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Driver Hand Control Reach

—SAE J287

SAE Recommended Practice
Approved July 1976

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Report of Human Factors Engineering Committee approved July 1976.

1. Introduction—The hand reach envelopes were developed using data acquired from test subjects performing reach tasks in test fixtures simulating a range of actual vehicle configurations.^{1,2} The test subjects included equal numbers of men and women selected to represent the (United States) driving population on the basis of stature and age, and were tested both with and without upper torso three-point restraint (a diagonal non-extending shoulder strap attached separately to the lap belt, that is, not a continuous loop). The envelopes constructed using the non-extending shoulder and lap belt are meant to define a restrained reach and the envelopes constructed using the lap belt only will describe an unrestrained reach. The hand reach envelopes are three-dimensional surfaces described in table form and can be referenced to a particular vehicle seating configuration according to procedures described in Sections 5 and 6. Only the 95% boundaries are presented in the tables.

2. Scope—This recommended practice describes boundaries of hand control locations that can be reached by desired proportions of different driver populations in passenger cars, multi-purpose passenger vehicles, and light and medium trucks. This recommended practice is not applicable for heavy trucks.

3. Field of Application

3.1 This Practice is primarily directed towards the initial design stages of a new vehicle program, where reference to H-point or Rearmost H-point implies Rearmost Design H-point or Seating Reference Point (SgRP). Its application for checking purposes in actual vehicles and prototype seat models will take into account an allowable tolerance for actual H-point.

3.2 The hand reach envelopes are directly applicable to left hand drive motor vehicles designed for seated operators in full width or single width seats having fore and aft seat adjustment approximately horizontal. Application to right hand drive vehicles is assumed to be symmetrically opposite.

3.3 The hand reach envelopes are directly applicable for a three-finger grasping reach to a forward mounted control knob of 25 mm (1 in) diameter maneuvered horizontally in the fore-aft direction.

4. Definitions

4.1 Driver Hand Reach Capability—The maximum reach capability of drivers in a simulated driving situation with the non-reaching hand on the steering wheel and the right foot on the accelerator pedal.

¹D. Hammond and R. Roe, "SAE Controls Reach Study," SAE Paper 720199 presented at SAE Automotive Engineering Congress and Exposition, Detroit, Michigan, January 1972.

²D. Hammond, D. Maurer, and L. Razgunas, "Controls Reach—The Hand Reach of Drivers," SAE Paper 750357 presented at SAE Automotive Engineering Congress and Exposition, Detroit, Michigan, February 1975.

4.2 Basic Reach Task—The hand reach to a forward mounted control with the control held in a three-finger grasp. See Fig. 1.

4.3 Hand Reach Envelopes—Geometric description of the hand reach capability for a specified proportion of a driver population and type of torso restraint system. The contour of the hand reach envelope refers to the geometric center of the control knob face. If the control knob face is at or rearward of the contour, it is estimated that at least the specified proportion of the indicated driver population can reach and operate the control.

4.4 Hand Reach Reference Plane (HR Plane)—A vertical reference plane extending laterally across the vehicle used to properly position the hand reach envelopes with respect to the geometry of the vehicle seating configuration. The horizontal location of the HR plane rearward of the Accelerator Heel Point is determined by application of the General Package Factor (G) as shown below:

$$\begin{aligned} \text{HR} &= 786 - (99) G, \text{ mm} \\ \text{HR} &= 30.96 - (3.90) G, \text{ in} \end{aligned}$$

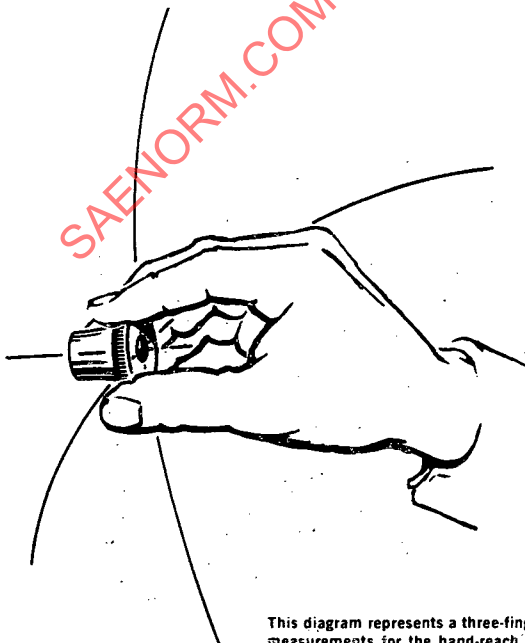
4.5 General Package Factor (G)—An algebraic equation that expresses and summarizes the geometry of a particular vehicle seating configuration in terms of a single index value. See Figs. 3 and 4.

4.6 Interior Dimensions—All interior dimensions referred to in this Recommended Practice, except where noted, are defined in SAE Recommended Practice J1100a, "Motor Vehicle Dimensions." All dimensions are defined normal to the three-dimensional reference system of the vehicle as described in SAE Recommended Practice J182a, "Motor Vehicle Fiducial Marks."

The characteristics of seat geometry are described in terms of the two- and three-dimensional H-point devices with 95 percentile leg length adjustments as described in SAE Recommended Practice J826b, "Devices for Use in Defining and Measuring Vehicle Seating Accommodation." The interior dimensions are measured with the front seat in the rearmost normal driving position as specified by the manufacturer. All other adjustable features, such as steering wheel, seat height, or tilt adjustment for the seat back or seat cushion, are located as specified by the manufacturer, and if not specified will be positioned at a normal driving position.

4.7.1 CENTERLINE OF OCCUPANT (C/LO)—Centerline of occupant is the "Y" coordinate of the H-point and is represented by the centerplane of the occupant or H-point machine in each designated seating position.

4.7.2 ACCELERATOR HEEL POINT (AHP)—Accelerator heel point is located at the intersection of the two- or three-dimensional device heel point and the depressed floor covering with the shoe on the undepressed accelerator pedal



This diagram represents a three-finger grasping reach to a 25 mm (1.0 in.) diameter control knob. All measurements for the hand-reach envelope are referenced to the centre of the control knob face.

FIG. 1—THREE-FINGER GRASPING REACH

and the foot angle at a minimum of 87 deg. For vehicles with SgRP to heel (H30) greater than 457 mm (18 in), the accelerator pedal may be depressed as specified by the manufacturer. If the depressed pedal is used, the foot must be flat on the accelerator pedal.

4.7.3 TYPE 2A—A seat belt assembly consisting of either a separate upper torso restraint intended for use only with a Type 1 seat belt assembly or an upper torso restraint which may be connected to a Type 1 seat belt assembly for use as a Type 2 seat belt assembly.

5. Required Characteristics

5.1 The following table lists the ranges of the interior dimensions for which this Recommended Practice is applicable:

L40	Back angle-front	9.0 deg	33.0 deg
L42	Hip angle-front	87 deg	103 deg
H30	SgRP-front to heel pt	130 mm (5 in)	to 520 mm (20.4 in)
L23	Normal driving and riding seat track travel	130 mm (5 in)	nominal
W9	Steering wheel maximum outside diameter	330 mm (13 in)	to 600 mm (23.6 in)
H18	Steering wheel angle	10.0 deg	to 70.0 deg
L11	Accelerator heel point to steering wheel center	660 mm (26 in)	to 152 mm (6 in)
H17	Accelerator heel point to steering wheel center	530 mm (21 in)	to 838 mm (33 in)

5.2 The envelopes describe the boundaries of control locations that can be reached by at least 95% of certain driver populations that include mixtures of 50/50, 75/25, and 90/10 male to female driver population ratios. The envelopes for each of these categories are described as referenced in a fore and aft direction to specified seating coordinates. The envelopes extend from 400 mm (15.7 in) outboard to 600 mm (23.6 in) inboard of operator centerline and from -100 mm (-3.9 in) below the Seating Reference Point to 800 mm (31.5 in) above the Seating Reference Point. See Fig. 2.

5.3 Hand reach envelopes are provided in the following tables for seven different seating configurations and three male, female driver population ratios. The selection of an envelope for a vehicle is based on the calculated value of the General Package Factor (G) and the identification of the male, female driver population ratio appropriate for the vehicle. The General Package Factor (G) is calculated using the dimensions describing the vehicle seating configuration as shown in Figs. 3 and 4.

5.4 The Hand Reach Envelope is located in the vehicle by employing a relationship that utilizes the value of the General Package Factor (G). The horizontal component of the envelope is measured as a distance forward of a

Hand Reach Reference Plane. The fore and aft location of this plane rearward from the Accelerator Heel Point is determined from the value of the General Package Factor (G) as shown in paragraph 4.4.

6. Procedure for Using the Hand Reach Envelopes

6.1 The envelopes are located in the vehicle according to a set of orthogonal reference planes: a "Z" plane through the Seat Reference Point set at zero, an "X" plane set at HR, and a "Y" plane extending through the C/LO.

6.1.1 ESTABLISH A REFERENCE ORIGIN

6.1.1.1 Specify the dimensions describing the geometry of the vehicle seating configuration and calculate the value of the General Package Factor (G) as described in Fig. 3.

6.1.1.2 Calculate HR from the value of the General Package Factor (G) as shown in paragraph 4.4. Determine the longitudinal location of the hand reach reference plane by comparing HR to L53, the horizontal distance from SgRP to Accelerator Heel Point.

6.1.1.2.1 If (HR-L53) is less than zero, then the hand reach reference plane is located longitudinally at a distance (HR) rearward of the Accelerator Heel Point.

6.1.1.2.2 If (HR-L53) is greater than zero, the hand reach reference plane is located longitudinally at the H-point of the rearmost normal driving position as specified by the manufacturer.

6.1.2 IDENTIFY THE APPROPRIATE HAND REACH ENVELOPE

6.1.2.1 Referring to the following tables, identify the hand reach envelope appropriate for the value of the General Package Factor (G) calculated for this vehicle and for the specified driver population.

6.1.2.2 Determine the lateral locations of the controls of interest. These locations will be described as lateral locations from the (C/LO). Determine the height of the control above the horizontal elevation reference plane described in paragraph 6.1 above.

6.1.3 DETERMINE IF THE CONTROL IS WITHIN REACH³

6.1.3.1 The limiting value of reach can be read from the appropriate table at the designated elevation and station locations. Interpolation may be required if the necessary locations are not included in the table. Interpolate laterally first before interpolating vertically. Curvilinear interpolations should be made using two locations on either side of the desired control.

³The blank areas in the hand reach tables are regions where hand reach was not measured or where design limit values could not be established. The gray areas are regions where the difference between the hand reach model and the observed design limit values exceeded 25 mm (1 in). The reach values shown in these areas should be used cautiously.

