DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

[Docket No. NHTSA- 2014-0088]

Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation (DOT).

ACTION: Notice of Federal guidelines; clarifications.

SUMMARY: On April 26, 2013, NHTSA released the Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices (Phase 1 Guidelines) in an effort to promote safety by discouraging the introduction of excessively distracting devices in vehicles. These Guidelines cover original equipment (OE) in-vehicle (i.e., integrated) electronic devices that are operated by the driver through visual-manual means (i.e., the driver looks at a device, manipulates a device-related control with his or her hand, and/or watches for visual feedback from the device). This document clarifies some ambiguities that have been identified in these Guidelines. For some of these clarifications, revisions to the Guidelines text are indicated. A revised version of the Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices (Phase 1 Guidelines), including these revisions, will be posted on www.regulations.gov in Docket NHTSA-2014-0088.

DATES: The corrections made in this document are effective upon publication.

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SUPPLEMENTARY INFORMATION:

In June 2012, NHTSA released a "Blueprint for Ending Distracted Driving," (document available at www.distraction.gov) summarizing steps that NHTSA intends to take to eliminate crashes attributable to driver distraction. This document was an update of the "Overview of the National Highway Traffic Safety Administration's Driver Distraction Program" that was released in April 2010[1].

One of the steps called for in both of these documents is the development of nonbinding, voluntary guidelines for minimizing the distraction potential of in-vehicle and portable devices. NHTSA stated that these guidelines would be developed in three phases. The first phase covers visual-manual interfaces of electronic devices installed in vehicles as original equipment. The second phase will cover visual-manual interfaces of portable and aftermarket devices. The third phase will expand these guidelines to cover tasks performed via auditory-vocal interactions.

The Phase 1 NHTSA Guidelines were released for public comment in February 2012. The final version of the Phase 1 Distraction Guidelines was published in April 2013.[2]

The Phase 1 Guidelines list certain secondary tasks believed by the agency to interfere inherently with a driver's ability to safely control the vehicle. The NHTSA Guidelines recommend that in-vehicle devices be designed so that they cannot be used by the driver to perform these inherently distracting secondary tasks while driving. For all other visual-manual secondary tasks, the NHTSA Guidelines specify a test method for measuring eye glance behavior

[1] "Overview of the National Highway Traffic Safety Administration's Driver Distraction Program," DOT HS 811 299, April 2010. Available at http://www.nhtsa.gov/staticfiles/nti/distracted_driving/pdf/811299.pdf. Also available at www.regulations.gov, Docket NHTSA_2010-0053, Document Number 0001.
[2] 78 FR 24817 (Apr. 26, 2013).

during those tasks. Eye glance metrics are compared to acceptance criteria to evaluate whether a task interferes too much with driver attention, rendering it unsuitable for a driver to perform while driving. If a task does not meet the acceptance criteria, the NHTSA Guidelines recommend that the task be made inaccessible for performance by the driver while driving.

In addition, the NHTSA Guidelines contain several recommendations to limit and reduce the potential for distraction associated with the use of OE in-vehicle electronic devices. Examples include a recommendation that performance of visual-manual tasks should not require the use of more than one hand, a recommendation that each device's active display be located as close as practicable to the driver's forward line of sight, and a recommendation of a maximum downward viewing angle to the geometric center of each display.

Clarifications

The agency is making the following clarifications and corrections to the Phase 1 Guidelines and a revised version of the Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices (Phase 1 Guidelines), including these revisions, will be posted on www.regulations.gov in Docket NHTSA-2014-0088.

