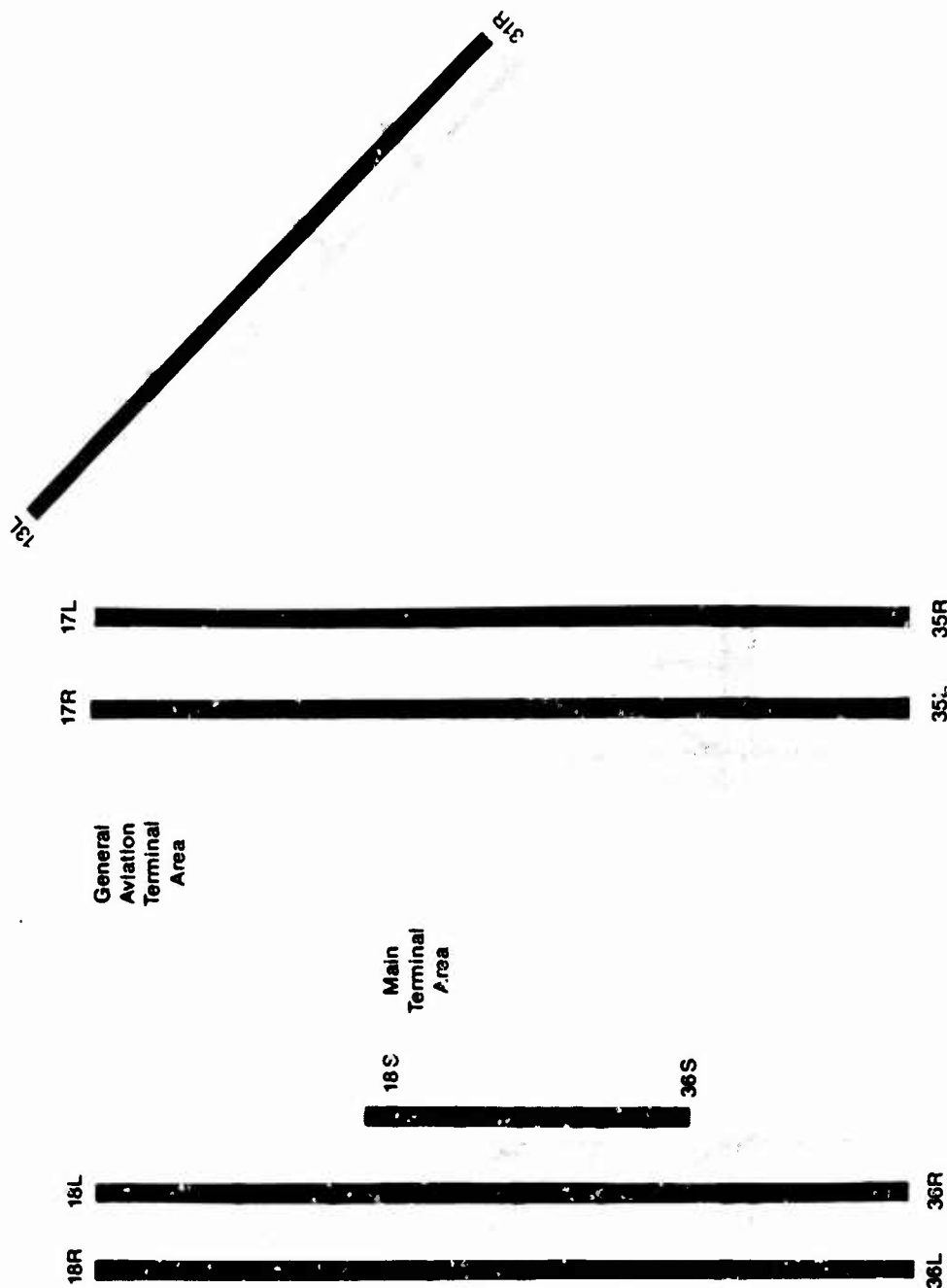


FIGURE 2-4
DALLAS-FORT WORTH INTERNATIONAL AIRPORT

General
Aviation
Terminal
Area

8L 26R
8R 26L

Main
Terminal
Area

9L 27R
9R 27L

FIGURE 2-5
HARTSFIELD ATLANTA INTERNATIONAL AIRPORT

3. ANALYSIS OF DATA AND CONCLUSIONS

Descriptive statistics were produced for Small and Large aircraft using a computer-based statistical package. They are summarized in Tables 3-1 through 3-4.

The overall average ROT at Los Angeles was close to 50 seconds under predominantly tailwind landing conditions. It is likely that the average ROTs would drop below 50 seconds in the absence of this tailwind; therefore, Los Angeles should be a suitable site for the demonstration.

The overall average ROT at San Francisco was over 57 seconds. This high average ROT was due to the following two procedures in effect on runways 28L and 28R:

1. General Aviation aircraft (including business jets) were allowed to use the entire length of the runways, when landing, to reach the fixed base operator at the far end.
2. United Airlines, Wings West, and West Air consistently used exits beyond high-speed exits E, J, and T to reach their gates.

These procedures reduced taxi time and helped relieve congestion on outer taxiway B. They were used in all but the heaviest traffic conditions.

Due to the high ROTs resulting from these procedures, San Francisco would not be a suitable site for the demonstration.

ROTs at Dallas-Fort Worth and Atlanta averaged well under 50 seconds (under the conditions described). These sites should be suitable for the demonstration.

TABLE 3-1
SUMMARY OF LOS ANGELES
RUNWAY OCCUPANCY TIME DATA*

<u>RUNWAY</u>	<u>MEAN (seconds)</u>	<u>STD. DEV. (seconds)</u>	<u>NUMBER OF OBSERVATIONS</u>
24L	48.7	7.5	68
24R	50.3	9.4	70
25L	51.8	10.8	102
25R	52.0	7.7	43
Overall	50.7	9.4	283

TABLE 3-2
SUMMARY OF SAN FRANCISCO
RUNWAY OCCUPANCY TIME DATA*

<u>RUNWAY</u>	<u>MEAN (seconds)</u>	<u>STD. DEV. (seconds)</u>	<u>NUMBER OF OBSERVATIONS</u>
1L	30.0	0.0	1
1R	43.0	11.7	9
28L	59.6	15.2	120
28R	56.2	13.3	177
Overall	57.1	14.3	307

*Small and large aircraft only.

TABLE 3-3
SUMMARY OF DALLAS-FORT WORTH
RUNWAY OCCUPANCY TIME DATA*

<u>RUNWAY</u>	<u>MEAN (seconds)</u>	<u>STD. DEV. (seconds)</u>	<u>NUMBER OF OBSERVATIONS</u>
17L	45.1	8.4	97
18R	46.4	7.1	55
Overall	45.6	8.0	152

TABLE 3-4
SUMMARY OF ATLANTA
RUNWAY OCCUPANCY TIME DATA*

<u>RUNWAY</u>	<u>MEAN (seconds)</u>	<u>STD. DEV. (seconds)</u>	<u>NUMBER OF OBSERVATIONS</u>
8L	42.4	5.0	69
9R	40.4	5.8	106
27L	42.8	5.7	63
Overall	41.6	5.6	238

* Small and Large aircraft only.

APPENDIX A
RUNWAY OCCUPANCY TIME

This appendix contains:

- Table A-1 -- Airline Codes
- Table A-2 -- Aircraft Type Codes
- Table A-3 -- Los Angeles Runway Occupancy Time Data
- Table A-4 -- San Francisco Runway Occupancy Time Data
- Table A-5 -- Dallas-Fort Worth Runway Occupancy Time Data
- Table A-6 -- Atlanta Runway Occupancy Time Data

This data base consists of one record per aircraft, where each record is of the following form:

17L AA 02 14:34:58 14:35:45 7 47

The data items are defined as follows:

<u>Item</u>	
1	Runway
2	Airline code (see Table A-1)
3	Aircraft type code (see Table A-2)
4	Time over the runway threshold (local time in hours, minutes, seconds)
5	Runway exit time (local time in hours, minutes, seconds)
6	Exit number used
7	Runway Occupancy Time (in seconds)

TABLE A-1
AIRLINE CODES

AA	American Airlines	NW	Northwest Orient
AC	Air Canada	NY	New York Air
AL	US Air	OW	National Air
AO	Eastern Atlantis	OZ	Ozark
AS	Atlantic Southeast	PA	Pan Am
BA	British Airways	PE	People Express
BN	Braniff	PI	Piedmont
CO	Continental	PO	Rio Airways
CR	Air Atlanta	QH	Air Florida
DL	Delta	RC	Republic
EA	Eastern	RP	Precision
EC	Eagle Air	RZ	Ransome
EM	Eastern Metro	SK	Skytem
ER	Emery	ST	Stage
EV	Evergreen	TG	Thai Airways
FC	Chaparral	TN	air taxi
FE	Federal Express	TS	Trans Southern
FL	Frontier (and Frontier Horizon)	TV	Transamerica
FT	Flying Tigers	TW	Transworld
FY	Metroflight	UA	United
GG	North American	UR	Empire
IT	Interflight	WA	Western
KL	KLM	WC	World Airways
LH	Lufthansa	YX	Midwest Express
ML	Midway	ZZ	Zantop
MR	Martin Air		

