AC 150/5060-

AIRPORT CAPACITY CRITERIA USED IN PREPARING THE NATIONAL AIRPORT PLAN

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: AIRPORT CAPACITY CRITERIA USED IN PREPARING THE NATIONAL AIRPORT PLAN

1. PURPOSE. This circular presents the capacity methodology used by the Federal Aviation Administration for determining when additional runways, taxiways, and aprons should be recommended in the National Airport Plan. The guidance material presented is also useful to sponsors and engineers in developing Airport Layout Plans and for determining when additional airport pavement facilities should be provided to increase airport capacity to accommodate more aircraft.

2. CANCELLATION. This circular cancels AC 150/5060-1, Airport Capacity Criteria Used in Preparing the National Airport Plan, dated November 10, 1966.

3. REFERENCES.

   a. Annual National Airport Plan for the next Five Fiscal Years -- Available through the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, for $1.00.

   b. Advisory Circular 150/5310-1, Preparation of Airport Layout Plans, dated September 9, 1965 -- Available through the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D. C. 20590.

   c. Advisory Circular 150/5330-3, Wind Effect on Runway Orientation, dated May 5, 1966 -- Available through the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D. C. 20590.

   d. Advisory Circular 150/5335-1, Airport Taxiways, dated January 28, 1965 -- Available through the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D. C. 20590.

Initiated by: AS-440

4. BACKGROUND. Advisory Circular 150/5060-1 was originally issued on November 10, 1966. Appendix 2 of this circular is based on the publication, Airport Capacity, FAA BRD-136, prepared by Airborne Instruments Laboratory (AIL) and published in June 1963. The AIL is in the process of updating the 1963 publication. From review of the initial draft of this update, it is apparent that significant changes will occur to the airport capacity calculations as obtained from the advisory circular when large aircraft are involved. New Paragraph 3 and the other changes now shown in Advisory Circular 150/5060-1A will provide an interim adjustment to the advisory circular until the update of the report is completed by AIL. The AIL update probably will not be issued prior to late in FY 1969. When the update is issued, any additional specific changes to AC 150/5060-1A will be made. Appendix 3 has been added to the circular to outline the proper method for assigning winds in a capacity analysis.

5. SCOPE. The criteria on capacity for runways, taxiways, and aprons given in this advisory circular, except for minor editorial changes or otherwise noted, are taken verbatim from FAA directives. Appendix 2 of this circular provides the methodology used in determining delays and capacity related to the runway pavement system, and Appendix 3 outlines the method for assigning winds in a capacity analysis.

6. EXPLANATION OF REVISIONS.

a. New cover page, table of contents, new Page 8, and new Appendix 3 have been added to the circular.

b. The following phrase has been added to the last sentence of the first paragraph under 2c: "once a parallel taxiway has been justified."

c. Table 1, Appendix 1, under parallel runways, the three references to 5,000' on layouts 1a and 1b have been changed to 3,500' and the following statement added to the remarks column: "For parallel runways spaced greater than 3,500' but less than 5,000', for second column of 1a and 1b may be increased by 20%.

d. Table 1, Appendix 2, B-747 and B-2707 have been added to the list of type "A" aircraft and "Aero" to "Jet" on the first type "C" aircraft.

e. Appendix 2, Paragraph 1d, the parenthetical statement at the beginning of this paragraph has been deleted.

f. Appendix 2, Paragraph 2d, Example 2, the number 65 has been inserted as the answer to the final calculation.

g. Appendix 2, Figure 1, the graph reference to Figures 12 and 13 has been made more legible.

h. Appendix 2, Figure 2, instruction section, the Page 50 reference has been changed to Page 11.

i. Appendix 2, Figure 7, since the configuration of landing threshold offset as shown in the example at the top of this figure reduces capacity, all + and - symbols have been reversed. The correction curve for offset thresholds is still correct. The open curve on Figure 7 may also be used for simultaneous approach - departure IFR parallels. (See AT P 7110.8.)

j. Appendix 2, Figure 9, the peak hour operations as a percent of peak daily operations which corresponds to each of the curves has been added for additional explanation and use of this graph.

k. Appendix 2, Figure 14, Example section, the reference to Figure 10 has been changed to Figure 1 and on the graph the horizontal line has been darkened between correction factor 1.20 and exit rating 1, correction for touch and go.

l. Information on wind data analysis previously contained in Paragraph 4 of Appendix 2 has been transfered to Appendix 3 in toto.

