PRELIMINARY

747-8
Airplane Characteristics for Airport Planning

Boeing Commercial Airplanes

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PRELIMINARY

747-8 AIRPLANE CHARACTERISTICS
LIST OF ACTIVE PAGES

Page	Date	Page	Date	Page	Date
Original i to 112	Preliminary September 2008				

PRELIMINARY

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

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1.0 SCOPE AND INTRODUCTION

1.1 Scope

1.2 Introduction

1.3 A Brief Description of the 747-8

1.0 SCOPE AND INTRODUCTION

1.1 Scope

This document provides, in a standardized format, airplane characteristics data for general airport planning. Since operational practices vary among airlines, specific data should be coordinated with the using airlines prior to facility design. Boeing Commercial Airplanes should be contacted for any additional information required.

Content of the document reflects the results of a coordinated effort by representatives from the following organizations:

- Aerospace Industries Association
- Airports Council International – North America
- International Industry Working Group
- International Air Transport Association

The airport planner may also want to consider the information presented in the "Commercial Aircraft Design Characteristics - Trends and Growth Projections," for long range planning needs and can be accessed via the following web site:

http://www.boeing.com/airports

The document is updated periodically and represents the coordinated efforts of the following organizations regarding future aircraft growth trends.

- International Civil Aviation Organization
- International Coordinating Council of Aerospace Industries Associations
- Airports Council International – North America and World Organizations
- International Industry Working Group
- International Air Transport Association

1.2 Introduction

This document conforms to NAS 3601. It provides characteristics of the Boeing Model 747- Freighter airplane for airport planners and operators, airlines, architectural and engineering consultant organizations, and other interested industry agencies. Airplane changes and available options may alter model characteristics. The data presented herein will be mainly the 747-8F at this time. As the data for the 747-8 Intercontinental becomes available, for publication, it will be added. These data will reflect typical airplanes in each model category. Data used is generic in scope and not customer-specific.

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1.3 A Brief Description of the 747-8

The 747-8 is the latest derivative of the 747 family of airplanes and is being developed in both Freighter and Passenger versions. The -8 is externally similar to the 747-400 with a higher gross weight, longer fuselage and increased wingspan. The 747-8 Freighter retains the 747-400F nose cargo door, continuing the capability to easily load outsized cargo. The 747-8 will use the new high bypass ratio engines which are the quiet, efficient GEnx engines being developed for the 787 aircraft. By combining changes in the wing, adding the raked wingtips, and using the GEnx engines, the 747-8 will be the fastest flying aircraft at Mach 0.845 for the Freighter and Mach 0.855 for the Intercontinental. The 747-8 will enter into service in 2009.

Other characteristics unique to the 747-8 compared to the 747-400 include:

- Next generation advanced alloys
- New wing design, including new airfoils and raked wingtips replacing the winglets
- Derivative 787 Next Gen engines, including light weight composite fan case and fan blades
- Improved flight deck while preserving 747-400 operational commonality
- New interior architecture to enhance passenger experience
- Improved aerodynamic efficiency and reduced seat-mile cost

2.0 AIRPLANE DESCRIPTION

2.0 AIRPLANE DESCRIPTION

2.1 General Characteristics

Maximum Design Taxi Weight (MTW). Maximum weight for ground maneuver as limited by aircraft strength and airworthiness requirements. (It includes weight of taxi and run-up fuel.)

Maximum Design Takeoff Weight (MTOW). Maximum weight for takeoff as limited by aircraft strength and airworthiness requirements. (This is the maximum weight at start of the takeoff run.)

Maximum Design Landing Weight (MLW). Maximum weight for landing as limited by aircraft strength and airworthiness requirements.

Maximum Design Zero Fuel Weight (MZFW). Maximum weight allowed before usable fuel and other specified usable agents must be loaded in defined sections of the aircraft as limited by strength and airworthiness requirements.

Operating Empty Weight (OEW). Weight of structure, powerplant, furnishing systems, unusable fuel and other unusable propulsion agents, and other items of equipment that are considered an integral part of a particular airplane configuration. Also included are certain standard items, personnel, equipment, and supplies necessary for full operations, excluding usable fuel and payload.

Maximum Payload. Maximum design zero fuel weight minus operational empty weight.

Maximum Seating Capacity. The maximum number of passengers specifically certificated or anticipated for certification.

Maximum Cargo Volume. The maximum space available for cargo.

Usable Fuel. Fuel available for aircraft propulsion.

PRELIMINARY

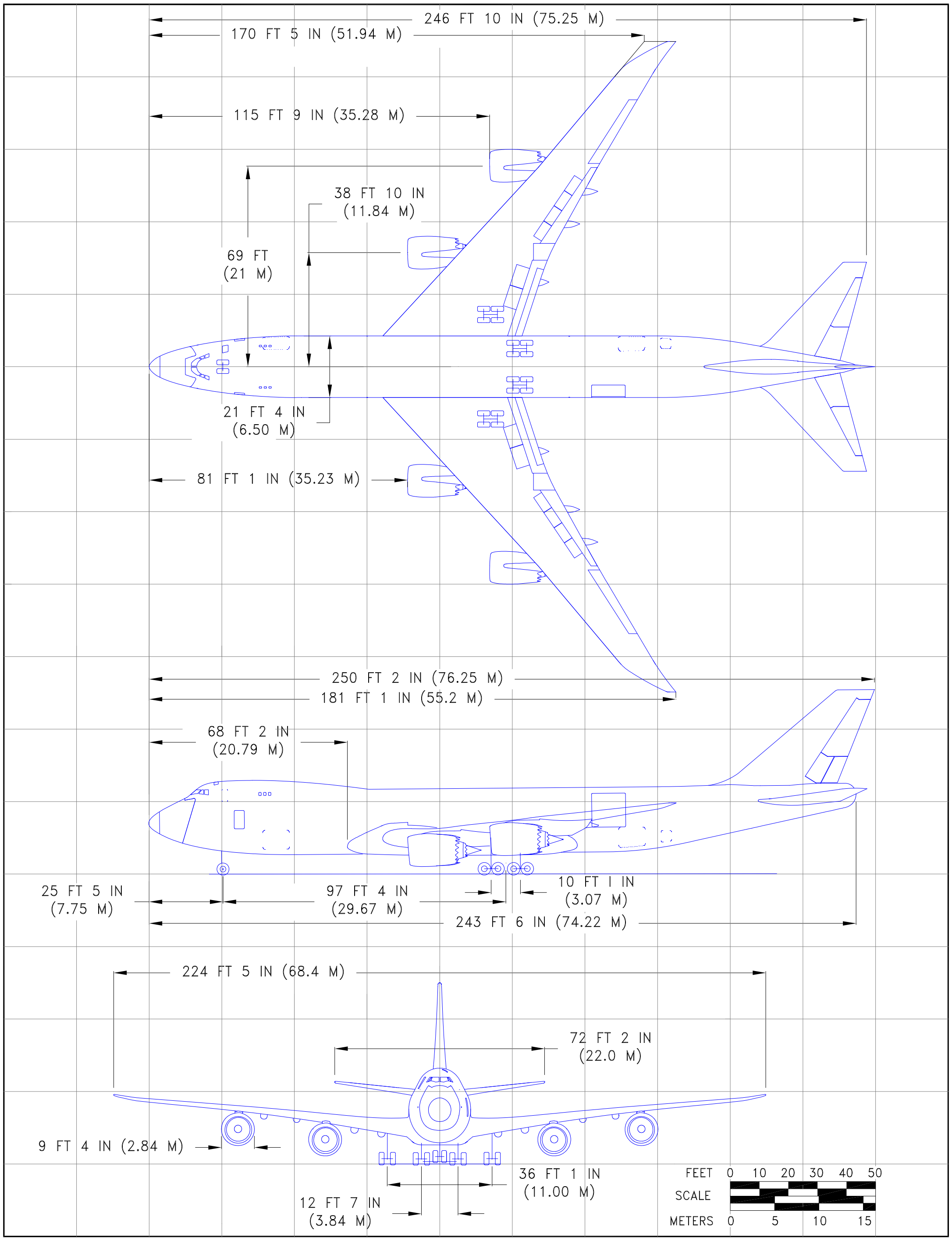
CHARACTERISTICS	UNITS	GEnx 2B67 ENGINES
MAX DESIGN TAXI WEIGHT	POUNDS	978,000
	KILOGRAMS	443,614
MAX DESIGN TAKEOFF WEIGHT	POUNDS	975,000
	KILOGRAMS	442,253
MAX DESIGN LANDING WEIGHT	POUNDS	757,000
	KILOGRAMS	343,370
MAX DESIGN ZERO FUEL WEIGHT	POUNDS	717,000
	KILOGRAMS	325,226
SPEC OPERATING EMPTY WEIGHT	POUNDS	421,200
	KILOGRAMS	191,053
MAX STRUCTURAL PAYLOAD	POUNDS	295,200
	KILOGRAMS	133,901
TYPICAL SEATING CAPACITY (INCLUDES UPPER DECK)	UPPER DECK	N/A FOR FREIGHTER
	MAIN DECK	N/A FOR FREIGHTER
MAX CARGO - LOWER DECK CONTAINERS (LD-1)	CUBIC FEET	5,536
	CUBIC METERS	157
MAX CARGO - LOWER DECK BULK CARGO	CUBIC FEET	835
	CUBIC METERS	24
USABLE FUEL CAPACITY	U.S. GALLONS	60,211
	LITERS	227,923
	POUNDS	403,414
	KILOGRAMS	182,981

NOTES:

1. SPEC OPERATING EMPTY WEIGHT REFLECTS STANDARD ITEM ALLOWANCES. ACTUAL OEW WILL VARY WITH AIRPLANE CONFIGURATION. CONSULT USING AIRLINE FOR ACTUAL OEW.

2.1.1 GENERAL CHARACTERISTICS
MODEL 747-8F

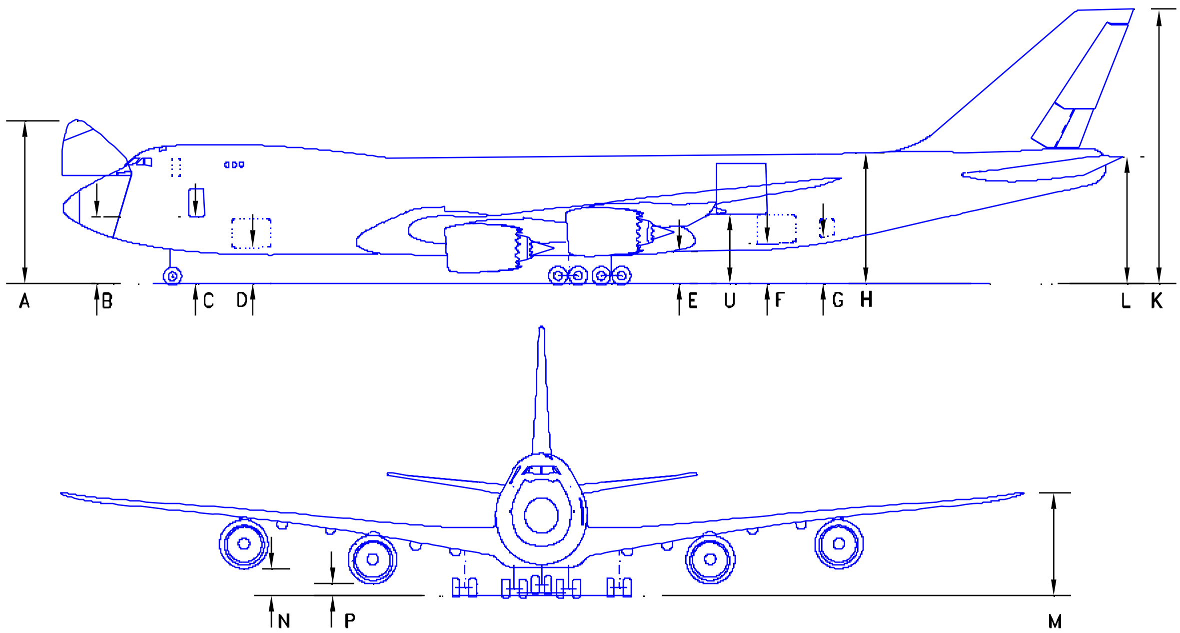
PRELIMINARY



2.2 GENERAL DIMENSIONS

MODEL 747-8F

PRELIMINARY



	MINIMUM		MAXIMUM	
	FT - IN	M	FT - IN	M
A	TBD	TBD	TBD	TBD
B	15 - 6	4.72	17 – 11	5.46
C	15 - 8	4.80	17 - 8	5.41
D	9 - 1	2.77	10 - 10	3.30
E	TBD	TBD	TBD	TBD
F	9 - 1	2.77	10 - 9	3.23
G	9 – 7	2.92	11 - 4	3.45
H	TBD	TBD	TBD	TBD
K	TBD	TBD	TBD	TBD
L	TBD	TBD	TBD	TBD
M	TBD	TBD	TBD	TBD
N	TBD	TBD	TBD	TBD
P	TBD	TBD	TBD	TBD
U	16 - 0	4.88	17 - 3	5.26

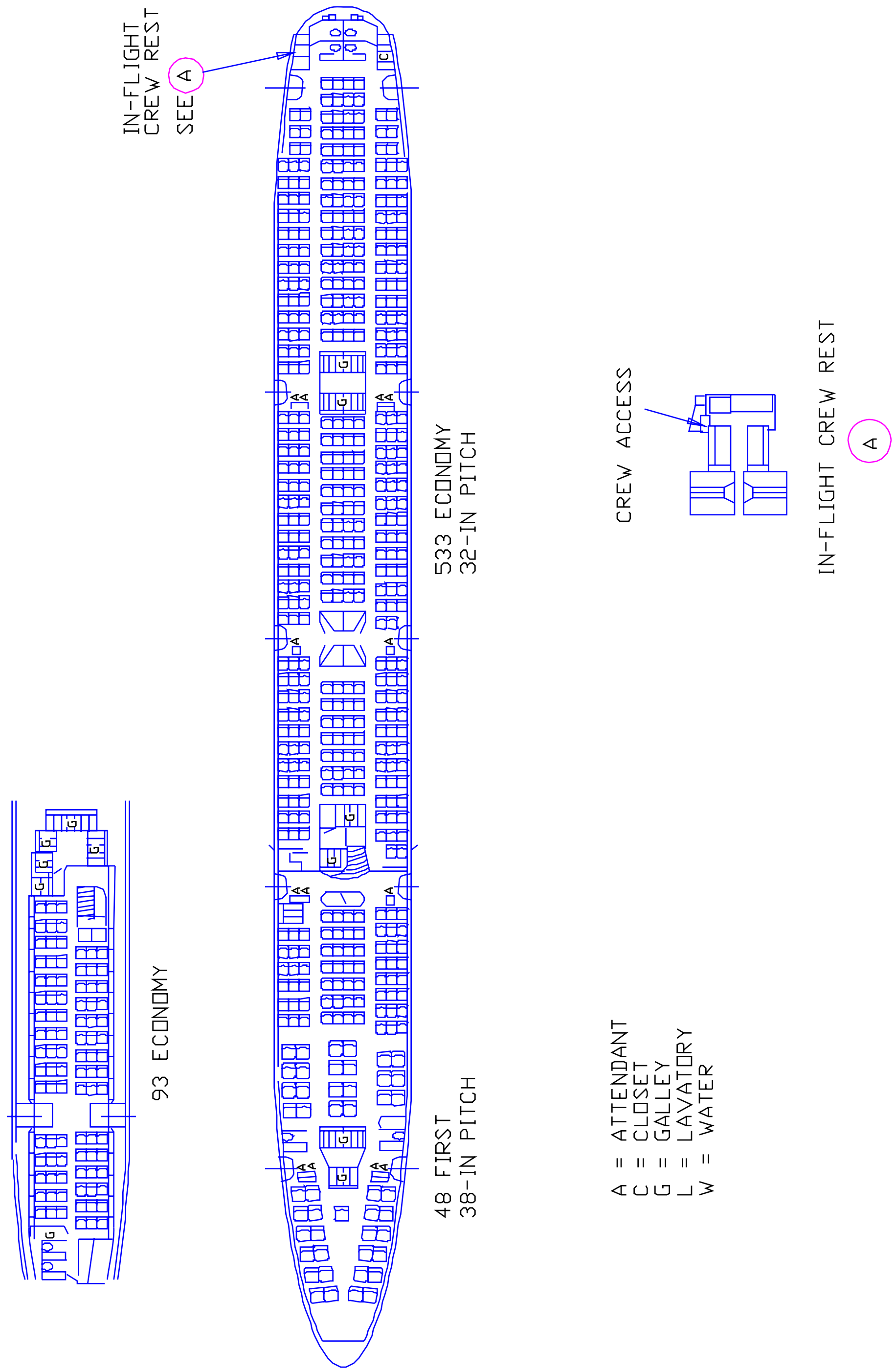
NOTES: VERTICAL CLEARANCES SHOWN OCCUR DURING MAXIMUM VARIATIONS OF AIRPLANE ATTITUDE. COMBINATIONS OF AIRPLANE LOADING/UNLOADING ACTIVITIES THAT PRODUCE THE GREATEST POSSIBLE VARIATIONS OF ATTITUDE WERE USED TO ESTABLISH THE VARIATIONS SHOWN. DURING ROUTINE SERVICING, THE AIRPLANE REMAINS RELATIVELY STABLE; PITCH AND ELEVATION CHANGES OCCUR SLOWLY.

AT MAJOR TERMINALS, A GSE TETHERING DEVICE MAY BE USED TO MAINTAIN STABILITY BETWEEN THE MAIN DECK DOOR SILL AND THE LOADING DOCK. CARGO BRIDGE ATTACHMENT FITTINGS LOCATED ON THE NOSE DOOR SILL AT THE FORWARD EDGE OF THE MAIN CARGO DOOR DECK MAY BE USED FOR NOSE DOOR SILL STABILIZATION.

2.3 GROUND CLEARANCES

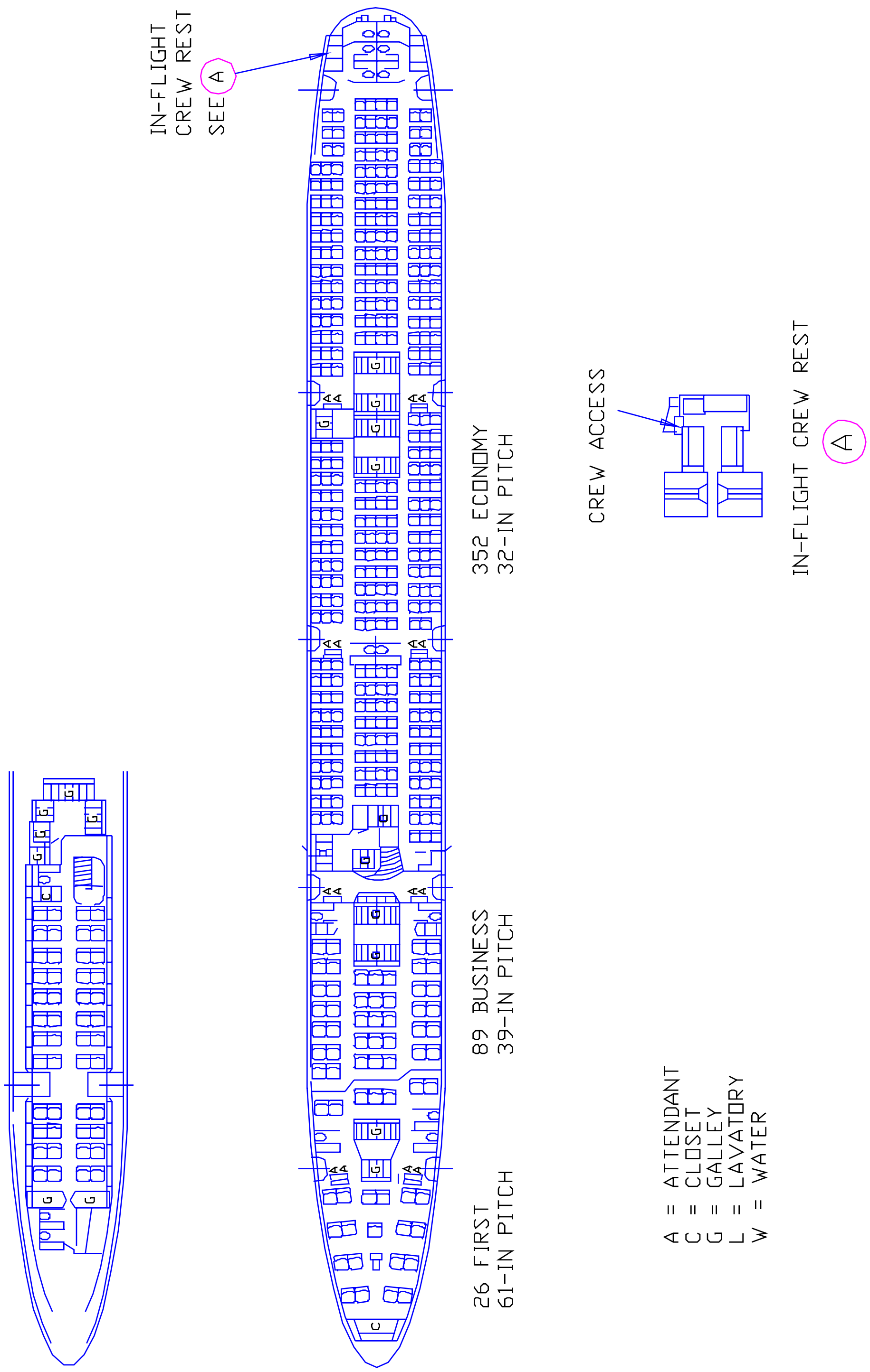
MODEL 747-8F

PRELIMINARY



2.4.1 TYPICAL INTERIOR ARRANGEMENTS, TWO CLASS, 581 PASSENGERS
MODEL 747-8

PRELIMINARY



2.4.2 TYPICAL INTERIOR ARRANGEMENTS, THREE CLASS, 467 PASSENGERS
MODEL 747-8

THE 747-8 FREIGHTER DOES NOT HAVE A TYPICAL INTERIOR ARRANGEMENT FOR PASSENGERS.

2.4.3 TYPICAL INTERIOR ARRANGEMENTS
MODEL 747-8F

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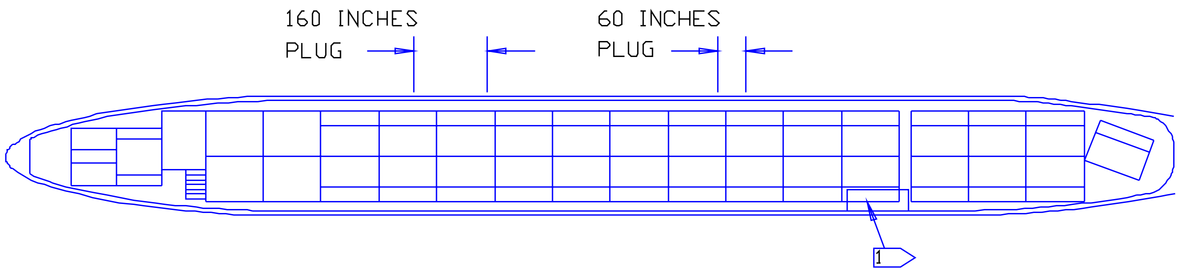
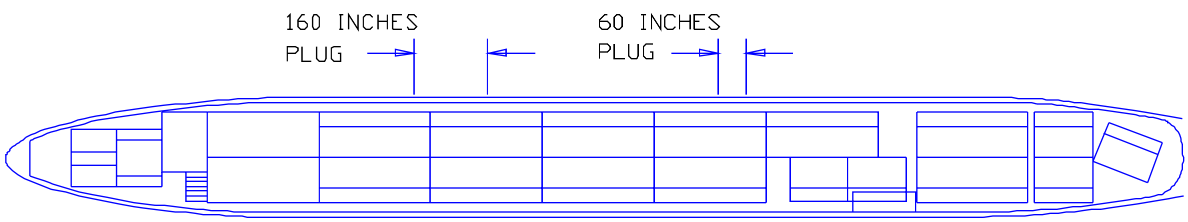
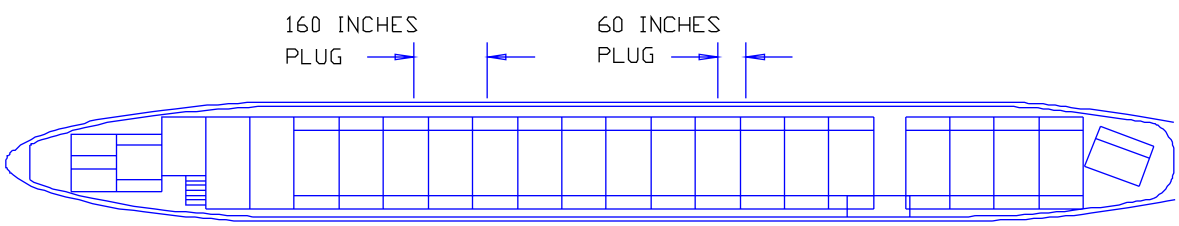


(34) 96 INCHES X 125 INCHES PALLETS



(13) 96 INCHES X 238.5 INCHES PALLETS
(8) 96 INCHES X 125 INCHES PALLETS

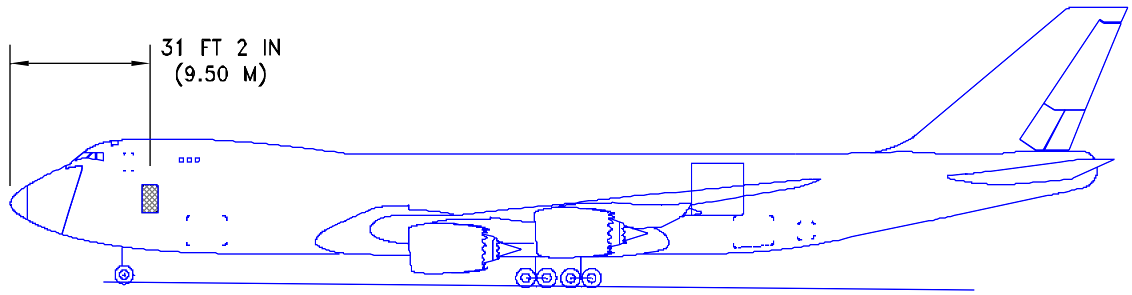


(19) 96 INCHES X 196 INCHES PALLETS
(4) 96 INCHES X 125 INCHES PALLETS
(24 ADDITIONAL PALLET LOCKS REQUIRED)

1 88 INCHES X 125 INCHES PALLETS ARE LIMITED TO THESE POSITIONS ONLY.

2.6 LOWER CARGO COMPARTMENTS - CONTAINERS AND BULK CARGO
MODEL 747-8F

PRELIMINARY



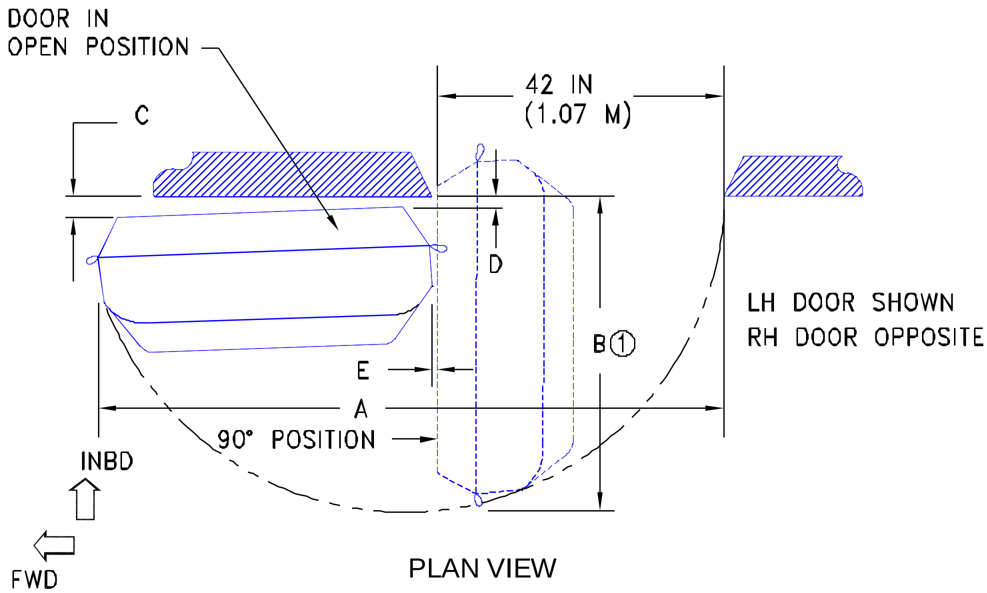
NOTES:

(1) 1 PASSENGER DOOR – LEFT SIDE ONLY
DOOR OPENING SIZE = 42 BY 76 IN (1.07 BY 1.93 M)
OVERALL DOOR SIZE = 47 BY 76 IN (1.19 BY 1.93 M)

(2) SEE SECTION 2.3 FOR DOOR SILL HEIGHTS

2.7.1 DOOR CLEARANCES - MAIN ENTRY DOOR LOCATIONS
MODEL 747-8F

PRELIMINARY



PLAN VIEW

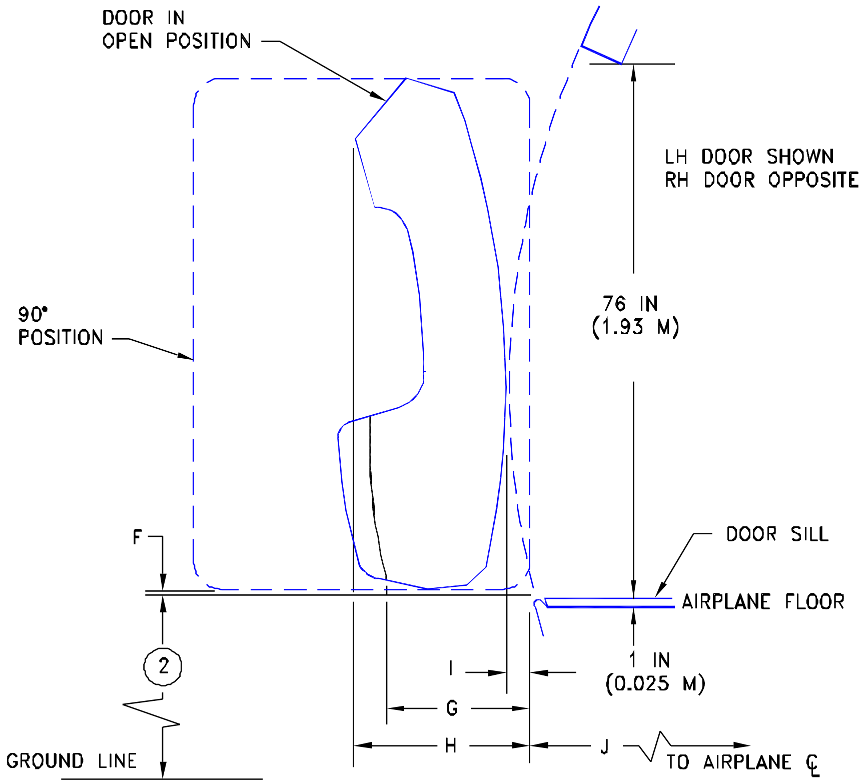
	DOOR NUMBER
	1 ②
A	7 FT 6 IN
	2.29 M
B ①	3 FT 9 IN
	1.14 M
C	4 IN
	0.102 M
D	1 IN
	0.025 M
E	1 IN
	0.025 M

① MEASURED AT DOOR OPENING CENTERLINE AT DOOR SILL LEVEL AT 90° FROM AIRPLANE CENTERLINE.

② LH SIDE ONLY ON 747-8F.

