PROCEEDINGS –

Twenty-fifth Annual Meeting

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TRANSPORTATION RESEARCH FORUM

PROCEEDINGS—

Twenty-fifth Annual Meeting

Theme:

"Beyond Deregulation: Let Freedom Ring!"

October 22-24, 1984
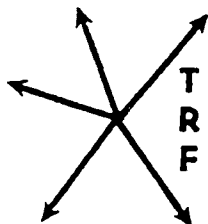Parker House
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TRANSPORTATION RESEARCH FORUM
in conjunction with

CANADIAN TRANSPORTATION RESEARCH FORUM

Airport Demand Analysis Model (ADAM)

*by Dr. Salah Hamzawi**

SUMMARY

ADAM is a computerized analytical model designed to study and analyze traffic demand peaking phenomena at airport terminals. Three types of traffic are handled by the model: enplaning and/or deplaning passengers, departing and/or arriving air carrier aircraft movements, and departing and/or arriving air carrier aircraft seats. The model performs certain statistical analyses on 30-minute traffic throughputs to airport terminals and displays graphically the seasonal and annual distributions of traffic as well as the daily traffic profiles. In addition to its use for analysis of traffic peaking, the model is used in the development of various planning peak standards and determination of planning peak volumes which are utilized in the sizing of airport terminals. The model is also used to synthesize and display the traffic profiles implied by the forecast nominal schedules used in the planning and design of airport facilities.

ANALYSIS TIME INTERVALS

One of the key features of ADAM is its use of a 30-minute time interval as the basic time unit for all analyses. This capability permits the determination of the airport planning peaks and other planning parameters on a "floating" ½-hour basis instead of the existing fixed 60-minute clock hour scheme utilized within the Canadian Air Transportation Administration (CATA). Analyses conducted using ADAM and a similar but clock hour-based model[1] for various Canadian airports revealed significant differences, in certain cases, between the planning peak clock hour and the planning peak floating hour volumes.[2] An interval of 30 minutes was considered appropriate as it represents the average aircraft turnaround time at most airports and entails reasonable data collection and storage requirements for the national airport system. An 18-hour operating day, 6:00 a.m. to midnight, is considered throughout the model analyses. Analysis of air traffic flows at the top 30 airports in Canada showed that this 18-hour period contains, on average, approximately 99% of the 24-hour enplaning passenger traffic and nearly 98% in the deplaning direction.[2]

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DATA BASE

A semi-hourly traffic activity data base for ADAM has been created from the CATA Station Activity Data System. It presently covers the top 30 airport terminals in Canada (which collectively handle more the 90% of the total annual enplaning/deplaning passengers in the country) over a period of 6 years: 1977 to 1982. The Station Activity Data System comprises only scheduled (mainline unit-toll) operations of Air Canada, CP Air, Canadian regional carriers, and foreign airlines. Up to 15 combinations involving 5 traffic sectors (domestic, transborder, other international, total international, and total all sectors) and 3 travel directions (enplaning/departing, deplaning/arriving, and enplaning plus deplaning/departing plus arriving) can be analyzed in one run of the model. Semi-hourly traffic data for only 6 of these combinations are required as a data base. The model internally synthesizes the data pertaining to the remaining 9 combinations. Exhibit 1 illustrates these combinations for passenger traffic flow. The particular Canadian airport terminals included in the data base and the traffic sectors applicable to each appear in Exhibit 2.

MODEL OUTPUTS AND USAGE

The model produces the following outputs for any or all of the above mentioned 15 sector-direction combinations. Computer printouts produced by ADAM for 1982 domestic enplaning/departing traffic at Lester B. Pearson International Airport—Terminal 2 (arbitrarily coded as YZB) are presented here to illustrate these outputs.

(a) A day-by-day listing of traffic demand volumes throughout the year along with certain "total" and "average" traffic indicators including: total annual traffic volume, total number of active days in the year (an active day means a day with traffic activity), total number of active half-hours in the year, average daily volume, average half-hourly traffic throughput, average number of active half-hours per day, and the highest half-hourly traffic peak. Exhibits 3, 4 and 5 demonstrate these outputs for passenger, aircraft and seat traffic flows, respectively.

(b) A tabulation as well as a graphical representation of the seasonal (monthly and quarterly) distribution of traffic on a total and an

TIME OF DAY

MONTH / DAY

6:00 6:30 7:00 . . . . . . 23:30

01 01	x x x x
01 02	x x x x
01 03	x x x x
. .	. . . .
. .	DOMESTIC .
. .	.
12 31	x x x x

#1 D E

#6 E+D *

#11 *

01 01	x x x x
01 02	x x x x
01 03	x x x x
. .	. . .
. .	TRANSBORDER .
12 31	x x x x

#2 D E

#7 E+D *

#12 *

01 01	x x x x
01 02	x x x x
01 03	x x x x
. .	. . .
. .	OTHER INT'L .
12 31	x x x x

#3 D E

#8 E+D *

#13 *

01 01	x x x x
01 02	x x x x
01 03	x x x x
. .	. . .
. .	TOTAL INT'L .
12 31	x x x x

#4 D E *

#9 E+D *

#14 *

01 01	x x x x
01 02	x x x x
01 03	x x x x
. .	. . .
. .	ALL SECTORS .
12 31	x x x x

#5 D E *

#10 E+D *

#15 *

x = Half-hourly traffic volume

E = Enplaning
D = Deplaning

* Dataset generated internally by the model

EXHIBIT 1. Data Structure and Traffic Sector-Direction Combinations

average daily basis. Exhibits 6, 7 and 8 illustrate these distributions for the 3 types of traffic analyzed by the model. In addition to their individual uses, Exhibits 3 to 8 could be used collectively to estimate overall ratios of passengers to aircraft (average aircraft load), passengers to seats (average involvement ratio) and seats to aircraft (average aircraft size) on a daily, monthly, quarterly or annual basis.

(c) An identification of a set of busiest traffic seasons in the year, including: the busiest

month, the busiest 2 consecutive months, the busiest 3 consecutive months, the busiest quarter, and the busiest n (user specified) consecutive days in the year. These are utilized in the development and application of planning peak standards for sizing of air terminal building facilities.[2] Exhibits 6, 7 and 8 show that the busiest season for domestic travel at this particular airport (and indeed at almost all other Canadain airports analyzed by the model) is the summer period. The Exhibits also indicate that the pattern of seasonal

TRAFFIC SECTOR-DIRECTION *

AIRPORT	O.A.G. CODE	DOMESTIC			TRANSBORDER			OTHER INT'L			TOTAL INT'L			ALL SECTORS		
		E R	D A	E+D R+A	E R	D A	E+D R+A	E R	D A	E+D R+A	E R	D A	E+D R+A	E R	D A	E+D R+A
Sault Ste. Marie	YAM	x	x	x												
Edmonton International	YEG	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fredericton	YFC	x	x	x												
Halifax International	YHZ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Kamloops	YKA	x	x	x												
Kelowna	YLW	x	x	x												
Mirabel International	YMX	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ottawa International	YOW	x	x	x	x	x	x							x	x	x
Quebec	YQB	x	x	x												
Windsor	YQG	x	x	x												
Moncton	YQM	x	x	x												
Regina	YQR	x	x	x												
Thunder Bay	YQT	x	x	x	x	x	x							x	x	x
Gander International	YQX	x	x	x												
Sydney	YQY	x	x	x												
Sudbury	YSB	x	x	x												
Saint John, N.B.	YSJ	x	x	x	x	x	x							x	x	x
Montreal (Dorval) Int'l	YUL	x	x	x	x	x	x							x	x	x
Vancouver International	YVR	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Winnipeg International	YWG	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Saskatoon	YXE	x	x	x												
Fort St. John	YXJ	x	x	x												
Prince George	YXS	x	x	x												
Calgary International	YYC	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Charlottetown	YYG	x	x	x												
Victoria International	YYJ	x	x	x	x	x								x	x	x
St. John's, NFLD.	YYT	x	x	x												
Sept-Iles	YZV	x	x	x												
Pearson Int'l (Terminal 1)	YZA	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pearson Int'l (Terminal 2)	YZB	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

* E = Enplaning   D = Deplaning   R = Departing   A = Arriving

EXHIBIT 2. Canadian Airports and Associated Traffic Sectors/Directions

variation is almost identical for passenger, aircraft and seat traffic flows, and that the various busiest periods of traffic activity determined independently by ADAM for each of the 3 types of traffic are virtually the same in this particular example.

(d) A ranking of the days of the year in a descending order according to the daily traffic volume. This is produced in a tabular form as well as a graphical cumulative distribution showing the "traffic percentile" and the "Nth highest day" corresponding to each daily traffic volume. Exhibits 9 and 10 present examples of these outputs for passenger traffic. Similar outputs are produced by ADAM for air carrier aircraft and seat traffic flows.

(e) Rankings and graphical cumulative distributions similar to those produced in (d) are also generated for the hourly and half-hourly traffic throughputs throughout the entire year. Exhibits 11 and 14 show examples of these outputs for enplaning passenger traffic. Again, similar tables and graphs are produced by ADAM for air carrier aircraft movements and seats.

These hourly and half-hourly rankings and cumulative distributions along with those produced in (d) above for the planning day are utilized, inter alia, to develop and apply planning peak standards used by CATA for design of airport terminals[2]

(f) A listing of traffic flow (at the gates) every 30 minutes from 6:00 a.m. to midnight for each day included in the user-selected design busy season(s) as identified in (c) above or alternatively in any user-specified date or period of the year. Exhibit 15 is provided here as an example of the passenger traffic flow pattern during the busiest month of the year. The model collapses the individual daily traffic distributions (profiles) in the selected design busy season into an average (composite) profile that represents a typical (average) day in that season. An ordinate of the composite profile represents the average traffic throughput in the selected season during the half-hour corresponding to that ordinate. The standard deviation of each ordinate is also determined and displayed. Days with no traffic activity during a given half-hour period are excluded in calculating that half-hour's profile ordinate and its standard deviation. The model also produces an adjusted profile whose ordinates are "weighted averages"; thus including the days with zero-traffic activities in determining the profile ordinates. Composite hourly traffic profiles representing 30-minute "moving" blocks (windows) of 1 to 6 hours are also produced as shown in Exhibit 15. these profiles provide certain airport planning peaks and parameters.[2]

(g) Graphical representations of the composite 30- and 60-minute daily profiles of traffic over the 18-hour operating day as determined in (f) above. Any of the busiest seasons deter-