1. Clarification of Determination of Downward Viewing Angle

In the April 2013 Final Guidelines Notice, NHTSA committed to clarifying the process of determining the downward viewing angle. In particular, the agency noted that several commenters had requested notations regarding the measurement of eye height to ground in grid coordinates for 2D and SAE curb ground line coordinates in 3D. NHTSA interpreted those comments as requesting figures similar to those found in the Alliance of Automobile Manufacturers' distraction guidelines (Alliance Guidelines).[3] The figures in the Alliance Guidelines are intended to clarify coordinates and measurements used when calculating a display's downward viewing angle, and the agency indicated that it would add similar figures to the Phase 1 Guidelines. Accordingly, the Phase 1 Guidelines are being amended to reference an additional SAE standard in Subsection III.B and the sections related to downward viewing angle have been revised and illustrative diagrams have been added. Finally, a more detailed explanation of the figures and mathematical calculations of the angles have been added in order to make the figures easier to understand.

The original text of Subsection III.B reads:

> SAE Recommended Practice J941, "Motor Vehicle Drivers' Eye Locations." Any of the following versions of SAE J941 are acceptable: SAE J941 (June 1992), SAE J941 (June 1997), SAE J941 (September 2002), SAE J941 (October 2008), or SAE J941 (March 2010).

[3] Alliance of Automobile Manufacturers, Driver Focus-Telematics Working Group, Statement of Principles, Criteria and Verification Procedures on Driver Interactions with Advanced In-Vehicle Information and Communication Systems (June 26, 2006).

The text was revised to add the following reference:

SAE Recommended Practice J670 JAN2008, "Vehicle Dynamics Terminology," revised January 2008.

The original text of Subsections V.C.7 and V.C.8 read:

7. Determination of 2D Downward Viewing Angle. Create a fore-and-aft plane (Plane FA) through the nominal driver eye point. Define Point B as the laterally projected (while maintaining the same fore-and aft and vertical coordinates) position of the geometric center of the display of interest onto Plane FA. Generate two lines in Plane FA, Line 1 and Line 2. Line 1 is a horizontal line (i.e., maintaining the same vertical coordinate) going through the nominal driver eye point. Line 2 goes through the nominal driver eye point and Point B. The 2D Downward Viewing Angle is the angle from Line 1 to Line 2.

8. Determination of 3D Downward Viewing Angle. Generate two lines, Line 3 and Line 4. Line 3 is a horizontal line (i.e., maintaining the same vertical coordinate) going through the nominal driver eye point and a point vertically above, below, or at, the geometric center of the display of interest. Line 4 goes through the nominal driver eye point and the geometric center of the display. The 3D Downward Viewing Angle is the angle from Line 3 to Line 4.

The revised text of Subsections V.C.7 and V.C.8 read as follows:

7. Determination of 2D Downward Viewing Angle.

a. Coordinate System.

The SAE J670 JAN2008 Vehicle Axis System, denoted by (X_V, Y_V, Z_V) is used. SAE J670 JAN2008 provides two choices for the direction of the Z_V axis,

pointing upward (the Z-Up orientation) or pointing downwards (the Z-Down orientation). For this document, the Z-Up orientation is chosen.

The SAE J670 JAN2008 Vehicle Axis System (X_V, Y_V, Z_V) in the Z-Up orientation is an *axis system* fixed in the *reference frame* of the vehicle *sprung mass* such that the X_V axis is substantially horizontal, points forward, and is parallel to the *vehicle plane of symmetry*. The Y_V axis is perpendicular to the *vehicle plane of symmetry* and points to the left. The Z_V axis is perpendicular to both the X_V and Y_V axes and points upward.

b. Create a fore-and-aft plane (Plane FA) through the nominal driver eye point. Determine the (X_{EP}, Y_{EP}, Z_{EP}) coordinates of the nominal driver eye point. Plane FA is parallel to both the X_V and Z_V axes and is perpendicular to the Y_V axis. Since the nominal driver eye point is generally not on the *vehicle plane of symmetry*, Plane FA will normally be offset, either to the left or to the right, from the vehicle reference point shown in Figure 1. All points in Plane FA will have the same Y_V coordinate, Y_{EP}.

c. Define Point B. Point B is the laterally projected position of the geometric center of the display of interest onto Plane FA. Determine the (X_V, Y_V, Z_V) coordinates of the geometric center of the display of interest. Then laterally project (i.e., while maintaining the same X_V and Y_V coordinates) the geometric center of the display of interest onto Plane FA. In other words, if the geometric center of the display of interest has coordinates of (X_{GC}, Y_{GC}, Z_{GC}), then the coordinates of Point B will be (X_{GC}, Y_{EP}, Z_{GC}).