2.7.2 DOOR CLEARANCES - MAIN ENTRY DOORS (PLAN VIEW)

MODEL 747-8F



VIEW LOOKING FORWARD

	DOOR NUMBER
	1 (3)
F	2 IN (0.05 M)
G (1)	1 FT 7 IN (0.48 M)
H (1)	1 FT 11 IN (0.58 M)
I (1)	1 IN (0.025 M)
J (1)	9 FT 6 IN (2.90 M)

(1) MEASURED AT DOOR OPENING CENTERLINE AT DOOR SILL LEVEL AT 90° FROM AIRPLANE CENTERLINE

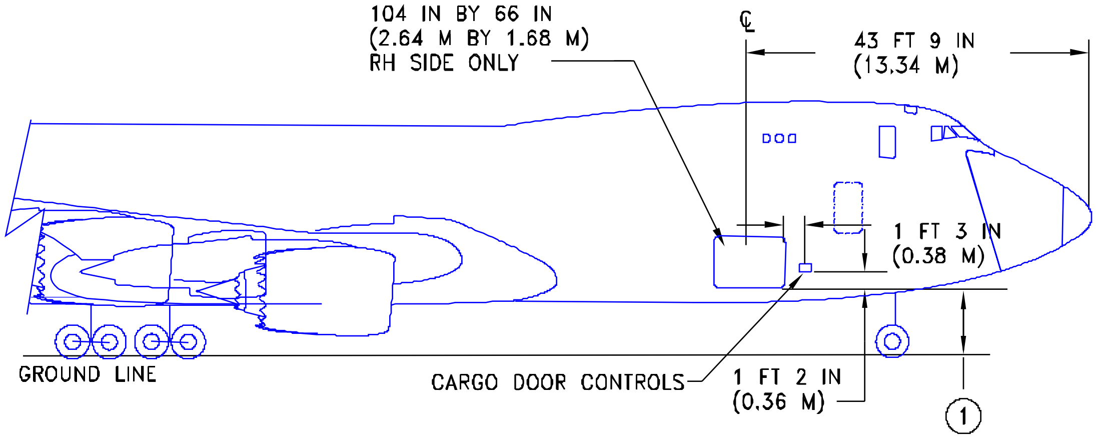
(2) SEE SEC. 2.3 FOR DOOR SILL HEIGHTS

(3) LH SIDE ONLY ON 747-8F

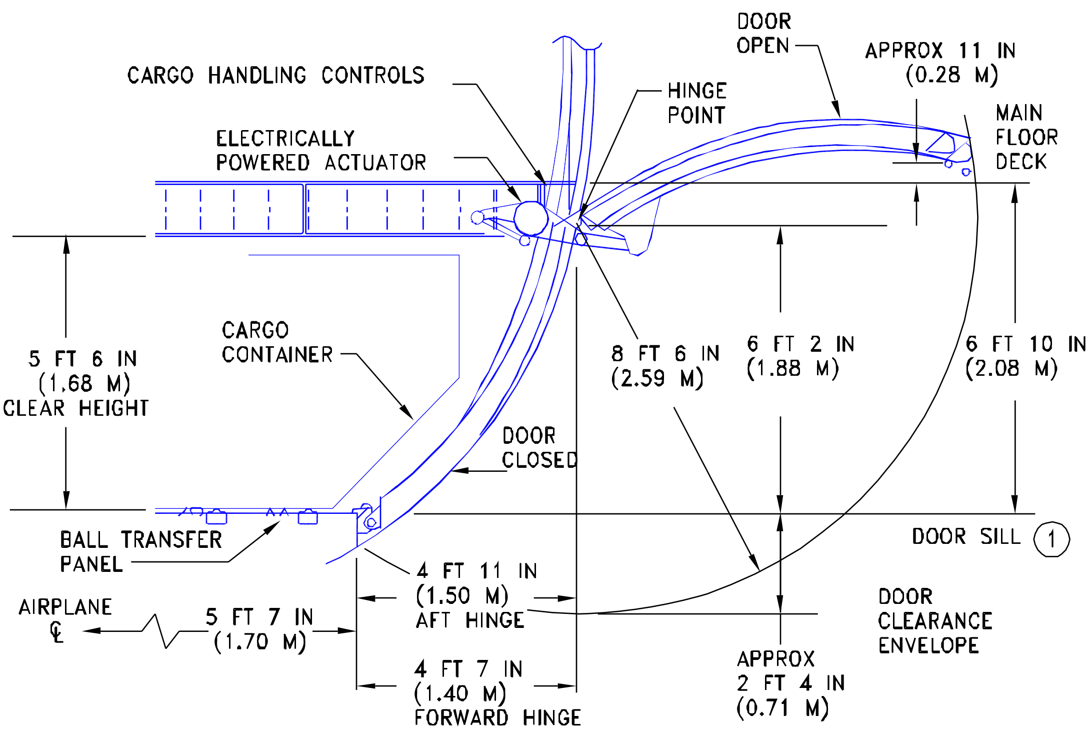
2.7.3 DOOR CLEARANCES - MAIN ENTRY DOOR 1 (SIDE VIEW)

MODEL 747-8F

PRELIMINARY



RIGHT SIDE VIEW



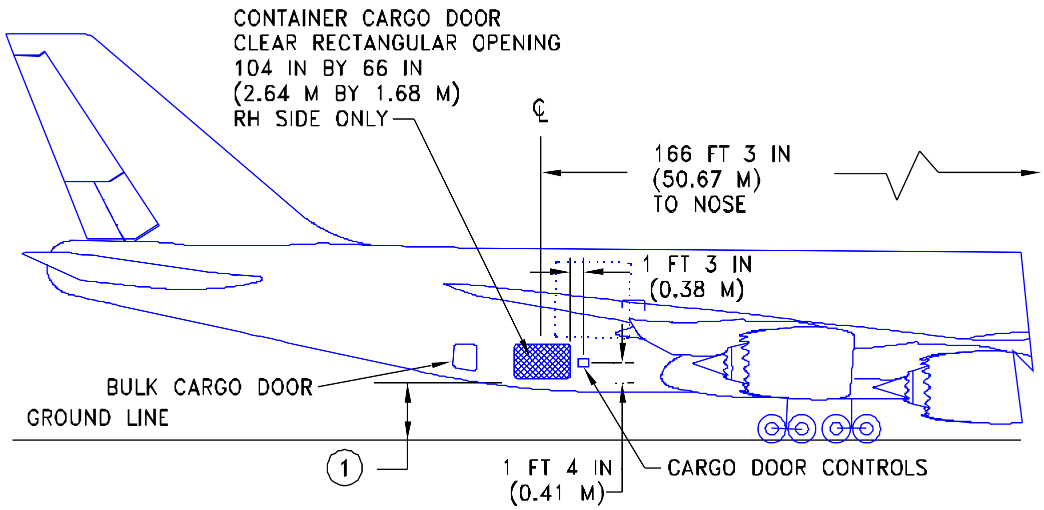
CONTAINER CARGO DOOR - VIEW LOOKING FORWARD

(1) SEE SECTION 2.3 FOR DOOR SILL HEIGHTS

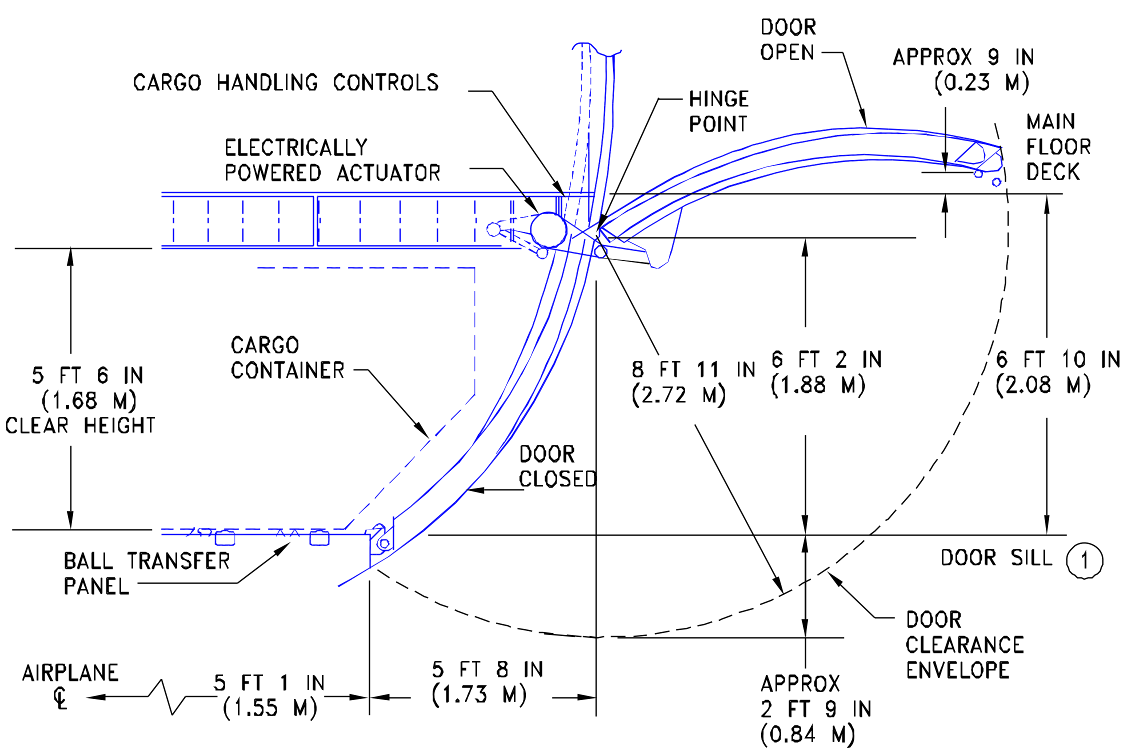
2.7.4 DOOR CLEARANCES – LOWER FORWARD CARGO COMPARTMENT

MODEL 747-8F

PRELIMINARY



RIGHT SIDE VIEW

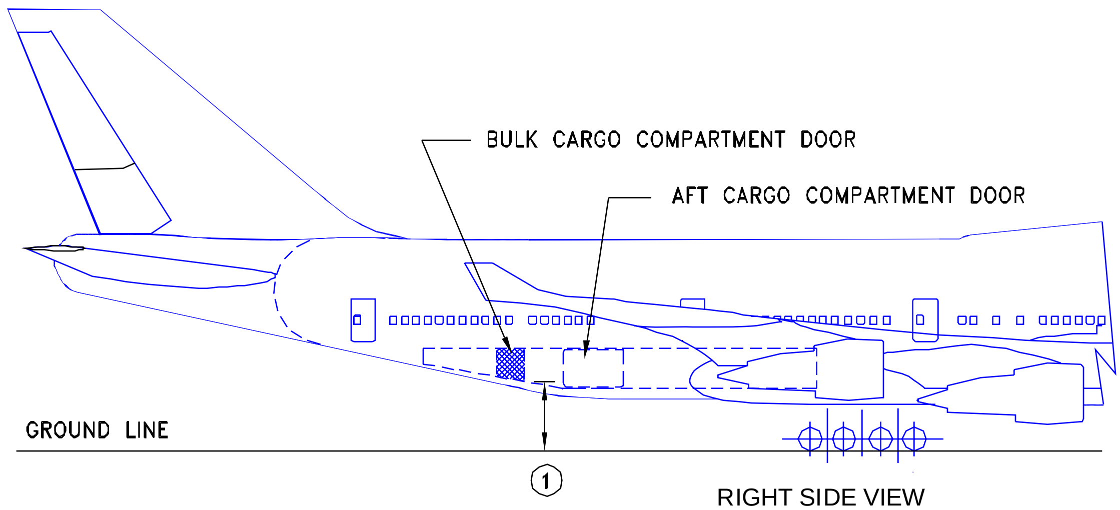


CONTAINER CARGO DOOR - VIEW LOOKING FORWARD

(1) SEE SECTION 2.3 FOR DOOR SILL HEIGHTS

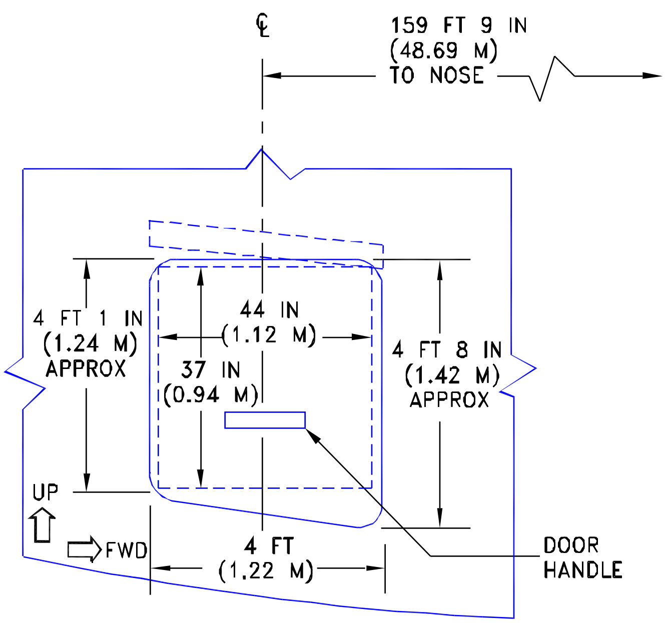
2.7.5 DOOR CLEARANCES – LOWER AFT CARGO COMPARTMENT
MODEL 747-8F

PRELIMINARY

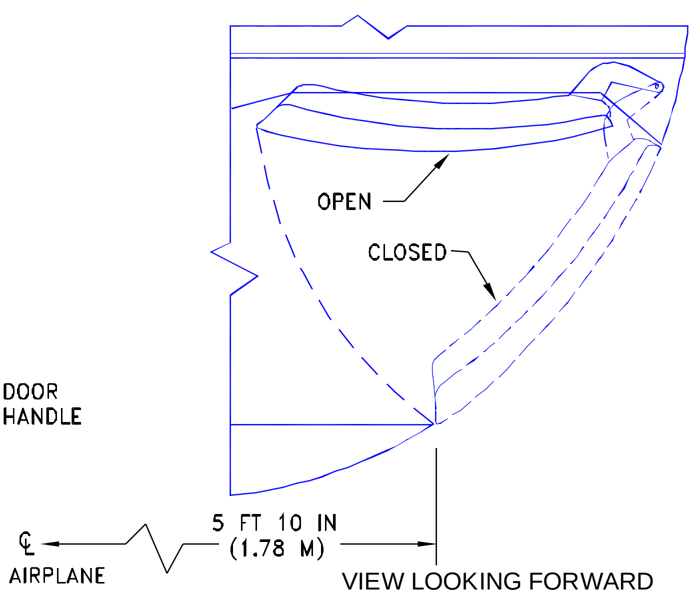


RIGHT SIDE VIEW

1 SEE SECTION 2.3 FOR DOOR SILL HEIGHTS

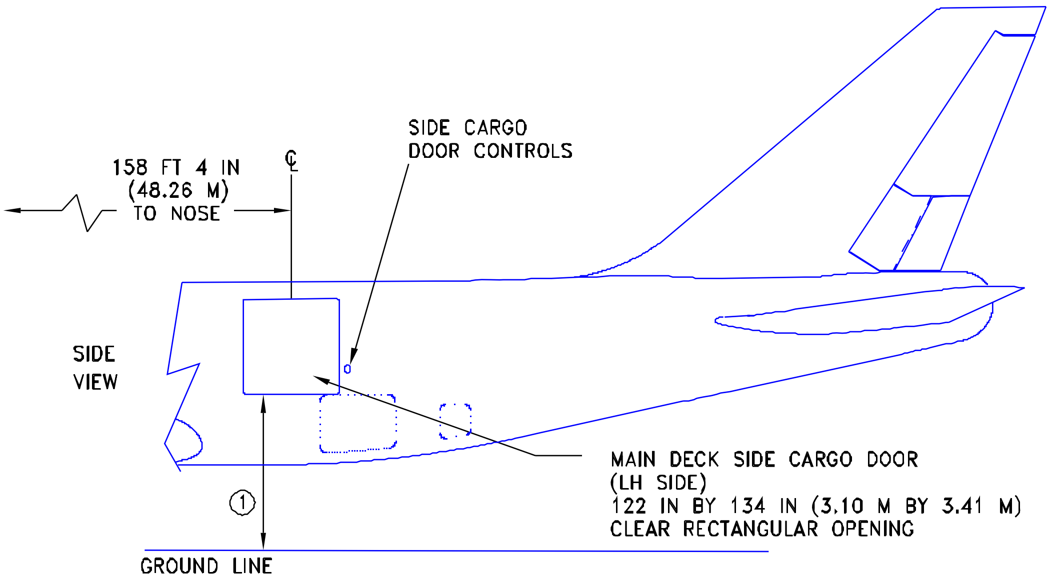


RIGHT SIDE VIEW

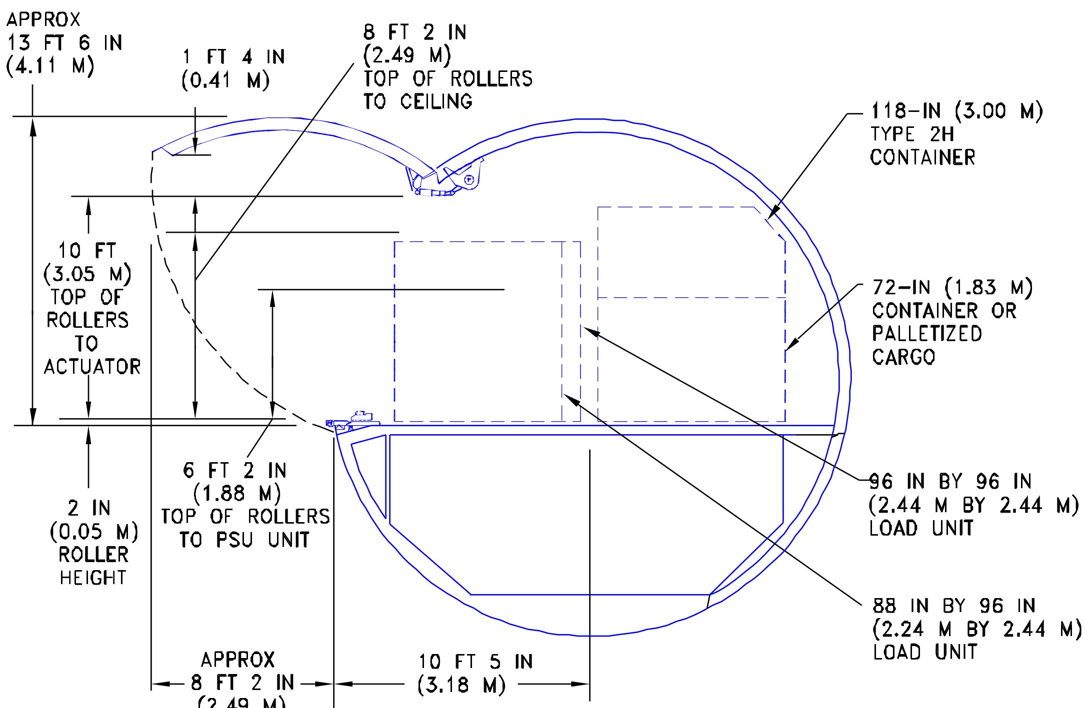


VIEW LOOKING FORWARD

2.7.6 DOOR CLEARANCES - BULK CARGO COMPARTMENT
MODEL 747-8F



LEFT SIDE VIEW



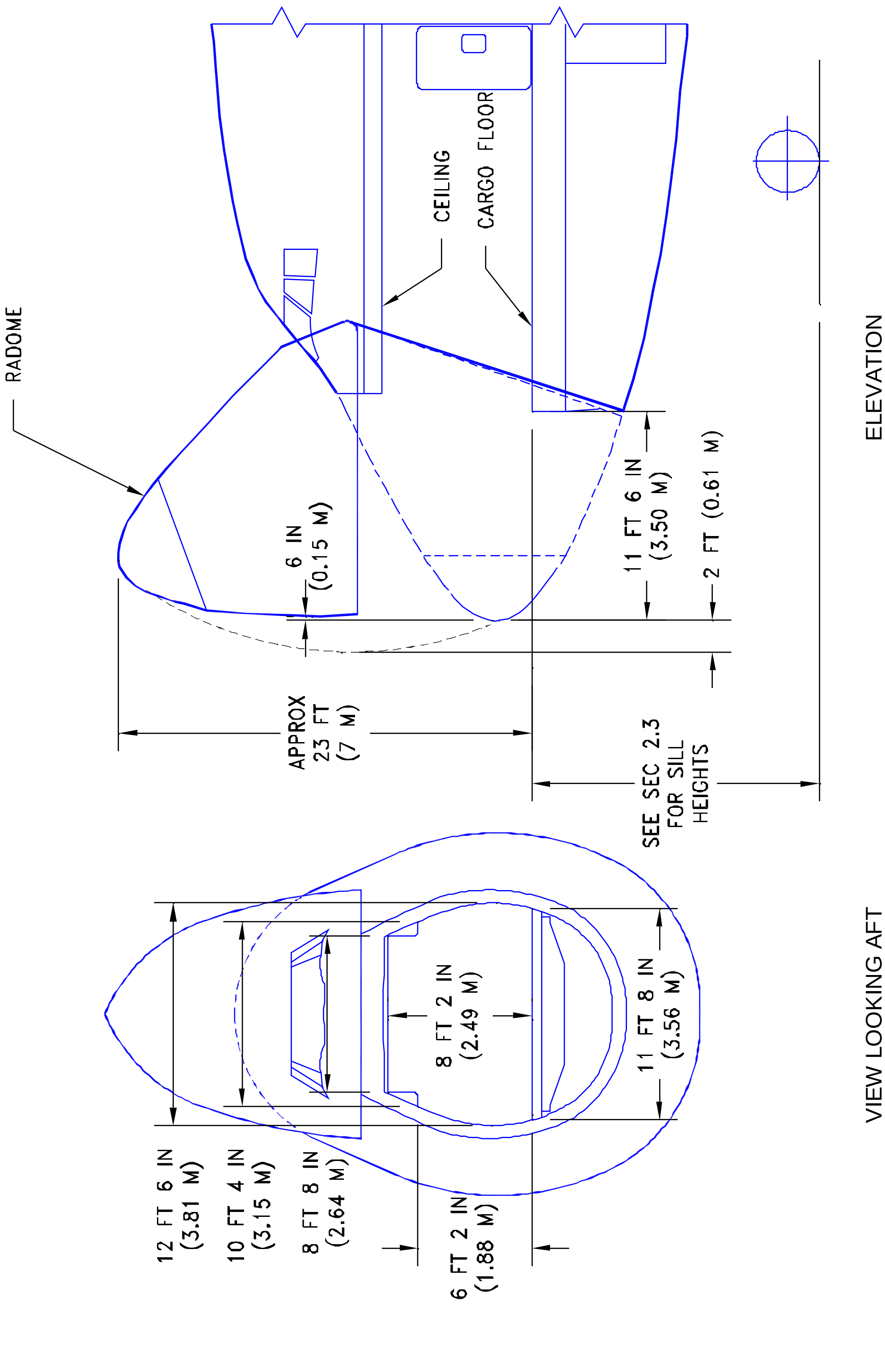
VIEW LOOKING FORWARD

① SEE SECTION 2.3 FOR DOOR SILL HEIGHTS

2.7.7 DOOR CLEARANCES – MAIN DECK CARGO DOOR

MODEL 747-8F

PRELIMINARY



2.7.8 DOOR CLEARANCES - NOSE CARGO DOOR
MODEL 747-8F

3.0 AIRPLANE PERFORMANCE

3.0 AIRPLANE PERFORMANCE

3.1 General Information

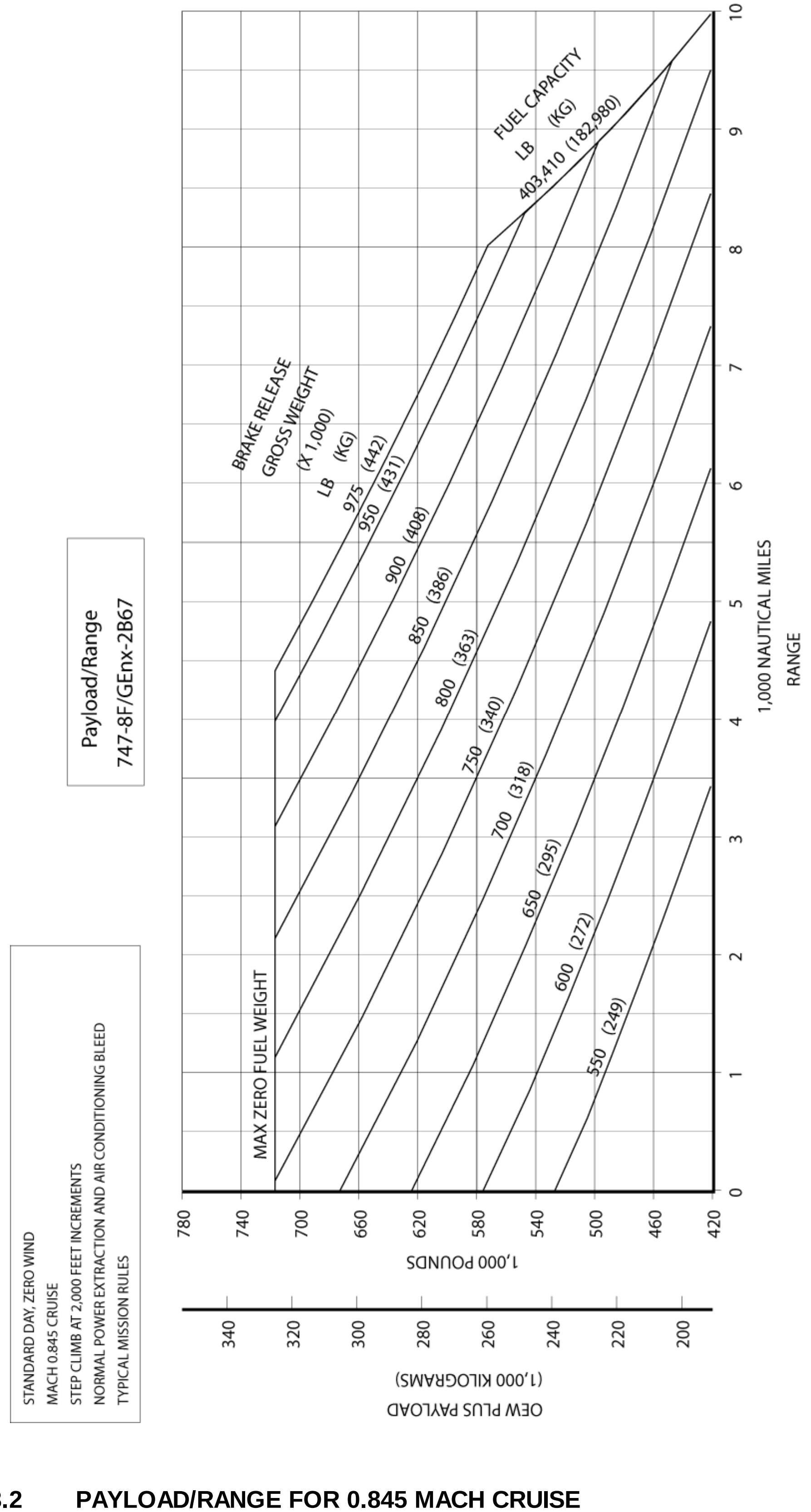
The graphs in Section 3.2 provide information on operational empty weight (OEW) and payload, trip range, brake release gross weight, and fuel limits for airplane models with the different engine options. To use these graphs, if the trip range and zero fuel weight (OEW + payload) are know, the approximate brake release weight can be found, limited by fuel quantity. Examples of loading conditions under certain OEW's are illustrated in each graph.

The graphs in Section 3.3 provide information on F.A.R. takeoff runway length requirements with the different engines at different pressure altitudes. Maximum takeoff weights shown on the graphs are the heaviest for the particular airplane models with the corresponding engines. Standard day temperatures for pressure altitudes shown on the F.A.R. takeoff graphs are given below:

PRESSURE ALTITUDE		STANDARD DAY TEMP	
FEET	METERS	^{0}F	^{0}C
0	0	59.0	15.00
2,000	610	51.9	11.04
4,000	1,219	44.7	7.06
6,000	1,829	37.6	3.11
8,000	2,438	30.5	-0.85
10,000	3,048	23.3	-4.81

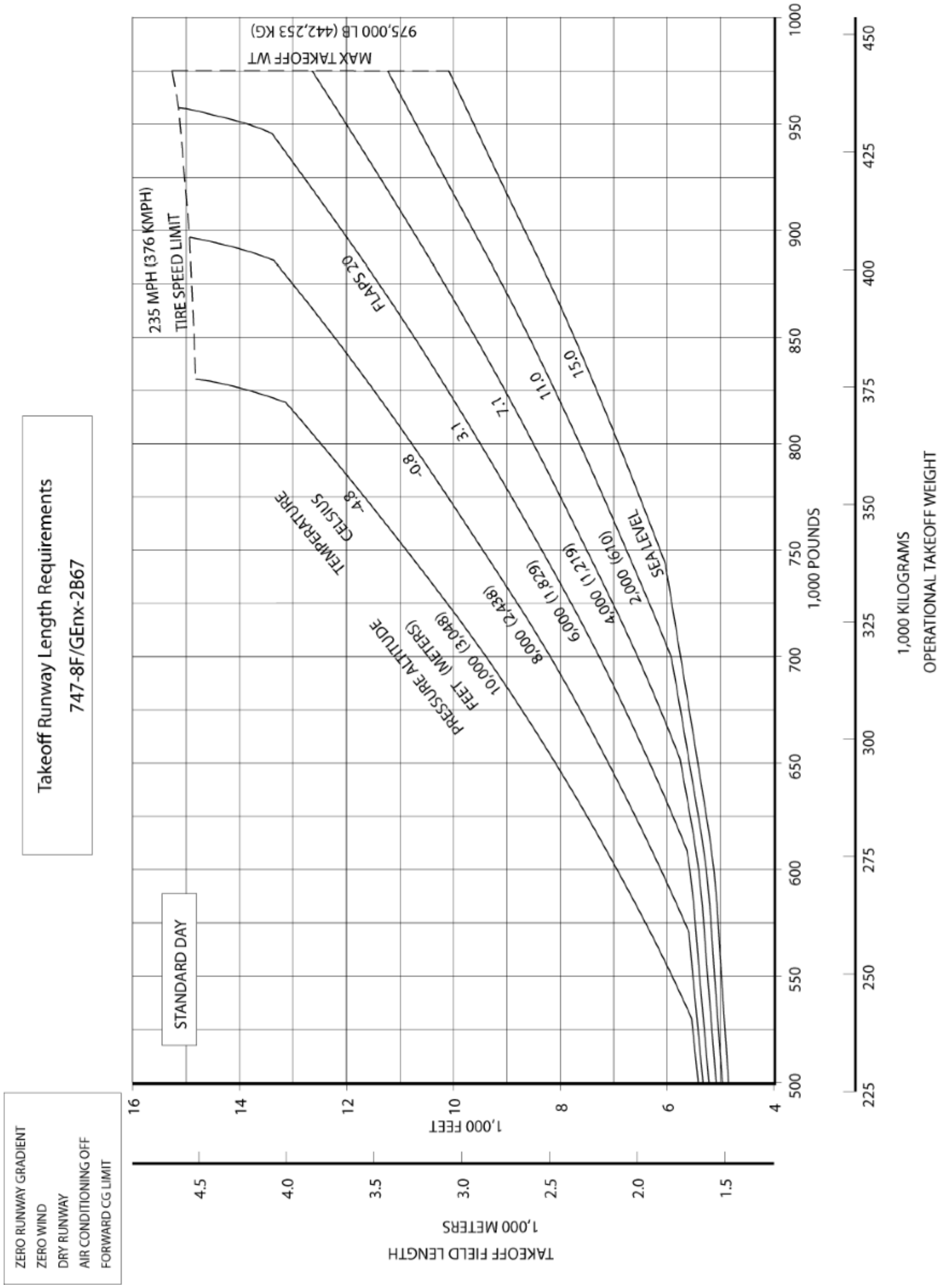
The graphs in Section 3.4 provide information on landing runway length requirements for different airplane weights and airport altitudes. The maximum landing weights shown are the heaviest for the particular airplane model.