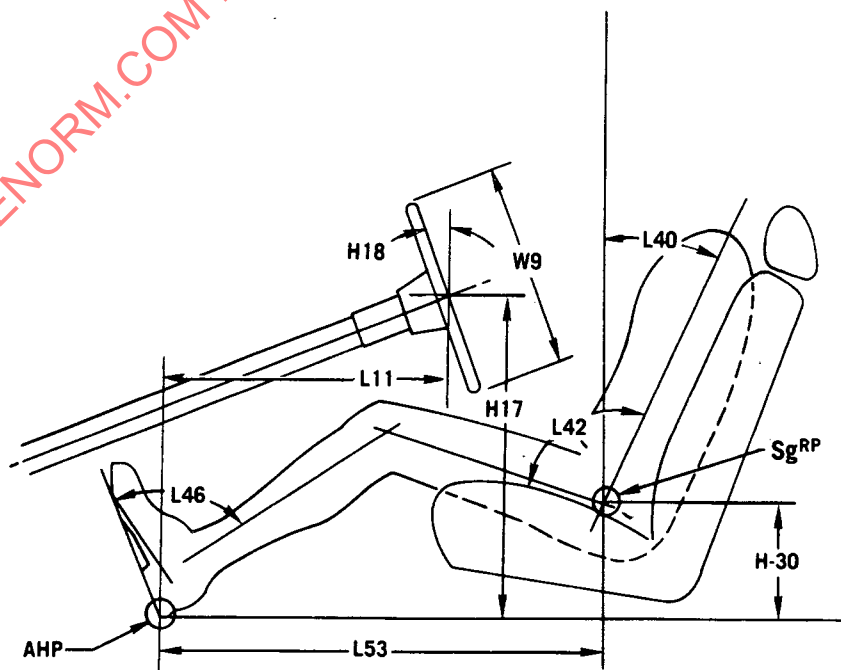


FIG. 2—VEHICLE SEATING CONFIGURATION

The General Package Factor (G) is a synthesized variable that provides a quantitative index of a vehicle's workspace geometry. The G value for a vehicle can be calculated by substituting the principal package dimensions into the equation shown below.

In computations using millimetres:

$$G = 0.0018 (H30) - 0.0197 (L40) + 0.0027 (W9) + 0.0106 (H18)$$

$$- 0.0011 (L11) + 0.0024 (H17) + 0.0027 (L42) - 3.0853$$

In computations using inches:

$$G = 0.0458 (H30) - 0.0197 (L40) + 0.0688 (W9) + 0.0106 (H18)$$

$$- 0.0283 (L11) + 0.0603 (H17) + 0.0027 (L42) - 3.0853$$

FIG. 3—GENERAL PACKAGE FACTOR (G)

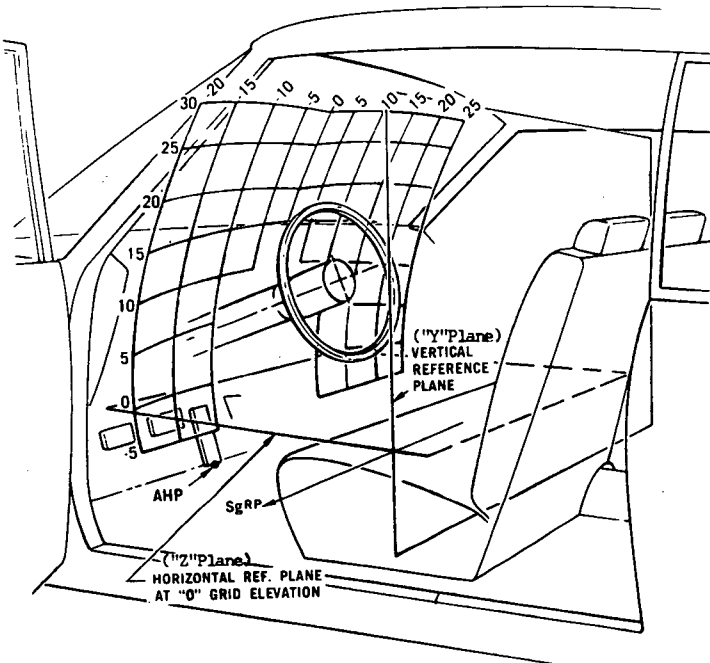


FIG. 4—HAND REACH ENVELOPE IN VEHICLE POSITION

TABLE 1

HAND REACH ENVELOPE

VEHICLE RANGE: (G LESS THAN -1.25)

POPULATION MIX: 50/50 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED Laterally FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.																
	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
<u>35.0</u>	12.4	13.8	15.0	15.9	16.5	16.9	17.0	16.9	17.0	17.1	16.9	16.3	15.4	14.8	14.2	13.6	13.0
<u>32.5</u>	14.8	16.1	17.1	17.9	18.4	18.8	19.1	18.7	19.0	19.1	18.8	18.3	17.4	16.7	16.1	15.5	14.9
<u>30.0</u>	16.9	18.1	18.9	19.6	20.0	20.4	20.7	20.3	20.8	20.8	20.5	20.0	19.2	18.5	17.8	17.2	16.6
<u>27.5</u>	18.7	19.7	20.5	21.0	21.4	21.7	21.9	21.7	22.2	22.3	22.0	21.5	20.8	19.9	19.0	17.8	16.4
<u>25.0</u>	20.1	21.0	21.7	22.2	22.5	22.7	22.7	22.7	23.4	23.5	23.3	22.8	22.1	21.4	20.5	19.4	17.9
<u>22.5</u>	21.2	22.1	22.7	23.1	23.4	23.4	23.2	23.6	24.3	24.4	24.3	23.9	23.3	22.6	21.7	20.6	19.0
<u>20.0</u>	22.0	22.8	23.4	23.8	24.0	23.8	23.2	24.1	24.9	25.1	25.0	24.7	24.2	23.6	22.7	21.5	19.9
<u>17.5</u>	22.6	23.3	23.9	24.3	24.4	23.9	22.9	24.4	25.2	25.5	25.6	25.4	24.9	24.3	23.3	22.1	20.5
<u>15.0</u>	22.8	23.5	24.1	24.5	24.5	23.8	22.3	24.4	25.2	25.7	25.9	25.4	25.4	24.7	23.7	22.4	20.4
<u>12.5</u>	22.8	23.4	24.1	24.6	24.4	23.4	21.3	24.2	24.9	25.5	26.0	26.1	25.7	25.0	23.8	22.4	20.4
<u>10.0</u>	22.4	23.0	23.8	24.3	24.2			24.4	25.1	25.8	26.1	25.8	24.9	23.6	22.0	20.5	
<u>7.5</u>	21.9	22.4	23.3	23.9	23.6			24.4	25.4	25.9	25.6	24.7	23.1	21.4	19.9		
<u>5.0</u>	21.0	21.6	22.6	23.3					24.7	25.4	25.3	24.2	22.3	20.4	19.0		
<u>2.5</u>	19.9	20.5	21.6	22.4					23.9	24.8	24.7	23.4	21.3	19.0	17.4		
<u>0.0</u>	18.6	19.2							22.7	23.9	23.8	22.4	19.9	17.4	15.8		
<u>-2.5</u>	17.0	17.6							21.4	22.9	22.8	21.1	18.3	15.4	13.4		

TABLE 2

HAND REACH ENVELOPE

VEHICLE RANGE: (G LESS THAN -1.25)

POPULATION MIX: 75/25 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF CL/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	13.8	15.2	16.4	17.2	17.8	18.1	18.2	18.5	18.7	18.7	18.5	17.9	17.0	15.8	14.5	13.1	
32.5	16.2	17.4	18.4	19.1	19.6	20.0	20.3	20.2	20.6	20.6	20.3	19.8	18.9	17.9	16.7	15.5	
30.0	18.2	19.3	20.2	20.8	21.2	21.5	21.9	21.7	22.2	22.2	21.9	21.4	20.6	19.7	18.7	17.5	
27.5	19.9	20.9	21.7	22.2	22.5	22.8	23.0	22.9	23.5	23.6	23.3	22.8	22.1	21.3	20.4	19.2	17.8
25.0	21.3	22.2	22.9	23.3	23.6	23.7	23.7	23.9	24.6	24.7	24.5	24.0	23.4	22.7	21.8	20.7	19.1
22.5	22.4	23.2	23.8	24.2	24.4	24.4	24.1	24.6	25.4	25.6	25.4	25.0	24.5	23.8	22.9	21.8	20.2
20.0	23.2	23.9	24.5	24.9	25.0	24.7	24.0	25.1	25.8	26.1	26.1	25.8	25.3	24.7	23.8	22.6	21.0
17.5	23.6	24.3	24.9	25.3	25.3	24.8	23.6	25.3	26.0	26.4	26.5	26.4	26.0	25.3	24.3	23.1	21.5
15.0	23.8	24.5	25.1	25.5	25.4	24.6	22.9	25.2	25.9	26.5	26.8	26.7	26.4	25.7	24.6	23.2	21.6
12.5	23.7	24.4	25.1	25.5	25.3	24.1	21.7	24.9	25.5	26.2	26.8	26.9	26.6	25.8	24.6	23.1	21.5
10.0	23.4	24.0	24.8	25.3	25.0			25.7	26.5	26.8	26.6	26.6	25.7	24.3	22.6	21.1	
7.5	22.7	23.4	24.3	24.8	24.4			24.9	26.0	26.5	26.3	26.3	25.3	23.7	21.8	20.4	
5.0	21.9	22.5	23.5	24.2					25.3	26.0	25.9	24.7	22.8	20.7	19.4		
2.5	20.7	21.4	22.6	23.3					24.3	25.3	25.2	23.8	21.6	19.2	18.0		
0.0	19.3	20.1							23.1	24.4	24.3	22.7	20.1	17.5	16.4		
-2.5	17.7	18.5							21.6	23.2	23.1	21.3	18.3	15.4	14.4		

TABLE 3

HAND REACH ENVELOPE

VEHICLE RANGE: (G LESS THAN -1.25)

POPULATION MIX: 90/10 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	14.7	16.1	17.1	18.0	18.5	18.9	19.0	19.4	19.6	19.7	19.4	18.9	18.0	16.8	15.5	14.2	
32.5	17.0	18.2	19.2	19.9	20.3	20.7	21.0	21.1	21.5	21.5	21.2	20.7	19.8	18.8	17.7	16.4	
30.0	19.0	20.1	20.9	21.5	21.9	22.2	22.5	22.5	23.0	23.1	22.8	22.2	21.5	20.6	19.6	18.4	
27.5	20.7	21.7	22.4	22.8	23.2	23.4	23.7	23.7	24.3	24.4	24.1	23.6	22.9	22.1	21.2	20.1	18.6
25.0	22.0	22.9	23.5	24.0	24.2	24.3	24.4	24.6	25.3	25.4	25.2	24.8	24.2	23.4	22.6	21.4	19.9
22.5	23.1	23.9	24.5	24.9	25.0	24.9	24.6	25.3	26.0	26.2	26.1	25.7	25.2	24.5	23.6	22.5	20.9
20.0	23.8	24.6	25.2	25.5	25.6	25.3	24.5	25.7	26.4	26.7	26.7	26.4	26.0	25.3	24.4	23.2	21.6
17.5	24.3	25.0	25.6	25.9	25.9	25.3	24.0	25.8	26.5	27.0	27.1	27.0	26.6	25.9	24.9	23.6	22.0
15.0	24.4	25.1	25.8	26.1	26.0	25.0	23.2	25.7	26.4	26.9	27.3	27.3	26.9	26.2	25.1	23.7	22.1
12.5	24.3	25.0	25.7	26.1	25.8	24.5	22.0	25.3	25.9	26.7	27.2	27.4	27.1	26.3	25.0	23.5	21.9
10.0	23.9	24.6	25.4	25.8	25.4			26.1	26.9	27.3	27.0	26.1	24.6	22.9	21.4		
7.5	23.3	24.0	24.9	25.4	24.8			25.2	26.4	26.9	26.7	25.7	24.0	22.1	20.7		
5.0	22.4	23.1	24.1	24.7					25.6	26.4	26.2	25.0	23.0	20.9	19.6		
2.5	21.2	22.0	23.1	23.8					24.5	25.6	25.5	24.0	21.7	19.3	18.2		
0.0	19.8	20.6							23.3	24.6	24.5	22.9	20.2	17.5	16.5		
-2.5	18.2	19.0							21.8	23.4	23.3	21.4	18.3	15.3	14.4		

