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PORTLAND

INTERNATIONAL AIRPORT

Data Package Number 3

Airport Capacity Enhancement Plan Update

November 2000

Prepared by
Federal Aviation Administration
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey

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Information in this document is subject to change as Design Team analysis progresses.

16. Abstract

This interim report contains technical data pertaining to the Portland International Airport Capacity Enhancement Plan Update.

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Portland International Airport (PDX)

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LIST OF EXHIBITS

1. POTENTIAL IMPROVEMENTS AND AIRPORT DIAGRAM

The Portland International Airport Capacity Enhancement Plan was published in 1996. The current Design Team was formed to provide an updated study due to the impact of terminal and runway expansion.

Exhibit 1 summarizes proposed improvements for the Airport Capacity Enhancement Plan Update Study. The potential improvements are grouped as follows:

- Airfield.
- Facilities and Equipment.
- Operational.
- User and Policy.

The proposals for this Design Team study do not require detailed analysis of taxiways and gates. The simulations will focus on the runways and the immediate airspace. The Airfield Delay Simulation Model (ADSIM) and SIMMOD are capable of simulating the PDX departure procedures. However, the Runway Delay Simulation Model (RDSIM) cannot simulate the PDX departure procedures and will not be used.

Exhibit 2 lists the proposed simulation scenarios.

Exhibit 3 presents a diagram of the existing airport.

Exhibit 4 presents PDX Do-Nothing runway configurations.

Exhibits 5 and 6 are the airspace maps for the West and East Flows.

Exhibit 7 shows the airfield map for the existing airport.

The Experimental Design will consist of three demand levels (daily aircraft schedules). The Experimental Design normally includes runs for VFR and IFR conditions and for operations in both directions on each runway. The Design Team may decide that some of these runs can be eliminated if, for example, analysis of east and west runway operations produce nearly equivalent results. Combining improvements into logical packages may also help reduce the required experiments to a more manageable number.

The following changes were made to improvements and scenarios at the July 20th Meeting:

- **Simulate a FULL-LENGTH Runway -- triples are permitted in VFR.**
- **ANALYTICAL LOOK -- may also look at the number of runway crossings associated with new terminal locations.**

EXHIBIT 1 - POTENTIAL IMPROVEMENTS (PDX)

(Updated 11/27/00)

Airfield Improvements

NARRATE -- Benefit of a PROP-ONLY Runway.

- Without departure noise restrictions.
- 3 independent arrival streams to parallel runways in VFR -- TRIPLES IN VFR.
- 2 independent arrival streams to outboard runways in IFR -- NO TRIPLE APPROACHES in IFR.
- A runway, which is restricted to PROPS-ONLY, would provide limited benefit. Since triple approaches are not permitted in IFR, a prop-only runway would provide less benefit than the existing parallel runways in IFR and would not be used in IFR. Based on information from the airlines, the Design Team expects the airlines to replace many of their Turbo Props with Regional Jets. The Team believes that at some point, Regional Jets will replace as many as 50% of the Large Turbo Props and 50% of the Small+ aircraft. As the demand increases, and the percentages of props are significantly reduced, the benefits of a PROP-ONLY runway would be reduced. Therefore, the Design Team did not consider a limited use runway to be a reasonable alternative.

SIMULATE -- Benefit of a FULL-LENGTH Runway.

- 12,000' long and 2,500' south of existing 10R/28L.
- Without departure noise restrictions.
- 3 independent arrival streams to parallel runways in VFR -- TRIPLES IN VFR.
- 2 independent arrival streams to outboard runways in IFR -- NO TRIPLE APPROACHES in IFR.
- North/South Taxiway connecting the East ends of the existing parallel runways -- all demands.
- North/South Taxiways connecting the East & West ends of the new runway to 10R/28L -- Future 2.

SIMULATE -- N/S taxiway connecting East ends of the existing parallel runways.

- **Imp 4B in 1996 Data Pkg 13.**
- North/South taxiway will relieve ground congestion and enable runways to be assigned based on direction of flight rather than gate location.

ANALYTICAL LOOK at increased taxi times and/or number of runway crossings associated with new terminal locations -- Centralized vs. Decentralized for New 12,000' Runway -- at the Future 2 demand.

Facilities and Equipment Improvements

DO NOT SIMULATE -- Install new technology to permit simultaneous approaches to the parallel runways in IFR.

- Do not simulate Simultaneous (independent) IFR Approaches because the 1996 Study showed limited savings. The benefit is primarily an operational one. During periods when there are mixed operations on both runways, the controllers cannot take advantage of the reduced arrival spacing.

EXHIBIT 1 - POTENTIAL IMPROVEMENTS (PDX) (Cont.)

(Updated 11/27/00)

Operational Improvements

DO NOT SIMULATE -- Simultaneous (independent) CAT I approaches to existing parallel runways.

- **Imp 13 in 1996 Data Pkg 13.**
- **Requires PRM (Precision Runway Monitor), GPS, or other technologies.**
- Do not simulate Simultaneous (independent) IFR Approaches because the 1996 Study showed limited savings. The benefit is primarily an operational one. During periods when there are mixed operations on both runways, the controllers cannot take advantage of the reduced arrival spacing.

SIMULATE -- Immediate north divergent turns for Turbo Props and Biz Jets in both flow directions.

- **Affects LTP and S+ aircraft.**
- **Similar to Imp 16 in 1996 Data Pkg 13.** Turbo Props that were treated as M (Medium) in the 1996 study are treated as LTP (Large Turbo Prop) or S+ (Small+) aircraft in this study.
- Currently, Turbo Props turn north at 3,000' (about 4 NM from the end of the runway). Because of noise restrictions, when a Turbo Prop is followed by a jet, the D/D separation is 2 minutes (instead of 1 minute).
- The improvement would allow northbound and eastbound Large Turbo Props and Biz Jets to diverge and avoid the same initial departure heading as larger jets. No departure noise restrictions would apply to these aircraft.
- Since Regional Jets are classified as Large Jets, Regional Jets will not be considered to have divergent headings.
- **Will increase departure capacity and give more direct routing.**
- **Will eliminate prop-to-jet departure penalty.**

SIMULATE -- Immediate divergent turns for all aircraft.

- **Imp 19 in 1996 Data Pkg 13.**
- All aircraft could turn immediately after takeoff onto divergent courses.
- Will allow independent departures from both parallel runways in both flows.
- **Will increase departure capacity and give more direct routing.**
- **Will eliminate prop-to-jet departure penalty.**

User and Policy Improvements/Options -- none

Notes: DO-NOTHING (Baseline) assumes simultaneous straight-in visual approaches are permitted.
FAATC notes on 1999 instrument approaches at PDX:

CAT II/III ILS:	10R
CAT I ILS:	10R/L, 28R/L
LOC/DME:	21
VOR/DME:	21, 28R
NDB or GPS:	28L
NDB:	28R

EXHIBIT 2 - SIMULATION SCENARIOS (PDX)

(Updated 11/27/00)

Pkg	Description of Package	Simulate at These Demand Levels 1999	F1	F2
(0)	**CALIBRATION (with 2.5 NM Minimum IFR Spacing) -- BASE-CASE** • **1.5 NM Staggered Approaches in IFR (10L & 10R, 28L & 28R)**	Y	Y	Y
(A)	**All Turbo Props and Biz Jets Can Do Divergent Turns** • No departure noise restrictions for Turbo Props & Biz Jets--LTP & S+ aircraft	Y	Y	Y
(B)	**All Aircraft Can Do Divergent Turns** • No departure noise restrictions for any aircraft	Y	Y	Y
(C)	**N/S Twy Connecting Existing Parallels & All Aircraft Can Do Divergent Turns** • **Staggered Approaches in IFR**	N	Y	Y
(D)	**FULL LENGTH Parallel Runway & All Departures Can Diverge** • **N/S Twy Connecting East Ends of Existing Parallels -- all demands** • **N/S Twys to East & West Ends of New Runway -- Future 2 demand** • **3 Independent Arrival Streams to Parallels in VFR -- triple approaches in VFR** • **2 Independent Arrival Streams to Outboards in IFR -- no triple approaches in IFR**	N	Y	Y

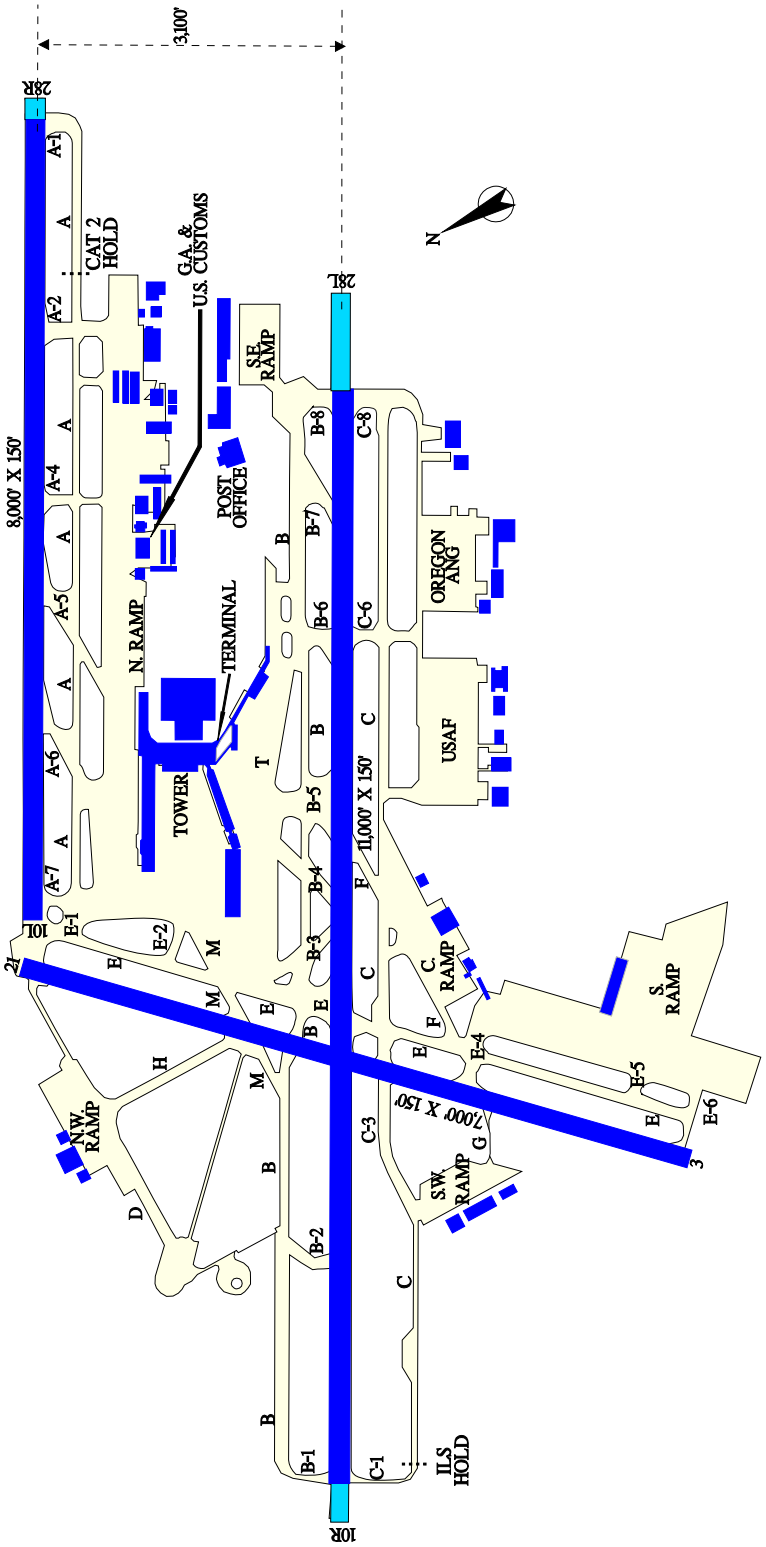
Analytic Modeling

Analytical look at increased taxi times and/or number of runway crossings associated with new terminal locations -- Centralized vs. Decentralized for the 12,000' Runway – at the Future 2 demand.

Notes:

- **Y/N/? -- Do/Do Not/Maybe Simulate at this demand level.**
- **PDX Do-Nothing case in 2000 study has CAT I ILS on 10R/L and 28R/L.**
- **Staggered approaches in IFR, and unrestricted arrivals on these runways.**
- **Departure restrictions are still in effect.**
- **Runway 3/21 will be considered an operational runway.**

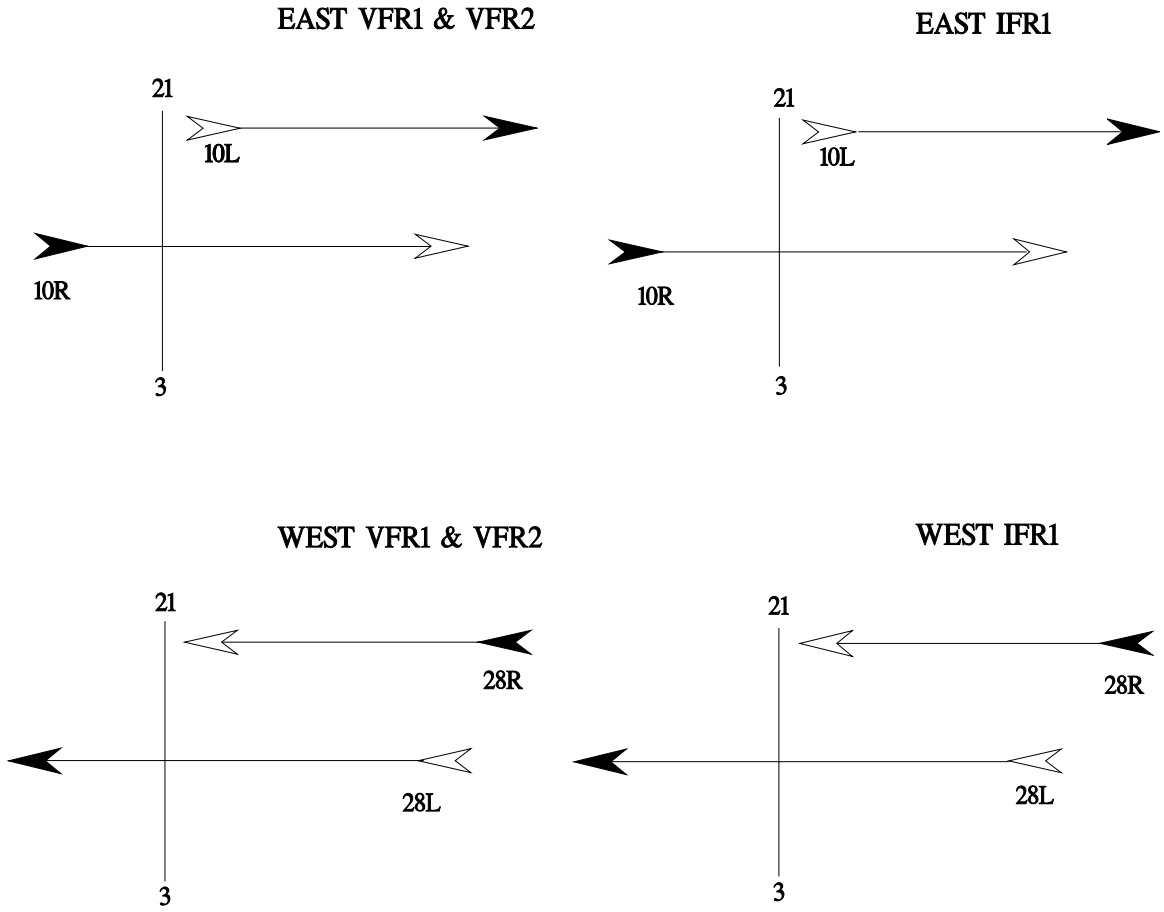
EXHIBIT 3 - PORTLAND AIRPORT LAYOUT



Updated 10/4/00: **Exits B-3 & B-4 were added. Gate areas were updated.**

Taxiway T was extended west. Hold lines were moved. Exit A-3 was removed.