7. <u>HOW TO GET THIS CIRCULAR</u>. Additional copies of this circular may be obtained from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D. C. 20590.

Chester G. Bowers
Chester G. Bowers
Director, Airports Service

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. INTRODUCTION. The Federal Aviation Administration has developed a tool for determining airport runway capacity and when runway capacity should be increased depending on cost of development. The method presented in this advisory circular is used in preparing the National Airport Plan (NAP) which is a document prepared annually by the FAA. The NAP identifies the airports in the national system of airports and shows airport improvements recommended by the FAA within the ensuing five years. The methodology presented herein is equally useful to those concerned with airport development, and, therefore, the agency's instructions to its own people are being provided to the public. The information given in this advisory circular pertains to planning criteria for runways, taxiways, and aprons. The use of the techniques presented in this document was intended for internal FAA use for advance planning and thus should not preclude the application of more detailed procedures by an airport consultant in developing the final Airport Layout Plan, especially in the area of cost/benefit considerations.

. CAPACITY CRITERIA. For NAP purposes, an airport runway(s) may generally be considered to have reached capacity when delays to departures average four minutes during the normal peak two hour period (adjacent hours) of the week. At specific runways used by small aircraft only, this departure delay level is two minutes for the peak hour of the week (see paragraph 1 of Appendix 2 for a more complete definition). The timing of capacity oriented airport development does not necessarily depend on demand reaching these delay levels. Airport facility development may be included in the NAP so that its theoretical completion date falls before "four-minute" or "two-minute" capacity is reached. However, airport facility cost must be correspondingly low in order to justify development at lower delay levels, thus providing a satisfactory benefit/cost basis for its inclusion. The criteria are expressed in terms of activity levels and development costs. Capacity of a given runway configuration may be determined by application of procedures outlined in Appendix 2. The use of the procedures in the Appendix can be avoided in most instances by the use of Table 1 of Appendix 1. This table specifies the probable lower limits of runway activity that must be forecast within the NAP period in order to use the criteria set forth in the following subsections of this paragraph. Thus, if the forecast activity falls below these lower limits, additional runways for capacity purposes would not normally be justified. The upper limits of Table 1 represent the probable lower values of runway capacity for appropriate configurations that would be obtained by use of the Appendix. In between the upper and lower limits given in Table 1, the point at which additional facilities should be planned is dependent on cost. If the demand forecast for the NAP period is more than 20% above the value determined by the use of Table 1 (consistent with the established cost criteria) the development may be included in the NAP without the use of Appendix 2. An example of the use of this table is given at the end of paragraph 2a.

a. Runways. The annual capacity of a single runway airport configuration will exceed 150,000 operations with suitable taxiway facilities. An airport runway system that is primarily used by locally based aircraft will probably not attain an annual demand of more than 150,000 operations if its based aircraft total is less than 200. However, the development of an additional runway based on capacity requirements may be considered for airports with a current demand level below 150,000, if construction cost is nominal and if the traffic is increasing. For the purposes of these instructions, nominal cost for all associated construction is considered to be $50 per linear foot for runways serving small aircraft, $150 per foot for runways serving twin engine aircraft, and $300 per foot for runways serving all aircraft. When costs are four times the foregoing values, additional facilities should not be planned for development until runway demand equals capacity. However, for costs between these limits (one to four times nominal), plan the timing of development in proportion to the cost as shown in the "example" at the end of paragraph 2a, (acquisition of land may precede construction by three to five years, see paragraph 2e).

The following criteria should be applied in determining the need for an additional runway to enhance capacity. These criteria are currently applicable to about 150 airports nationally, although for airport layout planning purposes they should apply to many more.

(1) A parallel runway may be included when the demand is forecast to reach the existing runway capacity during the NAP period (ensuing five years).

