Phoenix Sky Harbor International Airport

Airport Capacity Tactical Initiative

Ground Movement Analysis During Reconstruction of Runway 7L/25R

Prepared by
Modeling and Analysis Group
FAA Wm. J. Hughes Technical Center
Atlantic City International Airport, New Jersey

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16. Abstract

This technical note is a summary of a ground movement analysis conducted by the FAA for Phoenix – Sky Harbor International Airport to evaluate ground delays during the reconstruction of Runway 07L/25R.

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I. Introduction

In August of 2002, the Office of System Capacity (ASC) was contacted to assist Phoenix Sky Harbor Air Traffic Control Tower (PHX-ATCT) in an evaluation of delay impacts caused by the reconstruction of Runway 7L/25R scheduled for January of 2003. The Office of System Capacity asked the Modeling and Analysis Group of the FAA Technical Center to apply their fast-time computer modeling techniques to analyze the ground movement implications of the reconstruction.

II. Background

The reconstruction of Runway 7L/25R is to be accomplished in several phases: Phase 1 was the preparation work for the reconstruction with the work being accomplished without major runway impacts; Phase 2 requires the complete closure of runway 7L/25R with only limited taxiways available for crossing the construction zone: Phase 3 occurs when a portion of Runway 7L/25R becomes available for aircraft use.

Runway 7L/25R is scheduled to be closed for fifty (50) calender days commencing as early as January 6th or as late as January 14, 2002. The fifty day runway closure is known as Phase 2 Construction.

This report addresses only Phase 2 - the complete closure of Runway 7L/25R.

The original design for constructing the runway during the closure requires truck and vehicular traffic to cross the active taxiways and was divided into two subphases.

Subphase 1 - Identified in this report as Subphase1-Original

Air Traffic using existing taxiways for crossing points - Taxiways E6/F5 and/or E11/F11

While work is being performed in Subphase 1, the aircraft crossing points will be existing taxiways E6, F5, E11, and F11. This permits the construction of Runway 7L/25R west of Taxiway E6/F5 without any interference between construction traffic and taxiing aircraft. Reconstruction of the runway between taxiways E6/F and E11/F11 will require crossing for construction traffic. Although the work areas would be available 24 hours per day and seven days per week, most of the work would be restricted to night time activities only because up to 150 trucks per hour would need to cross the active taxiways. Reconstruction of the existing taxiways would also be started and/or completed during Subphase 1.

Subphase 2 - Identified in this report as Subphase2 - Original

Air Traffic using existing taxiways for crossing - Taxiways E1/F1 and E11/F11

Subphase 2 will commence when the new taxiways E1/F1 are reconstructed and able to accommodate taxiing aircraft. Existing taxiways at E6/F5 will be reconstructed along

with the portion of the runway within the E6/F5 safety areas.

In an effort to avoid truck traffic crossing active taxiways, an alternative to the original project design of construction phasing was developed. This alternative requires the construction of a temporary asphaltic concrete taxiway connecting Runway 7L/25R and Taxiway F. This temporary connecting taxiway is located immediately south of existing taxiway E5, and during the runway closure period it will be identified as taxiway F4 since the existing taxiway F4 will be closed and reconstructed in conjunction with the runway closure.

This alternative is also divided into two subphases.

Subphase 1 - Identified in tis report as Subphase1-Alternative

Air traffic using existing taxiways for crossings - Taxiways E5/Temporary F4 and E6/F5

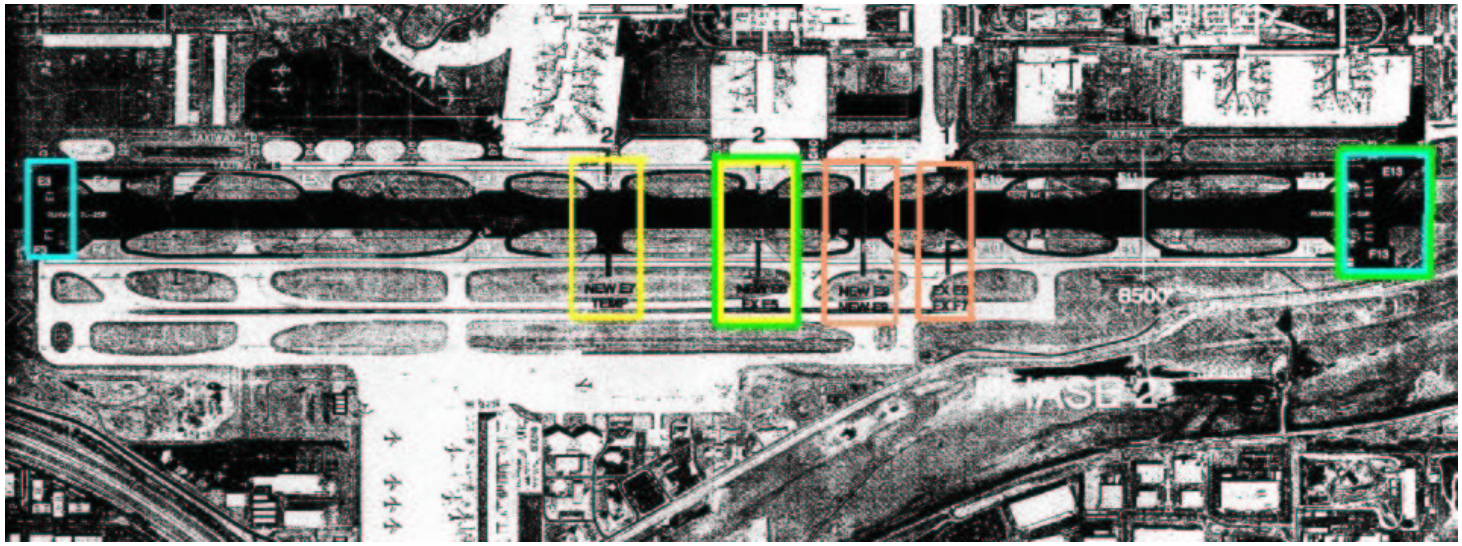
While work is being performed in subphase 1, the aircraft crossing points will be existing taxiways E5, E6, F5, and temporary F4. This permits the construction of runway 7L/25R west of taxiway E5 and east of taxiway E6. Reconstruction of the existing taxiways E7, F6, E8, and F7 will also be completed during subphase 1.

Subphase 2 - Identified in this report as Suphase2-Alternative

Air traffic using existing taxiways for crossings - Taxiways E7/F6 and E8/F7

Subphase 2 will commence when the new taxiways to replace taxiways E7,F6, E8, and F7 are constructed and able to accommodate taxiing aircraft. Once air traffic is switched to the newly constructed connecting taxiways replacing existing taxiways E7, F6, E8, and F7, then construction work west of taxiways E7/F6 can be completed.