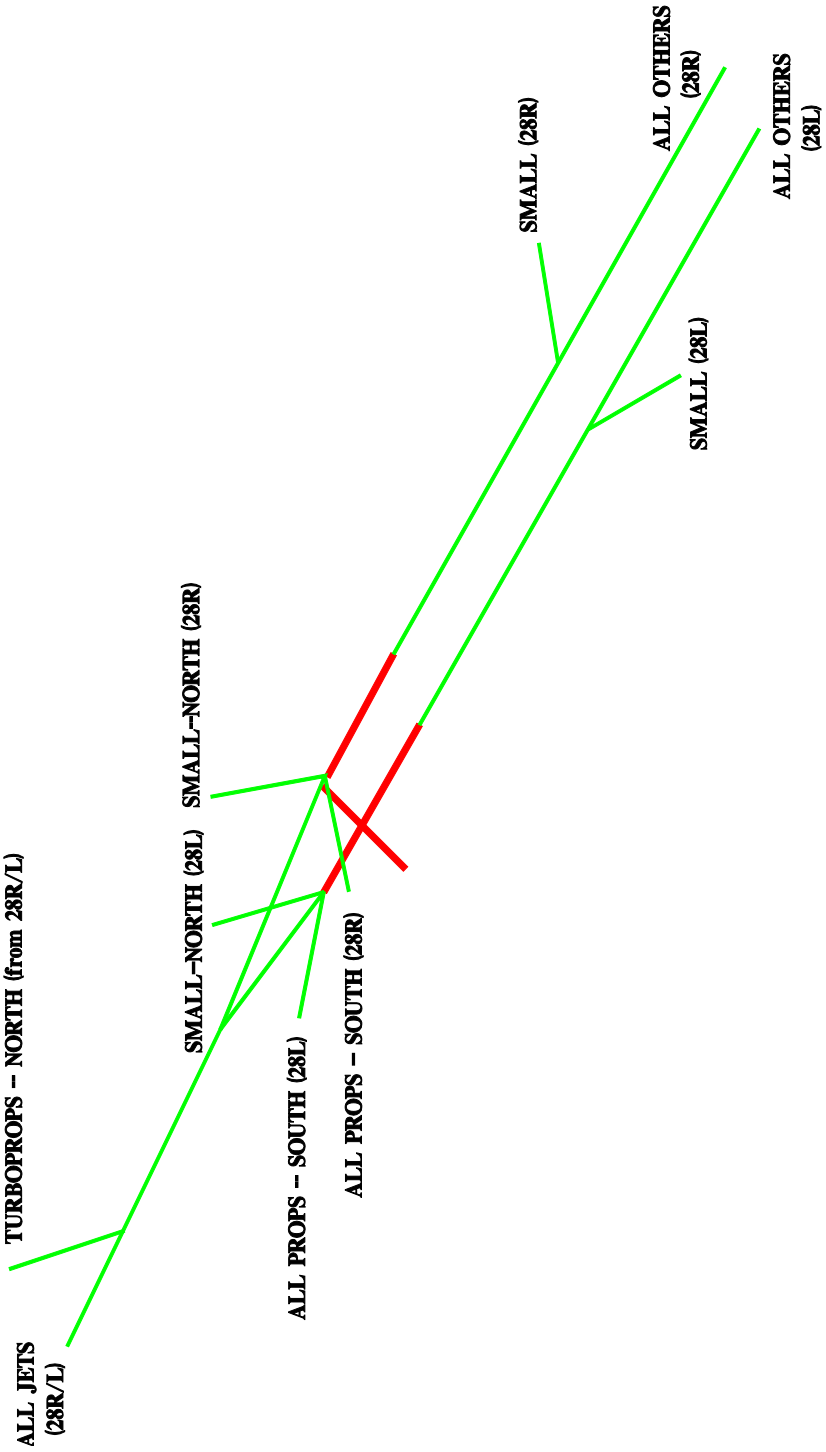
EXHIBIT 4 - RUNWAY CONFIGURATIONS (PDX DO-NOTHING)



◄ = PRIMARY ARR OR DEP RUNWAY

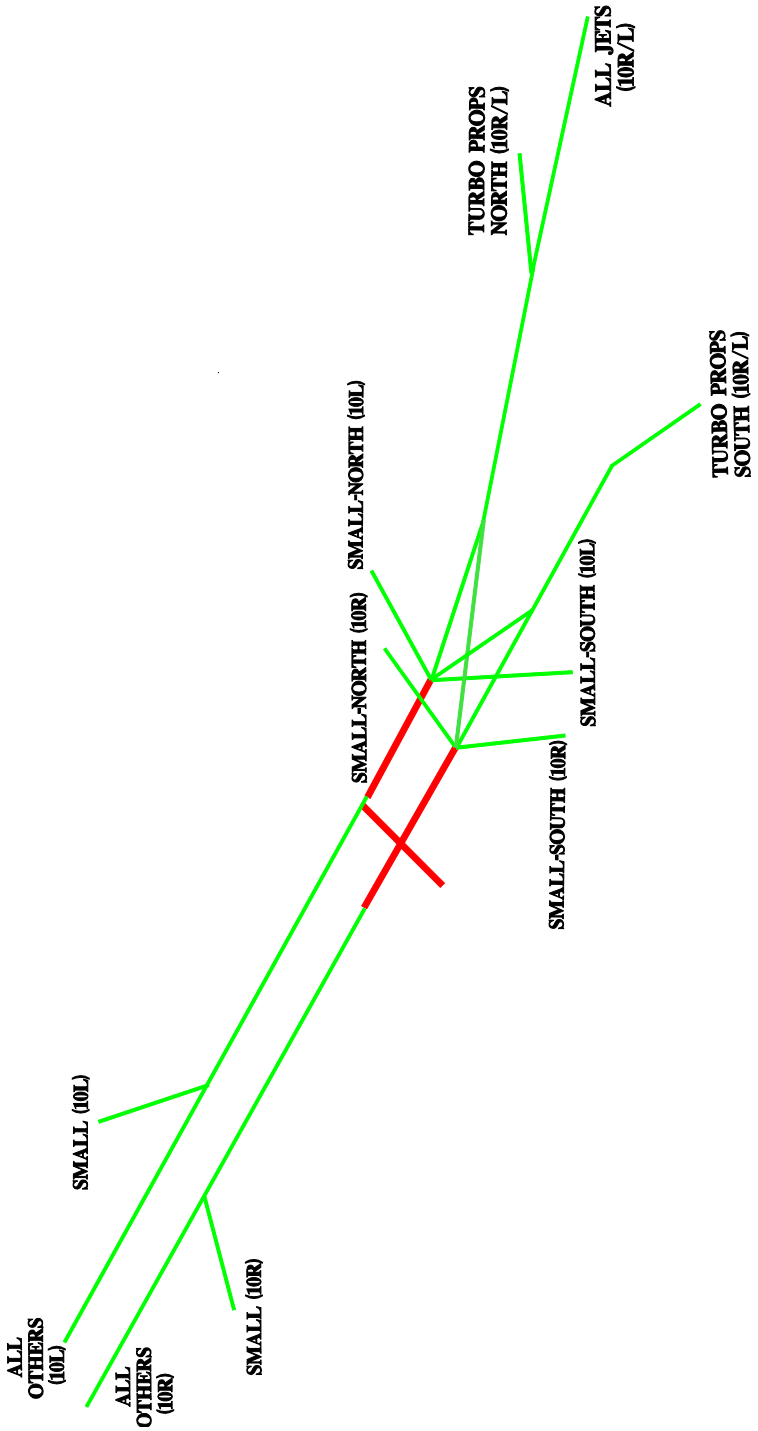
Note: **Accepted by the PDX Design Team at the meeting on July 20, 2000.**
Runway 3/21 will be considered an operational runway.
VFR2 -- any size aircraft can land on 10L and 28L.
10L & 28L have CAT I ILS -- with staggered approaches in IFR.

EXHIBIT 5 - MODELING AIRSPACE MAP -- WEST FLOW (PDX DO-NOTHING)



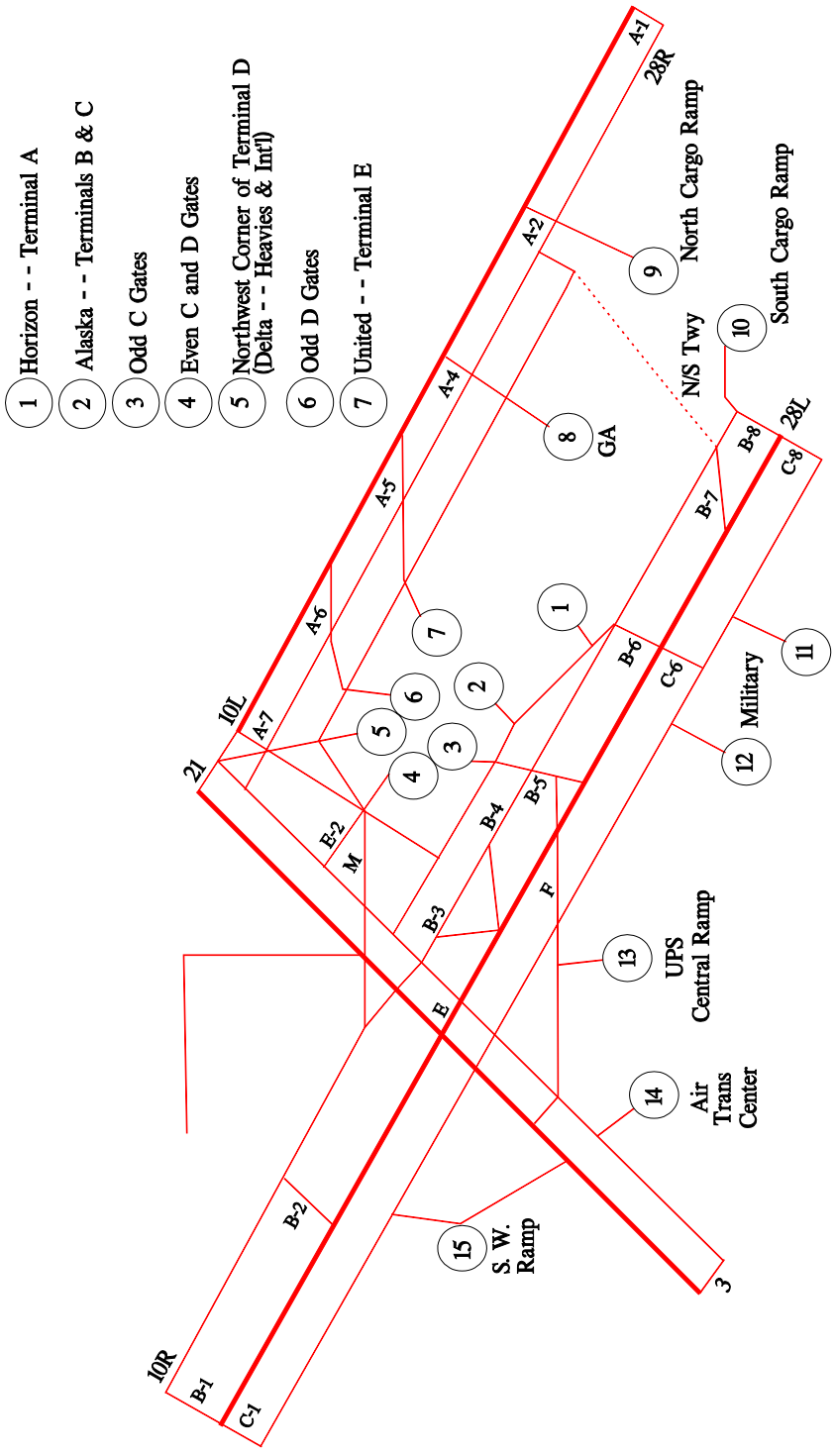
Accepted 10/12/00: **Departure restrictions still apply.**
LTP and S+ aircraft classes are considered Turbo Props in this study.

EXHIBIT 6 - MODELING AIRSPACE MAP -- EAST FLOW (PDX DO-NOTHING)



Accepted 10/12/00: **Departure restrictions still apply.**
LTP and S+ aircraft classes are considered Turbo Props in this study.

EXHIBIT 7 - MODELING AIRFIELD MAP (PDX DO-NOTHING)



Accepted 10/12/00: **Runway 3/21 will be considered an operational runway.**
VFR2 -- any size aircraft can land on 10L and 28L.
10L & 28L have CAT I ILS -- with staggered approaches in IFR.
Taxiway T was extended west and intersects with 3/21.
Exits B-3 & B-4 were added.

Updated 11/14/00: **Alaska is at Terminals B & C.**

2. MODEL INPUTS

Accepted Model Inputs

The Design Team accepted the following model inputs, which were presented in Data Package 2 at the October 12th meeting. These inputs will be used in the simulations. Their details will appear in Appendix A.

- Aircraft classifications.
- 1999 fleet mix.
- Runway exit usage and the arrival runway occupancy times (ROTs) by aircraft class.
- Miscellaneous input data such as length of common approach on final, approach speeds, and departure runway occupancy times.
- PDX noise dependencies for a single runway for the West and East Flows.
- Simulated weather and operations procedures.

Status of PDX Inputs and Tasks

Exhibit 8 describes the status of the PDX inputs and tasks.

Model Inputs

Exhibit 9 describes the simulated fleet mixes.

Exhibit 10 shows the hourly Tower counts for July 27, 1999. Exhibit 11 provides the hour counts for the Baseline demand -- as a table and as a chart. Exhibit 12 shows the hour counts for the future demands.

Exhibit 13 provides the hour count summary for the 3 demands -- as a table and as a chart.

