U.S. Department
of Transportation

**Federal Aviation
Administration**

Airport Capacity
and Delay

FILE

Advisory Circular

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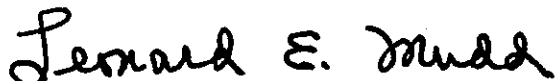| Subject: AIRPORT CAPACITY AND DELAY	Date: 9/23/83	AC No: 150/5060-5
	Initiated by: AAS-100	Change:

1. **PURPOSE.** This advisory circular (AC) explains how to compute airport capacity and aircraft delay for airport planning and design.

2. **CANCELLATIONS.** This publication cancels the following Federal Aviation Administration (FAA) Advisory Circulars (ACs):

    a. AC 150/5060-1A, Airport Capacity Criteria Used in Preparing the National Airport Plan, dated July 8, 1968, and

    b. AC 150/5060-3A, Airport Capacity Criteria Used in Long Range Planning, dated December 24, 1969.

3. **BACKGROUND.** Changes in the composition of the nation's aircraft fleet together with improvements in air traffic control (ATC) practices have outdated capacity calculations contained the cancelled ACs. An FAA contractor reexamined the procedures for determining airport capacity and suggested improvements to update them. This AC implements these improvements. In addition, this AC refines definitions of capacity and delay. CAPACITY is the throughput rate, i.e. the maximum number of operations that can take place in an hour. DELAY is the difference in time between a constrained and an unconstrained aircraft operation. These definitions take into account that delays occur because of simultaneous demands on the facility. The acceptable level of delay will vary from airport to airport.

4. **APPLICATION TO AIRPORT DESIGN.** To apply these procedures, a reasonable understanding of the aeronautical activities being conducted at, or projected for, the airport is required. Care should be exercised in using available data so as to avoid data which represents a level of activity occurring sporadically during the year--unless it is intended to examine that specific condition. Since few airports operate at "peak demand" levels for more than two or three consecutive hours in any one day and demand fluctuates throughout a period even as short as one hour, some delay will occur during a typical hours operations. It is suggested that airport design be based on an hourly demand which can be expected to occur at least on a weekly basis.

6. <u>REFERENCE</u>. Report No. FAA-RD-74-124, Techniques for Determining Airport Airside Capacity and Delay, dated June 1976 is available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161, telephone (703) 557-4650. The NTIS reference number is AD-A032 475.

LEONARD E. MUDD
Director, Office of Airport Standards

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CHAPTER 1. AIRPORT CAPACITY AND AIRCRAFT DELAY

1-1. <u>GENERAL</u>. Hourly airport capacities and annual aircraft delay computations are needed to design and evaluate airport development and improvement projects. The method for computing airport capacity and aircraft delay is the throughput method provided in this AC.

     a. <u>Background</u>. The throughput method for calculating airport capacity and average delay per aircraft is derived from computer models used by the Federal Aviation Administration (FAA) to analyze airport capacity and reduce aircraft delay. Calculations of hourly capacity are needed to determine average delay. Since airport and airport component hourly capacities vary throughout the day due to variations in runway use, aircraft mix, ATC rules, etc., a number of calculations may be needed.

     b. <u>AC Organization</u>.

        (1) Chapter 1 provides an overview of airport capacity and aircraft delay analyses.

        (2) Chapter 2 contains calculations for computing airport capacity, annual service volume (ASV), and aircraft delay for long range evaluations.

        (3) Chapter 3 contains more detailed computations suitable for a wide range of airport design and planning applications.

        (4) Chapter 4 contains special computations of capacity relating to:

            (i) Periods of poor visibility and ceiling conditions.

            (ii) Airports without radar coverage and/or an instrument landing system (ILS).

            (iii) Airports with parallel runways when one runway is limited to use by small aircraft.

        (5) Chapter 5 identifies computer models which may be used to further refine runway capacity and aircraft delay analyses.

        (6) The appendices contain examples applying chapter 2, 3, and 4 calculations.

     c. <u>Units</u>. Since FAA operational standards for spacing aircraft taking-off and landing are in customary units (feet, knots, etc.), it is expedient to perform capacity and delay computations in the same units.

1-2. <u>AIRPORT COMPONENTS</u>.

     a. <u>Runway</u>. The term runway includes the landing surface, plus those portions of the approach and departure paths used in common by all aircraft.

     b. <u>Taxiway</u>. The term taxiway includes the parallel taxiways, entrance-exit taxiways, and crossing taxiways, recognizing that a capacity limiting condition may exist where an arriving or departing stream of aircraft must cross an active runway.

c. <u>Gate Group</u>. The term gate group identifies the number of gates located in the terminal complex which are used by an airline, or shared by two or more airlines, or other aircraft operating at the airport on a regularly scheduled basis. In most cases the terminal gates are not used by general aviation aircraft.

1-3. <u>CAPACITY TERMS</u>. The following subpargraphs define terms used herein. Symbols used in this AC are defined in Appendix 4, Glossary of Symbols/Terms.

a. <u>Aircraft Mix</u>. Aircraft mix is the relative percentage of operations conducted by each of the four classes of aircraft (A, B, C, and D). Table 1-1 identifies physical aspects of the four aircraft classes and their relationship to terms used in the wake turbulence standards.

Table 1-1. Aircraft classifications

Aircraft Class	Max. Cert. T.O. Weight (lbs)	Number Engines	Wake Turbulence Classification
A	12,500 or less	Single	Small (S)
B	12,500 or less	Multi	Small (S)
C	12,500 - 300,000	Multi	Large (L)
D	over 300,000	Multi	Heavy (H)

b. <u>Annual Service Volume (ASV)</u>. ASV is a reasonable estimate of an airport's annual capacity. It accounts for differences in runway use, aircraft mix, weather conditions, etc., that would be encountered over a year's time.

c. <u>Capacity</u>. Capacity (throughput capacity) is a measure of the maximum number of aircraft operations which can be accommodated on the airport or airport component in an hour. Since the capacity of an airport component is independent of the capacity of other airport components, it can be calculated separately.

d. <u>Ceiling and Visibility</u>. For purposes of this AC, the terms VFR, IFR, and PVC are used as measures relating to the following ceilings and visibilities.

(1) Visual flight rule (VFR) conditions occur whenever the cloud ceiling is at least 1,000 feet above ground level and the visibility is at least three statute miles.

(2) Instrument flight rule (IFR) conditions occur whenever the reported cloud ceiling is at least 500 feet but less than 1,000 feet and/or visibility is at least one statute mile but less than three statute miles.

(3) Poor visibility and ceiling (PVC) conditions exist whenever the cloud ceiling is less than 500 feet and/or the visibility is less than one statute mile.

e. <u>Delay</u>. Delay is the difference between constrained and unconstrained operating time.

f. Demand. Demand is the magnitude of aircraft operations to be accommodated in a specified time period.

g. Gate. A gate is an aircraft parking position used by a single aircraft loading or unloading passengers, mail, cargo, etc. A parking position which is regularly used by two aircraft at the same time is two gates for capacity calculations.

(1) Gate type is the size of the gate. A Type 1 gate is capable of accommodating all aircraft, including widebodies such as the A-300, B-747, B-767, DC-10, L-1011. A Type 2 gate will accommodate only non-widebodied aircraft.

(2) Gate mix is the percent of non-widebodied aircraft accommodated by the gate group.

(3) Gate occupancy time is the length of time required to cycle an aircraft through the gate.

h. Mix Index. Mix index is a mathematical expression. It is the percent of Class C aircraft plus 3 times the percent of Class D aircraft, and is written: %(C+3D).

i. Percent Arrivals (PA). The percent of arrivals is the ratio of arrivals to total operations and is computed as follows:

$$\text{Percent arrivals} = \frac{A + \frac{1}{2}(T\&G)}{A + DA + (T\&G)} \times 100, \text{ where}$$

A = number of arriving aircraft in the hour
DA = number of departing aircraft in the hour
T&G = number of touch and go's in the hour

j. Percent Touch and Go's. The percent touch and go's is the ratio of landings with an immediate takeoff to total operations and is computed as follows:

$$\text{Percent touch and go's} = \frac{(T\&G)}{A + DA + (T\&G)} \times 100, \text{ where}$$

A = number of arriving aircraft in the hour
DA = number of departing aircraft in the hour
T&G = number of touch and go's in the hour

Touch and go operations are normally associated with flight training. The number of these operations usually decreases as the number of air carrier operations increase, as demand for service approaches runway capacity, or as weather conditions deteriorate.

k. Runway-use Configuration. Runway-use configuration is the number, location, and orientation of the active runway(s), the type and direction of operations, and the flight rules in effect at a particular time.

1-4. <u>CAPACITY, DEMAND, DELAY RELATIONSHIPS</u>. As demand approaches capacity, individual aircraft delay is increased. Successive hourly demands exceeding the hourly capacity result in unacceptable delays. When the hourly demand is less than the hourly capacity, aircraft delays will still occur if the demand within a portion of the time interval exceeds the capacity during that interval. Because the magnitude and scheduling of user demand is relatively unconstrained, reductions in aircraft delay can best be achieved through airport improvements which increase capacity.

CHAPTER 2. CAPACITY AND DELAY CALCULATIONS FOR LONG RANGE PLANNING

2-1. GENERAL. This chapter contains calculations for determining hourly airport capacity, ASV, and aircraft delay for long-range airport planning. Appendix 1 contains examples of these calculations. When more precise results are required, or if the conditions differ significantly from the assumptions described in the following paragraphs, apply the calculations found in subsequent chapters.

2-2. CAPACITY ASSUMPTIONS. Hourly VFR and IFR values in figure 2-1 are based on runway utilizations which produce the highest sustainable capacity consistent with current ATC rules and practices. These values are representative of typical U.S. airports having similar runway-use configurations. VFR and IFR hourly airport capacities in figure 2-1 are based on the following assumptions:

    a. Runway-use Configuration. Any runway layout can be approximated by one of the 19 depicted runway-use configurations. Multiple arrival streams are only to parallel runway configurations.

    b. Percent Arrivals. Arrivals equal departures.

    c. Percent Touch and Go's. The percent of touch and go's is within the ranges in table 2-1.

    d. Taxiways. There is a full-length parallel taxiway, ample runway entrance/exit taxiways, and no taxiway crossing problems.

    e. Airspace Limitations. There are no airspace limitations which would adversely impact flight operations or otherwise restrict aircraft which could operate at the airport. Missed approach protection is assured for all converging operations in IFR weather conditions.

    f. Runway Instrumentation. The airport has at least one runway equipped with an ILS and has the necessary ATC facilities and services to carry out operations in a radar environment.

Table 2-1. Assumptions incorporated in figure 2-1

Mix Index %(C+3D)	Percent Arrivals	Percent Touch & Go	Demand Ratios	
			Annual Demand / Av. Daily Demand*	Av. Daily Demand* / Av. Peak Hour Demand*
0-20	50	0-50	290	9
21-50	"	0-40	300	10
51-80	"	0-20	310	11
81-120	"	0	320	12
121-180	"	0	350	14

* In the peak month

2-3. ASV ASSUMPTIONS. The ASV values in figure 2-1 are based on the assumptions of paragraph 2-2, Table 2-1, and the following:

      a. Weather. IFR weather conditions occur roughly 10 percent of the time.

      b. Runway-use Configuration. Roughly 80 percent of the time the airport is operated with the runway-use configuration which produces the greatest hourly capacity.

2-4. AIRPORT CAPACITY AND ANNUAL SERVICE VOLUME. Calculate the approximate hourly capacities and the ASV as follows:

      a. Determine the percentage of aircraft classes C and D using, or expected to use, the airport.

      b. Select the runway-use configuration from figure 2-1 that best represents the airport. Runway-use configurations 9 through 19 show by means of arrows the predominant direction of runway operations. When no direction is specified, the direction of operation is not critical. Runway-use configurations 14 through 19 indicate by dashed lines the limit of the range of runway orientation. For airports having three or more runway orientations (consider parallel runways as one runway orientation), identify the two-runway orientation that is operated most frequently. To adjust for staggered thresholds see paragraph 4-6.

      c. Calculate the mix index.

      d. Read the approximate VFR and IFR hourly capacities and the ASV directly from figure 2-1.
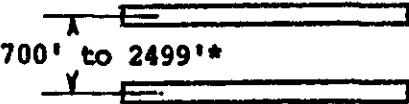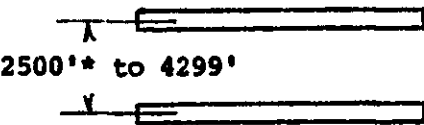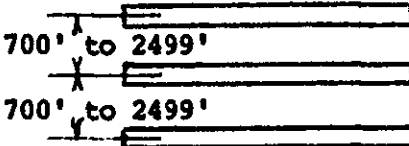
2-5. AIRCRAFT DELAY. Calculate the aircraft delay as follows:

      a. Estimate annual demand using current or historical information or projections of future traffic.

      b. Calculate the ratio of annual demand to ASV.
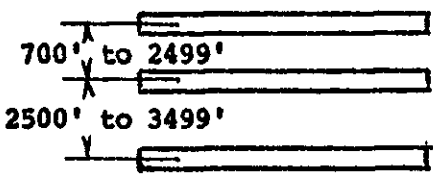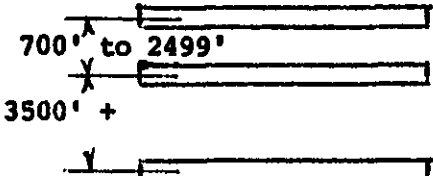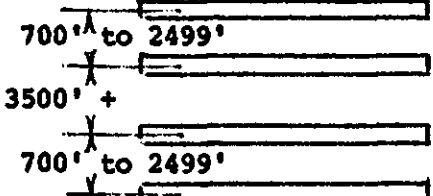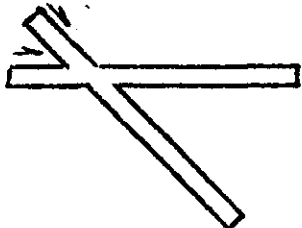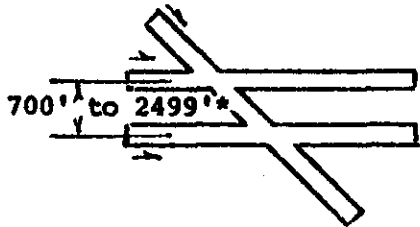
      c. Obtain average delay per aircraft from figure 2-2. The upper portion of the band applies to airports where air carrier operations dominate. The full width of the band applies to airports where general aviation operations dominate. Delays 5 to 10 times average could be experienced by individual aircraft.

      d. Calculate total annual aircraft delay as the average delay multiplied by the annual demand.

No.	Runway-use Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr VFR	IFR	Annual Service Volume Ops/Yr
1.		0 to 20	98	59	230,000
		21 to 50	74	57	195,000
		51 to 80	63	56	205,000
		81 to 120	55	53	210,000
		121 to 180	51	50	240,000
2.	700' to 2499'*	0 to 20	197	59	355,000
		21 to 50	145	57	275,000
		51 to 80	121	56	260,000
		81 to 120	105	59	285,000
		121 to 180	94	60	340,000
3.	2500'* to 4299'	0 to 20	197	62	355,000
		21 to 50	149	63	285,000
		51 to 80	126	65	275,000
		81 to 120	111	70	300,000
		121 to 180	103	75	365,000
4.	4300' +	0 to 20	197	119	370,000
		21 to 50	149	113	320,000
		51 to 80	126	111	305,000
		81 to 120	111	105	315,000
		121 to 180	103	99	370,000
5.	700' to 2499' / 700' to 2499'	0 to 20	295	62	385,000
		21 to 50	213	63	305,000
		51 to 80	171	65	285,000
		81 to 120	149	70	310,000
		121 to 180	129	75	375,000
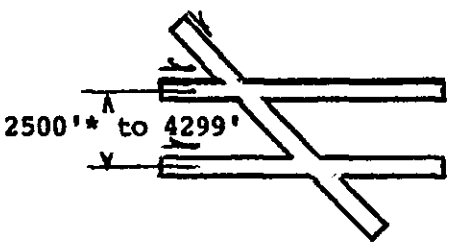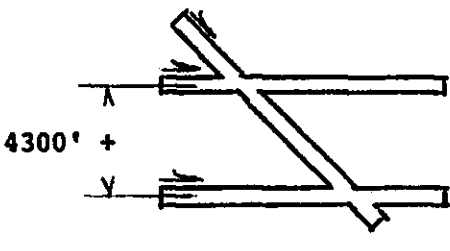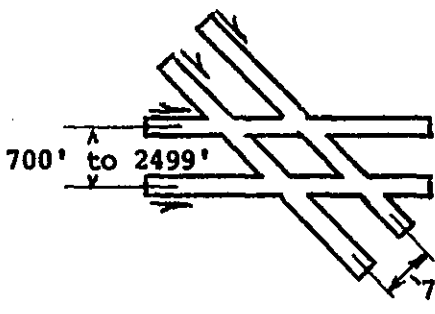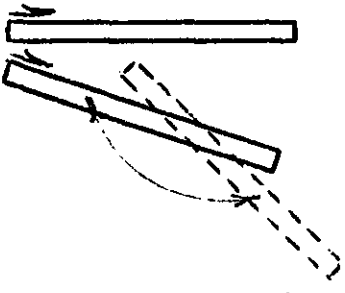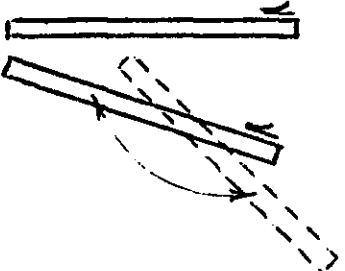
* Staggered threshold adjustments may apply, see paragraph 4-6.

Figure 2-1. Capacity and ASV for long range planning

Runway-use Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr VFR	IFR	Annual Service Volume Ops/Yr
700' to 2499' / 2500' to 3499'	0 to 20	295	62	385,000
	21 to 50	219	63	310,000
	51 to 80	184	65	290,000
	81 to 120	161	70	315,000
	121 to 180	146	75	385,000
700' to 2499' / 3500' +	0 to 20	295	119	625,000
	21 to 50	219	114	475,000
	51 to 80	184	111	455,000
	81 to 120	161	117	510,000
	121 to 180	146	120	645,000
700' to 2499' / 3500' + / 700' to 2499'	0 to 20	394	119	715,000
	21 to 50	290	114	550,000
	51 to 80	242	111	515,000
	81 to 120	210	117	565,000
	121 to 180	189	120	675,000
(intersecting runways)	0 to 20	98	59	230,000
	21 to 50	77	57	200,000
	51 to 80	77	56	215,000
	81 to 120	76	59	225,000
	121 to 180	72	60	265,000
700' to 2499'* (intersecting runways)	0 to 20	197	59	355,000
	21 to 50	145	57	275,000
	51 to 80	121	56	260,000
	81 to 120	105	59	285,000
	121 to 180	94	60	340,000

*Staggered threshold adjustments may apply, see paragraph 4-6.

Figure 2-1. Capacity and ASV for long range planning (cont.)

No.	Runway-use Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr VFR	IFR	Annual Service Volume Ops/Yr
11.		0 to 20	197	62	355,000
		21 to 50	149	63	285,000
	2500'* to 4299'	51 to 80	126	65	275,000
		81 to 120	111	70	300,000
		121 to 180	103	75	365,000
12.		0 to 20	197	119	370,000
		21 to 50	149	114	320,000
	4300' +	51 to 80	126	111	305,000
		81 to 120	111	105	315,000
		121 to 180	103	99	370,000
13.		0 to 20	197	59	355,000
		21 to 50	147	57	275,000
	700' to 2499'	51 to 80	145	56	270,000
		81 to 120	138	59	295,000
	700' to 2499'	121 to 180	125	60	350,000
14.		0 to 20	150	59	270,000
		21 to 50	108	57	225,000
		51 to 80	85	56	220,000
		81 to 120	77	59	225,000
		121 to 180	73	60	265,000
15.		0 to 20	132	59	260,000
		21 to 50	99	57	220,000
		51 to 80	82	56	215,000
		81 to 120	77	59	225,000
		121 to 180	73	60	265,000

*Staggered threshold adjustmants may apply, see paragraph 4-6.

Figure 2-1. Capacity and ASV for long range planning (cont.)

b.	Runway-use Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr VFR	IFR	Annual Service Volume Ops/Yr
6.	700' to 2499'	0 to 20	295	59	385,000
		21 to 50	210	57	305,000
		51 to 80	164	56	275,000
		81 to 120	146	59	300,000
		121 to 180	129	60	355,000
7.	700' to 2499'	0 to 20	197	59	355,000
		21 to 50	145	57	275,000
		51 to 80	121	56	260,000
		81 to 120	105	59	285,000
		121 to 180	94	60	340,000
8.	700' to 2499'	0 to 20	301	59	385,000
		21 to 50	210	57	305,000
		51 to 80	164	56	275,000
		81 to 120	146	59	300,000
		121 to 180	129	60	355,000
	700' to 2499'				
9.	700' to 2499'	0 to 20	264	59	375,000
		21 to 50	193	57	295,000
		51 to 80	158	56	275,000
		81 to 120	146	59	300,000
		121 180	129	60	355,000
	700' to 2499'				

Figure 2-1.   Capacity and ASV for long range planning (cont.)
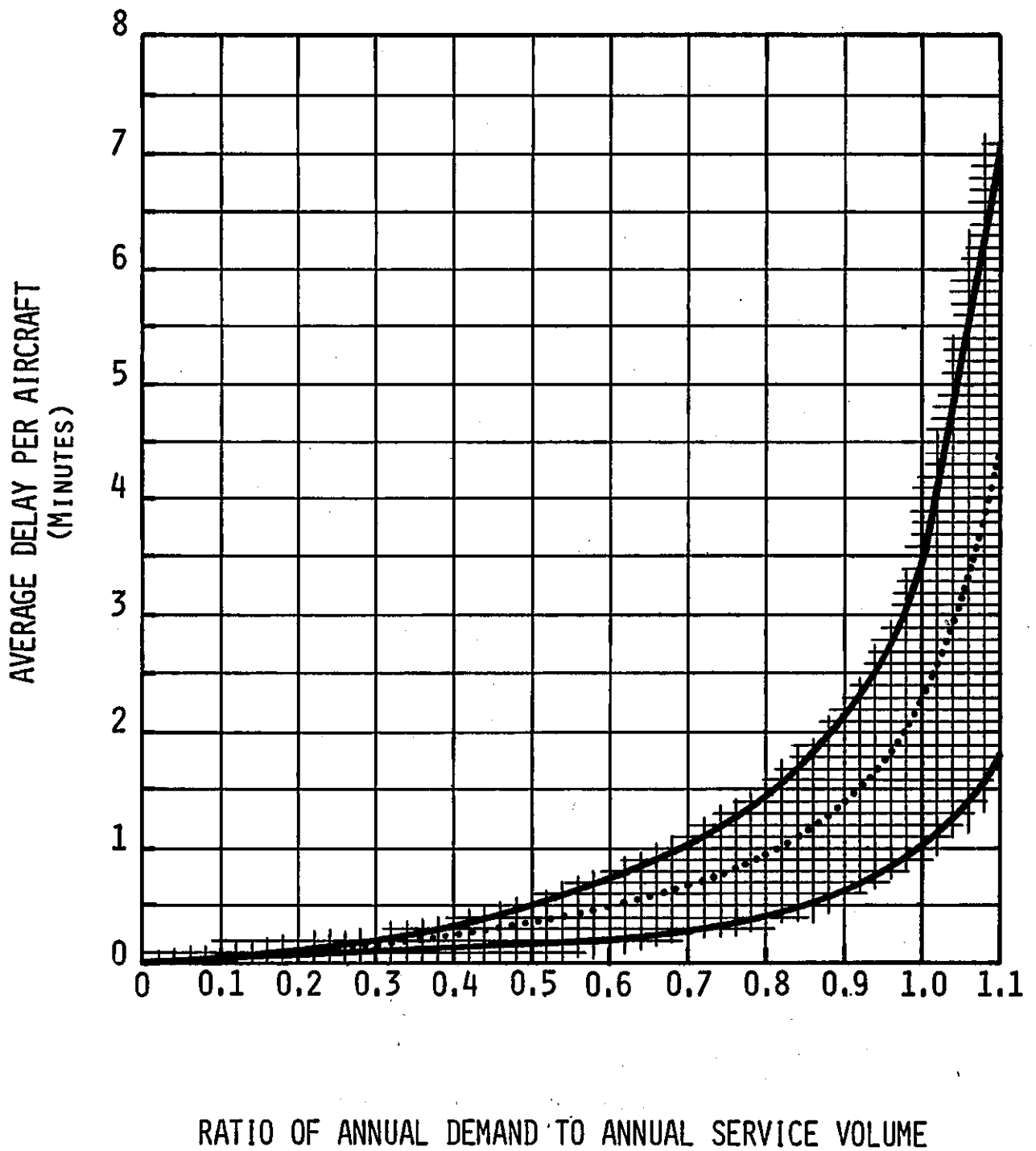
Figure 2-2. Average aircraft delay for long range planning

CHAPTER 3.   AIRPORT CAPACITY AND AIRCRAFT DELAY CALCULATIONS

3-1. <u>GENERAL</u>. This chapter contains instructions for calculating hourly capacity, ASV, and aircraft delay for a wide range of runway-use configurations and operational alternatives.

    a. <u>Capacity Calculations</u>.

        (1) Hourly capacity of the runway component.
        (2) Hourly capacity of the taxiway component.
        (3) Hourly capacity of gate group components.
        (4) Airport hourly capacity.
        (5) ASV.

    b. <u>Delay Calculations</u>.

        (1) Hourly delay.
        (2) Daily delay.
        (3) Annual delay.

Figure 3-1 provides a checklist of the data required for these calculations. Appendix 2 contains examples of these calculations.

3-2. <u>HOURLY CAPACITY OF THE RUNWAY COMPONENT</u>. Except for situations involving PVC conditions, an absence of radar coverage or ILS, and airports with parallel runways when one runway is limited to use by small aircraft (all of which are covered in chapter 4), calculate the runway component hourly capacity as follows:

    a. Select the runway-use configuration in figure 3-2 which best represents the use of the airport during the hour of interest. To adjust for staggered thresholds, see paragraph 4-6.

    b. Identify from figure 3-2 the figure number for capacity (for C^*, T, and E).

    c. Determine the percentage of Class C and D aircraft operating on the runway component and calculate the mix index.

    d. Determine percent arrivals (PA).

    e. Determine hourly capacity base (C*).

    f. Determine the percentage of touch and go operations during VFR operations and determine the touch and go factor (T). During IFR operations, T will be 1.00.

    g. Determine the location of exit taxiways (measured from the threshold at the approach end of the runway) and determine the exit factor (E).

    h. Calculate the hourly capacity of the runway component by the following equation:

$$\text{Hourly capacity of the runway component} = C^* \cdot T \cdot E$$

OUTPUT	INPUT NEEDED

OUTPUT   INPUT NEEDED

1. Hourly capacity of runway
    component
       See: paragraph 3-2
           appendix 2 (figure A2-1)

    a. Ceiling and visibility (VFR, IFR, or
         FVC)
       b. Runway-use configuration
       c. Aircraft mix
       d. Percent arrivals
       e. Percent touch and go
       f. Exit taxiway locations

2. Hourly capacity of taxiway
    component
       See: paragraph 3-3
           appendix 2 (figure A2-2)

    a. Intersecting taxiway location
       b. Runway operations rate
       c. Aircraft mix on runway being
         crossed

3. Hourly capacity of gate group
    components
       See: paragraph 3-4
           appendix 2 (figure A2-3)

    a. Number and type of gates in each
         gate group
       b. Gate mix
       c. Gate occupancy times

4. Airport hourly capacity
       See: paragraph 3-5
           appendix 2 (figure A2-4)

    Capacity outputs from 1, 2, and
    3 above

5. Annual service volume
       See: paragraph 3-6
           appendix 2 (figure A2-5)

    a. Hourly capacities of runway component
       b. Occurence of operating conditions

6. Hourly delay to aircraft on runway
    component
       See: paragraph 3-7
           appendix 2 (figure A2-6)

    a. Hourly demand
       b. Hourly capacity of the runway
         component
       c. Demand profile factor

7. Daily delay to aircraft on runway
    component
       See: paragraphs 3-8 and 3-9
           appendix 2 (figures A2-7,
           and A2-8)

    a. Hourly delay
       b. Hourly demand
       c. Hourly capacity

8. Annual delay to aircraft on runway
    component
       See: paragraph 3-10
           appendix 2 (figure A2-9)

    a. Annual demand
       b. Daily delay
       c. Hourly demand
       d. Hourly capacities
       e. Percent VFR/IFR conditions
       f. Runway-use configuration

Data Sources:
National Climatic Center, Asheville, North Carolina
Air Traffic Control Tower records
Offical Airline Guides
Airport Management
Observations

Figure 3-1.   Information required for capacity and delay calculations

3-3. HOURLY CAPACITY OF THE TAXIWAY COMPONENT. Calculate the hourly capacity of a taxiway component as follows:

    a. Determine the distance from the runway end (start of takeoff roll) to the taxiway crossing.

    b. Determine the runway operations rate, i.e., the demand being accommodated on the runway being crossed.

    c. Calculate the mix index of the runway being crossed.

    d. Determine the hourly capacity of the taxiway crossing.

        (1) Use figure 3-66 when the crossed runway accommodates arrivals or mixed operations.

        (2) Use figure 3-67 when the crossed runway accommodates only departures and touch and go's.

3-4. HOURLY CAPACITY OF GATE GROUP COMPONENTS. Calculate the hourly gate group capacities as follows:

    a. Determine the number of gate groups and the number of gates in each gate group.

    b. Determine the gate mix, i.e., the percent of non-widebodied aircraft using each gate group.

    c. Determine the percentage of gates in each gate group that can accommodate widebodied aircraft.

    d. Determine for each gate group the average gate occupancy time for wide-bodied and non-widebodied aircraft.

    e. When widebodied aircraft are served, calculate the gate occupancy ratio (R) by the following equation:

$$R = \frac{\text{Average gate occupancy time for widebodied aircraft}}{\text{Average gate occupancy time for non-widebodied aircraft}}$$

When widebodied aircraft are not served, R equals 1.00.

    f. Calculate the hourly capacity of each gate group by use of figure 3-68.

3-5. AIRPORT HOURLY CAPACITY. Calculate the airport hourly capacity as follows:

    a. Calculate the hourly capacities of the runway, taxiway, and gate groups components and determine the hourly demands on each.

    b. Calculate the demand ratio for each component by dividing the component demand by the runway component demand.

  c. Calculate the component quotients by dividing each components capacity by its demand ratio.

  d. Identify the airport hourly capacity, i.e., the lowest quotient calculated in c above.

3-6. ANNUAL SERVICE VOLUME (ASV). Calculate the ASV as follows:

  a. Calculate the weighted hourly capacity (C_w) for the runway component as follows:

   (1) Identify the different runway-use configurations used over the course of a year.

   (2) Determine the percent of time each runway-use configuration is in use (P_1 through P_n). Include those times when the hourly capacity is zero, i.e., the weather conditions are below airport minimums or the airport is closed for other reasons. If a runway-use configuration is used less than 2 percent of the time, that time may be credited to another runway-use configuration.

   (3) Calculate the hourly capacity for each runway-use configuration (C_1 through C_n).

   (4) Identify the runway-use configuration that provides the maximum capacity. Generally, this configuration is also the configuration most frequently used.

   (5) Divide the hourly capacity of each runway-use configuration by the hourly capacity of the runway-use configuration that provides the maximum capacity.

   (6) Determine the ASV weighting factor (W_1 through W_n) for each runway-use configuration from Table 3-1.

Table 3-1. ASV Weighting Factors

Percent of Maximum Capacity	Weighting Factors			
	VFR	IFR		
		Mix Index (0-20)	Mix Index (21-50)	Mix Index (51-180)
91+	1	1	1	1
81-90	5	1	3	5
66-80	15	2	8	15
51-65	20	3	12	20
0-50	25	4	16	25

(7) Calculate the weighted hourly capacity (C_w) of the runway component by the following equation:

$$C_w = \frac{(P_1 \cdot C_1 \cdot W_1) + (P_2 \cdot C_2 \cdot W_2) + \ldots + (P_n \cdot C_n \cdot W_n)}{(P_1 \cdot W_1) + (P_2 \cdot W_2) + \ldots + (P_n \cdot W_n)}$$

b. Calculate the ratio of annual demand to average daily demand during the peak month (D). Typical annual demand to average daily demand ratios are provided in table 3-2.

c. Calculate the ratio of average daily demand to average peak hour demand during the peak month (H). Typical average daily to average peak hour demand ratios are provided in table 3-2.

Table 3-2. Typical Demand Ratios

Mix Index	Daily (D)	Hourly (H)
0-20	280-310	7-11
21-50	300-320	10-13
51-180	310-350	11-15

d. Calculate ASV by the following equation:

$$ASV = C_w \cdot D \cdot H$$

3-7. HOURLY DELAY TO AIRCRAFT ON THE RUNWAY COMPONENT. Hourly delay calculations described in this paragraph apply to those hours when the hourly demand does not exceed the hourly capacity of the runway component. For those hours when the hourly demand exceeds the hourly capacity of the runway component, paragraph 3-9 calculations apply. Calculate hourly delay as follows:

a. Calculate the hourly capacity of the runway component for the specific hour of interest.

b. Identify from figure 3-2 the figure number for delay (for the arrival delay index (ADI) and the departure delay index (DDI)).

c. Identify the hourly demand (HD) and the peak 15 minute demand (Q) on the runway component.

d. Calculate the ratio of hourly demand to hourly capacity (D/C).

e. Determine the arrival delay index (ADI) and departure delay index (DDI).

f. Calculate the arrival delay factor (ADF) and departure delay factor (DDF) by the following equations:

$$ADF = ADI \cdot (D/C)$$

$$DDF = DDI \cdot (D/C)$$

g. Calculate the demand profile factor (DPF) by the following equation:

$$DPF = \frac{100 \; Q}{HD}$$

NOTE: Airports with a high percentage of air carrier activity normally have a DPF of 50 percent. Airports with a high percentage of general aviation activity normally have a DPF in the 30 to 35 percent range.

h. Calculate the average delay for arriving aircraft (DAHA) and departing aircraft (DAHD) figure 3-69.

i. Calculate hourly delay (DTH) by the following equation:

$$DTH = HD(PA \cdot DAHA + (100 - PA) \cdot DAHD)/100$$

3-8. DAILY DELAY TO AIRCRAFT ON THE RUNWAY COMPONENT WHEN THE D/C RATIO IS 1.0 OR LESS FOR EACH HOUR. Calculate the daily delay as follows:

a. For each hour, calculate the hourly delay to aircraft on the runway component.

b. Calculate the delay for the time period in question by summing the delay for each of the hours.

3-9. DAILY DELAY TO AIRCRAFT ON THE RUNWAY COMPONENT WHEN THE D/C RATIO IS GREATER THAN 1.0 FOR ONE OR MORE HOURS. Calculate the daily delay as follows:

a. Identify the saturated time periods. A saturated period consists of the consecutive hours when demand exceeds capacity (termed the overload phase) plus the subsequent hour(s) required to accommodate the residual demand (termed the recovery phase).

b. For each saturated period (overload plus recovery phase), calculate the delay to aircraft as follows:

(1) Determine the duration of the overload phase.

(2) Calculate the hourly AD/C ratio during the overload phase, i.e., the sum of the hourly demands during the overload phase divided by the sum of the hourly capacities during the overload phase.

(3) Determine the percent of arrivals (PAS) for the saturated (overload plus recovery) period.

(4) Determine the ADI and the DDI for the saturated (overload plus recovery) period.

(5) Calculate the arrival delay factor (ADF) and departure delay factor (DDF) using the following equations:

$$ADF = ADI \cdot (AD/C)$$

$$DDF = DDI \cdot (AD/C)$$

(6) Determine the average delay per arrival (DASA) and per departure (DASD) during the saturated (overload plus recovery) period from figure 3-70.

(7) Calculate the delay in the saturated period (DTS) by the following equation:

$$DTS = (HD_1 + HD_2 + \ldots + HD_n) \cdot (PAS \cdot DASA + (100 - PAS) DASD)/100, \text{ where}$$

HD_1 through HD_n = Hourly demand during hours 1 through n of the saturated period.

c. Determine for each unsaturated hour the delay in accordance with the procedures in paragraph 3-8.

d. Calculate the total daily delay by summing the saturated and unsaturated delays.

3-10. ANNUAL DELAY TO AIRCRAFT ON THE RUNWAY COMPONENT. The following procedure uses 24 representative days, one VFR and one IFR for each calander month. Other increments of time may be selected. If the airport has considerable fluctuation in operations during the week, or if a more precise delay determination is needed, one representative VFR and one representative IFR day should be used for each day of the week. Variation in seasonal traffic will require repetition of these computations for each season. Airports which have consistent patterns of operations throughout the week and year require fewer computations.

a. Convert annual demand to average day demand for each month.

(1) Distribute the annual demand to the 12 calendar months to account for seasonal variations in traffic.

(2) Develop average day demand by dividing the monthly demands by the number of days in the respective month.

b. Adjust the average day demand to account for differences in VFR and IFR demand.

(1) Determine from weather records the percent of the time that IFR and PVC operating conditions prevail (%IFR).

(2) Determine from traffic records the percent IFR (and PVC) demand to VFR demand (%IFR demand).

(3)   Calculate the representative VFR day demand (VFR demand) and representative IFR day demand (IFR demand) by the following equations:

$$\text{VFR demand} = \frac{\text{(Average day demand)}}{1 - \%IFR(1 - \%IFR \text{ demand}/100)/100}$$

$$\text{IFR demand} = \text{VFR demand} \cdot \%IFR \text{ demand}/100$$

c.   From historical data, develop a breakdown of hourly demand for the representative day(s).

d.   Calculate the representative daily delays.

e.   Determine monthly delay by multiplying the representative daily delays by the number of days it represents and summing these quotients.

f.   Sum the monthly delays.

3-11. HOURLY DEMAND CORRESPONDING TO A SPECIFIED LEVEL OF AVERAGE HOURLY DELAY.
Determine the hourly demand which corresponds to a stipulated average level of delay by trial and error, i.e., using a graphical plotting of delay versus demand.

Table 1

Diagram	Diag. No.	Runway Spacing in Feet (s)	For Capacity VFR	For Capacity IFR	For Delay VFR	For Delay IFR
	1	NA	3-3	3-43	3-71	3-90
	2	700 or more	3-4	3-44	3-72	3-91
	3	700 to 2499	3-5	3-44	3-73	3-91
	4	2500 or more	3-6	3-45	3-74	3-92
	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
	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
	14	2500 to 2999	3-11	3-53	3-76	3-97
	15	3000 or more	3-11	3-54	3-76	3-98
	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
	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
	23*	700 or more	3-14	3-56	3-78	3-100
	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
	27*	700 to 2999	3-15	3-52	3-79	3-97
	28	3000 or more	3-17	3-54	3-80	3-98
	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
	32	3000 or more	3-20	3-58	3-72	3-91
	33	3000 or more	3-20	3-58	3-72	3-91
	34	3000 or more	3-21	3-58	3-82	3-91

Table 2

Runway-use Diagram	Diag. No.	Runway Spacing in Feet (s)	For Capacity VFR	For Capacity IFR	For Delay VFR	For Delay IFR
	35	3000 or more	3-21	3-58	3-82	3-91
	36*	3000 to 4299	3-22	3-55	3-83	3-99
	37	4300 or more	3-22	3-58	3-83	3-91
	38*	3000 or more	3-22	3-58	3-83	3-91
	39*	3000 or more	3-23	3-58	3-84	3-91
	40*	3000 or more	3-24	3-58	3-84	3-91
	41*	3000 or more	3-25	3-58	3-80	3-91
	42*	3000 or more	3-26	3-58	3-71	3-91

Legend

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.

Table 3

Runway-use Diagram	Diag. No.	Runway Intersection Distance in Feet (x)	(y)	For Capacity VFR	For Capacity IFR	For Delay VFR	For Delay IFR
	43	0 to 1999	< 4000	3-27	3-59	3-85	3-91
	44	2000 to 4999	< 4000	3-28	3-60	3-86	3-99
	45	5000 to 8000	< 4000	3-29	3-61	3-86	3-99
	46	0 to 1999	≥ 4000	3-30	3-52	3-86	3-99
	47	2000 to 4999	≥ 4000	3-31	3-63	3-71	3-102
	48	5000 to 8000	≥ 4000	3-32	3-64	3-71	3-102
	49	0 to 1999	< 4000	3-27	3-59	3-85	3-91
	50	2000 to 4999	< 4000	3-28	3-60	3-86	3-99
	51	5000 to 8000	< 4000	3-29	3-61	3-86	3-99
	52	0 to 1999	≥ 4000	3-30	3-62	3-86	3-99
	53	2000 to 4999	≥ 4000	3-31	3-65	3-71	3-90
	54	5000 to 8000	≥ 4000	3-3	3-43	3-71	
	55*	0 to 1999	< 4000	3-33	3-59	3-85	3-91
	56*	2000 to 4999	< 4000	3-34	3-60	3-86	3-99
	57*	5000 to 8000	< 4000	3-35	3-61	3-86	3-99
	58*	0 to 1999	≥ 4000	3-36	3-62	3-86	3-99
	59*	2000 to 4999	≥ 4000	3-37	3-63	3-87	3-102
	60*	5000 to 8000	≥ 4000	3-38	3-64	3-87	3-102
	61*	0 to 1999	< 4000	3-33	3-44	3-85	3-91
	62*	2000 to 4999	< 4000	3-39	3-44	3-85	3-91
	63*	5000 to 8000	< 4000	3-35	3-44	3-86	3-91
	64*	0 to 1999	≥ 4000	3-36	3-44	3-86	3-91
	65*	2000 to 4999	≥ 4000	3-37	3-44	3-87	3-91
	66*	5000 to 8000	≥ 4000	3-9	3-44	3-71	3-91

Table 4

Runway-use Diagram	Diag. No.	Runway Spacing in Feet (s)	For Capacity VFR	For Capacity IFR	For Delay VFR	For Delay IFR
	67*	700 or more	3-4	3-44	3-72	3-91
	68*	700 to 2499	3-9	3-44	3-71	3-91
	69	2500 to 2999	3-10	3-49	3-71	3-95
	70	3000 to 4299	3-10	3-50	3-71	3-95
	71	4300 or more	3-10	3-51	3-71	3-96

Table 5

Runway-use Diagram	Diag. No.	Angle θ	For Capacity VFR	For Capacity IFR	For Delay VFR	For Delay IFR
	72	NA	3-4	3-44	3-72	3-91
	73	NA	3-4	3-44	3-72	3-91

Runway-use Diagram	Diag. No.	Angle ø	Figure No. For Capacity VFR	Figure No. For Capacity IFR	Figure No. For Delay VFR	Figure No. For Delay IFR
	74	0° to 14°	3-6	3-44	3-74	3-91
	75	15° to 90°	3-6	3-45	3-74	3-92
	76	NA	3-8	3-44	3-75	3-91
	77*	0° to 14°	3-14	3-44	3-78	3-91
	78*	15° to 90°	3-14	3-57	3-78	3-101
	79	NA	3-12	3-44	3-77	3-91
	80*	0° to 14°	3-40	3-44	3-88	3-91
	81*	15° to 90°	3-40	3-57	3-88	3-101
	82*	NA	3-17	3-44	3-80	3-91
	83*	NA	3-41	3-44	3-89	3-91

Runway-use Diagram	Diag. No.	Angle ø	Figure No. For Capacity VFR	Figure No. For Capacity IFR	Figure No. For Delay VFR	Figure No. For Delay IFR
	84*	NA	3-41	3-44	3-89	3-91
	85*	0° to 14°	3-42	3-44	3-74	3-91
	86	15° to 90°	3-42	3-57	3-74	3-101
	87	NA	3-4	3-44	3-72	3-91
	88	NA	3-4	3-44	3-72	3-91
	89	0° to 14°	3-6	3-44	3-74	3-91
	90	15° to 90°	3-6	3-45	3-74	3-92
	91	NA	3-8	3-44	3-75	3-91
	92*	0° to 14°	3-14	3-44	3-78	3-91
	93	15° to 90°	3-14	3-57	3-78	3-101
	94	NA	3-12	3-44	3-77	3-91
	95*	0° to 14°	3-40	3-44	3-88	3-91
	96	15° to 90° c ≥ 2000	3-40	3-57	3-88	3-101

Runway-use Diagram	Diag. No.	Angle ø
	97*	NA
	98*	NA
	99*	NA
	100*	0° to 14°
	101*	15° to 90°
	102*	NA

NOTES:

1. THE MINIMUM CENTERLINE SPACING OF PARALLEL RUNWAYS U... OPERATIONS IS:

   A. 700 FEET IF USED BY ALL AIRCRAFT CLASSES A,B,C.

   B. 500 FEET IF USED ONLY BY AIRCRAFT CLASSES A AND ...

   C. 300 FEET IF USED EXCLUSIVELY BY AIRCRAFT CLASS A ...

   *D. EXCEPTION: AT A POSITIVE CONTROLLED AIRPORT (IFR ... PREDOMINATES THE CENTERLINE-TO-CENTERLINE SPACING ... NEOUS ARRIVAL STREAMS IS 2,500 FEET EVEN IN VFR C... LIMITING FACTOR ON CLOSELY SPACED PARALLEL RUNWAY ... AIRPORTS THAT NEEDS CAREFUL EVALUATION IS THE CO... OF THE CONTROLLER.

2. WHEN THERE ARE THREE, OR MORE, PARALLEL RUNWAYS USED ... FOLLOWING RELATIONSHIP IS ASSUMED.

   A. 700 ≤ C ≤ 2499
   B. WHEN
   700 ≤ S ≤ 2499   2500
   2500 ≤ S ≤ 2999   3000
   S ≥ 3000

3. WHEN APPLICABLE, APPLY THE THRESHOLD STAGGER CORRECT... CHAPTER 4, PARAGRAPH 4-6, TO DETERMINE WHETHER RUNWA... (9 OR 10), (13 OR 14), (16 OR 17), (19 OR 20), (24 o... (68 OR 69) SHOULD BE USED IN THE CALCULATIONS.

