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AC 150/5325-7

IS YOUR AIRPORT READY FOR THE BOEING 747

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DEPARTMENT OF TRANSPORTATION
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SUBJECT: IS YOUR AIRPORT READY FOR THE BOEING 747

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1. <u>PURPOSE</u>. This advisory circular presents a preliminary condensed survey of today's airport design criteria and their suitability to the presently known characteristics of the Boeing 747 airplane.

2. <u>REFERENCES</u>. The Bibliography, Appendix 8, enumerates publications of the Federal Aviation Administration for further guidance in the assessment of your airport's capability for accommodating this new airplane.

3. <u>HOW TO GET THIS PUBLICATION</u>. Obtain additional copies of this circular AC 150/5325-7, Is Your Airport Ready For The Boeing 747, from the Department of Transportation, Federal Aviation Administration, Distribution Unit, TAD 484.3, Washington, D. C. 20590.

William M. Flener

William M. Flener
Acting Director
Airports Service

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1. INTRODUCTION.

a. The revolutionary transition from piston-engine power to the jet age was accomplished with remarkably little difficulty, but there were problems. Generally, the change to turbine power in civil use was performed in an orderly manner, and the standards of operations, airworthiness and airport design that had distinguished the growth of commercial service within the period 1940-1960 were maintained despite significant differences in a number of major aspects. The fact that these differences did not disrupt growth at this vital stage of airport development was the result of a similarity of the basic aircraft characteristics that affect airport design, the gradual introduction of these aircraft into use within the airport system, and the cooperation of manufacturers, airlines and municipalities with Federal agencies.

b. The overall use of civil jet transport aircraft reinforced the growth of air transportation to a significant degree. Because of their high speeds, greater passenger comfort and flexibility of operations, turbojet airplanes were an immediate success with the traveling public. Their widespread use and complete acceptance have stimulated growth to the extent that a new step in the evolution of air transportation became inevitable. Industry's response to this need is the development of giant airliners which will further enhance air travel. The first of these new airplanes is the Boeing 747 which is scheduled to be operational in the early 1970's.

c. The Boeing 747 is being designed to operate at airports that are developed to accommodate today's larger jet airplanes with a minimum additional impact on airport design. Nevertheless, the great size and weight of the 747 warrants an evaluation of existing airport facilities and criteria to preclude stifling present operational effectiveness. The Boeing 747 is longer, wider, heavier, and taller than present-day large jets. Since in the design and development of airports, airplane requirements prevail, the airport facilities and/or operational procedures may need to be modified to retain the existing levels of safety, efficiency and convenience. This circular contains a general description of the 747's characteristics as they relate to the capability of airports developed in accordance with existing airport design criteria for the B-707, DC-8, CV-990, etc.

d. The material set forth in this paper does not constitute new design standards. It does, however, provide guidance material indicating a relationship between presently known characteristics of the Boeing 747 and current airport standards. As future aircraft design and development progress, indications of pilot capability with the aircraft become known, and certain necessary ground maneuvering test results become available, changes in airport design criteria will be incorporated in the appropriate agency advisory circulars.

2. APPENDIXES.

a. Appendixes to this advisory circular depict various aspects of the Boeing 747 as related to airport design.

b. Appendix 1 sets forth aircraft data of the normally used airplane dimensions needed in determining airport design components.

c. Runway orientation, as influenced by crosswind, is contained in Appendix 2.

d. An examination of runway length requirements for takeoff and landing, Appendix 3, indicates that the Boeing 747 meets the design requirements of existing standards.

e. There is sufficient knowledge available now to realize a need for increased taxiway and pavement fillets as shown in Appendix 4.

f. Appendix 5 illustrates the method for location of exit taxiways. It also depicts a layout for a 90 degree turn exit with additional pavement for the initial B-747 and its stretched counterpart.

g. The vastness of the area needed to park the B-747 is described in Appendix 6. Careful examination of terminal parking facilities should be made in the planning of apron expansion or parking accommodations for the B-747.

h. Design items of particular concern to the B-747 are recapped in Appendix 7 in tabular form. Included in the tables are pertinent remarks and references as a reminder to airport authorities and engineers in reviewing the adequacy of any specific airport.

APPENDIX 8. BIBLIOGRAPHY

1. The following items may be obtained from the Superintendent of Documents, United States Government Printing Office, Washington, D. C. 10402. No c.o.d. orders are accepted. Enclose with your request a check or money order made payable to the Superintendent of Documents.

a. Federal Aviation Regulations, Part 1, Definitions and Abbreviations. ($0.25)

b. Federal Aviation Regulations, Part 25, Airworthiness Standards: Transport Category Airplanes. ($1.50)

c. Federal Aviation Regulations, Part 77, Objects Affecting Navigable Airspace. ($0.35)

d. Federal Aviation Regulations, Part 121, Certification and Operations: Air Carriers and Commercial Operators of Large Aircraft. ($1.25)

2. Obtain copies of the following circulars and additional copies of this circular from the Department of Transportation, Federal Aviation Administration, Distribution Unit, TAD 484.3, Washington, D. C. 20590.

a. AC 120-20, Criteria for Approval of Category II Landing Weather Minima.

b. AC 121-12, Wet or Slippery Runways.

c. AC 150/5060-1, Airport Capacity Criteria Used in Preparing the National Airport Plan.

d. AC 150-5320-6A, Airport Paving.

e. AC 150-5325-4, Runway Length Requirements for Airport Design.

f. AC 150-5325-5A, Aircraft Data.

g. AC 150-5325-6, Effects of Jet Blast.

h. AC 150-5330-3, Wind Effect on Runway Orientation.

i. AC 150-5335-1, Airport Taxiways.

j. AC 150-5335-2, Airport Aprons.

k. AC 150/5340-1A, Marking of Serviceable Runways and Taxiways.

l. AC 150-5340-4A, Installation Details for Runway Centerline and Touchdown Zone Lighting Systems.

m. AC 150-5340-13A, High Intensity Runway Lighting Systems.

n. AC 150-5340-15A, Taxiway Edge Lighting System.

i. A comprehensive evaluation must be made to determine if your airport is ready for the next generation of airplanes. Appendix 8 is a bibliography of some of the pertinent criteria to be considered for the future in planning modifications of your airport.

3. ADDITIONAL CONSIDERATIONS. Early modification of the basic facilities enumerated in the appendixes will insure acceptance of this and similarly large airplanes soon to be available. However, as the number of operations of these aircraft increase and more such aircraft become an integral part of the fleet, it may be prudent to seek other avenues in master planning airport needs. Several suggestions for consideration are:

a. Preparation and modification of only one runway at this time.

b. Establishment of carefully planned, especially designated, taxiing routes for the B-747.

c. New separate airport facilities for these or other types of aircraft having a high operational level at specific locations.

d. Adoption of new satellite concepts on the airport to segregate ground traffic and passenger and cargo handling. Independent facilities would enhance flexibility in movement. This flexibility could possibly eliminate special blast protection devices and the need for additional ground maneuvering equipment for parking by allowing the use of aircraft power. Separate facilities should provide ample space to obtain vital horizontal and vertical clearances.

e. Development of innovations to the present day airport concept such as centrally located city terminal facilities for passengers and cargo with direct high speed shuttle to aircraft holding areas.

APPENDIX 1. AIRCRAFT DATA

1. INTRODUCTION.

   a. Airplane physical characteristics have operational and economic significance that could materially affect airport development, use, firefighting, and rescue services requirements. To insure maximum possible safety and utilization consistent with anticipated demand, engineers must consider these characteristics when planning new airports or improving existing airports.

   b. To handle anticipated increases in air traffic, for example, the airport designer must consider the influences of the physical characteristics of the airplanes on ground operating areas since a low acceptance rate of a particular ground area may govern the acceptance rate of the entire airport. Engineering personnel must weigh such considerations in establishing the design and utility of landing areas, taxiways, ramps, aprons, fueling facilities, and gate positions.

   c. The general arrangement, dimensions, and clearance data on airplanes in common use in the civil fleet are presented in AC 150/5325-5A, Aircraft Data. To assist in comparing the Boeing 747 with the other airplanes in the civil fleet, the Boeing 747 data are presented in the same format.

2. EXPLANATORY INSTRUCTIONS. To assist in the proper interpretation of certain column headings in this appendix, the following explanations are provided:

   a. The distance from outside wheel to wing tip is the horizontal distance from the outside of the outboard main landing gear wheel to the wing tip.

   b. Wheelbase is the distance between the centerline of the nose gear to the centerline of the forward trucks of the main gear. The distance between the centerline of the forward and rear trucks of the main gear is 10 feet.

   c. Nose to centerline of main gear is the distance between the airplane nose to the centerline of the forward trucks of the main gear.