TABLE A-2
AIRCRAFT TYPE CODES

1	A300
2	B727
3	B737
4	B747
5	B757
6	B767
7	DH7
8	F28
9	DC9
10	DC10
11	L1011
12	BAC111
13	DH6
14	Business Jet (Lear, Citation, Gulfstream, etc.)
15	Shorts 330
16	Convair 440, YS11, MU2
17	Light Twin
18	F27
19	B99
20	Convair 580
21	Swearingen Metroliner
22	DC6
23	DC3
24	L188 (Lockheed Electra)
25	DC8, B707
26	Single Engine

TABLE A-3
LOS ANGELES RUNWAY OCCUPANCY TIME DATA

24L	9	07:17:33	07:18:33	7	60
24L TW	2	07:19:11	07:20:03	7	52
25L	2	07:22:14	07:23:25	7	72
24L EA	2	07:27:46	07:28:29	6	43
24R PS	27	07:28:40	07:29:29	2	49
25L IM	21	07:30:08	07:30:57	5	49
25L MI	14	07:31:34	07:32:43	7	69
25L WA	2	07:35:23	07:36:16	5	53
24R SA	27	07:35:47	07:36:36	2	49
25R WA	3	07:38:47	07:39:29	5	42
25L IM	27	07:39:41	07:40:27	3	46
25L DE	21	07:41:02	07:42:07	6	65
24L PS	9	07:43:25	07:44:36	7	71
24R UA	2	07:45:01	07:46:04	3	63
25L GA	17	07:46:27	07:47:04	2	37
24L PS	9	07:47:37	07:48:29	6	52
25L SA	21	07:49:07	07:50:11	5	64
24L PS	9	07:51:15	07:51:58	5	43
24R WW	19	07:51:23	07:52:18	2	55
24R WW	13	07:56:48	07:57:26	1	38
25R NN	19	07:57:49	07:58:46	2	57
24L OC	3	07:58:41	07:59:27	5	46
24L PS	9	07:59:44	08:00:38	7	54
24R PS	28	08:01:30	08:02:27	2	57
25R UA	2	08:02:12	08:03:04	6	52
24L OC	3	08:04:19	08:05:02	5	43
24L OC	3	08:06:03	08:06:55	5	52
24R PS	21	08:07:05	08:08:11	3	66
24R SA	27	08:09:02	08:09:49	2	47
25L SA	14	08:09:57	08:10:52	6	55
25L SA	3	08:11:56	08:12:44	6	48
25L SA	21	08:15:46	08:16:33	3	47
25R NN	19	08:16:13	08:16:58	2	45
25R AA	2	08:19:22	08:20:16	6	54
25R IM	19	08:21:41	08:22:29	3	48
25L DE	19	08:25:03	08:25:44	5	41
24L SW	3	08:29:21	08:30:08	5	47
25R UA	3	08:31:42	08:32:25	3	43
24L IM	19	08:33:22	08:34:19	4	57
25R WA	3	08:33:47	08:34:37	5	50
24L NW	2	08:35:32	08:36:33	7	61

TABLE A-3
(continued)

25L IM 19	08:36:41	08:37:25	3	44
25L IM 21	08:37:45	08:38:28	3	43
25R WA 3	08:49:37	08:50:23	6	46
25L IM 15	08:50:59	08:51:43	3	44
24R PS 9	08:52:42	08:53:47	3	65
25L WW 15	08:53:54	08:54:52	6	58
25L WW 2	08:56:48	08:58:01	7	73
24L SW 2	08:58:45	08:59:32	5	47
24R OC 3	08:59:51	09:00:28	2	37
24R AM 9	09:01:33	09:02:35	3	62
25L WA 2	09:02:06	09:03:11	7	65
25R WA 2	09:08:31	09:09:25	6	54
25L GA 14	09:09:37	09:10:46	6	69
24L PS 9	09:15:38	09:16:24	6	46
25L MI 14	09:15:47	09:16:38	4	51
24R IM 21	09:16:01	09:16:58	2	57
24R IM 19	09:17:35	09:18:09	2	34
25R WA 2	09:17:20	09:18:14	5	54
24R UA 2	09:20:18	09:21:15	3	57
25L GA 14	09:21:55	09:22:41	6	46
24R PS 9	09:22:11	09:23:04	3	53
25L IM 15	09:23:55	09:24:47	6	52
25L IM 15	09:24:50	09:25:30	3	40
24R WW 19	09:26:03	09:27:02	2	59
25L IM 2	09:26:14	09:27:04	6	50
25R UA 3	09:27:29	09:28:26	3	57
24R WW 19	09:27:47	09:28:35	2	48
25R WA 2	09:28:45	09:29:43	5	58
25L WA 3	09:29:09	09:30:14	7	65
25R WA 2	09:30:11	09:31:10	6	59
25L AW 3	09:32:11	09:32:56	6	45
25L DE 21	09:34:58	09:35:52	6	54
24L OC 3	09:37:41	09:38:25	5	44
24R PS 9	09:40:48	09:41:47	3	59
24R SA 21	09:42:13	09:43:20	3	67
25L CO 2	09:43:08	09:43:53	6	45
25R WA 3	09:44:58	09:45:55	6	57
25R WA 21	09:46:28	09:47:27	6	59
25L IM 27	09:50:44	09:51:32	3	48
25L RC 2	09:58:41	09:59:25	6	44
25L DL 2	10:00:39	10:01:24	5	45

TABLE A-3
(continued)

24L UA	3	10:01:58	10:02:44	5	46
25R UA	2	10:03:06	10:03:52	3	46
25L IM	19	10:03:16	10:04:08	3	52
24R PS	9	10:08:00	10:08:56	3	56
24R OC	3	10:10:16	10:11:07	2	51
24L SW	3	10:10:21	10:11:14	5	53
25L SA	21	10:10:58	10:11:57	6	59
25L GA	26	10:12:44	10:13:19	1	35
25L UA	2	10:14:36	10:15:35	6	59
25L GA	17	10:17:26	10:18:14	2	48
24L GA	17	10:19:34	10:20:13	3	39
25R AA	2	10:21:21	10:22:18	4	57
24L TW	2	10:26:04	10:26:49	5	45
25R GA	17	10:26:37	10:27:24	2	47
24L AM	9	10:41:27	10:42:32	5	65
24R PS	9	10:43:18	10:44:01	2	43
24L EA	2	10:43:15	10:44:10	5	55
24R MI	14	10:49:18	10:50:20	3	62
25L MX	2	10:50:09	10:50:54	6	45
25R RC	2	10:51:41	10:52:38	5	57
24L SW	2	10:53:19	10:54:19	5	60
24R PS	9	10:55:39	10:56:15	2	36
24L OC	3	10:57:23	10:58:06	5	43
25R UA	2	10:57:59	10:58:48	5	49
24L WA	2	10:59:05	10:59:44	5	39
25R WA	3	10:59:35	11:00:30	5	54
24L OC	3	11:00:26	11:01:08	4	42
24L WW	19	11:02:05	11:02:41	3	36
25L IM	27	11:01:59	11:03:08	4	69
25R RC	9	11:03:02	11:04:01	5	59
24L SW	3	11:05:14	11:06:06	5	52
24R IM	27	11:05:19	11:06:19	2	60
24R SA	21	11:06:44	11:07:13	2	29
25L WW	13	11:07:25	11:08:19	6	54
24R PS	28	11:09:37	11:10:27	2	50
25L RC	2	11:09:48	11:10:56	7	68
24R IM	13	11:11:09	11:11:59	2	50
25L WA	2	11:11:45	11:12:52	5	67
24R WW	15	11:12:53	11:13:31	1	38
24R MC	9	11:18:12	11:19:11	3	59
25L PI	2	11:20:35	11:21:28	6	53

TABLE A-3
(continued)

24R CP	3	11:22:07	11:22:54	2	47
25L FL	3	11:23:13	11:24:14	6	61
24R IM	19	11:27:52	11:28:50	2	58
24L PS	9	11:30:36	11:31:26	6	50
25L GA	17	11:33:25	11:34:08	2	43
25L WA	3	11:35:07	11:36:03	7	56
24R SA	21	11:39:23	11:40:21	2	58
25L WA	2	11:41:24	11:42:11	6	47
24R AC	2	11:41:32	11:42:35	3	63
24R WA	3	11:43:14	11:44:07	3	53
24R AL	2	11:46:31	11:47:09	2	38
24R GA	13	11:47:59	11:48:52	2	53
24R GA	17	11:51:05	11:51:55	2	50
24L PS	9	11:52:01	11:52:40	5	39
25R UA	2	11:52:07	11:52:54	5	47
24R WW	19	11:53:54	11:54:30	1	36
24L WW	21	11:56:29	11:57:26	4	57
24L OC	3	11:58:44	11:59:34	5	50
25L IM	27	11:59:06	11:59:52	5	46
24R SW	3	12:00:50	12:01:41	2	51
24L OC	3	12:02:56	12:03:47	5	51
25R WA	2	12:04:12	12:05:10	6	58
25L IM	27	12:04:38	12:05:27	5	49
24R DE	19	12:08:26	12:09:34	2	68
24R WW	19	12:10:09	12:10:42	1	33
24L SA	21	12:10:28	12:11:09	4	41
24R WW	19	12:11:14	12:11:45	1	31
25L GA	17	12:12:20	12:13:25	6	65
24R GA	17	12:12:46	12:13:37	2	51
25L AW	2	12:14:10	12:14:55	6	45
24L PS	9	12:14:25	12:15:10	5	45
24R NN	21	12:18:53	12:19:43	2	50
25R AW	3	12:19:14	12:19:58	5	44
24L PS	9	12:19:52	12:20:32	5	40
24L OC	3	12:23:20	12:24:20	5	60
25L WA	3	12:26:05	12:26:57	6	52
24L GA	14	12:27:31	12:28:21	5	50
24L MC	9	12:29:13	12:29:50	5	37
25L IM	15	12:30:33	12:31:21	3	48
24L PS	9	12:32:37	12:33:25	5	48
24R SA	21	12:35:28	12:36:18	2	50