Figure 3-2. Runway-use diagrams

HOURLY CAPACITY BASE C*

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.04
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.20
31 to 40	0 to 10	1.31
41 to 50	0 to 10	1.40

C* × T × 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	0.72	0.87	0.94	0.70	0.86	0.94	0.67	0.84	0.92
21 to 50	3000 to 5500	0.79	0.86	0.94	0.76	0.84	0.93	0.72	0.81	0.90
51 to 80	3500 to 6500	0.79	0.95	0.92	0.76	0.93	0.91	0.73	0.81	0.90
81 to 120	5000 to 7000	0.82	0.89	0.93	0.80	0.88	0.94	0.77	0.86	0.93
121 to 180	5500 to 7500	0.86	0.93	0.98	0.82	0.91	0.96	0.79	0.91	0.97

FIGURE 3-3. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 1,54 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

T = 1.00

C* × T × 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	0.81	0.93	0.97

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

HOURLY CAPACITY BASE C*

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

40
50
60

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.05
21 to 30	0 to 40	1.09
31 to 40	0 to 10	1.13
41 to 50	0 to 10	1.20

C* × T × 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	0.85	0.96	0.98	0.83	0.93	0.97	0.83	0.93	0.97

FIGURE 3-5. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 3 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

40
50
60

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

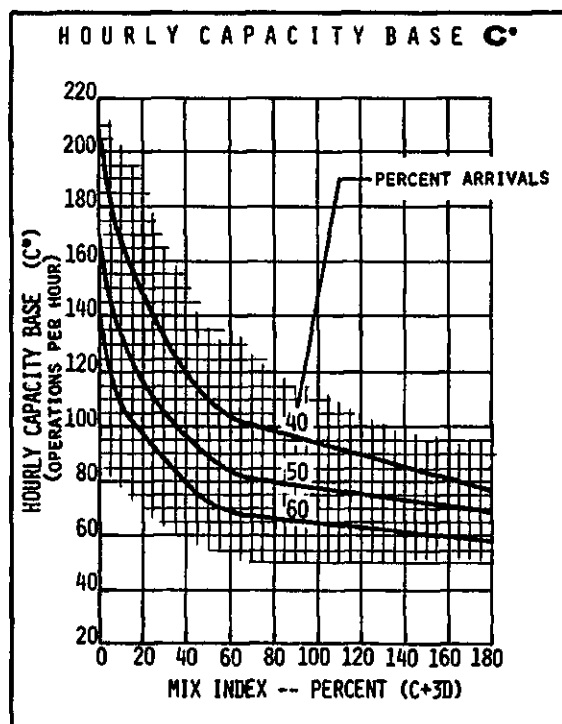| Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.02
11 to 20	0 to 70	1.04
21 to 30	0 to 40	1.08
31 to 40	0 to 10	1.13
41 to 50	0 to 10	1.17

C* × T × 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	0.83	0.93	0.97	0.83	0.93	0.97	0.83	0.93	0.97

FIGURE 3-6. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 4,67,74,75,85,90 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.02
11 to 20	0 to 70	1.05
21 to 30	0 to 40	1.08
31 to 40	0 to 10	1.11
41 to 50	0 to 10	1.14

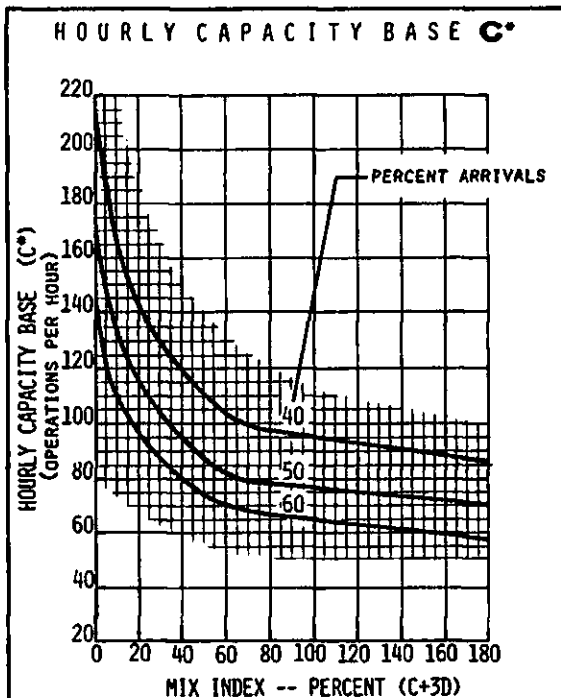### C* x T x E = Hourly Capacity

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	0.75	0.88	0.94	0.72	0.86	0.94	0.69	0.84	0.93
21 to 50	3000 to 5500	0.83	0.91	0.97	0.80	0.89	0.96	0.77	0.86	0.96
51 to 80	3500 to 6500	0.85	0.91	0.96	0.82	0.89	0.95	0.79	0.87	0.93
81 to 120	5000 to 7000	0.89	0.93	0.97	0.87	0.91	0.96	0.84	0.89	0.95
121 to 180	5500 to 7500	0.97	1.00	1.00	0.91	0.97	0.99	0.90	0.96	0.98

FIGURE 3-7. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 5 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

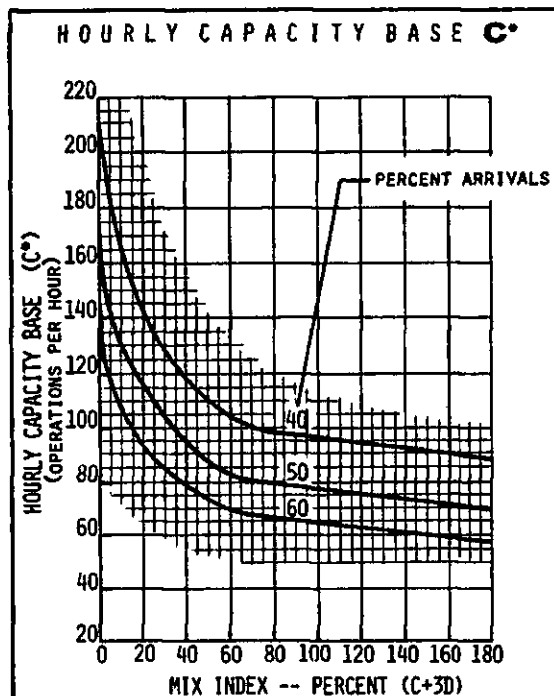| Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.02
11 to 20	0 to 70	1.05
21 to 30	0 to 40	1.08
31 to 40	0 to 10	1.11
41 to 50	0 to 10	1.14

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	0.75	0.88	0.94	0.72	0.86	0.94	0.69	0.84	0.93
21 to 50	3000 to 5500	0.83	0.91	0.97	0.81	0.89	0.96	0.78	0.87	0.95
51 to 80	3500 to 6500	0.85	0.91	0.95	0.82	0.89	0.94	0.80	0.88	0.94
81 to 120	5000 to 7000	0.89	0.93	0.96	0.87	0.91	0.96	0.84	0.90	0.95
121 to 180	5500 to 7500	0.97	1.00	1.00	0.90	0.96	0.98	0.88	0.95	0.98

FIGURE 3-8. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 6-8,70,91 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE (C*)
(OPERATIONS PER HOUR)

HOURLY CAPACITY BASE C*

MIX INDEX — PERCENT (C+3D)

PERCENT ARRIVALS

FIGURE 3-9. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 9,66,68 FOR VFR CONDITIONS.

C* × T × E = Hourly Capacity

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index—Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 100	1.00
1 to 10	0 to 20	1.04
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.20
31 to 40	0 to 40	1.31
41 to 50	0 to 10	1.40

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	N=3 or)	N=0	N=1	N=2	N=3 or)	N=0	N=1	N=2	N=3 or)
0 to 20	2000 to 4000	0.72	0.90	0.94	0.97	0.70	0.86	0.94	0.97	0.67	0.84	0.84	0.97
21 to 50	3000 to 5500	0.79	0.86	0.94	0.76	0.76	0.84	0.93	0.72	0.81	0.90
51 to 80	3500 to 6500	0.79	0.86	0.93	0.76	0.76	0.84	0.93	0.72	0.81	0.90
81 to 120	5000 to 7000	0.83	0.87	0.94	0.77	0.84	0.86	0.93	0.89	0.90
121 to 180	5500 to 7500	0.83	0.93	0.98	0.97	0.94	0.95	0.97

HOURLY CAPACITY BASE (C*)
(OPERATIONS PER HOUR)

HOURLY CAPACITY BASE C*

MIX INDEX — PERCENT (C+3D)

PERCENT ARRIVALS

FIGURE 3-10. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 10-12,69-71 FOR VFR CONDITIONS.

C* × T × E = Hourly Capacity

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index—Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 100	1.00
1 to 10	0 to 20	1.04
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.20
31 to 40	0 to 40	1.31
41 to 50	0 to 10	1.40

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

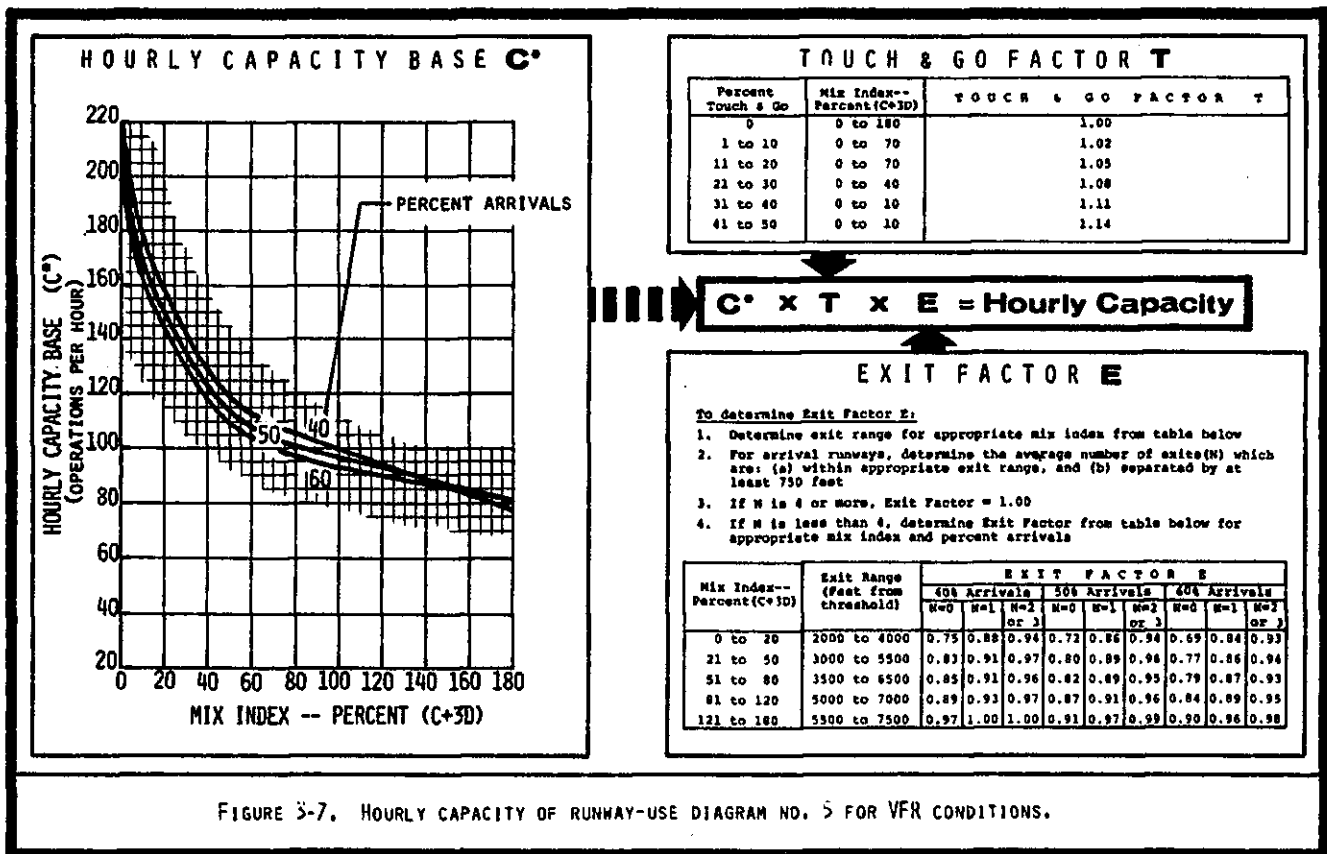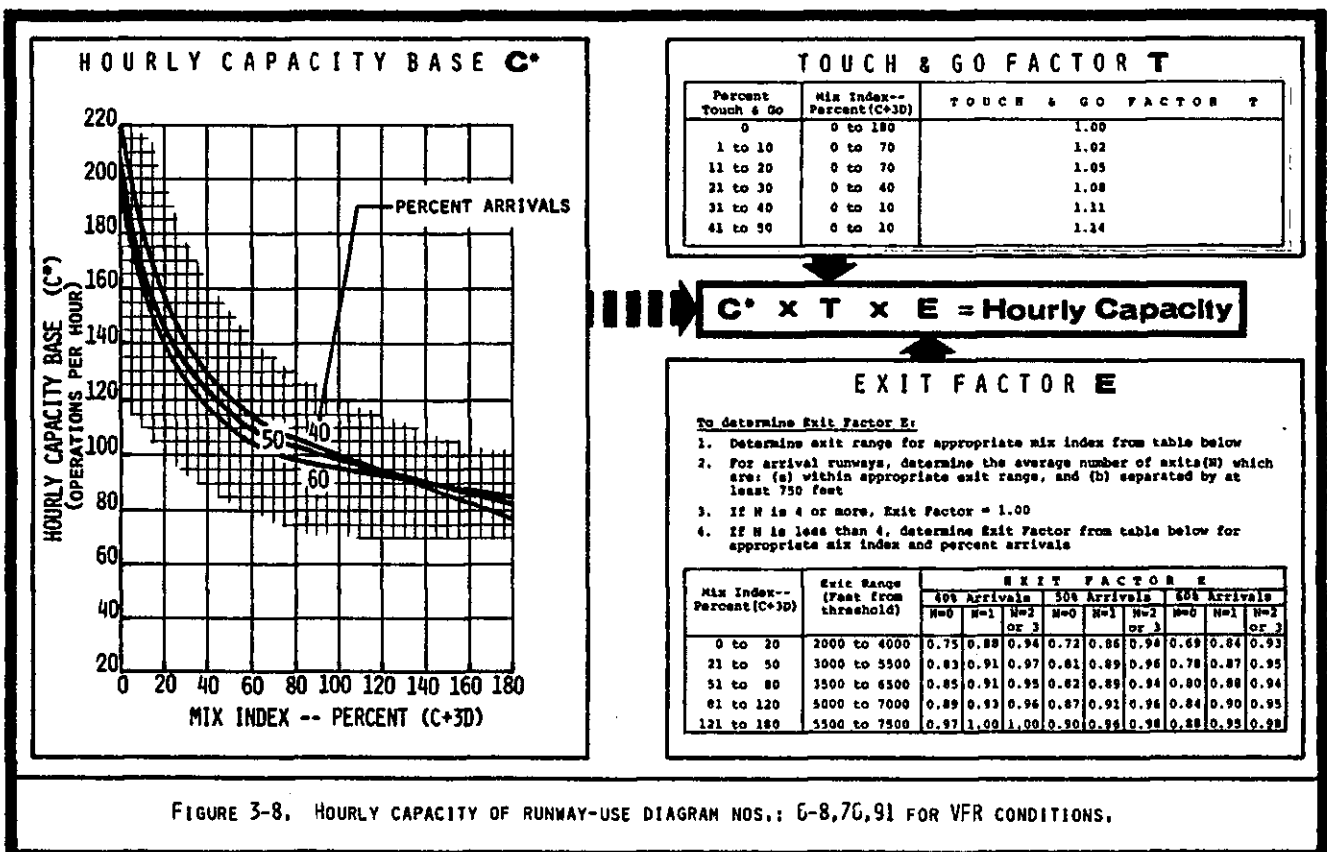| Mix Index—Percent(C+3D) | Exit Range (feet from threshold) | EXIT FACTOR E | | | | | | | | | | | |
		40% Arrivals				50% Arrivals				60% Arrivals			
		N=0	N=1	N=2	N=3 or)	N=0	N=1	N=2	N=3 or)	N=0	N=1	N=2	N=3 or)
0 to 20	2000 to 4000	0.72	0.87	0.84	0.70	0.86	0.94	0.67	0.84	0.84	0.97
21 to 50	3000 to 5500	0.79	0.86	0.94	0.76	0.76	0.84	0.93	0.72	0.81	0.90
51 to 80	3500 to 6500	0.79	0.86	0.93	0.76	0.76	0.84	0.91	0.72	0.81	0.90
81 to 120	5000 to 7000	0.82	0.89	0.80	0.80	0.84	0.77	0.86	0.93
121 to 180	5500 to 7500	0.86	0.94	0.98	0.94	0.95	0.96	0.79	0.91	0.97

FIGURE 3-11. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 13-15 FOR VFR CONDITIONS.

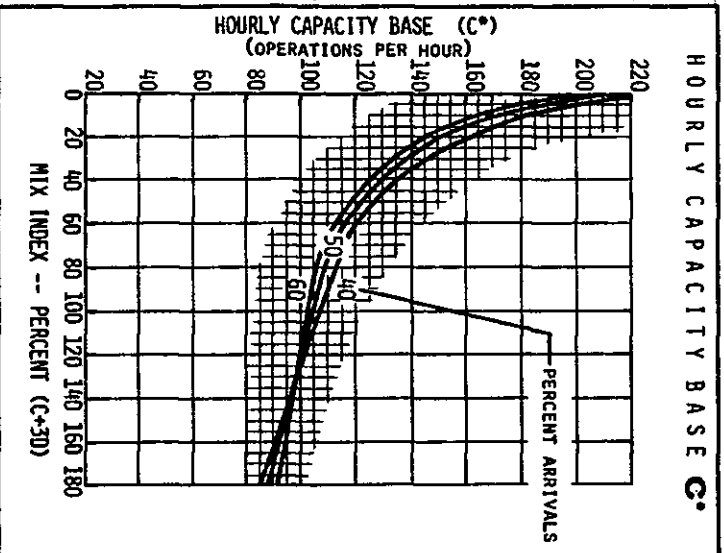**FIGURE 3-12.** HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 16,79,94 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

MIX INDEX -- PERCENT (C+3D)

PERCENT ARRIVALS
40
50
60

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.05
21 to 30	0 to 40	1.11
31 to 40	0 to 10	1.20
41 to 50	0 to 10	1.26

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)	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	0.76	0.88	0.94	0.65	0.83	0.93	0.62	0.79	0.90
21 to 50	3000 to 5500	0.83	0.90	0.96	0.72	0.83	0.94	0.72	0.83	0.93
51 to 80	3500 to 6500	0.85	0.91	0.96	0.75	0.84	0.92	0.75	0.84	0.92
81 to 120	5000 to 7000	0.90	0.94	0.97	0.82	0.88	0.95	0.80	0.87	0.94
121 to 180	5500 to 7500	0.93	0.98	1.00	0.90	0.97	0.99	0.86	0.95	0.98

FIGURE 3-13. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 17,18,20-22 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

MIX INDEX -- PERCENT (C+3D)

PERCENT ARRIVALS
40
50
60

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.05
21 to 30	0 to 40	1.11
31 to 40	0 to 10	1.20
41 to 50	0 to 10	1.26

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)	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	0.76	0.88	0.94	0.65	0.83	0.93	0.62	0.79	0.90
21 to 50	3000 to 5500	0.83	0.90	0.96	0.72	0.83	0.94	0.72	0.83	0.93
51 to 80	3500 to 6500	0.85	0.91	0.96	0.75	0.84	0.92	0.75	0.84	0.92
81 to 120	5000 to 7000	0.90	0.94	0.97	0.82	0.88	0.95	0.80	0.87	0.94
121 to 180	5500 to 7500	0.93	0.98	1.00	0.90	0.97	0.99	0.86	0.95	0.98

FIGURE 3-14. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 19,23,77,78,92,93 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.01
11 to 20	0 to 70	1.02
21 to 30	0 to 40	1.03
31 to 40	0 to 10	1.04
41 to 50	0 to 10	1.05

C* × T × 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)	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	0.75	0.88	0.94	0.72	0.86	0.93	0.69	0.84	0.93
21 to 50	3000 to 5500	0.82	0.89	0.96	0.79	0.87	0.95	0.76	0.86	0.95
51 to 80	3500 to 6500	0.83	0.90	0.95	0.81	0.89	0.95	0.78	0.86	0.93
81 to 120	5000 to 7000	0.88	0.92	0.97	0.85	0.90	0.95	0.83	0.89	0.95
121 to 180	5500 to 7500	0.91	0.97	0.99	0.88	0.95	0.98	0.85	0.94	0.97

FIGURE 3-15. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 24,27 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.01
11 to 20	0 to 70	1.02
21 to 30	0 to 40	1.03
31 to 40	0 to 10	1.04
41 to 50	0 to 10	1.05

C* × T × 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)	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	0.75	0.88	0.94	0.72	0.86	0.93	0.69	0.84	0.93
21 to 50	3000 to 5500	0.82	0.89	0.96	0.79	0.87	0.95	0.76	0.86	0.95
51 to 80	3500 to 6500	0.83	0.90	0.95	0.81	0.89	0.95	0.70	0.86	0.93
81 to 120	5000 to 7000	0.88	0.92	0.97	0.85	0.90	0.95	0.83	0.89	0.95
121 to 180	5500 to 7500	0.91	0.97	0.99	0.88	0.95	0.98	0.85	0.94	0.97

FIGURE 3-16. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 25,26 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS

MIX INDEX -- PERCENT (C+3D)

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.04
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.20
31 to 40	0 to 10	1.31
41 to 50	0 to 10	1.40

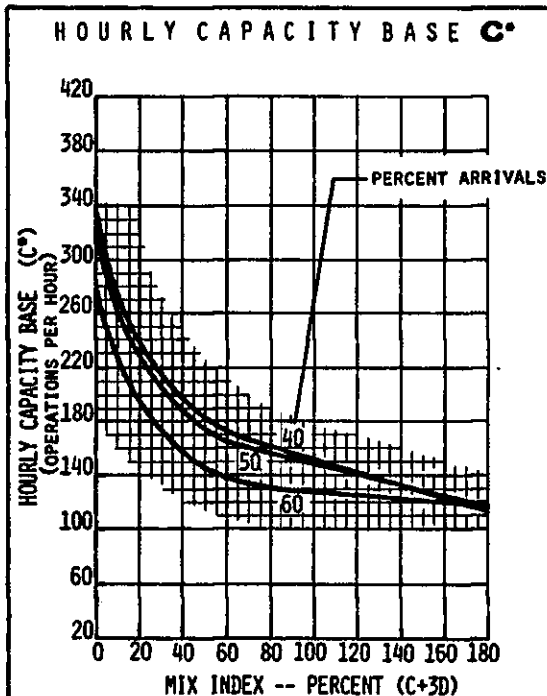## C* x T x E = Hourly Capacity

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)	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	0.72	0.87	0.94	0.70	0.86	0.94	0.67	0.84	0.92
21 to 50	3000 to 5500	0.79	0.86	0.94	0.76	0.84	0.93	0.73	0.81	0.90
51 to 80	3500 to 6500	0.79	0.86	0.92	0.76	0.83	0.91	0.73	0.81	0.90
81 to 120	5000 to 7000	0.82	0.89	0.93	0.80	0.88	0.94	0.77	0.86	0.93
121 to 180	5500 to 7500	0.86	0.94	0.98	0.82	0.91	0.96	0.79	0.91	0.97

FIGURE 3-18. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 29 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS

MIX INDEX -- PERCENT (C+3D)

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.01
11 to 20	0 to 70	1.02
21 to 30	0 to 40	1.03
31 to 40	0 to 10	1.04
41 to 50	0 to 10	1.05

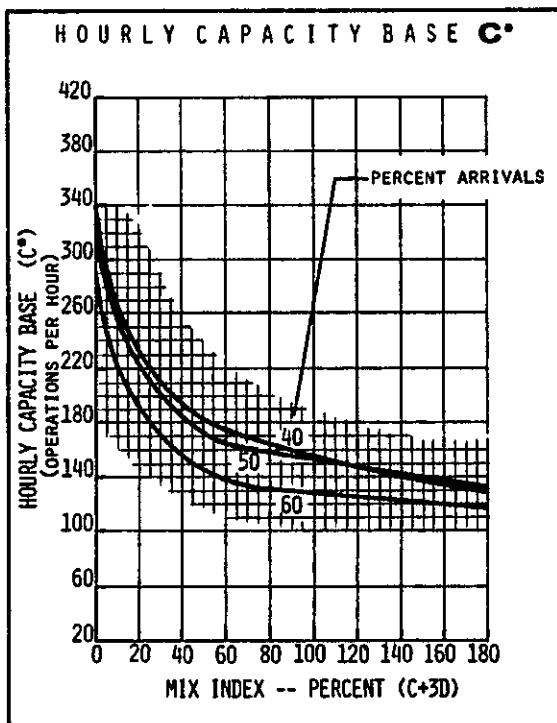## C* x T x E = Hourly Capacity

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)	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	0.75	0.88	0.94	0.73	0.86	0.93	0.69	0.84	0.93
21 to 50	3000 to 5500	0.82	0.89	0.96	0.79	0.87	0.95	0.76	0.86	0.95
51 to 80	3500 to 6500	0.83	0.90	0.95	0.81	0.89	0.95	0.78	0.86	0.93
81 to 120	5000 to 7000	0.88	0.92	0.97	0.85	0.90	0.95	0.83	0.89	0.95
121 to 180	5500 to 7500	0.91	0.97	0.99	0.88	0.95	0.98	0.85	0.94	0.97

FIGURE 3-17. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 28, 82, 97 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C^*

PERCENT ARRIVALS

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.04
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.20
31 to 40	0 to 10	1.31
41 to 50	0 to 10	1.40

$$C^* \times T \times E = \text{Hourly Capacity}$$

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	0.72	0.87	0.94	0.70	0.86	0.94	0.67	0.84	0.92
21 to 50	3000 to 5500	0.79	0.86	0.94	0.76	0.84	0.93	0.72	0.81	0.90
51 to 80	3500 to 6500	0.79	0.86	0.92	0.76	0.83	0.91	0.73	0.81	0.90
81 to 120	5000 to 7000	0.82	0.89	0.93	0.80	0.88	0.94	0.77	0.86	0.93
121 to 180	5500 to 7500	0.86	0.94	0.98	0.83	0.91	0.96	0.79	0.91	0.97

FIGURE 3-19. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 30,31 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C^*

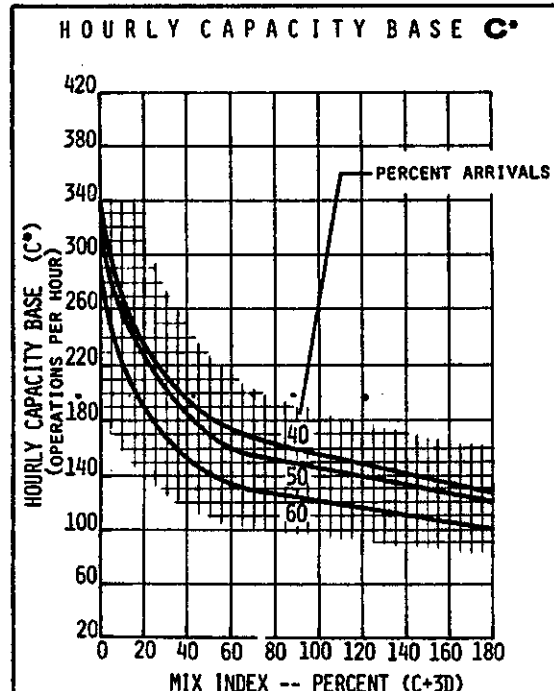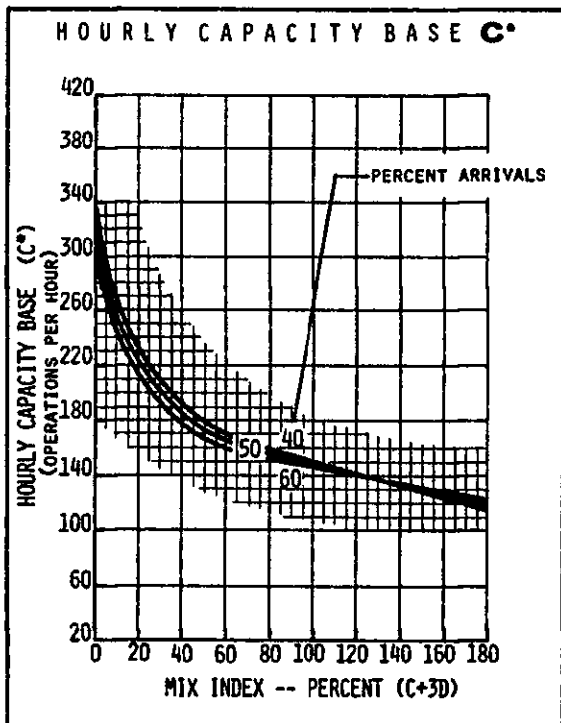PERCENT ARRIVALS

TOUCH & GO FACTOR T

$T = 1.00$

$$C^* \times T \times E = \text{Hourly Capacity}$$

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 3-20. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 32,33 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index--Percent(C+3D)	Touch & Go Factor T
0	0 to 180	1.00
1 to 10	0 to 70	1.02
11 to 20	0 to 70	1.05
21 to 30	0 to 40	1.09

C* × T × 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)	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	0.85	0.96	0.98	0.83	0.93	0.97	0.83	0.93	0.97

FIGURE 3-21. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 34,35 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

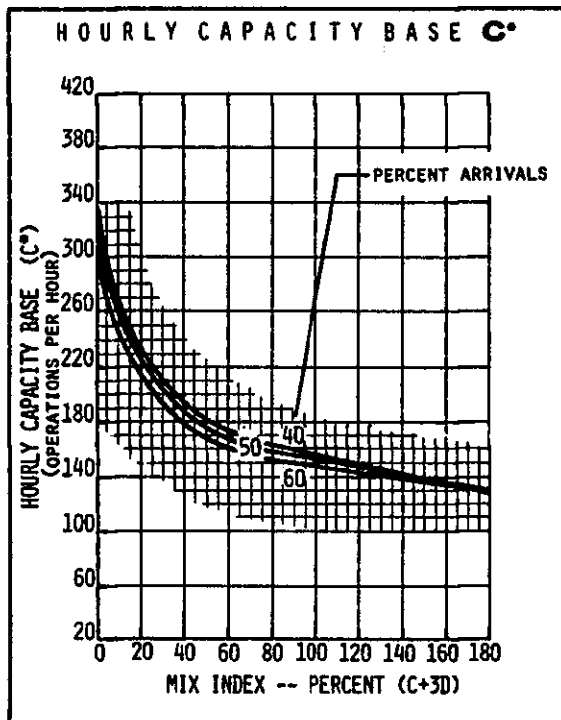| Percent Touch & Go	Mix Index--Percent(C+3D)	Touch & Go Factor T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.09
21 to 30	0 to 40	1.14

C* × T × 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)	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	0.76	0.88	0.94	0.72	0.86	0.94	0.64	0.83	0.93
21 to 50	3000 to 5500	0.83	0.90	0.96	0.80	0.88	0.95	0.72	0.83	0.93
51 to 80	3500 to 6500	0.85	0.91	0.95	0.82	0.89	0.95	0.75	0.86	0.92
81 to 120	5000 to 7000	0.89	0.93	0.97	0.87	0.91	0.96	0.81	0.87	0.94
121 to 180	5500 to 7500	0.94	0.98	0.99	0.92	0.97	0.99	0.89	0.96	0.98

FIGURE 3-22. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 36-38 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE **C***

TOUCH & GO FACTOR **T**

Percent Touch & Go	Mix Index-- Percent(C+3D)	T O U C H & G O F A C T O R T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.18

C* x **T** x **E** = **Hourly Capacity**

E X I T F A C T O R **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)	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	0.76	0.88	0.94	0.73	0.86	0.94	0.64	0.82	0.93
21 to 50	3000 to 5500	0.83	0.90	0.96	0.80	0.88	0.95	0.72	0.83	0.93
51 to 80	3500 to 6500	0.85	0.91	0.95	0.82	0.89	0.95	0.75	0.84	0.92
81 to 120	5000 to 7000	0.89	0.93	0.97	0.87	0.91	0.96	0.81	0.87	0.94
121 to 180	5500 to 7500	0.94	0.98	0.99	0.92	0.97	0.99	0.89	0.96	0.98

FIGURE 3-23. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 39 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE **C***

TOUCH & GO FACTOR **T**

Percent Touch & Go	Mix Index-- Percent(C+3D)	T O U C H & G O F A C T O R T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.18

C* x **T** x **E** = **Hourly Capacity**

E X I T F A C T O R **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)	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	0.76	0.88	0.94	0.72	0.86	0.94	0.64	0.82	0.93
21 to 50	3000 to 5500	0.83	0.90	0.96	0.80	0.88	0.95	0.72	0.83	0.93
51 to 80	3500 to 6500	0.85	0.91	0.95	0.82	0.89	0.95	0.75	0.84	0.92
81 to 120	5000 to 7000	0.89	0.93	0.97	0.87	0.91	0.96	0.81	0.87	0.94
121 to 180	5500 to 7500	0.94	0.98	0.99	0.92	0.97	0.99	0.89	0.96	0.98

FIGURE 3-24. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 40 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

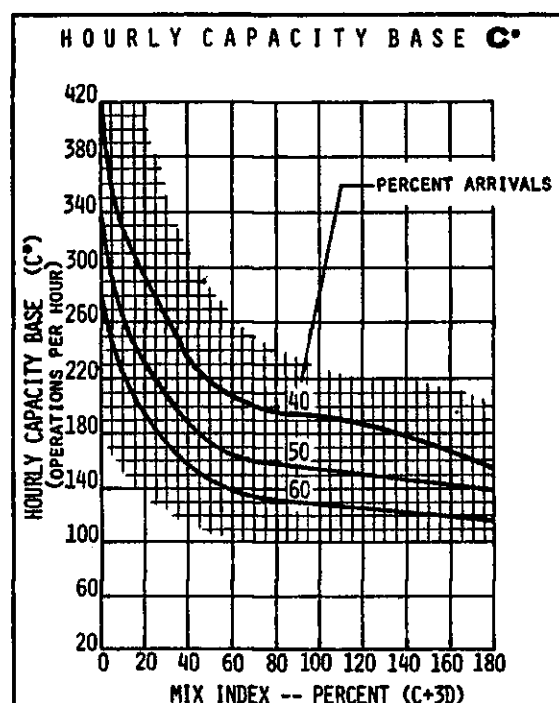| Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.15

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	0.75	0.89	0.96	0.72	0.86	0.93	0.69	0.84	0.92
21 to 50	3000 to 5500	0.82	0.89	0.96	0.79	0.87	0.95	0.77	0.86	0.95
51 to 80	3500 to 6500	0.84	0.90	0.95	0.81	0.88	0.94	0.79	0.87	0.94
81 to 120	5000 to 7000	0.88	0.92	0.96	0.86	0.90	0.95	0.85	0.90	0.96
121 to 180	5500 to 7500	0.92	0.96	0.97	0.89	0.94	0.96	0.90	0.96	0.98

FIGURE 3-25. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 41 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.04
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.20
31 to 40	0 to 10	1.31
41 to 50	0 to 10	1.40

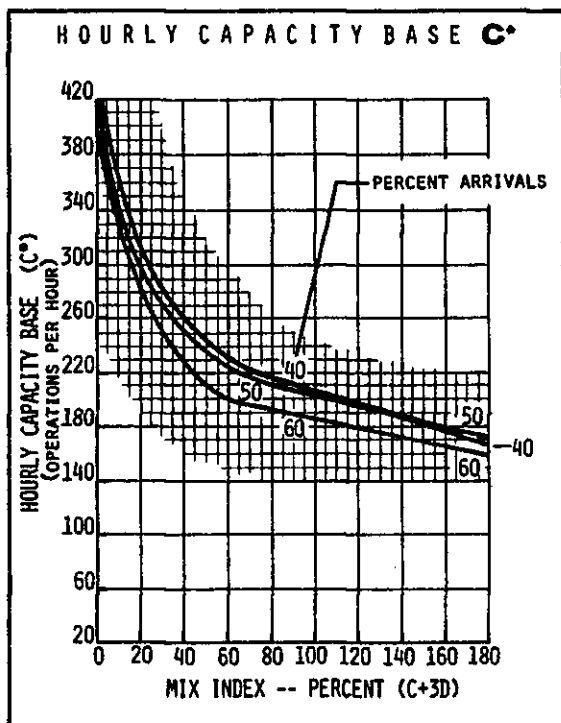### C* x T x E = Hourly Capacity

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	0.72	0.87	0.94	0.70	0.86	0.94	0.67	0.84	0.93
21 to 50	3000 to 5500	0.79	0.86	0.94	0.76	0.84	0.93	0.72	0.81	0.90
51 to 80	3500 to 6500	0.79	0.86	0.92	0.76	0.83	0.91	0.73	0.81	0.90
81 to 120	5000 to 7000	0.83	0.89	0.93	0.80	0.87	0.94	0.77	0.86	0.93
121 to 180	5500 to 7500	0.85	0.93	0.95	0.81	0.91	0.97	0.78	0.93	0.97

FIGURE 3-26. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 42 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS — 40, 50, 60

Y-axis: HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)
X-axis: MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.06
21 to 30	0 to 40	1.13
31 to 40	0 to 10	1.26
41 to 50	0 to 10	1.33

$$C^* \times T \times E = \text{Hourly Capacity}$$

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)	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	0.86	0.88	0.94	0.80	0.85	0.93	0.71	0.83	0.93
21 to 50	3000 to 5500	0.84	0.91	0.98	0.71	0.85	0.92	0.71	0.85	0.92
51 to 80	3500 to 6500	0.81	0.91	0.97	0.76	0.85	0.91	0.75	0.86	0.91
81 to 120	5000 to 7000	0.83	0.90	0.95	0.80	0.86	0.92	0.80	0.87	0.92
121 to 180	5500 to 7500	0.93	0.99	1.00	0.84	0.94	0.98	0.85	0.94	0.98

FIGURE 3-27. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 43,49 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS — 50, 40, 60

Y-axis: HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)
X-axis: MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.17
31 to 40	0 to 10	1.28
41 to 50	0 to 10	1.36

$$C^* \times T \times E = \text{Hourly Capacity}$$

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

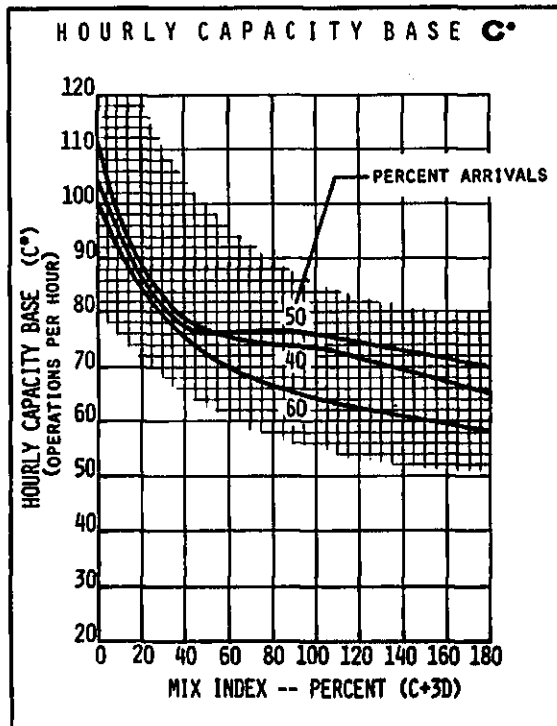| Mix Index-- Percent (C+3D)	Exit Range (Feet from threshold)	40% Arrivals			50% Arrivals			60% Arrivals		
		N=0	N=1	N=2 or 3	N=0	N=1	N=2 or 3	N=0	N=1	N=2 or 3
0 to 20	2000 to 4000	0.81	0.88	0.95	0.74	0.86	0.94	0.74	0.85	0.93
21 to 50	3000 to 5500	0.91	0.93	0.97	0.87	0.92	0.99	0.75	0.87	0.98
51 to 80	3500 to 6500	0.94	0.96	1.00	0.77	0.89	0.97	0.73	0.82	0.91
81 to 120	5000 to 7000	0.96	0.97	1.00	0.81	0.88	0.93	0.80	0.87	0.92
121 to 180	5500 to 7500	0.99	1.00	1.00	0.86	0.96	0.97	0.85	0.94	0.97

FIGURE 3-28. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 44,50 FOR VFR CONDITIONS.

Chap 3

HOURLY CAPACITY BASE C*

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.17
31 to 40	0 to 10	1.28
41 to 50	0 to 10	1.36

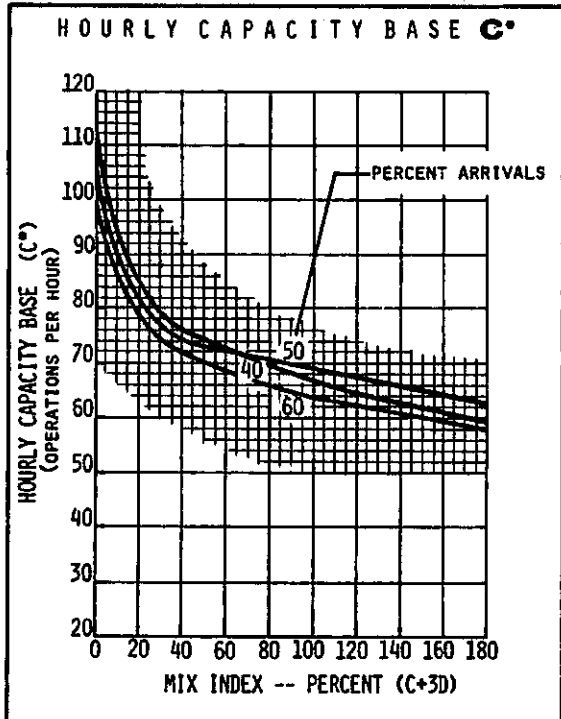$$C^* \times T \times E = \text{Hourly Capacity}$$

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	0.81	0.88	0.94	0.78	0.86	0.93	0.74	0.84	0.92
21 to 50	3000 to 5500	0.94	0.97	0.99	0.91	0.97	0.99	0.80	0.94	0.98
51 to 80	3500 to 6500	0.95	0.97	1.00	0.83	0.93	1.00	0.74	0.82	0.91
81 to 120	5000 to 7000	0.98	0.99	1.00	0.89	0.97	1.00	0.80	0.87	0.92
121 to 180	5500 to 7500	1.00	1.00	1.00	0.95	1.00	1.00	0.86	0.94	0.97

FIGURE 3-29. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 45,51 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.19
31 to 40	0 to 10	1.31
41 to 50	0 to 10	1.40

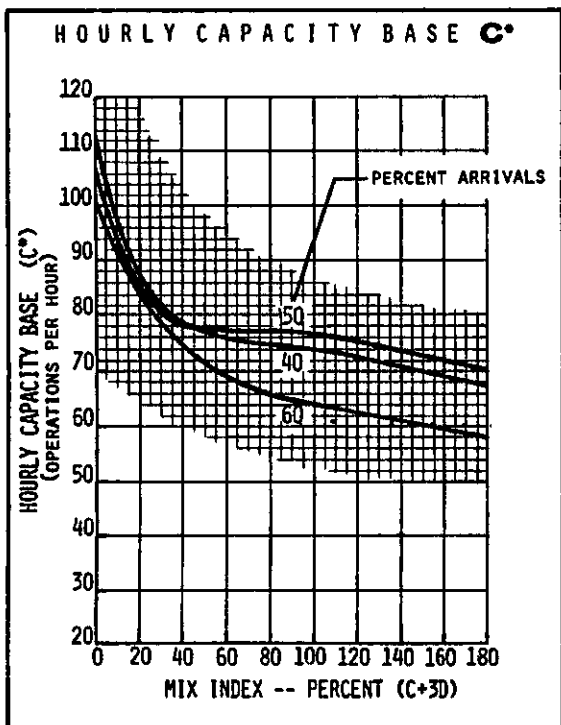$$C^* \times T \times E = \text{Hourly Capacity}$$

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	0.74	0.86	0.92	0.70	0.84	0.92	0.67	0.82	0.91
21 to 50	3000 to 5500	0.86	0.88	0.92	0.83	0.86	0.91	0.74	0.84	0.90
51 to 80	3500 to 6500	0.90	0.91	0.96	0.79	0.88	0.97	0.72	0.86	0.91
81 to 120	5000 to 7000	0.94	0.95	0.98	0.80	0.86	0.92	0.80	0.87	0.92
121 to 180	5500 to 7500	0.98	0.99	1.00	0.84	0.94	0.97	0.85	0.94	0.97

FIGURE 3-30. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 46,52 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

40
50
60

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

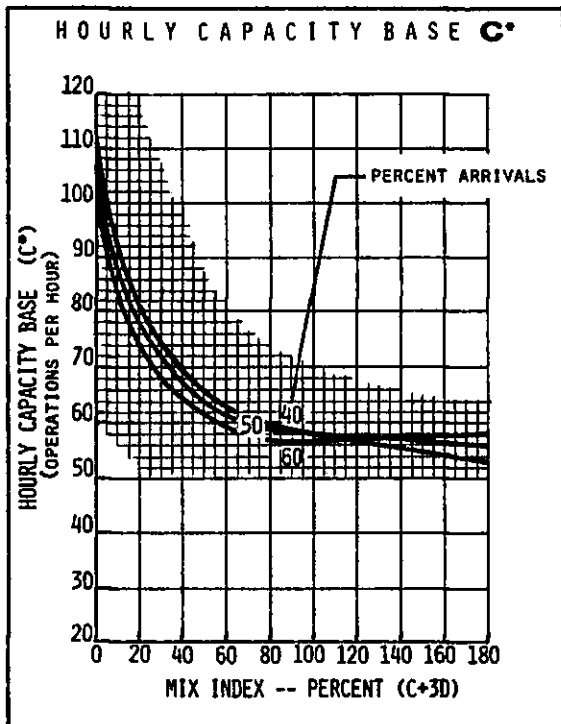| Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.19
31 to 40	0 to 10	1.31
41 to 50	0 to 10	1.40

C* × T × 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)	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	0.73	0.88	0.95	0.71	0.87	0.94	0.69	0.85	0.93
21 to 50	3000 to 5500	0.89	0.92	0.95	0.87	0.90	0.94	0.84	0.89	0.94
51 to 80	3500 to 6500	0.96	0.97	0.99	0.95	0.96	0.98	0.89	0.94	0.97
81 to 120	5000 to 7000	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.97	1.00
121 to 180	5500 to 7500	1.00	1.00	1.00	1.00	1.00	1.00	0.84	0.94	0.98

FIGURE 3-31. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 47,53 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

40
50
60

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

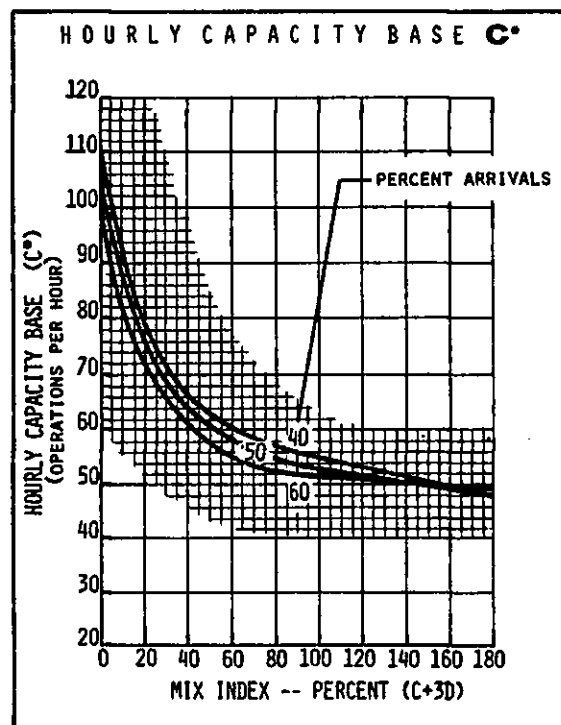T = 1.00

C* × T × 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)	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	0.74	0.88	0.95	0.72	0.87	0.94	0.69	0.85	0.93
21 to 50	3000 to 5500	0.90	0.93	0.97	0.88	0.91	0.95	0.86	0.90	0.95
51 to 80	3500 to 6500	0.97	0.98	1.00	0.95	0.96	0.98	0.92	0.97	0.99
81 to 120	5000 to 7000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
121 to 180	5500 to 7500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

FIGURE 3-32. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 48 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

(Graph: HOURLY CAPACITY BASE (C*), OPERATIONS PER HOUR, y-axis 20–420; x-axis MIX INDEX -- PERCENT (C+3D) 0–180; curves labeled PERCENT ARRIVALS 40, 50, 60)

TOUCH & GO FACTOR T

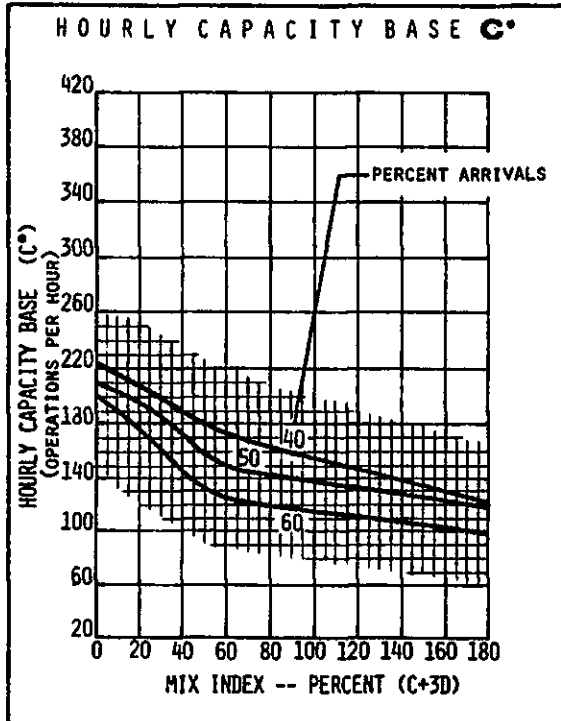| Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.04
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.20
31 to 40	0 to 10	1.28
41 to 50	0 to 10	1.36

C* × T × 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)	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	0.86	0.87	0.96	0.82	0.85	0.93	0.77	0.84	0.92
21 to 50	3000 to 5500	0.88	0.91	0.96	0.73	0.86	0.94	0.73	0.86	0.94
51 to 80	3500 to 6500	0.84	0.87	0.93	0.78	0.87	0.93	0.78	0.87	0.93
81 to 120	5000 to 7000	0.83	0.90	0.96	0.83	0.90	0.96	0.83	0.90	0.96
121 to 180	5500 to 7500	1.00	1.00	1.00	0.92	0.97	1.00	0.92	0.97	1.00

FIGURE 3-33. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 55,61 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

(Graph: HOURLY CAPACITY BASE (C*), OPERATIONS PER HOUR, y-axis 20–420; x-axis MIX INDEX -- PERCENT (C+3D) 0–180; curves labeled PERCENT ARRIVALS 40, 50, 60)