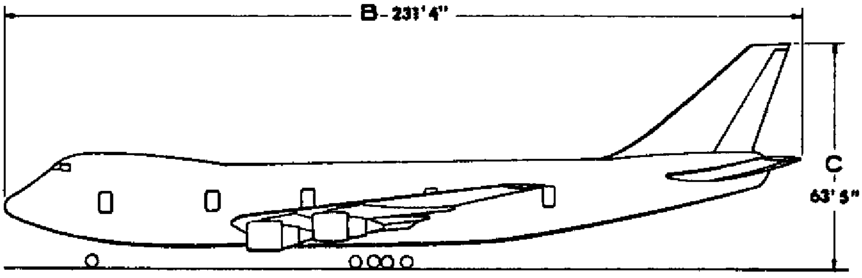
   d. The distance from the pivot point to the centerline of the airplane is for the full nose wheel steering angle of 70 degrees.

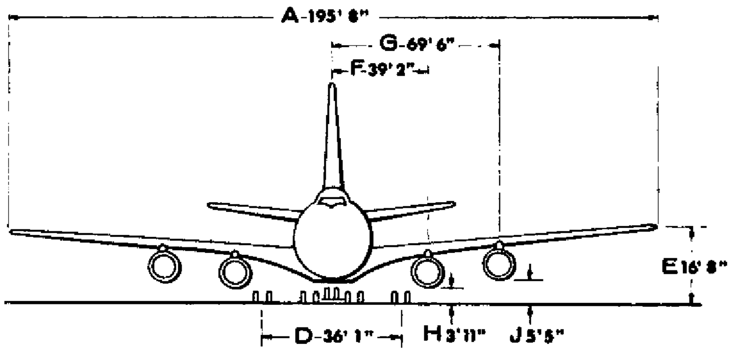
e. The turning radius is for full nose wheel steering angle and is the distance from the pivot point to the furthest extremity of the airplane.

f. The "H" inboard and "J" outboard dimensions are the distances from the ground to the lowest point of the jet engine nacelle for a fully loaded airplane.

g. All dimensions shown which are influenced by aircraft weight are based on a fully loaded airplane.

BOEING 747





SEE FIGURE 2 FOR PLAN VIEW

MAXIMUM TAKEOFF WEIGHT	MAXIMUM LANDING WEIGHT	DIST. OUTSIDE WHEEL TO WING TIP	WHEEL BASE	NOSE TO ℄ MAIN GEAR	PIVOT POINT TO ℄ AIRCRAFT	TURN RADIUS
680,000#	564,000#	77' 1"	78' 11"	104' 5"	47' 0"	156' 0"

A SPAN	B LENGTH	C HEIGHT OVER-ALL	D TREAD	E WING TIP	F INBD	G OUTBD	H INBD	J OUTBD
195' 8"	231' 4"	63' 5"	36' 1"	16' 8"	39' 2"	69' 6"	3' 11"	5' 5"

FIGURE 1. AIRCRAFT DATA FOR BOEING 747

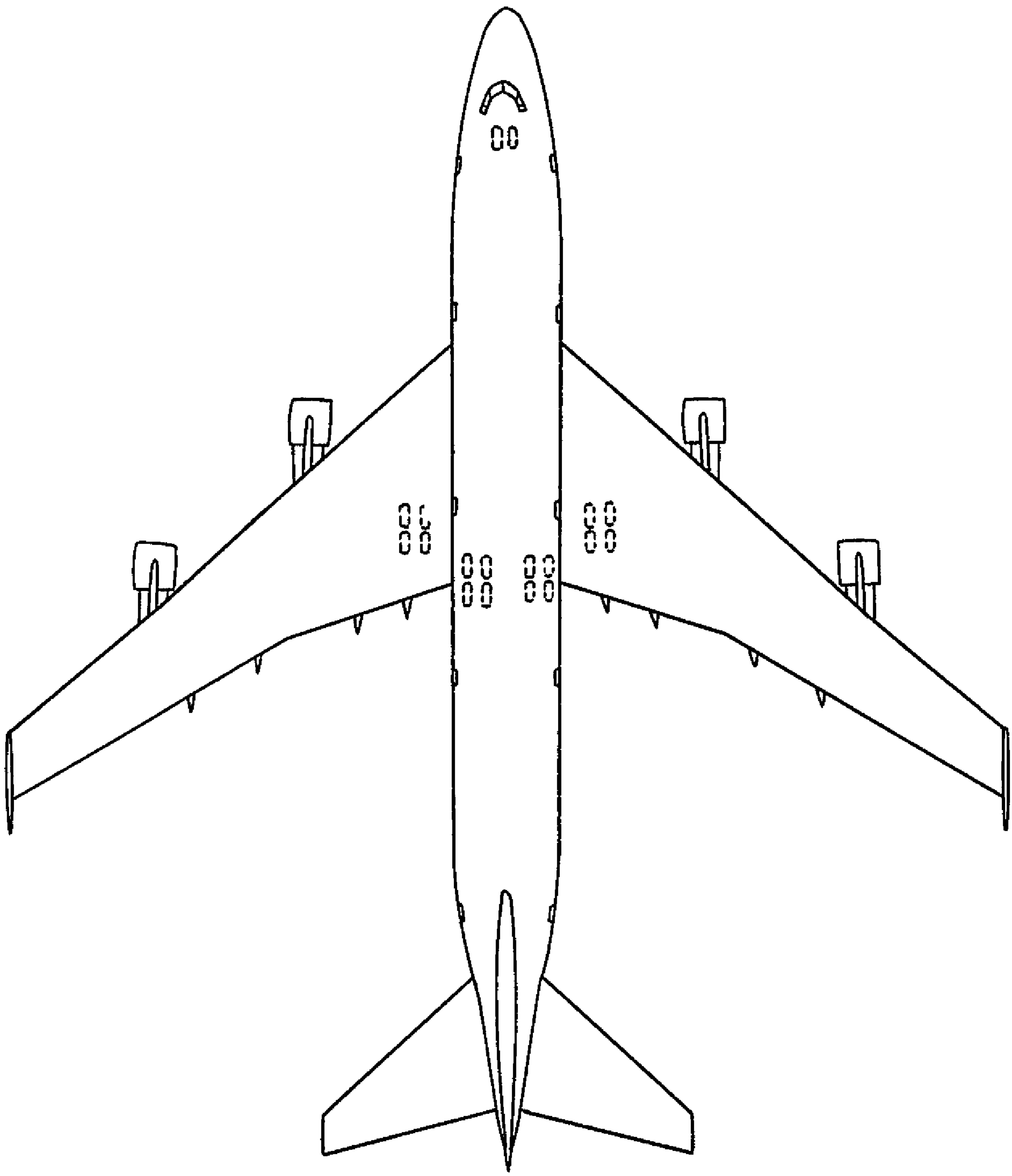


FIGURE 2. PLAN VIEW OF BOEING 747

APPENDIX 2. RUNWAY ORIENTATION AS INFLUENCED BY WIND

GENERAL.

1. In the certification of large airplanes, there is a requirement that the maximum limiting crosswind value be determined for each airplane. Only the maximum crosswind value in which the airplane was tested is available. Demonstrated crosswind values are usually accompanied with a statement in the airplane flight manuals that this crosswind value is not limiting. In reality, this crosswind value is limiting until the airplane is tested in a larger crosswind and is found to operate in a satisfactory manner. Most large turbine engine powered airplanes have demonstrated a capability to operate in a satisfactory manner with crosswind components from 25 to 38 knots (reported wind at the 50-foot height).

2. For the Boeing 747, crosswind components up to 25 knots are considered satisfactory for airport design. Therefore, runways for the B-747 operations should be oriented to minimize the crosswind components in excess of 25 knots at a height of 50 feet even though a larger crosswind component may be operationally acceptable. This crosswind design component is larger than that presently used for modern jet airplanes.

APPENDIX 3. RUNWAY LENGTH

1. GENERAL. The takeoff and landing requirements of airplanes expected to use an airport dictate the length of the runway. This appendix presents design curves for the landing and takeoff requirements of the B-747. These curves are based on preliminary data and will be revised as necessary after certification tests. It can be seen by comparison with runway design curves for other larger jet aircraft that the longest runway length needed at any particular airport may not necessarily be for the B-747.

2. RUNWAY CONSIDERATIONS. In addition to the normal elements of aircraft weight, airport elevation and temperature, two other important factors must be considered in determining the overall runway length needed.

   a. Wet or slippery runways. Where wet or slippery runway conditions prevail to a degree that should be considered, use the line on the landing curves labeled wet runway and zero wind. Guidelines on the application of the "wet runway" rule are contained in AC 121-12, Wet or Slippery Runways. Figures 1 and 2 provide additional guidance in applying the "wet runway" rule.

   b. Percent of Effective Runway Gradient. Runway length accountability for gradient with the B-747 is not expected to be significantly different from that used for present large jet aircraft.

3. LANDING RUNWAY LENGTH. The landing runway length requirements are dependent on the premise that clear runway approaches will be provided and maintained.

   a. Use the entire length of the runway to satisfy the runway length requirements if the obstruction clearance planes intersect the runway centerline at the runway ends and if these points of intersection can be expected to remain at the runway ends. See Federal Aviation Regulation, Part 121, Section 121.171(c) for definition of obstruction clearance plane.

   b. If the obstruction clearance planes intersect the runway centerline other than at the runway ends, or if these points of intersection cannot be expected to remain at the runway ends, use the maximum effective length of the runway for landing that can be expected to remain in each direction. See Federal Aviation Regulation, Part 121, Section 121.171(b) for definition of effective length of the runway.