PRELIMINARY

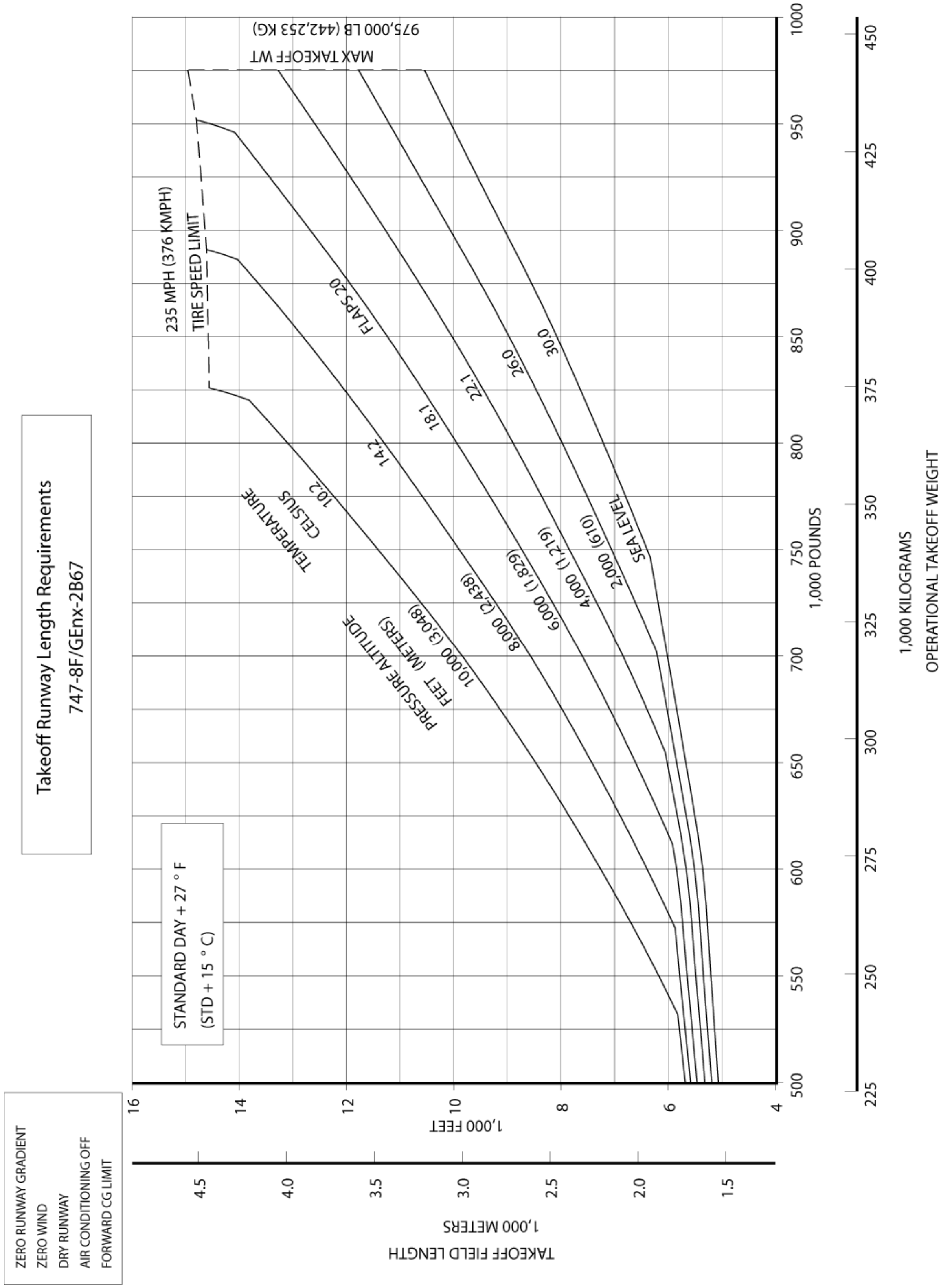


3.2 PAYLOAD/RANGE FOR 0.845 MACH CRUISE
MODEL 747-8F

PRELIMINARY



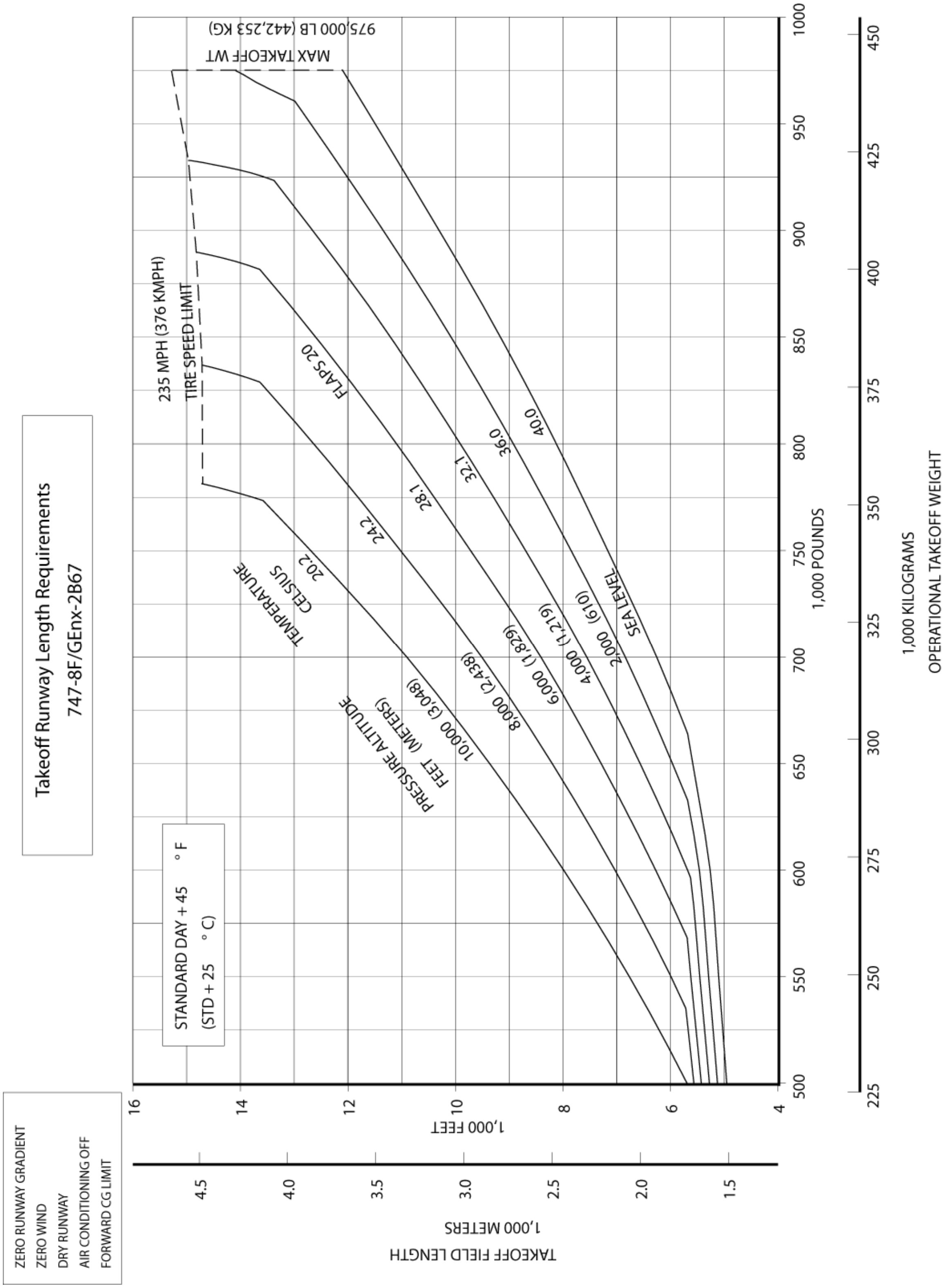
3.3.1 F.A.R. TAKEOFF RUNWAY LENGTH REQUIREMENTS - STANDARD DAY
MODEL 747-8F



3.3.2 F.A.R. TAKEOFF RUNWAY LENGTH REQUIREMENTS - STANDARD DAY + 27°F (STD + 15°C)

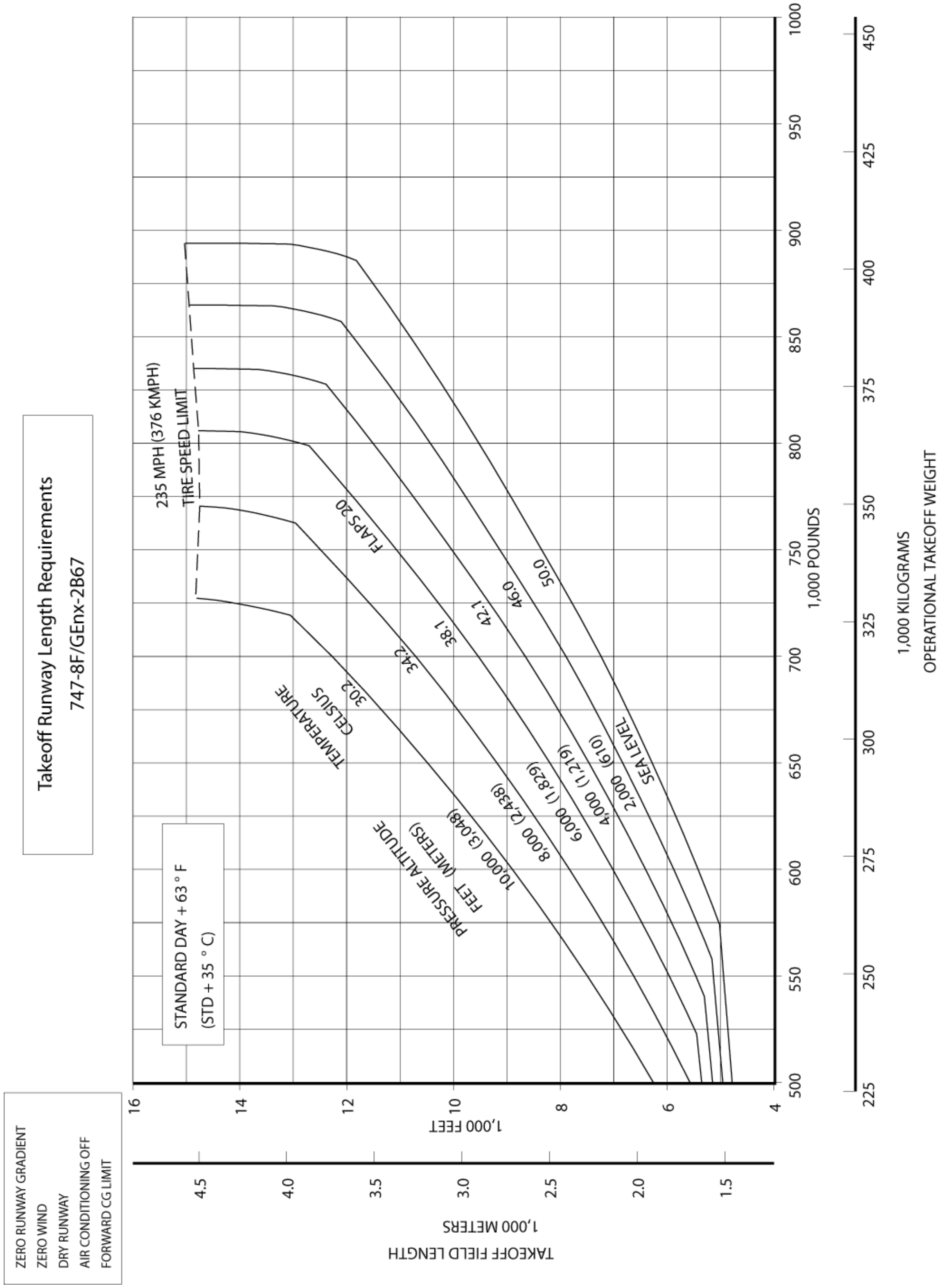
MODEL 747-8F

PRELIMINARY



3.3.3 F.A.R. TAKEOFF RUNWAY LENGTH REQUIREMENTS - STANDARD DAY + 45°F (STD + 25°C)

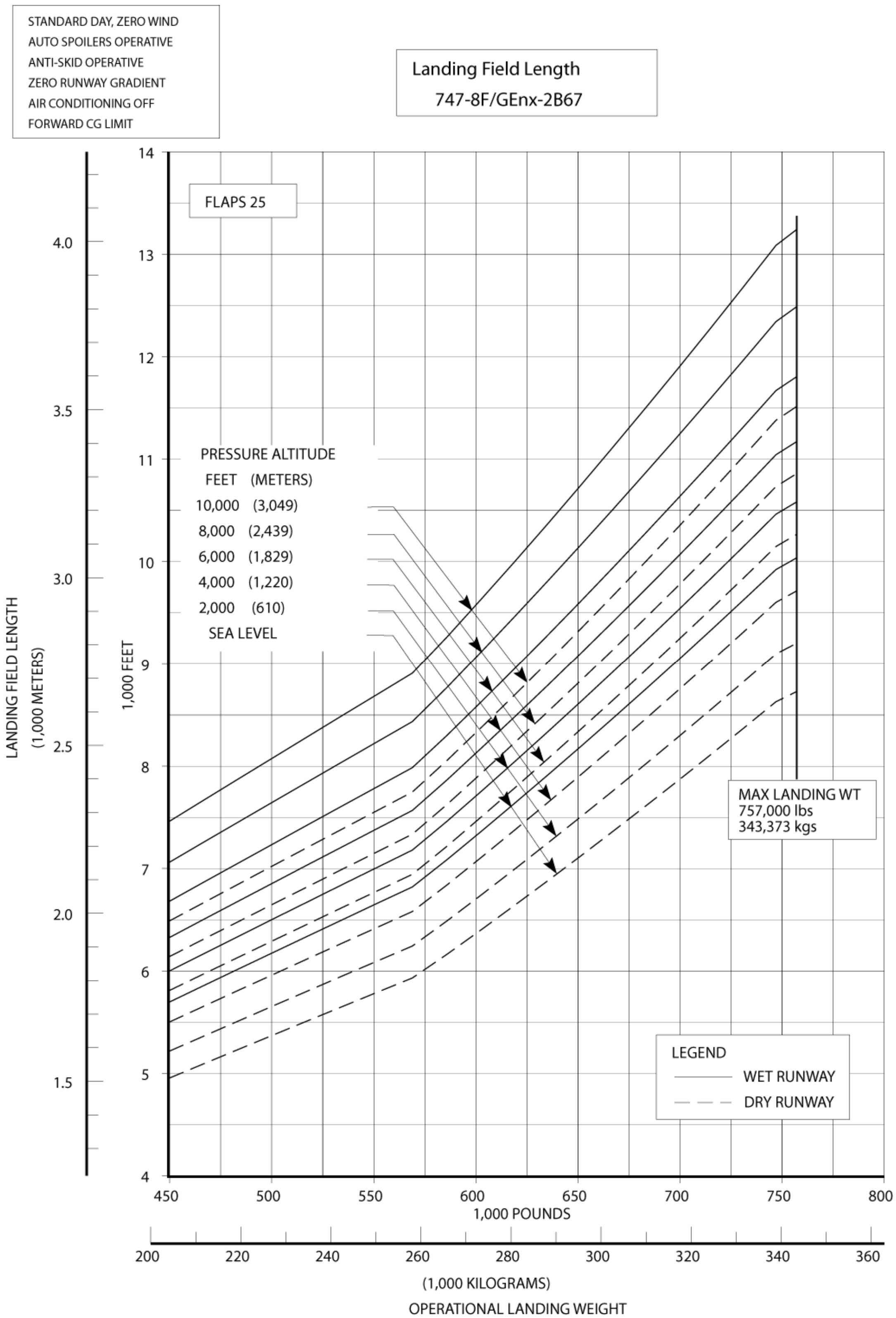
MODEL 747-8F



3.3.4 F.A.R. TAKEOFF RUNWAY LENGTH REQUIREMENTS – STANDARD DAY + 63˚F (STD + 35˚C)

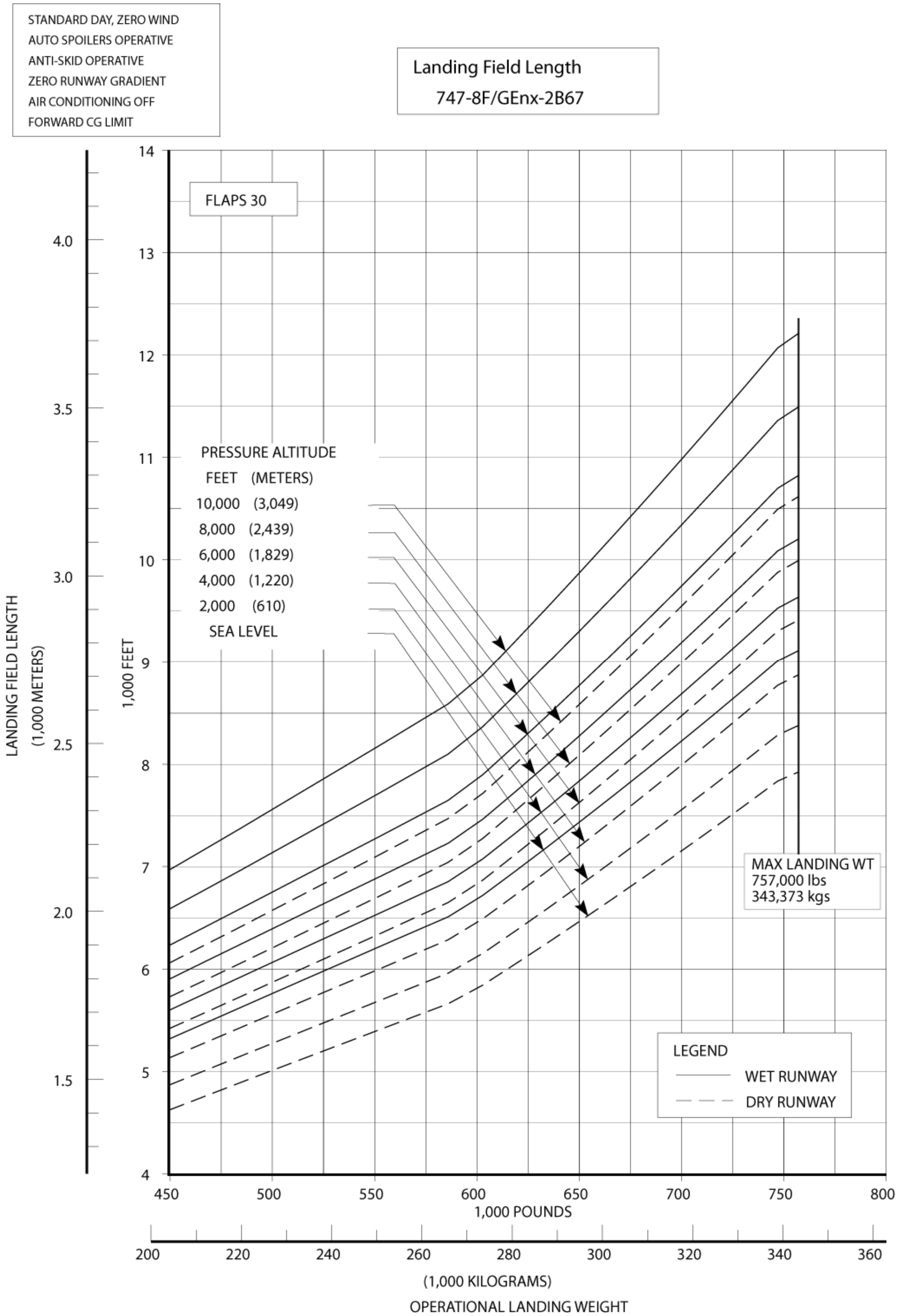
MODEL 747-8F

PRELIMINARY



3.4.1 F.A.R. LANDING RUNWAY LENGTH REQUIREMENTS - FLAPS 25
MODEL 747-8F

PRELIMINARY



3.4.2 F.A.R. LANDING RUNWAY LENGTH REQUIREMENTS - FLAPS 30
MODEL 747-8F

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4.0 GROUND MANEUVERING

4.1 General Information

4.2 Turning Radii

4.3 Clearance Radii

4.4 Visibility from Cockpit in Static Position

4.5 Runway and Taxiway Turn Paths

4.6 Runway Holding Bay

4.0 GROUND MANEUVERING

4.1 General Information

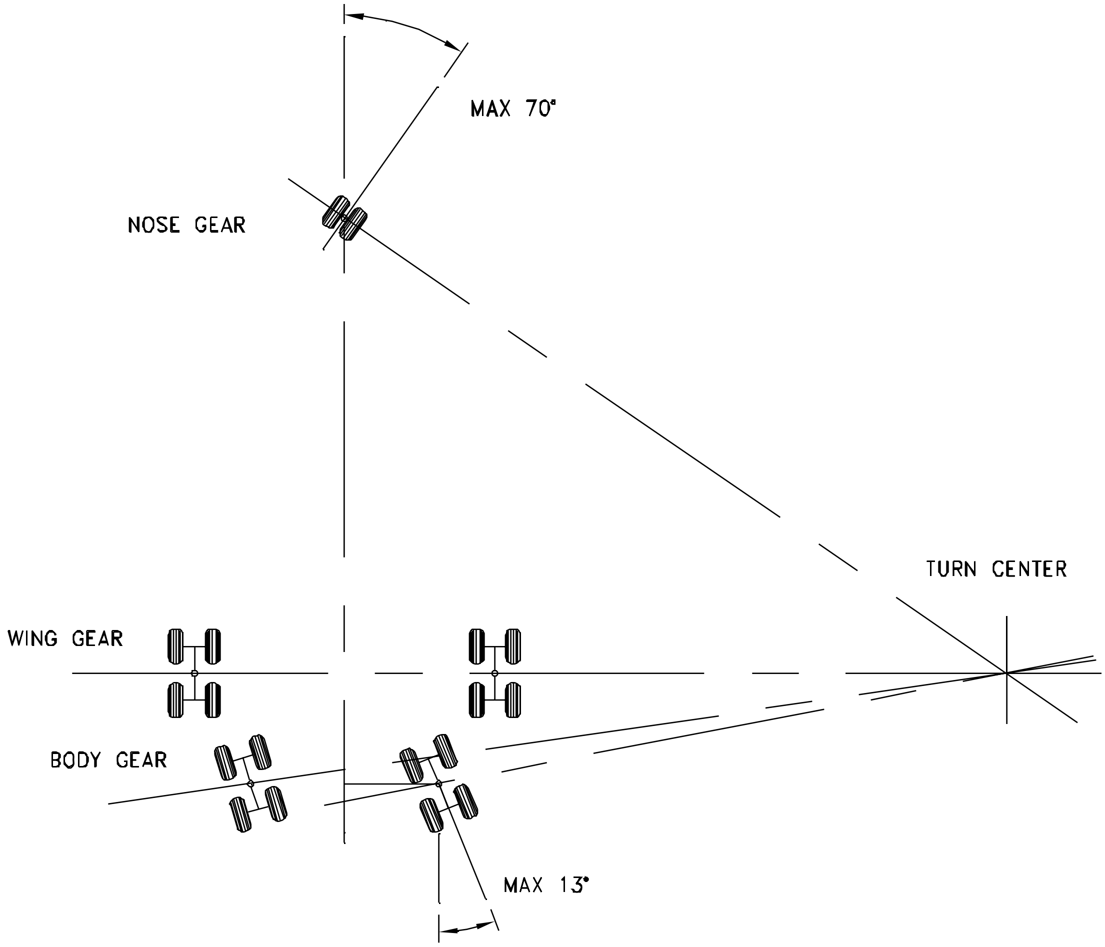
The 747-8F main landing gear consists of four main struts, each strut with four wheels. This geometric arrangement of the four main gears results in somewhat different ground maneuvering characteristics from those experienced with typical landing gear aircraft.

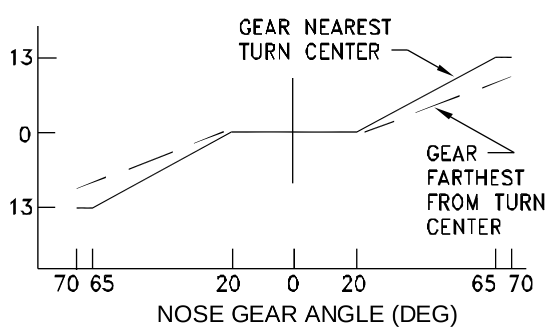
Basic factors that influence the geometry of the turn include:

1. Nose wheel steering angle
2. Engine power settings
3. Center of gravity location
4. Airplane weight
5. Pavement surface conditions
6. Amount of differential braking
7. Ground speed
8. Main landing gear steering

The steering system of the 747-8 Freighter incorporates steering of the main body landing gear in addition to the nose gear steering. This body gear steering system is hydraulically actuated and is programmed electrically to provide steering ratios proportionate to the nose gear steering angles. During takeoff and landing, the body gear steering system is centered, mechanically locked, and depressurized.

Steering of the main body gear has the following advantages over ground maneuvering without this steering feature; overall improved maneuverability, including improved nose gear tracking; elimination of the need for differential braking during ground turns, with subsequent reduced brake wear; reduced thrust requirements; lower main gear stress levels; and reduced tire scrubbing. The turning radii shown in Section 4.2 are derived from a previous test involving a 747-200. The 747-8F is expected to follow the same maneuvering characteristics.



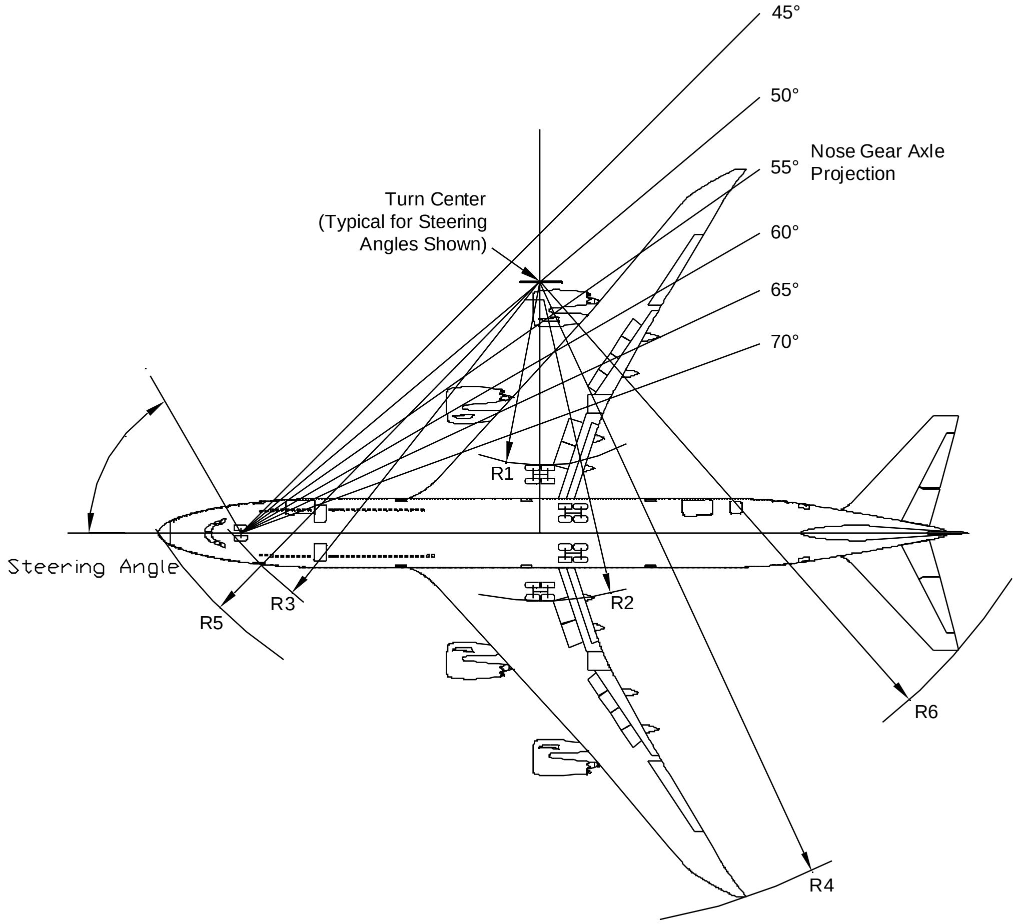


NOSE GEAR	BODY GEAR
0° TO 20°	0°
20° TO 70°	0° TO 13°

NOSE GEAR/BODY GEAR TURN RATIOS

4.1.1 GENERAL INFORMATION – BODY GEAR STEERING SYSTEM

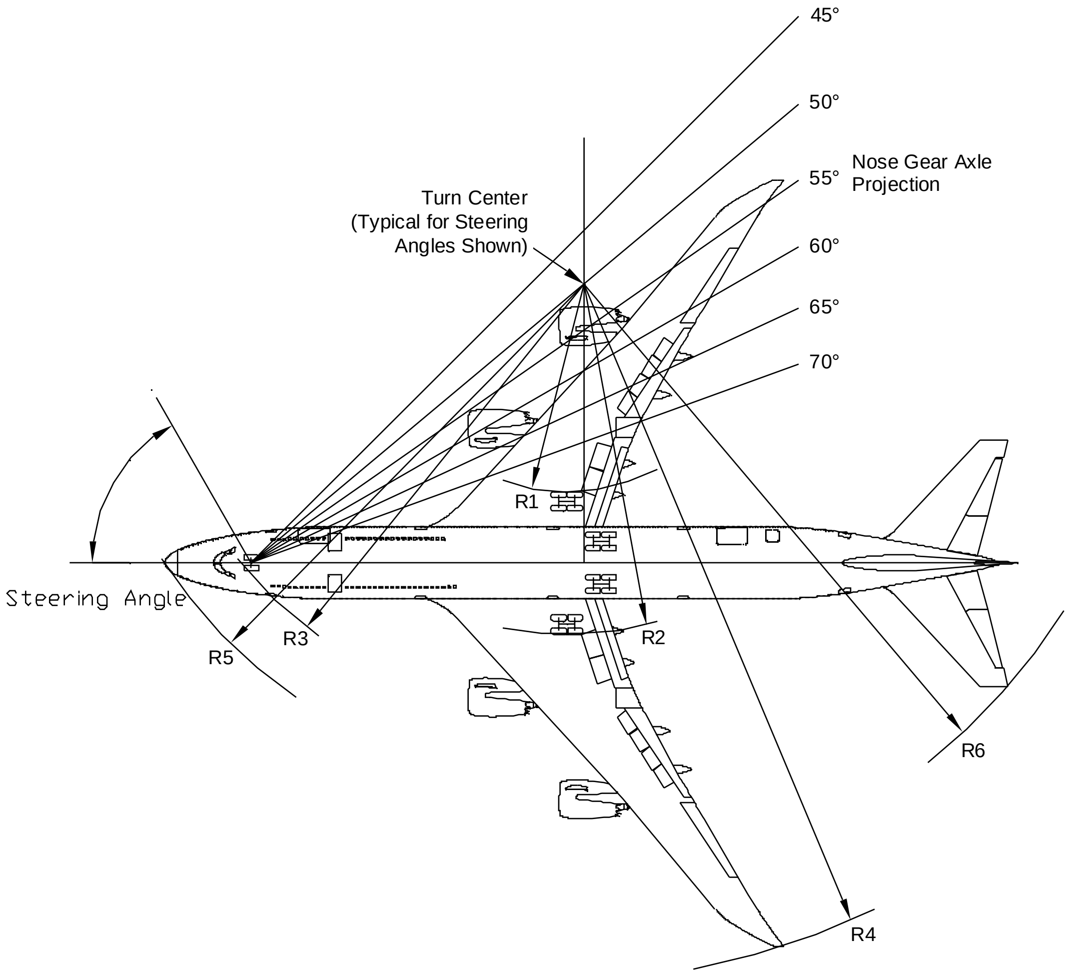
MODEL 747-8, 747-8F



NOTES: DATA SHOWN FOR AIRPLANE WITH BODY GEAR STEERING
ACTUAL OPERATING TURNING RADII MAY BE GREATER THAN SHOWN
CONSULT WITH AIRLINE FOR SPECIFIC OPERATING PROCEDURE
DIMENSIONS ROUNDED TO NEAREST FOOT AND 0.1 METER

STEERING ANGLE	R1 INNER GEAR		R2 OUTER GEAR		R3 NOSE GEAR		R4 WING TIP		R5 NOSE		R6 TAIL	
(DEG)	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	139	42.4	181	55.2	188	57.3	280	85.3	199	60.7	233	71.0
35	111	33.8	153	46.6	164	50.0	252	76.8	177	53.9	210	64.0
40	89	27.1	131	39.9	147	44.8	231	70.4	161	49.1	193	58.8
45	72	21.9	113	34.4	134	40.8	214	65.2	150	45.7	180	54.9
50	57	17.4	98	29.9	124	37.8	200	61.0	141	43.0	170	51.8
55	44	13.4	86	26.2	116	35.4	188	57.3	134	40.8	162	49.4
60	33	10.1	74	22.6	110	33.5	177	53.9	129	39.3	155	47.2
65	22	6.7	64	19.5	105	32.0	168	51.2	125	38.1	149	45.4
70 (MAX)	13	4.0	55	16.8	101	30.8	159	48.5	123	37.5	144	43.9

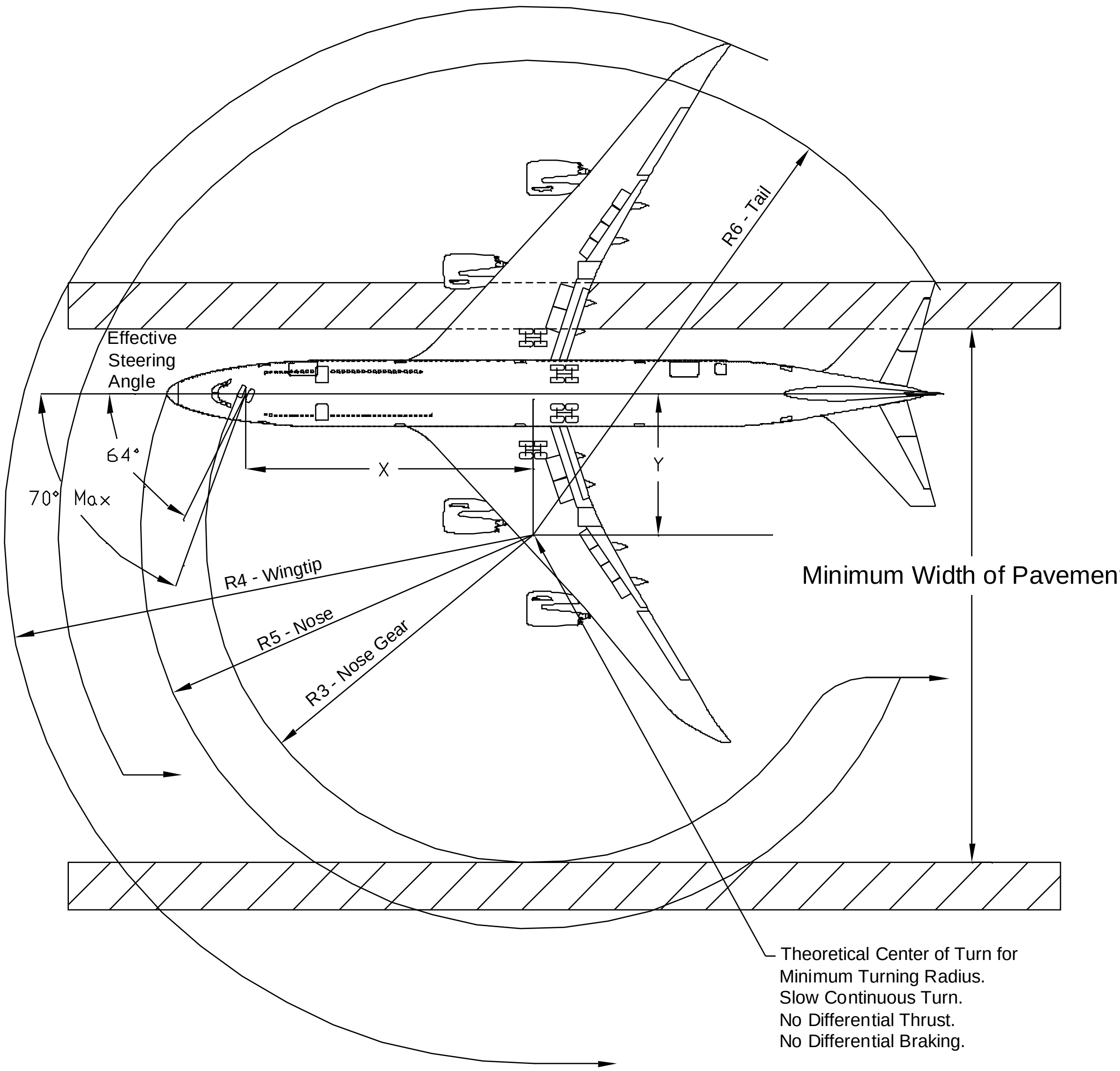
4.2.1 TURNING RADII – NO SLIP ANGLE – WITH BODY GEAR STEERING
MODEL 747-8F



NOTES: DATA SHOWN FOR AIRPLANE WITH BODY GEAR STEERING INOPERATIVE
ACTUAL OPERATING TURNING RADII MAY BE GREATER THAN SHOWN
CONSULT WITH AIRLINE FOR SPECIFIC OPERATING PROCEDURE
DIMENSIONS ROUNDED TO NEAREST FOOT AND 0.1 METER