Figure 1. Alternative Construction Zone Crossing Points



Subphase 1-Original
s1-o

Subphase 2-Original
s2-o

Subphase 1-Alternative
s1-a

Subphase 2 -Alternative
s2-a

III.Methodology

The Modeling and Analysis Group chose to use the FAA's Airfield Delay Simulation Model(ADSIM) for this analysis because of its superiority in ground movement simulation and the ability to leverage previous simulation work for Phoenix to accelerate the analysis process. A detailed description of the ADSIM model is contained in Appendix A.

Utilizing previously accumulated data for Phoenix, ADSIM simulation inputs were quickly developed for the required scenarios. A summary of the inputs used is included as Appendix B.

For this analysis a daily demand of 1658 aircraft operations was proposed. In preliminary review with PHX ATCT, it was determined that the activity level for the America West commuter operation (Mesa Airlines) appeared to be too low. Consequently, this operation was augmented by additional aircraft bringing the simulated demand to 1724 operations per day. It was also felt that the activity level for Southwest Airlines was somewhat low but further investigation revealed that it was acceptable.

A detailed description of the simulation day demand appears as Appendix C.

The performance metrics chosen for this analysis were:

Average and Total Arrival Runway Delay per Operation
Average and Total Arrival Ground Delay per Operation
Average and Total Arrival Ground Travel Time per Operation

Average and Total Departure Ground Delay per Operation
Average and Total Departure Queue Delay per Operation
Average and Total Departure Ground Travel Time per Operation

It is important to include travel time in the metrics because the location of the crossings may increase the undelayed travel time unnecessarily compared to other crossing points.

Each scenario was simulated using ADSIM which replicates each scenario ten times and calculates averages for all response variables. These averages were used to calculate the response metrics in this analysis.

IV. Analysis

Typically in these types of analysis annual delay values are computed taking into account different configurations, weather conditions and, operating conditions. Comparisons are then based on differences in these computed annual delays. In this analysis, because of the overall short time period of the closure of 07L/25R annual delay comparisons would not be meaningful. Consequently, in this analysis comparisons will be based on average delay per operation, average travel time per operation, total daily delay and, total daily travel time. From these comparisons the relative merits of each scenario can be evaluated.

Additionally, several unique operating situations were examined for their potential impact during the runway closure. The first of these examined was the platooning of pushbacks in the gate alleyways. This was simulated by changing the pushback time of all aircraft scheduled during a 5minute window to the last minute of the window. The second was to examine the impact of the jet stream during the runway closure. This was simulated by shifting the arrival times 30 minutes ahead of originally scheduled for eastern arrivals to simulate the impact of a weak jet stream. The last examined was a combination of both platooning the puskbacks and the weak jet stream.

In the following tables and figures the various scenarios are identified as appears in Table 1.

Table 1. Taxiway Alternatives

Scenario	***Active taxiways***	***Identifier***
Normal three runway Operation	All	east/west 3rwy
Subphase 1 Alternative	E5/Temp F4 and E6/F5	east/west s-1-a
Subphase 1 Alternative with modified taxiway routing	E5/Temp F4 and E6/F5	east s-1-a-a
Subphase 1 Original	E6/F5 and E11/F11	east/west s-1-o
Subphase 2 Alternative	E7/F6 and E8/F7	east/west s-2-a
Subphase 2 Original	E1/F1 and E11/F11	east/west s-2-o

Table 2 is a summary of the performance metrics of delay and travel time for the simulations performed with normal demand during this analysis including results for the normal three runway operation for both East and West flow.

Figure 2 is a graphical comparison of the results presented in Table 2.

Table 3 is a summary of the performance metrics of delay and travel time for the

simulations performed with the platooned pushbacks during this analysis .

Figure 3 is a graphical comparison of the results presented in Table 3.

Table 4 is a summary of the performance metrics of delay and travel time for the simulations performed with the weak jet stream schedule during this analysis .

Figure 4 is a graphical comparison of the results presented in Table 4.

Table 5 is a summary of the performance metrics of delay and travel time for the simulations performed with the platooned pushbacks and the weak jet stream during this analysis.

Figure 5 is a graphical comparison of the results presented in Table 5.

Table 2. Delay Summary for Normal Schedule

	Arrival Runway Delay	Arrival Taxi-in Delay	Arrival Undelayed Travel Time	Departure Runway Delay	Departure Taxi-out Dealy	Departure Undelayed Travel Time	Total Ground Travel Time
east-s-1-a	17.76	0.42	10.53	6.64	1.55	9.58	11.03
east-s-1-a-a	16.58	0.24	9.99	6.48	1.09	9.59	10.46
east-s-1-o	17.20	0.36	10.24	7.16	1.42	9.58	10.80
east-s-2-a	17.23	0.23	9.35	7.14	1.25	9.55	10.19
east-s-2-o	18.72	0.69	10.26	6.32	2.51	9.38	11.41
east3rwy	3.10	0.27	14.05	1.75	0.81	8.79	11.98
west-s-1-a	3.16	0.28	12.74	5.72	0.89	7.46	10.70
west-s-1-o	3.08	0.95	15.91	5.20	0.72	6.56	12.10
west-s-2-a	3.16	0.36	15.93	4.90	0.73	6.82	11.94
west-s-2-o	3.14	0.35	16.19	4.77	0.82	6.61	12.01
west3rwy	3.13	0.63	15.62	1.59	0.60	6.21	11.56