TABLE A-3
(continued)

25R BN	2	12:36:58	12:37:46	4	48
24R WA	2	12:37:38	12:38:16	2	38
25L IM	27	12:39:19	12:40:17	4	58
25L PS	9	12:41:37	12:42:26	6	49
25L GA	17	12:46:20	12:47:58	6	98
24R OC	3	12:50:53	12:51:44	2	51
24L PS	9	12:52:52	12:53:37	4	45
24R OC	3	12:53:48	12:54:45	2	57
24L AL	2	12:56:14	12:57:06	5	52
24R WW	21	12:57:41	12:58:29	2	48
25L UA	3	12:58:35	12:59:13	5	38
24L PS	9	13:01:03	13:01:56	5	53
25L RC	2	13:02:16	13:03:07	6	51
25L PS	9	13:03:57	13:04:52	6	55
24L PS	28	13:04:07	13:05:00	4	53
25R OC	3	13:06:54	13:07:52	6	58
24R OC	3	13:06:59	13:07:55	2	56
25L EA	2	13:10:31	13:11:37	7	66
25R UA	2	13:11:06	13:11:47	3	41
24L PS	28	13:12:46	13:13:43	5	57
25L GA	14	13:16:04	13:16:59	6	55
25L GA	17	13:18:48	13:19:26	2	38
25L IM	27	13:22:32	13:23:22	3	50
25L UA	3	13:27:32	13:28:12	6	40
24L AM	9	13:27:43	13:28:42	6	59
24R SA	21	13:27:53	13:28:50	2	57
25L FL	3	13:29:39	13:30:27	5	48
25L GA	17	13:34:20	13:35:33	6	73
25L IM	15	13:41:23	13:42:25	5	62
24R SP	21	13:50:06	13:51:00	2	54
24L IM	27	13:52:24	13:53:06	3	42
25R WA	3	13:51:51	13:53:17	6	86
24R WA	2	13:54:49	13:55:32	2	43
24R WW	19	13:58:58	13:59:45	2	47
25R CO	9	13:58:49	13:59:46	3	57
24L PS	9	14:00:18	14:01:07	5	49
24L WW	21	07:39:31	07:40:30	6	59
25L GA	15	07:41:48	07:42:47	4	59
25R UA	2	07:45:51	07:46:36	3	45
24R SP	19	07:46:54	07:47:47	2	53
24L GA	17	07:47:58	07:48:33	3	35

TABLE A-3
(continued)

24L PS	9	07:51:36	07:52:15	6	39
25L DE	19	07:53:33	07:54:18	3	45
24L PS	9	07:57:26	07:58:21	6	55
24R SP	15	07:58:47	07:59:28	2	41
24L OC	3	08:03:48	08:04:49	7	61
24L PS	9	08:06:03	08:06:49	5	46
24L PS	28	08:08:16	08:09:05	5	49
24L OC	3	08:09:55	08:10:35	6	40
25L AW	3	08:13:21	08:14:09	6	48
24R SA	21	08:14:26	08:15:08	2	42
25R SA	21	08:15:24	08:16:19	6	55
25L UA	2	08:17:01	08:17:43	6	42
25L IM	19	08:20:51	08:21:38	5	47
25L GA	14	08:23:22	08:24:16	6	54
25L GA	17	08:25:42	08:26:22	2	40
25R WA	2	08:26:51	08:27:39	5	48
25L AA	2	08:28:16	08:29:17	7	61
25R IM	19	08:30:41	08:31:19	3	38
25L AA	3	08:35:05	08:35:46	2	41
25L GA	17	08:38:03	08:38:58	6	55
25L AM	9	08:39:40	08:40:41	6	61
25R WA	3	08:45:59	08:46:49	6	50
24R DE	19	08:48:18	08:49:02	2	44
25L GA	17	08:49:23	08:50:32	6	69
25L SP	15	08:51:17	08:52:05	6	48
24L IM	15	08:52:33	08:53:15	5	42
25L UA	2	08:54:42	08:55:42	3	60
25L HA	9	08:59:35	09:00:38	7	63
25R WA	2	09:05:31	09:06:23	6	52
25L WA	2	09:06:11	09:06:51	6	40
24R OC	3	09:11:35	09:12:16	2	41
25L WA	3	09:11:52	09:12:47	8	55
25R WA	2	09:14:55	09:15:44	6	49
24R OC	3	09:16:05	09:17:11	3	66
24R PS	9	09:18:54	09:19:50	3	56
25L WA	2	09:19:42	09:20:40	7	58
24L WA	2	09:20:56	09:21:42	6	46
25L GA	17	09:21:21	09:23:23	6	62
25L AW	3	09:25:46	09:26:30	6	44
24L PS	9	09:27:03	09:27:56	6	53
25L WA	2	09:27:44	09:28:20	6	36

TABLE A-3
(concluded)

25R	WA	3	09:29:25	09:30:19	6	54
25L	WA	2	09:30:35	09:31:15	6	40
24R	WW	19	09:30:57	09:31:45	2	48
24L	SP	19	09:31:24	09:32:00	3	36
25L	IM	15	09:32:46	09:33:34	6	48
24L	GA	17	09:33:28	09:34:16	4	48
24R	SA	21	09:35:31	09:36:16	2	45
25L	CO	2	09:36:53	09:37:29	6	36
25R	UA	2	09:40:50	09:41:42	5	52
24L	GA	17	09:41:52	09:42:41	4	49
25R	UA	2	09:42:05	09:42:52	6	47
25L	GA	14	09:44:23	09:45:13	6	50
24R	WW	19	09:45:40	09:46:30	2	50
24R	GA	17	09:47:06	09:47:43	1	37
25L	IM	27	09:49:08	09:49:46	3	38
24R	SA	21	09:50:03	09:50:51	2	48
25R	UA	2	09:51:20	09:52:08	5	48
24L	SA	21	09:56:12	09:57:00	5	48
25L	GA	17	09:58:11	09:58:54	2	43
25R	IM	21	09:58:46	09:59:43	6	57
24L	SW	3	10:00:58	10:01:45	5	47
25L	IM	27	10:01:40	10:02:18	4	38
24R	WW	19	10:02:26	10:03:08	2	42
25L	DL	2	10:03:29	10:04:12	6	43
25L	UA	2	10:05:14	10:06:08	6	54
24L	TW	2	10:06:58	10:07:45	6	47
24R	PS	9	10:08:27	10:09:25	3	58
25L	SA	27	10:10:20	10:11:05	6	45
24L	OC	3	10:12:24	10:13:17	6	53
24L	PS	9	10:13:59	10:14:44	6	45
24L	OC	3	10:16:50	10:17:36	6	46
25L	GA	17	10:17:56	10:18:28	2	32
25L	UA	2	10:19:29	10:20:14	6	45
25L	PI	2	10:21:45	10:22:44	7	59
25L	WA	3	10:23:20	10:24:14	7	54
25L	RC	2	10:25:00	10:25:39	6	39
24R	PS	9	10:26:30	10:27:23	3	53

TABLE A-4
SAN FRANCISCO RUNWAY OCCUPANCY TIME DATA

28R NW	2	14:28:52	14:29:49	6	57
28L WS	13	14:31:20	14:33:00	9	100
28R PS	9	14:37:44	14:38:29	6	45
28L OC	3	14:43:49	14:44:56	7	67
28L OC	14	14:45:41	14:47:05	10	84
28L GA	14	14:51:40	14:52:52	10	72
28R WW	19	14:53:52	14:54:52	6	60
28L WS	13	14:57:24	14:58:39	8	75
28R PS	28	15:00:21	15:01:19	6	58
28R AS	2	15:01:37	15:02:27	6	50
28R FL	2	15:03:28	15:04:22	6	54
28L PS	9	15:04:42	15:05:26	5	44
28L UA	2	15:06:13	15:07:22	8	69
28R UA	3	15:09:21	15:10:13	7	52
28R WW	21	15:13:22	15:14:14	6	52
28R UA	2	15:14:33	15:15:18	6	45
28L PS	9	15:21:27	15:22:08	5	41
28L UA	3	15:25:54	15:26:59	7	65
28R UA	2	15:27:47	15:28:44	7	57
28L PS	9	15:32:40	15:33:25	5	45
28R UA	2	15:35:27	15:36:19	6	52
28R UA	2	15:35:27	15:36:19	6	52
28L PS	9	15:39:09	15:40:01	6	52
28L PS	9	15:41:57	15:42:52	6	55
28L WA	2	15:44:12	15:44:48	5	36
28R GA	26	15:43:34	15:44:55	8	81
28L UA	3	15:46:54	15:47:56	7	62
28L GA	14	15:48:06	15:48:58	7	52
28L SW	3	15:50:03	15:50:46	5	43
28L PS	9	15:59:01	16:00:06	7	65
28L GA	14	16:01:21	16:02:15	5	54
28L PS	9	16:04:36	16:05:15	5	39
28R WS	13	16:06:09	16:07:08	7	59
28L PS	9	16:09:04	16:09:55	5	51
28R WW	15	16:10:19	16:11:05	6	46
28L GA	14	16:10:47	16:11:58	10	71
28R GA	17	16:12:14	16:13:19	6	65
28L NN	19	16:12:40	16:13:28	6	48
28L PS	9	16:14:15	16:15:11	6	56
28R UA	3	16:17:11	16:17:57	6	46
28L PS	9	16:17:18	16:18:00	5	42