STEERING ANGLE	R1 INNER GEAR		R2 OUTER GEAR		R3 NOSE GEAR		R4 WING TIP		R5 NOSE		R6 TAIL	
(DEG)	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	148	45.1	190	57.9	198	60.4	287	87.5	209	63.7	240	73.2
35	118	36.0	160	48.8	173	52.7	258	78.6	186	56.7	215	65.5
40	95	29.0	137	41.8	155	47.2	236	71.9	169	51.5	196	59.7
45	77	23.5	118	36.0	141	43.0	218	66.4	157	47.9	182	55.5
50	61	18.6	103	31.4	130	39.6	203	61.9	148	45.1	171	52.1
55	47	14.3	89	27.1	122	37.2	190	57.9	141	43.0	162	49.4
60	36	11.0	77	23.5	116	35.4	178	54.3	135	41.1	155	47.2
65	25	7.6	66	20.1	111	33.8	168	51.2	131	39.9	149	45.4
70 (MAX)	15	4.6	57	17.4	107	32.6	159	48.5	128	39.0	143	43.6

4.2.2 TURNING RADII – NO SLIP ANGLE –BODY GEAR STEERING INOPERATIVE
MODEL 747-8F



Notes:

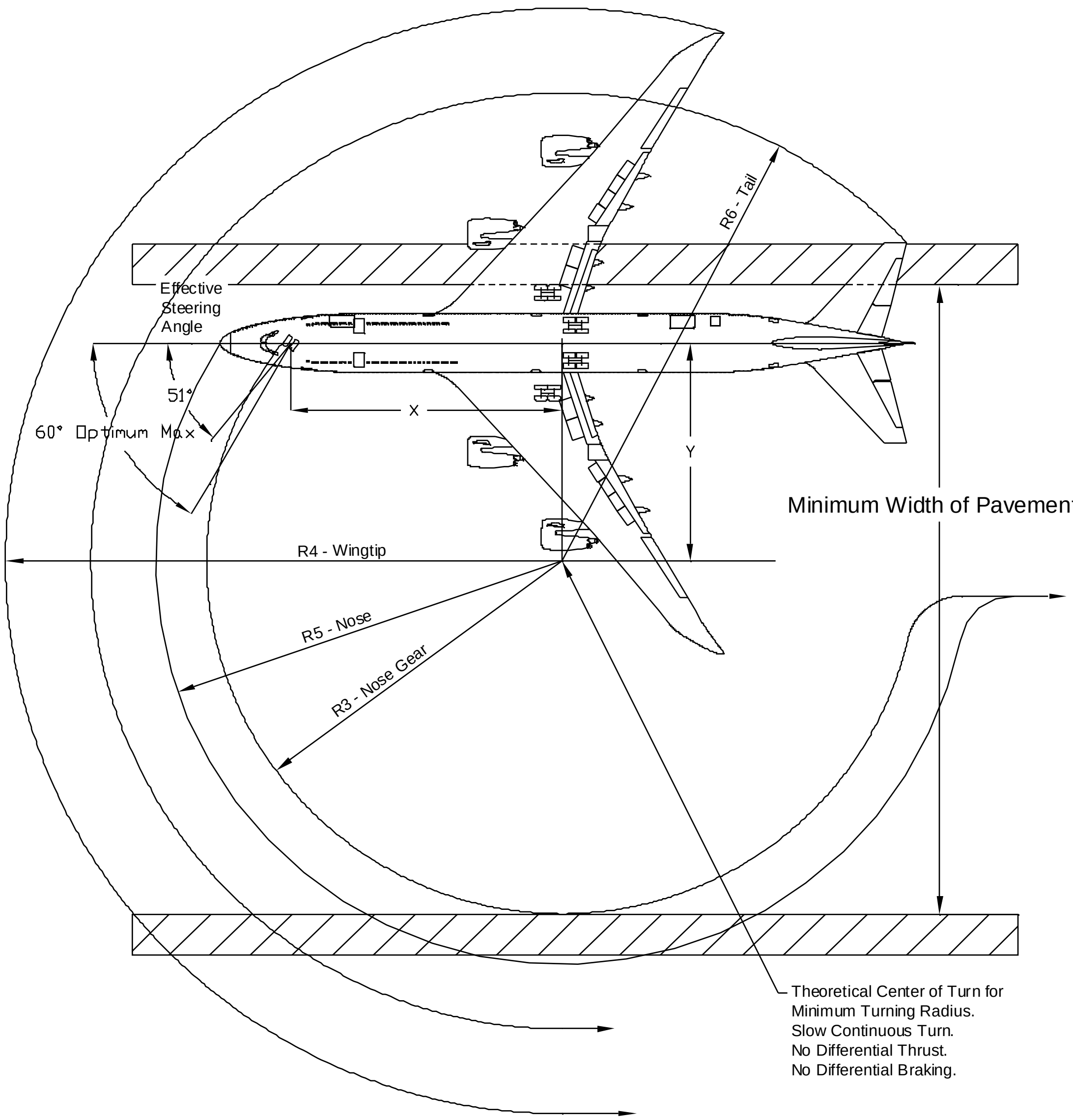
- **6° Tire Slip Angle – Approximate Only For 70° Maximum Turn Angle**
- **Consult Airline For Actual Operating Data.**

AIRPLANE MODEL	EFFECTIVE TURNING ANGLE (DEG)	X		Y		A		R3		R4		R5		R6	
		FT	M	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
747-8F	64	92	28.0	45	13.7	172	52.4	106	32.3	170	51.8	126	38.4	150	45.7

NOTE: DIMENSIONS ARE ROUNDED TO THE NEAREST FOOT AND 0.1 METER.

4.3.1 CLEARANCE RADII – WITH BODY GEAR STEERING
MODEL 747-8F

PRELIMINARY



Notes:

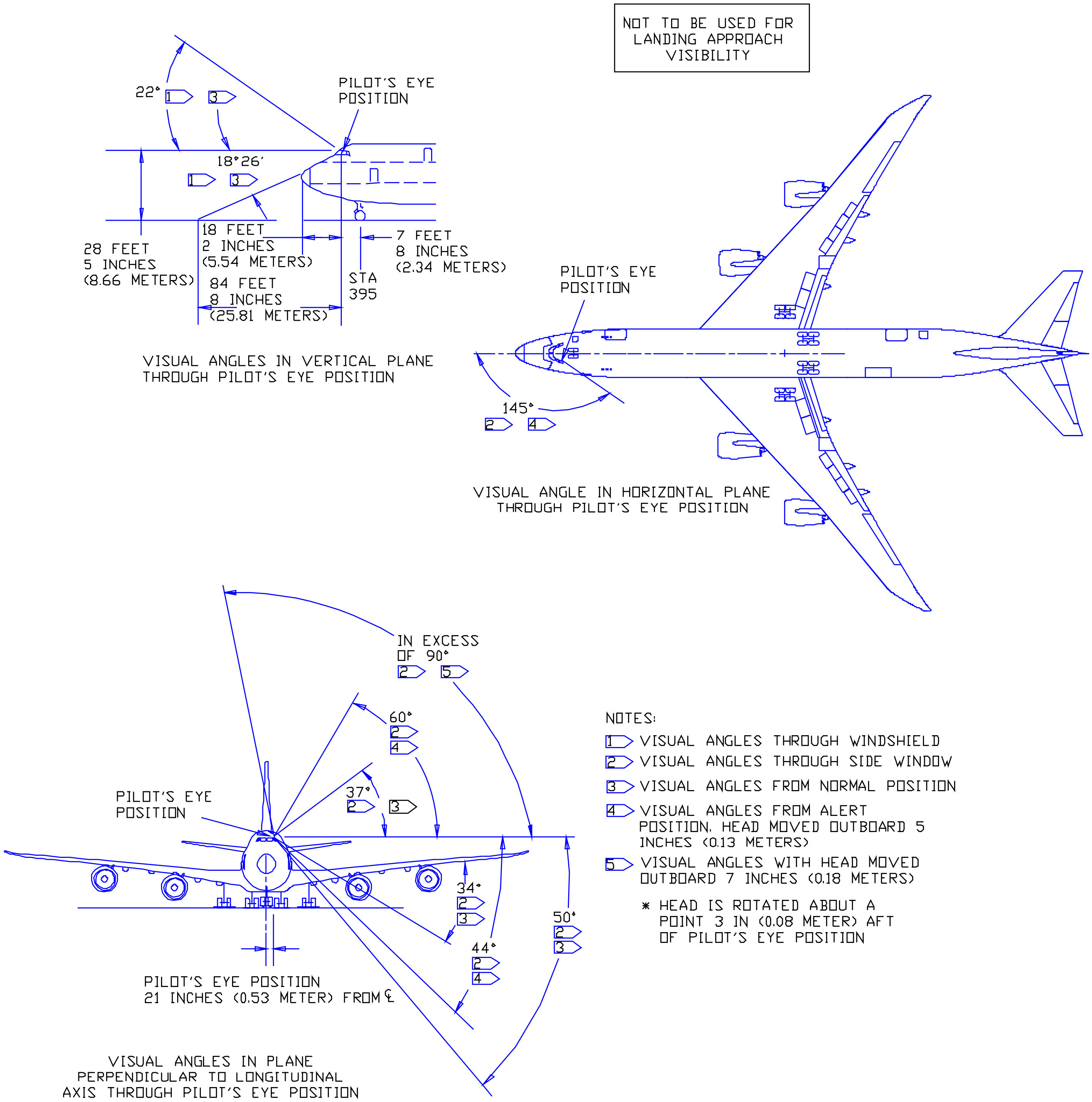
- **Body Gear Steering Inoperative Rarely Occurs. Data Provided As Reference Only**
- **9° Tire Slip Angle – Approximate Only For 60° Turn Angle (Optimum Max Steering Angle)**
- **Consult Airline For Actual Operating Data.**

AIRPLANE MODEL	EFFECTIVE TURNING ANGLE (DEG)	X		Y		A		R3		R4		R5		R6	
		FT	M	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
747-8F	51	98	29.9	79	24.1	228	69.5	129	39.3	200	61.0	146	44.5	169	51.5

NOTE: DIMENSIONS ARE ROUNDED TO THE NEAREST FOOT AND 0.1 METER.

4.3.2 CLEARANCE RADII –BODY GEAR STEERING INOPERATIVE
MODEL 747-8F

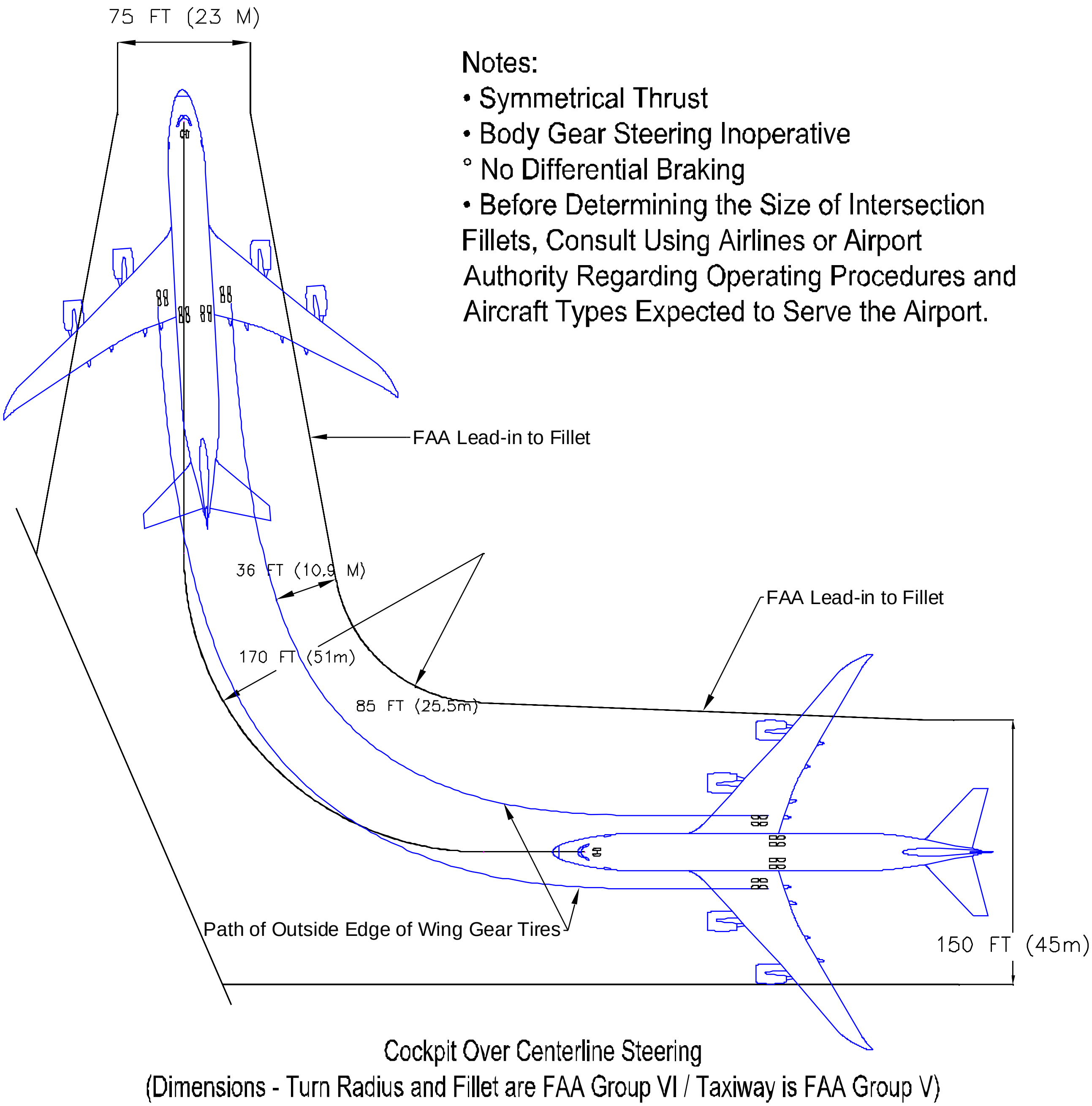
PRELIMINARY



4.4 VISIBILITY FROM COCKPIT IN STATIC POSITION

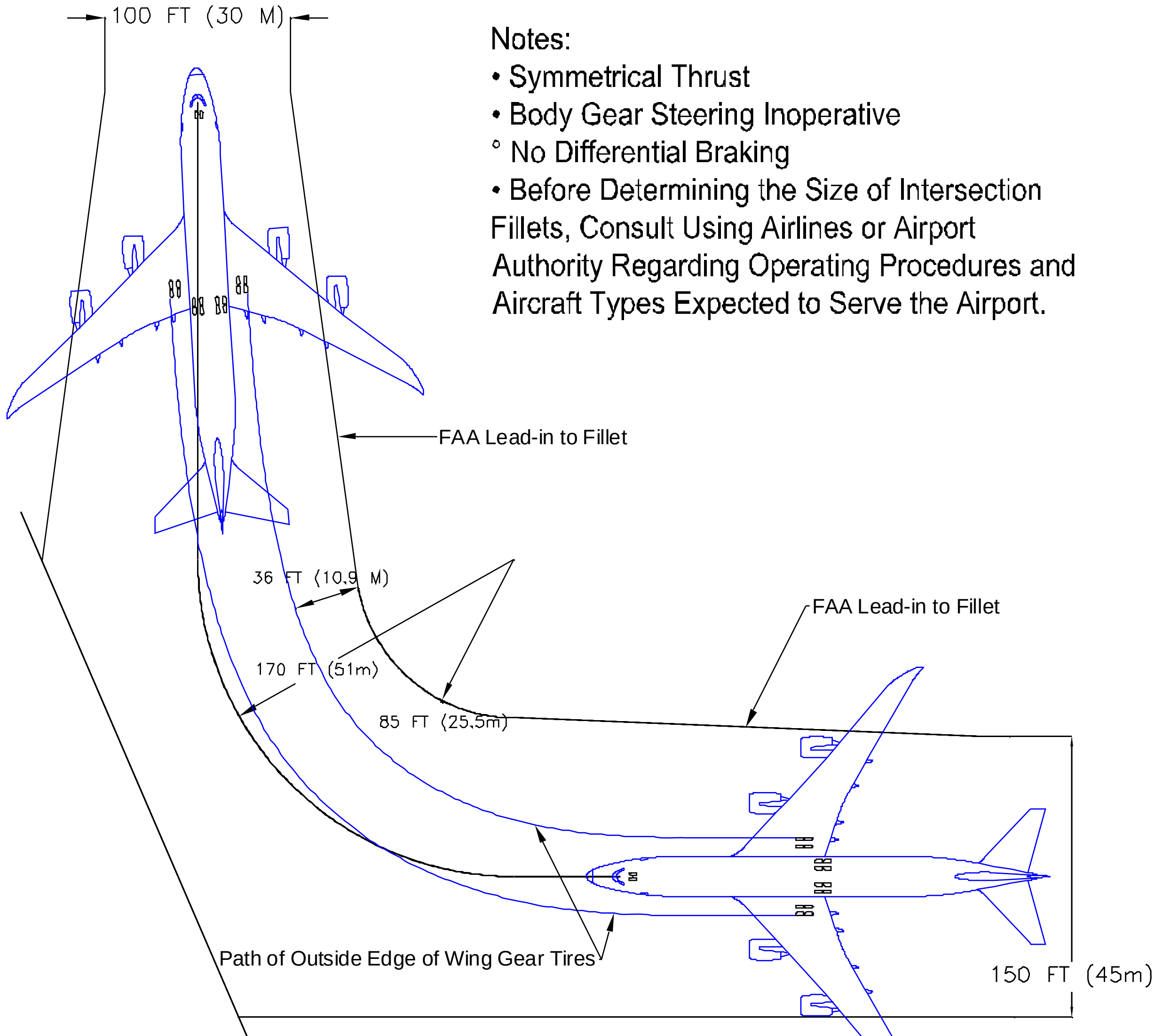
MODEL 747-8F

PRELIMINARY



4.5.1 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, 90 DEGREES, COCKPIT OVER CENTERLINE (FAA GROUP VI RADIUS/FILLET TO GROUP V TAXIWAY)

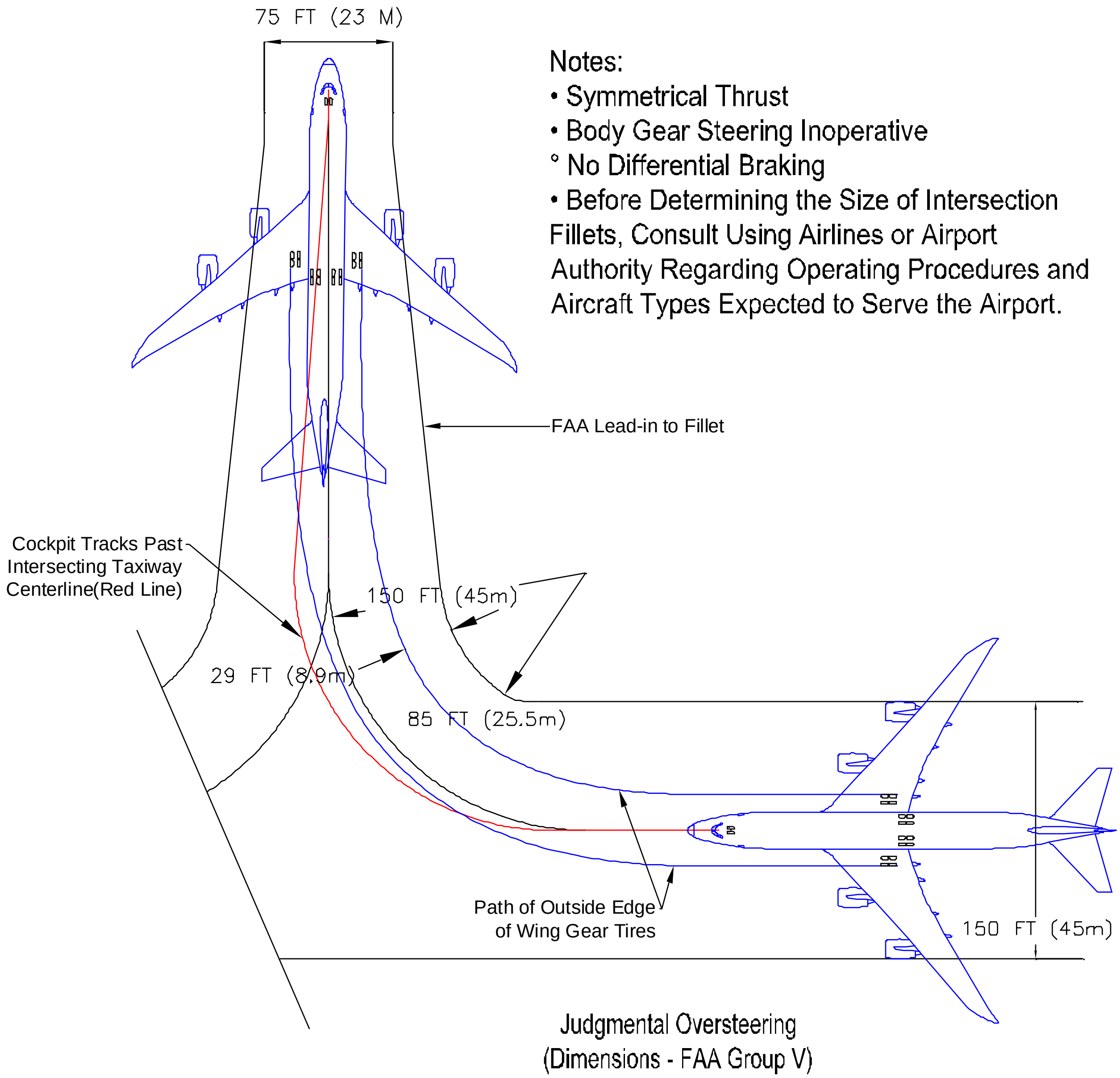
MODEL 747-8F



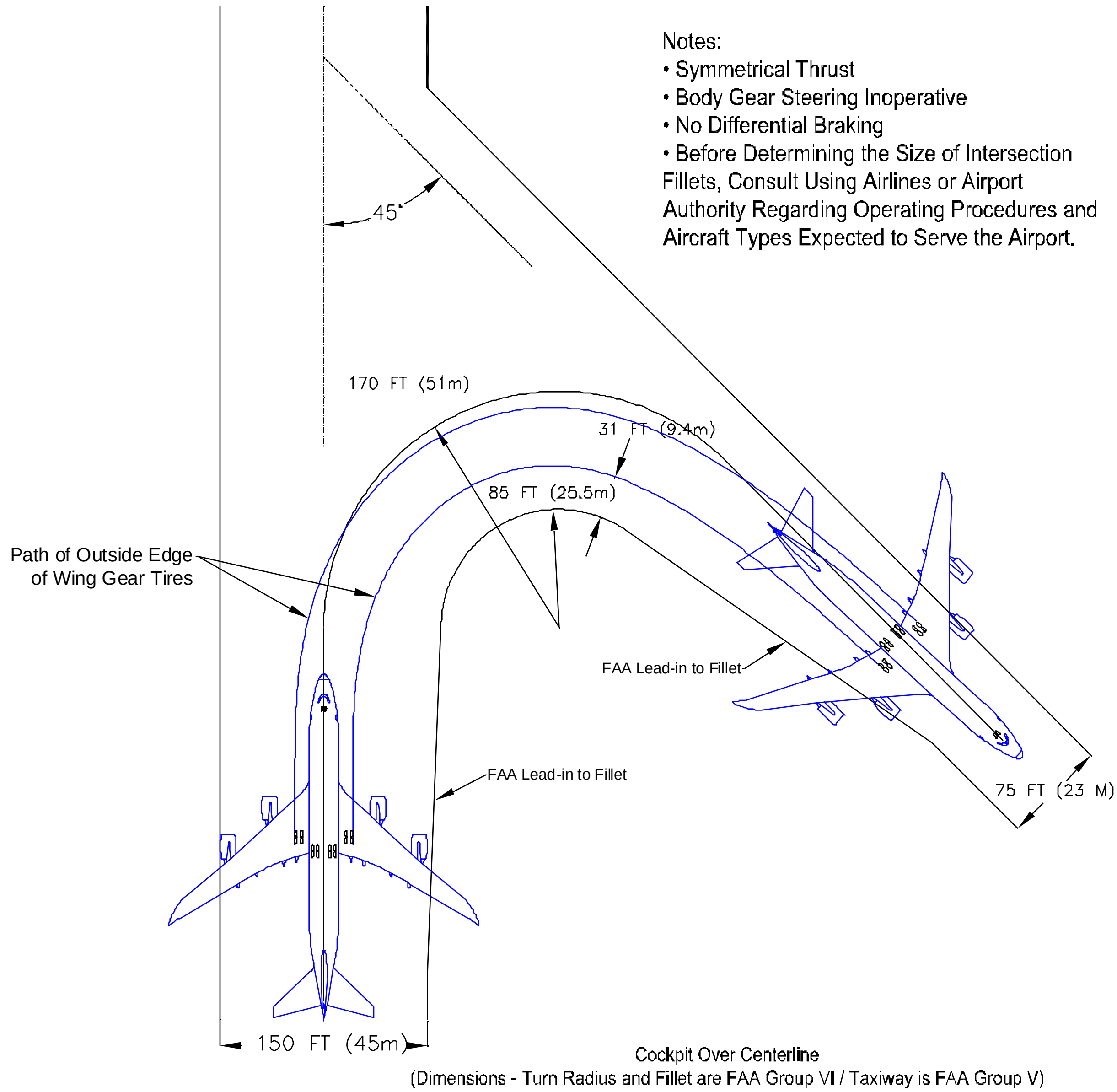
Cockpit Over Centerline Steering
(Dimensions - Turn Radius and Fillet are FAA Group VI / Taxiway is FAA Group VI)

4.5.2 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, 90 DEGREES, COCKPIT OVER CENTERLINE (FAA GROUP VI RADIUS/FILLET TO GROUP VI TAXIWAY)

MODEL 747-8F

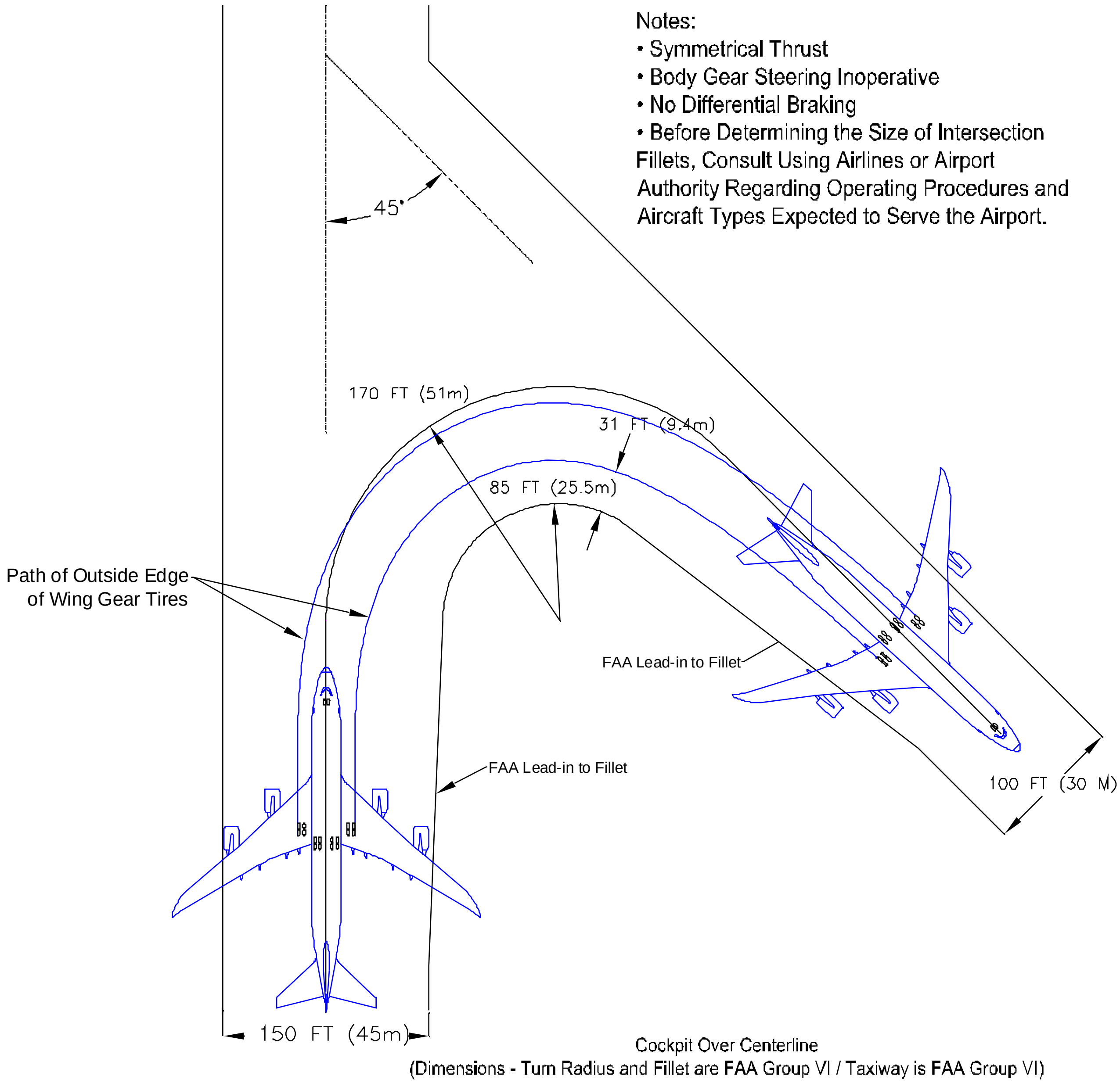


4.5.3 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, 90 DEGREES, JUDGMENTAL OVERSTEER (FAA GROUP V RADIUS/FILLET TO GROUP V TAXIWAY)
MODEL 747-8F

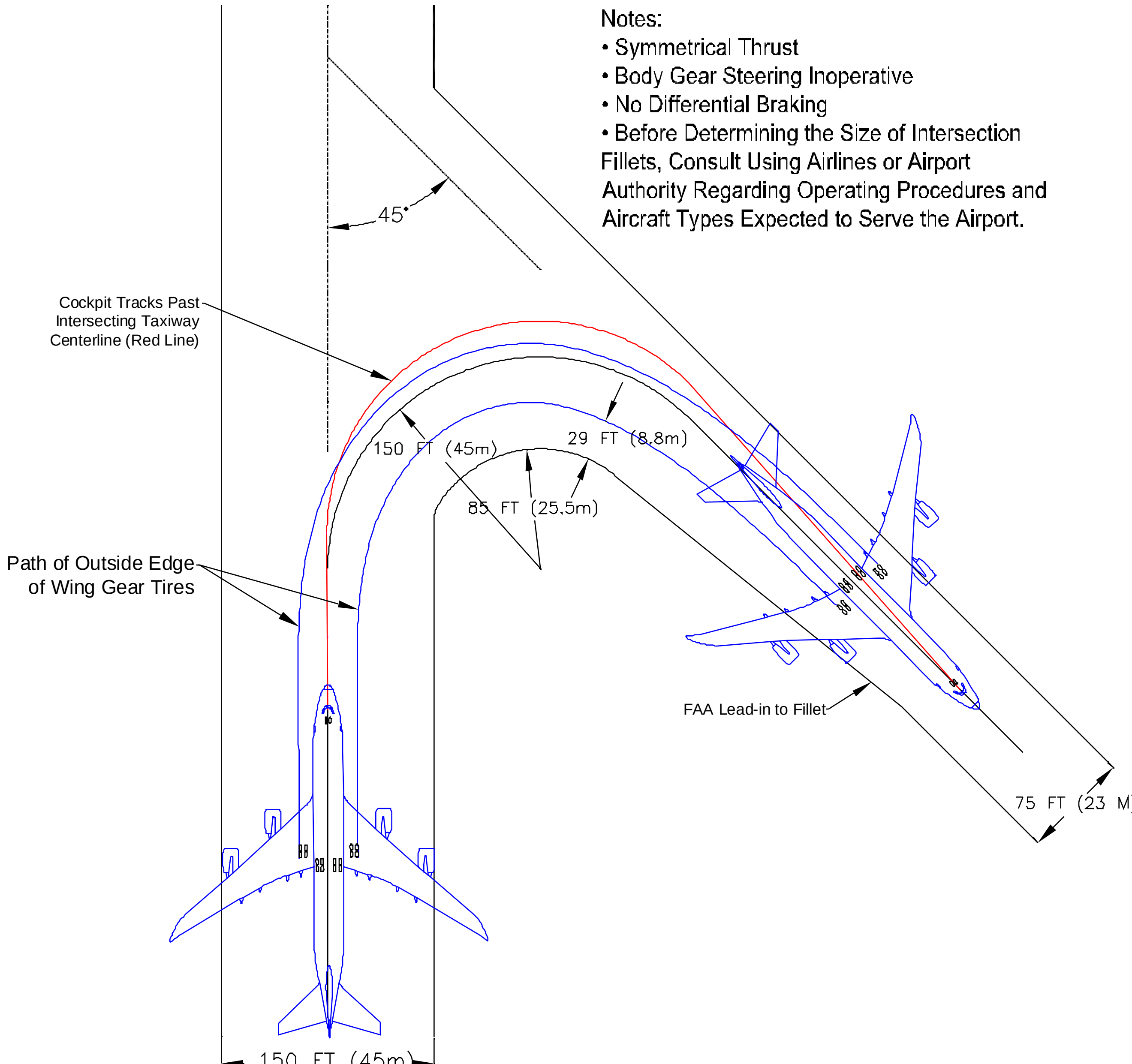


4.5.4 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, MORE THAN 90 DEGREES, COCKPIT OVER CENTERLINE (FAA GROUP VI RADIUS TO GROUP V TAXIWAY)

MODEL 747-8F



4.5.5 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, MORE THAN 90 DEGREES, COCKPIT OVER CENTERLINE (FAA GROUP VI RADIUS TO GROUP VI TAXIWAY)
MODEL 747-8F