TABLE 4

HAND REACH ENVELOPE

VEHICLE RANGE: $(-1.24 < G < -0.75)$

POPULATION MIX: 50/50 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)										
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	
35.0	12.5	14.0	15.2	16.1	16.7	17.1	17.2	17.2	17.3	17.4	17.2	16.6	15.7	14.5	13.0	11.6		
32.5	15.0	16.3	17.3	18.0	18.6	19.0	19.3	19.0	19.3	19.4	19.1	18.6	17.7	16.6	15.4	14.1		
30.0	17.0	18.2	19.1	19.7	20.2	20.6	20.9	20.6	21.1	21.1	20.8	20.3	19.5	18.6	17.5	16.3		
27.5	18.8	19.8	20.6	21.2	21.5	21.8	22.1	21.9	22.5	22.6	22.3	21.8	21.1	20.3	19.3	18.1	16.7	
25.0	20.2	21.1	21.8	22.3	22.6	22.8	22.9	23.0	23.6	23.8	23.5	23.1	22.4	21.7	20.4	19.7	18.1	
22.5	21.3	22.2	22.8	23.3	23.5	23.5	23.3	23.8	24.5	24.7	24.5	24.1	23.6	22.9	22.0	20.9	19.3	
20.0	22.1	22.9	23.5	23.9	24.1	23.9	23.4	24.3	25.1	25.3	25.3	25.0	24.5	23.8	22.9	21.8	20.2	
17.5	22.6	23.4	24.0	24.4	24.5	24.1	23.1	24.6	25.3	25.7	25.8	25.6	25.2	24.5	23.6	22.3	20.7	
15.0	22.9	23.5	24.2	24.6	24.6	24.0	22.5	24.6	25.3	25.8	26.1	26.1	25.7	25.0	23.9	22.6	21.0	
12.5	22.8	23.4	24.2	24.6	24.6	23.6	21.5	24.3	25.0	25.7	26.1	26.3	25.0	25.2	24.0	22.5	21.0	
10.0	22.5	23.1	23.9	24.4	24.3			25.2	25.9	26.3	26.0	25.1	23.8	22.1	20.6			
7.5	21.9	22.5	23.4	24.0	23.8			24.5	25.5	26.0	25.8	24.8	23.2	21.4	20.0			
5.0	21.1	21.6	22.6	23.3					24.9	25.6	25.4	24.3	22.4	20.4	19.0			
2.5	20.0	20.5	21.6	22.5					23.9	24.9	24.4	23.5	21.3	19.1	17.8			
0.0	18.6	19.1							22.8	24.1	24.0	22.5	20.0	17.4	16.3			
-2.5	17.0	17.6							21.4	23.0	22.9	21.2	18.3	15.4	14.4			

TABLE 5

HAND REACH ENVELOPE

VEHICLE RANGE: $(-1.24 < G < -0.75)$

POPULATION MIX: 75/25 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)										
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	
35.0	14.0	15.5	16.6	17.5	18.0	18.4	18.5	18.7	18.9	19.0	18.7	18.2	17.3	16.1	14.8	13.4		
32.5	16.4	17.7	18.6	19.3	19.9	20.2	20.5	20.5	20.8	20.9	20.6	20.0	19.2	18.2	17.0	15.8		
30.0	18.4	19.5	20.4	21.0	21.4	21.8	22.1	22.0	22.5	22.5	22.2	21.7	20.9	20.0	19.0	17.8		
27.5	20.1	21.1	21.8	22.3	22.7	23.0	23.2	23.2	23.8	23.9	23.6	23.1	22.4	21.6	20.7	19.5	18.1	
25.0	21.5	22.4	23.0	23.5	23.8	23.9	24.0	24.2	24.8	25.0	24.8	24.3	23.7	23.0	22.1	21.0	19.4	
22.5	22.5	23.3	24.0	24.4	24.6	24.6	24.3	24.9	25.6	25.8	25.7	25.3	24.8	24.1	23.2	22.1	20.5	
20.0	23.3	24.0	24.6	25.0	25.1	24.9	24.3	25.3	26.1	26.4	26.3	26.1	25.6	24.9	24.0	22.8	21.2	
17.5	23.8	24.5	25.1	25.5	25.5	25.0	23.9	25.5	26.2	26.7	26.8	26.6	26.2	25.5	24.6	23.3	21.7	
15.0	23.9	24.6	25.2	25.7	25.6	24.8	23.2	25.4	26.1	26.7	27.0	27.0	26.6	25.9	24.8	23.4	21.9	
12.5	23.8	24.5	25.2	25.6	25.5	24.4	22.1	25.0	25.7	26.4	27.0	27.1	26.8	26.0	24.8	23.3	21.7	
10.0	23.5	24.1	24.9	25.4	25.1			25.9	26.7	27.1	26.8	25.9	24.5	22.8	21.3			
7.5	22.8	23.5	24.3	24.9	24.6			25.1	26.2	26.8	26.5	25.5	23.8	22.0	20.5			
5.0	21.9	22.6	23.6	24.2					25.4	26.3	26.1	24.9	22.9	20.8	19.5			
2.5	20.8	21.4	22.6	23.4					24.5	25.5	25.4	24.0	21.7	19.4	18.2			
0.0	19.4	20.1							23.2	24.6	24.5	22.9	20.2	17.6	16.5			
-2.5	17.7	18.5							21.4	23.4	23.4	21.5	18.4	15.5	14.6			

TABLE 6

HAND REACH ENVELOPE

VEHICLE RANGE: $(-1.24 < G < -0.75)$

POPULATION MIX: 90/10 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	14.9	16.3	17.4	18.3	18.8	19.2	19.3	19.6	19.9	19.9	19.7	19.1	18.2	17.1	15.8	14.4	
32.5	17.2	18.5	19.4	20.1	20.6	21.0	21.3	21.3	21.7	21.8	21.5	20.9	20.1	19.1	18.0	16.7	
30.0	19.2	20.3	21.1	21.7	22.1	22.5	22.8	22.8	23.3	23.3	23.0	22.5	21.8	20.9	19.9	18.7	
27.5	20.9	21.8	22.6	23.1	23.4	23.7	23.9	23.9	24.6	24.6	24.4	23.9	23.2	22.4	21.5	20.4	18.9
25.0	22.2	23.1	23.7	24.2	24.4	24.6	24.6	24.9	25.5	25.7	25.5	25.0	24.4	23.7	22.8	21.7	20.2
22.5	23.2	24.0	24.7	25.0	25.2	25.2	24.9	25.5	26.2	26.5	26.3	26.0	25.5	24.8	23.9	22.7	21.2
20.0	24.0	24.7	25.3	25.7	25.8	25.5	24.8	25.9	26.6	27.0	27.0	26.7	26.3	25.6	24.7	23.5	21.9
17.5	24.4	25.1	25.7	26.1	26.1	25.5	24.4	26.0	26.7	27.2	27.4	27.2	26.8	26.1	25.1	23.9	22.3
15.0	24.6	25.2	25.9	26.3	26.1	25.3	23.6	25.9	26.6	27.2	27.5	27.6	27.2	26.5	25.3	23.9	22.4
12.5	24.4	25.1	25.8	26.2	26.0	24.8	22.4	25.5	26.1	26.8	27.4	27.6	27.3	26.5	25.2	23.7	22.2
10.0	24.1	24.7	25.5	26.0	25.6					26.3	27.1	27.5	27.3	26.3	24.9	23.1	21.7
7.5	23.4	24.0	24.9	25.5	25.0				25.4	26.6	27.2	27.0	25.9	24.2	22.3	20.9	
5.0	22.5	23.1	24.2	24.8						25.8	26.6	26.5	25.2	23.2	21.1	19.8	
2.5	21.3	22.0	23.2	23.9							24.7	25.9	25.7	24.3	21.9	19.5	18.4
0.0	19.9	20.6									23.5	24.9	24.8	23.1	20.4	17.7	16.7
-2.5	18.2	19.0									22.0	23.7	23.6	21.7	18.5	15.5	14.7

TABLE 7

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.74 < G < -0.25)$

POPULATION MIX: 50/50 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	12.7	14.2	15.4	16.3	16.9	17.3	17.4	17.5	17.6	17.7	17.5	16.9	16.0	14.8	13.4	12.0	
32.5	15.1	16.4	17.4	18.2	18.8	19.2	19.4	19.3	19.7	19.7	19.4	18.9	18.0	17.0	15.8	14.5	
30.0	17.2	18.3	19.2	19.9	20.4	20.7	21.0	20.9	21.4	21.4	21.1	20.6	19.4	18.9	17.8	16.6	
27.5	18.9	20.0	20.7	21.3	21.7	22.0	22.2	22.2	22.8	22.9	22.6	22.1	21.4	20.6	19.6	18.5	17.0
25.0	20.3	21.3	22.0	22.5	22.8	23.0	23.0	23.2	23.9	24.0	23.8	23.4	22.7	22.0	21.1	20.0	18.4
22.5	21.4	22.3	22.9	23.4	23.6	23.6	23.5	24.0	24.7	24.9	24.8	24.4	23.9	23.2	22.3	21.2	19.6
20.0	22.2	23.0	23.6	24.1	24.2	24.1	23.6	24.5	25.2	25.6	25.5	25.3	24.8	24.1	23.2	22.0	20.4
17.5	22.7	23.4	24.1	24.5	24.6	24.2	23.3	24.7	25.5	25.9	26.0	25.9	25.5	24.8	23.8	22.6	21.0
15.0	23.0	23.6	24.3	24.7	24.7				26.0	26.3	26.3	25.9	25.2	24.1	22.8	21.2	
12.5	22.9	23.5	24.2	24.7	24.7				25.8	26.3	26.5	26.2	25.4	24.2	22.7	21.1	
10.0	22.6	23.1	23.9	24.5	24.4				25.3	26.1	26.5	26.2	25.3	23.9	22.2	20.7	
7.5	22.0	22.5	23.4	24.0	23.9				24.6	25.6	26.2	26.0	25.0	23.4	21.5	20.1	
5.0	21.1	21.6	22.6	23.4						25.0	25.8	25.6	24.4	22.5	20.5	19.1	
2.5	20.0	20.5	21.6	22.5						24.0	25.1	25.0	23.6	21.4	19.1	17.9	
0.0	18.6	19.1	20.4	21.4							22.9	24.2	24.1	22.6	20.0	17.4	
-2.5	17.0	17.5	19.0	20.1							21.5	23.1	23.1	21.3	18.3	15.4	

