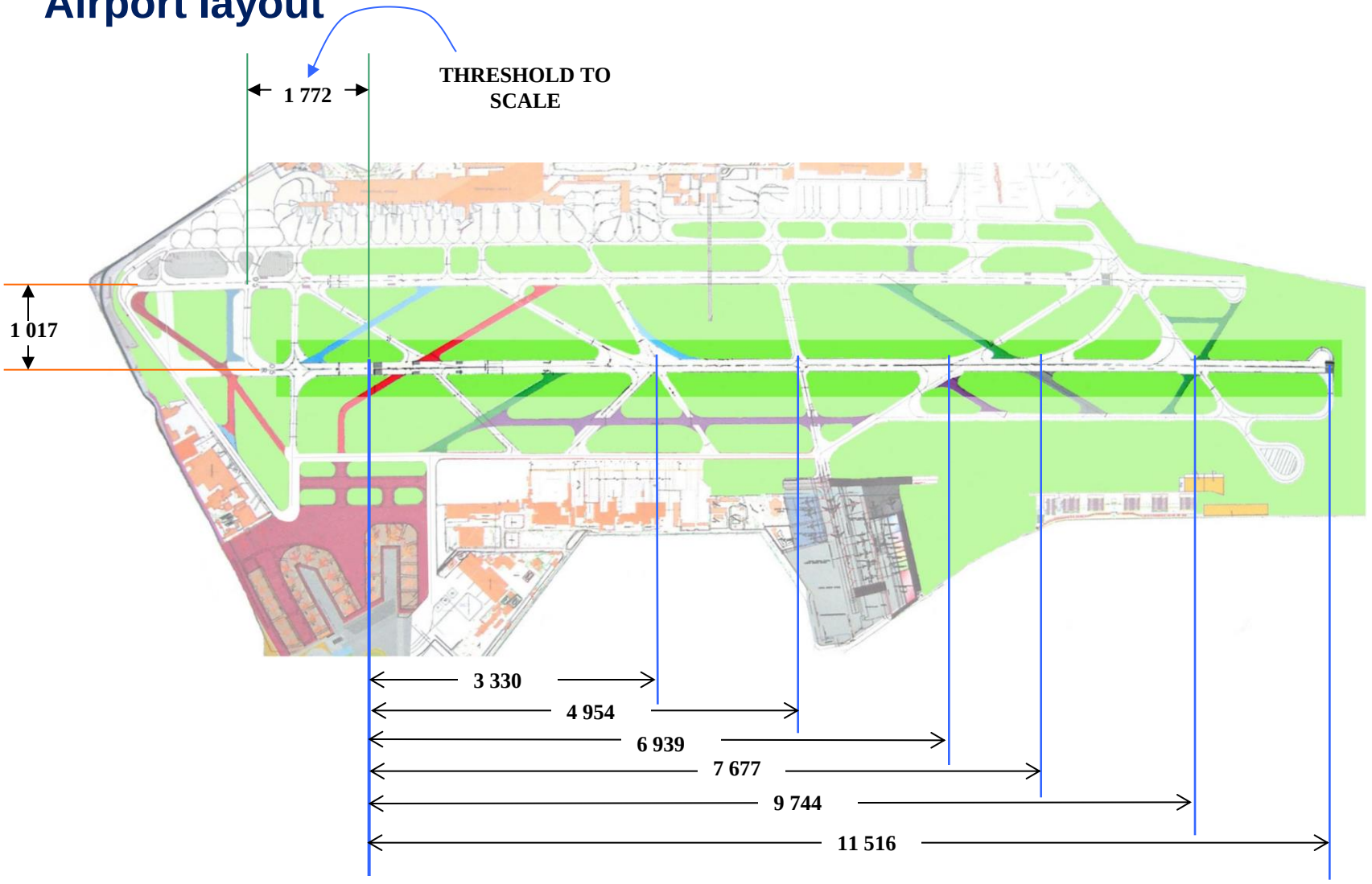
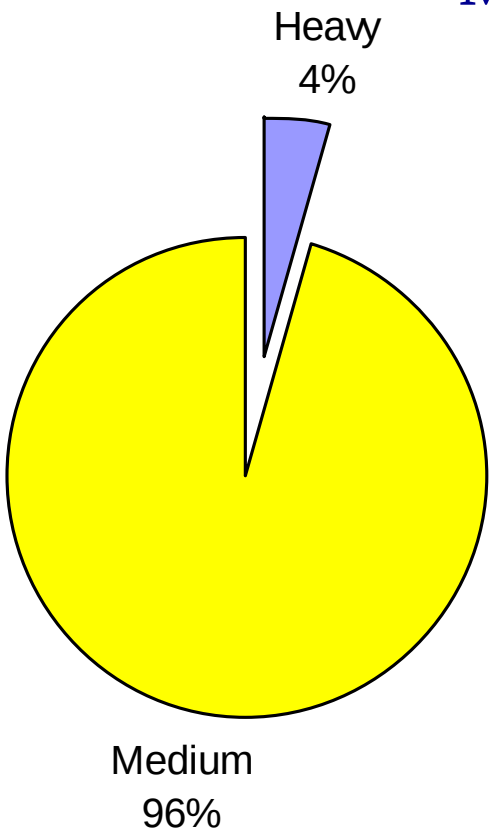
Determining Airport Acceptance Rate (AAR)