Figure 2. Delay Summary for Normal Schedule

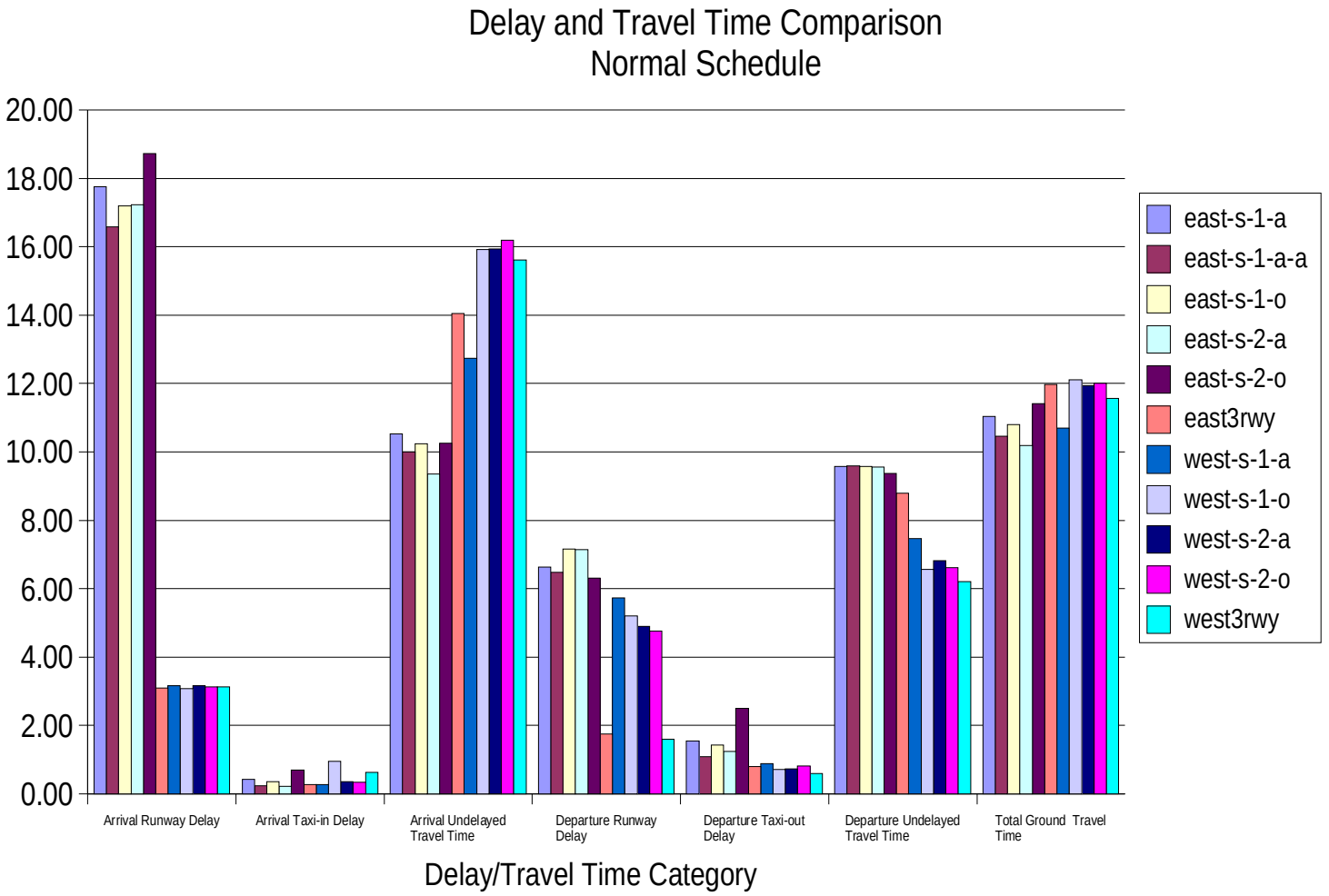


Table 3. Delay Summary for Grouped Pushback

	Arrival Runway Delay	Arrival Taxi-in Delay	Arrival Undelayed Travel Time	Departure Runway Delay	Departure Taxi-out Dealy	Departure Undelayed Travel Time	Total Ground Travel Time
east-s-1-a	18.34	0.45	10.49	6.93	1.62	9.58	11.07
east-s-1-a-a	17.30	0.27	10.02	6.27	1.14	9.60	10.51
east-s-1-o	17.66	0.23	10.23	6.47	1.11	9.61	10.59
east-s-2-a	17.15	0.22	9.39	6.94	1.23	9.55	10.19
east-s-2-o	18.17	0.91	10.30	6.69	2.84	9.22	11.64
west-s-1-a	3.16	0.47	15.51	5.31	0.74	7.47	12.12
west-s-1-o	3.11	0.53	16.06	5.21	0.60	6.59	11.92
west-s-2-a	3.12	0.49	15.94	5.55	0.76	6.83	12.03
west-s-2-o	3.16	0.36	16.42	5.02	0.83	6.62	12.14