TABLE 8

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.74 < G < -0.25)$

POPULATION MIX: 75/25 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED Laterally FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.																	
ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
<u>35.0</u>	14.3	15.7	16.8	17.7	18.3	18.7	18.8	19.0	19.2	19.3	19.0	18.4	17.6	16.4	15.0	13.7	
<u>32.5</u>	16.6	17.9	18.8	19.6	20.1	20.5	20.7	20.7	21.1	21.2	20.9	20.3	19.5	18.5	17.3	16.1	
<u>30.0</u>	18.6	19.7	20.6	21.2	21.6	22.0	22.3	22.2	22.7	22.8	22.5	22.0	21.2	20.3	19.3	18.1	
<u>27.5</u>	20.2	21.3	22.0	22.5	22.9	23.2	23.4	23.4	24.1	24.2	23.9	23.4	22.7	21.9	21.0	19.8	18.3
<u>25.0</u>	21.6	22.5	23.2	23.7	23.9	24.1	24.2	24.4	25.1	25.2	25.0	24.6	24.0	23.3	22.4	21.2	19.7
<u>22.5</u>	22.6	23.5	24.1	24.5	24.7	24.7	24.5	25.1	25.8	26.1	25.9	25.6	25.1	24.4	23.5	22.3	20.7
<u>20.0</u>	23.4	24.2	24.8	25.2	25.3	25.1	24.5	25.5	26.3	26.6	26.6	26.4	25.9	25.2	24.3	23.1	21.5
<u>17.5</u>	23.9	24.6	25.2	25.6	25.6	25.2	24.2	25.7	26.4	26.9	27.0	26.9	26.5	25.8	24.8	23.5	21.9
<u>15.0</u>	24.0	24.7	25.4	25.8	25.7					26.9	27.2	27.3	26.9	26.2	25.1	23.7	22.1
<u>12.5</u>	23.9	24.6	25.3	25.7	25.6					26.6	27.2	27.4	27.1	26.3	25.0	23.5	21.9
<u>10.0</u>	23.6	24.2	25.0	25.5	25.3					26.0	26.9	27.3	27.0	26.1	24.6	22.9	21.5
<u>7.5</u>	22.9	23.5	24.4	25.0	24.7					25.2	26.4	27.0	26.8	25.7	24.0	22.1	20.7
<u>5.0</u>	22.0	22.6	23.6	24.3						25.6	26.5	26.3	25.1	23.1	21.0	19.7	
<u>2.5</u>	20.9	21.5	22.6	23.4						24.6	25.7	25.6	24.2	21.9	19.5	18.3	
<u>0.0</u>	19.4	20.1	21.4	22.3						23.4	24.8	24.7	23.1	20.4	17.7		
<u>-2.5</u>	17.8	18.4	19.9	21.0						21.9	23.6	23.6	21.7	18.6	15.6		

TABLE 9

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.74 < G < -0.25)$

POPULATION MIX: 90/10 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED Laterally FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)		STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)										
		15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0		
35.0	15.8	16.6	17.7	18.5	19.1	19.5	19.6	19.9	20.1	20.2	19.9	19.4	18.5	17.3	16.0	14.7			
32.5	17.5	18.7	19.7	20.4	20.9	21.2	21.5	21.6	22.0	22.0	21.7	21.2	20.4	19.4	18.2	17.0			
30.0	19.4	20.5	21.3	21.9	22.4	22.7	23.0	23.0	23.6	23.6	23.3	22.8	22.0	21.2	20.2	19.0	17.6		
27.5	21.0	22.0	22.8	23.3	23.6	23.9	24.1	24.2	24.8	24.9	24.6	24.1	23.5	22.7	21.8	20.6	19.1		
25.0	22.4	23.3	23.9	24.4	24.7	24.8	24.8	25.1	25.8	25.9	25.7	25.3	24.7	24.0	23.1	22.0	20.4		
22.5	23.4	24.2	24.8	25.2	25.4	25.4	25.2	25.7	26.5	26.7	26.6	26.3	25.7	25.1	24.2	23.0	21.4		
20.0	24.1	24.9	25.5	25.9	26.0	25.7	25.1	26.1	26.9	27.2	27.2	27.0	26.5	25.9	24.9	23.7	22.1		
17.5	24.5	25.2	25.9	26.2	26.3	25.8	24.7	26.2	26.9	27.4	27.6	27.5	27.1	26.4	25.4	24.1	22.5		
15.0	24.7	25.4	26.0	26.4	26.3					27.4	27.8	27.8	27.5	26.7	25.6	24.2	22.6		
12.5	24.6	25.2	25.9	26.4	26.2					27.0	27.7	27.9	27.6	26.8	25.5	23.9	22.4		
10.0	24.2	24.8	25.6	26.1	25.8					26.5	27.4	27.8	27.5	26.6	25.1	23.3	21.9		
7.5	23.5	24.1	25.0	25.6	25.2					25.6	26.8	27.4	27.2	26.1	24.4	22.4	21.1		
5.0	22.6	23.2	24.2	24.9						26.0	26.9	26.7	25.5	23.4	21.2	20.0			
2.5	21.4	22.0	23.2	23.9						25.0	26.1	26.0	24.5	22.1	19.7	18.6			
0.0	19.9	20.6	21.9	22.4						23.7	25.1	25.0	23.3	20.6	17.9				
-2.5	18.2	18.9	20.5	21.5						22.2	23.9	23.8	21.7	18.7	15.7				

TABLE 10

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.24 < G < +0.24)$

POPULATION MIX: 50/50 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)		STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)										
		15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	
35.0		12.9	14.4	15.6	16.5	17.1	17.5	17.7	17.7	18.0	18.0	17.8	17.2	16.3	15.1	13.7	12.3		
32.5		15.2	16.6	17.6	18.4	18.9	19.3	19.6	19.6	20.0	20.0	19.7	19.1	18.3	17.3	16.1	14.8		
30.0		17.3	18.5	19.4	20.0	20.5	20.9	21.2	21.1	21.7	21.7	21.4	20.9	20.1	19.2	18.2	17.0		
27.5		19.0	20.1	20.9	21.4	21.8	22.1	22.4	22.4	23.1	23.2	22.9	22.4	21.7	20.9	20.0	18.8	17.3	
25.0		20.4	21.4	22.1	22.6	22.9	23.1	23.2	23.4	24.1	24.3	24.1	23.6	23.0	22.3	21.4	20.3	18.7	
22.5		21.5	22.4	23.0	23.5	23.7	23.8	23.6	24.2	24.9	25.2	25.1	24.7	24.2	23.5	22.6	21.4	19.4	
20.0		22.3	23.1	23.7	24.2	24.3	24.2	23.7	24.7	25.4	25.8	25.8	25.5	25.1	24.4	23.5	22.3	20.7	
17.5		22.8	23.5	24.2	24.6	24.7	24.4	23.5	24.9	25.6	26.1	26.2	26.1	25.7	25.0	24.0	22.8	21.2	
15.0		23.0	23.7	24.4	24.8	24.9				26.1	26.5	26.5	26.2	25.4	24.3	22.9	21.4		
12.5		23.0	23.6	24.3	24.8	24.8				25.9	26.5	26.7	26.4	25.6	24.3	22.8	21.3		
10.0		22.7	23.2	24.0	24.6	24.5				25.4	26.2	26.7	26.4	25.5	24.0	22.4	20.9		
7.5		22.1	22.6	23.4	24.1	24.0				24.6	25.8	26.4	26.2	25.2	23.5	21.6	20.2		
5.0		21.2	21.7	22.7	23.4						25.1	25.9	25.8	24.6	22.6	20.5	19.2		
2.5		20.1	20.5	21.6	22.5						24.1	25.2	25.1	23.8	21.5	19.1	17.9		
0.0		18.7	19.1	20.4	21.4						23.0	24.3	24.3	22.7	20.1	17.4			
-2.5		17.1	17.5	18.9	20.1						21.6	23.2	23.2	21.4	18.4	15.5			

TABLE 11

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.24 < G < +0.24)$

POPULATION MIX: 75/25 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.																
	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
<u>35.0</u>	14.5	15.9	17.1	17.9	18.6	18.9	19.1	19.2	19.5	19.5	19.3	18.7	17.8	16.7	15.3	14.0	
<u>32.5</u>	16.8	18.1	19.0	19.8	20.3	20.7	21.0	21.0	21.4	21.4	21.2	20.6	19.8	18.8	17.6	16.4	
<u>30.0</u>	18.7	19.9	20.7	21.4	21.8	22.2	22.5	22.5	23.0	23.1	22.8	22.2	21.5	20.6	19.6	18.4	
<u>27.5</u>	20.4	21.4	22.2	22.7	23.1	23.4	23.6	23.7	24.3	24.4	24.2	23.7	23.0	22.2	21.3	20.1	18.6
<u>25.0</u>	21.7	22.7	23.4	23.8	24.1	24.3	24.4	24.6	25.3	25.5	25.3	24.9	24.3	23.6	22.7	21.5	20.0
<u>22.5</u>	22.8	23.6	24.3	24.7	24.9	24.9	24.8	25.3	26.0	26.3	26.2	25.9	25.3	24.7	23.8	22.6	21.0
<u>20.0</u>	23.5	24.3	24.9	25.3	25.5	25.3	24.8	25.7	26.5	26.8	26.8	26.6	26.2	25.5	24.6	23.3	21.7
<u>17.5</u>	24.0	24.7	25.3	25.7	25.8	25.4	24.4	25.9	26.6	27.1	27.3	27.2	26.8	26.1	25.1	23.8	22.2
<u>15.0</u>	24.2	24.8	25.5	25.9	25.9				27.0	27.4	27.5	27.2	26.4	25.3	23.9	22.3	
<u>12.5</u>	24.1	24.7	25.4	25.9	25.8				26.7	27.4	27.6	27.3	26.5	25.2	23.6	22.1	
<u>10.0</u>	23.7	24.3	25.0	25.6	25.4				26.2	27.1	27.5	27.3	26.3	24.8	23.1	21.6	
<u>7.5</u>	23.0	23.6	24.5	25.1	24.9				25.3	26.5	27.2	27.0	25.9	24.2	22.3	20.9	
<u>5.0</u>	22.1	22.7	23.7	24.4						25.8	26.7	26.5	25.3	23.2	21.1	19.8	
<u>2.5</u>	20.9	21.5	22.6	23.5						24.8	25.9	25.8	24.4	22.0	19.6	18.5	
<u>0.0</u>	19.5	20.0	21.4	22.3						23.6	25.0	24.9	23.2	20.5	17.8		
-2.5	17.8	18.4	19.9	21.0						22.1	23.8	23.8	21.9	18.7	15.8		

