BOEING 737-SERIES

TOWING

Introduction:

The 737Series can be towed with a conventional tow tractor using a towbar that mates with the nose gear tow fitting. Tow tractor size, which is dependent upon specific towing conditions, can be determined using Figure 09-1 and Figure 09-2. The tow fitting on the nose gear is shown on Figure 09-3. Airplanes are delivered with a cross bolt installed in the tow fitting so a tow bar with a claw type coupling can be used.

All 737 tow fittings are dimensionally similar, therefore, 737 claw type tow bars will mate properly with all models of the 737 family of airplanes which have the cross bolt installed. However, shear and torque values vary for the many 737 models.

The tow bar should have fuse pins installed with a nominal shear protection not to exceed the maximum push-pull towing loads (see Figure 09-5) and 61,500 inch-pounds torsion. Tow bars intended for use on all 737 models should meet the allowable load data and interface information given in drawing C09002 - Data Sheet - 737 Tow bar Design. Consult the applicable Airplane Maintenance Manual for details. Also, a ground power cable and intercom cable would be desirable.

A special eyebolt (F72719-500) can be installed at the bottom of each main gear for use in towing during abnormal conditions. Two eyebolts and associated cable assemblies are required for each airplane.

Braking Distance:

Tow tractor braking distance is dependent on several factors. Some of the more important factors include the initial velocity of the tow tractor, surface grade, surface conditions, airplane weight, tractor weight, rolling resistance and load distribution.

Basic engineering equations may be used to estimate reasonable stopping distances, however, because calculations require a good deal of specific tow tractor design data, it is recommended that tow tractor manufacturers be contacted and the required information requested.

Towbarless Towing:

Several ground support equipment manufacturers have developed unique vehicles to replace conventional tow tractors and tow bars. These vehicles are generally referred to as towbarless tow vehicles (TLTV) because they move airplanes without the use of a tow bar. Instead, the airplane's nose wheel is picked up and held by the tow vehicle. The nose gear load effectively increases the traction of the tow vehicle. Currently, towbarless towing is only being used for pushback and maintenance towing. No airlines are using TLTVs for dispatch or revenue towing of loaded airplanes. See Boeing Towbarless Towing Service Letter 737-SL-09-002. Attached to this Service Letter is a towbarless vehicle test assessment criteria document for use by airlines or TLTV manufacturers. The steering system must still be deactivated for towbarless towing operations.

Ground Support Equipment:

(1) Tow bar - Specification per Drawing Part Number C09002
(2) Tractor - See Figure 09-1 and Figure 09-2. (28,000 Gross Vehicle Weight, 20,000 Drawbar Pull) (typical)
(3) Lockpin - Nose Gear Towing Lever Drawing Part Number A09003
(4) Towbarless Tractor- per D6-56872, Towbarless Towing Vehicle Assessment Criteria (attached to 737-SL09-002-A)

Maximum towbarless tow loads, torques and steering angles are 80% of conventional tow bar maximum towing loads (see Figure 09-5). This reduction is needed because of the absence of load/shear protection in the pick up devices of many TLTVs. Airplanes operated under JAA regulations, must have over-steer indication or protection systems installed on the vehicle. See Service Letter 737-SL-09-002 for details. JAA towbarless towing restrictions do not apply to older 737-100/-200/-300/-400/-500 airplanes.

Figure 09-1 GROUND TOWING REQUIREMENTS, (ENGLISH UNITS)