M-DAY	#PAX	M-DAY	#PAX	M-DAY	#PAX	M-DAY	#PAX	M-DAY	#PAX	M-DAY	#PAX	M-DAY	#PAX	M-DAY	#PAX
1- 1	4284	2-16	7177	4- 3	4773	5-19	8211	7- 4	7696	8-19	10285	10- 4	7807	11-19	7196
1- 2	7144	2-17	7818	4- 4	6897	5-20	9008	7- 5	9211	8-20	9551	10- 5	8132	11-20	3868
1- 3	9064	2-18	7982	4- 5	7627	5-21	9043	7- 6	7008	8-21	7008	10- 6	8291	11-21	6283
1- 4	8209	2-19	8301	4- 6	7805	5-22	4779	7- 7	8482	8-22	8497	10- 7	9089	11-22	6489
1- 5	8902	2-20	5497	4- 7	8420	5-23	3477	7- 8	9168	8-23	10173	10- 8	9445	11-23	6439
1- 6	8757	2-21	7323	4- 8	9019	5-24	6398	7- 9	8482	8-24	9723	10- 9	4187	11-24	7432
1- 7	7406	2-22	7931	4- 9	4754	5-25	8320	7-10	6502	8-25	9723	10-10	3426	11-25	6716
1- 8	8762	2-23	7337	4-10	2960	5-26	7917	7-11	7090	8-26	10018	10-11	6720	11-26	8411
1- 9	4625	2-24	8027	4-11	4381	5-27	8510	7-12	8983	8-27	9032	10-12	8503	11-27	3464
1-10	6109	2-25	8141	4-12	8087	5-28	8275	7-13	8044	8-28	6981	10-13	7935	11-28	8049
1-11	8225	2-26	8624	4-13	7740	5-29	5787	7-14	9120	8-29	8030	10-14	8388	11-29	7518
1-12	8278	2-27	8170	4-14	8179	5-30	7357	7-15	9561	8-30	9608	10-15	7973	11-30	7142
1-13	7497	2-28	7805	4-15	8307	5-31	8470	7-16	9043	8-31	9529	10-16	4973	12- 1	6379
1-14	7240	3- 1	8108	4-16	8078	6- 1	8092	7-17	7281	9- 1	8738	10-17	7178	12- 2	5600
1-15	7504	3- 2	7457	4-17	5345	6- 2	8544	7-18	7585	9- 2	9640	10-18	7887	12- 3	6258
1-16	4408	3- 3	8217	4-18	7949	6- 3	8582	7-19	9207	9- 3	9041	10-19	7701	12- 4	3508
1-17	8415	3- 4	7540	4-19	8411	6- 4	8437	7-20	8783	9- 4	5319	10-20	7988	12- 5	5434
1-18	7101	3- 5	8581	4-20	7954	6- 5	5688	7-21	8646	9- 5	5318	10-21	7984	12- 6	6122
1-19	6471	3- 6	5655	4-21	8621	6- 6	7150	7-22	9252	9- 6	7908	10-22	8218	12- 7	6621
1-20	6899	3- 7	7514	4-22	7922	6- 7	8549	7-23	8376	9- 7	8086	10-23	4733	12- 8	6814
1-21	7484	3- 8	7400	4-23	8320	6- 8	7896	7-24	6828	9- 8	9683	10-24	6815	12- 9	6902
1-22	7409	3- 9	7319	4-24	5531	6- 9	8405	7-25	7099	9- 9	9224	10-25	6927	12-10	6683
1-23	4041	3-10	8380	4-25	7109	6-10	8479	7-26	8483	9-10	8350	10-26	7762	12-11	3725
1-24	6818	3-11	7943	4-26	7902	6-11	8430	7-27	9531	9-11	8046	10-27	7183	12-12	4947
1-25	7310	3-12	8188	4-27	7599	6-12	6298	7-28	9344	9-12	7954	10-28	5679	12-13	6136
1-26	6806	3-13	5718	4-28	7681	6-13	7204	7-29	10045	9-13	8637	10-29	7476	12-14	7888
1-27	7286	3-14	7817	4-29	8167	6-14	8904	7-30	10477	9-14	8291	10-30	4089	12-15	8307
1-28	6955	3-15	8100	4-30	8272	6-15	8387	7-31	7814	9-15	8816	10-31	5698	12-16	8448
1-29	7159	3-16	7378	5- 1	5673	6-16	9022	8- 1	7209	9-16	9072	11- 1	6360	12-17	8016
1-30	4323	3-17	8918	5- 2	7417	6-17	9041	8- 2	8414	9-17	9381	11- 2	8424	12-18	8103
1-31	5270	3-18	9152	5- 3	7717	6-18	9237	8- 3	9485	9-18	5580	11- 3	7445	12-19	4878
2- 1	7324	3-19	8716	5- 4	7542	6-19	8535	8- 4	9541	9-19	7770	11- 4	7173	12-20	8642
2- 2	6266	3-20	8040	5- 5	8188	6-20	7854	8- 5	9514	9-20	8615	11- 5	7041	12-21	7986
2- 3	7111	3-21	7088	5- 6	7854	6-21	9498	8- 6	8796	9-21	8214	11- 6	3968	12-22	8029
2- 4	7322	3-22	7015	5- 7	8056	6-22	8650	8- 7	6809	9-22	8722	11- 7	6152	12-23	8387
2- 5	7476	3-23	6807	5- 8	4861	6-23	9182	8- 8	7961	9-23	8835	11- 8	8258	12-24	8250
2- 6	4590	3-24	6815	5- 9	7152	6-24	9113	8- 9	9721	9-24	8461	11- 9	6510	12-25	2460
2- 7	6551	3-25	6048	5-10	8164	6-25	9389	8-10	9717	9-25	5103	11-10	7190	12-26	3091
2- 8	6098	3-26	7355	5-11	7874	6-26	6884	8-11	9205	9-26	7071	11-11	6468	12-27	5144
2- 9	6684	3-27	4617	5-12	8374	6-27	7988	8-12	9980	9-27	7755	11-12	5956	12-28	5617
2-10	7536	3-28	6426	5-13	8192	6-28	9818	8-13	8900	9-28	7973	11-13	3758	12-29	5847
2-11	7485	3-29	7144	5-14	8307	6-29	9490	8-14	7324	9-29	8531	11-14	6895	12-30	5887
2-12	7951	3-30	7088	5-15	5587	6-30	10470	8-15	8659	9-30	8732	11-15	7168	12-31	4033
2-13	5155	3-31	7417	5-16	7480	7- 1	7785	8-16	10054	10- 1	8896	11-16	7809		
2-14	6701	4- 1	7711	5-17	8143	7- 2	8875	8-17	10074	10- 2	5399	11-17	7313		
2-15	7502	4- 2	7344	5-18	7532	7- 3	8443	8-18	9937	10- 3	7317	11-18	7144		

TOTAL #PASSENGERS= 2725360
AVERAGE #PAX/DAY = 7475

NO. ACTIVE HALF-HOURS = 11020
AVERAGE #PAX/HALF-HOUR= 248

AV. #HALF-HOURS/DAY= 30.2 (365 ACTIVE DAYS)
HIGHEST HALF-HOUR PEAK IN THE YEAR= 1210 PAX

EXHIBIT 3. Daily Distribution of Annual Traffic - 1982 'YZB' Enplaning Domestic Passengers

M-DAY	#A/C	M-DAY	#A/C	M-DAY	#A/C	M-DAY	#A/C	M-DAY	#A/C	M-DAY	#A/C	M-DAY	#A/C	M-DAY	#A/C
1-1	55	2-16	84	4-3	65	5-19	88	7-4	80	8-19	93	10-4	88	11-19	85
1-2	63	2-17	86	4-4	76	5-20	90	7-5	93	8-20	87	10-5	88	11-20	63
1-3	84	2-18	87	4-5	83	5-21	93	7-6	94	8-21	74	10-6	88	11-21	68
1-4	74	2-19	88	4-6	88	5-22	84	7-7	94	8-22	83	10-7	85	11-22	84
1-5	87	2-20	67	4-7	83	5-23	65	7-8	93	8-23	96	10-8	90	11-23	81
1-6	90	2-21	75	4-8	89	5-24	79	7-9	97	8-24	95	10-9	65	11-24	83
1-7	88	2-22	88	4-9	74	5-25	89	7-10	76	8-25	92	10-10	65	11-25	83
1-8	85	2-23	85	4-10	62	5-26	89	7-11	83	8-26	93	10-11	77	11-26	85
1-9	67	2-24	85	4-11	70	5-27	89	7-12	96	8-27	95	10-12	89	11-27	63
1-10	68	2-25	85	4-12	85	5-28	93	7-13	95	8-28	78	10-13	87	11-28	69
1-11	82	2-26	83	4-13	88	5-29	70	7-14	95	8-29	84	10-14	85	11-29	83
1-12	86	2-27	69	4-14	87	5-30	74	7-15	94	8-30	95	10-15	91	11-30	83
1-13	84	2-28	80	4-15	84	5-31	90	7-16	95	8-31	83	10-16	64	12-1	80
1-14	81	3-1	84	4-16	88	6-1	90	7-17	74	9-1	91	10-17	89	12-2	78
1-15	86	3-2	84	4-17	66	6-2	88	7-18	83	9-2	84	10-18	86	12-3	82
1-16	67	3-3	84	4-18	78	6-3	88	7-19	95	9-3	97	10-19	88	12-4	62
1-17	76	3-4	78	4-19	85	6-4	83	7-20	83	9-4	76	10-20	89	12-5	68
1-18	79	3-5	87	4-20	87	6-5	70	7-21	91	9-5	78	10-21	85	12-6	83
1-19	84	3-6	67	4-21	87	6-6	74	7-22	95	9-6	85	10-22	91	12-7	85
1-20	85	3-7	78	4-22	86	6-7	90	7-23	95	9-7	95	10-23	64	12-8	85
1-21	86	3-8	85	4-23	89	6-8	91	7-24	76	9-8	92	10-24	88	12-9	84
1-22	86	3-9	85	4-24	68	6-9	88	7-25	84	9-9	94	10-25	88	12-10	85
1-23	51	3-10	88	4-25	75	6-10	88	7-26	92	9-10	96	10-26	86	12-11	61
1-24	80	3-11	86	4-26	89	6-11	92	7-27	96	9-11	76	10-27	82	12-12	67
1-25	80	3-12	84	4-27	91	6-12	70	7-28	91	9-12	68	10-28	59	12-13	87
1-26	84	3-13	68	4-28	90	6-13	75	7-29	89	9-13	86	10-29	91	12-14	83
1-27	85	3-14	78	4-29	89	6-14	89	7-30	96	9-14	88	10-30	64	12-15	83
1-28	84	3-15	85	4-30	92	6-15	87	7-31	75	9-15	85	10-31	86	12-16	85
1-29	84	3-16	83	5-1	70	6-16	89	8-1	83	9-16	85	11-1	84	12-17	88
1-30	56	3-17	87	5-2	75	6-17	89	8-2	87	9-17	87	11-2	75	12-18	68
1-31	60	3-18	87	5-3	90	6-18	91	8-3	96	9-18	65	11-3	84	12-19	58
2-1	80	3-19	87	5-4	89	6-19	75	8-4	92	9-19	69	11-4	83	12-20	78
2-2	83	3-20	68	5-5	89	6-20	83	8-5	93	9-20	86	11-5	88	12-21	84
2-3	81	3-21	76	5-6	90	6-21	95	8-6	93	9-21	87	11-6	64	12-22	89
2-4	85	3-22	83	5-7	91	6-22	97	8-7	75	9-22	85	11-7	88	12-23	88
2-5	84	3-23	85	5-8	70	6-23	96	8-8	83	9-23	87	11-8	84	12-24	68
2-6	69	3-24	86	5-9	76	6-24	93	8-9	91	9-24	90	11-9	84	12-25	42
2-7	78	3-25	72	5-10	89	6-25	94	8-10	94	9-25	66	11-10	85	12-26	54
2-8	84	3-26	87	5-11	90	6-26	76	8-11	94	9-26	67	11-11	78	12-27	71
2-9	84	3-27	67	5-12	89	6-27	83	8-12	96	9-27	86	11-12	86	12-28	73
2-10	86	3-28	77	5-13	91	6-28	95	8-13	97	9-28	87	11-13	84	12-29	72
2-11	85	3-29	86	5-14	93	6-29	92	8-14	75	9-29	86	11-14	69	12-30	72
2-12	86	3-30	86	5-15	70	6-30	95	8-15	83	9-30	86	11-15	84	12-31	63
2-13	69	3-31	87	5-16	75	7-1	80	8-16	96	10-1	90	11-16	84		
2-14	76	4-1	88	5-17	89	7-2	85	8-17	96	10-2	67	11-17	84		
2-15	84	4-2	86	5-18	89	7-3	76	8-18	93	10-3	86	11-18	83		