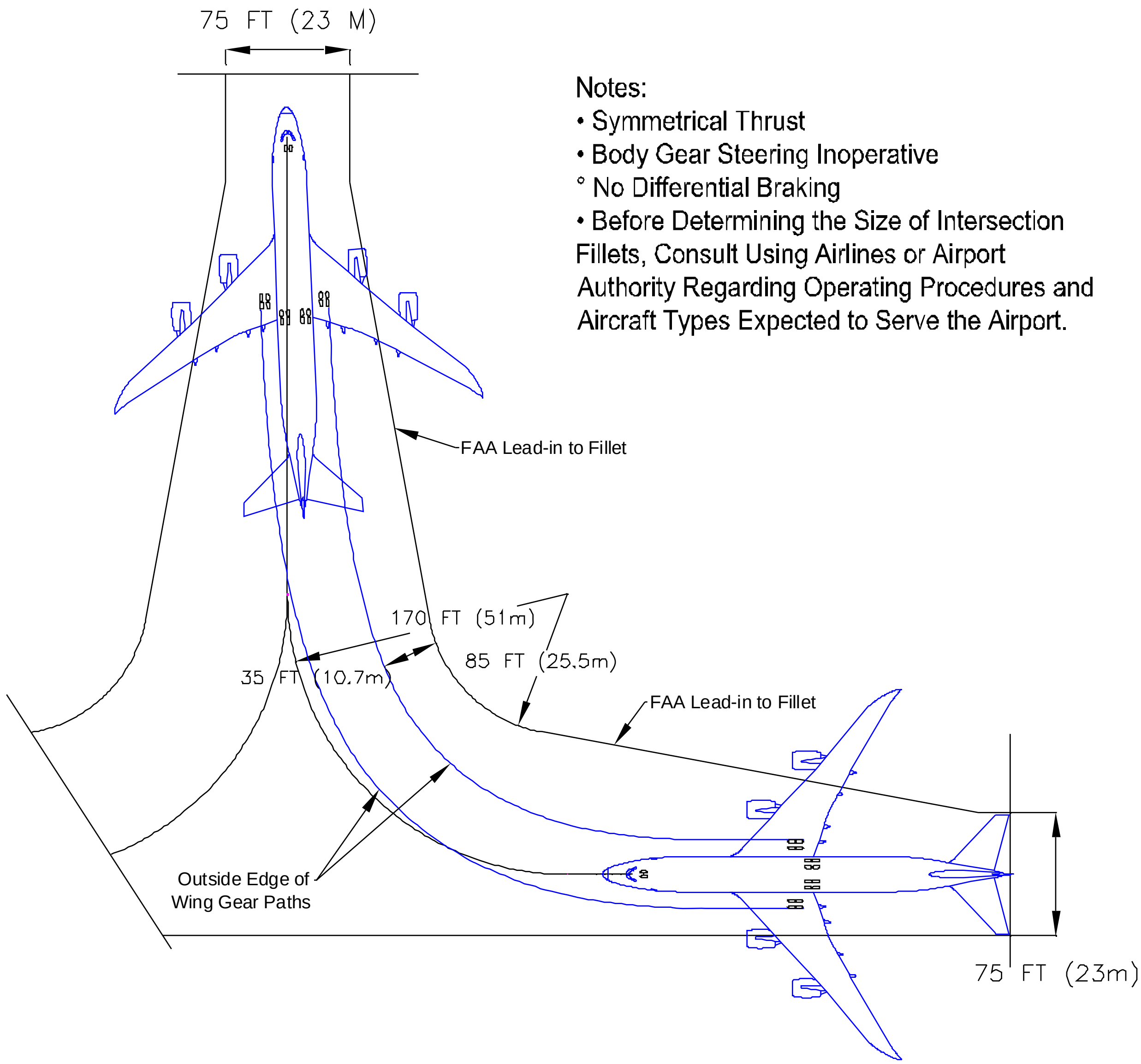


Judgmental Oversteer
(Dimensions - Turn Radius and Fillet are FAA Group V / Taxiway is FAA Group V)

4.5.6 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, MORE THAN 90 DEGREES, JUDGMENTAL OVERSTEER (FAA GROUP V RADIUS TO GROUP V TAXIWAY)

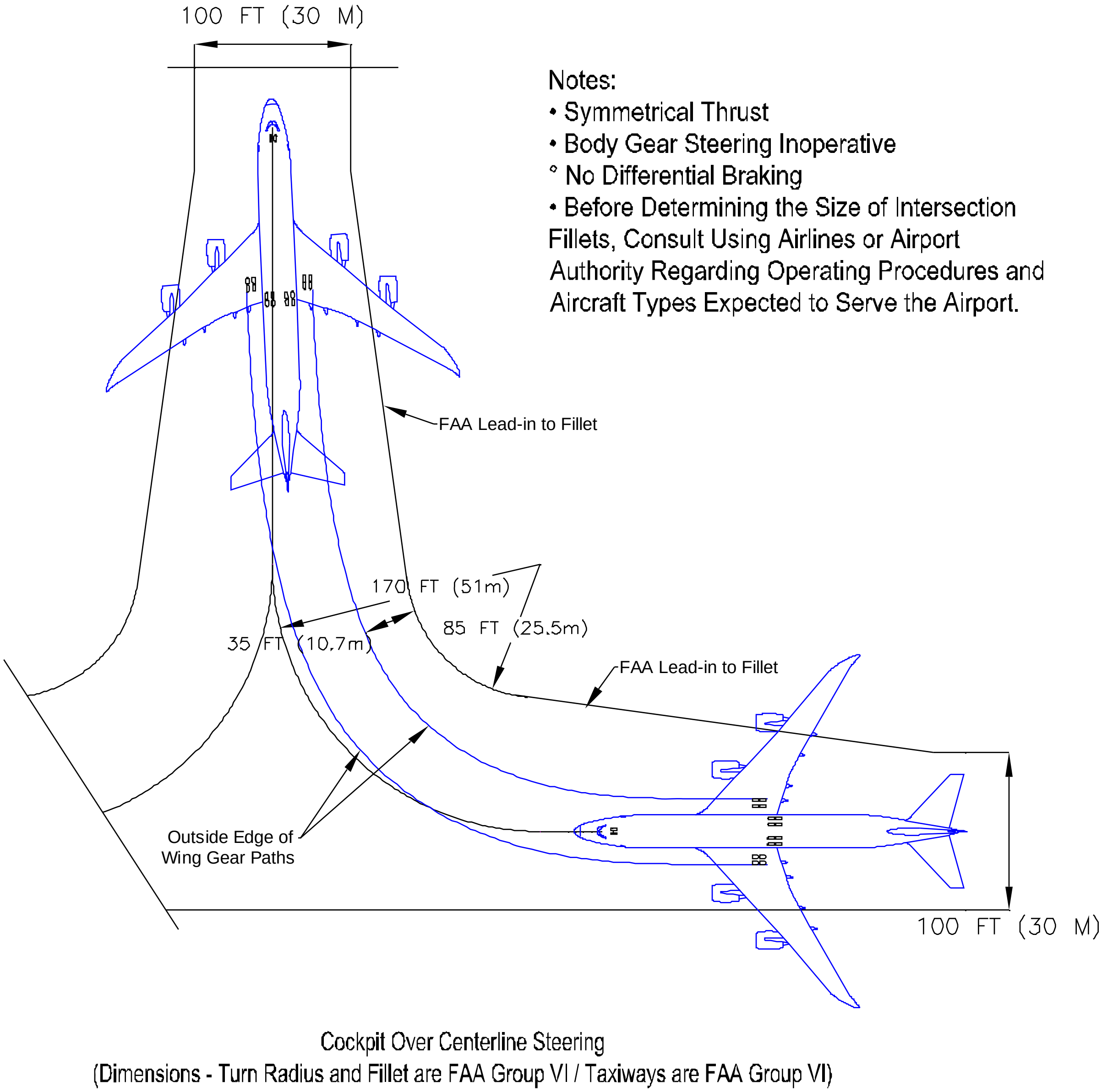
MODEL 747-8F

PRELIMINARY



Cockpit Over Centerline Steering
(Dimensions - Turn Radius and Fillet are FAA Group VI / Taxiways are FAA Group V)

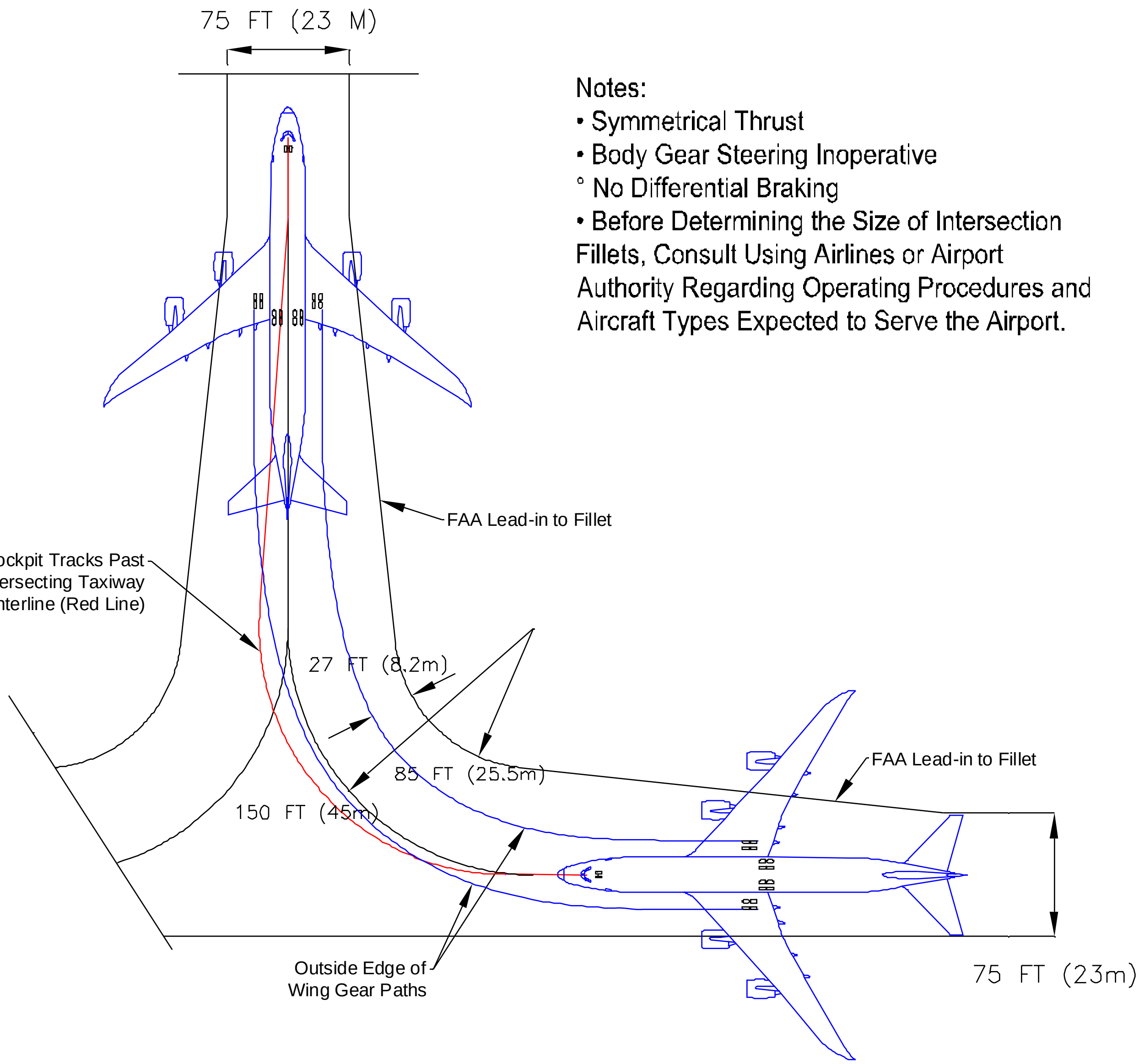
4.5.7 RUNWAY AND TAXIWAY TURNPATHS - TAXIWAY -TO-TAXIWAY, 90 DEGREES, COCKPIT OVER CENTERLINE (FAA GROUP VI RADIUS TO GROUP V TAXIWAYS)
MODEL 747-8F



4.5.8 RUNWAY AND TAXIWAY TURNPATHS - TAXIWAY -TO-TAXIWAY, 90 DEGREES, COCKPIT OVER CENTERLINE (FAA GROUP VI RADIUS TO GROUP VI TAXIWAYS)

MODEL 747-8F

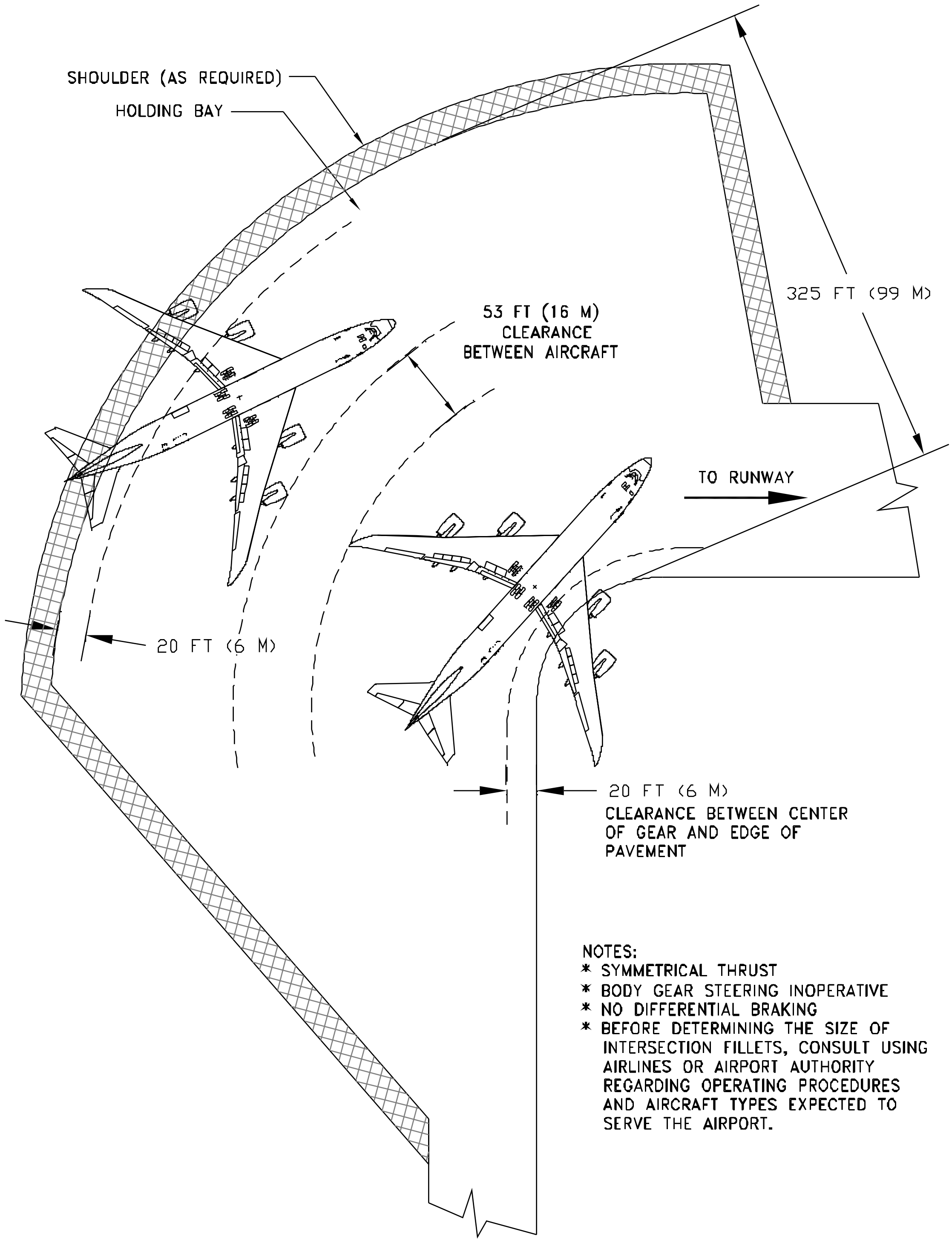
PRELIMINARY



Judgmental Oversteering
(Dimensions - Turn Radius and Fillet are FAA Group V / Taxiways are FAA Group V)

4.5.9 RUNWAY AND TAXIWAY TURNPATHS - TAXIWAY -TO-TAXIWAY, 90 DEGREES, JUDGMENTAL OVERSTEER (FAA GROUP V RADIUS TO GROUP V TAXIWAY)

MODEL 747-8F



4.6 RUNWAY HOLDING BAY

MODEL 747-8F

5.0 TERMINAL SERVICING

5.0 TERMINAL SERVICING

During turnaround at the terminal, certain services must be performed on the aircraft, usually within a given time, to meet flight schedules. This section shows service vehicle arrangements, schedules, locations of service points, and typical service requirements. The data presented in this section reflect ideal conditions for a single airplane. Service requirements may vary according to airplane condition and airline procedure.

Section 5.1 shows typical arrangements of ground support equipment during turnaround. As noted, if the auxiliary power unit (APU) is used, the electrical, air start, and air-conditioning service vehicles would not be required. Passenger loading bridges or portable passenger stairs could be used to load or unload passengers.

Sections 5.2 and 5.3 show typical service times at the terminal. These charts give typical schedules for performing service on the airplane within a given time. Service times could be rearranged to suit availability of personnel, airplane configuration, and degree of service required.

Section 5.4 shows the locations of ground service connections in graphic and in tabular forms. Typical capacities and service requirements are shown in the tables. Services with requirements that vary with conditions are described in subsequent sections.

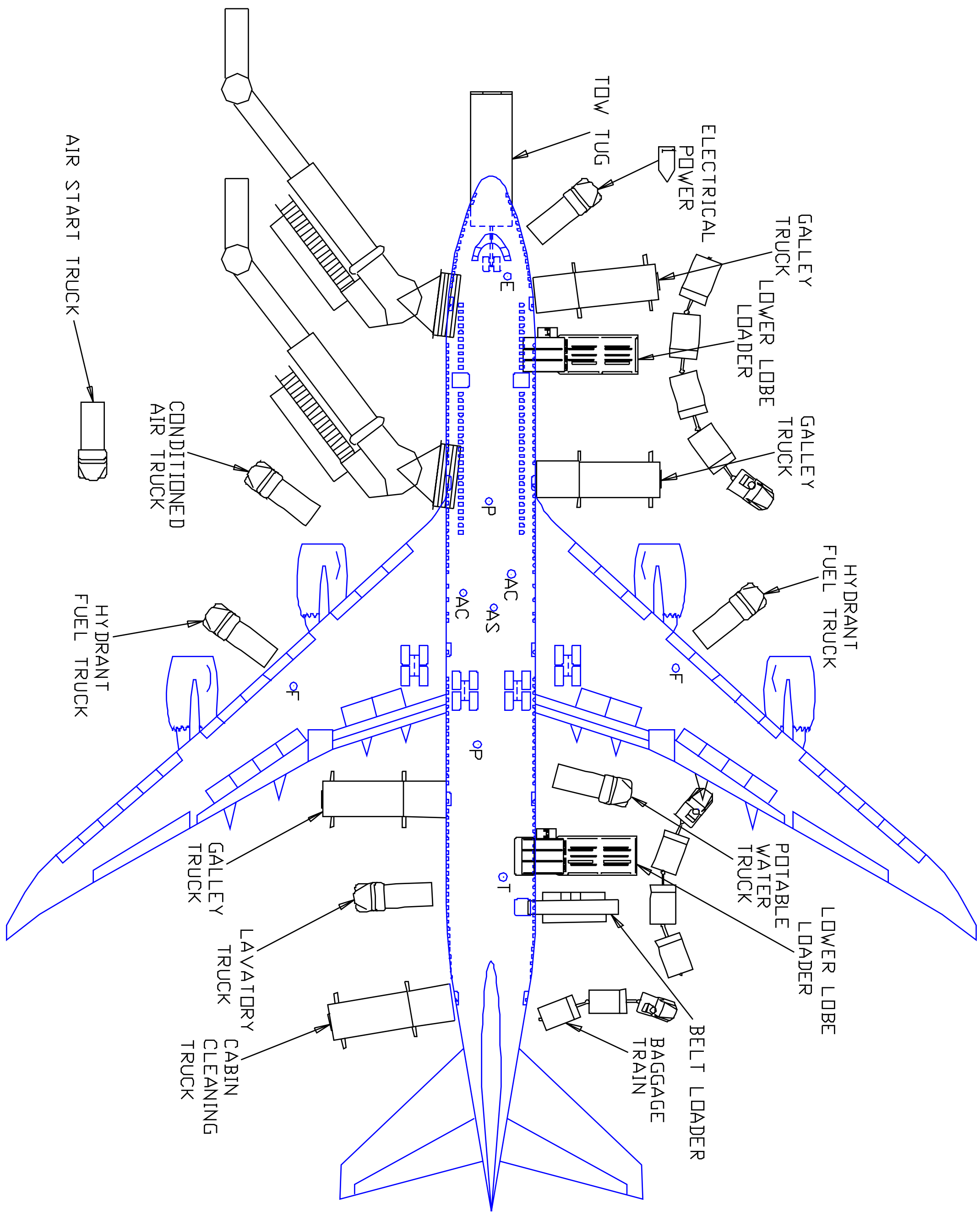
Section 5.5 shows typical sea level air pressure and flow requirements for starting different engines. The curves are based on an engine start time of 90 seconds.

Section 5.6 shows pneumatic requirements for heating and cooling (air conditioning) using high pressure air to run the air cycle machine. The curves show airflow requirements to heat or cool the airplane within a given time and ambient conditions. Maximum allowable pressure and temperature for air cycle machine operation are 60 psia and 450^{o}F, respectively.

Section 5.7 shows pneumatic requirements for heating and cooling the airplane, using low pressure conditioned air. This conditioned air is supplied through an 8-in ground air connection (GAC) directly to the passenger cabin, bypassing the air cycle machines.

Section 5.8 shows ground towing requirements for various ground surface conditions.

PRELIMINARY



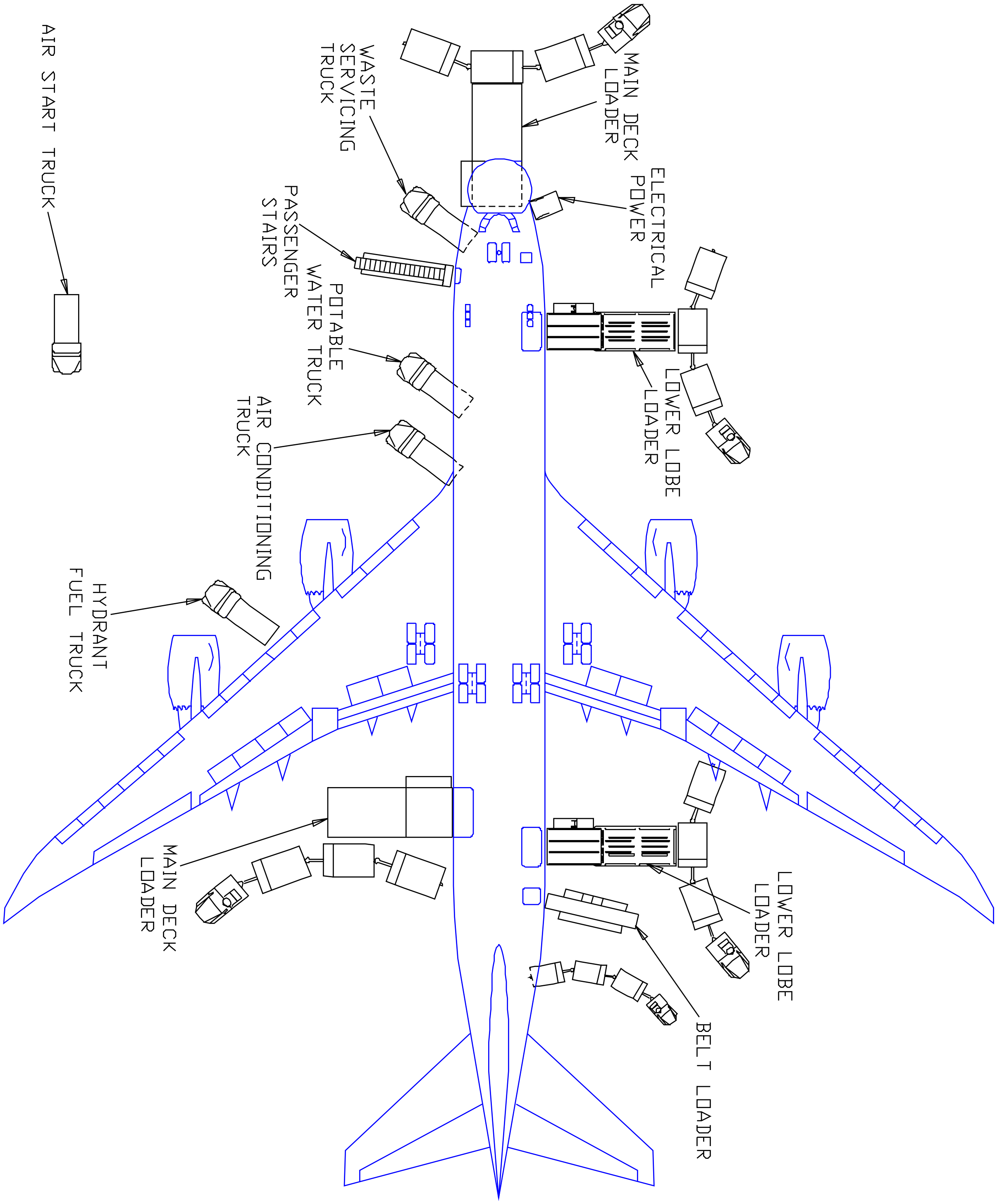
LEGEND:

○ POTABLE WATER, AIR CONTITIONING, OR GROUND POWER MAY BE SUPPLIED FROM THE PASSENGER BRIDGE IF SO EQUIPED

5.1.1 AIRPLANE SERVICING ARRANGEMENT - TYPICAL TURNAROUND

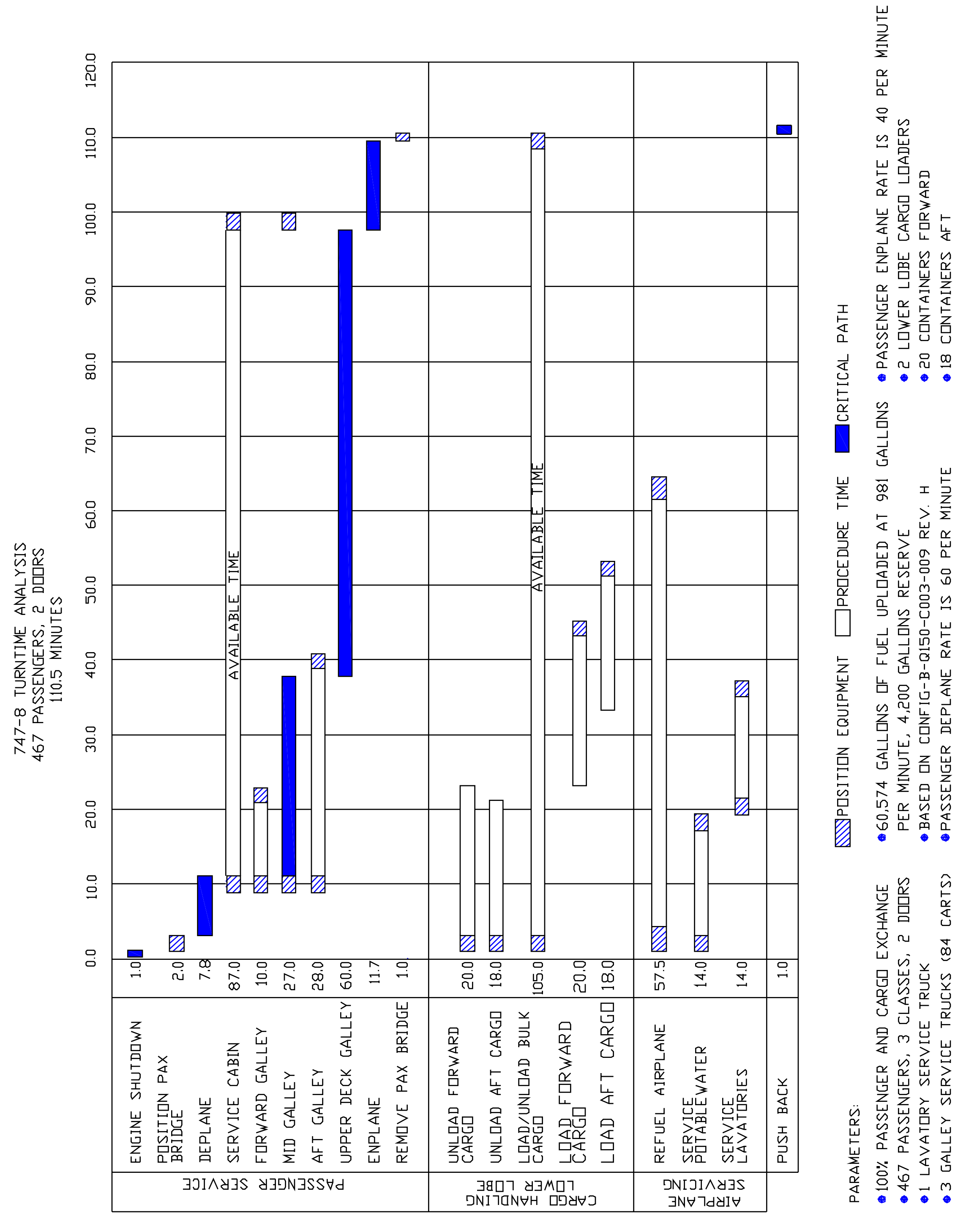
MODEL 747-8

PRELIMINARY



5.1.2 AIRPLANE SERVICING ARRANGEMENT - TYPICAL TURNAROUND
MODEL 747-8F

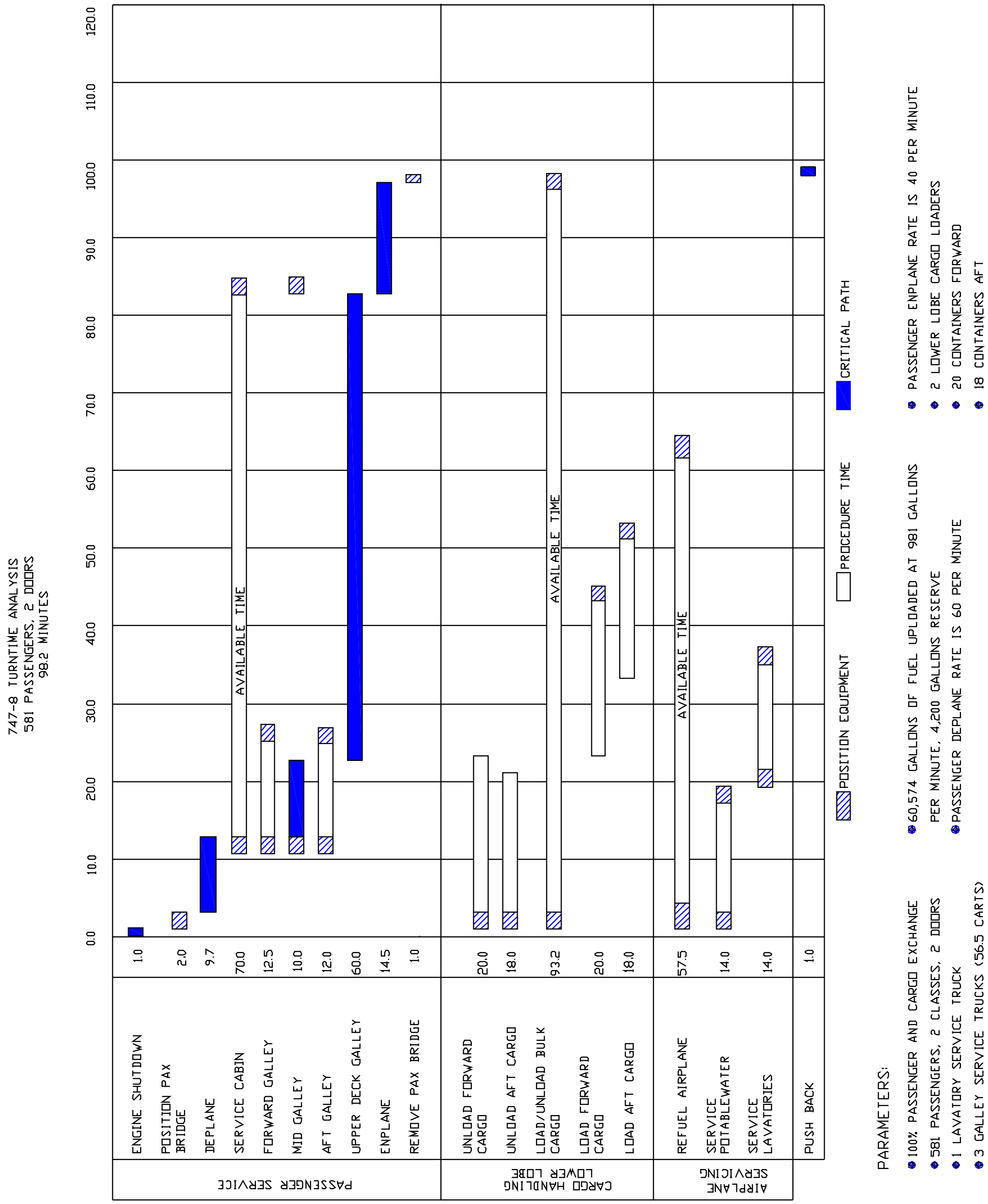
PRELIMINARY



5.2.1 TERMINAL OPERATIONS - TURNAROUND STATION – ALL PASSENGER

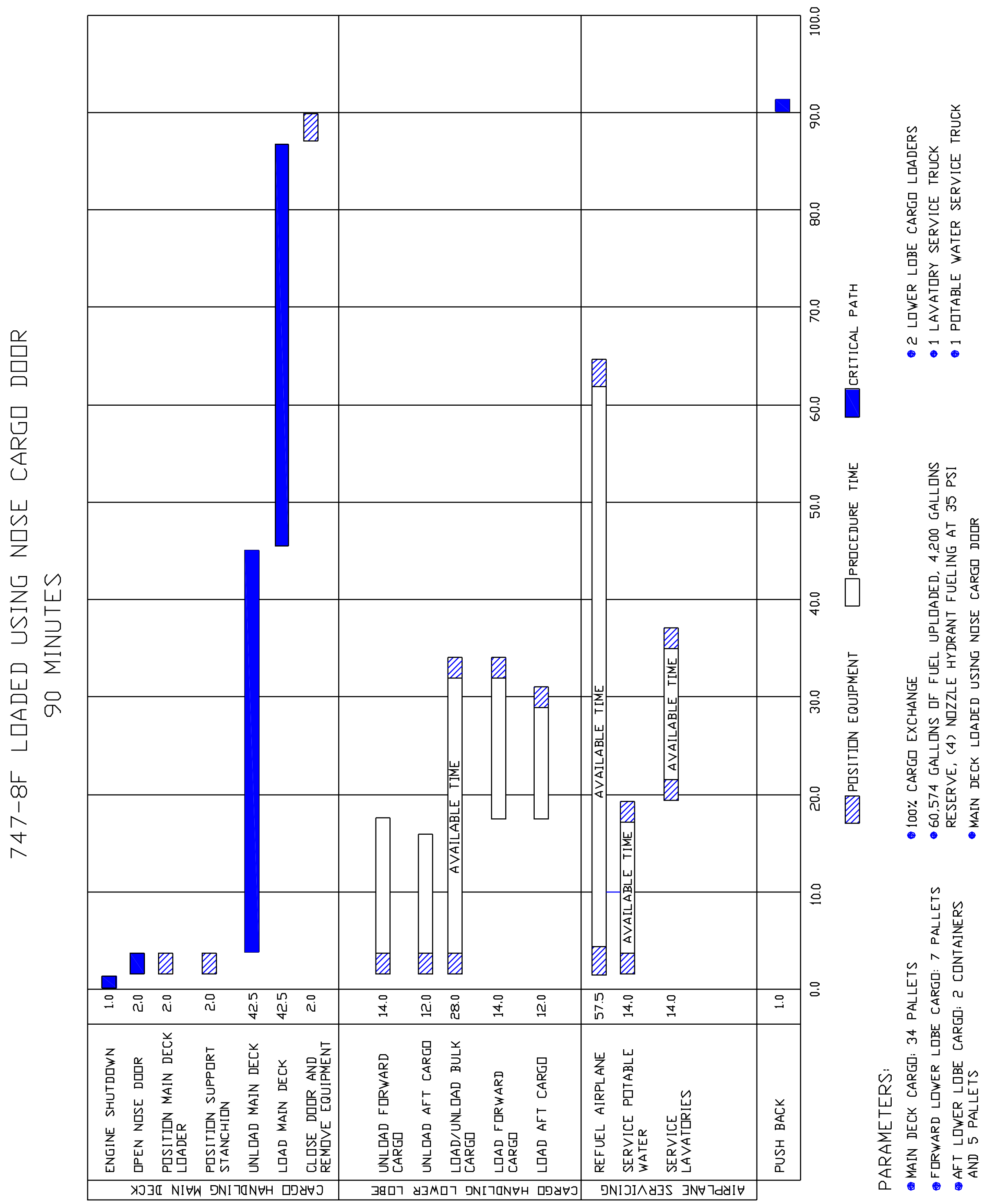
MODEL 747-8

PRELIMINARY



5.2.2 TERMINAL OPERATIONS - TURNAROUND STATION – PASSENGER
MODEL 747-8

PRELIMINARY



5.2.3 TERMINAL OPERATIONS - TURNAROUND STATION – ALL CARGO, NOSE DOOR LOADING

MODEL 747-8F

PRELIMINARY

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5.3.1 TERMINAL OPERATIONS - EN ROUTE STATION - ALL PASSENGER
MODEL 747-8