(2) A new short parallel runway may be justified at an airport forecast to have, within the NAP period, a demand greater than 60% of existing runway capacity, providing the gross cost for this facility (all associated costs) is nominal. To qualify under this 60% criterion, taxiing distances between the new runway and the terminus area must be favorable. In general, extra long taxiing distances will result in reduced demand for this runway and invalidate the 60% criterion. A "short" parallel runway should be long enough and wide enough to provide sufficient capacity so that additional construction for capacity purposes due to changes in airport population would not be required within five years following completion of construction. See Appendix 2, paragraph 2e, to analyze the effect of runway length on capacity.

(3) An airport having 75,000 operations consisting of 30,000 or more transport type aircraft may be planned for a short parallel runway to serve small aircraft if the gross cost for this facility is less than $50 per linear foot (includes all runway/taxiway costs).

(4) When airport demand reaches or is expected to reach 75% or more of the capacity of the existing parallel runway configuration within the NAP period, a parallel runway can be extended to increase capacity providing the cost is nominal. (See paragraph 2a on preceding page.)

(5) Although intersecting or open V runways are not generally recommended for the purpose of increasing capacity, consideration of terrain, noise, or obstructions may make these layouts acceptable. To be acceptable from a capacity standpoint, these configurations may be included in the NAP provided justification is given and a comparison of capacities and costs is made with the parallel runway configuration. It should be shown that the configuration chosen will provide sufficient runway capacity to accommodate demand into the foreseeable future or will provide a substantial increase in runway capacity at a much reduced cost compared to a parallel. If the solution does not provide adequate runway capacity for at least 10 years following the completion of construction, it should be shown that other ways to increase capacity are not economically feasible.

Example: The following example demonstrates the use of the foregoing criteria and Table 1, Appendix 1:

A single runway airport has a forecast demand in five years of 120,000 operations. Fifty percent of the operations are transport category (over 12,500 pounds). A short parallel 4,500-foot runway is planned to principally serve the nontransport activity which consists of a significant portion of twin engine aircraft. The cost is anticipated to be $300 per linear foot of runway including land, taxiways, grading, paving, lighting, etc. From Table 1, the probable lower limits at which to plan the foregoing runway is interpolated to be from 85,000 to 145,000 operations: i.e., the forecast population of 50% greater than 12,500 pounds is about halfway between the two columns of annual operations.

The 85,000 operations may justify the development if the cost were \$150/ft. of runway (see Par 2a); if the cost is 4 x \$150/ft. of runway, the development may not be justified until airport activity reached 145,000 operations or more. Since the cost is \$300/foot, the operating rate which should be used as the basis for deciding whether or not to use the Appendix is:

$$85{,}000 + \frac{(300-150)}{(600-150)}\,(145{,}000-85{,}000) = 105{,}000 \text{ operations.}$$

Since the demand of 120,000 is less than 20% greater than 105,000 operations, it is necessary to use the Appendix to determine runway capacity more accurately. Had the forecast demand been 140,000 operations instead of 120,000 operations, the new runway would have qualified for the NAP without the use of the Appendix since it would have been more than 20% greater than 105,000 operations. Also, it would not have been necessary to use the Appendix had the forecast demand been less than 105,000 operations.

b. Taxiways. The addition of taxiway facilities to the runway configuration increases airport operational efficiency by allowing the runway to realize its maximum capacity potential.

(1) Taxiway turnarounds as described in AC 150/5335-1 at both ends of the runway are recommended for the fundamental airport (i.e., a minimum airport facility) provided the cost of the turnarounds is not prohibitive.

At locations where unusual conditions exist which make it more practical and economical to construct a partial parallel taxiway in lieu of a turnaround, it should be the recommended development. A stub taxiway to the apron should also be recommended for the fundamental airport.

(2) Parallel taxiways, assuming reasonableness of cost, may be justified for inclusion in the NAP when any one of the following criteria is forecast to be reached within the NAP period. (The normal peak hour referred to below is the peak hour of the week averaged for one year; however, as applied to instrument approaches it is the average of the highest 10% of the hours during which time instrument approaches are being made):

(a) There are four instrument approaches (those which are counted toward annual instrument approaches) during the normal peak hour;

(b) the annual operations total 50,000;

(c) the normal peak hour itinerant operations total 20; or

(d) the hourly total (itinerant plus local) operations are:

1 30 operations per normal peak hour - for runways serving more than 90% small aircraft and where there are less than 20% touch and go operations; 40 operations per normal peak hour where there are more than 20% touch and go operations (each touch and go is considered two operations).