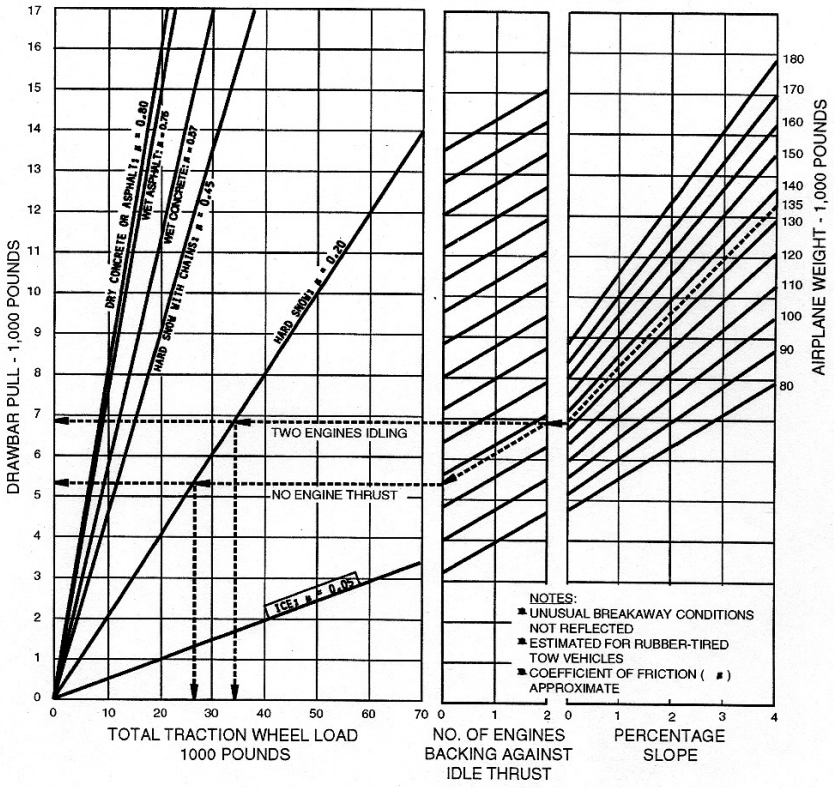


Figure 09-2 GROUND TOWING REQUIREMENTS, (METRIC UNITS)