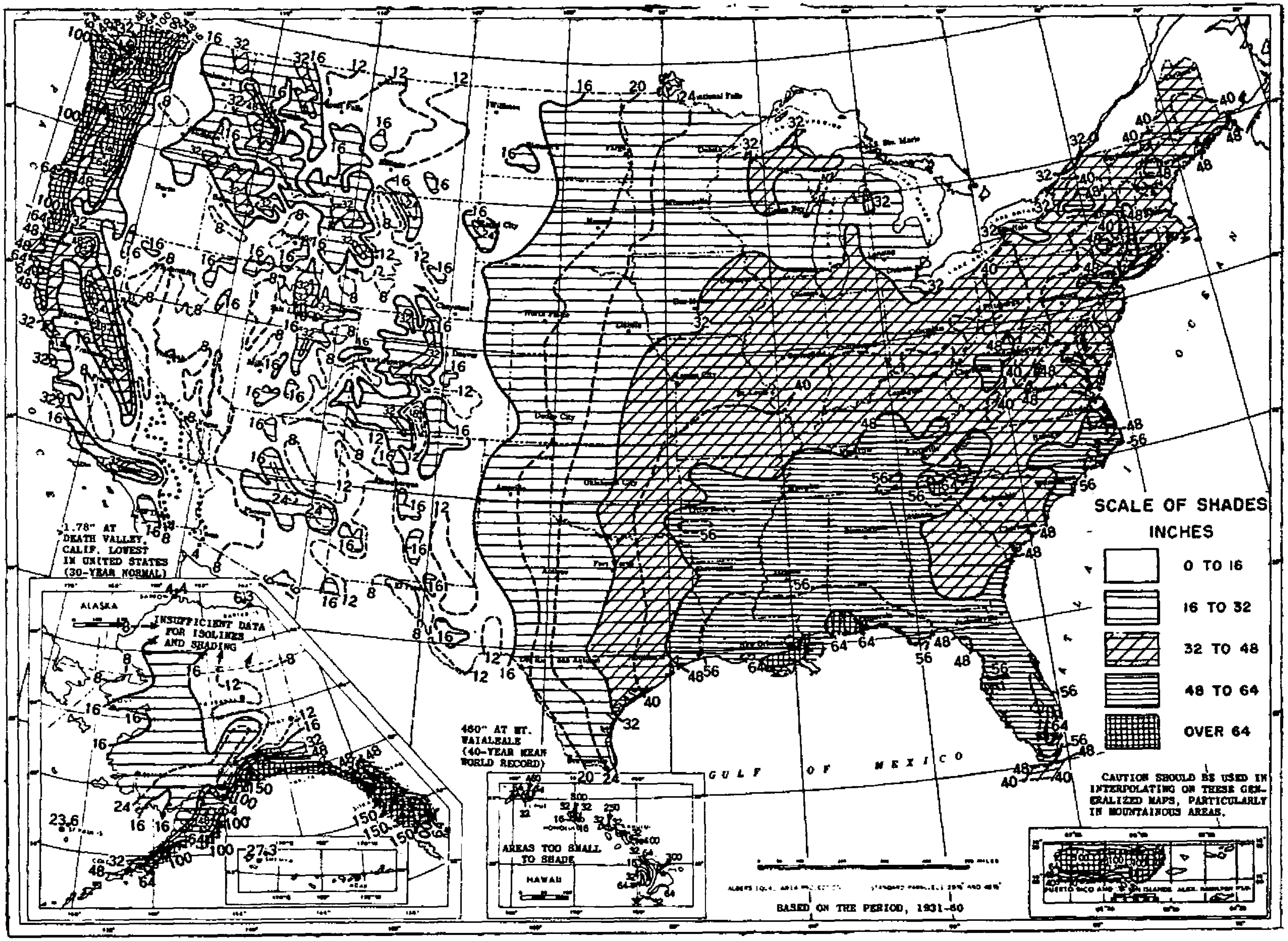


FIGURE 1. NORMAL ANNUAL TOTAL PRECIPITATION (INCHES)

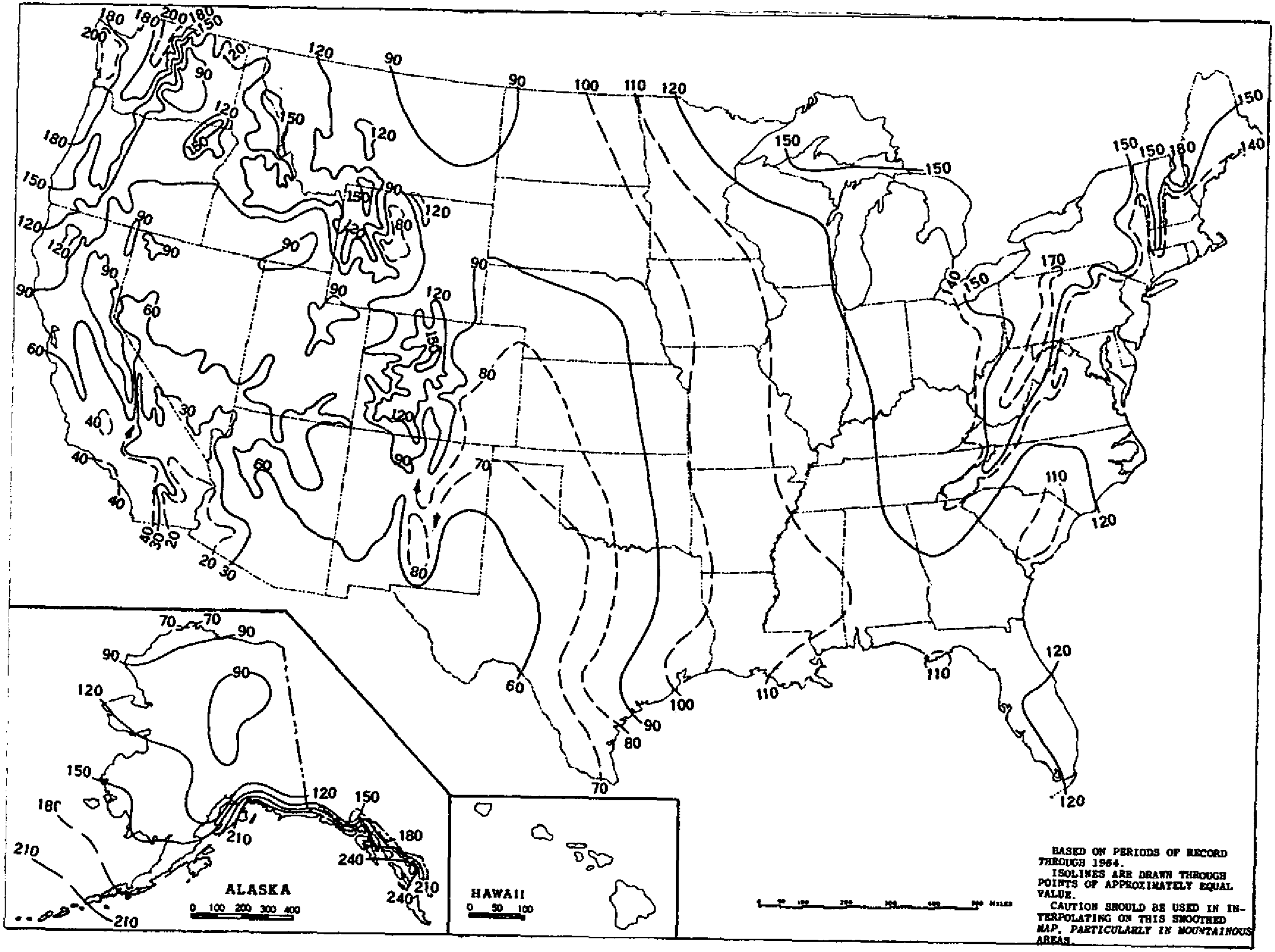


FIGURE 2. MEAN ANNUAL NUMBER OF DAYS WITH 0.01 INCH OR MORE OF PRECIPITATION

4. BOEING 747 LANDING RUNWAY LENGTH REQUIREMENT. The landing runway length requirement that must be satisfied in airport design is the runway length dictated by the airplane with the longest requirements. The landing runway design length for the Boeing 747 can be obtained from Figure 3. This may not necessarily be the critical airplane for landing length when compared with requirements for other present large jets.

5. TAKEOFF RUNWAY LENGTH. The takeoff runway length requirements are dependent on the premise that departure paths from ends of runways are maintained clear of obstacles. To satisfy this premise, keep all net takeoff flight paths clear of obstacles. See Federal Aviation Regulations, Part 25, Section 25.115(b) for definition of net takeoff flight paths. Obstacle clearance criteria are found in FAR Part 121, Section 121.189(d)(2), (e), (f), and (g). For the purpose of airport design, it can be assumed:

   a. That net takeoff flight paths begin at the end of the runway.

   b. That the B-747 is not banked in the first 750 feet of the net takeoff flight path.

   c. That the radius of turn for the B-747 resulting from a bank of 15 degrees is 10,000 feet.

   d. That the takeoff runway design length can be obtained from Figure 4.