Exhibit 14 shows the OAG and cargo counts for July 27, 1999 that will be the basis for building the schedules for the Baseline (1999) demand. Cargo schedules were obtained from the primary cargo airlines.

Exhibit 15 lists the cargo locations.

Exhibit 16 presents the gate service times (minimum turn-around times).

Exhibits 17 and 18 present the VFR and IFR aircraft separations, respectively. The numbers reflect the addition of the Small+ aircraft class and the treatment of a 757 as a Heavy. The separations include:

- arrival to arrival (A/A)
- departure to departure (D/D)
- departure to arrival (D/A)
- arrival to departure (A/D)

Exhibit 19 describes the other departure dependencies.

Exhibit 20 presents the historical operational procedures and minima.

EXHIBIT 8 - STATUS OF PDX INPUTS AND TASKS

(Updated 10/30/00)

INPUTS AND TASKS	STATUS
ALPs, Improvements, Simulation Scenarios	DP3
Aircraft Classifications	X
ATC Separations	DP3
Departure Noise Dependencies -- Same Runway	X
Dependencies between Parallel Runways	DP3
Other Runway Dependencies	X
Operational Procedures and Minima (By Configuration)	X
Lateness Distribution (Arrival Variability Distribution)	X
Gate Service Times (Minimum Turn-Around Times)	DP3
Other Model Inputs	DP3
Annual Demand Levels (1999 and Future Demands)	X
Demand Characteristics (1999 and Future Demands)	DP3
Hourly Tower Counts (Tuesday, July 27, 1999)	DP3
Hour Counts (1999)	DP3
Hour Counts (Future Demands)	DP3
Capacity Analysis (Existing Airport and 1999 Demand)	
Experimental Design	
Simulation Results -- Calibration	
Simulation Results -- Improvements	
Fleet Mix Costs	
Annual Delay Costs and Savings	

NOTE: X: The item was previously accepted and appears in Appendix A of this data package.

DPn: Data Package n.

EXHIBIT 9 - SIMULATED FLEET MIXES -- PDX

(Updated 10/24/00)

Overall -- Daily Fleet Mix by Class

H		757		LJ		LTP		S+		S		Total		
47	4.7%	52	5.2%	466	46.3%	177	17.6%	148	14.7%	116	11.5%	1,006	100.0%	Baseline
74	4.9%	80	5.3%	720	47.6%	274	18.1%	212	14.0%	152	10.1%	1,512	100.0%	Future 1
97	5.0%	106	5.5%	940	48.5%	360	18.6%	261	13.5%	174	9.0%	1,938	100.0%	Future 2

Commercial -- Daily Fleet Mix by Class

H		757		LJ		LTP		S+		S		Total		
47	5.5%	52	6.0%	444	51.7%	173	20.1%	100	11.6%	44	5.1%	860	100.0%	Baseline
74	5.5%	80	6.0%	694	51.7%	270	20.1%	156	11.6%	68	5.1%	1342	100.0%	Future 1
97	5.5%	106	6.0%	914	51.7%	356	20.1%	205	11.6%	90	5.1%	1768	100.0%	Future 2

GA -- Daily Fleet Mix by Class

H		757		LJ		LTP		S+		S		Total		
0	.0%	0	.0%	2	1.7%	0	.0%	48	40.7%	68	57.6%	118	100.0%	Baseline
0	.0%	0	.0%	4	2.9%	0	.0%	56	40.0%	80	57.1%	140	100.0%	Future 1
0	.0%	0	.0%	4	2.9%	0	.0%	56	40.0%	80	57.1%	140	100.0%	Future 2

Military -- Daily Fleet Mix by Class

H		757		LJ		LTP		S+		S		Total		
0	.0%	0	.0%	20	71.4%	4	14.3%	0	.0%	4	14.3%	28	100.0%	Baseline
0	.0%	0	.0%	22	73.3%	4	13.3%	0	.0%	4	13.3%	30	100.0%	Future 1
0	.0%	0	.0%	22	73.3%	4	13.3%	0	.0%	4	13.3%	30	100.0%	Future 2

NOTES: **Baseline Demand Characteristics developed from 1999 Port data as follows:**

Overall fleet mix -- from Port data, Calendar Year 1999.
GA and MI fleet mixes -- from Port data, Calendar Year 1999.
GA fleet mix -- revised by Design Team on 10/12/00.
Commercial fleet mix -- computed from the other Baseline fleet mixes.

Future 1 and Future 2 Demand Characteristics developed as follows:

GA fleet mix -- same as GA fleet mix in Baseline Demand.
MI fleet mix -- same as MI fleet mix in Baseline Demand -- as close as possible.
Commercial mix -- same as Commercial fleet mix in Baseline Demand.
Overall fleet mix -- computed from the other fleet mixes for that future demand.

Percentages are rounded to 1 decimal place.

EXHIBIT 10 - HOURLY TOWER COUNTS FOR JULY 27, 1999

Tuesday -- July 27, 1999 Tower Counts
Source: Port of Portland

LOCAL HOUR	ARRIVALS HOUR COUNTS				DEPARTURES HOUR COUNTS				TOTAL HOUR COUNTS			
	AC	GA	MI	TOTAL	AC	GA	MI	TOTAL	AC	GA	MI	TOTAL
0	6	0	0	6	2	3	0	5	8	3	0	11
1	4	0	0	4	3	0	0	3	7	0	0	7
2	2	0	0	2	1	0	0	1	3	0	0	3
3	5	0	0	5	1	0	0	1	6	0	0	6
4	3	0	0	3	4	0	0	4	7	0	0	7
5	7	1	0	8	9	0	0	9	16	1	0	17
6	12	0	0	12	43	0	0	43	55	0	0	55
7	16	3	0	19	39	3	0	42	55	6	0	61
8	19	7	0	26	26	3	0	29	45	10	0	55
9	21	2	2	25	18	4	2	24	39	6	4	49
10	24	2	1	27	18	1	0	19	42	3	1	46
11	24	2	0	26	19	1	1	21	43	3	1	47
12	24	2	0	26	25	2	1	28	49	4	1	54
13	19	7	3	29	25	6	1	32	44	13	4	61
14	14	3	1	18	21	3	1	25	35	6	2	43
15	19	5	0	24	11	7	0	18	30	12	0	42
16	28	4	0	32	22	4	0	26	50	8	0	58
17	32	6	0	38	26	3	0	29	58	9	0	67
18	24	3	0	27	15	6	0	21	39	9	0	48
19	29	4	0	33	18	3	0	21	47	7	0	54
20	26	2	0	28	25	1	0	26	51	3	0	54
21	19	1	0	20	16	1	0	17	35	2	0	37
22	23	0	0	23	13	1	0	14	36	1	0	37
23	13	2	0	15	7	0	0	7	20	2	0	22
	413	56	7	476	407	52	6	465	820	108	13	941

Notes: **AC = Air Carrier, Commuter, Air Taxi (FAA Definition)**
AC = Commercial (Port Definition)

EXHIBIT 10 - HOURLY TOWER COUNTS FOR JULY 27, 1999 (Cont.)

HOUR	ARR	DEP	ARR+DEP
0	6	5	11
1	4	3	7
2	2	1	3
3	5	1	6
4	3	4	7
5	8	9	17
6	12	43	55
7	19	42	61
8	26	29	55
9	25	24	49
10	27	19	46
11	26	21	47
12	26	28	54
13	29	32	61
14	18	25	43
15	24	18	42
16	32	26	58
17	38	29	67
18	27	21	48
19	33	21	54
20	28	26	54
21	20	17	37
22	23	14	37
23	15	7	22
	476	465	941

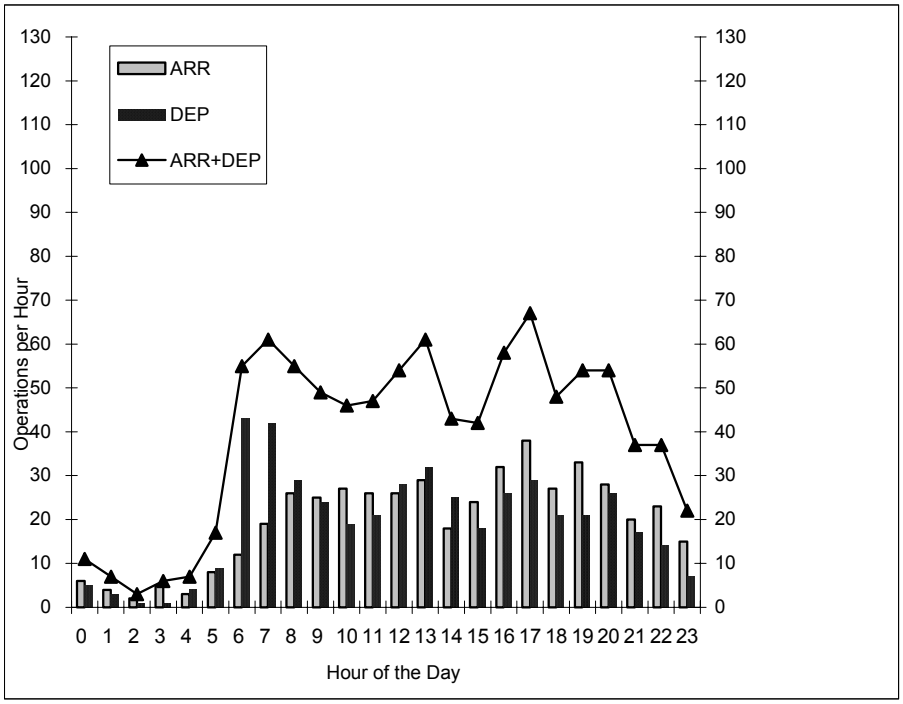


EXHIBIT 11 - HOUR COUNTS -- BASELINE DEMAND

HOUR COUNTS -- 1999 DEMAND (SCD-322)

LOCAL HOUR	ARRIVALS HOUR COUNTS				DEPARTURES HOUR COUNTS				TOTAL HOUR COUNTS			
	AC	GA	MI	TOTAL	AC	GA	MI	TOTAL	AC	GA	MI	TOTAL
0	6	0	0	6	2	3	0	5	8	3	0	11
1	4	0	0	4	3	0	0	3	7	0	0	7
2	2	0	0	2	1	0	0	1	3	0	0	3
3	5	0	0	5	1	0	0	1	6	0	0	6
4	4	0	0	4	4	0	0	4	8	0	0	8
5	7	1	0	8	9	0	0	9	16	1	0	17
6	12	0	0	12	48	0	0	48	60	0	0	60
7	16	3	0	19	42	4	0	46	58	7	0	65
8	19	7	0	26	28	3	2	33	47	10	2	59
9	21	3	3	27	18	4	3	25	39	7	6	52
10	24	3	2	29	19	2	1	22	43	5	3	51
11	31	3	0	34	19	2	1	22	50	5	1	56
12	24	2	1	27	28	3	2	33	52	5	3	60
13	19	7	3	29	27	6	2	35	46	13	5	64
14	17	3	1	21	21	4	1	26	38	7	2	47
15	20	5	1	26	15	7	0	22	35	12	1	48
16	29	4	0	33	22	4	1	27	51	8	1	60
17	34	6	0	40	27	3	0	30	61	9	0	70
18	24	3	1	28	15	6	1	22	39	9	2	50
19	30	4	0	34	20	3	0	23	50	7	0	57
20	27	2	2	31	25	1	0	26	52	3	2	57
21	19	1	0	20	16	2	0	18	35	3	0	38
22	23	0	0	23	13	1	0	14	36	1	0	37
23	13	2	0	15	7	1	0	8	20	3	0	23
	430	59	14	503	430	59	14	503	860	118	28	1006

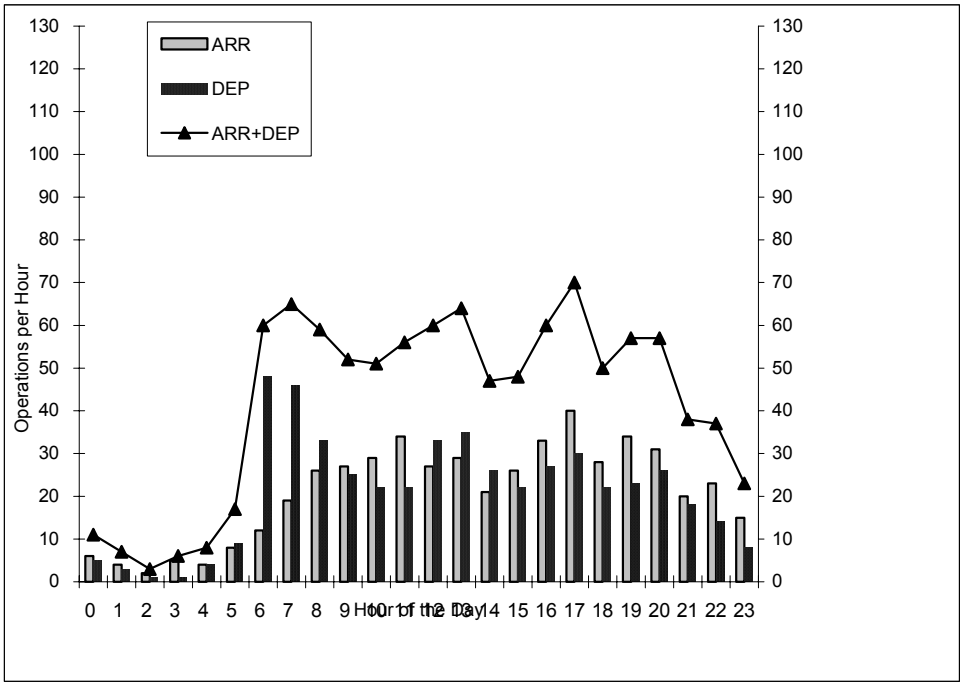
NOTES: **AC counts include Air Carrier, Commuter, and Air Taxi.**

AC -- **Tower Counts & OAG counts were supplemented to get AC counts. The counts include all cargo ops.**

GA/MI -- **The 1999 counts were based on the hourly PDX Tower counts for 7/27/99 and the cargo schedules obtained from the cargo operators.**

EXHIBIT 11 - HOUR COUNTS -- BASELINE DEMAND (Cont.)

HOUR	ARR	DEP	ARR+DEP
0	6	5	11
1	4	3	7
2	2	1	3
3	5	1	6
4	4	4	8
5	8	9	17
6	12	48	60
7	19	46	65
8	26	33	59
9	27	25	52
10	29	22	51
11	34	22	56
12	27	33	60
13	29	35	64
14	21	26	47
15	26	22	48
16	33	27	60
17	40	30	70
18	28	22	50
19	34	23	57
20	31	26	57
21	20	18	38
22	23	14	37
23	15	8	23
	503	503	1006



Hour Counts -- Baseline demand

The Technical Center used the Tower Counts and OAG from Tuesday, July 27, 1999, and cargo schedules for August 2000, to develop hour counts. July 1999 was selected because it is one of the months for which we have OAG data and July is a busy month at PDX. Tuesday the 27th was selected because we wanted a good VFR day with low airline-reported delays obtained from CODAS (Consolidated Operations and Delay Analysis System) on APO-130's web site.