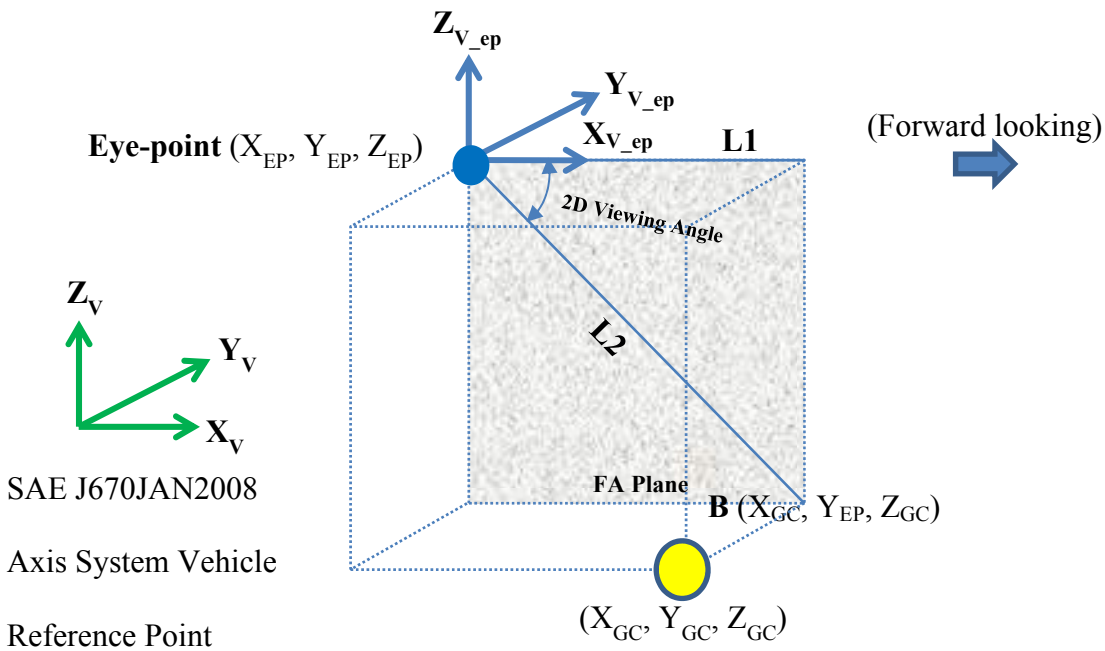
d. Generate two lines in Plane FA, Line 1 and Line 2 as described in paragraphs e. and f., below.

e. Generate Line 1. Line 1 is a horizontal line (i.e., maintaining the same vertical (Z_V) coordinate) in Plane FA going through the nominal driver eye point. Figure 1 shows Plane FA. Line 1 is marked in Figure 1.

f. Generate Line 2. Line 2 is in Plane FA and goes through the nominal driver eye point and Point B. Figure 1 also shows Line 2 in Plane FA. Lines 1 and 2 will intersect at the nominal driver eye point.

g. Determine the 2D Downward Viewing Angle. The 2D Downward Viewing Angle is the angle, measured in Plane FA, from Line 1 to Line 2. Figure 1 also shows the 2D Downward Viewing Angle.