Mexico City Airport Case Study

Airport layout



Aircraft mix
data taken from March 9 thru March 24, 2006



$$MixIndex = \%(Medium + 3 \times Heavy)$$

$$MixIndex = 96 + 3 \times 4$$

$$MixIndex = 108$$

AC 150 5060 Airport Capacity & Delays

Runway-use Diagram	Diag. No.	Runway Spacing in Feet (s)	Figure No. For Capacity VFR	For Capacity IFR	For Delay VFR	For Delay IFR
	1	NA	3- 3	3-43	3-71	3-90
S	2	700 or more	3- 4	3-44	3-72	3-91
S	3	700 to 2499	3- 5	3-44	3-73	3-91
	4	2500 or more	3- 6	3-45	3-74	3-92
S	5*	700 to 2499	3- 7	3-44	3-75	3-91
	6	2500 to 2999	3- 8	3-46	3-75	3-93
	7	3000 to 4299	3- 8	3-47	3-75	3-93
	8	4300 or more	3- 8	3-48	3-75	3-94
S	9*	700 to 2499	3- 9	3-44	3-71	3-91
	10	2500 to 2999	3-10	3-49	3-71	3-95
	11	3000 to 4299	3-10	3-50	3-71	3-95
	12	4300 or more	3-10	3-51	3-71	3-96
C S	13	700 to 2499	3-11	3-52	3-76	3-97
	14	2500 to 2999	3-11	3-53	3-76	3-97
	15	3000 or more	3-11	3-54	3-76	3-98
C S	16	700 to 2499	3-12	3-52	3-77	3-97
	17	2500 to 2999	3-13	3-53	3-78	3-97
	18	3000 or more	3-13	3-55	3-78	3-99
C S	19	700 to 2499	3-14	3-56	3-78	3-100
	20	2500 to 2999	3-13	3-49	3-78	3-95
	21	3000 to 4299	3-13	3-53	3-78	3-95
	22	4300 or more	3-13	3-55	3-78	3-99
C S	23*	700 or more	3-14	3-56	3-78	3-100
C S	24*	700 to 2499	3-15	3-52	3-79	3-97
	25	2500 to 2999	3-16	3-53	3-80	3-95
	26	3000 or more	3-16	3-55	3-80	3-99
C S	27*	700 to 2999	3-15	3-52	3-79	3-97
	28	3000 or more	3-17	3-54	3-80	3-98
C S	29*	700 to 2499	3-18	3-49	3-81	3-95
	30	2500 to 2999	3-19	3-53	3-71	3-95
	31	3000 or more	3-19	3-55	3-71	3-99
C S	32	3000 or more	3-20	3-58	3-72	3-91
C S C	33	3000 or more	3-20	3-58	3-72	3-91
C S C	34	3000 or more	3-21	3-58	3-82	3-91
C S C	35	3000 or more	-21	3-58	3-82	3-91
C S C	36*	3000 to 4299	3-22	3-55	3-83	3-[illegible]
	37	4300 or more	3-22	3-58	3-83	3-91
C S C	38*	3000 or more	3-22	3-58	3-83	3-91
C S C	39*	3000 or more	3-23	3-58	3-84	3-91
C S C	40*	3000 or more	3-24	3-58	3-84	3-91
C S C	41*	3000 or more	3-25	3-58	3-80	3-91
C S C	42*	3000 or more	3-26	3-58	3-71	3-91

LEGEND

Indicates that an arrival (landing) can occur on the runway indicated.

Indicates that a departure (takeoff) can occur on the runway indicated.

The lack of a symbol means that aircraft operations will not occur on the runway indicated.

S Indicates a variable runway spacing.

C Indicates a runway spacing of 700 to 2499 feet.

x,y Indicates intersection distances.

θ Indicates the angle between nonparallel runways.

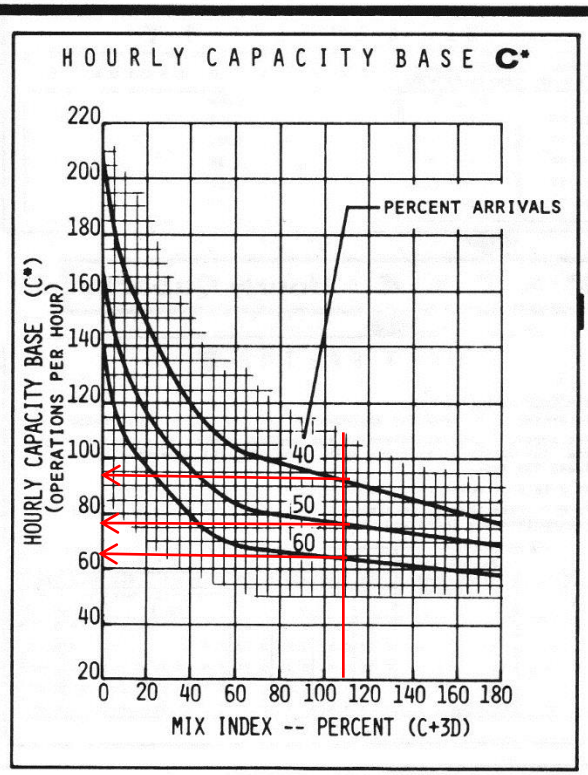
N.A. Means Not Applicable.

< Indicates "less than".

≮ Indicates "greater than or equal to".

For those cases in which the majority of aircraft are restricted from using one, or more, of the runways, see Chapter 4.

Runway-use Diagram	Diag. No.	Runway Spacing in Feet (s)	Figure No. For Capacity VFR	For Capacity IFR	For Delay VFR	For Delay IFR
	1	NA	3- 3	3-43	3-71	3-90
S	2	700 or more	3- 4	3-44	3-72	3-91
S	3	700 to 2499	3- 5	3-44	3-73	3-91
	4	2500 or more	3- 6	3-45	3-74	3-92
S	5*	700 to 2499	3- 7	3-44	3-75	3-91
	6	2500 to 2999	3- 8	3-46	3-75	3-93
	7	3000 to 4299	3- 8	3-47	3-75	3-93
	8	4300 or more	3- 8	3-48	3-75	3-94
S	9*	700 to 2499	3- 9	3-44	3-71	3-91
	10	2500 to 2999	3-10	3-49	3-71	3-95
	11	3000 to 4299	3-10	3-50	3-71	3-95
	12	4300 or more	3-10	3-51	3-71	3-96
	13	700 to 2499	3-11	3-52	3-76	3-97