TABLE 12

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.24 < G < +0.24)$

POPULATION MIX: 90/10 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	15.4	16.8	18.0	18.8	19.4	19.8	19.9	20.1	20.4	20.4	20.2	19.6	18.7	17.6	16.3	14.9	
32.5	17.7	18.9	19.9	20.6	21.1	21.5	21.8	21.8	22.3	22.3	22.0	21.4	20.6	19.7	18.5	17.3	
30.0	19.6	20.7	21.6	22.2	22.6	23.0	23.3	23.3	23.8	23.9	23.6	23.0	22.3	21.5	20.5	19.3	
27.5	21.2	22.2	23.0	23.5	23.9	24.1	24.4	24.4	25.1	25.2	24.9	24.4	23.8	23.0	22.1	20.9	19.4
25.0	22.5	23.4	24.1	24.6	24.9	25.0	25.1	25.3	26.0	26.2	26.0	25.6	25.0	24.3	23.4	22.3	20.7
22.5	23.5	24.4	25.0	25.4	25.6	25.6	25.4	26.0	26.7	27.0	26.9	26.5	26.0	25.4	24.5	23.3	21.7
20.0	24.2	25.0	25.6	26.0	26.2	26.0	25.4	26.3	27.1	27.4	27.5	27.3	26.8	26.1	25.2	24.0	22.4
17.5	24.7	25.4	26.0	26.4	26.4	26.0	25.0	26.4	27.2	27.6	27.9	27.8	27.4	26.7	25.7	24.3	22.8
15.0	24.8	25.5	26.1	26.6	26.5					27.6	28.0	28.1	27.8	27.0	25.8	24.4	22.8
12.5	24.7	25.3	26.0	26.5	26.4					27.8	27.9	28.2	27.9	27.0	25.7	24.1	22.6
10.0	24.3	24.9	25.7	26.2	26.0					26.6	27.6	28.0	27.3	26.8	25.3	23.5	22.1
7.5	23.6	24.2	25.1	25.7	25.4					25.8	27.0	27.7	27.5	26.4	24.6	22.6	21.3
5.0	22.6	23.2	24.3	25.0						26.2	27.1	27.0	25.7	23.6	21.4	20.2	
2.5	21.4	22.0	23.2	24.0						25.2	26.3	26.2	24.4	22.3	19.9	18.8	
0.0	20.0	20.6	21.9	22.9						23.9	25.4	25.3	23.6	20.8	14.1		
-2.5	18.2	18.9	20.4	21.5						22.4	24.2	24.1	22.1	19.0	15.9		

TABLE 13

HAND REACH ENVELOPE

VEHICLE RANGE: $(+0.25 < G < +0.74)$

POPULATION MIX: 50/50 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	13.1	14.5	15.7	16.7	17.3	17.7	17.9	18.0	18.3	18.3	18.1	17.5	16.6	15.4	14.0	12.6	
32.5	15.4	16.7	17.8	18.6	19.1	19.5	19.8	19.8	20.3	20.3	20.0	19.5	18.6	17.6	16.4	15.2	
30.0	17.4	18.6	19.5	20.2	20.7	21.0	21.3	21.4	22.0	22.0	21.7	21.2	20.4	19.6	18.5	17.3	
27.5	19.1	20.2	21.0	21.6	22.0	22.3	22.5	22.7	23.3	23.4	23.2	22.7	22.0	21.2	20.3	19.1	17.6
25.0	20.5	21.5	22.2	22.7	23.0	23.2	23.3	23.7	24.4	24.6	24.4	23.9	23.4	22.6	21.7	20.6	19.0
22.5	21.6	22.5	23.1	23.6	23.9	23.9	23.8	24.4	25.1	25.4	25.3	25.0	24.5	23.8	22.9	21.7	20.1
20.0	22.4	23.2	23.8	24.3	24.5	24.4	23.9	24.8	25.6	26.0	26.0	25.8	25.3	24.7	23.7	22.5	20.9
17.5	22.9	23.6	24.3	24.7	24.8	24.5	23.7	25.0	25.8	26.2	26.5	26.4	26.0	25.3	24.3	23.0	21.4
15.0	23.1	23.8	24.4	24.9	25.0					26.3	26.7	26.8	26.4	25.7	24.5	23.1	21.5
12.5	23.1	23.7	24.4	24.9	24.9					26.0	26.7	26.9	26.6	25.8	24.5	22.9	21.4
10.0	22.7	23.3	24.0	24.6	24.6					25.5	26.4	26.8	26.6	25.7	24.2	22.5	21.0
7.5	22.1	22.6	23.5	24.2	24.1					24.7	25.9	26.6	26.4	25.3	23.6	21.7	20.3
5.0	21.3	21.7	22.7	23.5						25.2	26.1	26.0	24.7	22.7	20.6	19.3	
2.5	20.1	20.5	21.6	22.6						24.2	25.4	25.3	23.9	21.5	19.2	18.0	
0.0	18.7	19.1	20.4	21.4						23.0	24.5	24.4	22.8	20.1	17.5		
-2.5	17.1	17.5	18.9	20.1						21.6	23.4	23.4	21.5	18.4	15.5		

TABLE 14

HAND REACH ENVELOPE

VEHICLE RANGE: (+0.25 < G < +0.74)

POPULATION MIX: 75/25 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	14.7	16.1	17.3	18.2	18.8	19.2	19.3	19.5	19.8	19.8	19.6	19.0	18.1	16.9	15.6	14.3	
32.5	17.0	18.3	19.3	20.0	20.5	20.9	21.2	21.2	21.7	21.7	21.4	20.9	20.1	19.1	17.9	16.7	
30.0	18.9	20.1	20.9	21.6	22.0	22.4	22.7	22.7	23.3	23.4	23.1	22.5	21.8	20.9	19.9	18.7	
27.5	20.5	21.6	22.4	22.9	23.3	23.6	23.8	23.9	24.6	24.7	24.4	23.9	23.3	22.5	21.6	20.4	18.9
25.0	21.9	22.8	23.5	24.0	24.3	24.5	24.6	24.8	25.6	25.8	25.6	25.2	24.6	23.9	23.0	21.8	20.2
22.5	22.9	23.8	24.4	24.8	25.1	25.1	25.0	25.5	26.3	26.5	26.5	26.1	25.6	24.9	24.1	22.9	21.3
20.0	23.6	24.4	25.0	25.5	25.6	25.5	25.0	25.9	26.7	27.0	27.1	26.9	26.5	25.8	24.8	23.6	22.0
17.5	24.1	24.8	25.4	25.9	26.0	25.6	24.7	26.0	26.8	27.3	27.5	27.4	27.1	26.3	25.3	24.0	22.4
15.0	24.3	24.9	25.6	26.0	26.1					27.2	27.7	27.8	27.4	26.7	25.5	24.1	22.5
12.5	24.2	24.8	25.5	26.0	25.9					26.9	27.6	27.9	27.6	26.7	25.4	23.8	22.3
10.0	23.8	24.3	25.1	25.7	25.6					26.3	27.3	27.8	27.5	26.6	25.0	23.3	21.8
7.5	23.1	23.7	24.5	25.2	25.0					25.5	26.7	27.4	27.2	26.1	24.4	22.4	21.0
5.0	22.2	22.7	23.7	24.5							26.0	26.9	26.8	25.5	23.4	21.2	20.0
2.5	21.0	21.5	22.6	23.5							24.9	26.1	26.0	24.6	22.2	19.8	18.6
0.0	19.5	20.0	21.3	22.4							23.7	25.2	25.1	23.4	20.7	18.0	
-2.5	17.8	18.3	19.8	21.0							22.3	24.0	24.0	22.1	18.9	15.9	

Table 15

HAND REACH ENVELOPE

VEHICLE RANGE: (+0.25 < G < +0.74)

POPULATION MIX: 90/10 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	15.7	17.1	18.2	19.1	19.7	20.1	20.2	20.4	20.7	20.7	20.4	19.8	19.0	17.9	16.6	15.2	
32.5	17.9	19.3	20.1	20.9	21.4	21.8	22.0	22.1	22.5	22.6	22.3	21.7	20.9	19.9	18.8	17.5	
30.0	19.8	20.9	21.8	22.4	22.9	23.2	23.5	23.5	24.1	24.1	23.8	23.3	22.6	21.7	20.7	19.6	
27.5	21.4	22.4	23.2	23.7	24.1	24.4	24.6	24.7	25.3	25.4	25.2	24.7	24.1	23.3	22.4	21.2	19.7
25.0	22.7	23.6	24.3	24.8	25.1	25.2	25.3	25.6	26.3	26.5	26.3	25.9	25.3	24.6	23.7	22.6	21.0
22.5	23.7	24.5	25.2	25.6	25.8	25.8	25.7	26.2	26.9	27.2	27.1	26.8	26.3	25.6	24.7	23.6	22.0
20.0	24.4	25.2	25.8	26.2	26.3	26.2	25.7	26.5	27.3	27.7	27.7	27.6	27.1	26.4	25.5	24.2	22.6
17.5	24.8	25.5	26.1	26.6	26.6	26.3	25.3	26.6	27.4	27.9	28.1	28.1	27.7	27.0	25.9	24.6	23.0
15.0	25.0	25.6	26.3	26.7	26.7					27.8	28.2	28.4	28.0	27.3	26.1	24.6	23.1
12.5	24.8	25.4	26.1	26.6	26.5					27.4	28.1	28.4	28.2	27.3	25.9	24.3	22.8
10.0	24.4	25.0	25.8	26.3	26.2					26.8	27.8	28.3	28.1	27.1	25.5	23.7	22.3
7.5	23.7	24.3	25.2	25.8	25.6					25.9	27.2	27.9	27.8	26.6	24.8	22.8	21.5
5.0	22.7	23.3	24.3	25.0							26.4	27.4	27.2	25.9	23.8	21.6	20.4
2.5	21.5	22.1	23.2	24.1							25.4	26.6	26.5	25.0	22.6	20.1	19.0
0.0	20.0	20.6	21.9	22.9							24.1	25.6	25.5	23.3	21.0	18.3	
-2.5	18.3	18.8	20.3	21.5							22.6	24.4	24.4	22.4	19.2	16.1	

TABLE 16

HAND REACH ENVELOPE

VEHICLE RANGE: (+0.75 < G < +1.24)

POPULATION MIX: 50/50 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED Laterally FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)		STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)										
		15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	
<u>35.0</u>		13.2	14.7	15.9	16.9	17.5	17.9	18.1	18.3	18.6	18.6	18.4	17.8	16.9	15.7	14.4	13.0		
<u>32.5</u>		15.5	16.9	17.9	18.7	19.3	19.7	20.0	20.1	20.6	20.6	20.3	19.8	18.9	18.0	16.8	15.5		
<u>30.0</u>		17.5	18.7	19.7	20.3	20.8	21.2	21.5	21.7	22.2	22.3	22.0	21.5	20.8	19.9	18.9	17.6		
<u>27.5</u>		19.2	20.3	21.1	21.7	22.1	22.4	22.7	22.9	23.6	23.7	23.5	23.0	22.3	21.5	20.6	19.4	17.9	
<u>25.0</u>		20.6	21.6	22.3	22.8	23.2	23.4	23.5	23.9	24.6	24.8	24.6	24.2	23.7	22.9	22.0	20.9	19.3	
<u>22.5</u>		21.7	22.6	23.3	23.7	24.0	24.1	24.0	24.6	25.3	25.6	25.6	25.3	24.8	24.1	23.2	22.0	20.4	
<u>20.0</u>		22.5	23.3	23.9	24.4	24.6	24.5	24.1	25.0	25.8	26.2	26.2	26.1	25.6	24.9	24.0	22.7	21.1	
<u>17.5</u>		23.0	23.7	24.3	24.8	24.9	24.7	23.9	25.2	25.9	26.4	26.7	26.6	26.3	25.5	24.5	23.2	21.6	
<u>15.0</u>		23.2	23.8	24.5	25.0	25.1				26.4	26.9	27.0	26.7	25.9	24.7	23.3	21.7		
<u>12.5</u>		23.1	23.7	24.4	25.0	25.0				26.1	26.8	27.1	26.9	26.0	24.7	23.1	21.6		
<u>10.0</u>		22.8	23.3	24.1	24.7				25.6	26.5	27.0	26.8	26.8	25.9	24.3	22.6	21.1		
<u>7.5</u>		22.2	22.7	23.5	24.2					24.7	26.0	26.7	26.6	25.5	23.7	21.7	20.4		
<u>5.0</u>		21.3	21.7	22.7	23.5					25.3	26.2	26.1	24.9	22.8	20.6	19.4			
<u>2.5</u>		20.2	20.6	21.7	22.6					24.3	25.5	25.5	24.0	21.6	19.2	18.1			
<u>0.0</u>		18.8	19.1	20.4	21.5					23.1	24.6	24.6	22.9	20.2	17.5	16.5			
<u>-2.5</u>		17.1	17.4	18.8	20.1						21.7	23.5	23.5	21.6	18.5	15.5	14.6		