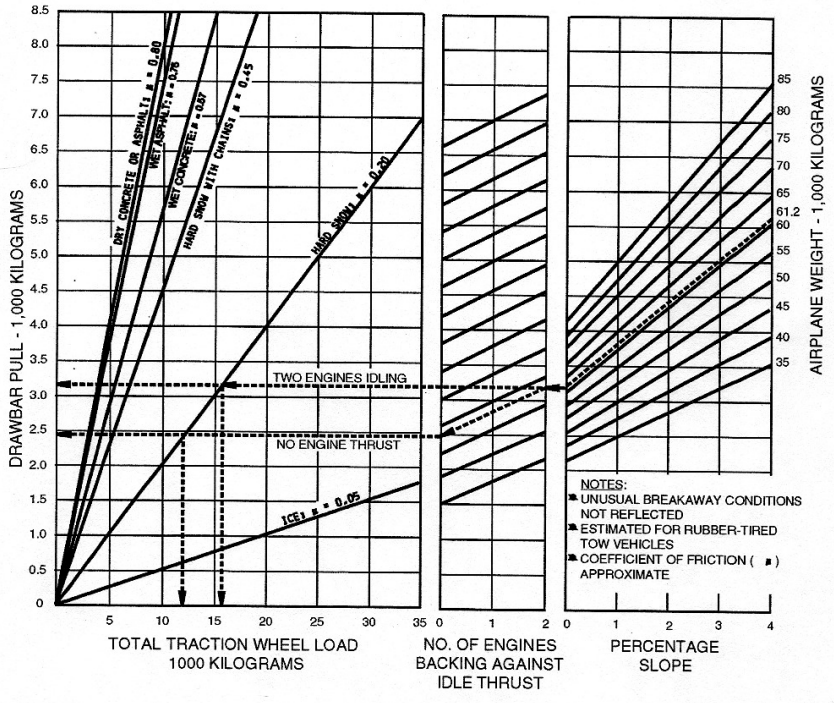


Figure 09-3 NOSE GEAR TOWING ATTACHMENT FITTING