TOUCH & GO FACTOR T

T = 1.00

C* x T x E = Hourly Capacity

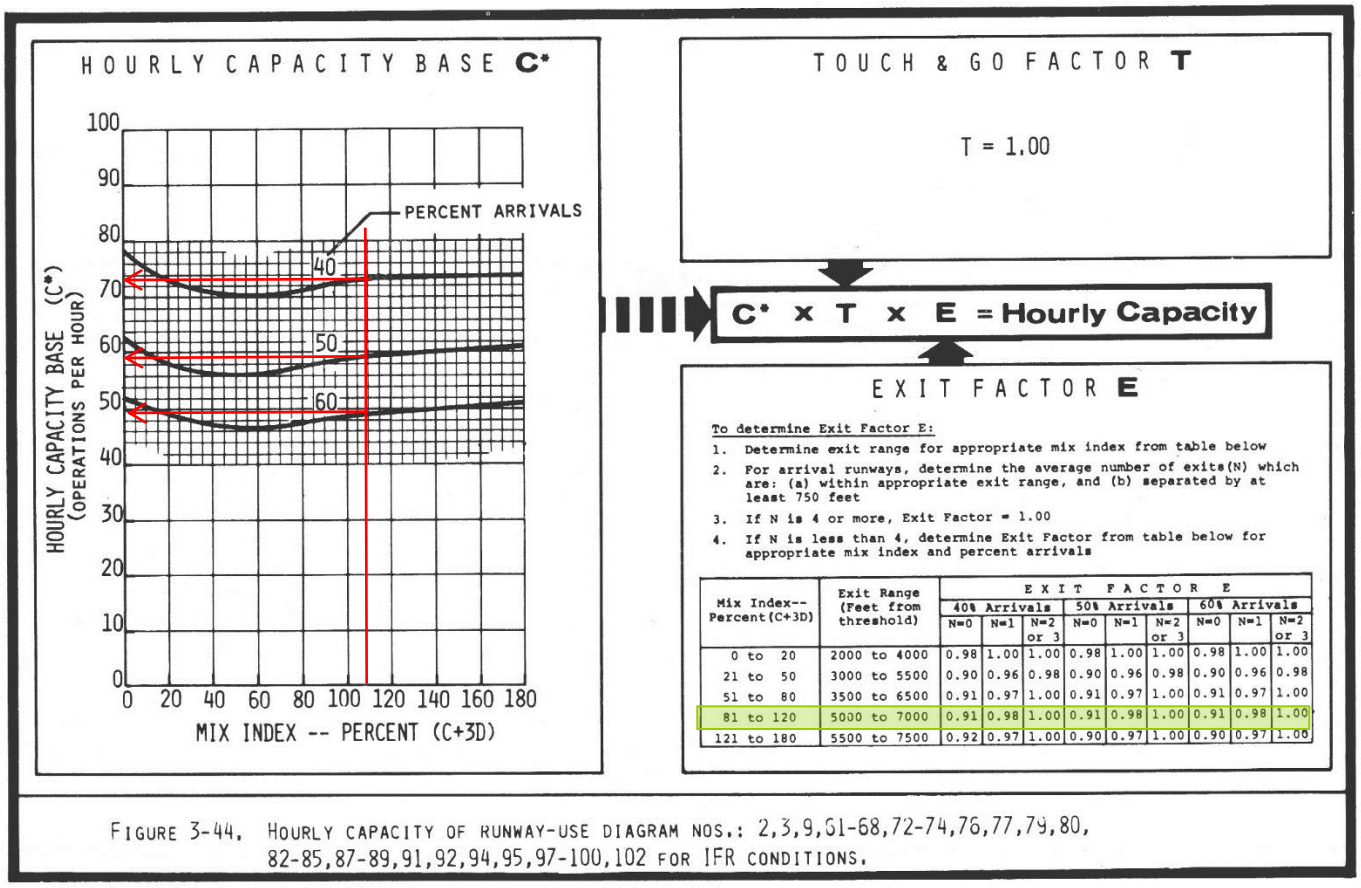
EXIT FACTOR E

To determine Exit Factor E:

1. Determine exit range for appropriate mix index from table below
2. For arrival runways, determine the average number of exits(N) which are: (a) within appropriate exit range, and (b) separated by at least 750 feet
3. If N is 4 or more, Exit Factor = 1.00
4. If N is less than 4, determine Exit Factor from table below for appropriate mix index and percent arrivals

Mix Index--Percent(C+3D)	Exit Range (Feet from threshold)	EXIT FACTOR E								
		40% Arrivals			50% Arrivals			60% Arrivals		
		N=0	N=1	N=2 or 3	N=0	N=1	N=2 or 3	N=0	N=1	N=2 or 3
0 to 20	2000 to 4000	0.62	0.79	0.90	0.62	0.79	0.90	0.62	0.79	0.90
21 to 50	3000 to 5500	0.72	0.83	0.93	0.72	0.83	0.93	0.72	0.83	0.93
51 to 80	3500 to 6500	0.75	0.84	0.92	0.75	0.84	0.92	0.75	0.84	0.92
81 to 120	5000 to 7000	0.80	0.87	0.94	0.80	0.87	0.94	0.80	0.87	0.94
121 to 180	5500 to 7500	0.94	1.00	1.00	0.83	0.93	0.97	0.83	0.93	0.97

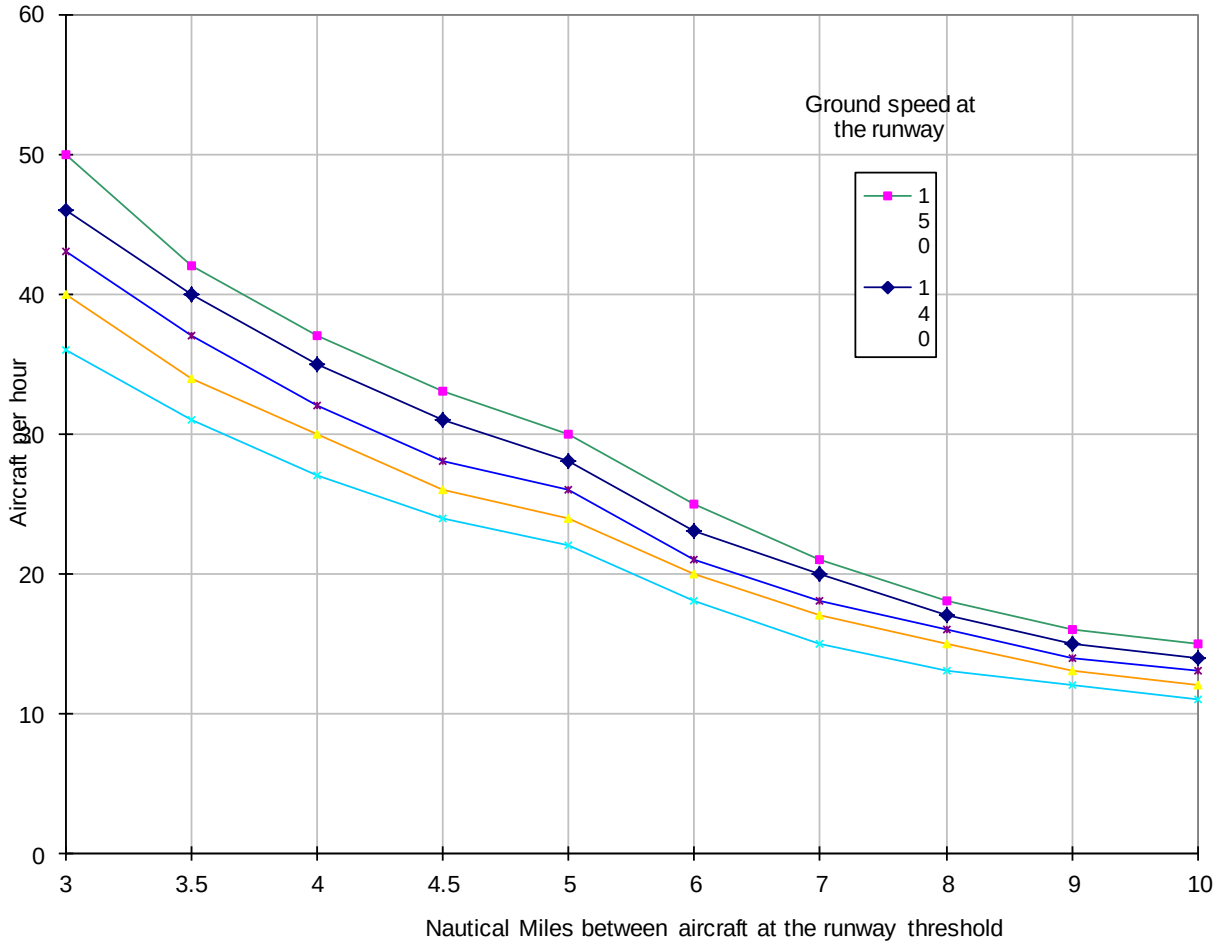
FIGURE 3-4. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 2,72,73,87,88 FOR VFR CONDITIONS.