TABLE A-4
(continued)

28R OC	9	16:19:22	16:20:13	6	51
28L PS	28	16:19:31	16:20:21	5	50
28R GA	14	16:21:35	16:23:10	7	95
28R RC	2	16:23:38	16:24:30	5	52
28L OC	9	16:24:20	16:25:07	6	47
28L WA	3	16:25:37	16:26:28	6	51
28R UA	3	16:27:19	16:28:05	6	46
28L WA	2	16:27:56	16:28:38	5	42
28L UA	2	16:29:48	16:31:07	8	79
28L WW	21	16:31:50	16:32:57	7	67
28R GA	14	16:31:30	16:33:08	10	98
28L UA	2	16:33:32	16:34:17	5	45
28L UA	3	16:35:43	16:36:55	7	72
28R GA	17	16:36:49	16:37:36	6	47
28L NW	2	16:37:13	16:38:19	7	66
28R WS	15	16:37:57	16:38:54	7	57
28L AS	2	16:39:04	16:39:56	5	52
28R WW	19	16:40:46	16:41:40	6	54
28L NN	13	16:40:54	16:42:19	8	85
28R UA	2	16:42:13	16:43:03	6	50
28L OC	3	16:43:31	16:44:32	7	61
28R GA	17	16:43:50	16:45:09	10	79
28L AL	2	16:45:59	16:46:43	6	44
28L OC	3	16:47:58	16:49:07	7	69
28L WS	15	16:52:00	16:52:56	7	56
28L UA	3	16:53:03	16:54:12	7	69
28L HO	18	17:02:49	17:03:46	5	57
28L UA	2	17:04:46	17:05:58	8	72
28R SW	3	17:06:34	17:07:32	6	58
28L UA	3	14:43:54	14:45:05	8	71
28L WW	21	14:52:05	14:53:12	7	67
28R PS	9	14:55:53	14:56:45	5	52
28L AS	2	14:59:21	15:00:04	5	43
28R PS	9	15:03:42	15:04:31	6	49
28R GA	26	15:06:55	15:08:09	10	74
28R UA	2	15:08:43	15:09:42	6	59
28L GA	14	15:09:02	15:10:28	10	86
28R UA	3	15:20:53	15:22:01	6	68
28L WA	2	15:25:37	15:26:14	5	37
28L PS	9	15:26:56	15:27:44	6	48
28L PS	9	15:30:46	15:31:36	6	50

TABLE A-4
(continued)

28L PS	9	15:32:54	15:34:03	7	69
28L WW	21	15:39:23	15:40:10	5	47
28L SW	3	15:42:12	15:42:56	5	44
28L WW	19	15:44:40	15:45:26	5	46
28L GA	14	15:51:00	15:52:18	10	78
28L GA	14	15:54:26	15:55:30	6	64
28L GA	17	15:56:37	15:57:38	8	61
28L PS	9	15:59:34	16:00:25	6	51
28L PS	28	16:04:39	16:05:25	5	46
28R PS	9	16:04:43	16:05:30	6	47
28L WW	21	16:05:55	16:06:41	5	46
28R CO	2	16:06:08	16:06:57	6	49
28L PS	9	16:08:06	16:08:53	6	47
28R PS	9	16:08:14	16:09:02	6	48
28L UA	3	16:10:40	16:11:23	5	43
28R WS	15	16:14:32	16:15:28	6	56
28L OC	9	16:15:19	16:16:30	7	71
28R GA	19	16:15:32	16:16:53	10	81
28L UA	3	16:16:50	16:17:57	8	67
28R UA	3	16:18:15	16:19:03	6	48
28R WD	17	16:19:19	16:20:09	6	50
28L PS	9	16:21:32	16:22:35	7	63
28R GA	14	16:21:35	16:22:53	10	78
28R RC	2	16:23:25	16:24:17	6	52
28L GA	14	16:23:39	16:24:37	6	58
28R UA	2	16:25:01	16:26:01	6	60
28L UA	2	16:25:35	16:26:27	7	52
28R OC	9	16:26:45	16:27:32	6	47
28L WS	13	16:27:54	16:28:50	5	56
28L UA	3	16:29:25	16:30:31	6	66
28R UA	2	16:30:51	16:31:41	6	50
28L WS	15	16:32:40	16:33:19	5	39
28R WS	15	16:32:49	16:33:38	6	49
28L UA	3	16:33:59	16:35:24	8	85
28R AL	2	16:38:46	16:39:47	6	61
28L UA	2	16:39:11	16:40:28	7	77
28L AS	2	16:41:06	16:41:55	6	49
28R OC	3	16:45:06	16:45:57	6	51
28L OC	3	16:53:00	16:54:11	7	71
28L SW	3	16:55:24	16:56:10	5	46
28R WA	3	16:57:51	16:58:43	7	52

TABLE A-4
(continued)

28L	GA	14	16:58:18	16:59:27	7	69
28L	UA	3	16:59:46	17:00:31	5	45
28L	HO	18	17:00:59	17:01:45	5	46
28R	OC	3	17:05:05	17:05:58	6	53
28R	UA	3	17:09:06	17:09:58	6	52
28L	UA	3	17:10:37	17:11:40	7	63
28L	UA	3	17:12:12	17:13:10	8	58
28L	UA	2	17:15:02	17:15:42	5	40
28R	UA	2	17:14:59	17:16:03	6	64
28R	UA	3	17:17:32	17:18:22	6	50
28L	PS	9	17:18:15	17:18:57	5	42
28R	UA	3	17:20:40	17:21:36	6	56
28R	UA	3	17:23:57	17:24:49	6	52
28L	UA	2	17:27:52	17:29:12	8	80
28L	PS	9	17:29:59	17:30:43	5	44
28R	GA	17	17:30:05	17:30:58	6	53
28L	GA	17	17:33:07	17:34:53	10	106
28L	GA	14	17:37:00	17:37:53	5	53
28R	AA	2	17:38:41	17:39:37	6	56
28L	OC	3	17:41:03	17:42:28	7	85
28L	WW	21	17:42:37	17:43:25	6	48
28L	WW	21	17:43:54	17:44:50	5	56
28R	CO	2	17:45:50	17:46:45	6	55
28R	GA	17	17:47:10	17:48:29	6	79
28L	WW	21	17:47:37	17:48:43	5	66
28L	UA	2	17:49:40	17:50:20	5	40
28L	GA	17	17:53:05	17:54:11	5	66
28R	GA	23	17:53:54	17:55:20	6	86
28L	UA	3	17:55:01	17:56:29	8	88
28R	CP	3	17:58:37	17:59:33	5	56
28L	PS	9	17:59:30	18:00:10	5	40
28L	PS	9	18:04:22	18:05:14	5	52
28R	GA	17	18:04:50	18:06:05	9	75
28L	WA	2	18:06:34	18:07:14	5	40
28L	WW	21	18:08:40	18:09:37	5	57
28R	WS	13	18:09:00	18:09:58	6	58
28R	NW	2	18:10:53	18:11:33	6	40
28L	GA	14	18:11:03	18:12:38	9	95
28L	OC	3	18:25:29	18:26:53	6	84
28L	GA	14	18:30:37	18:31:31	5	54
28L	PS	9	18:32:42	18:33:32	5	50

TABLE A-4
(continued)

28R	WA	2	18:33:24	18:34:06	6	42
28R	GA	14	18:34:53	18:35:58	6	65
28L	MX	2	18:36:09	18:37:02	6	53
28L	SW	3	18:38:47	18:39:36	5	49
28R	GA	17	18:39:10	18:40:35	7	85
28R	UA	2	18:41:57	18:42:44	6	47
28L	GA	14	18:41:46	18:43:13	8	87
28R	NN	2	18:46:05	18:47:21	7	76
28L	UA	3	18:49:55	18:51:09	7	74
28R	RC	9	18:55:59	18:57:08	6	69
28R	CO	2	19:01:04	19:02:05	6	61
28L	PS	9	19:01:34	19:02:21	5	47
28R	WS	21	19:02:56	19:04:08	6	72
28L	RC	9	19:08:05	19:08:56	5	51
28R	GA	26	19:08:14	19:10:08	8	114
28L	OC	3	19:10:23	19:11:46	7	83
28L	UA	3	19:12:36	19:13:58	8	82
28R	UA	2	19:13:34	19:14:23	6	49
28L	PS	9	19:16:37	19:17:29	5	52
28L	PS	9	19:18:08	19:18:55	5	47
28R	GA	26	19:19:38	19:21:14	6	96
28L	PS	9	19:20:36	19:21:41	7	65
28R	GA	23	19:21:27	19:23:11	8	104
28L	AS	2	19:22:55	19:23:46	5	51
28R	GA	17	19:23:20	19:24:36	8	76
28L	WS	15	19:27:27	19:28:22	5	55
28R	PS	28	19:27:44	19:29:04	6	80
28L	PS	9	19:30:07	19:30:54	5	47
28L	WW	21	19:31:11	19:32:23	7	72
28L	OC	3	19:33:08	19:34:13	6	65
28R	WS	15	19:35:02	19:36:18	6	76
28L	OC	9	19:35:25	19:36:37	7	72
28R	WS	17	19:37:50	19:39:23	9	93
28L	OC	3	19:41:56	19:43:14	8	78
28L	AC	2	19:43:27	19:44:22	5	55
28L	AA	2	19:46:56	19:48:21	6	85
28R	TW	2	19:49:07	19:50:16	6	69
28R	WS	15	10:00:08	10:00:54	6	46
28R	UA	3	10:01:52	10:02:51	6	59
28R	PS	9	10:10:35	10:11:21	6	46
28R	NS	17	10:13:23	10:13:59	6	36