TOTAL #AIRCRAFT = 30087   NO. ACTIVE HALF-HOURS = 11059   AV. #HALF-HOURS/DAY= 30.3 (365 ACTIVE DAYS)

AVERAGE #A/C/DAY = 82   AVERAGE #A/C/HALF-HOUR= 3   HIGHEST HALF-HOUR PEAK IN THE YEAR= 12 A/C

EXHIBIT 4. Daily Distribution of Annual Traffic - 1982 'YZB' Departing Domestic Aircraft

M-DAY	#STS	M-DAY	#STS	M-DAY	#STS	M-DAY	#STS	M-DAY	#STS	M-DAY	#STS	M-DAY	#STS
1- 1	8950	2-16	12506	4- 3	9843	5-19	13315	7- 4	12081	8-19	13813	10- 4	12271
1- 2	10686	2-17	13424	4- 4	11366	5-20	13175	7- 5	13983	8-20	14590	10- 5	12981
1- 3	12358	2-18	13365	4- 5	12845	5-21	13990	7- 6	14538	8-21	11185	10- 6	13143
1- 4	11200	2-19	14093	4- 6	13412	5-22	10048	7- 7	13661	8-22	12093	10- 7	12961
1- 5	13535	2-20	10307	4- 7	12826	5-23	13767	7- 8	13767	8-23	14423	10- 8	14393
1- 6	14038	2-21	10823	4- 8	13661	5-24	11370	7- 9	14818	8-24	13992	10- 9	9932
1- 7	13759	2-22	12989	4- 9	11335	5-25	13107	7-10	11455	8-25	13713	10-10	9253
1- 8	12925	2-23	12806	4-10	9072	5-26	12791	7-11	12456	8-26	14078	10-11	11584
1- 9	10711	2-24	13140	4-11	10392	5-27	13110	7-12	14449	8-27	14312	10-12	13264
1-10	9841	2-25	13327	4-12	12540	5-28	14273	7-13	14383	8-28	11580	10-13	12699
1-11	12168	2-26	13768	4-13	13281	5-29	10781	7-14	13869	8-29	12527	10-14	12714
1-12	12687	2-27	10563	4-14	13288	5-30	10748	7-15	13988	8-30	14156	10-15	14518
1-13	13139	2-28	12068	4-15	13598	5-31	13553	7-16	14413	8-31	13836	10-16	9720
1-14	11774	3- 1	12813	4-16	14097	6- 1	13344	7-17	10787	9- 1	13501	10-17	10626
1-15	13656	3- 2	12835	4-17	10038	6- 2	12928	7-18	12609	9- 2	14007	10-18	12828
1-16	10281	3- 3	13189	4-18	11661	6- 3	13003	7-19	14096	9- 3	14826	10-19	13345
1-17	11231	3- 4	12112	4-19	12948	6- 4	13862	7-20	13998	9- 4	11462	10-20	13581
1-18	11204	3- 5	13490	4-20	13382	6- 5	10802	7-21	13650	9- 5	11800	10-21	12407
1-19	12574	3- 6	10235	4-21	13134	6- 6	10653	7-22	14281	9- 6	12546	10-22	14052
1-20	13037	3- 7	11879	4-22	12848	6- 7	13388	7-23	14555	9- 7	14003	10-23	9703
1-21	13481	3- 8	12629	4-23	14075	6- 8	13584	7-24	11361	9- 8	13340	10-24	10237
1-22	13800	3- 9	12747	4-24	10105	6- 9	13042	7-25	12894	9- 9	13990	10-25	12419
1-23	8125	3-10	13238	4-25	11054	6-10	13158	7-26	13894	9-10	14611	10-26	12961
1-24	11868	3-11	12701	4-26	13292	6-11	13808	7-27	14786	9-11	11551	10-27	12352
1-25	11882	3-12	13100	4-27	13867	6-12	10750	7-28	13253	9-12	10644	10-28	8985
1-26	12589	3-13	10093	4-28	13349	6-13	11023	7-29	14008	9-13	12571	10-29	13908
1-27	12959	3-14	11651	4-29	13396	6-14	12982	7-30	15342	9-14	12504	10-30	9804
1-28	12937	3-15	12458	4-30	14351	6-15	12779	7-31	11594	9-15	12920	10-31	9842
1-29	12952	3-16	12477	5- 1	10795	6-16	12997	8- 1	12535	9-16	12568	11- 1	12031
1-30	8877	3-17	13187	5- 2	11763	6-17	12934	8- 2	13008	9-17	13398	11- 2	11151
1-31	9570	3-18	13158	5- 3	13444	6-18	13928	8- 3	14425	9-18	10111	11- 3	12023
2- 1	11239	3-19	13440	5- 4	13372	6-19	11438	8- 4	13314	9-19	10883	11- 4	12169
2- 2	12359	3-20	9973	5- 5	13275	6-20	12861	8- 5	13818	9-20	12417	11- 5	13395
2- 3	12588	3-21	11146	5- 6	13334	6-21	14259	8- 6	13912	9-21	12720	11- 6	9855
2- 4	12805	3-22	12334	5- 7	14044	6-22	14388	8- 7	11491	9-22	13426	11- 7	10042
2- 5	13040	3-23	12780	5- 8	10763	6-23	14042	8- 8	12758	9-23	13230	11- 8	12155
2- 6	10448	3-24	12966	5- 9	11367	6-24	13948	8- 9	13780	9-24	13582	11- 9	12050
2- 7	11158	3-25	11170	5-10	12995	6-25	14107	8-10	14191	9-25	10290	11-10	12180
2- 8	12008	3-26	13635	5-11	14079	6-26	11609	8-11	13854	9-26	10087	11-11	10977
2- 9	13481	3-27	10203	5-12	13551	6-27	12481	8-12	14114	9-27	12564	11-12	12633
2-10	12931	3-28	11411	5-13	13718	6-28	14529	8-13	14650	9-28	13035	11-13	9816
2-11	12752	3-29	12383	5-14	14647	6-29	13954	8-14	11229	9-29	13039	11-14	10274
2-12	13416	3-30	12958	5-15	10493	6-30	13857	8-15	12364	9-30	12879	11-15	12387
2-13	10458	3-31	13111	5-16	11334	7- 1	11850	8-16	14123	10- 1	13812	11-16	12578
2-14	11408	4- 1	13371	5-17	12845	7- 2	12816	8-17	14226	10- 2	10096	11-17	12449
2-15	12458	4- 2	13494	5-18	13233	7- 3	11596	8-18	13669	10- 3	9809	11-18	12250

M-DAY	#STS
11-19	13428
11-20	9746
11-21	10245
11-22	12357
11-23	12284
11-24	12269
11-25	12041
11-26	13297
11-27	9888
11-28	10376
11-29	12069
11-30	12136
12- 1	11903
12- 2	11386
12- 3	11903
12- 4	9388
12- 5	10074
12- 6	11800
12- 7	12316
12- 8	12298
12- 9	12207
12-10	13347
12-11	9276
12-12	10123
12-13	11719
12-14	11840
12-15	12166
12-16	12419
12-17	11265
12-18	10994
12-19	8911
12-20	11589
12-21	12537
12-22	13236
12-23	13411
12-24	10499
12-25	6595
12-26	8056
12-27	10176
12-28	10382
12-29	10078
12-30	10059
12-31	8740

TOTAL #A/C SEATS = 4519026
AVERAGE #STS/DAY = 12381

NO. ACTIVE HALF-HOURS = 11059
AVERAGE #STS/HALF-HOUR = 409

AV. #HALF-HOURS/DAY = 30.3 (365 ACTIVE DAYS)
HIGHEST HALF-HOUR PEAK IN THE YEAR = 2280 STS

EXHIBIT 5. Daily Distribution of Annual Traffic - 1982 'YZB' Departing Domestic A/C Seats

MONTHLY TRAFFIC DISTRIBUTION

MONTH	PAX/MONTH	#DAYS	AV.DAILY
1	212459	31	6854
2	200785	28	7170
3	228137	31	7369
4	218495	30	7283
5	229885	31	7416
6	251286	30	8376
7	262338	31	8463
8	279458	31	9015
9	242574	30	8086
10	219449	31	7079
11	191889	30	6396
12	191634	31	6182

QUARTERLY TRAFFIC DISTRIBUTION

PAX/QUARTER	#DAYS	AV.DAILY
641381	90	7126
699686	91	7689
784370	92	8526
602972	92	6564

IN 1982, THE BUSIEST MONTH IS .... MONTH 8
THE BUSIEST TWO CONSECUTIVE MONTHS ARE ..... MONTHS 7 AND 8
THE BUSIEST THREE CONSECUTIVE MONTHS ARE MONTHS 6, 7 AND 8
THE BUSIEST QUARTER IS .... QUARTER 3
THE BUSIEST 90 CONSECUTIVE DAYS ARE .... 6-13 TO 9-10

AVERAGE #PAX/DAY

MONTH		/DAY	/MONTH
1	|#########	6854	212459
2	|#########	7170	200785
3	|#########	7369	228137
4	|#########	7283	218495
5	|#########	7416	229885
6	|#########	8376	251286
7	|#########	8463	262338
8	|#########	9015	279458
9	|#########	8086	242574
10	|#########	7079	219449
11	|#########	6396	191889
12	|#########	6182	191634
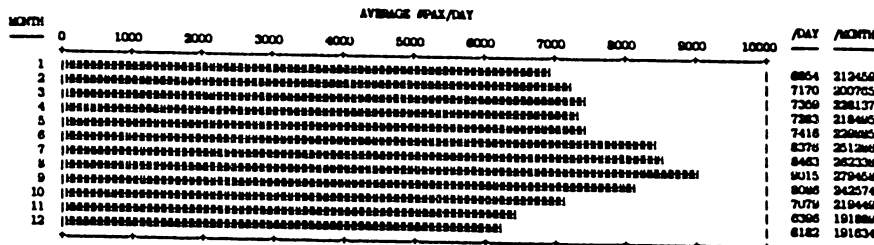
EXHIBIT 6. Seasonal Distribution of Annual Traffic - 1982 'YZB' Enplaning Domestic Passengers

MONTHLY TRAFFIC DISTRIBUTION				QUARTERLY TRAFFIC DISTRIBUTION		
MONTH	A/C/MONTH	#DAYS	AV.DAILY	A/C/QUARTER	#DAYS	AV.DAILY
1	2407·	31	78			
2	2274	28	81	7200	90	80
3	2519	31	81			
4	2473	30	82			
5	2588	31	83	7678	91	84
6	2617	30	87			
7	2753	31	89			
8	2780	31	90	8056	92	88
9	2523	30	84			
10	2480	31	79			
11	2387	30	79	7153	92	78
12	2325	31	75			