Figure 3. Delay Summary for Grouped Pushback

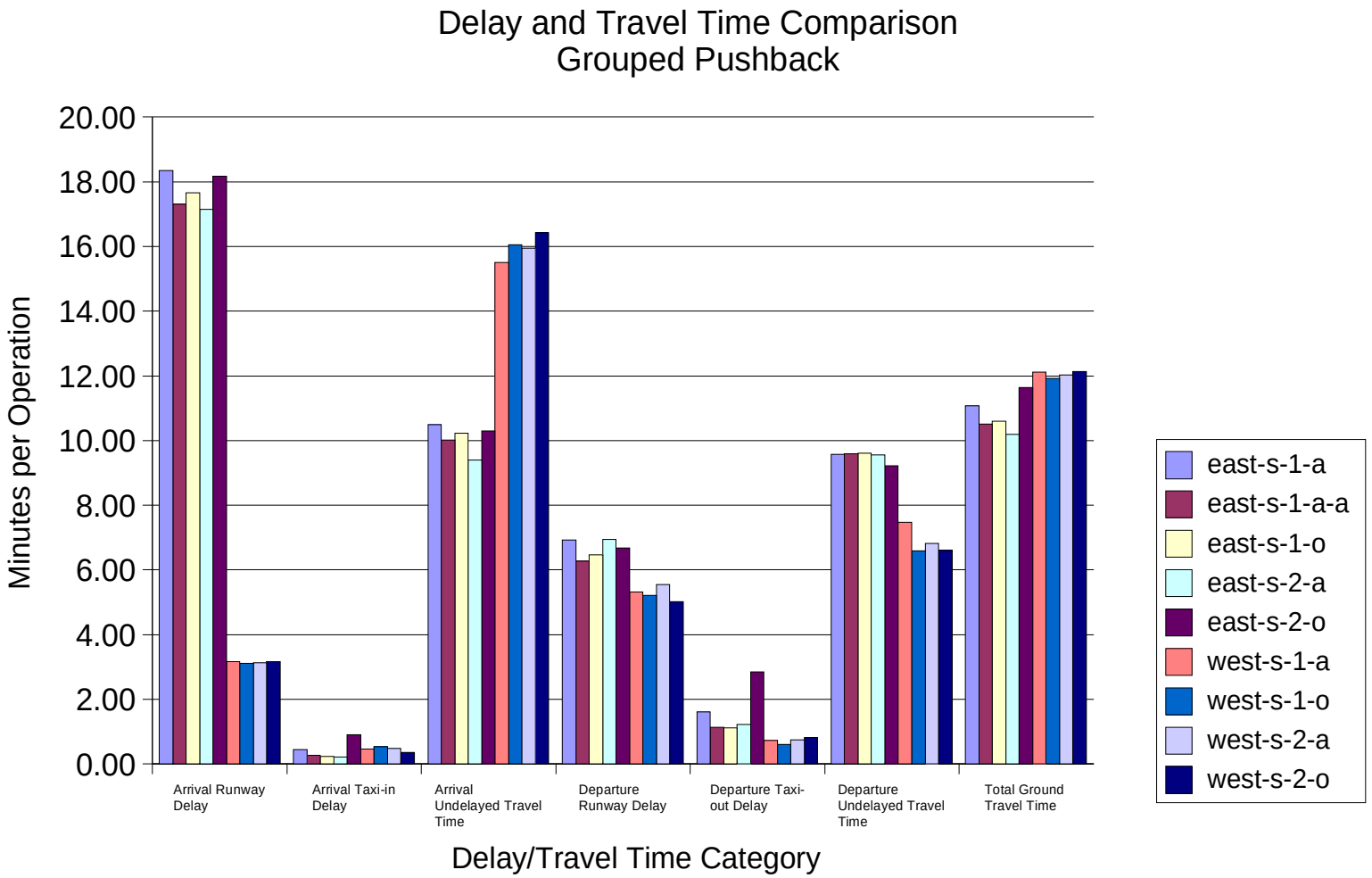


Table 4. Delay Summary for Jet Stream Shifted Arrivals

	Arrival Runway Delay	Arrival Taxi-in Delay	Arrival Undelayed Travel Time	Departure Runway Delay	Departure Taxi-out Dealy	Departure Undelayed Travel Time	Total Ground Travel Time
east-s-1-a	17.33	0.87	11.33	8.05	2.05	9.55	11.90
east-s-1-a-a	18.60	0.23	10.70	5.92	1.10	9.60	10.81
east-s-1-o	17.44	0.28	11.07	7.04	1.23	9.60	11.09
east-s-2-a	18.40	0.32	10.08	7.66	1.33	9.54	10.63
east-s-2-o	17.55	1.02	13.26	7.31	2.40	9.44	13.07
west-s-1-a	2.64	1.45	16.64	6.46	0.94	7.47	13.28
west-s-1-o	2.72	1.19	17.01	5.83	0.72	6.61	12.79
west-s-2-a	2.68	1.09	16.84	5.99	0.87	6.81	12.83
west-s-2-o	3.05	1.15	17.06	5.63	0.98	6.61	12.93

Figure 4. Delay Summary for Jet Stream Shifted Arrivals

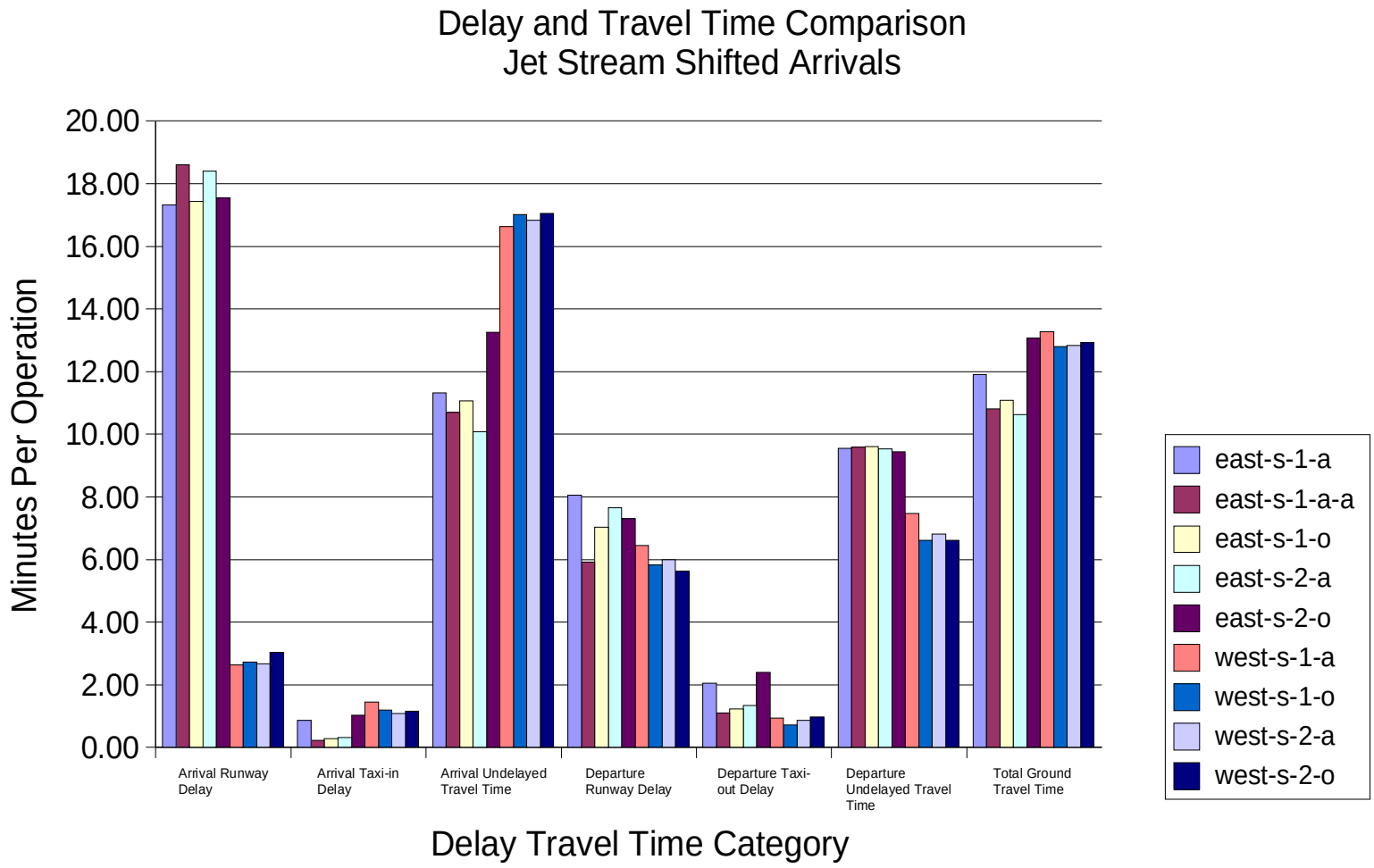
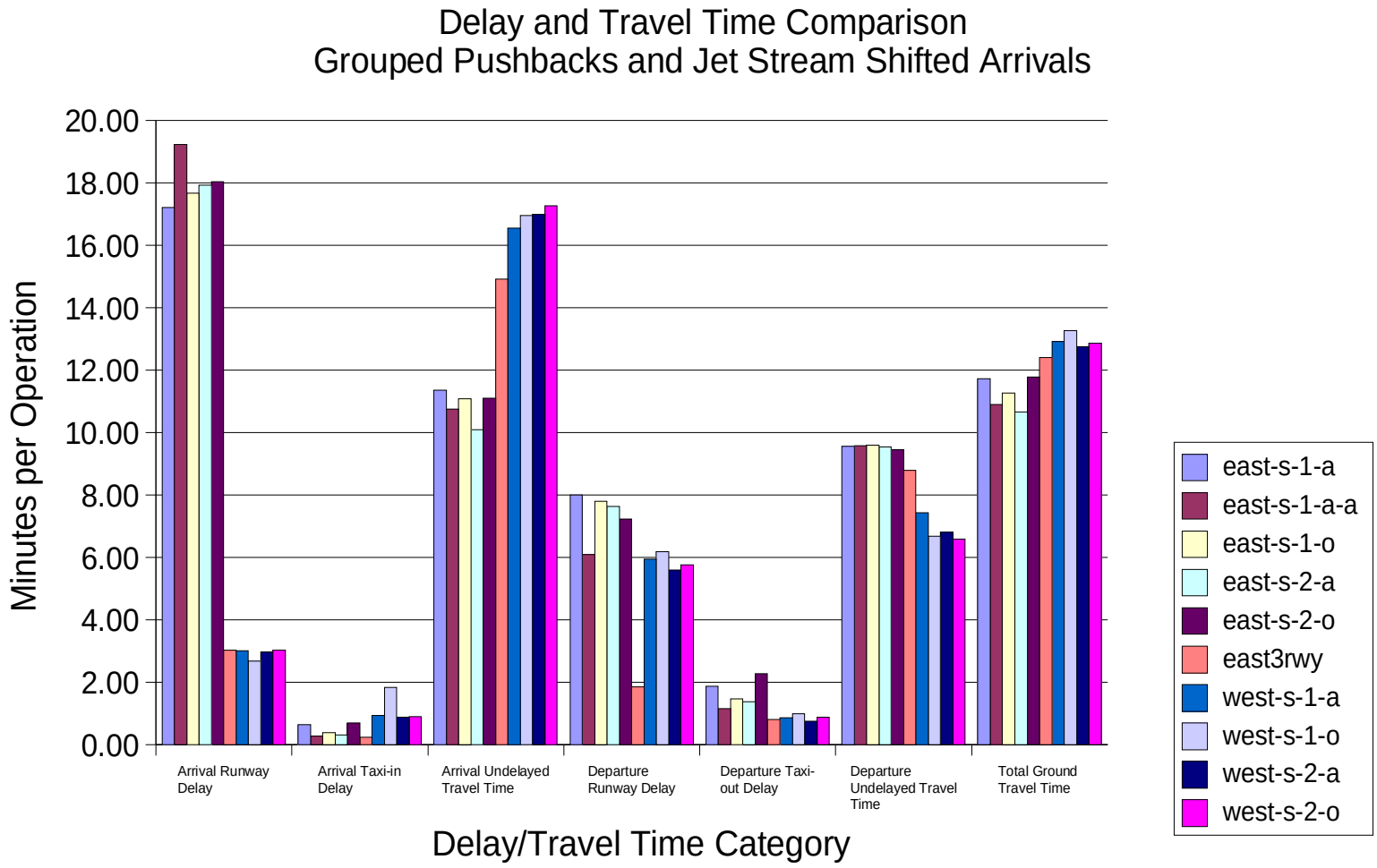