BOEING 747

INITIAL ENGINE

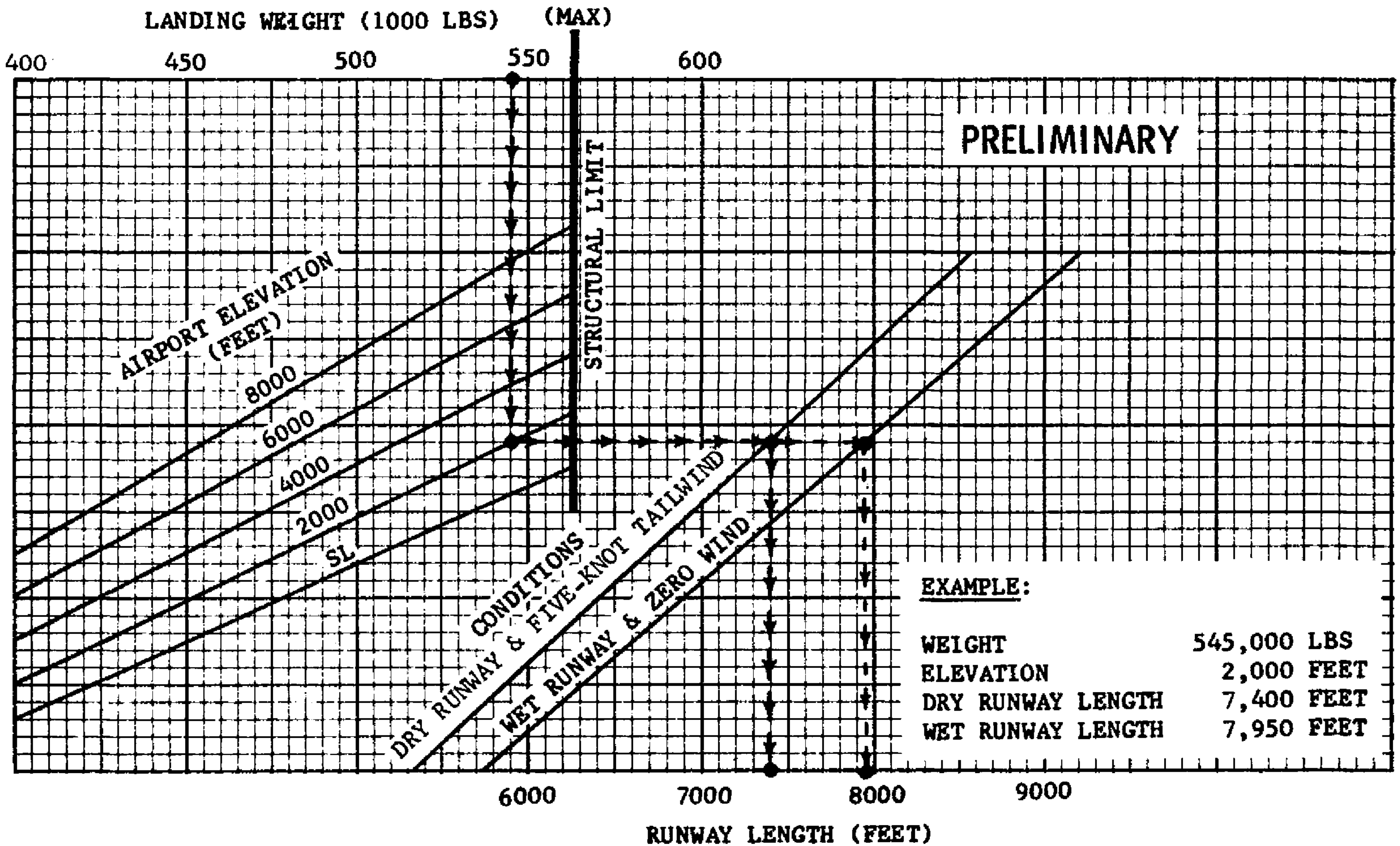


FIGURE 3. LANDING RUNWAY LENGTH FOR BOEING 747 (PRELIMINARY DATA)

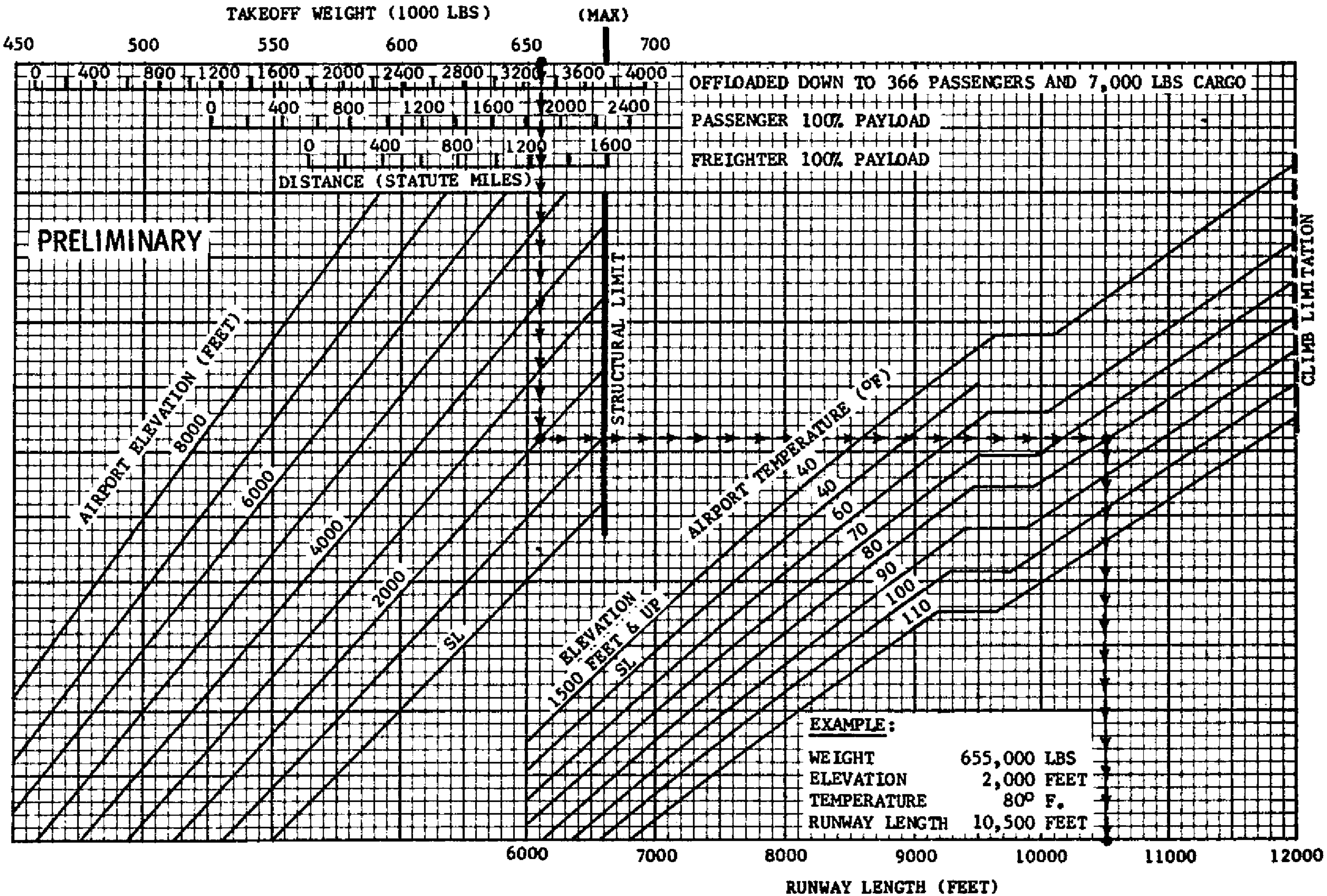


FIGURE 4. TAKEOFF RUNWAY LENGTH FOR BOEING 747 (PRELIMINARY DATA)

APPENDIX 4. TAXIWAY AND PAVEMENT FILLETS

1. INTRODUCTION. Ground areas for airplane use are based on the type and amount of activity the airport is intended to support. It is generally accepted that the requirement for an efficient taxiway system increases as the volume of traffic handled at the airport increases.

2. GENERAL REQUIREMENTS. The following general requirements determine the need for taxiways:

   a. Taxiways between apron areas and runways should be as direct as possible so that aircraft moving between the aprons and the runways may follow simple routes and instructions from the air traffic controller.

   b. All taxiways may not have to be designed for the critical airplane demands. Taxiway routing for the Boeing 747 may be limited, thus only certain taxiways would be affected.

   c. A sufficient number of connecting taxiways must be provided to join the runway entrance and exit points and apron areas.

   d. The airport should be designed so as to minimize the taxiway crossings with active runways or taxiways.

   e. Ground maneuvering test data on various operational procedures are yet to be determined. Several concepts which may provide for efficient turning of this airplane are:

      (1) Cockpit over centerline.
      (2) Nose wheel over centerline.
      (3) "Follow me" type guidance.
      (4) Pilot skill in overpassing markers.