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IN 1982, THE BUSIEST MONTH IS ................................ MONTH  8
        THE BUSIEST TWO CONSECUTIVE MONTHS ARE ..... MONTHS  7 AND  8
        THE BUSIEST THREE CONSECUTIVE MONTHS ARE MONTHS  6,  7 AND  8
        THE BUSIEST QUARTER IS ............................. QUARTER 3
        THE BUSIEST  90 CONSECUTIVE DAYS ARE .......... 6-14 TO  9-11
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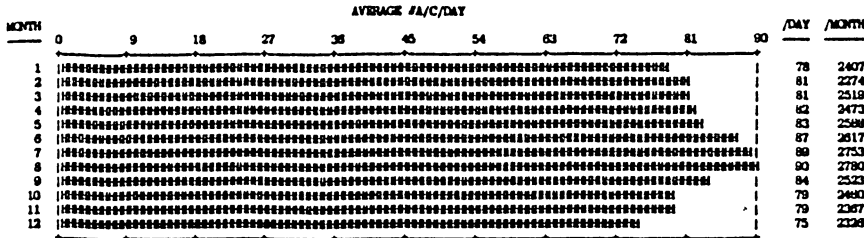

EXHIBIT 7. Seasonal Distribution of Annual Traffic - 1982 'YZB' Departing Domestic Aircraft

MONTHLY TRAFFIC DISTRIBUTION

MONTH	STS/MONTH	#DAYS	AV.DAILY
1	368734	31	11895
2	344332	28	12298
3	381092	31	12293
4	375229	30	12508
5	388720	31	12539
6	390198	30	13007
7	415011	31	13387
8	415727	31	13411
9	377003	30	12567
10	369940	31	11934
11	350343	30	11678
12	342697	31	11055

QUARTERLY TRAFFIC DISTRIBUTION

STS/QUARTER	#DAYS	AV.DAILY
1094158	90	12157
1154147	91	12683
1207741	92	13128
1062980	92	11564

IN 1982, THE BUSIEST MONTH IS .... MONTH 8
THE BUSIEST TWO CONSECUTIVE MONTHS ARE ..... MONTHS 7 AND 8
THE BUSIEST THREE CONSECUTIVE MONTHS ARE MONTHS 6, 7 AND 8
THE BUSIEST QUARTER IS .... QUARTER 3
THE BUSIEST 90 CONSECUTIVE DAYS ARE .... 6-14 TO 9-11

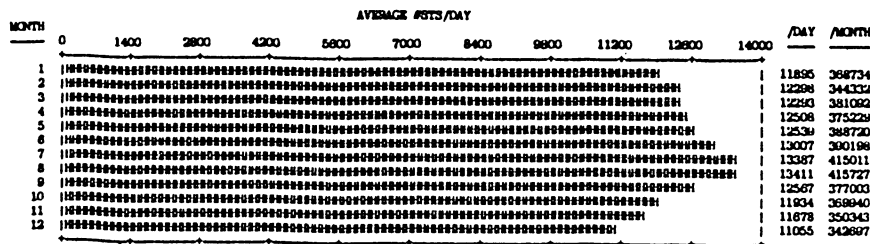**EXHIBIT 8. Seasonal Distribution of Annual Traffic - 1982 'YZB' Departing Domestic A/C Seats**

●●●●●●●●●●●●●●● PLANNING DAY ANALYSIS - 1982 ●●●●●●●●●●●●●●●

M-DAY	RNK	#PAX	%ILE	M-DAY	RNK	#PAX	%ILE	M-DAY	RNK	#PAX	%ILE	M-DAY	RNK	#PAX	%ILE	M-DAY	RNK	#PAX	%ILE
7-30	1	10477	100.0	9-22	74	8722	75.0	9-28	147	7973	52.7	10- 3	220	7317	32.2	11- 1	293	6380	13.8
6-30	2	10470	99.6	3-19	75	8716	74.7	10-15	148	7973	52.4	11-17	221	7313	32.0	12- 1	294	6379	13.5
8-19	3	10285	99.2	10- 1	76	8696	74.3	6-27	149	7968	52.1	1-25	222	7310	31.7	6-12	295	6298	13.3
8-23	4	10173	98.9	8-15	77	8659	74.0	12-21	150	7966	51.8	1-27	223	7286	31.4	11-21	296	6283	13.1
8-17	5	10074	98.5	6-22	78	8650	73.7	8- 8	151	7961	51.5	7-17	224	7281	31.2	2- 2	297	6266	12.8
8-16	6	10054	98.1	7-21	79	8646	73.4	9-12	152	7954	51.2	1-14	225	7240	30.9	12- 3	298	6258	12.6
7-29	7	10045	97.7	9-13	80	8637	73.1	4-30	153	7954	50.9	8- 1	226	7209	30.6	11- 8	299	6256	12.4
8-26	8	10018	97.4	2-26	81	8634	72.8	2-12	154	7951	50.6	6-13	227	7204	30.4	12-24	300	6250	12.2
8-12	9	9980	97.0	4-21	82	8621	72.4	3-11	155	7943	50.4	11-19	228	7198	30.1	2-27	301	6170	11.9
8-18	10	9937	98.6	9-20	83	8615	72.1	10-13	156	7935	50.1	11-10	229	7190	29.8	11- 7	302	6152	11.7
6-28	11	9818	96.3	6- 3	84	8602	71.8	3-22	157	7931	49.8	10-27	230	7183	29.6	12-13	303	6138	11.5
8-25	12	9723	95.9	3- 5	85	8561	71.5	4-22	158	7922	49.5	10-17	231	7178	29.3	12- 6	304	6122	11.3
8-24	13	9723	95.6	6- 7	86	8549	71.2	5-26	159	7917	49.2	2-16	232	7177	29.1	1-10	305	6109	11.0
8- 9	14	9721	95.2	6- 2	87	8544	70.9	9- 6	160	7908	48.9	11- 4	233	7173	28.8	12-18	306	6103	10.8
8-10	15	9717	94.8	9-29	88	8531	70.6	4-26	161	7902	48.6	11-15	234	7168	28.5	11-28	307	6049	10.6
9- 8	16	9683	94.5	5-27	89	8510	70.2	6- 8	162	7898	48.3	1-29	235	7159	28.3	9-11	308	6046	10.4
9- 2	17	9649	94.1	10-12	90	8503	69.9	6-20	163	7854	48.0	5- 9	236	7152	28.0	3-25	309	6046	10.1
9- 9	18	9634	93.8	8-22	91	8497	69.6	5- 6	164	7854	47.7	6- 6	237	7150	27.7	3-20	310	6040	9.9
8-30	19	9608	93.4	7- 9	92	8482	69.3	2-17	165	7818	47.5	11-18	238	7144	27.5	10-31	311	5908	9.7
7-15	20	9581	93.1	6-10	93	8479	69.0	3-14	166	7817	47.2	3-29	239	7144	27.2	12-30	312	5887	9.5
8-20	21	9551	92.7	5-31	94	8470	68.7	2-28	167	7805	46.9	1- 2	240	7144	27.0	11-12	313	5856	9.3
8- 4	22	9541	92.4	9-24	95	8461	68.4	7- 1	168	7785	46.6	11-30	241	7142	26.7	12- 2	314	5850	9.0
7-27	23	9531	92.0	12-16	96	8448	68.1	9-19	169	7770	46.3	2- 3	242	7111	26.4	12-29	315	5847	8.8
8-31	24	9529	91.7	6- 4	97	8437	67.8	10-26	170	7762	46.0	4-25	243	7109	26.2	5-29	316	5787	8.6
8- 5	25	9514	91.3	6-11	98	8430	67.4	9-27	171	7755	45.7	1-18	244	7101	25.9	3-13	317	5718	8.4
6-21	26	9498	91.0	4- 7	99	8420	67.1	4-13	172	7740	45.5	7-25	245	7099	25.7	6- 5	318	5688	8.2
6-29	27	9490	90.6	8- 2	100	8414	66.8	5- 3	173	7717	45.2	3-21	246	7096	25.4	10-28	319	5679	8.0
8- 3	28	9485	90.3	4-19	101	8411	66.5	4- 1	174	7711	44.9	7-11	247	7090	25.1	5- 1	320	5673	7.8
10- 8	29	9445	89.9	6- 9	102	8405	66.2	10-19	175	7701	44.6	9-26	248	7071	24.9	3- 6	321	5655	7.6
6-25	30	9389	89.6	10-14	103	8388	65.9	12-14	176	7698	44.3	3-30	249	7068	24.6	12-28	322	5617	7.4
12-23	31	9387	89.2	6-15	104	8387	65.6	7- 4	177	7686	44.0	11- 5	250	7041	24.4	5-15	323	5587	7.1
9-17	32	9381	88.9	3-10	105	8380	65.3	4-28	178	7681	43.8	3-22	251	7015	24.1	9-18	324	5580	6.9
1- 3	33	9364	88.6	7-23	106	8378	65.0	5-11	179	7674	43.5	8-21	252	7002	23.8	4-24	325	5531	6.7
7-28	34	9344	88.2	5-12	107	8374	64.7	10-18	180	7667	43.2	2- 8	253	6998	23.6	2-20	326	5497	6.5
9- 3	35	9341	87.9	9-10	108	8350	64.4	4- 5	181	7627	42.9	8-28	254	6981	23.3	12- 5	327	5424	6.3
7- 6	36	9330	87.5	5-25	109	8320	64.1	7-31	182	7614	42.6	1-28	255	6955	23.1	10- 2	328	5399	6.1
7-22	37	9252	87.2	4-23	110	8320	63.8	11-16	183	7609	42.4	10-25	256	6927	22.8	4-17	329	5345	5.9
6-18	38	9237	86.9	5-14	111	8307	63.4	10- 4	184	7607	42.1	12- 9	257	6902	22.6	9- 4	330	5319	5.7
7- 5	39	9211	86.5	4-15	112	8307	63.1	4- 6	185	7605	41.8	1-20	258	6899	22.3	9- 5	331	5318	5.5
7-19	40	9207	86.2	2-19	113	8301	62.8	4-27	186	7599	41.5	11-14	259	6885	22.1	1-31	332	5270	5.4

M-DAY	RNK	#PAX	%ILE	M-DAY	RNK	#PAX	%ILE	M-DAY	RNK	#PAX	%ILE	M-DAY	RNK	#PAX	%ILE	M-DAY	RNK	#PAX	%ILE
12-15	68	8807	76.9	2-24	141	8027	54.4	2-23	214	7337	33.9	11-23	287	6439	15.2	12-11	360	3725	0.7
8- 6	69	8796	76.6	12-17	142	8016	54.2	2- 1	215	7324	33.6	3-24	288	6426	14.9	12- 4	361	3508	0.5
7-20	70	8783	76.3	4-18	143	7999	53.9	6-14	216	7324	33.3	11- 2	289	6424	14.7	11-27	362	3464	0.5
1- 6	71	8757	75.9	10-20	144	7986	53.6	2-21	217	7323	33.0	1-17	290	6415	14.5	10-10	363	3426	0.3
9- 1	72	8738	75.6	10-21	145	7984	53.3	2- 4	218	7322	32.8	11-26	291	6411	14.2	4-10	364	2980	0.2
9-30	73	8732	75.3	2-18	146	7982	53.0	3- 9	219	7319	32.5	5-24	292	6398	14.0	12-25	365	2460	0.1