TOUCH & GO FACTOR T
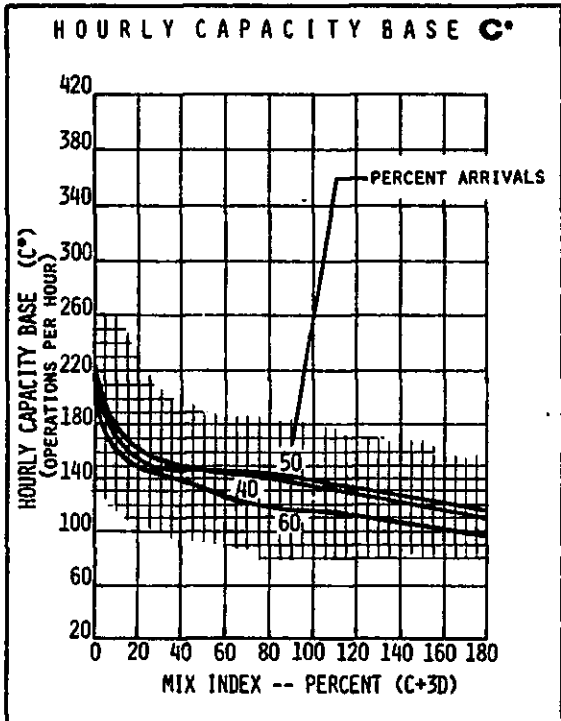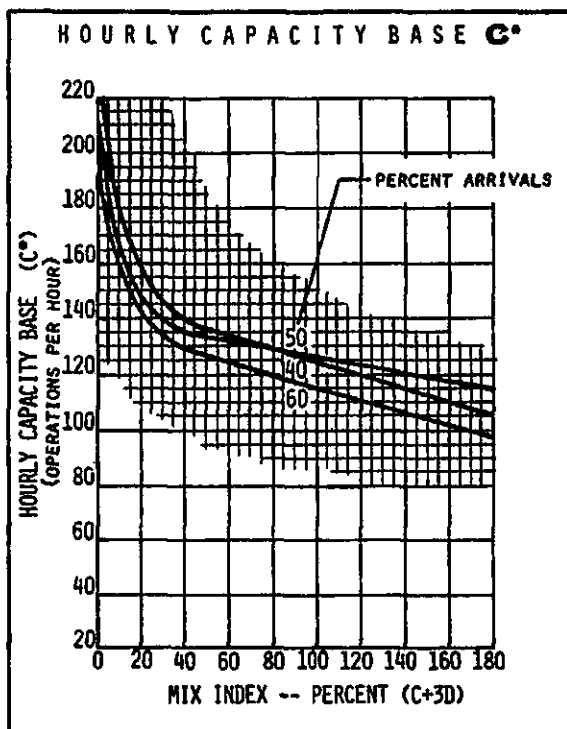
T = 1.00

C* × T × 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)	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	0.79	0.89	0.95	0.76	0.86	0.95	0.74	0.86	0.94
21 to 50	3000 to 5500	0.96	1.00	1.00	0.91	1.00	1.00	0.78	0.92	0.97
51 to 80	3500 to 6500	0.93	0.96	1.00	0.80	0.90	0.97	0.78	0.87	0.93
81 to 120	5000 to 7000	0.93	0.96	1.00	0.83	0.90	0.96	0.83	0.90	0.96
121 to 180	5500 to 7500	0.97	0.99	1.00	0.93	0.97	1.00	0.92	0.97	1.00

FIGURE 3-34. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 56 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.17
31 to 40	0 to 10	1.28
41 to 50	0 to 10	1.36

C* × T × 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)	40% Arrivals N=0	40% Arrivals N=1	40% Arrivals N=2 or 3	50% Arrivals N=0	50% Arrivals N=1	50% Arrivals N=2 or 3	60% Arrivals N=0	60% Arrivals N=1	60% Arrivals N=2 or 3
0 to 20	2000 to 4000	0.83	0.89	0.95	0.81	0.88	0.95	0.79	0.86	0.94
21 to 50	3000 to 3500	1.00	1.00	1.00	0.98	1.00	1.00	0.85	1.00	1.00
51 to 80	3500 to 6500	0.95	0.98	1.00	0.87	0.97	1.00	0.78	0.87	0.93
81 to 120	5000 to 7000	0.95	0.98	1.00	0.90	0.97	1.00	0.83	0.90	0.96
121 to 180	5500 to 7500	0.97	1.00	1.00	0.95	1.00	1.00	0.92	0.97	1.00

FIGURE 3-35. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 57,63 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

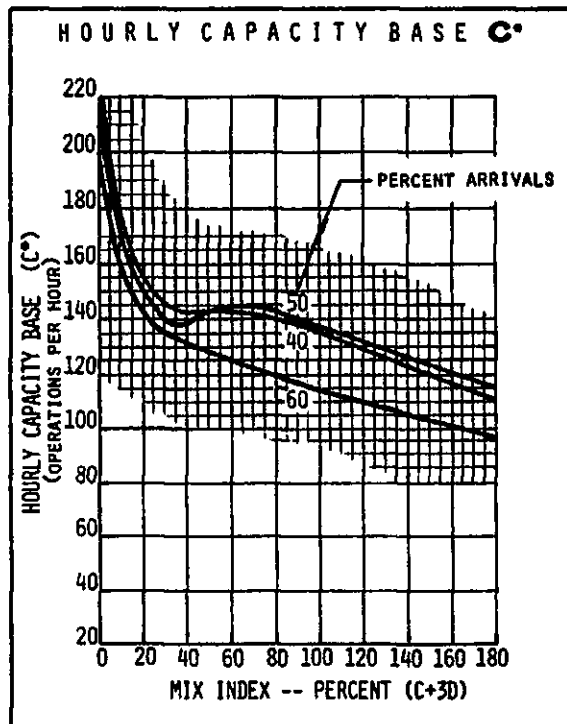| Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.17
31 to 40	0 to 10	1.28
41 to 50	0 to 10	1.36

C* × T × 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)	40% Arrivals N=0	40% Arrivals N=1	40% Arrivals N=2 or 3	50% Arrivals N=0	50% Arrivals N=1	50% Arrivals N=2 or 3	60% Arrivals N=0	60% Arrivals N=1	60% Arrivals N=2 or 3
0 to 20	2000 to 4000	0.78	0.89	0.95	0.76	0.88	0.95	0.73	0.86	0.94
21 to 50	3000 to 3500	0.96	0.98	0.98	0.95	0.95	0.98	0.83	0.94	0.98
51 to 80	3500 to 6500	0.90	0.93	0.97	0.81	0.90	0.96	0.78	0.87	0.94
81 to 120	5000 to 7000	0.92	0.95	0.99	0.83	0.90	0.98	0.83	0.90	0.96
121 to 180	5500 to 7500	0.98	1.00	1.00	0.92	0.97	1.00	0.92	0.97	1.00

FIGURE 3-36. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 58,64 FOR VFR CONDITIONS.
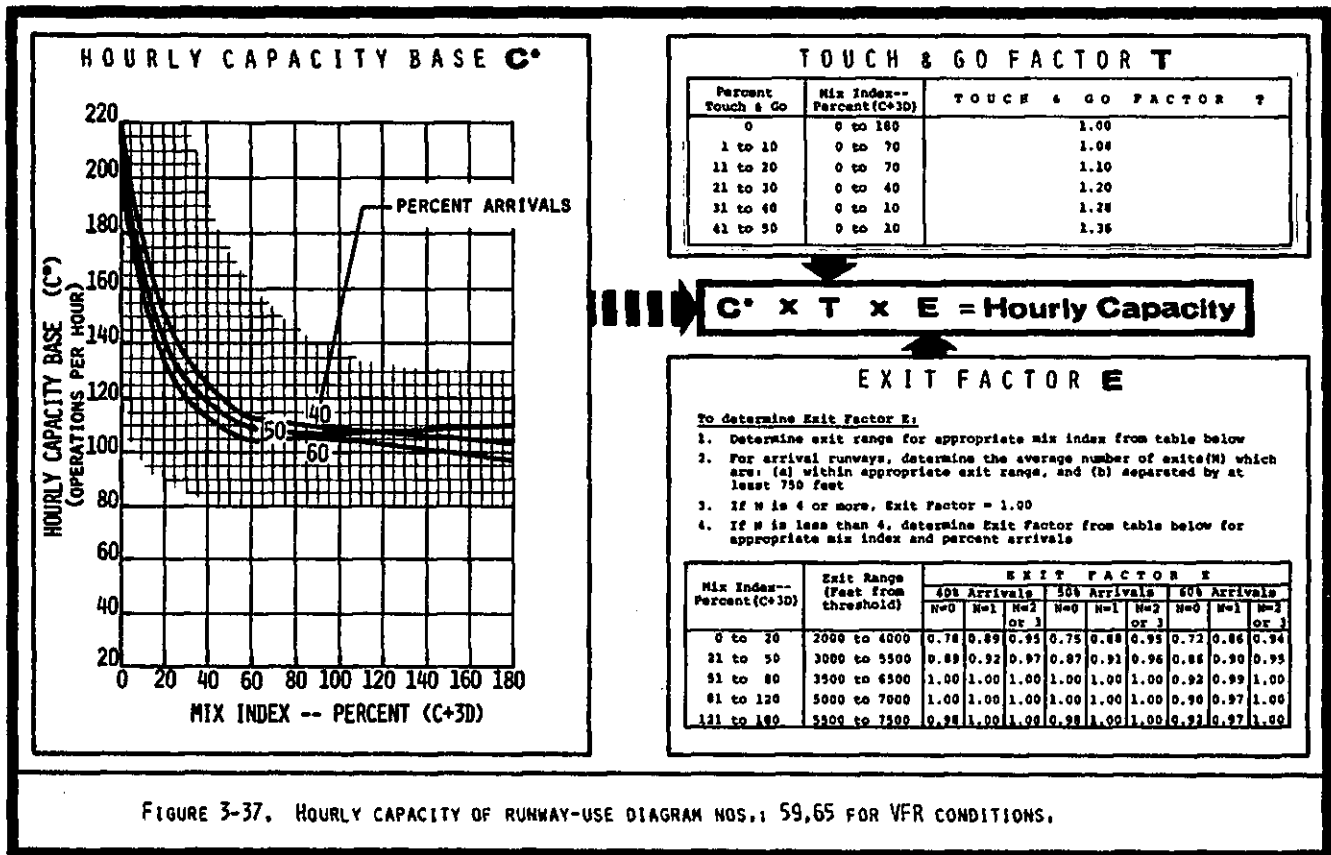
HOURLY CAPACITY BASE C*

FIGURE 3-37. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 59,65 FOR VFR CONDITIONS.

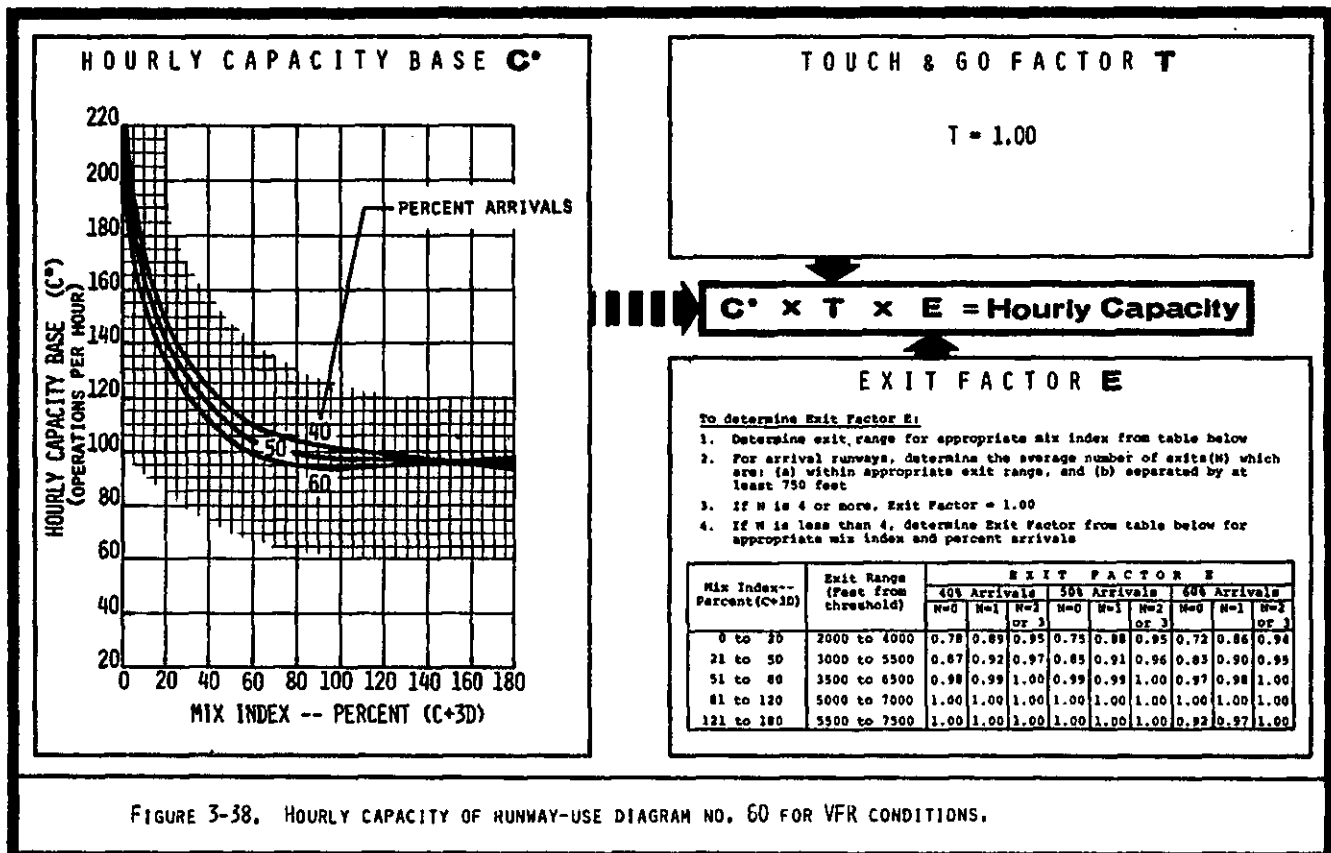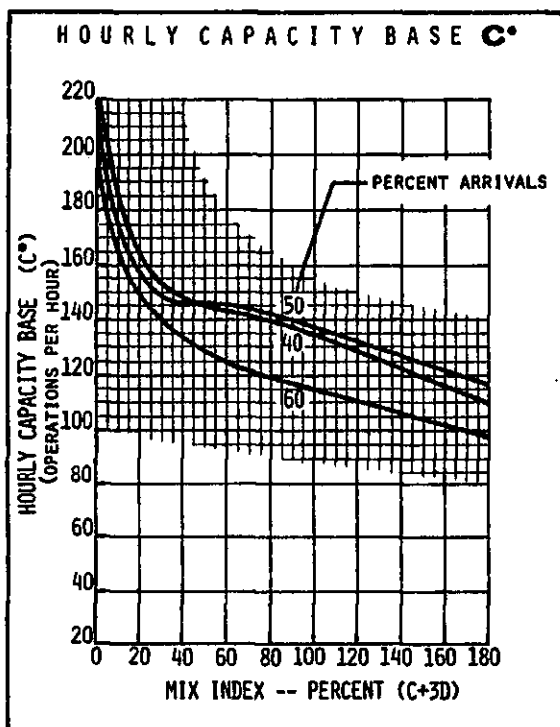FIGURE 3-38. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 60 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS

50
40
60

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.04
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.20
31 to 40	0 to 10	1.31
41 to 50	0 to 10	1.40

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	3000 to 4000	0.70	0.86	0.93	0.67	0.85	0.92	0.64	0.83	0.91
21 to 50	3000 to 5500	0.96	1.00	1.00	0.91	1.00	1.00	0.78	0.92	0.97
51 to 80	3500 to 6500	0.93	0.96	1.00	0.80	0.90	0.97	0.78	0.87	0.93
81 to 120	5000 to 7000	0.93	0.96	1.00	0.83	0.90	0.96	0.83	0.90	0.96
121 to 180	5500 to 7500	0.97	0.99	1.00	0.93	0.97	1.00	0.92	0.97	1.00

FIGURE 3-39. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 62 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS

40
50
60

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

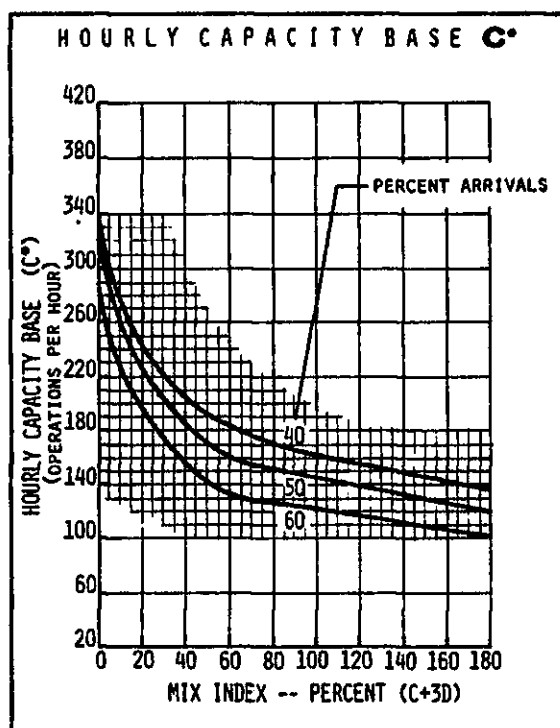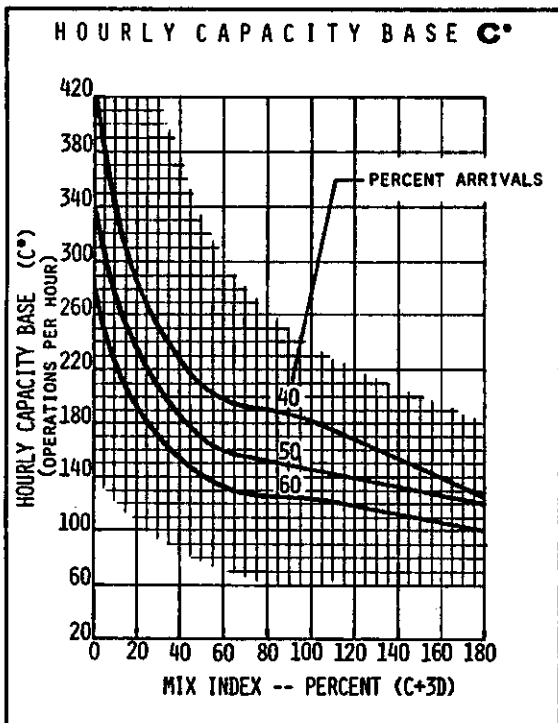| Percent Touch & Go	Mix Index-- Percent (C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.10
21 to 30	0 to 40	1.18

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	0.75	0.87	0.94	0.64	0.82	0.93	0.62	0.79	0.90
21 to 50	3000 to 5500	0.81	0.89	0.96	0.72	0.83	0.93	0.72	0.83	0.93
51 to 80	3500 to 6500	0.81	0.90	0.95	0.75	0.84	0.92	0.75	0.84	0.92
81 to 120	5000 to 7000	0.86	0.92	0.97	0.81	0.87	0.94	0.81	0.87	0.94
121 to 180	5500 to 7500	0.93	0.97	0.98	0.89	0.96	0.98	0.89	0.96	0.98

FIGURE 3-40. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 80,81,95,96 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C°

420
380
340
300
260
220
180
140
100
60
20

HOURLY CAPACITY BASE (C°) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

40
50
60

0   20   40   60   80   100 120 140 160 180
MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

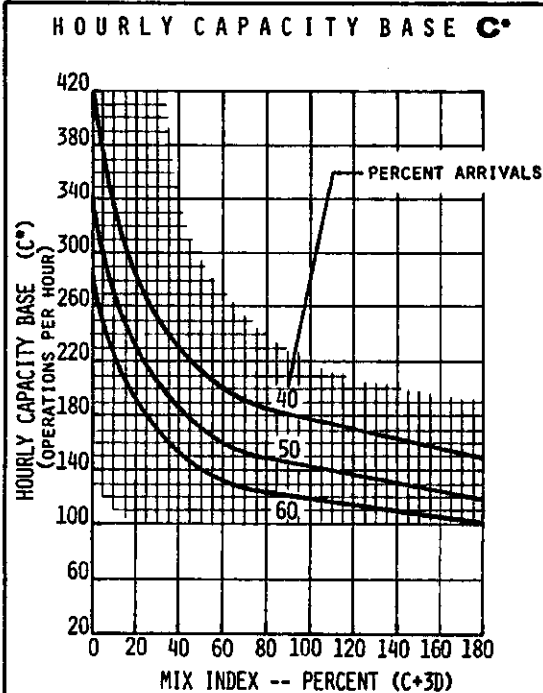| Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.05
21 to 30	0 to 40	1.09
31 to 40	0 to 10	1.15
41 to 50	0 to 10	1.20

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)	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	0.81	0.87	0.94	0.81	0.87	0.94	0.81	0.87	0.94
121 to 180	5500 to 7500	1.00	1.00	1.00	0.89	0.96	0.98	0.89	0.96	0.98

FIGURE 3-41. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 83,84,98,99,102 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C°

420
380
340
300
260
220
180
140
100
60
20

HOURLY CAPACITY BASE (C°) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

40
50
60

0   20   40   60   80   100 120 140 160 180
MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

Percent Touch & Go	Mix Index-- Percent(C+3D)	TOUCH & GO FACTOR T
0	0 to 180	1.00
1 to 10	0 to 70	1.03
11 to 20	0 to 70	1.05
21 to 30	0 to 40	1.09
31 to 40	0 to 10	1.15
41 to 50	0 to 10	1.20

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)	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	0.81	0.87	0.94	0.81	0.87	0.94	0.81	0.87	0.94
121 to 180	5500 to 7500	0.89	0.96	0.98	0.89	0.96	0.98	0.89	0.96	0.98

FIGURE 3-42. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 85,86,100,101 FOR VFR CONDITIONS.

HOURLY CAPACITY BASE C°

HOURLY CAPACITY BASE (C°)
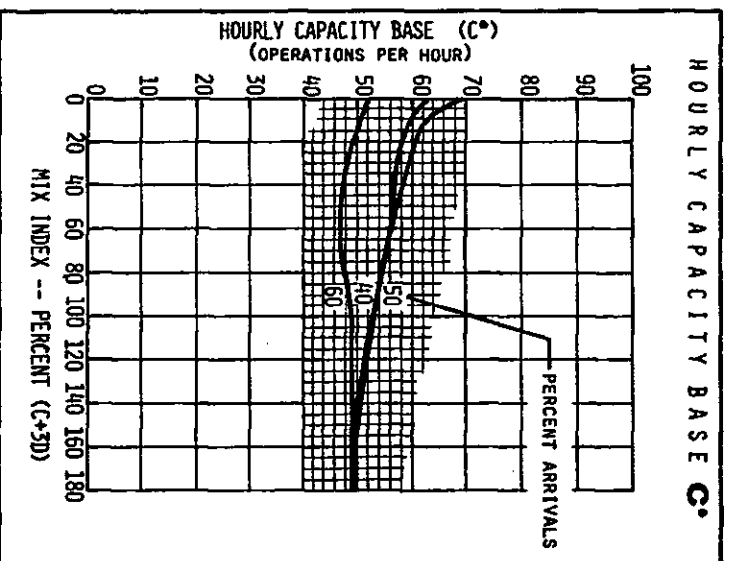(OPERATIONS PER HOUR)

MIX INDEX — PERCENT (C+3D)

PERCENT ARRIVALS

FIGURE 3-45. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 1,54 FOR IFR CONDITIONS.

TOUCH & GO FACTOR T

T = 1.00

C° × T × 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)	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	0.81	0.91	0.95	0.83	0.92	0.95	0.92	1.00	1.00
21 to 50	3000 to 5500	0.79	0.84	0.92	0.77	0.85	0.89	0.90	0.96	1.00
51 to 80	3500 to 6500	0.81	0.87	0.93	0.77	0.83	0.91	0.90	0.98	1.00
81 to 120	5000 to 7000	0.83	0.90	0.94	0.80	0.88	0.91	0.92	0.98	0.97
121 to 180	5500 to 7500	0.86	0.94	0.98	0.89	0.91	0.96	0.78	0.89	0.95

HOURLY CAPACITY BASE C°

HOURLY CAPACITY BASE (C°)
(OPERATIONS PER HOUR)
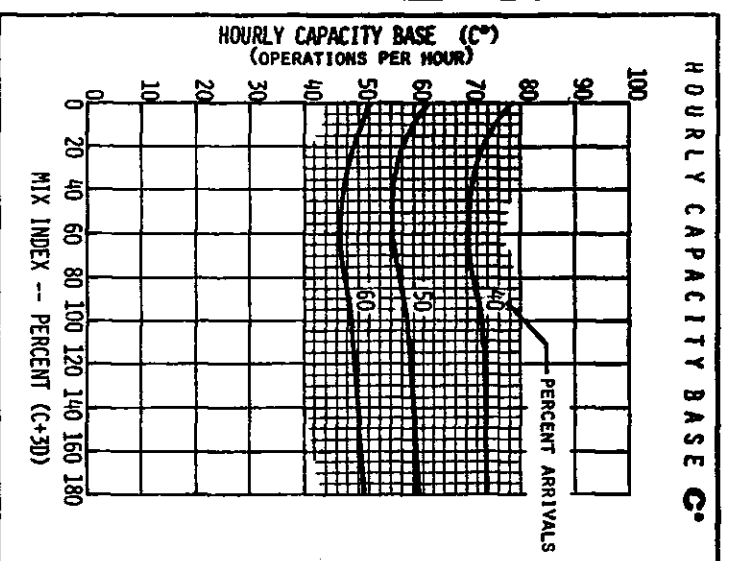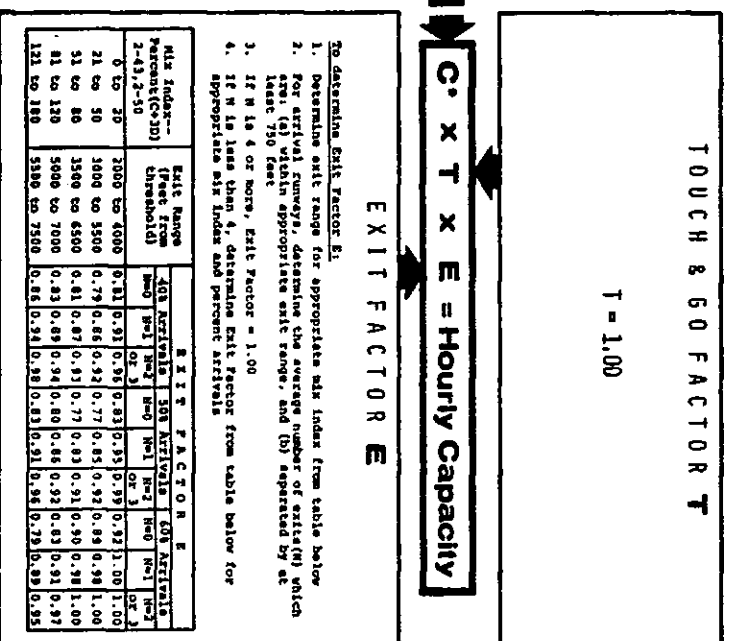
MIX INDEX — PERCENT (C+3D)

PERCENT ARRIVALS
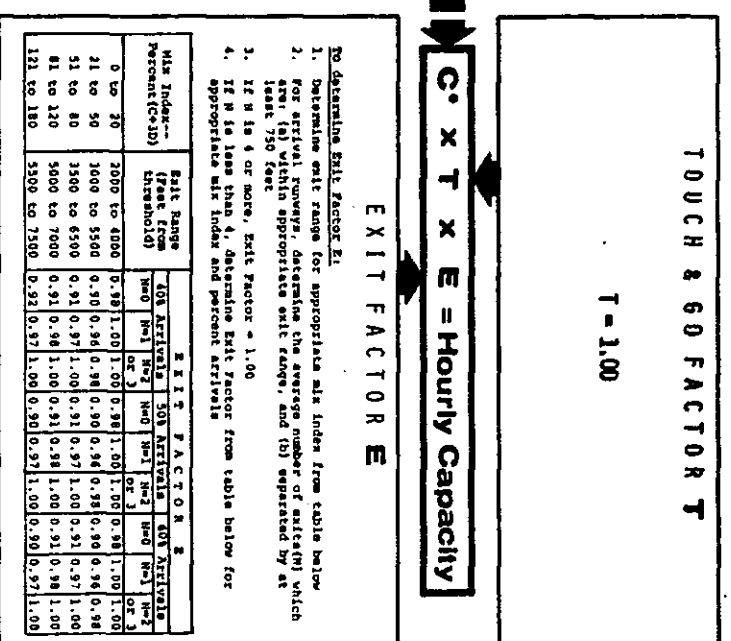
FIGURE 3-44. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 2,3,9,51-68,72-74,76,77,79,80, 82-85,87-89,91,92,94,95,97-100,102 FOR IFR CONDITIONS.

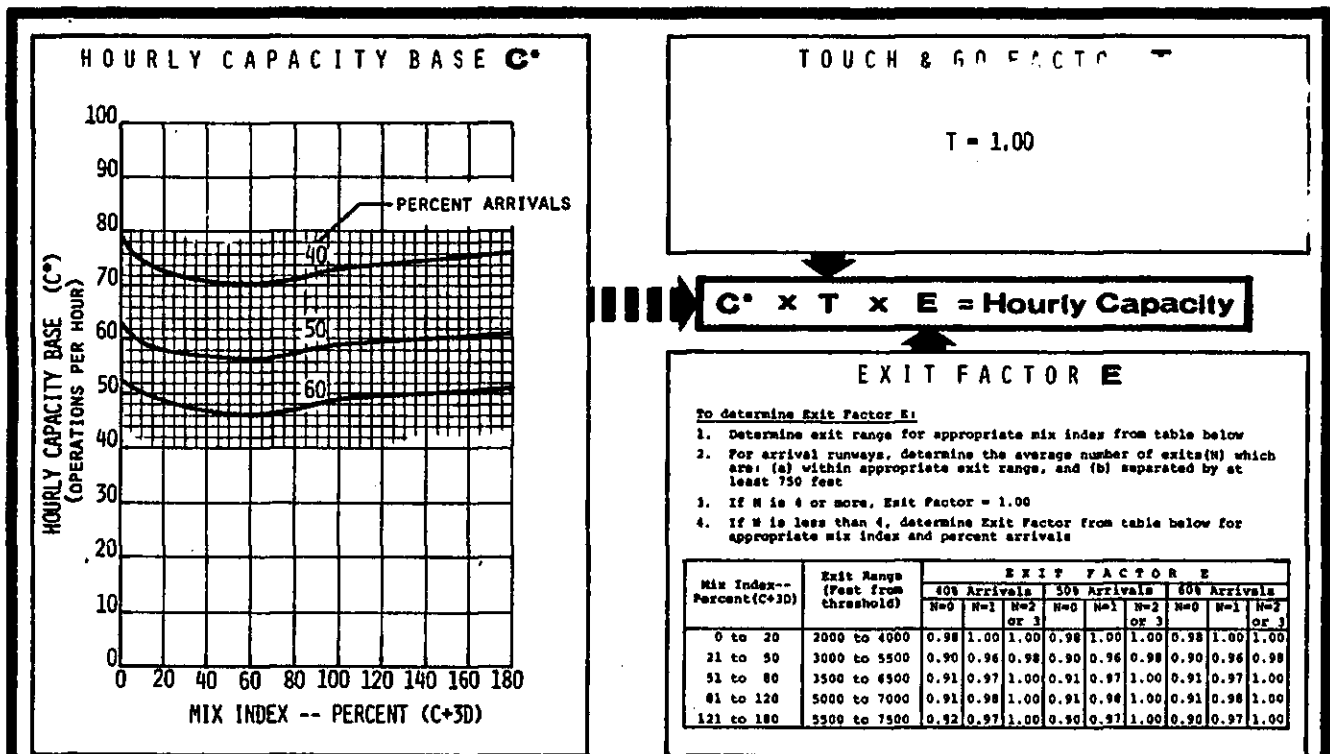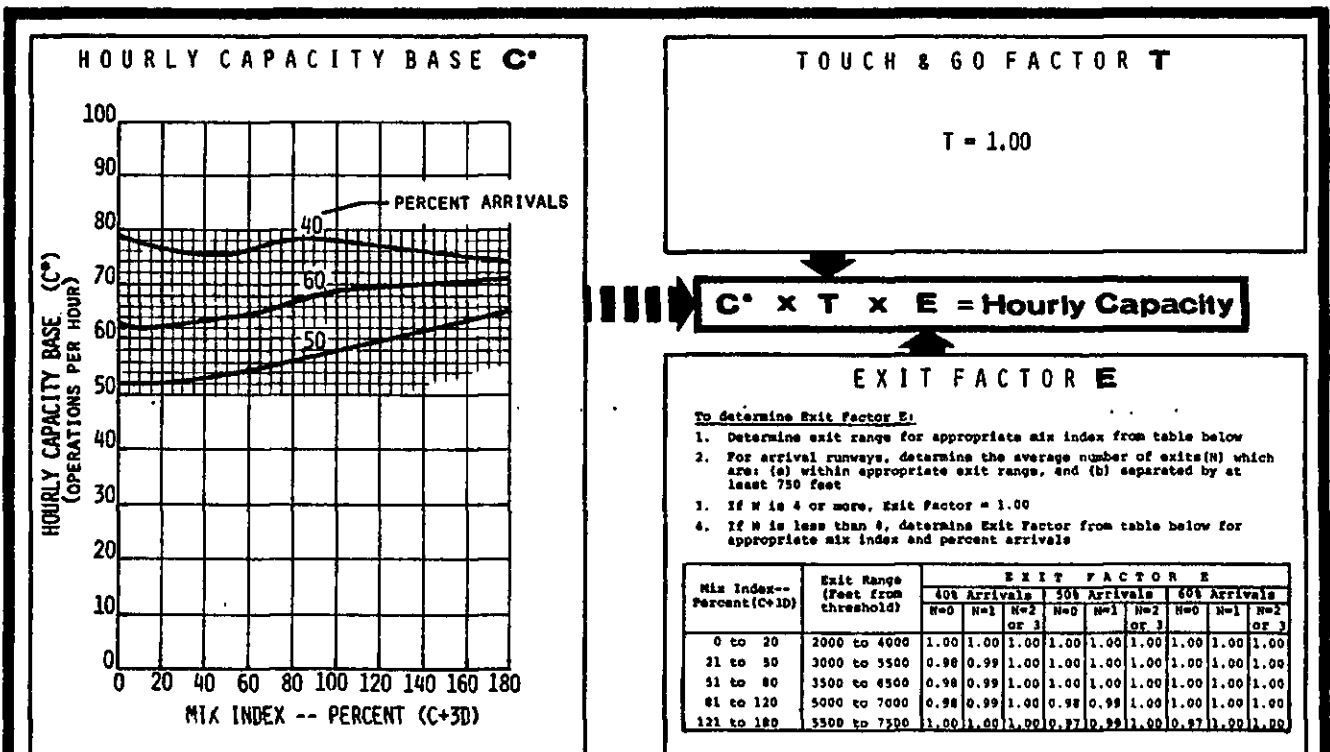**TOUCH & GO FACTOR T**

T = 1.00

C° × T × E = Hourly Capacity

EXIT FACTOR E

To determine Exit Factor E:

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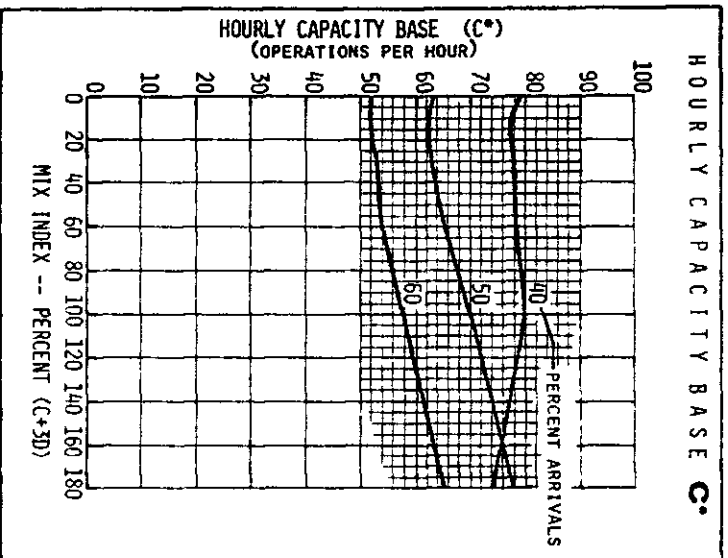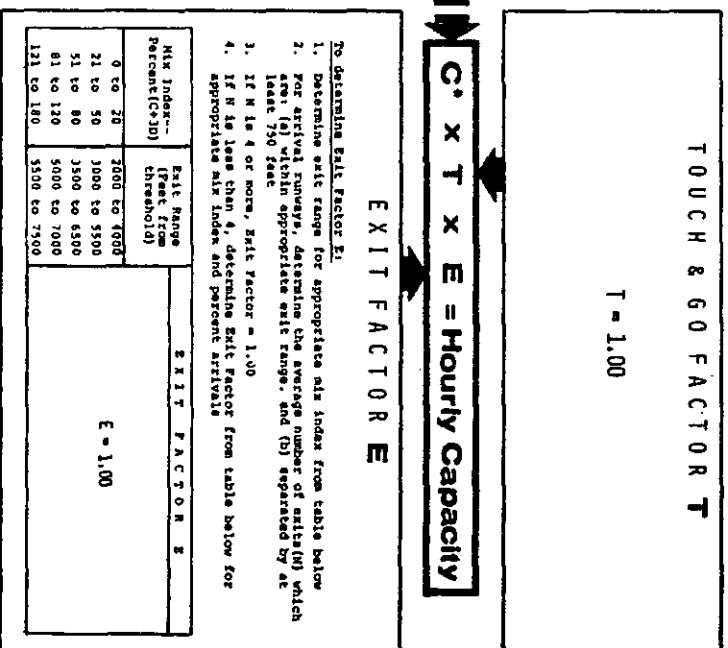2. For arrival runways, determine the average number of exits(N) which are, (a) within appropriate exit range, and (b) separated by at least 750 feet.
3. If N is 4 or more, Exit Factor = 1.00
4. If N is less than 4, determine Exit Factor from table below for appropriate mix index and percent arrivals

Mix Index—Percent(C+3D)	Exit Range (feet from threshold)	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	0.94	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	0.98	1.00	0.90	0.97	1.00

HOURLY CAPACITY BASE C*

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	0.98	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

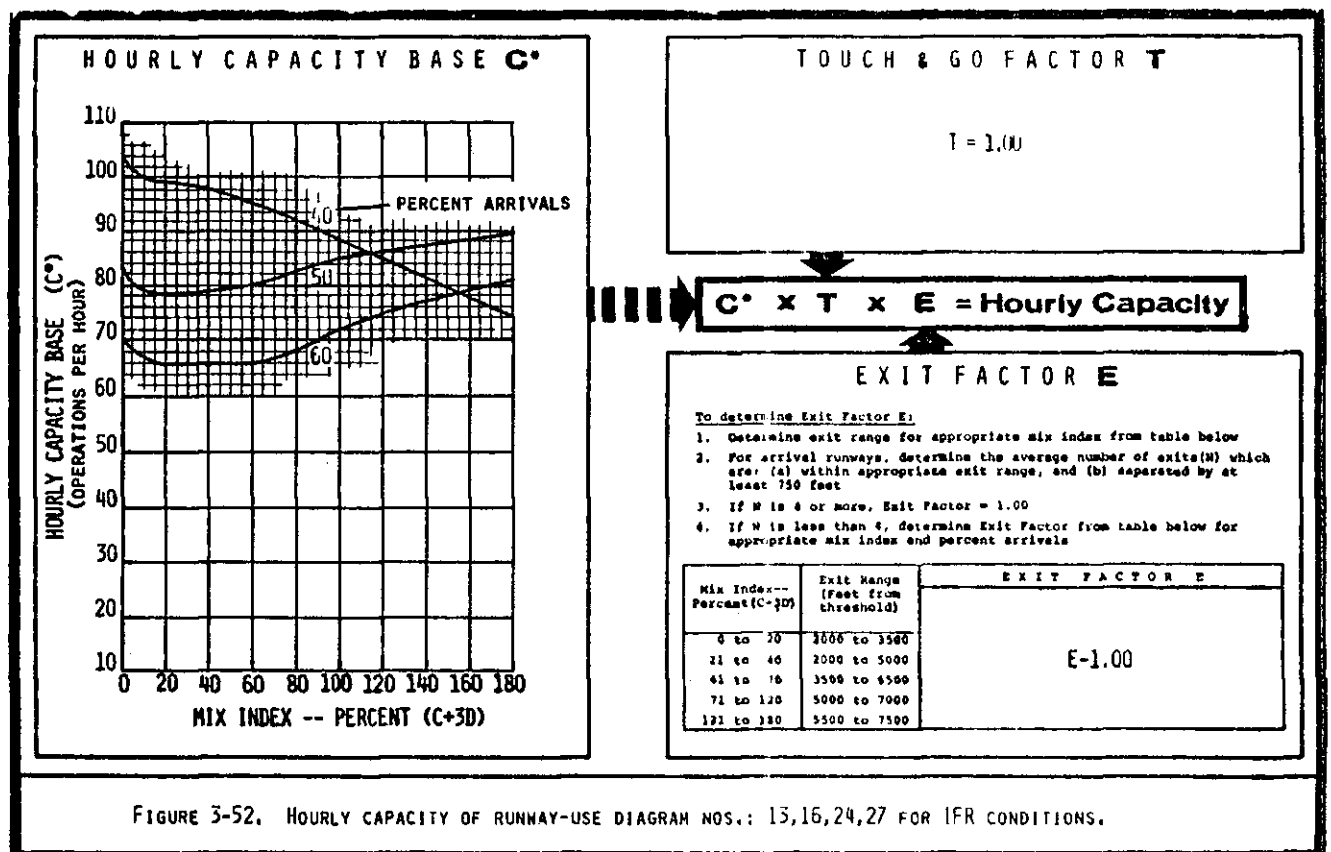FIGURE 3-45. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 4,5,75,90 FOR IFR CONDITIONS.
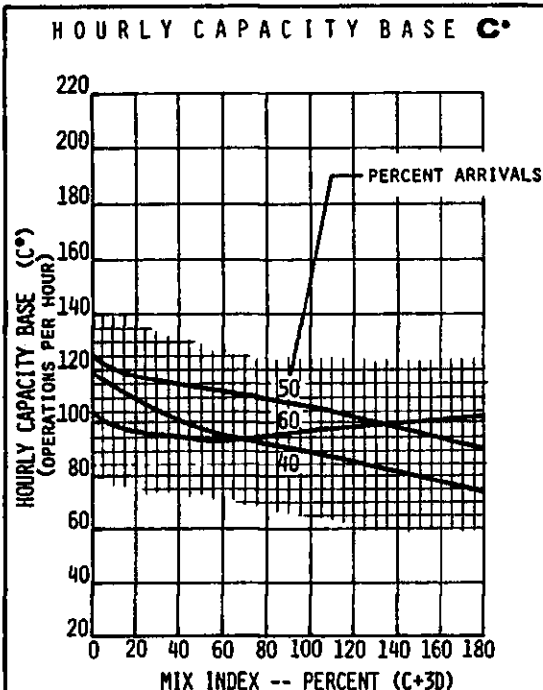

HOURLY CAPACITY BASE C*

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	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21 to 50	3000 to 5500	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
51 to 80	3500 to 6500	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
81 to 120	5000 to 7000	0.98	0.99	1.00	0.98	0.99	1.00	1.00	1.00	1.00
121 to 180	5500 to 7500	1.00	1.00	1.00	0.97	0.99	1.00	0.97	1.00	1.00

FIGURE 3-46. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 5 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C'
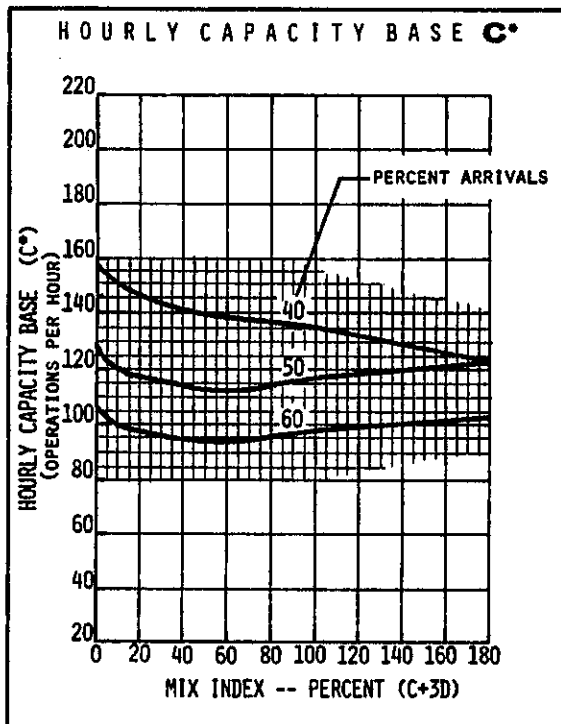

MIX INDEX -- PERCENT (C+3D)

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)	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 3500	0.95	0.98	1.00	0.95	0.99	1.00	1.00	1.00	1.00
21 to 40	2000 to 5000	0.92	0.97	1.00	0.90	0.95	1.00	0.98	1.00	1.00
41 to 70	3500 to 6500	0.93	0.97	1.00	0.90	0.95	1.00	0.96	1.00	1.00
71 to 120	5000 to 7000	0.94	0.98	1.00	0.92	0.96	1.00	0.94	0.99	1.00
121 to 180	5500 to 7500	0.96	1.00	1.00	0.93	0.98	1.00	0.96	0.97	1.00

FIGURE 3-47. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 7 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C'
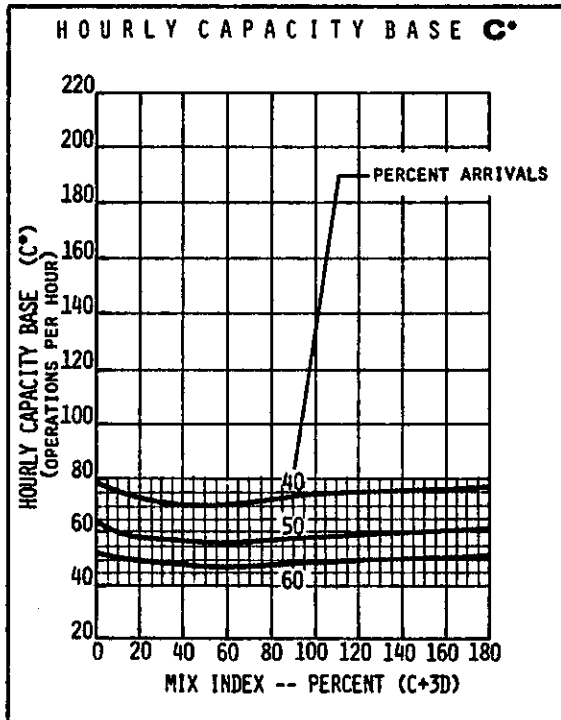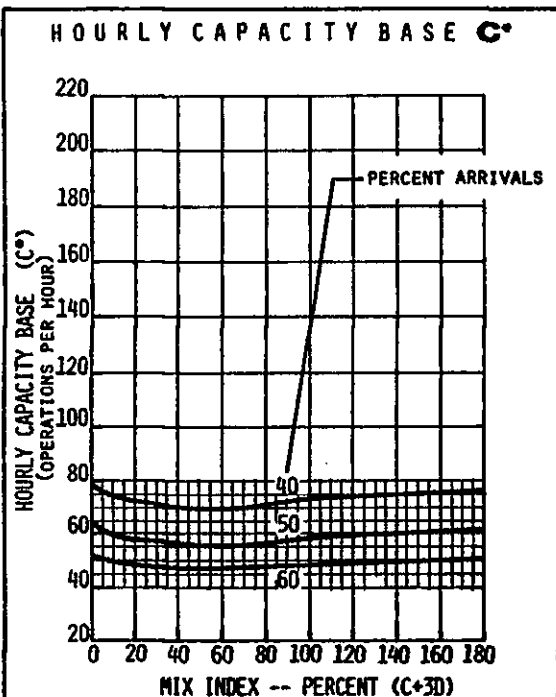

MIX INDEX -- PERCENT (C+3D)

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)	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	0.99	1.00	1.00	0.99	1.00	1.00	0.98	0.99	1.00
21 to 50	3000 to 5500	0.95	0.98	0.99	0.93	0.98	0.99	0.91	0.97	0.99
51 to 80	3500 to 6500	0.95	0.98	1.00	0.94	0.98	1.00	0.92	0.98	1.00
81 to 120	5000 to 7000	0.96	0.99	1.00	0.94	0.99	1.00	0.93	0.99	1.00
121 to 180	5500 to 7500	0.98	1.00	1.00	0.95	1.00	1.00	0.96	0.99	1.00

FIGURE 3-48. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 8 FOR IFR CONDITIONS.