TABLE A-4
(continued)

28R NS	17	10:14:11	10:15:05	6	54
28R AA	2	10:16:43	10:17:26	6	43
28R AA	2	10:17:51	10:18:37	6	46
28R DL	2	10:20:24	10:21:14	6	50
28R PS	9	10:23:09	10:23:59	6	50
28R UA	3	10:25:51	10:26:44	6	53
28R FL	2	10:27:29	10:28:22	6	53
28R WW	21	10:29:10	10:30:11	6	61
28R SW	3	10:31:16	10:32:17	6	61
28R GA	19	10:36:49	10:37:39	6	50
28R OC	3	10:39:57	10:40:38	6	41
28R UA	2	10:43:02	10:43:50	6	48
28R RC	2	10:47:12	10:48:04	6	52
28R GA	17	10:51:27	10:52:16	6	49
28R UA	2	10:54:50	10:55:38	6	48
28R PS	9	10:56:22	10:57:15	6	53
28R WW	21	10:58:16	10:58:56	6	40
28R CO	2	11:07:46	11:08:42	6	56
28R GA	17	11:10:11	11:10:51	6	40
28R GA	14	11:11:31	11:12:19	6	48
28R EA	2	11:12:56	11:13:48	6	52
28R OC	9	11:14:28	11:15:10	6	42
28R PA	2	11:15:48	11:16:42	5	54
28R WA	2	11:17:21	11:18:07	5	46
28R SO	21	11:19:51	11:20:37	6	46
28R PI	2	11:20:45	11:21:38	6	53
28R OC	3	11:22:10	11:22:59	6	49
28R WW	21	11:26:19	11:27:00	6	41
28R AC	2	11:27:26	11:28:25	6	59
28R WW	15	11:28:29	11:29:18	6	49
28R UA	3	11:30:22	11:31:15	6	53
28R PS	9	11:34:01	11:35:09	6	68
28R WW	21	11:37:34	11:38:28	6	54
28R SO	21	11:38:43	11:39:43	6	60
28R GA	26	11:41:38	11:42:41	6	63
28R PA	2	11:45:29	11:46:26	6	57
28R OC	3	11:46:48	11:47:44	6	56
28R UA	3	11:50:10	11:51:00	6	50
28R DL	2	11:52:01	11:52:59	6	58
28R WA	2	11:53:38	11:54:28	6	50
28R RC	2	11:55:13	11:56:09	6	56

TABLE A-4
(continued)

28R OC	3	11:56:53	11:57:47	6	54
28R PA	2	11:58:09	11:59:00	6	51
28R AL	2	12:02:07	12:03:08	6	61
28R PS	9	12:03:45	12:04:36	6	51
28R WW	21	12:05:10	12:06:08	6	58
28R PS	28	12:07:06	12:08:03	6	57
28R PI	2	12:08:38	12:09:32	6	54
28R CP	3	12:14:13	12:15:16	6	63
28R PS	9	12:18:05	12:18:49	5	44
28R UA	3	12:19:32	12:20:22	6	50
28R CO	2	12:20:41	12:21:28	6	47
28R PS	9	12:22:57	12:23:45	6	48
01R WW	15	12:23:36	12:24:07	2	31
01L GA	17	12:23:54	12:24:24	2	30
28R UA	2	12:24:27	12:25:21	6	54
28R UA	2	12:28:06	12:28:53	6	47
28R PS	9	12:29:49	12:30:30	5	41
28R UA	2	12:33:07	12:33:54	6	47
01R GA	3	12:35:53	12:36:46	3	53
28R PS	9	12:37:07	12:38:07	6	60
01R WW	15	12:38:19	12:39:05	2	46
01R GA	26	12:40:42	12:41:12	1	30
28R UA	3	12:42:05	12:42:56	7	51
28R PS	9	12:43:39	12:44:31	6	52
28R UA	3	12:47:41	12:48:26	6	45
28R WA	3	12:48:55	12:49:43	6	48
28R PS	9	12:52:47	12:53:42	6	55
28R GA	17	12:54:18	12:55:16	3	58
28R UA	3	12:55:43	12:56:39	6	56
28R NW	2	12:57:01	12:57:49	6	48
28R UA	3	12:58:27	12:59:19	6	52
28R SO	21	13:00:31	13:01:07	4	36
28R UA	3	13:01:11	13:01:53	6	42
28R UA	3	13:03:01	13:03:51	6	50
28R OC	3	13:04:30	13:05:21	6	51
28R UA	2	13:05:45	13:06:40	7	55
28R EA	2	13:06:58	13:07:45	6	47
28R PS	9	13:08:10	13:08:59	6	49
01R WW	19	13:10:21	13:10:59	2	38
01R WS	13	13:12:07	13:13:04	2	57
28R PS	28	13:12:29	13:13:21	6	52

TABLE A-4
(concluded)

01R	WS	13	13:17:08	13:18:04	2	56
28R	UA	3	13:17:44	13:18:33	6	49
28R	PS	9	13:19:43	13:20:33	6	50
01R	WS	13	13:24:06	13:25:05	2	59
01R	WW	21	13:26:18	13:26:53	2	35
28R	BN	2	13:26:41	13:27:35	7	54
28R	SO	21	13:28:41	13:29:35	6	54
28R	UA	2	13:30:03	13:30:51	6	48
28R	UA	3	13:32:14	13:32:56	6	42
28R	UA	3	13:34:30	13:35:21	6	51
28R	OC	3	13:36:42	13:38:14	8	92
28R	GA	17	13:38:29	13:40:07	9	98
28R	DL	2	13:41:09	13:41:50	6	41
28R	PS	9	13:43:03	13:43:50	6	47
28R	AS	2	13:44:34	13:45:24	6	50
28R	GA	14	13:46:35	13:47:32	6	57
28R	OC	3	13:48:39	13:49:34	6	55
28R	GA	14	13:50:06	13:50:57	6	51
28R	GA	17	13:51:40	13:52:35	5	55
28R	GA	17	13:55:56	13:56:52	6	56

TABLE A-5
DALLAS-FORT WORTH RUNWAY OCCUPANCY TIME DATA

17L AA 09	14:33:24	14:34:00	02	36
17L AA 02	14:34:58	14:35:45	03	47
17L AA 09	14:36:30	14:37:10	03	40
17L AA 02	14:38:20	14:39:10	03	50
17L AA 02	14:39:47	14:40:33	03	46
17L AA 02	14:42:10	14:42:50	02	40
17L AA 02	14:43:23	14:44:10	02	47
17L AA 09	14:45:24	14:45:56	02	32
17L AA 02	14:46:35	14:47:17	03	42
17L FY 13	14:48:50	14:49:26	02	36
17L FY 20	14:51:21	14:52:05	02	44
17L AA 02	14:52:46	14:53:30	03	44
17L AA 02	14:54:22	14:54:58	03	36
17L FC 19	14:56:04	14:56:45	02	41
17L SK 21	14:57:36	14:58:20	02	44
17L AA 10	14:59:28	15:00:15	03	47
17L AA 02	15:01:24	15:02:14	03	50
17L ZZ 25	15:02:40	15:03:56	04	76
17L CO 09	15:05:38	15:06:15	03	37
17L GA 21	15:07:07	15:07:50	02	43
17L GA 14	15:10:20	15:10:53	02	33
17L ZZ 25	15:11:36	15:12:57	04	81
17L GA 14	15:15:20	15:16:03	02	43
17L DL 02	15:17:05	15:18:00	03	55
17L DL 03	15:20:48	15:21:40	03	52
17L PO 19	15:22:10	15:22:48	02	38
17L PI 02	15:23:24	15:23:54	02	30
17L TG 04	15:25:32	15:27:21	02	109
17L DL 03	15:28:18	15:28:57	02	39
17L DL 03	15:30:36	15:31:20	03	44
18R AA 09	14:40:36	14:41:20	04	44
18R AA 02	14:44:26	14:45:20	04	54
18R AA 02	14:46:02	14:46:45	04	43
18R IT 25	14:47:52	14:48:40	04	48
18R AA 02	14:49:43	14:50:37	04	54
18R AA 02	14:51:05	14:51:54	04	49
18R AA 02	14:52:29	14:53:10	04	41
18R AA 02	14:54:10	14:54:56	04	46
18R AA 10	14:55:35	14:56:08	04	33
18R AA 02	14:57:35	14:58:17	04	42
18R AA 02	15:01:23	15:01:56	02	33