3. MODIFIED PAVEMENT FILLETS TO PROVIDE FOR ADDITIONAL CLEARANCE. Figure 1 shows what could be done to a pavement fillet to obtain at least 15-foot wheel-to-pavement edge clearance with the Boeing 747. This additional pavement around the fillets will also accommodate the Boeing 747 with a 25 percent increase in wheelbase.

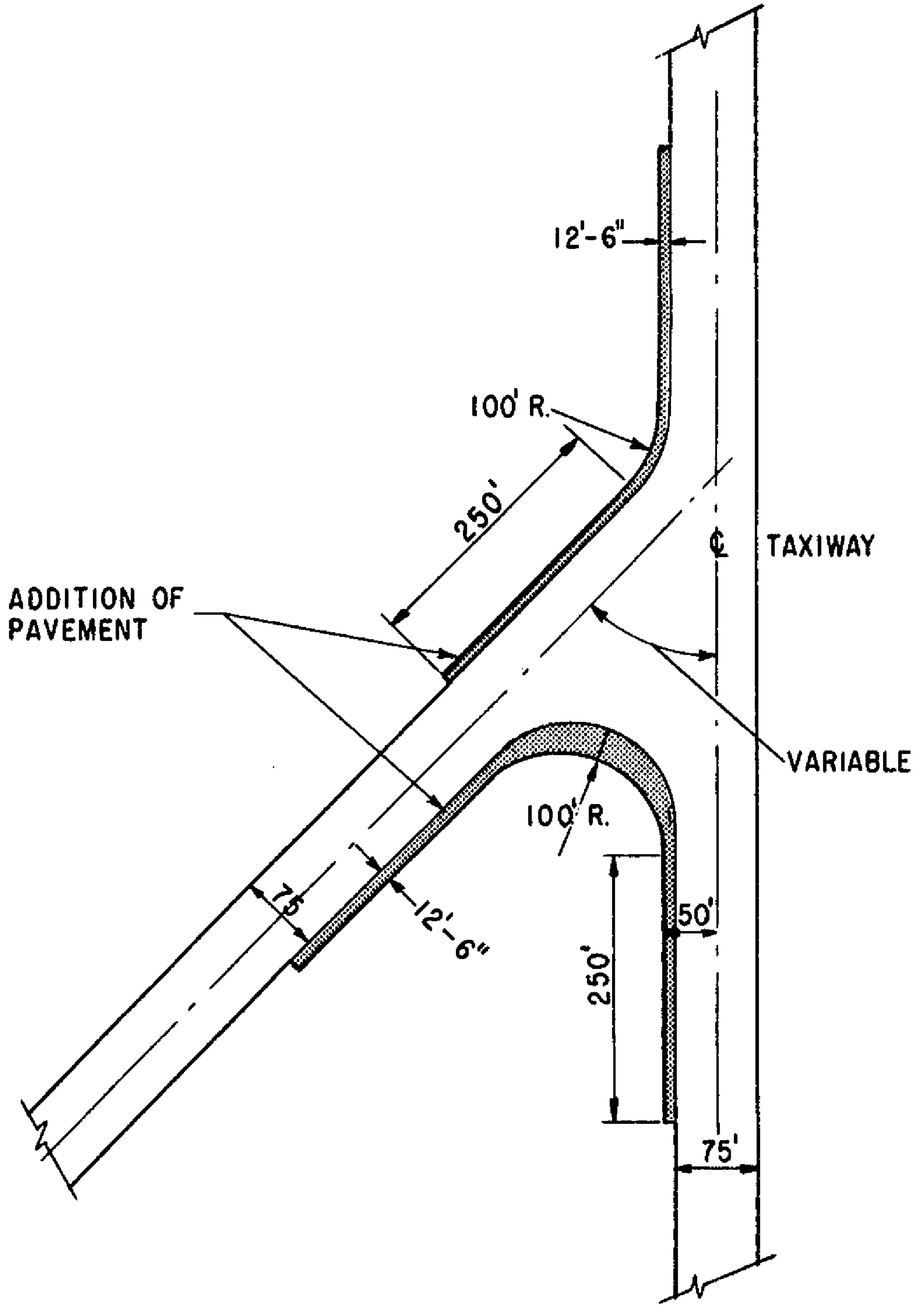


FIGURE 1. MODIFIED PAVEMENT FILLET TO PROVIDE 15-FOOT CLEARANCE

APPENDIX 5. EXIT TAXIWAYS

1. INTRODUCTION. The continual increase of air traffic and the increasing size and power of airplanes requiring longer runway lengths have made runway occupancy time more critical. The construction of exit taxiways located and designed to accept specified aircraft decreases this time factor. The touchdown point and landing roll of the airplane control the optimum exit taxiway location.

2. EXIT TAXIWAY LOCATIONS. The type of airplanes and number of each type that operate during the peak period establish the number of exit taxiways needed. See AC 150/5060-1, Airport Capacity Criteria Used in Preparing the National Airport Plan, for criteria on number of exit taxiways needed.

The most desirable exit taxiway location to serve the Boeing 747, the Boeing 707, the Douglas DC-8, the Convair 880, the Caravelle, and similar airplanes is given by the following formula:

$$S_c = 6500\ (1 + 0.036E + 0.001E^2)\ (0.8863 + 0.001928t) \pm 700$$

Where:

S_c = Distance from threshold to exit taxiway

E = Airport elevation (1000 feet)

t = Normal daily average Fahrenheit temperature at the airport for the hottest month. Use Figure 1 to obtain these temperatures.

Formulas for other types of aircraft are available in AC 150/5335-1 Airport Taxiways.

3. EXIT TAXIWAY DESIGN. Figure 2 shows a suggested design for exit taxiways to accommodate the Boeing 747. The reasons for selecting this design are:

a. To insure ease in making this turn with the Boeing 747 landing gear configuration. Up to a 25 percent increase in wheelbase can be accommodated by the design.

b. To provide ample clearances between the airplane wheels and the edge of the pavement.

c. To permit some variance from the taxiway centerline when the airplane does not start its turn at the point indicated on the runway.