Figure 3-49 (right panel)

HOURLY CAPACITY BASE (C*)
(OPERATIONS PER HOUR)

HOURLY CAPACITY BASE C*

MIX INDEX -- PERCENT (C+3D)

PERCENT ARRIVALS

C* × T × E = Hourly Capacity

TOUCH & GO FACTOR T

T = 1.00

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)
0 to 20	2000 to 4000
21 to 50	3000 to 5500
51 to 80	3500 to 6500
81 to 120	5000 to 7000
121 to 180	5500 to 7500

E = 1.00

FIGURE 3-49. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 10,20,29,69 FOR IFR CONDITIONS.

Figure 3-50 (left panel)

HOURLY CAPACITY BASE (C*)
(OPERATIONS PER HOUR)

HOURLY CAPACITY BASE C*

MIX INDEX -- PERCENT (C+3D)

PERCENT ARRIVALS

C* × T × E = Hourly Capacity

TOUCH & GO FACTOR T

T = 1.00

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	N=3	N=0	N=1	N=2	N=3	N=0	N=1	N=2	N=3
0 to 20	2000 to 3500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21 to 40	3000 to 5000	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41 to 70	3500 to 6500	0.90	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
71 to 120	5000 to 7000	0.89	0.97	1.00	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00
121 to 180	5500 to 7500	0.84	0.95	1.00	0.84	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

FIGURE 3-50. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 11,70 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C*

220
200
180
160
140
120
100
80
60
40
20

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

40
50
60

0   20 40 60 80 100 120 140 160 180
MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T

T = 1.00

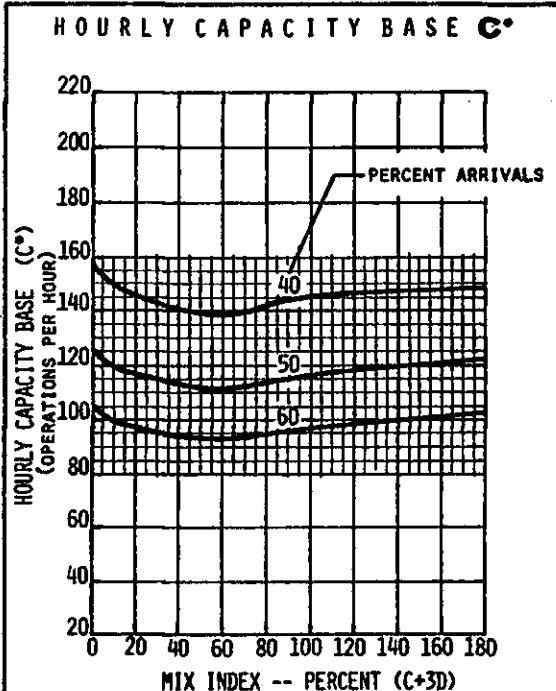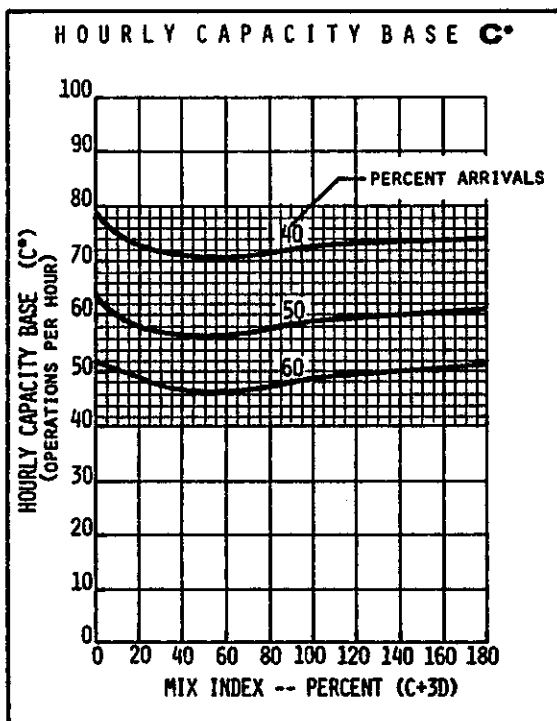## C* x T x E = Hourly Capacity

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) 2-43,2-50	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	0.81	0.91	0.96	0.83	0.95	0.99	0.92	1.00	1.00
21 to 50	3000 to 5500	0.79	0.86	0.92	0.77	0.85	0.92	0.89	0.98	1.00
51 to 80	3500 to 6500	0.81	0.87	0.93	0.77	0.83	0.91	0.90	0.98	1.00
81 to 120	5000 to 7000	0.83	0.89	0.94	0.80	0.86	0.92	0.83	0.91	0.97
121 to 180	5500 to 7500	0.86	0.94	0.98	0.83	0.91	0.96	0.79	0.99	0.95

FIGURE 3-51. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 12,71 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C*

110
100
90
80
70
60
50
40
30
20
10

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

PERCENT ARRIVALS

40
50
60

0   20 40 60 80 100 120 140 160 180
MIX INDEX -- PERCENT (C+3D)

TOUCH & GO FACTOR T
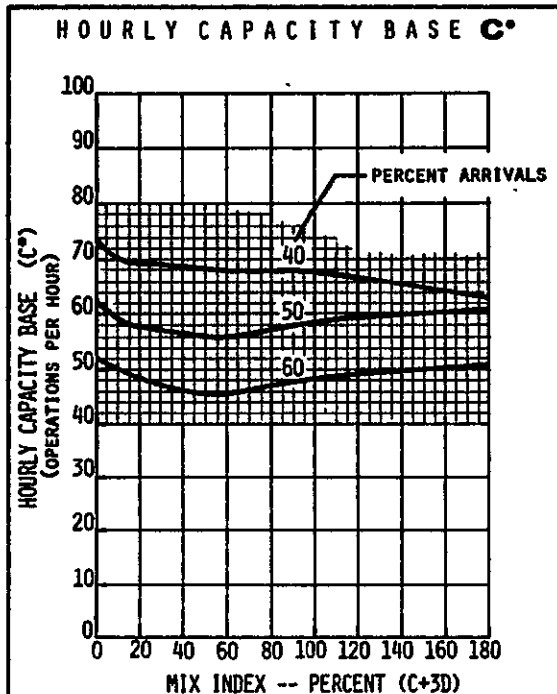
T = 1.00

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
0 to 20	2000 to 3500	
21 to 40	2000 to 5000	
41 to 70	3500 to 6500	E=1.00
71 to 120	5000 to 7000	
121 to 180	5500 to 7500	

FIGURE 3-52. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 13,16,24,27 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C°

TOUCH & GO FACTOR T
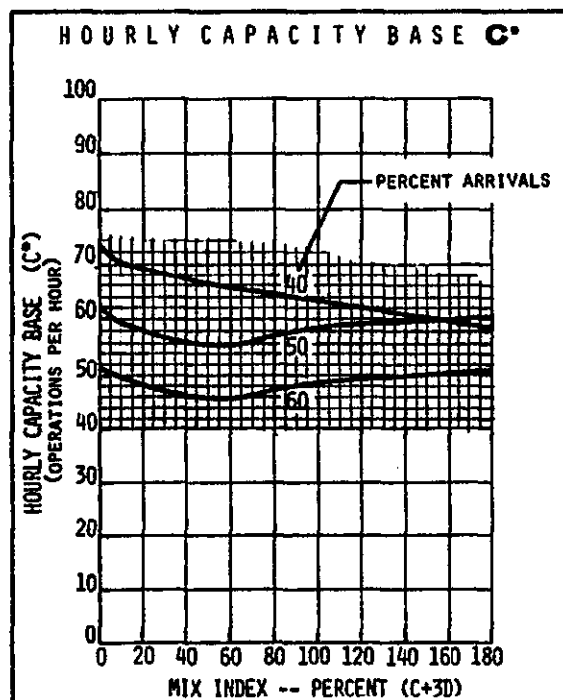
T = 1.00

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 3500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21 to 40	2500 to 5000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41 to 70	3500 to 6500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
71 to 120	5000 to 7000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
121 to 180	5500 to 7500	0.91	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00

FIGURE 3-53. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 14,17,21,25,30 FOR IFR CONDITIONS.
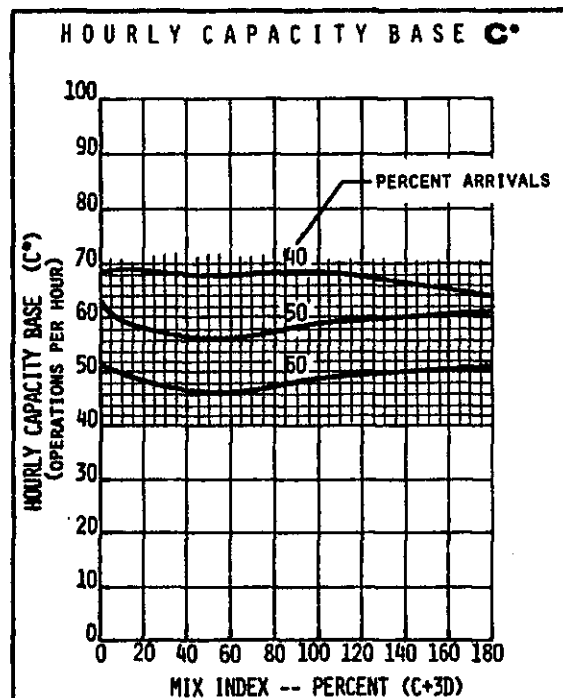
HOURLY CAPACITY BASE C°

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	1.00	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00
21 to 50	3000 to 5500	1.00	1.00	1.00	0.90	0.96	0.98	0.90	0.96	0.98
51 to 80	3500 to 6500	1.00	1.00	1.00	0.91	0.97	1.00	0.91	0.97	1.00
81 to 120	5000 to 7000	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.98	1.00
121 to 180	5500 to 7500	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.97	1.00

FIGURE 3-54. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 15,28 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

T = 1.00

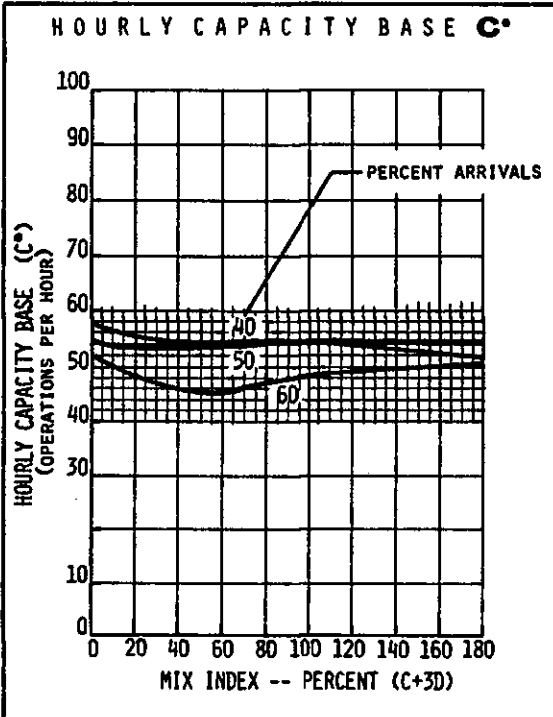**C* × T × E = Hourly Capacity**

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)	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	0.99	1.00	0.98	0.99	1.00	0.98	0.99	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	0.92	0.98	1.00	0.92	0.98	1.00	0.91	0.97	1.00
81 to 120	5000 to 7000	0.95	0.99	1.00	0.92	0.99	1.00	0.91	0.98	1.00
121 to 180	5500 to 7500	0.95	0.99	1.00	0.90	0.97	1.00	0.90	0.97	1.00

FIGURE 3-55. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 18,22,26,31,36 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C*

TOUCH & GO FACTOR T

T = 1.00

C* × T × 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)	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 3-56. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 19,23 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C^*
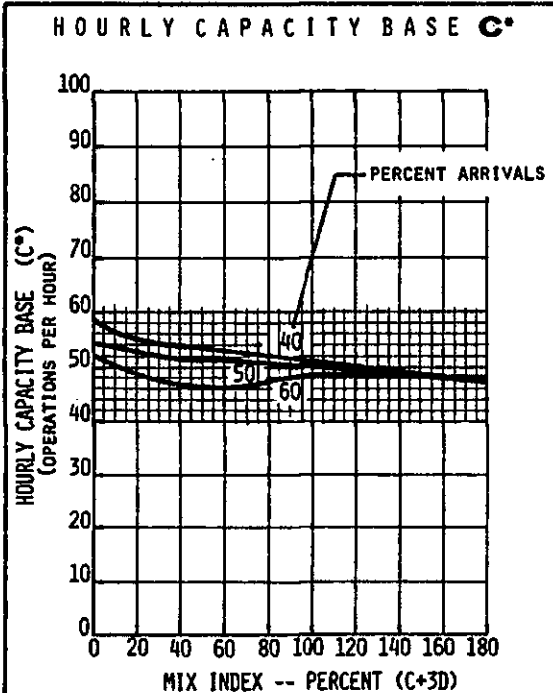
PERCENT ARRIVALS

TOUCH & GO FACTOR T

$T = 1.00$

$C^* \times T \times E =$ 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	0.98	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 3-57. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 78,81,86,93,96,101 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C^*

PERCENT ARRIVALS

TOUCH & GO FACTOR T

$T = 1.00$

$C^* \times T \times E =$ 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	0.98	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 3-58. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 32-35,37-42 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C°

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	0.98	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00
21 to 50	3000 to 5500	0.92	0.99	1.00	0.91	0.99	1.00	0.92	1.00	1.00
51 to 80	3500 to 6500	0.91	0.98	1.00	0.90	0.97	1.00	0.92	0.99	1.00
81 to 120	5000 to 7000	0.94	0.98	1.00	0.91	0.97	1.00	0.91	0.97	1.00
121 to 180	5500 to 7500	0.95	1.00	1.00	0.92	0.99	1.00	0.91	0.99	1.00

FIGURE 3-59. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 43,49,55 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C°

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	0.98	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00
21 to 50	3000 to 5500	0.92	0.99	1.00	0.91	0.99	1.00	0.92	1.00	1.00
51 to 80	3500 to 6500	0.91	0.98	1.00	0.90	0.97	1.00	0.92	0.99	1.00
81 to 120	5000 to 7000	0.94	0.98	1.00	0.91	0.97	1.00	0.91	0.97	1.00
121 to 180	5500 to 7500	0.95	1.00	1.00	0.92	0.99	1.00	0.91	0.99	1.00

FIGURE 3-60. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 44,50,56 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

MIX INDEX -- PERCENT (C+3D)

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	0.99	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00
21 to 50	3000 to 5500	0.96	1.00	1.00	0.92	0.99	1.00	0.93	1.00	1.00
51 to 80	3500 to 6500	0.93	1.00	1.00	0.90	0.97	1.00	0.90	0.98	1.00
81 to 120	5000 to 7000	0.99	1.00	1.00	0.91	0.97	1.00	0.91	0.97	1.00
121 to 180	5500 to 7500	1.00	1.00	1.00	0.92	0.99	1.00	0.92	0.99	1.00

FIGURE. 3-61. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 45,51,57 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

MIX INDEX -- PERCENT (C+3D)

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	0.94	0.95	1.00	0.99	1.00	1.00	0.98	1.00	1.00
21 to 50	3000 to 5500	0.95	0.98	1.00	0.93	0.99	1.00	0.93	1.00	1.00
51 to 80	3500 to 6500	0.92	0.97	1.00	0.90	0.97	1.00	0.90	0.98	1.00
81 to 120	5000 to 7000	0.96	0.98	1.00	0.91	0.97	1.00	0.91	0.97	1.00
121 to 180	5500 to 7500	0.98	1.00	1.00	0.92	0.99	1.00	0.92	0.99	1.00

FIGURE 3-62. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 46,52,58 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE **C***

PERCENT ARRIVALS

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	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00
21 to 50	3000 to 5500	1.00	1.00	1.00	0.97	1.00	1.00	0.91	1.00	1.00
51 to 80	3500 to 6500	1.00	1.00	1.00	0.94	1.00	1.00	0.92	0.99	1.00
81 to 120	5000 to 7000	1.00	1.00	1.00	0.98	1.00	1.00	0.91	0.97	1.00
121 to 180	5500 to 7500	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.99	1.00

FIGURE 3-63. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 47,59 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE **C***

PERCENT ARRIVALS

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	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00
21 to 50	3000 to 5500	1.00	1.00	1.00	0.97	1.00	1.00	0.91	1.00	1.00
51 to 80	3500 to 6500	1.00	1.00	1.00	0.94	1.00	1.00	0.92	0.99	1.00
81 to 120	5000 to 7000	1.00	1.00	1.00	0.98	1.00	1.00	0.91	0.97	1.00
121 to 180	5500 to 7500	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.99	1.00

FIGURE 3-64. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 48,60 FOR IFR CONDITIONS.

HOURLY CAPACITY BASE C*

PERCENT ARRIVALS

HOURLY CAPACITY BASE (C*) (OPERATIONS PER HOUR)

MIX INDEX -- PERCENT (C+3D)

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	0.81	0.91	0.96	0.83	0.95	0.99	0.92	1.00	1.00
21 to 50	3000 to 5500	0.79	0.86	0.92	0.77	0.85	0.92	0.88	0.98	1.00
51 to 80	3500 to 6500	0.81	0.87	0.93	0.77	0.83	0.91	0.90	0.98	1.00
81 to 120	5000 to 7000	1.00	1.00	1.00	0.98	1.00	1.00	0.91	0.97	1.00
121 to 180	5500 to 7500	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.99	1.00

FIGURE 3-65. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 53 FOR IFR CONDITIONS.

FIGURE 3-66. HOURLY CAPACITY OF A TAXIWAY CROSSING AN ACTIVE RUNWAY WITH ARRIVALS ONLY OR WITH MIXED OPERATIONS.

FIGURE 3-67A   RUNWAY OPERATIONS RATE
0 TO 35 OPERATIONS PER HOUR
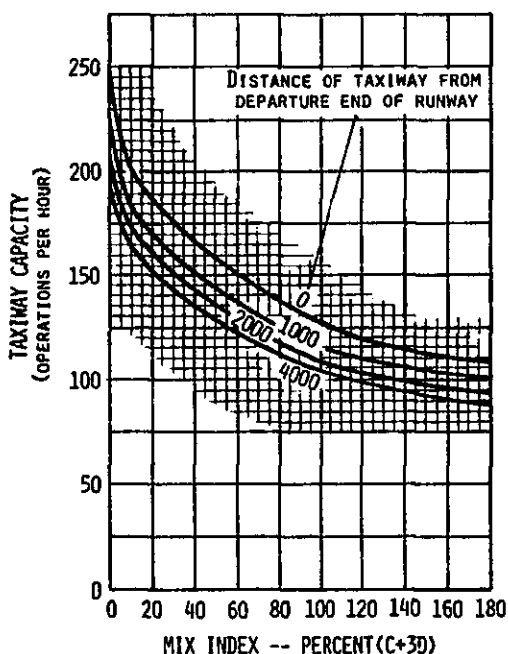
FIGURE 3-57B   RUNWAY OPERATIONS RATE
36 TO 55 OPERATIONS PER HOUR
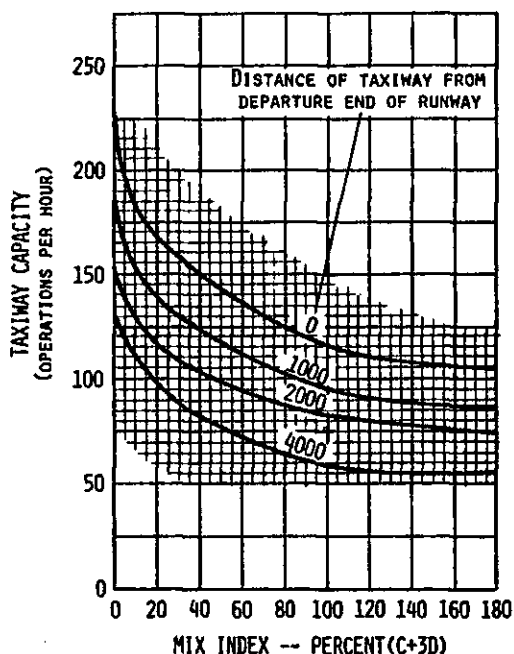
FIGURE 3-67C   RUNWAY OPERATIONS RATE
56 TO 75 OPERATIONS PER HOUR
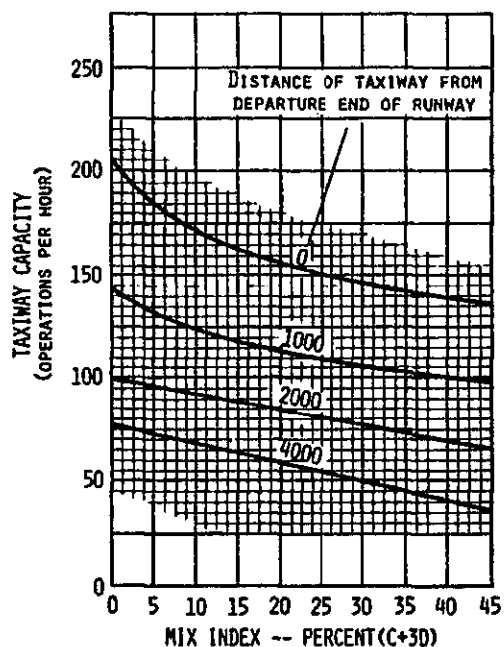
FIGURE 3-67D   RUNWAY OPERATIONS RATE
76 TO 95 OPERATIONS PER HOUR
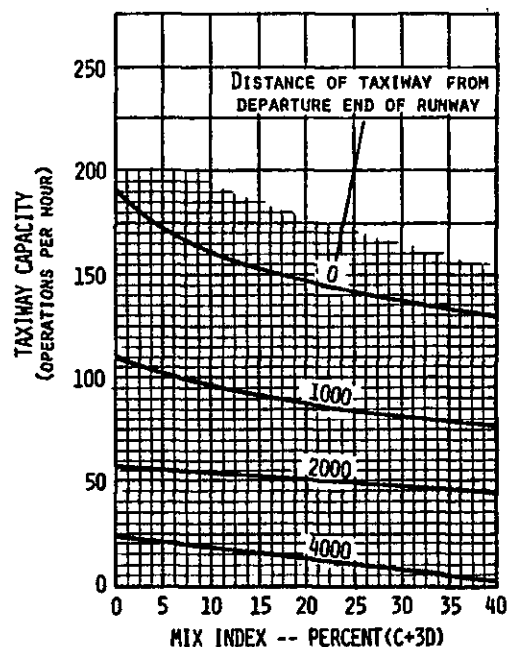
FIGURE 3-67.   HOURLY CAPACITY OF A TAXIWAY CROSSING AN ACTIVE RUNWAY WITHOUT ARRIVALS.

FIGURE 3-58. HOURLY CAPACITY OF GATES.
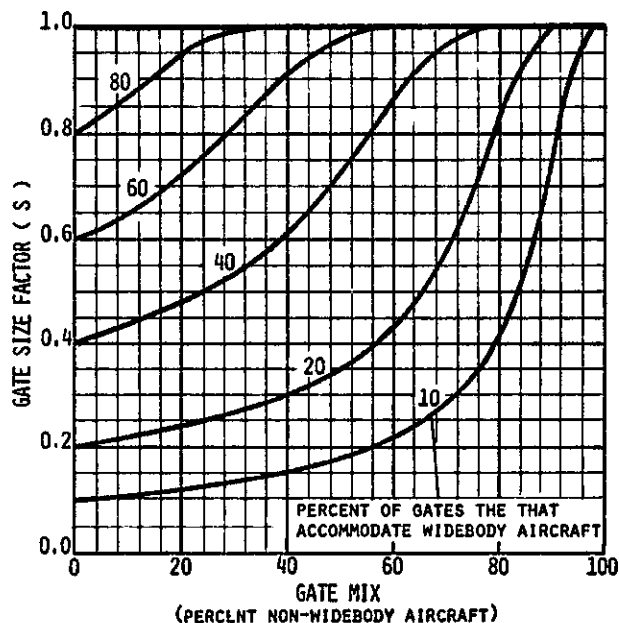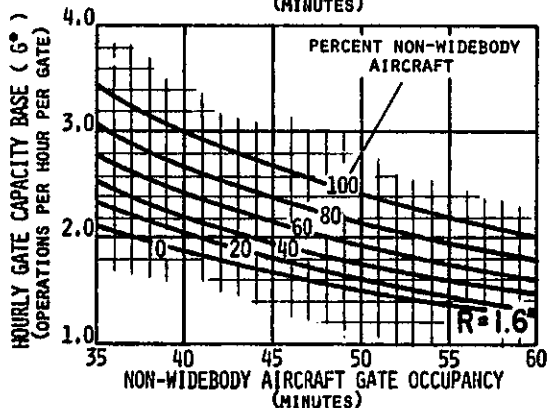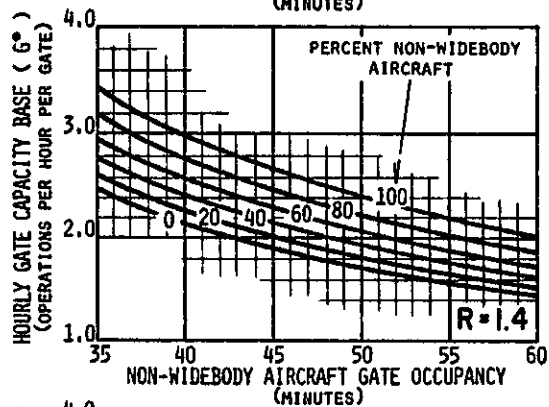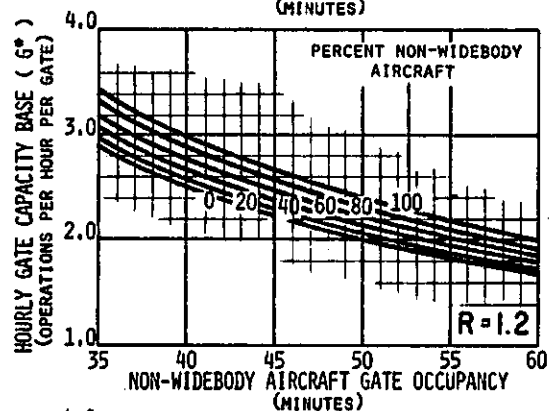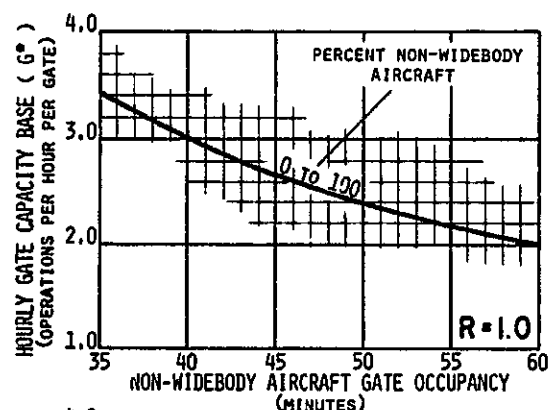
$G^* \times S \times N$ = Hourly Capacity

NUMBER OF GATES (N)

NOTES:

(1) $R = \dfrac{\text{AVERAGE GATE OCCUPANCY TIME FOR WIDEBODY AIRCRAFT}}{\text{AVERAGE GATE OCCUPANCY TIME FOR NON-WIDEBODY AIRCRAFT}}$

(2) IF OPERATIONS DO NOT INCLUDE WIDEBODY AIRCRAFT, GATE MIX = 100 AND R = 1.0

FIGURE 3-69. AVERAGE AIRCRAFT DELAY IN AN HOUR.

DURATION OF OVERLOAD PHASE ONE HOUR

DURATION OF OVERLOAD PHASE TWO HOURS

DURATION OF OVERLOAD PHASE THREE HOURS

DURATION OF OVERLOAD PHASE FOUR HOURS

DURATION OF OVERLOAD PHASE FIVE HOURS
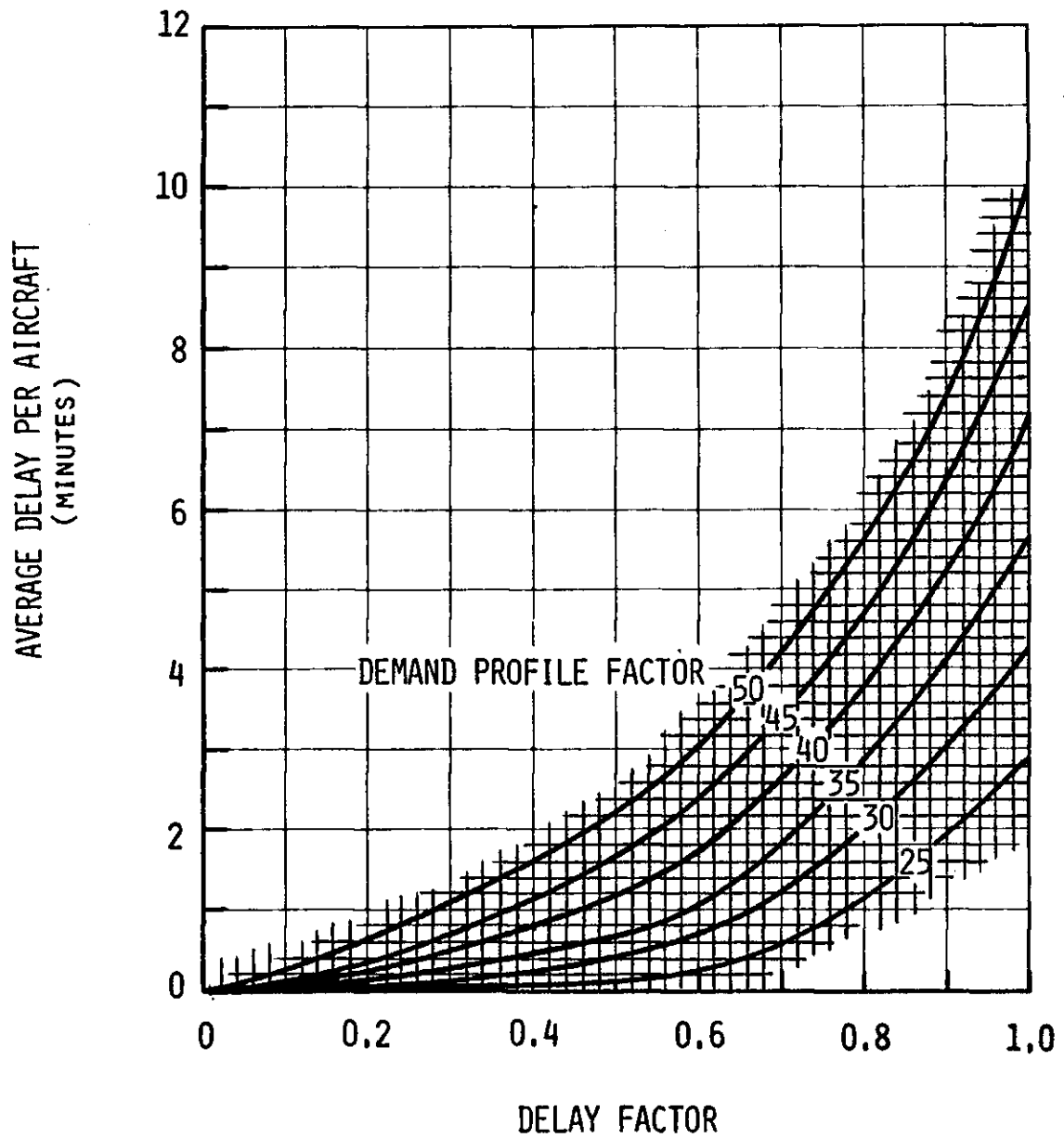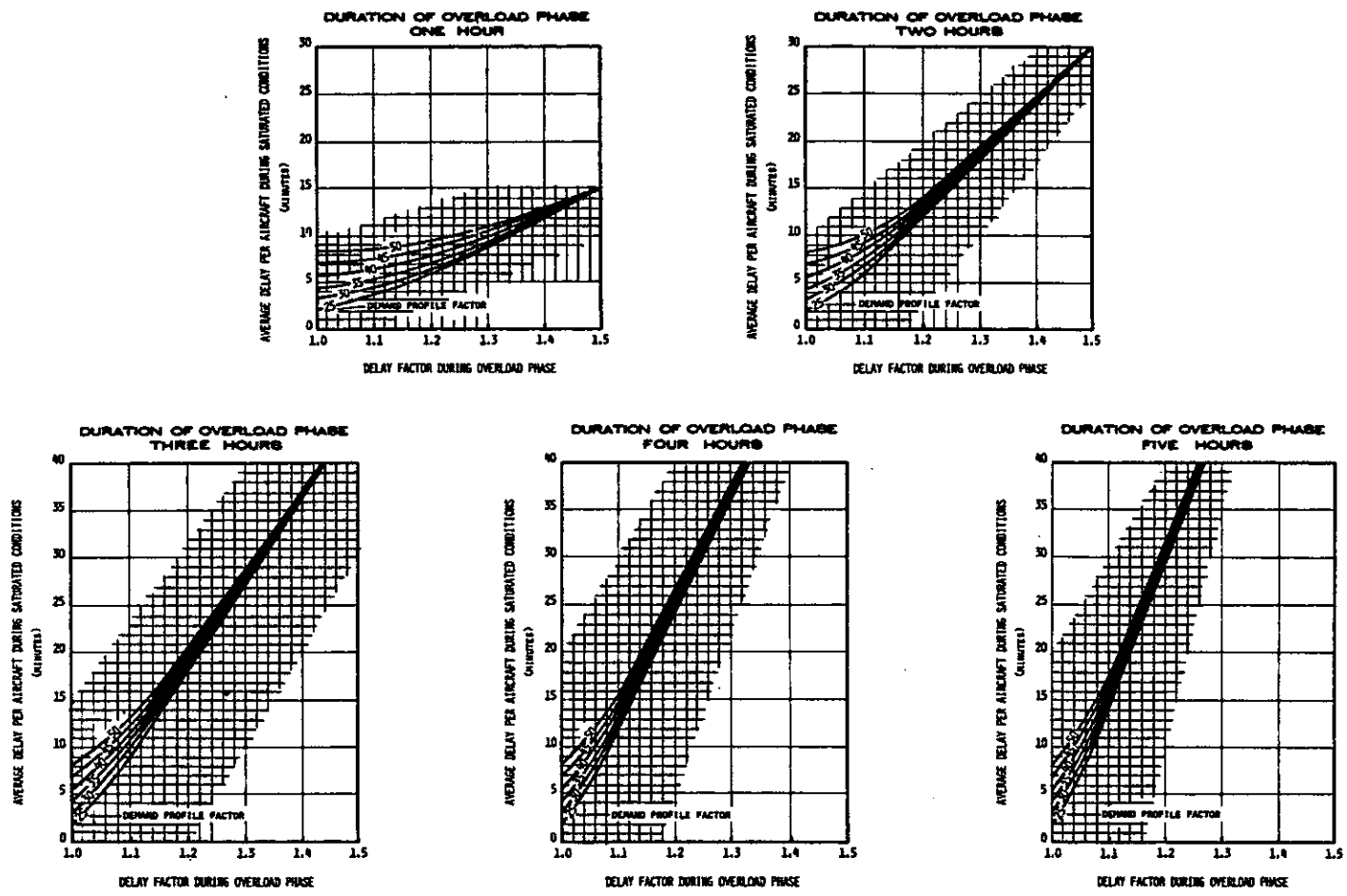
(NOTE: FOR DISCUSSION AND EXAMPLES OF THE TERMS "OVERLOAD PHASE" AND "SATURATED PERIODS", SEE PARAGRAPH 28.C ON PAGE 59.)

FIGURE 3-70. AVERAGE AIRCRAFT DELAY DURING SATURATED CONDITIONS.

FIGURE 3-72. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 2,32,33,67,72,73,87,88 FOR VFR CONDITIONS.
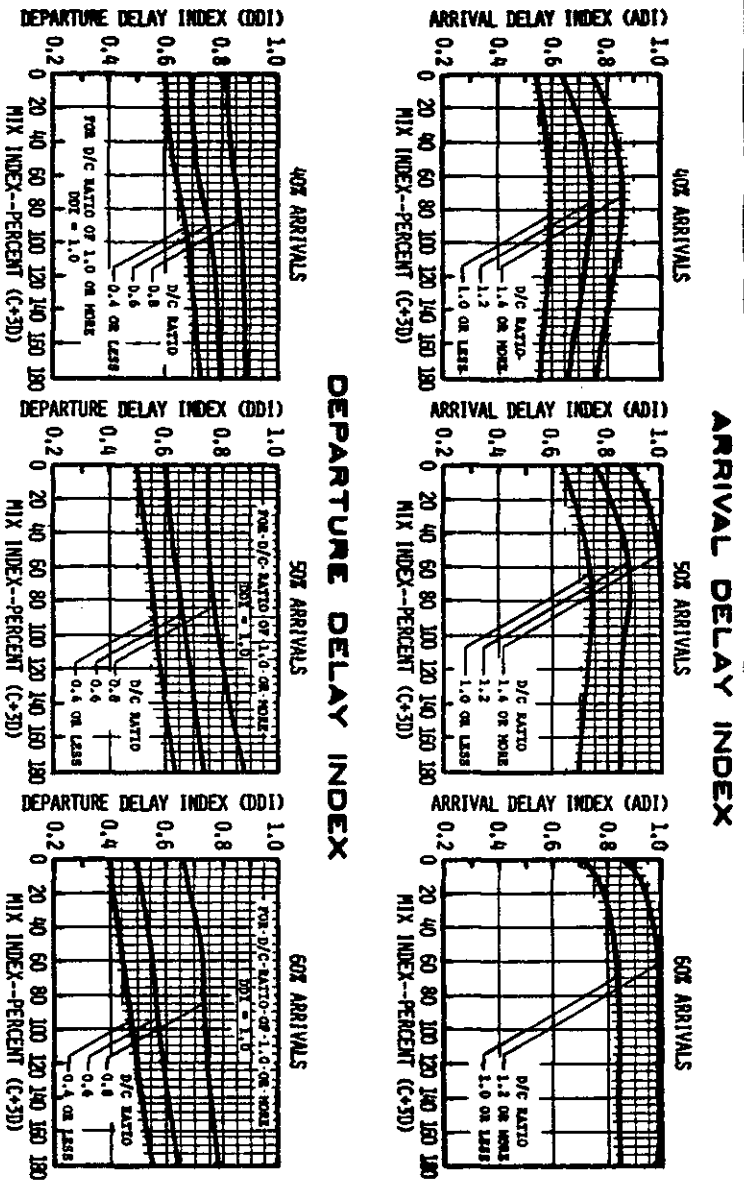
FIGURE 3-71. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 1,9-12,30,31,42,47,48,53,54,66,68-71 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX = 1.00

ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX
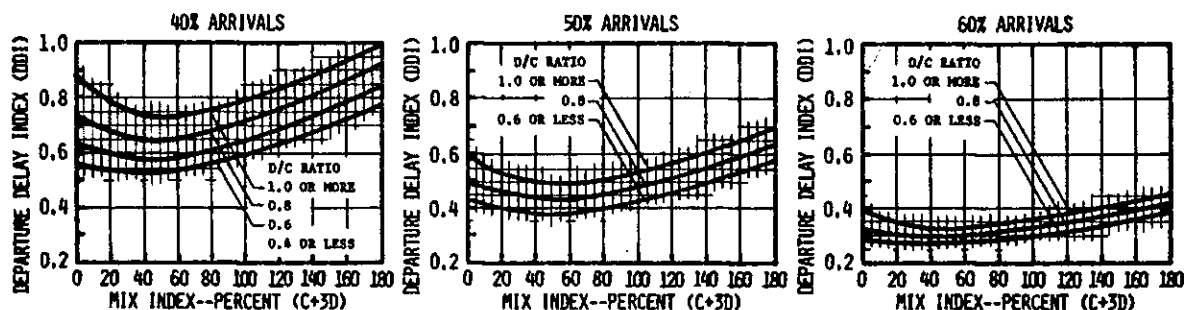
FIGURE 3-73. DELAY INDICES FOR RUNWAY-USE DIAGRAM NO. 3 FOR VFR CONDITIONS.

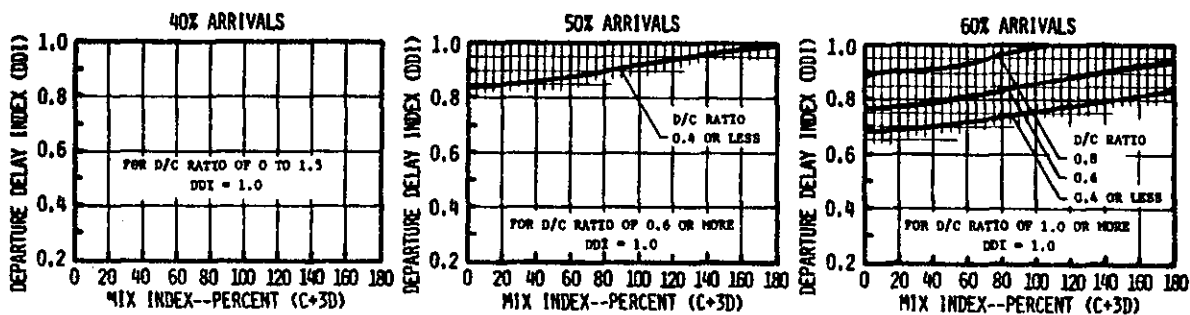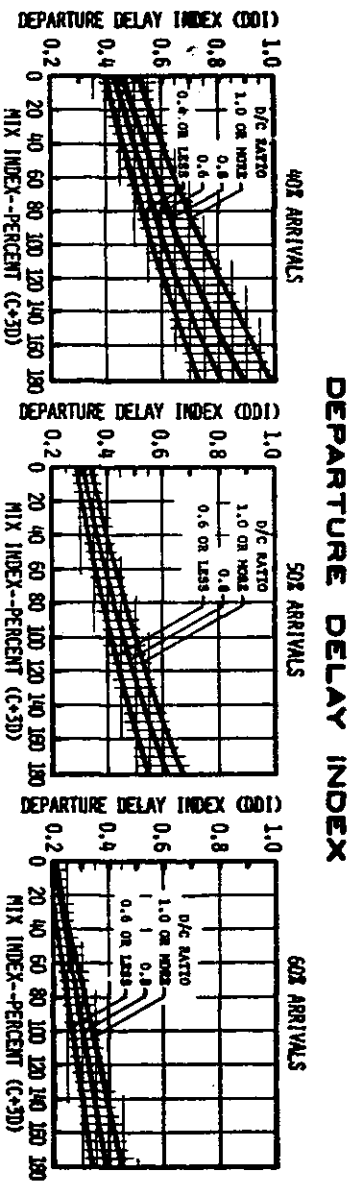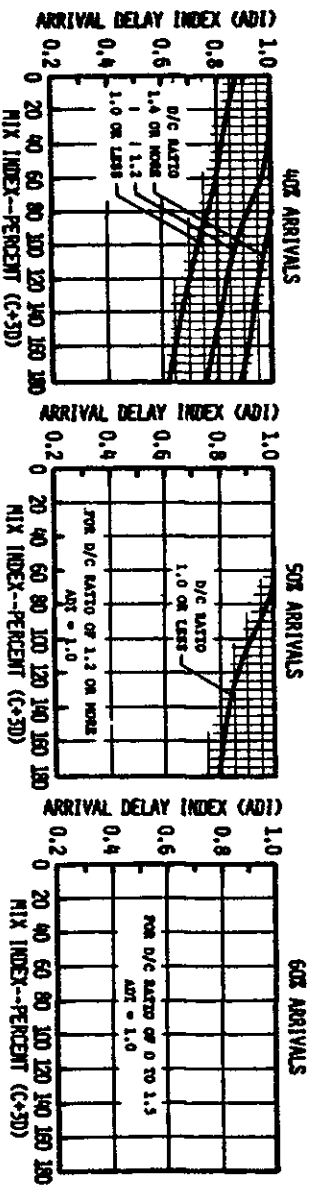ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX
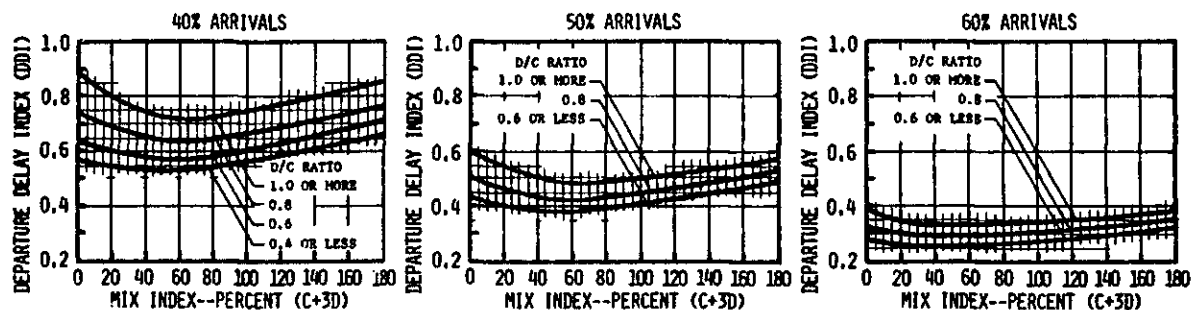
FIGURE 3-74. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 4,74,75,85,86,89,90,100,101 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX
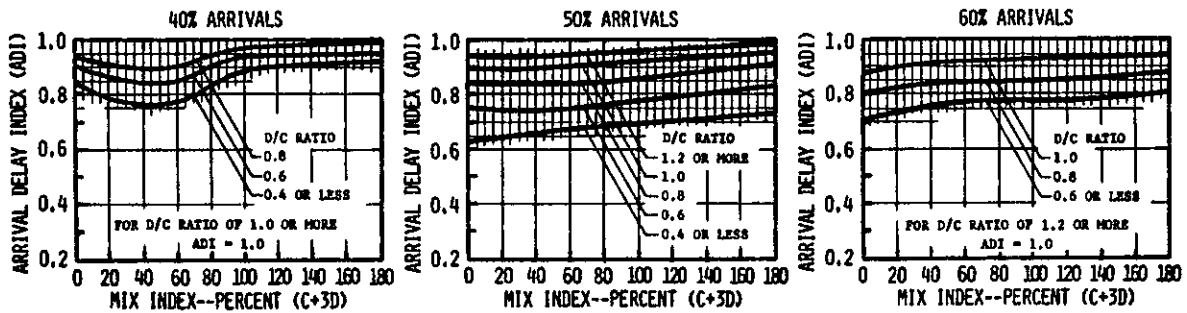
DEPARTURE DELAY INDEX = 1.00

FIGURE 3-75. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 5-8,76,91 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX
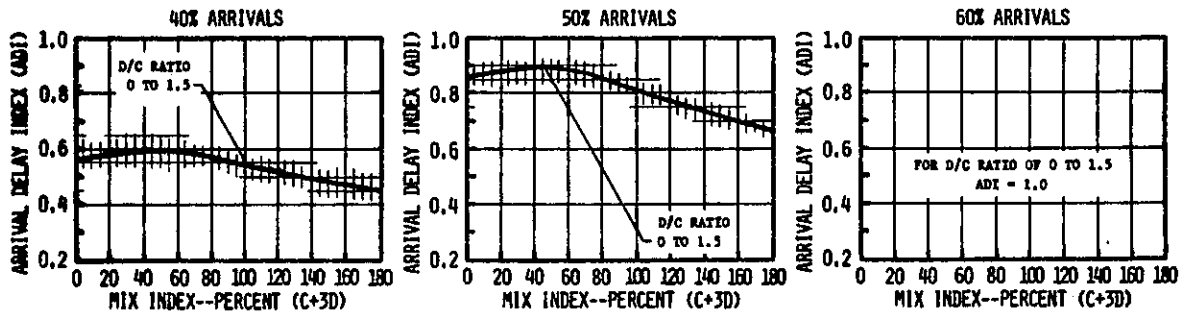
DEPARTURE DELAY INDEX
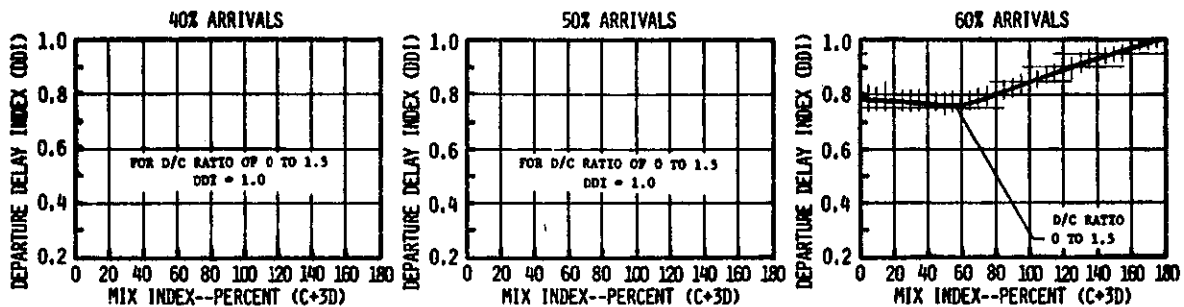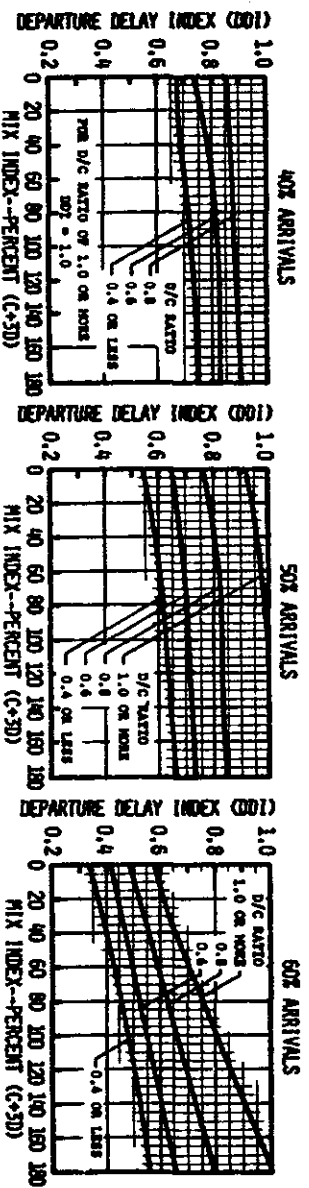

FIGURE 3-76. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 13-15 FOR VFR CONDITIONS.

