

Driver Selected Seat Position for Class B Vehicles - Seat Track Length and SgRP

RATIONALE

Previously this practice provided procedures for determining the seat track placement and length necessary to accommodate a given percentage of drivers in both Class A vehicles (Passenger Cars and Light Trucks) and Class B vehicles (Heavy Trucks and Buses). Procedures for Class A vehicles have been updated and moved to SAE J4004 Positioning the H-Point Design Tool – Seating Reference Point and Seat Track Length. This practice has been revised to apply only to Class B vehicles.

This edition of SAE J1517 includes a recommended location for the SgRP, clarification of the procedure for determining seat track length and location, and utilization of new definitions and procedures in SAE J1100. The seat track procedure is similar to the Class A procedure given in SAE J4004. Since several SAE J1100 vehicle interior dimensions are related to the SgRP, it is important that SgRP be determined in a consistent manner across Class B vehicles.

1. SCOPE

This Recommended Practice provides a procedure to locate driver seat tracks, establish seat track length, and define the SgRP in Class B vehicles (heavy trucks and buses). Three sets of equations that describe where drivers position horizontally adjustable seats are available for use in Class B vehicles depending on the percentages of males to females in the expected driver population (50:50, 75:25, and 90:10 to 95:5). The equations can also be used as a checking tool to estimate the level of accommodation provided by a given length of horizontally adjustable seat track.

These procedures are applicable for both the SAE J826 HPM and the SAE J4002 HPM-II.

2. REFERENCES

2.1 Applicable Documents

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1100 Motor Vehicle Dimensions

SAE J1516 Accommodation Tool Reference Point

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2.2 Related Publications

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2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

N. L. Philippart, R. W. Roe, A. J. Arnold, T. J. Kuechenmeister (1984), "Driver Selected Seat Position Model," SAE Paper No. 840508, Detroit, MI.

M. S. Sanders (1983), "U. S. Truck Driver Anthropometric and Truck Workspace Data Survey," Final Report Submitted to: SAE International, Warrendale, PA.

B. E. Shaw and M. S. Sanders (1984), "Female U. S. Truck Driver Anthropometric and Truck Workspace Data Survey," Final Report Submitted to: SAE International, Warrendale, PA.

3. DEFINITIONS

The following definitions are given in SAE J1100:

- a. H-point
- b. Seat SgRP height (H30)
- c. Steering wheel diameter (W9)
- d. Accelerator heel point (AHP)
- e. Seating reference point (SgRP)

3.1 CLASS B VEHICLES

Vehicles whose seat SgRP height (H30) is between 405 and 530 mm, and steering wheel diameter (W9) is between 450 and 560 mm.

NOTE: Class B vehicles include heavy trucks, some medium duty trucks, and some buses. In most cases these vehicles have flat treadle accelerator pedals and horizontal fore/aft seat travel paths.

3.2 H-POINT TRAVEL PATH

Travel path of seat H-point when the seat is moved through its full range of vertical and fore/aft adjustments.

NOTE: The seat is loaded with a weight equal to that of an SAE H-point machine (or an HPM is installed in the seat per SAE J826 or J4002) and all other seat adjustments are set to the manufacturer's design nominal condition.

3.3 DESIGN H-POINT TRAVEL PATH

Fore/aft H-point travel path with the seat vertical adjustment set at its mid-height value.

NOTE: The design H-point travel path is used to determine SgRP and H30.

3.4 DRIVER SELECTED SEAT POSITION LINES

Series of two-dimensional side-view lines which express driver selected seat position aft of AHP for various accommodation levels as a function of seat H-point height above AHP.

NOTE 1: Three sets of lines are provided to accommodate truck driver populations with male-to-female ratios of 50:50, 75:25, and 90:10 to 95:5.

NOTE 2: The AHP location is determined using SAE J1516.

3.5 SGRP LINE

Two-dimensional side-view line which defines the SgRP x location as a function of H30 relative to the AHP for the purpose of defining a specified level of driver fore/aft seat accommodation.

NOTE 1: This line is the 95th percentile driver seat position line for a 50/50 male/female driver population.

NOTE 2: This line is used to define the SgRP in a consistent way across vehicle manufacturers, enabling meaningful comparisons of several SAE J1100 dimensions reported by each manufacturer.