We used cargo schedules for August 2000 because the cargo operators could not provide us with schedules for 1999.

We will simulate 1,006 ops at the baseline demand -- 860 air carrier (commercial), 118 GA, and 28 Military ops.

EXHIBIT 12 - HOUR COUNTS -- FUTURE DEMANDS

HOUR COUNTS -- FUTURE 1 DEMAND (SCD-484)

LOCAL HOUR	ARRIVALS HOUR COUNTS				DEPARTURES HOUR COUNTS				TOTAL HOUR COUNTS			
	AC	GA	MI	TOTAL	AC	GA	MI	TOTAL	AC	GA	MI	TOTAL
0	9	0	0	9	3	3	0	6	12	3	0	15
1	6	0	0	6	5	0	0	5	11	0	0	11
2	3	0	0	3	2	0	0	2	5	0	0	5
3	8	0	0	8	2	0	0	2	10	0	0	10
4	6	0	0	6	6	0	0	6	12	0	0	12
5	11	1	0	12	14	0	0	14	25	1	0	26
6	19	0	0	19	75	0	0	75	94	0	0	94
7	25	4	0	29	65	5	0	70	90	9	0	99
8	30	8	0	38	44	4	3	51	74	12	3	89
9	33	4	4	41	28	5	3	36	61	9	7	77
10	38	4	2	44	30	2	1	33	68	6	3	77
11	48	3	0	51	30	2	1	33	78	5	1	84
12	37	2	1	40	44	4	2	50	81	6	3	90
13	30	8	3	41	42	7	2	51	72	15	5	92
14	27	4	1	32	33	5	1	39	60	9	2	71
15	31	6	1	38	23	8	0	31	54	14	1	69
16	45	5	0	50	34	5	1	40	79	10	1	90
17	53	7	0	60	42	4	0	46	95	11	0	106
18	37	4	1	42	23	7	1	31	60	11	2	73
19	47	5	0	52	31	4	0	35	78	9	0	87
20	42	2	2	46	39	1	0	40	81	3	2	86
21	30	1	0	31	25	2	0	27	55	3	0	58
22	36	0	0	36	20	1	0	21	56	1	0	57
23	20	2	0	22	11	1	0	12	31	3	0	34
	671	70	15	756	671	70	15	756	1342	140	30	1512

NOTES: **AC counts include Air Carrier, Commuter, and Air Taxi.**

Future 1 hour counts are 50% higher than 1999 hour counts.

As agreed upon by the Design Team, no attempt was made to smooth out hourly counts at higher demands. AC, GA, and MI maintain their own peaking characteristics.

EXHIBIT 12 - HOUR COUNTS -- FUTURE DEMANDS (Cont.)

HOUR COUNTS -- FUTURE 2 DEMAND (SCD-620)

LOCAL HOUR	ARRIVALS HOUR COUNTS				DEPARTURES HOUR COUNTS				TOTAL HOUR COUNTS			
	AC	GA	MI	TOTAL	AC	GA	MI	TOTAL	AC	GA	MI	TOTAL
0	12	0	0	12	4	3	0	7	16	3	0	19
1	8	0	0	8	7	0	0	7	15	0	0	15
2	4	0	0	4	3	0	0	3	7	0	0	7
3	10	0	0	10	3	0	0	3	13	0	0	13
4	8	0	0	8	8	0	0	8	16	0	0	16
5	14	1	0	15	18	0	0	18	32	1	0	33
6	25	0	0	25	99	0	0	99	124	0	0	124
7	33	4	0	37	86	5	0	91	119	9	0	128
8	40	8	0	48	58	4	3	65	98	12	3	113
9	43	4	4	51	37	5	3	45	80	9	7	96
10	50	4	2	56	40	2	1	43	90	6	3	99
11	63	3	0	66	40	2	1	43	103	5	1	109
12	49	2	1	52	58	4	2	64	107	6	3	116
13	40	8	3	51	55	7	2	64	95	15	5	115
14	36	4	1	41	43	5	1	49	79	9	2	90
15	41	6	1	48	30	8	0	38	71	14	1	86
16	59	5	0	64	45	5	1	51	104	10	1	115
17	70	7	0	77	55	4	0	59	125	11	0	136
18	49	4	1	54	30	7	1	38	79	11	2	92
19	62	5	0	67	41	4	0	45	103	9	0	112
20	55	2	2	59	51	1	0	52	106	3	2	111
21	40	1	0	41	33	2	0	35	73	3	0	76
22	47	0	0	47	26	1	0	27	73	1	0	74
23	26	2	0	28	14	1	0	15	40	3	0	43
	884	70	15	969	884	70	15	969	1768	140	30	1938

NOTES: **AC counts include Air Carrier, Commuter, and Air Taxi.**

Future 2 hour counts are 28% higher than the Future 1 hour counts.

As agreed upon by the Design Team, no attempt was made to smooth out hourly counts at higher demands. AC, GA, and MI maintain their own peaking characteristics.

EXHIBIT 13 - HOUR COUNT SUMMARY -- ALL DEMANDS

HOUR COUNT SUMMARY FOR 3 DEMAND LEVELS -- PDX

LOCAL HOUR	SCD-322 (1999) HOUR COUNTS			SCD-484 (FUTURE 1) HOUR COUNTS			SCD-620 (FUTURE 2) HOUR COUNTS		
	ARR	DEP	TOTAL	ARR	DEP	TOTAL	ARR	DEP	TOTAL
0	6	5	11	9	6	15	12	7	19
1	4	3	7	6	5	11	8	7	15
2	2	1	3	3	2	5	4	3	7
3	5	1	6	8	2	10	10	3	13
4	4	4	8	6	6	12	8	8	16
5	8	9	17	12	14	26	15	18	33
6	12	48	60 *	19	75	94 **	25	99	124 ***
7	19	46	65 *	29	70	99 **	37	91	128 ***
8	26	33	59	38	51	89	48	65	113
9	27	25	52	41	36	77	51	45	96
10	29	22	51	44	33	77	56	43	99
11	34	22	56	51	33	84	66	43	109
12	27	33	60 *	40	50	90 **	52	64	116 ***
13	29	35	64 *	41	51	92 **	51	64	115 ***
14	21	26	47	32	39	71	41	49	90
15	26	22	48	38	31	69	48	38	86
16	33	27	60 *	50	40	90 **	64	51	115 ***
17	40	30	70 *	60	46	106 **	77	59	136 ***
18	28	22	50	42	31	73	54	38	92
19	34	23	57	52	35	87	67	45	112
20	31	26	57	46	40	86	59	52	111
21	20	18	38	31	27	58	41	35	76
22	23	14	37	36	21	57	47	27	74
23	15	8	23	22	12	34	28	15	43
	503	503	1006	756	756	1512	969	969	1938

NOTES: **Counts include AC (Air Carrier/Commuter/Air Taxi), GA, and MI.**

1999 -- **Highest hour count is 70 -- at 5pm (1700 hrs).**
6 hours have counts of at least 60. See *.
Between 5pm and 8pm, the number of hourly ops ranges from 50 to 70.

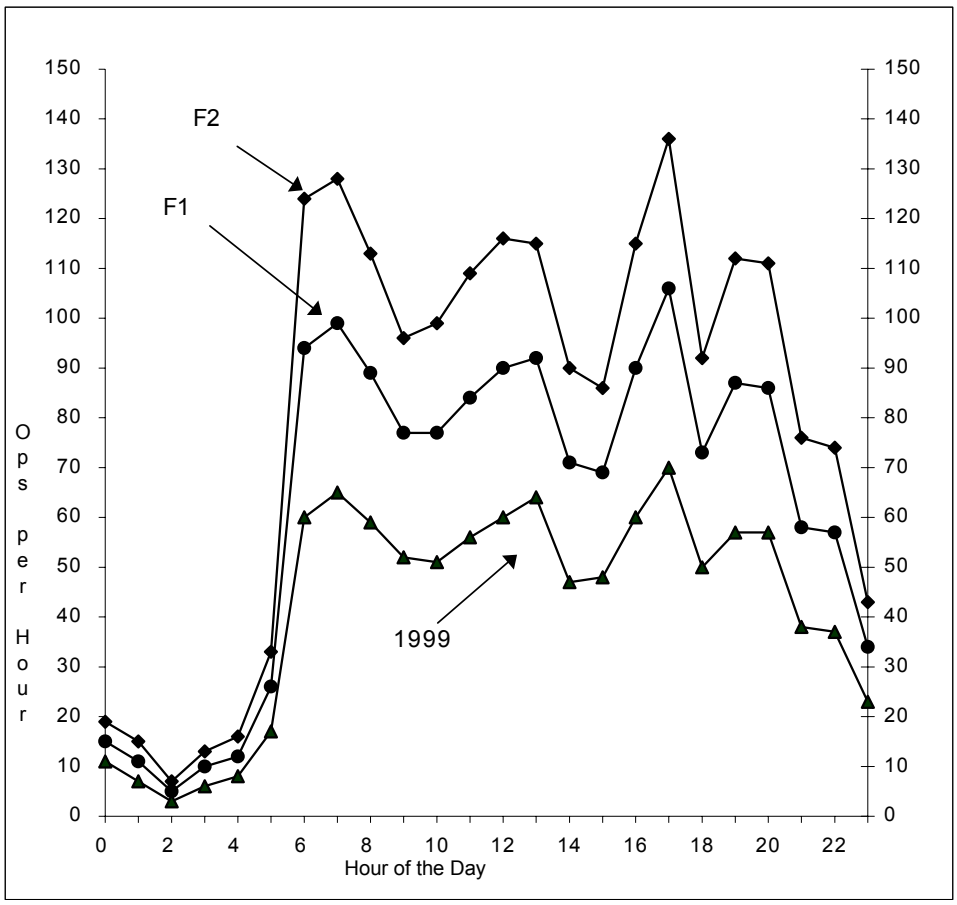
Future 1 -- **Highest hour count is 106 -- at 5pm (1700 hrs).**
6 hours have counts of at least 90. See **.
Between 5pm and 8pm, the number of hourly ops ranges from 73 to 106.

Future 2 -- **Highest hour count is 136 -- at 5pm (1700 hrs).**
6 hours have counts of at least 115. See *.**
Between 5pm and 8pm, the number of hourly ops ranges from 92 to 136.

EXHIBIT 13 - HOUR COUNT SUMMARY -- ALL DEMANDS (Cont.)

PDX CHART -- HOUR COUNT SUMMARY FOR 3 DEMAND LEVELS

HOUR	1999	F1	F2
0	11	15	19
1	7	11	15
2	3	5	7
3	6	10	13
4	8	12	16
5	17	26	33
6	60	94	124
7	65	99	128
8	59	89	113
9	52	77	96
10	51	77	99
11	56	84	109
12	60	90	116
13	64	92	115
14	47	71	90
15	48	69	86
16	60	90	115
17	70	106	136
18	50	73	92
19	57	87	112
20	57	86	111
21	38	58	76
22	37	57	74
23	23	34	43
	1006	1512	1938



NOTES: **Future 1 hour counts are 50% higher than 1999 hour counts.**
Future 2 hour counts are 28% higher than the Future 1 hour counts.

As agreed upon by the Design Team, no attempt was made to smooth out hourly counts at higher demands. AC, GA, and MI maintain their own peaking characteristics.

EXHIBIT 14 - OAG & CARGO COUNTS FOR JULY 27, 1999 -- BY AIRLINE

Airlines (Passenger Carriers)	OAG/FAATC Code	FAA Code	ARR	DEP	TOTAL
Air Canada (AirBc, Ltd.)--Large Turbos	ZX	ABL	5	5	10
Alaska Airlines	AS	ASA	49	49	98
American Airlines	AA	AAL	4	2	6
America West Airlines	HP	AWE	6	6	12
Canadian Airlines (CX -- Large Turbos)	CP/CX	CDN	3	3	6
Continental Airlines	CO	COA	3	2	5
Delta Airlines (D1--HVY&Intl, DL--Other Jets)	DL/DL&D1	DAL	25	25	50
Frontier Airlines	F9	FFT	----	----	----
Hawaiian Airlines	HA	HAL	1	1	2
Horizon Airlines (HZ--Large Jets)	QX/HZ	QXE	30	30	60
Horizon Airlines (QX--Large Turbos)	QX	QXE	65	65	130
Northwest Airlines	NW	NWA	3	3	6
Reno Air	QQ	ROA	5	5	10
Skywest (DL Connection)	OO/DL	SKW/DAL	2	2	4
Skywest (UA Express) (UX--Large Turbos)	OO/UA/UX	SKW/UAL	39	39	78
Southwest Airlines	WN	SWA	31	31	62
Trans World Airlines	TW	TWA	3	3	6
United Airlines	UA	UAL	31	31	62
TOTAL PASSENGER OPS			**305**	**302**	**607**

Airlines (Cargo Carriers)	OAG/FAATC Code	FAA Code	ARR	DEP	TOTAL
Airborne Express	1F/C3	ABX	2	2	4
Ameriflight--Box-Haulers	B4	AMF	12	12	24
BAX Global / Burlington--Jets	H1/8W/C3	ATN	1	1	2
DHL Airways (via KHA in 1999)--Jets	ER/C1	DHL/KHA	1	1	2
Emery Worldwide--Jets	EB/C3	EWW	1	1	2
Federal Express--Box-Haulers	FM/B3	FDX	10	8	18
Kitty Hawk Airlines (supports DHL)--Jets	1K	KHA/DHL	----	2	2
Nippon Cargo Airlines--Jets	1N	NCA	1	----	1
UPS--Box-Haulers via Ameriflight	5X/B2	UPS	12	12	24
UPS--Jets	5X/C2	UPS	5	5	10
TOTAL CARGO OPS			**45**	**44**	**89**
GRAND TOTALS			**350**	**346**	**696**

Source: **OAG of July 27,1999 and cargo operations for August 2000. The Tech Center modified the cargo operations in order to conform to the fleet mix of the Baseline demand.**

Note: **The Tech Center added some codes to assist us in our schedule generation. We want to easily identify Large Turbo Props and Box-Haulers from the Jet operations. Therefore, we used some codes that help us; but these codes do not mean anything to the rest of the Design Team:**

- **B1, B2, B3, and B4 represent Box-Haulers by gate ramp areas: South Ramp, Central Ramp (UPS), Air Trans Center, and SW Ramp (Ameriflight), respectively.**
- **Similarly, C1, C2, C3, and C4 represent Jet operations at those ramp areas.**
- **CX, QX, UX, ZX represent Large Turbo Props for CP, QX, UA/Skywest, and ZX.**
- **HZ represents Horizon jets.**

EXHIBIT 15 - CARGO LOCATIONS FOR PDX

Cargo Locations -- 2000 Study

North Cargo Ramp:	None
South Cargo Ramp:	DHL (Operated by Kitty Hawk in 1999 and Reliant in 2000) Evergreen (contracted by USPS--US Postal Service) Kitty Hawk
Central Cargo Ramp:	UPS (& Box-Haulers via Ameriflight & Western Air Express)
South West Cargo Ramp:	Ameriflight (& Ameriflight courier Box-Haulers)
Air Trans Center:	Airborne, AirPac, BAX, Burlington, Cargolux, Emery, Federal Express (& Box-Haulers by Empire), Korean Air, Nippon Cargo Airlines

Comments:

- **Gate usage is based on July 1999, when PDX Terminals B & C were undergoing construction.**
- **Box-Haulers are Small/Small+ cargo feeders. Some Small aircraft (SW3, BE9/BE99, and BE90) were reclassified as Small+ because they are Turbo Props and cannot diverge to the North. The Box-Haulers are associated with the following cargo carriers:**
  - **Ameriflight**
  - **UPS and Airborne (via Ameriflight)**
  - **Federal Express (via Western Air Express)**
- **Box-Hauler statistics -- provided by the Port for 1999 -- updated on 11/14/00:**
  - **5:30am - 8:00am: 24 Box-Hauler Departures per day -- on average**
  - **4:30pm - 6:00pm: 23 Box-Hauler Arrivals per day -- on average**
  - **7:00pm - 8:30pm: 14 Box-Hauler Arrivals per day -- on average**
- **The number of Box-Haulers simulated is similar, but not identical, to the above numbers.**

EXHIBIT 16 - PDX AIRCRAFT GATE SERVICE TIMES

(Minimum Turn-Around Times in Minutes)

To simulate more realistic conditions, the departure time of a continuing arrival is adjusted to assure the aircraft meets its minimum gate service time (minimum turn-around time).