Chap 3

ARRIVAL DELAY INDEX

DEPARTURE DELAY INDEX
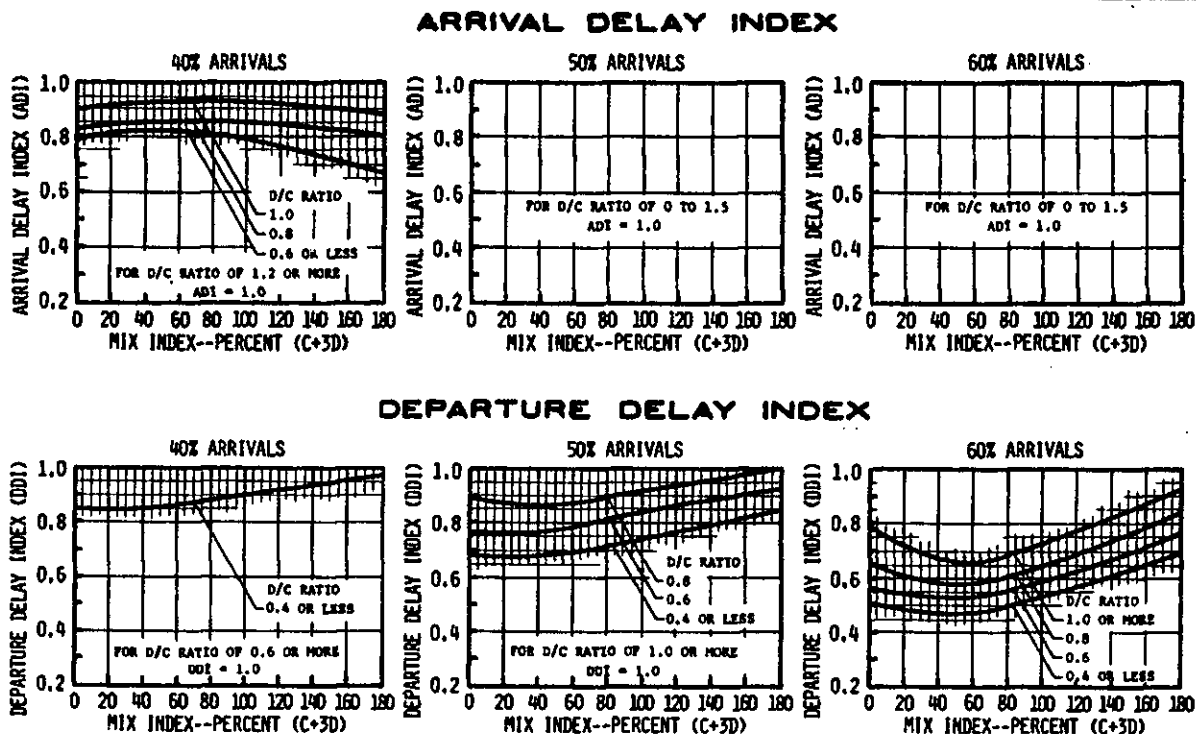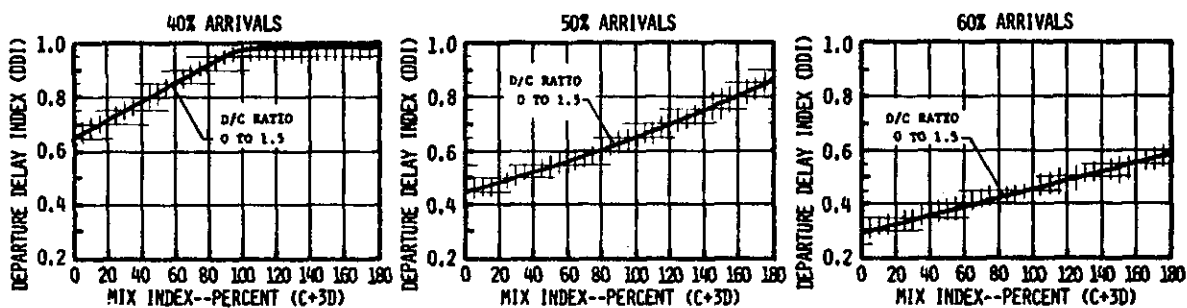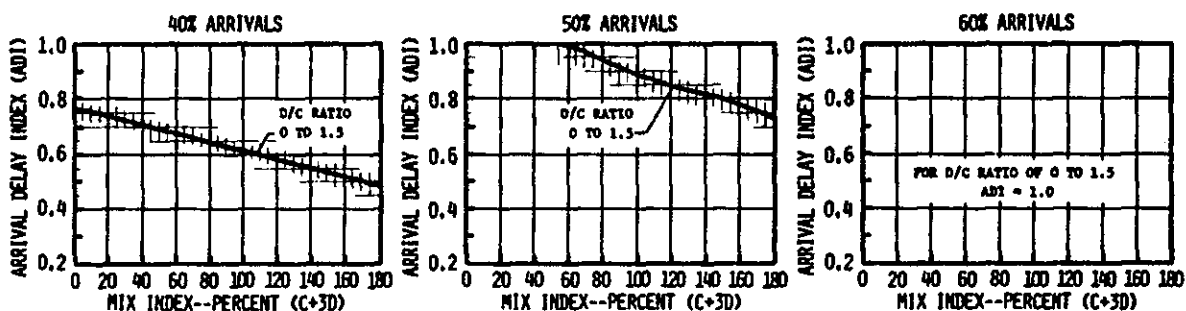
FIGURE 3-77. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 16,79,94 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX

DEPARTURE DELAY INDEX
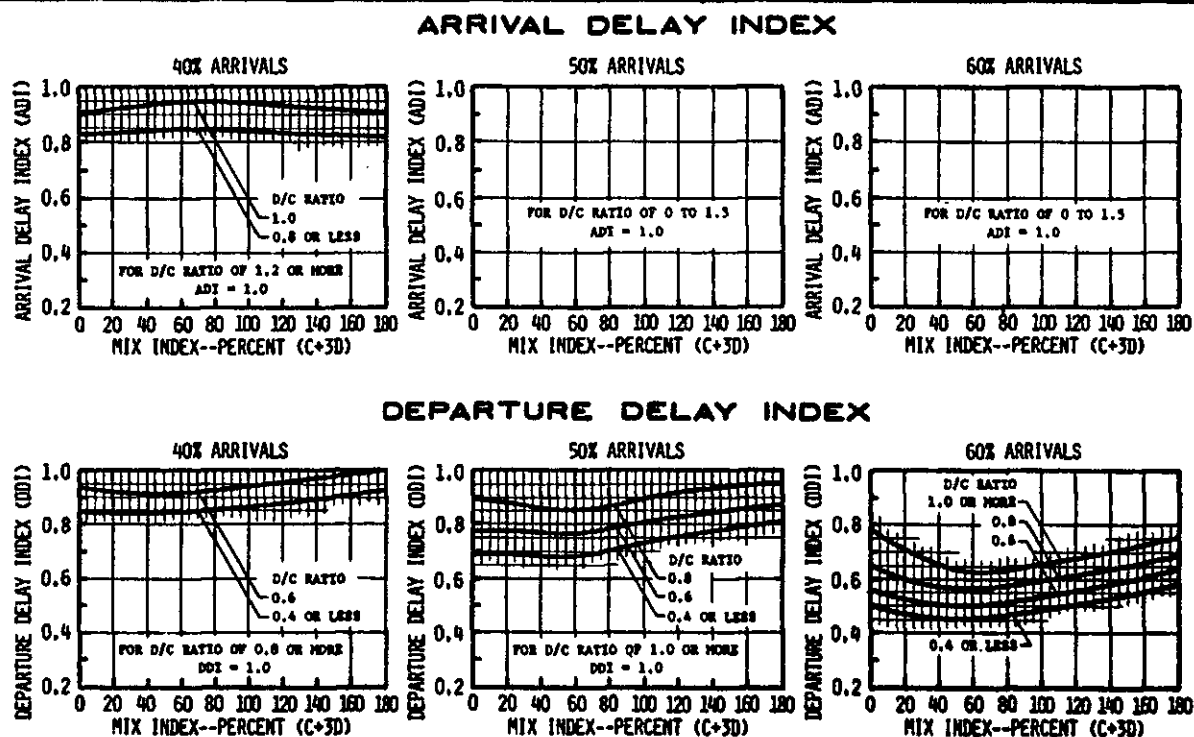
FIGURE 3-78. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 17-23, 77,78,92,93 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX
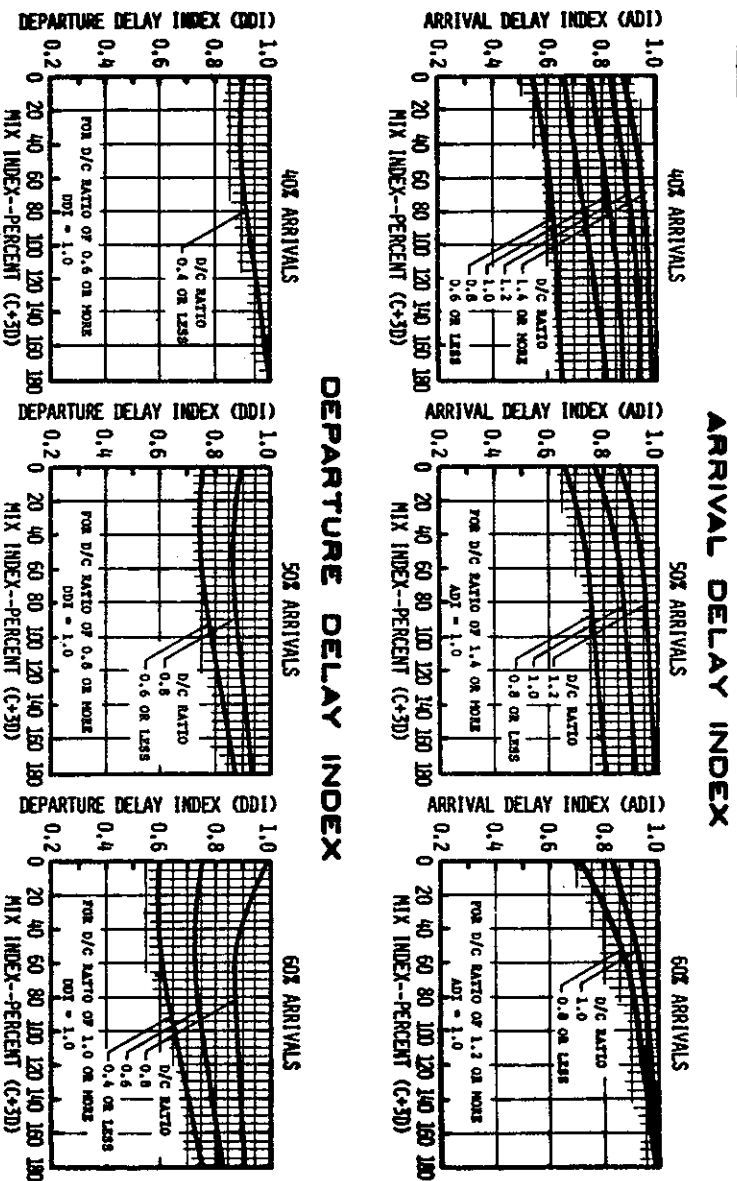
FIGURE 3-79. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 24,27 FOR VFR CONDITIONS.

DEPARTURE DELAY INDEX

ARRIVAL DELAY INDEX

DEPARTURE DELAY INDEX
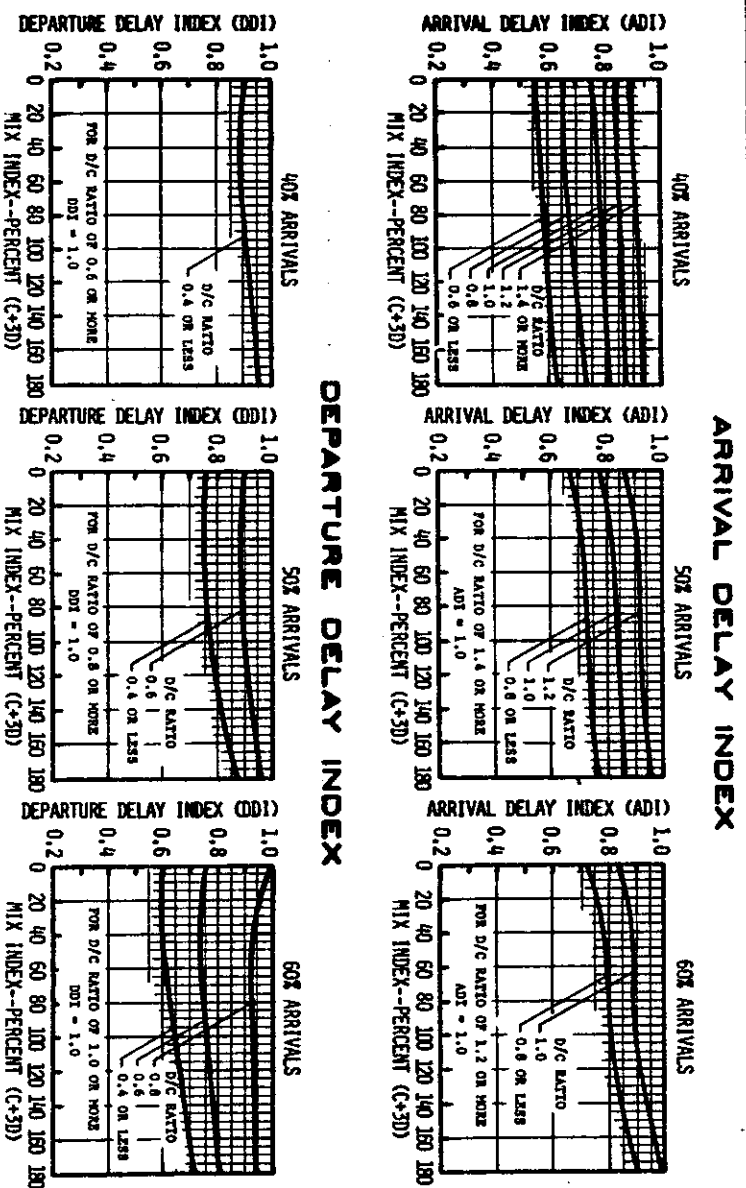
FIGURE 3-80. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 25,26,28,41,82,97 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX

40% ARRIVALS

ARRIVAL DELAY INDEX (ADI)

MIX INDEX--PERCENT (C+3D)

D/C RATIO
1.4 OR MORE
1.2
1.0 OR LESS

50% ARRIVALS

ARRIVAL DELAY INDEX (ADI)

MIX INDEX--PERCENT (C+3D)

D/C RATIO
1.4 OR MORE
1.2
1.0 OR LESS

60% ARRIVALS

ARRIVAL DELAY INDEX (ADI)

MIX INDEX--PERCENT (C+3D)

D/C RATIO
1.2
1.0 OR LESS

FOR D/C RATIO OF 1.4 OR MORE
ADI = 1.0

DEPARTURE DELAY INDEX

40% ARRIVALS

DEPARTURE DELAY INDEX (DDI)

MIX INDEX--PERCENT (C+3D)

D/C RATIO
0.8
0.6
0.4 OR LESS

FOR D/C RATIO OF 1.0 OR MORE
DDI = 1.0

50% ARRIVALS

DEPARTURE DELAY INDEX (DDI)

MIX INDEX--PERCENT (C+3D)

D/C RATIO
0.8
0.6
0.4 OR LESS

FOR D/C RATIO OF 1.0 OR MORE
DDI = 1.0

60% ARRIVALS

DEPARTURE DELAY INDEX (DDI)

MIX INDEX--PERCENT (C+3D)
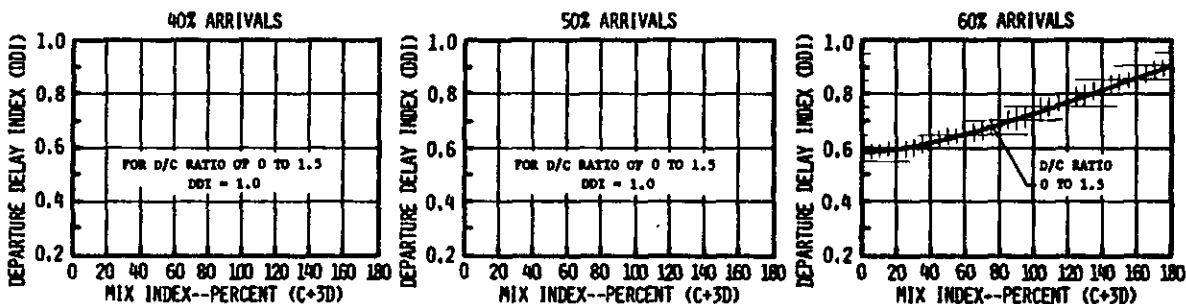
D/C RATIO
0.8
0.6
0.4 OR LESS

FOR D/C RATIO OF 1.0 OR MORE
DDI = 1.0

FIGURE 3-81. DELAY INDICES FOR RUNWAY-USE DIAGRAM NO. 29 FOR VFR CONDITIONS.
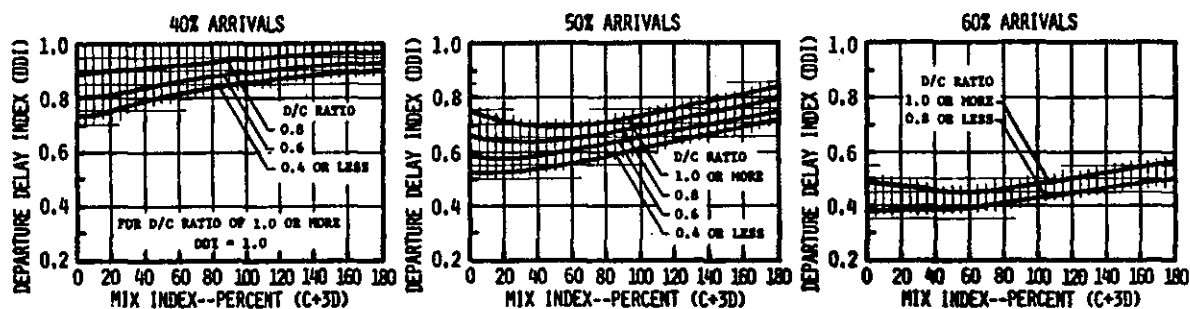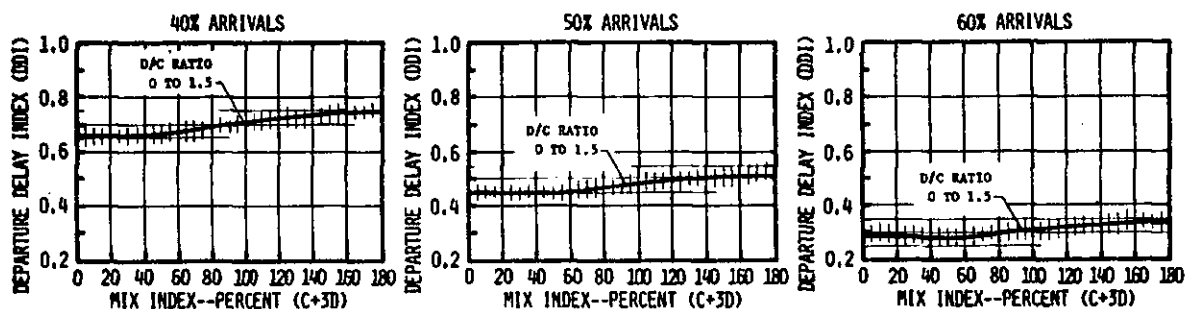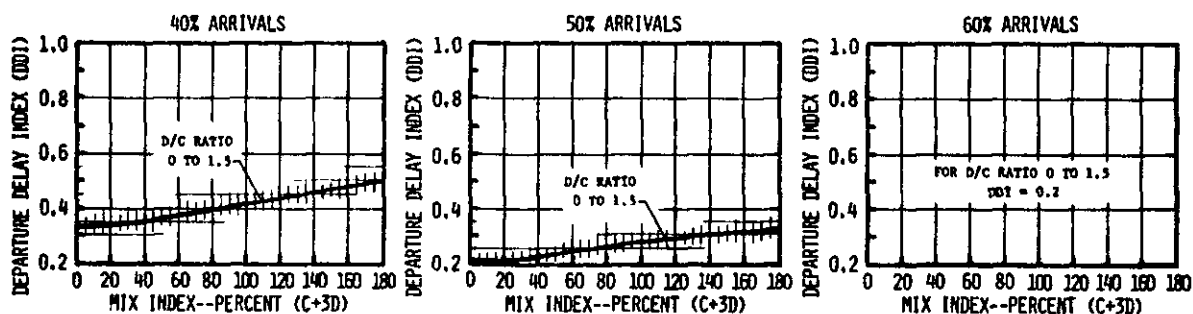
ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX

40% ARRIVALS

DEPARTURE DELAY INDEX (DDI)

MIX INDEX--PERCENT (C+3D)

D/C RATIO
1.0 OR MORE
0.8
0.6 OR LESS

50% ARRIVALS

DEPARTURE DELAY INDEX (DDI)

MIX INDEX--PERCENT (C+3D)

D/C RATIO
1.0 OR MORE
0.8 OR LESS

60% ARRIVALS

DEPARTURE DELAY INDEX (DDI)

MIX INDEX--PERCENT (C+3D)

D/C RATIO
0 TO 1.5

FIGURE 3-82. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 34,35 FOR VFR CONDITIONS.

FIGURE 3-83. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 36-38 FOR VFR CONDITIONS.
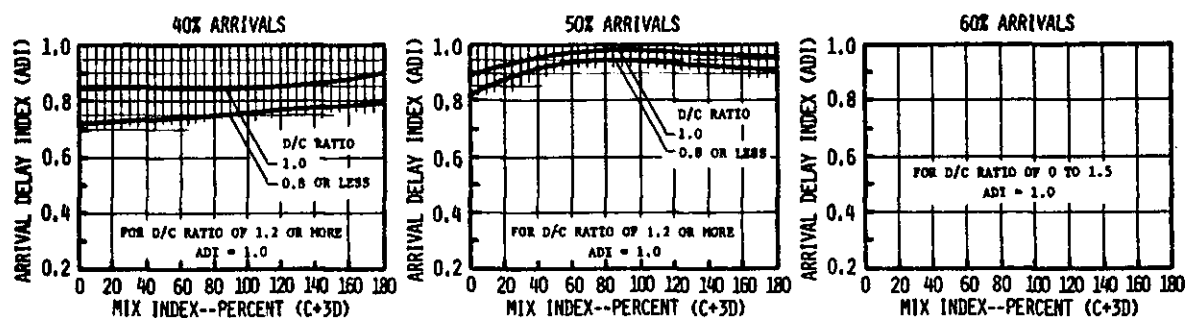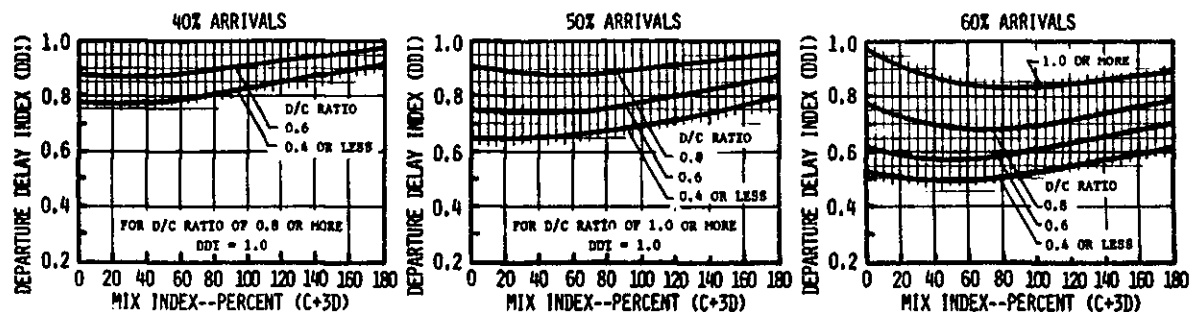
FIGURE 3-84. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 39,40 FOR VFR CONDITIONS.
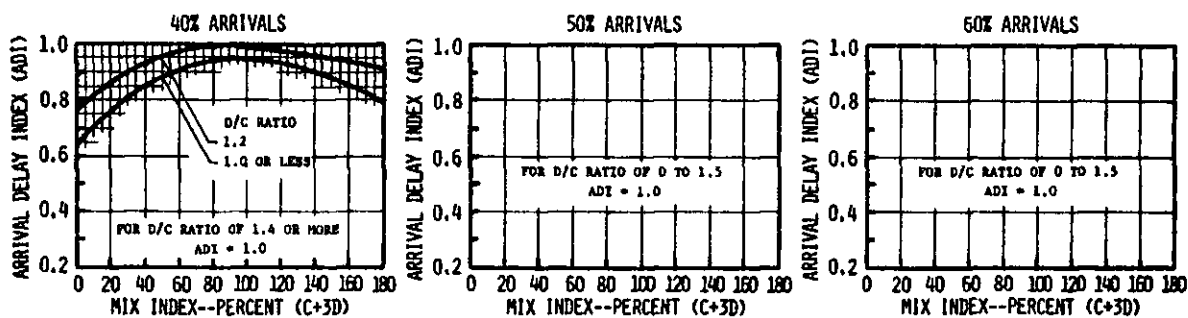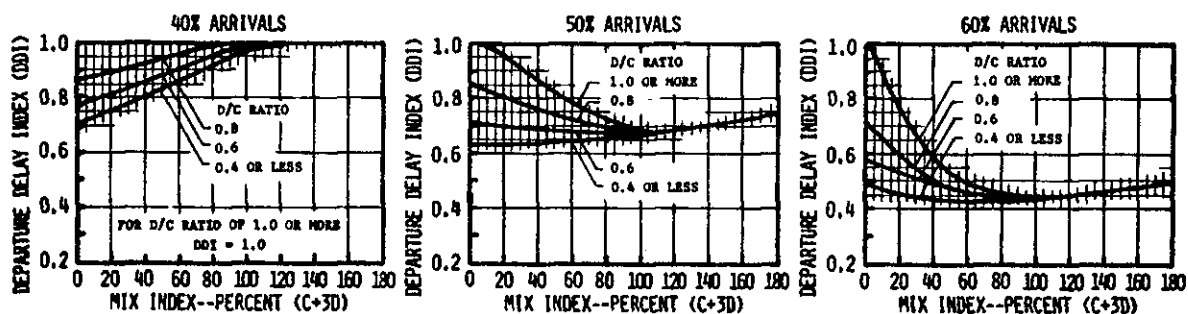
ARRIVAL DELAY INDEX

FIGURE 3-85. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 43,49,55,61 FOR VFR CONDITIONS.
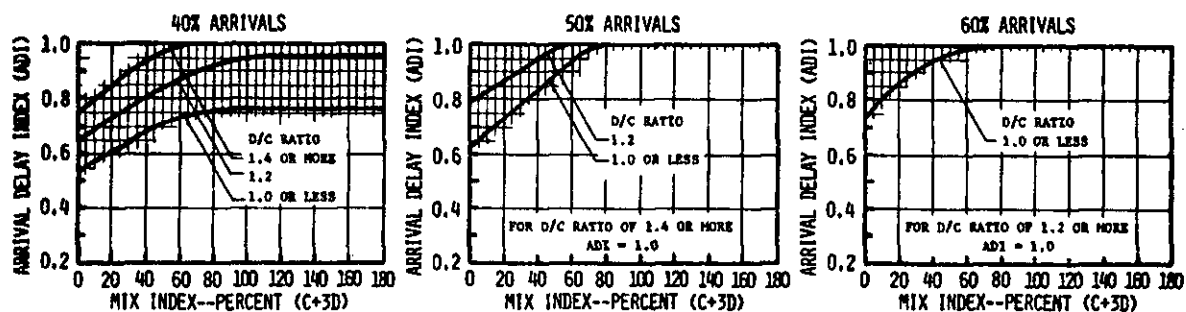
ARRIVAL DELAY INDEX
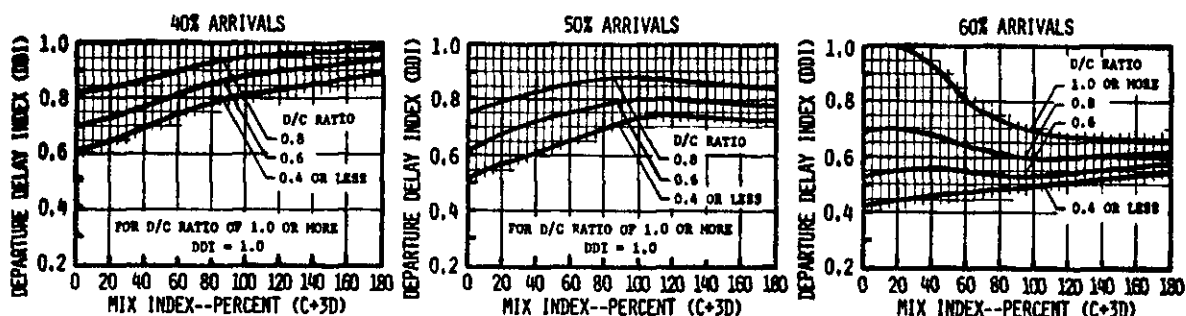
FIGURE 3-86. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 44-46,50-52,56-58,62-64 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX

ARRIVAL DELAY INDEX (ADI) — DEPARTURE DELAY INDEX (DDI)

40% ARRIVALS

50% ARRIVALS

60% ARRIVALS

MIX INDEX—PERCENT (C+3D)
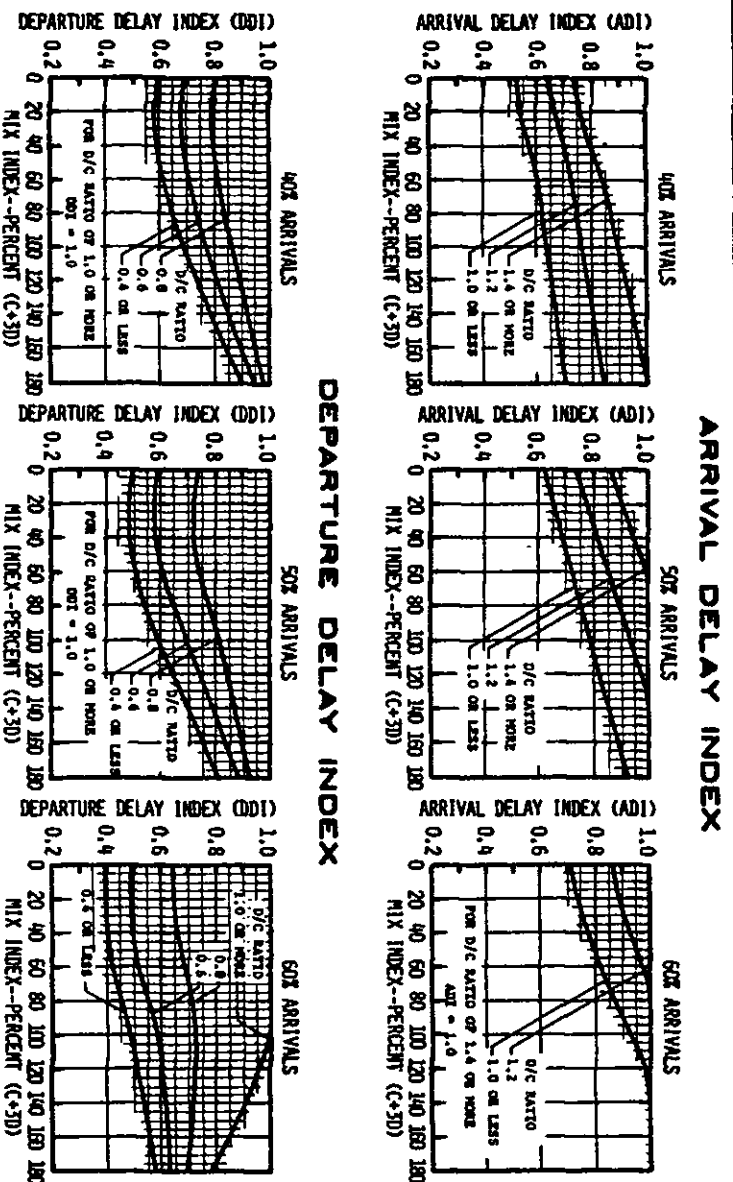
FIGURE 3-87. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 59,60,65 FOR VFR CONDITIONS.

DEPARTURE DELAY INDEX

ARRIVAL DELAY INDEX

DEPARTURE DELAY INDEX

ARRIVAL DELAY INDEX (ADI) — DEPARTURE DELAY INDEX (DDI)

40% ARRIVALS

50% ARRIVALS

60% ARRIVALS

MIX INDEX—PERCENT (C+3D)
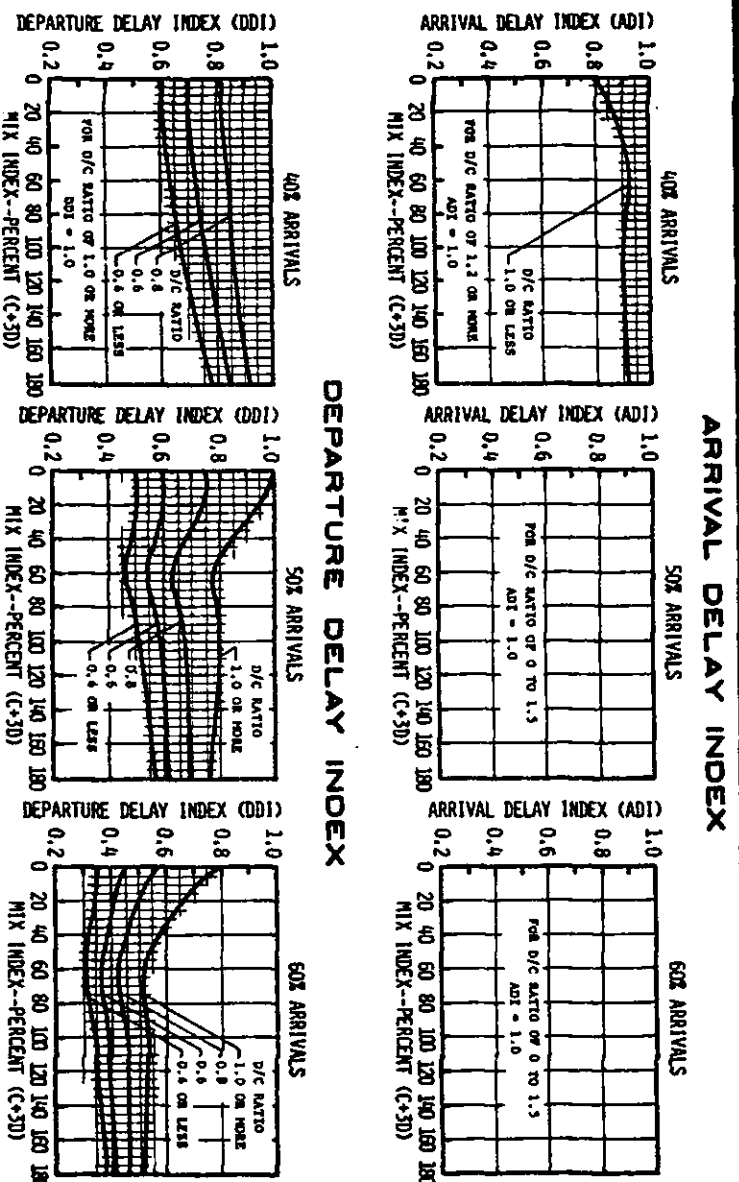
FIGURE 3-88. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 80,81,95,96 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX
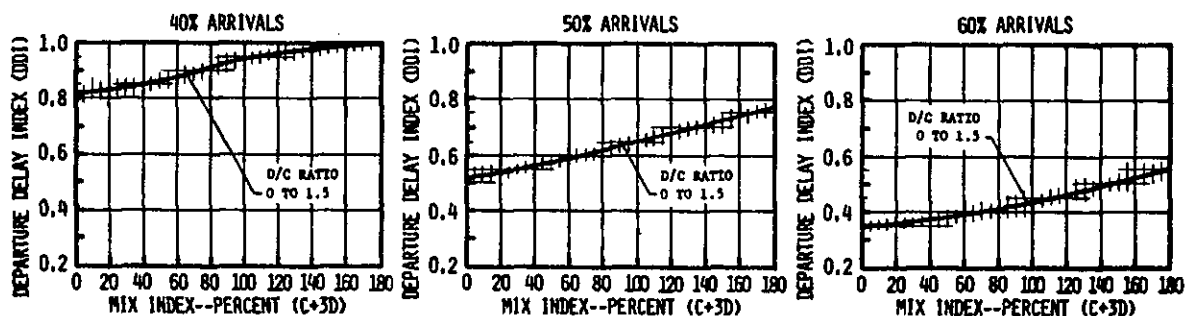
FIGURE 3-89. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 83,84,98,99,102 FOR VFR CONDITIONS.

ARRIVAL DELAY INDEX
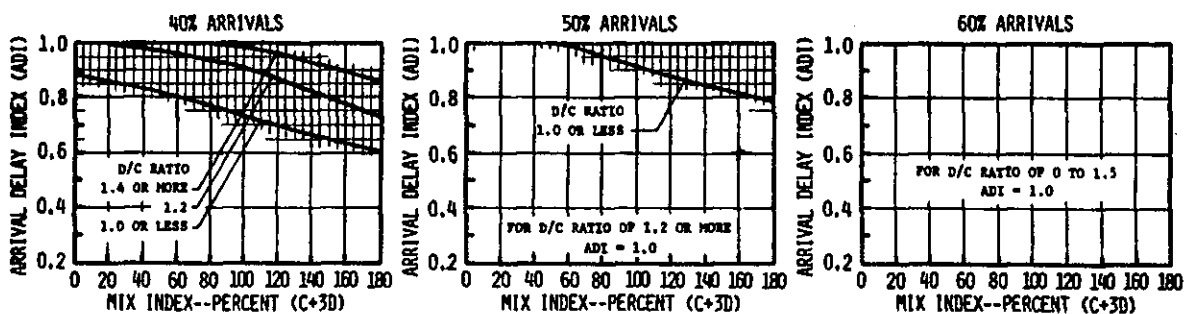
DEPARTURE DELAY INDEX
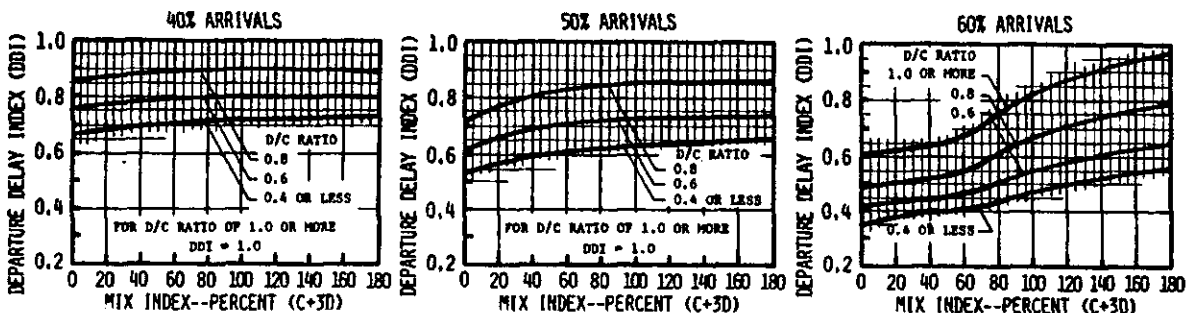
FIGURE 3-90. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 1,53,54 FOR IFR CONDITIONS.
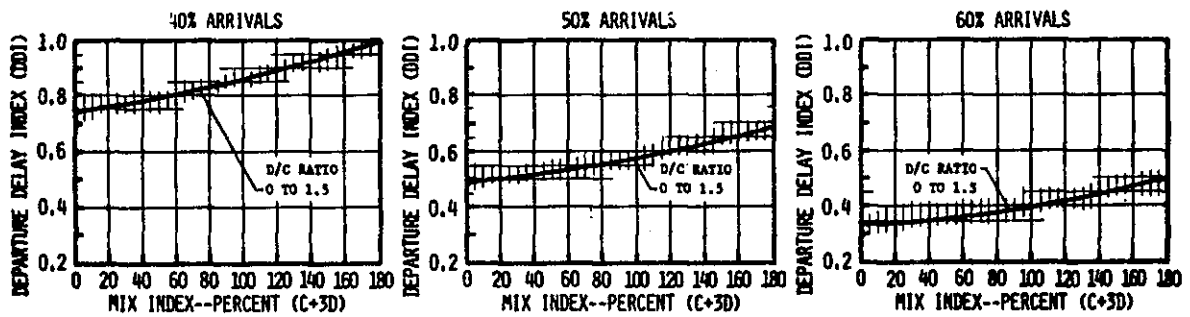
ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX

FIGURE 3-91. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 2,3,5,9,32-35,37-43,49,55,61-68,72-74,76, 77,79,80,82-85,87-89,91,92,94,95,97-100,102 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX
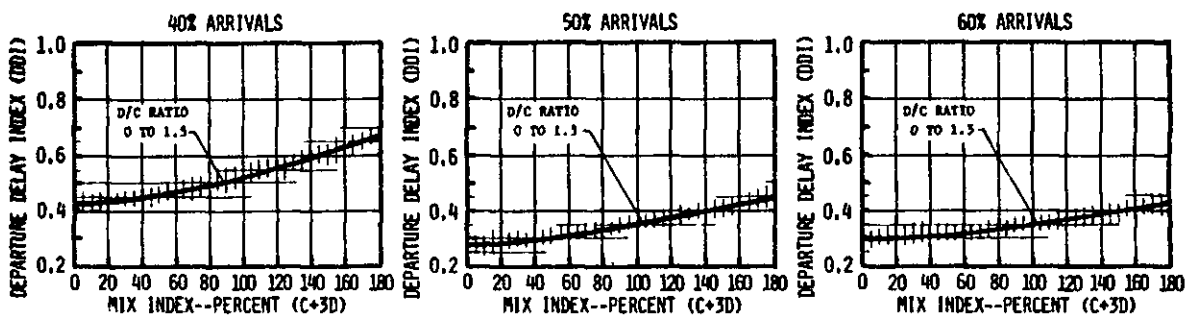
FIGURE 3-92. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 4,75,90 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX
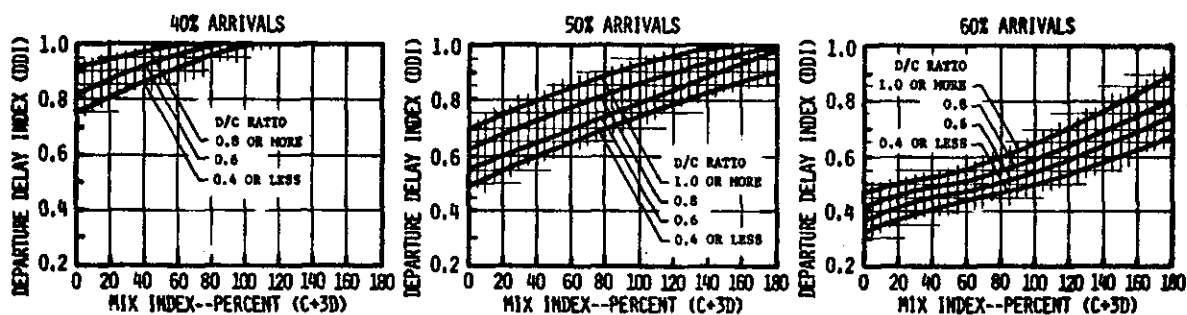
FIGURE 3-93. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 6,7 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX
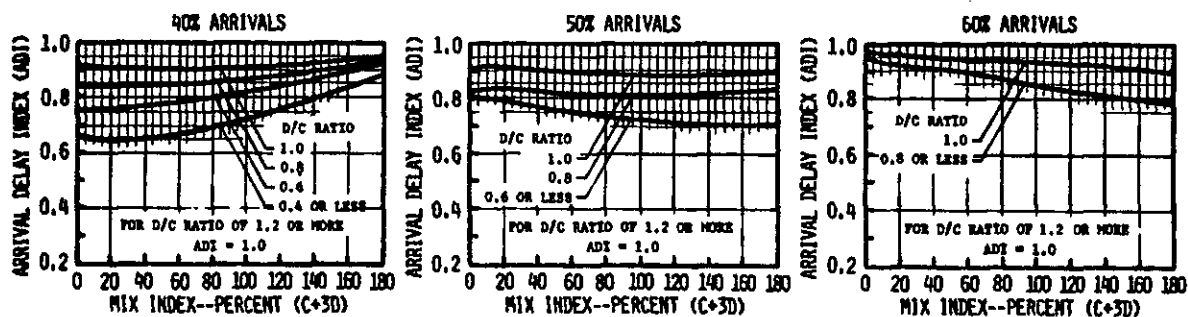
DEPARTURE DELAY INDEX

FIGURE 3-94. DELAY INDICES FOR RUNWAY-USE DIAGRAM NO. 8 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX

FIGURE 3-95. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 10,11,20,21,25,29,30,69-71 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX

DEPARTURE DELAY INDEX

FIGURE 3-96. DELAY INDICES FOR RUNWAY-USE DIAGRAM NO. 12 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX

FIGURE 3-97. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 13,14,16,17,24,27 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX

DEPARTURE DELAY INDEX

FIGURE 3-98. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 15,28 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX

FIGURE 3-99. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 18,22,26,31,36,44-46,50-52,56-58 FOR IFR CONDITIONS.

ARRIVAL DELAY INDEX = 1.00

DEPARTURE DELAY INDEX

FIGURE 3-100. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 19,23 FOR IFR CONDITIONS.

Chap 3

FIGURE 3-101. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 78,81,86,93,96,101 FOR IFR CONDITIONS.
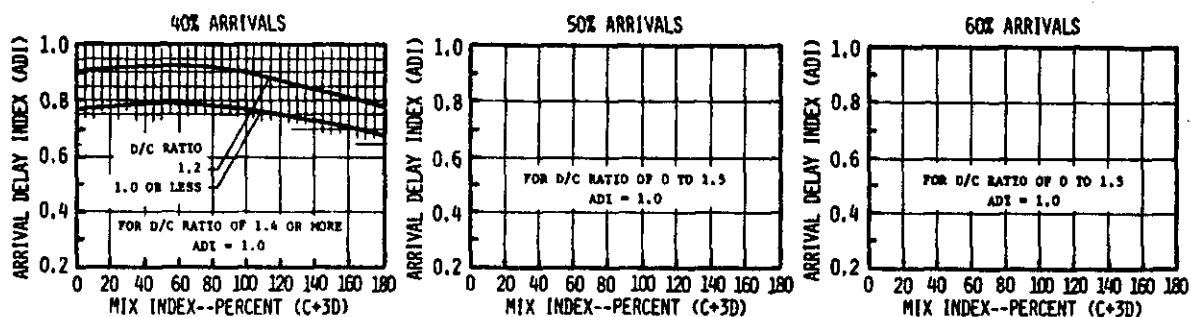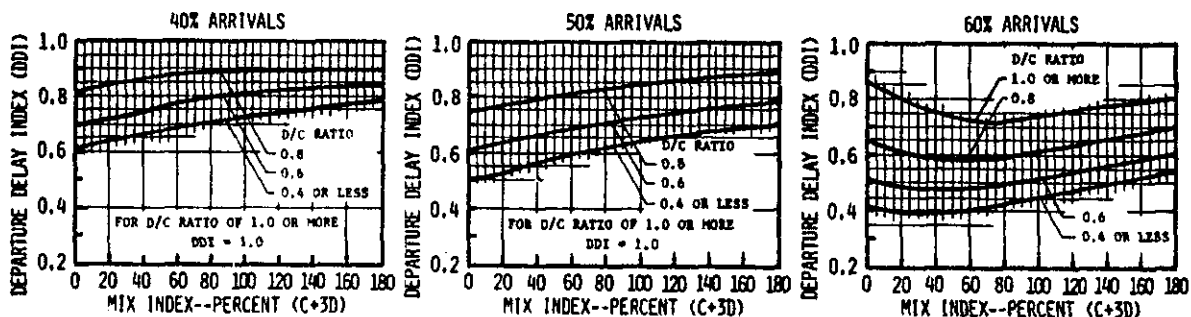
FIGURE 3-102. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 47,48,59,60 FOR IFR CONDITIONS.