2 30 operations per normal peak hour - for runways serving 60% to 90% small aircraft.

3 20 operations per normal peak hour - for runways serving 40% to 100% large aircraft.

If construction costs are more than twice average costs, (i.e., average for the state or region) the above activity levels must be increased 25% to justify parallel taxiway development. Parallel taxiways provide safety benefits in addition to increased efficiency. These safety benefits cannot be easily assessed. However, the criteria given are based on having stage development following the construction of taxiway turnarounds.

If the construction cost of a parallel taxiway doe not exceed the cost of turnarounds by more than on third, it should be the preferred development.

A partial parallel taxiway, or equivalent (as can obtained by intersecting runways), provides satisf efficiency as well as safety to aircraft operation In many instances, adequate capacity can be obtain by the construction of a partial parallel taxiway. This solution can prove especially desirable where construction costs are high. A partial parallel i generally economically justified at activity level equal to 60% of the values given for full parallel If a full or partial taxiway is strongly preferred over taxiway turnarounds, it may be planned if cur operations are 20,000 per year, if there are no tu arounds existing, and if cost is less than half th average costs.

(3) Exit taxiways beyond a basic layout of one at the run ends and one in between are justified for inclusion in NAP if demand is forecast to exceed 40% of the runway capacity providing taxiway costs are average, and at 7 of capacity if costs are high (more than four times av A sufficient number of exits should be planned so that additional exits would not be required within five yea following the completion of construction.

c. Holding aprons and bypass taxiways enhance airport capacity. facilities seldom, if ever, constitute restraints on the att of full airport capacity within the existing airport propert land areas are normally always available to permit their con tion. However, the need for these facilities should be dete sufficiently in advance to prevent bottlenecks and delays th would occur due to a lack of these facilities. The followin criteria should be applied in determining the need for holdi aprons and bypass taxiways, once a parallel taxiway has been justified.

When activity is forecast to reach 30 total operations per n peak hour within the NAP period, or 20,000 annual itinerant tions or 75,000 total operations, a holding apron should be planned, giving due consideration to other factors. These f are:

Mixture of types of aircraft such as air carrier or military aircraft operations simultaneously with general aviation aircraft.

The intensity of activity (i.e., the amount of operations in a given period of time, usually in an hour or in a day).

The airport layout (i.e., from the standpoint of "as-built" conditions).

Location of navigational aids (i.e., the criticial area surrounding a navaid - existing or proposed - in relation to possible holding apron locations).

:re is insufficient economic justification for construction of a .ding apron to accommodate less than two aircraft. Also provision ' more than four aircraft is not usually justified. If the traf- . density is such that more than four holding positions appear :essary, investigation will generally disclose that another .ution to the problem is in order.

<u>minal Aprons, Aircraft Loading, and Parking Aprons.</u> The number gates required is related to the maximum number of aircraft being 'viced in the terminal area at any one time during the day. It : been found that future gate requirements are proportional to the wth in enplaned passengers. Unless information indicates other- .e, such as changes in payload, apron occupancy, and peaking of 1and, future gate requirements can be estimated by projecting 'rent gate requirements in proportion to the growth of enplaned 3sengers and increased by 10 percent to account for flexibility scheduling and operational factors.

'ormation on which to base requirements for general aviation 'king apron positions is presently limited. However, as a guide, :ure requirements can be estimated from current needs in proportion the growth in general aviation operations. Current requirements ıld not generally exceed the number of itinerant general aviation :rations during the normal peak hour (itinerant) of the week. The 'mal peak hour of the week for the total traffic can be estimated om the annual operations by use of Figure 9, Appendix 2. The 'mal peak hour itinerant general aviation aircraft can then be :imated by multiplying the total peak hour operations by the 'tion of itinerant general aviation operations at the airport : obtained from air traffic activity statistics).

e. Land Acquisition Prior to Reaching Capacity. If land values ar increasing rapidly, adequate property interests for airport de ment should be included in the NAP at the same time the airpor development is planned. However, where land values are expect increase at more than 6 percent per year, compounded annually, property interests may be included in the NAP three to five ye advance of forecast airport development.