4. BACKGROUND

Seat position data used to develop the driver selected seat position lines for Class B vehicles were collected from a heavy truck workspace study (see Reference M. S. Sanders, 1983 and B. E. Shaw and M. S. Sanders, 1984).¹ The workspace simulated three truck cab configurations with H-point heights of 405, 468, and 530 mm and steering wheel diameters of 457, 508, and 560 mm. All configurations had a treadle accelerator pedal and suspended clutch. Driver selected seat position of male and female heavy truck drivers were collected in the workspace. Data were converted to H-point locations relative to an accelerator heel point reference for each package. See SAE J1516 for determining the accelerator heel point.

A statistical technique was used to generate four populations from the original truck workspace data with the following male-to-female ratios 50:50, 75:25, 90:10, and 95:5. The 2.5, 5th, 10th, 50th, 90th, 95th, and 97.5 percentile H-point locations were determined for the cab configurations by population mix and plotted as a function of H-point height (H30). Straight lines were fit to each of the four mixes of data for each percentile level. (Second degree equations were not used due to paucity of data.) Separate sets of equations define horizontal H-point locations as a function of H-point height for truck driver populations with 50:50 and 75:25 male-to-female ratios. The sets of linear expressions for populations with 90:10 and 95:5 male-to-female ratios were very similar. Therefore, one equation, appropriate for both mixes, was developed to define horizontal H-point location as a function of H-point height. These three sets of accommodation lines define horizontal H-point location as a function of H-point height for three separate truck driver populations for Class B vehicles.

The intersection of the design H-point travel path with the accommodation lines can be used to estimate the seat track location (aft of the accelerator point) and length of horizontal seat travel heel needed to provide a specified level of accommodation for the target gender percentages of drivers.

¹ Changes in the stature and weight of the current truck driver population relative to the driver population in the Sanders, et.al., study may require some adjustments to the seat track length and location in section 6.

5. DRIVER SELECTED SEAT POSITION ACCOMMODATION LINES

Equations are given that define driver selected seat position as a function of H-point height. Three sets of first degree equations as a function of H-point height (z) define horizontal H-point location for Class B vehicles at the 2.5, 5th, 10th, 50th, 90th, 95th, and 97.5 percentile accommodation levels for three different male/female driver populations. See Figure 1 and equation sets 1, 2 and 3.

For 50:50 male-to-female ratios:

$$\begin{aligned}
 X_{97.5} &= 916.50 - 0.471z \\
 X_{95} &= 900.23 - 0.471z \\
 X_{90} &= 888.44 - 0.487z \\
 X_{50} &= 798.74 - 0.446z \\
 X_{10} &= 668.97 - 0.340z \\
 X_{5} &= 637.76 - 0.317z \\
 X_{2.5} &= 625.21 - 0.327z
 \end{aligned}
 \tag{Eq. 1}$$

For 75:25 male-to-female ratios:

$$\begin{aligned}
 X_{97.5} &= 941.88 - 0.514z \\
 X_{95} &= 928.86 - 0.519z \\
 X_{90} &= 909.79 - 0.512z \\
 X_{50} &= 822.44 - 0.460z \\
 X_{10} &= 699.71 - 0.354z \\
 X_{5} &= 668.86 - 0.339z \\
 X_{2.5} &= 641.35 - 0.329z
 \end{aligned}
 \tag{Eq. 2}$$

For 90:10 to 95:5 male-to-female ratios:

$$\begin{aligned}
 X_{97.5} &= 929.13 - 0.480z \\
 X_{95} &= 922.49 - 0.494z \text{ (SgRP line)} \\
 X_{90} &= 903.03 - 0.485z \\
 X_{50} &= 855.31 - 0.509z \\
 X_{10} &= 785.36 - 0.492z \\
 X_{5} &= 762.17 - 0.485z \\
 X_{2.5} &= 732.62 - 0.460z
 \end{aligned}
 \tag{Eq. 3}$$

where:

x_i is the location in mm of the i^{th} percentile of the driver seat position distribution aft of the accelerator heel point, and z is the vertical distance from AHP to the seat H-point, in mm.