TABLE A-5
(continued)

18R	FC	19	15:04:12	15:05:04	02	52
18R	GA	19	15:06:18	15:07:03	01	45
18R	PA	02	15:08:30	15:09:10	02	40
18R	UA	02	15:19:40	15:20:30	04	50
17L	AA	10	15:53:52	15:54:45	03	53
17L	AA	02	15:56:14	15:56:45	02	31
17L	FY	20	16:00:00	16:00:31	02	31
17L	AA	02	16:00:57	16:01:35	02	38
17L	AA	02	16:02:14	16:02:52	02	38
17L	AA	02	16:06:05	16:06:47	03	42
17L	AA	09	16:07:17	16:08:06	03	49
17L	AA	02	16:09:11	16:09:58	03	47
17L	AA	02	16:10:16	16:10:58	03	42
17L	AA	02	16:11:44	16:12:26	03	42
17L	AA	02	16:13:10	16:13:58	03	48
17L	AA	02	16:15:00	16:15:50	03	50
17L	AA	02	16:17:00	16:17:45	03	45
17L	OZ	09	16:18:40	16:19:20	02	40
17L	AA	02	16:20:09	16:20:50	02	41
18R	PO	19	15:53:37	15:54:22	02	45
18R	ST	19	15:55:30	15:56:22	01	52
18R	BN	02	15:57:43	15:58:20	02	37
18R	AA	02	16:03:10	16:04:04	04	54
18R	AA	02	16:06:24	16:07:13	04	49
18R	AA	09	16:08:20	16:08:57	04	37
18R	AA	10	16:11:05	16:11:51	04	46
18R	AA	02	16:13:27	16:14:15	04	48
18R	AA	02	16:15:05	16:15:52	04	47
18R	AA	02	16:16:32	16:17:17	04	45
18R	GA	17	16:19:45	16:20:23	02	33
18R	AA	02	16:19:50	16:20:45	04	55
18R	AA	09	16:21:38	16:22:28	04	50
18R	AA	02	16:23:33	16:24:18	04	45
18R	AA	02	16:25:25	16:26:12	04	47
18R	AA	09	16:27:05	16:27:52	04	47
18R	TN	16	16:28:47	16:29:25	02	38
18R	FY	19	16:30:05	16:30:48	02	43
18R	FC	19	16:31:34	16:32:32	04	58
18R	TN	16	16:41:12	16:41:50	02	38
18R	GA	17	16:43:49	16:44:17	05	28
18R	UA	02	16:49:40	16:50:44	04	64

TABLE A-5
(continued)

18R	BN	02	16:51:11	16:52:05	02	54
18R	PO	19	16:53:45	16:54:40	02	55
18R	FT	20	16:55:30	16:56:20	02	50
18R	FL	03	16:57:56	16:58:49	02	53
18R	DL	02	16:59:31	17:00:12	04	41
18R	BN	02	17:01:40	17:02:31	04	51
18R	NW	02	17:03:32	17:04:26	04	54
18R	RC	09	17:04:59	17:05:44	02	45
17L	FY	13	16:22:20	16:23:31	02	71
17L	FY	13	16:24:13	16:25:04	02	51
17L	AA	02	16:26:40	16:27:11	02	31
17L	EC	19	16:30:11	16:30:55	01	44
17L	GA	17	17:04:35	17:05:17	05	42
17L	DL	02	17:05:30	17:06:12	03	42
17L	OZ	09	17:08:28	17:09:17	03	49
17L	DL	03	17:10:12	17:10:56	03	44
17L	DL	02	17:12:26	17:12:58	02	32
17L	PO	07	17:14:21	17:15:25	02	64
17L	DL	09	17:16:13	17:17:20	03	67
17L	DL	02	17:17:25	17:18:11	03	46
17L	DL	11	17:21:28	17:22:09	02	41
17L	AA	06	17:23:42	17:24:32	03	50
17L	DL	02	17:25:34	17:26:20	03	46
17L	AC	09	17:28:47	17:29:30	02	43
17L	DL	02	17:30:33	17:31:15	03	42
17L	AA	02	17:32:23	17:33:06	03	43
17L	AA	02	17:56:32	17:57:20	02	48
17L	FY	20	17:58:08	17:58:56	03	48
17L	FY	20	17:58:47	17:59:40	02	53
17L	FY	13	18:00:00	18:01:12	02	72
17L	OZ	09	18:02:25	18:03:08	02	43
17L	AA	10	18:05:19	18:05:55	02	36
17L	AA	02	18:07:41	18:08:39	03	58
17L	AA	02	18:10:48	18:11:46	02	58
17L	AA	02	18:12:30	18:13:14	02	44
17L	AA	09	18:14:32	18:15:16	02	44
17L	AA	09	18:16:06	18:16:56	03	50
17L	AA	02	18:17:49	18:18:35	03	46
17L	AA	02	18:18:49	18:19:25	02	36
17L	AA	09	18:20:17	18:21:05	03	48
17L	EA	09	18:21:30	18:22:40	03	70
17L	AA	02	18:23:02	18:23:40	02	38
17L	AA	02	18:24:30	18:25:21	02	51

TABLE A-5
(concluded)

17L	AA	02	18:25:50	18:26:33	02	43
17L	CO	09	18:27:08	18:27:57	03	49
17L	AA	09	18:28:25	18:29:05	02	40
17L	DL	02	18:29:42	18:30:28	03	46
17L	DL	02	18:32:42	18:33:35	02	53
17L	DL	02	18:34:18	18:34:58	02	40
17L	PO	19	18:35:10	18:35:58	02	48
17L	DL	02	18:37:46	18:38:40	02	54
17L	DL	06	18:39:38	18:40:24	03	46
17L	DL	09	18:41:49	18:42:30	02	41
17L	DL	02	18:44:15	18:44:53	02	38
17L	PI	03	18:48:36	18:49:22	02	46
17L	DL	03	18:50:36	18:51:32	03	56
17L	PI	02	19:33:20	19:34:21	03	61
17L	AA	09	19:37:00	19:37:42	02	42
17L	AA	09	19:44:14	19:44:53	03	39
17L	AA	09	19:48:07	19:48:48	02	41
17L	AA	10	19:50:19	19:50:59	02	40
17L	AA	02	19:52:58	19:53:41	03	43
17L	FY	13	19:53:45	19:54:33	02	48
17L	FC	19	19:55:30	19:56:07	02	37
17L	AA	10	19:57:18	19:58:01	03	43
17L	AA	10	19:59:05	19:59:49	03	44
17L	AA	02	20:01:22	20:02:03	03	41
17L	AA	09	20:03:12	20:04:06	03	54
17L	AA	02	20:05:05	20:05:56	03	51
17L	FY	13	20:06:52	20:07:35	02	43
17L	AA	02	20:08:18	20:09:04	03	46
18R	FY	20	19:26:59	19:27:55	03	56
18R	FL	03	19:36:23	19:37:04	02	41
18R	DL	11	19:38:20	19:39:02	02	42
18R	AA	10	19:45:19	19:46:06	04	47
18R	MX	02	19:49:32	19:50:24	04	52
18R	AA	02	19:53:15	19:53:55	04	40
18R	AA	02	19:54:45	19:55:30	04	45
18R	AA	02	19:56:35	19:57:10	04	35
18R	AA	02	19:58:07	19:58:45	02	38
18R	AA	02	19:59:28	20:00:07	02	39
18R	AA	02	20:00:31	20:01:30	04	59
18R	GA	16	20:01:49	20:02:37	04	48
18R	AA	02	20:03:11	20:03:57	04	46
18R	AA	02	20:04:29	20:05:16	04	47
18R	AA	02	20:07:34	20:08:20	04	46

TABLE A-6
ATLANTA RUNWAY OCCUPANCY TIME DATA

27L EA 02	13:51:15	13:51:55	05	40
27L EM 16	13:52:22	13:53:02	04	40
27L AO 21	13:53:20	13:54:00	04	40
27L EA 02	13:54:03	13:54:49	05	46
27L DL 05	13:58:32	13:59:22	05	50
27L AS 21	14:01:32	14:02:20	04	48
27L DL 09	14:02:58	14:03:45	04	47
27L DL 09	14:04:26	14:05:01	04	35
27L RC 09	14:08:02	14:08:47	05	45
27L PI 08	14:09:12	14:10:02	05	50
27L AS 13	14:11:47	14:12:32	04	45
27L AS 13	14:12:34	14:13:22	04	48
27L DL 09	14:13:40	14:14:36	05	56
27L RC 09	14:15:05	14:15:42	04	37
27L DL 02	14:16:08	14:16:51	04	43
27L CR 02	14:16:53	14:17:35	04	42
27L DL 05	14:18:10	14:18:49	05	39
27L DL 11	14:19:17	14:20:05	05	48
27L DL 03	14:20:59	14:21:45	05	46
27L DL 09	14:22:46	14:23:33	05	47
27L DL 02	14:23:57	14:24:30	04	33
27L DL 03	14:24:54	14:25:26	04	32
27L DL 02	14:26:02	14:26:44	05	42
27L DL 06	14:27:17	14:28:00	05	43
27L AS 13	14:28:59	14:29:36	04	37
27L DL 02	14:29:58	14:30:47	05	49
27L DL 02	14:30:50	14:31:35	05	45
27L DL 11	14:32:00	14:32:44	05	44
27L DL 02	14:33:30	14:34:03	04	33
27L RC 09	14:34:52	14:35:30	04	38
27L DL 03	14:35:58	14:36:43	05	45
27L AS 07	14:36:56	14:37:38	04	42
27L EM 16	14:37:40	14:38:25	04	45
27L DL 11	14:38:35	14:39:36	06	61
27L DL 05	14:41:02	14:41:50	04	38
27L DL 25	14:41:52	14:42:30	05	38
27L DL 03	14:43:05	14:43:42	04	37
27L AS 07	14:43:58	14:44:45	05	47
27L EA 02	14:45:18	14:45:59	05	41
27L AS 13	14:46:20	14:47:02	04	42
27L EA 02	14:47:19	14:47:55	04	36