3. ADJUSTMENT TO CAPACITY CALCULATIONS WHEN LARGE AIRCRAFT ARE IN USE

New information has been obtained through additional investigation observation of large aircraft operating at airports with control t Class "A" aircraft operate and can be handled by air traffic contr significantly better than original data indicated. This improved operation in turn improves capacity; and appropriate adjustment to airport capacity calculations from Appendix 2 should be made where Class "A" aircraft are included in the calculations. The followin general rule applies to the detailed calculations of Appendix 2:

For 0% Class "A" aircraft - no adjustment.

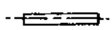
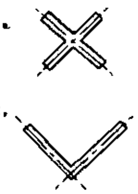
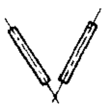
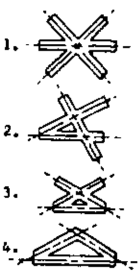
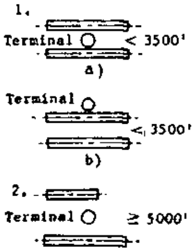
For 60% or more Class "A" aircraft, increase the practical ann capacity by 10%. If individual hourly capacities of various configurations are the objectives of the study, these should b increased by 10%.

For percentages between 0 and 60 Class "A", proportion the adju For example, at 30% Class "A" capacity would be increased 5%.

The above adjustment will hold true for all situations except two curves on Figure 7 and the top curve on Figure 8 of Appendix 2. T two curves on Figure 7 are the "arrival only" curve at the bottom the graph and the "open V runway curve operations away from inters All three of these curves remain the same -- no 10% increase.

TABLE 1

WHEN TO PLAN FOR ADDITIONAL RUNWAYS - PROBABLE LOWER RANGE OF VALUES 1/

Configuration		% Aircraft over 12,500 # Using Airport		Remarks
		less than 10% 2/	greater than 80%	
		Annual Operations		
	Single Runway	90,000-150,000	80,000-140,000	
 1. 2.	Two Intersecting Runways Location of intersection 1. In the middle or far end 2. At ends, operations away from intersection. a. 60% or less of the time b. 80% of time c. 90% of time d. 100% of time	 95,000-160,000 95,000-160,000 120,000-200,000 135,000-225,000 160,000-270,000	 95,000-160,000 95,000-160,000 100,000-170,000 125,000-210,000 145,000-230,000	Capacity may be less than shown if more than 50% of aircraft cannot use one runway, re para. 2e of Appendix 2, for effects of restricted runway use. This remark applies to all other configurations shown below.
	Open V Runways Operations away from intx. 1. 60% or less of the time 2. 80% of the time 3. 90% of the time 4. 100% of the time	 110,000-180,000 135,000-225,000 150,000-250,000 210,000-350,000	 100,000-170,000 120,000-200,000 135,000-225,000 160,000-270,000	
 1. 2. 3. 4.	Three Intersecting Runways Location of intersections 1. All at middle of runways 2. One pair at ends 3. Two pairs intersecting at ends. 4. All runways intersecting at ends.	 100,000-170,000 110,000-180,000 125,000-210,000 160,000-270,000	 100,000-170,000 110,000-180,000 125,000-210,000 140,000-230,000	
	Parallel Runways 1. Close parallels (less than 3500' separation) a) No taxiway crossing problem. b) Taxiways crossing active runways more than 1/3 from active thresholds. 2. Open parallels (more than 5000' separation)	 240,000-400,000 170,000-280,000 240,000-400,000	 140,000-230,000 140,000-230,000 180,000-300,000	Low values were obtained by close parallels in the second column due to IFR limited capacities. For parallel runways spaced greater than 3500' but less than 5000', the second column of 1a and 1b may be increased by 20%.