These times represent the minimum time it takes to service an aircraft -- from the time it arrives at the gate until pushback. If an aircraft arrives late, the model will delay its departure in order to insure that the minimum gate service time is met.

Minimum Turn-Around Times in Minutes -- with a cumulative probability distribution

Heavy		757		LJ		LTP		S+		Small	
Min.	Cum. Prob.	Min.	Cum. Prob.	Min.	Cum. Prob.	Min.	Cum. Prob.	Min.	Cum. Prob.	Min.	Cum. Prob.
60	0.79	45	0.92	20	0.20	20	0.07	20	1.00	10	0.16
90	1.00	50	1.00	25	0.25	30	0.97			15	0.56
				30	0.50	40	1.00			20	0.64
				35	0.64					25	1.00
				40	1.00						

Source:

Heavy, 757, LJ, LTP, S+ -- Based on November 2000 values provided by the airlines serving PDX and their minimum turn-around times at PDX.

Small -- Values were from the 1996 PDX Design Team. Values for Small were weighted by percent of small-twins and small-singles in the 1996 study. The maximum gate service time at PDX was then reduced to 25 minutes (from 35 minutes). The original values for small-twins and small-singles were developed during the Newark Study (before 1990) and were used in the Charlotte, Dulles, and Cincinnati Design Team studies.

EXHIBIT 17 - VFR SEPARATIONS

STANDARD VFR1 (VISUAL) ARR/ARR SEPARATIONS -- AVERAGE

Report FAA-EM-78-8A -- with updated ATC separations (7110.65) for Hvy/757/S+ and PDX approach speeds
At Point of Closest Approach <<with missed approach buffer>>

ARR/ARR (NM)

LEAD	*TRAIL----*	HVY	757	LJ	LTP	S+	SM
HVY	*(7110.65--Heavy)*	4.26	5.06	5.06	4.69	5.56	5.04
757	*Treat as Heavy*	4.26	5.06	5.06	4.69	5.56	5.04
LJ	*(7110.65--Large)*	3.40	3.19	3.19	2.96	3.76	3.39
LTP	*(7110.65--Large)*	3.40	3.19	3.19	2.96	3.76	3.39
S+	*(7110.65--Small)*	3.40	3.19	3.19	2.96	2.96	3.39
SM	*(7110.65--Small)*	3.40	3.19	3.19	2.96	2.96	2.66

Expected VFR1 ARR/ARR separations for PDX: 3.4 NM 1.52 minutes
Expected VFR1 Arrival Flow Rates for PDX: 39 arrivals/runway (max thruput)

STANDARD VFR1 (VISUAL) DEP/DEP SEPARATIONS (in Minutes) -- AVERAGE

Report FAA-EM-78-8A -- with updated ATC separations (7110.65) for Hvy/757/S+

D/D (Minutes)

LEAD	*TRAIL----*	HVY	757	LJ	LTP	S+	SM
HVY	*(7110.65--Heavy)*	1.50	2.00	2.00	2.00	2.00	2.00
757	*Treat as Heavy*	1.50	2.00	2.00	2.00	2.00	2.00
LJ	*(7110.65--Large)*	1.00	1.00	1.00	1.00	1.00	0.83
LTP	*(7110.65--Large)*	1.00	1.00	1.00	1.00	1.00	0.83
S+	*(7110.65--Small)*	1.00	1.00	1.00	1.00	1.00	0.83
SM	*(7110.65--Small)*	0.83	0.83	0.75	0.75	0.75	0.58

Expected VFR1 D/D separations for PDX: 1.05 minutes
Expected VFR1 Departure Flow Rates for PDX: 57 departures/runway (max thruput) -- with no mixed ops

STANDARD VFR1 (VISUAL) DEP/ARR SEPARATIONS -- AVERAGE

Report FAA-EM-78-8A -- with updated ATC separations (7110.65) for Hvy/757/S+ and PDX approach speeds

D/A (NM)

LEAD	*TRAIL----*	HVY	757	LJ	LTP	S+	SM
HVY	*(7110.65--Heavy)*	1.68	1.52	1.52	1.41	1.41	1.19
757	*Treat as Heavy*	1.68	1.52	1.52	1.41	1.41	1.19
LJ	*(7110.65--Large)*	1.68	1.52	1.52	1.41	1.41	1.19
LTP	*(7110.65--Large)*	1.68	1.52	1.52	1.41	1.41	1.19
S+	*(7110.65--Small)*	1.68	1.52	1.52	1.41	1.41	1.19
SM	*(7110.65--Small)*	1.46	1.32	1.32	1.23	1.23	1.04

Expected VFR1 D/A separations for PDX: 1.43 NM
When departure starts to roll, arrival must be at least this far from threshold: 0.64 minutes

NOTES: VFR A/D Separations (minutes) are the Runway Occupancy Times (ROTs).
Approach Speeds in Knots: Heavy--155; 757--140; LJ --140; LTP--130; S+--130; SM--110
Expected PDX approach speed: 134 knots (2.23 NM/minute)

Notes on Sigmas:

In general, the models will vary the separations by ± 3 sigmas (standard deviations).
Separations will be within ± 1 sigma approximately 68.3% of the time.
Separations will be within ± 2 sigmas approximately 91% of the time.
Separations will be within ± 3 sigmas approximately 99.7% of the time.
ARR/ARR Standard Sigma = 18 Seconds. (Source: FAA-EM-78-8A)
Critical Function: The 18 second sigma is used to calculate the buffer, which is added to the minimum IFR separations, to generate the average IFR separations.

For a pair of arrivals, the average separation = (minimum separation in NM) + (1.65 * sigma in NM).

EXHIBIT 18 - IFR SEPARATIONS

STANDARD IFR ARR/ARR SEPARATIONS -- AVERAGE

Report FAA-EM-78-8A -- with updated ATC separations (7110.65) for Hvy/757/S+ and PDX approach speeds

At Point of Closest Approach <<with 2.5 NM minimum spacing on a Runway>>

ARR/ARR (NM)

LEAD	*TRAIL----*	HVY	757	LJ	LTP	S+	SM
HVY	*(7110.65--Heavy)*	5.29	6.16	6.16	6.07	7.07	6.91
757	*Treat as Heavy*	5.29	6.16	6.16	6.07	7.07	6.91
LJ	*(7110.65--Large)*	3.79	3.66	3.66	3.57	5.07	4.91
LTP	*(7110.65--Large)*	3.79	3.66	3.66	3.57	5.07	4.91
S+	*(7110.65--Small)*	3.79	3.66	3.66	3.57	3.57	4.91
SM	*(7110.65--Small)*	3.79	3.66	3.66	3.57	3.57	3.41

Expected IFR ARR/ARR separations for PDX: 4.15 NM 1.86 minutes

Expected IFR Arrival Flow Rates for PDX: 32 arrivals/runway (max thruput)

STANDARD IFR DEP/DEP SEPARATIONS (in Minutes) -- AVERAGE

Report FAA-EM-78-8A -- with updated ATC separations (7110.65) for Hvy/757/S+

DEP/DEP (Minutes)

LEAD	*TRAIL----*	HVY	757	LJ	LTP	S+	SM
HVY	*(7110.65--Heavy)*	1.50	2.00	2.00	2.00	2.00	2.00
757	*Treat as Heavy*	1.50	2.00	2.00	2.00	2.00	2.00
LJ	*(7110.65--Large)*	1.00	1.00	1.00	1.00	1.00	1.00
LTP	*(7110.65--Large)*	1.00	1.00	1.00	1.00	1.00	1.00
S+	*(7110.65--Small)*	1.00	1.00	1.00	1.00	1.00	1.00
SM	*(7110.65--Small)*	1.00	1.00	1.00	1.00	1.00	1.00

Expected IFR DEP/DEP separations for PDX: 1.10 minutes

Expected IFR Departure Flow Rates for PDX: 55 departures/runway (max thruput) -- with no mixed ops

STANDARD IFR DEP/ARR SEPARATIONS -- AVERAGE

Report FAA-EM-78-8A -- with updated ATC separations (7110.65) for Hvy/757/S+ and PDX approach speeds

DEP/ARR (NM)

LEAD	*TRAIL----*	HVY	757	LJ	LTP	S+	SM
ALL CLASSES		2.00	2.00	2.00	2.00	2.00	2.00

Expected IFR DEP/ARR separations for PDX: 2.00 NM

When departure starts to roll, arrival must be at least this far from threshold: 0.90 minutes

NOTES: IFR A/D Separations (minutes) are the Runway Occupancy Times (ROTs).

Approach Speeds in Knots: Heavy--155; 757--140; LJ --140; LTP--130; S+--130; SM--110

Expected PDX approach speed: 134 knots (2.23 NM/minute)

Notes on Sigmas:

In general, the models will vary the separations by ± 3 sigmas (standard deviations).
Separations will be within ± 1 sigma approximately 68.3% of the time.
Separations will be within ± 2 sigmas approximately 91% of the time.
Separations will be within ± 3 sigmas approximately 99.7% of the time.
ARR/ARR Standard Sigma = 18 Seconds. (Source: FAA-EM-78-8A)
Critical Function: The 18 second sigma is used to calculate the buffer, which is added to the minimum IFR separations, to generate the average IFR separations.

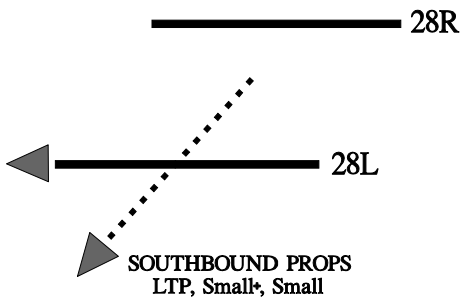
For a pair of arrivals, the average separation = (minimum separation in NM) + (1.65 * sigma in NM).

EXHIBIT 19 - OTHER DEPARTURE DEPENDENCIES

(Updated 10/30/00)

D/D Rwy Dependencies due to Departure Air Crossovers

WEST FLOW -- SOUTHBOUND AIR CROSSOVERS -- from 1996 PDX Study (Data Pkg 13, Appendix A, page A-10)



SOUTHBOUND PROPS (LTP or S+ or Small) departing 28R are permitted to turn south as soon as they are airborne. Therefore, there is a dependency between a southbound departure on 28R and a departure on 28L. Under the existing noise restrictions, any prop (LTP or S+ or Small) can turn south immediately.

28R/28L: Southbound Departure on 28R Followed by Departure on 28L

28R/28L

LTP or S+ or Small/Any Aircraft:	VFR:	50 seconds for Prop to cross 28L
	IFR1:	70 seconds for Prop to cross 28L & be verified by radar

28L/28R: Departure on 28L Followed by Southbound Departure on 28R

(D/D Offsets & Separations in the 1996 Study, Data Pkg 13, Appendix A, *pages A-14 & A-22*)

28L/28R

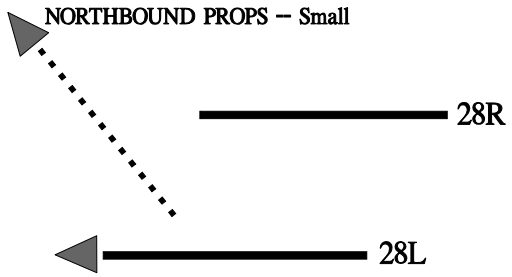
Heavy or 757/LTP or S+ or Small:	VFR:	1.75 minutes (due to wake vortex & offset thresholds)
	IFR1:	1.75 minutes (due to wake vortex & offset thresholds)
		Updated 757 info on 10/30/00.
LJ/LTP or S+ or Small:	VFR:	20 seconds (due to diverging paths & offset thresholds)
	IFR1:	45 seconds (due to diverging paths & offset thresholds)
LTP or S+ northbound/LTP or S+:	VFR:	20 seconds (due to diverging paths & offset thresholds)
	IFR1:	45 seconds (due to diverging paths & offset thresholds)
LTP or S+ southbound/LTP or S+:	VFR:	45 seconds (due to offset thresholds)
	IFR1:	45 seconds (due to offset thresholds)
LTP or S+/Small:	VFR:	20 seconds (due to diverging paths & offset thresholds)
	IFR1:	45 seconds (due to diverging paths & offset thresholds)
Small/LTP or S+ or Small:	VFR:	20 seconds (due to diverging paths & offset thresholds)
	IFR1:	45 seconds (due to diverging paths & offset thresholds)

EXHIBIT 19 - OTHER DEPARTURE DEPENDENCIES (Cont.)

(Updated 10/30/00)

D/D Rwy Dependencies due to Departure Air Crossovers

WEST FLOW -- NORTHBOUND AIR CROSSOVERS -- from 1996 PDX Study
(Data Pkg 13, Appendix A, page A-11)



SMALL NORTHBOUND PROPS departing 28L are permitted to turn north as soon as they are airborne. Therefore, there is a dependency between a northbound departure on 28L and a departure on 28R. Under the existing noise restrictions, any Small can turn north immediately.