CHAPTER 4. SPECIAL APPLICATIONS

4-1. <u>GENERAL</u>. This chapter provides calculations of runway capacity for situations involving PVC conditions, the absence of radar coverage and/or ILS, and airports with one runway or a runway restricted to small aircraft. Appendix 3 contains examples of these calculations.

4-2. <u>PVC CONDITIONS</u>. Runway hourly capacity in PVC conditions is reduced by increased in-trail separations of approaches and departures and increased runway occupancy times. Calculate PVC runway component hourly capacity as follows:

      a. Select the runway-use configuration in figure 4-1 which best represents the airport and identify the figure number for determining capacity in PVC conditions. To adjust for staggered thresholds, see paragraph 4-6.

      b. Determine the percent of class C and D aircraft and calculate the mix index.

      c. Determine the percent arrivals.

      d. Determine the runway hourly capacity from the figure identified in paragraph b above.

4-3. <u>ABSENCE OF RADAR COVERAGE OR ILS</u>. Except for single runway airports used almost exclusively by class A and B aircraft (which are covered in paragraph 4-5), calculate the hourly capacity of the runway component in the absence of radar coverage or ILS as follows:

      a. Select the runway-use configuration in figure 4-1 which best represents the airport and identify the figure number for determining capacity with an inoperative navaid.

      b. Determine whether the radar or the ILS is operative and determine whether a straight-in or a circling approach is authorized.

      c. Determine the percent of class C and D aircraft and calculate the mix index.

      d. Determine the runway hourly capacity from the figure identified in paragraph b above.

4-4. <u>PARALLEL RUNWAY AIRPORTS WITH ONE RUNWAY RESTRICTED TO USE BY SMALL AIRCRAFT</u>. Calculate the hourly capacity of a parallel runway configuration when one of the runways is unable to accommodate class C and D aircraft as follows:

      a. Select the runway-use configuration in figure 4-1 which best represents the airport and identify the figure number for determining capacity in restricted runway use. To adjust for staggered thresholds, see paragraph 4-6.

      b. Determine the percent of class C and D aircraft and calculate the mix index.

      c. Determine the percent arrivals.

   e. Determine the runway hourly capacity from the figure identified in paragraph b above.

4-5. SINGLE RUNWAY AIRPORT--SMALL AIRCRAFT ONLY. Calculate the capacity of a small airport used almost exclusively by Class A and B aircraft without radar coverage or ILS as follows:

   a. Conditions.

       (1) The airport is used almost exclusively by Class A and B aircraft.

       (2) The airport does not have radar coverge or an ILS, but it has an approved approach procedure.

       (3) Arrivals equal departures.

       (4) There are no airspace limitations affecting runway use.

   b. Capacity Calculations.

       (1) Select the airport configuration from figure 4-26 that best represents the airport.

       (2) Determine the percent of touch-and-go operations.

       (3) Read the range of hourly VFR and IFR capacities from figure 4-26.

4-6. THRESHOLD STAGGER. FAA ATC procedures permit simultaneous departures and simultaneous departure--arrival operations on parallel runways spaced 2,500 feet apart with even thresholds and at lesser/greater separations if the thresholds are staggered. When thresholds are staggered, the equivalent unstaggered separation is calculated increasing or decreasing the actual separation depending upon whether the arriving aircraft is approaching the near or far threshold. Stagger adjustments are only applicable when the parallel runway separations that are at least 1000 feet apart and less than 4300 feet apart.

   a. Calculation.

       (1) If the approaches are to the near threshold and the separation is less than 4299 feet, the equivalent separation is the actual separation increased by 100 feet for each 500 feet of threshold stagger up to a maximum of 4299 feet.

       (2) If the approaches are to the far threshold and the separation is greater than 1000 feet, the equivalent separation is the actual separartion decreased by 100 feet for each 500 feet of threshold stagger down to a minimum of 700 feet.

b. Application. Apply the equivalent separation to determine which parallel runway-use configuration to use. Note: the calculation for equivalency need only determine whether the equivalent runway separation is 2500 feet or greater or 2499 feet or less.

c. Examples.

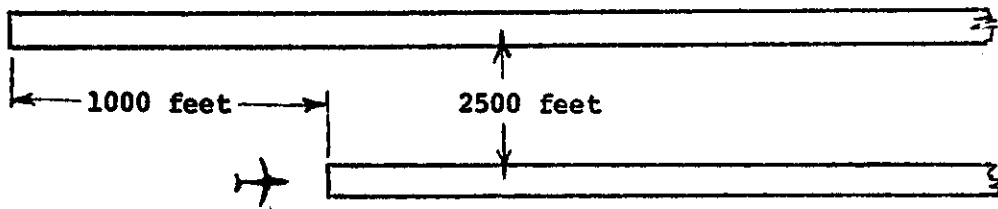Case 1. Staggered thresholds, approaches to near threshold.
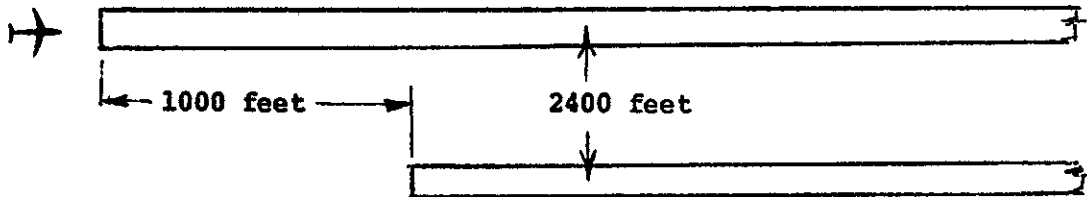
$(1000/500) \cdot 2 = 200$
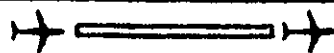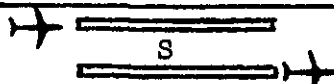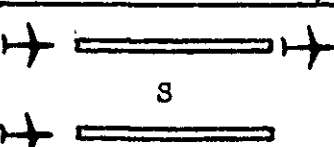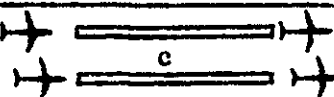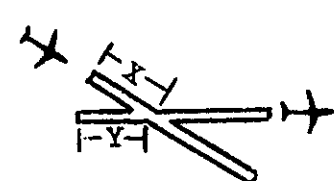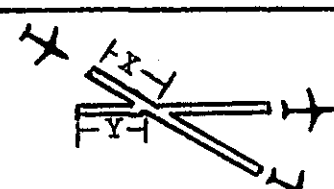Separation for equivalency is increased by 200 feet
$2400 + 200 = 2600$ feet
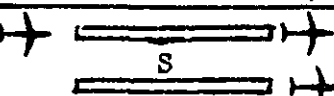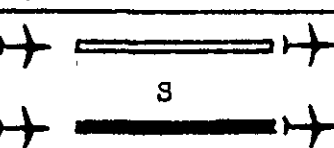
Case 2. Staggered thresholds, approaches to far threshold.

$(-1000/500) \cdot 2 = -200$
Separation for equivalency is decreased by 200 feet
$2500 - 200 = 2300$ feet

Runway-use Diagram	Diag. No.	Runway Spacing (S) in feet		Figure No. for Capacity			
				Poor Visibility Conditions	Inoperative Navaids	Restricted Runway-use	
						VFR	IFR
[diagram 1]	1	N A		4- 2	4-15	-	-
[diagram 2a/2b]	2a	700 to 2499		4- 3	4-16	-	-
	2b	2500 or more		4- 4			
[diagram 3/4]	3	700 to 2499		4- 3	4-16	-	-
	4	2500 or more		4- 5			
[diagram 5-8]	5	700 to 2499		4- 3	4-16	-	-
	6	2500 to 2999		4- 6			
	7	3000 to 4299		4- 7			
	8	4300 or more		4- 8			
[diagram 9-12]	9	700 to 2499		4- 3	4-16	4-17	4-21
	10	2500 to 2999		4- 9			
	11	3000 to 4299		4-10		4-18	
	12	4300 or more		4-11			4-22
[diagram 28/29]	28	2500 to 3499		-	-	4-19	4-23
	29	3500 or more					4-24
[diagram 40]	40	3500 or more		-	-	4-20	4-25
[diagram 43-48]		X(ft)	Y(ft)				
	43&46	0 to 1999	0	4-12	4-15	-	-
	44&47	2000 to 4999	to	4-13			
	45&48	5000 to 8000	8000	4-14			
[diagram 49-54]	49&52	0 to 1999	0	4-12	4-15	-	-
	50&53	2000 to 4999	to	4-13			
	51&54	5000 to 8000	8000	4-14			

c = 700' to 2499'

⊢✈ = Type of operation that can occur.

▬▬▬ = Runway used only by A and B aircraft.

Figure 4-1.   Special applications

FIGURE 4-4. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 2b.

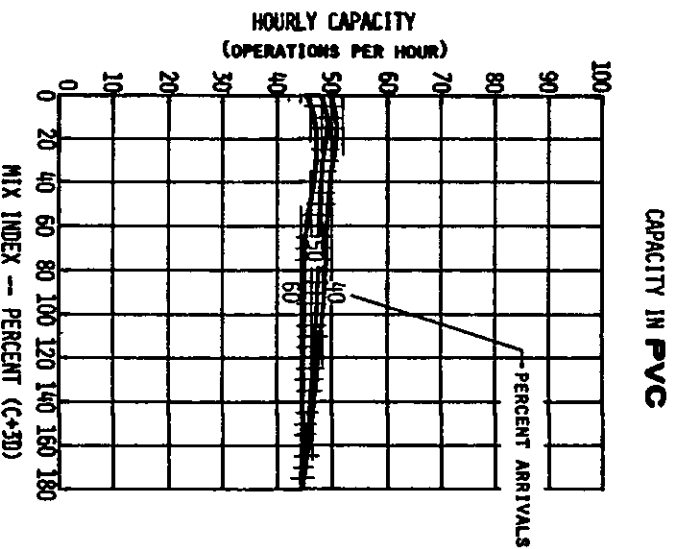FIGURE 4-2. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 1.

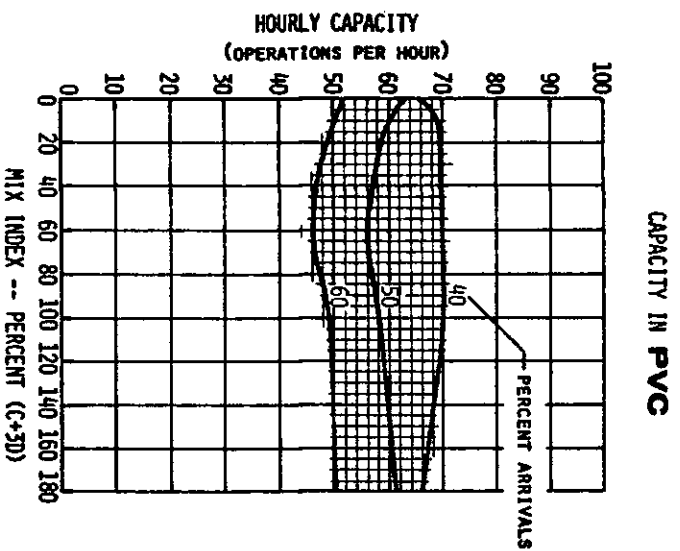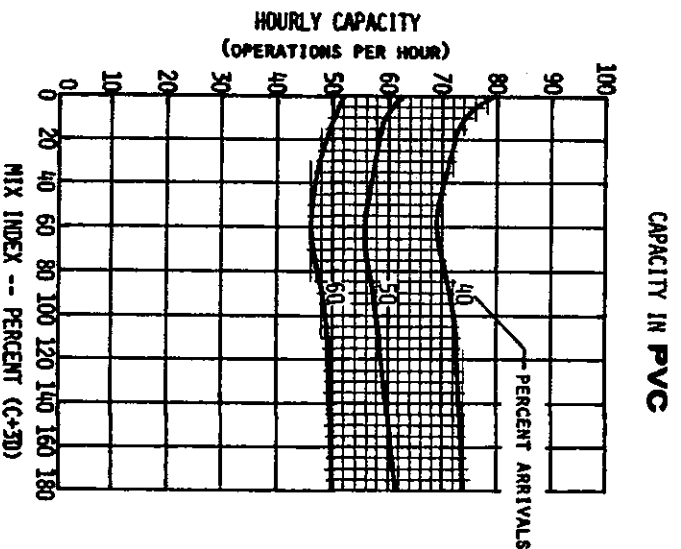FIGURE 4-5. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 4.

FIGURE 4-3. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS. 2a, 3, 5, 9.
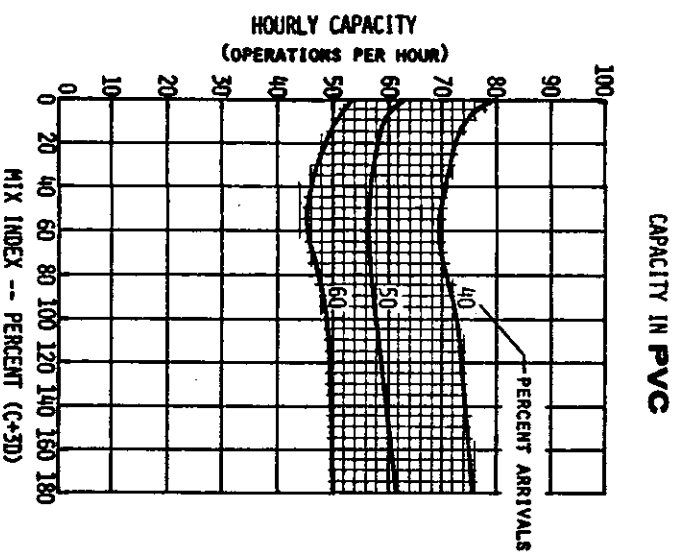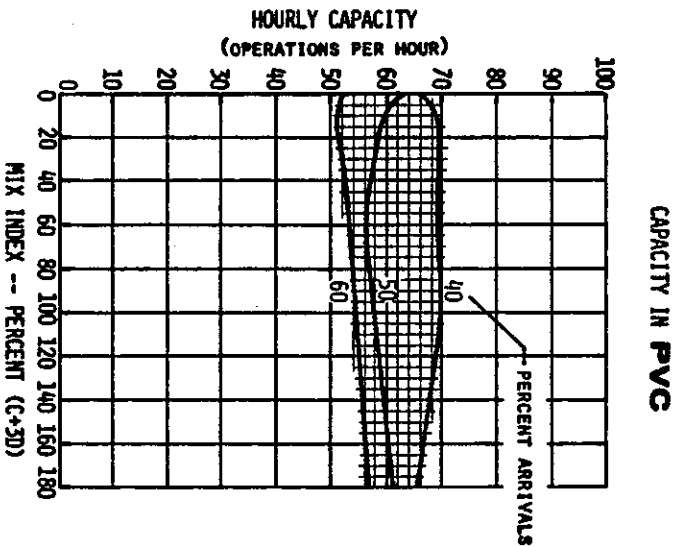
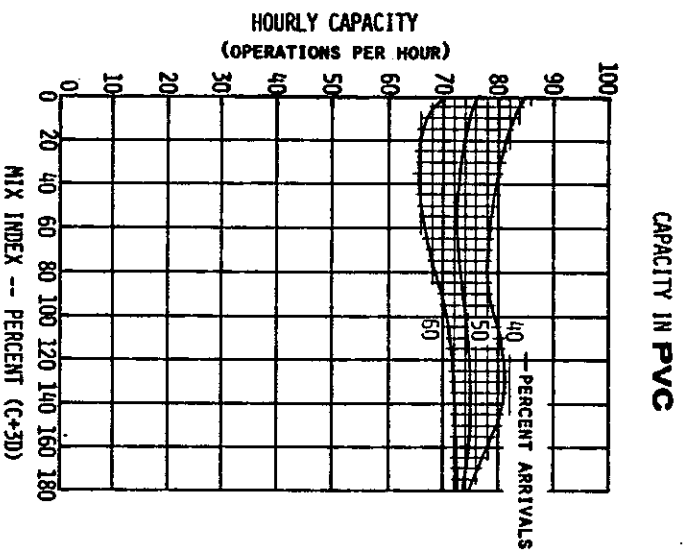FIGURE 4-6. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 6.

FIGURE 4-7. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 7.
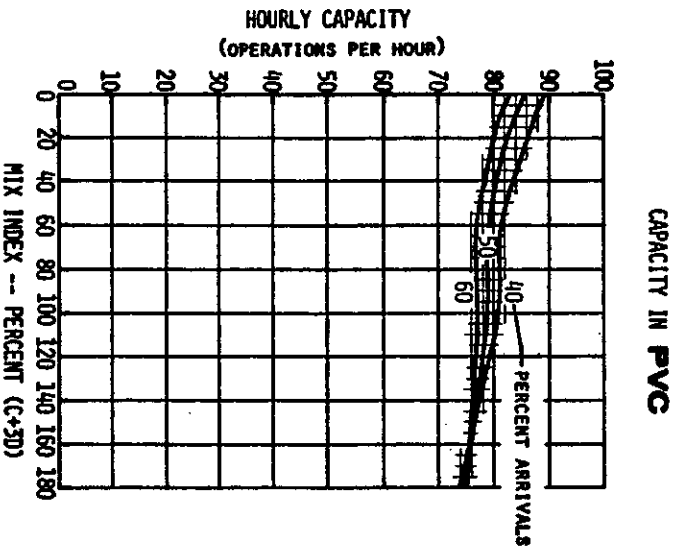
FIGURE 4-8. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 8.

FIGURE 4-9. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 10.

FIGURE 4-10. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NO. 11.
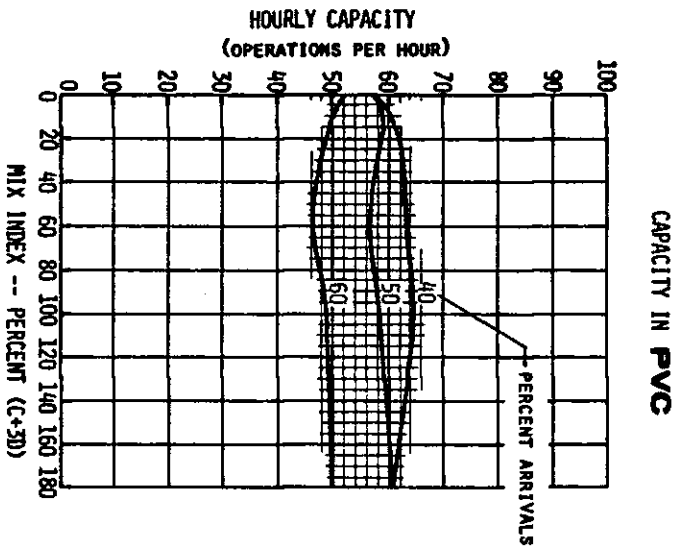
FIGURE 4-12. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NOS. 43, 45, 49, 52.
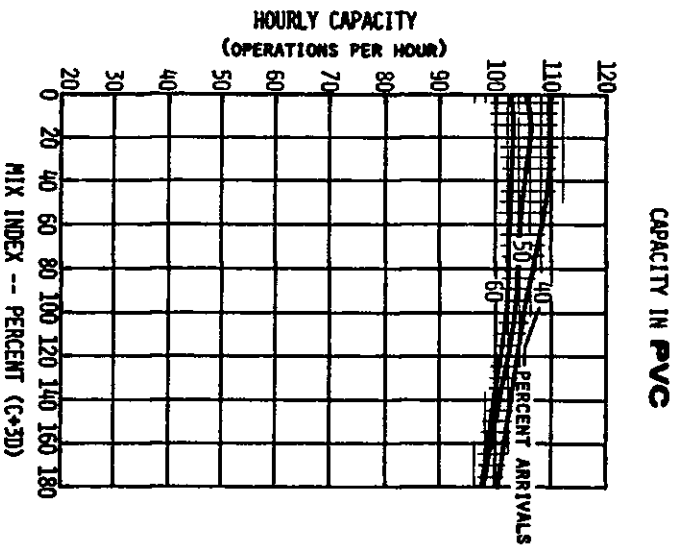
FIGURE 4-11. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NO. 12.

FIGURE 4-13. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NOS. 44, 47, 50, 53.
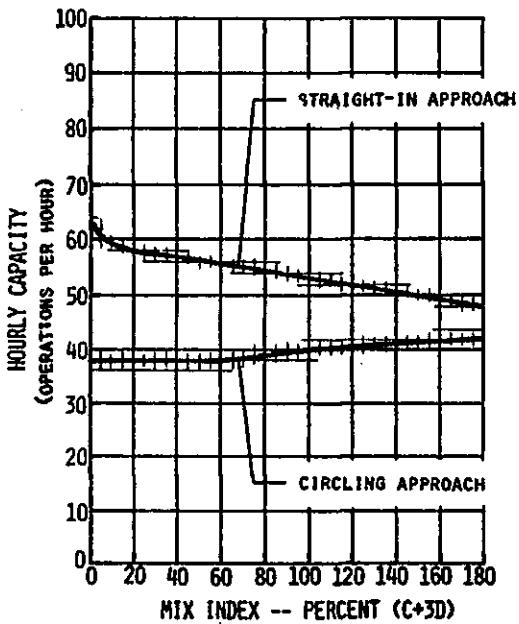
CAPACITY IN **PVC**

PERCENT ARRIVALS

HOURLY CAPACITY (OPERATIONS PER HOUR)

MIX INDEX -- PERCENT (C+3D)

FIGURE 4-14. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS. 45, 48, 51, 54.

FIGURE A3-2A.
HOURLY CAPACITY IN RADAR ENVIRONMENT

FIGURE A3-2B.
HOURLY CAPACITY IN NONRADAR ENVIRONMENT
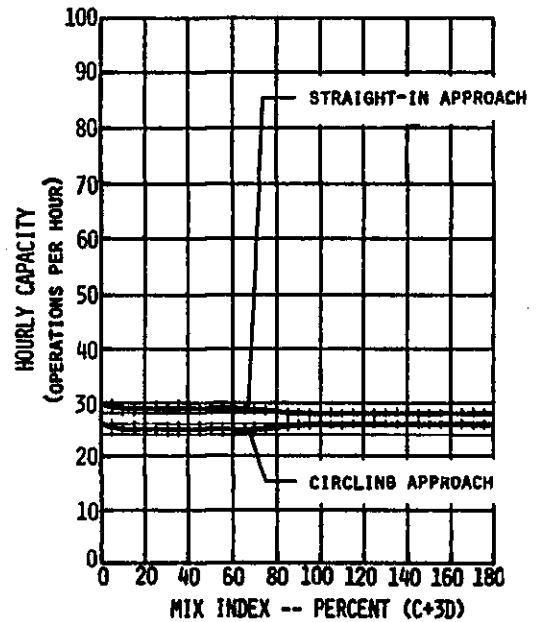
FIGURE 4-15. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS. 1, 43-54.

FIGURE A3-3A.
HOURLY CAPACITY IN RADAR ENVIRONMENT
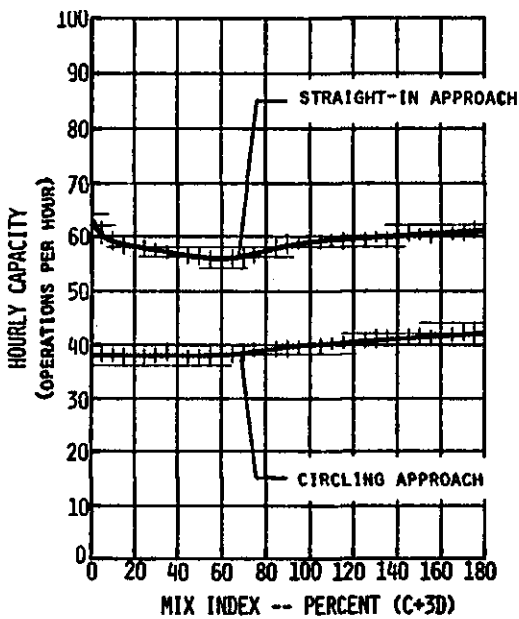
FIGURE A3-3B.
HOURLY CAPACITY IN NONRADAR ENVIRONMENT
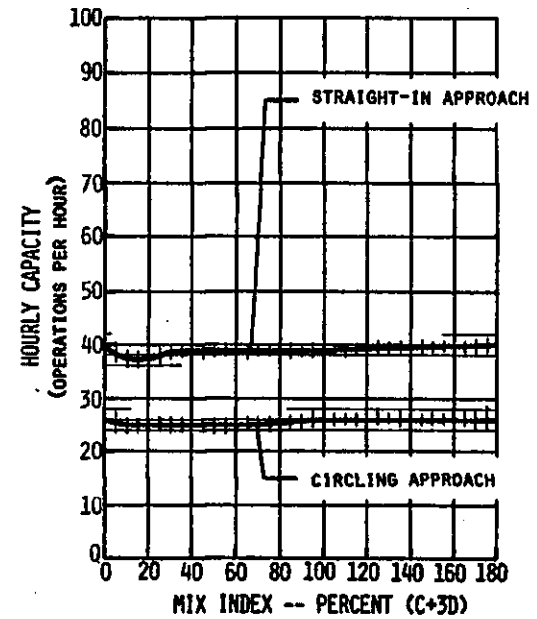
FIGURE 4-16. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS. 2A, 2B, 3-12.
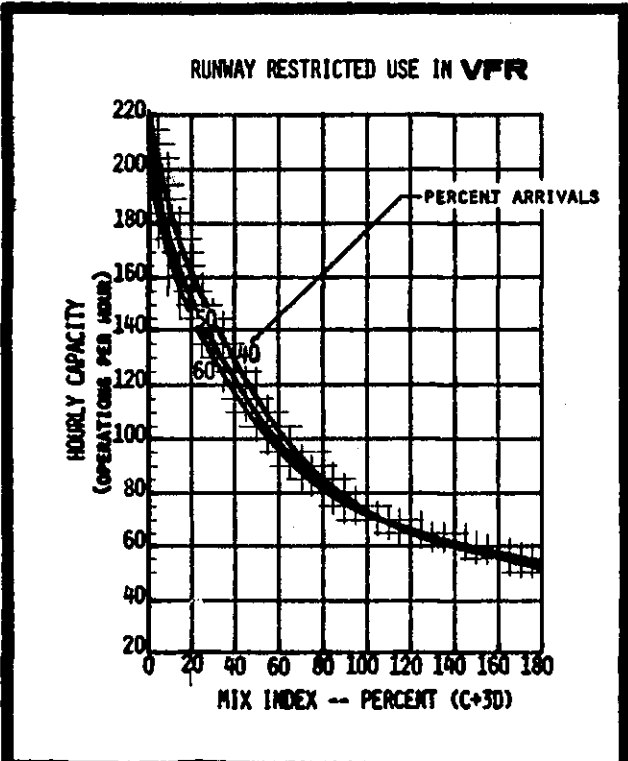
FIGURE 4-17. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NO. 9.
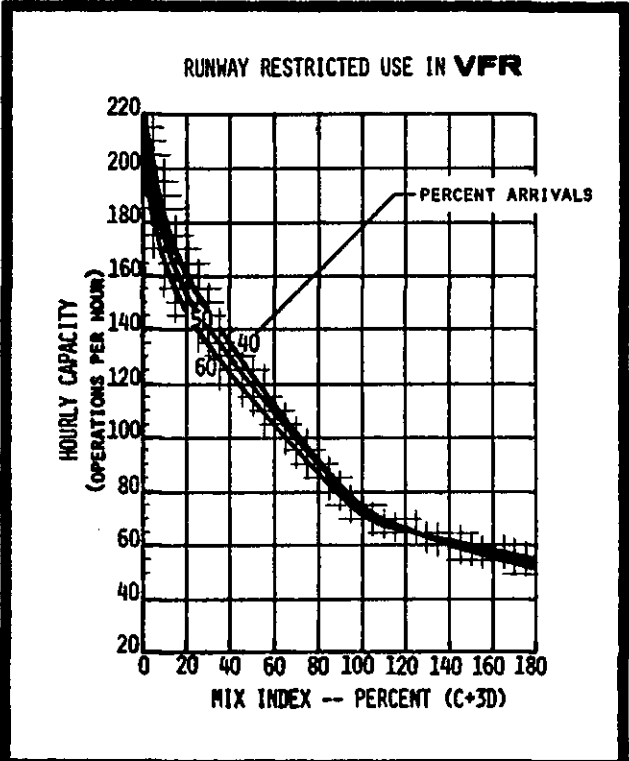
FIGURE 4-18. HOURLY CAPACITY OF RUNWAY-USE
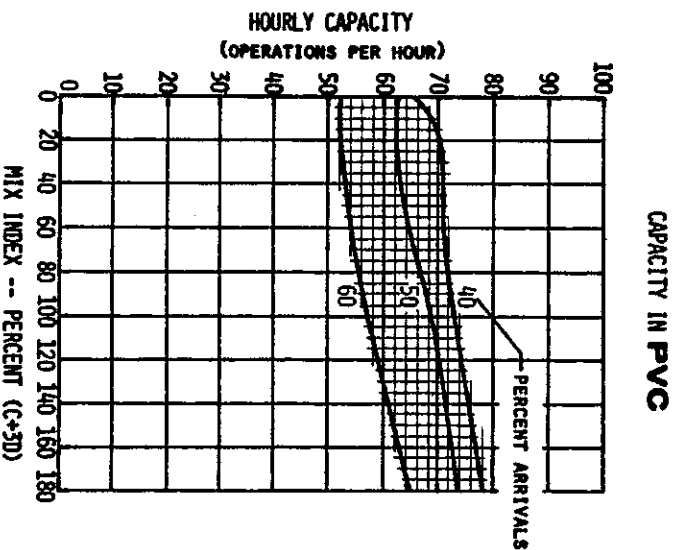DIAGRAM NOS. 10, 11, 12.
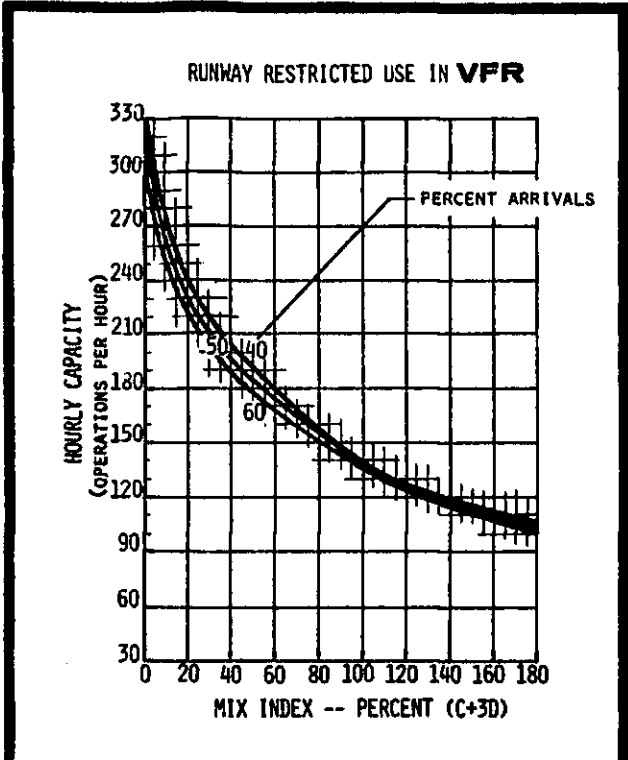
FIGURE 4-19. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NOS. 28, 29.
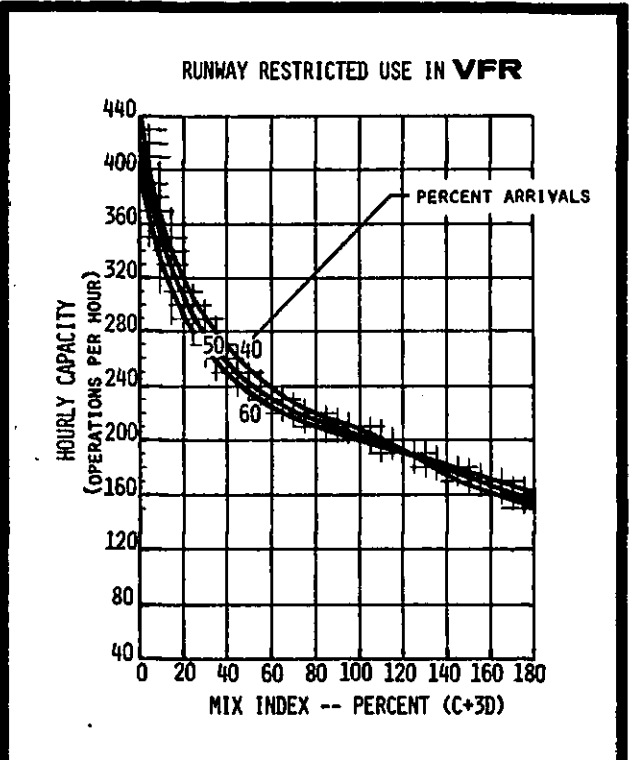
FIGURE 4-20. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NO. 40.
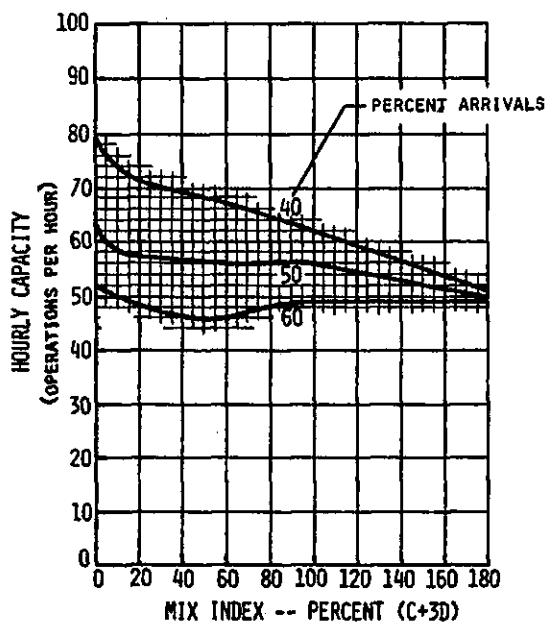
FIGURE 4-21. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS. 9, 10, 11.
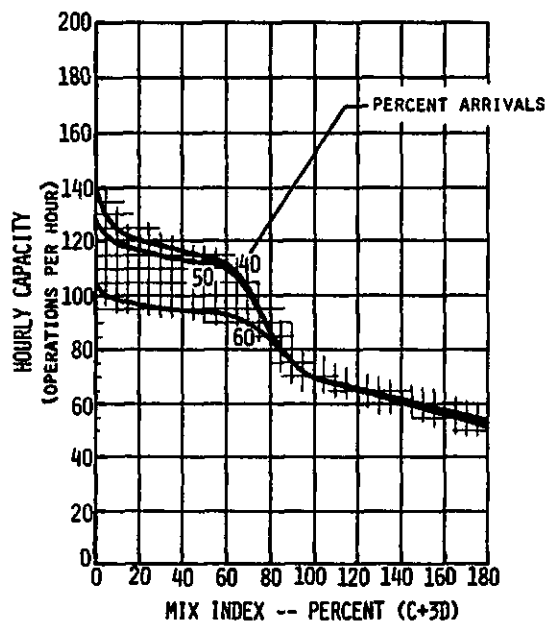
FIGURE 4-22. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 12.
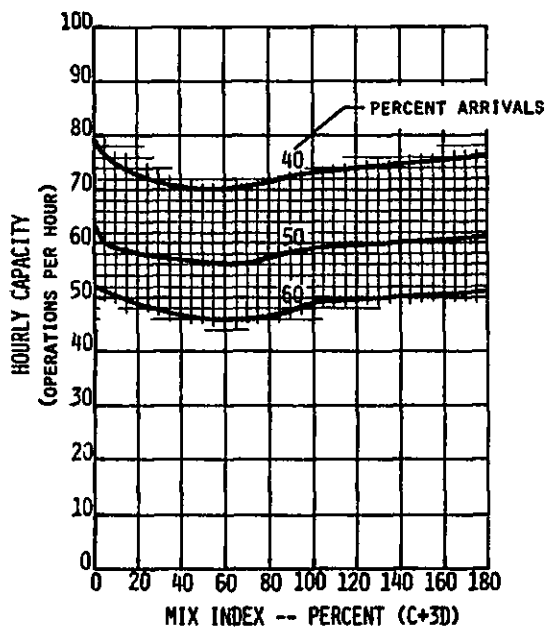
FIGURE 4-23. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 28.

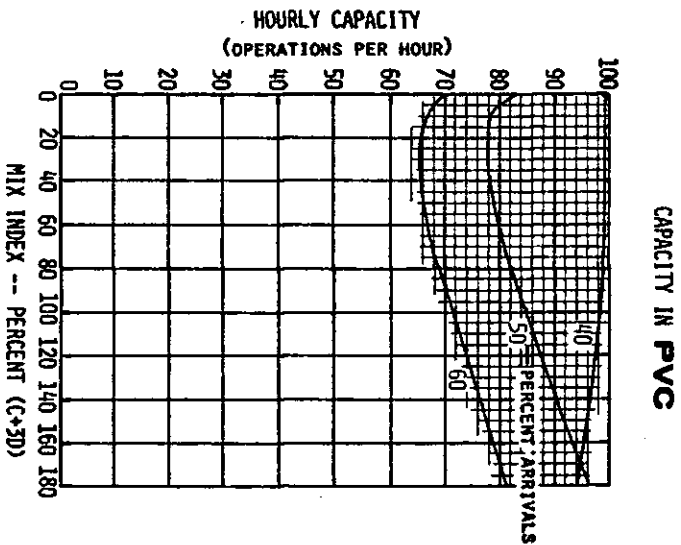FIGURE 4-24. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NO. 29.

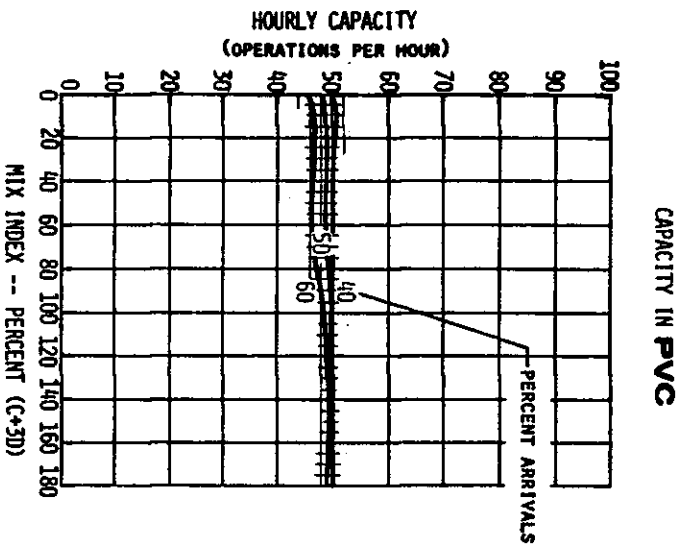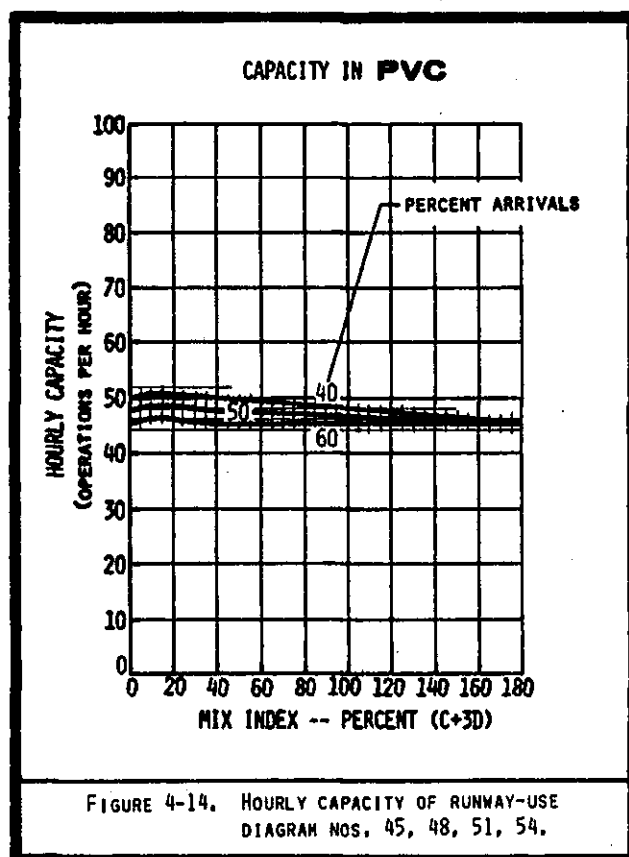RUNWAY RESTRICTED USE IN **IFR**

FIGURE 4-25. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NO. 40.
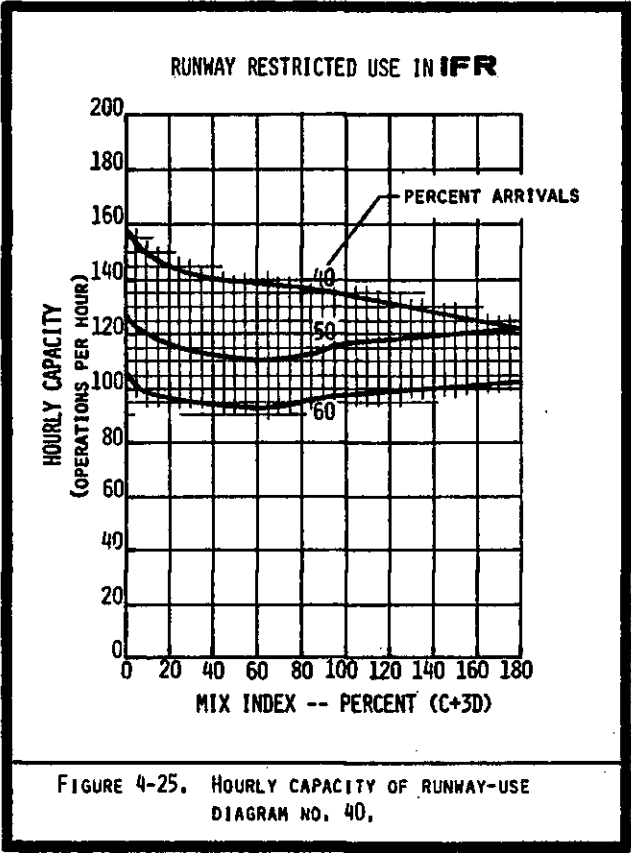
CONFIG. No.	AIRFIELD CONFIGURATION	HOURLY CAPACITY IN VFR PERCENT TOUCH-AND-GO		HOURLY CAPACITY IN IFR
		0 TO 25	26 TO 50	
		(OPERATIONS PER HOUR)		
1		54 TO 66	66 TO 85	20 TO 24
2		59 TO 72	72 TO 92	20 TO 24
3		40 TO 50	50 TO 67	20 TO 24
4		82 TO 97	97 TO 117	20 TO 24
5		71 TO 85	85 TO 106	20 TO 24
6		60 TO 72	72 TO 92	20 TO 24
7		SEE CHAPTER 3		

LEGEND:

██████████ RUNWAY

⌊___|___⌋ TAXIWAY

[B] BASING AREA

→ DIRECTION OF OPERATION

▽ TURNAROUND

Figure 4-26. **Hourly capacity of single runway airports, without radar coverage or ILS, serving small aircraft only.**

CHAPTER 5. COMPUTER PROGRAMS FOR RUNWAY CAPACITY AND DELAY

5-1. GENERAL. This chapter identifies computer models available for determining runway capacity and aircraft delay. The models may also be used to study the sensitivity of runway capacity to changes in airport physical or operational conditions. The models should be used whenever results beyond the scope of chapter 2, 3, or 4 procedures are required or desired.

5-2. RUNWAY CAPACITY MODEL. The Upgraded FAA Airfield Capacity Model is a computer program which analytically calculates the hourly capacities as defined in this AC for 52 runway-use configurations and a wide range of conditions. It has default values for elements of the current ATC system and operating practices, i.e., in-trail spacings, approach speeds, time deviations, etc.

5-3. ANNUAL DELAY MODEL. The Annual Delay Model is a computer program which analytically calculates total annual delay, average aircraft delay, and the distribution of aircraft delay over the year. The model may be operated with built-in default values or user supplied values.

5-4. ANNUAL SERVICE VOLUME MODEL. The Annual Service Volume Model is a computer program which analytically calculates ASV. The model operates with user supplied values.

5-5. MODEL AVAILABILITY.

a. A tape containing the programs for these models is available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Spingfield, Virginia 22161. The programs are written in FORTRAN IV and should be operable on any FORTRAN compatible computer with 210k bytes core capacity. The NTIS reference numbers are: ADA 105 687 for the tape and ADA 105 688 for the instruction manual.

b. Computer time-sharing companys have, or may be willing to make, the programs available. Contact the local representatives for program availability, operational costs, and accessing instructions.

5-6. SIMULATION MODELS. The FAA and some consultants have simulation models which enable users to determine not only airport capacity and delay but when and where the delay is occuring. An instruction manual to accompany the FAA simulation model is being developed.

APPENDIX 1. EXAMPLES APPLYING CHAPTER 2 CALCULATIONS

1. GENERAL. The examples in this appendix illustrate applications of chapter 2 capacity and delay calculations with portions of the appropriate tables and figures of chapter 2 reproduced in the examples. The work sheets provided in appendix 5 are used to record data.

2. EXAMPLES. The following three examples illustrate the progressive calculations of chapter 2.

   a. Examples.

      (1) Calculate existing runway capacity (figure Al-1).

      (2) Identify airport improvements to accommodate demand (figure Al-2).

      (3) Determine annual delay (figure Al-3).

   b. Data. The following data is given for the three examples.

        (1) The airport has a single runway with a full length parallel taxiway and entrance-exit taxiways. All required navigational and air traffic aids exist, or will exist, and there are no foreseeable airspace limitations.

        (2) The airport has a forecasted demand of 220,000 annual operations by the year 1990. The demand consists of 41 percent small aircraft (one half of these are single engined), 55 percent large aircraft, and 4 percent heavy aircraft. Air carrier operations predominate and touch-and-go operations are nominal.

EXAMPLE 1. Determine whether the runway capacity is adequate to accommodate the forecasted demand.

SOLUTION:

1. <u>Aircraft Mix</u>. Enter the mix of the forecasted demand (41% small, 55% large, 4% heavy) in columns 1 through 4 of the work sheet.

Table 1-1. Aircraft classifications

Aircraft Class	Max. Cert. T.O. Weight (lbs)	Number Engines	Wake Turbulence Classification
A	12,500 or less	Single	Small (S)
B		Multi	
C	12,500 - 300,000	Multi	Large (L)
D	over 300,000	Multi	Heavy (H)

2. <u>Runway-use</u>. Select the runway-use configuration from figure 2-1 that best represents the airport. Enter the diagram number (1) in column 6 and a line sketch of the configuration in column 7.

No.	Runway-use Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr VFR IFR	Annual Service Volume Ops/Yr
1.	[=========]	0 to 20	98 59	230,000
		21 to 50	74 57	195,000
		51 to 80	63 56	205,000
		81 to 120	55 53	210,000
		121 to 180	51 50	240,000

3. <u>Mix Index</u>. Calculate the mix index, 55+3(4) = 67, and enter in column 5.

4. <u>Hourly Capacity</u>. Enter the hourly VFR and IFR capacities and the ASV, obtained from diagram 1, figure 2-1, in columns 8, 9, and 10.

Aircraft Mix				Mix Index %(C+3D)	Configuration		Capacity (Ops/Hour) (000)		ASV (000)	Annual Demand (000)	Annual Demand ASV	Average Delay per Aircraft (Minutes)		Minutes of Annual Delay (000)	
%A	%B	%C	%D		No.	Sketch	VFR	IFR				Low	High	Low	High
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
21	20	55	4	67	1	———	63	56	205						

5. <u>Conclusion</u>. The ASV of 205,000 operations is less than the forecasted demand of 220,000 annual operations. Unless additional capacity is provided, delays will become costly.