Table 5. Delay Summary for Grouped Pushback and Jet Stream Shifted Arrivals

	Arrival Runway Delay	Arrival Taxi-in Delay	Arrival Undelayed Travel Time	Departure Runway Delay	Departure Taxi-out Dealy	Departure Undelayed Travel Time	Total Ground Travel Time
east-s-1-a	17.22	0.66	11.36	8.00	1.88	9.57	11.74
east-s-1-a-a	19.23	0.29	10.75	6.10	1.16	9.59	10.90
east-s-1-o	17.68	0.40	11.08	7.80	1.47	9.60	11.28
east-s-2-a	17.93	0.31	10.10	7.63	1.39	9.54	10.67
east-s-2-o	18.04	0.71	11.11	7.23	2.29	9.45	11.78
east3rwy	3.04	0.25	14.93	1.87	0.82	8.79	12.41
west-s-1-a	3.02	0.94	16.55	5.95	0.87	7.44	12.93
west-s-1-o	2.70	1.85	16.96	6.18	1.00	6.69	13.28
west-s-2-a	2.98	0.90	16.99	5.61	0.77	6.81	12.76
west-s-2-o	3.04	0.90	17.27	5.76	0.89	6.60	12.86

Figure 5. Delay Summary for Grouped Pushback and Jet Stream Shifted Arrivals



Examination of the above tables and figures reveal two things:

- arrival runway delays in east flow are much worst than in west flow
- the delays and travel times were remarkedly similar for all of the different taxiway scenarios for both the east and westflow simulations .

The arrival delays seen in east flow are a direct result of conducting staggered approaches to permit departures from both runways with the departure restrictions in east flow.

Continued examination shows that platooning the pushback of departing aircraft has little, if any, effect on delays or travel times. The weak jet stream arrivals appear to have some effect on the arrival parameters increasing both arrival ground delays and travel times. Similiarly, when combining both platooned pushbacks and weak jet stream arrivals, the same effect is seen, increased arrival delays and travel times.

While performing the simulations for east flow it became quite apparent that maintaining the staggered approaches as precisely as possible was of paramount importence to managing the arrival delays.

V. Conclusions

From the analysis conducted the following conclusions are made:

Arrival delays in east flow will be much greater than in west flow due to staggering the arrival streams to accommodate the departure restrictions in east flow. These delays may, indeed, be mitigated by air traffic by maximizing west flow operations and by only applying the arrival stagger during peak departure periods.

Of the various taxiway scenarios evaluated none appears to be clearly superior to the others.

Intuitively, the scenario where only the end taxiways are open is least advantegous due to increased travel times for the arrivals and a lack of departure queueing space in west flow.

Appendix A Airfield Delay Simulation Model (ADSIM) Description

Airfield Delay Simulation Model (ADSIM)

The Airfield Delay Simulation Model (ADSIM) simulates the movement of aircraft on the airport surface and in the immediate airspace, composed of the common approach and departure corridors. It is a critical event stochastic model that employs Monte Carlo sampling techniques.

ADSIM produces estimates of delays and hourly flow rates, and models the movements of aircraft throughout the airport system. It uses a demand profile that contains meticulous definitions of the characteristics of the airfield surface, ATC procedures, and aircraft serving the airport.

Principal inputs to the model include aircraft routings developed from a link node diagram of the airport, runway and taxiway usage, runway occupancy times and exit probabilities, aircraft approach and taxiing velocities, aircraft separations, gate service times, aircraft demand and mix, and ATC rules and procedures.