[GPO – PHOTO GRAPHIC]



[END PHOTO]

Figure 1. Plane FA Showing Lines 1 and 2 and the 2D Downward Viewing Angle

h. Equations for Calculating the 2D Downward Viewing Angle. The 2D Downward Viewing Angle can be calculated using the equations that follow:

Define the nominal driver eye point to be at coordinates (X_{EP}, Y_{EP}, Z_{EP}). As previously stated, the geometric center of the display of interest has coordinates of (X_{GC}, Y_{GC}, Z_{GC}) and the coordinates of Point B will be (X_{GC}, Y_{EP}, Z_{GC}). The 2D distance in Plane FA between the nominal driver eye point and Point B can be calculated by:

$$d_{2D} = \sqrt{(X_{EP} - X_{GC})^2 + (Z_{EP} - Z_{GC})^2} \qquad \text{(Equation 2)}$$

The 2D Downward Viewing Angle, θ_{2D}, can be calculated by:

$$\boldsymbol{\theta_{2D} = 57.2958 \sin^{-1}\left(\frac{(Z_{EP} - Z_{GC}}{d_{2D}}\right)} \qquad \text{(Equation 3)}$$

Where the above arcsine is calculated in radians and converted to degrees by multiplying by 57.5958 (additional digits of accuracy acceptable if desired).

i. Supplemental Note. The 2D Downward Viewing Angle could be negative (i.e., the geometric center of the display of interest could be above the nominal driver eye point). Therefore, it is not necessarily a downward viewing angle.

8. Determination of 3D Downward Viewing Angle.

Note: This section builds upon the information contained in Subsection V.C.7, "Determination of 2D Downward Viewing Angle."

a. Generate two lines, Line 3 and Line 4. Start by determining the (X_V, Y_V, Z_V) coordinates of both the nominal driver eye point and the geometric center of the display of interest. Lines 3 and 4 are in a vertically-oriented plane, Plane EP-GC, that contains both the nominal driver eye point (at coordinates (X_{EP}, Y_{EP}, Z_{EP})), and the geometric center of the display of interest (at coordinates of (X_{GC}, Y_{GC}, Z_{GC})).

b. Generate Line 3. Line 3 is a horizontal line (i.e., maintaining the same vertical coordinate), in Plane EP-GC, going through the nominal driver eye point and a point vertically above, below, or at (depending upon the values of Y_{EP} and Y_{GC}) the geometric center of the display of interest. Figure 2 illustrates Line 3 in Plane EP-GC.

c. Generate Line 4. Line 4 goes through the nominal driver eye point and the geometric center of the display. It is in Plane EP-GC and intersects with Line 3 at the nominal driver eye point. Figure 2 also illustrates Line 4 in Plane EP-GC.