FIGURE 1. NORMAL DAILY AVERAGE TEMPERATURE (°F.), JULY

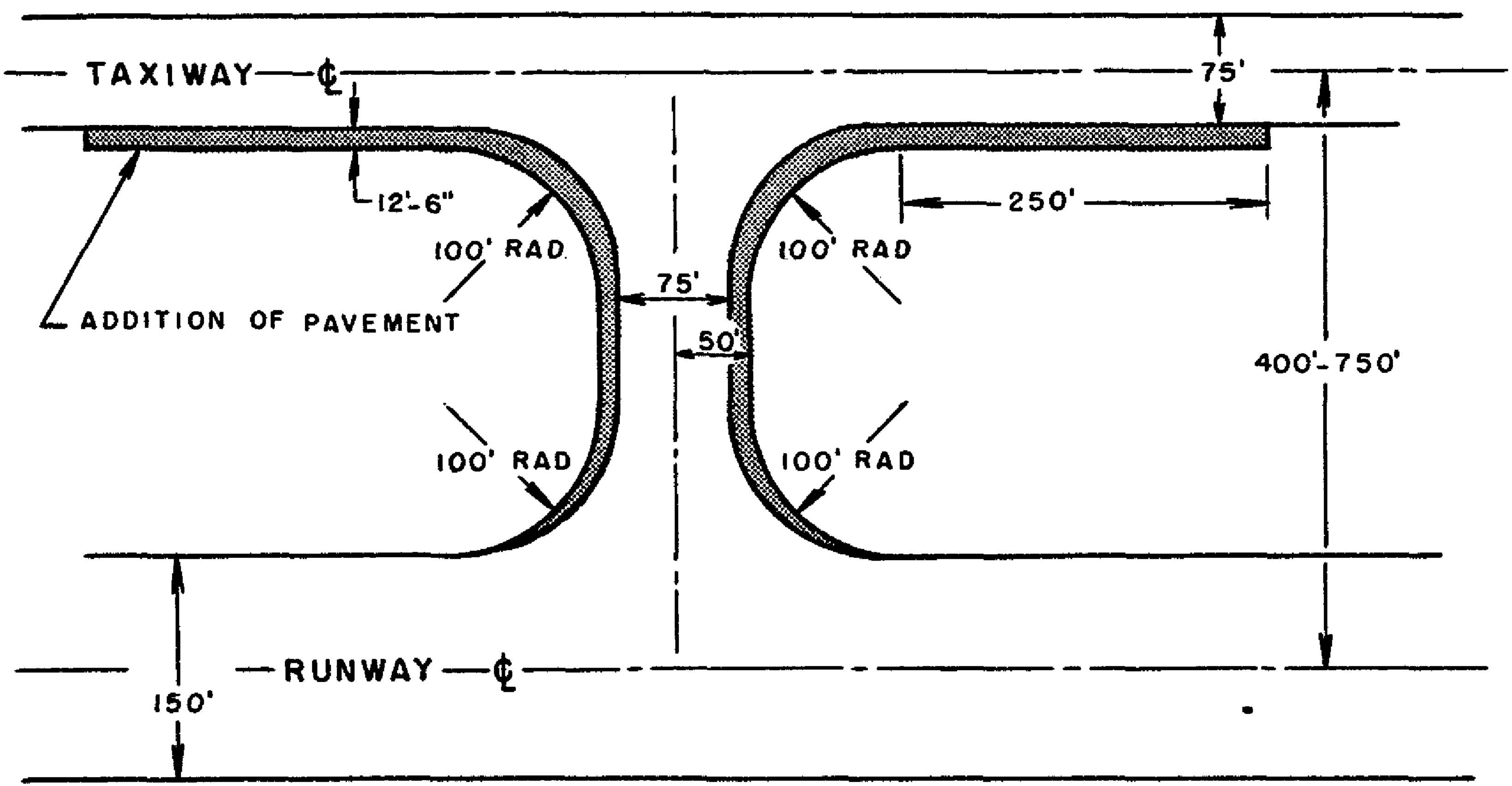


FIGURE 2. 90-DEGREE EXIT TAXIWAY CONFIGURATION

APPENDIX 6. APRONS

1. INTRODUCTION. On all airports, airplane operators require areas on which they may position the airplanes during ground operations other than those involving landing, taxiing, and takeoff. Such areas are generally referred to as aprons, and each is defined according to its use as one of the following: terminal, cargo, parking, service, hangar, or holding apron (referred to internationally as "holding bays"). The types and sizes of aprons required vary for each airport depending on the amount of activity and size of airplanes to be accommodated. To complete the design of the airport, the need for these areas must be considered along with other important factors.

2. TERMINAL APRON.

   a. The terminal apron is that area designed for use by airplanes which is adjacent or readily accessible to the terminal building. It is the key transitional area between air carriers and surface carriers. Therefore, design this apron to provide expeditious handling of airplanes as well as passengers, mail, cargo, express enroute airplane servicing, and personal services without resorting to unsafe double parking. This prompt handling is accomplished by positioning individual airplanes on the terminal apron in locations known as "gate" or loading positions. Factors influencing the size, number, and the location of gate positions are size and configuration of the airplanes, its maneuvering capability, methods of moving into and out of position, method of loading, volume of activity, size and amount of ground service equipment, propeller wash, blast, heat, noise, fumes, and location of buildings with such items as large glass panels. See Figure 1 for a typical configuration of a terminal apron.

   b. Such factors as airplane maneuvering capabilities (the capability of an airplane to get into and out of gate positions), taxiing procedures, wing tip clearance, and whether or not ground service equipment protrudes out of gate positions into taxiing corridors govern the width of the taxiing corridor requirement.

      (1) A 300-foot taxiing corridor will suffice to accommodate the Boeing 747. Of course, if the gates are positioned only on one side of the taxiing corridor, 100 feet of the corridor can extend beyond the edge of the apron opposite the gate.

      (2) For width of taxiing corridor to accommodate airplanes other than the Boeing 747, see AC 150/5335-2, Airport Aprons.

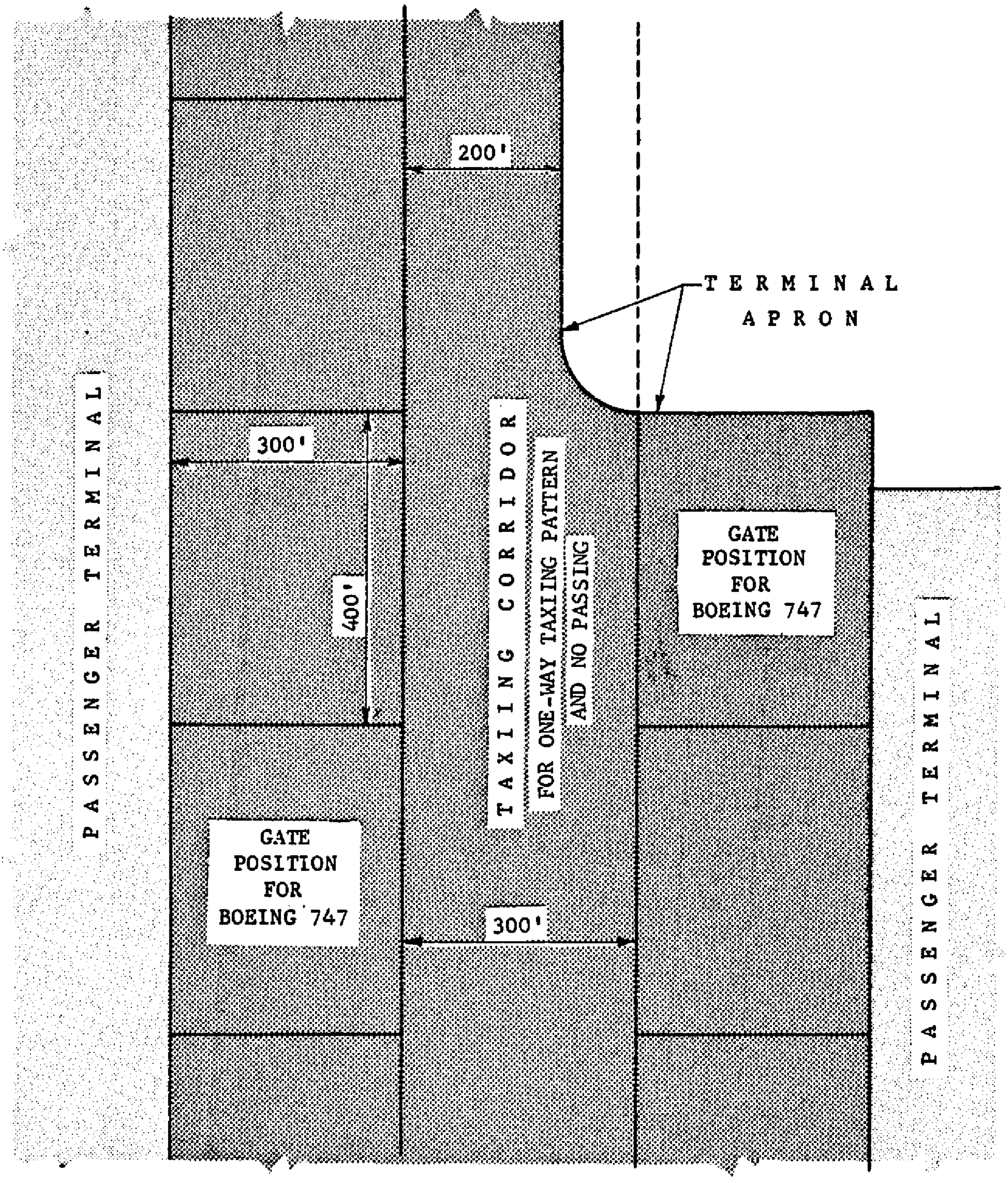


FIGURE 1. TYPICAL TERMINAL APRON

c. The number of gate positions for loading, unloading, and enroute airplane servicing is derived from the typical peak-hour operations and the time required to complete all activities at the gate position. The airplane time at the gate will depend on the type of airplane, the number of deplaning and enplaning passengers, the amount of baggage and express, the amount of fuel and routine services required, the efficiency of ground servicing personnel, and the airline's schedule. This information for various types of airplanes can best be determined by survey at the airport concerned. All gate positions at the airport need not be designed to accommodate the Boeing 747.

d. The size of a gate position is determined by such factors as aircraft maneuvering capabilities (turning radii), taxiing procedures, wing tip clearance, parking angle, size and amount of ground service equipment, and whether or not blast fences are used. The taxiing procedures include the methods of handling an aircraft in a gate position, i.e., (a) whether it taxies in and out under its own power, (b) whether it taxies in under its own power and is towed out, and (c) whether it is towed in and out. Of these methods, the one usually requiring the least time and number of supporting ground personnel is that in which the airplane is maneuvered under its own power.

(1) A gate position projecting 300 feet from the building, perpendicular to the taxiing corridor, and of 400 feet length parallel to the taxiing corridor will suffice to accommodate the Boeing 747. This gate position should also suffice when the Boeing 747 is stretched by 25 percent.

(2) For size of gate positions to accommodate airplanes other than the Boeing 747, see AC 150/5335-2.

3. <u>CARGO APRON</u>. Airplanes that carry only cargo are generally positioned on an apron near a cargo building located separately and at some distance from the terminal building. A cargo apron configuration would be similar in airplane positioning and spacing to that of a terminal apron. There should be enough space to accommodate as many airplanes as are expected at any one time. The intermingling of passenger and cargo traffic is not recommended; however, where the number of cargo operations is small, it would be possible to utilize a position on the terminal apron located as far as possible from any passenger activity. This becomes less desirable when large passenger aircraft such as the Boeing 747 are operating.