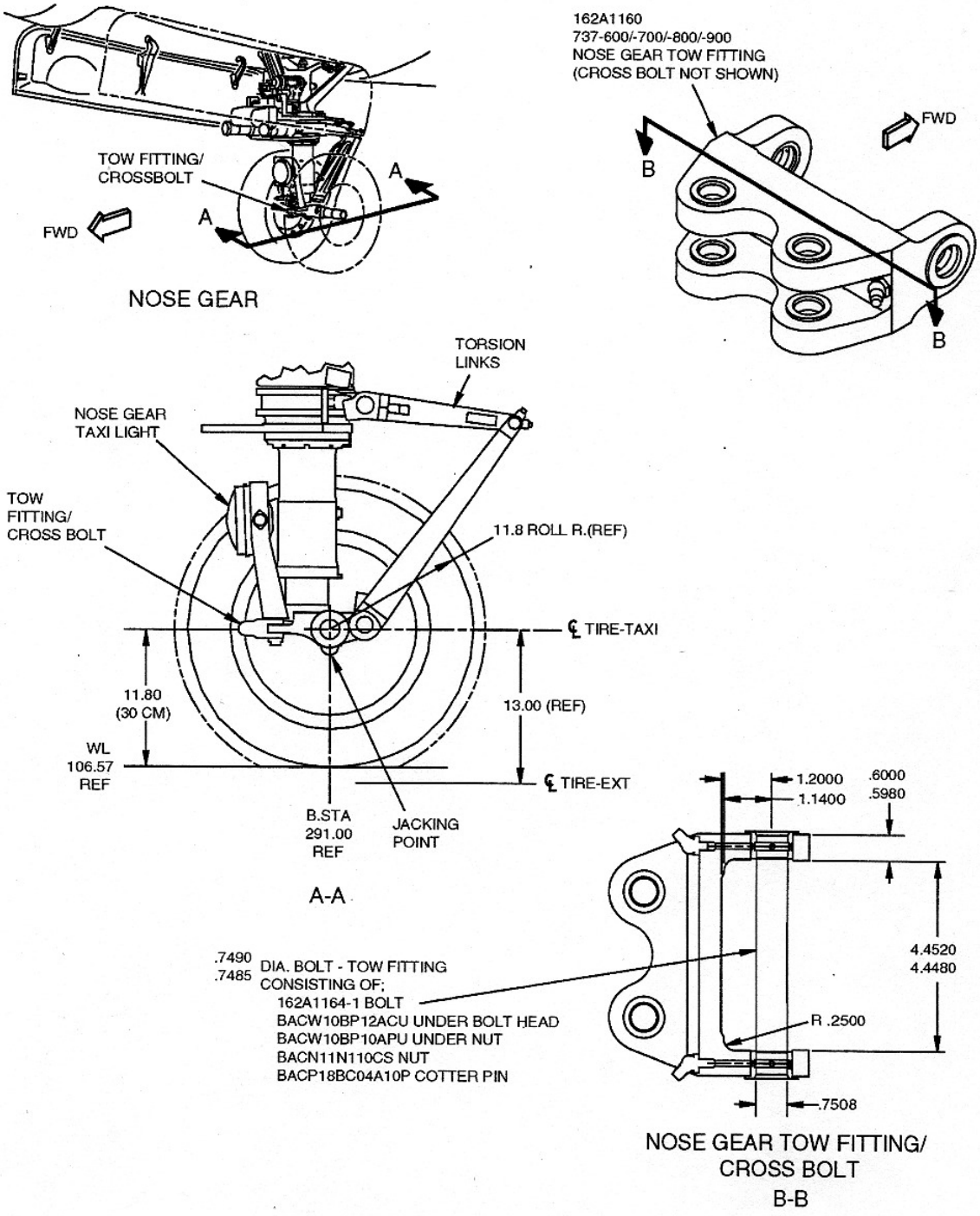
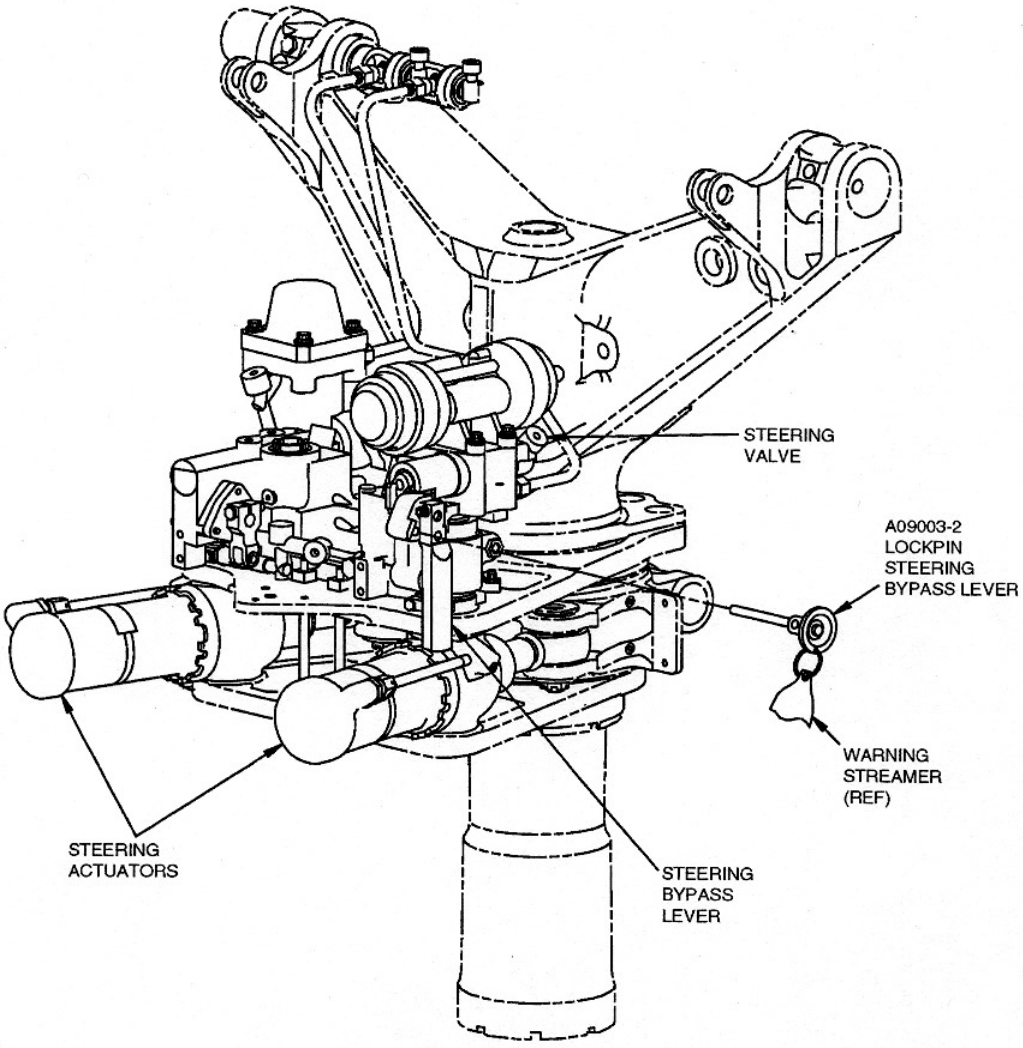
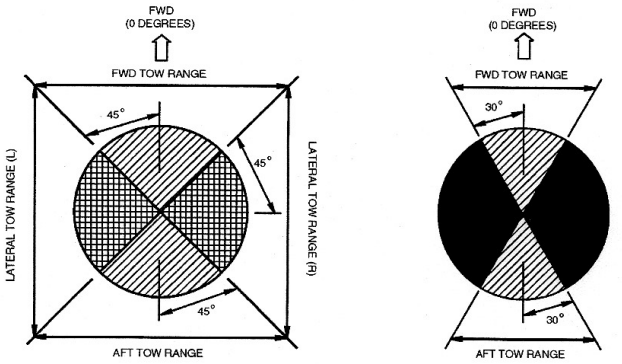