TABLE 17

HAND REACH ENVELOPE

VEHICLE RANGE: (+0.75 < G < +1.24)

POPULATION MIX: 75/25 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED Laterally FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.																	
ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	14.9	16.4	17.5	18.4	19.1	19.5	19.6	19.7	20.0	20.1	19.8	19.2	18.4	17.2	15.9	14.5	
32.5	17.1	18.4	19.5	20.2	20.8	21.2	21.4	21.5	22.0	22.0	21.7	21.1	20.3	19.4	18.2	17.0	
30.0	19.1	20.2	21.1	21.8	22.2	22.6	22.9	23.0	23.6	23.6	23.3	22.8	22.1	21.2	20.2	19.0	
27.5	20.7	21.7	22.5	23.1	23.5	23.8	24.0	24.2	24.8	25.0	24.7	24.2	23.6	22.8	21.9	20.7	19.2
25.0	22.0	23.0	23.7	24.2	24.5	24.7	24.8	25.1	25.8	26.0	25.8	25.4	24.9	24.2	23.3	22.1	20.5
22.5	23.0	23.9	24.6	25.0	25.3	25.3	25.2	25.7	26.5	26.8	26.7	26.4	25.9	25.2	24.3	23.1	21.5
20.0	23.8	24.5	25.2	25.6	25.8	25.7	25.2	26.1	26.9	27.3	27.3	27.2	26.7	26.0	25.1	23.8	22.2
17.5	24.2	24.9	25.6	26.0	26.1	25.8	24.9	26.2	26.9	27.5	27.7	27.7	27.3	26.6	25.6	24.2	22.6
15.0	24.4	25.0	25.7	26.2	26.2			27.4	27.9	28.0	27.7	27.7	26.9	25.7	24.3	22.7	
12.5	24.3	24.9	25.6	26.1	26.1			27.1	27.8	28.1	27.8	27.8	27.0	25.6	24.0	22.5	
10.0	23.9	24.4	25.2	25.8				26.5	27.5	28.0	27.8	27.8	26.8	25.2	23.4	22.0	
7.5	23.2	23.7	24.6	25.3				25.6	26.9	27.6	27.5	26.4	24.5	22.6	21.2		
5.0	22.3	22.8	23.7	24.5				26.1	27.1	27.0	25.7	23.6	21.4	20.1			
2.5	21.1	21.5	22.6	23.6				25.1	26.4	26.3	24.8	22.3	19.9	18.8			
0.0	19.6	20.0	21.3	22.4				23.9	25.4	25.3	23.6	20.8	18.1	17.1			
-2.5	17.9	18.3	19.8	21.0				22.4	24.2	24.2	22.3	19.1	16.0	15.2			

TABLE 18

HAND REACH ENVELOPE

VEHICLE RANGE: (+0.75 < G < +1.24)

POPULATION MIX: 90/10 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.								COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.									
ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
<u>35.0</u>	15.9	17.4	18.5	19.4	20.0	20.4	20.5	20.6	20.9	21.0	20.7	20.1	19.2	18.1	16.8	15.5	
<u>32.5</u>	18.1	19.4	20.4	21.1	21.7	22.0	22.3	22.3	22.8	22.8	22.5	22.0	21.2	20.2	19.1	17.8	
<u>30.0</u>	20.0	21.1	22.0	22.6	23.1	23.4	23.8	23.7	24.3	24.4	24.1	23.6	22.9	22.0	21.0	19.4	
<u>27.5</u>	21.5	22.6	23.4	23.9	24.3	24.6	24.8	24.9	25.6	25.7	25.5	25.0	24.3	23.6	22.7	21.5	20.0
<u>25.0</u>	22.8	23.8	24.5	25.0	25.3	25.5	25.6	25.8	26.5	26.7	26.6	26.2	25.6	24.9	24.0	22.8	21.2
<u>22.5</u>	23.8	24.7	25.3	25.8	26.0	26.1	25.9	26.4	27.2	27.5	27.4	27.1	26.6	25.9	25.0	23.8	22.2
<u>20.0</u>	24.5	25.3	25.9	26.4	26.5	26.4	25.9	26.8	27.5	27.9	28.0	27.8	27.4	26.7	25.8	24.5	22.9
<u>17.5</u>	24.9	25.7	26.3	26.7	26.8	26.5	25.6	26.8	27.5	28.1	28.4	28.3	28.0	27.2	26.2	24.8	23.2
<u>15.0</u>	25.1	25.7	26.4	26.8	26.9			28.0	28.5	28.6	28.3	27.5	26.3	24.9	23.3		
<u>12.5</u>	24.9	25.5	26.2	26.7	26.7			27.6	28.4	28.7	28.4	27.5	26.2	24.6	23.1		
<u>10.0</u>	24.5	25.1	25.9	26.4				27.0	28.0	28.5	28.3	27.3	25.7	24.0	22.5		
<u>7.5</u>	23.8	24.3	25.2	25.9				26.1	27.4	28.2	28.0	26.9	25.0	23.0	21.7		
<u>5.0</u>	22.8	23.4	24.4	25.1					26.6	27.6	27.5	26.2	24.0	21.8	20.6		
<u>2.5</u>	21.6	22.1	23.2	24.1					25.6	26.8	26.7	25.2	22.8	20.3	19.2		
<u>0.0</u>	20.1	20.6	21.9	22.9					24.3	25.9	25.8	24.1	21.2	18.5	17.5		
<u>-2.5</u>	18.3	18.8	20.3	21.5					22.8	24.7	24.6	22.6	19.4	16.4	15.5		

TABLE 19

HAND REACH ENVELOPE

VEHICLE RANGE: (G GREATER THAN 1.25) POPULATION MIX: 50/50 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C/L/O (inch)										
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	
35.0	13.4	14.9	16.1	17.0	17.7	18.1	18.3	18.6	18.9	19.0	18.7	18.1	17.2	16.1	14.7	13.3		
32.5	15.7	17.0	18.1	18.9	19.5	19.9	20.1	20.4	20.9	20.9	20.6	20.1	19.3	18.3	17.1	15.9		
30.0	17.6	18.9	19.8	20.5	21.0	21.4	21.7	21.9	22.5	22.6	22.3	21.8	21.1	20.2	19.2	18.0		
27.5	19.3	20.4	21.3	21.8	22.3	22.6	22.8	23.1	23.9	24.0	23.8	23.3	22.6	21.9	20.9	19.8	18.2	
25.0	20.7	21.7	22.4	23.0	23.3	23.5	23.6	24.1	24.9	25.1	24.9	24.5	24.0	23.2	22.4	21.2	19.6	
22.5	21.8	22.7	23.4	23.8	24.1	24.2	24.1	24.8	25.5	25.9	25.8	25.5	25.0	24.4	23.4	22.2	20.6	
20.0	22.6	23.4	24.0	24.5	24.7	24.6	24.2	25.2	25.9	26.4	26.5	26.3	25.9	25.2	24.2	23.0	21.4	
17.5	23.1	23.8	24.4	24.9	25.1	24.8	24.0	25.3	26.0	26.6	26.9	26.9	26.5	25.8	24.7	23.4	21.8	
15.0	23.3	23.9	24.6	25.1	25.2			26.5	27.1	27.2	26.9	26.1	24.9	23.4	21.9			
12.5	23.2	23.8	24.5	25.0	25.1			26.2	27.0	27.3	27.1	26.2	24.8	23.2	21.7			
10.0	22.9	23.4	24.2	24.8				25.6	26.7	27.2	27.0	26.0	24.5	22.7	21.2			
7.5	22.3	22.7	23.6	24.3				24.8	26.1	26.9	26.8	25.6	23.8	21.8	20.5			
5.0	21.4	21.8	22.7	23.6					25.4	26.4	26.3	25.0	22.9	20.7	19.4			
2.5	20.2	20.6	21.7	22.6					24.4	25.7	25.6	24.1	21.7	19.2	18.1			
0.0	18.8	19.1	20.4	21.5					23.2	24.8	24.7	23.0	20.2	17.5	16.5			
-2.5	17.2	17.4	18.8	20.1					21.8	23.6	23.7	21.7	18.5	15.5	14.7			

TABLE 20

HAND REACH ENVELOPE

VEHICLE RANGE: (G GREATER THAN 1.25) POPULATION MIX: 79/25 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)		STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
		15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0		15.1	16.6	17.8	18.7	19.3	19.7	19.9	20.0	20.3	20.4	20.1	19.5	18.6	17.5	16.2	14.8	
32.5		17.3	18.6	19.7	20.4	21.0	21.4	21.7	21.7	22.2	22.3	22.0	21.4	20.6	19.7	18.5	17.3	
30.0		19.2	20.4	21.3	22.0	22.4	22.8	23.1	23.2	23.8	23.9	23.6	23.1	22.4	21.5	20.5	19.3	
27.5		20.8	21.9	22.7	23.3	23.7	24.0	24.2	24.4	25.1	25.2	25.0	24.5	23.9	23.1	22.2	21.0	19.5
25.0		22.1	23.1	23.8	24.3	24.7	24.9	25.1	25.3	26.1	26.3	26.1	25.7	25.2	24.5	23.6	22.4	20.8
22.5		23.1	24.0	24.7	25.2	25.4	25.5	25.4	25.9	26.7	27.0	27.0	26.7	26.2	25.5	24.6	23.4	21.8
20.0		23.9	24.7	25.3	25.8	26.0	25.9	25.5	26.3	27.1	27.5	27.6	27.4	27.0	26.3	25.4	24.1	22.5
17.5		24.3	25.0	25.7	26.1	26.3	26.0	25.2	26.4	27.1	27.7	28.0	28.0	27.6	26.9	25.8	24.4	22.9
15.0		24.5	25.1	25.8	26.3	26.4					27.6	28.1	28.3	28.0	27.2	26.0	24.5	22.9
12.5		24.4	25.0	25.7	26.2	26.2					27.2	28.0	28.3	28.1	27.2	25.8	24.2	22.7
10.0		24.0	24.5	25.3	25.9						26.6	27.7	28.2	28.0	27.0	25.4	23.6	22.2
7.5		23.3	23.8	24.7	25.3						25.7	27.1	27.9	27.7	26.6	24.7	22.7	21.4
5.0		22.4	22.8	23.8	24.6							26.3	27.3	27.2	25.9	23.7	21.5	20.3
2.5		21.2	21.5	22.7	23.6							25.3	26.6	26.5	25.0	22.5	20.0	18.9
0.0		19.7	20.0	21.3	22.4							24.0	25.6	25.6	23.8	21.0	18.2	17.3
-2.5		17.9	18.3	19.7	21.0							22.6	24.4	24.4	22.5	19.2	16.2	15.4