28R/28L: Departure on 28R Followed by Northbound Departure on 28L

(D/D Separations in the 1996 Study, Data Pkg 13, Appendix A, page A-22)

28R/28L

Heavy or 757/Small:	VFR:	2 minutes (due to wake vortex)
	IFR1:	2 minutes (due to wake vortex) (D/D separations) **Updated 757 info on 10/30/00.**
LJ/Small:	VFR:	50 seconds (D/D separations)
	IFR1:	1 minute (D/D separations)
LTP or S+/Small:	VFR:	50 seconds (D/D separations)
	IFR1:	1 minute (D/D separations)
Small/Small:	VFR:	20 seconds (D/D separations)
	IFR1:	1 minute (D/D separations)

28L/28R: Northbound Departure on 28L Followed by Departure on 28R

28L/28R

Small/Any Aircraft:	VFR:	50 seconds for Prop to cross 28R
	IFR1:	70 seconds for Prop to cross 28R & be verified by radar

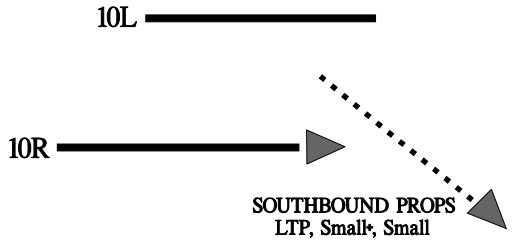
Note: Improvement Package (A), All Turbo Props and Biz Jets Can Do Divergent Turns, will permit LTP or S+ aircraft to turn north immediately. For that simulation, the separation for a LTP or S+ aircraft will be the same as that of a Small.

EXHIBIT 19 - OTHER DEPARTURE DEPENDENCIES (Cont.)

(Updated 10/30/00)

D/D Rwy Dependencies due to Departure Air Crossovers

EAST FLOW -- SOUTHBOUND AIR CROSSOVERS -- from 1996 PDX Study (Data Pkg 13, Appendix A, page A-12)



SOUTHBOUND PROPS (LTP or S+ or Small) departing 10L are permitted to turn south as soon as they are airborne. Therefore, there is a dependency between a southbound departure on 10L and a departure on 10R. Under the existing noise restrictions, any prop (LTP or S+ or Small) can turn south immediately.

10L/10R: Southbound Departure on 10L Followed by Departure on 10R

10L/10R		
LTP or S+ or Small/Any Aircraft:	VFR:	50 seconds for Prop to cross 10R
	IFR1:	70 seconds for Prop to cross 10R & be verified by radar

10R/10L: Departure on 10R Followed by Southbound Departure on 10L

(D/D Offsets & Separations in the 1996 Study, Data Pkg 13, Appendix A, pages A-15 & A-22)

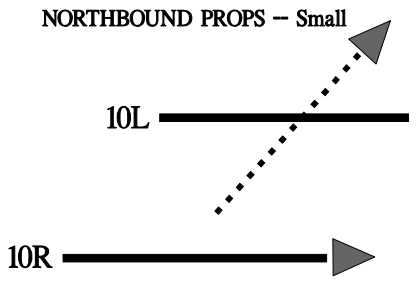
10R/10L		
Heavy or 757/LTP or S+ or Small:	VFR:	2.25 minutes (due to wake vortex & offset thresholds)
	IFR1:	2.25 minutes (due to wake vortex & offset thresholds)
		Updated 757 info on 10/30/00.
LJ/LTP or S+:	VFR:	1.25 minutes (due to offset thresholds)
	IFR1:	1.25 minutes (due to offset thresholds)
LJ/Small:	VFR:	1 minute (due to offset thresholds)
	IFR1:	1.25 minutes (due to offset thresholds)
LTP or S+ northbound/LTP or S+:	VFR:	2 minutes (due to offset thresholds)
	IFR1:	2 minutes (due to offset thresholds)
LTP or S+ southbound/LTP or S+:	VFR:	1.25 minutes (due to offset thresholds)
	IFR1:	1.25 minutes (due to offset thresholds)
LTP or S+ northbound/Small:	VFR:	2 minutes (due to offset thresholds)
	IFR1:	2 minutes (due to offset thresholds)
LTP or S+ southbound/Small:	VFR:	1.08 minutes (due to offset thresholds & diverging paths)
	IFR1:	1.25 minutes (due to offset thresholds & diverging paths)
Small northbound/Small:	N/A:	Small aircraft on 10R usually go southbound
Small southbound/Small:	VFR:	30 seconds (due to offset thresholds & diverging paths)
	IFR1:	45 seconds (due to offset thresholds & diverging paths)

EXHIBIT 19 - OTHER DEPARTURE DEPENDENCIES (Cont.)

(Updated 10/30/00)

D/D Rwy Dependencies due to Departure Air Crossovers

EAST FLOW -- NORTHBOUND AIR CROSSOVERS -- from 1996 PDX Study (Data Pkg 13, Appendix A, page A-13)



SMALL NORTHBOUND PROPS departing 10R are permitted to turn north as soon as they are airborne. Therefore, there is a dependency between a northbound departure on 10R and a departure on 10L. Under the existing noise restrictions, any Small can turn north immediately.

10L/10R: Departure on 10L Followed by Northbound Departure on 10R

(D/D Offsets & Separations in the 1996 Study, Data Pkg 13, Appendix A, pages A-15 & A-22)

10L/10R

Heavy or 757/Small:	VFR:	1.66 minutes (due to wake vortex & offset thresholds)
	IFR1:	1.66 minutes (due to wake vortex & offset thresholds)
		Updated 757 info on 10/30/00.
LJ/Small:	VFR:	20 seconds (due to offset thresholds & diverging paths)
	IFR1:	40 seconds (due to offset thresholds & diverging paths)
LTP or S+/Small:	VFR:	20 seconds (due to offset thresholds & diverging paths)
	IFR1:	40 seconds (due to offset thresholds & diverging paths)
Small/Small:	VFR:	20 seconds (due to offset thresholds & diverging paths)
	IFR1:	40 seconds (due to offset thresholds & diverging paths)

10R/10L: Northbound Departure on 10R Followed by Departure on 10L

10R/10L

Small/Any Aircraft:	VFR:	50 seconds for Prop to cross 10L
	IFR1:	70 seconds for Prop to cross 10L & be verified by radar

Note: Improvement Package (A), All Turbo Props and Biz Jets Can Do Divergent Turns, will permit LTP or S+ aircraft to turn north immediately. For that simulation, the separation for a LTP or S+ aircraft will be the same as that of a Small.

EXHIBIT 20 - OPERATIONAL PROCEDURES AND MINIMA

(Updated 10/30/00)

These were developed from the 1996 PDX Study -- based on the PDX Airside Capacity Study (final report), March 1991, pgs A-9 thru A-13. They were revised in July 2000 to reflect current conditions and assumptions:

- **1.5 NM staggered approaches to parallel runways in IFR for Do-Nothing case.**
- **Runway 3 will not be used for arrivals**. Current ATC rules for LAHSO (Land and Hold Short Operations) have such severe restrictions that they effectively do not permit simultaneous arrivals to Runway 3 and 10R/28L.

VFR1: Ceiling ≥ 3,500' *and* Visibility ≥ 10 miles.
Visual (VFR1) separations.
Simultaneous visual approaches to both parallel runways by all aircraft types.
Runway 3 not used for arrivals in VFR1.
Although not permitted under noise abatement procedures, ATC rules would permit certain small aircraft to make visual **dependent** approaches to Runway 3. Current LAHSO rules do not permit small aircraft to make simultaneous approaches to Runway 3 and 10R/28L, even when the runways are dry and there is no tailwind.

VFR2: Less than VFR1, *and*, Ceiling ≥ 2,000' *and* Visibility ≥ 5 miles.
IFR separations for A/A. Visual (VFR1) separations for others.
Simultaneous approaches may be permitted to the parallel runways.
10/26/95 Update: Small_as_Trail can use Visual A/A separations.
Runway 3 not used for arrivals in VFR2.
ATC rules would permit certain small aircraft to make **dependent** approaches to Runway 3 when the runways are dry. VFR2 usually occurs in the winter when the runways are wet. In addition, current LAHSO rules do not permit small aircraft to make simultaneous approaches to Runway 3. In reality, Runway 3 cannot and would not be used for arrivals in VFR2.

IFR1: Less than VFR2, *and*, Ceiling ≥ 200' *and* Visibility ≥ 0.5 miles.
IFR separations are required.
1.5 NM staggered approaches to existing parallel runways in West and East flows.
Visual approaches are not allowed to any runway.

IFR2: Less than IFR1, *and*, Ceiling ≥ 100' *and* Visibility ≥ 0.25 miles.
IFR separations. Arrive on 10R. Depart on 10R & 10L.

IFR3: Visibility < 0.25 miles *and* ≥ 0.125 miles.
IFR separations. Arrive on 10R. Depart on 10R & 10L.
SMGCS is expected in Fall 2001. 300' RVR will be the departure minimum for SMGCS equipped aircraft. 500' RVR will be the departure minimum for all others. **Updated 10/30/00.**

Minimums obtained from approach plates:

- **10R: CAT I minimums are 200'AGL and 3/8 mile.**
- **10L: CAT I minimums are 450' AGL and 1 mile.**
- **28R: CAT I minimums are 300 AGL and 1 mile. Updated 10/30/00.**
- **28L: CAT I minimums are 400' AGL and 1/2 mile. Updated 10/30/00.**

3. DESIGN TEAM SCHEDULE

Exhibit 21 lists the meetings concerning the completion of significant tasks, outputs, and target dates of the PDX Design Team schedule. These milestones and meetings will be held at key decision points, and will help the Design Team monitor the progress of the study.

EXHIBIT 21 - DESIGN TEAM SCHEDULE

(Updated 10/30/00)

Date	Event	Objective	Task	Responsibility	Output
3/16/00	1.	Preliminary Meeting. Review Design Team Purpose. Identify Objectives & Potential Improvements.	Review Potential Improvements & Data Package 13 from 1996 Study. Agree on Scope of Work, Assumptions, Forecasts, & Data Requirements.	Entire Design Team.	Initial List of Potential Improvements. Agree on Study Direction.
4//25/00 thru 4/27/00 & 5/17/00	2.	Perform Data Collection.	On-Site Data Collection.	Tech Center.	Establish Parameters for Analysis.
5/18/00	3.	Kick Off Meeting. Review Design Team Purpose. Identify Objectives & Potential Improvements.	Review Technical Plan, & Potential Improvements. Agree on Scope of Work, Assumptions, Forecasts, & Data Requirements. Review & Agree on Purpose and Inputs.	Entire Design Team.	Initial List of Potential Improvements. Agree on Study Direction.
7/20/00	4.	Determine Scope of Study, Select Model. Review Results of Data Collection.	Review Results of Data Collection. Review Data Package 1.	Entire Design Team.	Agree on Inputs & Direction.
10/12/00 scheduled	5.	Review Results of Data Collection, Model Inputs, & Potential Improvements.	Review Data Package 2.	Entire Design Team.	Agree on Inputs & Direction.
11/30/00	6.	Review Model Inputs & Potential Improvements.	Review Data Package 3.	Entire Design Team.	Agree on Inputs & Direction.
2/1/01	7.	Review Initial Calibration Results & Potential Improvements.	Review Data Package 4.	Entire Design Team.	Agree on Inputs & Direction.
/ /	?.	•			
		•			
		•			
10/30/01	?.	Complete & Publish Final Report.	Publish & Distribute Final Report.	FAA HQ.	Final Report.

* Number of meetings and target dates are tentative and may be adjusted as progress is achieved.

APPENDIX A

ACCEPTED MODEL INPUTS

NOTE: The PDX Tower owns a 5 NM ring around PDX.

AIRCRAFT CLASSIFICATIONS (UPDATED 8/11/00) **Accepted by PDX Team on 10/12/00**

H = **HEAVY**		**Heavy aircraft.** Heavy aircraft weighing more than 255,000 pounds (e.g., L1011, DC10, B747, B767, DC8S, A300).
757 = **757**	**B757.**	B757 only**.**
LJ = **LARGE JET**		**Large Jets. Includes Regional Jets.** Large jet aircraft weighing more than 41,000 pounds and up to 255,000 pounds (e.g., DC9, B737, B727, MD80, CRJ).
LTP = **LARGE TURBO PROP**		**Large Turbo Props.** Large commuter aircraft weighing more than 41,000 pounds and up to 255,000 pounds (e.g., ATR-42*, DH8, DH7, BA41*, SF34*).
S+ = **SMALL+**		**Small Commuters. Includes Business Jets.** Small commuter aircraft weighing more than 12,500 and less than 41,000 pounds (e.g., BA31, BE02, E120, LR31, LR36).
S = **SMALL**		**Small twin & single engine props.** Small, single or twin engine aircraft weighing 12,500 pounds or less (e.g. BE58, C340, C441, AC21, BE20, C172, C210, DO27).

Notes: **For wake turbulence application, FAA Handbook 7110.65 considers LJ & LTP as "large" and S+ & S as "small".**

- * The aircraft ATR-42 and SF34 are exempt from the small category and are classified as large aircraft for separation purposes. (Source: FAA memo from ANM-531.4). They are classified as LTP (Large Turbo Prop) in this study.
- The critical factor in determining aircraft class should be approach speeds and how arrivals are separated at the point of closest approach (at threshold, except for a faster aircraft followed by a slower aircraft).
- Weights refer to maximum certified takeoff weights.
- These aircraft classes will enable us to define the model inputs more accurately and more clearly by distinguishing the key differences in operational characteristics.

Notes: **At the July 20th meeting, the Design Team agreed on the following:**

- **Regional Jets have the same departure noise procedures and prop-to-jet penalties as Large Jets. Regional Jets will be in the same class as Large Jets.**
- **Turbo Props that were treated as M (Medium) in the 1996 study will be treated as LTP (Large Turbo Props or S+ (Small+) for this study.**

LENGTH OF COMMON APPROACH (NAUTICAL MILES) -- 1996 PDX STUDY (WITH 2000 CLASSES) **Accepted by PDX Team on 10/12/00**

For the simulations, it is defined as the length of the final common approach, along which speed control *cannot* be used to separate aircraft. This differs from the 8 NM final associated with Noise Abatement procedures. The Tracon can use speed control to separate aircraft, which are at least 5 NM away from the runway end.

	Class	Heavy	757	Large Jet	LTP	Small+	Small
VFR	NM	5	5	5	5	5	3
IFR	NM	5	5	5	5	5	5

Source: 1996 PDX STUDY

APPROACH SPEEDS (KNOTS) -- 1996 PDX STUDY (WITH 2000 CLASSES) **Accepted by PDX Team on 10/12/00**

The speed is given in knots for each class of aircraft flying along the common approach defined above. The standard deviation is 5 knots. The model uses three standard deviations in selecting approach speeds. Therefore, the speeds may vary by 15 knots, plus or minus.