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5.3.2 TERMINAL OPERATIONS - EN ROUTE STATION - ALL PASSENGER
MODEL 747-8F

PRELIMINARY

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5.4.1 GROUND SERVICE CONNECTIONS

MODEL 747-8

PRELIMINARY

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5.4.2 GROUND SERVICE CONNECTIONS
MODEL 747-8F

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5.4.3 GROUND SERVICING CONNECTIONS AND CAPACITIES

MODEL 747-8, 747-8F

PRELIMINARY

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5.4.4 GROUND SERVICING CONNECTIONS AND CAPACITIES

MODEL 747-8, 747-8F

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5.5.1 ENGINE START PNEUMATIC REQUIREMENTS - SEA LEVEL
MODEL 747-8, 747-8F

PRELIMINARY

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5.6.1 GROUND PNEUMATIC POWER REQUIREMENTS - HEATING/COOLING
MODEL 747-8, 747-8F

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5.7.1 CONDITIONED AIR FLOW REQUIREMENTS
MODEL 747-8, 747-8F

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5.8.1 GROUND TOWING REQUIREMENTS - ENGLISH UNITS

MODEL 747-8, 747-8F

PRELIMINARY

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5.8.2 GROUND TOWING REQUIREMENTS - METRIC UNITS

MODEL 747-8, 747-8F

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5.8.1 GROUND TOWING REQUIREMENTS - ENGLISH UNITS
MODEL 747-8, 747-8F

THIS PAGE IS BEING REVISED AND WILL BE PUBLISHED SOON.

5.8.2 GROUND TOWING REQUIREMENTS - METRIC UNITS
MODEL 747-8, 747-8F

6.0 JET ENGINE WAKE AND NOISE DATA

6.1 Jet Engine Exhaust Velocities and Temperatures

6.2 Airport and Community Noise

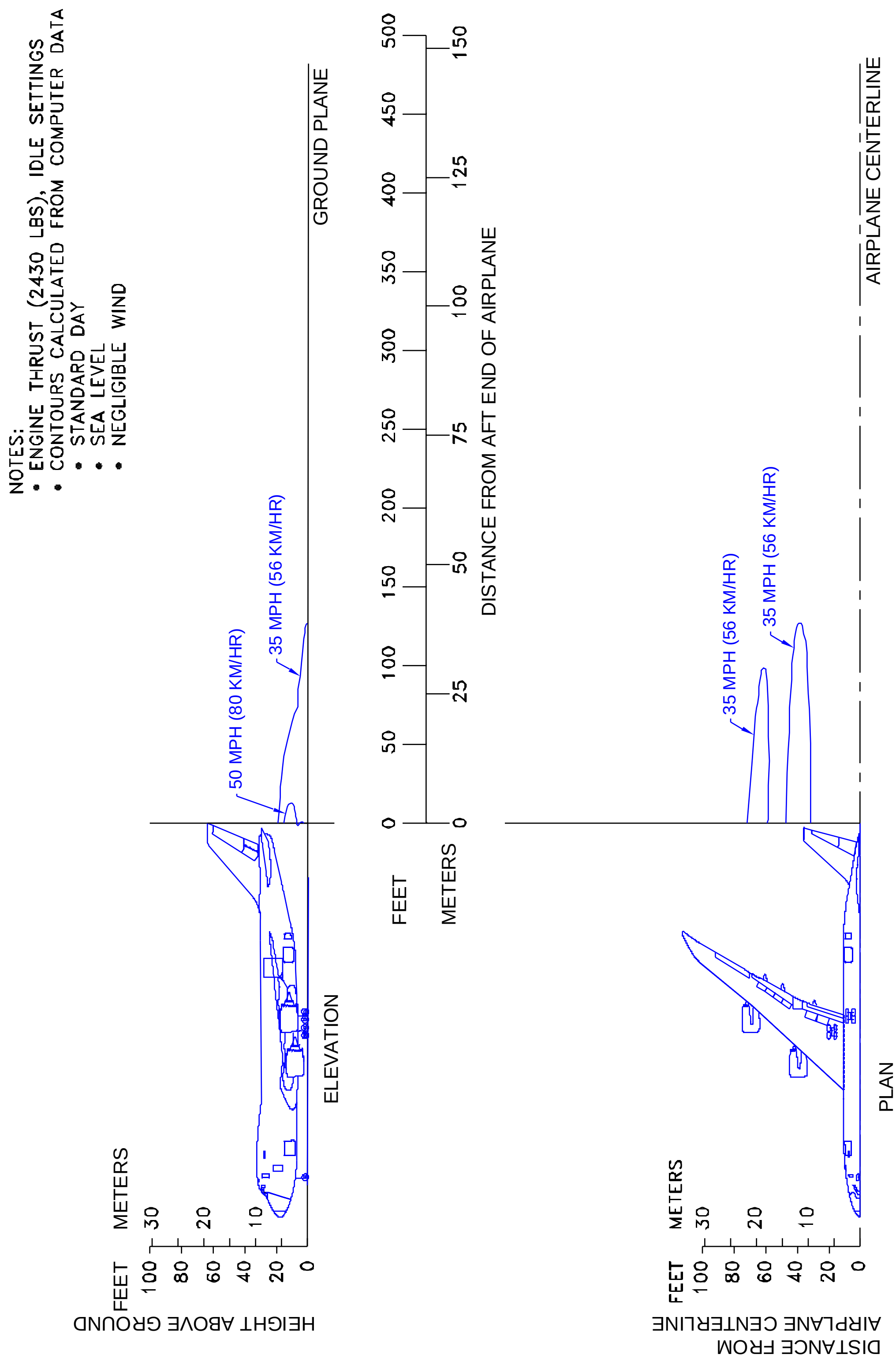
6.0 JET ENGINE WAKE AND NOISE DATA

6.1 Jet Engine Exhaust Velocities and Temperatures

This section shows exhaust velocity and temperature contours aft of the 747-8 Intercontinental and 747-8 Freighter airplanes due to the use of the same engine and same weight for both airplanes. The contours were calculated from a standard computer analysis using three-dimensional viscous flow equations with mixing of primary, fan, and free-stream flow. The presence of the ground plane is included in the calculations as well as engine tilt and toe-in. Mixing of flows from the engines is also calculated. The analysis does not include thermal buoyancy effects which tend to elevate the jet wake above the ground plane. The buoyancy effects are considered to be small relative to the exhaust velocity and therefore are not included.

The graphs show jet wake velocity and temperature contours for a representative engine. The results are valid for sea level, static, standard day conditions. The effect of wind on jet wakes was not included. There is evidence to show that a downwind or an upwind component does not simply add or subtract from the jet wake velocity, but rather carries the whole envelope in the direction of the wind. Crosswinds may carry the jet wake contour far to the side at large distances behind the airplane.

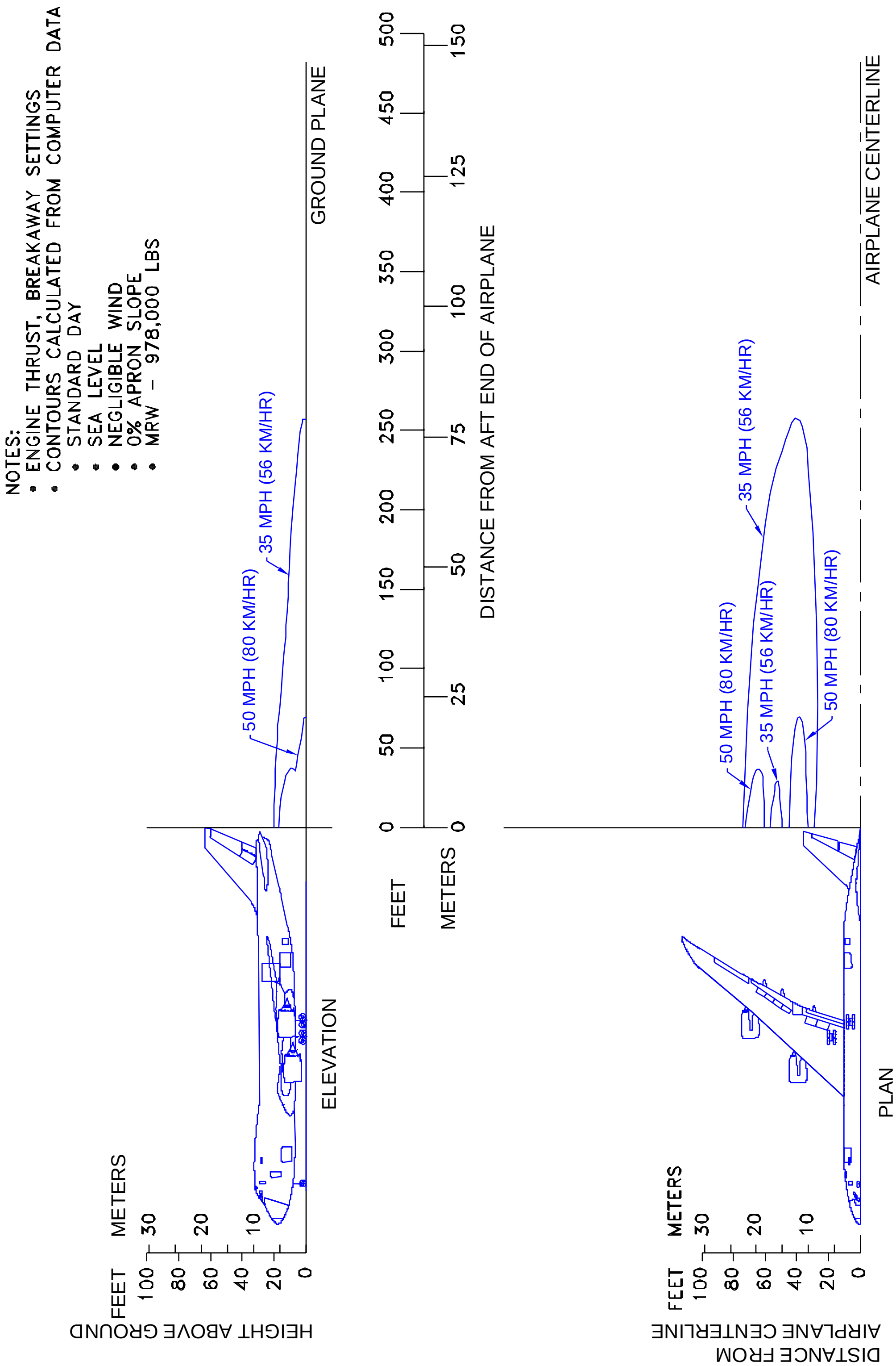
PRELIMINARY



6.1.1 JET ENGINE EXHAUST VELOCITY CONTOURS – IDLE THRUST

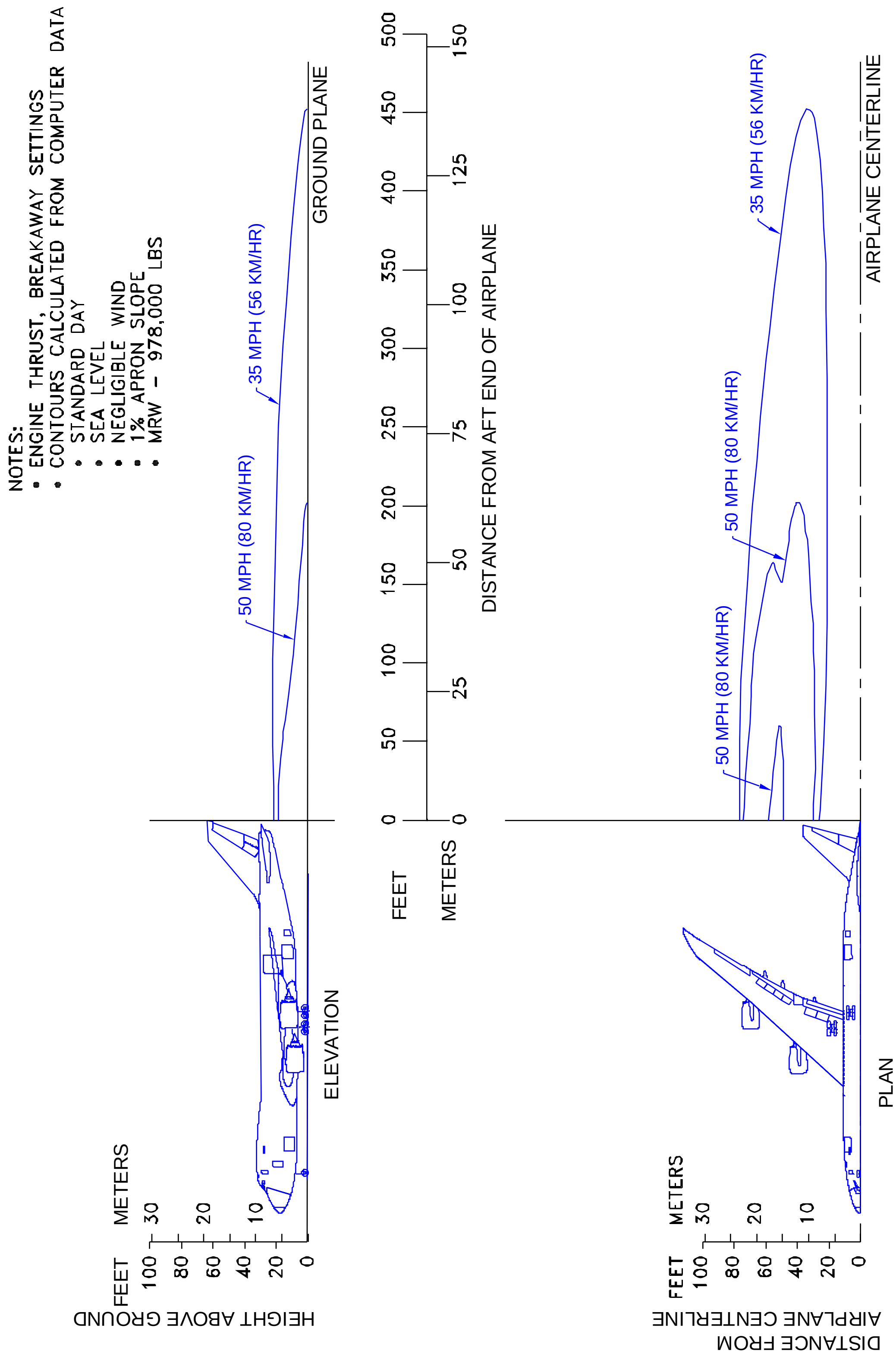
MODEL 747-8, 747-8F

PRELIMINARY



6.1.2 JET ENGINE EXHAUST VELOCITY CONTOURS – BREAKAWAY THRUST – LEVEL PAVEMENT

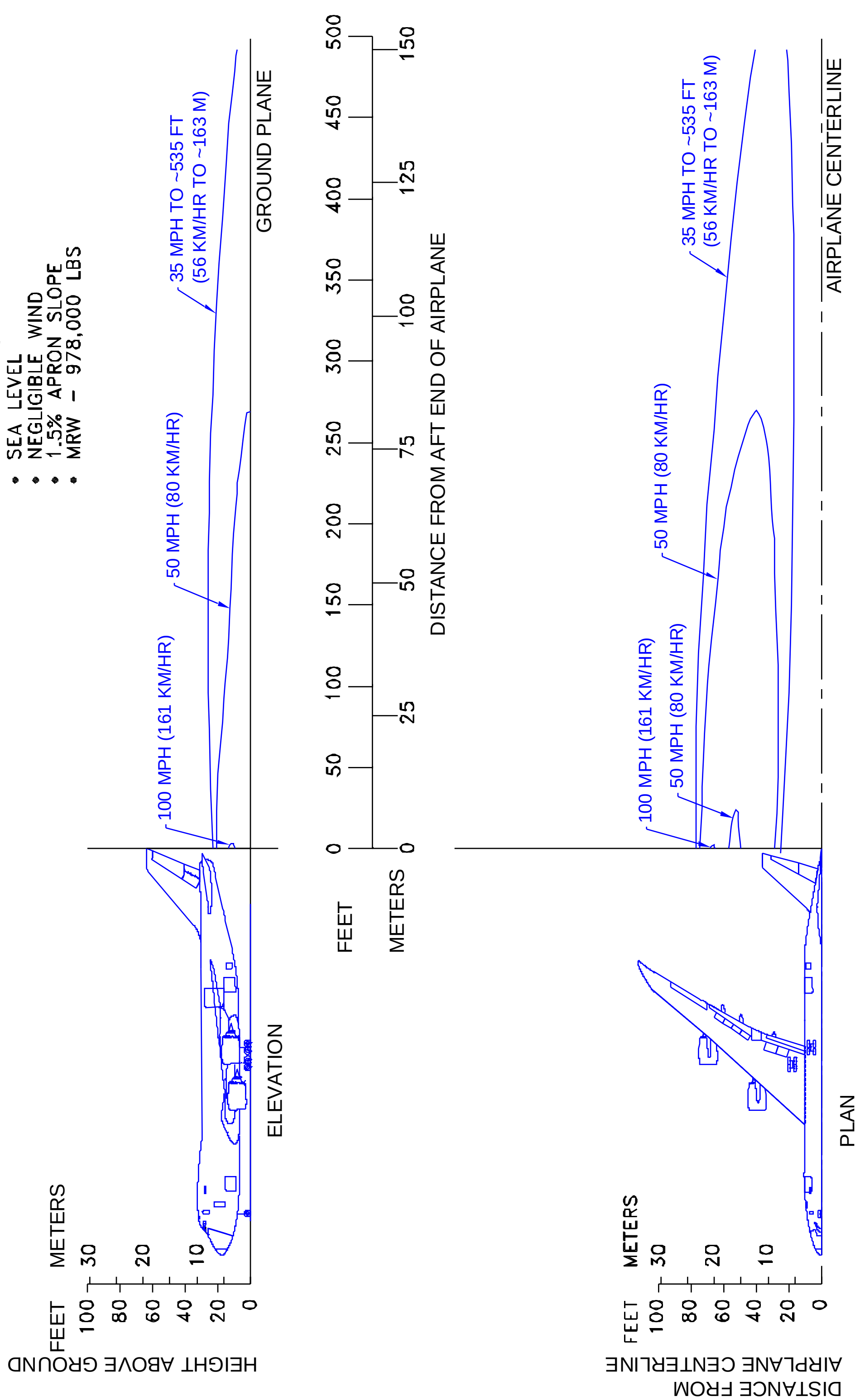
MODEL 747-8, 747-8F



6.1.3 JET ENGINE EXHAUST VELOCITY CONTOURS – BREAKAWAY THRUST - 1% PAVEMENT UPSLOPE

MODEL 747-8, 747-8F

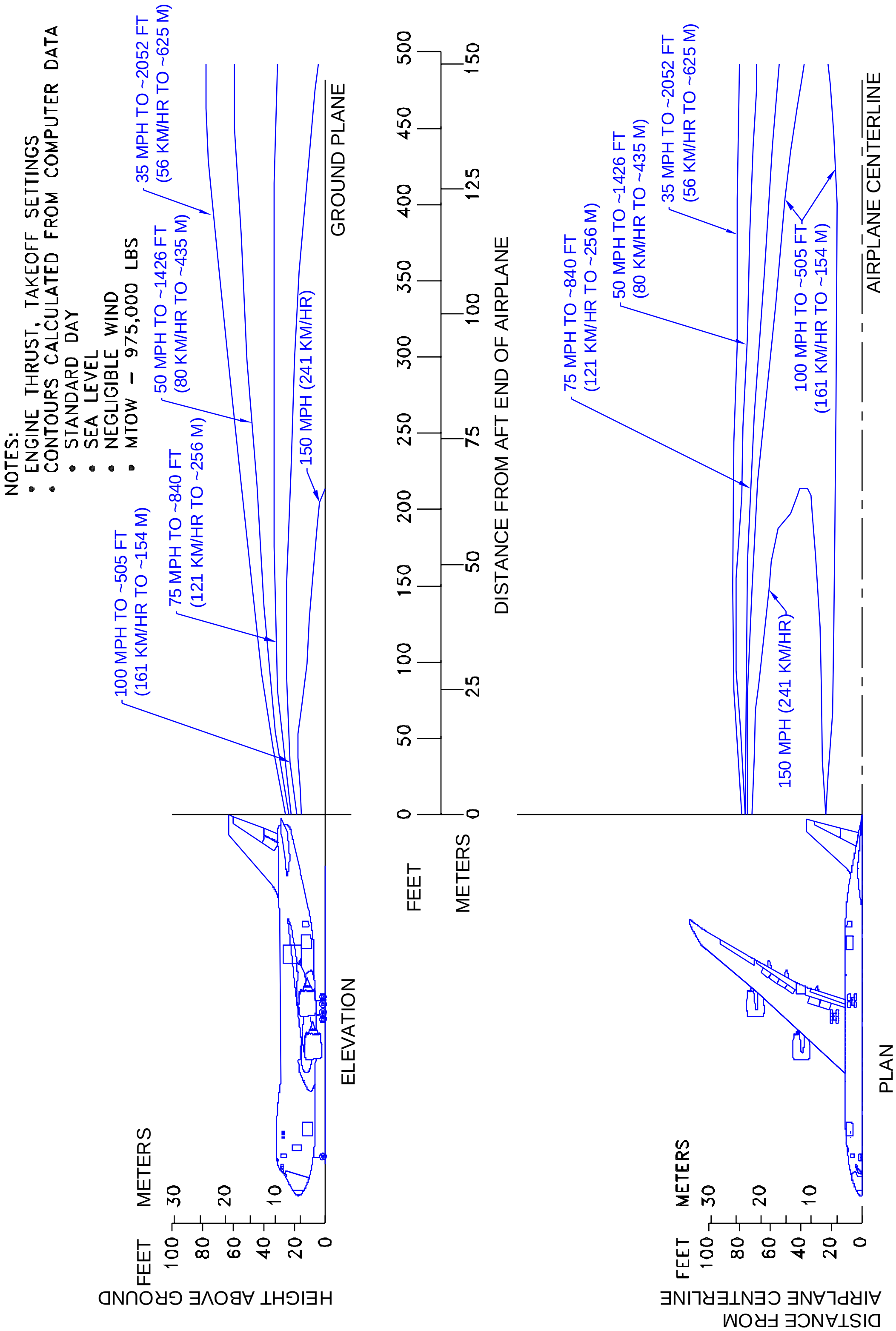
PRELIMINARY



6.1.4 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST - 1.5% PAVEMENT UPSLOPE

MODEL 747-8, 747-8F

PRELIMINARY



6.1.5 JET ENGINE EXHAUST VELOCITY CONTOURS - TAKEOFF THRUST

MODEL 747-8, 747-8F

PRELIMINARY

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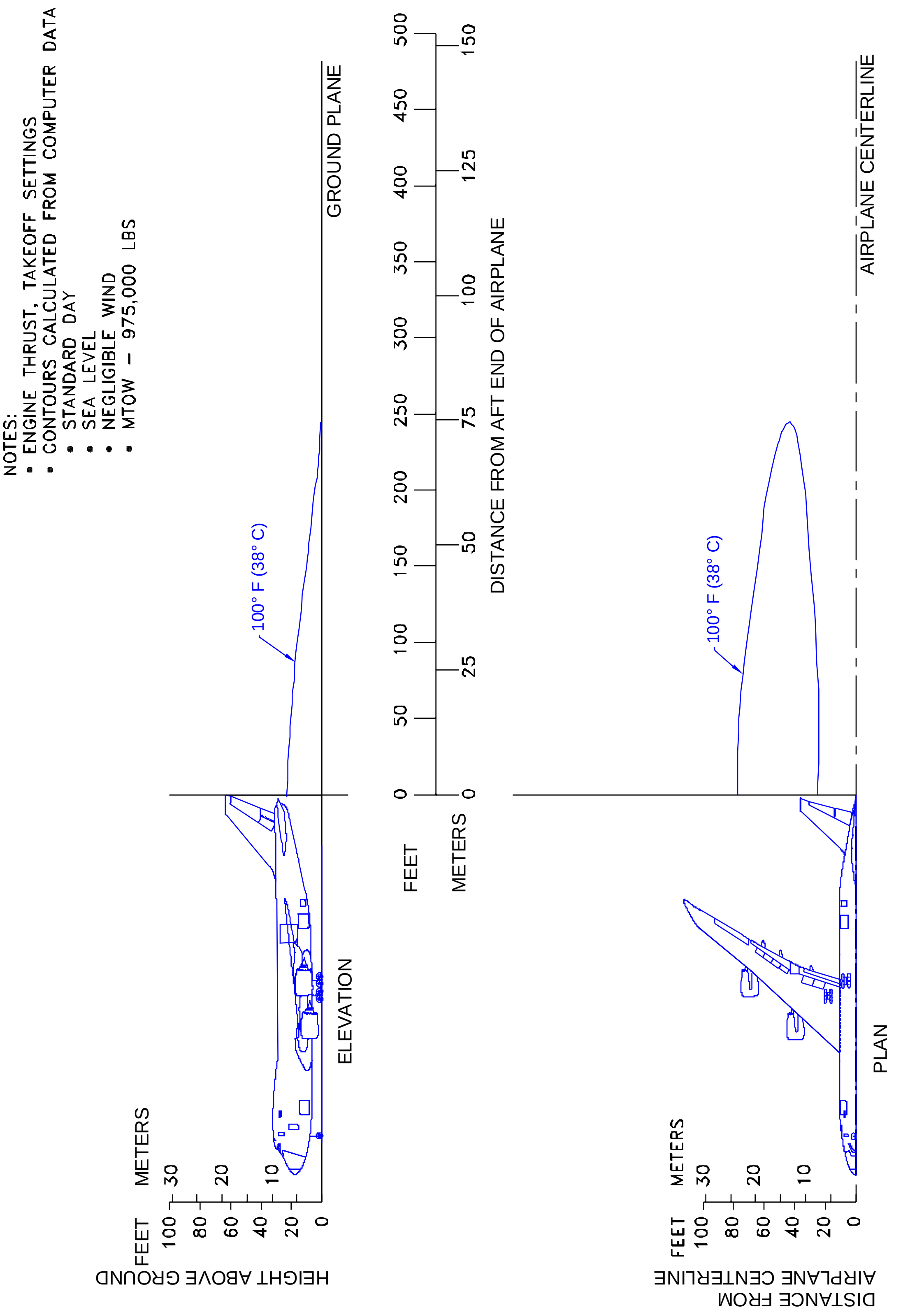
6.1.6 JET ENGINE EXHAUST TEMPERATURE CONTOURS – IDLE AND BREAKAWAY
MODEL 747-8, 747-8F

PRELIMINARY



6.1.7 JET ENGINE EXHAUST TEMPERATURE CONTOURS - TAKEOFF THRUST

MODEL 747-8, 747-8F

6.2 Airport and Community Noise

Airport noise is of major concern to the airport and community planner. The airport is a major element in the community's transportation system and, as such, is vital to its growth. However, the airport must also be a good neighbor, and this can be accomplished only with proper planning. Since aircraft noise extends beyond the boundaries of the airport, it is vital to consider the impact on surrounding communities. Many means have been devised to provide the planner with a tool to estimate the impact of airport operations. Too often they oversimplify noise to the point where the results become erroneous. Noise is not a simple subject; therefore, there are no simple answers.

The cumulative noise contour is an effective tool. However, care must be exercised to ensure that the contours, used correctly, estimate the noise resulting from aircraft operations conducted at an airport.

The size and shape of the single-event contours, which are inputs into the cumulative noise contours, are dependent upon numerous factors. They include the following:

1. Operational Factors

    (a) Aircraft Weight-Aircraft weight is dependent on distance to be traveled, en route winds, payload, and anticipated aircraft delay upon reaching the destination.

    (b) Engine Power Settings-The rates of ascent and descent and the noise levels emitted at the source are influenced by the power setting used.

    (c) Airport Altitude-Higher airport altitude will affect engine performance and thus can influence noise.

2. Atmospheric Conditions-Sound Propagation

    (a) Wind-With stronger headwinds, the aircraft can take off and climb more rapidly relative to the ground. Also, winds can influence the distribution of noise in surrounding communities.

    (b) Temperature and Relative Humidity-The absorption of noise in the atmosphere along the transmission path between the aircraft and the ground observer varies with both temperature and relative humidity.

3. Surface Condition-Shielding, Extra Ground Attenuation (EGA)

(a) Terrain-If the ground slopes down after takeoff or up before landing, noise will be reduced since the aircraft will be at a higher altitude above ground. Additionally, hills, shrubs, trees, and large buildings can act as sound buffers.

All these factors can alter the shape and size of the contours appreciable. To demonstrate the effect of some of these factors, estimated noise level contours for two different operating conditions are shown below. These contours reflect a given noise level upon a ground level plane at runway elevation.

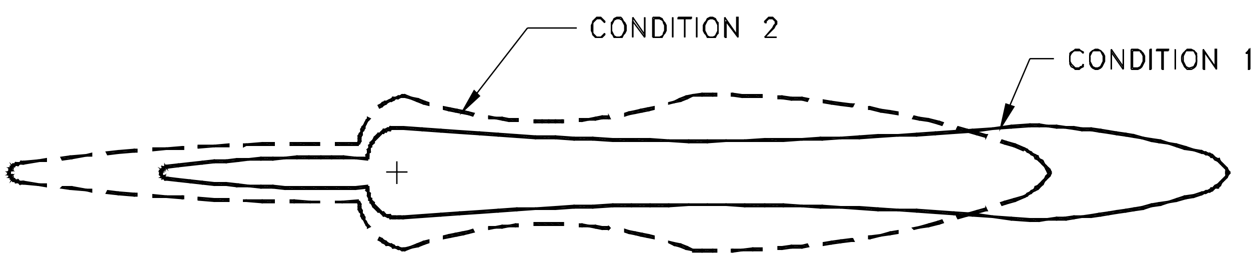
Condition 1

Landing

Maximum Structural Landing Weight
10-knot Headwind
3^{o} Approach
84 ^{o}F
Humidity 15%

Takeoff

Maximum Gross Takeoff Weight
Zero Wind
84 ^{o}F
Humidity 15%



Condition 2

Landing:

85% of Maximum Structural Landing Weight
10-knot Headwind
3^{o} Approach
59 ^{o}F
Humidity 70%

Takeoff:

80% of Maximum Gross Takeoff Weight
10-knot Headwind
59 ^{o}F
Humidity 70%

As indicated from these data, the contour size varies substantially with operating and atmospheric conditions. Most aircraft operations are, of course, conducted at less than maximum gross weights because average flight distances are much shorter than maximum aircraft range capability and average load factors are less than 100%. Therefore, in developing cumulative contours for planning purposes, it is recommended that the airlines serving a particular city be contacted to provide operational information.