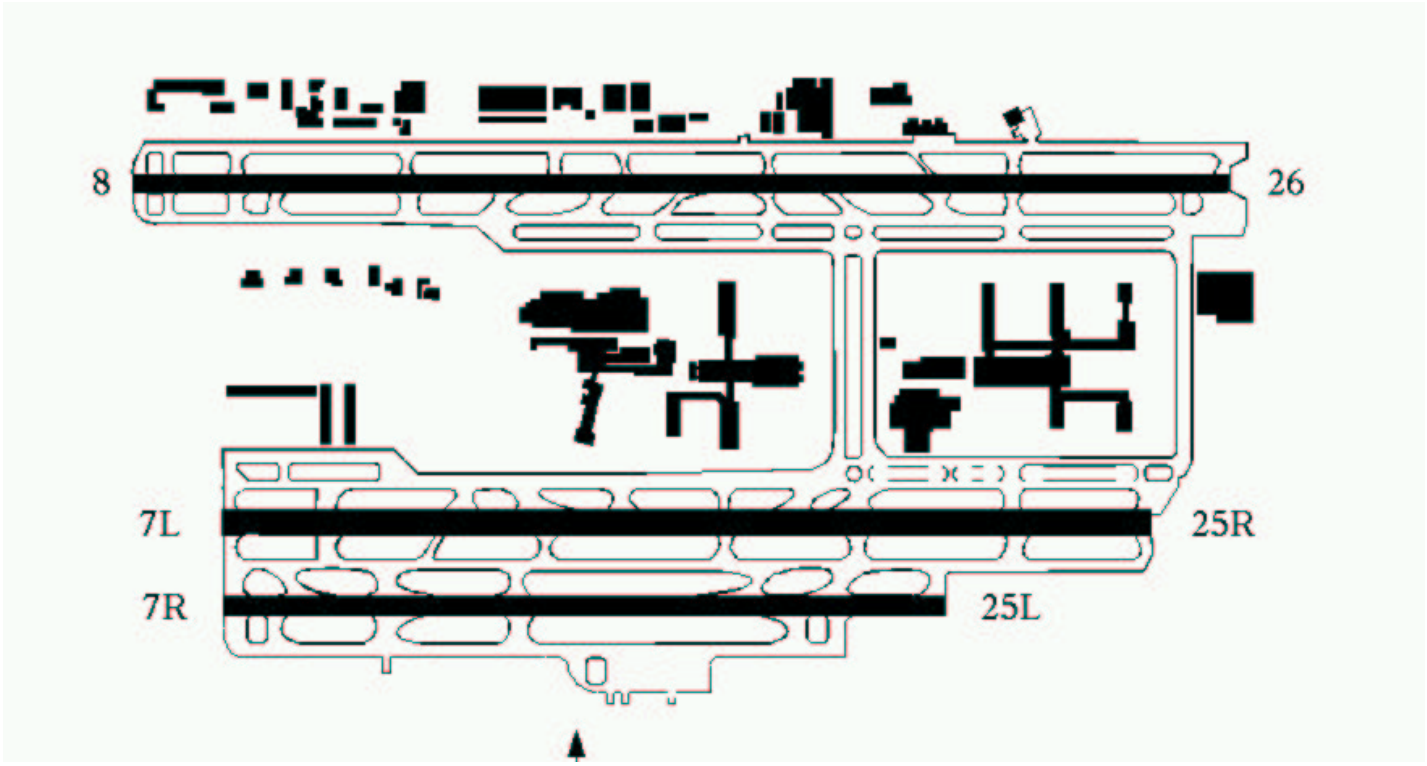
The outputs from the model consist of both an "echo" printing of the model inputs and the results of the model's execution.

Principal outputs of the model, by runway, are hourly arrival and departure flow rates, travel times, and arrival and departure delays. Also provided are total delay for each link on the airfield, departure queue lengths, and individual aircraft delays.

ADSIM is one of the most detailed models available for evaluating the operations and sources of delay on the airport's surface. In addition to estimating delays, ADSIM can also pinpoint their source. These advantages, however, must be balanced against the large investments in time and money required to set up and run the model.

Appendix B Model Inputs

Airport Diagram



Aircraft Class Definitions

Source : Standard class categories used by FAA Technical Center.

CLASS	TYPE OF AIRCRAFT
1	Heavy aircraft weighing more than 255,000 pounds (e.g., L1011, B767)
2	B757 Special class aircraft.
3	B737-100, B737-200, B727
4	Large aircraft weighing more than 41,000 pounds and up to 255,000 pounds (e.g., A320, B737, DC9, EA32, G2, MD80, FK10).
5	Small twin engine aircraft weighing less than 41,000 pounds (e.g., BA31, BA41, BE02, BE20, BE30, DA02, DA21, DH8, SF34).
6	Small single engine aircraft weighing less than 41,000 pounds(e.g., C152, C207, PA32)

*Note : SF34 and ATR-42 are categorized as Class 4 - Large, in accordance with FAA memo ANM-531.4

Configuration Definitions

Flow	Arrival Rwys	Departure Rwys
3 Runway		
West Flow	25L, 26	25R, 26
East Flow	7R, 8	7L, 8
2 Runway		
West Flow	25L, 26	25L, 26
East Flow	7R, 8	7R, 8

Aircraft Separations - VFR

Source: FAA Technical Center uses separations based on Report FAA-EM-78-8A including wake vortex revisions made August 18, 1997.

Arrival/Arrival (nm)		*Trail Aircraft (per class)*					
		Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Lead Aircraft (per class)	Class 1	5.15	5.07	6.07	6.07	5.99	6.91
	Class 2	5.15	5.07	6.07	6.07	5.99	6.91
	Class 3	3.06	2.97	2.97	2.97	2.89	4.91
	Class 4	3.06	2.97	2.97	2.97	2.89	4.91
	Class 5	3.06	2.97	2.97	2.97	2.89	2.81
	Class 6	3.06	2.97	2.97	2.97	2.81	2.81

Departure/Departure (min)		*Trail Aircraft (per class)*					
		Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Lead Aircraft (per class)	Class 1	2.00	2.00	2.00	2.00	2.00	2.00
	Class 2	2.00	2.00	2.00	2.00	2.00	2.00
	Class 3	0.75	0.75	0.75	0.75	0.75	0.75
	Class 4	0.75	0.75	0.75	0.75	0.75	0.75
	Class 5	0.75	0.75	0.75	0.75	0.75	0.83
	Class 6	0.83	0.75	0.75	0.75	0.75	0.58

Departure/Arrival (nm)		*Trail Aircraft (per class)*					
		Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Lead Aircraft (per class)	Class 1	1.72	1.72	1.72	1.72	1.44	1.11
	Class 2	1.72	1.72	1.72	1.72	1.44	1.11
	Class 3	1.72	1.72	1.72	1.72	1.44	1.11
	Class 4	1.72	1.72	1.72	1.72	1.44	1.11
	Class 5	1.51	1.51	1.51	1.51	1.26	0.97
	Class 6	1.51	1.51	1.51	1.51	1.26	0.97

Arrival/Departure (Min.) separations are the Runway Occupancy Times (ROTs) from Observed Field Data

Collection and/or estimated values that were accepted by the Capacity Design Team.