4. PARKING APRON. At airports with air cargo and/or passenger service, location of a parking apron close to the loading position at a safe distance from maneuvering airplanes should be considered for parking or storing airplanes during extended layovers. This apron is frequently used for servicing and light maintenance of temporarily grounded airplanes. The positioning and spacing would be similar to that used for terminal aprons.

5. HOLDING APRON.

a. A holding apron is located contiguous to the taxiway at or near the runway entrance. This apron is provided to permit the airplane cockpit checks and engine runups that are necessary before takeoff without interference with other airplanes.

b. Figure 2 depicts the areas that must be kept clear of holding airplanes to provide space for taxiing the Boeing 747. The size and number of airplanes to be held outside taxiing corridors dictate the holding apron general space requirements. Studies of airplanes equipped with dual-wheel undercarriages reveal that the length and width of the space required to maneuver and hold such airplanes are closely approximated by multiplying the wing span by factors varying between 1.35 and 1.50 for length parallel to taxiway and between 0.65 and 0.75 for width outside of taxiing corridor. Similar investigations for dual-tandem gear airplanes reveal that factors of between 1.60 and 1.75 for length parallel to taxiway and between 0.8 and 0.9 for width outside of taxiing corridor will suffice. Preliminary studies indicate that the factors for dual-tandem gear airplanes will suffice for the Boeing 747.

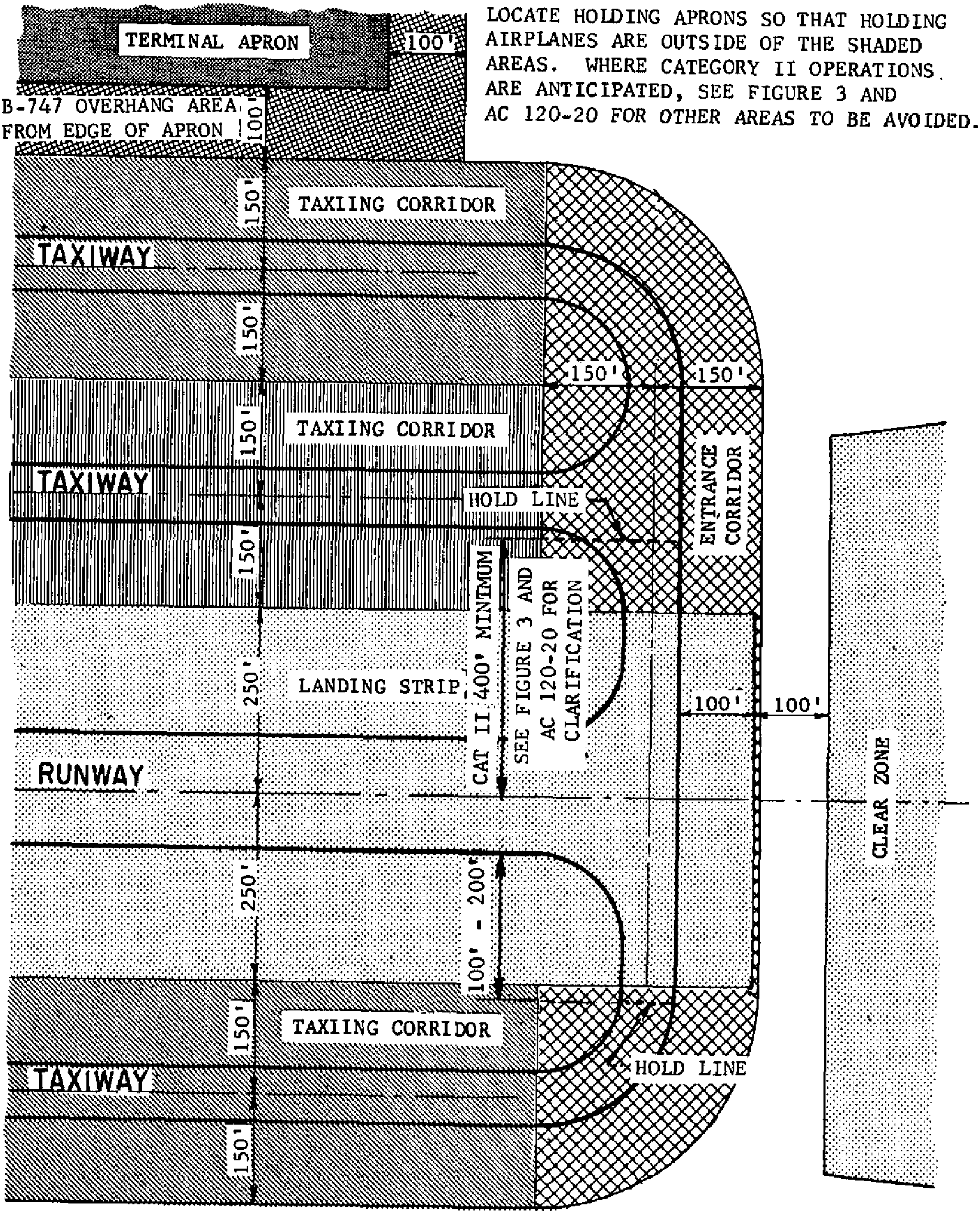
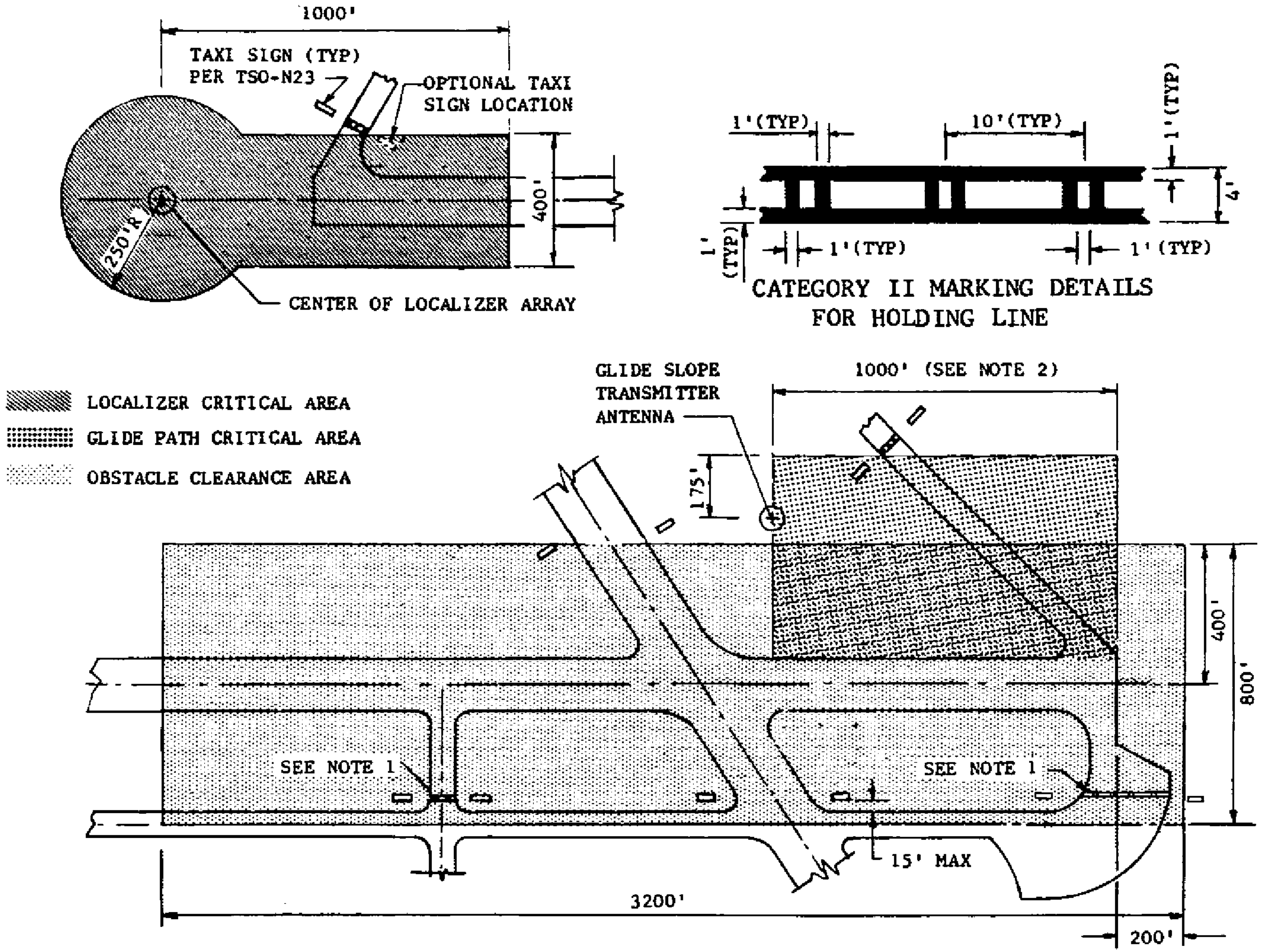


FIGURE 2. SPACE AVAILABLE FOR HOLDING APRONS



NOTE 1. Location of hold lines when operations are permitted on a 400' parallel taxiway.