TOTAL #PASSENGERS= 2728369   AVERAGE #PASSENGERS/DAY= 7475   AVERAGE #ACTIVE HALF-HOURS/DAY=30.2

EXHIBIT 9. Ranking and percentiles of Daily Traffic Flow - 1982 'YZB' Enplaning Domestic Passengers
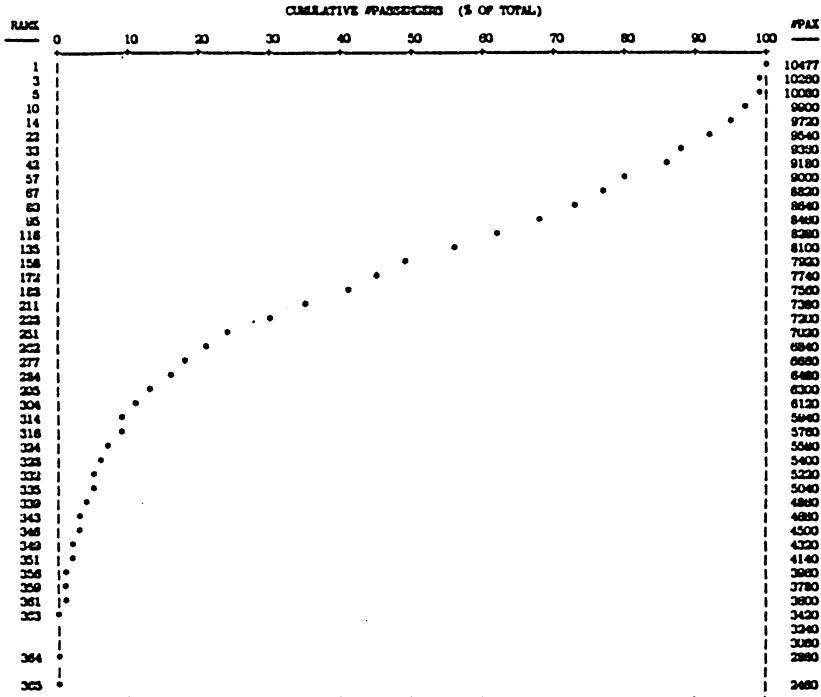
EXHIBIT 10. Cumulative Distribution of Ranked Daily Traffic Flows - 1982 'YZB' Enplaning Domestic Passengers

●●●●●●●●●●●●●●●● PLANNING 60-MINUTE ANALYSIS - 1982 ●●●●●●●●●●●●●●●●

%ILE	60-M PAX	RANK	%ILE	60-M PAX	RANK	%ILE	60-M PAX	RANK	%ILE	60-M PAX	RANK	%ILE	60-M PAX	RANK
100.0	1888-1881	1	96.0	1184-1177	87	76.3	880-873	844	42.8	576-569	1949	13.5	272-265	3924
99.9	1792-1785	2	95.8	1176-1169	91	75.7	872-865	671	41.9	568-561	1986	12.9	264-257	4000
99.9	1736-1729	3	95.6	1168-1161	97	74.8	864-857	700	41.2	560-553	2026	12.2	256-249	4078
99.8	1680-1673	4	95.4	1160-1153	101	73.9	856-849	727	40.4	552-545	2066	11.5	248-241	4163
99.7	1608-1601	5	95.2	1152-1145	106	73.1	848-841	752	39.6	544-537	2110	10.7	240-233	4244
99.7	1576-1569	6	95.0	1144-1137	112	72.3	840-833	775	38.7	536-529	2148	10.0	232-225	4324
99.6	1560-1553	7	94.8	1136-1129	118	71.6	832-825	801	37.9	528-521	2190	9.3	224-217	4401
99.6	1544-1537	9	94.5	1128-1121	124	70.8	824-817	825	37.1	520-513	2219	8.7	216-209	4473
99.5	1528-1521	10	94.3	1120-1113	134	70.1	816-809	846	36.6	512-505	2262	8.1	208-201	4549
99.4	1472-1465	11	93.9	1112-1105	143	69.5	808-801	881	35.8	504-497	2297	7.6	200-193	4635
99.3	1456-1449	12	93.5	1104-1097	155	68.4	800-793	913	35.1	496-489	2348	7.0	192-185	4724
99.3	1432-1425	13	93.0	1096-1089	168	67.5	792-785	937	34.3	488-481	2369	6.3	184-177	4809
99.2	1424-1417	14	92.5	1088-1081	180	66.8	784-777	959	33.5	480-473	2433	5.8	176-169	4896
99.2	1416-1409	15	92.0	1080-1073	188	66.2	776-769	983	32.7	472-465	2489	5.2	168-161	4975
99.1	1408-1401	16	91.7	1072-1065	197	65.5	768-761	1013	31.8	464-457	2544	4.7	160-153	5075
99.1	1392-1385	18	91.3	1064-1057	205	64.6	760-753	1056	30.8	456-449	2582	4.2	152-145	5184
99.0	1384-1377	20	91.0	1056-1049	222	63.5	752-745	1083	30.2	448-441	2637	3.7	144-137	5235
98.9	1376-1369	21	90.4	1048-1041	233	62.7	744-737	1108	29.3	440-433	2691	3.3	136-129	5333
98.8	1368-1361	22	89.9	1040-1033	240	62.0	736-729	1137	28.5	432-425	2746	2.8	128-121	5409
98.8	1360-1353	23	89.7	1032-1025	256	61.3	728-721	1177	27.6	424-417	2793	2.5	120-113	5482
94.7	1352-1345	28	89.1	1024-1017	273	60.2	720-713	1221	26.9	416-409	2840	2.2	112-105	5550
98.6	1328-1321	27	88.4	1016-1009	292	59.0	712-705	1265	26.2	408-401	2904	1.9	104-97	5631
98.5	1320-1313	31	87.7	1008-1001	308	57.9	704-697	1297	25.2	400-393	2953	1.6	96-89	5709
98.3	1312-1305	32	87.1	1000-993	321	57.1	696-689	1344	24.5	392-385	3001	1.4	88-81	5794
98.3	1296-1289	35	86.7	992-985	340	55.9	688-681	1384	23.8	384-377	3047	1.1	80-73	5880
98.2	1288-1281	38	86.0	984-977	357	54.9	680-673	1423	23.2	376-369	3113	0.9	72-65	5989
98.0	1280-1273	41	85.4	976-969	369	53.9	672-665	1465	22.3	368-361	3174	0.6	64-57	6059
97.9	1272-1265	44	84.9	968-961	383	52.9	664-657	1504	21.5	360-353	3228	0.4	56-49	6155
97.7	1264-1257	48	84.1	960-953	414	51.9	656-649	1541	20.8	352-345	3295	0.2	48-41	6216
97.6	1256-1249	47	83.4	952-945	432	51.0	648-641	1563	19.9	344-337	3361	0.1	40-33	6279
97.6	1248-1241	52	82.7	944-937	447	50.1	640-633	1623	19.1	336-329	3413	0.1	32-25	6319
97.4	1240-1233	54	82.2	936-929	472	49.1	632-625	1659	18.4	328-321	3472	0.0	24-17	6333
97.3	1232-1225	58	81.4	928-921	496	48.3	624-617	1701	17.7	320-313	3531	0.0	16-9	6350
97.1	1224-1217	60	80.6	920-913	513	47.3	616-609	1738	17.1	312-305	3594	0.0	8-1	6355
97.0	1216-1209	67	80.0	912-905	542	46.1	608-601	1793	16.3	304-297	3653			
96.7	1208-1201	75	79.0	904-897	567	45.3	600-593	1825	15.7	296-289	3714			
96.3	1200-1193	79	78.2	896-889	597	44.6	592-585	1870	15.0	288-281	3779			
96.2	1192-1185	83	77.2	888-881	626	43.8	584-577	1908	14.4	280-273	3862			

TOTAL #PASSENGERS= 2728369   #ACTIVE 60-MINUTE PERIODS= 6355   AVERAGE #PASSENGERS/60-MINUTES= 429

EXHIBIT 11. Ranking and Percentiles of 60-minute Traffic Flows - 1982 'YZB' Enplaning Domestic Passengers

CUMULATIVE #PASSENGERS (% OF TOTAL)
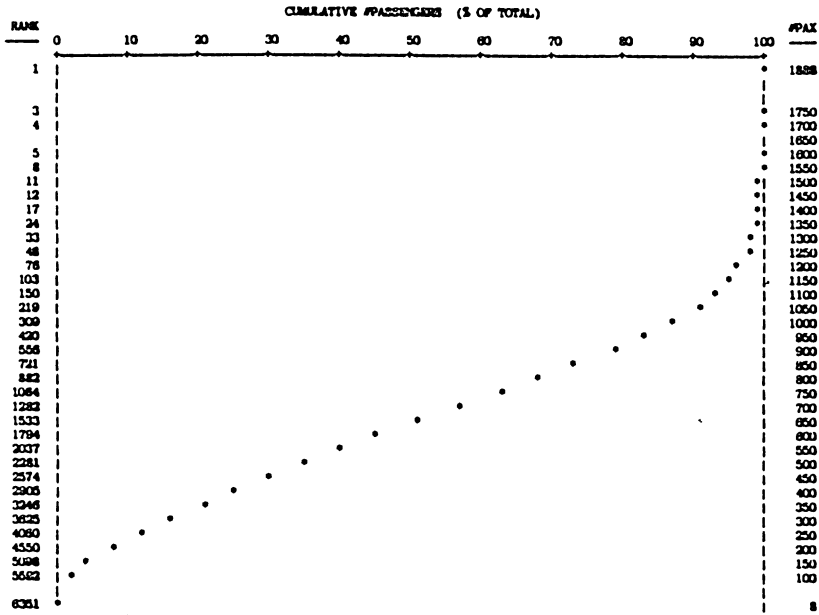
EXHIBIT 12. Cumulative Distribution of Ranked 60-minute Traffic Flows - 1982 'YZB' Enplaning Domestic Passengers