Aircraft Dependencies - 3 Runway

West Flow

Lead Aircraft	Lead Runway	Trail Aircraft	Trail Runway	Percent Dependent	Comments
No Dependencies					

East Flow

Lead Aircraft	Lead Runway	Trail Aircraft	Trail Runway	Percent Dependent	Comments
DEP	8	DEP	7R	100%	East D\D dependency is full on all runways for class1-4, due to aircraft departing intrail to same fix.
DEP	7R	DEP	8	100%	

Aircraft Dependencies - 2 Runway

West Flow

Lead Aircraft	Lead Runway	Trail Aircraft	Trail Runway	Percent Dependent	Comments
No Dependencies					

East Flow

Lead Aircraft	Lead Runway	Trail Aircraft	Trail Runway	Percent Dependent	Comments
DEP	7R	DEP	7L	100%	
DEP	7L	DEP	7R	100%	East D\D dependency is full on all runways for class1-4, due to aircraft departing intrail to same fix.
DEP	7R	DEP	8	100%	
DEP	8	DEP	7R	100%	
DEP	8	DEP	7L	100%	
DEP	7L	DEP	8	100%	

Runway Exit Data

Note : 1) In the tables below, the number to the left of the slash is the exit usage per class. The number to the right of the slash is the runway occupancy time in seconds.

Rwy 07R	Exit Name			
	3500	5500	6600	7500
Class 1			50%/47	50%/58
Class 2		15%/40	60%/50	25%/58
Class 3		10%/42	60%/48	30%/55
Class 4		10%/42	75%/46	15%/55
Class 5		40%/44	35%/47	25%/50
Class 6	10%/32	65%/47	25%/50	

Rwy 07L	Exit Name						
	E4/F4	ES	E6/F7	E7	F8/F6	E9/F7	F10/F8
	3485	4425	5500	6350	6975	8675	10,225
Class 1				25%/45	50%/55	25%/59	
Class 2			15%/40	25%/45	35%/55	25%/59	
Class 3			10%/42	20%/45	40%/51	30%/55	
Class 4			10%/42	25%/45	50%/47	15%/55	
Class 5		15%/42	25%/45	35%/47	25%/50		
Class 6	10%/32	20%/45	45%/48	25%/50			

Rwy 08	Exit Name						
	BA/A3	B5/A4	B6	B7/A5	B8	B9/A6	B10/A7
	3025	4100	5050	5975	6750	7825	8675
Class 1					25%/45	50%/55	25%/59
Class 2				15%/42	25%/45	35%/53	25%/59
Class 3				9%/42	54%/49	33%/53	
Class 4				9%/42	54%/49	33%/53	
Class 5		25%/48	50%/50	25%/55			
Class 6		50%/48	50%/52				

Runway Exit Data (cont'd)

Note : 1) In the tables below, the number to the left of the slash is the exit usage per class. The number to the right of the slash is the runway occupancy time in seconds.

Rwy 25L	Exit Name			
	7500	6900	6200	4700
Class 1	50%/58	50%/50		
Class 2	25%/58	45%/52	30%/50	
Class 3	25%/55	50%/48	15%/45	10%/42
Class 4	15%/55	45%/46	30%/44	10%/42
Class 5		35%/47	25%/45	40%/44
Class 6		25%/50	65%/47	10%/32

Rwy 25R	Exit Name							
	B3/A2 8990	B4/A3 7975	B5/A4 7000	B6 6050	B7/A5 5050	B8 4175	B9/A6 3100	B10/A7 2250
Class 1	25%/59	50%/55	25%/45					
Class 2	10%/57	30%/57	35%/50	25%/46				
Class 3		17%/53	66%/47	17%/43				
Class 4			41%/49	20%/44	21%/42	18%/39		
Class 5				22%/51	26%/47	37%/42	15%/30	
Class 6					20%/52	25%/49	40%/35	15%/28

Rwy 26	Exit Name							
	E1/F1 10225	E2/F2 9220	E3/F3 7975	E4/F4 6820	E5 5890	E6/F5 4725	E7 3875	E8/F6 3250
Class 1		25%/60	50%/55	25%/52				
Class 2		10%/57	30%/50	35%/48	25%/45			
Class 3			30%/55	40%/51	30%/48			
Class 4				27%/50	42%/45	20%/42	10%/40	
Class 5				15%/45	25%/42	35%/40	15%/36	10%/33
Class 6						25%/50	45%/45	20%/40

Gate Service Times

Class 1		Class 2		Class 3		Class 4		Class 5		Class 6	
Cumulative		Cumulative		Cumulative		Cumulative		Cumulative		Cumulative	
Minutes	Prob.	Minutes	Prob.	Minutes	Prob.	Minutes	Prob.	Minutes	Prob.	Minutes	Prob.
45	.12	20	.40	15	.07	20	.25	10	.40	10	.40
50	.31	40	.59	20	.32	25	.60	15	.80	15	.80
60	.43	50	.80	25	.63	30	.85	20	.90	20	.90
65	.55	60	.89	30	.95	40	1.00	25	1.00	25	1.00
85	1.00	65	1.00	40	1.00						

Gate Service Times for Southwest Airlines

Class 1		Class 2		Class 3		Class 4		Class 5		Class 6	
Cumulative		Cumulative		Cumulative		Cumulative		Cumulative		Cumulative	
Minutes	Prob.	Minutes	Prob.	Minutes	Prob.	Minutes	Prob.	Minutes	Prob.	Minutes	Prob.
				15	.40	15	.40				
				20	1.00	20	1.00				

Common Approach Length (nautical miles)

Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
6	6	6	6	3	3

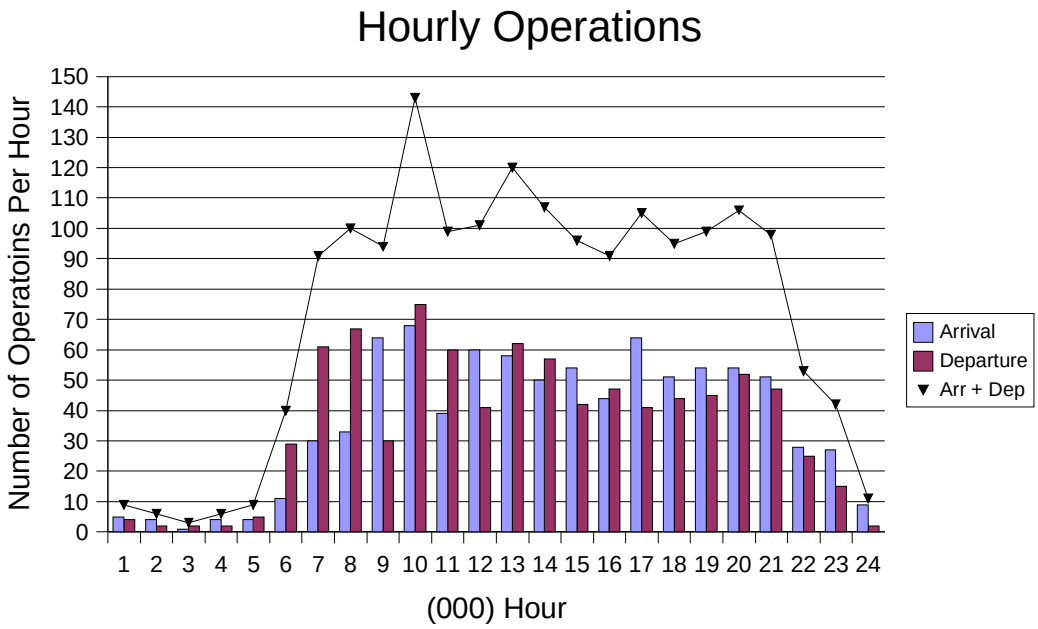
Common Approach Speed (knots)

Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
140	130	130	130	120	100

Appendix C. Profile of Simulation Day Demand

Profile of Daily Demand - Hourly Distribution

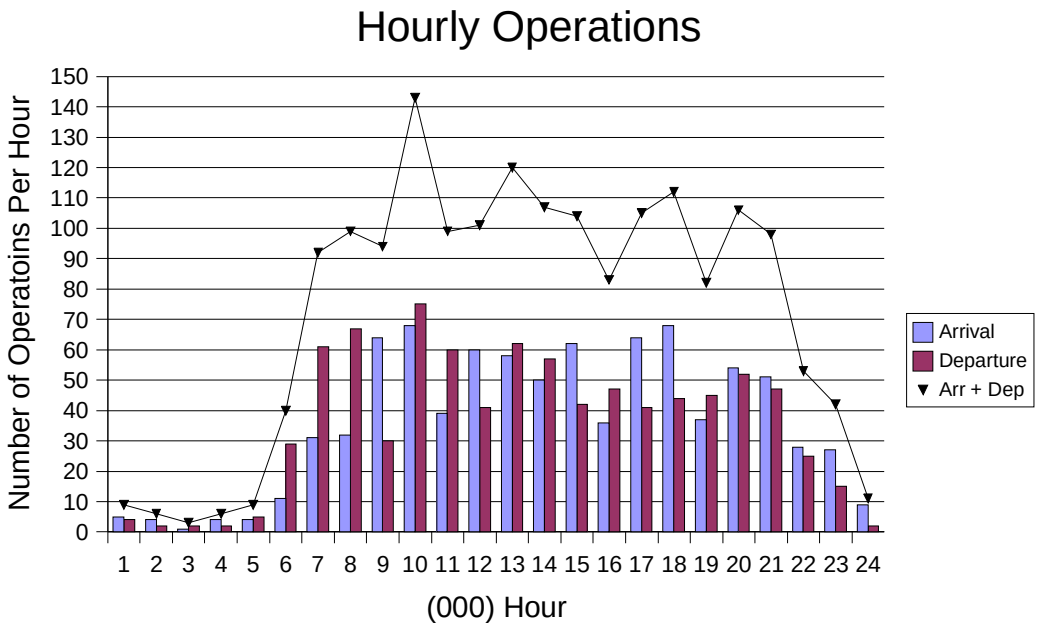
Hour	Arrivals	Departures	Total
0-1	5	4	9
1-2	4	2	6
2-3	1	2	3
3-4	4	2	6
4-5	4	5	9
5-6	11	29	40
6-7	30	61	91
7-8	33	67	100
8-9	64	30	94
9-10	68	75	143
10-11	39	60	99
11-12	60	41	101
12-13	58	62	120
13-14	50	57	107
14-15	54	42	96
15-16	44	47	91
16-17	64	41	105
17-18	51	44	95
18-19	54	45	99
19-20	54	52	106
20-21	51	47	98
21-22	28	25	53
22-23	27	15	42
23-24	9	2	11
	867	857	1724



Profile of Daily Demand - Hourly Distribution - Adjusted for Jetstream

Hour counts for schedule with America West Arrivals from the East coast arriving ½ hour early.

Hour	Arrivals	Departures	Total
0-1	5	4	9
1-2	4	2	6
2-3	1	2	3
3-4	4	2	6
4-5	4	5	9
5-6	11	29	40
6-7	31	61	92
7-8	32	67	99
8-9	64	30	94
9-10	68	75	143
10-11	39	60	99
11-12	60	41	101
12-13	58	62	120
13-14	50	57	107
14-15	62	42	104
15-16	36	47	83
16-17	64	41	105
17-18	68	44	112
18-19	37	45	82
19-20	54	52	106
20-21	51	47	98
21-22	28	25	53
22-23	27	15	42
23-24	9	2	11
	867	857	1724



Traffic Schedule Profile - Aircraft Class Usage

Aircraft Class	
Class 1	2%
Class 2	6%
Class 3	2%
Class 4	64%
Class 5	20%
Class 6	6%
	100%

Aircraft Runway Assignments - 3 Runway

	West Flow				East Flow			
	Arrivals		Departures		Arrivals		Departures	
	25L	26	25R	26	7R	8	7L	8
Class 1	10%	90%	100%	0%	10%	90%	100%	0%
Class 2	25%	75%	100%	0%	25%	75%	100%	0%
Class 3	25%	75%	100%	0%	25%	75%	100%	0%
Class 4	28%	72%	95%	5%	28%	72%	95%	5%
Class 5	50%	50%	20%	80%	50%	50%	20%	80%
Class 6	37%	63%	15%	85%	37%	63%	15%	85%

Aircraft Runway Assignments - 2 Runway

	West Flow				East Flow			
	Arrivals		Departures		Arrivals		Departures	
	25L	26	25L	26	7R	8	7R	8
Class 1	50%	50%	0%	100%	50%	50%	0%	100%
Class 2	55%	45%	0%	100%	55%	45%	0%	100%
Class 3	50%	50%	0%	100%	50%	50%	0%	100%
Class 4	58%	42%	40%	60%	58%	42%	40%	60%
Class 5	60%	40%	42%	58%	60%	40%	42%	58%
Class 6	55%	45%	33%	67%	55%	45%	33%	67%