In addition, there are no universally accepted methods for developing aircraft noise contours or for relating the acceptability of specific zones to specific land uses. It is therefore expected that noise contour data for particular aircraft and the impact assessment methodology will be changing. To ensure that the best currently available information of this type is used in any planning study, it is recommended that it be obtained directly from the Office of Environmental Quality in the Federal Aviation Administration in Washington, D.C.

It should be noted that the contours shown herein are only for illustrating the impact of operating and atmospheric conditions and do not represent the single-event contour of the family of aircraft described in this document. It is expected that the cumulative contours will be developed as required by planners using the data and methodology applicable to their specific study.

7.0 PAVEMENT DATA

7.0 PAVEMENT DATA

7.1 General Information

A brief description of the pavement charts that follow will help in their use for airport planning. Each airplane configuration is depicted with a minimum range of six loads imposed on the main landing gear to aid in interpolation between the discrete values shown. All curves for any single chart represent data based on rated loads and tire pressures considered normal and acceptable by current aircraft tire manufacturer's standards. Tire pressures, where specifically designated on tables and charts, are at values obtained under loaded conditions as certificated for commercial use.

Section 7.2 presents basic data on the landing gear footprint configuration, maximum design taxi loads, and tire sizes and pressures.

Maximum pavement loads for certain critical conditions at the tire-to-ground interface are shown in Section 7.3, with the tires having equal loads on the struts.

Pavement requirements for commercial airplanes are customarily derived from the static analysis of loads imposed on the main landing gear struts. The chart in Section 7.4 is provided in order to determine these loads throughout the stability limits of the airplane at rest on the pavement. These main landing gear loads are used as the point of entry to the pavement design charts, interpolating load values where necessary.

The flexible pavement design curves (Section 7.5) are based on procedures set forth in Instruction Report No. S-77-1, "Procedures for Development of CBR Design Curves," dated June 1977, and as modified according to the methods described in ICAO Aerodrome Design Manual, Part 3, Pavements, 2nd Edition, 1983, Section 1.1 (The ACN-PCN Method), and utilizing the alpha factors approved by ICAO in October 2007. Instruction Report No. S-77-1 was prepared by the U.S. Army Corps of Engineers Waterways Experiment Station, Soils and Pavements Laboratory, Vicksburg, Mississippi. The line showing 10,000 coverages is used to calculate Aircraft Classification Number (ACN).

The following procedure is used to develop the curves, such as shown in Section 7.5:

1. Having established the scale for pavement depth at the bottom and the scale for CBR at the top, an arbitrary line is drawn representing 10,000 coverages.

2. Values of the aircraft weights on the main landing gear are then plotted.

3. Additional annual departure lines are drawn based on the load lines of the aircraft gross weights already established.

All Load Classification Number (LCN) curves (Sections 7.6 and 7.8) have been developed from a computer program based on data provided in International Civil Aviation Organization (ICAO) document 9157-AN/901, Aerodrome Design Manual, Part 3, "Pavements," Second Edition, 1983. LCN values are shown directly for parameters of weight on main landing gear, tire pressure, and radius of relative stiffness (ℓ) for rigid pavement or pavement thickness or depth factor (h) for flexible pavement.

Rigid pavement design curves (Section 7.7) have been prepared with the Westergaard equation in general accordance with the procedures outlined in the Design of Concrete Airport Pavement (1955 edition) by Robert G. Packard, published by the Portland Cement Association, 3800 North Wilke Road, Arlington Heights, Illinois 60004-1268. These curves are modified to the format described in the Portland Cement Association publication XP6705-2, Computer Program for Airport Pavement Design (Program PDILB), 1968, by Robert G. Packard.

The following procedure is used to develop the rigid pavement design curves shown in Section 7.7:

1. Having established the scale for pavement thickness to the left and the scale for allowable working stress to the right, an arbitrary load line is drawn representing the main landing gear maximum weight to be shown.

2. Values of the subgrade modulus (k) are then plotted.

3. Additional load lines for the incremental values of weight on the main landing gear are drawn on the basis of the curve for k = 300, already established.

The rigid pavement design curves (Section 7.9) have been developed based on methods used in the FAA Advisory Circular AC 150/5320-6D, July 7, 1995. The following procedure is used to develop the curves, such as shown in Section 7.9:

1. Having established the scale for pavement flexure strength on the left and temporary scale for pavement thickness on the right, an arbitrary load line is drawn representing the main landing gear maximum weight to be shown at 5,000 coverages.

2. Values of the subgrade modulus (k) are then plotted.

3. Additional load lines for the incremental values of weight are then drawn on the basis of the subgrade modulus curves already established.

4. The permanent scale for the rigid-pavement thickness is then placed. Lines for other than 5,000 coverages are established based on the aircraft pass-to-coverage ratio.

The ACN/PCN 40 system (Section 7.10) as referenced in ICAO Annex 14, "Aerodromes," Fourth Edition, July, 2004, provides a standardized international airplane/pavement rating system replacing the various S, T, TT, LCN, AUW, ISWL, etc., rating systems used throughout the world. ACN is the Aircraft Classification Number and PCN is the Pavement Classification Number. An aircraft having an ACN equal to or less than the PCN can operate on the pavement subject to any limitation on the tire pressure. Numerically, the ACN is two times the derived single-wheel load expressed in thousands of kilograms, where the derived single wheel load is defined as the load on a single tire inflated to 181 psi (1.25 MPa) that would have the same pavement requirements as the aircraft. Computationally, the ACN/PCN system uses the PCA program PDILB for rigid pavements and S-77-1 for flexible pavements to calculate ACN values. The method of pavement evaluation is left up to the airport with the results of their evaluation presented as follows:

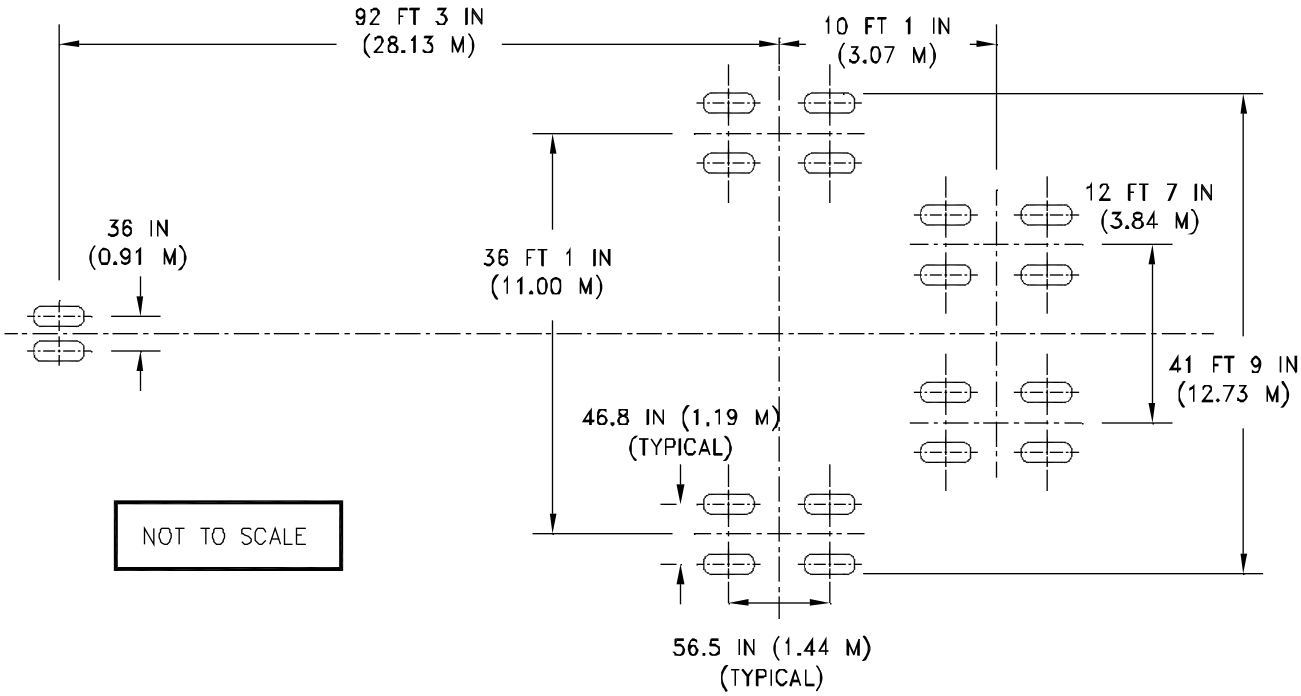
PCN	PAVEMENT TYPE	SUBGRADE CATEGORY	TIRE PRESSURE CATEGORY	EVALUATION METHOD
	R = Rigid	A = High	W = No Limit	T = Technical
	F = Flexible	B = Medium	X = To 217 psi (1.5 MPa)	U = Using Aircraft
		C = Low	Y = To 145 psi (1.0 MPa)	
		D = Ultra Low	Z = To 73 psi (0.5 MPa)	

Section 7.10.1 shows the aircraft ACN values for flexible pavements. The four subgrade categories are:

Code A - High Strength - CBR 15
Code B - Medium Strength - CBR 10
Code C - Low Strength - CBR 6
Code D - Ultra Low Strength - CBR 3

Section 7.10.2 shows the aircraft ACN values for rigid pavements. The four subgrade categories are:

Code A - High Strength, k = 550 pci (150 MN/m^3)
Code B - Medium Strength, k = 300 pci (80 MN/m^3)
Code C - Low Strength, k = 150 pci (40 MN/m^3)
Code D - Ultra Low Strength, k = 75 pci (20 MN/m^3)



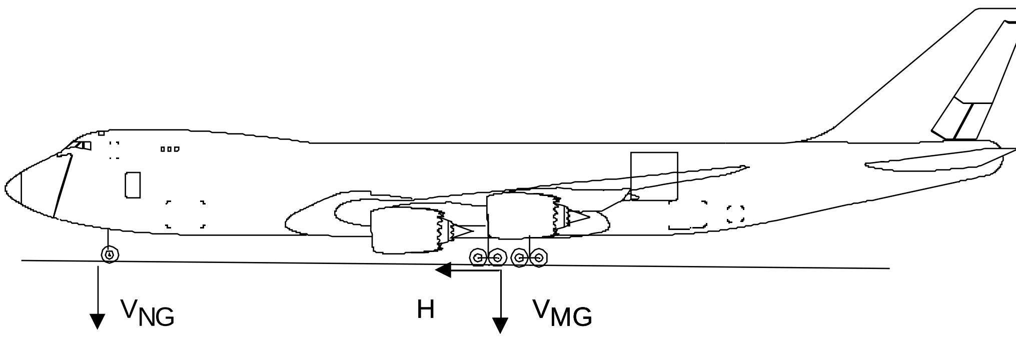
	UNITS	747-8	747-8F
MAXIMUM DESIGN TAXI WEIGHT	LB KG	978,000 443,613	978,000 443,613
PERCENT OF WEIGHT ON MAIN GEAR	%	SEE SECTION 7.4	
NOSE GEAR TIRE SIZE	IN.	50 X 20.0 R 22, 26 PR	50 X 20.0 R22, 26 PR
NOSE GEAR TIRE PRESSURE	PSI KG/CM^2	166 11.67	166 11.67
MAIN GEAR TIRE SIZE	IN.	52 X 21.0 R22, 36 PR	52 X 21.0 R22, 36 PR
MAIN GEAR TIRE PRESSURE	PSI KG/CM^2	221 15.54	221 15.54

7.2 LANDING GEAR FOOTPRINT
MODEL 747-8, 747-8F

PRELIMINARY

V_{NG} = MAXIMUM VERTICAL NOSE GEAR GROUND LOAD AT MOST FORWARD CENTER OF GRAVITY
V_{MG} = MAXIMUM VERTICAL MAIN GEAR GROUND LOAD AT MOST AFT CENTER OF GRAVITY
H = MAXIMUM HORIZONTAL GROUND LOAD FROM BRAKING

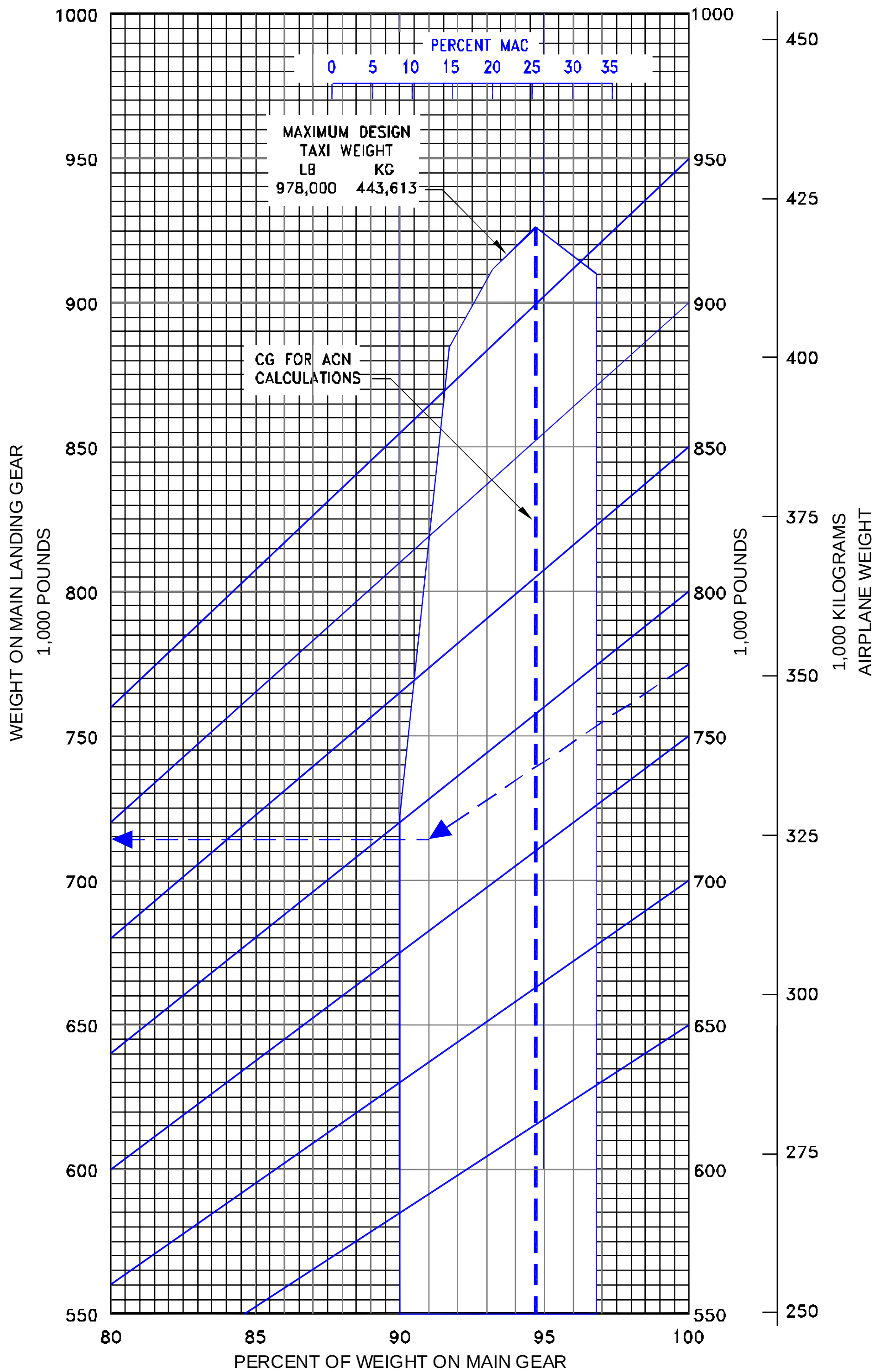
NOTE: ALL LOADS CALCULATED USING AIRPLANE MAXIMUM DESIGN TAXI WEIGHT



AIRPLANE MODEL	UNITS	MAX DESIGN TAXI WEIGHT	V_{NG}		V_{MG} PER STRUT (4)	H PER STRUT (4)	
			STATIC AT MOST FWD C.G.	STATIC + BRAKING 10 FT/SEC^2 DECEL	MAX LOAD AT STATIC AFT C.G.	STEADY BRAKING 10 FT/SEC^2 DECEL	AT INSTANTANEOUS BRAKING (m = 0.8)
747-8	LB	978,000	66,517	117,752	231,507	75,942	185,206
	KG	443,613	30,172	53,411	105,010	34,447	84,008
747-8F	LB	978,000	65,145	116,380	231,507	75,942	185,206
	KG	443,613	29,549	52,789	105,010	34,447	84,008

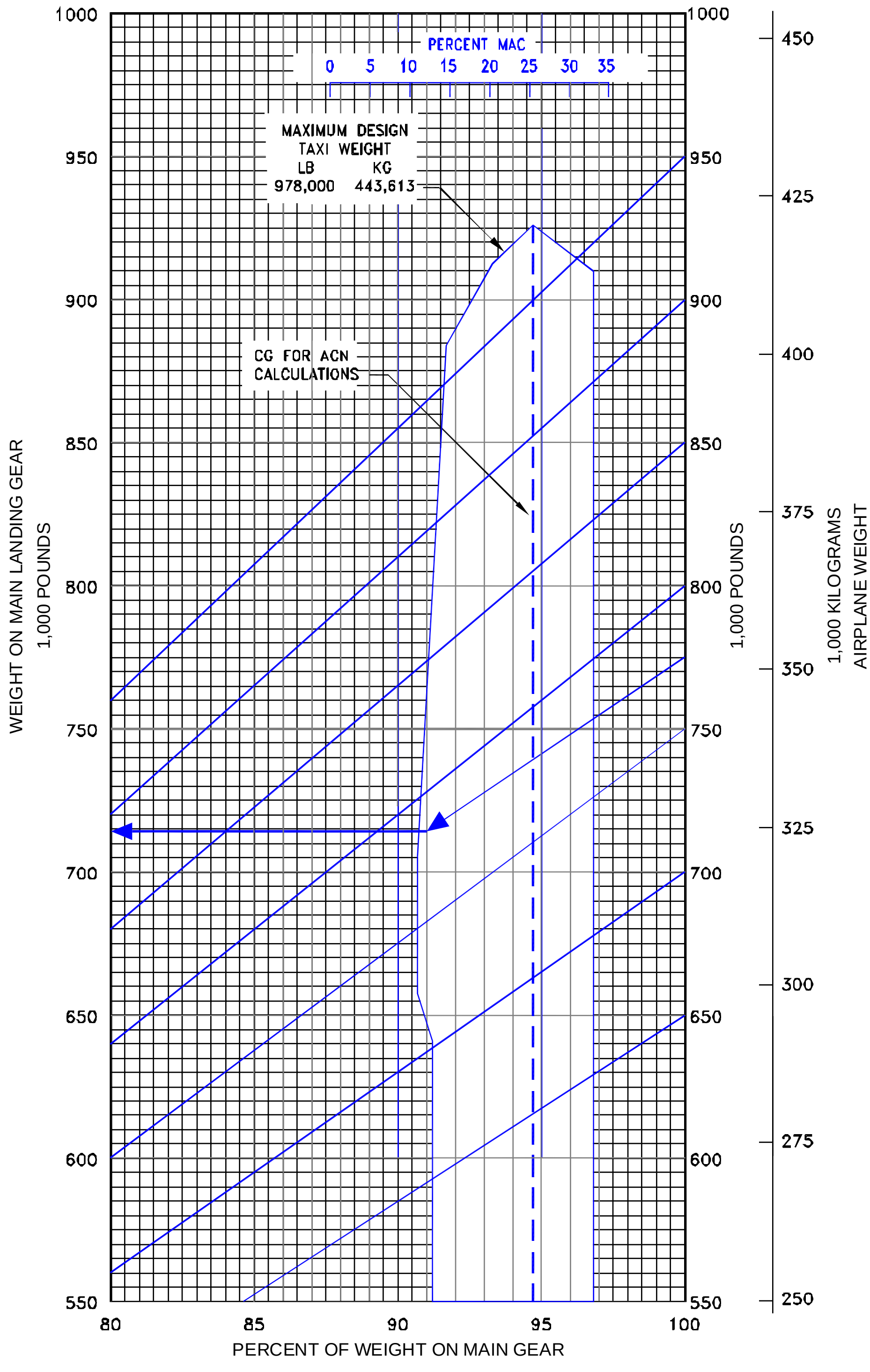
7.3. MAXIMUM PAVEMENT LOADS
MODEL 747-8, -747-8F

PRELIMINARY



7.4.1 LANDING GEAR LOADING ON PAVEMENT

MODEL 747-8



7.4.2 LANDING GEAR LOADING ON PAVEMENT

MODEL 747-8F

7.5 Flexible Pavement Requirements - U.S. Army Corps of Engineers Method (S-77-1)

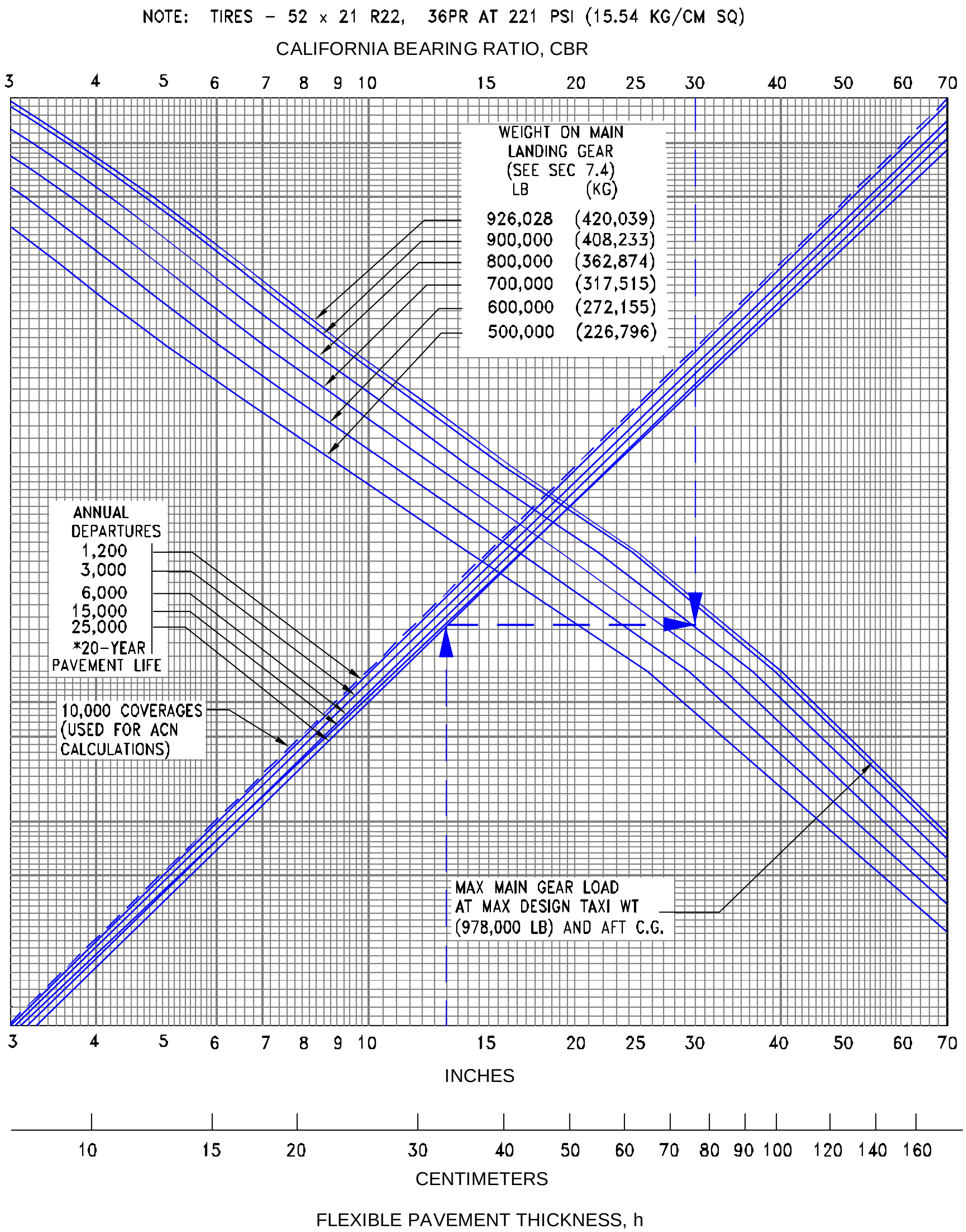
The following flexible-pavement design chart presents the data of six incremental main-gear loads at the minimum tire pressure required at the maximum design taxi weight.

In the example shown in Section 7.5, for a CBR of 30 and an annual departure level of 15,000, the required flexible pavement thickness for an airplane with a main gear loading of 800,000 pounds is 13.0 inches.

The line showing 10,000 coverages is used for ACN calculations (see Section 7.10).

The FAA design method uses a similar procedure using total airplane weight instead of weight on the main landing gears. The equivalent main gear loads for a given airplane weight could be calculated from Section 7.4.

PRELIMINARY



7.5.1 FLEXIBLE PAVEMENT REQUIREMENTS - U.S. ARMY CORPS OF ENGINEERS DESIGN METHOD (S-77-1)

MODEL 747-8, 747-8F

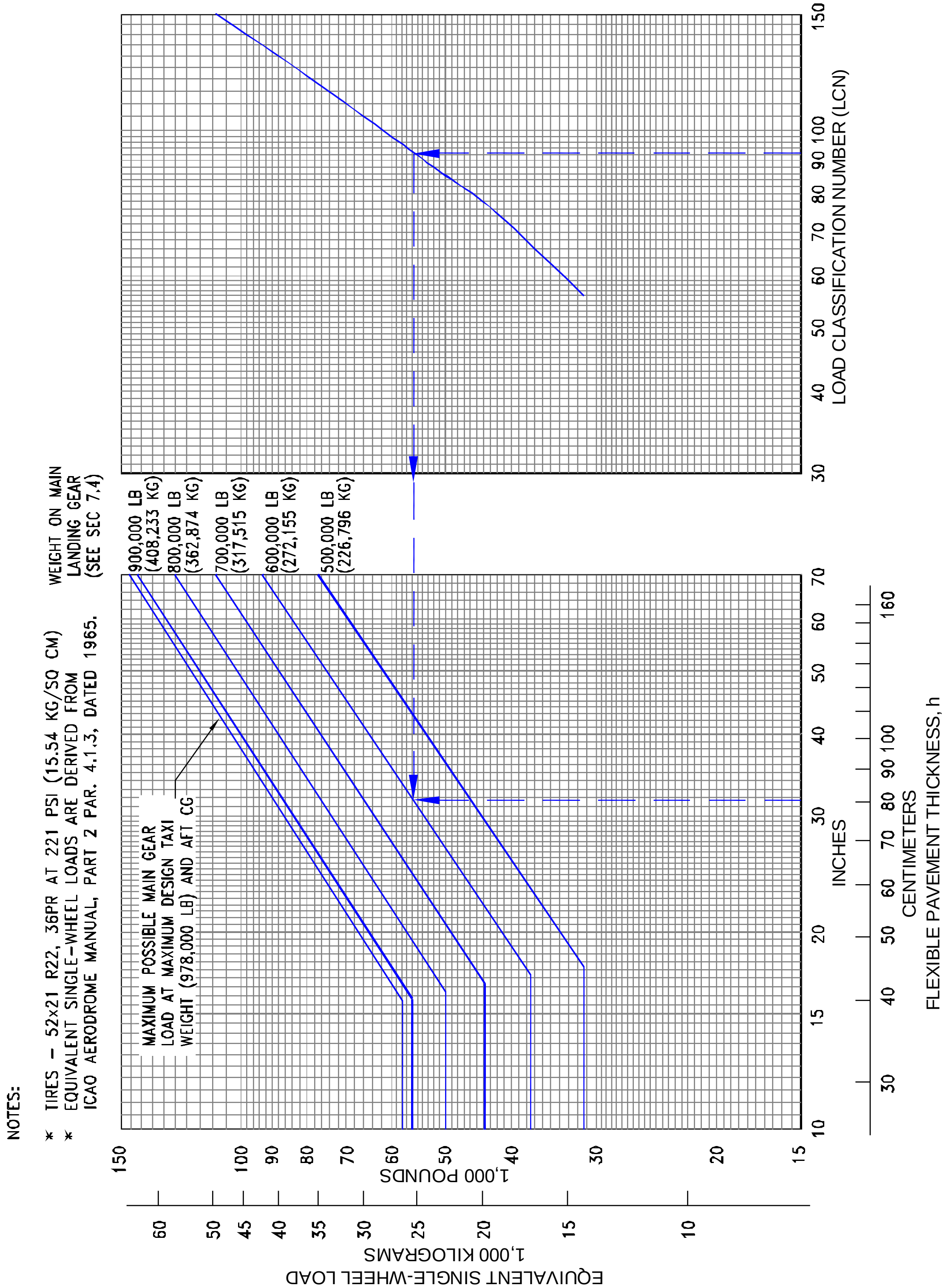
7.6 Flexible Pavement Requirements - LCN Method

To determine the airplane weight that can be accommodated on a particular flexible pavement, both the Load Classification Number (LCN) of the pavement and the thickness must be known.

In the example shown in Section 7.6, flexible pavement thickness is shown at 32 in. with an LCN of 92. For these conditions, the apparent maximum allowable weight permissible on the main landing gear is 600,000 lb for an airplane with 221-psi main gear tires.

Note: If the resultant aircraft LCN is not more that 10% above the published pavement LCN, the bearing strength of the pavement can be considered sufficient for unlimited use by the airplane. The figure 10% has been chosen as representing the lowest degree of variation in LCN that is significant (reference: ICAO Aerodrome Design Manual, Part 2, "Aerodrome Physical Characteristics," Chapter 4, Paragraph 4.1.5.7v, 2nd Edition dated 1965).

PRELIMINARY



7.6.1 FLEXIBLE PAVEMENT REQUIREMENTS - LCN METHOD

MODEL 747-8, 747-8F

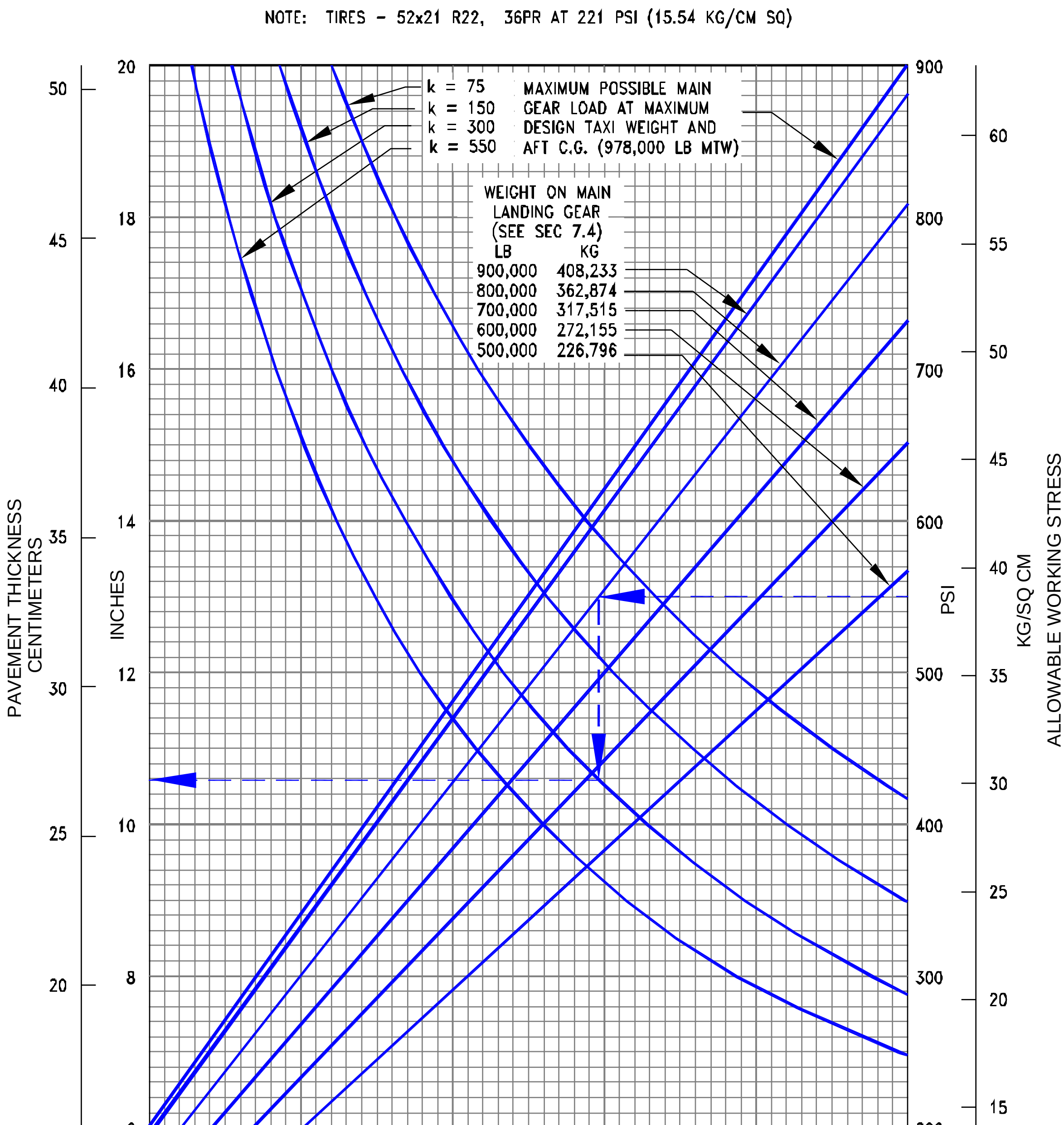
7.7 Rigid Pavement Requirements - Portland Cement Association Design Method

The Portland Cement Association method of calculating rigid pavement requirements is based on the computerized version of "Design of Concrete Airport Pavement" (Portland Cement Association, 1965) as described in XP6705-2, "Computer Program for Airport Pavement Design" by Robert G. Packard, Portland Cement Association, 1968.