TABLE A-6
(continued)

27L	DL	02	14:48:22	14:49:06	05	44
27L	DL	02	14:49:52	14:50:28	05	36
27L	DL	02	14:50:47	14:51:30	05	43
27L	GA	14	14:51:42	14:52:30	05	48
27L	DL	02	14:52:45	14:53:30	05	45
27L	UA	02	14:54:22	14:54:59	04	37
27L	AA	02	14:55:28	14:56:00	04	32
27L	EA	02	14:56:27	14:57:07	05	40
27L	AS	13	14:57:23	14:58:00	04	37
27L	EA	02	14:58:10	14:58:52	05	42
27L	EA	02	14:59:26	15:00:10	05	44
27L	EA	09	15:00:28	15:01:12	05	44
27L	EA	02	15:01:24	15:02:01	05	37
27L	EA	09	15:02:30	15:03:04	04	34
27L	EA	09	15:03:16	15:03:57	05	41
27L	EA	02	15:04:27	15:05:10	05	43
27L	EA	05	15:05:32	15:06:06	04	34
27L	EA	02	15:06:33	15:07:15	05	42
27L	EA	09	15:07:40	15:08:28	05	48
27L	EA	09	15:08:46	15:09:33	05	47
27L	EA	09	15:09:38	15:10:25	05	47
27L	EA	09	15:10:53	15:11:31	05	38
27L	EA	09	15:11:57	15:12:39	05	42
27L	EA	01	15:13:32	15:14:15	05	43
27L	EA	05	15:15:16	15:16:10	05	54
27L	EA	09	15:16:17	15:17:05	05	48
27L	DL	02	15:18:08	15:18:52	05	44
27L	EA	09	15:19:06	15:19:55	05	49
27L	EA	09	15:21:08	15:21:51	05	43
27L	EA	02	15:24:10	15:24:58	05	48
27L	AS	13	15:25:55	15:26:46	05	51
27L	EA	02	15:28:00	15:29:02	06	62
27L	PI	08	15:30:01	15:30:44	04	43
09R	NW	02	17:21:54	17:22:28	04	34
09R	DL	06	17:23:15	17:24:03	04	48
09R	DL	09	17:24:50	17:25:35	04	45
09R	DL	02	17:26:09	17:26:49	04	40
09R	RC	09	17:27:11	17:27:57	04	46
09R	DL	09	17:28:40	17:29:25	04	45
09R	TN	19	17:29:59	17:30:35	03	36
09R	DL	02	17:31:00	17:31:37	04	37

TABLE A-6
(continued)

09R DL 02	17:32:05	17:32:49	04	44
09R AS 07	17:34:01	17:34:54	04	53
09R CR 02	17:35:10	17:35:52	04	42
09R DL 09	17:36:14	17:36:55	04	41
09R PI 08	17:37:14	17:37:52	03	38
09R DL 02	17:38:12	17:38:51	04	39
09R DL 02	17:39:18	17:39:56	04	38
09R DL 02	17:40:32	17:41:14	04	42
09R DL 02	17:41:54	17:42:22	03	28
09R DL 09	17:42:53	17:43:37	04	44
09R DL 11	17:43:39	17:44:32	04	53
09R CR 02	17:45:09	17:45:39	03	30
09R DL 02	17:46:26	17:47:05	04	39
09R DL 05	17:47:48	17:48:35	04	47
09R DL 25	17:48:42	17:49:21	04	39
09R DL 25	17:50:10	17:51:21	06	71
09R DL 03	17:51:59	17:52:37	04	38
09R RC 09	17:52:48	17:53:47	06	59
09R DL 03	17:54:23	17:55:05	04	42
09R AS 07	17:55:40	17:56:15	03	35
09R AS 13	17:56:23	17:57:04	03	41
09R DL 02	17:57:22	17:57:59	04	37
09R LH 04	17:59:35	18:00:30	04	55
09R DL 06	18:01:21	18:02:03	04	42
09R DL 02	18:02:59	18:03:42	04	43
09R EA 09	18:03:59	18:04:40	04	41
09R AA 02	18:05:11	18:05:53	04	42
09R DL 02	18:06:18	18:06:53	04	35
09R EA 02	18:07:33	18:08:01	03	28
09R AS 13	18:08:40	18:09:20	03	40
09R EA 02	18:09:43	18:10:20	04	37
09R AA 02	18:12:30	18:13:00	03	30
09R TW 02	18:13:47	18:14:36	04	49
09R DL 03	18:14:57	18:15:25	03	28
09R EA 09	18:16:15	18:17:00	04	45
09R EA 09	18:17:18	18:17:49	03	31
09R EA 09	18:18:32	18:19:06	03	34
09R EA 09	18:19:32	18:20:11	04	39
09R EA 09	18:20:48	18:21:27	04	39
09R EA 09	18:22:17	18:22:59	04	42
09R EA 09	18:23:24	18:23:58	04	34

TABLE A-6
(continued)

09R	EA	02	18:24:59	18:25:37	04	38
09R	BH	03	18:25:59	18:26:40	04	41
09R	EA	09	18:27:25	18:28:05	04	40
09R	EA	02	18:28:27	18:29:07	04	40
09R	EA	02	18:29:41	18:30:21	04	40
09R	EA	09	18:31:34	18:32:12	04	38
09R	EA	02	18:32:55	18:33:31	04	36
09R	AO	21	18:34:44	18:35:33	04	49
09R	EA	09	18:37:22	18:37:59	04	37
09R	AS	13	18:43:21	18:43:52	03	31
09R	AS	07	18:58:29	18:59:10	03	41
09R	AS	13	19:01:58	19:02:35	03	37
09R	AS	13	19:06:38	19:07:26	03	48
09R	DL	11	19:11:13	19:12:13	06	60
09R	DL	11	19:12:59	19:13:38	04	39
09R	DL	03	19:14:57	19:15:42	04	45
09R	DL	02	19:16:23	19:17:05	04	42
09R	AO	16	19:17:56	19:18:37	03	41
09R	DL	09	19:19:21	19:20:11	04	50
09R	AS	13	19:20:25	19:21:06	03	41
09R	DL	09	19:21:31	19:22:05	03	34
09R	DL	02	19:22:52	19:23:32	04	40
09R	DL	05	19:24:32	19:25:08	03	36
09R	DL	09	19:25:40	19:26:30	04	50
09R	DL	25	19:27:13	19:27:59	04	46
09R	DL	11	19:28:40	19:29:20	04	40
09R	DL	06	19:30:45	19:31:30	04	45
09R	DL	02	19:32:12	19:32:48	04	36
09R	DL	09	19:33:13	19:33:56	03	43
09R	EA	05	19:34:09	19:34:35	03	26
09R	DL	02	19:34:50	19:35:31	04	41
09R	DL	05	19:36:03	19:36:47	04	44
09R	DL	02	19:36:48	19:37:30	04	42
09R	DL	09	19:37:40	19:38:12	03	32
09R	DL	09	19:38:30	19:39:14	04	44
09R	EA	02	19:39:15	19:39:53	04	38
09R	DL	02	19:40:13	19:40:54	04	41
09R	EA	02	19:41:07	19:41:51	04	44
09R	DL	03	19:42:28	19:43:22	06	54
09R	DL	02	19:43:23	19:44:10	06	47
09R	EA	09	19:44:16	19:44:55	03	39

TABLE A-6
(continued)