TABLE 21

HAND REACH ENVELOPE

VEHICLE RANGE: (G GREATER THAN 1.25) POPULATION MIX: 90/10 MALES-TO-FEMALES

(INCH)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (inch)	STATIONS OUTBOARD OF C L/O (inch)							STATIONS INBOARD OF C L/O (inch)									
	15.0	12.5	10.0	7.5	5.0	2.5	0.0	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
35.0	16.2	17.6	18.7	19.6	20.3	20.7	20.8	20.8	21.2	21.2	20.9	20.3	19.5	18.4	17.1	15.7	
32.5	18.3	19.6	20.6	21.4	21.9	22.3	22.6	22.5	23.0	23.1	22.8	22.2	21.4	20.5	19.4	18.1	
30.0	20.1	21.3	22.2	22.9	23.3	23.7	24.0	24.0	24.6	24.7	24.4	23.9	23.2	22.3	21.3	20.1	
27.5	21.7	22.8	23.5	24.1	24.5	24.8	25.1	25.1	25.8	26.0	25.7	25.3	24.6	23.9	23.0	21.8	20.2
25.0	23.0	23.9	24.6	25.1	25.5	25.7	25.8	26.0	26.8	27.0	26.8	26.4	25.9	25.2	24.3	23.1	21.5
22.5	23.9	24.8	25.5	25.9	26.2	26.3	26.2	26.6	27.4	27.7	27.7	27.4	26.9	26.2	25.3	24.1	22.5
20.0	24.6	25.4	26.1	26.5	26.7	26.6	26.2	27.0	27.7	28.1	28.3	28.1	27.7	27.0	26.0	24.8	23.1
17.5	25.1	25.8	26.4	26.9	27.0	26.7	25.9	27.0	27.8	28.3	28.6	28.6	28.2	27.5	26.4	25.1	23.5
15.0	25.2	25.9	26.5	27.0	27.1					28.2	28.7	28.9	28.6	27.8	26.6	25.1	23.5
12.5	25.1	25.6	26.4	26.9	26.9					27.8	28.6	28.9	28.7	27.8	26.4	24.8	23.3
10.0	24.6	25.2	26.0	26.5						27.2	28.2	28.8	28.6	27.6	26.0	24.2	22.7
7.5	23.9	24.4	25.3	26.0						26.3	27.7	28.4	28.3	27.1	25.2	23.2	21.9
5.0	23.0	23.4	24.4	25.2							26.8	27.9	27.7	26.4	24.2	22.0	20.8
2.5	21.7	22.1	23.3	24.2							25.8	27.1	27.0	25.5	23.0	20.5	19.4
0.0	20.2	20.6	21.9	22.9							24.5	26.1	26.0	24.3	21.4	18.7	17.7
-2.5	18.4	18.8	20.2	21.5							23.1	24.9	24.9	22.9	19.6	16.6	15.8

TABLE 1m

HAND REACH ENVELOPE

VEHICLE RANGE: (G LESS THAN -1.25)

POPULATION MIX: 50/50 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)	STATIONS OUTBOARD OF C L/O (mm)							STATIONS INBOARD OF C L/O (mm)									
	400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.	
800.	387.	439.	456.	470.	490.	497.	502.	493.	501.	504.	495.	483.	468.	448.	377.		
700.	463.	506.	520.	531.	546.	551.	556.	550.	562.	566.	557.	546.	532.	499.	455.		
600.	519.	555.	567.	576.	586.	588.	584.	580.	583.	611.	604.	595.	584.	555.	514.	449.	
500.	556.	586.	598.	606.	609.	603.	589.	614.	630.	638.	637.	631.	622.	595.	553.	486.	
450.	567.	595.	607.	615.	615.	604.	583.	640.	635.	645.	649.	644.	636.	609.	565.	498.	
400.	574.	600.	612.	621.	618.	601.	571.	621.	637.	648.	656.	654.	646.	619.	572.	506.	
350.	576.	601.	614.	623.	616.	594.	555.	619.	633.	646.	660.	660.	654.	625.	574.	511.	
300.	574.	597.	612.	622.	611.			639.		660.	662.	658.	626.	572.	510.		
250.	567.	590.	605.	617.	602.			628.		657.	662.	658.	624.	564.	506.		
200.	557.	578.	596.	608.	590.			613.		649.	658.	656.	618.	551.	498.		
100.	524.	544.	566.	581.						624.	639.	640.	593.	510.	469.		
0.	474.									584.	607.	610.	551.	449.	423.		
-100.	410.									528.	561.	567.	493.	367.	360.		

TABLE 2m

HAND REACH ENVELOPE

VEHICLE RANGE: (G LESS THAN -1.25)

POPULATION MIX: 75/25 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)	STATIONS OUTBOARD OF C L/O (mm)							STATIONS INBOARD OF C L/O (mm)									
	400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.	
800.	422.	470.	488.	501.	520.	526.	532.	530.	539.	542.	532.	520.	505.	466.	419.		
700.	496.	536.	550.	560.	574.	579.	584.	582.	595.	600.	590.	580.	567.	534.	492.		
600.	550.	584.	596.	604.	612.	612.	609.	619.	634.	640.	634.	626.	615.	586.	545.	480.	
500.	584.	614.	625.	633.	634.	625.	610.	630.	652.	663.	664.	658.	649.	622.	580.	513.	
450.	594.	622.	634.	641.	639.	625.	609.	642.	656.	668.	673.	670.	662.	634.	589.	523.	
400.	600.	626.	639.	647.	640.	620.	587.	642.	657.	668.	679.	678.	671.	642.	594.	529.	
350.	601.	627.	640.	648.	637.	611.	568.	637.	651.	664.	681.	682.	677.	646.	594.	531.	
300.	598.	623.	637.	646.	631.			651.		680.	683.	679.	646.	589.	529.		
250.	591.	615.	630.	641.	621.			643.		675.	681.	678.	642.	578.	523.		
200.	579.	603.	620.	632.	607.			643.		666.	675.	673.	633.	563.	513.		
100.	544.	568.	590.	604.						637.	654.	654.	604.	517.	480.		
0.	492.									593.	618.	621.	558.	451.	430.		
-100.	426.									534.	569.	575.	496.	364.	363.		

TABLE 3m

HAND REACH ENVELOPE

VEHICLE RANGE: (G LESS THAN - 1.25)

POPULATION MIX: 90/10 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)	STATIONS OUTBOARD OF C L/O (mm)							STATIONS INBOARD OF C L/O (mm)									
	400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.	
800.	443.	490.	507.	519.	538.	544.	550.	551.	561.	564.	554.	542.	527.	442.	443.		
700.	516.	555.	568.	578.	591.	596.	600.	601.	615.	619.	610.	600.	587.	555.	513.		
600.	568.	601.	613.	621.	628.	627.	624.	635.	651.	657.	652.	644.	633.	605.	564.	498.	
500.	601.	630.	641.	649.	648.	639.	622.	653.	669.	678.	640.	674.	666.	639.	595.	528.	
450.	611.	638.	650.	657.	653.	638.	612.	655.	671.	681.	688.	685.	677.	649.	604.	537.	
400.	616.	642.	654.	662.	653.	638.	597.	654.	668.	680.	693.	692.	685.	656.	607.	542.	
350.	616.	642.	655.	663.	649.	621.	573.	648.	661.	675.	694.	695.	690.	659.	605.	543.	
300.	613.	638.	652.	661.	642.					665.	691.	695.	691.	657.	598.	540.	
250.	605.	630.	645.	655.	631.					651.	685.	692.	689.	652.	587.	533.	
200.	592.	618.	635.	646.	617.					632.	675.	685.	684.	642.	570.	521.	
100.	556.	583.	604.	617.							644.	662.	662.	611.	521.	486.	
0.	503.										598.	624.	627.	562.	451.	434.	
-100.	436.										537.	573.	579.	497.	361.	365.	

TABLE 4m

HAND REACH ENVELOPE

VEHICLE RANGE: (-1.24 < G < -0.75)

POPULATION MIX: 50/50 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)	STATIONS OUTBOARD OF C L/O (mm)							STATIONS INBOARD OF C L/O (mm)									
	400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.	
800.	391.	441.	460.	474.	494.	501.	507.	500.	509.	512.	502.	491.	475.	435.	386.		
700.	466.	509.	523.	535.	550.	555.	560.	556.	569.	573.	564.	553.	540.	507.	464.		
600.	521.	558.	570.	579.	589.	590.	589.	595.	611.	617.	611.	602.	591.	562.	521.	456.	
500.	558.	589.	600.	609.	613.	606.	594.	618.	635.	643.	644.	638.	629.	602.	559.	492.	
450.	569.	597.	609.	618.	619.	608.	588.	624.	640.	649.	654.	650.	643.	615.	571.	504.	
400.	576.	602.	615.	623.	621.	605.	577.	625.	640.	651.	661.	660.	653.	625.	577.	512.	
350.	578.	602.	616.	625.	620.	598.	560.	622.	636.	649.	665.	665.	660.	630.	579.	516.	
300.	576.	599.	613.	624.	615.					641.	665.	664.	663.	631.	575.	515.	
250.	569.	591.	607.	618.	606.					630.	661.	667.	664.	629.	567.	510.	
200.	559.	580.	597.	610.	594.					614.	653.	662.	660.	622.	553.	502.	
100.	525.	545.	566.	582.							627.	643.	644.	596.	511.	471.	
0.	476.										586.	611.	614.	554.	449.	425.	
-100.	411.										530.	564.	570.	495.	367.	362.	

TABLE 6m

HAND REACH ENVELOPE

VEHICLE RANGE: $(-1.24 < G < -0.75)$

POPULATION MIX: 75/25 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)	STATIONS OUTBOARD OF C L/O (mm)							STATIONS INBOARD OF C L/O (mm)								
	400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.
800.	427.	475.	493.	506.	525.	532.	538.	536.	546.	549.	539.	527.	512.	474.	426.	
700.	500.	541.	555.	565.	579.	584.	589.	588.	602.	606.	597.	587.	574.	542.	499.	
600.	553.	588.	600.	608.	617.	617.	615.	624.	640.	646.	641.	633.	622.	594.	553.	487.
500.	587.	617.	628.	636.	638.	631.	618.	644.	650.	669.	670.	665.	657.	629.	586.	519.
450.	597.	625.	637.	645.	643.	631.	608.	647.	663.	673.	680.	676.	669.	641.	596.	529.
400.	603.	629.	641.	650.	645.	626.	595.	646.	661.	673.	685.	684.	678.	649.	600.	535.
350.	604.	629.	642.	651.	642.	617.	576.	641.	655.	668.	687.	688.	683.	652.	599.	537.
300.	601.	625.	639.	649.	636.			659.		685.	689.	685.	685.	652.	593.	535.
250.	593.	617.	632.	643.	626.			646.		680.	687.	684.	684.	647.	583.	528.
200.	582.	605.	622.	634.	612.			628.		671.	681.	679.	679.	639.	567.	518.
100.	546.	569.	591.	606.						641.	659.	660.	609.	521.	484.	
0.	494.									597.	623.	627.	563.	454.	435.	
-100.	427.									538.	574.	580.	500.	367.	368.	