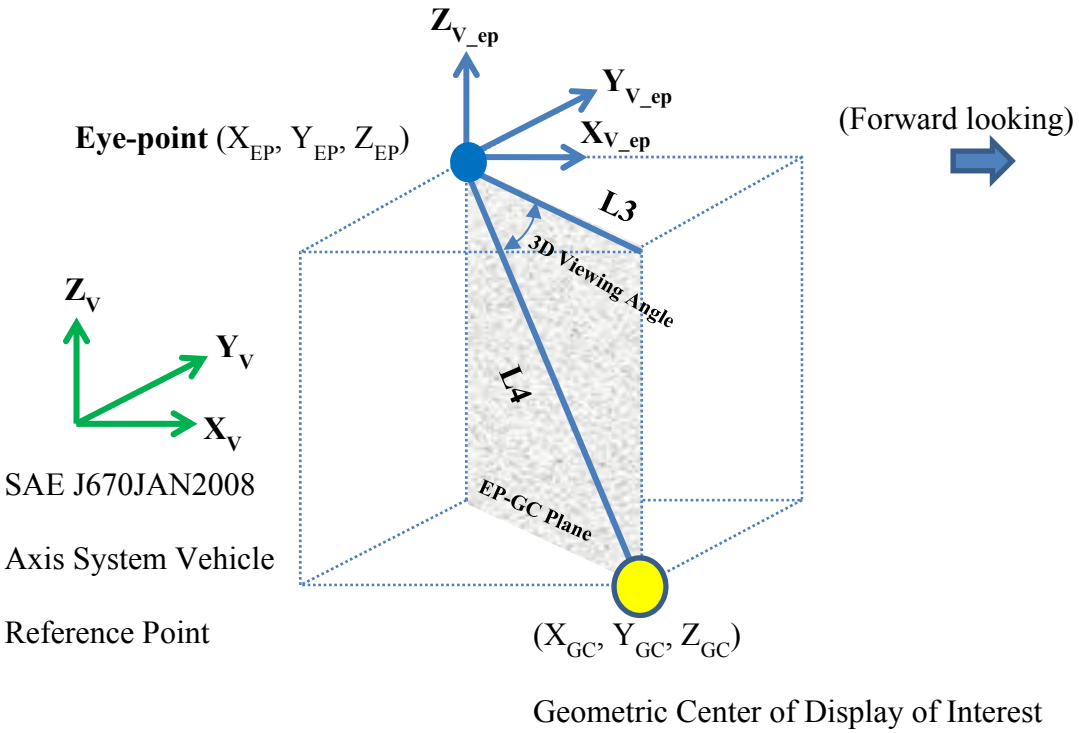


Figure 2. Plane EP-GC Showing Lines 3 and 4 and the

3D Downward Viewing Angle

d. Determine the 3D Downward Viewing Angle. The 3D Downward Viewing Angle is the angle, measured in Plane EP-GC, from Line 3 to Line 4. Figure 2 also shows the 3D Downward Viewing Angle.

e. Equations for Calculating the 3D Downward Viewing Angle. The 3D Downward Viewing Angle can be calculated using the equations that follow:

Define the nominal driver eye point to be at coordinates (X_{EP}, Y_{EP}, Z_{EP}). As previously stated, the geometric center of the display of interest has coordinates of (X_{GC}, Y_{GC}, Z_{GC}). The 3D distance in Plane EP-GC between the nominal driver eye point and geometric center of the display of interest can be calculated by:

$$\boldsymbol{d_{3D} = \sqrt{(X_{EP} - X_{GC})^2 + (Y_{EP} - Y_{GC})^2 + (Z_{EP} - Z_{GC})^2}} \qquad \text{(Equation 4)}$$

The 3D Downward Viewing Angle, θ_{3D}, can be calculated by:

$$\boldsymbol{\theta_{3D} = 57.2958 \sin^{-1}\left(\frac{(Z_{EP} - Z_{GC})}{d_{3D}}\right)} \qquad \text{(Equation 5)}$$

Where the above arcsine is calculated in radians and converted to degrees by multiplying by 57.5958 (additional digits of accuracy acceptable if desired).

f. Supplemental Note. The 3D Downward Viewing Angle could be negative (i.e., the geometric center of the display of interest could be above the nominal driver eye point). Therefore, it is not necessarily a downward viewing angle.

2. Clarification on Ordering of Test Trials When Multiple Tasks are Tested

NHTSA is revising Subsection VI.E.12, which discusses task acceptance test sessions involving multiple testable tasks. Although the Guidelines indicated that there is no limit to the number of tasks an individual test participant may be asked to perform in one test session, the agency feels that it is appropriate to caution that including too many tasks in a single session can overwhelm test participants and lead to worse performance by the participant, thereby increasing the likelihood of a task not meeting the acceptance criteria. Accordingly, Subsection VI.E.12 is being revised to incorporate a cautionary statement to that effect. NHTSA is also adding a similar cautionary recommendation that the instructions, practice, and testing for each task should be completed before beginning a new task in order to minimize the likelihood of test participant confusion.

The original text of Subsection VI.E.12 reads:

> 12. Multiple Testable Task Testing. To improve testing efficiency, multiple (different) testable tasks may be performed by the same test participant during one or more drives. There is no limit to the number of testable tasks that may be evaluated by a test participant.