Figure A1-1. Investigate runway capability

EXAMPLE 2. Example 1 concluded that the ASV of 205,000 operations is less than the forecasted 220,000 operational demand. Identify alternative two-runway configurations that will accommodate the demand.

SOLUTION:

1. Capacity of Alternatives. Repeat each of the calculations of example 1 for each of the two-runway configurations.

Aircraft Mix				Mix Index	Configuration		Capacity (Ops/Hour) (000)		ASV	Annual Demand	Annual Demand	Average Delay per Aircraft (Minutes)		Minutes of Annual Delay (000)	
%A	%B	%C	%D	%(C+3D)	No.	Sketch	VFR	IFR	(000)	(000)	ASV	Low	High	Low	High
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
21	20	55	4	67	1		63	56	205						
"	"	"	"	"	2		121	56	260						
"	"	"	"	"	3		126	65	275						
"	"	"	"	"	4		126	111	305						
"	"	"	"	"	9		77	56	215						
"	"	"	"	"	14		85	56	220						
"	"	"	"	"	15		82	56	215						

2. Conclusion. The parallel runway-use configuration (4), which meets the separation requirements for simultaneous instrument approaches, provides the best VFR and IFR hourly capacities and ASV. Any of the parallel runway-use configurations as well as the diverging runway-use configuration meet the forecasted demand. The crossing and converging runway-use configurations have less capacity than the forecasted demand.

Figure A1-2. Identify two-runway configurations

EXAMPLE 3. What annual delay is anticipated for the existing and each of the alternative runway-use configurations?

SOLUTION: The following calculations are for the existing single runway-use configuration are repeated for each of the alternative runway-use configurations.

1. Annual Demand. Enter 220,000 (operations) in column 11.

2. Demand-ASV Ratios. Divide the annual demand by the ASV and enter in column 12.

220/205 = 1.07

3. Average Aircraft Delay. Obtain the high and low average delays per aircraft from figure 2-2 and enter in columns 13 and 14.

4. Annual Delay. Calculate annual delay and enter results in columns 15 and 16.

3.5 x 220,000 =   770,000 minutes
5.8 x 220,000 = 1,276,000 minutes
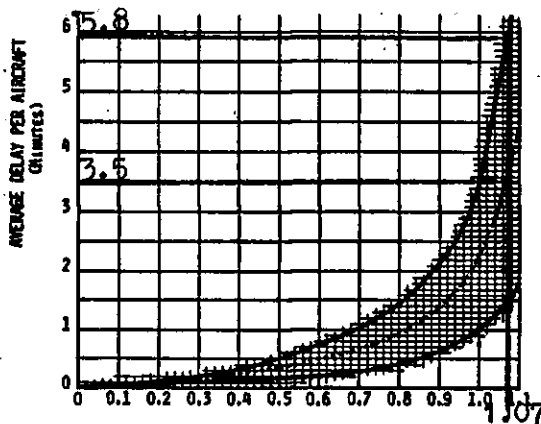
RATIO OF ANNUAL DEMAND TO ANNUAL SERVICE VOLUME

Figure 2-2. Average aircraft delay for long range planning

Aircraft Mix				Mix Index	Configuration		Capacity (Ops/Hour) (000)		ASV (000)	Annual Demand (000)	Annual Demand ASV	Average Delay per Aircraft (Minutes)		Minutes of Annual Delay (000)	
%A	%B	%C	%D	%(C+3D)	No.	Sketch	VFR	IFR				Low	High	Low	High
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
21	20	55	4	67	1		63	56	205	220	1.07	3.5	5.8	770	1276
"	"	"	"	"	2		121	56	260	"	.85	1.15	1.8	253	396
"	"	"	"	"	3		126	65	275	"	.80	.95	1.45	209	319
"	"	"	"	"	4		126	111	305	"	.72	.7	1.1	154	242
"	"	"	"	"	9		77	56	215	"	1.02	2.6	4.0	572	880
"	"	"	"	"	14		85	56	220	"	1.0	2.3	3.4	506	748
"	"	"	"	"	15		82	56	215	"	1.02	2.6	4.0	572	880

5. Conclusions. Average delay per aircraft and annual delay with parallel runway-use configurations are significantly less than with any of the other runway-use configurations.

Figure A1-3. Determine annual delay

APPENDIX 2. EXAMPLES APPLYING CHAPTER 3 CALCULATIONS

1. **GENERAL.** The examples in this appendix illustrate applications of chapter 3 capacity and delay calculations with portions of the appropriate tables and figures. of chapter 3 reproduced in the examples. The work sheets provided in appendix 5 are used to record data.

2. **EXAMPLES.** Ten examples, figures A2-1 through A2-10, illustrate the progressive calculations of chapter 3.

    a. **Examples.**

        (1) Hourly capacity of the runway component (figure A2-1).

        (2) Hourly capacity of the taxiway component (figure A2-2).

        (3) Hourly capacity of gate group components (figure A2-3).

        (4) Airport hourly capacity (figure A2-4).

        (5) Annual service volume (figure A2-5).

        (6) Hourly delay to aircraft on the runway component (figure A2-6).

        (7) Daily delay to aircraft on the runway component when the D/C ratio is 1.0 or less for each hour (figure A2-7).

        (8) Daily delay to aircraft on the runway component when the D/C ratio is greater than 1.0 for one or more hours (figure A2-8).

        (9) Annual delay to aircraft on the runway component (figure A2-9).

      (10) Hourly demand corresponding to a specified level of average hourly delay (figure A2-10).

    b. **Data.** Data necessary to solve each example is provided in the introductory statement. To the extent practical, results from one example are used in subsequent examples.

EXAMPLE 1. Determine VFR and IFR hourly capacities of the depicted airport. In the typical busy hour, it has 13 single-engine, 10 light twin-engine, 25 transport type, and two widebody operations. During VFR conditions, arrivals constitute 45 percent of the operations and there are three touch and go's. During IFR conditions, the busy hour count of small aircraft operations drops to two single-engine and five light twin-engine aircraft and arrivals constitute 55 percent of the operations. There are no touch and go's during IFR conditions. The airport typically operates with arrivals on one runway and departures on the other.
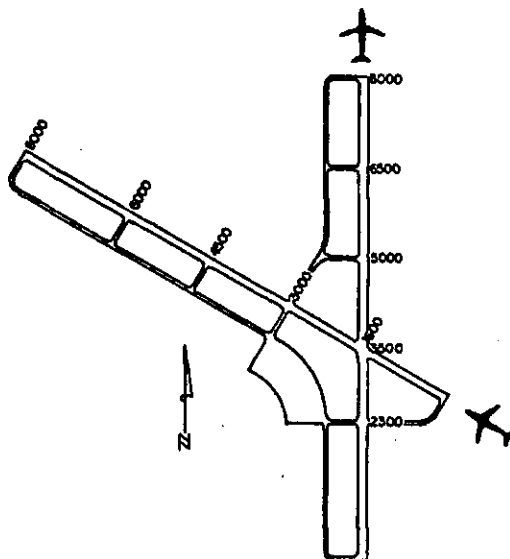
SOLUTION: The work sheet on page 5 illustrates one method of recording data.

1. Weather. Enter the weather condition(s) applicable to the capacity determination in column 1.

2. Runway-use. From figure 3-2 (illustrated), the runway-use configuration diagram is No. 43. Enter this diagram number in column 3, and a line sketch of the configuration in column 2.

3. Capacity Figure(s). The appropriate figures for determining capacity are No. 3-27 for VFR conditions and No. 3-59 for IFR conditions. These VFR and IFR references are entered on the line in column 4 corresponding to the weather condition.

| Runway-use Diagram | Diag. No. | Runway Intersection Distance in Feet | | Figure No. | | | |
| | | | | For Capacity | | For Delay | |
		(x)	(y)	VFR	IFR	VFR	IFR
	43	0 to 1999	· 4000	3-27	3-59	3-85	3-91
	44	2000 to 4999	· 4000	3-28	3-60	3-86	3-99
	45	5000 to 8000	· 4000	3-29	3-61	3-86	3-99
	46	0 to 1999	· 4000	3-30	3-62	3-86	3-99
	47	2000 to 4999	· 4000	3-31	3-63	3-71	3-102
	48	5000 to 8000	· 4000	3-32	3-64	3-71	3-102
	49	0 to 1999	· 4000	3-27	3-64		

Figure A2-1. Hourly capacity of the runway component

4. <u>Mix Index</u>. This input is calculated using data provided in the example statement. Table 1-1 (illustrated) is used to make the conversion.

Table 1-1. Aircraft classifications

Aircraft Class	Max. Cert. T.O. Weight (lbs)	Number Engines	Wake Turbulence Classification
A	12,500 or less	Single	Small (S)
B		Multi	
C	12,500 - 300,000	Multi	Large (L)
D	over 300,000	Multi	Heavy (H)

The computation of aircraft mix is carried out by setting up a table in the following format. The percent of operations by each aircraft class is recorded in columns 5 through 8.

Aircraft		VFR Mix		IFR Mix	
Description	Class	No. Ops.	% Ops.	No. Ops.	% Ops.
Single-engined	A	13	26	2	6
Light-twins	B	10	20	5	15
Transport-type	C	25	50	25	73
Widebodied	D	2	4	2	6
Totals (No. Ops. & % Ops.)		50	100	34	100

The mix indices are calculated and entered in column 9.

$$VFR = 50+3(4) = 62$$

$$IFR = 73+3(6) = 91$$

5. <u>Percent Arrivals</u>. The percent arrivals is given as 45 for VFR conditions and 55 for IFR conditions. Enter in column 10.

6. <u>Hourly Capacity Base (C*)</u>. Obtain C* from figure 3-27 for VFR and 3-59 for IFR, and enter in column 14.

7. <u>Touch and Go Factor (T)</u>. The statement specified 3 touch and gos during VFR and none in IFR. Since a touch and go is a landing and a takeoff (2 operations), the percent of touch and go operations in VFR conditions is 6/50 or 12 percent. Obtain the touch and go factor T from figure 3-27 for VFR and 3-59 for IFR and enter in column 15.

Figure A2-1. Hourly capacity of the runway component (cont.)

3

FIGURE 3-27. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 43,49 FOR VFR CONDITIONS.

FIGURE 3-59. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS.: 43,49,55 FOR IFR CONDITIONS.
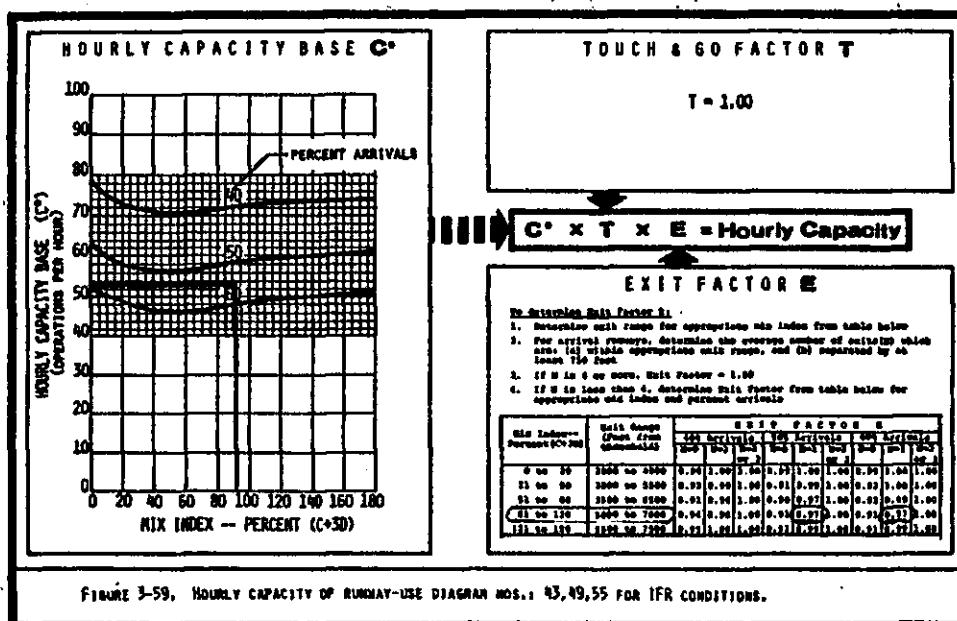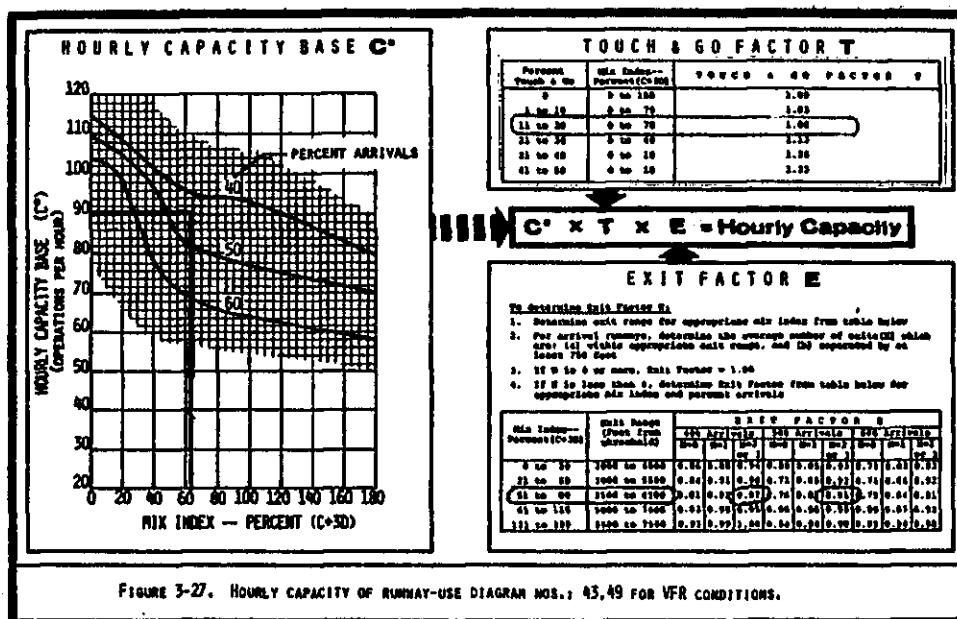
8. **Exit Factor E.** A landing aircraft might exit at the runway intersection (1600 feet) or at one of the three right-angled exits located 3000, 4500, and 6000 feet from the threshold. From figures 3-27 for VFR and 3-59 for IFR, determine the exit range and the exit factor E. In this example, only two exits are within the range between 3500 to 7000 feet. Enter the exit locations in columns 12 and the number of usable exits in column 13. The exit factors E are entered in column 16.

Figure A2-1. Hourly capacity of the runway component (cont.)

9. <u>Calculate Capacity</u>. Compute the hourly capacity of the runway-use configuration and enter in column 17.

VFR Capacity = 89·1.06·0.94 = 88.68 or 89 operations per hour

IFR Capacity = 53·1.00·0.97 = 51.41 or 51 operations per hour

Weather	Runway-use Diagram	No.	Capacity Figure No.	Aircraft Mix				Mix Index A(C+3D)	Percent Arrivals	Percent Touch & Go	Runway Exits (00 feet) Location			No.	Hourly Capac. Base C*	P & G Factor T	Exit Factor E	Hourly Capacity (000) C*·T·E
				%A	%B	%C	%D											
1	2	3	4	5	6	7	8	9	10	11	12			13	14	15	16	17
VFR		43	3-27	26	20	50	4	62	45	12	45	60		2	89	1.06	.94	89
IFR			3-59	6	15	73	6	91	55	0	60			1	53	1.00	.97	51

Work sheet for runway hourly capacity.

10. <u>Conclusion</u>. The calculated hourly capacities of the runway-use configuration of 89 operations per hour in VFR conditions and 51 operations per hour in IFR conditions exceeds the aeronautical demands of 50 VFR operations and 34 IFR operations specified in the statement.

Figure A2-1. Hourly capacity of the runway component (cont.)

EXAMPLE 2. Determine the VFR and IFR capacity of taxiway crossings (A and B) for the airport of example 1 when operated as shown. Use the traffic data from example 1. NOTE: Runway usage is reversed from that used in example 1 to permit illustation of the crossing effect on both arrivals and departures.
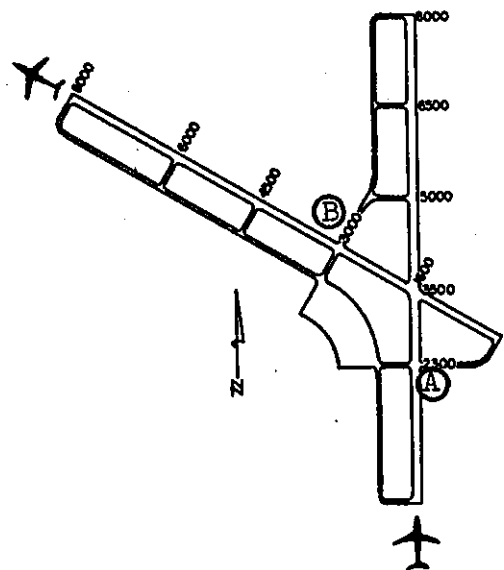
SOLUTION: The work sheet on page 7 illustrates one method of recording data.

    1. Weather. Enter type of weather in column 1.

    2. Crossing Location. Identify and enter crossing locations in columns 2 and 3. Taxiway crossing (A) is 2300 feet from the arrival threshold and taxiway crossing (B) is 3000 feet from the departure threshold.

    3. Runway Operations Rate. Determine operations rate and enter in column 4. The airport has a VFR demand of 50 operations per hour with 45 percent arrivals, i.e., 23 arrivals and 27 departures. The touch-and-go adjustment reduces the departure demand to 24 operations. In IFR there are 19 arrivals and 15 departures.

    4. Mix Index. Calculate the mix index and enter in column 5. VFR mix index is 62 and IFR mix index is 91.

    5. Taxiway Crossing Capacities. Obtain crossing capacities from figure 3-66A (illustrated) for the arrival crossing (A) and figure 3-67A (illustrated) for the departure crossing (B) and enter in columns 6 and 7.

        Crossing A (arrivals)   VFR capacity = 107, and IFR capacity = 92

        Crossing B (departures) VFR capacity = 125, and IFR capacity = 112

Figure A2-2. Hourly capacity of the taxiway component

Figure 3-66 (arrivals).
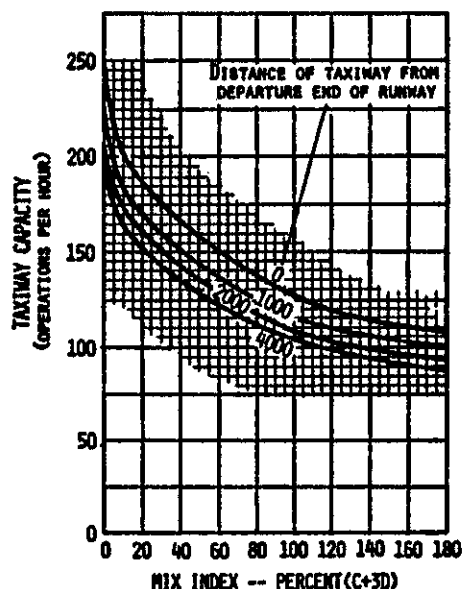
Figure 3-67 (departures).

Weather	Taxiway Crossing	Distance from Threshold	Runway		Taxiway Crossing Capacities (Operations per Hour)	
			Ops. Rate	Mix Index	Arrivals and Mixed Operations	Departures Plus T & G
1	2	3	4	5	6	7
VFR	A	2300'	24	62	107	–
"	B	3000'	20	62	–	125
IFR	A	2300'	15	91	92 .	–
"	B	3000'	19	91	–	112

Work sheet for taxiway crossing capacities.

6. Conclusion. The taxiway crossing capacities for the stipulated operational conditions would not be capacity limiting since the demand is less than one-fourth of the theoretical capacity.

Figure A2-2. Hourly capacity of the taxiway component (cont.)

EXAMPLE 3. Determine the hourly capacity of the terminal gate complex at the air-
port of example 1. It has 10 gates allocated to three airlines X, Y, and Z. Only
the end gates X-3 and Y-3 are capable of accommodating widebodied aircraft. During
an hour, airline X schedules 13 non-widebodies with an average gate time of 45 minu-
tes and two widebodies with an average gate time of 55 minutes. Airline Y schedules
eight non-widebodies with an average gate time of 40 minutes and airline Z schedules
four non-widebodies with an average gate time of 35 minutes.
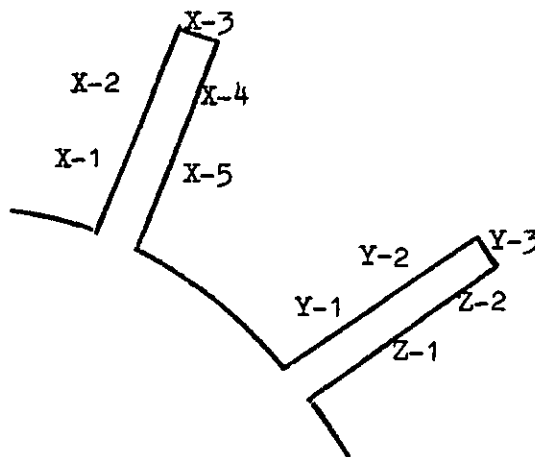
SOLUTION: The work sheet on page 9 illustrates one method of recording data.

1. Gates Groups. The gate groups (airlines identification) and type of gates
are entered in columns 1, 4, 5, and 13.

2. Gate Mix. Operational demands are entered in columns 2 and 3. The gate
mix obtained by dividing the number of non-widebodied operations by the total number
of operations is entered in column 6.

3. Gate Percentage. Calculate the percentage of widebodied gates in each gate
group and enter in column 7.

4. Gate Occupancy Time. Gate times are entered in columns 8 and 9. Since
gate times vary by airline and location, it is presumed that the example average
gate occupancy times were obtained by on-site surveys.

5. Gate Occupancy Ratio. Gate occupancy ratio (R), entered in column 10, is
determined by dividing the average gate occupancy time of the widebodied aircraft by
that of the non-widebodied aircraft.

Airline X, R = 55/45 = 1.22

When no widebodied aircraft are accomodated, R equals 1.00

Figure A2-3. Hourly capacity of gate group component

6. _Gate Capacity._ Calculate the hourly capacity for each gate group from the equation G*·S·N where N equals the number of gates in the group. Obtain values for G* and S from figure 3-68 (illustrated) and entered in columns 11 and 12. Do not interpolate, use the chart with the lower R value.

Non-widebody (N)   Widebody (W)

Gate Group	Demand		No. Gates		Gate Mix		Average Gate Time (Min.)		Gate Occupancy Ratio (T_w/T_n)	Hourly Capac. Base	Gate Size	No. Gates	Hourly Capacity
	(N)	(W)	(N)	(W)	(N) (%)	(W) (%)	(N) (T_n)	(W) (T_w)	(R)	(G*)	(S)	(N)	(G*·S·N)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
X	13	2	4	1	87	20	45	55	1.22	2.6	.97	5	13
Y	8	0	2	1	100	33	40	0	1.00	3.0	1.00	3	9
Z	4	0	2	0	100	0	35	0	1.00	3.4	1.00	2	7
										Capacity of the Terminal			29

Work sheet for gate capacity.

7. _Conclusion._ The gate group capacity of airline X is two operations short of its demand, whereas the calculated gate group capacities of airlines Y and Z exceed their demand by one and three operations respectively. The terminal capacity exceeds the combined airline demand by two operations per hour.

Figure A2-3. Hourly capacity of gate group components (cont.)

EXAMPLE 4.   Identify the constraining component under VFR conditions of the example
airport. Use previously calculated data.

SOLUTION: The work sheet below illustrates one method of recording data.

    1. Capacity and Demand. The airport components, hourly capacities and demands
obtained from examples 1, 2, and 3 are entered in columns 2 and 3 of the work sheet.

    2. Demand Ratio. Divide each component demand by the runway demand and enter
in column 4.

    3. Component Quotients. Divide each components hourly capacity by its demand
ratio and enter in column 5.

    4. Constraining Component. Identify the lowest component quotient in column 5
(i.e. 54).

Component	Hourly Capacity	Hourly Demand	Demand Ratio Componet Demand / Runway Demand	Component Quotient Component Capacity / Demand Ratio
1	2	3	4	5
Runway	89	50	50/50 = 1.00	89/1.00 = 89
Twy Xing A	107	20	20/50 = .40	107/.40 = 267
Twy Xing B	125	24	24/50 = .48	125/.48 = 260
Gates	29	27	27/50 = .54	29/.54 = 54

Work sheet for identifying the constraining component.

    5. Conclusion. The constraining component is the terminal gate complex which
limits the airports hourly capacity to 54 operations per hour.

Figure A2-4.   Airport hourly capacity

EXAMPLE 5. Determine the ASV of the example airport assuming there are 219,750 annual operations, 690 average day operations and 50 peak hour operations.

SOLUTION: The work sheet on page 12 illustrates one method of recording data.

    1. Calculate C_w.

        a. Runway-use Configuration. Identify the different runway-use conditions used over the course of a year and the mix index for each use. Enter in columns 1 through 4.

        b. Percent of Use (P). Identify the percent of the time each configuration is used and enter in column 5. The figures shown on the work sheet in column 5 are hypothetical.

        c. Runway Hourly Capacity (C). Calculate the hourly capacities of operating conditions as in example 1 and enter in column 6. Example 1 data are used for operating conditions 1 and 2.

        d. Maximum Capacity Configuration. Identify the runway-use configuration that provides the maximum capacity.

        e. Percent of Maximum Capacity. Divide the hourly capacity of each runway-use configuration by the capacity of the configuration that provides the maximum capacity and enter in column 7.
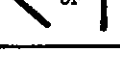
$$
\begin{array}{llll}
\text{Operating condition} & 1 & 89/89 = & 100 \\
\text{"} \qquad\qquad \text{"} & 2 & 51/89 = & 57 \\
\text{"} \qquad\qquad \text{"} & 3 & 62/89 = & 70 \\
\text{"} \qquad\qquad \text{"} & 4 & 52/89 = & 58 \\
\text{"} \qquad\qquad \text{"} & 5 & 59/89 = & 66 \\
\text{"} \qquad\qquad \text{"} & 6 & 46/89 = & 52 \\
\end{array}
$$

        f. ASV Weighting Factor (W). From Table 3-1, identify the weighting factor (W) for each operating condition and enter in column 8.

Table 3-1. ASV Weighting Factors

Percent of Maximum Capacity	Weighting Factors			
	VFR	IFR		
		Mix Index (0-20)	Mix Index (21-50)	Mix Index (51-180)
91+	1	1	1	1
81-90	5	1	3	5
66-80	15	2	8	15
51-65	20	3	12	20
0-50	25	4	16	25

Figure A2-5. Annual service volume

No.	Weather	Rwy-use Diagram	Mix Index	Percent of Year (P)	Hourly Capacity (C)	Percent Maximum Capacity	Weighting Factor (W)
1	2	3	4	5	6	7	8
1	VFR		62	74	89	100	1
2	IFR		91	5	51	57	20
3	VFR		62	5	62	70	15
4	IFR		91	5	52	58	20
5	VFR	or	62	4	59	66	15
6	IFR		91	4	46	52	20
7	IFR	Below Minimums		3		-	25

Work sheet for ASV factors.

g. Weighted Hourly Capacity (C_w). Calculate the weighted hourly capacity using the following equation:

$$C_w = \frac{(P_1 C_1 W_1) + (P_2 C_2 W_2) + \cdots (P_n C_n W_n)}{(P_1 W_1) + (P_2 W_2) + \cdots (P_n W_n)}$$

$$C_w = \frac{(.74 \cdot 89 \cdot 1) + (.05 \cdot 51 \cdot 20) + (.05 \cdot 62 \cdot 15) + (.05 \cdot 52 \cdot 20) + (.04 \cdot 59 \cdot 15) +}{(.74 \cdot 1) + (.05 \cdot 20) + (.05 \cdot 15) + (.05 \cdot 20) + (.04 \cdot 15) +}$$

$$\frac{(.04 \cdot 46 \cdot 20) + (.03 \cdot 0 \cdot 25)}{(.04 \cdot 29) + (.03 \cdot 25)}$$

$$C_w = \frac{287.56}{5.64} \quad \text{or 51 operations per hour.}$$

2. Daily Demand Ratio (D). Calculate D using the equation:

$$D = \frac{\text{Annual}}{\text{Average Day--peak month}} = \frac{219,750}{690} = 318$$

3. Hourly Demand Ratio (H). Calculate H from the equation:

$$H = \frac{\text{Average Day--peak month}}{\text{Average Peak Hour--peak month}} = \frac{690}{50} = 14$$

4. Calculate ASV. ASV is calculated from the equation $ASV = C_w \cdot D \cdot H$

$$ASV = 51 \cdot 318 \cdot 14 = 227,052 \text{ operations per year.}$$

5. Conclusion. ASV is an indicator of the annual operational capability of an airport adjusted for differences in hourly capacities which occur over the course of a year. In this example, the airport theoretically could have accommodated and additional 7,302 operations during the year.

Figure A2-5. Annual service volume (cont.)

EXAMPLE 6. Determine the hourly delay in VFR and IFR weather conditions for the example airport in its predominate mode of operation. The peak 15 minute demand in VFR is 20 operations and in IFR it is 15 operations. Extract necessary data from examples 1 through 5.

SOLUTION: The work sheet on page 16 illustrates one method of recording data.

1. Hourly Capacity. Enter the hourly capacities calculated in example 1 (89 VFR, 51 IFR) in column 5.

2. Identify Delay Figure Nos. From figure 3-2 (illustrated), identify the runway-use configuration as No. 43 and figures 3-85 and 3-91 for determining VFR and IFR delay. Enter in columns 2, 3, and 4.

Runway-use Diagram	Dia. No.	Runway Intersection Distance in Feet		Figure No.			
		(x)	(y)	For Capacity		For Delay	
				VFR	IFR	VFR	IFR
	43	0 to 1999	< 4000	3-27	3-59	3-85	3-91
	44	2000 to 4999	< 4000	3-28	3-60	3-86	3-99
	45	5000 to 8000	< 4000	3-29	3-61	3-86	3-99
	46	0 to 1999	> 4000	3-30	3-62	3-86	3-99
	47	2000 to 4999	> 4000	3-31	3-63	3-71	3-102
	48	5000 to 8000	> 4000	3-32	3-64	3-71	3-102
	49	0 to 1999	< 4000	3-27	3-59	3-85	3-91
	50	2000 to 4999	< 4000	3-28	3-60	3-86	3-99
	51	5000 to 8000	< 4000	3-29	3-61	3-86	3-99
	52	0 to 1999	> 4000	3-30	3-62	3-86	3-99
	53	2000 to 4999	> 4000	3-31	3-65	3-71	3-90
	54	5000 to 8000	> 4000	3- 3	3-43	3-71	3-90
	55	0 to 1999	< 4000				

3. Demands. Enter the hourly demand from example 1 (50 VFR, 34 IFR) in column 6, and the 15 minute demands of 20 VFR and 15 IFR in column 7.

4. Demand/Capacity Ratio. Calculate the D/C ratios and enter in column 8.

$$D/C \text{ ratio VFR} = 50/89 = 0.56$$

$$D/C \text{ ratio IFR} = 34/51 = 0.67$$

5. Delay Indices. From figure 3-85 and 3-91 (illustrated), obtain arrival delay index (ADI) and departure delay index (DDI) and enter in columns 11 and 13. Enter example 1 mix indices in column 10 (62 VFR, 91 IFR) and percent arrivals in column 9 (45% VFR, 55% IFR).

Figure A2-6. Hourly delay

FIGURE 3-85. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 43,49,55,61 FOR VFR CONDITIONS.
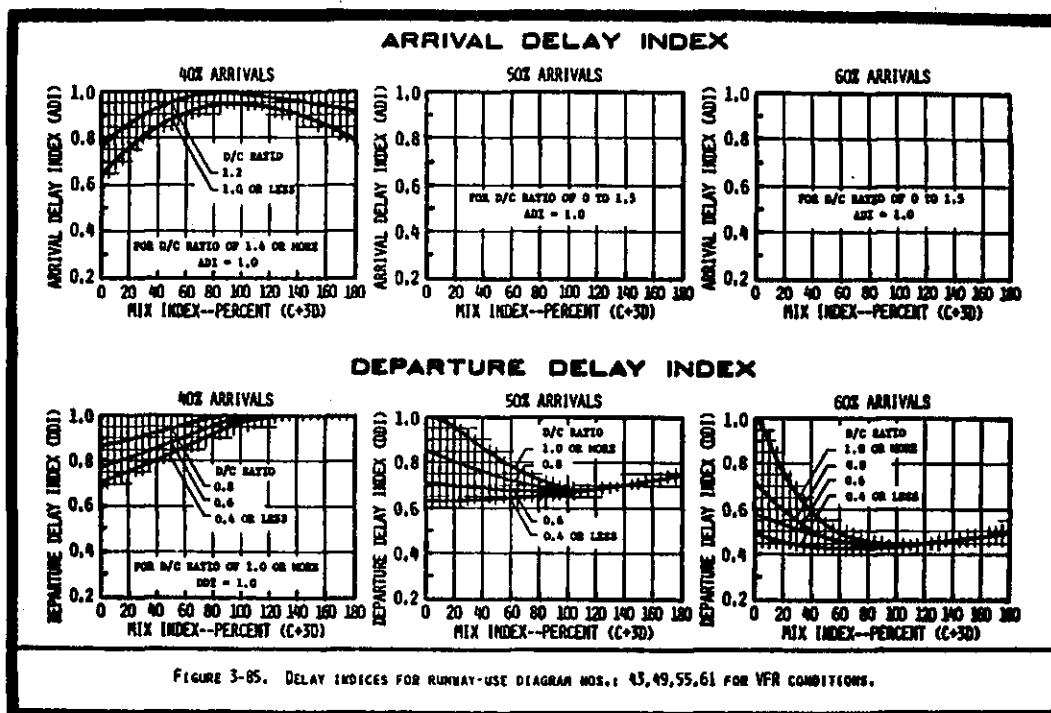
VFR   ADI at 40% = 0.90
 "   "   50% = 1.00
 "   "   45% = 0.95

VFR   DDI at 40% = 0.90
 "   "   50% = 0.67
 "   "   45% = 0.78

ARRIVAL DELAY INDEX = 1.00

FIGURE 3-91. DELAY INDICES FOR RUNWAY-USE DIAGRAM NOS.: 2,3,5,9,32-35,37-43,49,55,61-68,72-74,76,
77,79,80,82-85,87-89,91,92,94,95,97-100,102 FOR IFR CONDITIONS.
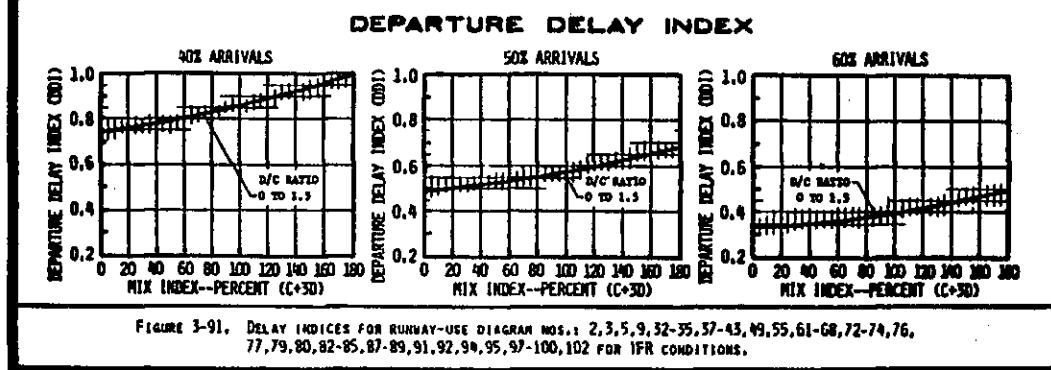
IFR ADI at 50% = 1.00
 "   "   60% = 1.00
 "   "   55% = 1.00

IFR ADI at 50% = 0.57
 "   "   60% = 0.38
 "   "   55% = 0.47

Figure A2-6. Hourly delay (cont.)

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6. **Delay Factors**. Calculate the arrival and departure delay factors (ADF and DDF) using the equation ADF = ADI·(D/C) and DDF = DDI·(D/C). Enter results in columns 12 and 14.

ADF for VFR = 0.95·0.56 = 0.53   DDF for VFR = 0.78·0.56 = 0.44

ADF for IFR = 1.00·0.67 = 0.67   DDF for IFR = 0.47·0.67 = 0.31

7. **Demand Profile Factor (DPF)**. Divide the 15 minute demand (column 7) by the hourly demand (column 5) and multiply the result by 100. Enter results in column 15.

DPF for VFR = (20/50)·100 = 40%

DPF for IFR = (15/34)·100 = 44%

8. **Determine Average Delay**. Using figure 3-69 (illustrated), the delay factors (columns 12 and 14), and the demand profile factors (column 15), determine the average delay to an arriving and a departing aircraft for VFR and IFR conditions and enter in column 16 and 17.

FIGURE 3-69. AVERAGE AIRCRAFT DELAY IN AN HOUR.
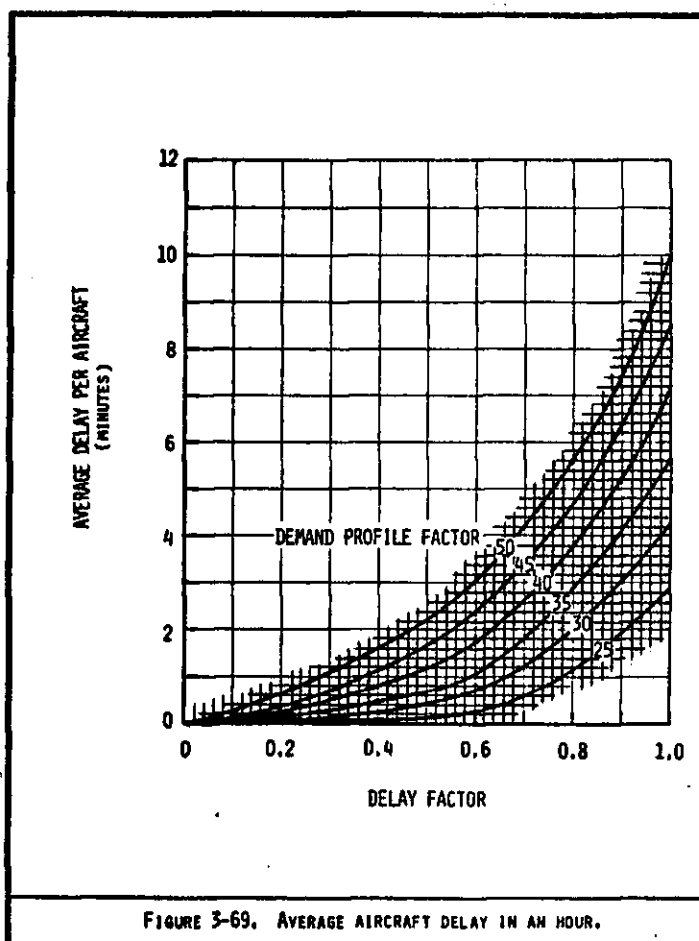
Figure A2-6. Hourly delay (cont.)

9. <u>Hourly Delay</u>. Calculate the hourly delay using the following equation and enter in column 18.

Hourly delay = Hourly demand [(% arrivals·average arrival delay)
                                + (% departures·average departure delay)]

Delay in VFR = 50 [(0.45·1.3)+(0.55·0.95)]= 55 minutes

Delay in IFR = 34 [(0.55·2.8)+(0.45·0.06)]= 53 minutes

Run-way Configuration Sketch	Delay Fig. No.			Capacity	Demand		D/C Ratio	Percent Arrivals	Mix Index	Arrival Delay		Depart. Delay		Demand Profile Factor DPF	Aver. Delay (Minutes)		Hourly Delay (Minutes)
	No.	VFR	IFR		Hourly	15 Min.				Index ADI	Factor ADF	Index DDI	Factor DDF		Arr.	Dep.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	43	85		89	50	20	.56	45	62	.95	.53	.78	.44	40	1.3	.95	55
	43		91	51	34	15	.67	55	91	1.00	.67	.47	.31	44	2.9	.60	53

Work sheet for hourly delay.

10. <u>Conclusion</u>. Because the demand is significantly less than capacity, and the scheduled airline operations are reasonably constant in VFR or IFR weather conditions, there is little difference in the minutes of delay experienced in the typical VFR or IFR hour.

Figure A2-6. Hourly delay (cont.)

EXAMPLE 7. Determine the daily delay in VFR conditions for the example airport. The hourly demand for a typical VFR day is as plotted. Demand is always less than capacity. For demands of 11 to 44 operations per hour, arrivals equal departures. For demands over 44 operations per hour, the arrival rate drops to 45 percent. Noise abatement practices limit the airport to the use of one runway from 10:00 pm to 7:00 am.
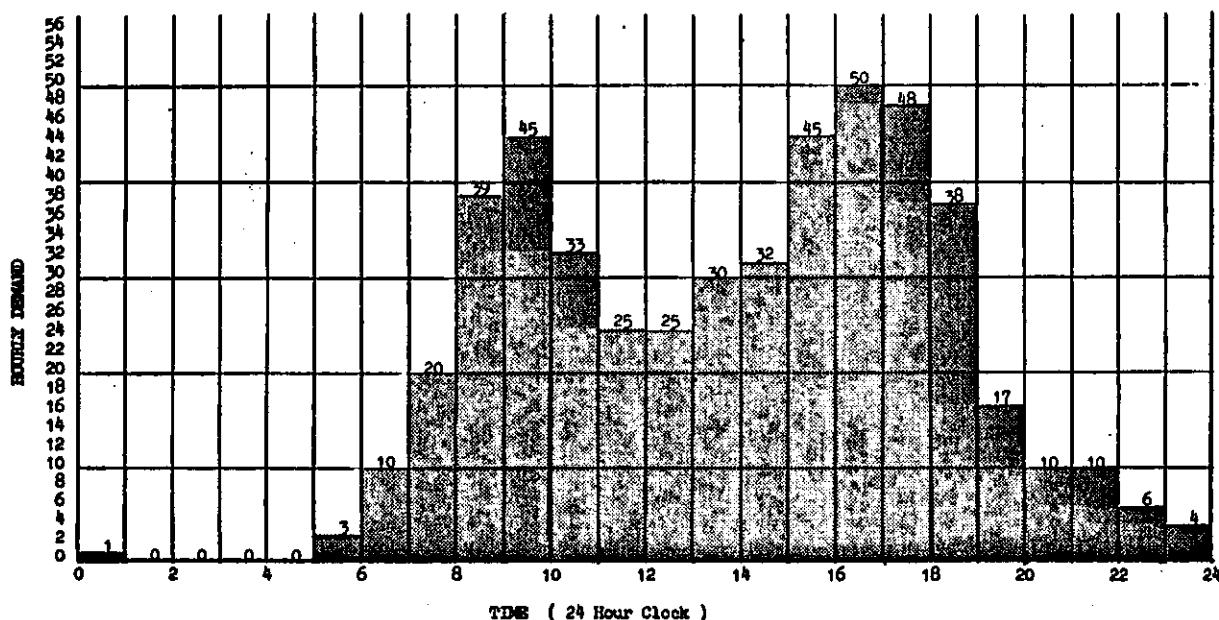
Histograph of daily demand

SOLUTION: The work sheet on page 18 illustrates one method of recording data.

1. **Calculate Capacities.** Calculated runway capacities for the different operating conditions are illustrated below. Assumptions were made for demand, aircraft mix, and percent of touch and go's for the first four operating conditions. Data from example 1 are used for the fifth operating condition.

Demand	Runway-use Diagram	No.	Capacity Figure No. VFR	IFR	Aircraft Mix %A	%B	%C	%D	Mix Index %(C+3D)	Arrivals %	Touch and Go %	Runway Exits Location	No.	Hrly. Cap. Base C*	T & G Factor T	Exit Factor E	Hourly Capacity (000) C*·T·E
11-19		1	3		23	75	2	0	2	50	5	30 45 60	1	103	1.04	.86	92
11-19		43	27		40	55	5	0	5	"	20	" " "	1	108	1.08	.85	97
20-35		"	"		35	35	30	0	30	"	10	" " "	2	102	1.03	.92	97
36-44		"	"		30	27	42	1	45	50	8	" " "	"	94	1.03	.92	89
45+		43	27		26	20	50	4	62	45	12	30 45 60	2	88	1.06	.94	89

Work sheet for hourly capacity.

Figure A2-7. Daily delay, D/C ratio equal or less than 1.00

2. <u>Calculate Hourly Delay</u>. The hourly runway delay calculations of example 6 are repeated 24 times to develop average arrival and departure delays per aircraft and the minutes of delay for each hour. Assume the demand is fairly uniform so that the DPF (column 11) is 25 when the demand is less than 10 operations per hour. When the demand is 10 or more, the DPF is 40. Forty percent of the operations occur in a 15 minute period whenever the demand is 10 or more.

Hour	Misc.	Hourly Demand	Hourly Capacity	D/C Ratio	Mix Index	Arrival Delay Index ADI	Arrival Delay Factor ADF	Depart. Delay Index DDI	Depart. Delay Factor DDF	Delay Factor DPF	Aver. Delay (Minutes) Arr.	Aver. Delay (Minutes) Dep.	Hourly Delay (Minutes)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
24:00-01:00		1	92	.01	0	0	0	0	0	0	0	0	0
01:00-02:00		0	-	-	-	-	-	-	-	-	-	-	-
02:00-03:00		"	-	-	-	-	-	-	-	-	-	-	-
03:00-04:00		"	-	-	-	-	-	-	-	-	-	-	-
04:00-05:00		"	-	-	-	-	-	-	-	-	-	-	-
05:00-06:00		3	92	.03	0	.64	.02	.50	.01	25	0	0	0
06:00-07:00		10	92	.11	2	.64	.07	.50	.06	40	.05	.05	1
07:00-08:00		20	97	.21	30	1.00	.21	.63	.13	"	.30	.15	4
08:00-09:00		39	89	.44	45	1.00	.44	.65	.29	"	.95	.50	28
09:00-10:00		45	"	.51	62	.95	.48	.78	.37	"	1.10	.80	42
10:00-11:00		33	89	.37	30	1.00	.37	.63	.23	"	.70	.35	17
11:00-12:00		25	97	.26	"	"	.26	"	.16	"	.40	.20	7
12:00-13:00		25	97	.26	"	"	.26	"	.16	"	.40	.20	7
13:00-14:00		30	89	.34	"	"	.34	"	.21	"	.60	.30	14
14:00-15:00		32	"	.36	30	1.00	.36	.63	.23	"	.65	.35	16
15:00-16:00		45	"	.51	62	.95	.48	.78	.39	"	1.10	.80	42
16:00-17:00		50	"	.56	"	"	.53	"	.44	"	1.30	.95	55
17:00-18:00		48	"	.54	62	.95	.51	.78	.43	"	1.20	.90	50
18:00-19:00		38	89	.43	45	1.00	.43	.65	.28	"	.90	.40	25
19:00-20:00		17	97	.18	5	"	.18	.63	.11	"	.25	.15	4
20:00-21:00		10	"	.10	"	"	.10	"	.06	"	.05	.05	1
21:00-22:00		10	97	.10	5	1.00	.10	.63	.06	40	.05	.05	1
22:00-23:00		6	92	.07	2	.64	.04	.50	.04	25	0	0	0
23:00-24:00		4	92	.04	0	.64	.03	.50	.02	25	0	0	0
											Daily Delay		295

Work sheet for daily runway delay.

3. <u>Total Delay</u>. Sum the hourly delays, i.e. 295 minutes.

4. <u>Conclusion</u>. The 295 minutes of delay for the day is influenced by scheduling practices within the hour.

Figure A2-7. Daily delay, D/C ratio equal or less than 1.00 (cont.)