●●●●●●●●●●●●●●●●● PLANNING 30-MINUTE ANALYSIS - 1982 ●●●●●●●●●●●●●●●●●

%ILE	30-M PAX	RANK	%ILE	30-M PAX	RANK	%ILE	30-M PAX	RANK	%ILE	30-M PAX	RANK	%ILE	30-M PAX	RANK
100.0	1210-1306	1	96.3	795- 791	130	85.2	595- 591	591	64.8	395- 391	2342	21.2	195- 191	5549
100.0	1075-1071	5	96.1	790- 786	128	84.6	540- 586	616	54.1	390- 386	2404	20.5	190- 186	5711
99.8	1040-1036	6	95.9	785- 781	137	84.1	585- 581	639	53.2	385- 381	2478	19.6	185- 181	5822
99.8	1035-1031	7	95.6	780- 776	146	83.6	580- 576	661	52.2	380- 376	2538	18.9	180- 176	5955
99.7	1030-1026	8	95.4	775- 771	150	83.1	575- 571	696	51.3	375- 371	2611	18.0	175- 171	6044
99.7	1025-1021	9	95.3	770- 766	156	82.6	570- 566	719	50.3	370- 366	2665	17.1	170- 166	6212
99.6	1020-1016	10	95.1	765- 761	161	81.9	565- 561	753	49.6	365- 361	2734	16.4	165- 161	6375
99.6	1015-1011	11	95.0	760- 756	169	81.2	560- 556	785	48.7	360- 356	2803	15.4	160- 156	6531
99.6	1005-1001	13	94.7	755- 751	173	80.5	555- 551	825	47.8	355- 351	2884	14.5	155- 151	6677
99.5	980- 976	14	94.6	750- 746	182	79.7	550- 546	857	46.7	350- 346	2957	13.7	150- 146	6845
99.5	975- 971	15	94.4	745- 741	191	79.1	545- 541	897	45.8	345- 341	3043	12.8	145- 141	6993
99.4	970- 966	17	94.1	740- 736	199	78.3	540- 536	940	44.7	340- 336	3105	12.0	140- 136	7146
99.4	965- 961	19	93.9	735- 731	213	77.5	535- 531	972	44.0	335- 331	3173	11.2	135- 131	7301
99.3	955- 951	20	93.6	730- 726	220	76.8	530- 526	1005	43.1	330- 326	3242	10.5	130- 126	7446
99.3	945- 941	24	93.4	725- 721	223	76.2	525- 521	1040	42.3	325- 321	3309	9.8	125- 121	7620
99.1	940- 936	25	93.3	720- 716	228	75.5	520- 516	1088	41.5	320- 316	3391	9.0	120- 116	7785
99.1	935- 931	31	93.2	715- 711	232	75.0	515- 511	1107	40.6	315- 311	3465	8.4	115- 111	7925
98.9	930- 926	32	93.1	710- 706	242	74.3	510- 506	1146	39.7	310- 306	3528	7.7	110- 106	8097
98.8	920- 916	33	92.8	705- 701	246	73.5	505- 501	1185	39.0	305- 301	3601	7.0	105- 101	8277
98.8	915- 911	35	92.6	700- 696	258	72.8	500- 496	1224	38.2	300- 296	3686	6.4	100- 96	8467
98.7	900- 896	36	92.4	695- 691	268	72.1	495- 491	1259	37.3	295- 291	3761	5.6	95- 91	8676
98.7	895- 891	39	92.1	690- 686	277	71.5	490- 486	1289	36.4	290- 286	3845	5.0	90- 86	8884
98.6	890- 886	41	91.9	685- 681	289	70.9	485- 481	1334	36.6	285- 281	3926	4.3	85- 81	9127
98.5	885- 881	45	91.6	680- 676	298	70.0	480- 476	1363	34.7	280- 276	4004	3.6	80- 76	9316
98.4	880- 876	47	91.4	675- 671	309	69.1	475- 471	1443	33.9	275- 271	4080	3.0	75- 71	9495
98.3	875- 871	48	91.1	670- 666	322	68.2	470- 466	1448	33.2	270- 266	4163	2.5	70- 66	9688
98.3	870- 866	52	90.8	665- 661	335	67.5	465- 461	1530	32.3	265- 261	4256	2.1	65- 61	9873
98.2	865- 861	55	90.5	660- 656	536	66.8	460- 456	1586	31.4	260- 256	4344	1.6	60- 56	10044
98.1	820- 856	59	90.2	655- 651	354	65.8	455- 451	1643	30.6	255- 251	4467	1.3	55- 51	10214
98.0	855- 851	63	90.0	650- 646	374	64.9	450- 446	1707	29.5	250- 246	4560	0.9	50- 46	10346
97.8	850- 846	65	89.5	645- 641	396	63.8	445- 441	1761	28.6	245- 241	4658	0.7	45- 41	10460
97.8	845- 841	68	89.0	640- 636	418	62.9	440- 436	1827	27.8	240- 236	4747	0.5	40- 36	10578
97.7	840- 836	72	88.6	635- 631	432	61.9	435- 431	1893	27.0	235- 231	4824	0.4	35- 31	10680
97.6	830- 825	77	88.2	630- 626	453	60.8	430- 426	1935	26.3	230- 226	4914	0.2	30- 26	10769
97.4	825- 821	84	87.7	625- 621	480	60.2	425- 421	1981	25.6	225- 221	4997	0.1	25- 21	10839
97.1	820- 816	96	87.1	620- 616	502	59.5	420- 416	2046	24.9	220- 216	5060	0.1	20- 16	10849
96.8	815- 811	101	86.6	615- 611	520	58.5	415- 411	2103	24.2	215- 211	5173	0.0	15- 11	10969
96.7	810- 806	104	86.2	610- 606	536	57.6	410- 406	2167	23.5	210- 206	5284	0.0	10- 6	11000
96.6	805- 801	107	85.8	605- 601	550	56.6	405- 401	2219	22.8	205- 201	5373	0.0	5- 1	11020
96.5	800- 796	113	85.5	600- 595	565	55.9	400- 396	2292	22.0	200- 196	5464			

TOTAL #PASSENGERS= 2726369   #ACTIVE 30-MINUTE PERIODS=11020   AVERAGE #PASSENGERS/30-MINUTES= 248

**EXHIBIT 13. Ranking and Percentiles of 30-minute Traffic Flows - 1982 'YZB' Enplaning Domestic Passengers**

CUMULATIVE #PASSENGERS (% OF TOTAL)

RANK	0	10	20	30	40	50	60	70	80	90	100	#PAX
1												1210
5												1050
10												1020
13												940
19												980
32												930
36												900
49												870
69												840
102												810
138												780
174												750
224												720
289												690
336												660
433												630
551												600
687												570
838												540
1108												510
1340												480
1644												450
1962												420
2343												390
2735												360
3174												330
3602												300
4081												270
4659												240
5174												210
5823												180
6578												150
7621												120
8377												90
9874												60
11004												5
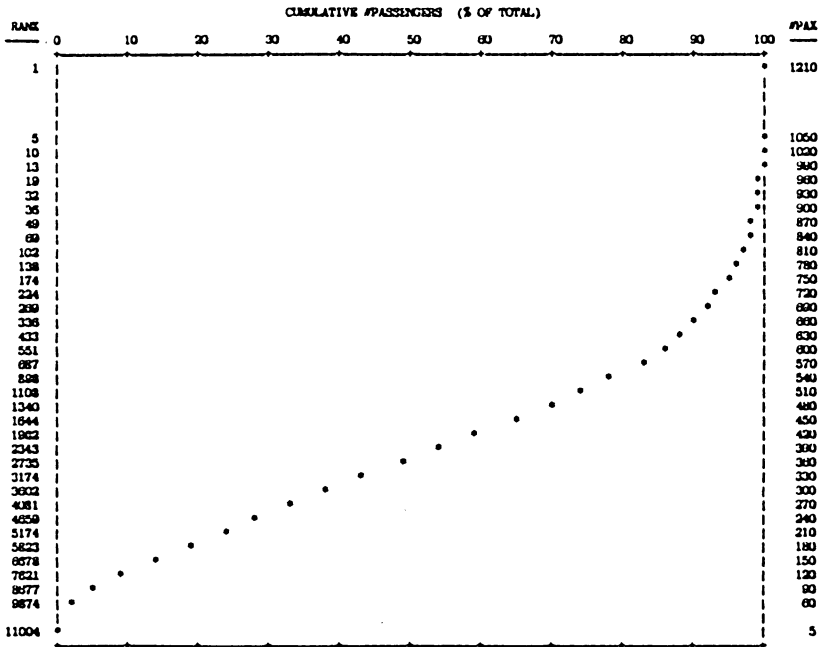
EXHIBIT 14. Cumulative Distribution of Ranked 30-minute Traffic Flows - 1982 'YZB' Enplaning Domestic Passengers

mined by the model (c above) or alternatively a user-selected specific date or period of the year could be chosen by the user to produce these composite profiles. Exhibits 16 and 17 show examples of the half-hourly and hourly composite profiles representing enplaning domestic passengers in the busiest month of the year. Exhibits 18 to 21 present the corresponding profiles generated by the model for the air carrier aircraft and seat flows. The information presented in Exhibits 16 to 21 is used to study the diurnal peaking characteristics of traffic at a given airport by sector and direction of travel. Average half-hourly and hourly ratios similar to those described in (b) could also be estimated from these Exhibits. The hourly profile is produced by ADAM in two formats: a profile in which the 60-minute time interval starts at the clock hour and another in which it starts at the half-hour. Such a scheme captures any "uneven" half-hourly distributions of traffic flows within the hour and ensures that the resulting profile and the airport planning peaks generated from it are realistic.

(h) A summary of planning peaks for day and ½,1,2,3,4,5, and 6 hour peak intervals. The model determines the time of day and traffic volume associated with each of these peaks and expresses their values as percentages of the planning day volume. The development and application of these planning peaks can

be found elsewhere[2]. As an illustration, the planning peak half-hour passengers for a given traffic sector-direction r at a given airport (PPhP), is obtained from the half-hourly conposite profile produced by ADAM for a certain design busy period of the year (e.g. Exhibit 16) as follows:

$$(\text{PPhP})_r = \text{Max}_i \{h_{ir}\} \qquad i = 1,2,3,..., 36$$

subject to $f_{ir} \geq \bar{f}_r \qquad \forall\ i$

where

h_{ir} = i^{th} ordinate of the half-hourly composite profile rerpresenting the selected design busy season for traffic sector-direction r.

f_{ir} = traffic frequency (in days) of the ith ordinate of the profile—i.e. number of days with traffic in that particular i^{th} half-hour of the profile.

$\bar{f}_r$ = minimum frequency (in days) below which an ordinate of the above profile is not considered "reasonably frequent" to qualify as a candidate for PPhP.

OTHER CAPABILITIES OF THE MODEL

In addition to its ability to handle 3 types of traffic: passengers, aircraft, and seats, and its capacity to analyze up to 15 traffic sector-direction combinations in one run, the model has other capabilities:

•••••••••••••••••••• CONCEPT 1 — AVERAGE DAY IN THE BUSIEST MONTH OF THE YEAR (MONTH 8 IN 1982) ••••••••••••••••••••

#PAX PER 30-MINUTES STARTING AT

M-DAY	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	TOTAL
	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	:30	
8- 1	0	156	529	642	275	66	79	361	205	281	193	173	332	344	298	83	55	0	7209
	0	0	0	217	125	0	78	53	545	107	109	558	236	539	254	82	223	33	
8- 2	0	155	348	636	356	134	0	351	334	420	0	189	434	439	391	59	0	0	8414
	9	136	290	215	106	0	75	41	685	193	147	689	197	580	422	166	157	70	
8- 3	0	301	818	480	303	123	82	430	379	240	150	292	387	514	322	137	0	0	9485
	52	263	157	617	110	0	75	67	675	212	105	642	193	732	290	123	168	46	
8-29	0	101	477	565	237	65	71	412	314	442	199	431	355	486	320	245	0	87	8030
	0	0	0	192	75	0	97	50	649	35	117	659	97	789	141	187	85	47	
8-30	0	306	782	853	423	140	124	370	207	403	184	371	425	474	361	69	0	0	9608
	34	265	142	297	133	0	69	47	863	89	133	642	153	583	304	154	180	38	
8-31	0	329	786	623	363	110	101	315	384	697	234	312	575	565	397	72	0	0	9529
	0	242	182	182	87	0	69	45	397	71	133	675	228	418	570	147	169	52	

NO. DAYS 0 16 31 23 31 27 31 31 26 31 0 29 28 31 25 31 31 31 31 30 31 31 31 31 31 31 30 31 31 2 30 7 31

TOTAL #PAX= 279456 (AV. 9015/DAY)   #ACTIVE HALF-HOURS= 954 (AV. 30.8/DAY)   AV.#PAX/30-MIN= 293 (ST DEV= 209)

THE COMPOSITE (AVERAGE) 30-MINUTE PROFILE OF THESE 31 DAYS IS AS FOLLOWS:

	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
AVRGE.	0	228	672	651	333	144	99	362	368	485	210	358	384	495	398	92	186	111
	61	200	196	329	119	0	80	77	561	108	112	585	199	567	299	170	156	49
ST DEV	0	107	181	147	91	50	38	65	91	170	93	110	137	100	75	45	131	19
	42	49	85	163	42	0	21	44	146	54	32	111	90	133	87	60	47	14
WTD AV	0	228	672	651	333	144	83	362	368	495	204	358	384	495	398	92	12	25
	31	148	171	329	108	0	72	62	561	108	112	585	199	567	289	170	151	49