2. Or to the end of the runway, whichever is greater.

FIGURE 3. CATEGORY II CRITICAL AREAS

280-553 O - 68 - 3

APPENDIX 7. SIGNIFICANT DESIGN ITEMS-RECAPITULATION

Description	Dimensional or Other Requirements	Remarks and References
Maximum Takeoff Weight	680,000 lbs.	The maximum takeoff and landing weights are for the initial B-747.
Maximum Landing Weight	564,000 lbs.	
Wing Span	195' 8"	Appendix 1 depicts the general arrangement, dimensions, and clearances of the B-747.
Length: Overall	231' 4"	
Height: Overall	63' 5"	
Tail Span	72' 9"	
Fuselage Height: Overall	32' 0"	
Tread	36' 1"	
Wheelbase	78' 11"	These distances are to the forward trucks of main gear. Add 10' to these distances to obtain the distance to the rear trucks of main gear.
Distance from Nose to Center of Main Gear	104' 5"	
Distance from Pivot Point to Centerline of Airplane	Min. 47'	Nose wheel steering angles other than maximum steering angle produce longer distances than 47'.
Turning Radius	Min. 156'	The turning radius is the distance from the pivot point to the furthest extremity of the airplane.
Distance from Outside Wheel to Wing Tip	77' 1"	This dimension is the horizontal distance from the outside of the outboard main landing gear wheel to the wing tip.
Vertical Clearances	Variable	See Appendix 1 for clearances. These clearances are for a fully loaded airplane.
Distance from Center-line of Cockpit to Forward Main Gear	87' 0"	Considered as the dimension to be used in performing normal turns.
Deck Height	15'4"-17'3"	Not compatible with existing fleet. Passenger ramps, mobile lounges, etc. will require modification.

FIGURE 1. BOEING 747 GENERAL DESCRIPTION

Description	Dimensional or Other Requirements	Remarks and References
Orientation	Variable	See Appendix 2 on criteria for runway orientation.
Length	Variable	See Appendix 3 on criteria for determining B-747 runway length.
Width	150'	Boeing is designing the B-747 to operate on a 150' runway.
Pavement Strength	Variable	Design critical pavement for 350,000-pound dual tandem and noncritical pavement as 90% of critical thickness in accordance with AC 150/5320-6A, Airport Paving. Overpasses and culverts may need additional strengthening.
Marking	Variable	See AC 150/5340-1A on criteria for marking of serviceable runways.
Lighting	Variable	See AC 150/5340-4A and AC 150/5340-13A on criteria for runway lighting.
Longitudinal Grade	Max. 1½%	Keep longitudinal grades to the practical minimum.
Longitudinal Grade Change	Max. 1½%	The runway centerline is identical to the landing strip centerline.
Length of Vertical Curve for each One Percent Grade Change	Min. 1,000'	
Maximum Difference of Centerline Elevation	1% of Runway Length	
Minimum Distance Between Changes in Grade	Variable	Keep the distance (in feet) between points of intersection for vertical curves at least equal to 1,000 times the sum of grade changes (in percent) associated with the two vertical curves.

FIGURE 2. RUNWAYS

Description	Dimensional or Other Requirements	Remarks and References
Minimum Sight Distance	4,000'	Design grade changes so there will be an unobstructed line of sight from any point 10' above the landing strip centerline to any other point 10' above the landing strip centerline within a distance of half the length of the landing strip or 4,000', whichever is less.
Transverse Grade	Max. 1½%	Keep transverse grades to the minimum consistent with local drainage requirements.
Parallel Runway Centerline Separation		For actual operations under conditions of simultaneous precision approaches, FAA requires specific electronic navigational aids and monitoring equipment, Air Traffic Service control, and approved procedures.
a. For Simultaneous Precision Approaches	Min. 5,000'	
b. For Simultaneous VFR Landings or Takeoffs	Min. 700'	
Clearance to Taxiway Centerline	Min. 400'	All clearances are from the runway and landing strip centerline. For new construction at existing airports, clearances should be in excess of the minimum shown in this table. To clear the Part 77 obstruction surfaces, the B-747 vertical stabilizer must be positioned at a distance of approximately 1,000 feet from the precision approach runway centerline.
Clearance to Near Edge of Aircraft Parking Area	Min. 650'	
Clearance to Building Line	Min. 750'	
Clearance to Obstacle		
a. For Precision Approach Runways	Min. 500'	
b. For Other than Precision	Min. 250'	

FIGURE 2. RUNWAYS (CONTINUED)

Description	Dimensional or Other Requirements	Remarks and References
Location	Variable	Design taxiway routes between apron areas and runways as direct as possible so that aircraft moving between aprons and runways may follow uncomplicated routes and instructions from the traffic controller. Advise special routing for B-747 initially.
Length	Variable	The length of the taxiway system is dependent upon the size and configuration of the airport.
Width	Min. 75'	Clearance for the B-747 on a straight section of a 75' taxiway is 16' as measured from the outside truck tire face and edge of full strength pavement. Appendix 4 illustrates various taxiway width requirements.
Pavement Strength	Variable	Design connecting and parallel taxiways for 350,000-pound dual tandem loading and design exit taxiways as 90% of 350,000-pound dual tandem thickness in accordance with AC 150/5320-6A, Airport Paving. Overpasses and culverts may need additional strengthening.
Marking	Variable	See AC 150/5340-1A on criteria for marking of taxiways.
Lighting	Variable	See AC 150/5340-15A on criteria for taxiway lighting.
Longitudinal Grade	Max. 1½%	For ease of towing and taxiing, keep the longitudinal grades to the practical minimum.
Transverse Grade	Max. 1½%	Keep transverse grades to the minimum consistent with local drainage requirements.
Pavement Fillet Radii	Min. 100'	Existing pavement fillet radii of 100' will provide a clearance in a turn of 13½', and 11' with a 75' fillet radii. To retain present operational effectiveness, Appendix 4 illustrates how to modify a pavement fillet radii to provide 15' clearance.

FIGURE 3. TAXIWAYS

Description	Dimensional or Other Requirements	Remarks and References
Entrance Taxiway	Fixed	Place at least one entrance taxiway at each end of the runway. The B-747 cannot negotiate a 180° turn on a 150' runway. These taxiways are also used as exits by airplanes that overshoot the exit taxiways.
Exit Taxiway Location	Variable	See Appendix 5 on location and configuration of exit taxiway.
Clearance to Runway Centerline	Min. 400'	All clearances are from taxiway centerline. For new construction at existing airports clearances should be in excess of the minimum shown in this table.
Clearance to Parallel Taxiway Centerline	Min. 300'	
Clearance to Near Edge of Aircraft Parking Areas	Min. 250'	
Clearance to Obstacle	Min. 200'	

FIGURE 3. TAXIWAYS (CONTINUED)

Description	Dimensional or Other Requirements	Remarks and References
Location	Variable	Locate aprons where required for safe and efficient operations on the airport.
Configuration	Variable	See Appendix 6 on criteria and clarification for determining apron dimensions and configurations.
Width of Taxiing Corridor	300'	
Length of Gate Position	400'	
Width of Gate Position	300'	
Pavement Strength	350,000-pound dual tandem	Design apron pavement for 350,000-pound dual tandem load in accordance with AC 150/5320-6A, Airport Paving. Culverts and other subsurface structures may need additional strengthening.
Pavement Grade in any Direction	Max. 1%	For fueling, ease of towing, and taxiing, keep apron slopes on grades to the minimum consistent with local drainage requirements. In airplane fueling areas, make every effort to keep the apron slope within 0.5%.
Clearance to Runway Centerline from any Edge	Min. 650'	Exclude holding aprons from this requirement. To clear the Part 77 obstruction surfaces, the B-747 vertical stabilizer must be positioned at a distance of approximately 1,000' from the precision approach runway centerline.
Clearance to Taxiway Centerline from any Edge	Min. 250'	Exclude connecting taxiways and holding aprons from this requirement.
Clearance to Obstacle from any Edge	Variable	Keep a minimum clearance of 25' between obstacles and all points of the airplane on the apron. This is the minimum considered adequate for the B-747.

FIGURE 4. APRONS

Description	Dimensional or Other Requirements	Remarks and References
Location	Variable	Advanced analysis of the B-747 reveals considerably more detrimental effect on runway shoulders. Care should be exercised in maintaining shoulder stabilization.
Length	Variable	The length and width of shoulders are dependent on the amount of protection against jet blast erosion that will be required adjacent to the edges of runways, taxiways, and aprons. AC 150/5325-6 contains jet blast erosion control data for smaller four-engine jets. These data for B-747 are not available.
Width	Variable	
Transverse Grade	Max. 2%	Keep transverse grades to the minimum consistent with local drainage requirements. For the first 10' out from the edge of pavements the grade may be increased up to 5% to improve drainage.
Clearance to Obstacle	Fixed	Along edges of runways, taxiways, and aprons where portions of the B-747 will extend during the taxiing operations, remove all obstacles including earth, rock, and all visual and navigational aids protruding more than 1' through a plane that extends outward from these edges for a distance of 100' on an upward slope of 5%.

FIGURE 5. SHOULDERS

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