1/ The values shown may be used as a guide to determine whether the methodology in Appendix 2 should be applied. For populations between those given, use linear interpolation for establishing annual capacities. The lower value shown for each configuration represents 60 percent of the probable lower limit of annual capacity. The higher value is the probable lower limit of annual capacity. The weighted hourly values of capacities that correspond to annual capacity, may be obtained by use of Figure 9 of Appendix 2. Runways with good exits (exit rate 2) were used to obtain the capacities given in this tabulation. In general, when planning for additional runways assume the exit rating is 1 or 2, since a fully developed runway should be provided prior to planning additional runways for capacity purposes.

2/ Touch and go operations were assumed to make up 60 percent of the total for populations consisting of 90 percent or more small aircraft. (See Figure 14 of Appendix 2.)

APPENDIX 2

AIRPORT RUNWAY CAPACITY DETERMINATION

1. INTRODUCTION. The methodology presented in this appendix is based on the publication, Airport Capacity, FAA BRD-136.[1] This publication can be used for reference and further discussion of the runway capacity methodology. The following factors are important to understanding the quantitative basis of hourly and annual capacities:

a. Hourly runway capacity is defined as that movement rate of aircraft which results in a reasonably acceptable average delay to operations. This delay depends on the aircraft population, the weather (IFR or VFR), and if the delay is in arrivals or departures. The delay levels considered as reasonably acceptable for general airport planning purposes are as follows: (See Table 1 of this Appendix for a listing of aircraft in each of the classes discussed below.)

(1) VFR Departures

Four minutes average delay where Class A & B aircraft constitute more than 10 percent of the population.

Three minutes average delay where Class A and B aircraft constitute one percent to 10 percent of the total aircraft population.

Two minutes where less than one percent of the population consists of Class A and B aircraft.

(2) VFR Arrivals

One minute average delay to all aircraft.

(3) IFR Arrivals or Departures (during IFR weather)

Four minutes average delay to arrivals or departures, whichever occur first.

The runway capacity is determined at whichever of these delay levels occur first. For example: During IFR weather a four minute arrival delay and three minute departure delay is considered runway capacity operation even though the average delay when arrivals equal departures is 3.5 minutes.

1/ See reference 1 of Appendix 4.

TABLE I 1/

CLASSIFICATION OF AIRCRAFT TYPES			
Aircraft Class	Aircraft Type	Aircraft Class	Aircraft Type
A	BAC VC 10 Boeing 707, 720, 747 and 2707 series Convair 880 and 990 de Haviland Comet Douglas DC-8 series Sud-Aviation Caravelle	D 2/	Aero Commander Beech Bonanza and Debonair Beech 50 Twin Bonanza Beech Queen Air Beech Travel Air Cessna Skyknight de Haviland Dove Piper Apache Piper Aztec
B	BAC 111 BAC Vanguard Boeing 727, 737, and DC-9 Bristol Brittannia Convair 240, 340, 440, 640 Douglas DC-6, DC-7 series Fairchild F-227 Lockheed Constellation Lockheed Electra Lockheed JetStar	E 2/	Aeronca Champion Beech Musketeer Cessna 140, 150, 170, 180, 210 series de Havilland Beaver (L-20) Mooney M20
C	Jet Commander Beech 18 series de Havilland 125 Douglas B-26, DC-3 Fairchild F-27 Grumman Gulfstream Lockheed Lodestar, Learstar series Nord 262 North American T-39 (Sabre Liner) Potez 840		

1/ These classes are not directly comparable to Terminal Instrument Procedures (TERPs) approach categories which define aircraft according to approach speeds and aircraft weights as follows:

Approach Category	Speed in Knots	or	Weight in Pounds
A	50-90		30,000 or less
B	91-120		30,001-60,000
C	121-140		60,001-150,000
D	141-165		weight over 150,000
E	Speed over 165 knots,		weight not considered

The above categories include such aircraft as:

Category A Aero Commander 680F; Grand Commander; Beechcraft; Douglas DC-3; most light single engine aircraft.

Category B Jet Commander; Beechcraft King Air(90); Super (18) and Queen Air (80); Convair-240, 340 and 580; Martin 202 and 204; Fairchild F-27.