Mix Index--Percent(C+3D)	Exit Range (Feet from threshold)	EXIT FACTOR E								
		40% Arrivals			50% Arrivals			60% Arrivals		
		N=0	N=1	N=2 or 3	N=0	N=1	N=2 or 3	N=0	N=1	N=2 or 3
0 to 20	2000 to 4000	0.98	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00
21 to 50	3000 to 5500	0.90	0.96	0.98	0.90	0.96	0.98	0.90	0.96	0.98
51 to 80	3500 to 6500	0.91	0.97	1.00	0.91	0.97	1.00	0.91	0.97	1.00
81 to 120	5000 to 7000	0.91	0.98	1.00	0.91	0.98	1.00	0.91	0.98	1.00
121 to 180	5500 to 7500	0.92	0.97	1.00	0.90	0.97	1.00	0.90	0.97	1.00

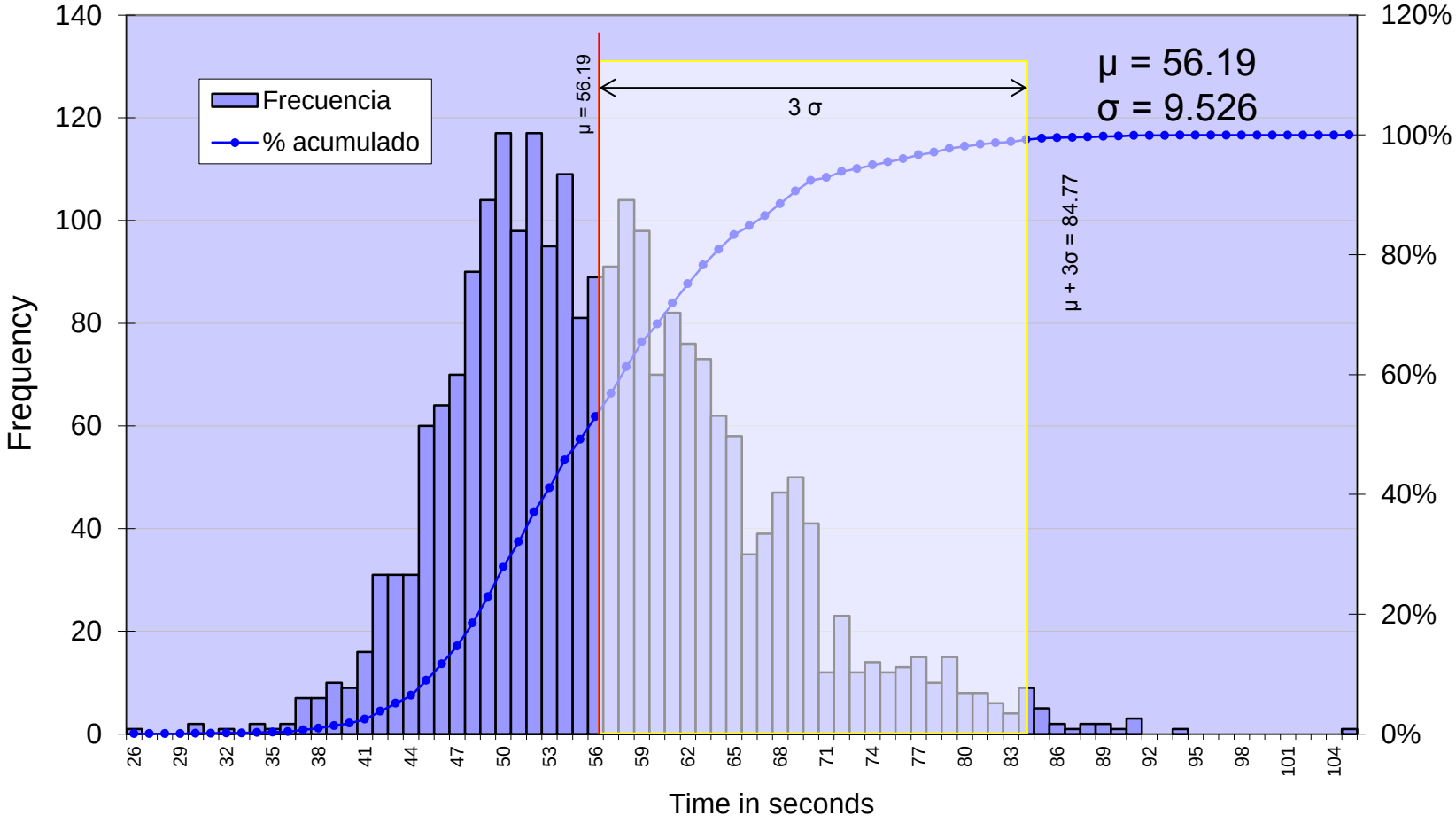
FIGURE 3-44. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 2,3,9,61-68,72-74,76,77,79,80, 82-85,87-89,91,92,94,95,97-100,102 FOR IFR CONDITIONS.

	Arrival percentage								
	40 %			50%			60%		
	Exit Factor **E**	Hourly capacity base **C***	Hourly Capacity **C**	Exit Factor **E**	Hourly capacity base **C*** *	Hourly Capacity **C**	Exit Factor **E**	Hourly capacity base **C***	Hourly Capacity **C**
VFR	0.87	92	80	0.87	76	66	0.87	65	56
	Departures 48		Arrivals 32	Departures 33		Arrivals 33	Departures 23		Arrivals 33
IFR	0.98	73	71	0.98	59	57	0.98	49	48
	Departures 43		Arrivals 28	Departures 29		Arrivals 28	Departures 20		Arrivals 28


Ground speed at the runway
150
140
Aircraft per hour
Nautical Miles between aircraft at the runway threshold
0
10
20
30
40
50
60
3
3.5
4
4.5
5
6
7
8
9
10

Runway Occupancy Time (ROT)