EXAMPLE 8. Determine the daily delay in VFR conditions if the example airport closes the north-south runway and the demand during the 3:00 PM to 6:00 PM time period is increased to exceed the runways capacity.
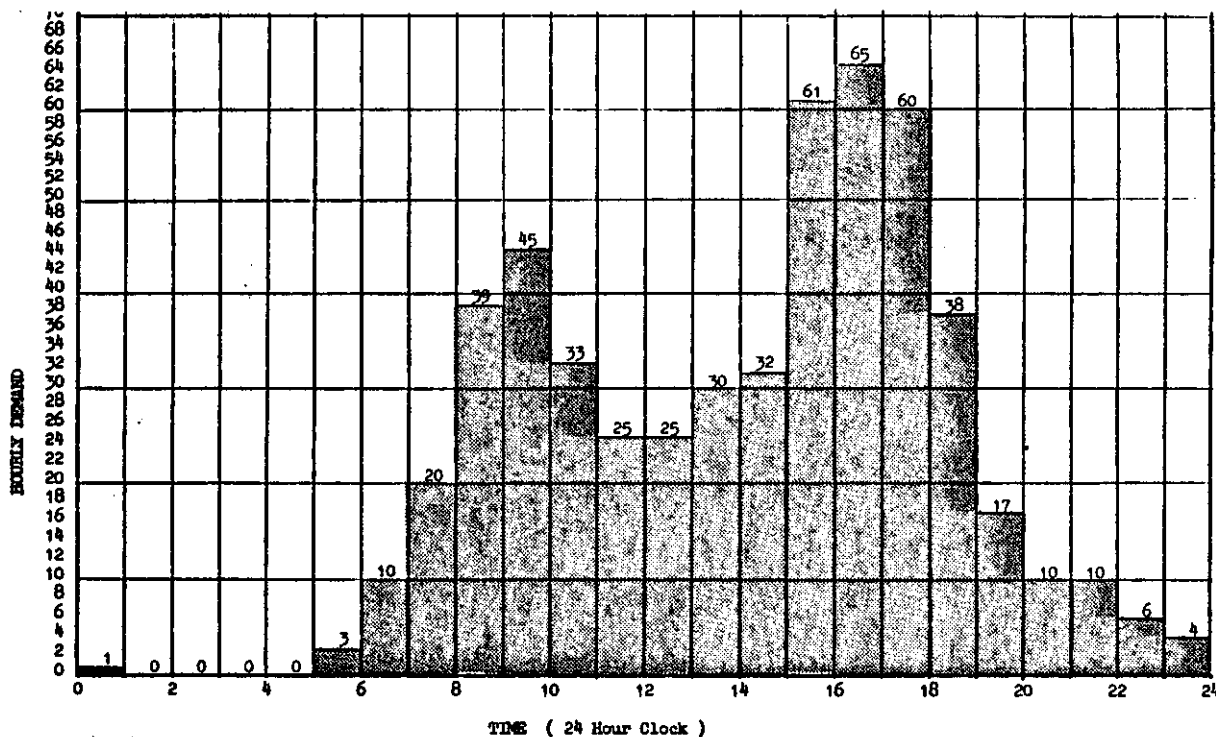
Histograph of daily demand.

SOLUTION: The work sheet on page 21 illustrate one method of recording data.

1. Identify Saturated Time Periods:

a. Calculate Capacities. Calculated runway capacities for the single runway condition are illustrated below. Since operations are limited to a single runway, capacity values will differ from those of example 7. Enter data from below and from example 7 in columns 3, 4, 6, and 11.

Demand	Runway-use Diagram	No.	Capacity Figure No. VFR	IFR	Aircraft Mix %A	%B	%C	%D	Mix Index %(C+3D)	Arrivals %	Touch and Go %	Runway Exits Location	No.	Hrly. Cap. Base C*	T & G Factor T	Exit Factor E	Hourly Capacity (000) C*·T·E
11-19		1	3		40	55	5	0	5	50	20	30 45 60	1	97	1.10	.86	92
20-35		"	"		35	35	30	0	30	50	10	" " "	2	71	1.04	.93	69
36-44		"	"		30	27	42	1	45	45	8	" " "	"	65	1.04	.93	63
45-50		"	"		26	20	50	4	62	"	12	" " "	"	62	1.10	.91	62
51-59		"	"		21	17	59	3	68	"	10	" " "	"	61	1.04	.91	58
60+		1	3		20	15	62	3	71	45	9	30 45 60	2	58	1.04	.91	55

Work sheet for capacity.

Figure A2-8. Daily delay when D/C ratio is greater than 1.00

b. Identify Saturated Period. Compare calculated capacities to the demand histograph. The time period from initial overload through recovery (15:00 to 20:00) is the saturated period.

Time Period	Demand	Capacity	Overload (Recovery)	Cummulative Overload
14:00-15:00	32	69	0	0
15:00-16:00	61	55	6	6
16:00-17:00	65	55	10	16
17:00-18:00	60	55	5	21
18:00-19:00	38	55	(17)	4
19:00-20:00	17	55	(4)	0
20:00-21:00	10	92	0	0

2. Saturated Period Delay. Calculate the delay for the saturated period as follows:

a. Duration of Overload Phase. Identified as 15:00 to 18:00 hours.

b. AD/C Ratio. Calculate the AD/C ratio for the overload period and enter in column 5.

$$AD/C = \frac{61+65+60}{55+55+55} = \frac{186}{165} = 1.13$$

c. Percent Arrivals. Given as 45%.

d. Delay Indices. Obtain ADI and DDI from figure 3-71 and enter in columns 7 and 9.

ADI at 40%	= 0.74		DDI at 40%	= 1.00
"	50% = 0.83		"	50% = 1.00
"	45% = 0.78		"	45% = 1.00

e. Arrival and Departure Delay Factors. Calculate ADF and DDF for the saturated period by multiplying ADI and DDI by the AD/C ratio and enter in columns 8 and 10.

$$ADF = 0.78 \cdot 1.13 = 0.88$$

$$DDF = 1.00 \cdot 1.13 = 1.13$$

f. Average Delays. Determine average delay from figure 3-70 for a 3-hour overload phase and entered in columns 12 and 13.

Figure A2-8. Daily delay when D/C ratio is greater than 1.00 (cont.)

g. <u>Saturated Period Delay</u>. Calculate the saturated period (DTS) delay and enter in column 14.

$$DTS = (61+65+60+38+17)(45 \cdot 4.9+(100-45) \cdot 13.7)/100$$
$$= 241(974.0)/100$$
$$= 2,347 \text{ minutes of delay}$$

3. <u>Hourly Delays Unsaturated Periods</u>. Calculate hourly delays for the unsaturated periods (24:00 to 15:00 and 20:00 to 24:00) as in example 6.

Hour	Misc.	Hourly		D/C Ratio	Mix Index	Arrival Delay		Depart. Delay		Delay Factor	Aver. Delay (Minutes)		Hourly Delay (Minutes)
		Demand	Capacity			Index ADI	Factor ADF	Index DDI	Factor DDF	DFF	Arr.	Dep.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
24:00-01:00		1	92	–	–	–	–	–	–	–	–	–	–
01:00-02:00		0	"	–	–	–	–	–	–	–	–	–	–
02:00-03:00		0	"	–	–	–	–	–	–	–	–	–	–
03:00-04:00		0	"	–	–	–	–	–	–	–	–	–	–
04:00-05:00		0	"	–	–	–	–	–	–	–	–	–	–
05:00-06:00		3	"	.03	5	.65	.02	.50	.02	40	0.0	0.0	0
06:00-07:00		10	92	.11	5	.65	.07	.50	.06	"	0.1	0.0	1
07:00-08:00		20	69	.29	30	.70	.20	.52	.15	"	0.2	0.2	4
08:00-09:00	.	39	63	.62	45	.72	.45	.64	.40	"	1.0	0.8	35
09:00-10:00		45	62	.73	62	.67	.49	.74	.54	"	1.1	1.4	57
10:00-11:00		33	69	.48	30	.70	.34	.56	.27	"	0.6	0.4	17
11:00-12:00		25	"	.36	"	"	.25	.52	.19	"	0.4	0.2	8
12:00-13:00		25	"	.36	"	"	.25	.52	.19	"	0.4	0.2	8
13:00-14:00		30	"	.43	"	"	.30	.53	.23	"	0.5	0.3	12
14:00-15:00		32	69	.46	30	.70	.32	.56	.26	40	0.6	0.4	16
15:00-16:00		61	55										
16:00-17:00		65	"	1.13	71	.78	.88	1.00	1.13	40	4.9	13.7	2347
17:00-18:00		60	"										
18:00-19:00		38	"										
19:00-20:00		17	55										
20:00-21:00		10	92	.11	5	.65	.07	.50	.06	40	0.1	0.0	1
21:00-22:00		10	"	.11	"	"	.07	"	.06	"	0.1	0.0	1
22:00-23:00		6	"	.07	"	"	.05	"	.04	"	0.0	0.0	0
23:00-24:00		4	92	.04	5	.65	.03	.50	.02	40	0.0	0.0	0
											Daily Delay		2507

Work sheet for daily delay when D/C ratio is greater than 1.00.

4. <u>Daily Delay</u>. Sum the hourly delays for the saturated and unsaturated periods, i.e. 2,507 minutes.

5. <u>Conclusion</u>. When demand exceeds capacity for several consecutive hours, daily delays increase significantly.

Figure A2-8. Daily delay when D/C ratio is greater than 1.00 (cont.)

EXAMPLE 9. Determine the annual runway delay for the example airport, assuming that the airport has an annual demand of 153,000 operations, a demand profile factor of 40, no runway closures, and relatively uniform daily demand throughout each month.

SOLUTION: The work sheet on page 25 illustrates one method of recording data.

NOTE: Use procedures illustrated in examples 7 and 8 to determine the delays for VFR and IFR days. To allow for seasonal variations of demand, 24 representative days are used, i.e., a VFR and an IFR day for each calender month.

    1. **Distribute Demands.** Distribute the annual demand of 153,000 operations to representative daily demands as follows:

        a. **Distribute to Months.** Distribute annual demand to the 12 calendar months and enter in column 3. Use historical data when available.

        b. **Distribute to Days.** Monthly demand is uniformly distributed over the days of the month and entered in column 4.

$$\text{January:} \quad \frac{11,631 \text{ operations}}{31 \text{ days}} = 375 \text{ operations/average day}$$

    2. **Develop Representative Days Demands.** Adjust average day demand to representative day demands to account for differences in VFR and IFR operations, as follows:

        a. **Percent IFR Weather.** From historical records, determine the percent of the time that IFR (and PVC) weather conditions prevail in each of the months and enter in column 6.

        January: 18% IFR weather
                  82% VFR weather

        b. **Number of Representative Days.** Convert percentages of VFR and IFR weather to days and enter results in column 7.

        January: 31 days·82% VFR weather = 25.4 VFR days

                 31 days·18% IFR weather = 5.6 IFR days

        c. **Percent IFR Demand.** The IFR demand is 68% of VFR demand.

        d. **Representative Day Demands.** Calculate daily demand as follows and enter in column 8.

$$\text{January:} \quad \frac{100 \cdot 375}{100-18(1-68/100)} = \frac{37500}{94.24} = 398 \text{ VFR ops/day}$$

$$398 \cdot 68/100 = 271 \text{ IFR ops/day}$$

Figure A2-9. Annual delay

3. **Develop Hourly Demand for Representative Days.** From historical data, determine the percentage of daily operations occuring in each hour of the day. The percentage of demand for each hour is assumed to be the same for each representative day whether it is an IFR or VFR day. A work sheet, similar to that on page 24, is useful for keeping track of hourly demands.

4. **Representative Daily Delay.** Calculated delay for a VFR day in January is illustrated below using the procedures of examples 7 and 8. Enter calculated delays in column 9.

Hour	Misc.	Hourly Demand	Hourly Capacity	D/C Ratio	Mix Index	Arrival Delay Index ADI	Arrival Delay Factor ADF	Depart. Delay Index DDI	Depart. Delay Factor DDF	Delay Factor DPF	Aver. Delay (Minutes) Arr.	Aver. Delay (Minutes) Dep.	Hourly Delay (Minutes)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
24:00–01:00		1	–	–	–	–	–	–	–	–	–	–	–
01:00–02:00		0	–	–	–	–	–	–	–	–	–	–	–
02:00–03:00		0	–	–	–	–	–	–	–	–	–	–	–
03:00–04:00		0	–	–	–	–	–	–	–	–	–	–	–
04:00–05:00		0	–	–	–	–	–	–	–	–	–	–	–
05:00–06:00		2	–	–	–	–	–	–	–	–	–	–	–
06:00–07:00		8	–	–	–	–	–	–	–	–	–	–	1
07:00–08:00		16	97	.16	5	1.00	.16	.62	.10	40	.15	.10	2
08:00–09:00		31	97	.32	30	"	.32	.63	.20	"	.55	.25	12
09:00–10:00		37	89	.42	45	"	.42	.65	.27	"	.85	.40	23
10:00–11:00		27	97	.28	30	"	.28	.63	.18	"	.40	.20	8
11:00–12:00		20	"	.21	"	"	.21	"	.13	"	.30	.10	4
12:00–13:00		20	"	.21	"	"	.21	"	.13	"	.30	.10	4
13:00–14:00		24	"	.25	"	"	.25	"	.16	"	.35	.15	6
14:00–15:00		26	97	.27	30	"	.27	.63	.17	"	.40	.15	7
15:00–16:00		37	89	.42	45	"	.42	.65	.27	"	.85	.40	23
16:00–17:00		41	"	.46	"	"	.46	"	.30	"	1.00	.50	31
17:00–18:00		39	89	.44	45	"	.44	.65	.29	"	.90	.45	26
18:00–19:00		31	97	.32	30	"	.32	.63	.20	"	.55	.25	12
19:00–20:00		14	97	.14	5	1.00	.14	.62	.09	40	.10	.10	1
20:00–21:00		8	–	–	–	–	–	–	–	–	–	–	1
21:00–22:00		8	–	–	–	–	–	–	–	–	–	–	1
22:00–23:00		5	–	–	–	–	–	–	–	–	–	–	1
23:00–24:00		3	–	–	–	–	–	–	–	–	–	–	–
											Daily Delay		163

Generally, it is not necessary to calculate delay for very low levels of demand. In this example, a one minute delay was assumed for demands between 5 to 10 operations per hour.

Figure A2-9. Annual runway delay (cont.)

Figure A2-9. Annual delay (cont.)

TABULATION OF HOURLY DEMAND FOR REPRESENTATIVE DAYS

Clock Time	Daily Ops	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR
x:00	a	398	271	414	282	430	292	428	291	436	296	478	325	473	322	521	354	440	299	449	305	440	299	426	290
12-1	.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-6	.6	2	2	2	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	2	2	3	2
6-7	2.0	8	5	8	6	9	6	9	6	9	6	10	6	9	6	10	7	9	6	9	6	9	6	9	6
7-8	4.1	16	11	17	12	18	12	18	12	18	12	20	13	19	13	21	15	18	12	18	13	18	12	17	12
8-9	7.9	31	21	33	22	34	23	34	23	34	23	38	26	37	25	41	28	35	24	35	24	35	24	34	23
9-10	9.2	37	25	38	26	40	27	39	27	40	27	44	30	44	30	48	33	40	28	41	28	40	28	39	27
10-11	6.7	27	18	28	19	29	20	29	19	29	20	32	22	32	22	35	24	29	20	30	20	29	20	29	19
11-12	5.1	20	14	21	14	22	15	22	15	22	15	24	17	24	16	27	18	22	15	23	16	22	15	22	15
12-13	5.1	20	14	21	14	22	15	22	15	22	15	24	17	24	16	27	18	22	15	23	16	22	15	22	15
13-14	6.1	24	17	25	17	26	18	26	18	27	18	29	20	29	20	32	22	27	18	27	19	27	18	26	18
14-15	6.5	26	18	27	18	28	19	28	19	28	19	31	21	31	21	34	23	29	19	29	20	29	19	28	19
15-16	9.2	37	25	40	26	40	27	39	27	40	27	44	30	44	30	48	33	40	28	41	28	40	28	39	27
16-17	10.2	41	28	42	29	44	30	44	30	44	30	49	33	48	33	53	36	45	30	46	31	45	30	43	30
17-18	9.8	39	27	41	28	42	29	42	29	43	29	47	32	46	32	51	35	43	29	44	30	43	29	42	28
18-19	7.7	31	21	32	22	33	22	33	22	34	23	37	25	36	25	40	27	34	23	35	23	34	23	33	22
19-20	3.5	14	9	14	10	15	10	15	10	15	10	17	11	17	11	18	12	15	10	16	11	15	10	15	10
20-21	2.0	8	5	8	6	9	6	9	6	9	6	10	6	9	6	10	7	9	6	9	6	9	6	9	6
21-22	2.0	8	5	8	6	9	6	9	6	9	6	10	6	9	6	10	7	9	6	9	6	9	6	9	6
22-23	1.2	5	3	5	3	5	4	5	3	5	4	6	4	6	4	6	4	5	4	5	4	5	4	5	3
23-24	.8	3	2	3	2	3	2	3	2	3	2	4	3	4	3	4	3	4	2	4	2	4	2	3	2

Representative daily demand VFR - IFR calculations.

January 12:00 to 13:00 hours.
VFR = 0.051·398 = 20
IFR = 0.051·271 = 14

5. __Monthly Delay.__ The delay for each representative VFR and IFR day is multiplied by the number of representative days and entered in column 10. Total monthly delay is entered in column 11.

6. __Annual Delay.__ Sum monthly delays to obtain annual delay.

| Month	No. Days	Demand per Month	Ave. Daily Demand	Weather	Percent Occur.	Representative Day(s)			Monthly Delay (minutes)	
						No. of Days	Demand	Delay	VFR/IFR	Total
1	2	3	4	5	6	7	8	9	10	11
Jan.	31	11,631	375	VFR	82	25.4	398	163	4,140	
				IFR	18	5.6	271	116	650	4,790
Feb	28	10,926	390	VFR	80	22.4	414	185	4,144	
				IFR	20	5.6	282	130	728	4,872
Mar.	31	12,561	405	VFR	85	26.4	430	199	5,254	
				IFR	15	4.6	292	146	146	5,926
Apr.	30	12,096	403	VFR	87	26.1	428	193	5,037	
				IFR	13	3.9	291	145	566	5,603
May	31	12,756	411	VFR	90	27.9	436	201	5,608	
				IFR	10	3.1	296	148	459	6,067
June	30	13,508	450	VFR	92	27.6	478	278	7,673	
				IFR	8	2.4	325	195	468	8,141
July	31	13,832	446	VFR	95	29.4	473	270	7,938	
				IFR	5	1.6	322	190	304	8,242
Aug.	31	15,227	491	VFR	98	30.4	521	355	10,792	
				IFR	2	0.6	354	251	151	10,943
Sep.	30	12,456	415	VFR	98	29.4	440	209	6,145	
				IFR	2	0.6	299	150	90	6,235
Oct.	31	13,119	423	VFR	96	29.8	499	225	6,705	
				IFR	4	1.2	305	162	194	6,899
Nov.	30	12,456	415	VFR	90	27.0	440	209	5,643	
				IFR	10	3.0	299	150	450	6,093
Dec.	31	12,432	401	VFR	85	26.3	426	192	5,050	
				IFR	15	4.7	290	143	672	5,722
						TOTALS:	VFR IFR		74,129 5,404	79,533

Work sheet for annual delay.

7. __Conclusion.__ Variations in demand contribute more to the 79,533 minutes of delay than weather, as can be seen in the difference between VFR delays and IFR delays for any month.

Figure A2-9. Annual delay (cont.)

EXAMPLE 10. Determine the hourly demand that results in an average departure delay of 0.5 minutes in VFR conditions. The demand profile factor is 40, the runway capacity is 89, the mix index is 62, and the arrival rate is 45 percent.

SOLUTION: Use a trial demand and compute the associated delay. Repeat for a refined demand closer to the target delay. Plotting the calculated demand--delay values on a graph will expedite the procedure.

    1. Plot Known Point.   From example 6, the average departure delay in VFR conditions is 0.95 minutes when the demand is 50 operations per hour. Plot this point.

    2. Calculate and Plot a Second Demand--Delay. Select a second demand, calculate the delay, and plot the point.

        a. A demand of 25 operations per hour is selected.

        b. The demand to capacity ratio is 25/89 or 0.28.

        c. From figure 3-85, the departure delay index is 0.75.

        d. The departure delay factor is 0.75·0.28 or 0.21.

        e. From figure 3-69, the average delay to a departure is 0.22 minutes.

        f. Plot the point and connect the two points.
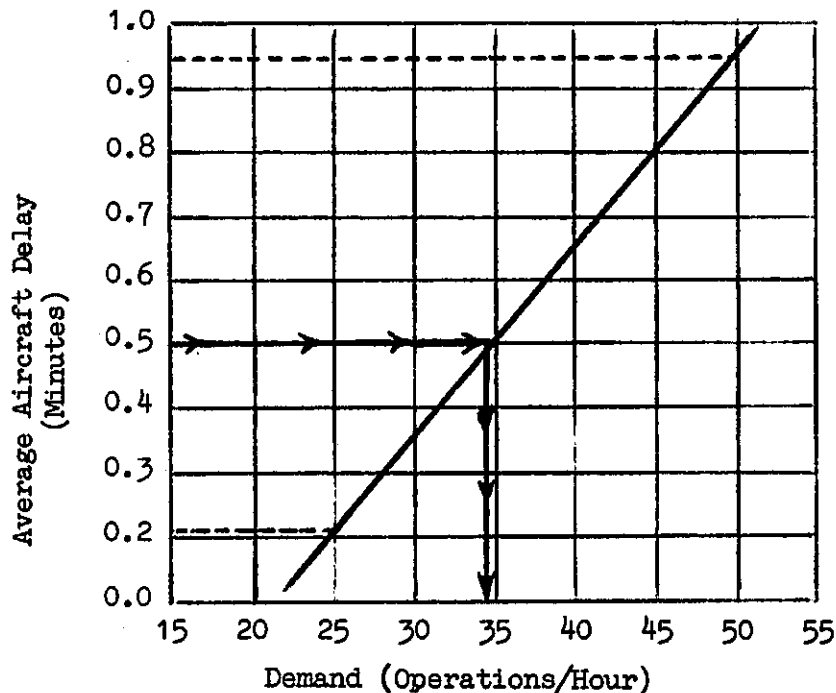
Demand versus delay graph.

Figure A2-10. Hourly demand at a specified level of delay

3. <u>Graphic Delay Demand</u>. The 0.5 minute delay line intersects the plotted line at a demand of 34 operations per hour.

4. <u>Check Graphic Derived Demand</u>. Calculate and plot the graphically derived demand.

    a. The demand is 34 operations per hour.

    b. The demand to capacity ratio is 34/89 or 0.38.

    c. The departure delay index is 0.75.

    d. The departure delay factor is 0.75·0.38 or 0.285; say 0.29.

    e. From figure 3-69, average departure delay is 0.5 minutes.

5. <u>Conclusion</u>. Limiting the demand to 34 operations per hour meets the average delay of 0.5 minutes per departing aircraft.

Figure A2-10. Hourly demand at a specified level of delay (cont.)

APPENDIX 3. EXAMPLES APPLYING CHAPTER 4 CALCULATIONS

1. GENERAL. The examples in this appendix illustrate applications of chapter 4
capacity calculations with portions of the appropriate figures reproduced in the
examples.

2. EXAMPLES. Four examples, figures A3-1 through A3-4, follow:

   a. Hourly capacity in FVC condition (figure A3-1).

   b. Hourly capacity in the absence of radar coverage or ILS (figure A3-2).

   c. Hourly capacity of parallel runway airport with one runway restricted to
small aircraft (figure A3-3).

   d. Hourly capacity of a single runway airport used exclusively by small
aircraft that lacks radar or ILS (figure A3-4).

LE 1. Determine the capacity of the example airport in PVC conditions. Opera-
are limited to the N-S runway. Hourly demand consists of 25 Class C and two
D aircraft with a 55 percent arrival rate.
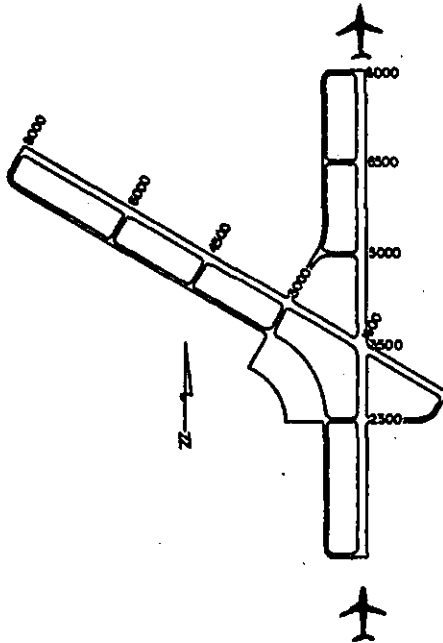
ION:

1. **Capacity Figure.** From figure 4-1 (illustrated), the runway-use configura-
ls diagram No. 1, and the figure for determining capacity is No. 4-2.

Runway-use Diagram	Diag. No.	Runway Spacing (S) in feet	Figure No. for Capacity			
			Poor Visibility Conditions	Inoperative Navaids	Restricted Runway-use	
					VFR	IFR
▶—◁▭▭▭▭▷◀	1	N A	4- 2	4-15	-	-
▶—▭▭▭▭▷ S ▭▭▭▭▷◀	2a	700 to 2499	4- 3	4-16	-	-
	2b	2500 or more	4- 4			

2. **Mix Index.** For 25 Class C aircraft and 2 by Class D aircraft, the mix
is:

$$(25/27) + 3(2/27) = 93 + 3(7) \text{ or } 114$$

3. **Percent Arrivals.** 55 percent.

Figure A3-1. Hourly capacity in PVC conditions

4. <u>Hourly Capacity</u>. From figure 4-2 (illustrated), the airport capacity i
operations per hour.

FIGURE 4-2. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NO. 1.
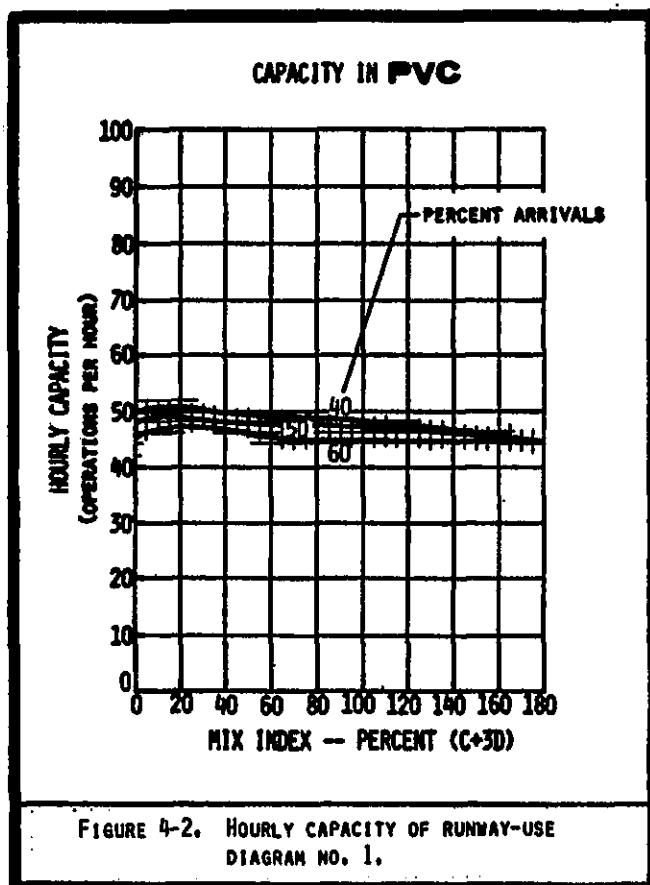
5. <u>Conclusion</u>. Under these conditions, the airport loses 10 percent of its
capacity when the weather deteriorates from IFR to PVC conditions.
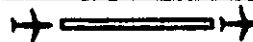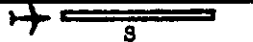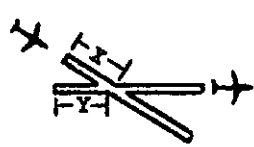
LE 2. Determine the IFR capacity of the example airport when the glide slope
on of the ILS is inoperative, radar coverage is out, and a circling approach is
Demand consists of 25 Class C and 2 Class D aircraft.
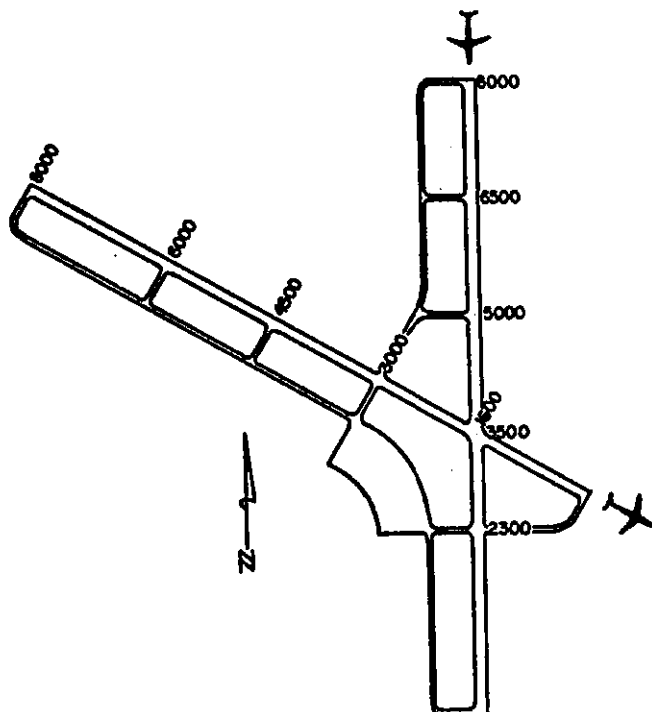
ION:

1. Capacity Figure. From figure 4-1 (illustrated), the runway-use configura-
is diagram No. 44 & 47 and the figure for determining capacity is No. 4-15.

Runway-use Diagram	Diag. No.	Runway Spacing (S) in feet		Figure No. for Capacity			
				Poor Visibility Conditions	Inoperative Navaids	Restricted Runway-use	
						VFR	IFR
↦ ▭ ↦	1	N A		4- 2	4-15	-	-
↦ ▭ S	2a	700 to 2499		4- 3	4-16	-	-
↗↗ ⊬↦ ⊢Y⊣	43&46	X(ft) 0 to 1999	Y(ft) 0	4-12	4-15	-	-
	44&47	2000 to 4999	to	4-13			
	45&48	5000 to 8000	8000	4-14			

2. Inoperative Aid. The radar and glide slope are out and a circling approach
d.

3. Mix Index. For 25 Class C and 2 Class D aircraft, the mix index is:

$$(25/27)+3(2/27) = 93+3(7) = 114$$

Figure A3-2. Hourly capacity in the absence of radar coverage or ILS

4. <u>Hourly Capacity</u>. From figure 4-15 (illustrated), the airport capacity
26 operations per hour.

FIGURE A3-2A.
HOURLY CAPACITY IN RADAR ENVIRONMENT

FIGURE A3-2B.
HOURLY CAPACITY IN NONRADAR ENVIRONMENT

FIGURE 4-15. HOURLY CAPACITY OF RUNWAY-USE DIAGRAM NOS. 1, 43-54.
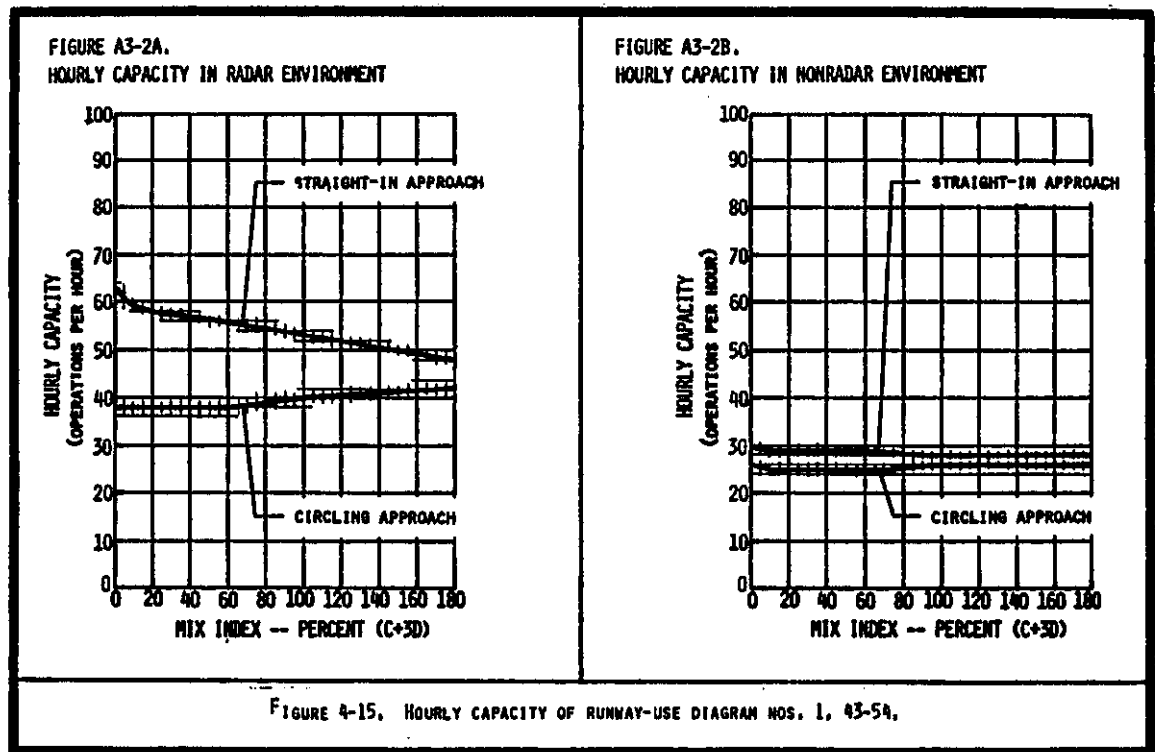
5. <u>Conclusion</u>. Airport capacity is limited to 26 operations per hour when
glide slope portion of the ILS or radar are inoperative and a circling approach
used. With radar coverage, the airport capacity is 40 operations per hour.

Figure A3-2. Hourly capacity in the absence of radar coverage or ILS (cont.)

LE 3. Determine the VFR hourly capacity of the runway configuration depicted
when one runway is used only by Class A and B aircraft. Hourly demand con-
of 20% Class A, 15% Class B, 55% Class C, and 10% Class D aircraft with a 50
nt arrival rate.
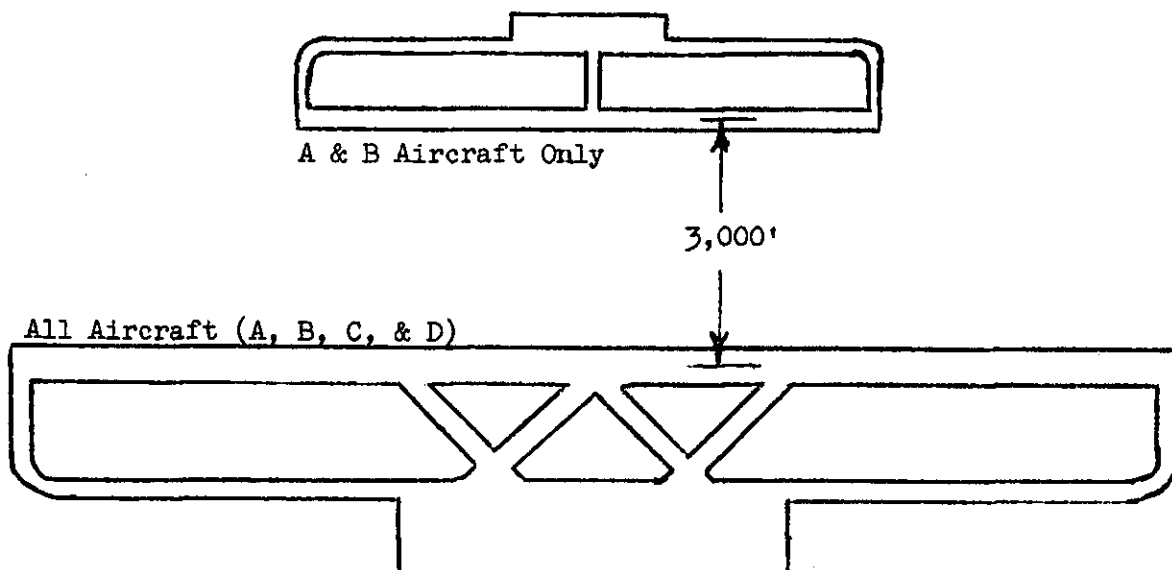
A & B Aircraft Only

3,000'

All Aircraft (A, B, C, & D)

ION:

1. Capacity Figure. From figure 4-1 (illustrated), the runway-use configura-
is diagram No. 11 and the figure for determining capacity is No. 4-18.

Runway-use Diagram	Diag. No.	Runway Spacing (S) in feet	Figure No. for Capacity				
			Poor Visibility Conditions	Inoperative Navaids	Restricted Runway-use		
					VFR	IFR
	9	700 to 2499	4- 3		4-17	
	10	2500 to 2999	4- 9	4-16		4-21
S	11	3000 to 4299	4-10		4-18	
	12	4300 or more	4-11			4-22

2. Mix Index. For 55% Class C and 10% Class D aircraft, the mix index is:

$$55 + 3(10) = 85$$

3. Percent Arrivals. 50 percent.

э A3-3. Hourly capacity of parallel runway airport with one runway restricted
          to small aircraft

4. Hourly Capacity. From figure 4-18 (illustrated), the airport capacity
83 operations per hour.

RUNWAY RESTRICTED USE IN **VFR**

FIGURE 4-18. HOURLY CAPACITY OF RUNWAY-USE
DIAGRAM NOS. 10, 11, 12.
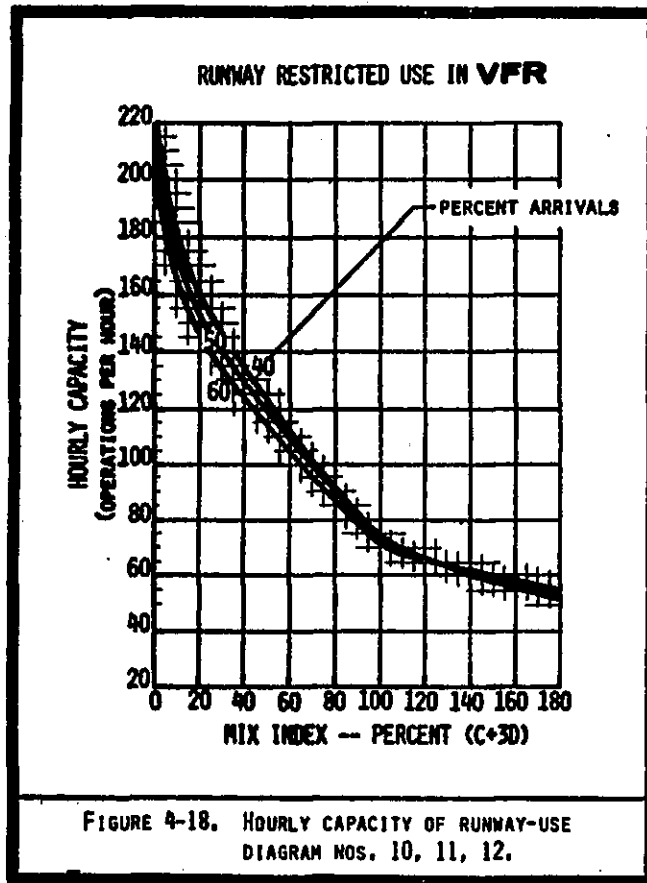
5. Conclusion. The capacity of a single runway under these conditions is
operations per hour. The capacity of full-length, parallel, unrestricted runwa:
is 115 operations per hour. The capacity of parallel runways when one is limite
use by small aircraft is 83 operations per hour.

Figure A3-3. Hourly capacity of parallel runway airport with one runway restric
to small aircraft (cont.)

LE 4. Determine the hourly capacity in VFR and IFR conditions of the runway-
ay configuration depicted below. The airport is used exclusively by small
is A and B) aircraft and there is no radar coverage or ILS facility. Arrivals
ally equal departures, and touch and go's approach the 20 percent level.
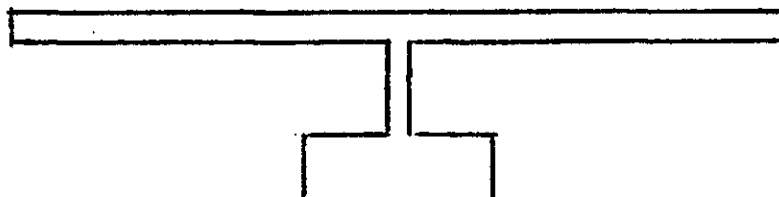
TION:

1. Airport Configuration. From figure 4-26 (illustrated), identify the runway-
ay configuration that best represents the airport.

2. Percent Touch-and-Go. 20 percent.

3. Hourly Capacity. From figure 4-26, the range of VFR and IFR hourly capacity
) to 72 operations, and 20 to 24 operations, respectively.

4. Conclusion. The airport is able to accomodate 59 to 72 operations per hour
FR conditions and 20 to 24 operations per hour in IFR conditions.

re A3-4. Hourly capacity of a single runway airport used exclusively by small
          aircraft that lacks radar or ILS.

APPENDIX 4. GLOSSARY OF SYMBOLS/TERMS

%(C+3D) = mix index = the percent of Class C aircraft plus 3 times the percen
Class D aircraft

%IFR = percent of the time that IFR and PVC operating conditions prevail

%IFR demand = 100·(IFR demand)/(VFR demand)

A = number of arriving aircraft in the hour

AD/C = average demand-capacity ratio = (the sum of the hourly demands during
overload phase)/(the sum of the hourly capacities during the overload

ADF = arrival delay factor = ADI·(D/C) or ADI·(AD/C) [overload phase]

ADI = arrival delay index (figures 3-2 and 3-71 through 3-102)

Annual capacity = ASV

ASV = annual service volume = C_w·D·H or (figure 2-1) [approximate]

C^* = hourly capacity base (figures 3-2 through 3-65)

C_i = hourly capacity for each runway-use configuration (C_1 through C_n)

Class A aircraft = single-engined small aircraft (table 1-1)

Class B aircraft = multi-engined small aircraft (table 1-1)

Class C aircraft = large aircraft (table 1-1)

Class D aircraft = heavy aircraft (table 1-1)

C_w = weighted hourly capacity =
$(P_1·C_1·W_1 + P_2·C_2·W_2 +...+ P_n·C_n·W_n)/(P_1·W_1 + P_2·W_2 +...+ P_n·W_n)$

D = demand ratio = (annual demand)/(average daily demand during the peak mout
(table 3-2) [typical]

DA = number of departing aircraft in the hour

DAH = average delay per aircraft (figure 2-2) [approximate]

DAHA = average delay for arriving aircraft (figure 3-69)

DAHD = average delay for departing aircraft (figure 3-69)

DASA = average delay per arrival (figure 3-70) [saturated period]

DASD = average delay per departure (figure 3-70) [saturated period]

D/C = demand-capacity ratio = (hourly demand)/(hourly capacity)

DDF = departure delay factor = DDI·(D/C) or DDI·(AD/C) [overload phase]

DDI = departure delay index (figures 3-2 and 3-71 through 3-102)

DPF = demand profile factor = 100·Q/HD

DTH = hourly delay = HD·(PA·DAHA + (100-PA)·DAHD)/100 or HD·DAH [approximate]

DTS = delay in saturated period =
    $(HD_1+HD_2+\ldots+HD_n)$·(PAS·DASA+(100-PAS)·DASD)/100

E = exit factor   (figure 3-2 through 3-65)

G^* = hourly gate capacity base   (figure 3-68)

H = demand ratio = (average daily demand)/(average peak hour demand during the
    peak month) or (table 3-2) [typical]

HD = hourly demand on the runway component

HD_i = hourly demand on the runway component during hours 1 through n of the
    saturated period

Hourly capacity of gates = G^*·S·N   (figure 3-68)

Hourly capacity of runway component = C^*·T·E or (figures 4-1 through 4-26) [special
    applications], or (figure 2-1) [approximate]

Hourly capacity of taxiway crossing an active runway   (figures 3-66 and 3-67)

Hourly delay on runway component = DTH

IFR demand = VFR demand · %IFR demand/100

N = number of gates

PA = percent arrivals = 100·(A+½(T&G))/(A+DA+(T&G))

PAS = percent of arrivals in the saturated period

PT&G = Percent touch and gos = 100·(T&G)/(A+DA+(T&G))

P_i = percent of the time each runway-use configuration is in use (P_1 through P_n)

PVC = poor visibility and ceiling = lower end of IFR conditions

Q = peak 15-minute demand on the runway compoment

R = gate occupancy ratio = (average gate occupancy time of widebodied
    aircraft)/(average gate occupancy time of non-widebodied aircraft)

S = factor for gate size   (figure 3-68)

T = touch and go factor   (figures 3-2 through 3-65)

T&G = number of touch and go's in the hour

Type 1 gate = a gate that is capable of accommodating all aircraft

Type 2 gate = a gate that will accommodate only non-widebodied aircraft

VFR demand = (average day demand)/(1-%IFR(1-%IFR demand/100)/100)

W_i = ASV weighting factor for each runway-use configuration (W_1 through W_n)
    (table 3-1)

APPENDIX 5. BLANK FORMS

Aircraft Mix				Mix Index	Configuration		Capacity (Ops/Hour) (000)		ASV (000)	Annual Demand (000)	Annual Demand ASV	Average Delay per Aircraft (Minutes)		Minutes of Annual Delay (000)	
%A	%B	%C	%D	%(C+3D)	No.	Sketch	VFR	IFR				Low	High	Low	High
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Figure A5-1.   Hourly capacity, ASV, delay for long range planning

Weather	Runway-use		Capacity Figure No.	Aircraft Mix				Mix Index	Percent Arrivals	Percent Touch & Go	Runway Exits (00 feet)			Hourly Capac. Base	T & G Factor	Exit Factor	Hourly Capacity (000)
	Diagram	No.	No.	%A	%B	%C	%D	%(C+3D)		& Go	Location		No.	C*	T	E	C*·T·E
1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17

Figure A5-2. Hourly capacity runway component

Weather	Taxiway Crossing	Distance from Threshold	Runway		Taxiway Crossing Capacities (Operations per Hour)	
			Ops. Rate	Mix Index	Arrivals and Mixed Operations	Departures Plus T & G
1	2	3	4	5	6	7

Figure A5-3. Hourly capacity taxiway coponent

Non-widebody (N)   Widebody (W)

Gate Group	Demand		No. Gates		Gate Mix		Average Gate Time (Min.)		Gate Occupancy Ratio (T_w/T_n)	Hourly Capac. Base	Gate Size	No. Gates	Hourly Capacity
	(N)	(W)	(N)	(W)	(N) (%)	(W) (%)	(N) (T_n)	(W) (T_w)	(R)	(G*)	(S)	(N)	(G*·S·N)
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Figure A5-4.   Hourly capacity gate group component

Component	Hourly Capacity	Hourly Demand	Demand Ratio Componet Demand Runway Demand	Component Quotient Component Capacity Demand Ratio
1	2	3	4	5

Figure A5-5.   Airport hourly capacity

No.	Operating Condition Weather	Operating Condition Rwy-use Diagram	Mix Index	Percent of Year (P)	Hourly Capacity (C)	Percent Maximum Capacity	Weighting Factor (W)
1	2	3	4	5	6	7	8

Figure A5-6.   Annual service volume

Rwy-use Configuration		Delay Fig. No.				Demand		D/C Ratio	Percent Arrivals	Mix Index	Arrival Delay		Depart. Delay		Demand Profile Factor	Aver. Delay (Minutes)		Hourly Delay
Sketch	No.	VFR	IFR	Capacity	Hourly	15 Min.					Index ADI	Factor ADF	Index DDI	Factor DDF	DPF	Arr.	Dep.	(Minutes)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Figure A5-7. Hourly delay

Hour	Misc.	Hourly		D/C Ratio	Mix Index	Arrival Delay		Depart. Delay		Delay Factor DPF	Aver. Delay (Minutes)		Hourly Delay (Minutes)
		Demand	Capacity			Index ADI	Factor ADF	Index DDI	Factor DDF		Arr.	Dep.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
24:00-01:00													
01:00-02:00													
02:00-03:00													
03:00-04:00													
04:00-05:00													
05:00-06:00													
06:00-07:00													
07:00-08:00													
08:00-09:00													
09:00-10:00													
10:00-11:00													
11:00-12:00													
12:00-13:00													
13:00-14:00													
14:00-15:00													
15:00-16:00													
16:00-17:00													
17:00-18:00													
18:00-19:00													
19:00-20:00													
20:00-21:00													
21:00-22:00													
22:00-23:00													
23:00-24:00													
											Daily Delay		

Figure A5-8. Daily delay

Clock Time	Daily Ops	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR
x:00	%																								
12-1																									
1-2																									
2-3																									
3-4																									
4-5																									
5-6																									
6-7																									
7-8																									
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18-19																									
19-20																									
20-21																									
21-22																									
22-23																									
23-24																									

Figure A5-9. Tabulation hourly demand for representative days

| Month | No. Days | Demand per Month | Av. Daily Demand | Weather | Percent Occur. | Representative Day(s) | | | Monthly Delay (minutes) | |
						No. of Days	Demand	Delay	VFR/IFR	Total
1	2	3	4	5	6	7	8	9	10	11

Figure A5-11. Annual delay

| Demand | Runway-use | | Capacity Figure No. | | Aircraft Mix | | | | Mix Index | Arrivals | Touch and Go | Runway Exits | | Hrly. Cap. Base | T & G Factor | Exit Factor | Hourly Capacity (000) |
	Diagram	No.	VFR	IFR	%A	%B	%C	%D	%(C+3D)	%	%	Location	No.	C*	T	E	C*·T·E
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Figure A5-10. Hourly delay, different demands

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