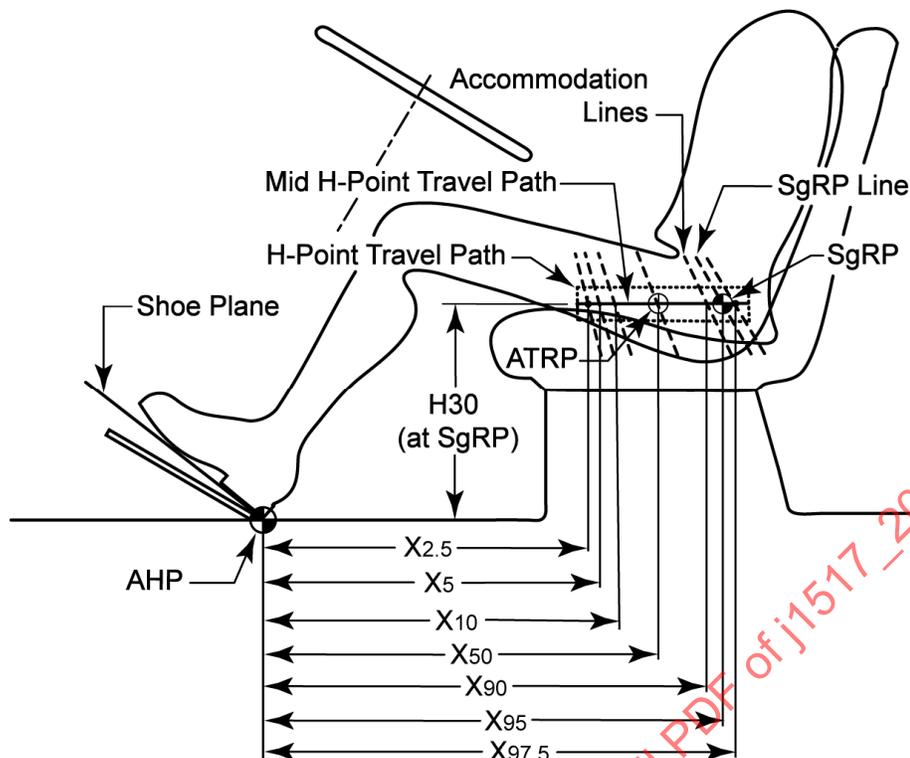


FIGURE 1: CLASS B VEHICLE DRIVER SEAT POSITION ACCOMMODATION LINES AND SGRP LOCATION

6. PROCEDURE FOR SEAT TRACK LENGTH AND LOCATION

6.1 Refer to SAE J1516 for determining the accelerator heel point location to position the driver accommodation lines.

6.2 Determine H30.

For a horizontal design H-point travel path, H30 is the height of this path above the AHP.

For an inclined H-point travel path, the SgRP location must first be determined. The SgRP is located graphically at the intersection of the design H-point travel path and the SgRP line. H30 is the vertical distance of the SgRP above the AHP. See 7.2.

6.3 Select the driver accommodation lines that correspond to the desired population mix of males and females. Locate these lines to the same accelerator heel point reference used to locate the accommodation tool reference point in SAE J1516. Note that the 50th percentile selected seat position line will coincide with the accommodation tool reference line.

6.3.1 Designing a vehicle to provide accommodation for 95% of drivers requires locating the H-point travel path between the 2.5 and 97.5 percentile seat position accommodation lines for the given seat H-point height (H30).

Seat Track Length: Figure 2 illustrates the seat track length needed to accommodate 95% of drivers for the 3 different driver population mixes as a function of H30.