AND THE COMPOSITE HOURLY PROFILES REPRESENTING 30-MINUTE MOVING BLOCKS (WINDOWS) OF 1- TO 6-HOURS ARE:

```
1-HR    61  376  843  980  441  144  155  424  929  802  315  943  583 1082  696  262  168   74
       259  820  821  663  251   99  434  430 1056  311  469  969  694  965  381  182  176
2-HR   204  610  912  711  293  150  290  677  785  459  629  783  823  875  475 · 212  119
       540  821  742  457  167  259  432  743  864  391  719  832  830  673  282  179
3-HR   417  733  755  522  247  241  503  652  616  620  614  862  777  670  371  186
       634  766  579  332  256  316  640  599  612  583  711  876  880  509  246
4-HR   558  660  602  430  291  413  528  568  698  611  726  819  649  544  297
       641  639  455  358  300  501  558  567  701  611  774  752  556  426
5-HR   534  557  513  429  419  451  485  643  674  701  718  707  551  450
       563  528  451  372  451  463  540  647  700  682  696  638  480
6-HR   469  490  498  512  449  428  561  633  739  699  642  617  472
       483  512  447  486  428  464  612  655  744  632  610  561
```

EXHIBIT 15. Analysis of Daily 30-minute Traffic Flows - 1982 'YZB' Enplaning Domestic Passengers

CONCEPT 1 — AVERAGE DAY IN THE BUSIEST MONTH OF THE YEAR   (MONTH 8 IN 1982)

31-DAY   C O M P O S I T E   P R O F I L E   (TRANSFERS INCLUDED)

#PAX PER 30-MINUTES STARTING AT TIME SHOWN

TIME	0	70	140	210	280	350	420	490	560	630	700	#PAX	#DAYS
6:00												0	0
6:30												61	18
7:00												238	31
7:30												200	23
8:00												672	31
8:30												196	27
9:00												651	31
9:30												329	31
10:00												333	31
10:30												119	28
11:00												144	31
11:30												0	0
12:00												99	25
12:30												81	23
13:00												352	31
13:30												77	25
14:00												365	31
14:30												661	31
15:00												425	31
15:30												108	31
16:00												210	30
16:30												112	31
17:00												358	31
17:30												545	31
18:00												364	31
18:30												199	31
19:00												405	31
19:30												567	31
20:00												348	31
20:30												294	30
21:00												92	31
21:30												170	31
22:00												186	2
22:30												156	30
23:00												111	7
23:30												49	31
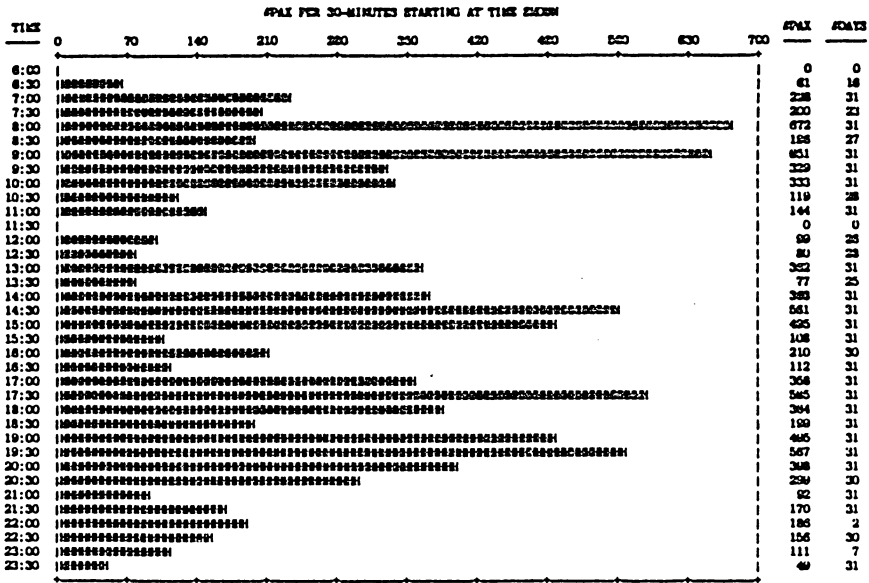
PLANNING PEAK PERIOD ...	1/2 HR	1-HR	2-HR	3-HR	4-HR	5-HR	6-HR	DAY
PLANNING PEAK STARTS AT	8:00	19:00	8:00	17:30	17:00	16:00	14:30	
PLANNING PEAK PASSENGERS	672	1052	1823	2628	3275	3590	4464	9015
% OF PLANNING PEAK DAY	7.45	11.74	20.22	29.15	36.33	39.82	49.52	100.

EXHIBIT 16. 30-minute Traffic Flow Profile — Planing Peaks - 1982 'YZB' Enplaning Domestic Passengers

31-DAY COMPOSITE PROFILE   (WEEKENDS INCLUDED)

#PAX PER 60-MINUTES STARTING AT TIME SHOWN

TIME	0	110	220	330	440	550	660	770	880	990	1100	#PAX	#DAYS
6:00												61	16
7:00												376	31
8:00												843	31
9:00												980	31
10:00												441	31
11:00												144	31
12:00												155	31
13:00												434	31
14:00												929	31
15:00												602	31
16:00												315	31
17:00												943	31
18:00												583	31
19:00												1082	31
20:00												688	31
21:00												262	31
22:00												168	30
23:00												74	31
6:30												259	31
7:30												820	31
8:30												821	31
9:30												665	31
10:30												251	31
11:30												99	26
12:30												434	31
13:30												430	31
14:30												1056	31
15:30												311	31
16:30												489	31
17:30												989	31
18:30												694	31
19:30												965	31
20:30												381	31
21:30												182	31
22:30												176	31

EXHIBIT 17. 60-minute Traffic Flow Profile & Planing Peaks - 1982 'YZB' Enplaning Domestic Passengers

•••••••••••••••••••• CONCEPT 1 — AVERAGE DAY IN THE BUSIEST MONTH OF THE YEAR (MONTH 8 IN 1982) ••••••••••••••••••••

31-DAY C O M P O S I T E   P R O F I L E   (WEEKENDS INCLUDED)

#A/C PER 30-MINUTES STARTING AT TIME SHOWN

TIME	0	1	2	3	4	5	6	7	8	9	10	#A/C	#DAYS
6:00												0	0
6:30		########										1	16
7:00		##############################								3	31
7:30		#########################								3	23
8:00		###			6	31
8:30		#####################									2	27
9:00		###				5	31
9:30		######################									2	31
10:00		#####################################							4	31
10:30		###########										1	28
11:00		#######################									2	31
11:30												0	0
12:00		########################									2	26
12:30		###########										1	28
13:00		##							4	31
13:30		##########										1	25
14:00		##				5	31
14:30		###################################							4	31
15:00		##################################							4	31
15:30		######################									2	31
16:00		######################									2	31
16:30		######################									2	31
17:00		#######################################						4	31
17:30		#######################################						4	31
18:00		###				5	31
18:30		###############################							3	31
19:00		#################################							4	31
19:30		#################################							4	31
20:00		#################################							4	31
20:30		###########################								3	30
21:00		########################									2	31
21:30		######################									2	31
22:00		#########										1	3
22:30		#####################									2	31
23:00		#########										1	7
23:30		#########										1	31

PLANING PEAK PERIOD ...	1/2 HR	1-HR	2-HR	3-HR	4-HR	5-HR	6-HR	DAY
PLANING PEAK STARTS AT	8:00	7:30	7:30	17:00	17:00	14:00	14:00	
PLANING PEAK AIRCRAFT	6	8	15	23	30	33	41	90
% OF PLANING PEAK DAY	6.67	8.89	16.67	25.56	33.33	36.67	45.56	100.

EXHIBIT 18. 30-minute Traffic Flow Profile & Planing Peaks - 1982 'YZB' Departing Domestic Aircraft
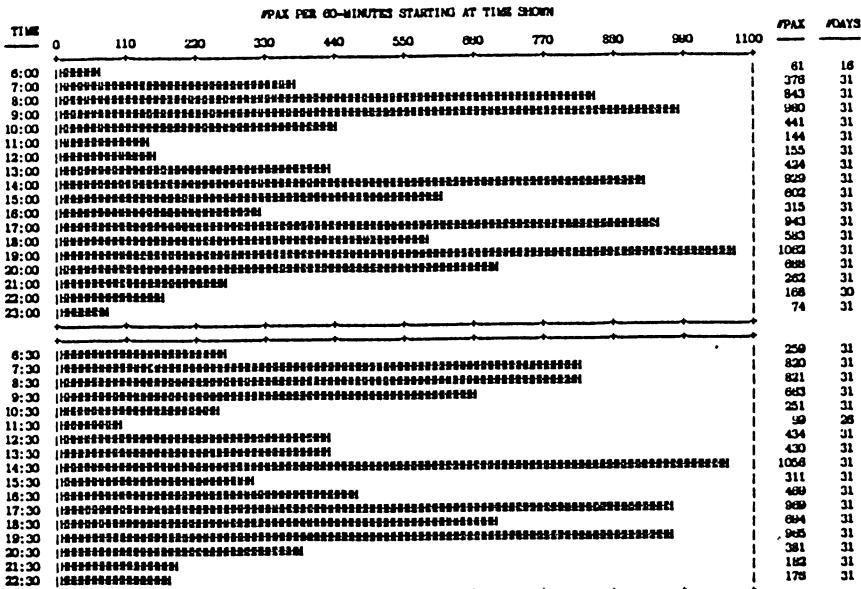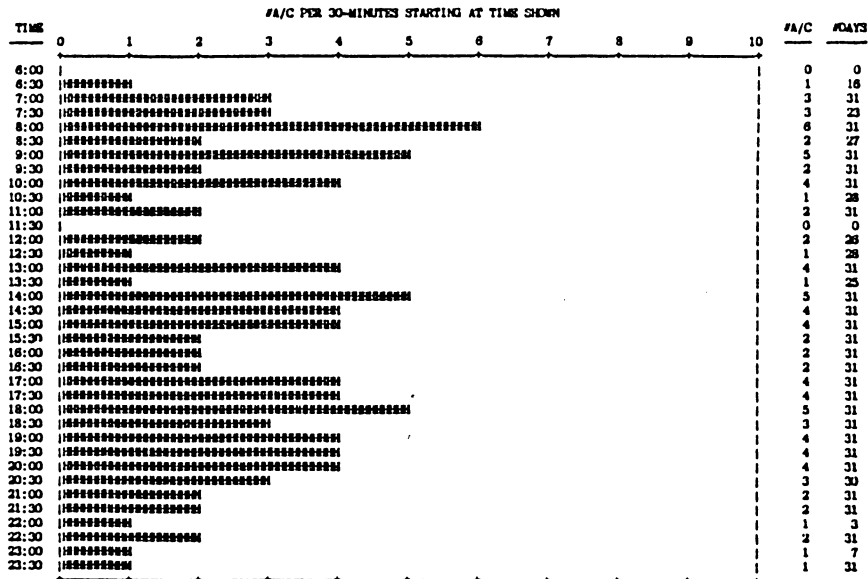
31-DAY COMPOSITE PROFILE (WEEKENDS INCLUDED)