The rigid pavement design chart in Section 7.7 presents the data for six incremental main gear loads at the minimum tire pressure required at the maximum design taxi weight.

In the example shown, for an allowable working stress of 550 psi, a main gear load of 800,000 lb, and a subgrade strength (k) of 300, the required rigid pavement thickness is 10.6 in.

PRELIMINARY



NOTE:
THE VALUES OBTAINED BY USING THE MAXIMUM LOAD REFERENCE LINE AND ANY VALUE OF k ARE EXACT.
FOR LOADS LESS THAN MAXIMUM, THE CURVES ARE EXACT FOR k = 300 BUT DEVIATE SLIGHTLY FOR OTHER VALUES OF k.

REFERENCES:
"DESIGN OF CONCRETE AIRPORT PAVEMENT" AND "COMPUTER PROGRAM FOR AIRPORT PAVEMENT DESIGN - PROGRAM PDILB" PORTLAND CEMENT ASSOCIATION.

7.7.1 RIGID PAVEMENT REQUIREMENTS - PORTLAND CEMENT ASSOCIATION DESIGN METHOD

MODEL 747-8, 747-8F

7.8 Rigid Pavement Requirements - LCN Conversion

To determine the airplane weight that can be accommodated on a particular rigid pavement, both the LCN of the pavement and the radius of relative stiffness (ℓ) of the pavement must be known.

In the example shown in Section 7.8.2, for a rigid pavement with a radius of relative stiffness of 47 with an LCN of 91, the apparent maximum allowable weight permissible on the main landing gear is 600,000 lb for an airplane with 221-psi main tires.

Note: If the resultant aircraft LCN is not more that 10% above the published pavement LCN, the bearing strength of the pavement can be considered sufficient for unlimited use by the airplane. The figure 10% has been chosen as representing the lowest degree of variation in LCN that is significant (reference: ICAO Aerodrome Design Manual, Part 2, "Aerodrome Physical Characteristics," Chapter 4, Paragraph 4.1.5.7v, 2nd Edition dated 1965).

PRELIMINARY

RADIUS OF RELATIVE STIFFNESS (ℓ)

VALUES IN INCHES

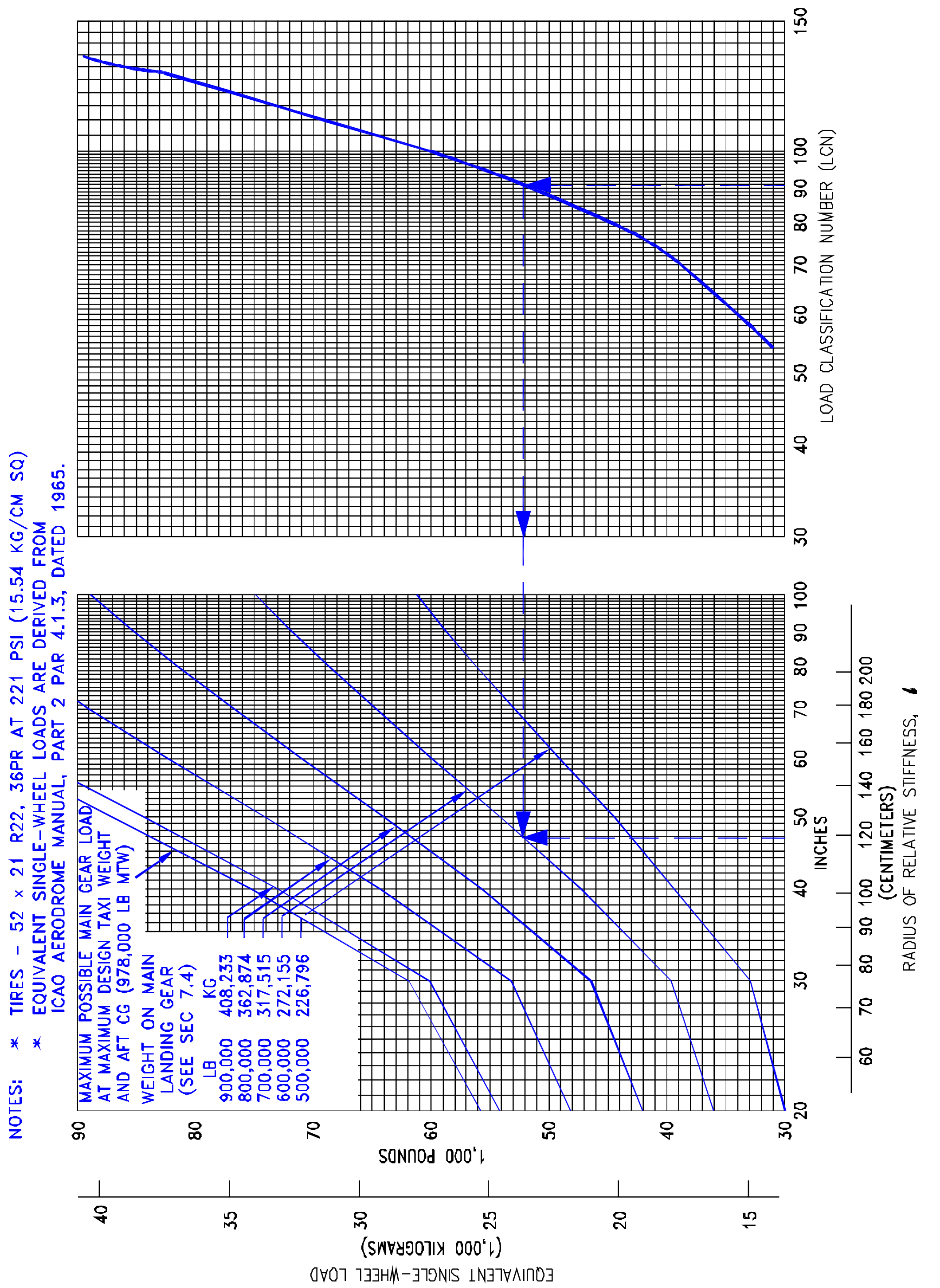
$$\ell = \sqrt[4]{\frac{Ed^3}{12(1-\mu^2)k}} = 24.1652\sqrt[4]{\frac{d^3}{k}}$$

WHERE: E = YOUNG'S MODULUS OF ELASTICITY = 4 x 10^6 psi
k = SUBGRADE MODULUS, LB PER CU IN
d = RIGID PAVEMENT THICKNESS, IN
μ = POISSON'S RATIO = 0.15

d	k = 75	k = 100	k = 150	k = 200	k = 250	k = 300	k = 350	k = 400	k = 500	k = 550
6.0	31.48	29.29	26.47	24.63	23.30	22.26	21.42	20.71	19.59	19.13
6.5	33.42	31.10	28.11	26.16	24.74	23.63	22.74	21.99	20.80	20.31
7.0	35.33	32.88	29.71	27.65	26.15	24.99	24.04	23.25	21.99	21.47
7.5	37.21	34.63	31.29	29.12	27.54	26.31	25.32	24.49	23.16	22.61
8.0	39.06	36.35	32.84	30.56	28.91	27.62	26.57	25.70	24.31	23.73
8.5	40.87	38.04	34.37	31.99	30.25	28.90	27.81	26.90	25.44	24.84
9.0	42.66	39.70	35.88	33.39	31.57	30.17	29.03	28.07	26.55	25.93
9.5	44.43	41.35	37.36	34.77	32.88	31.42	30.23	29.24	27.65	27.00
10.0	46.17	42.97	38.83	36.13	34.17	32.65	31.41	30.38	28.73	28.06
10.5	47.89	44.57	40.27	37.48	35.44	33.87	32.58	31.52	29.81	29.10
11.0	49.59	46.15	41.70	38.81	36.70	35.07	33.74	32.63	30.86	30.14
11.5	51.27	47.72	43.12	40.12	37.95	36.26	34.89	33.74	31.91	31.16
12.0	52.94	49.26	44.51	41.43	39.18	37.43	36.02	34.83	32.94	32.17
12.5	54.58	50.80	45.90	42.71	40.40	38.60	37.14	35.92	33.97	33.17
13.0	56.21	52.31	47.27	43.99	41.60	39.75	38.25	36.99	34.98	34.16
13.5	57.83	53.81	48.63	45.25	42.80	40.89	39.34	38.05	35.99	35.14
14.0	59.43	55.30	49.97	46.50	43.98	42.02	40.43	39.10	36.98	36.11
14.5	61.01	56.78	51.30	47.74	45.15	43.14	41.51	40.15	37.97	37.07
15.0	62.58	58.24	52.62	48.97	46.32	44.25	42.58	41.18	38.95	38.03
15.5	64.14	59.69	53.93	50.19	47.47	45.35	43.64	42.21	39.92	38.98
16.0	65.69	61.13	55.23	51.40	48.61	46.45	44.69	43.22	40.88	39.92
16.5	67.22	62.55	56.52	52.60	49.75	47.53	45.73	44.23	41.83	40.85
17.0	68.74	63.97	57.80	53.79	50.87	48.61	46.77	45.23	42.78	41.77
17.5	70.25	65.38	59.07	54.97	51.99	49.68	47.80	46.23	43.72	42.69
18.0	71.75	66.77	60.34	56.15	53.10	50.74	48.82	47.22	44.65	43.60
19.0	74.72	69.54	62.83	58.47	55.30	52.84	50.84	49.17	46.50	45.41
20.0	77.65	72.26	65.30	60.77	57.47	54.91	52.83	51.10	48.33	47.19
21.0	80.55	74.96	67.73	63.03	59.61	56.95	54.80	53.00	50.13	48.95
22.0	83.41	77.62	70.14	65.27	61.73	58.98	56.75	54.88	51.91	50.68
23.0	86.23	80.25	72.51	67.48	63.82	60.98	58.67	56.74	53.67	52.40
24.0	89.03	82.85	74.86	69.67	65.89	62.95	60.57	58.58	55.41	54.10
25.0	91.80	85.43	77.19	71.84	67.94	64.91	62.46	60.41	57.13	55.78

7.8.1 RADIUS OF RELATIVE STIFFNESS
(REFERENCE: PORTLAND CEMENT ASSOCIATION)

PRELIMINARY



7.8.2 RIGID PAVEMENT REQUIREMENTS - LCN CONVERSION

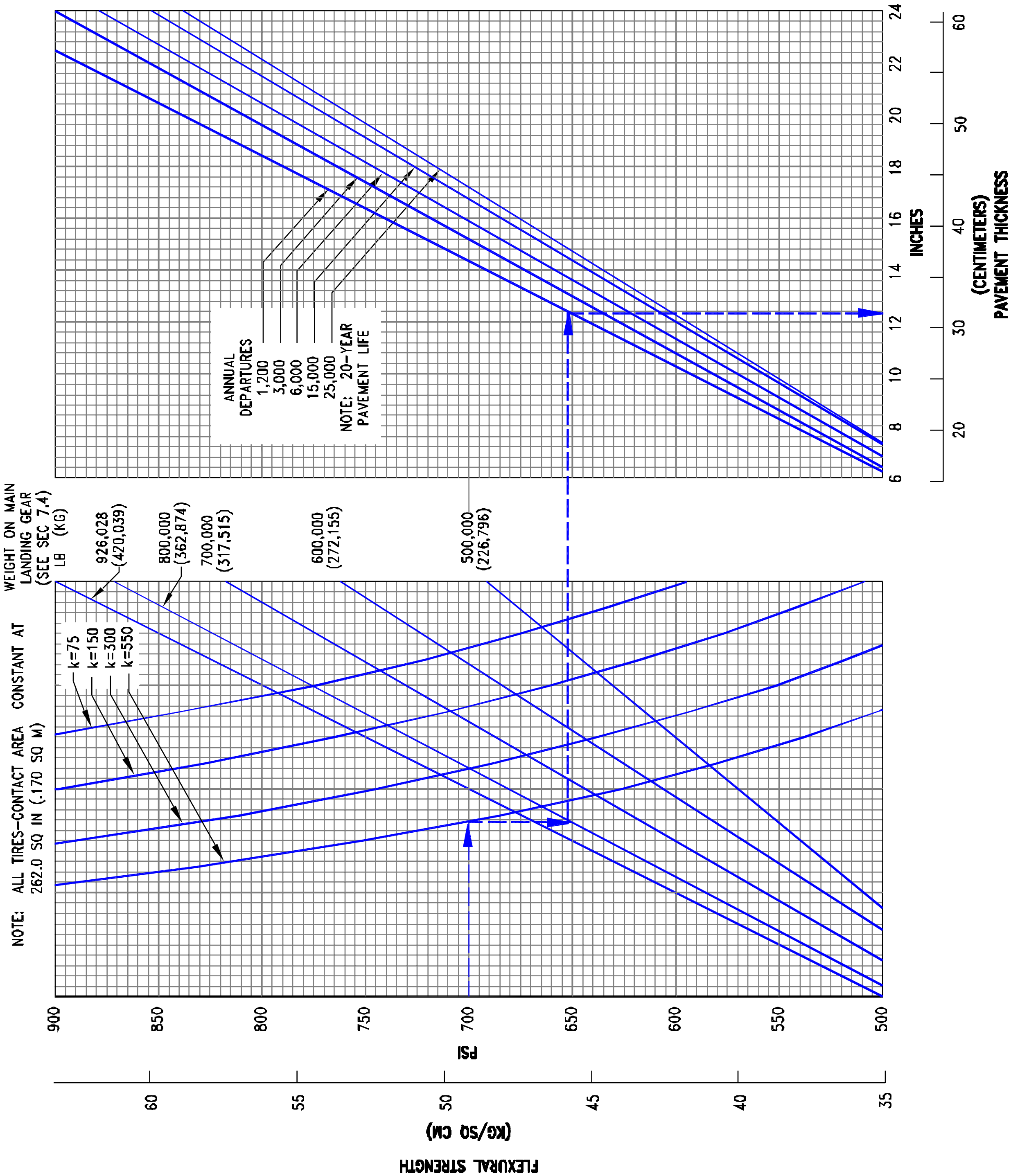
MODEL 747-8, 747-8F

7.9 Rigid Pavement Requirements - FAA Design Method

The rigid pavement design chart shown in Section 7.9 presents the data of five incremental main gear loads at the minimum tire pressure required at the maximum design taxi weight.

In the example shown, for a pavement flexure strength of 700 psi, a subgrade strength of k = 550, and an annual departure level of 1,200, the required rigid pavement thickness for an airplane with a main gear load of 800,000 lb is 12.4 in.

PRELIMINARY



7.9.1 RIGID PAVEMENT REQUIREMENTS - FAA DESIGN METHOD
MODEL 747-8, 747-8F

7.10 ACN/PCN Reporting System: Flexible and Rigid Pavements

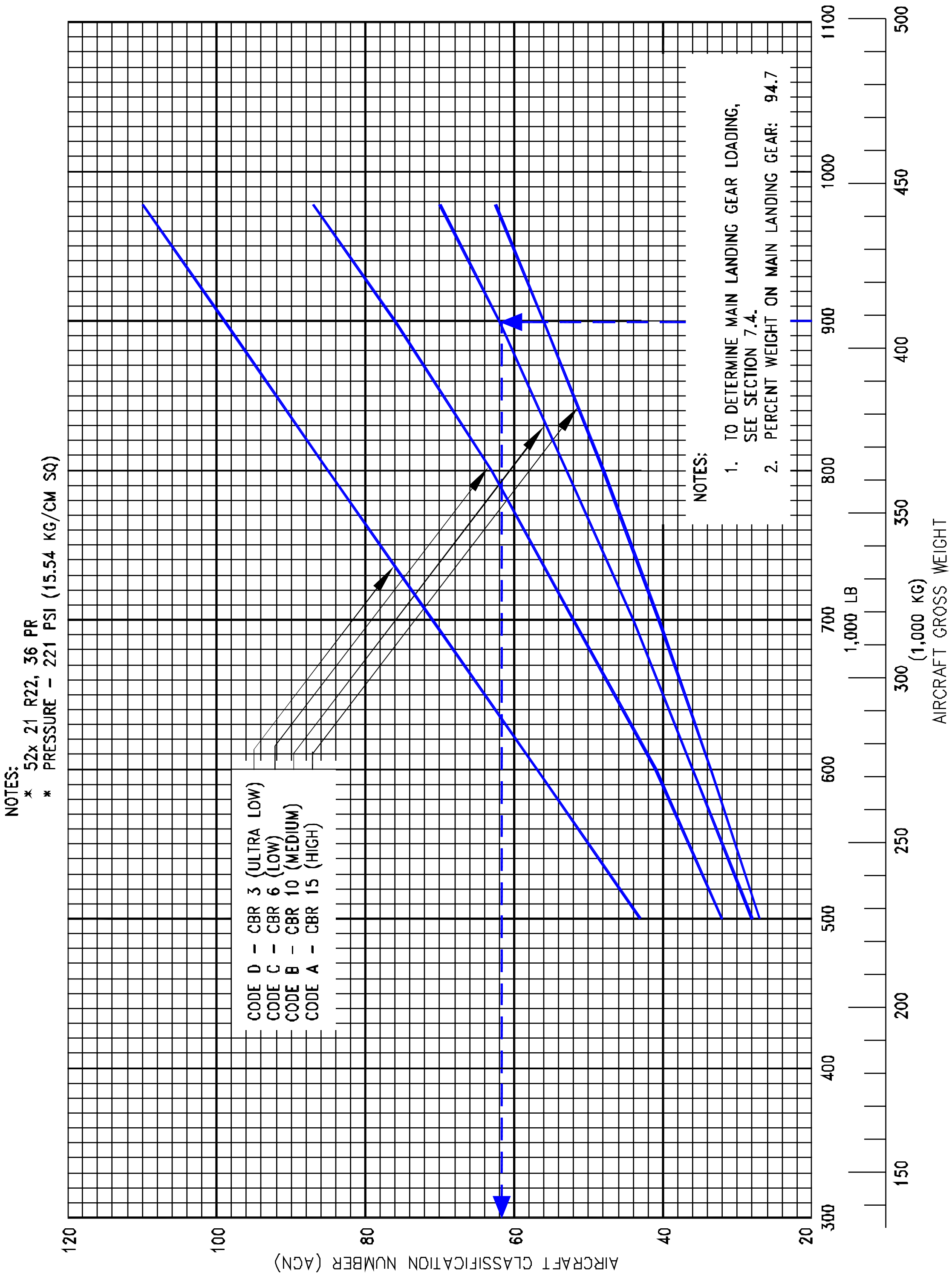
To determine the ACN of an aircraft on flexible or rigid pavement, both the aircraft gross weight and the subgrade strength category must be known. In the chart in Section 7.10.1, for an aircraft with gross weight of 900,000 lb and medium subgrade strength, the flexible pavement ACN is 62. In Section 7.10.2, for the same gross weight and subgrade strength, the rigid pavement ACN is 67.

The following table provides ACN data in tabular format similar to the one used by ICAO in the “Aerodrome Design Manual Part 3, Pavements”. If the ACN for an intermediate weight between maximum taxi weight and the empty weight of the aircraft is required, Figures 7.10.1 through 7.10.2 should be consulted.

				ACN FOR RIGID PAVEMENT SUBGRADES – MN/m^3				ACN FOR FLEXIBLE PAVEMENT SUBGRADES – CBR			
AIRCRAFT TYPE	MAXIMUM TAXI WEIGHT MINIMUM WEIGHT (1) LB (KG)	LOAD ON ONE MAIN GEAR LEG (%)	TIRE PRESSURE PSI (MPa)	HIGH 150	MEDIUM 80	LOW 40	ULTRA LOW 20	HIGH 15	MEDIUM 10	LOW 6	ULTRA LOW 3
747-8, -8F	978,000(443,613)	23.68	221 (1.52)	64	75	88	101	63	70	87	110
	500,000(226,796)			27	30	35	41	27	28	32	43

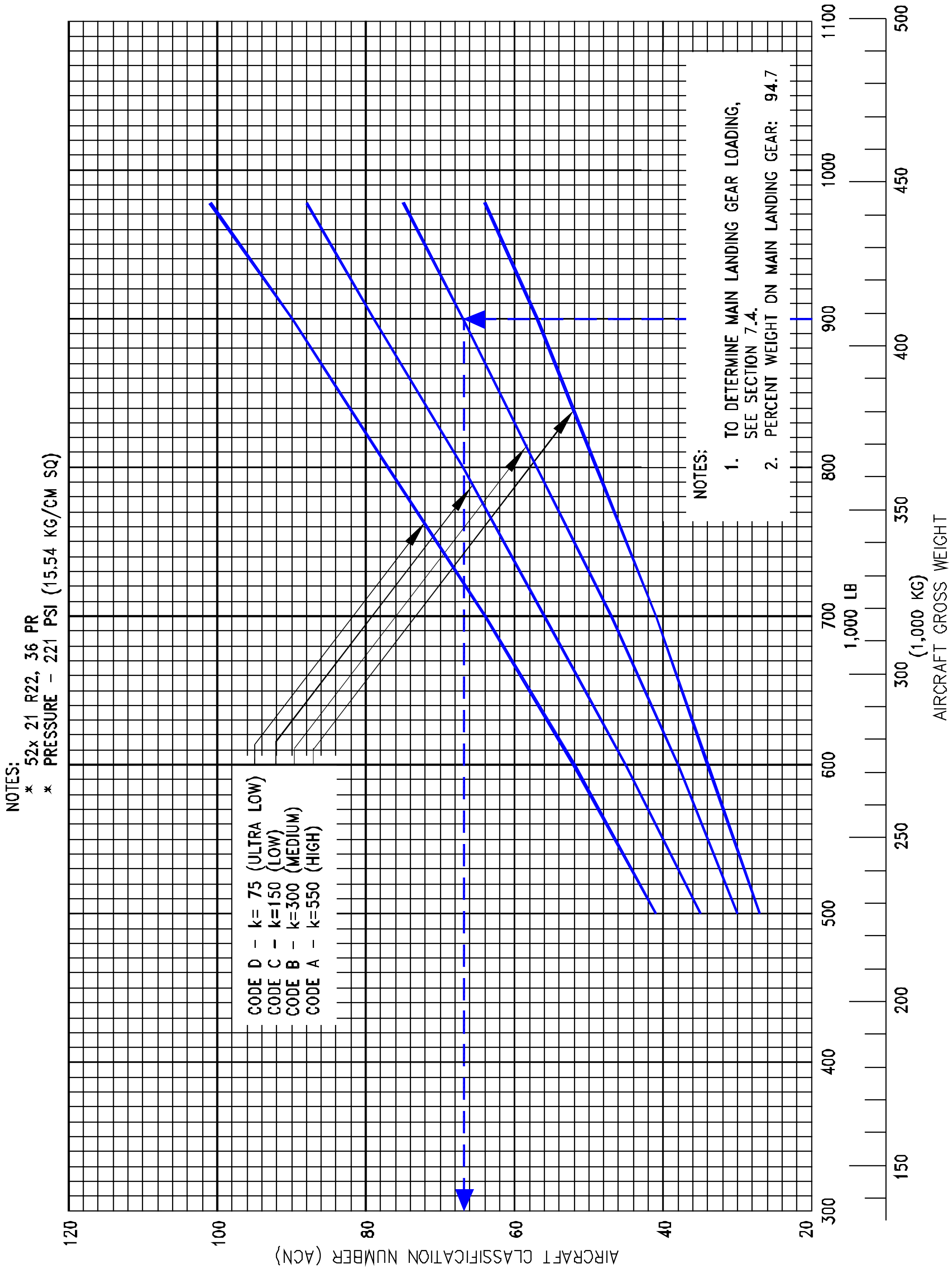
(1) Minimum weight used solely as a baseline for ACN curve generation.

PRELIMINARY



7.10.1 AIRCRAFT CLASSIFICATION NUMBER - FLEXIBLE PAVEMENT

MODEL 747-8, 747-8F



7.10.2 AIRCRAFT CLASSIFICATION NUMBER - RIGID PAVEMENT

MODEL 747-8, 747-8F

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8.0 FUTURE 747-8 DERIVATIVE AIRPLANES

8.0 FUTURE 747 DERIVATIVE AIRPLANES

Several derivatives are being studied to provide additional capabilities of the 747-8 family of airplanes. Future growth versions could address additional passenger count, cargo capacity, increased range, or environmental performance.

Whether and/or when these or other possibilities are actually built is entirely dependent on future airline requirements. In any event, the impact on airport facilities will be a consideration in configuration and design.

9.0 SCALED 747-8 DRAWINGS

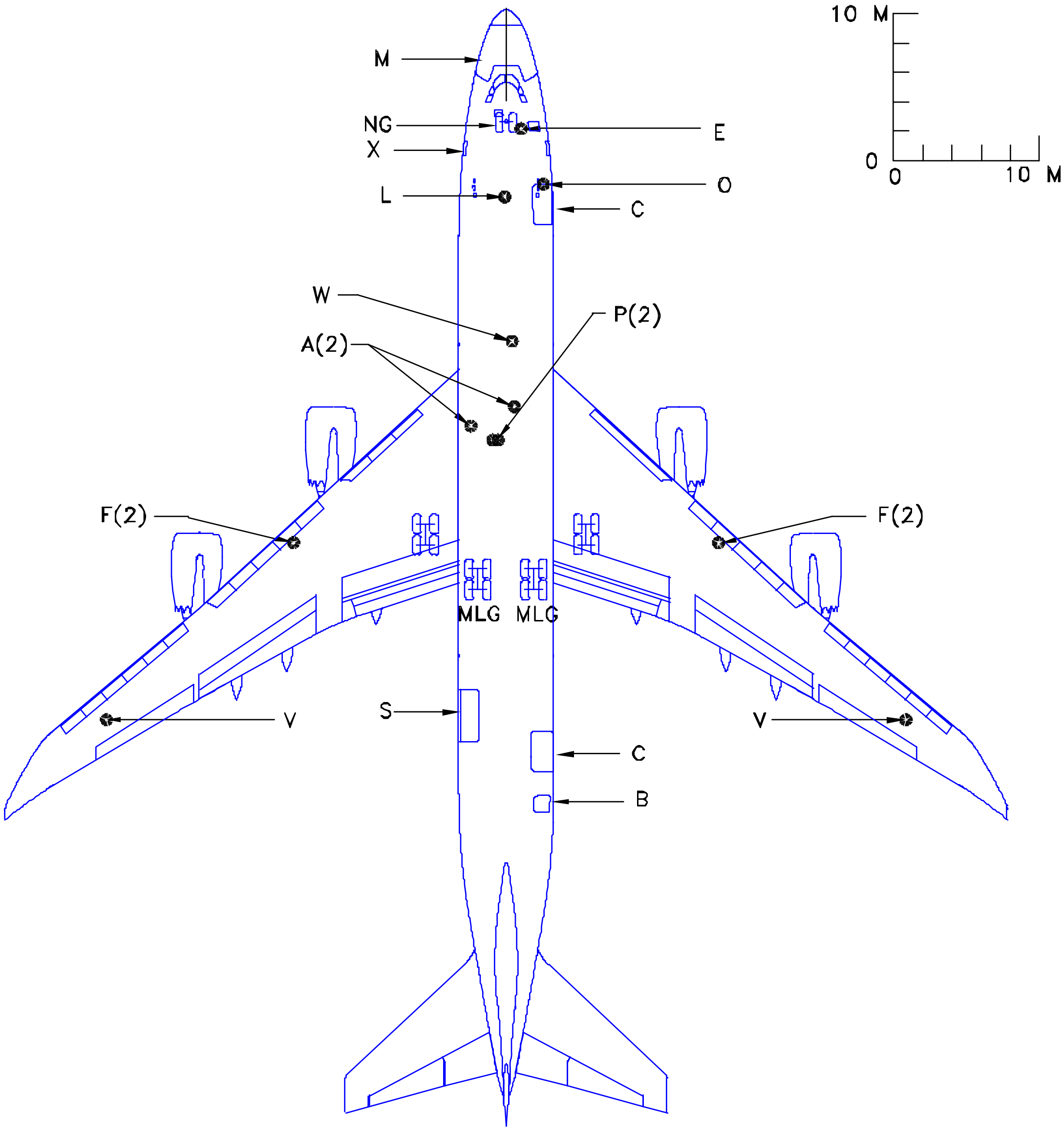
9.1 747-8, 747-8F

9.0 SCALED DRAWINGS

The drawings in the following pages show airplane plan view drawings, drawn to approximate scale as noted. The drawings may not come out to exact scale when printed or copied from this document. Printing scale should be adjusted when attempting to reproduce these drawings. Three-view drawing files of the 747-8 Freighter, along with other Boeing airplane models, may be downloaded from the following website:

http://www.boeing.com/airports

PRELIMINARY



LEGEND

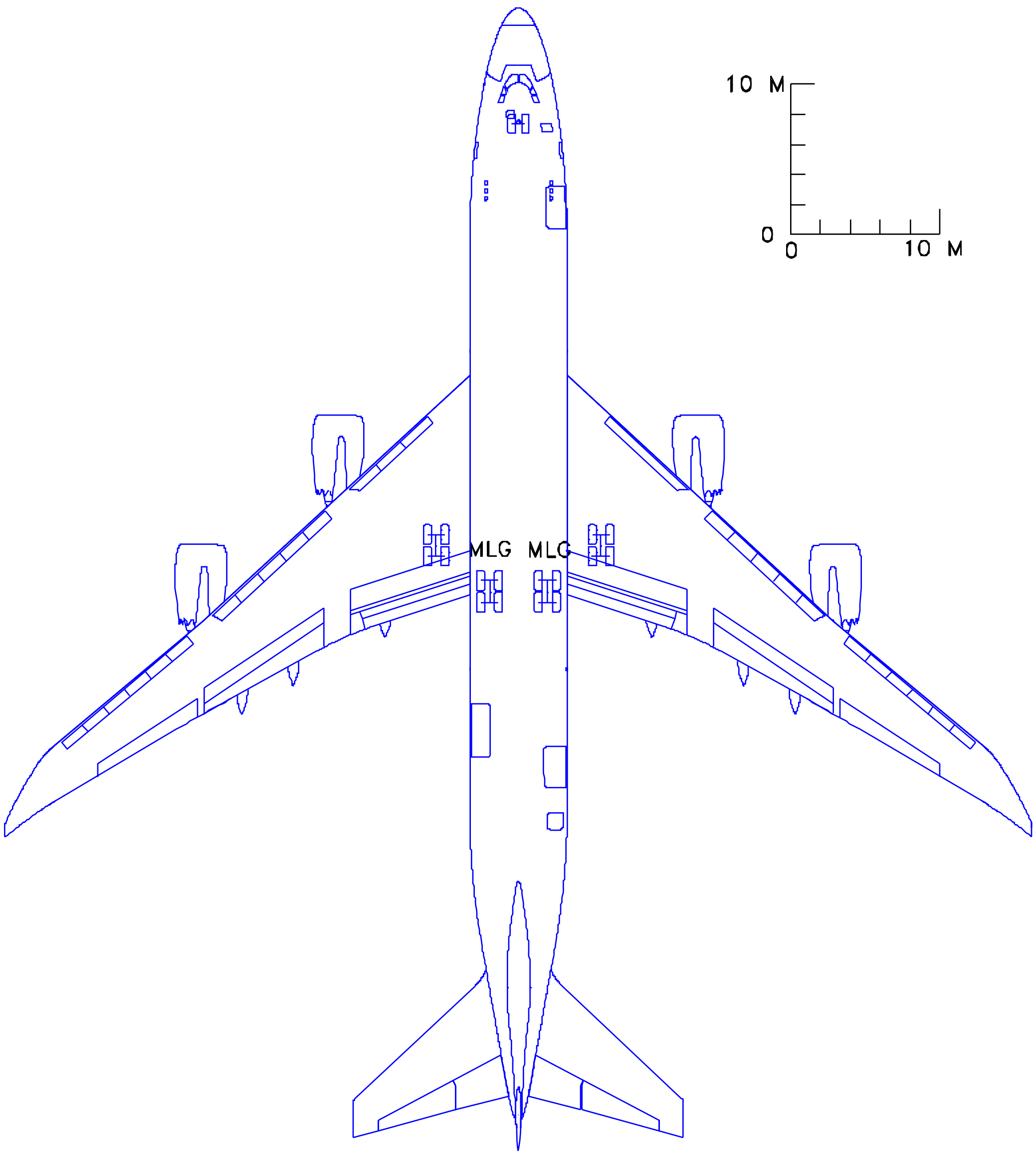
A(2)	AIR CONDITIONING (2 CONNECTIONS)	NG	NOSE GEAR
B	BULK CARGO DOOR	O	OXYGEN
C	CARGO CONTAINER DOOR	P(2)	PNEUMATIC (2 CONNECTIONS)
E(2)	ELECTRICAL (2 CONNECTIONS)	S	MAIN DECK SIDE CARGO DOOR
F(2)	FUEL (2 CONNECTIONS)	U	UPPER DECK EXIT DOOR
L	LAVATORY	V	FUEL VENT
M	MAIN DECK NOSE CARGO DOOR	W	POTABLE WATER
MLG	MAIN LANDING GEAR	X	PASSENGER DOOR

NOTE: ADJUST FOR PROPER SCALING WHEN PRINTING THIS PAGE

9.1.1 SCALED DRAWING - 1:500

MODEL 747-8 , 747-8F

PRELIMINARY



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9.1.2 SCALED DRAWING - 1:500

MODEL 747-8, 747-8F