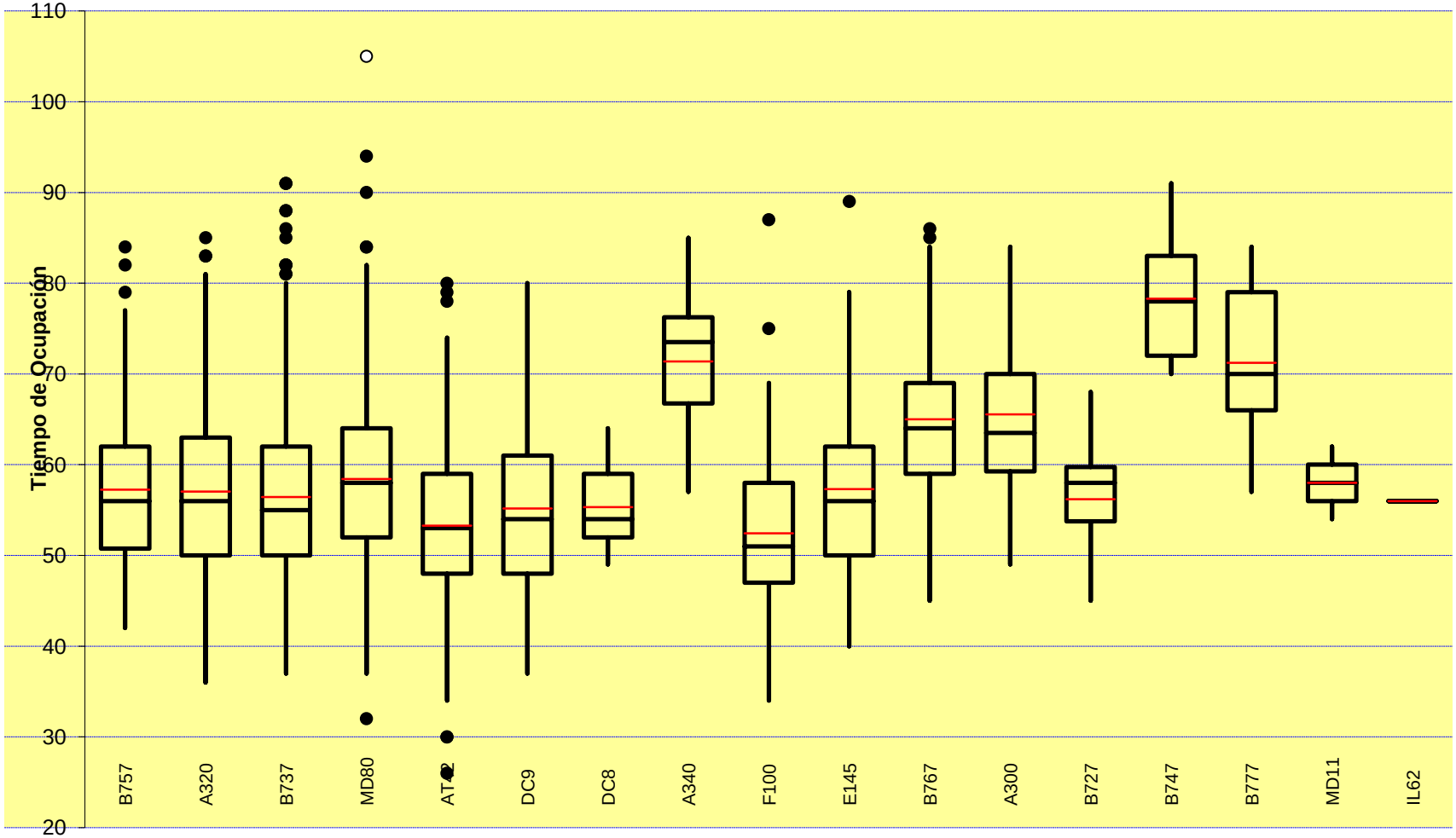
Ocupacy time Histogram

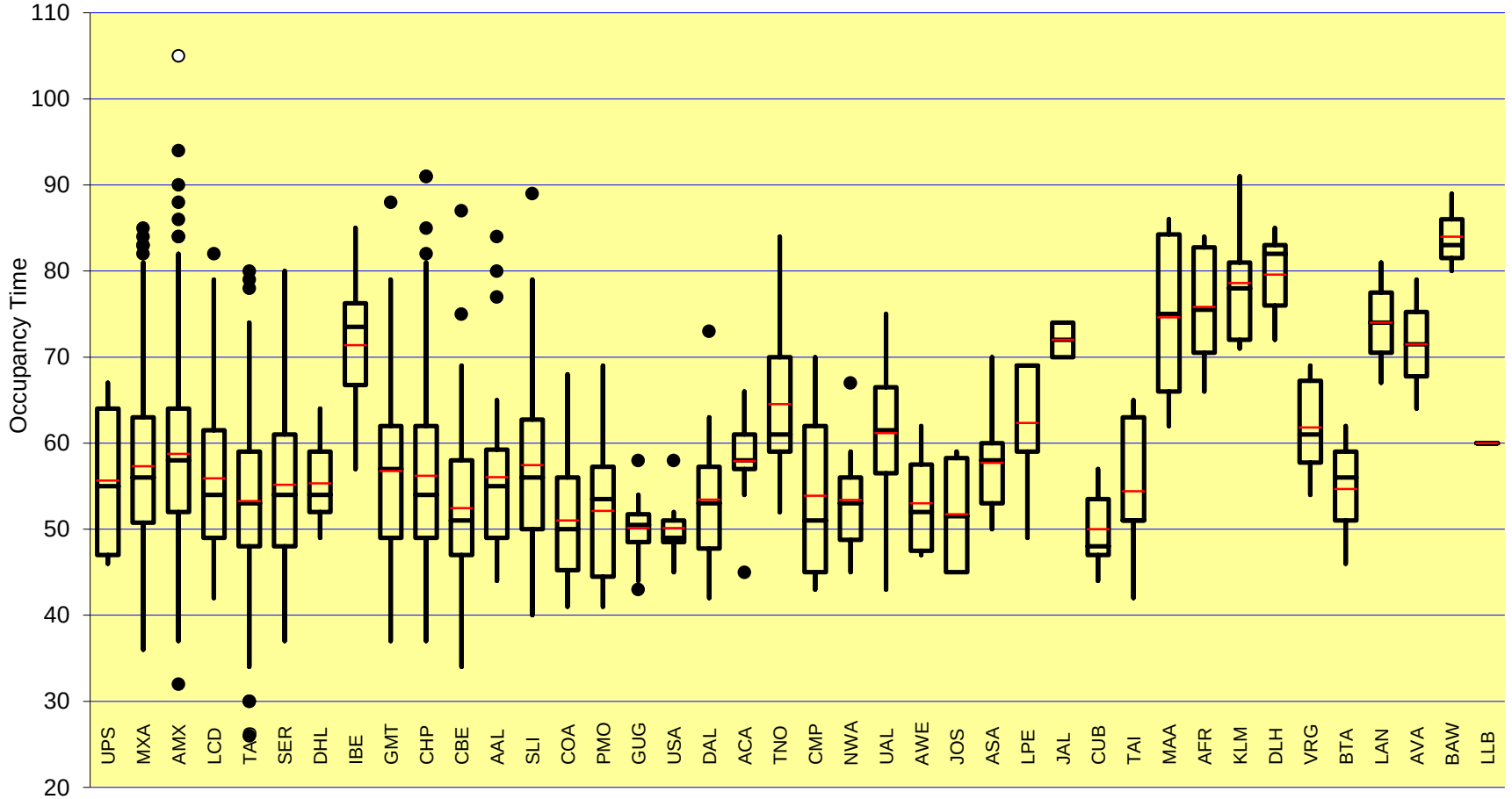


Statistical AAR

$$AAR =$$

$$AAR = \frac{3600}{84.77} = 42.5$$

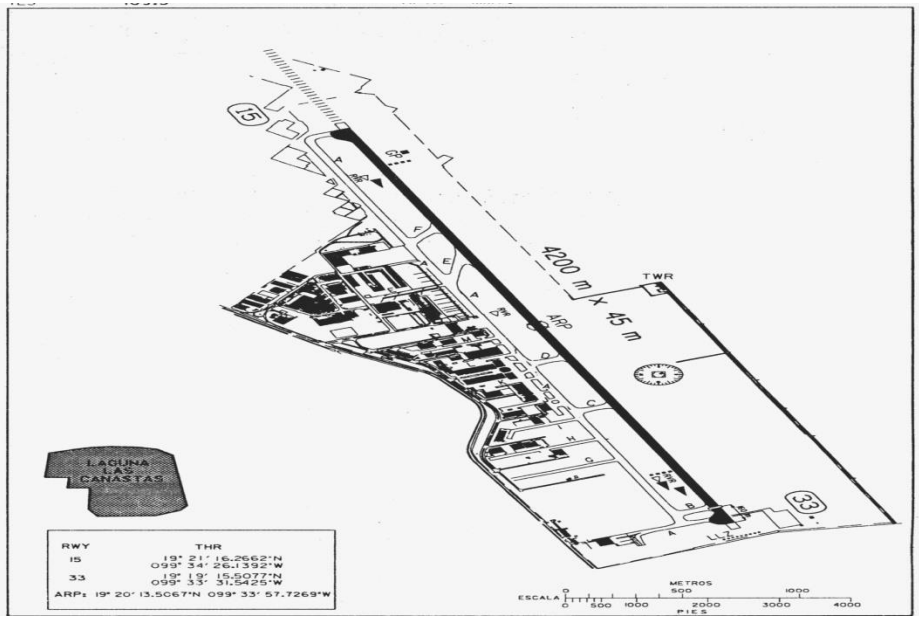

Tiempo de Ocupación
110
100
90
80
70
60
50
40
30
20
B757
A320
B737
MD80
AT2
DC9
DC8
A340
F100
E145
B767
A300
B727
B747
B777
MD11
IL62


Occupancy Time
110
100
90
80
70
60
50
40
30
20
UPS
MXA
AMX
LCD
TAM
SER
DHL