Category C Boeing 727; Caravelle; Douglas DC-4, 6, 7, and 9; Lockheed-649, 749, 1049, JetStar and 188.

Category D Boeing 707 and 720; Convair 880 and 990; Douglas DC-8.

2/ Classes D and E have been combined in these instructions. However, in order to facilitate comparability with the "Airport Capacity Handbook", identity of these two classes has been retained.

The IFR runway capacities given in Figures 7 and 8 were based on the use of speed control and improved radar control anticipated to be used in the 1970 to 1975 time period. Current IFR runway capacities are about 10 percent less than these values. In some cases where a high percentage of Class "A" aircraft exists, the VFR runway capacities were increased slightly over those obtained from the Airport Capacity Handbook because of the improved performance of this category of aircraft observed in today's operations.

b. Hourly Capacity versus Hourly Demand. The airport runway capacity curves are based on having a steady demand, hour after hour, of the same magnitude. It was determined that the hourly runway capacity obtained from the curves should be compared to the average demand for two hours where any Class "A" and "B" aircraft are included in the population and one hour otherwise. This procedure has been found to approximate the "steady state" solution and permits direct utilization of the capacity curves.

c. Annual Runway Capacities are based on having certain assumed distributions of demand which have been found to give practical answers when applied to actual problems. In general, these distributions are:

(1) For airports serving 90 percent or more Class "D" plus "E" aircraft, the activity during the peak hour of the week is 20 percent of the peak daily traffic.

(2) For airports serving 70 percent Class "D" plus "E" aircraft, the activity during the peak hour of the week is 15 percent of the peak daily traffic.

(3) For airports serving 50 percent Class "D" plus "E" aircraft, the peak hour of the week is 12.5 percent of the peak daily traffic, if local operations are 30 percent or more of the traffic.

(4) For airports serving 50 percent Class "D" plus "E" aircraft, the peak hour of the week is 10 percent of the peak daily traffic, if local operations are less than 30 percent of the traffic.

(5) For airports serving 40 percent or less Class "D" plus "E" aircraft, the peak hour of the week is eight percent of the peak daily traffic.

It was further assumed that there were 50 peak activity days per year at each airport, about 200 average days, about 50 below average days, and the rest IFR days. Distribution of demand during these periods varies, depending on population; however, the most important effect with regard to annual runway capacity was the assumption that during the 200 average days operations were at 80 percent of the peak days. These distributions of runway demand have been found to give reasonably accurate answers for annual runway capacity even though the distributions in themselves may vary considerably from actual observations; the reason for this is that there are a number of compensating factors involved. Nevertheless, if a sufficient number of hourly observations have been obtained at an airport, they may be used in lieu of annual figures for the purpose of planning new runway facilities. In this regard, averaging the runway demand for about 50 peak VFR periods or 10 peak IFR periods is sufficiently representative of peak VFR conditions or IFR conditions, respectively. In using hourly runway demand, either IFR or VFR observations have to be made, whichever is critical (e.g., at most airports VFR data are all that is required), and the demand should be averaged over a one-hour or two-hour period as specified in the preceding paragraph b.

d. Hourly and Annual Delays versus Capacity. The airport runway capacity curves give values representing practical operating capacities at the prementioned levels of delay. If hourly delays were to be increased to an average of 15 minutes to a half hour during peak periods, a capacity of 10 percent to 20 percent greater can be achieved then those given by the curves. In addition to this, for airports with Class "A" or "B" aircraft, if there is a sharp rise in runway demand during the peak hour as compared to the previous hour, the number of aircraft that can be handled during the peak hour would be greater than obtained from the capacity curves. For example, if the hour preceding the peak had a demand equal to 80 percent of the peak hour, the airport would be able to handle about 10 percent more operations without exceeding the four minute average delay value.

The foregoing helps explain why airports may be observed to occasionally handle peak demands of about 30 percent more than obtained from the capacity curves.

Figures 15 and 16 may be used to determine delays that average five minutes or less. For delays greater than five minutes, use the method in "Capacity of Airport Systems in Metropolitan Areas - Methodology of Analysis" 1/ pages E-11 and E-12.

1/ See reference 3 of Appendix 4.