Figure 09-4 NOSE GEAR STEERING VALVE LEVER



NOTE: 737-600/-700/-800/-900 STEERING LOCKOUT PIN (A09003-2) IS LARGER THAN THE STEERING LOCKOUT PIN USED ON OTHER 737 MODELS. THESE PINS ARE NOT INTERCHANGEABLE.

Figure 09-5 MAXIMUM TOWING LOADS AND TURNING RADIUS



MAXIMUM TOWING LOADS (TOWBAR)					
MODEL	NOSE LANDING GEAR LOAD (LB)			MAIN LANDING GEAR LOAD (LB) (EACH)	
	FWD (±45°)	AFT (180±45°)	LATERAL (±90°±45°)	FWD (±30°)	AFT (180°±30°)
737-600	21,600	21,600	10,800	16,200	16,200
737-700	23,020	23,020	11,510	17,260	17,260
737-800	25,950	25,950	12,975	19,460	19,460
737-900	26,200	26,200	13,100	19,650	19,650

NOTE: 0° = AIRPLANE FORWARD (FWD) DIRECTION

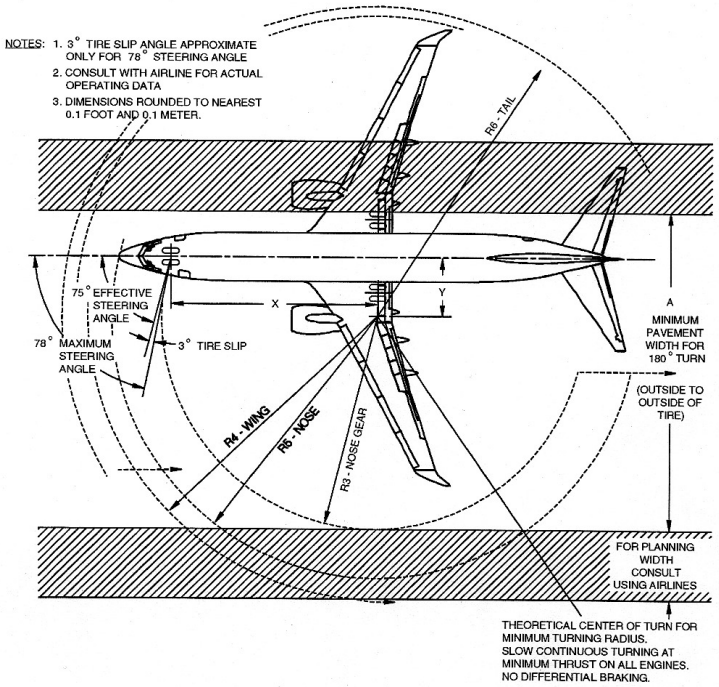
- FOR NOSE GEAR TOW ANGLES GREATER THAN 78 DEGREES, THE TORSION LINKS MUST BE DISCONNECTED.
- WITH TORSION LINK DISCONNECTED, NOSE GEAR TOWING ANGLE IS LIMITED TO APPROXIMATELY 90 DEGREES UNLESS NOSE GEAR TAXI LIGHT CABLE IS DISCONNECTED.
- LOADS ARE FOR BASIC AIRPLANE MODEL WEIGHTS. SEE AIRPLANE MAINTENANCE MANUAL FOR HIGHER GROSS WEIGHT AIRPLANE MODELS.
- TOWBARLESS TOWLOADS ARE 80% OF ABOVE VALUES. SEE SERVICE LETTER 737-SL-09-002 FOR DETAILS.

CAUTION: DEPRESSURIZE NOSE GEAR STEERING BEFORE TOWING AIRPLANE. FAILURE TO COMPLY COULD RESULT IN DAMAGE TO NOSE GEAR STEERING ACTUATOR.

Ground Maneuvering:

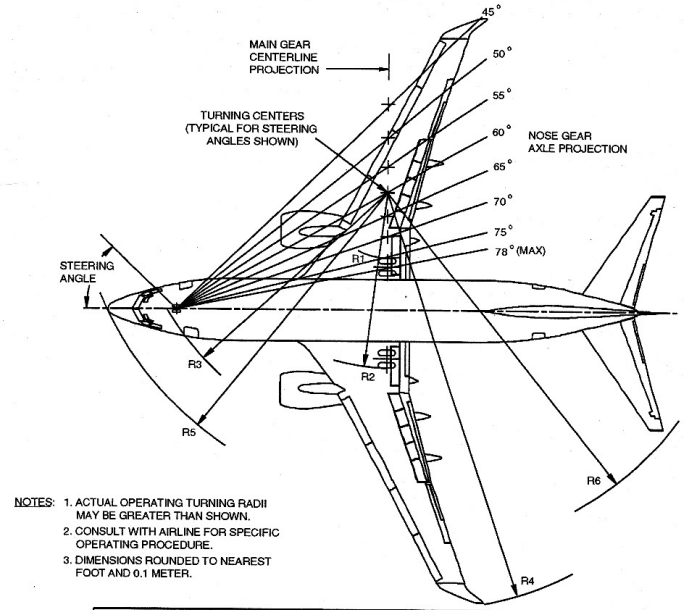
A lever for the steering metering valve is provided to deactivate steering and allow towing of the airplane without depressurizing the System A hydraulic system or disconnecting the nose gear torsion link. Lockpin A09003-2 is used to lock the nose landing gear steering lever during towing procedures. When towing the airplane at angles greater than 78°, disconnect the nose gear torsion link to prevent damage to the hydraulic steering system. If an angle in excess of 90° is required, disconnect the nose gear taxi light wire.