IBE
GMT
CHP
CBE
AAL
SLI
COA
PMO
GUG
USA
DAL
ACA
TNO
CMP
NWA
UAL
AWE
JOS
ASA
LPE
JAL
CUB
TAI
MAA
AFR
KLM
DLH
VRG
BTA
LAN
AVA
BAW
LLB

AAR México City Airport

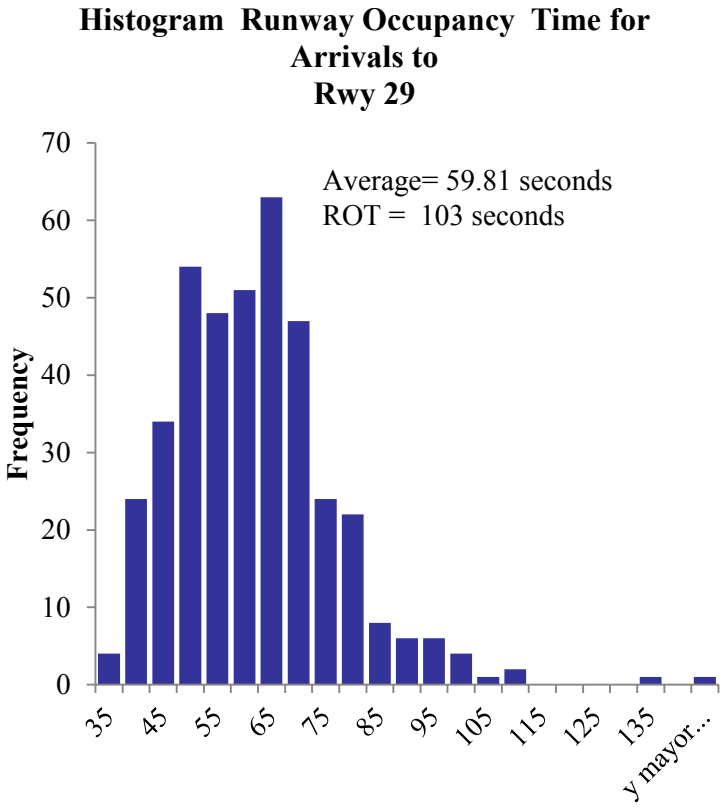
RUNWAY CONFIGURATION	Condition	MiT	AAR
05	Optimal	4	40
	IMC Poor braking action Windshear	5	36
	Rwy 05R closed Rwy 05L closed	8	28
23	Optimal	5	36
	IMC Poor Braking Windshear	5	36
	Rwy 23L closed	10	20
	Rwy 23R closed	10	20