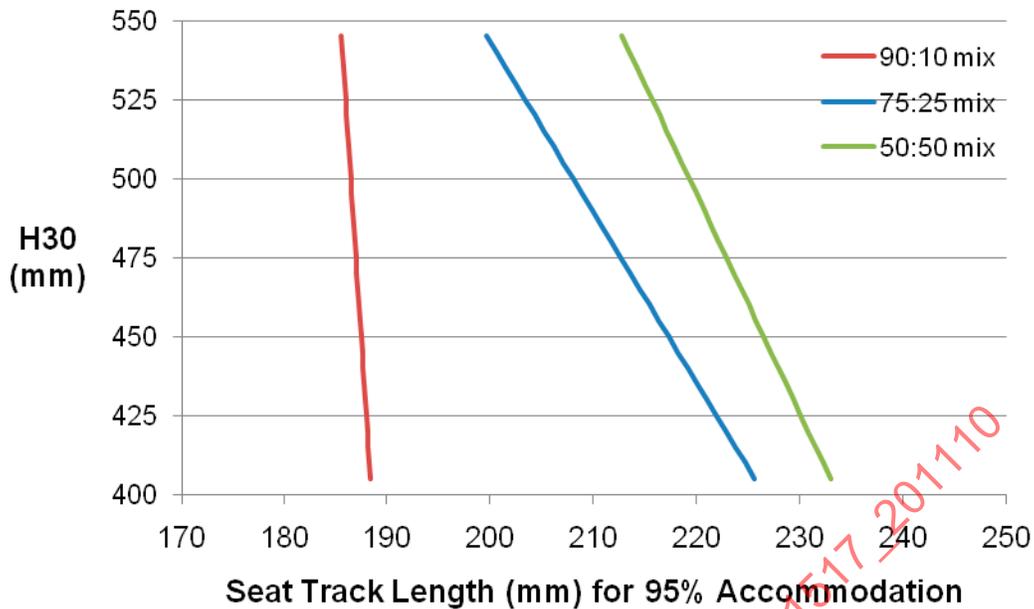


FIGURE 2: SEAT TRACK LENGTHS FOR 95% ACCOMMODATION OF THE 3 DRIVER POPULATIONS FOR VARIOUS H-POINT HEIGHTS

Seat Track Location: Figure 3 illustrates the placement of the seat track for a 75:25 male/female driver population and a seat track length that accommodates 95% of that driver population. Similar plots for the other population mixes are readily constructed from the accommodation equations.

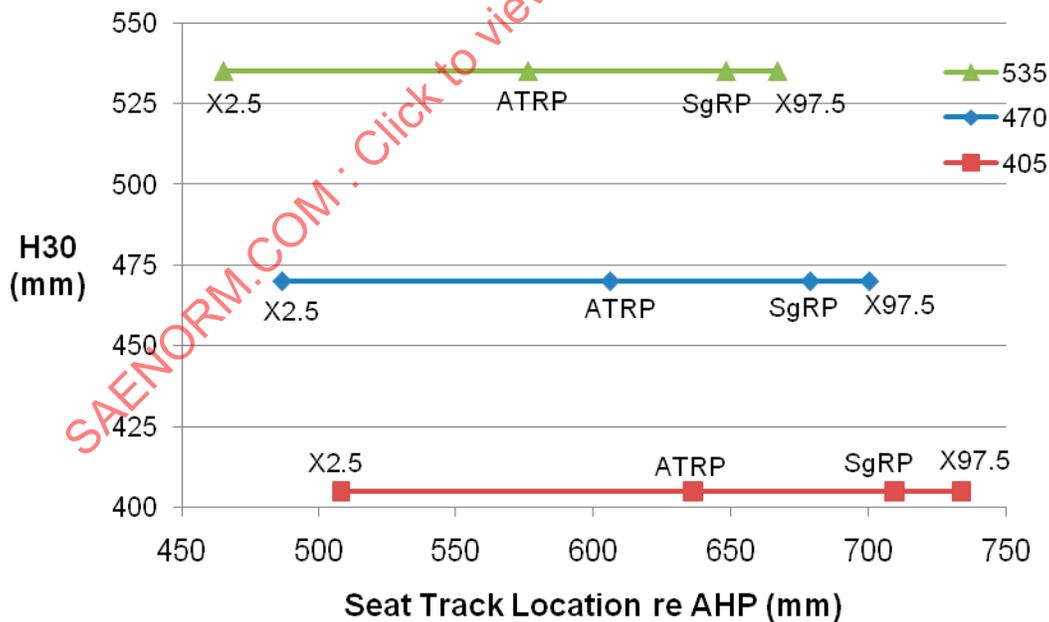


FIGURE 3: SEAT TRACK AND SGRP LOCATIONS FOR 95% ACCOMMODATION OF A 75:25 DRIVER POPULATION FOR 3 DIFFERENT SEAT HEIGHTS