Figure 09-7 TOWING MINIMUM TURNING RADII, 3 DEGREE SLIP ANGLE- WITH WINGLET



AIRPLANE MODEL	EFFECTIVE TURNING ANGLE (DEG.)	X		Y		A		R3 NOSE GEAR		R4 WING		R5 NOSE		R6 TAIL	
		FT	M	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
737-700	75	41.3	12.6	11.1	3.4	66.4	20.3	43.8	13.3	72.6	22.1	55.9	17.0	65.5	20.0
737-800	75	51.2	15.6	13.7	4.2	79.1	24.1	53.8	16.4	75.2	22.9	65.9	20.1	74.9	22.8
737-900	75	55.9	17.0	15.0	4.6	85.4	26.0	58.8	17.9	76.4	23.3	70.9	21.6	78.3	23.9

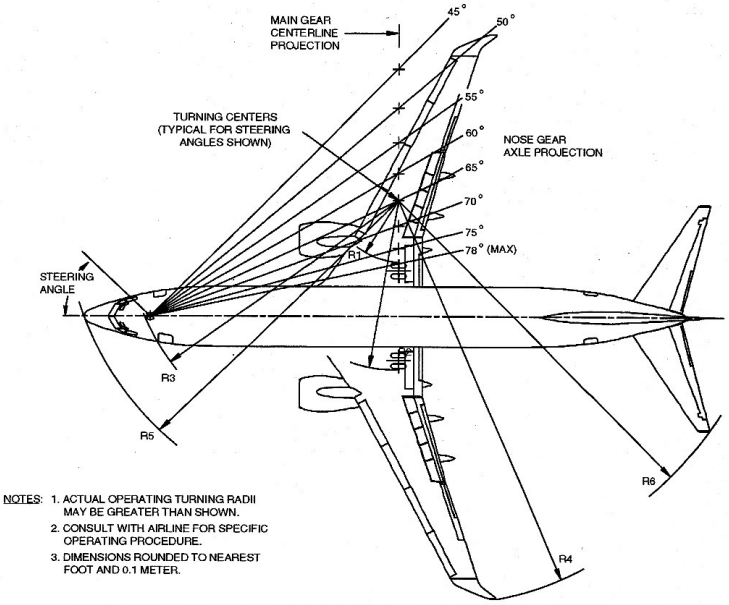
Figure 09-12 MINIMUM TURNING RADII, TOWING- WITH WINGLET, NO SLIP ANGLE, 737-700 (BBJ)



NOTES: 1. ACTUAL OPERATING TURNING RADII MAY BE GREATER THAN SHOWN.
2. CONSULT WITH AIRLINE FOR SPECIFIC OPERATING PROCEDURE.
3. DIMENSIONS ROUNDED TO NEAREST FOOT AND 0.1 METER.

STEERING ANGLE (DEGREES)	R1 INNER GEAR		R2 OUTER GEAR		R3 NOSE GEAR		R4 WING TIP		R5 NOSE		R6 TAIL	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	59.9	18.3	83.0	25.3	83.0	25.3	131.8	40.2	90.0	27.4	110.1	33.6
35	47.4	14.4	70.5	21.5	72.5	22.1	119.4	36.4	80.4	24.5	99.5	30.3
40	37.6	11.5	60.7	18.5	64.8	19.8	109.8	33.5	73.5	22.4	91.6	27.9
45	29.7	9.1	52.8	16.1	59.0	18.0	102.0	31.1	68.5	20.9	85.5	26.0
50	23.0	7.0	46.2	14.1	54.6	16.7	95.5	29.1	64.7	19.7	80.5	24.5
55	17.3	5.3	40.4	12.3	51.2	15.6	89.9	27.4	61.8	18.8	76.5	23.3
60	12.3	3.7	35.4	10.8	48.5	14.8	85.0	25.9	59.6	18.2	73.1	22.3
65	7.7	2.3	30.8	9.4	46.4	14.2	80.5	24.5	58.0	17.7	70.2	21.4
70	3.5	1.1	26.6	8.1	44.8	13.7	76.4	23.3	56.7	17.3	67.7	20.6
78 (MAXIMUM)	-2.8	-0.8	20.3	6.2	43.1	13.1	70.4	21.5	55.4	16.9	64.4	19.6