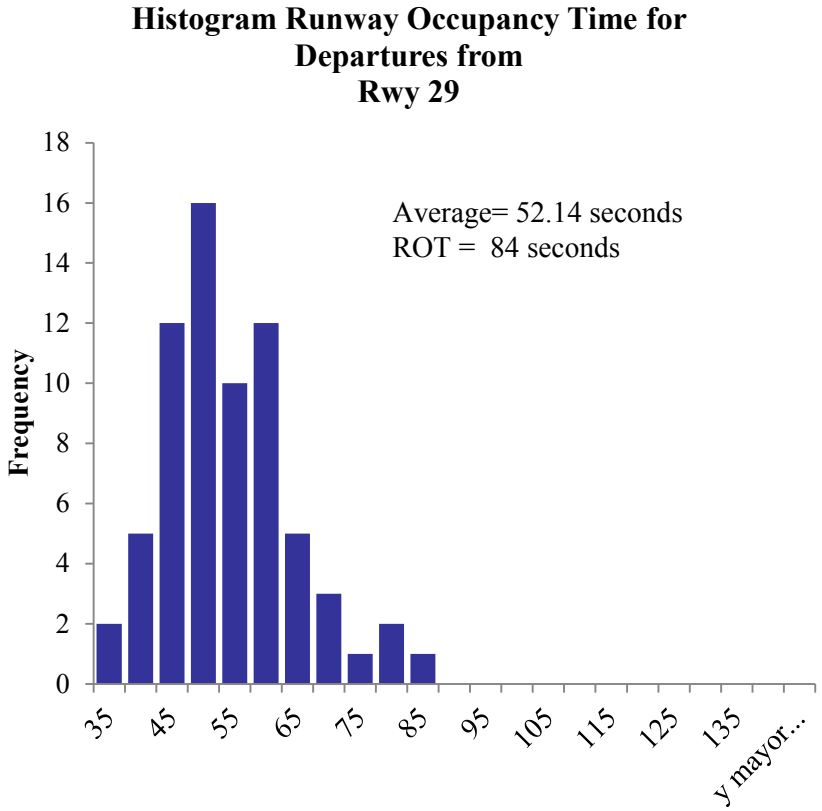
AAR Toluca



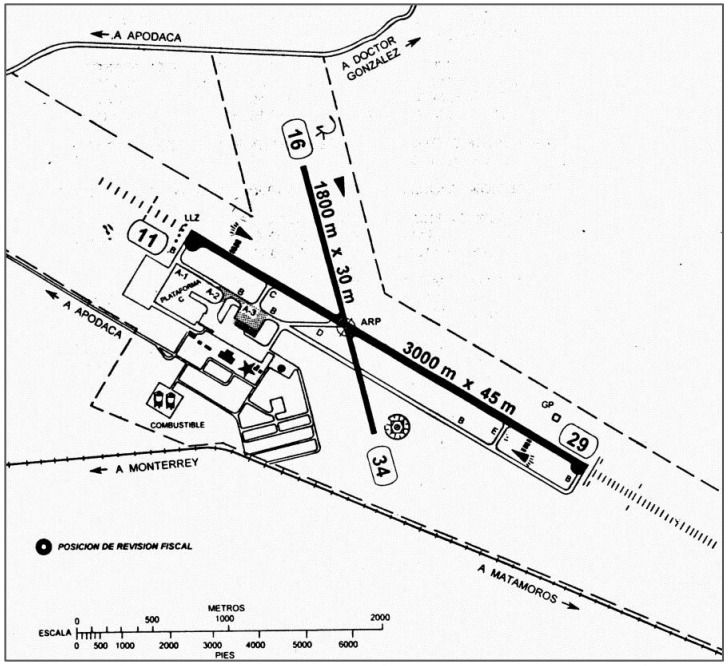
Runway Configuration	Condition	MiT	AAR
15	Optimal	9	24
33	Optimal	9	24

ROT MTY RWY 29





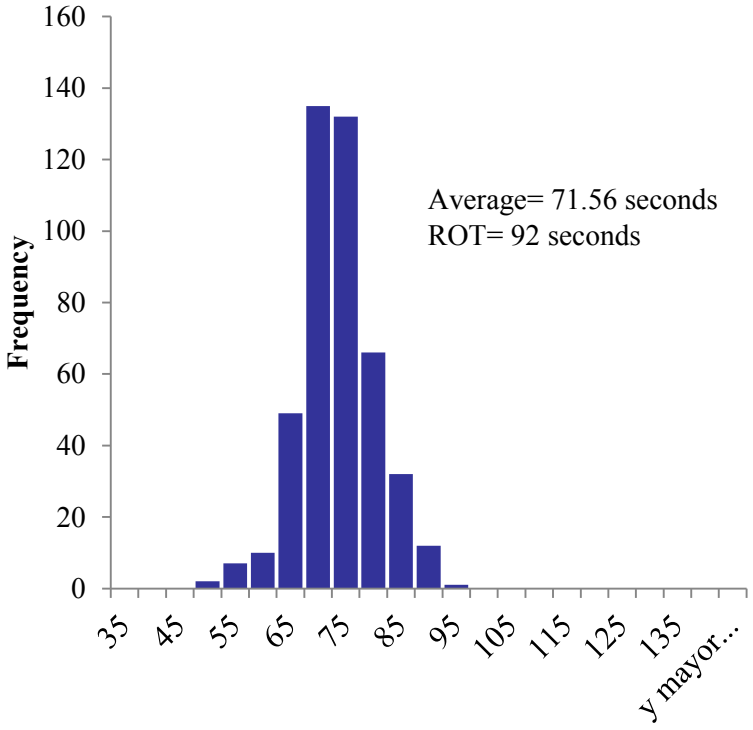
AAR Monterrey



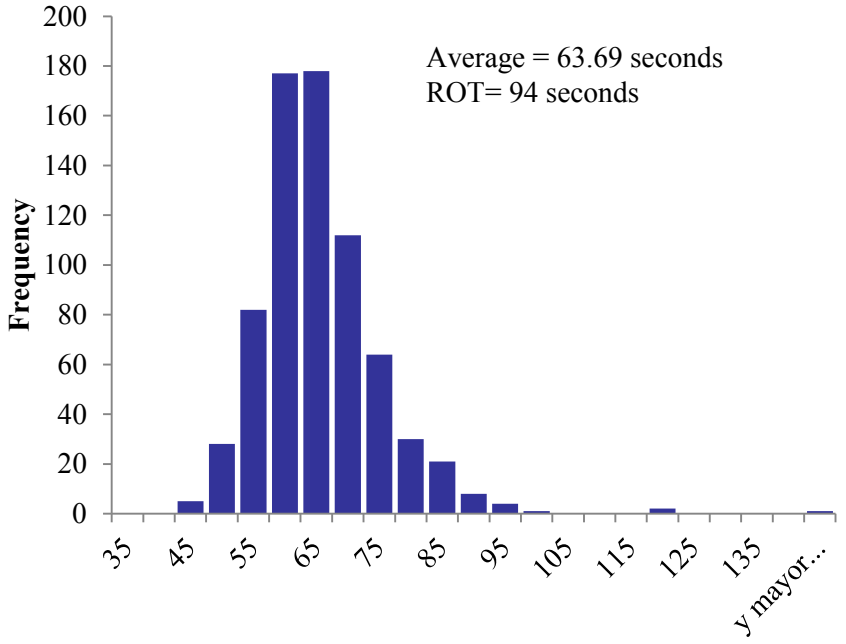
Runway Configuration	Condition	MiT	AAR
29	Optimal	10	19
11	Optimal	11	18