	Class	Heavy	757	Large Jet	LTP	Small+	Small
VFR	Knots	155	140	140	130	130	110
IFR	Knots	155	140	140	130	130	110

Source: 1996 PDX STUDY (Based on Arts data for 7/20/94.)

1999 PDX FLEET MIX (UPDATED 8/11/00) **Accepted by PDX Team on 10/12/00**

Aircraft Class	1999 Fleet Mix
Heavy	4.7%
B-757	5.2%
Large Jet	46.3%
Large Turbo Prop	17.6%
Small+	14.7%
Small	11.5%
TOTAL	100.0%

Source: Data provided by Port of Portland.

Notes: At the July 20, 2000 meeting, the Design Team agreed to the following:

- **Use the fleet mix presented in Data Package 1. Since that meeting, the mix was modified to reflect the change in an aircraft class definition -- Large Turbo Prop instead of Large Commuter.**
- **Regional Jets are included in the aircraft class Large Jet because they have the same departure noise restrictions, prop-to-jet penalties, approach speeds, and separations.**
- **Business Jets will be simulated as Small+/Small props, with the same departure procedures as the Small+/Small props. This was also done in the 1996 PDX Study because the percentage of Business Jets was small. Because we are limited to 6 aircraft classes in ADSIM, the Design Team agreed that it was still reasonable to treat Business Jets as Small+/Small props.**

SIMULATED DEMAND CHARACTERISTICS -- PDX **Accepted by PDX Team on 10/12/00**

ANNUAL & DAILY DEMAND

DEMAND LEVEL	ANNUAL OPERATIONS	DAILY OPERATIONS	EQUIVALENT DAYS
1999--Baseline	322,000	1,006	320
FUTURE 1	484,000	1,512	320
FUTURE 2	620,000	1,938	320

NOTE: (Annual Operations) / (Daily Operations) = Equivalent Days

PDX DEMAND CHARACTERISTICS

Annual Distribution of Traffic--(GA & MI annual ops increase according to Port's 2020 forecasts)

DEMAND	COMMERCIAL		GA		MILITARY		TOTAL	
1999-- Baseline	275,000	85.4%	38,000	11.8%	9,000	2.8%	322,000	100.0%
FUTURE 1	429,000	88.6%	45,000	9.3%	10,000	2.1%	484,000	100.0%
FUTURE 2	565,000	91.1%	45,000	7.3%	10,000	1.6%	620,000	100.0%

NOTES: **1999 distribution was based on the 1999 Port statistics.**
Commercial counts include Air Carrier, Commuter, and Air Taxis.
FAA Technical Center developed the FUTURE 1 & FUTURE 2 distributions based on the following growth assumptions of the Port's forecasts for PDX:

* FUTURE 1 represents the Port's expected forecast for 2020.
* FUTURE 2 represents the Port's high growth forecast for 2020.
* FUTURE 1 and FUTURE 2 have 45,000 annual GA operations.
* FUTURE 1 and FUTURE 2 have 10,000 annual MILITARY operations.

Daily Distribution of Traffic

DEMAND	COMMERCIAL		GA		MILITARY		TOTAL	
1999-- Baseline	860	85.5%	118	11.7%	28	2.8%	1,006	100.0%
FUTURE 1	1,342	88.8%	140	9.3%	30	2.0%	1,512	100.0%
FUTURE 2	1,768	91.2%	140	7.2%	30	1.5%	1,938	100.0%

NOTES: **Daily counts for Commercial, GA, and MI have an even number of ops per day in order to have equal numbers of arrivals and departures.**
Percentages are rounded to 1 decimal place.

GATE ASSIGNMENTS **Accepted by PDX Team on 10/12/00**

Airline (Passenger Carriers)	OAG Code	FAA Code	Terminal/Gates
Air Canada (AirBc, Ltd.)	ZX	ABL	E6
Alaska	AS	ASA	B2-B4, C2, C9, C13, C20-C23
American	AA	AAL	C4, C6
America West	HP	AWE	D3, D5
Canadian Airlines	CP	CDN	
Columbia Pacific	7C	COL	
Continental Airlines	CO	COA	D1,D4
Delta	DL	DAL	D5-D15
Frontier Airlines	F9	FFT	D6
Harbor Airlines	HG	HAR	A5-A12
Hawaiian Airlines	HA	HAL	D14
Horizon Air	QX	QXE	A1-A12, B4
Northwest	NW	NWA	C17, C19
Reno Air	QQ	ROA	C11
Skywest (DL Connection)	OO/DL	SKW/DAL	E7
Skywest (UA Express)	OO/UA	SKW/UAL	E6
Southwest	WN	SWA	C14-C16, C18
Trans World	TW	TWA	D2, D8
United Airlines	UA	UAL	E1-E5

Airline (Cargo Carriers)	OAG Code	FAA Code	Terminal/Gates
ABX Air, Inc.	W0	------	
Aeroflight		TTY	
Airborne Express	1F	ABX	Air Trans Center
AirPac (supports Airborne & Aeroflight)	------	APC	Air Trans Center
Ameriflight	------	AMF	South West Ramp
BAX Global (via Air Transport Intl)	H1	ATN	Air Trans Center
Burlington Air Express	8W	ASW	Air Trans Center
Cargolux Airlines (began service-2000)	S1	CLX	Air Trans Center
DHL Airways (via KHA in 1999)	ER	DHL/KHA	South Air Cargo Ramp
Emery Worldwide	EB	EWW	Air Trans Center
Empire Airlines (supports FedEx)	----	CFS	Air Trans Center
Evergreen Airlines (supports USPS)	1E	EIA	South Air Cargo Ramp
Federal Express	FM	FDX	Air Trans Center
Kitty Hawk Airlines (supports DHL)	1K	KHA/DHL	South Air Cargo Ramp
Korean Air	KE	KAL	Air Trans Center
Nippon Cargo Airlines	1N	NCA	Air Trans Center
UPS (& Box-Haulers via Ameriflight)	5X	UPS	UPS -- Central Ramp
Western Air Express (supports UPS)	----	WAE	UPS -- Central Ramp

Source: **Airlines were taken from the OAG of July 27, 1999, 2000 data collection, and the Port. Added Aeroflight (TTY) on 10/30/00.**

Comments:

- **Gate usage is based on July 1999, when PDX Terminals B & C were undergoing construction.**
- **Box-Haulers -- Ameriflight, UPS and Airborne (via Ameriflight), Federal Express (via Western Air Express).**

ARRIVAL AIRCRAFT LATENESS DISTRIBUTION -- 1996 PDX STUDY **Accepted by PDX Team on 7/20/00**

(ARRIVAL VARIABILITY DISTRIBUTION)

To simulate more realistic conditions, a lateness distribution (arrival variability distribution) is added to the OAG scheduled arrival time. The distribution should represent the average deviation from the scheduled arrival time, excluding delays at the destination airport (PDX).

The arrival aircraft lateness distribution is shown as a cumulative probability. For each arrival, the lateness distribution is sampled and the resulting time is added to the scheduled arrival time. This input varies the arrival time of an aircraft during each iteration of the simulation.

Amount by which actual arrival time at threshold would exceed scheduled arrival time at threshold	Distribution of aircraft lateness (cumulative %)
-20	0.0 %
-15	4.7 %
- 2	31.5 %
0	52.6 %
5	70.3 %
10	83.6 %
15	94.3 %
30	95.9 %
45	98.4 %
60	100.0 %

This table reads as follows:
0% arrive at the threshold more than 20 minutes early
4.7% (4.7% - 0%) arrive between 15 and 20 minutes early
26.8% (31.5% - 4.7%) arrive between 2 and 15 minutes early

Source: Values used in the 1994 & 1989 Seattle Design Team studies.

DEPARTURE PUSH -- 1996 PDX STUDY **Accepted by PDX Team on 7/20/00**

Departure Push = 5

Arrivals are usually given priority over departures. However, during a departure push, spacing between arrivals may be increased in order to reduce departure delay.

When five departures initiate their pushback, the Tower would space out arrivals in order to allow an aircraft to depart between two arrivals. At the current demand level, with both parallels operating, this would seldom occur. As demand increases, the Tower would increase the frequency of the departure pushes.

D/D Noise Dependency for Turboprop/Jet -- 1996 PDX STUDY **Accepted by PDX Team on 7/20/00**

VFR & IFR: 2 minutes (unless the 2 aircraft have divergent turns).

Without the noise restrictions, the standard VFR D/D separation for a Turboprop followed by a Jet would be 1 minute in VFR and 2 minutes in IFR.

With the PDX Noise restrictions, when a Turboprop departure is followed by a Jet departure, the Departure-to-Departure (D/D) separation is 2 minutes in both VFR and IFR. The additional 1-minute separation in VFR prevents the Jet from overtaking the Turboprop, which is a slower aircraft. This 2-minute separation in VFR does not apply when the Turboprop and the Jet have divergent turns.

DEPARTURE RUNWAY OCCUPANCY TIMES (SECONDS) -- STANDARD (WITH 2000 CLASSES): **Accepted by PDX Team on 7/20/00**

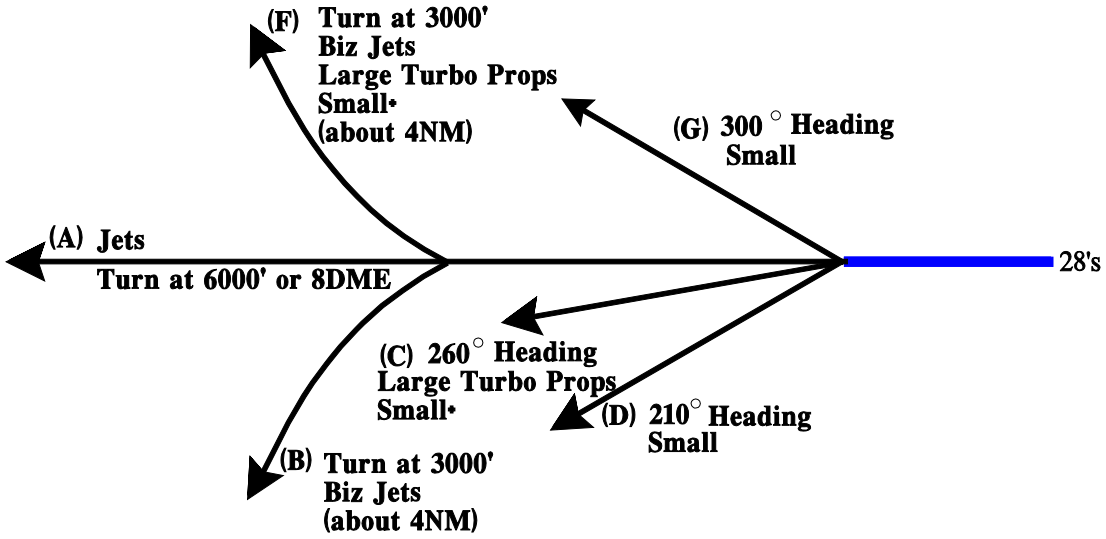
These are the minimum times a departure is on the runway. Runway crossing times and aircraft separations cannot violate these minimums.

	Class	Heavy	757	Large Jet	LTP	Small+	Small
Standard	Seconds	39	39	39	39	39	34

Source: Standard values used in all design team studies. These values were used in the 1996 PDX STUDY.

PDX NOISE DEPENDENCIES -- WEST FLOW (Same Runway) Accepted by PDX Team on 7/20/00 (Updated 8/2/00)

(B) & (C) & (D) -- Totally independent WRT noise
(A) & (C) & (D) -- Totally independent WRT noise
(C) & (D) & (G) -- Independent of everyone WRT noise
(A) South & (A) North -- Full noise dependency
(A) & (B) -- Noise Dependent up to 3000' (about 4NM from west end of runway)
(Jet / Turbine = 1 minute, Turbine / Jet = 2 minutes)
(A) & (F) -- Noise Dependent up to 3000' (about 4NM from west end of runway)
(Jet / Turbine = 1 minute, Turbine / Jet = 2 minutes)
(F) & (B) -- Noise Dependent up to 3000' (about 4NM from west end of runway)
(Jet / Turbine = 1 minute, Turbine / Jet = 2 minutes)



WEST FLOW: There are no departure fix restrictions for 2 dis-similar jets going to the same exit fix at the center. Updated 12/94.

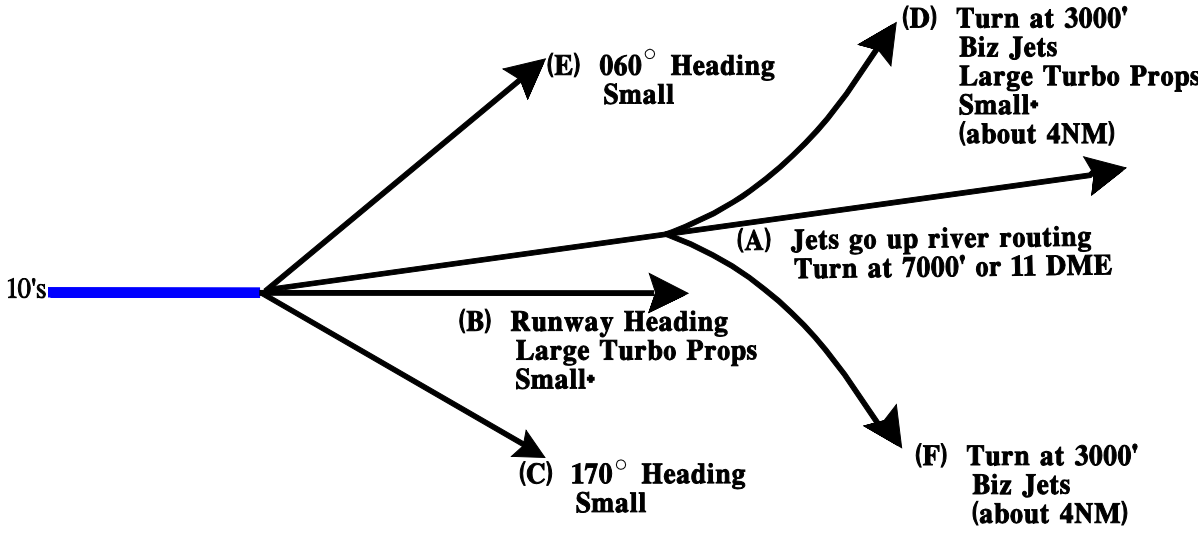
VFR FLIGHT PLAN -- Small aircraft can do an immediate turn onto any of several departure paths. Updated 12/94.

Note: Assume all Biz Jets are quiet because most are quiet.
WRT = with respect to.

Notes: **Headings for Southbound Small are now 210° (instead of 240° in 1996 Study).**
Small+ aircraft follow the same heading as Large Turbo Props.
Regional Jets have the same procedures as Large Jets (A).