TABLE 6m

HAND REACH ENVELOPE

VEHICLE RANGE: $(-1.24 < G < -0.75)$

POPULATION MIX: 90/10 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)	STATIONS OUTBOARD OF C L/O (mm)							STATIONS INBOARD OF C L/O (mm)								
	400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.
800.	448.	496.	513.	526.	544.	551.	557.	557.	567.	570.	560.	549.	534.	496.	450.	
700.	520.	560.	573.	583.	597.	602.	606.	608.	621.	626.	617.	607.	594.	562.	520.	
600.	572.	606.	617.	626.	633.	633.	630.	641.	657.	663.	659.	651.	640.	612.	571.	504.
500.	605.	634.	645.	653.	654.	645.	630.	658.	674.	683.	686.	681.	673.	646.	602.	535.
450.	614.	642.	653.	661.	658.	644.	620.	681.	676.	687.	694.	692.	684.	656.	610.	544.
400.	619.	646.	658.	665.	658.	639.	605.	659.	673.	686.	699.	698.	692.	663.	613.	549.
350.	620.	645.	658.	666.	655.	629.	585.	653.	666.	680.	700.	702.	697.	665.	611.	550.
300.	616.	641.	655.	664.	648.					670.	697.	702.	698.	664.	604.	546.
250.	608.	632.	648.	658.	637.					655.	691.	699.	696.	658.	592.	539.
200.	595.	620.	637.	648.	623.					636.	681.	692.	690.	648.	575.	527.
100.	558.	584.	605.	619.							650.	668.	669.	616.	526.	492.
0.	505.										604.	630.	634.	568.	456.	440.
-100.	437.										543.	579.	585.	503.	366.	371.

TABLE 7m

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.74 < G < -0.25)$

POPULATION MIX: 50/50 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)

STATIONS OUTBOARD OF C L/O (mm)

STATIONS INBOARD OF C L/O (mm)

400.

300.

250.

200.

100.

50.

0.

0.

50.

100.

200.

250.

300.

400.

500.

600.

800.

700.

600.

500.

450.

400.

350.

300.

250.

200.

100.

0.

-100.

394.

445.

464.

478.

498.

505.

511.

394.

445.

464.

478.

498.

505.

511.

394.

445.

464.

478.

498.

505.

511.

394.

445.

464.

478.

498.

505.

511.

507.

516.

519.

510.

498.

483.

443.

395.

507.

516.

519.

510.

498.

483.

443.

395.

507.

516.

519.

510.

498.

483.

443.

395.

507.

516.

519.

510.

498.

483.

443.

395.

TABLE 8m

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.74 < G < -0.25)$

POPULATION MIX: 75/25 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)	STATIONS OUTBOARD OF CL/O (mm)							STATIONS INBOARD OF C L/O (mm)									
	400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.	
<u>800.</u>	431.	480.	498.	512.	531.	538.	544.	543.	552.	556.	546.	534.	519.	481.	434.		
<u>700.</u>	504.	545.	559.	570.	584.	590.	594.	595.	608.	613.	604.	594.	581.	549.	507.		
<u>600.</u>	556.	591.	604.	613.	622.	622.	620.	630.	646.	653.	648.	640.	629.	601.	560.	493.	
<u>500.</u>	590.	620.	632.	640.	643.	636.	622.	649.	665.	674.	677.	672.	664.	636.	593.	525.	
<u>450.</u>	600.	628.	640.	648.	648.	636.	615.	652.	667.	678.	686.	683.	676.	648.	602.	535.	
<u>400.</u>	606.	632.	644.	653.	649.					677.	691.	690.	684.	655.	605.	541.	
<u>350.</u>	607.	632.	645.	654.	647.					673.	693.	695.	690.	658.	604.	543.	
<u>300.</u>	604.	627.	642.	652.	640.					663.	690.	695.	692.	658.	598.	540.	
<u>250.</u>	596.	619.	635.	646.	631.					649.	685.	693.	690.	653.	587.	534.	
<u>200.</u>	584.	606.	624.	636.	617.					631.	675.	687.	685.	644.	571.	523.	
<u>100.</u>	548.	570.	591.	607.							646.	664.	665.	614.	524.	489.	
<u>0.</u>	496.	518.	545.	565.							601.	628.	632.	567.	457.		
-100.	428.	451.	484.	509.							543.	579.	585.	505.	371.		

TABLE 9m

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.74 < G < -0.25)$

POPULATION MIX: 90/10 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)

STATIONS OUTBOARD OF C L/O (mm)

400.	300.	250.	200.	100.	50.	0.	
800.	453.	501.	519.	532.	551.	557.	563.
700.	524.	565.	578.	589.	603.	608.	613.
600.	575.	610.	622.	630.	639.	639.	637.
500.	608.	638.	649.	657.	659.	651.	637.
450.	617.	645.	657.	665.	663.	651.	628.
400.	622.	649.	661.	669.	664.		
350.	623.	648.	661.	670.	661.		
300.	619.	643.	657.	667.	654.		
250.	611.	634.	650.	661.	643.		
200.	598.	622.	639.	651.	629.		
100.	561.	585.	606.	621.			
0.	507.	532.	559.	578.			
-100.	438.	465.	498.	522.			

STATIONS INBOARD OF C L/O (mm)

0.	50.	100.	200.	250.	300.	400.	500.	600.
564.	574.	577.	567.	556.	541.	503.	457.	
614.	628.	632.	624.	614.	601.	570.	528.	
647.	663.	670.	666.	658.	647.	619.	578.	511.
664.	680.	689.	693.	688.	680.	653.	609.	541.
666.	681.	692.	701.	698.	691.	663.	616.	550.
		691.	705.	705.	699.	670.	619.	555.
		685.	706.	708.	704.	672.	617.	556.
		674.	703.	708.	705.	670.	609.	552.
		660.	697.	705.	703.	664.	597.	545.
		640.	686.	698.	697.	654.	580.	533.
			655.	674.	675.	622.	530.	498.
			609.	637.	640.	574.	461.	
				548.	586.	592.	509.	372.

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TABLE 10m

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.24 < G < +0.24)$

POPULATION MIX: 50/50 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 50% MALE AND 50% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)		STATIONS OUTBOARD OF C L/O (mm)							STATIONS INBOARD OF C L/O (mm)								
		400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.
<u>800.</u>		397.	449.	467.	482.	503.	510.	516.	514.	524.	527.	517.	506.	491.	452.	403.	
<u>700.</u>		472.	515.	530.	542.	557.	563.	568.	569.	583.	588.	579.	568.	555.	523.	480.	
<u>600.</u>		526.	563.	576.	586.	596.	597.	596.	606.	623.	629.	625.	617.	606.	578.	536.	470.
<u>500.</u>		562.	593.	605.	614.	619.	614.	603.	627.	644.	653.	656.	651.	643.	616.	572.	505.
<u>450.</u>		573.	602.	614.	623.	625.	616.	597.	632.	647.	658.	666.	663.	656.	628.	582.	516.
<u>400.</u>		580.	606.	619.	628.	628.					658.	672.	672.	666.	637.	587.	523.
<u>350.</u>		582.	606.	620.	630.	626.					654.	675.	677.	672.	641.	587.	525.
<u>300.</u>		580.	602.	617.	627.	621.					646.	673.	678.	675.	641.	582.	524.
<u>250.</u>		573.	594.	610.	622.	613.					633.	669.	677.	674.	637.	572.	518.
<u>200.</u>		563.	582.	599.	613.	601.					616.	660.	671.	670.	629.	557.	509.
<u>100.</u>		529.	546.	567.	584.							632.	651.	652.	602.	513.	477.
<u>0.</u>		479.	494.	520.	542.							590.	617.	621.	558.	450.	
<u>-100.</u>		414.	427.	460.	487.							534.	570.	577.	499.	368.	

TABLE 11m

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.24 < G < +0.24)$

POPULATION MIX: 75/25 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 75% MALE AND 25% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)		STATIONS OUTBOARD OF CL/O (mm)							STATIONS INBOARD OF C L/O (mm)								
		400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.
800.		436.	485.	503.	517.	537.	544.	549.	549.	559.	563.	553.	541.	527.	489.	442.	
700.		507.	549.	564.	575.	589.	595.	600.	601.	615.	620.	611.	601.	588.	557.	515.	
600.		559.	595.	608.	617.	626.	627.	626.	636.	652.	659.	655.	647.	637.	609.	567.	500.
500.		593.	624.	635.	644.	647.	641.	629.	654.	670.	679.	683.	679.	671.	643.	599.	532.
450.		603.	631.	643.	652.	652.	642.	622.	657.	672.	683.	692.	690.	683.	655.	607.	542.
400.		608.	635.	647.	656.	654.					682.	697.	697.	691.	662.	611.	547.
350.		610.	634.	648.	657.	654.					677.	698.	701.	696.	665.	609.	548.
300.		606.	630.	644.	654.	645.					667.	696.	701.	698.	663.	603.	546.
250.		599.	621.	637.	648.	635.					653.	690.	698.	696.	658.	591.	539.
200.		587.	608.	625.	638.	622.					634.	680.	692.	691.	649.	575.	528.
100.		551.	571.	592.	608.							650.	669.	671.	618.	527.	494.
0.		498.	518.	544.	565.							606.	633.	637.	572.	460.	
-100.		430.	449.	483.	508.							547.	584.	591.	509.	374.	

TABLE 12m

HAND REACH ENVELOPE

VEHICLE RANGE: $(-0.24 < G < +0.24)$

POPULATION MIX: 90/10 MALES-TO-FEMALES

(mm)

HORIZONTAL REACH FORWARD OF THE HR REFERENCE PLANE AT STATIONS LOCATED LATERALLY FROM THE CENTERLINE OF OPERATOR (C L/O) AND AT ELEVATIONS ABOVE THE REARMOST H POINT. THE ENVELOPE DESCRIBES A 95% LEVEL OF PERFORMANCE OF A DRIVER POPULATION COMPOSED OF 90% MALE AND 10% FEMALE DRIVERS WEARING A TYPE 2a RESTRAINT.

ELEVATION ABOVE H PT (mm)		STATIONS OUTBOARD OF C L/O (mm)							STATIONS INBOARD OF C L/O (mm)										
		400.	300.	250.	200.	100.	50.	0.	0.	50.	100.	200.	250.	300.	400.	500.	600.		
800.	459.	507.	524.	538.	557.	564.	570.	570.	581.	584.	574.	562.	548.	511.	464.				
700.	528.	569.	584.	594.	609.	614.	619.	620.	634.	639.	631.	621.	608.	577.	535.				
600.	579.	614.	626.	635.	644.	645.	643.	653.	669.	676.	672.	665.	655.	627.	585.	518.			
500.	611.	642.	653.	661.	664.	657.	644.	669.	685.	695.	699.	695.	687.	660.	615.	548.			
450.	621.	649.	661.	669.	669.	657.	636.	671.	686.	698.	707.	705.	698.	670.	623.	557.			
400.	626.	652.	664.	673.	669.					696.	712.	712.	706.	676.	625.	562.			
350.	626.	651.	664.	673.	666.					690.	712.	715.	711.	678.	622.	562.			
300.	622.	646.	660.	670.	659.					679.	709.	715.	712.	676.	615.	559.			
250.	614.	637.	653.	664.	649.					664.	702.	711.	709.	670.	602.	551.			
200.	601.	624.	641.	653.	634.					644.	692.	704.	703.	660.	585.	539.			
100.	564.	585.	607.	623.							661.	680.	682.	628.	535.	504.			
0.	510.	532.	559.	579.							615.	643.	647.	579.	466.				
-100.	439.	463.	496.	521.							554.	592.	598.	515.	378.				