The revised text of Subsection VI.E.12 appends the following sentences to the above section:

> However, it should be noted that including multiple tasks in a single session may lead to performance degradation due to test participant fatigue or confusion. Additionally, to ensure that the testing of each task reflects the demands of that task alone, all instructions, practice and testing for a single task should be completed before beginning a new task.

3. Clarification of Maximum Allowable Number of Eye Glances Longer than 2.0 Seconds

Subsequent to publication of the Phase 1 NHTSA Driver Distraction Guidelines, NHTSA became aware that the language used in Subsection VI.E.14.a, which describes the maximum number of eye glances longer than 2.0 seconds that may be observed for a conforming task during the driving simulator test procedure, was confusing to some readers. To improve the understandability of Subsection VI.E.14.a, that section has been revised as follows and an illustrative table has been added. Similar clarifying edits have also been made to Subsection VI.E.14.b, which describes the criteria for the mean duration of glances.

The original text of Subsection VI.E.14.a and b. read:

14. Acceptance Criteria. A testable task should be locked out from performance by drivers while driving **unless** the following three criteria are all met:
    a. For at least 21 of the 24 test participants, no more than 15 percent (rounded up) of the total number of eye glances away from the forward road scene have durations of greater than 2.0 seconds while performing the testable task one time.
    b. For at least 21 of the 24 test participants, the mean duration of all eye glances away from the forward road scene is less than or equal to 2.0 seconds while performing the testable task one time.

The text of Subsections VI.E.14.a and VI.E.14.b have been revised to read as follows:

a. For at least 21 of the 24 test participants, no more than 15 percent (rounded up to the next whole number) of each participant's total number of eye glances

away from the forward road scene have durations of greater than 2.0 seconds while performing the testable task one time.

Table 3: Maximum Allowable Number of Eye Glances Longer Than 2.0 Seconds

Number of Eye Glances Away from the Forward Road Scene Made by an Individual Test Participant in Performing a Task	15% of the Total Number of Eye Glances Away from the Forward Road Scene	Maximum Number of Allowable Off-Road Eye Glances Longer Than 2.0 Seconds
1	0.15	0*
2	0.30	1
3	0.45	1
4	0.60	1
5	0.75	1
6	0.90	1
7	1.05	2
8	1.20	2
9	1.35	2
10	1.50	2
11	1.65	2
12	1.80	2
13	1.95	2
14 through 20	>2.0	3

*Note: See Section VI.E.14.b. If a testable task takes a test participant exactly one glance to perform, that glance must be no longer than 2.0 seconds in order to have a mean duration that does not exceed 2.0 seconds for all eye glances.

b. For at least 21 of the 24 test participants, the mean duration of each participant's eye glances away from the forward road scene is less than or equal to 2.0 seconds while performing the testable task one time.

4. Typographical Error

A typographical error was found in Section VI.G.4.b of the Phase 1 NHTSA Driver Distraction Guidelines. The phrase "How to drive the occlusion apparatus while not performing a testable task," should read "Become familiar with the occlusion apparatus

operation while not performing a testable task." This change merely corrects the Guidelines language without substantively changing the content.

5. Inadvertent Omission

The agency inadvertently neglected to include a recommendation regarding multiple testable task testing in Subsection VI.G., which relates to the occlusion test protocol. As discussed above, a recommendation regarding multiple task testing was included in the section related to driving simulator testing. In order to provide consistent recommendations for both test protocols, the agency has included a recommendation similar to the revised Subsection VI.E.12 in Subsection VI.G.18 that reads as follows:

18. Multiple Testable Task Testing. To improve testing efficiency, multiple (different) testable tasks may be performed by the same test participant during one or more sessions. There is no limit to the number of testable tasks that may be evaluated by a test participant. However, it should be noted that including multiple tasks in a single session may lead to performance degradation due to test participant fatigue or confusion. Additionally, to ensure that the testing of each task reflects the demands of that task alone, all instructions, practice and testing for a single task should be completed before beginning a new task.

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