09R AS 21	19:44:59	19:45:29	03	30
09R EA 01	19:46:10	19:46:51	04	41
09R EA 09	19:48:00	19:48:49	04	49
09R AS 21	19:48:55	19:49:27	03	32
09R EA 02	19:50:09	19:50:53	04	44
09R DL 02	19:51:28	19:52:04	04	36
09R EA 02	19:52:19	19:53:01	04	42
09R EA 09	19:53:38	19:54:22	04	44
09R EA 09	19:54:49	19:55:32	04	43
09R EA 02	19:55:33	19:56:25	06	52
09R EA 05	19:57:10	19:57:59	04	49
09R EA 09	19:58:08	19:58:54	04	46
09R DL 02	19:59:09	19:59:52	04	43
09R EM 16	20:00:30	20:01:12	03	42
09R AS 21	20:01:20	20:01:55	03	35
09R EA 09	20:02:00	20:02:40	04	40
09R EA 05	20:03:09	20:03:58	04	49
09R EM 16	20:04:32	20:05:10	03	38
09R EA 02	20:06:22	20:07:10	04	48
09R EA 05	20:07:25	20:08:08	04	43
09R EA 09	20:08:31	20:09:20	04	49
09R EA 09	20:09:21	20:09:59	04	38
09R KL 04	20:10:55	20:11:50	06	55
09R EA 01	20:12:38	20:13:40	06	62
09R EM 16	20:14:24	20:15:04	03	40
09R EA 09	20:15:55	20:16:33	04	38
09R DL 11	20:17:00	20:17:43	04	43
09R EM 16	20:19:20	20:19:58	03	38
09R CR 02	20:20:28	20:21:09	04	41
09R AS 13	20:21:45	20:22:18	03	33
09R EM 16	20:22:42	20:23:25	04	43
09R AS 13	20:24:00	20:24:40	03	40
09R PI 03	20:24:52	20:25:26	03	34
09R DL 09	20:26:45	20:27:30	04	45
09R DL 02	20:31:22	20:32:02	04	40
09R DL 25	20:32:49	20:33:25	04	36
09R DL 03	20:38:50	20:39:29	04	39
09R DL 02	20:41:15	20:41:55	04	40
09R DL 25	20:41:59	20:42:50	06	51
09R DL 11	20:44:13	20:44:52	04	39
09R DL 06	20:47:58	20:48:42	04	44

TABLE A-6
(continued)

08L	EA	09	13:26:13	13:26:54	07	41
08L	EA	05	13:28:13	13:28:57	07	44
08L	GA	17	13:29:45	13:30:20	05	35
08L	CR	02	13:31:59	13:32:47	07	48
08L	EA	09	13:34:14	13:34:50	07	36
08L	TS	21	13:35:08	13:35:54	03	46
08L	EA	02	13:36:16	13:37:07	07	51
08L	EA	09	13:37:17	13:38:01	07	44
08L	EA	02	13:38:18	13:38:54	07	36
08L	GA	17	13:39:52	13:40:32	02	40
08L	EA	09	13:41:09	13:41:48	07	39
08L	EA	09	13:42:28	13:43:05	07	37
08L	EM	16	13:44:10	13:45:00	03	50
08L	EA	09	13:45:15	13:46:04	07	49
08L	EA	09	13:46:48	13:47:28	07	40
08L	AA	02	13:48:16	13:48:54	03	38
08L	EM	16	13:51:45	13:52:30	03	45
08L	EA	02	13:53:50	13:54:35	07	45
08L	GA	16	13:59:20	14:00:05	02	45
08L	PI	08	14:01:32	14:02:07	03	35
08L	DL	09	14:03:39	14:04:20	07	41
08L	EA	02	14:06:10	14:06:50	07	40
08L	ZZ	25	14:09:14	14:09:56	08	42
08L	DL	09	14:11:35	14:12:20	07	45
08L	DL	06	14:12:52	14:13:30	07	38
08L	DL	11	14:14:13	14:14:55	07	42
08L	DL	09	14:16:07	14:16:58	07	51
08L	AS	13	14:18:05	14:18:49	03	44
08L	RC	09	14:20:11	14:20:49	03	38
08L	DL	03	14:21:46	14:22:28	07	42
08L	DL	02	14:23:21	14:24:03	07	42
08L	DL	02	14:24:52	14:25:34	07	42
08L	RC	09	14:26:32	14:27:13	07	41
08L	DL	02	14:27:31	14:28:07	07	36
08L	DL	02	14:29:10	14:29:48	07	38
08L	EA	02	14:30:12	14:30:56	07	44
08L	DL	11	14:31:16	14:32:17	08	61
08L	AS	13	14:33:18	14:34:00	02	42
08L	DL	02	14:34:54	14:35:33	07	39
08L	EA	02	14:36:17	14:37:14	08	57
08L	DL	02	14:38:13	14:38:55	07	42

TABLE A-6
(concluded)

08L GA 16	14:40:05	14:40:56	05	51
08L AS 13	14:41:26	14:42:10	03	44
08L UA 02	14:44:12	14:44:45	03	33
08L EA 09	14:46:30	14:47:07	03	37
08L AA 02	14:48:22	14:48:59	03	37
08L EA 02	14:50:22	14:51:05	07	43
08L DL 02	14:51:30	14:52:15	07	45
08L EA 02	14:53:09	14:53:47	07	38
08L EA 09	14:55:08	14:55:40	07	32
08L GA 17	14:56:52	14:57:35	02	43
08L GA 16	14:58:59	14:59:45	05	46
08L EA 02	15:03:59	15:04:44	07	45
08L EA 09	15:06:05	15:06:48	07	43
08L EA 09	15:07:45	15:08:24	07	39
08L EA 09	15:09:39	15:10:22	07	43
08L EA 02	15:11:15	15:11:55	03	40
08L DL 02	15:13:26	15:14:11	07	45
08L AA 02	15:17:01	15:17:45	07	44
08L TW 02	15:20:09	15:20:43	03	34
08L DL 11	17:34:03	17:34:43	07	40
08L DL 09	17:35:57	17:36:37	07	40
08L DL 09	17:36:52	17:37:29	02	37
08L DL 02	17:39:55	17:40:35	07	40
08L AS 21	17:45:59	17:46:41	02	42
08L AS 21	17:49:44	17:50:30	02	46
08L GA 17	17:53:08	17:53:56	02	48
08L RC 09	17:54:22	17:55:11	07	49
08L DL 09	17:56:10	17:56:52	07	42
08L DL 02	17:57:50	17:58:36	07	46
08L EA 02	17:59:01	17:59:46	07	45
08L EV 02	18:01:07	18:02:00	08	53
08L EA 02	18:02:47	18:03:26	07	39
08L EM 16	18:04:21	18:05:09	05	48
08L EA 02	18:05:35	18:06:20	07	45

APPENDIX B
AUTOMATED DATA COLLECTION

The ROT data collected at Los Angeles and San Francisco were recorded using a notebook-sized portable computer. Using a program written in BASIC, it was possible for a single observer to collect data for observations on up to four runways simultaneously. At the end of each day, the data were archived to cassette tape for later retrieval and statistical analysis.

B.1 Program Description

The data collection program, written in BASIC, works in the following manner:

1. The program prompts the user for the name of a file (in memory) where the collected data is to be stored.
2. The main loop of the program begins by presenting the status of each runway (runway clear/ arrival on runway) and the time. (The time display is continuously updated.)
3. An event on a runway (arrival over the threshold or aircraft exiting the runway) is signaled to the program by pressing the function key associated with that runway. This action records the current time.
4. If the event is an arrival over the threshold, the program then prompts the user for the airline (GA, for general aviation, is entered if appropriate) and the aircraft type. Following this, the program returns to the main display and is ready to record another event.
5. If the event is the exiting of an aircraft from the runway, the program prompts the user for the exit number. All information on that arrival is displayed and the user is then asked if the information is correct. If the user responds "yes," the program writes the data on that arrival to the file and returns to the main display.
6. If the user responds "no" to the prompt, the program enters an editing mode, where the user may change the:
 - a. Runway;
 - b. Airline;
 - c. Aircraft type; or
 - d. Exit number.

The program then displays the new data and once again requests that the user verify its correctness. When the user responds "yes", the program writes the data to the file and returns to the main display.

7. Finally, the program also includes a "comment key", which the user may press while the program is in the main loop. This allows the entry of a comment directly into the data file.

Although the program described above could run on any of several small computers, two hardware functions are notable:

1. The computer must have a built-in clock so that times may be recorded automatically.
2. Function keys with program-interrupt capabilities are highly desirable. These allow the program to be written in an infinite-loop form that does nothing but update the display. The loop is interrupted to record an event and resumes following that.

B.2 Conclusions

The use of the portable computer for data collection had many benefits. The most obvious was efficiency; compared to earlier data-collection efforts, it was found that one observer could record in a shorter period of time the same amount of data as three to four observers. Also, because of the built-in clock, the times recorded were far more accurate than those recorded manually.

Another significant advantage was that the data were recorded in machine-readable format. This meant that the data could be transferred to a more powerful computer for statistical analysis in minutes rather than days. This electronic transfer of data also removed the need for manually entering each data record into the more powerful computer, thus eliminating a step where errors could be introduced.

Finally, the recording of data in the portable computer allowed the observer to instantly perform a preliminary statistical analysis of the data. This was accomplished using a simple statistical program retained in memory.

The computer used for this study contained 24 kilobytes of random access memory for retaining programs and data. This is the minimum amount of memory necessary to collect one day of data. It would be desirable to use a computer which includes a built-in disk drive, which is a faster and more reliable means

of archiving data than an external cassette tape recorder. Also, the retention of data in this form would facilitate the transfer of the data to a more sophisticated machine.

It should also be noted that the data collection program could be easily modified to obtain information on departures, inter-arrival separations, and so on. It represents an efficient means of collecting information vital to the airport capacity-increasing effort.

APPENDIX C
LIST OF ACRONYMS

FAA	Federal Aviation Administration
IMC	Instrument Meteorological Conditions
mph	Statute Miles Per Hour
nmi	Nautical Miles
ROT	Runway Occupancy Time
VMC	Visual Meteorological Conditions

APPENDIX D
REFERENCES

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