Figure 09-13 MINIMUM TURNING RADII, TOWING- WITH WINGLET, NO SLIP ANGLE, 737-800 (BBJ2)

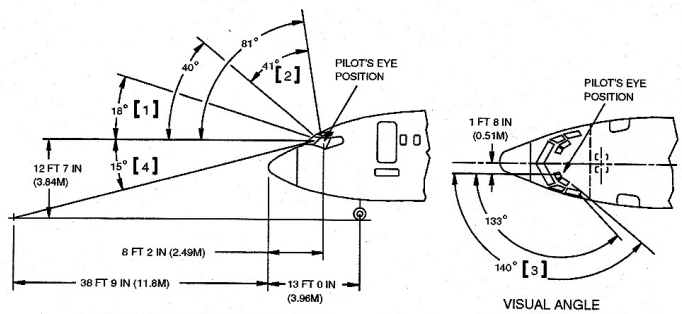


NOTES:
1. ACTUAL OPERATING TURNING RADII MAY BE GREATER THAN SHOWN.
2. CONSULT WITH AIRLINE FOR SPECIFIC OPERATING PROCEDURE.
3. DIMENSIONS ROUNDED TO NEAREST FOOT AND 0.1 METER.

STEERING ANGLE (DEGREES)	R1 INNER GEAR		R2 OUTER GEAR		R3 NOSE GEAR		R4 WING TIP		R5 NOSE		R6 TAIL	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	76.9	23.4	100.0	30.5	102.7	31.3	149.1	45.4	109.5	33.4	129.1	39.5
35	61.4	18.7	84.5	25.8	89.6	27.3	133.6	40.7	97.4	29.7	116.4	35.5
40	49.3	15.0	72.4	22.1	80.1	24.4	121.6	37.1	88.7	27.0	106.6	32.5
45	39.5	12.0	62.6	19.1	72.9	22.2	111.9	34.1	82.3	25.1	99.0	30.2
50	18.2	9.5	54.4	16.6	67.4	20.6	103.8	31.6	77.4	23.6	93.0	28.3
55	24.2	7.4	47.3	14.4	63.2	19.3	96.8	29.5	73.8	22.5	88.0	26.8
60	17.9	5.5	41.0	12.5	59.8	18.3	90.6	27.6	70.9	21.6	83.9	25.6
65	12.3	3.7	35.4	10.8	57.3	17.5	85.1	25.9	68.8	21.0	80.4	24.5
70	7.0	2.1	30.1	9.2	55.3	16.9	80.0	24.4	67.1	20.5	77.5	23.6
78 (MAXIMUM)	-0.7	-0.2	22.4	6.8	53.2	16.2	72.5	22.1	65.4	19.9	73.6	22.4

FLIGHT DECK SIGHT LINE

Figure 09-15 FLIGHT DECK SIGHT LINE, GROUND MANEUVERS

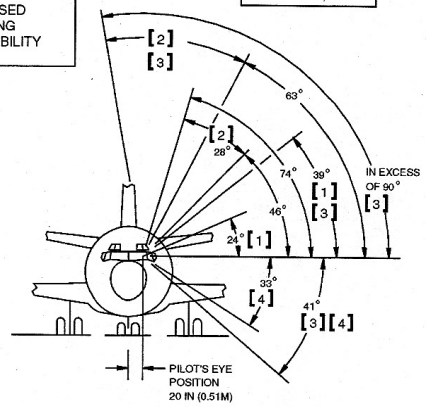


VISUAL ANGLES IN PLANE PARALLEL TO LONGITUDINAL AXIS THROUGH PILOT'S EYE POSITION

NOT TO BE USED FOR LANDING APPROACH VISIBILITY

VISUAL ANGLE IN HORIZONTAL PLANE THROUGH PILOT'S EYE POSITION

NOT TO SCALE



NOTE: HEAD ROTATED ABOUT POINT 3.3 IN. (0.08M) AFT OF PILOT'S EYE POSITION

[1] UPWARD VISION THROUGH MAIN WINDOW

[2] VISION THROUGH EYEBROW WINDOW

[3] WITH HEAD MOVED 5 IN. (0.13M) OUTBOARD

[4] DOWNWARD VISION THROUGH MAIN WINDOW

VISUAL ANGLES IN PLANE PERPENDICULAR TO LONGITUDINAL AXIS THROUGH PILOT'S EYE POSITION