#A/C PER 60-MINUTES STARTING AT TIME SHOWN

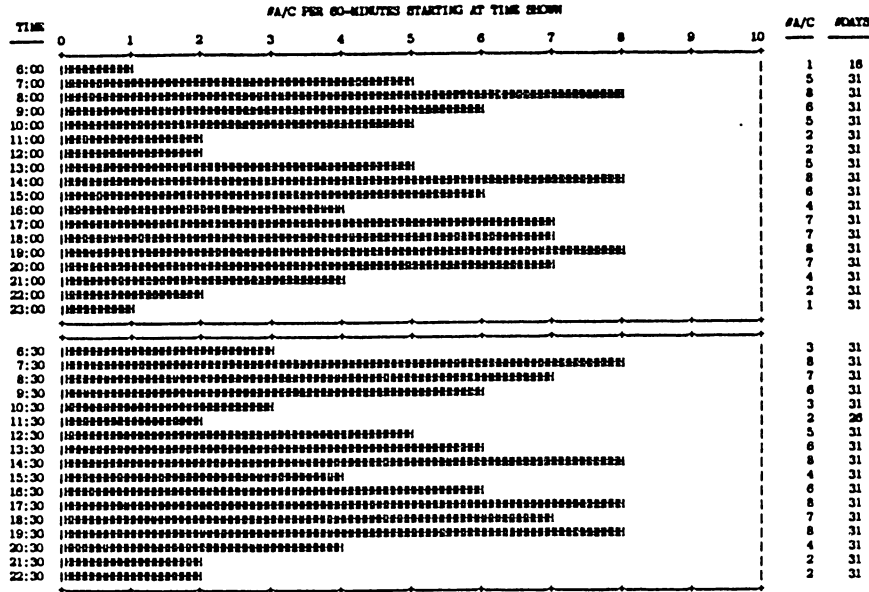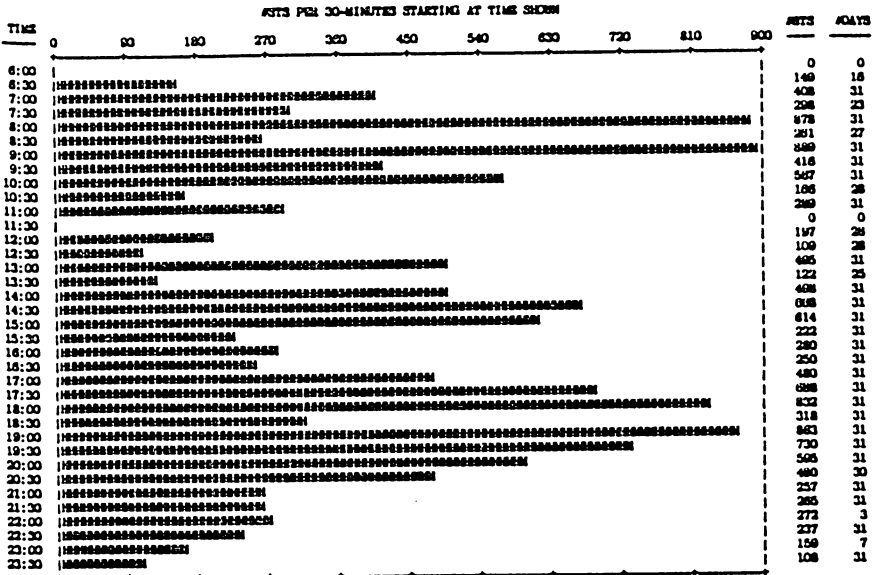| TIME	#A/C	#DAYS
6:00	1	16
7:00	5	31
8:00	8	31
9:00	6	31
10:00	5	31
11:00	2	31
12:00	2	31
13:00	5	31
14:00	8	31
15:00	6	31
16:00	4	31
17:00	7	31
18:00	7	31
19:00	8	31
20:00	7	31
21:00	4	31
22:00	2	31
23:00	1	31
6:30	3	31
7:30	8	31
8:30	7	31
9:30	6	31
10:30	3	31
11:30	2	26
12:30	5	31
13:30	6	31
14:30	8	31
15:30	4	31
16:30	6	31
17:30	8	31
18:30	7	31
19:30	8	31
20:30	4	31
21:30	2	31
22:30	2	31

EXHIBIT 19. 60-minute Traffic Flow Profile & Planing Peaks - 1982 'YZB' Departing Domestic Aircraft

••••••••••••••••••• CONCEPT 1 — AVERAGE DAY IN THE BUSIEST MONTH OF THE YEAR (MONTH 8 IN 1982) •••••••••••••••••••

31-DAY C O M P O S I T E   P R O F I L E   (MAXIMUMS INCLUDED)

SEATS PER 30-MINUTES STARTING AT TIME SHOWN

TIME	0	90	180	270	360	450	540	630	720	810	900	SEATS	#DAYS
6:00												0	0
6:30												149	16
7:00												408	31
7:30												298	23
8:00												878	31
8:30												281	27
9:00												889	31
9:30												416	31
10:00												567	31
10:30												166	28
11:00												289	31
11:30												0	0
12:00												197	28
12:30												109	28
13:00												495	31
13:30												122	25
14:00												408	31
14:30												618	31
15:00												614	31
15:30												222	31
16:00												280	31
16:30												250	31
17:00												480	31
17:30												698	31
18:00												832	31
18:30												318	31
19:00												843	31
19:30												730	31
20:00												565	31
20:30												480	30
21:00												257	31
21:30												265	31
22:00												272	3
22:30												237	31
23:00												159	7
23:30												108	31

PLANING PEAK PERIOD ...	1/2 HR	1-HR	2-HR	3-HR	4-HR	5-HR	6-HR	DAY
PLANING PEAK STARTS AT	9:00	19:00	18:00	17:30	17:00	16:00	14:30	
PLANING PEAK A/C SEATS	889	1560	2743	4025	4970	5600	6840	13411
% OF PLANING PEAK DAY	6.63	11.88	20.46	30.01	37.06	41.01	48.77	100.

EXHIBIT 20. 30-minute Traffic Flow Profile & Planing Peaks - 1982 'YZB' Departing Domestic A/C Seats

1. The model outputs described in (f), (g) and (h) above are produced for any, all or a combination of six alternative planning peak day concepts:

Concept 1: Average day in the busiest month of the year.

Concept 2: Average day in the busiest 2 consecutive months of the year.

Concept 3: Average day in the busiest 3 consecutive months of the year.

Concept 4: Average day in the busiest quarter of the year.

Concept 5: Average of the busiest n (user-specified) consecutive days in the year.

Concept 6: Average day in *any* user-specified period of the year.

The significance of these planning day concepts can be found elsewhere.[2]

2. Option is provided by the model to include or exclude the weekends from the analysis of any of the above six concepts. Traffic patterns during the weekends may, for some traffic sectors, be significantly different from those pertaining to the Monday-to-Friday portion of the week. In such cases, inclusion of the weekends affects the generated composite profiles and planning peak volumes.

3. The model contains an algorithm for synthesizing and graphically displaying the half-hourly and floating hourly traffic profiles implied by a given "nominal schedule." The nominal schedule is a prediction of the arrival/departure pattern of air carrier flights at a given airport in design year and the associated passenger traffic loads. The synthesis and graphical display of its traffic profiles is performed by the model for all possible combinations of traffic sectors and directions. Corresponding base-year planning traffic profiles are produced by ADAM, as described earlier, to which the design-year nominal schedule profiles and peaks are compared for reasonableness.

SOME TECHNICAL DATA

ADAM was developed and coded in FORTRAN IV computer language by the author. It requires a total core of approximately 150K to run. The total processing (CPU) time on Transport Canada's IBM System 3081 computer relating to the passenger traffic sample outputs presented in this paper is only 2.7 seconds (cost: less than $1.00).

TRANSPORTATION RESEARCH FORUM

31-DAY COMPOSITE PROFILE (WEEKENDS INCLUDED)

#STS PER 60-MINUTES STARTING AT TIME SHOWN

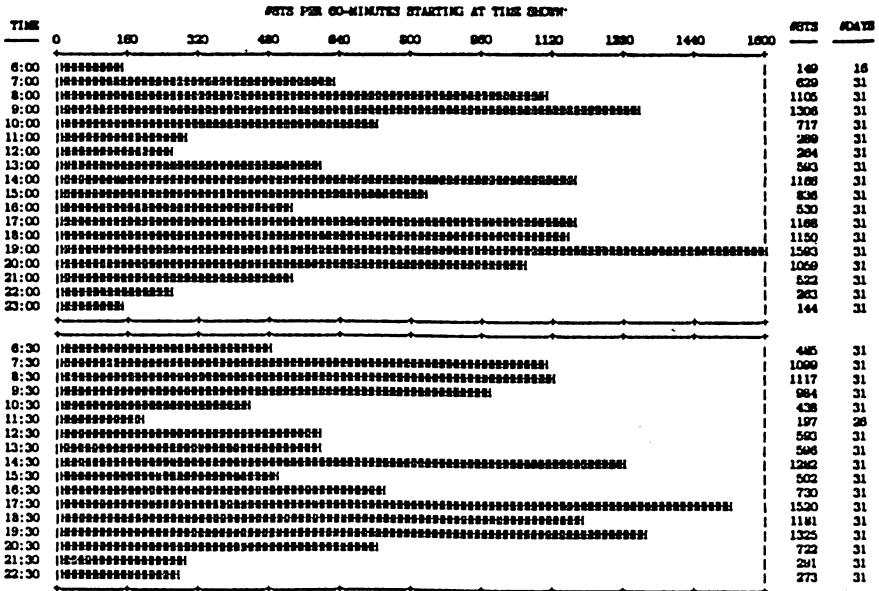| TIME	0	160	320	480	640	800	960	1120	1280	1440	1600	#STS	#DAYS
6:00												149	16
7:00												629	31
8:00												1105	31
9:00												1306	31
10:00												717	31
11:00												289	31
12:00												284	31
13:00												593	31
14:00												1186	31
15:00												836	31
16:00												530	31
17:00												1188	31
18:00												1150	31
19:00												1593	31
20:00												1069	31
21:00												522	31
22:00												263	31
23:00												144	31
6:30												445	31
7:30												1099	31
8:30												1117	31
9:30												984	31
10:30												438	31
11:30												197	26
12:30												593	31
13:30												596	31
14:30												1282	31
15:30												502	31
16:30												730	31
17:30												1520	31
18:30												1141	31
19:30												1325	31
20:30												722	31
21:30												291	31
22:30												273	31

EXHIBIT 21. 60-minute Traffic Flow Profile & Planing Peaks - 1982 'YZB' Departing Domestic A/C Seats

ABBREVIATIONS

AV. (AVRGE.)	Average
A/C	Air carrier aircraft movements
HR	Hour
M-DAY	Month-Day
PAX	Passengers
RNK	Rank (i.e. Nth Highest Day, Hour, etc.)
ST DEV	Standard Deviation
STS	Air carrier aircraft seats
WTD AV	Weighted Average
%ILE	Percentile
30-M(30-Min)	30-Minute

ACKNOWLEDGMENTS

REFERENCES

1. Hamzawi, S.G., "Airport Traffic Analysis Model (ATAM)," Technical Report TP 3935E, AK-41-02-300, Transport Canada, (July 1983).
2. Hamzawi, S.G., "Study of the Air Terminal Building Planning Standard," Technical Report TP 4771E, AK-42-02-400, Transport Canada, (July 1983).