ROT GDL RWY 28

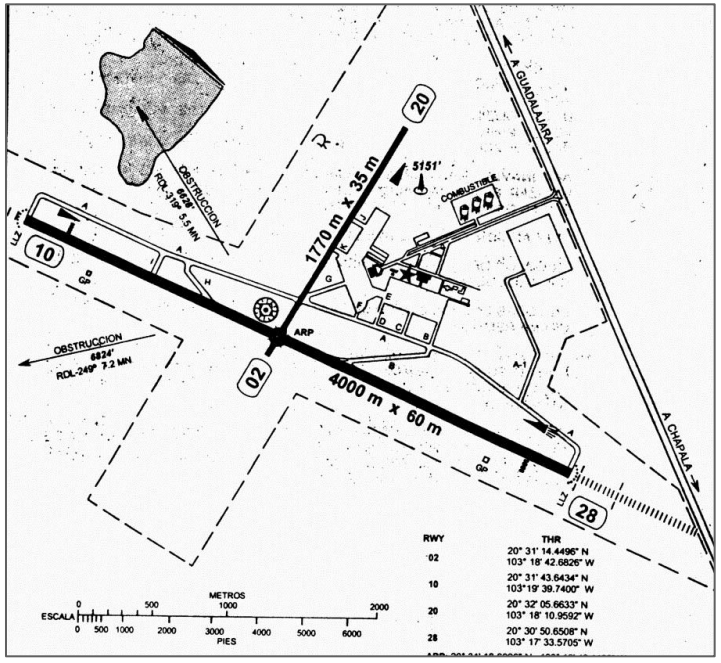
Histogram Runway Occupancy Time for Departures from Rwy 28



Histogram Runway Occupancy Time for Arrivals to Rwy 28

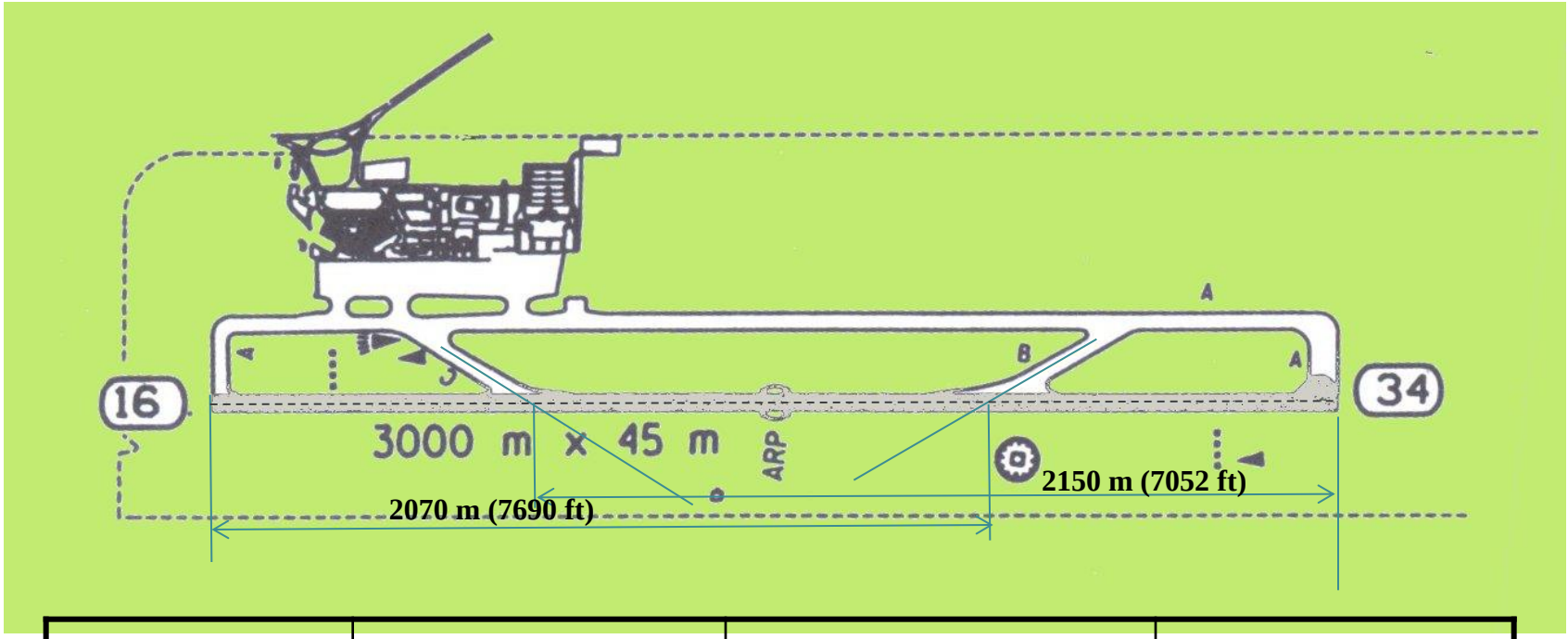


AAR Guadalajara



Runway Configuration	Condition	MiT	AAR
28	Optimal	10	19
10	Optimal	10	19

AAR San José del Cabo



Meteorological Conditions	Capacity per hour	Departures/Arrivals		MiT Arrivals
VMC	44	22	22	9 MN

Thank you !

Definitions

Airport Acceptance Rate (AAR):

A dynamic parameter specifying the number of arrival aircraft that an airport, in conjunction with:

- terminal airspace
- ramp space
- parking space, and
- terminal facilities

Able to accept under specific conditions and during any consecutive 60 minute period

Definitions

Airport Primary Runway Configuration:

An airport configuration which handles 3 percent or more of the annual operations

Definitions

Potential AAR:

The theoretical acceptance rate at the runway threshold – before taking other factors into consideration

Definitions

Actual AAR:

The Potential AAR at the runway threshold *adjusted* for other factors

Definitions

AAR adjustment factors:

The factors that must be considered when establishing the actual AAR. These may include:

- Weather conditions
- Runway conditions
- Aircraft type and fleet mix on final
- Taxiway layout
- Ramp space

For any runway configuration:

Potential AAR

– Adjustment Factors

Actual AAR

Calculate the Actual AAR value for each airport runway configuration for the following weather conditions:

Visual Meteorological Conditions (VMC) - weather allows vectoring for visual approaches

Marginal VMC - weather does not allow vectoring for visual approaches, but visual separation on final is possible

Instrument Meteorological Conditions (IMC) - visual approaches and visual separation on final are not possible

Step 1
Calculate the Potential AAR

Determine:

- **average ground speed** crossing the runway threshold, and
- **the spacing interval** required between successive arrivals

Divide the ground speed by the spacing interval to determine the Potential AAR

Step 1

Calculate the Potential AAR – formula method

Formula: Ground speed in knots at the runway threshold divided by spacing interval at the runway threshold in nautical miles

NOTE: when the quotient is a fraction, round down to the next whole number

Step 1
Potential AAR – examples

Example 1: 130 KTS/ 5 NM = 26

Potential AAR = 26 arrivals per hour

Example 2: 120 KTS / 7 NM = 17.14 (round down to 17)

Potential AAR = 17 arrivals per hour

Step 1

Calculate the Potential AAR – table method

	NM between aircraft at the runway threshold									
	3	3.5	4	4.5	5	6	7	8	9	10
Ground speed at the runway threshold	*Potential AAR*									
140 kt	46	40	35	31	28	23	20	17	15	14
130 kt	43	37	32	28	26	21	18	16	14	13
120 kt	40	34	30	26	24	20	17	15	13	12
110 kt	36	31	27	24	22	18	15	13	12	11

Thank you !