PDX NOISE DEPENDENCIES -- EAST FLOW (Same Runway) Accepted by PDX Team on 7/20/00
(Updated 8/2/00)

(A) & (B) & (C) & (E) -- Totally Independent WRT Noise
(B) & (C) & (E) -- Independent of Everyone WRT Noise
VFR Flight Plans -- No Noise Dependency
(A) South & (A) North -- Full Noise Dependency
(A) & (D) -- Noise Dependency to 3000' (about 4NM from east end of runway)
(Jet / Turbine = 1 minute, Turbine / Jet = 2 minutes)
(A) & (F) -- Noise Dependency to 3000' (about 4NM from east end of runway)
(Jet / Turbine = 1 minute, Turbine / Jet = 2 minutes)
(F) & (D) -- Noise Dependency to 3000' (about 4NM from east end of runway)
(Jet / Turbine = 1 miute, Turbine / Jet = 2 minutes)



EAST FLOW: To depart 2 dis-similar jets (when the trail aircraft is a smaller jet) going to the same exit fix at the center -- controllers must add 30 seconds to trail departure, if they cannot insert a different type of departure. However, they can usually insert a different type of departure, thereby eliminating the need to add the extra separation. Updated 12/94.

VFR FLIGHT PLAN -- Small aircraft can do an immediate turn onto any of several departure paths. Updated 12/94.

Note: Assume all Biz Jets are quiet because most are quiet.
WRT = with respect to.

Notes:
Headings for Southbound Small are now 170° (instead of 120° in 1996 Study).
Small+ aircraft follow the same heading as Large Turbo Props.
Regional Jets have the same procedures as Large Jets (A).

OTHER DEPARTURE DEPENDENCIES **Accepted by PDX Team on 7/20/00**

D/D Rwy Dependencies due to Noise for Offset Departure Thresholds

WEST FLOW -- from 1996 PDX Study (Data Pkg 13, Appendix A, page A-14)

Departure on 28R followed by a Departure on 28L -- VFR & IFR Noise Dependency:

28R/28L

Jet/Jet:	Use 1.25 minutes (0.25 minutes added to std Jet/Jet) When Heavy is lead aircraft, add 0.25 minutes to std Heavy/Jet When 757 is lead aircraft, add 0.25 minutes to std 757/Jet
Turboprop/Turboprop:	Use 1.25 minutes (0.25 minutes added to std Turboprop/Turboprop)
Turboprop/Jet:	Use 2.00 minutes (0.00 minutes added to std Turboprop/Jet)
Jet/Turboprop:	Use 1.00 minute (0.00 minutes added to std Jet/Turboprop) When Heavy is lead aircraft, add 0.00 minutes to std Heavy/Turboprop When 757 is lead aircraft, add 0.00 minutes to std 757/Turboprop

Departure on 28L followed by a Departure on 28R -- VFR & IFR Noise Dependency:

28L/28R

Jet/Jet:	Use 0.75 minutes (0.25 minutes subtracted from std Jet/Jet) When Heavy is lead aircraft, subtract 0.25 minutes from std Heavy/Jet When 757 is lead aircraft, subtract 0.25 minutes from std 757/Jet
Turboprop/Turboprop:	Use 0.75 minutes (0.25 minutes subtracted from std Turboprop/Turboprop)
Turboprop/Jet:	Use 2.00 minutes (0.00 minutes subtracted from std Turboprop/Jet)
Jet/Turboprop:	Use 0.75 minutes (0.25 minutes subtracted from std Jet/Turboprop)
Heavy/Turboprop:	When Heavy is lead aircraft, subtract 0.25 minutes from std Heavy/Turboprop When 757 is lead aircraft, subtract 0.25 minutes from std 757/Turboprop

Note: Turboprop can be LTP or S+.

OTHER DEPARTURE DEPENDENCIES **Accepted by PDX Team on 7/20/00**

D/D Rwy Dependencies due to Noise for Offset Departure Thresholds

EAST FLOW -- from 1996 PDX Study (Data Pkg 13, Appendix A, page A-15)

Departure on 10R followed by a Departure on 10L -- VFR & IFR Noise Dependency:

10R/10L

Jet/Jet:	Use 2.00 minutes (1.00 minute added to std Jet/Jet) When Heavy or 757 is lead aircraft, use 2.00 minutes
Turboprop/Turboprop:	Use 2.00 minutes (1.00 minute added to std Turboprop/Turboprop)
Turboprop/Jet:	Use 2.00 minutes (0.00 minutes added to std Turboprop/Jet)
Jet/Turboprop:	Use 1.25 minutes (0.25 minutes added to std Jet/Turboprop) When Heavy is lead aircraft, add 0.25 minutes to std Heavy/Turboprop When 757 is lead aircraft, add 0.25 minutes to std 757/Turboprop

Departure on 10L followed by a Departure on 10R -- VFR & IFR Noise Dependency:

10L/10R

Jet/Jet:	Use 0.66 minutes (0.34 minutes subtracted from std Jet/Jet) When Heavy is lead aircraft, subtract 0.34 minutes from std Heavy/Jet When 757 is lead aircraft, subtract 0.34 minutes from std 757/Jet
Turboprop/Turboprop:	Use 0.66 minutes (0.34 minutes subtracted from std Turboprop/Turboprop)
Turboprop/Jet:	Use 2.00 minutes (0.00 minutes subtracted from std Turboprop/Jet)
Jet/Turboprop:	Use 0.66 minutes (0.34 minutes subtracted from std Jet/Turboprop)
Heavy/Turboprop:	When Heavy is lead aircraft, subtract 0.34 minutes from std Heavy/Turboprop When 757 is lead aircraft, subtract 0.34 minutes from std 757/Turboprop

Note: Turboprop can be LTP or S+.

OTHER DEPARTURE DEPENDENCIES

Accepted by PDX Team on 10/30/00

Additional IFR1 Dependencies due to Departure Air Crossovers

A/D IFR1 Runway Dependencies due to Departure Air Crossovers

-- from 1996 PDX Study (Data Pkg 13, Appendix A, page A-9)

In IFR1, there is an additional runway dependency for an aircraft departing the north runway, turning south, and crossing over the south runway. The arrival on the south runway must have landing assured before the southbound departure can be released.

Similarly, in IFR1, there is an additional runway dependency for an aircraft departing the south runway, turning north, and crossing over the north runway. The arrival on the north runway must have landing assured before the southbound departure can be released.

Arrival/Departure Turning and Crossing the Arrival Runway

South Runway/North Runway:	IFR1:	5 seconds (for arrival to have landing assured)
North Runway/South Runway:	IFR1:	5 seconds (for arrival to have landing assured)

D/A IFR1 Runway Dependencies due to Departure Air Crossovers

-- from 1996 PDX Study (Data Pkg 13, Appendix A, page A-9)

In IFR1, there is an additional runway dependency for an aircraft departing the north runway, turning south, and crossing over the south runway. The arrival on the south runway must be at least 2 NM in-trail behind the southbound departure when the southbound departure is released.

Similarly, in IFR1, there is an additional runway dependency for an aircraft departing the south runway, turning north, and crossing over the north runway. The arrival on the north runway must be at least 2 NM in-trail behind the departure when the northbound departure is released.

The D/A separation of 2 NM must be adjusted to reflect the offsets of the runway thresholds.

Departure/Arrival (when departure turns and crosses the arrival runway)

28R/28L:	IFR1:	2.3 NM (distance of arrival from its threshold) (2 NM + 0.3 NM offset)
28L/28R:	IFR1:	1.7 NM (distance of arrival from its threshold) (2 NM - 0.3 NM offset)
10R/10L:	IFR1:	2.9 NM (distance of arrival from its threshold) (2 NM + 0.9 NM offset)
10L/10R:	IFR1:	1.1 NM (distance of arrival from its threshold) (2 NM - 0.9 NM offset)

Note: These A/D and D/A dependencies protect *for* a missed approach.

OPERATIONAL PROCEDURES AND MINIMA -- SIMULATED (UPDATED 8/11/00) **Accepted by PDX Team on 10/12/00**

At the July 20, 2000 meeting, the Design Team agreed it was reasonable to use the values from the 1996 PDX Study. With the addition of the new tower and CAT I ILS approaches to 10R and 28L, the minimums changed from 1996 minimums. However, the Design Team agreed that the percentages of VFR1, VFR2, and IFR1 were still reasonable to use in the annual delay calculations.

Weather	VFR1	VFR2	IFR1	
MINIMA	VISUAL	<VIS & ≥IFR	CAT I	ALL WEATHER
Ceiling:	3500'	2000'	200'	
Visibility:	10 miles	5 miles	0.5 miles	
EAST FLOW (10s)	35.3%	9.2%	7.8%	52.3%
WEST FLOW (28s)	39.1%	5.0%	3.6%	47.7%
	-----	-----	-----	-----
TOTAL	74.4%	14.2%	11.4%	100.0%

1996 PDX Study -- PDX Tower:

- All aircraft usually do or can operate in IFR1 & IFR2.
- Fog usually occurs from sunrise to 10am.
- VFR3 is not needed.
- VFR2 usually occurs in full days; thus, the VFR2 Factor = 1.
- IFR1 usually occurs in full days; thus, the IFR1 Factor = 1.

1996 PDX Study -- Design Team:

- At the January 18, 1995 meeting, the Design Team agreed to simulate only VFR1, VFR2, and IFR1 based on the list of improvements.
- The Technical Center compared the Port of Portland's 4 years of runway use data (1990-1993), presented at the May 1995 meeting, to the 10 years of runway use data (1979-1988) summarized above. For all weather conditions, both sets of data showed the East Flow usage was 52.3% and the West Flow usage was 47.7%. At the July 1995 meeting, the Design Team agreed to use the above values, *Operational Procedures and Runway Utilization Simulated*, for the SIMMOD annualizations**.**

RUNWAY EXIT DATA -- 1996 STUDY (WITH 2000 CLASSES) Accepted by PDX Team on 10/12/00 (UPDATED 8/11/00)

Note: At the July 20th meeting, the Design Team agreed to use the 1996 exit data for this study. The tables were updated to reflect the changes in the aircraft class definitions.

Runway 10R -- 1996 PDX STUDY (With 2000 Classes)

Exit Distance	E 4600'	---	B5/F 6900'*	B6/C6 8500'	TOTAL	
Heavy Usage			70%	30%	100%	Adjusted by
ROT			53	64	56 sec	Tower & FAATC 12/94
757 Usage	17%		81%	2%	100%	
ROT	40		53	64	51 sec	
Large Jet Usage	17%		81%	2%	100%	
ROT	40		53	64	51 sec	
LTP Usage	41%		54%	5%	100%	LTP treated
ROT	40		55	57	49 sec	as Medium in 1996 Study
Small+ Usage	41%		54%	5%	100%	Small+ treated
ROT	40		55	57	49 sec	as Medium in 1996 Study
Small Usage	93%		7%		100%	
ROT	47		60		48 sec	

Notes: Distance in feet from threshold. Conditions were VFR and dry. Observed by PDX Tower.
Exits B3/B4 have been added about 5,600' from the 10R threshold.
Most of the 2000 data collection had a key taxiway closed that affected exit usage.
At the July 2000 meeting, the Design Team agreed to use the 1996 exit data for this study.

Runway 10L -- 1996 PDX STUDY (With 2000 Classes)

Exit Distance	A5 3400'rhs	A4 4200'	A2/A3 5900'*	A1/END 8000'	TOTAL	
Heavy Usage			80%	20%	100%	
ROT			51	65	54 sec	
757 Usage	5%	5%	74%	16%	100%	
ROT	37	37	51	65	52 sec	
Large Jet Usage	5%	5%	74%	16%	100%	
ROT	37	37	51	65	52 sec	
LTP Usage	28%	50%	22%		100%	LTP treated
ROT	37	42	58		44 sec	as Medium in 1996 Study
Small+ Usage	28%	50%	22%		100%	Small+ treated
ROT	37	42	58		44 sec	as Medium in 1996 Study
Small Usage	16%	84%			100%	
ROT	42	47			46 sec	

Notes: Distance in feet from threshold. Conditions were VFR and dry. Observed by PDX Tower.

Legend: % - Exit Utilization (percent)
s - Runway Occupancy Time (seconds)
h - High Speed Exit (angled exit)
rhs - Reverse High Speed Exit (reverse angled exit)
* - Combination of h, rhs, and 90° exits

RUNWAY EXIT DATA (cont) **Accepted by PDX Team on 10/12/00**

Runway 28R -- 1996 PDX STUDY (With 2000 Classes)

Exit	A2/A3	A4	A5	A6	A7/END		
Distance	2100'	3800'	4600'hs	5900'hs	8000	TOTAL	
Heavy Usage				80%	20%	100%	
ROT				44	63	48 sec	
757 Usage		1%	21%	60%	18%	100%	
ROT		35	39	44	63	46 sec	
Large Jet Usage		1%	21%	60%	18%	100%	
ROT		35	39	44	63	46 sec	
LTP Usage		27%	64%	9%		100%	LTP treated
ROT		37	41	50		41 sec	as Medium in 1996 Study
Small+ Usage		27%	64%	9%		100%	Small+ treated
ROT		37	41	50		41 sec	as Medium in 1996 Study
Small Usage	5%	84%	11%			100%	
ROT	24	43	42			42 sec	

Notes: Distance in feet from threshold. Conditions were VFR and dry. Observed by PDX Tower.

Runway 28L -- 1996 PDX STUDY (With 2000 Classes)

Exit	B6/C6	B5/F	CE/E	B2		
Distance	2500'	4100'*	6400'	8500'	TOTAL	
Heavy Usage			80%	20%	100%	
ROT			57	61	58 sec	
757 Usage		18%	80%	2%	100%	
ROT		39	49	61	47 sec	
Large Jet Usage		18%	80%	2%	100%	
ROT		39	49	61	47 sec	
LTP Usage	18%	78%	4%		100%	LTP treated
ROT	31	40	60		39 sec	as Medium in 1996 Study
Small+ Usage	18%	78%	4%		100%	Small+ treated
ROT	31	40	60		39 sec	as Medium in 1996 Study
Small Usage	12%	80%	8%		100%	
ROT	34	42	48		42 sec	

Notes: Distance in feet from threshold. Conditions were VFR and dry. Observed by PDX Tower.
Exits B3/B4 have been added about 5,400' from the 28L threshold.
Most of the 2000 data collection had a key taxiway closed that affected exit usage.
At the July 2000 meeting, the Design Team agreed to use the 1996 exit data for this study.

Runway 3 -- Runway 2 in 1996 PDX STUDY (With 2000 Classes)

Exit	E4	C/CE	B	M		
Distance	2200'	3100'	4400'	4800'hs	TOTAL	
LTP Usage			50%	50%	100%	LTP treated
ROT			45	47	46 sec	as Medium in 1996 Study
Small+ Usage			50%	50%	100%	Small+ treated
ROT			45	47	46 sec	as Medium in 1996 Study
Small Usage	75%	25%			100%	
ROT	34	43			36 sec	

Notes: Distance in feet from threshold. Conditions were VFR and dry. Observed by FAATC.